



**GE Medical Systems**

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## **Technical Publications**

**Direction 2412350-100  
Revision 5**

### ***Millennium MPR/MPS Operator's Reference Manual Nuclear Medicine Imaging System Includes Genie Acq Version 4.5***

#### **GE Medical Systems**

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**Notes**

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# Chapter 1 - Safety and Regulatory Information

The safety precautions and regulatory information included in this chapter are provided in the following sub-sections:

- [General Safety on page 1-2](#)
- [Safety Definitions and Symbols Used on page 1-4](#)
- [Safety Devices on page 1-7](#)
- [Patient Safety and Emergency Egress on page 1-17](#)
- [Data Safety on page 1-21](#)
- [Safe Operation Guidelines on page 1-22](#)
- [Safety Labels and Rating Plates on page 1-25](#)
- [Regulatory Information on page 1-32](#)

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## General Safety

1. This product was designed and manufactured to ensure maximum safety of operation. It should be operated and maintained in strict compliance with the safety precautions, warnings and operating instructions contained herein, and in all other documentation specific to the product.
2. The system has been designed to meet all the safety requirements applicable to medical equipment. However, anyone attempting to operate the system must be fully aware of potential safety hazards.
3. There are no user serviceable parts in this system. The product should be installed, maintained and serviced by qualified service personnel according to procedures laid down in the product service manuals.
4. The system in whole or in part should not be modified in any way without prior written approval by GE Medical Systems.
5. The owner should make certain that only properly trained, fully qualified personnel are authorized to operate the equipment. An authorized operators list should be maintained.
6. It is important that this manual should be kept at hand, studied carefully and reviewed periodically by the authorized operators.
7. The manufacturer or Vendor of the equipment makes no representation, however, that the act of reading this manual renders the reader qualified to operate, test or calibrate the system.
8. Unauthorized personnel should not be allowed access to the system.
9. Do not leave the patient unobserved at any time.
10. If the product does not operate properly or if it fails to respond to the controls as described in this manual, the operator should:
  - First ensure the safety of the patient and then the protection of the equipment.
  - In any potentially unsafe situation, the patient should be evacuated from the area as quickly as possible.
  - Freeze the situation and prevent any changes.
  - Contact the service office immediately, report the incident and await further instructions.

11. The images and calculations provided by this system are intended as tools for the competent user. They are explicitly not to be regarded as a sole incontrovertible basis for clinical diagnosis. Users are encouraged to study the literature and reach their own professional conclusions regarding the clinical utility of the system.
12. The user should be aware of the product specifications, system accuracy, and stability limitations. These limitations must be considered before making any decision based on quantitative values.  
In case of doubt, please consult your sales representative.
13. Preventative maintenance must be carried out regularly to ensure safe operation of the equipment
14. For user maintenance of the system and performance tests, refer to maintenance and QC sections, respectively.
15. **Electrical Shock Hazard** - do not remove or open system covers or plugs. Internal circuits use high voltage capable of causing serious injury. An electrical hazard may exist if any light, monitor or visual indicator stays on after the system is shut down. To prevent possible injury, turn off the mains power supply wall switch, and contact your service office immediately. Fuses blown within 36 hours of being replaced may indicate malfunctioning electrical circuits within the system. Have the system checked by qualified service personnel, and do **not** attempt to replace any fuse. The 120VAC power distribution unit, used for the computer and monitor power supply, should not be placed on the floor.
16. **Electrical Fire** - conductive fluids that seep into the active circuit components of the system may cause short circuits that can result in electrical fires. Therefore, do not place any liquid or food on any part of the system.  
To avoid electrical shocks or burns caused by the use of wrong type of fire extinguisher, make sure that only fire extinguisher approved for use on electrical fires are used.
17. **Explosion Hazard** - do not operate the equipment in the presence of explosive liquids, vapors or gases. Do not plug in or turn on the system if hazardous substances are detected in the environment. If hazardous substances are detected after the system has been turned on, do not attempt to turn off or unplug the system until the area has been evacuated and ventilated.
18. **Implosion Hazard** - do not subject the system to serious mechanical shock, as the Cathode Ray Tube (CRT) can fracture if struck or jarred. This may result in flying pieces of glass and Phosphor coating, that can cause serious injury.
19. **Overheating** - Do not block the ventilation ports of the electronic equipment. Always maintain at least 6 inches (12 cm) clearance around the ventilation ports to prevent overheating and damage to the electronic hardware.

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## Safety Definitions and Symbols Used

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### Safety Definitions

The safety instructions contained in this manual are for the protection of the patient, operator and service personal. They identify hazards that will or may occur if instructions are ignored.

The identified hazards are defined and classified as follows:



#### DANGER

**Danger** is used to identify conditions or actions for which a specific hazard is known to exist. These hazards **will** cause severe personal injury, or result in damage to property if the relevant instructions are ignored.



#### WARNING

**Warnings** are used to identify conditions or actions for which a specific hazard is known to exist, which **may** cause severe personal injury, death or substantial property damage if the instructions are ignored.













#### CAUTION

**Cautions** are used to identify conditions or actions for which a potential hazard may exist, which will or can cause minor personal injury, or property damage if the instructions are ignored.

## IEC Symbols Used

The system may have labels with one or more of the following symbols. These symbols indicate the IEC standards to which the system conforms.

**Table 1-1:**


Symbol	IEC Standard
	Alternating Current
	Protective Earthing Point
	ON / Power
	OFF / Power OFF
	Input Power
	Output Power
	Functional Earth Ground
	Warning, Caution - consult accompanying documents
	Electrical Shock Hazard
	Type B Equipment

---

## System Safety Symbols

The system includes labels with one or more of the following symbols.

**Table 1-2:**

Symbol	Meaning
	Do not insert fingers or hands

## Safety Devices

The imaging system has 3 basic types of safety devices:

- [Emergency Stop Buttons on page 1-8](#) – used by the operator to halt the motorized system motions in cases where there is any possibility of danger to the patient.
- [Collision Sensors on page 1-11](#) – serve to protect against an inadvertent collision or contact between the patient and the detector during imaging procedures
- [3-Axes Patient Table – Lock/Unlock Pedals on page 1-15](#) – used by the operator in emergency situations to evacuate patients
- [Single Axis Patient Table – Lock/Unlock Pedals on page 1-16](#) – used by the operator in emergency situations to evacuate patients

**Important**

The operator must be familiar with the location and operation of all safety devices.



**WARNING**

If there is any possibility of danger to the patient, press one of the emergency stop buttons to halt the motion.

**Important**

The Safety Devices must be maintained and tested on a regular basis according to the procedures described in [Visual Inspection and Safety Device Tests on page 10-49](#).



**WARNING**

Do not place high activity sources close to an uncollimated detector. Sources greater than 0.5 mCi (18.5 MBq) placed within 0.5 m of an uncollimated detector may cause long term image quality defects

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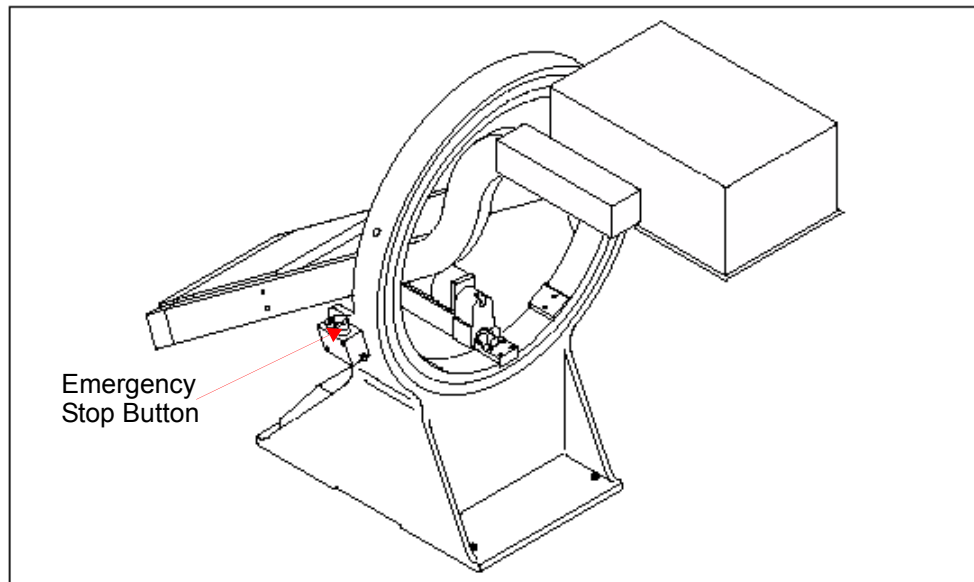
## Emergency Stop Buttons

- MPR: The system is fitted with 4 Emergency Stop (E-stop) buttons strategically located on both the Gantry and Patient Table.
- MPS: The system is fitted with 3 emergency stop buttons (E-stop), two on the gantry and one on the wall.

---

### Gantry E-stop Buttons

The gantry is fitted with two red E-stop buttons located on either side of the gantry ring as shown in [Figure 1-1](#).



**Figure 1-1.** Location of the Gantry E-stop Buttons

Pressing either of the E-stop buttons interrupts power to all motors, stops all motion, and engages the brakes on the motors.

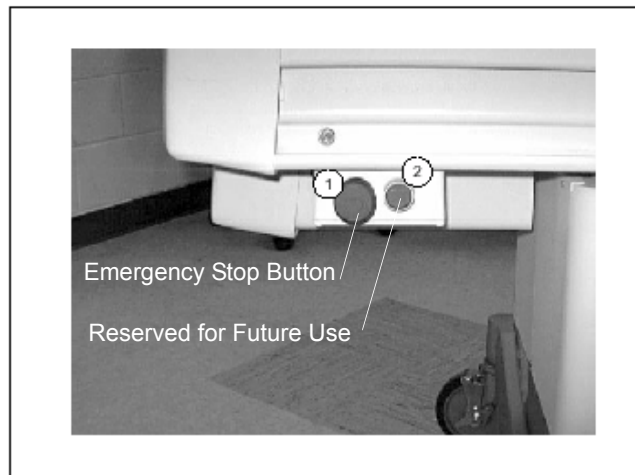
A warning message: ***E-Stop Depressed*** is displayed.

The [E-stop Recovery Procedure](#) is described on [page 1-10](#).

### 3-Axes Patient Table E-stop Buttons (MPR System)

Only the 3-axes Table has E-stop buttons.

There are two red E-stop buttons located on either side of the Patient Table as shown in. Pressing either of the emergency stop buttons interrupts power to the motors, and stops all motion.



**Figure 1-2.** Location of E-stop Buttons on the 3-Axes Table

**Table 1-3:** 3-Axes Table Emergency Stop Button

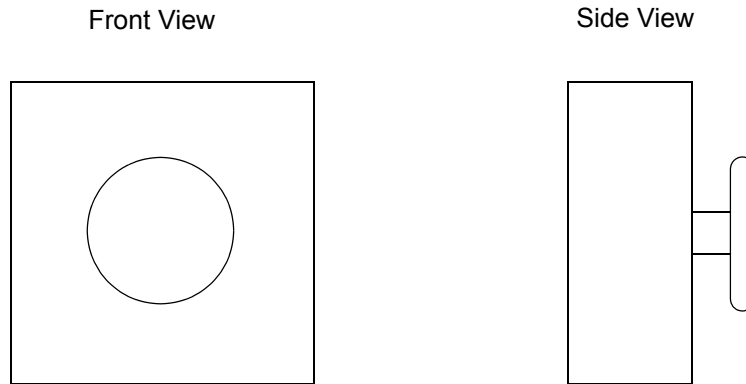
No	Description	Function
1	E-stop button	Interrupts power to all motors and stops all motion. A second Emergency Stop button is located in the same position on the other side of the Patient Table.
2	Future Use button	Currently not functional.

[E-stop Recovery Procedure](#) is described on [page 1-10](#).

---

### External E-stop Button for MPS System

Only the MPS with a single axis table has an external emergency stop (E-stop) button, which should be mounted on the wall next to the operator console.

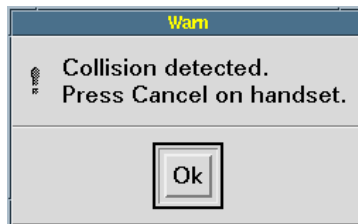


**Figure 1-3.** Wall Mounted E-stop for MPS Systems

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### E-stop Recovery Procedure

After the emergency stop button has been pressed, a warning message is displayed on the screen of the acquisition computer.



**Figure 1-4.** E-Stop Warning Message

To restore functionality to the system:

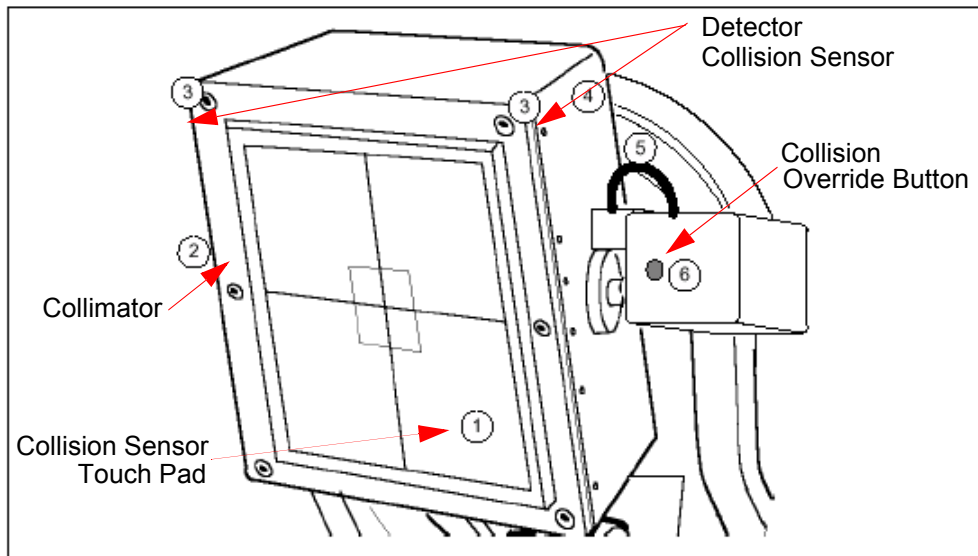
1. Clear the emergency condition before proceeding, including clearing any potential collisions or removing the patient from the system.
2. Reset the emergency stop button by rotating counterclockwise or pulling (depending on the type of E-stop button fitted) until you feel it release.

## Collision Sensors

### Collimator Touch Pad Collision Sensor

The collimator attached to the Millennium MPR/S detector is fitted with a touch pad Collision Sensor which covers the entire front surface and both sides of each collimator. See [Figure 1-5](#)

The collision sensors are designed to protect against an inadvertent collision or contact between the detector and patient (or any other object in the path of the detector) during imaging or detector orientation procedures



**Figure 1-5.** Detector and Collimator Collision Sensors

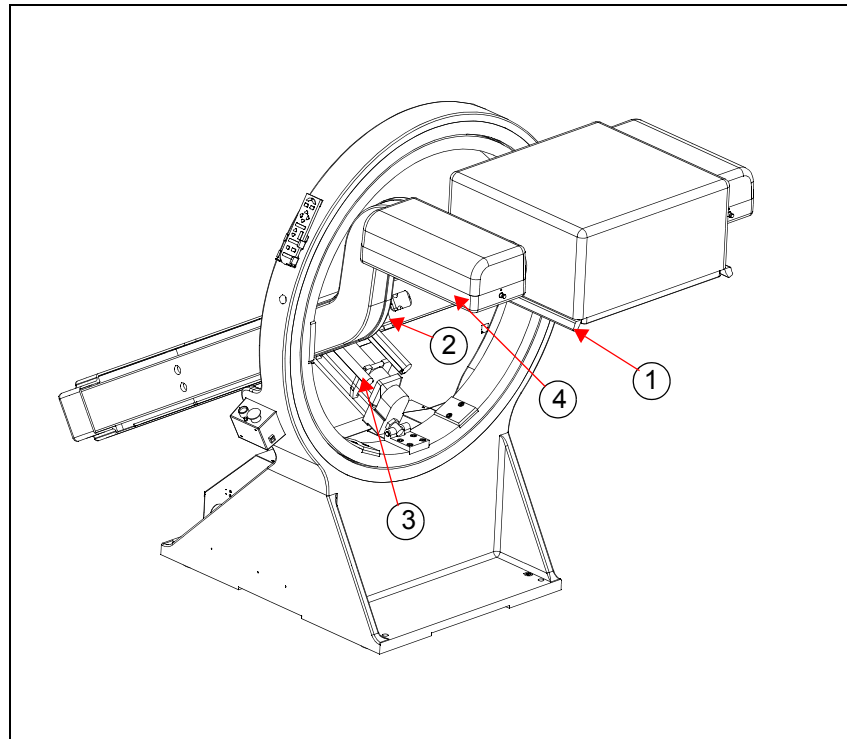
No.	Description	Function
1	Collimator Collision Touch Pad	Stops all gantry and table motion, upon collisions.
2	Collimator	Shield the detector from scatter radiation
3	Detector Collision Sensors	Stops all gantry and table motions upon collision
4	Detector casing	Protects crystal/detector electronics
5	Detector Cable	Houses electronic wiring
6	Collision Override Button	Permits gantry movement, upon collisions.

## Gantry Collision Touch Pad Sensors

There are two collision touch pads mounted on the gantry arms in front of the ring as shown in. These pads cover the parts of the gantry most likely to collide with the patient or table.

The Actuator and Tilt Axis covers are also fitted with collision touch pads.

See [Figure 1-6](#)



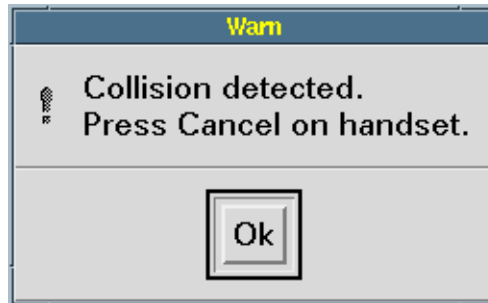
**Figure 1-6.** Collision Sensors

No.	Description	Function
1	Detector Sensors	When depressed, stops the gantry and table movements.
2	Gantry Arm Sensors	
3	Actuator Sensors	
4	Tilt Axis Cover Sensors	

**Important** Collision sensors do not eliminate the need for proper patient positioning. The patient and system must be constantly monitored for possible collisions during all procedures.

If the patient or table comes into contact with one of the collision sensors, power

is interrupted and all motion is stopped. A warning message appears.  
See [Figure 1-7](#)



**Figure 1-7.** Collision Warning

In addition, a buzzer will sound, and the collision activator latches in the **Collision** state.

**Note** Once latched in the *collision state*, subsequent collision activations have no effect on the system

---

### Collision Recovery Procedure

To recover motion after a collision situation, use the following steps

1. Remove the obstacle (patient or table) from the path of the collision sensor.
2. If motorized motion is required, press the <**Collision Override**> button (see [Figure 1-5](#)) and then press the required key on the Hand-held Controller.

**Note** The system will remain in the Collision State even after the obstacle has been removed.

3. Press the Handset <**CANCEL**> button to silence the beep and return the system to IDLE State (no collision).



#### CAUTION

Collision sensors should be tested daily and after every collimator exchange

---

## Collision Sensor Testing

1. Using the handset, set the Gantry in motion and apply pressure to one of the Collision Sensors  
Contact with the Collision Sensor should cause all motion to stop, a buzzer to sound, and the collision activator to latch in the *collision* state.
2. Press the <**Collision Override**> button (see [Figure 1-5](#) on [page 1-11](#)) and then press the required key on the Hand-held Controller; verify that all motions can be activated (the system is still in Collision State).
3. Press the Handset <**CANCEL**> button to silence the beeper and return the system to the IDLE State (no collision).



### WARNING

If for any reason the collision sensors are not functioning correctly, the system should **not** be used until repairs have been carried out.

## 3-Axes Patient Table – Lock/Unlock Pedals

Two locking pedals (one at each end of the table) are located at either end of the Patient Table and are used to lock the patient table to the floor mounted locator plates.

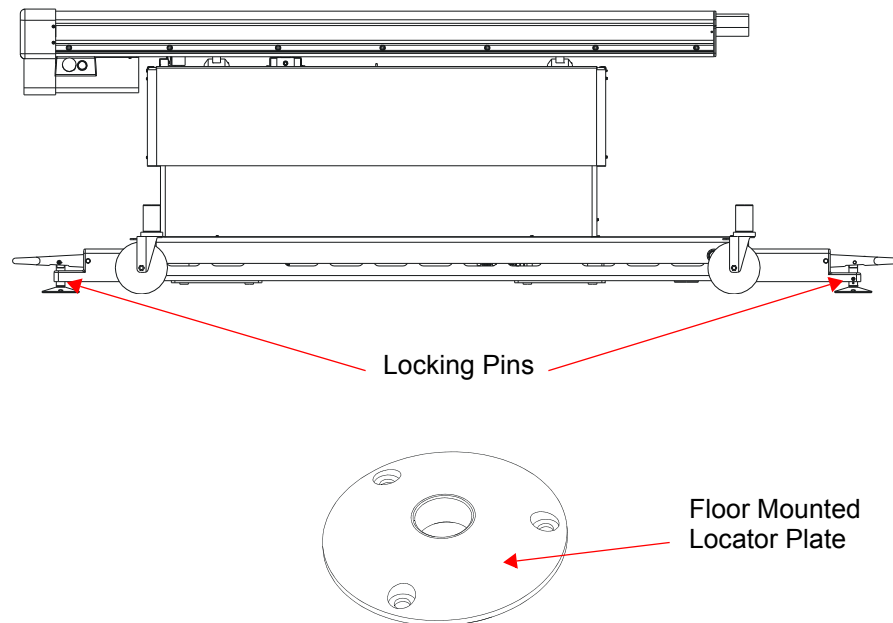
To release the patient table, lift up on one of the locking pedals with your foot until it unlocks with a “click”. The locking pedal will automatically return to its home position releasing the locking pin from the locator floor plate. Repeat the procedure for the other locking pedal.

Once released, the patient table is supported by four self-locking casters, located under the base, and can be easily maneuvered.



### CAUTION

The patient table weighs 370 Kg (820 lbs) unloaded. Take special care when moving the table and limit movement to a slow careful walk.



**Figure 1-8.** 3 - Axis Patient Table (Locking Device)

If the mains power is cut, or control to the gantry is lost, while a patient is underneath the detector, the table can be unlocked and wheeled away from the gantry. Carefully ease the patient past the detector.

Some room arrangements may only allow limited movement of the table. In this case, the operator may need to use the Manual Egress Device option (if available).

In cases where a Manual Egress Device is not fitted, carefully slide the patient along the table surface.

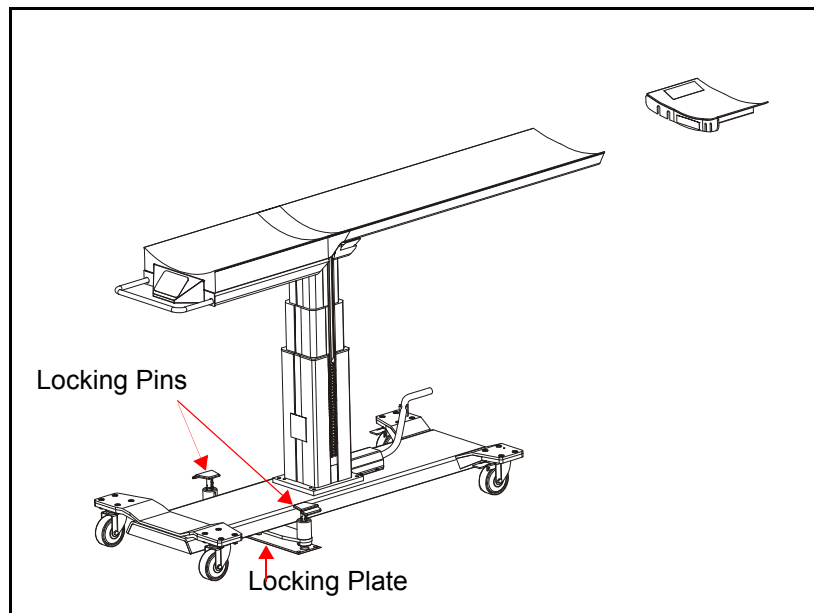


**WARNING**

Moving the table to the full extent of the power cable may cause damage to the cable.

## Single Axis Patient Table – Lock/Unlock Pedals

The Single Axis Patient table is shown in [Figure 1-9](#). Note the locking pedals and locking plate shown in the figure.



**Figure 1-9.** Single Axis Patient Table - Showing Locking Device

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## Patient Safety and Emergency Egress

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### Patient Handling

1. During studies, the table or gantry movements are automatic. Monitor the patient during the entire scan to ensure that there is enough clearance between the patient and the Head.

**CAUTION**

The patient, table and operator should remain clear of the gantry during all transitions. As the detector may be rotate care must be taken that nothing obstructs its path.

**CAUTION**


Do not use Defibrillator while patient is on system table. The table is well grounded thus defibrillation function is not assured.


**WARNING**

Unintended motion could cause Injury. Never leave the patient unattended and always monitor the position of the patient and equipment during scan procedures

2. Potential Pacemaker Hazard - though the possibility of interference with pacemakers is small, the operator should be alert to such a potential hazard from any equipment using high frequency electrical signals
3. Never exceed the rated load of patient handling devices.
4. The user should be aware of system limitations regarding particularly large or overweight patients. Please be aware of any particular system limits or safety precautions and labels regarding large or overweight patients. In

case of doubt, please contact your Vendor.

	<p style="text-align: center;"><b>CAUTION</b></p> <p>Large or overweight patients may encounter difficulties with the physical clearance of the system</p>
---	--

	<p style="text-align: center;"><b>WARNING</b></p> <p>Never exceed the rated load of patient handling devices as this may cause damage to equipment and possible injury.</p>
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## Patient Positioning

The operator should:

- Always assist the patient in getting on or off the table.
- Ensure that the patient is positioned securely on the stretcher, and is not in danger of falling.
- Ensure that the Table's velcro straps are properly secured and that patient's hands and legs do not protrude beyond the limits of the stretcher.

<b>Note</b>
-------------

In case the Velcro straps are too short to secure the patient's arms, use the alternate Arm Security Strap PN 46-229450P1/E8004AE.

- Ensure that patients do not raise their heads or move their bodies during scans.
- Ensure that obstacles do not interfere with the movement of the detector head.
- Ensure that patients are positioned in the Feet-first position for all acquisitions except Brain Scans.
- Advise the patient not to move during the positioning and study procedures



**WARNING**

Make sure that any patient connected lines, tubes etc. are long enough to allow for the full travel of the system, without pulling or restricting

---

## Emergency Egress

System operation may be stopped due to power failure or a safety event (something coming into contact with the collision sensors), or the system may be halted by the operator in response to emergency conditions.

In any case, the operator must first ensure that the patient is safely removed using the appropriate removal procedure.

---

## Patient Removal During Normal Operation

During normal operation, the table and gantry can be controlled from the handset. The patient can be removed using the handset controls to retract the table, lower the table or raise the detector to clear the patient.



### CAUTION

Use of the handset motion keys during a computer controlled scan such as wholebody or tomography may cause the acquisition to stop prior to the desired completion criteria.

---

## Patient Removal During Collision State

If the patient or table collides with a collision sensor, all motions are stopped and disabled. Motion may be re-enabled by pressing the desired handset motion key while simultaneously holding down one of the white **<collision override>** buttons on the detector. As soon as the collision is cleared, motion is enabled.

---

## Patient Removal With Power Removed Or Interrupted

If either the power is removed or control to the gantry is lost, and the patient is underneath the detector, the table can be unlocked and wheeled away from the gantry, taking care to ease the patient past the detector.

Some room arrangements may not provide for substantial movement of the table. In this case, the operator may need to access the patient with the table in its original position or slide the patient along the table surface.

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## Data Safety

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### General

- Verify and record the patient's identification before starting a scan.
- Observe and record the patient's orientation, position and anatomical landmarks before starting a scan. Ensure that the patient is positioned within the scan parameters.

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### Connectivity


When transferring data to a remote station which provides storage commit services, the dataset entries in the Patient Selector are flagged to display their storage commit status where a "C" flag before a dataset entry denotes **Committed**.

When sending to a remote station which does not provide storage commit services, always verify that the data transferred to another system has been correctly received.

## Safe Operation Guidelines

### Moving the System Components

Always check for obstructions before moving the Patient Table, the Operator Console or the Collimator Cart. Special care should be taken not to move these units over cables connected to the Gantry, Patient Table, or Operator Console.

	<p><b>CAUTION</b></p> <p>Do not put hands under table top when moving the table aside.</p>
---	--

### Collimator Carts

Collimators are supplied mounted on a collimator cart, which provides the means to transport the collimator to and from the gantry and store collimators that are not in use. The collimator cart is very heavy. It is important to follow the instructions on the CAUTION notice attached to the cart.

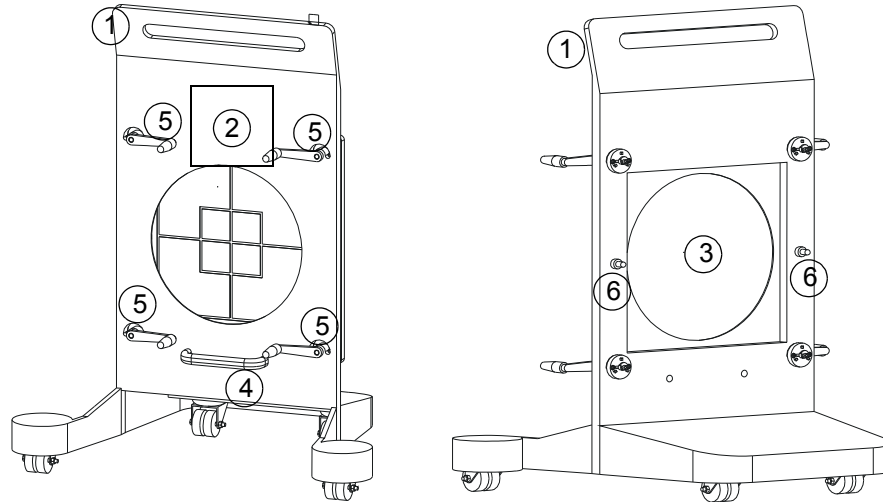


Figure 1-10. Collimator Cart

No.	Description	Function
1 & 4	Maneuvering Handle for hand operation	Used to dock cart to detector head
2	Operating Instructions	Step-by-step procedure for collimator changing
3	Collimator	Shield the detector from scatter radiation
5	Collimator Locking Handles	Lock or release collimator to/from cart
6	Guide pins	Align collimator and cart

## Collimator Exchange

Collimators should be properly installed and firmly secured.

Each time after loading a new set of collimators onto the heads and **before** performing any study, rotate the Gantry for a full rotation (360°) at least, without a patient on the Table, to verify that the collimators are firmly anchored in place.



**CAUTION**

Collision sensors should be tested after every collimator exchange

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## Environmental Protection

GE is committed to the protection of the environment and natural resources. Our devices are manufactured under strict guidelines to prevent contamination of the surrounding water, ground and air.

The packing materials you received your product in, are recyclable. Please ensure that all packing materials are either reused, recycled, or disposed of properly.

The majority of the material in this product (for example, metals, covers, etc.) are recyclable. GE encourages its customers to dispose of the product at the end of its useful life, for recycling, according to the local regulations.

The following parts are hazardous to the environment. They must be segregated and disposed of properly, according to local regulations:

- Batteries
- Lead from Detector Containers
- Scintillation Crystals from Detectors
- CRT Monitor

The WEEE label shown in [Figure 1-11](#) is required in order to comply with the WEEE directive 2002/96/E, indicating that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact the manufacturer or other authorized disposal company to decommission your equipment.”



**Figure 1-11.** WEEE Label

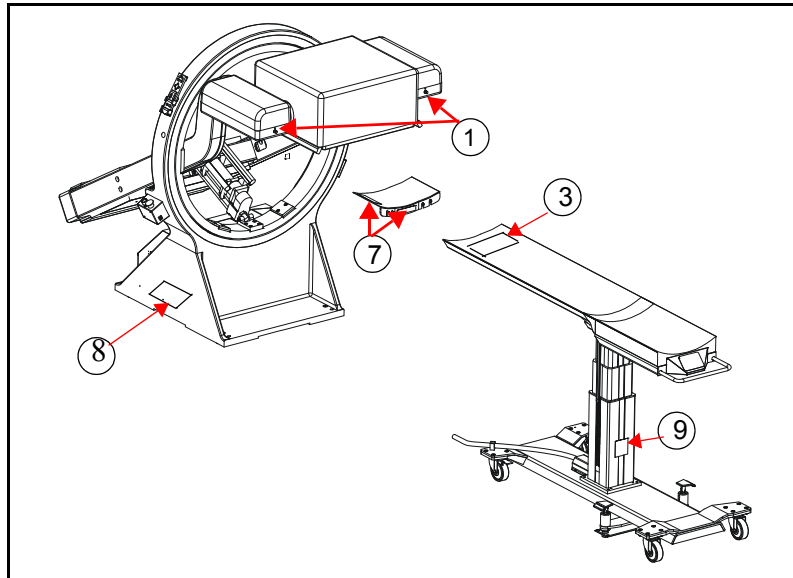
Please contact your nearest GE office for assistance.

## Safety Labels and Rating Plates

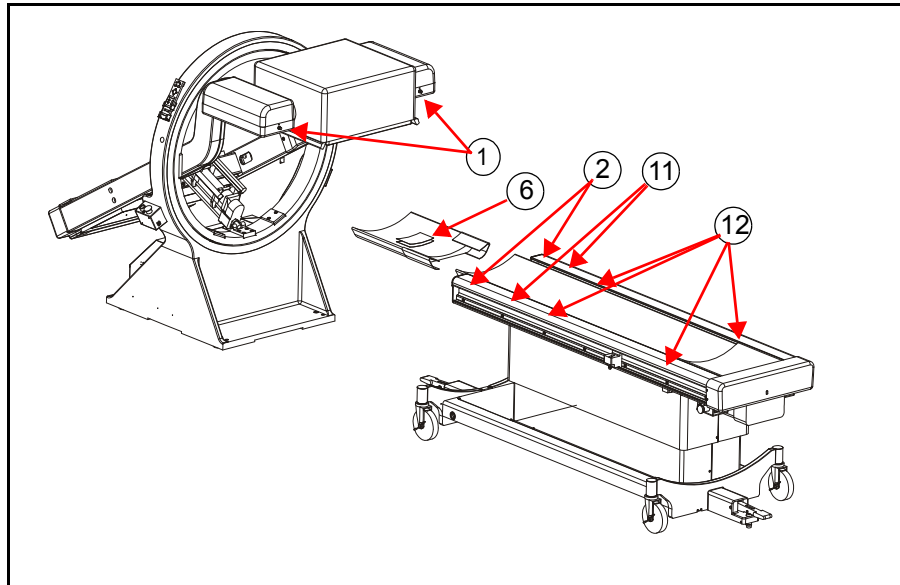
Safety labels and rating plates are located on various parts of the equipment as shown in the following figures:

- [Figure 1-12](#)– depicts the safety labels and rating plates on the gantry and the single axis table
- [Figure 1-13](#)– depicts the safety labels and rating plates on the gantry and the 3-axis table
- [Figure 1-14](#) – depicts the safety labels located on the collimator cart
- [Figure 1-15](#) – depicts the rating plate located on the monitor cart.

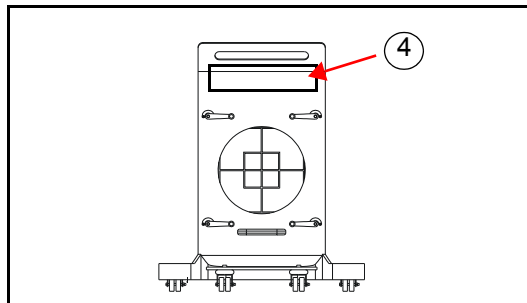
The various safety labels and rating plates are specified in [Table 1-4](#) according to the numbers assigned in the figures listed above.



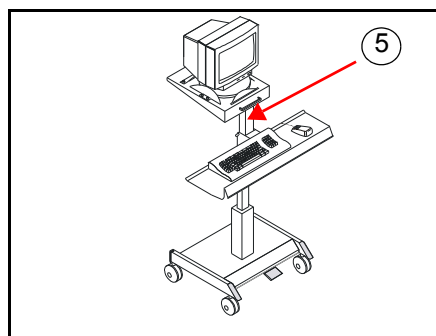
**Figure 1-12.** Warning Labels and Rating Plate Locations on MPS Systems



**Figure 1-13.** Warning Labels and Rating Plate Locations on MPR Systems





**Figure 1-14.** Warning Label Location on the Collimator Carts



**Figure 1-15.** Rating Plate Location on Mobile Cart

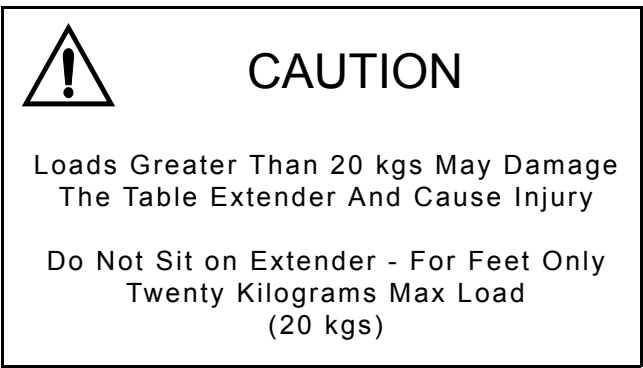
**Table 1-4:** Warning Labels and Rating Plates

Label No.	Label
<p><b>1.</b> Collision Override  (Collision override on gantry tilt covers)</p>	
<p><b>2.</b> Moving Part Caution  (3-axis table side extrusion)</p>	
<p><b>3.</b> Single Axis Table Loading</p>	<p style="text-align: center;"><b><u>WARNING!</u></b>  <b>MAX 80 Kg (176Lb)</b>  <b>AT THIS END</b></p>





**Table 1-4:** Warning Labels and Rating Plates

<p>4. Collimator Cart</p>	<p style="text-align: center;"><b>WARNING</b></p> <p><b>THESE HANDLES RELEASE THE COLLIMATOR</b></p> <p>Failure to follow the operating instructions could cause the collimator to fall and cause serious injury. Before moving, verify that all four latches are engaged.</p> <p style="text-align: center;"><b>CAUTION</b></p> <p><b>THIS UNIT WEIGHS UP TO 140 KG (310 LBS)</b></p> <p>Care must be used when transporting from one area of use to another. Failure to follow these precautions could result in uncontrolled motion and injury to the operator or others.</p> <p><b>ALWAYS:</b></p> <ol style="list-style-type: none"><li>1. Be sure the pathway is clear.</li><li>2. Limit the movement to a slow careful walk.</li><li>3. Use at least two people when moving on inclines.</li></ol>
<p>5. Mobile Cart</p>	<p style="text-align: center;"><u><b>IMPORTANT</b></u></p> <p><b>OPERATING INSTRUCTIONS – THE PNEUMATIC CYLINDER IN THIS UNIT IS DESIGNED AS AN ASSIST IN RAISING AND LOWERING, IT IS NOT INTENDED TO PROVIDE FINGER TIP CONTROL. TO ACTIVATE THE AIR CYLINDER, PLACE BOTH HANDS ON THE KEYBOARD SHELF, SQUEEZE ACTIVATING LEVER, THEN RAISE UNIT TO DESIRED HEIGHT.</b></p>

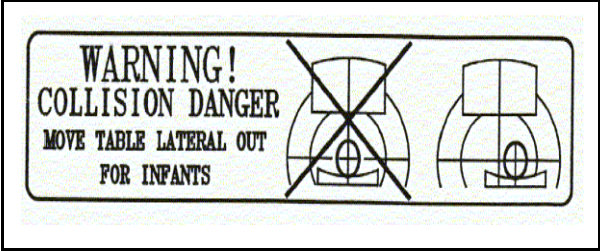
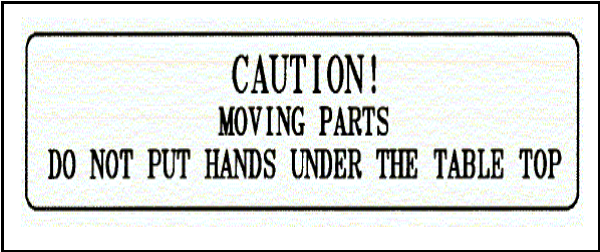
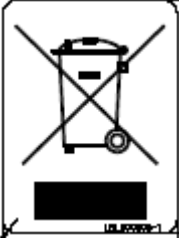
**Table 1-4:** Warning Labels and Rating Plates

<p>6. 3-Axis Table Cradle Extender</p>															
<p>7. Single Axis Table Cradle Extender</p>	<div style="border: 1px solid black; padding: 5px;"> <p>THIS PART, MADE OF METAL, IS AN EXTENSION OF THE STRETCHER. IT IS ONLY FOR THE CONVENIENCE OF THE PATIENT. DO NOT USE FOR IMAGING!</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>CHECK TIGHTNESS BEFORE PLACING PATIENT ON HEAD REST!</p> </div>														
<p>8. IPS Rating Plate</p>	<div style="border: 1px solid black; border-radius: 10px; padding: 10px;"> <p style="text-align: center;"><b>Millennium Integrated Power Supply</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Serial Number:</td> <td style="border: 1px solid black; width: 60px; height: 15px;"></td> </tr> <tr> <td>Date Code:</td> <td style="border: 1px solid black; width: 60px; height: 15px;"></td> </tr> <tr> <td>Weight:</td> <td>125 LBS / 57 KG</td> </tr> <tr> <td>Input Voltage:</td> <td>100/120/200/220/240 VAC</td> </tr> <tr> <td>Frequency:</td> <td>50/60 HZ</td> </tr> <tr> <td>Phase:</td> <td>Single</td> </tr> <tr> <td>Power:</td> <td>988 VA</td> </tr> </table> <p style="text-align: right; font-size: small; margin-top: 5px;">LBL 000693-AA</p> </div>	Serial Number:		Date Code:		Weight:	125 LBS / 57 KG	Input Voltage:	100/120/200/220/240 VAC	Frequency:	50/60 HZ	Phase:	Single	Power:	988 VA
Serial Number:															
Date Code:															
Weight:	125 LBS / 57 KG														
Input Voltage:	100/120/200/220/240 VAC														
Frequency:	50/60 HZ														
Phase:	Single														
Power:	988 VA														

**Table 1-4:** Warning Labels and Rating Plates

<p>9. MPR System Model</p>	<div style="border: 1px solid black; padding: 10px;">  <p><b>GE Medical Systems</b> <b>Millennium MPR</b></p> <p><b>Model</b> [Redacted]</p> <p><b>SER. No.</b> [Redacted]</p> <p><b>Manufactured:</b> [Redacted] </p> <hr/> <p>Manufactured By GE Medical Systems Israel Tirat Hacarmel, Israel For Distribution By General Electric Company Milwaukee, Wisconsin, USA</p> <p style="text-align: right;"><small>LBL500003-1</small></p> </div>
<p>10. MPS System Model</p>	<div style="border: 1px solid black; padding: 10px;">  <p><b>GE Medical Systems</b> <b>Millennium MPS</b></p> <p><b>Model</b> [Redacted]</p> <p><b>SER. No.</b> [Redacted]</p> <p><b>Manufactured:</b> [Redacted] </p> <hr/> <p>Manufactured By GE Medical Systems Israel Tirat Hacarmel, Israel For Distribution By General Electric Company Milwaukee, Wisconsin, USA</p> <p style="text-align: right;"><small>LBL500004-1</small></p> </div>

**Table 1-4:** Warning Labels and Rating Plates

<p><b>11.</b> Infant Safety Label</p>	
<p><b>12.</b> Table Lateral Caution Label</p>	
<p><b>13.</b> WEEE Label</p>	

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## Regulatory Information

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### Standard Compliance

The equipment complies with the IEC 601-1 standard. It is classified as Class 1 Type B equipment, Mode of Operation: Continuous.

This equipment generates and can radiate radio frequency energy. The equipment may cause radio frequency interference to other medical and non-medical devices and to radio communications. To provide reasonable protection against such interference, the camera complies with the emission limits for a Group 1, Class A Medical Devices as stated in EN 60601-1-2. However, there is no guarantee that interference will not occur in a particular installation.

If the equipment is found to cause interference (which may be determined by turning the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem by one or more of the following measures:

- Re-orient or relocate the affected device(s);
- Increase the separation between the equipment and the affected device;
- Power the equipment from a source different from that of the affected device;

and/or

- Consult the point of purchase or service representative for further suggestions

The manufacturer is not responsible for any interference caused by using other than recommended interconnect cables or by unauthorized change or modifications to this equipment.

Unauthorized change or modifications could void the user's authority to operate the equipment.

Do not use devices which intentionally transmit RF signals (cellular phones, transceivers, or radio-controlled products) in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

The medical staff in charge of this equipment is required to instruct technicians, patients, and other people who may be around this equipment to fully comply with the above requirement.

To comply with the regulations on electromagnetic interference for a Group 1, Class A Medical Device, all interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio frequency interference in violation of the local regulations.

Due to installation in less favorable environment, this equipment may be exposed to electromagnetic and electrostatic interference. To ensure a high level of reliability when exposed to such interference, this equipment complies with the immunity requirements as stated in EN60601-1-2. for immunity Class 1. The operating conditions are classified on the basis of performance criteria as defined in IEC 801-2.

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## CE Conformity

This product conforms with the requirements of council directive 93/42/EEC concerning Class IIA medical devices, and therefore bears the CE mark of conformity:



The name and address of the CE Representative appears on the back of the front page of this manual.

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## USA Regulations

- The system was cleared for sale in the USA by the FDA.
- Caution: Federal US law restricts this device for sale by or on the order of a physician.
- In the USA, this system should only be used with FDA-approved radiopharmaceuticals.



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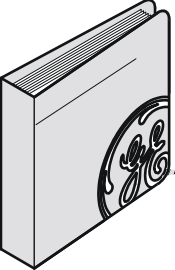
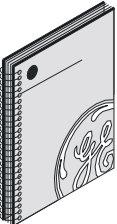
## Chapter 2 - System Overview

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### The Document Set

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#### Description

	<p><b><i>Millennium MPR/MPS Operator's Reference Manual</i></b></p> <p>This manual describes the functions of the Millennium MPR/MPS System and GENIE Acquisition in detail. It also contains a comprehensive glossary of terms and a master index for the complete documentation set.</p> <p><b>Use this Manual if you:</b></p> <ul style="list-style-type: none"><li>• Are a first time user who needs to find out the system components, their functions and how to use them.</li><li>• Need complete detailed reference information on a function or component</li></ul>
	<p><b><i>Millennium MPR/MPS Operator's Guide</i></b></p> <p>This manual provides step-by-step procedures for typical acquisition, display, and networking tasks.</p> <p><b>Use this manual if you:</b></p> <ul style="list-style-type: none"><li>• Want to know what steps to take to perform routine procedures.</li><li>• Are an experienced Millennium MPR/MPS and GENIE Acquisition user familiar with their structure and functions.</li></ul>

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## Chapter Overview

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### Description

This chapter provides an overview of the Millennium MPR/MPS system, and covers two main topics:

- [Intended Use on page 2-3](#), which explains the functions for which the Millennium MPR/MPS was designed.
- [System Components on page 2-4](#) which provides a description of main components of the Millennium MPR/MPS system.

**Important**

Ensure that the operating instructions (this manual) are kept with the system at all times.

**Note**

It is important to periodically review the safety procedures in [Chapter 1](#).

---

## Intended Use

Millennium MPR, MPS comprise a range of fully integrated systems for acquisition and display of Nuclear Medicine data. The Millennium MPR, MPS systems are intended for use as diagnostic imaging devices. When used with appropriate radiopharmaceuticals, the system produces images that represent the internal cardiac distribution of radioactivity.

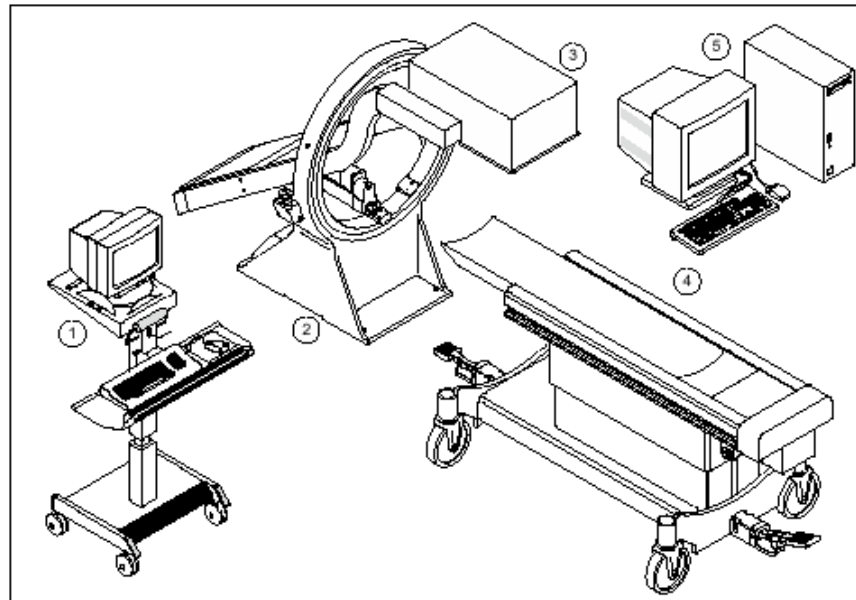
The system acquires data for all types of routine Nuclear Medicine studies, including static, dynamic, multigated, whole body, tomographic and multigated tomographic images. In addition, the system allows the operator to display the images for review, and transfer them to a GENIE or eNTEGRA Processing and Review workstation (also referred to as P & R system) for further processing, filming and archiving.

## System Components

The Millennium MPR/MPS system can be configured to fit a variety of Nuclear Medicine data acquisition needs, such as:

- Single detector planar imaging
- Dedicated whole body scanning
- Circular and elliptical tomographic acquisitions
- General purpose system to acquire the full range of Nuclear Medicine data

A Millennium MPR/MPS system consists of a detector, gantry, patient table and an acquisition computer. The detector, gantry and patient table are all controlled from the dedicated acquisition computer. In addition, all detector, gantry and table movements can be controlled from a handset.



**Figure 2-1.** Millennium MPR/MPS System Components

**Note**

The Table in the drawing above belongs to the MPR system. The Table for the MPS system is shown in [Figure 2-4](#).

**Table 2-1: Millennium MPR/MPS System Components**

No.	Description	Function
1	GENIE Acquisition	Personal computer used to set-up camera acquisitions.
2	Ring Gantry	Supports the camera and permits a full range of scans.
3	Detector	A square or rectangular camera used to detect gamma radiation.
4	Table	There are two patient tables: <ul style="list-style-type: none"> <li>• 3-Axis Table – basic for MPR systems</li> <li>• Single Axis Table – basic for MPS systems</li> </ul>
5	Processing Workstation	Workstation used to process and review acquisitions.

---

## Detectors

The Millennium system can be configured with two types of detectors:

- Rectangular (fitted to MPR systems)
- Square (fitted to MPS systems)

Both square and rectangular detectors are designed to detect gamma radiation and send the spatial and energy information to the acquisition computer.

Either detector, when mounted on the ring gantry, caters for a wide range of Nuclear Medicine needs.

### The MPR System

This system is supplied with a rectangular detector fitted to a floor mounted gantry. The rectangular detector is equipped with 48 photomultiplier tubes and has a 520 mm x 370 mm field of view. It provides increased capability for static, dynamic, multigated, tomographic and multigated tomographic studies, as well as for whole body studies.

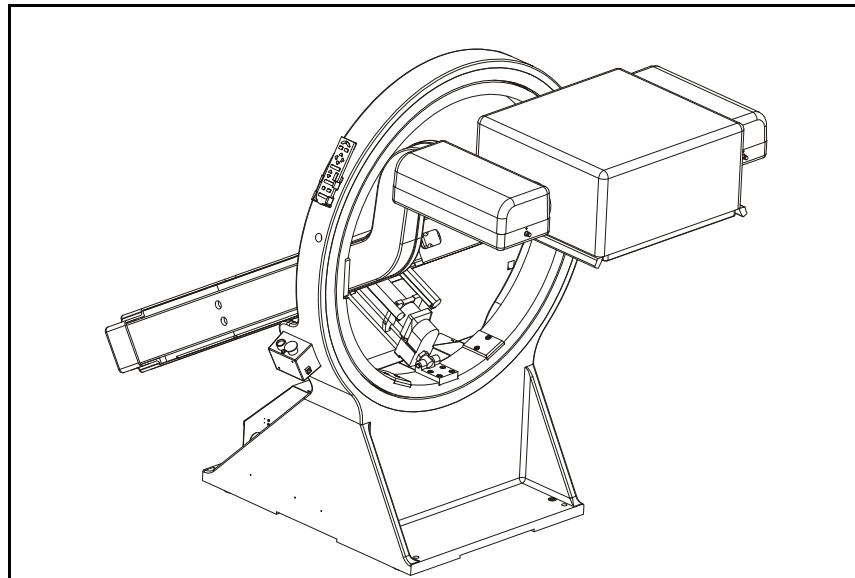
The system can either be setup for circular or elliptical tomographic acquisitions. Whole body acquisitions are carried out by scanning the patient with the table perpendicular to the gantry arms.

### The MPS System

This system has a square detector fitted to a floor mounted gantry. The square detector is equipped with 36 photomultiplier tubes and has a 370 mm x 370 mm field of view. It provides a cost effective solution for static, dynamic, multigated, whole body, tomographic and multigated tomographic studies.

### The Ring Gantry

The ring gantry facilitates the full range of Nuclear Medicine scans when combined with the appropriate patient table. The parallel arms that support the detector are mounted within a ring and are curved to allow closer positioning to the patient. The mounting and counterbalance are designed for easy and precise positioning of the detector. The ring gantry gives full control of detector rotation around the patient.



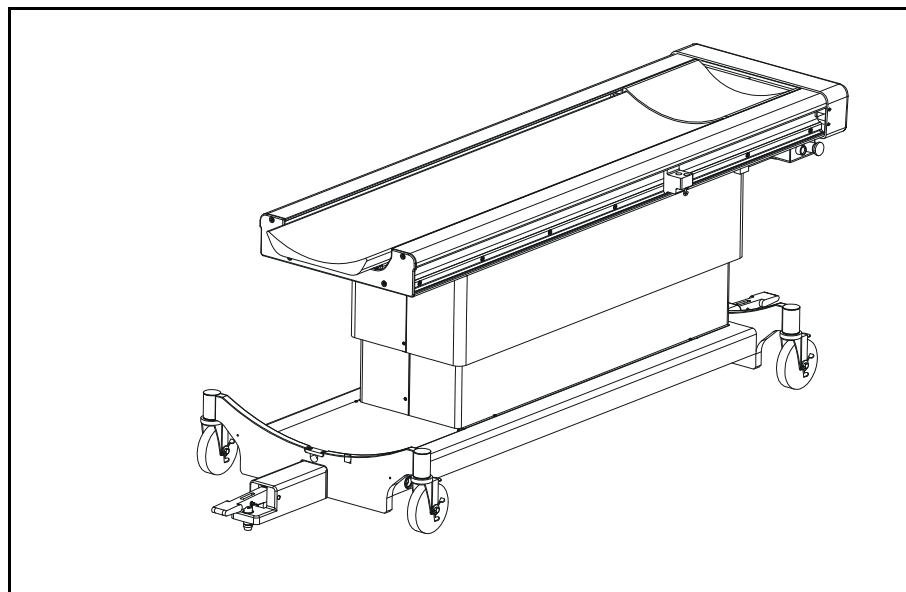
**Figure 2-2.** Ring Gantry

### 3-Axis Patient Table – (basic for MPR Systems)

The table supports the patient for general planar imaging and, additionally, allows circular and elliptical tomographic scanning, as well as whole body scanning. The table is supported on four locking casters for easy movement. Accurate table positioning is obtained by locking the table to the floor with two locking pins, one at each end of the table.

The table provides motorized motion in three axes, the vertical, the longitudinal and the lateral. The table is positioned using the handset only.

It supports patients up to 181 Kg (400 lbs)



**Figure 2-3.** 3-Axis Patient Table

When doing whole body studies on a MPR system, the table can be locked perpendicular to the gantry arms so that the longest axis of the rectangular detector lies across the width of the patient. This arrangement maximizes the detector resolution for whole body scanning.

For tomographic studies, the table can be locked parallel to the gantry arms so that the longest axis of the detector lies along the line of the patient's body. This arrangement makes best use of the detector resolution for tomographic imaging, especially with the rectangular detectors.

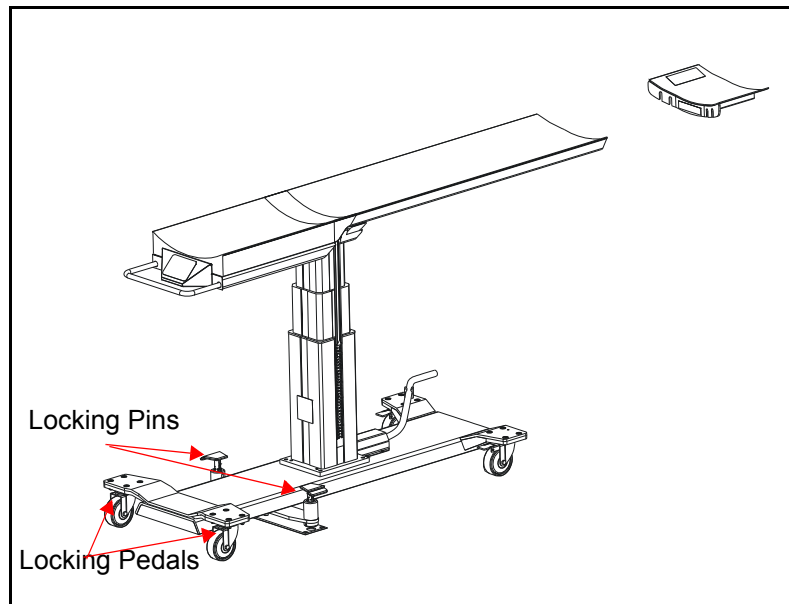
## Single Axis Patient Table - MPS System

The table supports the patient for general planar imaging and, additionally, allows circular tomographic scanning. The table is supported on four locking casters for easy movement. Accurate table positioning is obtained by locking the table to the floor with two locking pins, one on each side of the table.

The table provides motorized motion in the vertical axis only and can be positioned using the handset only. Limited forward/backward movement is possible by releasing the locking pedals on the rear wheels and sliding the table manually.

For all studies, the table is locked parallel to the gantry arms.

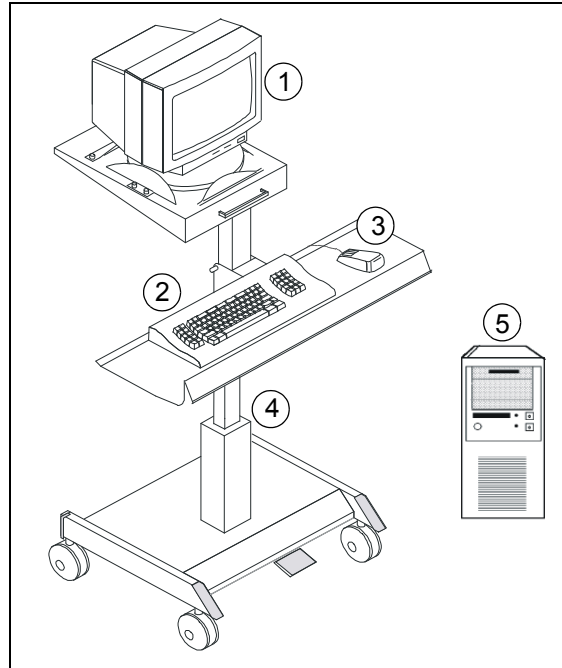
**Note:** Whole body studies are not possible on the MPS system.



**Figure 2-4.** Single Axis Patient Table

## Acquisition Computer

The acquisition computer is a specially modified PC with a color monitor, standard keyboard, mouse and computer cabinet. The monitor, keyboard, and mouse are mounted on a mobile stand that allows it to be operated from a standing or seated position. The mobile stand is supported on four self-locking casters for convenient positioning near the gantry.



**Figure 2-5.** Acquisition Computer on Mobile Stand

**Table 2-2:** Acquisition Computer Components

No.	Description	Function
1	Monitor	Displays images and acquisition information.
2	Keyboard	Used to set up the acquisition and enter patient information.
3	Mouse	Alternative to the keyboard; uses point and click interface.
4	Mobile Stand	Holds the monitor, keyboard and mouse.
5	Computer Cabinet	Contains the computer electronics used to run the system.

The 17" color monitor displays images and acquisition information and contains the graphical user interface used to operate the system. The keyboard is used to set up the acquisition and enter patient information.



**CAUTION**

Do not place any items on top of the monitor to avoid blocking the ventilation which could cause damage.



**CAUTION**

Do not load non-system software onto GENIE Acquisition. Running non-system applications may interfere with GENIE Acquisition operations.

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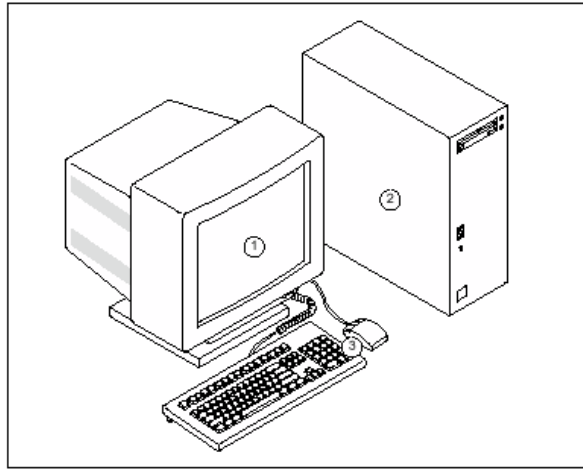
## Process and Review Workstation

The Processing and Review workstation is a computer with a color monitor, standard PC keyboard, mouse and computer cabinet.

The color monitor displays images and processing information, as well as the graphical user interface used to operate the system. The keyboard is used to set up processing, image manipulations and run the P&R protocols. The mouse provides an alternative to the keyboard for interacting with the graphical user interface on the P & R workstation. Processing, manipulation and protocol functions can be selected on the screen using a standard "point-and-click" operation.

**Note**

The P&R workstation may vary in appearance from one system to the another.



**Figure 2-6.** Acquisition Computer Components

No.	Description	Function
1	Monitor	Displays the Genie Graphical User Interface
2	CPU Cabinet	Contains a computer, hard disk drive, CD-ROM, and Genie software.
3	Keyboard and mouse	Allows user input.

## System Accessories

Several accessories are available to extend the usefulness of the Millennium MPR/MPS system. These accessories are described in more detail in [Chapter 9](#).

- R-wave Trigger – for multigated cardiac scans
- R-wave Recorder – for multigated cardiac scans
- Headholder and mounting panel – for brain tomography
- Patient straps
- Additional handsets
- Fillable Flood Phantom



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## Chapter 3 - System Components and Features

**Note**

Read [Chapter 1 - Safety and Regulatory Information](#) prior to using the system.

---

### Chapter Overview

This chapter provides a detailed description of the components of the Millennium MPR/S systems and their operation and describes:

- The detector, collimators and collision touch plate.
- The types and features of collimators on the Millennium system.
- The motion and acquisition controls available from the handset.
- The motions and operator controls used to position and set up the ring gantry.
- The motions and operator controls used to position and set up the Millennium MPR/S table, including the different scanning configurations.
- The Emergency Stop buttons and how to perform the emergency stop recovery procedure.
- The acquisition station components, controls and adjustment procedures

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## Detector

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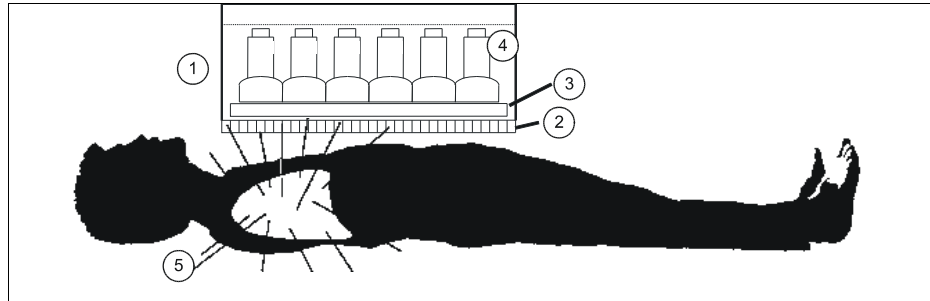
### Overview Of Detector Operation

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The MPR system has a rectangular detector, while the MPS system has a square detector. In all other aspects, except for the form and size, the of the two systems are alike.

The detector is used in association with a radioisotope labeled to pharmaceuticals to give information on spatial distribution of the isotope within the patient. The detector senses incoming gamma rays and provides position and energy output data that is sent to the acquisition computer for conversion, storage and display. The detector operate in the following manner:

1. Before an acquisition starts, the acquisition computer provides the detector with calibration and tuning information, as appropriate for the radiopharmaceutical that is to be used.
2. Gamma ray photons, originating from the radiopharmaceuticals within the patient's body, pass through the collimator mounted on the front of the detector. The collimator ensure that, as far as possible, a photon that hits the detector can be related directly to its originating position within the patient's body. This process is shown in [Figure 3-1](#).
3. Once an incident gamma ray photon has passed through the collimator, it interacts with the Sodium Iodide (NaI) crystal. This interaction produces visible light (known as "scintillations") within the crystal. The amount of light produced in the crystal is proportional to the energy of the gamma ray photon.
4. The visible light is detected by an array of photomultiplier tubes, mounted behind the crystal. There are 36 photomultiplier tubes in the square detector and 48 tubes in the rectangular detector.
5. The photomultiplier tubes amplify the scintillations in the crystal and provide a signal that is large enough to be useful to the detector electronics. The analog signals from the photomultiplier tubes are converted to digital and sent to the acquisition computer which can then display an image which closely resembles the distribution of the radiopharmaceutical within the patient.
6. The detector produces a digital X, Y, and E signals known as an event, for each gamma ray photon it detects. X and Y correspond to the spatial coordinates of the event. E is the energy of the gamma ray photon.



**Figure 3-1.** Detection of Gamma Ray Photons

**Table 3-1:** Gamma Ray Photons Detection Components

No.	Description	Function
1	Detector	Produces signals.
2	Collimator	Defines the detector view direction.
3	Crystal	Produces visible light (scintillations).
4	Photomultiplier tubes	Amplifies scintillations and provides signals.
5	Gamma ray photon	Radioactive emission.



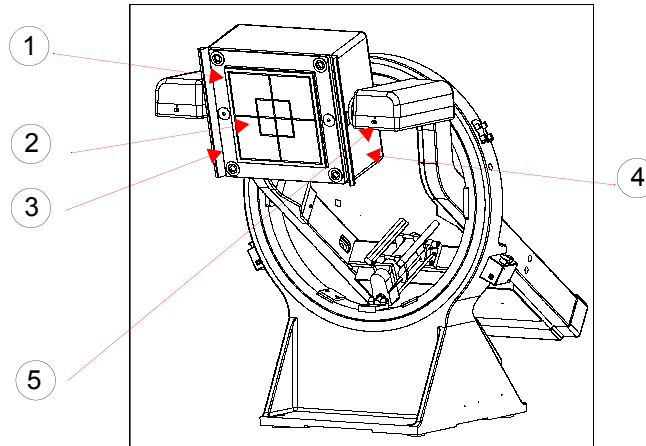
**WARNING**

Do not place high activity sources close to an uncollimated detector. Sources greater than 0.5 MPR/Si (18.5 MBq) placed within 0.5 m of an uncollimated detector may cause long term image quality effects.

The Millennium MPR/S detector specifications are as follows:

**Table 3-2:** Millennium Detector Specifications

Detector	Rectangular	Square
NaI crystal dimensions	402 mm x 558 mm	402 mm x 402 mm
Field of View	370 mm x 520 mm	370 mm x 370 mm
Number of photomultiplier tubes	48	36
Energy range	55 to 400 KeV	55 to 400 KeV



**Figure 3-2.** Square Detector

**Table 3-3:** Square Detector Components

No.	Description	Function
1	Collimator	Shields the detector from scatter radiation.
2	Collimator collision touch pad	Stops all gantry and table motions upon collision.
3	Detector collision sensor	Stops all gantry and table motion upon collision.
4	Detector casing	Protects crystal/detector electronics.
5	Collision override button	Permits gantry movement upon collision

## Detector Cables

The detector cable provides the following connections:

- Power from the gantry base.
- Communications and data from and to the GENIE acquisition computer.

All cables are routed through the gantry arms to the gantry base.

**Note**

Detector cables carry high voltage and are potential electric shock hazards. Detector cables should only be disconnected by qualified service personnel.

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## Collision Sensors

The Millennium MPR/S detector is fitted with two collision sensors as shown in [Figure 3-2](#).

There is one collision sensor on either side of the detector and along the edge next to the collimator. These sensors protect against an inadvertent collision between the patient and the detector during normal imaging procedures.

If a patient or table collides with one of the sensors, power is interrupted and all motion is stopped. The obstacle (patient or table) must be moved away from the site of the collision before any motorized motion can proceed.

If a collision occurs during an acquisition with the detector in a stationary position, the acquisition will continue to completion. If a motion is required to complete the acquisition, then the following collision recovery procedure must be followed.

**Important**

Collision sensors do not replace the need for proper patient positioning and monitoring. Always monitor your patient and system for potential collisions during scanning.

**WARNING**

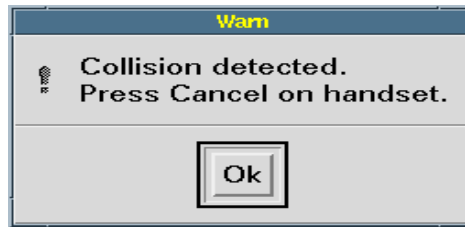
The collision sensors will not protect against collisions with the unprotected parts of the detector and gantry arms. Always monitor patient and system for potential collisions during positioning and scanning. If necessary, use the E-Stop to prevent collisions.

**CAUTION**

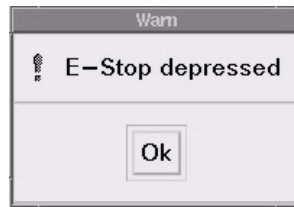
Collision sensors should be tested daily and after every collimator exchange.

## Collision Recovery Procedure

Depending on when the collision situation occurred, different warning or information pop-up messages will appear (examples are displayed in [Figure 3-3](#) and [Figure 3-4](#)).



**Figure 3-3.** Collision Warning



**Figure 3-4.** E-Stop Warning

Activation of the collision sensor causes the system to latch in the *collision state*. While in this state, a buzzer sounds until the <CANCEL> button on the handset is pressed.

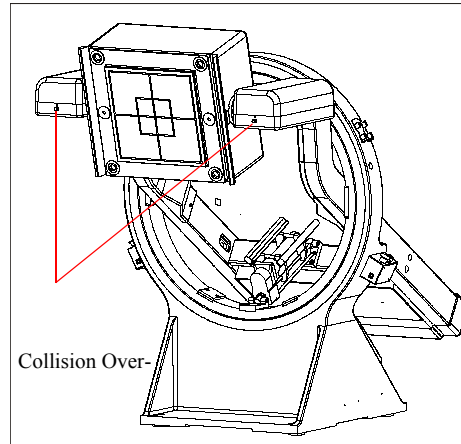
If the collision state occurred during acquisition, the [Quit], [Camera On], [Store], and [Resume] buttons will appear, as shown in [Figure 3-5](#).



**Figure 3-5.** Acquisition Control Buttons

To recover motion after a collision situation, use the following steps:

1. Remove the obstacle from the path of the collision sensor.
2. Activate one of the two **Collision Override** buttons located on the gantry arms either side of the detector as shown in [Figure 3-6](#). All motions under collision override remain as normal. However, the system is still in Collision State.
3. Press the Handset <CANCEL> button to silence the beep and return the system to IDLE State (no collision)



**Figure 3-6.** Collision Override Buttons

4. If the collision state occurred during acquisition:  
To continue the acquisition, click on the **[Resume]** button.

If the patient position has changed significantly, click on the **[Camera On]** button to reposition and restart the scan.

If enough of the scan was completed, click on **[Store]** to stop the acquisition and save the already acquired data.

To terminate the scan click on **[Quit]**.



**WARNING**

Patient injury or equipment damage is possible. Before activating the override and handset buttons, verify that this activation will only produce movement away from the collision point.

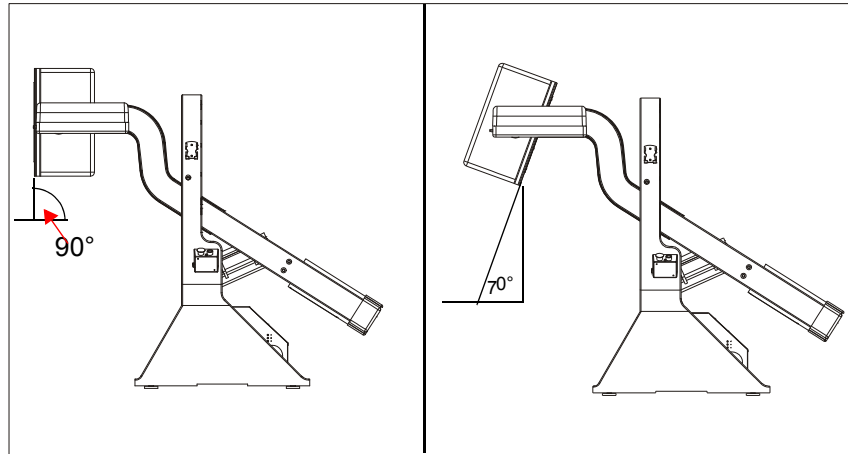


**WARNING**

Patient scans should not be run with the collision override button depressed. Pressing the collision override button disables the collision sensors and may result in serious injury to the patient if the system collides with the patient.

## Detector Tilt

The detector can be tilted between  $+90^\circ$ , with the detector facing away from the gantry and  $-70^\circ$  as shown in [Figure 3-7](#). The detector tilt is considered to be in the home position when it is at  $0^\circ$ . If gantry rotation is also at  $0^\circ$ , the detector face will be parallel to the floor in the home position.



**Figure 3-7.** Detector Tilt

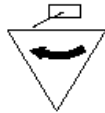
## Tilt Positioning

The tilt of the detector is primarily adjusted using the handset.

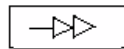
**Increase tilt:** Press and hold this button to increase the tilt of the detector. This causes the detector to face **away** from the gantry.



**Decrease tilt:** Press and hold this button to decrease the tilt of the detector. This causes the detector to face **toward** the gantry.



Pressing either tilt button alone will move the detector at low speed. To move the detector at high speed, press the speed button simultaneously with the tilt button. Release the button(s) when the desired position is obtained.



The detector tilt can be automatically set to 0° by GENIE Acquisition when setting up for whole body or tomographic scans. The detector tilt is also automatically positioned by GENIE Acquisition when using some of the pre-programmed moves:

- **Home Position:** Detector tilt moved to 0°
- **Detector Under Table:** Detector tilt moved to 0°
- **Collimator Changeout:** Detector tilt moved to 90°




**Figure 3-8.** Gantry Button

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## Collimators

The collimators are mounted on the face of the detector, immediately in front of the crystal.

Collimators restrict photons to those traveling in the direction of the holes while shielding the detector from unwanted photons traveling in other directions. The collimator permits the pattern of scintillations in the crystal to correspond to the distribution of the radiopharmaceutical being imaged.

	<p style="text-align: center;"><b>WARNING</b></p> <p>Do not attempt to operate the gantry without a collimator secured to the detector.</p>
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## Available Square Collimators

The following table shows the collimators that are available for Millennium MPR/S detectors:

**Table 3-4:** Square Detector Collimators

Collimator Type	Color	Abbreviation	Weight
Low Energy General Purpose	Blue	LEGP	43 kg
Low Energy High Resolution	White	LEHR	42 kg
Medium Energy General Purpose	Black	MEGP	63 kg
High Energy General Purpose	Brown	HEGP	97 kg
Low Energy Ultra High Sensitive	Yellow	LEUHS	40 kg
Low Energy Pinhole	Black	LEPINH	50 kg

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**Available Rectangular Collimators****Table 3-5:** Rectangular Detector Collimators

<b>Collimator Type</b>	<b>Color</b>	<b>Abbreviation</b>	<b>Weight</b>
Low Energy General Purpose	Blue	LEGP	52 kg
Low Energy High Resolution	White	LEHR	52 kg
Medium Energy General Purpose	Black	MEGP	83 kg
High Energy General Purpose	Brown	HEGP	97 kg
Low Energy Ultra High Sensitive	Yellow	LEUHS	49 kg

## Collimator Carts

The collimator cart is used to transport the collimator to and from the gantry as well as to store the collimators that are not in use. The collimator cart and the collimator exchange procedure are designed to allow collimators to be swapped in a safe manner and efficient manner.

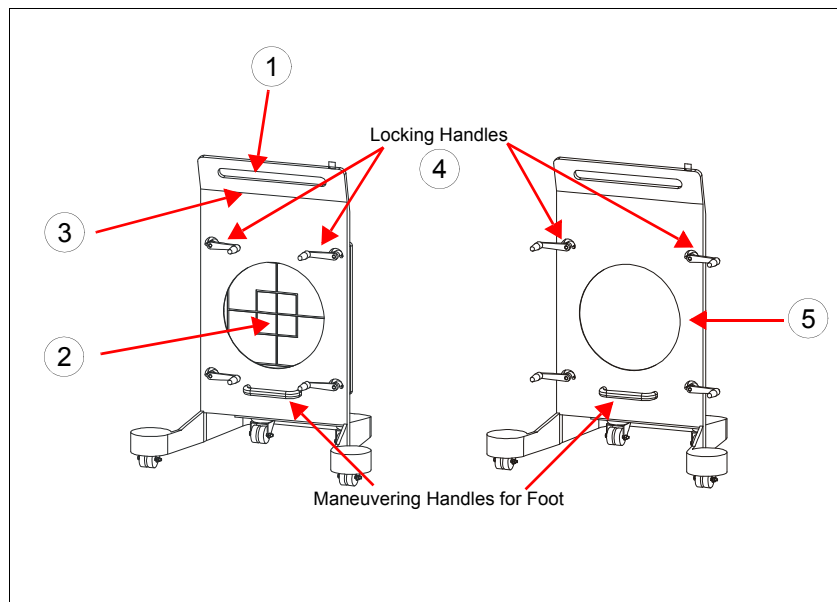
### CAUTION

#### THIS UNIT WEIGHT UP TO 270KG (596 LBS)

Care must be used when transporting from one area of use to another. Failure to follow these precautions could result in uncontrolled motion and injury to operator or others.

#### ALWAYS:

- Be sure the pathway is clear.
- Limit the movement to a slow careful walk.
- Use at least two people when moving on incline.

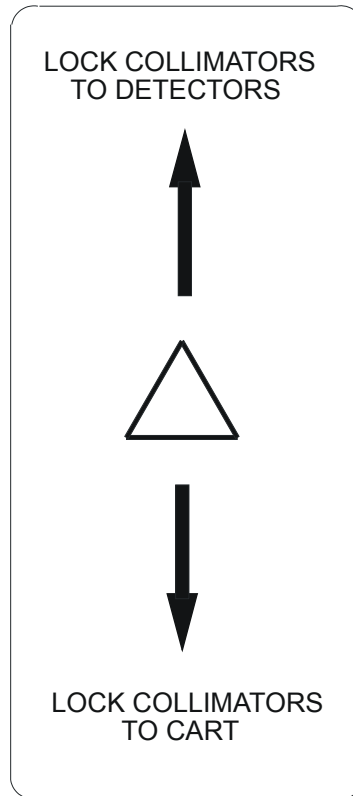


**Figure 3-9.** Collimator Cart Handles

**Table 3-6:** Collimator Cart Components

<b>No.</b>	<b>Description</b>	<b>Function</b>
1	Maneuvering handle for hand operation	Used to dock cart to detector head.
2	Collimator	Defines the detector view direction.
3	Operating instructions	Show handle direction for locking the collimators to the cart or gantry.
4	Collimator locking handles	Lock or release collimator with cart.
5	Guide pin	Align collimator and cart to the gantry and the detector.

Instructions for operating the collimator cart are located on the top of the cart. Those instructions are shown in [Figure 3-10](#).



**Figure 3-10.** Operating Instructions on Collimator Cart

When not in use, the collimators are stored attached to the carts. Multiple collimator carts can be stacked together to minimize the storage page occupied.

---

## Collimator Exchange Procedure

For detailed instructions on changing collimators refer to [Collimator Changing on page 7-10](#).

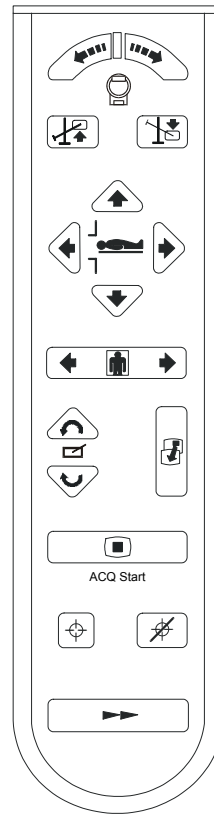
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## Handset

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### Overview

The handset provides a convenient means of moving and positioning the gantry, table and detector. In addition, it has buttons that can be used to start an acquisition, clear the persistence, and answer messages in pop-up boxes.



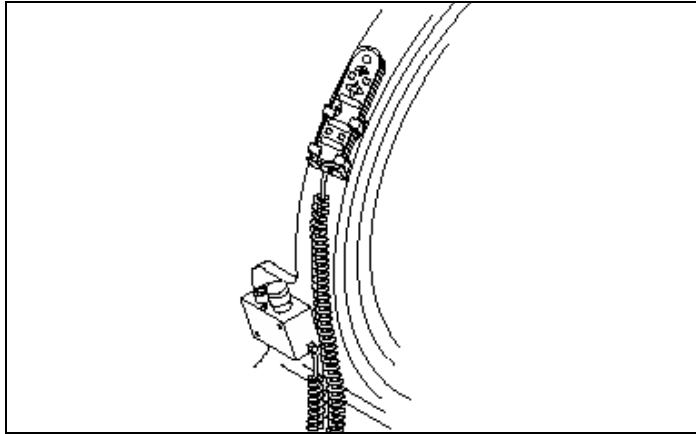
**Figure 3-11.** Handset

The handset is a small box with buttons on one side. The handset cable connects to the gantry or table by plugging into a jack. There are five jacking points for the handset: one on either side of the gantry, one on either side of the far end of the patient table and one in the gantry base which is used primarily for service. When not in use, the handset is stored in a holder on the side of the gantry.

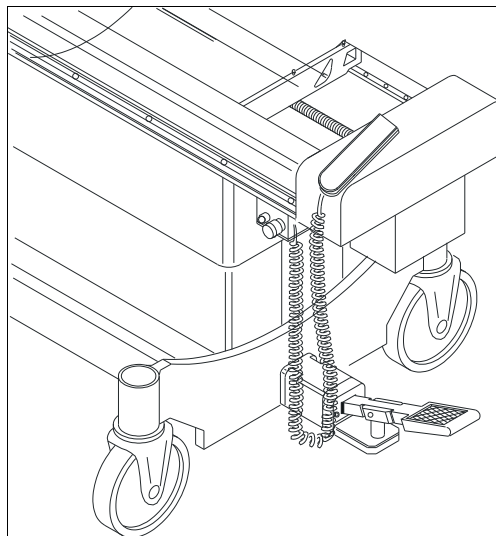


**CAUTION**

If the handset appears not to work or shows a flashing spot, check that the connector cable is fully inserted into a jacking point on the gantry, or on the table. If this fails to correct the fault, contact your GE service representative.



**Figure 3-12.** Location of Handset Holder on Gantry



**Figure 3-13.** Location of Handset on Table

To use the handset, remove it from the holder and hold it in one hand. A function or motion is activated by pressing the button with steady finger pressure and deactivated by releasing the pressure.

## Handset Buttons

The following table explains the function and operation of each handset.

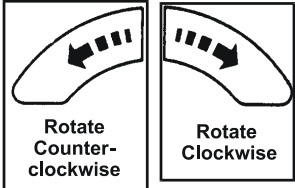
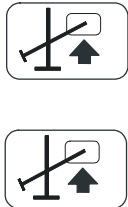
All motorized motions operate between set positional limits. When a handset button is pressed, the detector, gantry or table will only move if the motion lies within the set limits. See [Chapter 11 - System Specifications](#) for more detailed information about these limits and the speed of the motions.



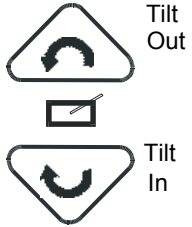
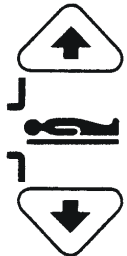


### CAUTION

To prevent collisions, always monitor the position of the patient and system hardware when the system is moving.




**Table 3-7:** Handset Function and Operation

	<p><b>Gantry Rotate Buttons</b></p> <p>Rotate the gantry clockwise and counterclockwise. The gantry can rotate from <math>-270^\circ</math> to <math>+270^\circ</math>, or one and a half complete revolutions. In keeping with the convention for SPECT scans, the clockwise direction is defined for the gantry when viewed from the patient table side.</p>
	<p><b>Gantry Radius Buttons</b></p> <p>Increase radius moves the detector away from the patient and table. Decrease radius moves the detector towards the patient and table. The gantry radius can be set from 0 mm to 350 mm, measured from the axis of rotation through the center of the ring.</p> <p>Note: It is best to think of gantry radius as moving the detector in or out, relative to the patient. Thinking of gantry radius as 'up' and 'down' could be confusing when the gantry is rolled by <math>180^\circ</math> and 'up' and 'down' become reversed.</p>

**Table 3-7: Handset Function and Operation (Continued)**

	<p style="text-align: center;"><b>Detector Tilt Buttons</b></p> <p>Use these two buttons to tilt the detector in or out.</p>
	<p style="text-align: center;"><b>3 Axis Table Vertical Buttons</b></p> <p>Move the table up and down. The table height can vary from 610 mm to 863 mm, measured from the floor.</p> <p style="text-align: center;"><b>1 Axis Table Vertical Buttons</b></p> <p>Move the table up and down. The table height can vary from 680 mm to 980 mm, measured from the floor.</p>
	<p style="text-align: center;"><b>3 Axis Table Longitudinal Buttons</b></p> <p>Extends and retracts the top of the table. The table position can vary from 0 mm to 1570 mm, measured from the fully withdrawn position of the table.</p>
	<p style="text-align: center;"><b>3 Axis Table Lateral Buttons</b></p> <p>Move the table left and right as seen when standing at the foot of the table. The table lateral position can vary from -107 mm to +107 mm, measured from center of the table travel.</p>

**Table 3-7: Handset Function and Operation (Continued)**

	<p><b>Clear Image Display</b></p> <p>The clear button provides a convenient means of clearing the persistence display area of the Acquisition card while remaining close to the patient. The clear button is only active when the Acquisition card is displayed during acquisition setup.</p>
	<p><b>Acquisition Start</b></p> <p>The acquisition start button provides a convenient means of starting the acquisition while remaining close to the patient. The start button becomes active once the acquisition is set up and <b>[Camera On]</b> has been clicked on the Acquisition card on GENIE acquisition. The acquisition may terminate automatically or be terminated manually by clicking the <b>[Stop]</b> button on the Acquisition card or in the gantry status area</p>
	<p><b>Set and Cancel Buttons</b></p> <p>The Set button allows you to answer <b>Yes</b> or <b>OK</b> to a pop-up box. The <b>Cancel</b> buttons allow you to answer No to a pop-up box. If there is only an <b>OK</b> button present in a pop-up box, the Cancel button is inactive.</p> <p>Note: If several pop-up boxes are present on the GENIE Acquisition screen simultaneously, it is unclear to which pop-up box the Set and Cancel button shall apply. Therefore, care should be taken when using the Set and Cancel buttons in this case</p>

---

## Gantry

The gantry supports the detector and allows them to be positioned. The ring gantry provides motorized motion in three axes, and allows manual or automated detector positioning around the patient. Manual positioning is done with a handset which can be connected to the gantry on either side.

The ring gantry supports the full range of Nuclear Medicine studies, including whole body and circular and elliptical tomographic scans when combined with the appropriate table position. See the Table Section later in this chapter for more detailed table information.

The ring gantry consists of two parallel arms that support a detector at one end and a counterweight at the other, mounted inside a circular ring, that is in turn mounted on a base.

---

## Gantry Base

The gantry base is a solid, floor mounted base that provides mechanical support for the rest of the gantry. The base houses the power supply for the entire system. For details on safe power down and power up of the system, refer to Chapter 4.

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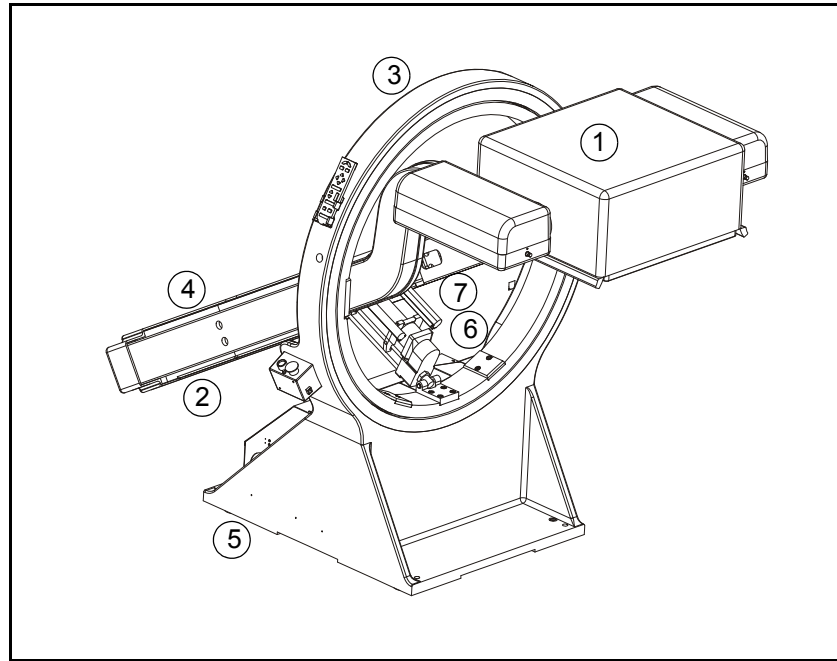
## Gantry Ring

The outside of the gantry ring is mounted on the gantry base. The inside of the ring holds the gantry arms and can rotate. The gantry ring allows the detector to be rotated around the patient.

---

## Counterweight

The counterweight is mounted on the gantry arms, at the opposite end to the detector. The counterweight balances the detector and collimator ensuring that only a small force is needed to change the gantry radius.



**Figure 3-14.** Gantry

**Table 3-8:** Millennium MPR/S Gantry Components

No.	Description	Function
1	Detector	Detects gamma radiation which is sent to the acquisition computer.
2	Gantry Arm	Supports the detector.
3	Gantry Ring	Supports the ring gantry and is bolted to the floor.
4	Counterweight	Counter-balances the weight of the detector
5	Gantry Base	Supports the ring gantry and is bolted to the floor
6	Actuator	Connects the counter-balance to the ring and permits radial movements
7	Gantry Collision Pads	When depressed, stops the gantry and table movements

---

## Gantry Positioning

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### Gantry Motions

The gantry has the following motions:

- Rotational motion rotates the detector around the patient in a circular path. The inside of the ring rotates while the outside remains fixed.
- Radial motion moves a detector closer to, or further from, the patient. Radius is controlled using an actuator mounted between the arm assembly and the ring.
- Tilt motion adjusts the detector angle relative to the patient. When the gantry radius is changed the gantry maintains the set tilt. Detector tilt is described in detail above in the Detector Section.

---

### Gantry Rotation

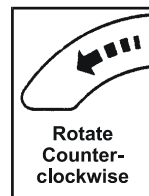
Gantry rotation is measured from 0° in the home position, with the tops of the gantry arms horizontal and parallel to the floor. The gantry can be rotated between -360° and +360°, two full rotations around the patient.

---

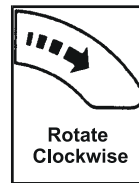
### Rotation Positioning

Gantry rotation is primarily adjusted using the handset.

**Rotate Counterclockwise:** Press and hold this button to rotate the detector counterclockwise.



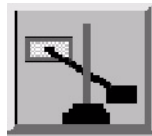
**Rotate Clockwise:** Press and hold this button to rotate the detector clockwise.



Pressing either rotate button alone will move the detector at slow speed. To rotate at high speeds, press the FAST speed button simultaneously with the rotate button. Release the button(s) when the desired position is obtained.

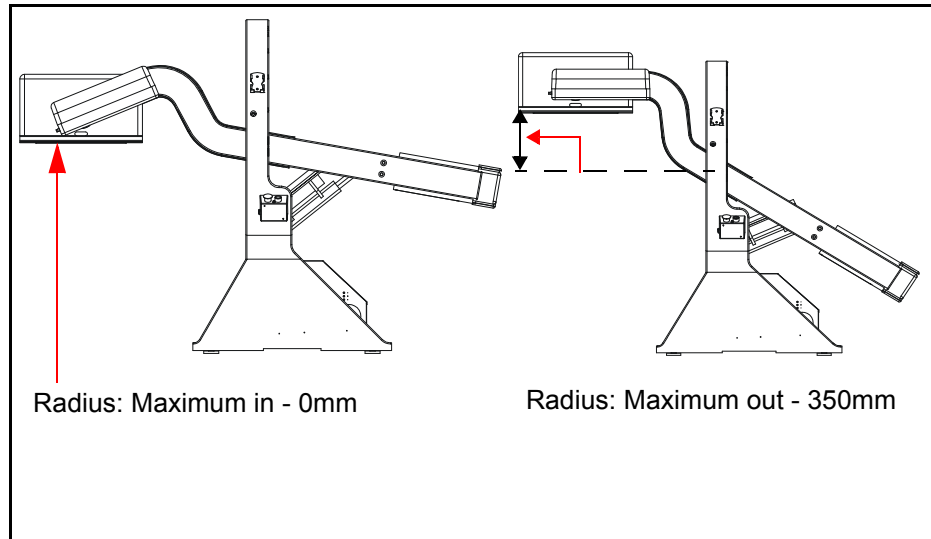
The gantry rotation will be automatically controlled by GENIE Acquisition during circular or elliptical tomographic scans. The gantry is also automatically rotated when using one of the pre-programmed moves.

- **Home Position:** Gantry rotated to 0°
- **Detector Under Table:** Gantry rotated to 180°
- **Collimator Change:** Gantry rotated to 180°



## Gantry Radius

Radius is measured in terms of the distance between the detector face and the axis of rotation. The radius can be varied between 0 mm and 350 mm.



**Figure 3-15.** Gantry Radius

As the radius changes, the system automatically adjusts the detector tilt at the same time to maintain the detector at a fixed angle, relative to the plane of the gantry ring. This means, if the detector tilt is at  $0^\circ$ , the detector will remain level as the radius is changed.

A permanent magnet type brake is mounted on the actuator holding the gantry at a fixed radius when the arms are out of balance during collimator changing.

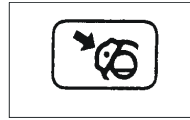
## Radial Positioning

Radial positioning is primarily adjusted using the handset:

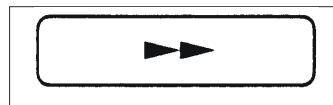
**Increase Radius:** Press and hold this button to move the detector(s) **away** from the patient and table.



**Decrease Radius:** Press and hold this button to move the detector **toward** the patient and table.



Pressing either radius button alone will move both detector at low speed. To move the detector radius at high speed, press the speed button simultaneously with the radius button. Release the button(s) when the desired position is obtained.



The detector radial position will be automatically controlled by GENIE Acquisition during elliptical tomographic scans. In addition, the radius is also automatically adjusted when using the pre-programmed moves for Table/Gantry to Home, Detector Under Table, and Collimator Changeout.

The actual radius settings will vary depending upon your type of system and installation.

---

## 3-Axes Table

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### Overview



**WARNING**

The patient table is designed to support up to 440 LBS. (200 Kg). Overloading the table may result in injury.

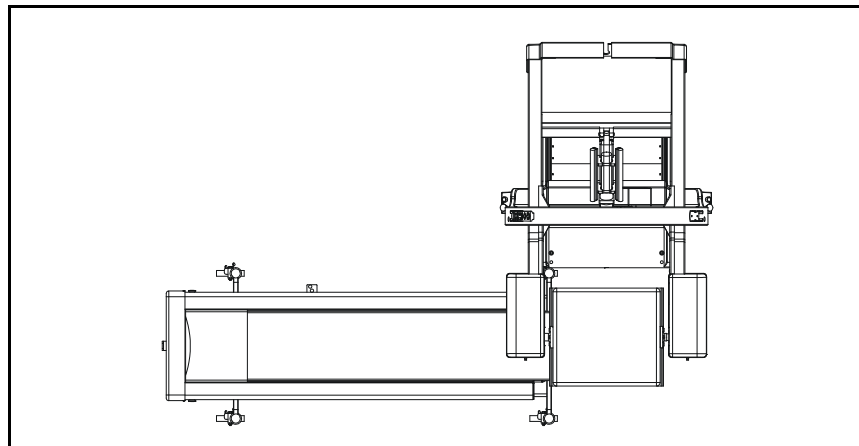
The table is used to support and position the patient during scans that require it. The table is equipped with motion in all three axes: vertical, lateral and longitudinal. These motions can be adjusted either manually with a handset or automatically with GENIE Acquisition. A handset can be connected to the table at two jack points, one on each side of the table. The table is capable of supporting a maximum of 200 Kg (440 lbs).

The table is attached to the gantry via an interconnecting cable and locked to the floor in the following position with respect to MPR/S systems.

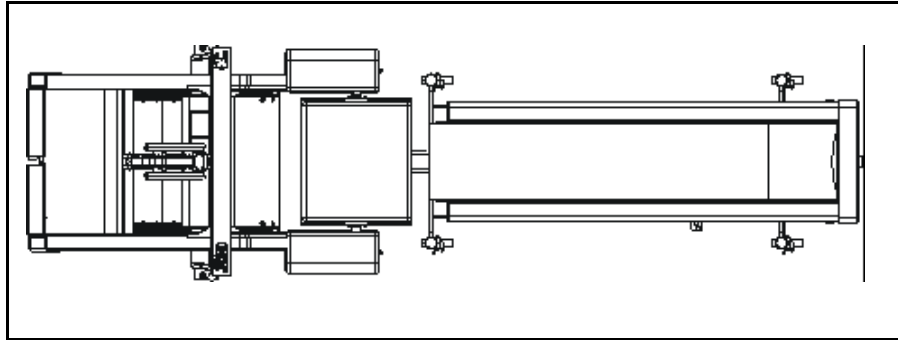
For Whole body scans, the table is placed in perpendicular position to the gantry arms (applicable only to MPR systems). See [Figure 3-16](#).

For SPECT scanning, the table is placed in parallel position to the gantry arms (see [Figure 3-17](#)).

Two green emergency release buttons are located at both sides of the Patient Table, at the far end from the gantry. For fast retraction of the cradle, press in both buttons. In response, the cradle slides back.



**Figure 3-16.** Table Positioning for Whole Body Scan – Top View



**Figure 3-17.** Table Positioning for SPECT Scans – Top View



**CAUTION**

The table cable is mounted above one of the front casters. Be careful when walking near the cable to prevent tripping on it.

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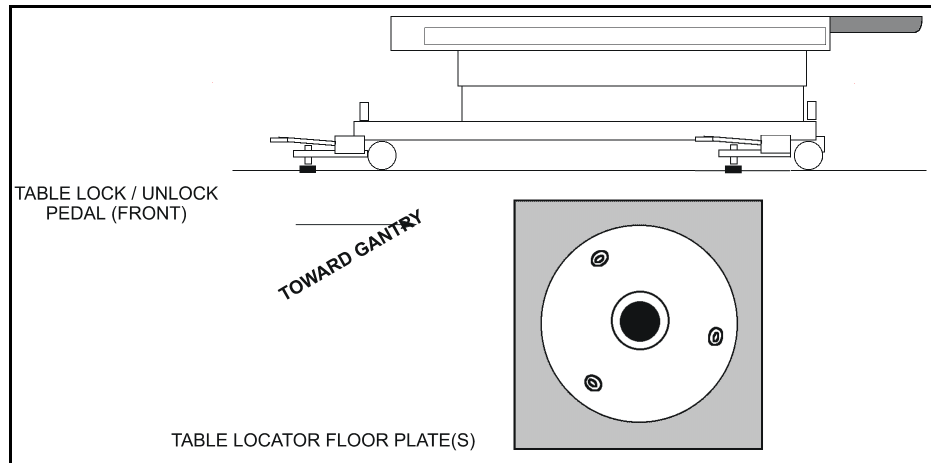
## Table Maneuvering

The table is supported by four self-locking casters under the base for maneuvering the table. Handles are positioned in the back of the table so that it can be easily maneuvered. When in use, the table has to be locked accurately in a fixed position with respect to the gantry in order to achieve the best image quality. This accurate positioning is obtained by locking the table to the floor by using locking pedals, one at the end of each table.



**CAUTION**

The table weighs 370 Kg (820 lbs) unloaded. Take special care when moving the table and limit movement to a slow careful walk.



**Figure 3-18.** Table Locking Device

### Locking The Table

Position the table over the two table locator floor plates. See [Figure 3-18](#). Be careful of the table cable when moving and locking the table. Align one of the locking pins over its table locator floor plate until the locking pin can be inserted. Step all the way down on the pedal until it reaches its locked position. Repeat the procedure for the other locking pedal.

---

## Releasing The Table

Pull up on one of the locking pedals with your foot until it unlocks with a “click”. The locking pedal will automatically return to its home position releasing the locking pin from the locator floor plate. Repeat the procedure for the other locking pedal. The table is now free to move.

**WARNING**

Do NOT move the table to the full extent of the table cable. This may cause damage to the table cable.

---

## Table Positioning

The table has three motorized motions:

- Vertical motion raises and lowers the table.
- Longitudinal motion extends and retracts the table.
- Lateral motion moves the imaging table side to side.

**CAUTION**

Do not put hands under table top when moving the table aside.

## Vertical Table Positioning

Vertical motion is primarily adjusted using the handset.

**Table Up:** Press and hold this button to move the table up.



**Table Down:** Press and hold this button to move the table down.



Pressing either table vertical button alone moves the table at low speed. Pressing the speed button simultaneously with the table vertical button will make the table move at high speed. Release the button(s) when the desired position is obtained.



The vertical motion of the table is also automatically controlled by GENIE Acquisition during learned elliptical tomographic scans. In addition, the table is also automatically adjusted when using some of the pre-programmed moves:

- **Wheelchair Height:** Table vertical to approximately 620 mm
- **Gurney Height:** Table vertical to approximately 835 mm
- **Home Position:** Table vertical to 740 - 750 mm

**Note**

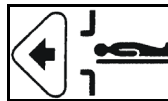
Actual pre-programmed move positions are based upon individual system characterizations.

---

## Longitudinal Table Positioning

Longitudinal motion is primarily adjusted with the handset:

**Table Extend:** Press and hold this button to extend the table towards the detector.



**Table Retract:** Press and hold this button to retract the table away from the detector.



Pressing either table longitudinal button alone moves the table at low speed. Pressing the speed button simultaneously with the table longitudinal button will make the table move at high speed. Release the button(s) when the desired position is obtained.

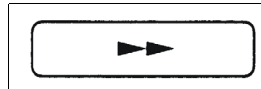


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## Lateral Table Positioning

Lateral table motion is primarily adjusted with the handset.

**Table Right:** Press and hold this button on the right side to move the table to the right as viewed from the end of the table.



**Table Left:** Press and hold this button on the left side to move the table to the left as viewed from the end of the table.



Pressing either table lateral button alone moves the table at low speed. Pressing the speed button simultaneously with the table lateral button will make the table move at high speed. Release the button(s) when the desired position is obtained.



The lateral motion of the table is controlled by GENIE Acquisition during elliptical tomographic scans. In addition, the lateral motion of the table is also automatically controlled by GENIE Acquisition.

---

## 3 - Axes Table Extender

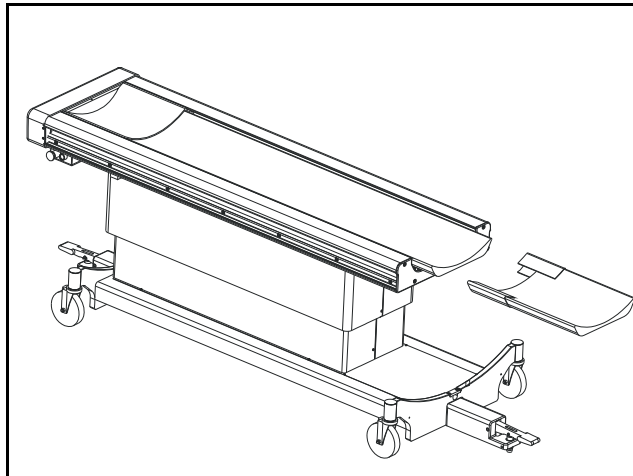
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### Using The Table Extender

The table extender is provided to gain additional table length. When using the table extender, patients are to be positioned feet first. A maximum of 20 Kg (44 lbs) is capable of being supported by the extender.

**WARNING**

Don't have patients support their body weight using their feet on the table extender.



**Figure 3-19.** Table Extender

---

### Fitting The Table Extender

The procedure for fitting the Table Extender to the Table follows:

1. Remove the mattress pad.
2. Ensure that the patient table (cradle) is extended at least four inches from its fully retracted position.
3. Slide the panel over the end of the table top, locating the guides on either side of the table.
4. Slide the panel backwards (away from the detector) to the end stop.
5. Replace the mattress.

---

### Removing The Table Extender

The procedure for removing the Table Extender follows:

1. Slide the mounting panel forward until the guides are clear of the end of the table.
2. Remove the table extender.



**WARNING**

Failure to follow this procedure may result in patient injury.



**WARNING**

The Table Extender is designed to support a maximum weight of 20 kgs. Do not stand or sit on the extender, or load it beyond its 20 kg limit. Failure to follow this warning may result in patient injury.

The Table Extender is not intended to support the head. It should only be used to support the feet/legs. Failure to follow this warning may result in patient injury.

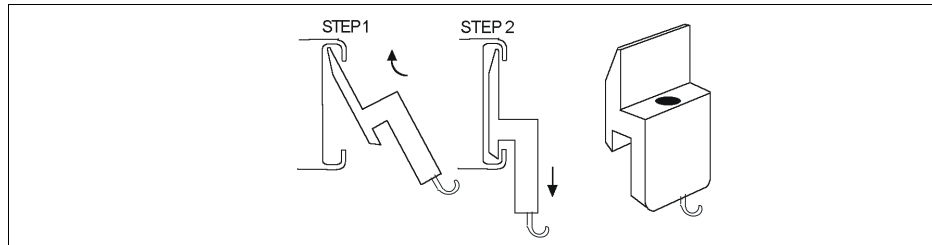
## IV Pole Holder

The IV pole holder can be located on either side of the table and can be positioned at any point along the table side by sliding the pole holder along the table side.

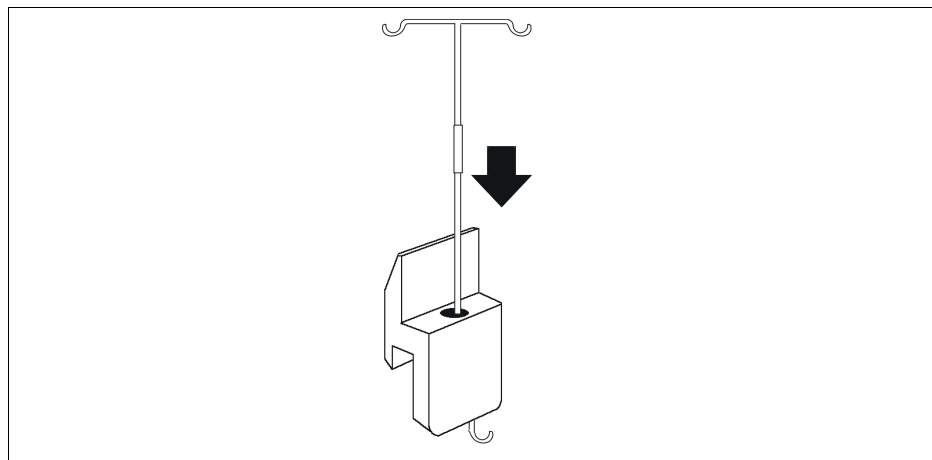
The IV pole holder consists of a pole holder located on the table and a IV pole inserted into the holder, [Figure 3-20](#). A metal extension from the lower part of the pole holder is used for attaching urinary catheter bags or similar items.

### To mount the pole holder and IV pole on the table:

1. Insert the upper part of the pole holder into the slot on the side of the table. (See [Figure 3-20](#), Step 1).
2. Turn the pole holder to the vertical position and lower it into its locked position. (See [Figure 3-20](#), Step 2).
3. Place the IV pole into the hole on the top of the pole holder (see [Figure 3-21](#)).
4. Position IV pole holder appropriately along side of table.



**Figure 3-20.** Mounting the Pole Holder



**Figure 3-21.** IV Pole Holder

---

## Single Axis Table

---

### Overview

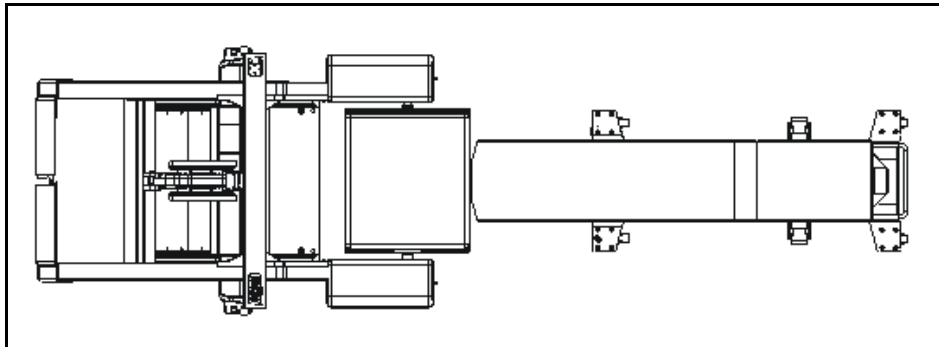


#### WARNING

The patient table is designed to support up to 350 LBS. (160 Kg). Overloading the table may result in injury.

The table is used to support and position the patient during scans. The table is equipped with motion in the vertical axis only. This motion can be adjusted with the handset. The table is capable of supporting a maximum of 160 Kg (350 lbs).

The table is attached to the gantry via an interconnecting cable and locked to the floor parallel to the gantry arms, as shown in [Figure 3-22](#).



**Figure 3-22.** Single Axis Table Position – Top View



#### CAUTION

The table cable is mounted above one of the front casters. Be careful when walking near the cable to prevent tripping on it.

---

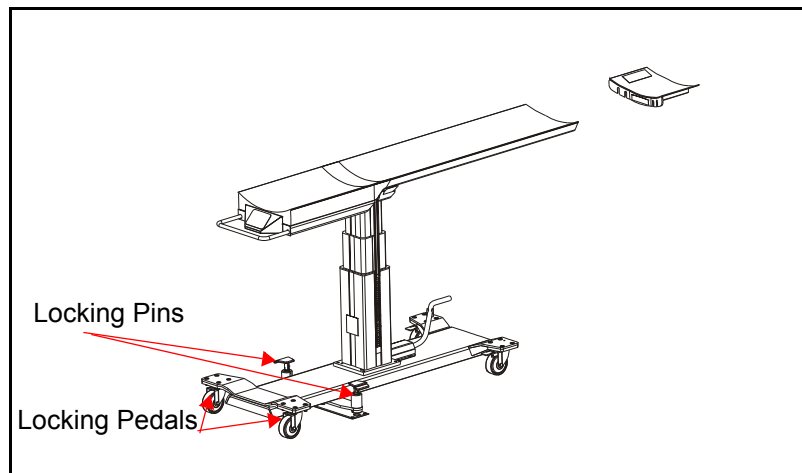
## Table Maneuvering

The table is supported by four self-locking casters under the base for maneuvering the table. A handle is positioned at the back of the table so that it can be easily maneuvered. When in use, the table has to be locked accurately in a fixed position with respect to the gantry in order to achieve the best image quality. This accurate positioning is obtained by locking the table to the floor by using locking pedals, located on either side of the table.



### CAUTION

As the table weighs 370 Kg (820 lbs) unloaded, take special care when moving it and limit movement to a slow careful walk.



**Figure 3-23.** Table Locking Device

---

### Locking The Table

Position the table over the two table locator floor plates. See [Figure 3-18](#). Be careful of the table cable when moving and locking the table. Align one of the locking pins over its table locator floor plate until the locking pin can be inserted. Step all the way down on the pedal until it reaches its locked position. Repeat the procedure for the other locking pedal.

---

## Releasing The Table

Pull up on one of the locking pedals with your foot until it unlocks with a “click”. The locking pedal will automatically return to its home position releasing the locking pin from the locator floor plate. Repeat the procedure for the other locking pedal. The table is now free to move.



### WARNING

Do NOT move the table to the full extent of the table cable. This may cause damage to the table cable.

---

## Adjusting the Table Height

Vertical motion is primarily adjusted using the handset.

**Table Up:** Press and hold this button to move the table up.



**Table Down:** Press and hold this button to move the table down.



---

## Single Axis Table Extender

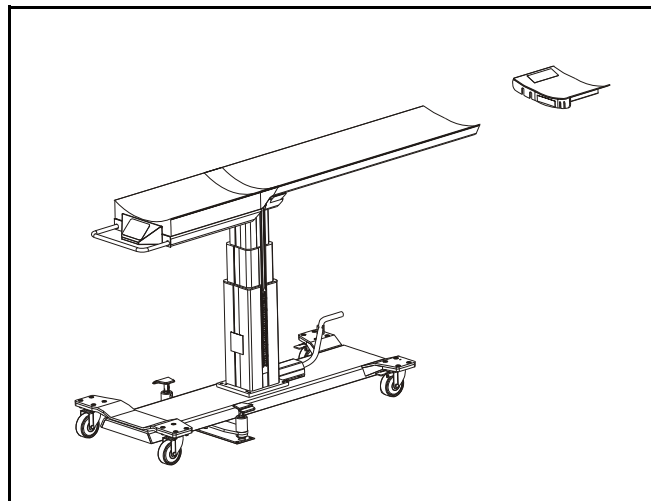
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### Using the Table Extender

The table extender is provided to gain additional table length. When using the table extender, patients are to be positioned feet first. A maximum of 20 Kg (44 lbs) is capable of being supported by the extender. r

**WARNING**

Don't use the table extender to support the patient's feet.



**Figure 3-24.**

---

### Fitting the Table Extender

The procedure for fitting the Table Extender to the Table follows:

1. Remove the mattress pad.
2. Release the four screws at the end of the table.
3. Insert extender between screws.
4. Line up the screws.
5. Replace the mattress.

---

### Removing the Table Extender

The procedure for removing the Table Extender follows:

1. Slide the table maximum back.
2. Release the four screws at the end of the table and remove the table extender.



**WARNING**

Failure to follow this procedure may result in patient injury.



**WARNING**

The Table Extender is designed to support a maximum weight of 20 kgs. Do not stand or sit on the extender, or load it beyond its 20 kg limit. Failure to follow this warning may result in patient injury.

The Table Extender is not intended to support the head. It should only be used to support the feet/legs. Failure to follow this warning may result in patient injury.

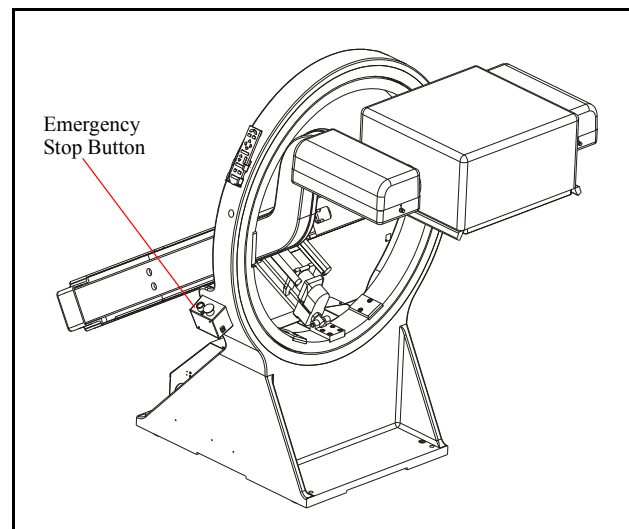
---

## Emergency Stop

---

### Gantry Emergency Stop Buttons

The gantry has two red emergency stop push buttons. An emergency stop button is located on either side of the gantry ring as shown in [Figure 3-25](#).



**Figure 3-25.** Emergency Stop Push Button

Pressing either of the emergency stop buttons interrupts power to all motors, stopping all motion and engages the brakes. The emergency stop button must be rotated counterclockwise to release it before motorized motion can proceed.

If the emergency stop is pressed during an acquisition, all data acquired to that point is retained. Once the emergency situation has cleared and the emergency stop button is released, power is restored and the acquisition can be resumed or restarted. The emergency stop recovery procedure is described on [page 3-43](#).

---

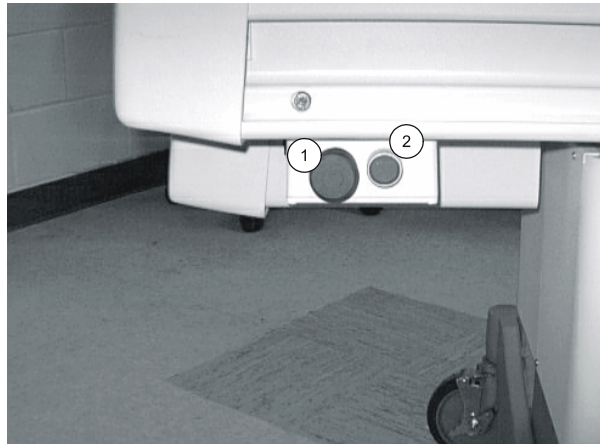
### 3-Axes Table Emergency Stop Buttons

**Note**

Only the 3-Axes table is fitted with Emergency Stop Buttons.

The patient table has two red emergency stop push buttons. An emergency stop

button is located on either side of the table as shown in [Figure 3-26](#). Pressing either of the emergency stop buttons interrupts power to all motors, stopping all motion and engages the brakes. The emergency stop button must be rotated counterclockwise to release it before motorized motion can proceed.



**Figure 3-26.** Emergency Stop Push Buttons

**Table 3-9:** Emergency Stop Push Button Components

No.	Description	Function
1	Gantry Emergency Stop button	Interrupts power to all motors and stops all motion. Another button in the same position on the other side of the table.
2	Future Use button	Currently not functional.

If the emergency stop is pressed during an acquisition, all data acquired to that point is retained. Once the emergency situation has been cleared and the emergency stop button is released, power is restored and the acquisition can be resumed or restarted. The [Emergency Stop Recovery Procedure](#) is described on the next page.

## Emergency Stop Recovery Procedure

To regain all functionality after pressing the emergency stop button:

1. Clear the emergency condition before proceeding, including clearing any potential collisions or removing the patient from the system.
2. Reset the emergency stop button by rotating it counterclockwise until you feel it release and it pops up slightly.
3. The acquisition computer provides a warning message: “E–Stop Depressed” and sets on a buzzer.

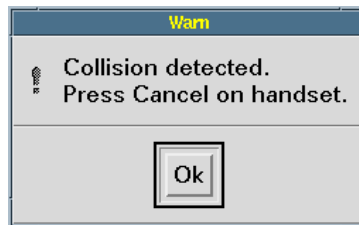


Figure 3-27. E–Stop Warning

4. Remove the obstacle (patient or table) from the path of the collision sensor
5. Use the <Collision Override> button if motorized motion is required. See [Figure 1-5](#).

**Note**

The system will remain in the Collision State even after the obstacle has been removed.

6. Press the Handset <CANCEL> button to silence the beep and return the system to IDLE State (no collision).
7. In addition, the [Quit], [Camera On], [Store] and [Resume] buttons will appear:

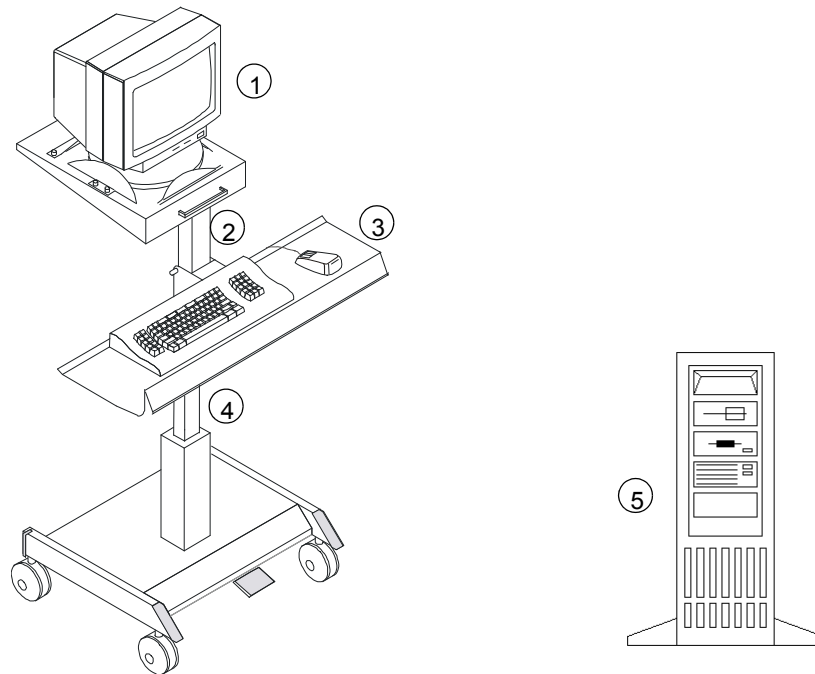


Figure 3-28. Resume Button

Click on the [Resume] button to continue the acquisition. If the patient position has changed significantly, click on the [Camera On] button to reposition. If enough of the scan was completed, click on [Store] to stop the acquisition and save the already acquired data. To terminate the scan, click on [Quit].

## GENIE Acquisition Station

The acquisition computer is called GENIE Acquisition and is a PC computer with a monitor, keyboard, and mouse. The monitor, keyboard and mouse are mounted on a mobile stand for convenient positioning near the gantry. To make the mobile stand more convenient to maneuver, the computer is mounted on the wall or placed on the floor next to the gantry.



**Figure 3-29.** GENIE Acquisition Components

**Note**

The controls on your computer may be different and may be in different locations than those shown in [Figure 3-29](#), above

**Table 3-10:** GENIE Acquisition Components

No.	Description	Function
1	Monitor	Displays images and acquisition information.
2	Keyboard	Used primarily to enter text when setting up acquisitions.
3	Mouse	Allows point and click interface to the acquisition computer.
4	Mobile Stand	Adjustable stand used to hold the monitor, keyboard, and mouse.
5	Computer Tower	Contains computer electronics and peripheral devices.

GENIE Acquisition provides the following functions:

- Displays the main user interface, images and other acquisition information.
- Sets up the detector to perform an acquisition.
- Receives data from the detector and, optionally, cardiac beat information from an ECG trigger unit. Converts the data into a form that can be stored and displayed.
- Controls gantry and table movements during circular and elliptical tomographic scans.
- Manages and displays data that has been acquired.
- Transfers acquired data to other systems for processing.

---

## Computer Tower

The computer tower houses GENIE Acquisition's computer electronics and contains two disk drives and a floppy disk drive. The front panel features the acquisition computer power switch, reset switch, and three indicator lights. The turbo switch is non-functional and is not present on all systems.

**Table 3-11: Computer Components**

No.	Description	Function
1	CD Drive	Used for loading software .
2	Floppy Disk Drive	Used for service tasks only.
3	Power switch	Powers the acquisition computer and monitor on and off.
4	Reset switch	Stops GENIE Acquisition and restarts its normal power on sequence.
5	Power light (Green)	Lit when the computer cabinet is powered on and receiving power.
6	Hard Disk Drive light (Green)	Lit when the internal hard disk is being accessed.
7	First Disk Drive	For system software.
8	Second Disk Drive	For system backup.

---

## Power, Switches, And Indicator Lights

GENIE Acquisition is powered from the gantry base through a connection in the back of the computer cabinet. Connections to the Mobile Stand and the Monitor, Keyboard and the Mouse are also made from the back of the computer cabinet. The computer is normally left switched on so that power to the whole system can be controlled by the one switch on the back of the gantry base.



### CAUTION

Care should be taken to follow the system shutdown and startup procedures described in Chapter 4 before switching the power supply off. Turning off the power or pressing the reset switch without following the system shutdown procedure may cause data to be lost.

All switches and indicator lights are located on the front panel of the computer cabinet. The switches are described in [Table 3-11](#).

---

## Floppy Disk Drive

The Computer Cabinet has a standard PC 3.5I, 1.44 Mbyte floppy disk drive. Currently the floppy disk drive is used only for service tasks.

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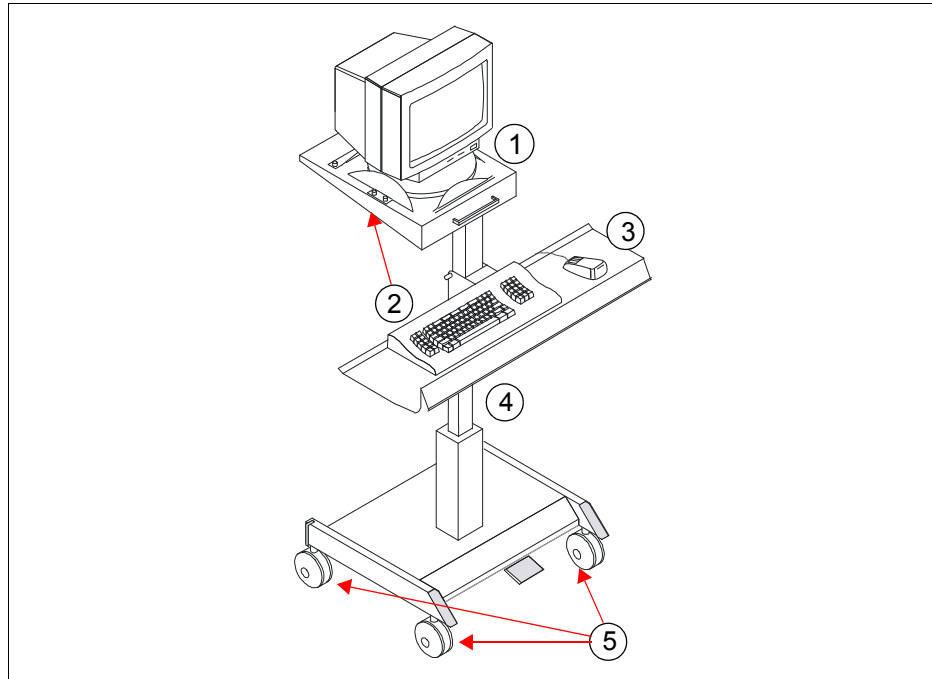
## Second Hard Disk

The computer has a second hard disk that is used to backup and restore data.

---

## Mobile Stand

The monitor, keyboard, and mouse for GENIE Acquisition are mounted on a mobile stand for easy and convenient positioning close to the gantry. The stand is supported by four self-locking casters for easy maneuvering. The stand can be positioned at full height for standing operation, or can be adjusted to accommodate various seated positions.

**Figure 3-30.** Mobile Stand**Table 3-12:** Mobile Stand Components

No.	Description	Function
1	Monitor Platform	Supports the monitor.
2	Handles for Height Adjustment	Allows adjustment for sitting and standing positions by squeezing and holding the two handles while raising or lowering the stand. Releasing the handles locks the stand at the desired height.
3	Keyboard and Mouse Shelf	Supports the keyboard and mouse.
4	Mobile Stand	Adjustable for all positions.
5	Casters	Allows cart to be maneuverable.

The rear of the mobile stand has a cable handling bracket that locks the cables going to the computer cabinet located on the wall or on the floor next to the gantry. This ensures that a cable is not accidentally disconnected when the

stand is moved.



**WARNING**

Possible injury to operator. When not moving the mobile stand, make sure the four casters are locked at all times.



**WARNING**

To prevent injury or equipment damage, always be aware of the position of the computer interconnect cables when persons are present or equipment is being moved.

---

### Mobile Stand Height Adjustment

To adjust the height of the Mobile Stand:

1. Squeeze and hold the two handles under the monitor support together.
2. Lower or raise the stand to the desired height. If necessary, place your foot on the base of the Mobile Stand to provide additional leverage during the adjustment.
3. Release the two handles. See [Figure 3-30](#).

## Monitor

The GENIE Acquisition monitor is a 17" color screen giving a 1280 by 1024 pixel, flicker-free display in 256 colors.

The monitor is mounted on a base that allows it to be tilted and swiveled to a comfortable viewing position.

For a detailed description of the location and function of the monitor controls, refer to the original monitor user's manual that is included with the system.



**Figure 3-31.** Monitor Displaying User Interface



### CAUTION

Do *not* place any items on top of the monitor to avoid blocking the ventilation. Internal heat buildup can damage the equipment.

---

## Adjusting the Monitor Brightness And Contrast

The brightness and contrast of the monitor must be properly adjusted so that images will be displayed correctly. If all monitors in your department are adjusted properly, the same image would display identically on each monitor. In addition, any films taken of the image should match the image as seen on the monitor.

The monitor should be adjusted under the normal lighting levels used in the department.

The controls for brightness and contrast adjustment are located on the front of the monitor, on a panel below the screen. In addition, these controls adjust other monitor functions such as vertical centering, height, etc. These other functions should be adjusted only by service engineers.

The two controls are called [**SELECT**] and [**ADJUST**]. There are two buttons for each control. Pressing either [SELECT] button will display a menu of monitor functions. If necessary, use either right or left [SELECT] button to toggle to the CONTRAST function. To adjust the contrast, press either the right (increase) or left (decrease) [ADJUST] buttons.

For brightness, use the [SELECT] buttons to toggle to the BRIGHTNESS function. To adjust the brightness, press either the right (increase) or left (decrease) [ADJUST] buttons. When completed, the menu selections or adjusting icons will disappear from the screen.

The brightness and contrast are adjusted as follows:

1. From the default patient calibration file, load the formatter dataset.
2. Change the color map to linear.
3. Adjust the brightness level so that the 15 bands of the gray scale in the test image are clearly distinguishable from each other and the bottom band is just visible.
4. Adjust the contrast level so that the top band of the gray scale is white. The gray scale should have a constant width with no sideways spread of the white sections.

If necessary, repeat steps until the gray scale meets both conditions.

Once the brightness and contrast have been set for normal lighting levels, they should not need to be readjusted.

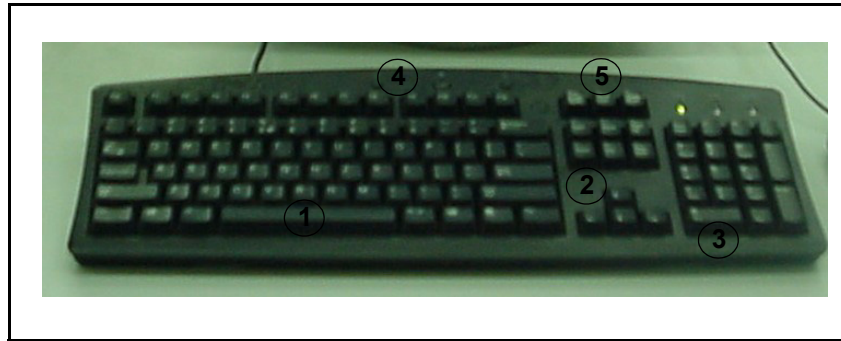
---

### **Other Monitor Adjustments**

For other monitor adjustments, refer to the original monitor user's manual that is included with the system.

## Keyboard

The GENIE Acquisition keyboard is a conventional PC 102 keyboard with a standard QWERTY main keypad, numeric keypad, dedicated editing keys and function keys. There are three indicator lights at the top right of the keyboard for the numeric keypad shift lock, main keypad shift lock and screen scroll lock.



**Figure 3-32.** Keyboard



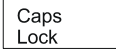

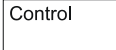
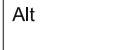
**Table 3-13:** Keyboard Components

No.	Description	Function
1	Main keypad	Used along with the editing keys and numeric keypad to enter patient and acquisition set up information.
2	Editing keys	Used along with the main and numeric keypads to enter patient and acquisition set up information.
3	Numeric keypad	Used along with the main keypad and the editing keys to enter patient and acquisition set up information.
4	Function keys	Not used by GENIE Acquisition.
5	Indicator lights	Shows the status of the keyboard.

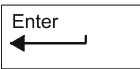

## Main Keypad

The main keypad area contains the normal alphabetic, numeric and punctuation keys in the standard QWERTY layout along with a number of special keys.

**Table 3-14:** Main Keypad Special Keys

Key	Operation	Description
	Escape	Not used.
	Tab	When <Tab> is pressed the cursor moves forward between various screen controls and type-in fields without using the mouse. When <Tab> and <Shift> are pressed simultaneously, the cursor moves backwards to the previous screen control field.
	Caps Lock	Toggles the <Caps Lock> function on and off. When <Caps Lock> is on, all alphabetic keys on the main keyboard produce upper case letters. Normally, if <Caps Lock> is off, lower case letters are produced.
	Shift	When <Shift> is held down and an alphabetic key is pressed, an upper case letter is produced. When <Shift> and another main keypad key are pressed simultaneously, the upper symbol or function labelled on the key is produced. Normally, keys labelled with two symbols or functions produce the lower of the two.
	Control	When <Ctrl> and <Tab> are pressed simultaneously, the cursor moves out of a type-in field.
	Alternative	Modifier key function.




**Table 3-14:** Main Keypad Special Keys

Key	Operation	Description
	Enter	When used within a type-in field, <Enter> starts a new line of text. When used in a window that has a default button, <Enter> performs the default action.
	Back Space	The <Back Space> key is located above the <Enter> key. When used in a type-in field, <Back Space> deletes the character to the left of the cursor. When the text in a type-in field has been highlighted, <Back Space> removes the entire text.








### Editing Keys

There are a number of dedicated editing keys on the keyboard. When used with the main and numeric keypads, they allow easier entry of patient and acquisition information.




**Table 3-15:** Main Keypad Special Keys

Key	Operation	Description
	Print Screen SysReq	Not used.
	Scroll Lock	Not used.
	Pause Break	Not used.

**Table 3-15:** Main Keypad Special Keys

Key	Operation	Description
	Cursor Up	When used in a type-in field, <Cursor Up> moves the cursor up by one line. When used in a graphical window, <Cursor Up> selects the next item or button above the current one.
	Cursor Left	When used in a type-in field, <Cursor Left> moves the cursor to the left by one character. When used in a graphical window, <Cursor Left> selects the next item or button to the left of the current one.
	Cursor Down	When used in a type-in field, <Cursor Down> moves the cursor down by one line. When used in a graphical window, <Cursor Down> selects the next item or button below the current one.
	Cursor Right	When used in a type-in field, <Cursor Right> moves the cursor to the right by one character. When used in a graphical window <Cursor Right> selects the next item or button to the right of the current one.
	Insert	When used in a type-in field, <Insert> switches between insert and over-write modes. <Insert> allows placement of a character between two other existing characters.
	Home	When used in a type-in field, <Home> moves the cursor to the start of the current line. When used in a list, <Home> scrolls to the beginning of the list.
	Delete	When used in a type-in field, <Delete> removes the character to the right of the cursor or all the text that is highlighted. When a type in field has been highlighted, <Delete> removes the entire text.

**Table 3-15:** Main Keypad Special Keys

Key	Operation	Description
	End	When used in a type-in field, <b>&lt;End&gt;</b> moves the cursor to the end of the current line. When used in a list, <b>&lt;End&gt;</b> scrolls to the end of the list.
	Page Up	When used in a type-in field, <u>Page Up</u> scrolls to the page of text before the current one. When used in a list, <u>Page Up</u> scrolls the list back one page.
	Page Down	When used in a type-in field, <u>Page Down</u> scrolls to the page of text after the current one. When used in list <u>Page Down</u> scrolls the list forward one page.

---

### Numeric Keypad

The numeric keypad duplicates the function of other keys on the keyboard. It is provided for convenient numeric data entry.

---

### Function Keys

Currently, there are no GENIE Acquisition functions associated with these keys.

---

### Keyboard Indicator Lights

There are three green indicator lights located at the top right of the keyboard.

These lights indicate the status of the keyboard.

**Table 3-16:** Keyboard Indicator Lights

Light	Description
Num Lock	The keyboard Numbers Lock is toggled on and off by pressing the <Num Lock> key at the top left of the numeric keypad. When <Num Lock> is on, the keys on the numeric keypad labelled 0 to 9 along with the period produce numeric input. When <Num Lock> is off, these keys produce editing functions identical to those of the dedicated editing keys.
Caps Lock	The keyboard <Caps Lock> is toggled on and off by pressing the <Caps Lock> key on the left of the main keypad. When <Caps Lock> is on, the alphabetic keys on the main keypad produce upper case letters. When <Caps Lock> is off, these keys produce lower case letters unless pressed simultaneously with either of the two <Shift> keys.
Scroll Lock	This indicator light is not currently functional on GENIE Acquisition.

---

## Mouse

The pointing device used by GENIE Acquisition is a Mouse. The Mouse is a standard, PC style, three button mouse which is used to interact with the graphical user interface.

Mouse usage is described in the section [Using the Mouse on page 4-5](#).



---

## Chapter 4 - GENIE Acquisition User Interface

**Note**

Read the section on Safety in [Chapter 1](#) prior to using the system.

---

### Chapter Overview

This chapter provides a detailed description of the GENIE Acquisition User Interface. Instructions on using GENIE Acquisition to operate the system and perform scans are given in Chapter 7. The information in this chapter is provided in the following breakdown:

- [Introduction to GENIE Acquisition User Interface on page 4-2](#), including a short description of the two main screens used by GENIE Acquisition.
- [The User Interface Controls on page 4-4](#) – providing a description of the user interface controls, an explanation of how to use the mouse and a list of the user control conventions used throughout the manual.
- [Acquisition and Review Screen on page 4-16](#) – provides an overview of the GENIE Acquisition user interface. Detailed descriptions of the Acquisition and Review cards are provided in [Chapter 5](#) and [Chapter 6](#), respectively.
- [Main Screen on page 4-29](#) – a description and explanation of the Main screen including the Patient Database and Network card.

---

## Introduction to GENIE Acquisition User Interface

GENIE Acquisition uses a graphical user interface which occupies the whole screen on the monitor. It is used to display images and acquisition control information. It also controls the gantry and table as well as any attached peripheral devices, such as the digital audio tape drive.

The user interface has been designed so that the user can walk up to the GENIE Acquisition monitor, instantly recognize the current state of the system and quickly select the controls needed to accomplish a given task.

The graphical user interface is composed of a set of windows and controls organized into a set of task oriented cards. Windows are used to display images, trigger files, and energy spectra. Windows also divide the screen into areas of related information and functions. On-screen buttons are used to activate functions and options so that the user need not memorize command names. Cards are provided for:

- Setting up and acquiring a scan
- Quality control
- Displaying previously acquired data
- Interacting with the database
- Forwarding data to another computer for subsequent processing, displaying, filming, or archiving

A detailed explanation of the various GENIE Acquisition screens and controls can be found in the following sections.

---

## Screens Overview

GENIE Acquisition's graphical user interface has two screens: the **Main** screen and the **Acquisition and Review** screen.

The **Main** Screen is used to select data for review or to transfer data to a Processing and Review workstation. It contains the Patient Selector card and the Network card.

The **Acquisition and Review** screen is used to set up and control all acquisitions as well as display data that has already been acquired. It contains the Acquisition card, the Review card and the Quality Control card.


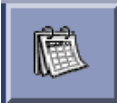
Each card on the **Acquisition and Review** screen is designed to support a particular task and occupies the most of the screen area. Cards are used throughout the user interface to group related controls and to provide easy access to many functions and options within a limited screen area. Each card has a tab that is not covered by other cards in the stack. Clicking the tab brings the card to the front. Tabs are labeled with text or a picture to denote the purpose of the card.

A card can be active even when it is not at the front of the stack. This allows tasks to be performed in parallel. For example, previously acquired data may be reviewed and sent to a processing station while an acquisition is in progress.

The Acquisition and Review screen has a Status area at the top of the screen which is never covered by another card, even when the Acquisition card is not at the front of the stack. This means that the state of the system is always visible.

On start up the **Acquisition and Review** screen is displayed with the **Acquisition** card at the front. This makes it easy to acquire data as soon as the system is started.

The operator can switch from the **Acquisition and Review** screen to the **Main** screen and vice versa by clicking the top left icon on the screen. This icon differs for the two screens, as follows:

	<b>Main Screen</b> icon, displayed in the <b>Acquisition and Review</b> screen. When clicked switches the display to the <b>Main</b> screen.
	<b>Acquisition and Review</b> icon, displayed in the <b>Main</b> screen. When clicked switches the display to the <b>Acquisition and Review</b> screen.

The GENIE Acquisition user interface has two themes. The green/gray colored theme used in the Classic User Interface (similar to the GENIE Processing and Review workstation user interface) and the new blue color CUI (Common User Interface) theme used in the Xeleris workstation. By default, the system is set to the CUI theme.

---

## The User Interface Controls

The GENIE User Interface is controlled by means of:

- Graphic Controls such as buttons and icons, sliders and scroll bars
- Pull-down menus and drop-down lists, providing a list of operations, options or submenus to be selected by the user.
- Radio Buttons, which provide mutual exclusive options
- Check boxes, which when checked determine user selected options
- Type-in fields, which are selected by the mouse, but the information is typed-in via the keyboard

Since all the above control except for the type-in fields are operated by means of the mouse, this sections starts by explaining how to operate the mouse to achieve the various tasks.

---

## Using the Mouse

This section describes procedures for using the Mouse to operate the user interface controls:

- Moving the Mouse Pointer
- Clicking
- Selecting
- Toggling
- Dragging

The mouse is equipped with three buttons, referred to as the left, middle and right mouse buttons. Since most mouse operations are carried out by using the left mouse button, only the operation is stated throughout this manual.

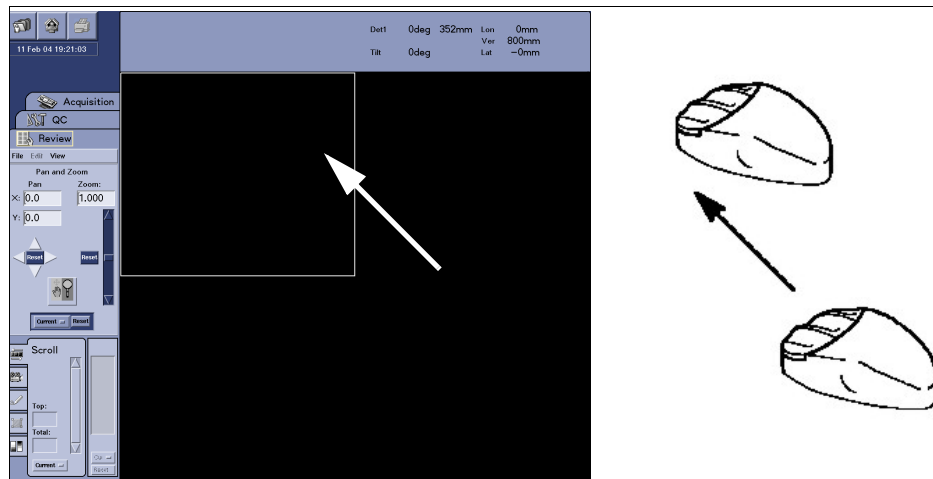
When the middle or the right mouse buttons are to be used, they are explicitly specified together with the needed operation.

---

### Moving the Mouse–Pointer

The Mouse controls the position of the on screen **pointer**, called **cursor**. Moving the Mouse causes the cursor to move around on the screen.

The shape of the cursor changes as it moves across different areas on the screen. When the cursor is located in a type-in field, its shape is changed into an I beam shape, indicating that it is in a typing mode. In other screen areas, the pointer has an arrow shape, indicating that it is in a point and click mode, as shown in [Figure 4-1](#)



**Figure 4-1.** Moving the Pointer

---

## Clicking

Clicking selects actions and options that appear as on screen buttons or are represented by icons, or selects one or more items from a list.

1. Use the mouse to move the cursor over a button, an icon or an object.
2. Press and release a mouse button.

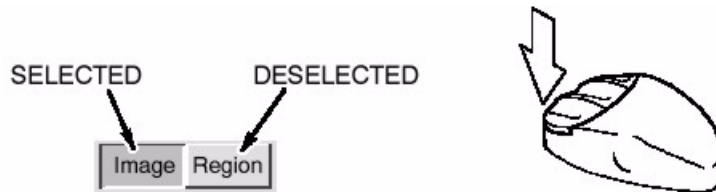
Throughout this manual, Click, Click Left, or Clicking means to press and release the left mouse button. Click Middle or Click Right means to press and release the middle or right button respectively

---

## Selecting

An item changes color or becomes highlighted to show it is selected.

1. Use the mouse to move the cursor over a button or object.
2. Click left on the item.



---

## Toggle

Toggle switches a function from on-to-off or off-to-on.

1. Use the mouse to move the cursor over a button or an object.
2. Click left on the item.

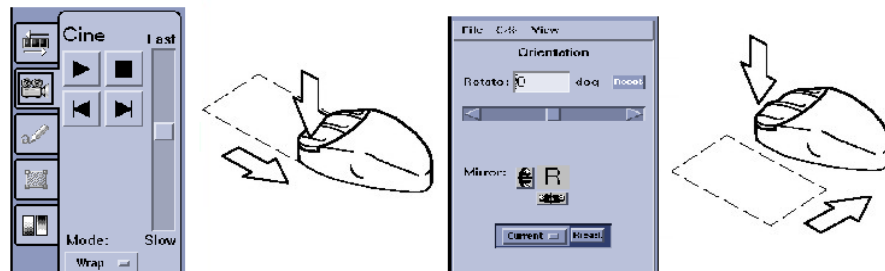


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**Drag**

Dragging moves an object vertically or horizontally across the screen.

1. Use the mouse to move the cursor over the object.
2. Press and hold down the left mouse button.
3. Move the mouse while holding the left mouse button. The object will move on the screen following the cursor.
4. Release the left mouse button when the object is in the new location.



**Figure 4-2.** Dragging

## Using the Controls

GENIE Acquisition uses several different types of controls to operate the system.

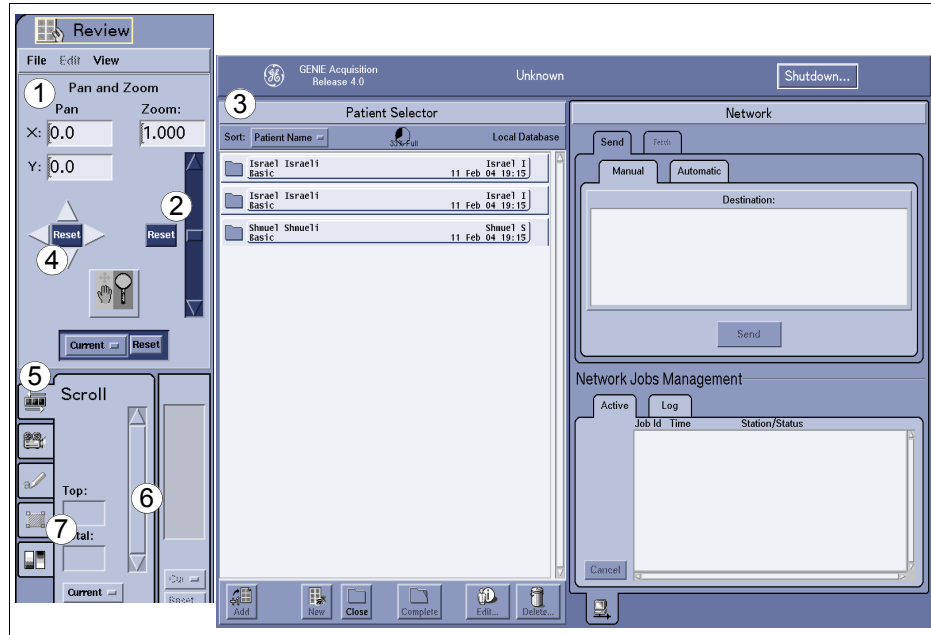


Figure 4-3. User Control Examples

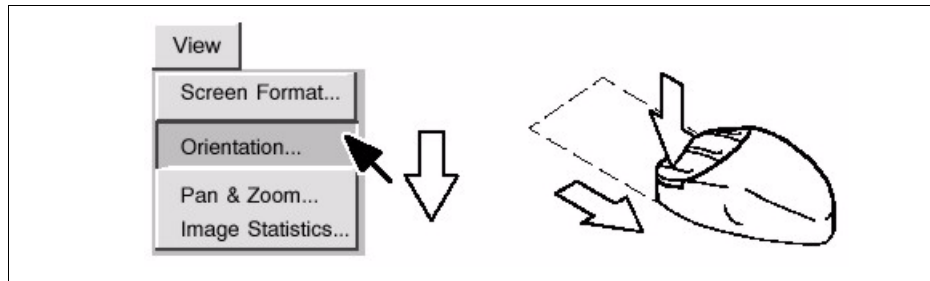
Table 4-1: User Control Examples Components

No.	Description	Function
1	Pulldown menu	Lists multiple options and appears within a window on the screen.
2	Slider	Continuously adjusts a parameter.
3	Icon	Activates a function when selected.
4	Button	Activates a function when selected.
5	Tab	Brings a menu item or a card to the front when selected.
6	Scroll bar	Moves a screen object or advances through a collection of items.
7	Type-in field	Used to enter text.

---

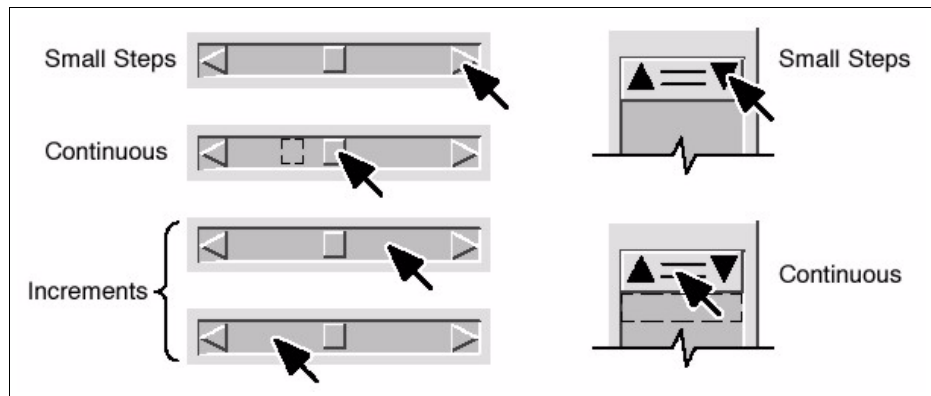
**Using Pulldown Menus**

1. Use the mouse to move the cursor over the text or graphic where the pulldown is located.
2. Press and hold the left mouse button. The pulldown menu appears.
3. Drag the mouse downward while holding the left mouse button. The text under the cursor is highlighted.
4. Release the left mouse button over the desired selection. The highlighted text is selected.



## Using Sliders

1. Use the mouse to move the cursor over the arrow, the slider or the trough of the slider.
2. Click on an arrow at the end of the slider to increase or decrease the adjustment in small steps.
3. Drag on the slider to adjust continuously.
4. Click in the trough of the slider control to increase adjustments by pre-determined increments depending on the feature.



## Using Icons and Buttons

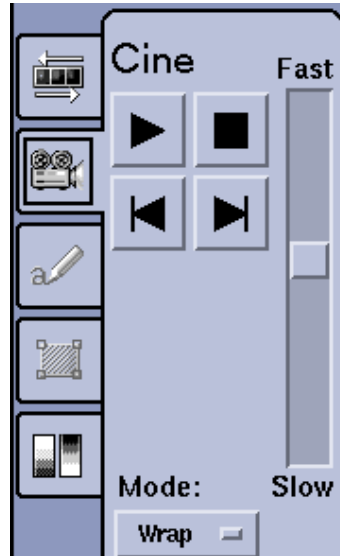
1. Use the mouse to move the cursor over an icon or button.
2. Click left.
3. The icon or button appears to be pushed in or depressed to show it has been selected.



---

**Using Tabs**

1. Use the mouse to move the cursor over a tab.
2. Click left.
3. The panel or card connected to the selected tab is displayed.



---

## Using Scroll Bars

1. Use the mouse to move the cursor over the arrow, the slider or the trough of the slider.
2. Click on an arrow at one end of the scroll bar to advance through a list of items one step at a time.
3. Drag on a scroll bar to move continuously through the list of items and release the mouse button when the desired item in the list appears.
4. Click in the scroll bar trough to skip to the next or previous group of items.

Also, clicking Middle while the cursor is over the scroll bar trough moves the scroll bar directly to the cursor position.



SMALL STEPS



CONTINUOUS

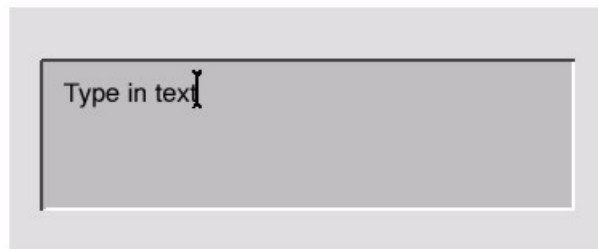


BY GROUPS

---

## Using Type-In Fields

1. Use the mouse to place the cursor over a type-in field and click left. The small vertical line will blink.
2. Enter text with the keyboard. The text will appear at the vertical line.
3. All of the editing operations involve changing existing information that are displayed in type-in fields. Information in a type-in field that is highlighted in black indicates it is selected. In this case, simply type in new information with the keyboard to replace what is selected. (Information can be selected by clicking and dragging over it with the mouse.) To change information that is not selected, click in the type-in field behind the information you want to change. Use the Backspace key to erase the information preceding the vertical line and then type in the new information with the keyboard.



---

## User Control Conventions

Table 4-1 lists the conventions used in this manual for the various user controls.

Input Type	Convention	Example
Pull Down Menu Names	Bold	Select <b>Pan &amp; Zoom</b> from the <b>View</b> pulldown.
Buttons and Tabs	Square Brackets with their name/character written in bold faced characters	Select [ <b>Close</b> ] to close the Main screen.
Keyboard Keys	Angled brackets with their name/character written in bold faced characters	Press < <b>Enter</b> >, < <b>Ctrl</b> >.
Literals to be entered via Type-in Fields	<i>Courier font, typed in exactly as shown in the text.</i>	Type: 3.32
Named parameters to be entered via Type-in Fields	<i>Courier font in italic style</i>	Type: <i>hostname</i>

## Selecting the User Interface Theme

Over the course of time, the 'look and feel' of the GENIE Acquisition user interface has evolved from the original green/gray colored theme used in the **Classic User Interface**.

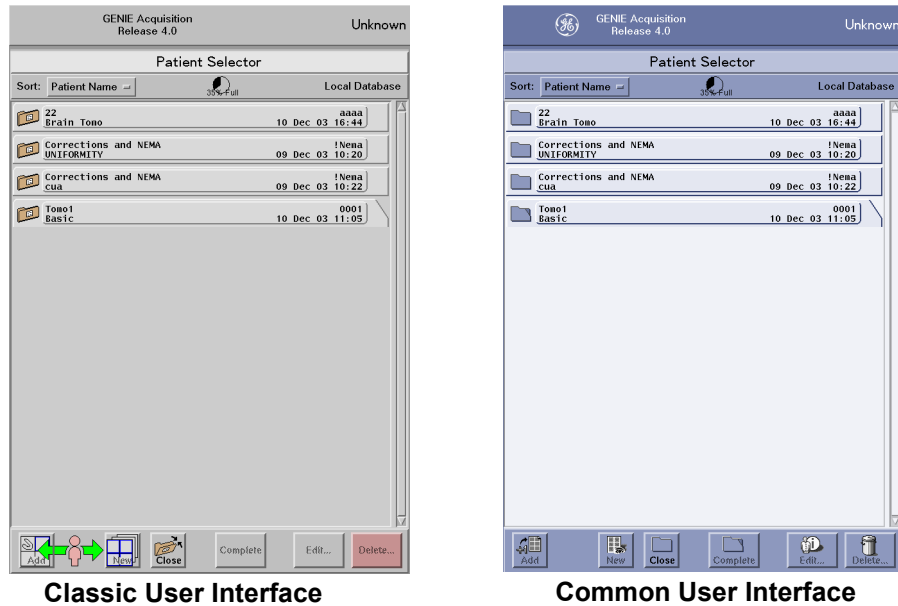


Figure 4-4. User Interfaces

The user interface used in more recent systems now has a blue color with fonts and other screen elements similar to those used in Xeleris stations. This look and feel is called **CUI (Common User Interface)**.

Commencing with GenieAcq Software version 4.0, the CUI theme is now the default for the user interface appearance.

However the classic user interface theme may still be selected by users who prefer this appearance.

To configure your system to classic mode, call your local GE service engineer.

## Acquisition and Review Screen

This section provides an overview of the Acquisition and Review card in the following breakdown:

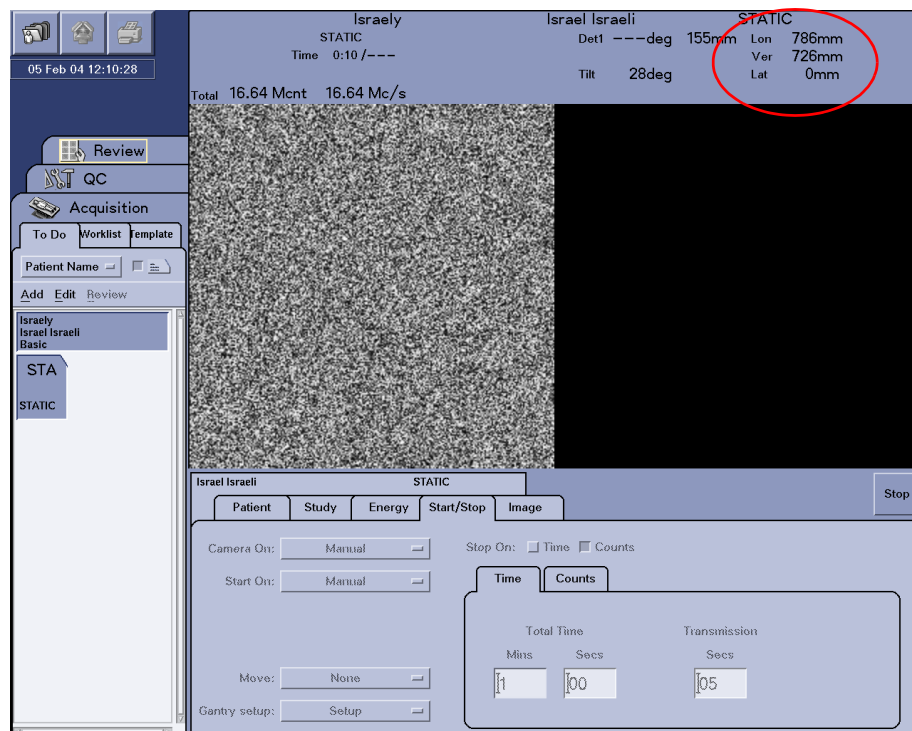
- [Acquisition and Review Card - General Description on page 4-18](#)
- [Gantry and Table Pre-Programmed Positions on page 4-20](#)
- [Acquisition Card – General Description on page 4-25](#)
- [Review Card – General Description on page 4-26](#)
- [Quality Control Card on page 4-27](#)

This manual deals with two types of systems:

- MPR System using the 3-axes table
- MPS System using the single axis table

The acquisition screens for each of these respectively, are shown below.

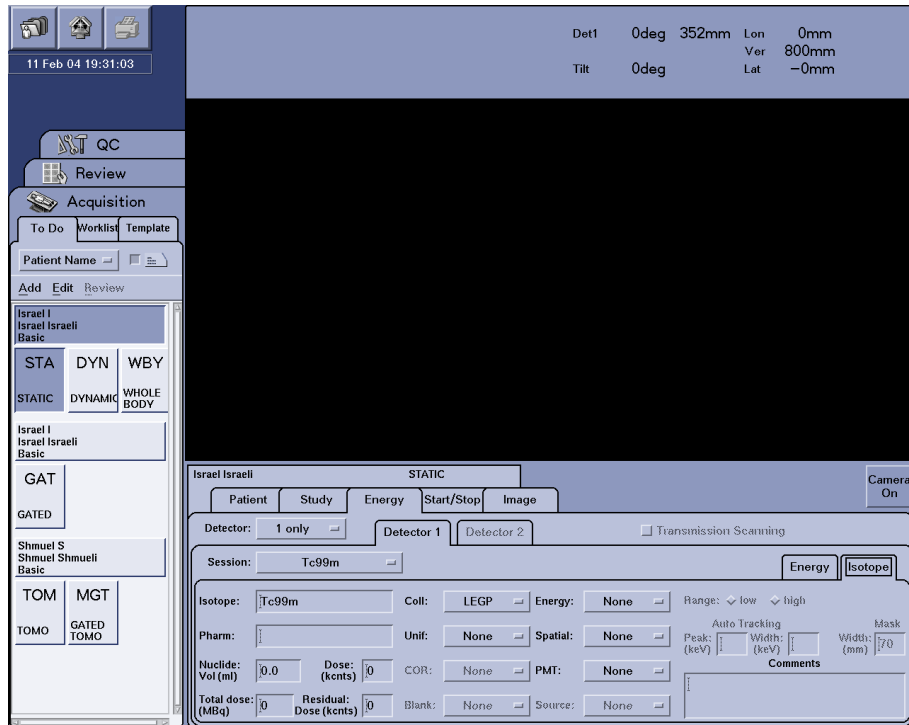
The MPR acquisition screen shows gantry and table information (the table information is circled).



**Figure 4-5.** MPR Acquisition Screen (with table information circled)

The MPS acquisition screen, [Figure 4-6](#), shows gantry information only as the single axis table is not computerized.

**Note:** For presentation purposes, the acquisition screens that follow in this manual refer to the MPR system. However, users of the MPS system can refer to the same acquisition screen illustrations.



**Figure 4-6.** MPS Acquisition Screen (showing gantry information only)

## Acquisition and Review Card - General Description

The Acquisition and Review screen is the first screen displayed after login and occupies the entire screen area.

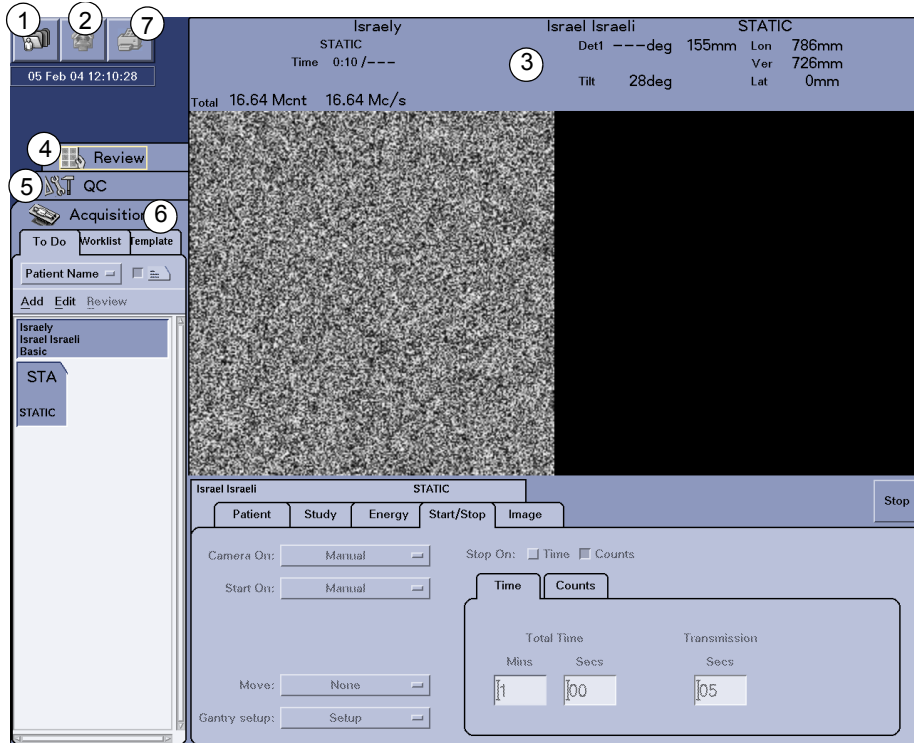


Figure 4-7. Acquisition and Review Screen

Table 4-2: Acquisition and Review Screen Components

No.	Description	Function
1	<a href="#">Main Screen icon</a>	Switches to the Main screen
2	Gantry icon	Allows access to pre-programmed motions. See <a href="#">page 4-20</a> .
3	Status area	Shows gantry and table positions along with the status of the current acquisition. See <a href="#">page 5-43</a> .
4	Review card	Displays acquired data for review. See <a href="#">Chapter 6</a> .
5	Quality Control card	Accesses the quality control procedures. See <a href="#">page 4-27</a> .
6	Acquisition card	Sets up and starts acquisitions. See <a href="#">Chapter 5</a> .
7	Print icon	Prints the screen. See <a href="#">page 7-122</a> .

The **[Main Screen]** icon at the top left provides access to **Main** screen with patient selection and network functions.

The **[Gantry]** icon to the right of the **[Main Screen]** icon provides access to pre-programmed table and gantry positions.

The **Acquisition** card is used to set up and acquire scans. Patient studies are created using predefined acquisition templates which can be customized if required. Each patient study can contain any number of scans or datasets. During an acquisition, the Acquisition Card displays image data so that the progress of the scan can be monitored.

The **Review** card is used to verify that the data has been acquired correctly and with sufficient quality. Basic image display operations are provided on the review card including screen format, window level, pan, zoom, cine, scroll and color map.

The **Quality Control** card is used to verify that the detector is operating to specification and to acquire new corrections, if required.

The Acquisition, Review and Quality Control cards appear as a stack on the screen. The Acquisition card is displayed at the top of the stack with the Review card and the Quality Control card behind. You can switch between cards by clicking on any visible part of the card. When clicked, the card is brought to the front.

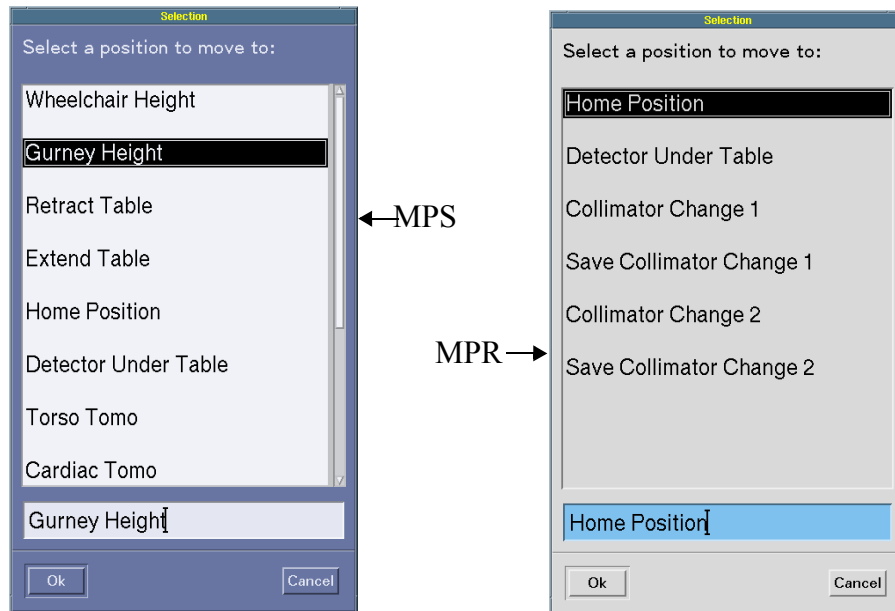
## Gantry and Table Pre-Programmed Positions

### Description



GENIE Acquisition provides several pre-programmed gantry and table positions for quick and reliable system positioning. The programmed positions, including the collimator change position, are accessed by clicking on the gantry icon at the top left of the acquisition and review screen

When the **[Gantry]** icon is clicked, the gantry positioning pop-up (dialog box) is displayed. The pop-up provides a selection for each programmed position as shown in [Figure 4-8](#).



**Figure 4-8.** Gantry Positioning Selection



#### **WARNING**

Always ensure the patient and equipment cannot collide when using preprogrammed motions. Injury or equipment damage can result.



#### **WARNING**

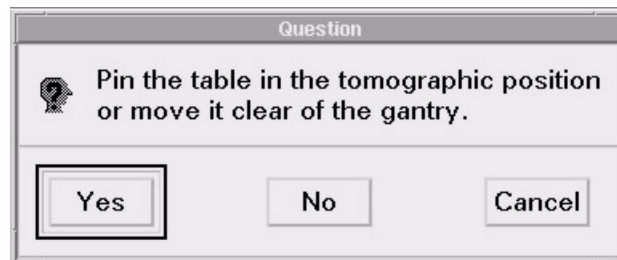
Do not leave patient on table when using collimator changeout preprogrammed motions. Collisions resulting in patient injury may result.

**WARNING**

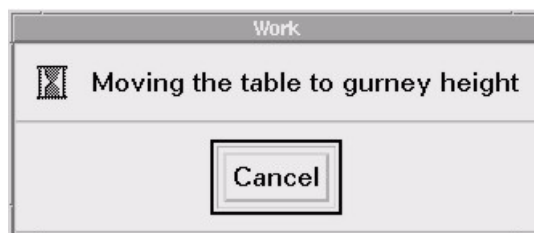
It is the operator's responsibility to monitor all gantry and table motions and to make use of the emergency stop buttons, if the situation requires it. The system cannot detect all situations that may be a patient or equipment hazard. The operator must not rely on the collision detection mechanism or the acquisition computer for safe system operation.

**Procedure****To move the gantry and or table to a programmed position:**

1. Click on the **[Gantry]** icon to bring up the gantry positioning pop-up.
2. Select the required programmed position and then click **[OK]**. Click **[Cancel]** to remove the pop-up without moving the gantry or table.
3. To move to some positions, GENIE Acquisition requires that the table be in a known position. In this case a pop-up is displayed asking to ensure that the table is properly locked in position by the locking pins. Ensure the table is locked in position and click **[Yes]** to proceed with the move. Press **[No]** or **[Cancel]** to cancel the request without moving the table or gantry.



4. The table and/or gantry moves to the new position and a message is continuously displayed until the selected motion is completed.



**Table 4-3:** Pre-programmed positions available in GenieAcq V3.0 - MPR

Pre-programmed Position (Starting Geometry)	Available as part of scan set up	Description of table and gantry motion
Wheelchair Height	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Table moves longitudinally to minimum</li> <li>4. Table moves laterally to 0°</li> <li>5. Table moves vertically to 623mm</li> </ol>
Gurney Height	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Detector rolls to 0°</li> <li>4. Table moves longitudinally to 0°</li> </ol>
Retract Table	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Detector rolls to 0°</li> <li>4. Table moves longitudinally to 0°</li> <li>5. Table moves vertically to 800mm</li> </ol>
Extend Table	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Detector rolls to 0°</li> <li>4. Table moves laterally to 0°</li> <li>5. Table moves longitudinally to maximum</li> </ol>
Home Position	No	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Detector rolls to 0°</li> <li>4. Table moves laterally to 0°</li> <li>5. Table moves longitudinally to 0°</li> <li>6. Table moves vertically to 720mm</li> </ol>
Detector Under Table	No	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Table moves longitudinally to 0°</li> <li>4. Table moves laterally to 0°</li> <li>5. Detector rolls to -90° or 90°</li> <li>6. Table moves vertically to 760mm</li> <li>7. Detector rolls to -180° or 180°</li> <li>8. Radial moves to 180°</li> </ol>

**Table 4-3:** Pre-programmed positions available in GenieAcq V3.0 - MPR

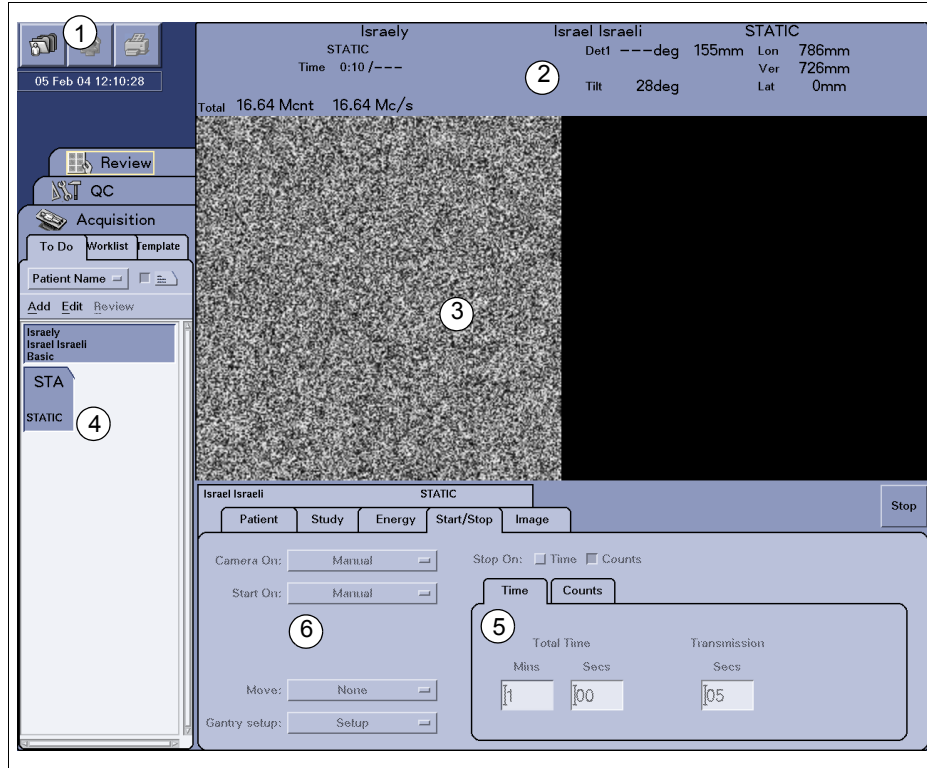
Cardiac Tomo (Cardiac Geometry)	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Table moves laterally to 0°</li> <li>4. Detector rolls to 0°</li> <li>5. Table moves vertically to 752mm</li> <li>6. Detector rolls to -45° or 60°</li> <li>7. Table moves longitudinally to to 800mm</li> </ol>
Collimator Change 1	No	<ol style="list-style-type: none"> <li>1. Detector rolls to 180°</li> <li>2. Tilt moves to 90°</li> <li>3. Radial moves to 250°</li> </ol> <p>or to another saved position 1</p>
Collimator Change 2	No	<ol style="list-style-type: none"> <li>1. Detector rolls to 180°</li> <li>2. Tilt moves to 90°</li> <li>3. Radial moves to 250°</li> </ol> <p>or to the saved position 2</p>
Torso Tomo	Yes	<ol style="list-style-type: none"> <li>1. Tilt moves to 0°</li> <li>2. Table moves laterally to 0°</li> <li>3. Detector rolls to 0°</li> <li>4. Table moves vertically to 750mm</li> <li>5. Table moves longitudinally to 840mm</li> </ol>
Brain Tomo	Yes	<ol style="list-style-type: none"> <li>1. Radial moves to 280°</li> <li>2. Tilt moves to 0°</li> <li>3. Table moves laterally to 0°</li> <li>4. Detector rolls to 0°</li> <li>5. Table moves longitudinally to minimum</li> </ol>

**Table 4-4:** Pre-programmed positions available in GenieAcq V3.0 - MPS

Home Position	No	<ol style="list-style-type: none"><li>1. Tilt moves to 0°</li><li>2. Detector rolls to 0°</li><li>3. Radial moves to 280°</li></ol>
Detector Under Table	No	<ol style="list-style-type: none"><li>1. Tilt moves to 0°</li><li>2. Radial moves to 180°</li><li>3. Detector rolls to -180°</li></ol>
Collimator Change 1	No	<ol style="list-style-type: none"><li>1. Detector rolls to 180°</li><li>2. Tilt moves to 90°</li><li>3. Radial moves to 250°</li></ol> or to the saved position 1
Collimator Change 2	No	Move to the saved position 2

## Acquisition Card – General Description

The acquisition card is used to set up and acquire scans. The card is divided into six main areas.



**Figure 4-9.** Acquisition Card and Acquisition & Review Screen

**Table 4-5:** Acquisition Card and Acquisition & Review Screen Components

No.	Description	Function
1	Gantry icon	Allows access to pre-programmed motions – <a href="#">page 4-20</a> .
2	Status area	Shows gantry and table positions along with the status of the current acquisition. See <a href="#">page 5-43</a> .
3	Image Display area	Displays data during acquisition or for review
4	Scan Selector Area	Creates and selects patient/studies and scans for acquisition. See <a href="#">page 5-3</a> .
5	Scan Setup Area	Specifies the details of the selected scan. See <a href="#">page 5-12</a> .
6	Scan Control Area	Contains buttons that control the acquisition. See <a href="#">page 5-40</a>

For detailed information on the Acquisition Card, refer to [Chapter 5](#).

## Review Card – General Description

GENIE Acquisition provides a single Review card to view image, trigger, and spectrum data once it has been acquired. The review card can display data from one or more scans and from one or more patient studies.

GENIE Acquisition does not provide functions to process the acquired data. Acquired data should be transferred to a GENIE Processing and Review (GENIE P & R) workstation for processing.

The review card provides a sub-set of the functions and controls available on GENIE P & R Processing Cards. These controls are identical to those on GENIE P & R, and are sufficient to verify the quality of the acquired data.

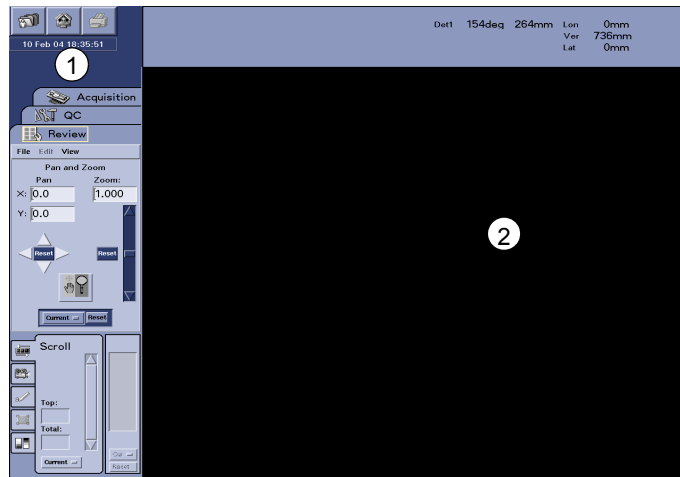


Figure 4-10. Review Card

Table 4-6: Review Card Components

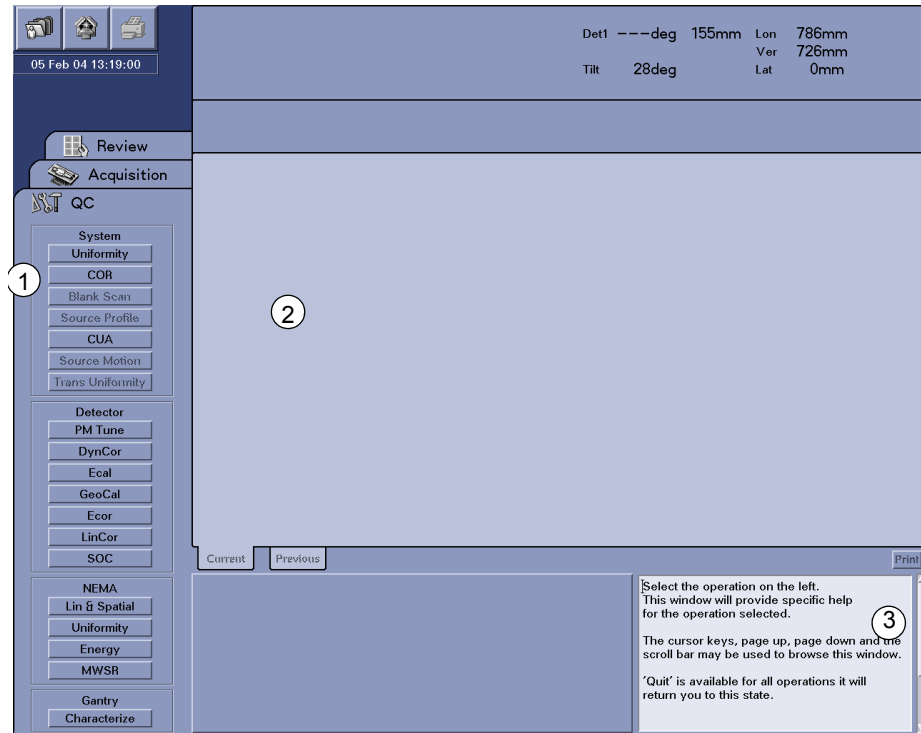
No.	Description	Function
1	Card Control area	Provides tools for viewing and manipulating image data.
2	Card Display area	Area used to view image data.

The Review card is analogous to illuminated patient film viewing stations or light boxes. The right side, the Card Display area, is for viewing patient data. The left side, the Card Control area, has controls for adjusting the brightness and so on. While a light box may only have a power switch and a brightness control, the Review card has many sophisticated image manipulation controls.

For detailed information on the Review Card, refer to [Chapter 6](#).

## Quality Control Card

The Quality Control card provides the means to perform various operations that ensure the system maintains its image quality performance and applies the necessary corrections to the data. Most of the operations are used by a Service Engineer in cases when the detector, gantry or table require calibration or correction.



**Figure 4-11.** Quality Control Card

**Table 4-7:** Quality Control Card Components

No.	Description	Function
1	Quality Control buttons	Selects a quality control procedure and initiates the set up.
2	Setup area	Allows input of set up parameters needed for the selected quality control procedure.
3	Help Window	Provides written help on performing the quality control procedure selected.

For normal system operation the Quality Control card provides options to acquire collimator uniformity, center of rotation corrections, and to update the detector energy correction. In addition, a camera uniformity analysis procedure is available. Detailed instructions on performing these quality control procedures can be found in [Camera Quality Control on page 10-2](#).

Quality control operations can take time to set up and complete. Normal scans cannot be performed while a quality control operation is in progress. Choose a time when there are no patients scheduled on the system.

Quality control operations can have a significant impact on system performance and, if performed incorrectly, can cause degraded image quality. If in doubt about the purpose of a quality control operation, consult a qualified Service Engineer before proceeding.

# Main Screen

## Overview

The **Main** screen is used to select acquired data. Selected data can be displayed in the **Review** card, transferred to a GENIE P&R workstation for processing, or deleted from the database.

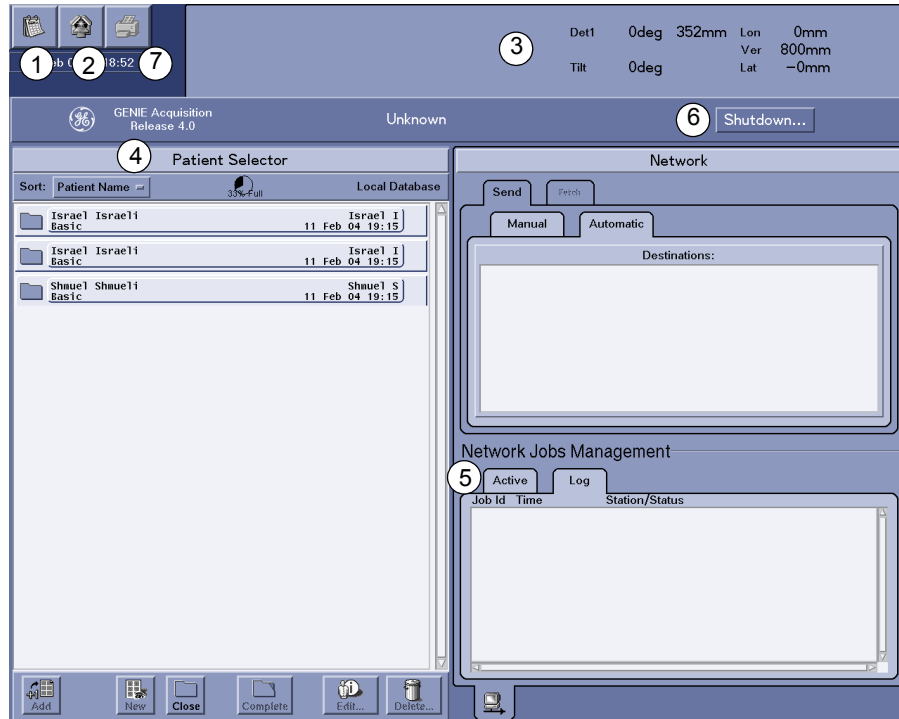


Figure 4-12. Main Screen

Table 4-8: Main Screen Components

No.	Description	Function
1	Lightbox icon	Switches to the Acquisition and Review Screen.
2	Gantry icon	Allows access to pre-programmed motions – <a href="#">page 4-20</a>
3	Status area	Shows gantry and table positions along with the status of the current acquisition. See <a href="#">page 5-43</a>
4	Patient Selector	Displays the contents of the patient database – <a href="#">page 4-35</a>
5	Network card	Used to initiate and monitor sending acquired data to a P & R workstation for processing, filming, or archiving – <a href="#">page 4-43</a>
6	Shutdown button	Stops the GENIE Acquisition Software and returns the system to the login screen. See <a href="#">page 7-6</a> for details.
7	Print icon	See <a href="#">page 7-122</a> for more information.

The Patient Selector and Network card appear side by side on the Main screen. The Patient Selector allows data that has been acquired to be selected for review, network transfer, or deletion. If no data has been acquired, the Patient Selector will be empty. The Network card is used to select a destination workstation, and to send acquired data to that workstation.

The acquisition Status area is visible above the Main screen. The status area shows the state of any acquisition in progress and the positions of the detector, gantry and table.

---

## Database

The database is held on GENIE Acquisition's internal hard disk. Each scan that is created and acquired adds data to the database. Once in the database, the data can be displayed or transferred to another computer for processing.

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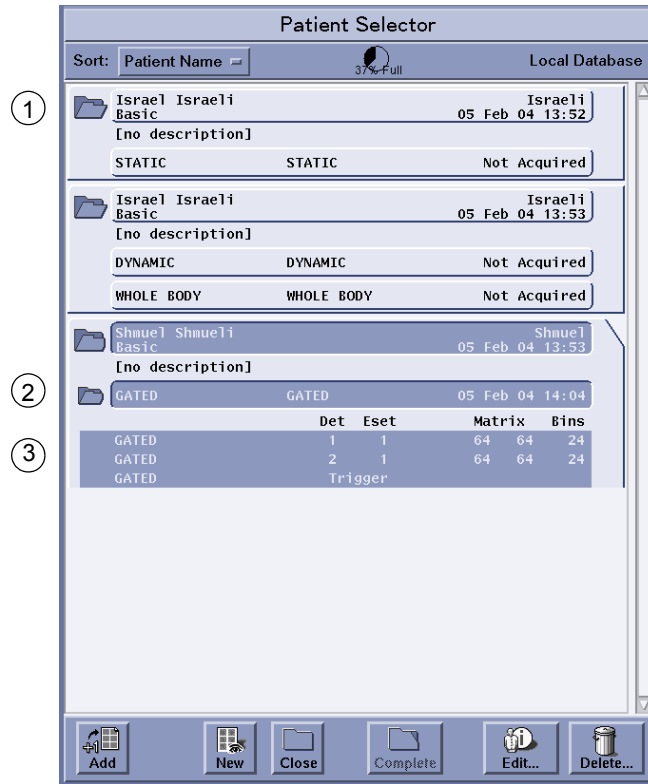
### Patient Information Database

The patient information database holds the data that was acquired for each scan, along with the scan definition that was used to acquire it.

The database is organized as a three level hierarchy:

- The first level is the Patient Study. A Patient Study entry contains series and scan entries.
- The second level is the Series. A series contains scan (dataset) entries.
- The third level is the Dataset level. This level contains image datasets (scans) for energy spectra or trigger histograms. An image dataset entry contains one or more frames that were acquired for each detector and for each energy set defined. For a multigated tomographic acquisition, each tomographic dataset contains frames from a single multigated tomographic bin. Each frame is a single multigated tomographic view.

[Figure 4-13](#) shows an example of the database structure as it appears in the **Patient Selector** of the **Main Screen**.



**Figure 4-13.** Patient Database Structure

**Table 4-9:** Patient Database Components

No.	Description	Function
1	Patient Study entry	Top level of the hierarchy. Contains series and dataset entries.
2	Series entry	Middle level of the hierarchy. Contains dataset entries.
3	Dataset entry	Bottom of the hierarchy. Can be images, spectrums, or trigger histograms.

## Acquired Data Types

Acquired data for a scan is stored within a single series in the database. The series will contain one or more sets of data, depending on the scan type, the number of energy sets and other options.

There are three types of data that can be acquired:

<b>Image Set</b>	An image set contains one or more frames (images).
<b>Trigger Histogram</b>	A trigger histogram contains a set of time coded trigger signals derived from the ECG trigger input
<b>Energy Spectrum</b>	An energy spectrum contains a histogram of the number of counts across the detector energy range.

[Table 4-10](#) shows the data that is produced by a number of different acquisitions.

**Table 4-10: Data Produced by Scans**

Acquisition Parameters				Data Acquired				
Type	Energy Sets	Matrix	Options	Image Sets	Images per Image Set	Trigger Histograms	Spectrums	Disk Size MBytes
Static	1	256		1	1	0	0	0.13
	2	512		2	1	0	0	1.00
	4	512		4	1	0	0	2.00
Dynamic	1	64	1200 frames	1	1200	0	0	9.38
	2	64	512 frames, triggers	2	512	1	0	8.00
	4	64	64 frames, triggers	4	64	1	0	2.00
Whole Body	1	256 x 1024		1	1	0	0	0.50
	2	256 x 1024		2	1	0	0	1.0
Gated	1	128	64 bins, triggers	1	64	1	0	2.00
	1	64	128 bins, triggers	1	128	1	0	1.00
	2	256	8 bins, triggers	2	8	1	0	2.00
Tomo	1	64	64 views	1	64	0	0	0.50
	2	128	128 views	2	128	0	0	8.00
Gated tomo	1	128	128 views, 8 bins	8	128	0	0	32.00
	2	64	64 views, 32 bins, triggers	64	64	1	0	32.00
Spectrum	N/A	2048 x 1		0	0	0	1	0.01

## Database Capacity

GENIE Acquisition is fitted with a 2 GByte internal disk space. Approximately 300 MBytes is used by system software. The remainder of the disk is available for patient information and images. Most of the space in the database is used for images. A small proportion is used for related patient, study, scan and software information.

The number of acquisitions that can be stored in the database depends on the type of scan performed and the set up parameters that effect the size of data acquired.

If a scan is set up that will not fit in the available database space, a warning pop-up is displayed and it will not be possible to start the acquisition. Either reduce the size of the acquisition (by decreasing the matrix size, the number of frames or the number of energy sets) or delete sufficient data from the database to allow the scan to proceed.

[Table 4-11](#) summarizes the capacity of the database for different scan types. Each line shows the maximum number of scans that can be stored, assuming that there are no other scans stored in the database. The calculation assumes that there are two series for each patient and two scans for each series.

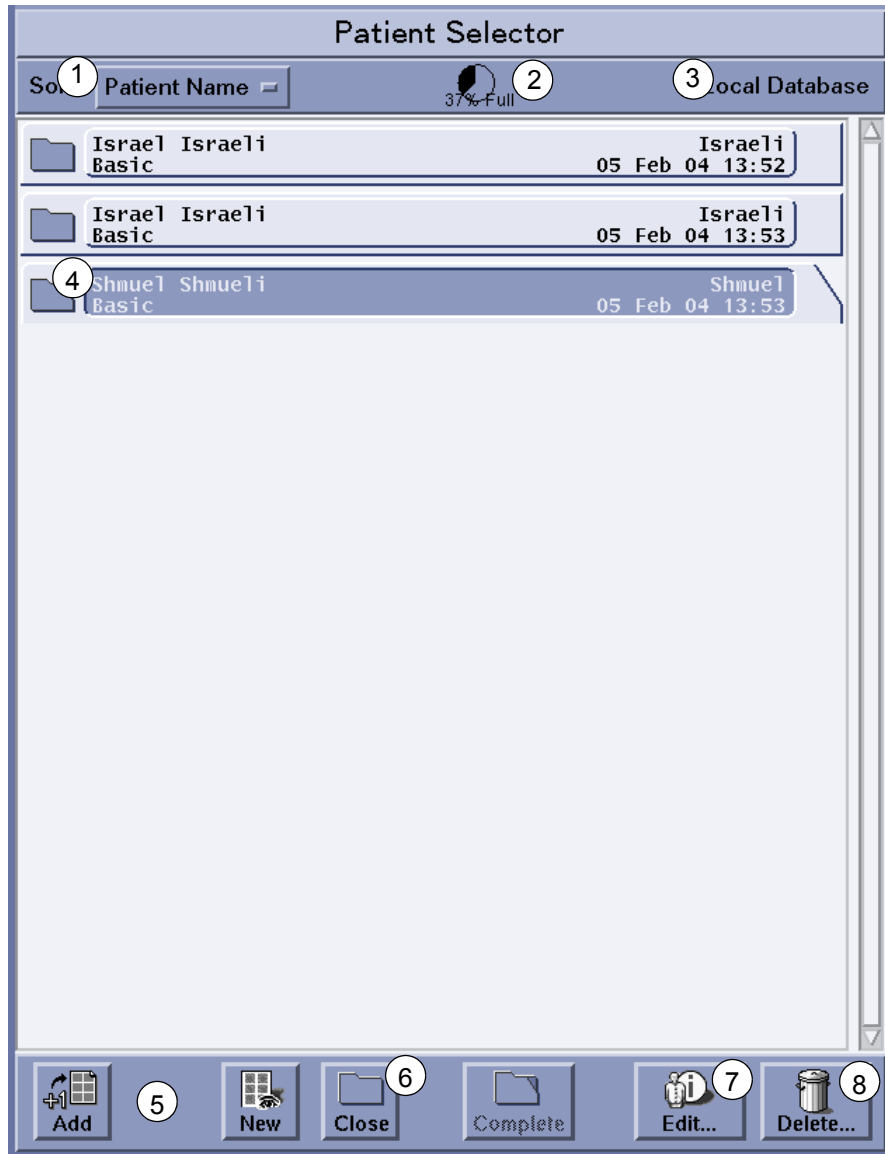
**Table 4-11: Patient Database Capacity**

Type of Scan	Maximum Number of Scans (for 1 GByte Disk)	Maximum Number of Scans (for 2 GByte Disk Partition)
Static, 64 x 64 single energy	81152	221224
Static, 128 x 128 single energy	19094	49935
Static, 256 x 256 dual energy	4844	12670
Static, 512 x 512, single energy	1263	3303
Dynamic, 64 x 64 x 64, single energy	1263	3303
Dynamic, 64 x 64 x 1200, single energy	67	176
Gated, 128 x 128 x 32, single energy	618	1616
Tomography, 64 x 64 x 64, single energy	1243	3252
Gated Tomography, 64 x 64 x 64 x 8, single energy	156	410
Whole Body, 256x1024, single energy	1234	3227

## Patient Selector

The **Patient Selector** provides a single point to browse and select information from the patient database. Selected data may be reviewed, sent over the network, and deleted when it is no longer needed on GENIE Acquisition.

The top level of the list combines patients and studies into a single entry. There is a single top level entry for each patient in the database. The list may be sorted to group the studies for each patient next to each other.



**Figure 4-14.** Patient Selector

**Table 4-12: Patient Selector Components**

No.	Description	Function
1	Sort pull-down menu	<p>Selects how the Patient Database listing will be sorted:</p> <ul style="list-style-type: none"> <li>• Patient Name.</li> <li>• Patient ID.</li> <li>• Study Name.</li> <li>• Date.</li> <li>• Reverse Date.</li> </ul>
2	Disk Space indicator	Displays the amount of disk space currently being used.
3	Current Database indicator	Displays the name of the database currently displayed on the Patient Selector panel. Currently GENIE Acquisition can only display the local database.
4	Patient Database	Lists patient studies in the current database. Refer to <a href="#">Viewing and Selecting Entries on page 4-37</a> for more detailed information.
5	Load Data buttons	<p>Provides two methods of loading Patient Studies onto the Review Card:</p> <ul style="list-style-type: none"> <li>• <b>Add To.</b> Adds selected Patient Studies to the data already displayed on the Review Card.</li> <li>• <b>New.</b> Loads the newly selected Patient Studies onto a new Review Card. Up to four Review Cards can be loaded at once. The Review Card and data added last is deleted for each additional Review Card beyond four.</li> </ul> <p>Refer to <i>Review Card</i> section in this chapter for more detailed information on the Review Card.</p>
6	Close button	Closes opened database folders.
7	Edit button	Used to modify patient ID and/or patient name.
8	Delete button	Deletes a Patient Study, series or dataset.

## Viewing and Selecting Entries

The Patient Selector list allows the information in the patient database to be viewed and selected at the Patient Study, Series or Dataset levels.

A folder icon appears to the left of each entry that contains sub-entries. Clicking the folder icon opens the folder and displays the contents of the entry. The contents are indented to show that they are contained in the entry above. Clicking the folder icon again closes the entry causing the contents of the entry to be hidden.

John Doe	786898
CEqual 1 Day	20 Apr 04 03:27
Hypothetical Person	
REST	TOMO 20 Apr 04 03:44
STRESS	TOMO 20 Apr 04 03:44
SGATE	GATED TOMO Not Acquired

Series that have not been acquired do not have a folder icon next them and are labelled as Not Acquired.

Test Patient	1234
Example Static	20 Apr 04 03:31
Example For Operator's Manual	
STATIC	STATIC Not Acquired

Once a dataset within a series has been started, it is labelled as Acquiring and a folder icon appears next to the entry.

The folder can be opened to see the datasets being acquired for the scan. When the acquisition completes, the label is replaced by the completion date and time.

Test Patient	1223
Example Static	20 Apr 04 04:06
Example for Operator's Manual	
STATIC	STATIC Acquiring

Clicking an entry selects that entry and all its contents. Selected entries are displayed with a black background.

John Doe	786898
CEqual 1 Day	20 Apr 04 03:27
John Doe	768898
Whole Body Bone	20 Apr 04 04:24

To select multiple entries, hold down the **Shift** key and click the additional entry. To deselect an entry, hold down the **Shift** key and click the entry.

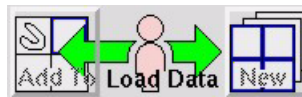
Selecting an entry automatically selects all its sub-entries. An entry is partially selected when some, but not all, of its sub-entries are selected. A partially selected entry has a gray background and white text.

John Doe	786898
CEqual 1 Day	20 Apr 04 03:27
Hypothetical Person	
REST	TOMO
20 Apr 04 03:44	
STRESS	TOMO
20 Apr 04 03:44	
SGATE	GATED TOMO
Not Acquired	

The **[Close]** button closes all the folders in the Patient Selector. Only a list of Patient Studies is then displayed.



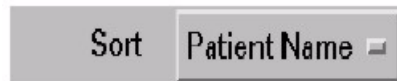
Clicking either the **[Add To]** or **[New]** button loads the selected entries onto the Review Card. These buttons are not available when there are no entries selected. Instructions on loading data onto the Review Card is described in the Reviewing Data section of Chapter 4.



---

## Sorting The Patient Selector Entries

The **Sort** pull-down menu controls the order that Patient Study entries are displayed in the list.



Clicking on this button brings up a pull-down menu with the following sorts:

- Patient Name
- Patient ID
- Study Name
- Date
- Reverse Date

### To sort the database:

1. Click on the [**Main Screen**] icon to switch to the Main Screen.
2. Click on the **Sort** pull-down menu to display the pull-down menu.
3. Click on the desired sort option.

---

## Moving Series from Study to Study

A series acquired for one study can be moved to another study as follows:

1. Select the source Patient Study (which includes the series to be moved).
2. Select one or more series to be moved.
3. Press down the **Middle** mouse button, drag the selected series to the desired Patient Study and release the mouse button.

---

## Deleting Data

Patient Study, series and dataset entries are deleted using the **[Delete]** button on the Patient Selector.



Data can be deleted at any level in the list. When an entry is deleted, all entries that it contains are also deleted. When all the entries contained in a Patient Study or series are deleted the Patient Study or series is also deleted.



### WARNING

Deleting data removes it from the database. It cannot be recovered after it is deleted.

Deleting data from the database creates space for new scans. Data from a scan should only be deleted if it is no longer needed, or it has been transferred successfully to another workstation.

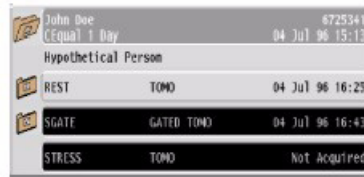
The Disk Space Indicator at the top of the Patient Selector shows the percentage of disk space available for acquiring new data.



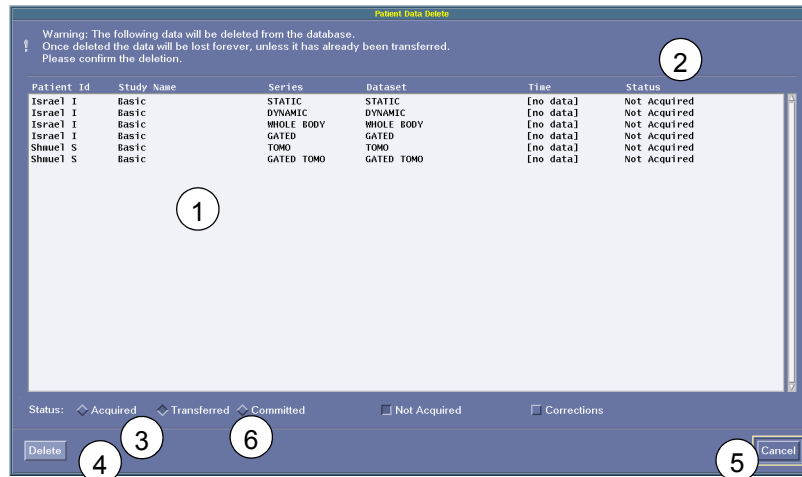
If the Disk Space indicator shows that the disk is 95% full or more, you may not have sufficient space to acquire a large scan such as a multigated tomographic acquisition. The database section earlier in this chapter gives details of the data that is acquired for each scan type, and how much disk space it requires.

### To delete a Patient Study, series or dataset entry from the database:

1. Click on the **[Main Screen]** Icon to switch to the **Main** Screen.
2. Find the Patient Study entry that contains the data to be deleted. Use the scroll bar on the right side of the list to bring the Patient Study entry into view, or click on the **Sort** pull-down menu to order the list as required.
3. If you do not want to delete all the data for a Patient Study, click the folder next to the Patient Study to display its contents.
4. Click on the entry to be deleted. If more entries are to be deleted, hold down the **<Shift>** key and click on each entry to be deleted.



- Click the [Delete] button. The **Delete Confirmation** pop-up is displayed. The pop-up will contain a list of the datasets that have been selected to be deleted, as shown in [Figure 4-15](#).



**Figure 4-15.** Delete Confirmation Pop-Up

**Table 4-13:** Delete Confirmation Pop-Up Components

No.	Description	Function
1	Dataset listing	Displays the patient ID, study name, series name, dataset name and date and time of acquisition of each entry selected.
2	Status column	Indicates the data type and whether the dataset has been acquired, not acquired or transferred to another workstation.
3	Data Type Toggles	Used to define the types of data to be deleted.
4	Delete Transferred button	Deletes all defined dataset types included in the Dataset Listing.
5	Cancel button	Closes the pop-up without deleting any data.

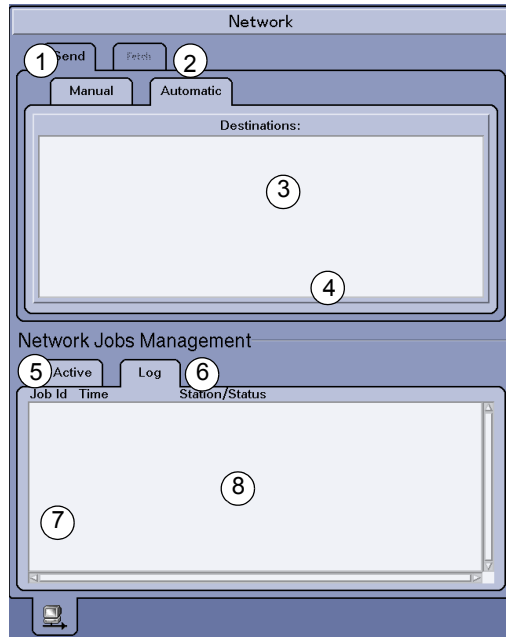
**Table 4-13:** Delete Confirmation Pop-Up Components

No.	Description	Function
6	Committed button	Part of the Status column that indicates whether the dataset has been committed. Commit requests that have not yet been committed (Commit Pending status) are treated as transferred but not committed when deleting them.

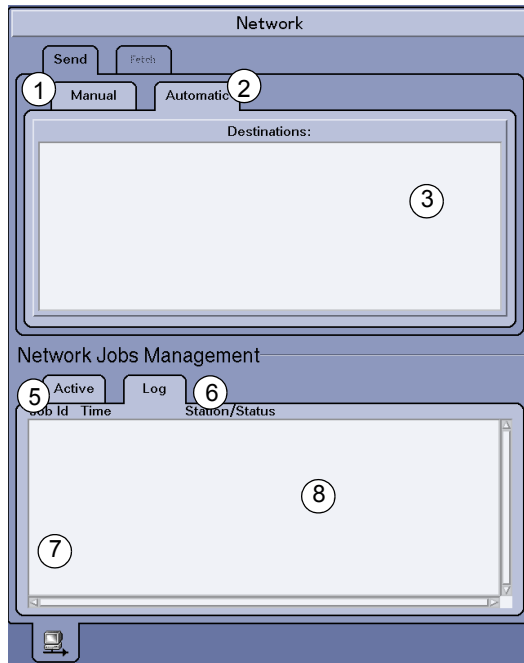
6. Click the toggle buttons that match the data type to be deleted: Acquired, Not acquired, Corrections, Transferred or Committed.
7. If you are sure that you want to delete *ALL* the data listed, click the [**Delete Selection**] button. The listed data is deleted from the database and the pop-up disappears.
8. If you want to delete only the data that has been transferred to another workstation, click the [**Delete Transferred**] button. The data that has been transferred is deleted from the database while data that has not been transferred is retained and the pop-up disappears.
9. Similarly, if you want to delete only the data that has been committed to another remote station (i.e. the remote station has confirmed that it has accepted responsibility for the safekeeping of acquired data), click the [**Delete Committed**] button.
10. If you are not sure that you wish to delete the data listed, click the [Cancel] button at the bottom of the pop-up. No data will be deleted and the pop-up disappears.

## Network Card

The **Network** card provides the means to transfer data acquired on GENIE Acquisition to a remote processing station (Processing and Review workstation, Starcam, eNTEGRA or a Xeleris computer for processing, reviewing, archiving and filming.



**Figure 4-16.** Manual Sub-card of Network Card



**Figure 4-17.** Automatic Sub-card of Network Card

**Table 4-14:** Network Card Components

No.	Description	Function
1	Send Tab card	Provides the controls for sending data to another station.
2	Fetch Tab card	Not functional.
3	Send Station toggles	Selects the P & R workstation or Starcam computer to send the data to.
4	Send button	Initiates the send operation after the data has been selected.
5	Active Tab card	Provides tools for viewing information about or cancelling transfer jobs currently being transferred.
6	Log tab card	Provides data transfer status information.
7	Cancel button	Cancels transfer of jobs selected in the Job Status Listing Area.
8	Job Status Listing Area	Lists information about jobs currently being transferred.

---

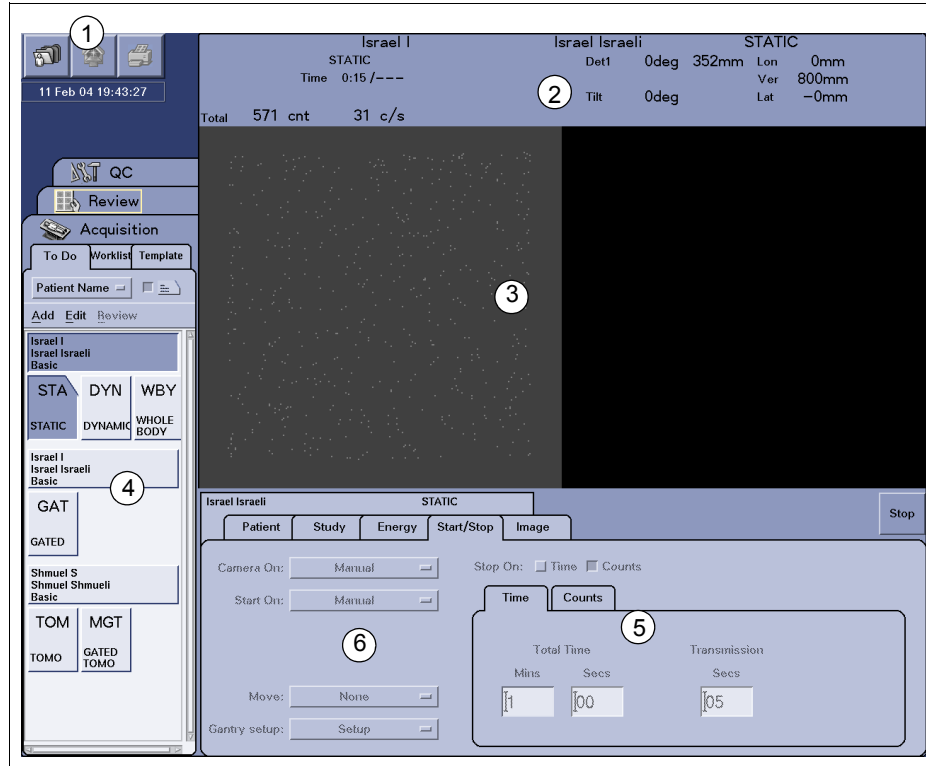
## Chapter 5 - Acquisition Card

This chapter provides a detailed description of the **Acquisition** card in the following breakdown:

- [Description on page 5-2](#)
- [Scan Selector on page 5-3](#)
- [Scan–Selector To Do Card on page 5-4](#)
- [Scan Setup Area on page 5-12](#)
- [Scan Control Area on page 5-40](#)
- [Status Area on page 5-43](#)
- [Setting the Window Level and Color Map on page 5-49](#)
- [Scan Selector – Worklist Card on page 5-52](#)
- [Scan Selector - Templates Card on page 5-54](#)

## Description

The acquisition card is used to set up and acquire scans. The card is divided into six main areas.



**Figure 5-1.** Acquisition Card and Acquisition & Review Screen

**Table 5-1:** Acquisition Card and Acquisition & Review Screen Components

No.	Description	Function
1	Gantry icon	Allows access to pre-programmed motions
2	Status area	Shows gantry and table positions along with the status of the current acquisition. See <a href="#">page 5-43</a> .
3	Image Display area	Displays data during acquisition or for review
4	Scan Selector Area	Creates and selects patient/studies and scans for acquisition. See <a href="#">page 5-3</a> .
5	Scan Setup Area	Specifies the details of the selected scan. See <a href="#">page 5-12</a> .
6	Scan Control Area	Contains buttons that control the acquisition. See <a href="#">page 5-40</a>

---

## Scan Selector

The scan selector is used to create and select patients, studies and datasets or scans. The scan selector has three cards: a **To Do** card, a **Worklist** card, and a **Templates** card.

- The **To Do** card creates scans to be acquired, shows scans that have not been acquired, and, optionally, shows scans that have already been acquired.
- The **Worklist** Card shows patients on the department's DICOM information system and can be used to select patients and studies to acquire without typing in the patient's information.
- The **Templates** card contains predefined acquisition templates, that are used to create new patients, studies, and scans. Refer to the Templates section in this chapter for more information on using Templates.

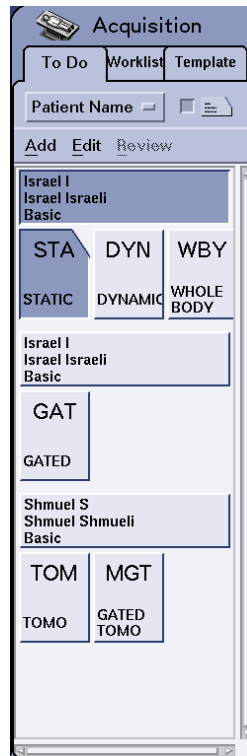


Figure 5-2. Scan Selector

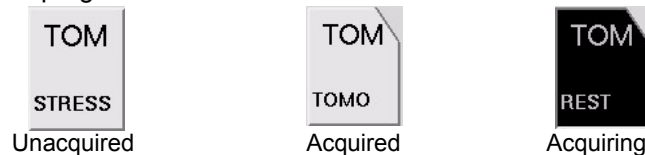
## Scan–Selector To Do Card

The To Do card is a scrolling display of patient study entries. Patient studies are identified by the patient ID, patient name and study name, which are displayed for each entry in the scan selector. Each entry displays the patient ID at the top, the patient name on the second line, and the study name on the bottom. The patient ID must be unique for the patient. All patient study entries with the same patient ID have the same patient name and associated patient details and comments. A scroll bar along the right edge of the To Do card allows you to view the entire list of patient studies.



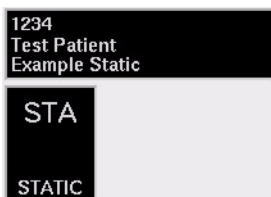
A patient study contains scans which appear as individual entries below the patient study entry. Each scan entry shows the type of scan at the top and the scan name at the bottom. Only three scan entries can be displayed at one time across the To Do card. If there are more than three scan entries, a scroll bar along the bottom edge of the card allows you to view all scan entries in a patient study. An unacquired scan is displayed in a rectangle. An acquired scan is displayed with the upper right corner cut from the rectangle and has black text.

A black rectangle with blinking upper right corner indicates a scan being acquired and in progress.



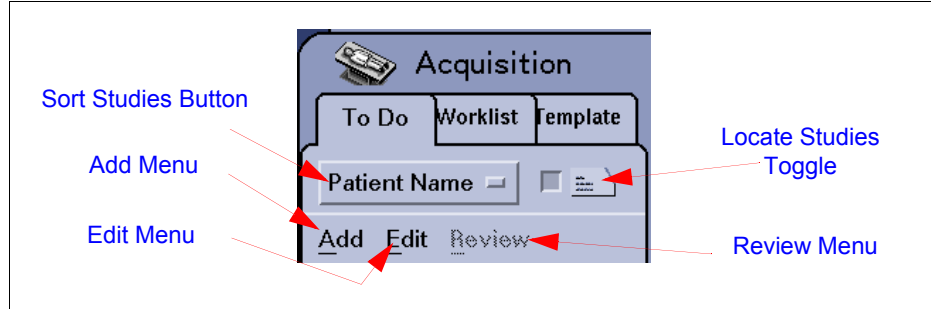
A patient study or scan is selected by clicking the entry in the scan selector. If a study containing any scans is selected, the first of the scans that has not been acquired is automatically selected. If a scan is selected, then its patient study is also automatically selected. Clicking a selected scan deselects it.

When a scan is selected, the entry turns black and its details are displayed on a stack of cards in the scan set up area. These cards provide the means to enter further patient and study details and to modify the scan. See the Scan Setup Area Section for further details.



## To Do Components

The To Do card on the Scan Selector has three pull-down menus: **Add**, **Edit**, and **Review**. It also has a **Sort Type** pull-down menu and a **Locate All** toggle



## Add Pull-down Menu

Table 5-2 lists the **Add** pull-down menu.

When any option is chosen on the **Add** pull-down menu, a sub-menu is displayed showing all the available acquisition template groups. When a particular group is selected, all the templates and protocols for that group are displayed and can then be selected.

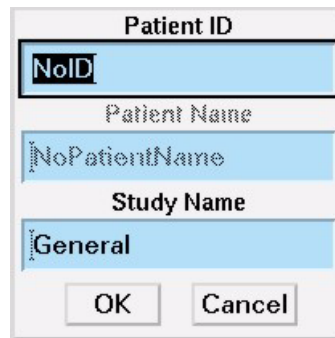
**Table 5-2: Add Pull-down Menu Components**

No.	Description	Function
1	Patient	Creates new Patient Study
2	Study	Creates new Patient Study using currently selected patient name.
3	Scan	Adds a new scan to the currently selected patient or protocol

---

## Patient Option

The **Patient** option is available when you select the **Add** pull-down from the **To Do** tab. When it is chosen, a new Patient Study is added to the **To Do** list on the **Scan Selector**. The scans that compose the template or protocol that has been selected are copied into the newly created Patient Study. The Patient Study Edit pop-up is then displayed in the Scan Selector. The default Patient ID is **NoID**, and the default Patient Name is **NoPatientName**. The Study Name is taken from the protocol selected. Enter the appropriate patient information. For instructions, see the [Edit Pull Down Menu on page 5-7](#) section below.



The image shows a dialog box titled "Patient ID". It contains three text input fields: "Patient ID" with the value "NoID", "Patient Name" with the value "NoPatientName", and "Study Name" with the value "General". At the bottom of the dialog box are two buttons: "OK" and "Cancel".

---

## Study Option

The **Study** option is available on the **To Do** card. It creates a new Patient Study for the currently selected patient. The patient details are copied from the selected patient, so it is not necessary to enter them again. A Patient Study must be selected for the **Study** option to be available.

---

## Scan Option

The **Scan** option is available on the **To Do** card. It allows new scans to be added to an existing Patient Study. Choosing a study or scan type from the Scan sub-menu adds one or more scans to the selected Patient Study. The scans are added after any scans that are already in the study. A Patient Study must be selected for the **Scan** option to be available.

## Edit Pull Down Menu

Table 5-3 lists and explains the Patient Edit pulldown menu options.

**Table 5-3: Patient Edit Pulldown Components**

No.	Description	Function
1	Patient Information	Changes patient information and study name.
2	Scan Information	Changes scan (image dataset) name.
3	Undo	Currently not functional.
4	Delete Scan	Deletes selected scan from the patient study.
5	Cut	Currently not functional.
6	Copy	Currently not functional.
7	Paste	Currently not functional.

### Patient Info Option

The identifying information for a Patient Study entry is changed by selecting the entry on the To Do card and then choosing the **Patient Info** option from the **Edit** pull–down menu. When the option is chosen a Patient Study Edit dialog is displayed over the Patient Study entry which allows the entry to be changed.

The image shows a dialog box titled "Patient ID". It contains four text input fields, each with a light blue background and a black border. The first field contains "NoID", the second "Patient Name", the third "Study Name", and the fourth "General". Below the fields are two buttons: "OK" and "Cancel".

**To update the Patient Study identification information:**

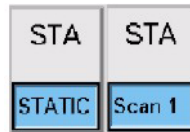
1. The first line is the **Patient ID** type–in field. Change the information on this line if necessary. If the patient ID is changed to that of a patient already in the database, the patient name is automatically updated to match the name of the patient with that ID. If the patient ID is not in the database, a new patient is created.
2. Press the <Tab> key to move to the second line, or click in the type–in field. This is the **Patient Name** type–in field. Change the name appropriately.
3. Press the <Tab> key to move to the next line, or click in the type–in field. This is the **Study Name** type–in field. Change the name, if desired.
4. Once the patient study identifying information has been set, click the [OK] button or press the <Enter> key to modify the entry. To leave the entry unchanged, click the [Cancel] button or press the <Esc> key.

---

**Scan Info Option**

Each scan (image dataset) entry has a name to identify the type of data that it acquires. When a scan is created, its name is copied from the template scan.

The scan name is changed by selecting the scan and then choosing the **Scan Info** option from the **Edit** menu. When the option is chosen a Scan Information pop–up is displayed over the selected scan entry which allows the name to be changed.



**To update the Scan Name:**

1. Select the scan from the Scan Selector on the **To Do** or **Template** card.
2. Select the **Scan Info** option from the **Edit** menu.
3. Change the name appropriately in the type–in field.
4. Once the information has been edited, press the <Enter> key to modify the name. To leave the scan name unchanged, press the <Esc> key.

---

## Delete Scan Option

A scan entry can be deleted from the Scan Selector. This is useful if a scan was added to a Patient Study by mistake.

An entire patient study can be deleted from the Scan Selector by using the Delete Study Option. If any scans in the selected patient study have been acquired but not transferred, this option is not available.

### To delete a scan entry:

1. Select the patient scan in the Scan Selector on the **To Do** card. The patient scan cannot be deleted if one of its scan is currently in **Camera On** state. Click the [**Camera Off**] button to remove the scan from Camera Mode.
2. Choose the **Delete Scan** option from the **Edit** pull-down menu.

---

## Review Pull-down Menu

One or more acquired patient studies can be reviewed on the **Review** card. This option automatically displays the selected scans on the **Review** card and brings the **Review** card to the front of the screen.

[Table 5-4](#) lists the review Pulldown menu options.

**Table 5-4:** Review Pull-Down Menu

No.	Description	Function
1	Add	Adds the currently acquired study to the selected Review card.
2	New	Creates a new Review card and loads the current study onto it.

## Sort Pull–down Menu

The list of Patient Studies can be sorted by five different parameters. This provides a means of arranging the entries in a manner most appropriate for a particular facility. On start up, the list will be sorted by Patient Name.



**Figure 5-3.** Patient Studies Sort Pull–Down Menu

**Table 5-5:** Sort Pull–Down Menu Components

No.	Description	Function
1	Patient Name	Sorts the list numerically and alphabetically by patient name. Patient names beginning with a number are listed first. Capitalized names are listed second. Names beginning with a lower case letter are listed last.
2	Patient ID	Sorts the list numerically and alphabetically by patient ID. Patient IDs beginning with a number are listed first. Patient IDs beginning with a capitalized letter are listed second. Patient IDs beginning with a lower case letter are listed last.
3	Study Name	Sorts the list numerically and alphabetically by study name. Study names beginning with a number are listed first. Study names beginning with a capitalized letter are listed second. Study names beginning with a lower case letter are listed last.
4	Date	Sorts the list chronologically by creation date. The oldest Patient Study is listed first and the newest Patient Study is listed last.

**Table 5-5:** Sort Pull–Down Menu Components

No.	Description	Function
5	Reverse Date	Sorts the list chronologically by reverse creation date. The newest Patient Study is listed first and the oldest Patient Study is listed last.

---

## Locate All Toggle

On start up, the Scan Selector **To Do** card only displays Patient Studies that have scans that have not been acquired. The **Locate All** toggle provides a means to display all the Patient Study entries in the database, even if there are no scans left to acquire in the study or to display only the Patient Studies that contain incomplete scans. This is useful to review the details of a scan already performed, or to add an additional scan for a Patient Study already acquired.

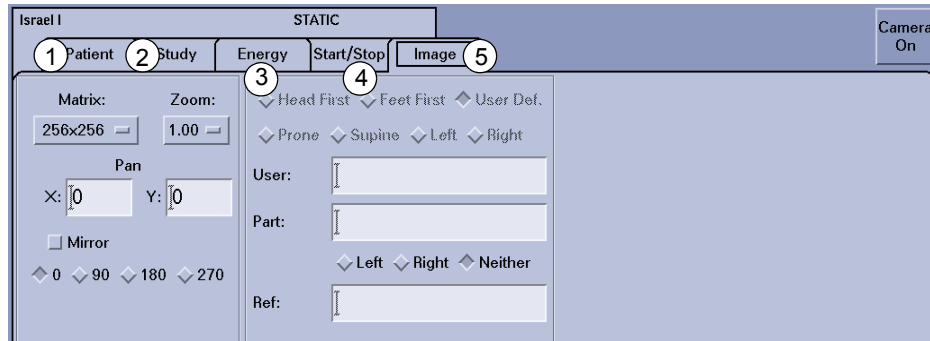
**Figure 5-4.** Locate All Toggle

When the Locate All toggle is on, all Patient Study entries in the database are displayed. This is useful for adding additional scans to a completed patient study, or for reviewing scan parameters for a scan already completed. When the Locate All toggle is off, only Patient Studies that are still incomplete are displayed. This option limits the number of patients in the list. This is the case when at least one scan in a study has not yet been acquired. On start up the Locate All toggle is on, so all patient studies are displayed.

## Scan Setup Area

### Description

The Scan Setup area contains a stack of cards for the selected scan. Each card contains related controls that specify the parameters of the scan to be performed. Cards are available to specify the patient and study details, the energy characteristics of the scan, the termination criteria, the image format, and when appropriate, ECG trigger parameters. The **Patient**, **Study**, **Energy**, **Start/Stop** and **Image** cards are displayed for all scan types. The **Image** card is displayed for all acquisitions except for Spectrum Acquisition. The **Trigger** card is only displayed for dynamic, gated and gated tomographic scan types.



**Figure 5-5.** Scan Setup Area

**Table 5-6:** Scan Setup Area Components

No.	Description	Function
1	<a href="#">Patient Card</a>	Specifies patient details.
2	<a href="#">Study Card</a>	Specifies study details.
3	<a href="#">Energy Card</a>	Specifies energy related corrections and parameters and shows energy spectrum.
4	<a href="#">Start/Stop Card</a>	Specifies termination criteria for the scan.
5	<a href="#">Image Card</a>	Specifies image related parameters.
6	<a href="#">Trigger Card</a>	Specifies ECG parameters and shows trigger histogram.

The scan setup cards contain many parameters to control the large number of options supported by GENIE Acquisition for Nuclear Medicine scans. Scan templates ensure that complex scan definitions can be easily and reliably reproduced without the need to modify the scan setup each time a scan is performed.

Some scan parameters are dependent on other parameters in the scan definition. If a parameter is set to a value that conflicts with another parameter, the conflicting fields are highlighted in white to indicate the source of the problem. The tabs for any card containing a conflict are also highlighted in white.

If the scan setup contains conflicting parameters, it is not possible to acquire the scan. The conflict can be removed by changing one of the dependent parameters to an acceptable value. Once this is done, the highlight is removed and the scan can be acquired.

Once a scan has been acquired, only the patient and study information on the **Patient** setup card may be modified. No other set up parameters can be changed.

## Patient Card

The **Patient** card contains various type-in fields for recording information and comments about the patient. Patient information is input on the left half of the card; study information is input on the right.

**Figure 5-6.** Patient Card

**Table 5-7:** Patient Card Components

No.	Description	Function
1	Gender toggle	Specifies whether the patient is male or female.
2	Date of Birth type-in field	Specifies the patient's date of birth.
3	Ethnic Group type-in field	Specifies the patient's ethnic origin.

**Table 5-7: Patient Card Components (Continued)**

No.	Description	Function
4	Other Names type-in field	Specifies additional names by which the patient is known.
5	Other IDs type-in field	Specifies additional identification numbers used by the patient.
6	Patient Comments type-in field	Specifies additional patient related information.
7	Age type-in field	Specifies the patient's age.
8	Weight type-in field	Specifies the patient's weight in kilograms.
9	Height type-in field	Specifies the patient's height in meters.
10	Alert type-in field	Specifies special alert information about the patient condition, if any.
11	Special Needs type-in field	Specifies special patient needs, if any.
12	Pregnancy State	Specifies pregnancy month, if any.
13	Occupation type-in field	Specifies the patient's occupation.
14	History type-in field	Specifies details of the patient's medical history pertinent to this study.
15	State type-in field	Specifies the patient's origin state.
16	Transport	Specifies the means by which the patient is transported to the clinic.
17	Location	Patient hospitalization location

## Study Card

The **Study** card can be update automatically according to the information retrieved from the Hospital Information System (HIS) Scheduled Procedure Step (SPS). However, it can be filled out manually by the operator.

The screenshot shows the 'Study Card' interface. At the top, there are tabs for 'Patient', 'Study', 'Energy', 'Start/Stop', and 'Image'. A 'Camera On' button is in the top right. Below these are tabs for 'Scheduled', 'Acquisition', and 'Processing'. The 'Scheduled' tab is active, showing a 'Scheduled Procedure Step' section with an 'ID' field (circled 5) and a 'Requested Procedure' section with an 'ID' field (circled 4) and a 'Priority' field. On the left side, there are three input fields: 'Accession Number:' (circled 1), 'Pre-medication:' (circled 2), and 'Comments:' (circled 3).

**Figure 5-7.** Study Card

**Table 5-8:** Patient Card Components

No.	Description	Function
1	Accession No. type-in field	Specifies the hospital ID number assigned to the patient.
2	Premedication type-in field	Specifies the medication that was administered to the patient before the study, if any.
3	Processing Tag type-in field	Specifies the study name that twill be used when the patient Study is sent to the P&R station.
4	Referring Physician type-in field	Specifies the physician that referred the patient for this study.
5	Reading Physician type-in field	Specifies the physician that will read the study.
6	Comments type-in field	Specifies additional study related information.
7	Requested Procedure type-in field	Specifies the procedure that was requested for this study.
8	Scheduled Procedure Step type-in field	Specifies the actual procedure applied for this study.

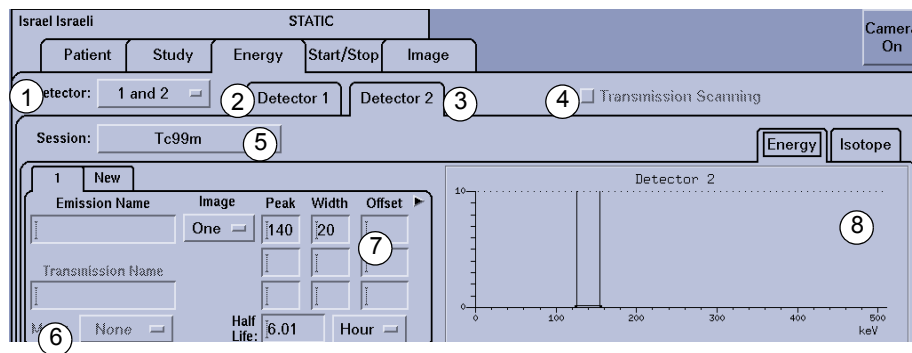
The only field requiring data is the Processing Tag type-in data. It is not always necessary to specify any of the other information on this card. However, some information may be required to correctly process the acquired data on a P&R station.

The **Study** card contains various type-in-fields for recording information and comments about the study. The Processing Tag often determines how the processing and review workstation processes the data, and should be verified for accuracy. The accession number is related to the DICOM worklist and may be filled in automatically if this feature is being used.

## Energy Card

The **Energy** card contains type-in fields and controls relating to the energy and isotope set ups for the scan. It contains two sub-cards for energy and isotope specific set ups. The energy sub-card contains further sub-cards to cater for multiple detector systems and for multiple energy set scans.

The Energy card contains many options for controlling the detector. In general, it should not be necessary to modify any of the energy parameters for a scan, since the template used to create the scan will contain the correct energy set up. Great care should be taken if any energy parameters are modified, since doing so can compromise the integrity of the acquired data.



**Figure 5-8.** Energy Card: Energy Sub-card

**Table 5-9:** Energy Card: Energy Sub-Card Components

No.	Description	Function
1	Detector pull-down menu	Allows the detector to acquire count data.
2	Detector 1 Tab card	Specifies the energy settings for Detector 1.
3	Detector 2 Tab card	Specifies the energy settings for Detector 2.
4	Transmission toggle	Enables transmission scan settings.
5	Energy session pull-down menu	Selects a predefined energy session to use for the acquisition from a pull down menu.
6	Mask pull-down menu	Currently not functional.
7	Energy Set Tab cards	Specifies the parameters for up to sixteen different energy sets.
8	Spectrum window	Displays the energy spectrum while in persistence or acquiring.

When GENIE Acquisition is in persistence mode, or is acquiring, the Energy sub-card displays the energy spectrum of the gamma rays being received by the detector. This provides a visual confirmation that the correct energy ranges will be acquired.

Clicking on the **Energy Session** pull-down menu brings up a pull-down menu of predefined energy sessions. These energy sessions provide the means to reliably set all the energy related parameters for a particular radiopharmaceutical or combination of radiopharmaceuticals. An energy session establishes the energy set definitions and detector corrections for the scan.

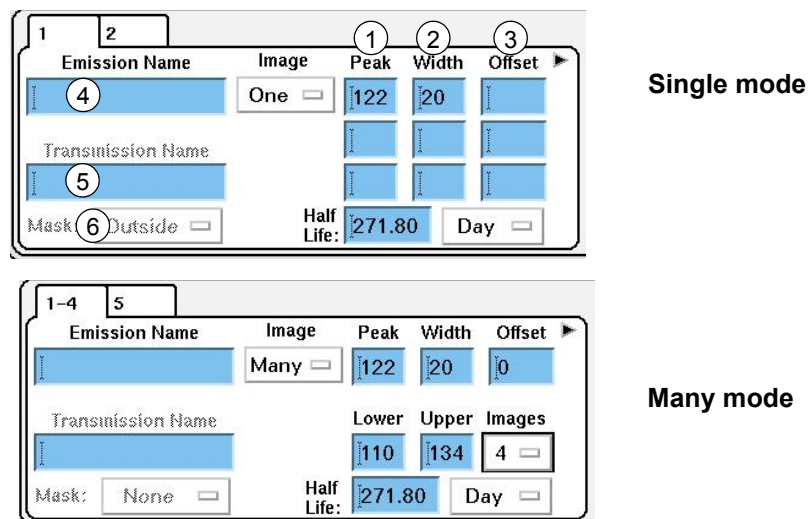


GENIE Acquisition is supplied with a set of GE defined energy sessions which can be modified. These contain the energy set up parameters used by the GE templates. New energy sessions can also be defined. [Chapter 8](#) gives details on creating and customizing energy sessions.

There are up to eight energy window definition cards. Each card defines the energy windows used to acquire the scan. There are two modes controlled by the 'Mode' option menu; **Single mode** and **Many mode**. The card may be expanded to show more detail by clicking on the <Expand> button in the top right hand corner. When the energy window definition card is expanded, the energy histogram is not displayed.

In Single mode, up to three windows may be defined by entering an energy peak width and offset. These windows will be used to acquire one image. When the definition card is expanded the upper and lower energy window settings are displayed and may be edited.

In Many mode, a single energy window can be defined which is then split into up to eight sub-windows. Each sub-window will be acquired into a separate image. If the definition card is expanded the sub-windows may be individually edited.



**Figure 5-9.** Energy Card: Energy Set Tab Card

**Table 5-10: Energy Set Tab Card Components**

No.	Description	Function
1	Peak type—in field	Specifies the peak energy of the window in keV
2	Width type—in field	Specifies the width of the energy window around the peak in percent.
3	Offset type—in field	Specifies the window offset in percent of the peak.
4	Emission Name type—in field	Specifies the name of the isotope defined in the energy set.
5	Transmission Name type—in field	Currently not functional.
6	Mask pull—down menu	Currently not functional.

The **Isotope** sub-card contains type—in fields for specifying the details of the radiopharmaceutical used and pull—down menus for selecting collimator and detector corrections to be applied to the data as it is acquired and processed.

**Figure 5-10. Energy Card: Isotope Sub-card****Table 5-11: Isotope Sub-Card Components**

No.	Description	Function
1	Isotope type—in field	Specifies the name of the peak isotope.
2	Pharmaceutical type—in field	Specifies the chemical form of the radiopharmaceutical being used.
3	Nuclide Volume type—in field	Specifies the volume of the injected dose in milliliters.
4	Total Dose type—in field	Specifies the activity of the injected dose in Mega Becquerels.
5	Dose type—in field	Specifies the activity of the injected dose in Kilocounts.
6	Residual Dose type—in field	Specifies the activity of the residual dose left in the syringe in Kilocounts.

**Table 5-11: Isotope Sub-Card Components (Continued)**

No.	Description	Function
7	Collimator pull-down menu	Specifies the collimator being used for the acquisition.
8	Uniformity pull-down menu	Specifies the uniformity correction associated with the acquisition.
9	COR pull-down menu	Specifies the center of rotation correction associated with the acquisition.
10	Blank pull-down menu	Currently not functional.
11	Energy pull-down menu	Specifies the energy correction being used for the acquisition.
12	Spatial pull-down menu	Specifies the spatial correction being used for the acquisition.
13	PMT pull-down menu	Specifies the photomultiplier tube tuning correction being used for the acquisition.
14	Source pull-down menu	Currently not functional.
15	Range toggles	Currently not functional.
16	AutoTracking Peak type-in field	Not functional for Millennium MPR/MPS.
17	AutoTracking Width type-in field	Not functional for Millennium MPR/MPS.
18	Mask Width type-in field	Currently not functional.
19	Comments type-in field	Specifies additional isotope related details.

If the collimator is changed using the **Collimator** pull-down menu, the uniformity and center of rotation corrections are set to the default parameters for that collimator. If a default correction is not available, the correction option is set to none.

If the energy session is changed using the **Energy Session** pull-down menu, the Energy, Spatial and PMT corrections are set to the default for that energy session. If a detector or collimator correction is changed using one of the pull-down menus on the Isotope Tab card, the new setting will override the default setting for the energy session and collimator.

The Isotope, Pharmaceutical, Include Volume, Total Dose Residual Dose and Comments type-in-fields do not need to be specified.



**WARNING**

Using an inappropriate detector correction can adversely affect the quality of the acquired data. Do not override the detector Energy or Spatial corrections unless you are directed to do so by a qualified service engineer.

**WARNING**

Using an inappropriate collimator correction can adversely affect image processing. Be sure to select the appropriate uniformity and center Of rotation corrections for the collimator being used for imaging.

---

**Start/Stop Card**

The **Start/Stop** setup card defines how the scan starts and stops (termination criteria). Scans can always be started manually by clicking the [Start] button and stopped manually by clicking the [Stop] button in the Acquisition Card Scan Control area (described later in this chapter), or in the Status area if the Acquisition card is not at the front of the stack.

The Start/Stop card, is divided into two areas: the Start area and Stop area. The Start area defines how the acquisition is to be started and the Stop area defines how to end the acquisition.

The controls on the Start/Stop card vary depending on the type of acquisition being set up.

Each start and stop criteria requires parameters to define the condition that will cause the scan to start and stop. A scan can start manually, automatically, based on Time or when a desired Count Rate is detected. A scan can stop automatically based on Time, Counts, Length or Triggers. If more than one termination criteria is selected, then an acquisition ends based upon the parameters first completed. If all Start/Stop options are deselected, the scan will not end automatically and no further parameters need to be specified. In this case, the scan must be stopped manually.

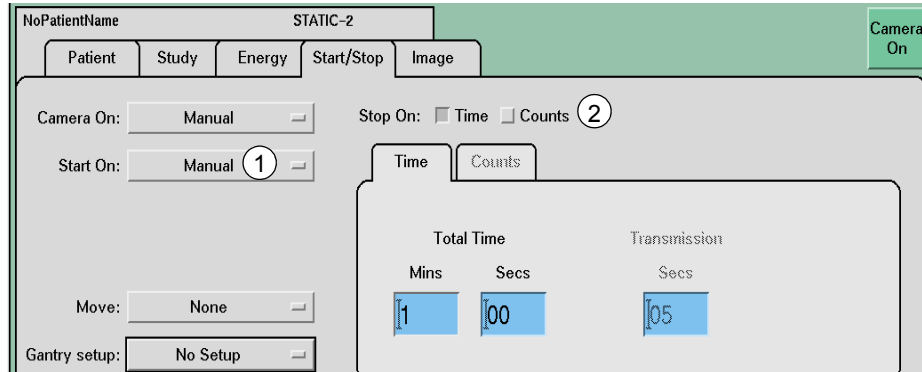


Figure 5-11. Start/Stop Card Areas

Table 5-12: Start/Stop Card Areas

No.	Description	Function
1	Start Method area	Specifies how to start the acquisition.
2	Stop Method area	Specifies how the scan will terminate.

### Including a Pre-Programmed Position into an Acquisition

One of the pre-programmed positions can be included into your acquisition using the following procedure:

1. Click <Move> (see [Figure 5-12](#)).
2. From the drop-down list, select the pre-programmed position you want to include in the acquisition.

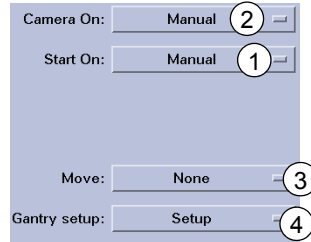
When acquisition is started, the pre-programmed position will be performed **first**.

**Note**

See [Table 4-3](#) for a list of pre-programmed positions.

## Start Methods

The Start methods are the same for each scan type.



**Figure 5-12.** Start/Stop Card

**Table 5-13:** Start/Stop Card: Components

No.	Description	Function
1	Start Method pull-down menu	Specifies whether the scan will start manually, on time or at a count rate.
2	Camera On pull-down menu	Specifies whether the next acquisition in a study will be automatically brought up to Camera On state (Automatic) or need to be selected (Manual).
3	Move pull-down menu	Allows a selected pre-programmed position to be performed as a part of the acquisition.
4	Gantry pull-down menu	Specifies whether or not gantry and table movement prompts will be displayed after Camera On occurs. With tomographic acquisitions, the acquisition begins based on the current gantry/table position, providing No Setup is selected. If Setup is selected, prompts will be given to determine gantry/table positions.

There are three ways to start an acquisition:

- [Manual Start](#)
- [Start on Time](#)
- [Start on Count Rate](#)

### Manual Start

The Manual start option starts the acquisition when the [Start] button is enabled in the Camera On state and clicked. [Figure 5-13](#) shows the start on Manual selection.

### Start on Time

The Start on Time option automatically starts the acquisition after the typed in delay expires.

**Figure 5-13.** Start/Stop Card: Start on Time

**Table 5-14:** Start/Stop Card: Start on Time Components

No.	Description	Function
1	Start Time Minutes type-in field	Specifies the number of minutes before starting acquisition.
2	Start Time Seconds type-in field	Specifies the number of seconds before starting acquisition. Must be a value less than 60.

### Start on Count Rate

The Start on Count Rate automatically starts the acquisition when the typed in count rate in coagulants is detected.

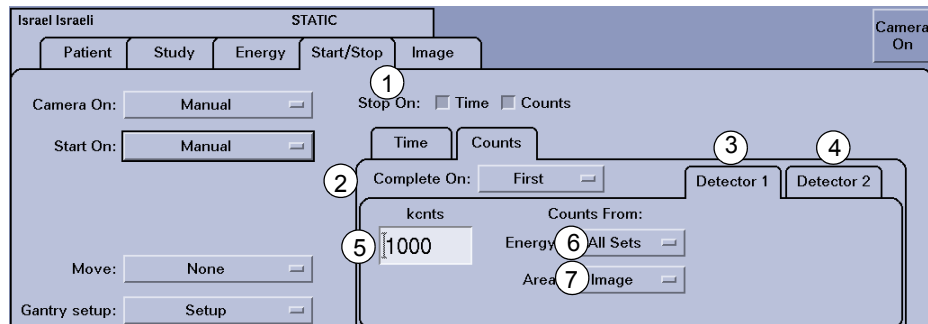
**Figure 5-14.** Start/Stop Card: Start on Count Rate

## Termination Methods

There are different methods to terminate acquisition based on the scan type. Most terminations are done by time, counts, scan length, or trigger. If more than one termination criteria is selected, then an acquisition ends based upon the parameter completed first. If all Start/Stop options are deselected, the scan will not end automatically and no further parameters need to be specified. In this case the scan must be stopped manually.

No matter how the termination criteria are set, scans can always be stopped manually by clicking on the [Stop] button in the Acquisition card Scan Control area, or in the Status area if the Acquisition card is not at the front of the stack.

### Static Scans Termination Methods

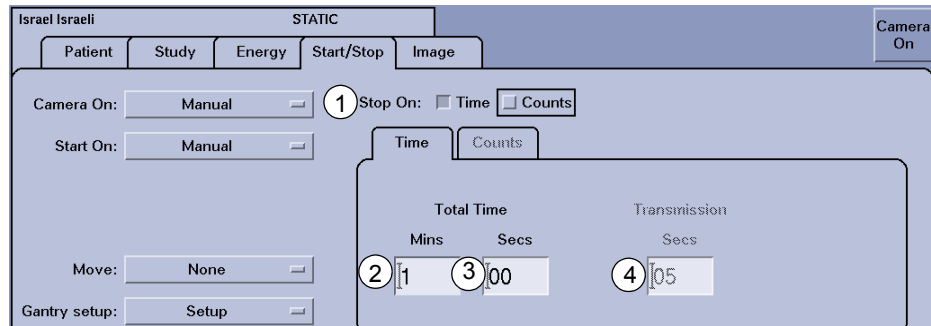


**Figure 5-15.** Static Start/Stop Card: Termination by Counts

**Table 5-15:** Static Start/Stop Card: Termination by Counts Components

No.	Description	Function
1	Stop On Count toggle	The count toggle is selected indicating the scan will terminate on counts.
2	Complete On pull-down menu	Specifies which detector will terminate the scan when a specified count is reached: First is the only option available for Millennium MPR/MPS.
3	Detector 1 Tab card	Specifies the termination criteria for Detector 1.
4	Detector 2 Tab card	Not relevant for single head system.
5	Kilocounts type-in field	Specifies the number of Kilocounts needed to end the acquisition.
6	Energy Set pull-down menu	Specifies whether the number of counts necessary to terminate the scan should come from a specific energy set; if All Sets is selected, counts from all of the energy sets are combined.
7	Count Area toggle	Specifies whether the counts in the entire image, or inside or outside of an ROI will be used to terminate the scan.

If the Inside ROI or Outside ROI Count Area toggle is selected, when the [Camera On] button is clicked, a square ROI will be displayed over the image in the Image Display Area. Using the mouse, adjust the size and location of the ROI before starting the acquisition.

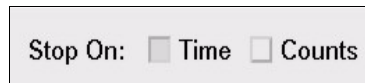


**Figure 5-16.** Static Start/Stop Card: Termination by Time

**Table 5-16:** Static Start/Stop Card: Termination by Time Components

No.	Description	Function
1	Stop On Time toggle	Time toggle is selected indicating the scan will terminate on time.
2	Minutes type-in field	Specifies the time in minutes needed to terminate the acquisition.
3	Seconds type-in field	Specifies the time in seconds needed to terminate the acquisition. Must be a value less than 60.
4	Seconds type-in field Transmission Scanning	Currently not functional.

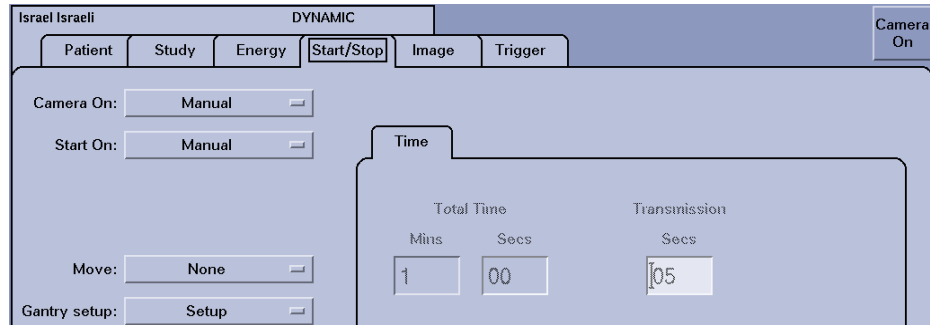
If both Stop On Time and Stop On Counts are selected, the scan is terminated by whichever option is completed first.



**Figure 5-17.** Static Start/Stop Card: Manual Termination

If neither Stop On option is selected, the scan must be terminated manually by clicking the [Stop] button in the **Acquisition Scan Control** area.

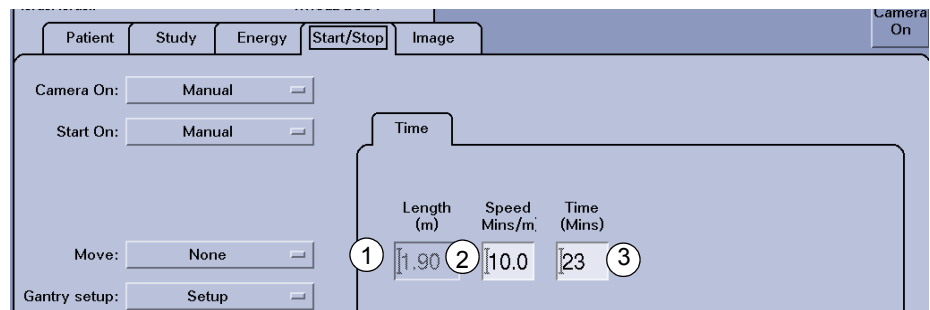
## Dynamic Scan Start/Stop Card



**Figure 5-18.** Dynamic Start/Stop Card

The Start On options are the same as for the Static scan. Refer to Figures 3-25, 3-26, and 3-27 for more detailed information. There are no Stop On options. These parameters are defined on the **Image** card.

## Whole Body Scans Start/Stop Card



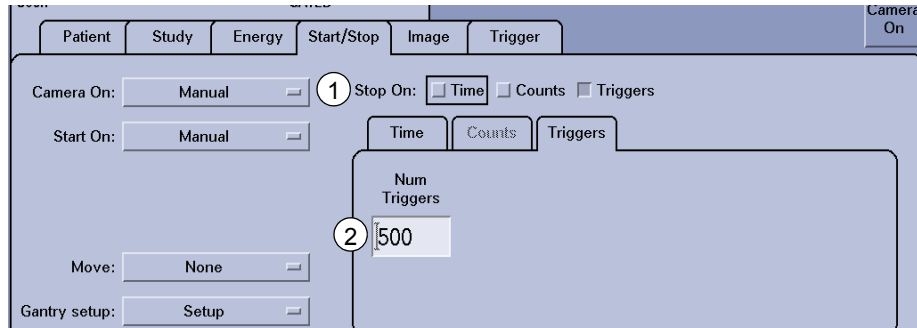
**Figure 5-19.** Whole Body Start/Stop Card

**Table 5-17:** Whole Body Start/Stop Card Components

No.	Description	Function
1	Length type—in field	Shows the length of the whole body scan in meters. This field is modified on the <b>Image</b> card.
2	Speed type—in field	Specifies the speed of the acquisition in minutes/meter.
3	Time type—in field	Specifies the total time of the acquisition in minutes.

The 3 type—in fields on the Whole Body Start/Stop card are inter-related. Entering information into 2 of the 3 fields, will automatically fill in the appropriate information in the 3rd field. For example, if the length and speed of the acquisition are specified, GENIE Acquisition will calculate the total time of the acquisition.

## Gated Scans Termination



**Figure 5-20.** Gated Start/Stop Card: Termination by Triggers

**Table 5-18:** Gated Start/Stop Card: Termination by Triggers Components

No.	Description	Function
1	Stop On Triggers toggle	Trigger toggle is selected indicating the scan will terminate by number of triggers.
2	Number of Triggers type-in field	Specifies the number of triggers needed to terminate the acquisition.

The controls for the Stop On Counts and Stop On Time options are the same as for the static scan. See [Figure 5-12](#), and [Figure 5-14](#) for more detailed information on the controls.

### Tomographic Scans Termination

**Figure 5-21.** Tomographic Start/Stop Card: Termination by Time

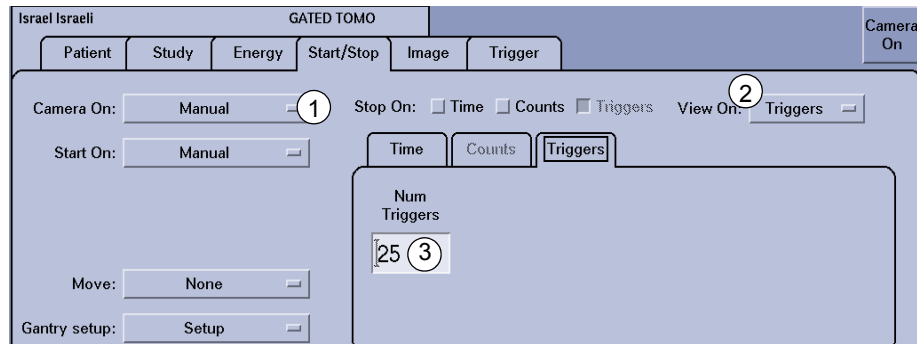
**Table 5-19:** Tomographic Start/Stop Card: Termination by Time Components

No.	Description	Function
1	Termination Method toggles	Time toggle is selected indicating the scan will terminate on time.
2	Minutes type-in field	Specifies the total time in minutes needed to terminate the acquisition.
3	Seconds type-in field	Specifies the total time in seconds needed to terminate the acquisition. Must be a value less than 60.
4	Emission Seconds type-in field	Specifies the time in seconds needed to acquire each view.
5	Transmission Seconds type-in field	Currently not available.
6	Views type-in field	Displays the total number of views for the acquisition that is specified on the Image Card. This value cannot be changed on the Start/Stop Card.

The controls for the Stop On Counts option is the same as for the static scan. See [Figure 5-11](#) and [Figure 5-12](#) for more detailed information on the controls.

If the Stop On Counts toggle is selected, the first view of the tomographic scan will terminate on the specified number of counts. All remaining views in the acquisition will terminate on the time it took for the first view to acquire.

## Gated Tomographic Scans



**Figure 5-22.** Gated Tomographic Start/Stop Card: Termination by Triggers

**Table 5-20:** Gated Tomographic Start/Stop Card: Termination by Triggers Components

No.	Description	Function
1	Stop On Trigger toggle	Trigger toggle is selected indicating the scan will terminate on triggers.
2	View On pull-down menu	Specifies how the remaining views of the scan (after the first view) will terminate. The options are: Time or Triggers.
3	Number of Triggers type-in field	Specifies the number of triggers needed to terminate the first view of the acquisition.

The Stop On toggles specifies how the first view of the scan will terminate. The **View On** pull-down menu determines how the remainder of the views will terminate. If the **View On Time** pull-down option is selected, the remaining views will terminate on the time it takes for the first view to acquire. If the **View On Triggers** pull-down option is selected, the remaining views will terminate after the same number of triggers is acquired as was acquired in the first view.

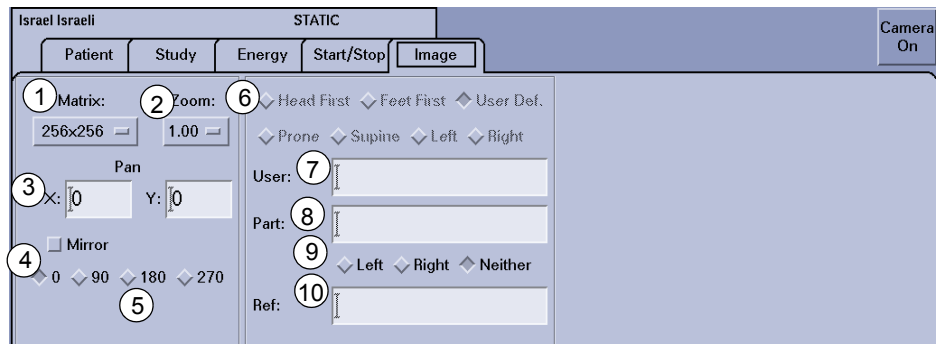
The controls for the Stop On Time option is the same as for the Tomographic scan. See [Figure 5-15](#) for more detailed information on the controls.

If the Stop On Time toggle is selected, the type-in fields on the Gated Tomographic Start/Stop card are relational. If information is input into two of these fields, the third field will automatically fill in the appropriate information. For example, if the time per view and number of views are specified, GENIE Acquisition will calculate the total time of the acquisition.

The controls for the Stop On Counts option is the same as for the Static scan. See [Figure 5-11](#) and [Figure 5-12](#) for more detailed information on the controls.

## Image Card

The **Image** setup card contains controls defining the image format to be acquired, and whether the acquired data should be panned, zoomed or transformed as it is received. Additional parameters are available and vary depending on the type of scan selected.

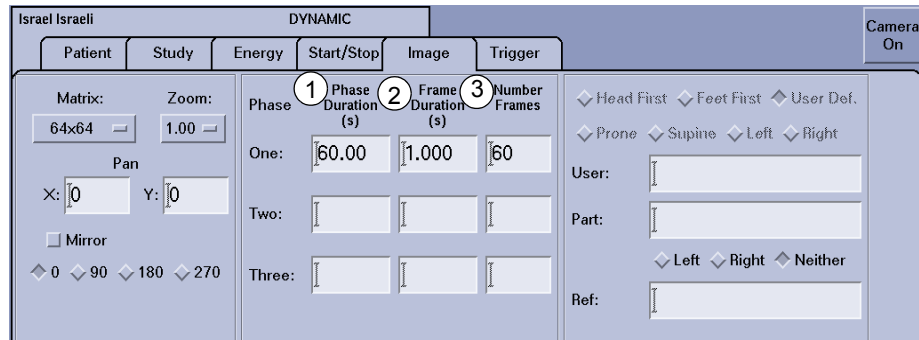


**Figure 5-23.** Scan Setup Area: Static Image Card

**Table 5-21:** Static Image Card Components

No.	Description	Function
1	Matrix pull-down menu	Specifies the dimensions of the acquisition matrix.
2	Zoom pull-down menu	Specifies the zoom factor to use for the acquisition. Along with the Pan Type-in fields, determines the area of the detector field of view that is used to form the image.
3	Pan type-in fields	Specifies the position around which the acquisition is centered. Along with the Zoom pull-down menu, determines the area of the detector field of view that is used to form the image.
4	Mirror buttons	If selected, the acquired image will be mirrored around its vertical axis.
6	Orientation toggles	Specifies if the patient's head or feet are positioned under/over the detector. This indicates which part will be imaged first. These controls are not functional on the Static Image Card, for which this control is set to User Defined.
7	User type-in field	Specifies the user defined patient position. This field is informational only.
8	Part type-in field	Specifies the body part to be scanned.
9	Left/Right/Neither toggles	Specifies which side of the body needs attention. This field is informational only.
10	Reference type-in field	Specifies an anatomical reference. This field is informational only.

Most Image cards are divided into thirds. The left third of each image card contains the controls for the matrix size, pan and zoom, mirror and image rotation. The right third contains the controls and type-in fields for patient orientation. The controls in the left and right thirds remain the same for all scan types, although some controls may be deactivated or removed. The controls in the middle third, however, are unique to the scan type selected.



**Figure 5-24.** Dynamic Image Card

**Table 5-22:** Dynamic Image Card Components

No.	Description	Function
1	Phase Duration type-in fields	Specifies the total length of the phase in seconds.
2	Frame Duration type-in fields	Specifies the length of each frame in the phase in seconds.
3	Number of Frames type-in fields	Specifies the total number of frames in the phase.

The Dynamic Image card allows the acquisition to be divided into one to three phases which follow immediately after each other during acquisition. Phase Duration, Frame Duration, and Number of Frames can be defined separately for each phase, but do remain relational.

The controls on the left and right thirds of this card are identical to those found on the Static Image card. Refer to [Figure 5-23](#) for detailed information on these controls.

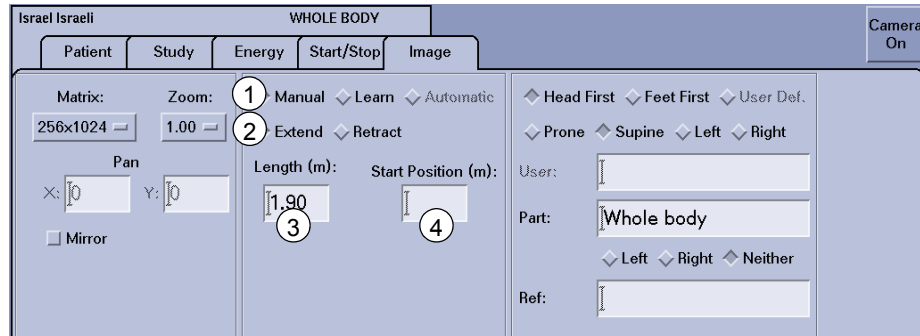


Figure 5-25. Whole Body Image Card

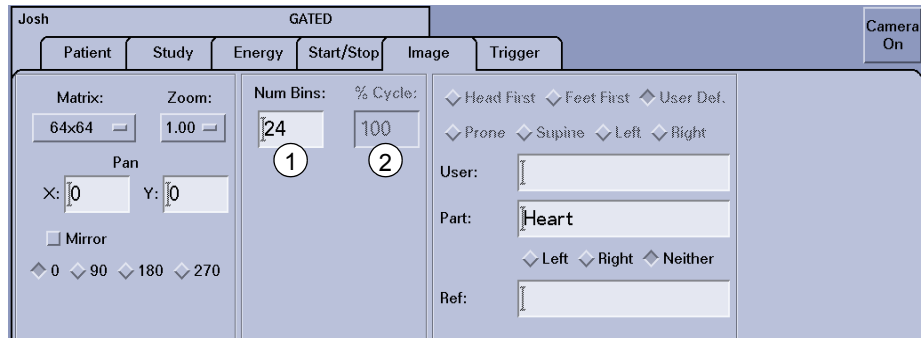
Table 5-23: Whole Body Image Card Components

No.	Description	Function
1	Method toggles	Specifies whether the acquisition will be acquired manually or automatically. The Manual selection indicates that any table height adjustment during the scan must be done manually. The automatic method is not applicable to MPR/MPS systems.
2	Direction toggles	Specifies whether the table will extend (move into the gantry) or retract (move away from the gantry) during acquisition.
3	Length type—in field	Specifies the length of the whole body scan in meters. Scan range must be between 0 to 1.90 m.
4	Start Position type—in field	Specifies the table start position; between 0 to 1.90 m. The value to be entered can be read from the status area, but must be converted from millimeters to meters. Leave blank if you do not want to specify.

The controls on the left and right thirds of this card are identical to those found on the Static Image card except that there are no Rotation toggles, and the Orientation toggles are now active.

**Head First** indicates that the scan will start at the head of the patient, so the image will built from the top of the screen down. **Feet First** indicates that the scan will start at the feet of the patient, so the image will built from the bottom up. It Does **not** refer to the location of the patient's head in relation to the gantry.

Refer to [Figure 5-23](#) for detailed information on these controls.



**Figure 5-26.** Gated Image Card

**Table 5-24:** Gated Image Card Components

No.	Description	Function
1	Number of Bins type-in field	Specifies the number of bins (frames) into which each heart cycle is divided.
2	Percent of Cycle type-in field	Specifies the percent of the heart cycle imaged. Currently set to 100% and cannot be changed.

The controls on the left and right thirds of this card are identical to those found on the Static Image card. Refer to [Figure 5-23](#) for detailed information on these controls.

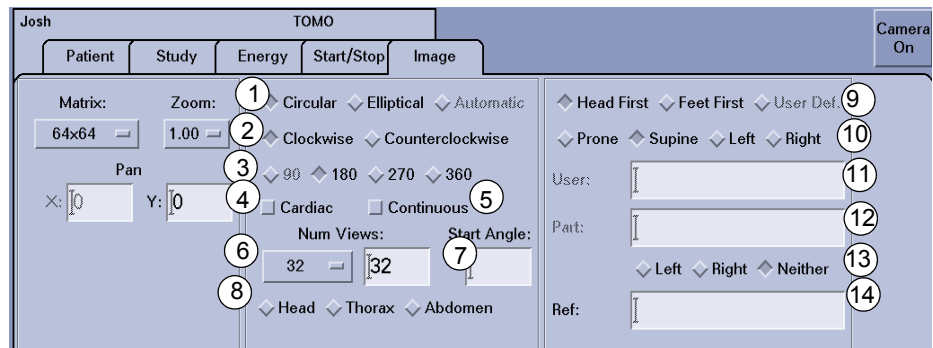


Figure 5-27. Tomographic Image Card

Table 5-25: Tomographic Image Card Components

No.	Description	Function
1	Rotation Type buttons	Specify the type of rotation orbit: Circular or elliptical. The automatic method (body contouring) is not applicable to MPR/MPS systems.
2	Rotation direction buttons	Specify the rotation direction: CW or CCW.
3	Arc buttons	Specify the rotation arc. For non-ECT acquisitions, this compensates for non-standard patient positioning. If the patient is positioned head first into the gantry, the 0 toggle can be selected.
4	Gantry Mode Toggle	Specifies whether the gantry is in cardiac or opposed mode.
5	Acquisition Mode Toggle	Specifies whether the acquisition will be continuous or Step & Shoot.
6	Number of Views button and type-in field	Specifies the number of frames to be acquired.
7	Start Angle type-in field	Detector start position. For Clockwise direction it refers to Detector 1. For counterclockwise direction, it refers to detector 2.
8	Part buttons	Specify the part of the body being imaged.
9	Orientation toggles	Specifies if the patient's head or feet are positioned under/over the detector. This indicates which part will be imaged first. These controls are not functional on the Static Image Card, for which this control is set to User Defined.
10	Position toggles	Specifies the patient positioning: Prone, Supine or lying on his/her left or right side.

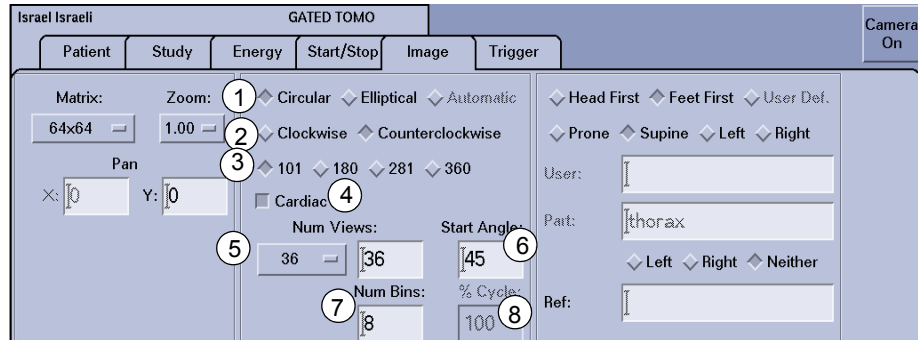
**Table 5-25: Tomographic Image Card Components (Continued)**

No.	Description	Function
11	User type—in field	Specifies the user defined patient position. This field is informational only.
12	Part type—in field	Specifies the body part to be scanned.
13	Left/Right/Neither toggles	Specifies which side of the body needs attention. This field is informational only.
14	Reference type—in field	Specifies an anatomical reference. This field is informational only.

The controls on the left and right thirds of this card are identical to those found on the Static Image card except that there are no Mirror or Rotation toggles, and the Orientation toggles are now active. In addition, the X Pan value cannot be changed.

**Head First** indicates that the head of the patient is pointed into the gantry. **Feet First** indicates that the feet of the patient are pointed into the gantry.

Refer to [Figure 5-23](#) for detailed information on these controls.



**Figure 5-28.** Gated Tomographic Image Card

**Table 5-26:** Gated Tomographic Image Card Components

No.	Description	Function
1	Type toggles	Specifies whether the scan will be done using a circular or programmable body contour (elliptical) orbit. The programmable body contour orbit is not applicable for MPR/S systems.
2	Direction toggles	Specifies whether the acquisition will be acquired clockwise (CW) or counterclockwise (CCW).
3	Arc toggles	Specifies the arc of acquisition.
4	Gantry Mode toggle	Specifies whether cardiac or opposed gantry mode is used. Changes Arc and Number of Views options to match those available in the opposed (180 degree) or cardiac (101 degree) positions.
5	Number of Views type-in field	Specifies the total number of views in the acquisition.
6	Start Angle type-in field	Specifies the start angle for the acquisition. If specified, GENIE Acquisition will automatically move to this angle prior to beginning the acquisition.
7	Number of Bins type-in field	Specifies the number of bins (frames) into which each heart cycle is divided.
8	Percent of Cycle type-in field	Specifies the percent of the heart cycle imaged. Currently set to 100% and cannot be changed.

The controls on the left and right thirds of this card are identical to those found on the Static Image card except that there are no Mirror or Rotation toggles, and the Orientation toggles are now active. In addition, the X Pan value cannot be changed. **Head First** indicates that the head of the patient is pointed into the gantry. **Feet First** indicates that the feet of the patient are pointed into the gantry.

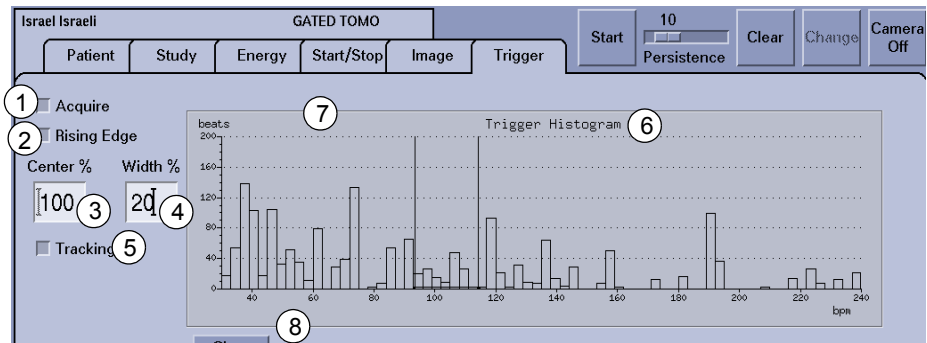
Refer to [Figure 5-23](#) for detailed information on these controls.

## Trigger Card

The **Trigger** setup card defines how data is accepted and rejected during a gated or gated tomographic scan. The **Trigger** card defines which acquired data is to be added to the image set. It also allows for data acquired during atypical heart cycles to be discarded.

The **Trigger** card displays a histogram of the number of heart beats that are received from the ECG trigger input in each beat range. The Beat Acceptance Window is indicated by a pair of vertical lines.

The Trigger card is only available for Gated, Gated Tomographic and Dynamic scans.



**Figure 5-29.** Trigger Card

**Table 5-27:** Trigger Card Components

No.	Description	Function
1	Acquire toggle	If selected, a trigger history will be acquired and saved with the image set. If the acquire toggle is not selected, the scan will not gate.
2	Rising Edge toggle	If selected, triggering occurs on the rising edge of the QRS complex. If deselected, triggering occurs on the falling edge of the QRS complex.
3	Center type—in field	Specifies the center of the Beat Acceptance Window as a percentage of the ten beat heart rate average. The Center is 100% if the window is centered over the ten beat average.
4	Width type—in field	Specifies the width of the Beat Acceptance Window as a percentage of the center.

**Table 5-27: Trigger Card Components (Continued)**




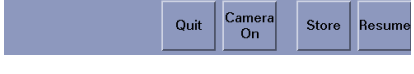
No.	Description	Function
5	Tracking toggle	If selected, the Beat Acceptance Window will follow the ten beat average if it changes during the acquisition. If it is not selected, the Beat Acceptance Window will remain fixed during the acquisition. The Beat Acceptance Window always tracks while in Persistence mode.
6	Trigger Histogram	Displays a histogram of the number of heart beats received from the ECG trigger.
7	Beat Acceptance Window	Range of heart beats that will be accepted during the acquisition.
8	Clear Heart Rate Average button	Clears the current Heart Rate Average and acquires another ten beat average. Also clears the Trigger Histogram.

The Beat Acceptance Window is specified using type-in fields for the Center and Width of the range. A Center of 100% will have the Beat Acceptance Window centered over the ten beat average. For example, assume the Beat Acceptance Window is centered over an average heart rate of 70 bpm with a window width of 20%. This means the Beat Acceptance Window extends from 63 bpm to 77 bpm.

Increasing the Center percentage moves the window to the right; decreasing it moves the window to the left.

## Scan Control Area

The Scan Control area contains buttons that control the acquisition of the scan. When no scan is selected, no buttons are displayed. With a scan selected, the Scan Control area has the following four states with different controls available in each state.

Scan Controls	State	Description
	Camera Off	A scan is selected but no image data is being displayed.
	Camera On	A camera image is displayed.
	Acquire	The scan is being acquired.
	Manual Stop	The acquisition has been stopped by the operator.

## Camera Off State

The [**Camera On**] button is the only button available. Clicking the [**Camera On**] button activates the Image Display area and prepares the detector and gantry to acquire the scan. The system is then in the Camera On State. The image displayed shows data that is being received from the detector for the first energy set of the scan. The image display is used to ensure that the detector and patient are properly positioned, and that the energy set up is correct before acquiring the scan.

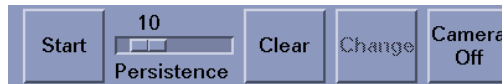


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## Camera On State

Whole body, tomographic and gated tomographic scans require the gantry to be positioned before the scan can be acquired. A sequence of pop-ups are displayed in the top left corner of the screen giving instructions on how to position the gantry. Once the gantry is positioned, the **[Start]** button becomes available.

The **[Start]** button is not available until the detector and gantry are ready to perform the scan. Clicking the **[Start]** button begins the acquisition, and moves the system to the Acquire State.



The Persistence Slider sets the rate of persistence of the camera image in the Image Display Area. A short persistence means the camera image will decay rapidly. This is useful for images with a lot of counts that need to be refreshed often during positioning. A long persistence means the camera image will build up over a longer period of time. This is useful for low count images where the build up allows better visualization of the area of interest.

Clicking the **[Clear]** button clears the camera image in the Image Display Area. This is used to clear the old image after the detector or patient has been repositioned.

If the Scan Setup Cards are used to modify the scan parameters, the **[Start]** button becomes unavailable. Clicking the **[Change]** button sends the modified scan definition to the detector and gantry. Once the new scan parameters are accepted, the **[Start]** button becomes available again.

The **[Camera Off]** button cancels the scan, stops the camera image display, and moves the system to the Camera Off State. Once the camera is off, a new scan can be acquired.

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## Acquire State

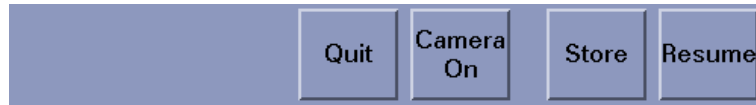
Clicking the **[Stop]** button manually stops the acquisition, and moves the system to the Manual Stop State. If a scan is stopped manually, the acquired data may be incomplete.



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## Manual Stop State

The [**Quit**] button cancels the scan, stops the camera image display, and deletes the data that has been acquired to that point. The system is moved to the Camera Off State. The scan can be reacquired, if desired.



The [**Camera On**] button deletes the data that has been acquired to that point, and returns to the Camera On State. The scan can then be restarted.

The [**Store**] button saves the data acquired to that point. The data is stored in the database. Once stored, the scan cannot be resumed or reacquired.

The [**Resume**] button restarts the acquisition of data from the point where it was stopped manually. Resume returns to the Acquire State and adds to the data already acquired.

## Status Area

The acquisition Status Area is displayed at the top the Acquisition Card. In the Camera Off state, this area is blank except for gantry and table positional information which is always present.

The status area always shows the status of the scan that is in progress, even if the acquisition card is not at the front of the stack.

## Camera On State

When the **[Camera On]** button is clicked or when an acquisition is in progress, the Status Area displays the name and ID of the patient, the name and type of scan that is being performed, and the detector count rate. Gated and gated tomographic acquisitions also display the average heart rate. Whole body scans display the scan length.



**Figure 5-30.** Status Area for Static: Camera On State

**Table 5-28:** Status Area for Static: Camera On State Components

No.	Description	Function
1	Patient ID	ID number of patient being set up.
2	Patient Name	Name of patient being set up.
3	Scan Name	Name of scan being set up.
4	Scan Type	Type of scan being set up.
5	Gantry Status	Current rotate, and radial positions of the gantry.
6	Table Status	Current longitudinal, vertical, and lateral positions of the table.
7	Detector Count Rate	Real time detector count rate for Detector 1.

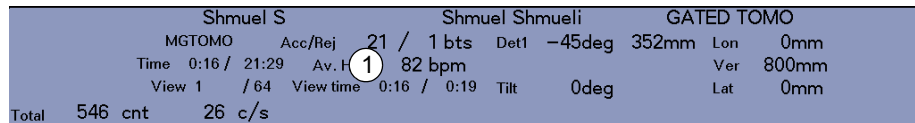
For all types of acquisitions the status areas also display the same types of information in the Camera On State except as noted below.



**Figure 5-31.** Status Area for Whole Body: Camera On State

**Table 5-29:** Status Area for Whole Body: Camera On State Components

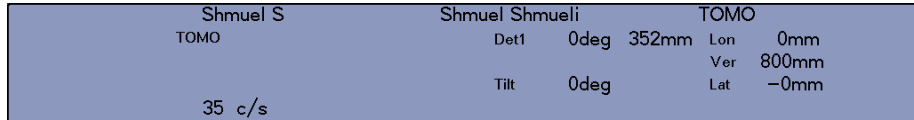
No.	Description	Function
1	Length of Scan	Total length of the scan defined on the Start/Stop Card. This is only shown when a whole body scan is being set up or acquired.



**Figure 5-32.** Status Area for Gated: Camera On State

**Table 5-30:** Status Area for Gated: Camera On State Components

No.	Description	Function
1	Average Heart Rate	Average Heart Rate calculated from the ten beat average. This is only shown when a gated or gated tomographic scan is being set up or acquired. If Acquire is selected on the Trigger Card, the status area will read: Av. HR --- bpm until 10 beat heart rate coverage is achieved. If Acquire is not selected on the Trigger Card, the status area will read: HR! bpm.



**Figure 5-33.** Status Areas for Tomographic Status: Camera On State

The Gated Tomographic status area shows the same types of information in the Camera On State as the Tomographic Status plus the average heart rate.



**Figure 5-34.** Status Area for Gated Tomographic: Camera On State

## Acquire State

During an acquisition the elapsed time, estimated time to the end of the scan, and total acquired counts are displayed for all scan types. Additional scan specific parameters are also displayed.



**Figure 5-35.** Status Area for Static: Acquire State

**Table 5-31:** Status Area for Static: Acquire State Components

No.	Description	Function
1	Elapsed Time	Elapsed time of acquisition in minutes and seconds.
2	Estimated Time to End	Estimated time to the end of the acquisition in minutes and seconds.
3	Total Acquired Counts	Total number of counts acquired so far.



**Figure 5-36.** Status Area for Dynamic: Acquire State

**Table 5-32:** Status Area for Dynamic: Acquire State Components

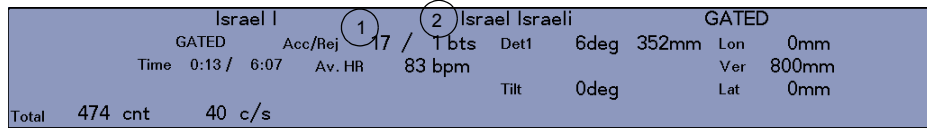
No.	Description	Function
1	Current Frame Number	Number of the current frame being acquired.
2	Total Number of Frames	Total number of frames to be acquired.
3	Current Phase Number	Number of the current phase being acquired.
4	Total Number of Phases	Number of total phases to be acquired.



**Figure 5-37.** Status Area for Whole Body: Acquire State

**Table 5-33:** Status Area for Whole Body: Acquire State Components

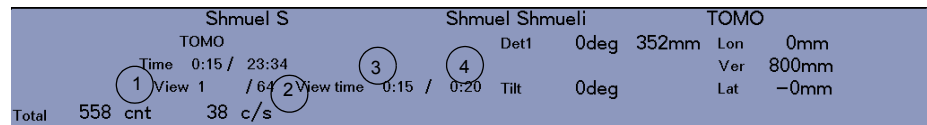
No.	Description	Function
1	Current Scan Length	Scan length already acquired.
2	Total Scan Length	Total length of the scan defined on the Start/Stop Card.



**Figure 5-38.** Status Area for Gated: Acquire State

**Table 5-34:** Status Area for Gated: Acquire State Components

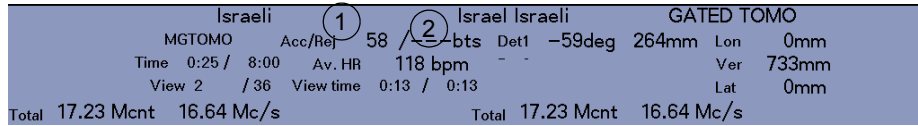
No.	Description	Function
1	Number of Accepted Beats	Number of accepted beats acquired.
2	Number of Rejected Beats	Number of rejected beats which were not acquired.



**Figure 5-39.** Status Area for Tomographic: Acquire State

**Table 5-35:** Status Area for Tomographic: Acquire State Components

No.	Description	Function
1	Current View Number	Number of the current view being acquired.
2	Total Number of Views	Total number of views to be acquired.
3	Elapsed View Time	Elapsed time acquired in the current view.
4	Total View Time	Total time to acquire for each view.



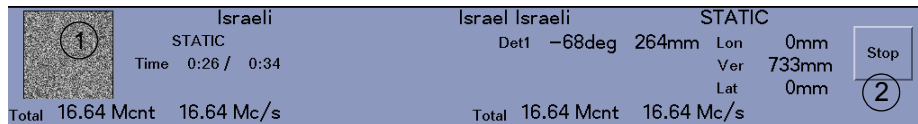
**Figure 5-40.** Status Area for Gated Tomographic: Acquire State

**Table 5-36:** Status Area for Gated Tomographic: Acquire State Components

No.	Description	Function
1	Number of Accepted Beats	Number of accepted beats acquired.
2	Number of Rejected Beats	Number of rejected beats which were not acquired.

## Exam Watch

The status area always shows the status of the scan that is in progress, even if the acquisition card is not at the front of the stack. If another card is brought in front of the acquisition card or the screen is switched to the main screen while a scan is in progress, the status area changes. The **Exam Watch** window on the left displays the image data being acquired. The [Stop] button on the right can be used to manually terminate the acquisition at any time.



**Figure 5-41.** Status Area in Acquire State when Acquisition Card is Not on Top

**Table 5-37:** Status Area in Acquire State Components

No.	Description	Function
1	Exam Watch Window	Image data being acquired.
2	Acquisition Stop button	Terminates the acquisition at any time.

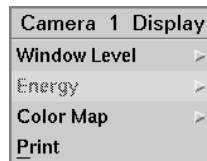
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## Setting the Window Level and Color Map

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### Window Level/Color Map Menu

Window level and color map can be set for the detector display areas on the **Acquisition** card during Camera On and acquisition.



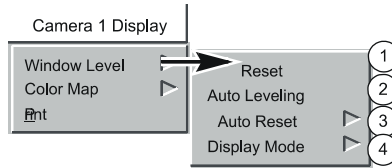
**Figure 5-42.** Window Level/Color Map Popup Menu

**Table 5-38:** Window Level/Color Map Popup Menu

No.	Description	Function
1	Window Level	Opens a menu to provide options for: <ul style="list-style-type: none"> <li>• Reset</li> <li>• Auto Leveling</li> <li>• Auto Reset</li> <li>• Display Mode</li> </ul>
2	Color Map	Contains three color map selections: <ul style="list-style-type: none"> <li>• Linear</li> <li>• GE Color</li> <li>• Mid 4 Mono</li> </ul>
3	Print	Captures the currently selected image and sends the image data to a PostScript printer OR to the printer that was designated for Secondary Capture

Click *Right* over the detector display areas to access the Window Level/Color Map menu.

**Window Level/Color Map Menu: Window Level**



**Figure 5-43.** Window Level

**Table 5-39:** Window Level

No.	Description	Function
1	Reset	Resets the window levels to their default values.
2	Auto Leveling	Turns Auto Leveling on or off
3	Auto Reset	Enables or disables Auto Reset
4	Display Mode	Displays one of the following at the top of the acquisition display area: <ul style="list-style-type: none"> <li>• Center/Width: Center pixel value and width (range) of pixel values</li> <li>• Upper/Lower: Upper and lower pixel values</li> </ul>

When **Auto Leveling** is enabled, the window levels are rescaled for each update of the display. That is, the maximum pixel value for the each persistence and acquisition image is used to determine the window levels for that image, along with the amount of change the operator may have previously made to the window levels. The minimum pixel value used for setting window levels during camera and acquisition modes is always zero. Auto Leveling is enabled by default. When Auto Leveling is disabled, the maximum pixel value of the last data point is maintained.

When **Auto Reset** is enabled, the window levels are reset back to their default values whenever the camera is turned off and back on. 'Default values' are the maximum pixel value in the image (upper) and 0 (lower). Auto Reset is enabled by default. When Auto Reset is disabled, the upper and lower values remain constant regardless of how often the camera is turned off or on.

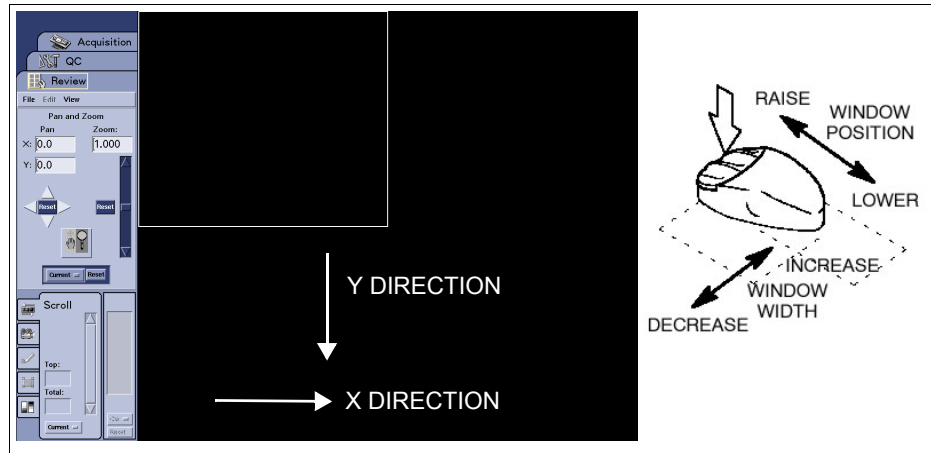
The **Display Mode** menu option allows the operator to set a preference for the way window levels are adjusted and displayed in the popup text box. **Center/Width** displays the center pixel value and the width (range) of pixel values. **Upper/Lower** displays the upper and lower pixel values. The default mode is **Upper/Lower**. The **Upper/Lower** option is also the most commonly used window leveling method in Nuclear Medicine.

Refer to [Image Display Toolkit: Pan and Zoom on page 6-12](#), for more information on how window levels are defined.

## Direct Setting of Window Level and Window Width

To set the **Window Width** directly on the image, using the **Center/Width Option**:

1. Click left on the Window Level Tool tab.
2. Move the cursor to the image to be changed.
3. Click and hold the center mouse button. Drag in the X direction to increase or decrease the width of the display window. See [Figure 5-44](#).
4. Release the center mouse button when the desired window width is obtained.



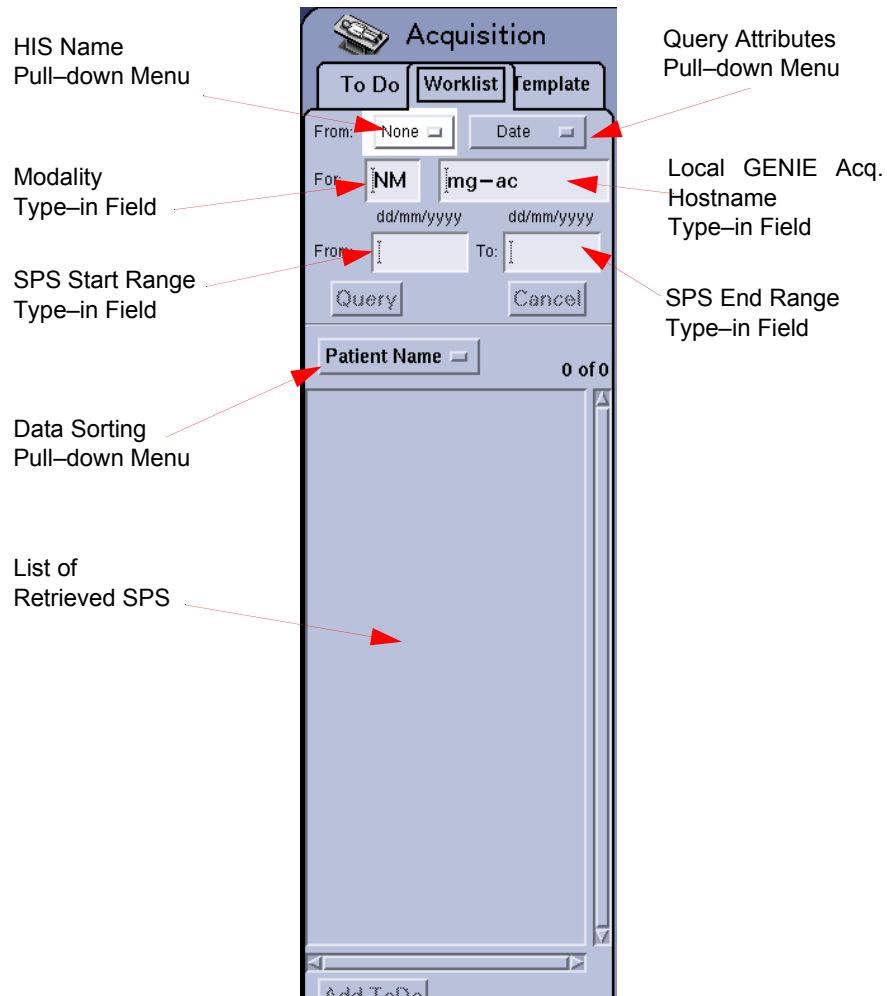
**Figure 5-44.** Window Level Control Using the Mouse

To set **Window Level** directly on an image, using the **Upper/Lower Option**:

1. Move the cursor over the image to change.
2. Click and hold the center mouse button. Drag the mouse straight up and down to increase or decrease the upper level. Drag the mouse to the left and right to increase or decrease the lower level.
3. Release the center mouse button when the desired window level is obtained.

## Scan Selector – Worklist Card

The **Worklist** card is used to retrieve the NM tasks to be performed from the Hospital's Information System (HIS). Once retrieved this information, termed Scheduled Procedure Steps (SPS) is transferred to the **To Do** list.



**Figure 5-45.** Worklist Card

The operator identifies the information to be retrieved as follows:

- **From** – pull-down menu used to specify the name of the HIS.
- **Attributes** – pull-down menu of the SPS attributes to be retrieved, which is one of: Date, Physician Name, Accession Number, Patient Name and Patient ID.

- **For** – Modality Name type-in field
- **Local GENIE Acquisition Hostname** type-in field
- Type in field(s) used to define the range of the SPS. This field(s) corresponds to the selected attribute.
- **[Query]** button – used to initiate the retrieve operation.
- **[Cancel]** button – used to stop data transfer.
- **Sort** pull-down menu – used to sort the SPS according to: Patient Name, Description and Date.
- **[Add ToDo]** button – used to transfer the retrieved SPS to the **To Do** list.

**Note**

For more information about the Worklist Card, see [Fetching Data from a Remote Workstation on page 7-97](#)

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## Scan Selector - Templates Card

The **Templates** card displays entries for each GE or user defined acquisition template. Templates ensure that the same data is acquired with the same set up parameters each time a scan or group of scans is performed. In addition, user defined energy sessions can be created and added (or removed) from the nuclide pop up menu.

Acquisition templates contain any number of scans whose parameters have been predefined. The template can either be a simple collection of individual scans or can be a protocol. A protocol is an ordered set of scans that define all the acquisitions that should be performed for a clinical study.

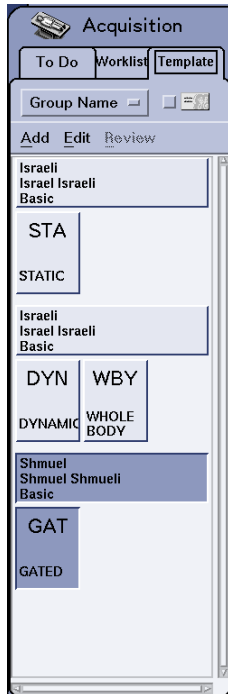
All scan parameters can be set in a template so that a new scan created from the template can be started immediately without any further definition. Alternately, parameters in a template can be left undefined so that they must be set before a new scan is acquired.

Acquisition templates are separated into either GE or User categories. The GE templates come standard on the system and cannot be changed by a user. However, GE templates may be copied and then modified for placement into the User category. User defined templates can be created to suit individual site preferences as described in [Chapter 8](#). You must have an appropriate user privilege level to access the Template card. For details on the user privilege levels available, refer to [Different Logins on page 10-47](#).

Acquisition templates are separated into related groups. Groups provide the means to organize protocols so that the number of menu options does not become excessive. The GE Templates are organized into the following groups:

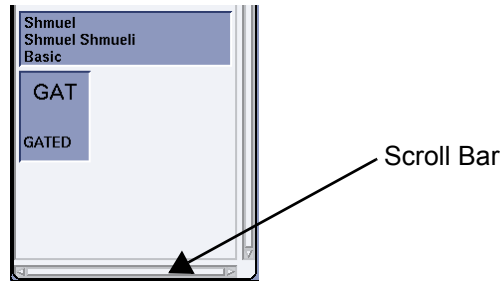
- General
- Bone
- Heart
- Kidney
- Liver/GI
- Lung
- Brain
- Quality Control
- Other

The General group contains generic static, dynamic, whole body, gated, tomographic and gated tomographic scans which can be used to do simple acquisitions, add a single scan to an existing Patient Study or build a user defined template. The other groups contain predefined GE protocols.



The Templates card is a scrolling display of entries similar to the **To Do** card. Each entry displays the Group Name at the top, and the Template Name on the bottom. A scroll bar along the right edge of the Templates card allows you to view the entire list of entries.

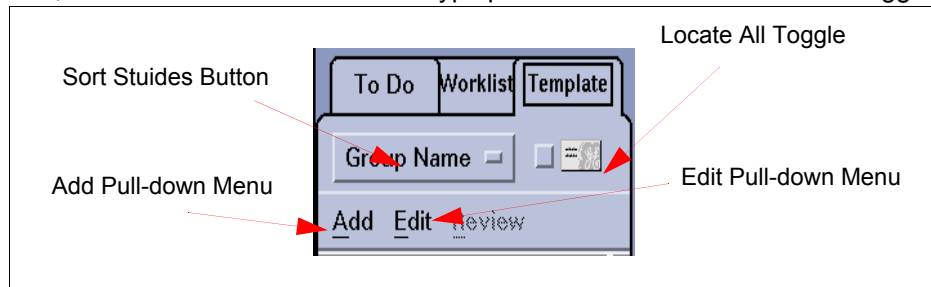
A template entry contains scans which appear as individual entries below the main entry. Each scan entry shows the type of scan at the top and the scan name at the bottom. Only three scan entries can be displayed at one time across the Templates card. If there are more than three scan entries, a scroll bar along the bottom edge of the card allows you to view all scan entries in a template entry.



Selecting a template entry in the **Scan Selector** changes the entry to black and displays its details in the **Scan Setup** area. User templates are customized by selecting the scan entry and modifying the details in one of the cards in the **Scan Setup** area. Customizing a scan template has no effect on scans that have already been created on the **To Do** card. New scans that are created using that sub-menu option will be copied from the customized scan template.

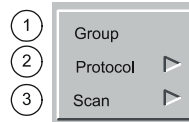
## Template Components

The Templates card on the Scan Selector has three pull-down menus: Add, Edit, and Review. It also has a Sort Type pull-down menu and Locate All toggle



## Template Card – Add Pull-down Menu

When any option is chosen on the **Add** pull-down menu, a sub-menu is displayed showing all the available acquisition template groups. When a particular group is selected, all the templates and protocols for that group are displayed and can then be selected.



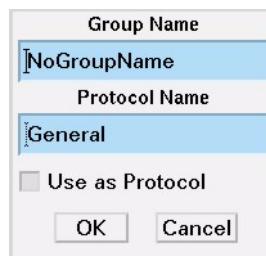
**Figure 5-46.** Add Pull-down Menu

**Table 5-40:** Add Pull-down Menu Components

No.	Description	Function
1	Group	Creates new User Group.
2	Protocol	Creates new Protocol under the currently selected group.
3	Scan	Adds a new scan to the currently selected protocol

### Group Option

The **Group** option is available when you select the **Add** pull-down from the Templates card. When it is chosen, a new Group name and Protocol are added to the list of user defined templates. The scans that compose the template or protocol that has been selected on the sub-menu are copied into the newly created protocol template. The Group Information Edit pop-up is then displayed in the Scan Selector. The default Group Name is NoGroupName. The default Protocol Name is taken from the protocol selected on the sub-menu. Enter in the appropriate group and protocol information. See the **Edit** pull-down menu section below for instructions on using the Group Information Edit pop-up.



---

## Protocol Option

The **Protocol** option is available on the Templates card. It creates a new Protocol under the currently selected Group. A user defined template must be selected for the **Protocol** option to be available.

<b>Note</b>	Acquisition templates having in their title the name XPERT, will be used only if the acquired data will be transferred to and processed on an XPERT workstation.
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## Scan Option

The **Scan** option is available on the Templates card. It allows new scans to be added to an existing acquisition template. Choosing a study or scan type from the Scan sub-menu adds one or more scans to the selected template. The scans are added after any scans that are already in the template. A template must be selected for the **Scan** option to be available.

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## Edit Pull-down Menu

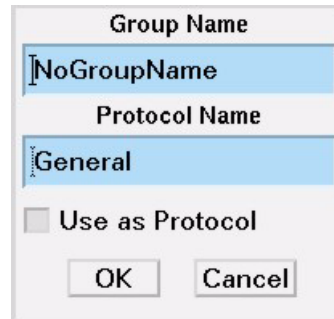
**Table 5-41:** Edit Pull-down Menu Components

No.	Description	Function
1	Group Information	Changes group and protocol names on the templates card.
2	Scan Information	Changes scan (image dataset) name.
3	Undo	Currently not functional.
4	Delete Scan	Deletes selected scan from the patient study.
5	Cut	Currently not functional.
6	Copy	Currently not functional.
7	Paste	Currently not functional.

---

## Group Info Option

The identifying information for a Group or Protocol entry is changed by selecting the entry on the Templates Card and then choosing the **Group Info** option from the **Edit** pull-down menu. When the option is chosen a Group Information Edit Pop-up is displayed over the entry which allows it to be changed.



The image shows a dialog box titled "Group Information Edit". It has two text input fields. The first field is labeled "Group Name" and contains the text "NoGroupName". The second field is labeled "Protocol Name" and contains the text "General". Below these fields is a checkbox labeled "Use as Protocol" which is currently unchecked. At the bottom of the dialog are two buttons: "OK" and "Cancel".

### To update Group Information:

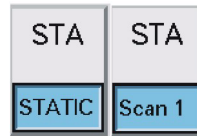
1. The first line is the **Group Name** type-in field. Change the information on this line if necessary. If the group does not exist, a new group with this name is created. If the group does exist, the corresponding protocol is placed into that group.
2. Press the <Tab> key to move to the second line, or click in the type-in field. This is the **Protocol Name** type-in field. Change the name appropriately.
3. Below the Protocol Name type-in field is the **Use As Protocol** toggle. If this toggle is selected, the template will be regarded as a protocol and the protocol name will be displayed on the Templates card entry and in the sub-menu. When selecting the protocol from the **To Do** card, all of the individual scans in the protocol become set up. If this toggle is not selected, the template is regarded as a basic scan description only, and no protocol name is associated with it on the entry or in the sub-menu. In this case, when setting up a scan on the **To Do** card, the user has the option of selecting each individual scan one at a time.
4. Once the group and protocol information has been set, click the [OK] button or press the <Enter> key to modify the entry. To leave the entry unchanged, click the [Cancel] button or press the <Esc> key.

---

## Scan Info Option

Each scan (image dataset) entry has a name to identify the type of data that it acquires. When a scan is created, its name is copied from the template scan.

The scan name is changed by selecting the scan and then choosing the **Scan Info** option from the **Edit** menu. When the option is chosen a Scan Information pop-up is displayed over the selected scan entry which allows the name to be changed.



### To update the Scan Information:

1. Select the scan from the Scan Selector on the **Templates** card.
2. Select the **Scan Info** option from the **Edit** menu.
3. Change the name appropriately in the type-in field.
4. Once the information has been edited, press the **<Enter>** key to modify the name. To leave the scan name unchanged, press the **<Esc>** key.

---

## Delete Scan Option

A scan entry that added to an acquisition by mistake or is no longer required can be deleted from the Scan Selector.

### To delete a scan entry:

1. Select the scan in the Scan Selector on the Templates card. The scan can not be deleted if it is currently in Camera On state. Click the **[Camera Off]** button to remove the scan from Camera Mode.
2. Choose the **Delete Scan** option from the **Edit** pull-down menu. If the scan being deleted is the only scan in the template, the Patient Study or template will also be deleted.

---

## Review Pull-down Menu

The Review menu is not available for the **Templates** card.

---

## Sort Pull-down Menu

The list of Patient Studies can be sorted by five different parameters. This provides a means of arranging the entries in a manner most appropriate for a particular facility.



**Figure 5-47.** Sort Pull-Down Menu

**Table 5-42:** Sort Pull-Down Menu Components

No.	Description	Function
1	Group Name	Sorts the list by Group name.
2	Protocol Name	Sorts the list by Protocol name.
3	Date	Sorts the list chronologically by creation date. The oldest Protocol is listed first and the newest Protocol is listed last.
4	Reverse Date	Sorts the list chronologically by reverse creation date. The newest Protocol is listed first and the oldest Protocol is listed last.

---

## Locate All Toggle

The **Locate All** toggle provides a means to display all the protocols or templates in the database or to display only the user defined protocols and templates. The GE protocols are indicated by the GE logo on the right side of each entry.



**Figure 5-48.** Locate All Toggle

When the Locate All toggle is on, all protocols and templates (GE and user defined) are displayed. When the **Locate All** toggle is off, only user defined protocols and templates are displayed.



---

## Chapter 6 - Review Card

This chapter describes the review card as follows:

- [Description on page 6-2](#)
- [Card Display Area on page 6-3](#)
- [Card Control Area on page 6-5](#)
- [Image Display Toolkit on page 6-14](#)

## Description

GENIE Acquisition provides a single Review card to view image, trigger, and spectrum data once it has been acquired. The review card can display data from one or more scans and from one or more patient studies.

GENIE Acquisition does not provide functions to process the acquired data. Acquired data should be transferred to a GE Processing and Review (P & R) workstation for processing.

The review card provides a sub-set of the functions and controls available on the Enstein and GENIE P & R **Processing** Cards. These controls are identical to those on GENIE P & R, and are sufficient to verify the quality of the acquired data.

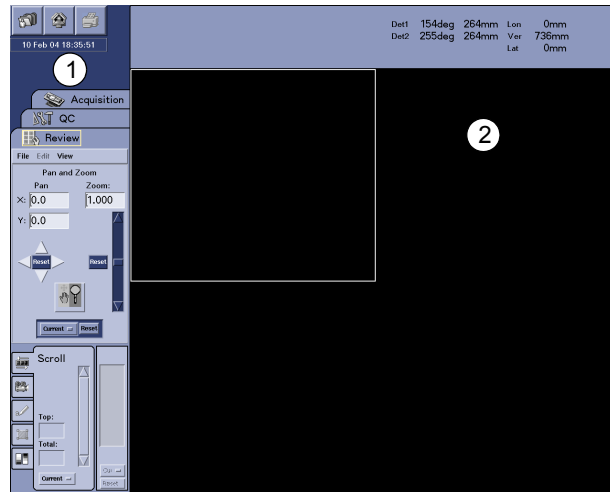


Figure 6-1. Review Card

Table 6-1: Review Card Components

No.	Description	Function
1	Card Control area	Provides tools for viewing and manipulating image data.
2	Card Display area	Area used to view image data.

The **Review** card is analogous to illuminated patient film viewing stations or light boxes. The right side, the Card Display area, is for viewing patient data. The left side, the Card Control area, has controls for adjusting the brightness and so on. While a light box may only have a power switch and a brightness control, the Review card has many sophisticated image manipulation controls.

---

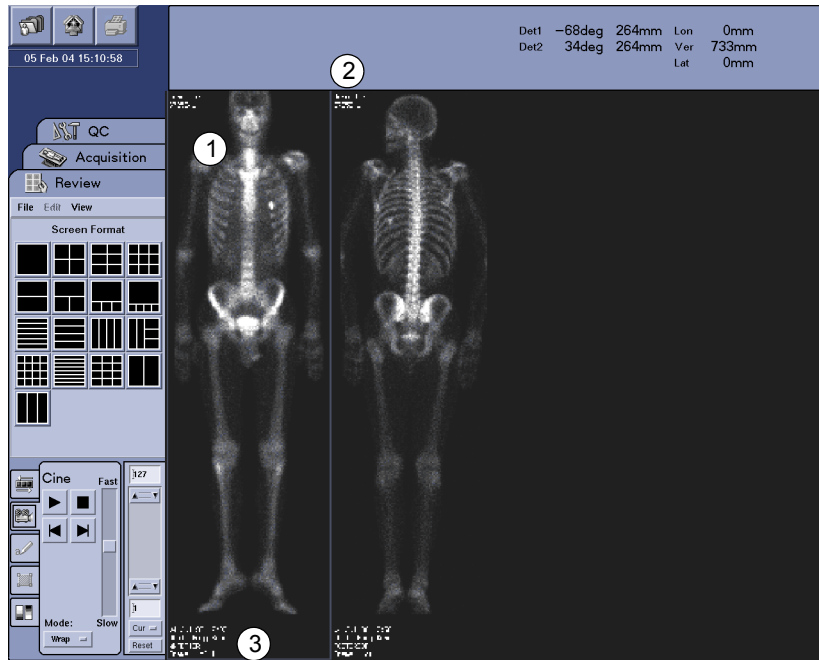
## Card Display Area

Image, trigger, and spectrum data can be viewed in image cells in the **Card Display** area. Data is loaded onto the **Review** card using the **Patient Selector** on the **Main** screen. One or more Patient Studies, series or datasets can be loaded onto the Review card in a single operation. See the [Patient Selector on page 4-35](#) for detailed information.

The data may also be loaded from the **Acquisition** card. For detailed information, refer to [Review Pull-down Menu on page 5-9](#), which is selected from the **To Do** Card.

It may be necessary to use the **Screen Format** option on the **View** Pull-down Menu to see all the data loaded. See the [View Pull-down Menu on page 6-7](#) Section for detailed information.

All data that is displayed is automatically annotated with its related patient, study, and dataset information.



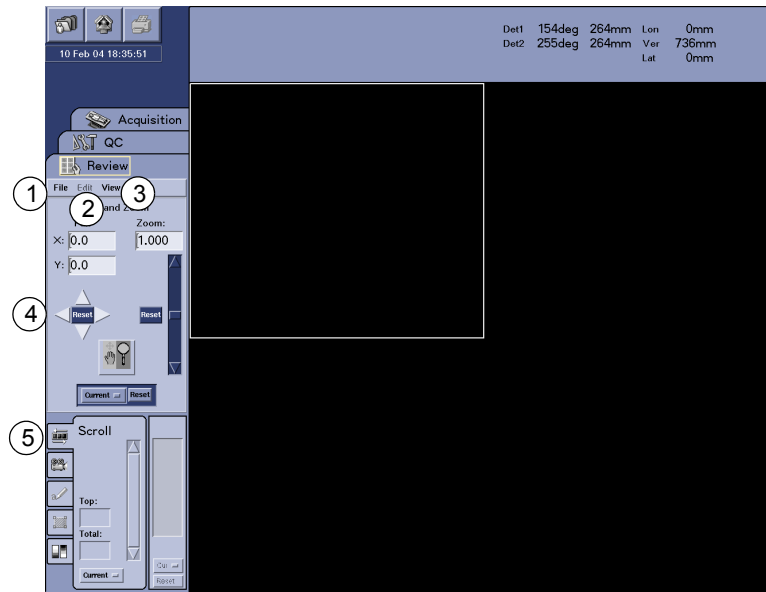
**Figure 6-2.** Card Display Area

**Table 6-2:** Card Display Area Components

No.	Description	Function
1	Image Display cell	Section of the Display Area used to display one dataset. The Display Area can be divided into various arrangements and numbers of cells.
2	Patient Information Annotation	Annotates the image in the cell with the patient information. The top line is the patient name. The bottom line is the patient identification.
3	Study and Dataset Annotation	Annotates the image in the cell with the study and dataset information. The first line is the date and time of acquisition. The second line is the study name. The third line is the dataset name. The fourth line indicates the current frame number out of the total number of frames.

## Card Control Area

The **Card Control** area provides tools for manipulating images manually without using any protocols. The results of the manipulations display immediately on the selected image. Each pull-down menu item or tab displays different tools.



**Figure 6-3.** Card Control Area

**Table 6-3:** Card Control Area Components

No.	Description	Function
1	File Pull-down menu	Provides file management tools for erasing the screen.
2	Edit Pull-down menu	Currently not functional.
3	View Pull-down menu	Provides options to change the parameters of images displayed, such as position, pan, zoom and orientation.
4	Pull-down Display panel	Displays the tools for the currently selected pull-down.
5	Image Display Toolkit	Provides tools for enhancing specific image characteristics such as color maps, window level, scroll and cine.

---

## File Pull-down Menu

The **File** pull-down Menu affects dataset files selected and displayed on the Review card. One or all datasets can be cleared from the display. Some **File** options are not currently available

**Table 6-4:** File Pull-down Menu Components

No.	Description	Function
1	Clear	Clears the currently selected cell on the display.
2	Clear All	Clears all cells in the Review card.
3	Save	Currently not functional.
4	Save As	Currently not functional.
5	Print	Performs a screen capture of the images on the Review screen and sends the image data to a PostScript printer OR a DICOM station that was designated for Secondary Capture.
6	Patient Info	Currently not functional.
7	Exit card	Currently not functional.

### To Clear an image:

1. Click left on the image cell you wish to clear to select it.
2. On the **Review** card, click on **File**.
3. From the pull-down menu, select the **Clear** option.

### To Clear all images:

1. On the **Review** card, click on **File**.
2. From the pull-down menu, select the **Clear All** option.

---

## View Pull-down Menu

The **View** pull-down Menu provides tools for changing the appearance or display format of currently loaded images.

The GENIE Data Display area is specified by a Screen Format which is composed of a number of individual display zones called cells. In the Review card, there are several possible formats available with a variety of cell configurations. The first pull-down menu choice allows selection of the layout.

Once the **Screen Format** has been specified, the **Orientation** and **Pan & Zoom** choices can be used to set up each displayed item as desired. The details of display can be specified for individual cells or all cells taken as a group. These choices allow:

- Changing the orientation of images by rotating or mirroring.
- Changing the offset or magnification of images by panning and zooming.

**Table 6-5:** View Pull-down Menu Components

No.	Description	Function
1	Screen Format	Determines the number of datasets displayed simultaneously.
2	Orientation	Rotates and mirrors an image.
3	Pan & Zoom	Shifts and magnifies or minifies displayed images.
4	Image Statistics	Currently not functional.

## Screen Format

Use the **Screen Format** to select the display format for the images, trigger histograms and spectrums. There are several image display formats, ranging from a single, full-screen image to sixteen datasets on one screen. Some formats display square images. Other formats display images as narrow rectangles suitable for whole body images. The areas where images are displayed are called cells. Each Screen Format cell can show images from different Patient Studies.

Each screen format has a limited number of data items that can be displayed at once. If more datasets are selected than can be displayed in the chosen format, the remaining datasets are not shown unless a Screen Format with more cells is selected.

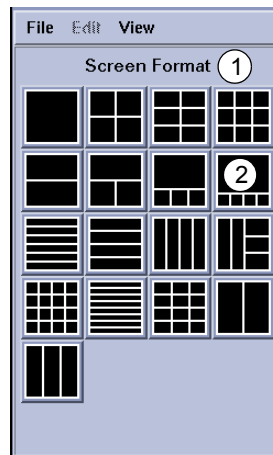


Figure 6-4. Screen Format Panel

Table 6-6: Screen Format Components

No.	Description	Function
1	Screen Format panel	Shows possible screen formats for the Card Display Area.
2	Screen Format icon	Click left on the desired format icon to select.

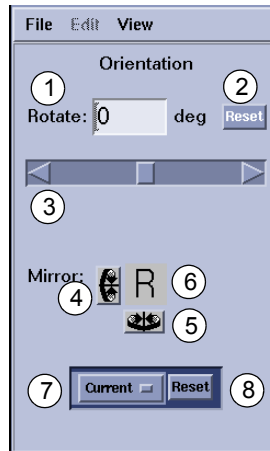
### To select a Screen Format:

1. On the **Review** card, click on **View**.
2. From the pull-down menu, select the **Screen Format** option and click on the desired format icon.
3. Click on the desired **Screen Format** icon to select.

## Orientation

Use the Orientation panel to rotate displayed images about their center. The original images in a study are assumed to be at zero degrees of rotation. The degree of rotation is indicated in the **Rotate** type-in field on the Orientation Panel. Counterclockwise rotation is indicated by a minus in front of the degree number.

Mirror tools are available to flip images vertically or horizontally. The mirror status is displayed on the Orientation Panel in the “**R**” Mirror Status Window.



**Figure 6-5.** Orientation Panel

**Table 6-7:** Orientation Panel Components

No.	Description	Function
1	Rotate type-in field	Displays current degree of image rotation. Also provides entry for the degrees of rotation to rotate the selected image.
2	Rotate Reset button	Resets the selected image rotation to zero degrees.
3	Rotate slider	Allows rotation of the selected image. Drag right for increasing (clockwise) degrees of rotation and left for decreasing (counterclockwise) degrees of rotation.
4	Mirror Vertical button	Flips the selected image vertically.
5	Mirror Horizontal button	Flips the selected image horizontally.
6	Mirror Status Window	Indicates the mirror status of the image.
7	Current Image pull-down menu	Allows orientation manipulations to affect only the currently selected dataset or all the datasets on the Review Card.
8	Reset button	Resets all orientation settings to their defaults.

**To Rotate an image:**

1. On the **Review** card, click on **View**.
2. From the pull-down menu, select the **Orientation** option. This will display the Orientation Panel.
3. Click on the **Current** image pull-down menu to choose to manipulate the currently selected dataset or all displayed datasets.
4. Drag the **Rotate** slider bar to rotate the image clockwise or counterclockwise.
5. The **Rotate** type-in field indicates the degree of rotation.
6. Release the mouse button when the desired image rotation is displayed.
7. Alternately, click the left and right arrows at the end of the slider bar to rotate the image.
8. Click the [**Reset**] button to reset the image position to zero.

**To Mirror an image:**

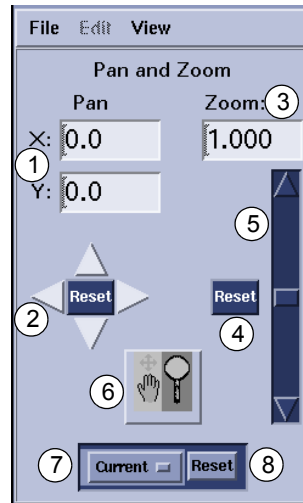
1. On the **Review** card, click on **View**.
2. From the pull-down menu, select the **Orientation** option. This will display the Orientation Panel.
3. Click on the **Current** image pull-down menu to choose to manipulate the currently selected dataset or all displayed datasets.
4. Click the [**Mirror Vertical**] or [**Mirror Horizontal**] button.
5. The image's orientation is shown in the Mirror Status Window according to [Table 6-8](#).

**Table 6-8: Mirror Status**

No.	Function
R	Indicates no mirror.
Я	Indicates left/right mirror about the vertical axis.
Б	Indicates top/bottom mirror about the horizontal axis.
Р	Indicates both top/bottom and left/right mirror status.

## Pan and Zoom

The Pan and Zoom panel provides tools for shifting image position on the display (pan) and magnifying or reducing images (zoom).



**Figure 6-6.** Pan and Zoom Panel

**Table 6-9:** Pan and Zoom Panel Components

No.	Description	Function
1	Pan Coordinates type-in fields	Displays the X and Y coordinate positions of the currently selected dataset. Also allows you to change the pan position by entering in a new value.
2	Pan Click Left buttons	Pans the dataset in the direction the arrow is pointing. Clicking left on [Reset] in the middle resets the dataset position to X=0, Y= 0.
3	Zoom Size type-in field	Displays the zoom size of the currently selected dataset. Also allows you to change the zoom size by entering in a new value. The default is 1.0.
4	Zoom Reset button	Resets the zoom size to 1.0.
5	Zoom Size Slider	The slider bar makes the image larger when moved up and smaller when moved down. The top arrow makes the image larger each time it is pressed, and the bottom arrow makes the image smaller each time it is pressed.
6	Pan and Zoom button	Selects the mouse to control dataset pan position and zoom size interactively.
7	Current Image pull-down menu	Allows pan and zoom manipulations to affect only the currently selected dataset or all the datasets on the Review Card.
8	Display Reset button	Cancels all pan and zoom modifications and resets currently displayed datasets to the original default settings.

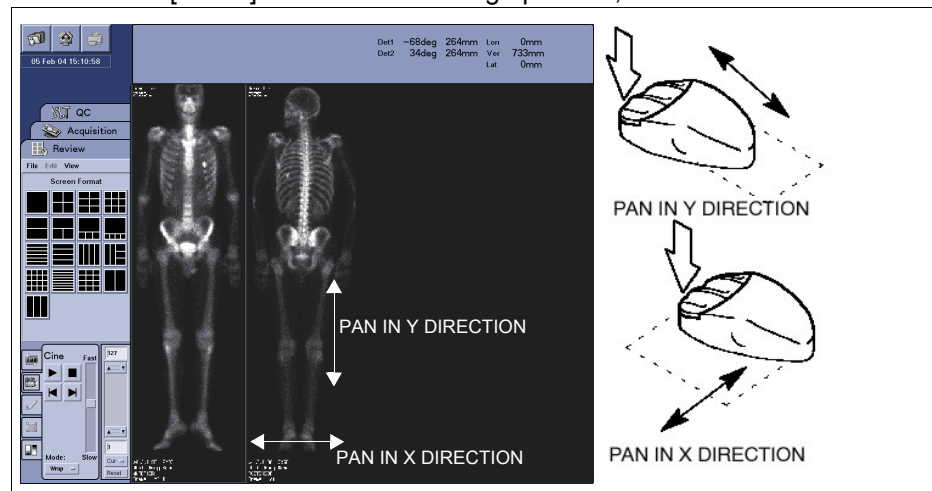
When the **[Pan and Zoom]** button is selected, a green bar at the bottom of the icon is displayed. The mouse then performs the following functions:

**Table 6-10:** Mouse buttons with Pan and Zoom

Mouse button	Function	Drag	Result
Left	Pan	Anywhere	Shifts the image to follow the mouse position.
Right	Zoom	Up	Magnifies the image.
		Down	Minifies the image.

**To Pan an image:**

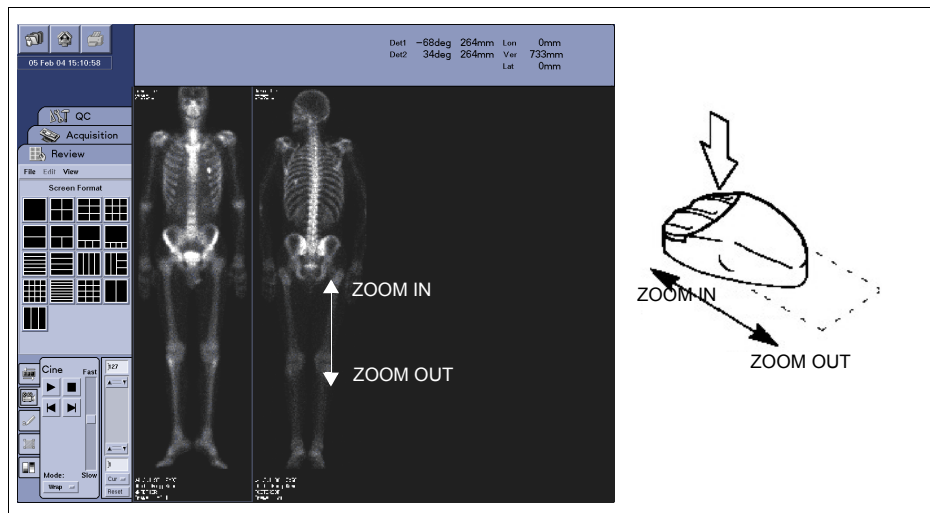
1. On the **Review** card, click on **View**.
2. From the pull-down menu, select the **Pan & Zoom** option. This will display the **Pan & Zoom** panel.
3. Click on the **Current** image pull-down button to choose to manipulate the currently selected dataset or all displayed datasets.
4. Click the **[Pan and Zoom]** button.
5. Move the cursor to the image to be panned.
6. Drag in X and Y directions to pan the image while holding down the left mouse button. See [Figure 6-7](#).
7. Release the mouse button when the image is in the desired position.
8. Alternately, click the **[Pan]** buttons on the **Pan and Zoom** panel.
9. Click the **[Reset]** button to reset image position, if desired.



**Figure 6-7.** Panning

**To Zoom an image:**

1. On the **Review** card, click on **View**.
2. From the pull-down menu, select the **Pan & Zoom** option. This will display the **Pan & Zoom** panel.
3. Click on the **Current** image pull-down button to choose to manipulate the currently selected dataset or all displayed datasets.
4. Click the [**Pan and Zoom**] button.
5. Move the cursor to the image to be zoomed.
6. Drag in Y direction only to magnify or minify the image while holding down the right mouse button (See [Figure 6-8](#)).
7. Release the mouse button when the desired image size is displayed.
8. Alternately drag the Zoom Size slider on the **Pan and Zoom** Panel.
9. Click the [**Zoom Reset**] button to reset image position, if desired.

**Figure 6-8. Zooming**

## Image Display Toolkit

The **Review** card provides further image manipulation tools in a toolkit in the lower left corner of the card. The tools available are:

- Color Map Tool
- Window Level Tool
- Scroll Tool
- Cine Tool

### Color Map Tool

The **Color Map** Tool provides the controls for changing the color scheme on images. The relationship between colors in an image can be changed to emphasize specific features. The relative shading can also be adjusted using the **Window Level** Tool. See the [Window Level Tool on page 6-15](#) section for detailed information.



**Figure 6-9.** Color Map Tool

**Table 6-11:** Color Map Tool Components

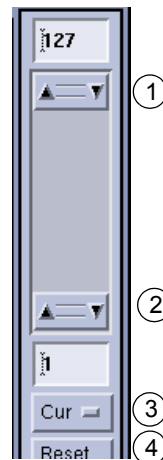
No.	Description	Function
1	Linear Map	General purpose monochrome map.
2	GE Color Map	Also called a rainbow scale.
3	Mid4 Mono Map	Monochrome map that is useful for displaying bone images.
4	Mid8 Mono Map	Monochrome map that is useful for displaying tomographic images.
5	Hot Iron Map	Emphasizes the red color, representing iron, in images.
6	Custom button	Currently not functional.

**To use the Color Map Tool:**

1. Click on the **Color Map** Tool tab.
2. Click on the desired color or monochrome map.
3. The Card Display area will use the newly selected map to display all images.

**Window Level Tool**

The **Window Level** Tools adjust the maximum and minimum window level of displayed images.



**Figure 6-10.** Window Level Tool

**Table 6-12:** Window Level Tool Components

No.	Description	Function
1	Maximum slider	Adjusts the maximum window levels. The level setting is displayed above the slider area.
2	Minimum slider	Adjusts the minimum window levels. The level setting is displayed below the slider area.
3	Selected Images pull-down menu	Selects whether the currently selected image or all images will be affected by the window level controls.
4	Reset button	Resets the window level to the default levels.

There are two methods for changing window levels:

- **Method 1:** Drag up or down on the sliders while holding down the left mouse button.
- **Method 2:** Drag over an image while holding down the center mouse button.

---

### Method 1: Window Level Control Sliders

Use the left mouse button to control the maximum and minimum window level.

**Table 6-13:** Window Level Sliders

Slider	Drag	Result
Maximum	Up	Raises the maximum window level.
	Down	Lowers the maximum window level.
Minimum	Up	Raises the minimum window level.
	Down	Lowers the minimum window level.

---

### Method 2: Center Mouse button

Use the center mouse button to change the Maximum and Minimum window level.

**Table 6-14:** Window Level with Center Mouse button

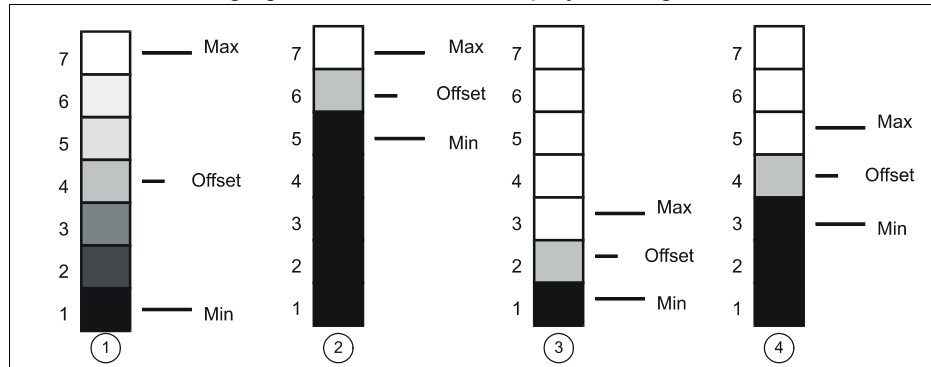
Drag	Result
Up	Raises the minimum and maximum window level by the same amount (increases the window level offset).
Down	Lowers the minimum and maximum window level by the same amount (decreases the window level offset).
Right	Raises the maximum window level and lowers the minimum window level (increases the window level range).
Left	Lowers the maximum window level and raises the minimum window level (increases the window level range).

## Maximum and Minimum Window Level

Each pixel in an image has a value corresponding to the number of counts detected at that location during acquisition. GENIE Acquisition assigns a gray scale brightness value to each count value. All count values above the maximum window level are considered white and all count values below the minimum window level are considered black.

The range between the maximum and minimum window levels is the window width. This range defines the range of count values where brightness values are between black and white.

The midpoint between the maximum and minimum is the window position (or window level offset). Increasing or decreasing the offset increases or decreases the maximum and minimum window levels by the same amount without affecting the window width. An example described in the figure and table below illustrates the effects of changing window levels on displayed images:



**Figure 6-11.** Window Level Example

**Table 6-15:** Window Level Example Components

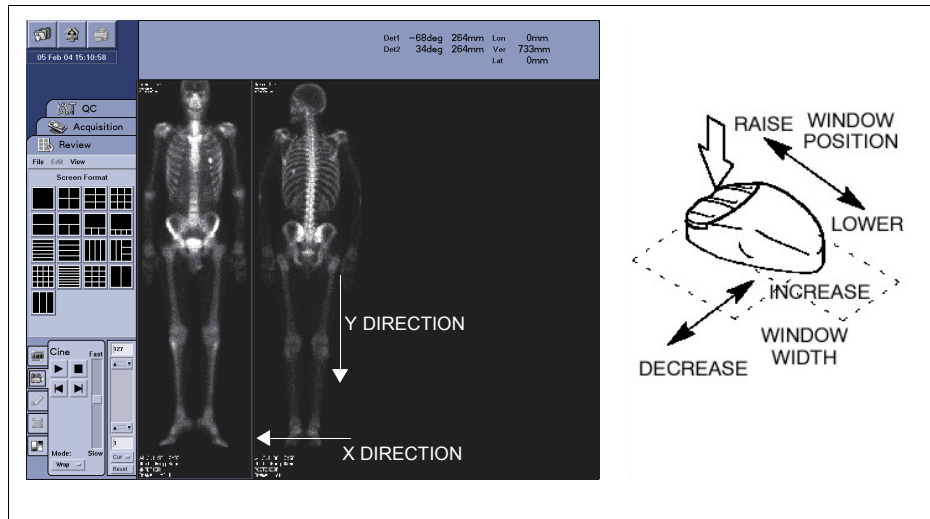
No.	Description	Function
1	Default window levels	When a dataset is loaded, GENIE Acquisition assigns white to the maximum pixel count, black to the minimum pixel count, and an even (linear) progression between black and white to counts between the maximum and minimum.
2	Increasing the minimum	GENIE assigns black to higher count values. Notice that the offset has increased and the range between black and white, or window width, is narrower.
3	Decreasing the maximum	GENIE assigns white to lower count values. Notice that the range between black and white, or window width, is narrower.
4	Decreasing the maximum and increasing the minimum	GENIE assigns white to lower count values and black to higher count values. Notice that the range between black and white, or window width, is narrower. Also, if the maximum is decreased by the same amount the minimum is increased, the offset does not change.

**To set the Window Width using the window sliders:**

1. Click on the **Window Level** Tool tab.
2. Move the cursor to the maximum or minimum window slider.
3. Click and hold the left mouse button. Drag the slider up or down.
4. Release the mouse button when the desired window level is obtained.

**To set the Window Width directly on the image:**

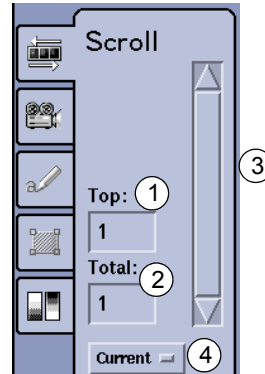
1. Click left on the **Window Level** Tool tab.
2. Move the cursor to the image to be changed.
3. Click and hold the center mouse button. Drag in the X and Y directions to change the window level. See [Figure 6-12](#).
4. Release the center mouse button when the desired window width is obtained.



**Figure 6-12.** Window Level Control Using the Mouse

## Scroll Tool

The **Scroll** Tool tab card provides tools for stepping through a set of images one image at a time or in groups within the dataset.



**Figure 6-13.** Scroll Tool

**Table 6-16:** Scroll Tool Components

No.	Description	Function
1	Top Image field	Displays the current frame number of the selected image.
2	Total field	Shows the total number of frames in the dataset.
3	First/Last slider	Controls movement through an image series.
4	Selected Images pull-down menu	<b>All</b> scrolls through all the datasets in the Screen Format cell and <b>Current</b> scrolls through the images in the selected dataset.
5	Reset button	Resets the current frame to frame 1.

### To use the Scroll Tool:

1. Click on the **Scroll** Tool tab.
2. Select the image to scroll.
3. Click and hold the left mouse button. Drag on the First/Last Slider to change the frame being displayed.
4. Release the mouse button when the desired frame is obtained.
5. Alternately, you can click on the arrows on either end of the First/Last Slider to scroll through the dataset one frame at a time. The top arrow decrements through the frames while the bottom arrow increments through them.

## Cine Tool

The Cine Tool tab card provides tools for viewing a series of images sequentially one image at a time or in rapid succession to simulate animation.



**Figure 6-14.** Cine Tool

**Table 6-17:** Cine Tool Components

No.	Description	Function
1	Play button	Starts the cine sequence.
2	Stop button	Stops the cine sequence.
3	Step Backward button	Steps to the previous image in the series, one image at a time until reaching the first image in the dataset.
4	Step Forward button	Steps to the next image in the series, one image at a time until reaching the last image in the dataset.
5	Cine Mode pull-down menu	Selects between Wrap and Bounce mode: <ul style="list-style-type: none"> <li>• Wrap repeats the images from first to last image in a series. Example: 1 to 16, 1 to 16, etc.</li> <li>• Bounce repeats a first-to-last image sequence followed by a last-to-first image sequence of a series. Example: 1 to 16, 16 to 1, 1 to 16, etc.</li> </ul>
6	Speed Control slider	Controls the speed of the cine.

**To use the Cine Tool:**

1. Click on the **Cine** Tool tab.
2. Select the image to cine.
3. Click the [**Start**] button to begin the cine.
4. Click and hold the left mouse button. Drag on the Speed Control slider to change the speed of the cine.
5. Release the mouse button when the desired speed is obtained.
6. Click the [**Stop**] button to end the cine.



---

# Chapter 7 - Operating Instructions

**Note**

Read the section on Safety in [Chapter 1](#) prior to using the system.

---

## Chapter Overview

This chapter gives detailed instructions of how to use the Millennium MPR/MPS system to perform the full range of Nuclear Medicine scans. This chapter includes procedures for:

- [System Startup And Shutdown on page 7-2](#), including Gantry and Table calibration
- [Collimator Changing on page 7-10](#)
- [3 - Axis Table Positioning on page 7-21](#)
- [Patient Positioning on page 7-25](#)
- [Acquisition Types on page 7-30](#)
- [Performing an Acquisition on page 7-39](#):
  - m [Static Acquisition on page 7-39](#)
  - m [Dynamic Acquisition on page 7-43](#)
  - m [Whole Body Acquisition: Manual Mode-MPR on page 7-46](#)
  - m [Whole Body Acquisition: Learn Mode MPR on page 7-52](#)
  - m [Multigated Acquisition on page 7-58](#)
  - m [Multigated Acquisition on page 7-58](#)
  - m [Multigated Tomographic Acquisition on page 7-72](#)
- [Scan Interruptions on page 7-77](#)
- [Reviewing the Acquisition on page 7-85](#)
- [Auto Processing of Study Data \(Ignite\) on page 7-87](#)
- [Transferring Acquired Studies on page 7-92](#)
- [PostScript Printing and Secondary Capture Printing on page 7-116](#)

**Note**

GE advises that the user read and understand all instructions in this manual prior to attempting to use this device. In particular, strict attention should be paid to all safety information in [Chapter 1](#) and throughout this manual.

---

## System Startup And Shutdown

---

### Overview

The Millennium MPR/MPS system receives electrical power from a single AC power line into the power supply in the base of the gantry. The gantry power supply distributes power to the detector, table and acquisition computer in the form they each require.

Normally you would leave your system powered up all the time. The only daily routine to carry out is to shut down the Acquisition Computer software and hardware last thing at night.

Detector power is left on to maintain working temperature. If the detector is switched off, it will require a warm-up period ([System Startup And Shutdown on page 7-4](#)).

You may at some time, experience a power cut or someone may just turn the system off by mistake. We have included procedures for turning the system ON and OFF so that if this were to occur, you will be able to resume operation without having to call an engineer.



#### WARNING

Do not use the handset during genie Acquisition power-up.

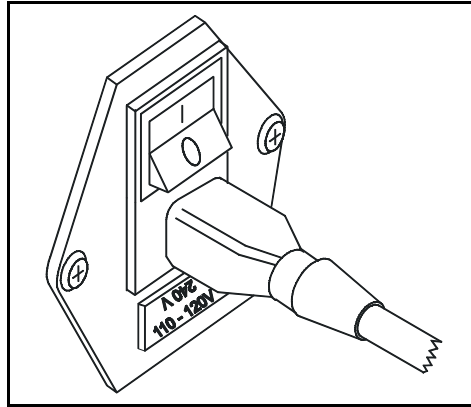


#### CAUTION

Turning off the power or pressing the reset switch on GENIE Acquisition without following the system shutdown procedure may cause data to be lost and causes the system to take longer to power up. Care should be taken to follow the system start up, shutdown and reset procedures.

The system power switch is located above the AC power input line at the back of the gantry base. It is a large, black, two position switch labeled **0** for off and **I** for on. This switch controls all power to the system.

Next to this switch is a power save switch. The Power save switch allows power to be removed from the motor drives and acquisition computer without disturbing the power to the detector. This allows significant power saving when the system is not in use.



**Figure 7-1.** System Mains Input

**Table 7-1:** Back of Gantry Base Components

No.	Description	Function
1	System Power switch	Turns power for entire system on and off.
2	AC Power Input	Supplies AC power to the system
3	115 VAC Output	Supplies AC power to other components of the system like the acquisition computer.

---

## System Startup

If the system is powered off or in power save standby, follow the instructions for System Power On. If the system is already powered on but the operator is not logged in, begin with the instructions for System Login.

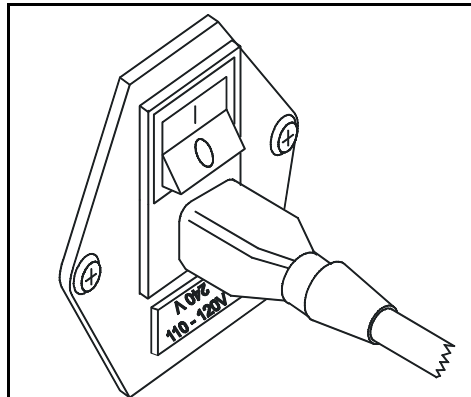
When you restore power to the detector, calculate the warm-up time as four times the shutdown time, e.g., 30 minutes off requires two hours for warm-up; never allow less than 15 minutes. The detector should never need more than four hours to warm-up.

---

## System Power ON

**To start the system when the power is off:**

1. Check that the power is present at the AC power outlet that supplies the gantry and that the power cord is attached.
2. Check that the main power switch at the back of the gantry base is in the on position as shown in [Figure 7-2](#). Turn off the power save switch prior to switching on the main power switch.
3. Switch the power save switch to the on position. The sound of the gantry power supply cooling fans will be heard. The power on indicator lights should illuminate.



**Figure 7-2.** Switching System Power ON

4. Check that the power indicator light on the front of the computer cabinet is lit. If it is not lit, press the power switch on the front of the computer cabinet. The location of this switch is shown in Chapter 3. The power indicator light will come on.
5. Check that the GENIE Acquisition monitor status indicator light, located on the front panel below the screen, is ON. If not, press the power switch on the front of the monitor. The status indicator light should now be ON.

6. This will initiate the acquisition system boot process. After a few minutes the login screen is displayed on the monitor. When a valid login name and password are entered, GENIE Acquisition is started and the **Acquisition and Review** screen is displayed. The login screen ensures that only authorized users can gain access to the system software. Continue with the System Login instructions below.



**Figure 7-3.** Login Screen

---

## System Login

Once the system is powered on, perform the following steps to start the GENIE Acquisition software:

1. Check that text cursor (a single vertical line) is next to the words “User Name”. If it is not, press the **<Enter>** key once to move the cursor to that position, or click next to the words using the mouse and pointer.
2. Type in your user name in lower case letters. In most cases this will be the word `genieacq`. When your user name is correct, press **<Enter>**. If the text appears in upper case, press the **<Caps Lock>** key to turn the Caps Lock off, remove the text by pressing the **<Backspace>** key one or more times, and then re-type `genieacq`.
3. Type your password in lowercase letters. Again, in most cases this is the word `genieacq`. Asterisk characters (\*) are displayed as you type. When your password is complete press **<Enter>**. If you make a mistake you can remove it by pressing the **<Backspace>** key and then typing in the correct letter.
4. If your user name and password are valid, the screen will clear and, after a few moments, the Acquisition and Review screen is displayed on the monitor with the Acquisition card at the front and the Review card and Quality Control card behind. The GENIE Acquisition is now ready for use. If the login is invalid or contained a mistake, an error message is displayed below the password field. Repeat steps 1 to 3.

For more detailed information on the various user privileges available, see [Different Logins on page 10-47](#).

---

## System Shutdown and Power Off

When you are finished using GENIE Acquisition, it is recommended to perform a system shutdown which returns the system to the login screen. In addition, it is important to prepare the system before turning the standby or main power switch off. Therefore, in either case, begin with the instructions for shutdown.

---

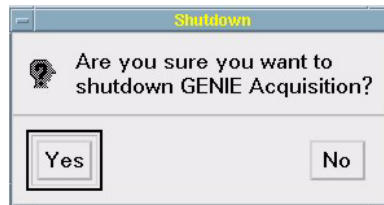
### System Shutdown

#### To shut down the system:

1. Check whether GENIE Acquisition's software is running. If the monitor is blank, move the mouse to activate the screen. If the software is running, display the **Main** Screen. If software is not running and the system is at the **Login** Screen, continue with the **Power Off** instructions below providing you need to power the system down.
2. Click on the [**Shutdown**] button. This button is located in the upper right corner of the **Main** Screen.



3. If an acquisition or a quality control operation is in progress, a pop-up is displayed explaining that the system cannot be shutdown. Either wait until the acquisition or quality control operation completes, or stop it and then shutdown the system.
4. If the system can be shutdown, a pop-up is displayed asking for confirmation that GENIE Acquisition should be shutdown. Click on [**Yes**] to shutdown the system. Click on [**No**] to cancel the shutdown and continue using GENIE Acquisition.



5. If [**Yes**] was selected, after several minutes, the Login screen will be displayed. This is where you will normally leave the system when powered up. If you wish to enter the power save mode or power off, continue with the **System Power Off** instructions next.

---

**System Power to Standby or Off****CAUTION**

The main power to the system should be left on at all times. There is no need to turn off the power switch on the acquisition computer or any peripheral devices connected to the power supply in the gantry base. The power switch at the AC power outlet need not be turned off unless the system is to be serviced.

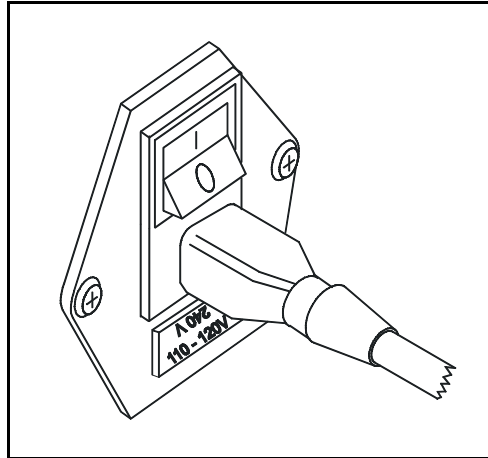
**CAUTION**

When cycling any power, wait a minimum of 1 minute before turning the power back on. Less time does not allow all of the power supplies to discharge. Some parts may come back up in an unknown state.

**To power down the acquisition system:**

1. Check whether GENIE Acquisition's software is running. If the monitor is blank, move the mouse to activate the screen. If the software is running, follow the System Shutdown instructions above before continuing. If the Login Screen is displayed, continue with the instructions below.
2. Check that text cursor (a single vertical line) is next to the words "User Name". If it is not, press the **<Enter>** key once to move the cursor to that position, or click next to the words using the mouse and pointer.
3. Type in the word `shutdown` in lower case letters. When the user name is correct, press **<Enter>**.  
If the text appears in upper case, press the **<Caps Lock>** key to turn the Caps Lock off, remove the text by pressing the **<Backspace>** key one or more times, and then re-type shutdown.
4. Type in the word `shutdown` as the password. Again this needs to be in lowercase letters. Asterisk characters (\*) are displayed as you type. If you make a mistake you can remove it by pressing the **<Backspace>** key and then typing in the correct letter. When your password is complete, press **<Enter>**. If the login contained a mistake, an error message is displayed below the password field. Repeat steps 2 to 4.
5. A message is displayed stating that the system will be down in five seconds. No other message is displayed. Wait for five to ten seconds.

6. Press the power off button on the front of the Acquisition Computer.
7. If you wish to remove all power from the system, press the main power switch to the off position. To restore operation from this condition will require time for detector stabilization as well as the normal acquisition system login process



**Figure 7-4.** Switching System Power Off

## Gantry and 3 Axis Table Calibration

When the system is powered on, it is necessary to calibrate the gantry and table to ensure that it is operating correctly and that each axis can be positioned accurately. A System Login without having to power on will not normally require a gantry and table calibration.



### CAUTION

The table must be moved away from the gantry before the system is calibrated, to prevent the possibility of a collision. Chapter 2 gives instructions on moving the table.

If the gantry or table requires calibration, a calibration pop-up is displayed in the top left corner of the screen giving instructions on how to perform the calibration. Also, the Status Area displays blanked out axis positions for each uncalibrated axis.

Det1	-68deg	264mm	Lon	0mm
			Ver	733mm
			Lat	0mm
Total	16.64 Mcnt	16.64 Mc/s		

### To calibrate the table and gantry:

1. Ensure that the table is away from the gantry and that there are no other obstructions near the system.
2. Click the **[Yes]** button on the calibration pop-up to begin calibration. If you click **[No]**, the pop-up will disappear and the system will not calibrate.
3. The calibration sequence automatically moves each axis to accurately establish its position. Once an axis has been calibrated, its position appears in the appropriate place in the **Status Area**.

The gantry must be calibrated *before* whole body, tomographic and gated tomographic scans can be acquired. It is recommended that the gantry be calibrated as soon as the system is started.

---

## Collimator Changing

---

### Overview

Before beginning a scan on a patient, you must ensure that the proper collimator for the study is loaded onto the detector. The use of an inappropriate collimator will affect image quality.

Acquisition and processing parameter cards have been included along with the Millennium MPR/MPS Operator's Reference Manual and the Millennium MPR/MPS Operator's Guide. The acquisition parameter cards suggest appropriate collimators to use with different types of scans and procedures. If there is a question as to which collimator to use, please refer to these reference cards.

Each collimator is color coded and labeled with its name. For example, the Low Energy General Purpose Collimator is blue and is labeled with the letters LEGP. Check which collimator is currently on the detector.

Decide which collimator you would like to use and change to that collimator if necessary using the following procedure.

---

### Collimator Changing Procedure



#### CAUTION

Collimators are, of necessity, made from a dense material and are therefore heavy. Millennium detectors require collimators that are too heavy to handle without a mechanical aid. Collimators should be handled using the collimator carts provided and care should be taken to follow the collimator changing procedure described in this section.



#### CAUTION

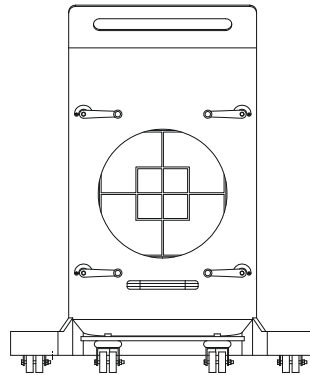
The detector should always be left with a collimator mounted on its face. This protects the detector from accidental damage and minimizes the effects of temperature changes on the detector.

The steps to take to change collimators on Millennium are as follows: The steps should be followed in the order that they are described.



### CAUTION

When changing collimators, rotate all locks fully 180° to secure the locking mechanisms. Verify that all four locks are engaged before moving the collimator cart.



### Step 1: Unlock The table

If a table is currently locked to the floor it must be unlocked and moved away from the gantry. See the Section on Table Maneuvering in Chapter 2 for detailed instructions on how to unlock and move the table.

### Step 2: Move The Gantry To The Collimator Changing Position

1. To initiate the collimator changing procedure, click the [**Gantry Icon**] once on the GENIE Acquisition and Review screen.

Gantry Icon



Figure 7-5. Gantry Button

2. Click on the **Collimator Changeout** option on the **Gantry Positioning** pop-up menu to select it, then click on the [OK] button.

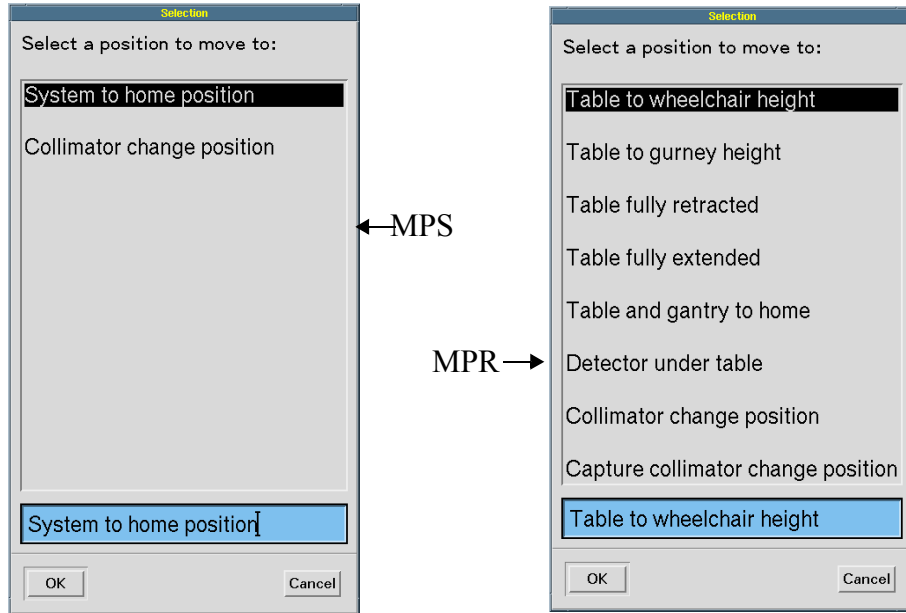


Figure 7-6. Gantry Positioning Pop-Up Menu

3. This will make the following message pop-up:

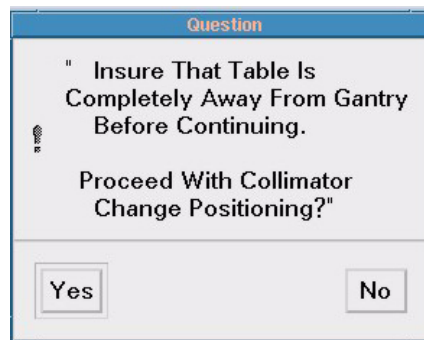


Figure 7-7. Collimator Changing Warning



**WARNING**

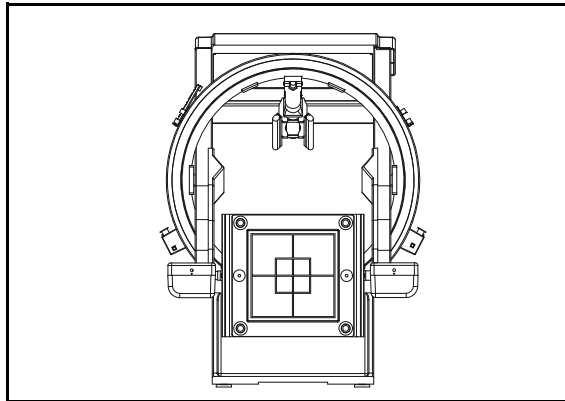
Possible injury to operator. When the collimator changing procedure is initiated, the gantry moves automatically to the pre-defined collimator position. Be sure the table is moved away and the area around the gantry is clear before clicking the [Yes] button.

4. Click the **[Yes]** button to make the gantry move to the collimator changing position.

**Note**

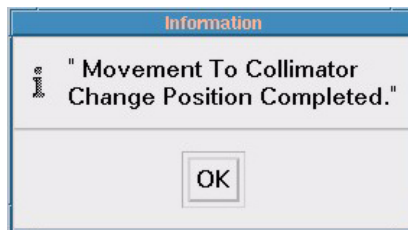
Make sure you have selected the right home position: Collimator Exchange1 for light collimators, Collimator Exchange 2 for heavy collimators.

5. GENIE Acquisition will now automatically rotate the gantry 180°, tilt the Detector to 90°, and set the gantry radius to a preset position. The exact positions will vary slightly from site to site, and are normally set on installation by Service.



**Figure 7-8.** Detector Position for Collimator Changing

6. When the movement has finished, the following message pops up:



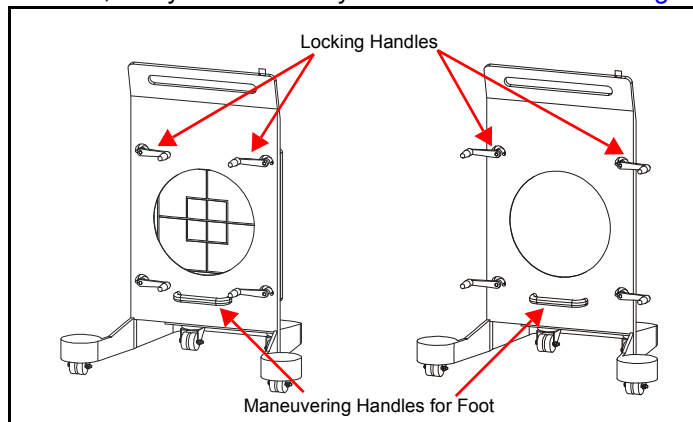
**Figure 7-9.** Collimator Changing Position Confirmation

7. Click the **[OK]** button to confirm.

### Step 3: Remove the Current Collimator

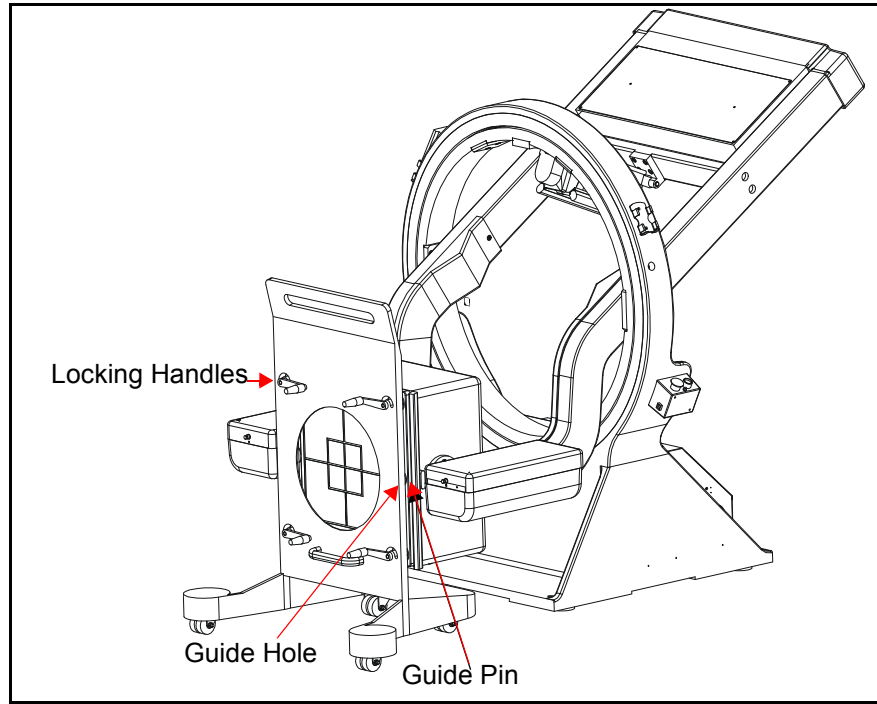
Once the table has been unlocked and removed, and the gantry and detector are in the collimator changing position, you can remove the collimator from the detector:

1. Check that the floor in front of the detector is clear of obstructions.
2. Ensure that all four locking handles on the empty collimator cart are turned fully outwards, away from the body of the cart as shown in [Figure 7-10](#).



**Figure 7-10.** Collimator Cart Locking Handles

3. Position the empty collimator cart directly in front of the collimator on the detector.
4. Carefully push the empty cart forward, checking that the two guide pins on the cart align and engage with the guide holes on either side of the collimator. See [Figure 7-11](#).



**Figure 7-11.** Removing the Collimator

**Table 7-2:** Removing the Collimator Components

Description	Function
Collimator locking handles	Locks or releases collimator from cart.
Guide hole	Used to align Detector with collimator cart.
Guide pin	Aligns collimator and Cart.

5. Once the guide pin are engaged, push the cart firmly towards the detector so that all four corners of the cart are in contact with all four locking devices on the collimator. This is best done by pressing the top of the cart by means of the hands, and the bottom of the cart by means of the foot simultaneously.
6. Check the alignment of all four locks in turn and ensure each locking handle is free to turn inwards. Each of the locking handles has a built-in safety lock which will block the handle of the cart is not in correct position. If any of the handles are blocked, return to step 5 and try aligning the cart again.

7. Once all four locks are in correct contact with the collimator, fully rotate all four locking handles inward. **The collimator become attached to the cart.**
8. Carefully pull the cart with the attached collimator away from the detector face, taking care not to hit the collimator or cart against the detector.
9. Remove the collimator cart and store it.

**Note**

Once a lock handle has been turned inwards by more than  $20^{\circ}$  it locks that cart, collimator and detector together. The collimator and cart will be released from the detector when all four handles are turned inwards by  $180^{\circ}$ .



**CAUTION**

Turn all four locks fully inwards  $180^{\circ}$  to secure the collimator to the cart. Verify that all four locks are engaged before moving the cart away from the detector.



**CAUTION**

The gantry is not balanced when there is no collimator mounted on the detector face. The gantry should not be moved until a collimator has been mounted on the detector.

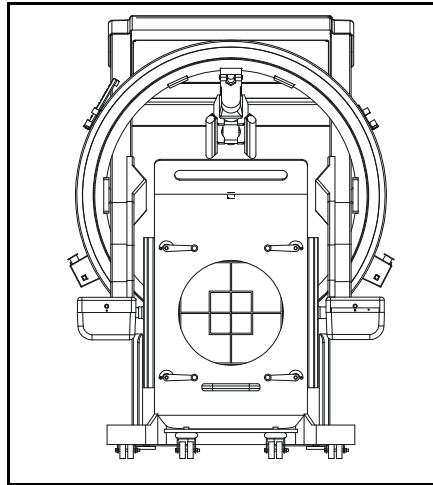
**To mount the new collimator on the detector:**

**Note**

On some occasions, when replacing a "light" collimator with a "heavy" collimator, the collimator exchange position will not fit. In the case follow instructions at the end of this section.

1. Check that the floor in front of the detector is clear of obstructions.
2. Select the cart carrying the desired collimator.

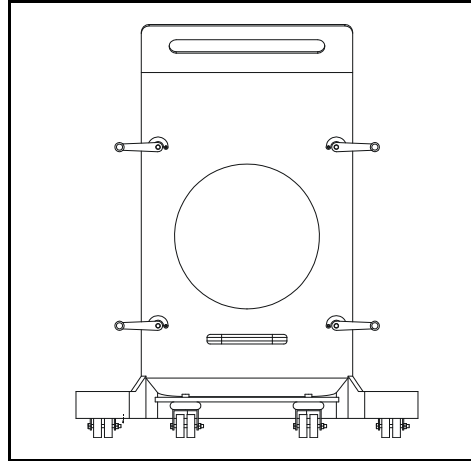
3. Ensure that all four locking handles on the collimator cart are turned fully inwards, as shown in [Figure 7-12](#).



**Figure 7-12.** Collimator Cart Locking Handles in Locked Position

4. Position the collimator cart directly in front of the detector face.
5. Carefully push the cart forward, checking that two guide pins on either side of the detector align and engage with the guide holes on either side of the collimator.
6. Once the guide pins are engaged, push the cart firmly towards the detector so that all four corners of the collimator are in contact with the face of the detector. This is best done by pressing the top of the cart by means of the hands and the bottom of the cart by means of the foot simultaneously.
7. Check the alignment of all four locks in turn and ensure each locking handle is free to turn outwards. Each of the locking handles has a built-in safety lock which will block the handle if the cart is not in correct position. If any of the handles is blocked, return to step 6 and try aligning the collimator again.

8. Once all four locks are correctly aligned, fully rotate all four locking handles outwards as shown in Figure 7-14. **The collimator is now attached to the detector.**



**Figure 7-13.** Collimator Cart Unlocked Position

9. Carefully pull the empty cart away from the collimator. When removing the cart, take care not to hit the collimator.
10. Store the empty cart.

**Note**

Once a lock handle has been turned inwards by more than  $20^\circ$  it locks the cart, collimator and detector together. The collimator and cart will be released from the collimator when all four handles are turned outwards by  $180^\circ$ .



**CAUTION**

Turn all four locks fully outwards  $180^\circ$  to secure the collimator to the detector. Verify that all four locks are engaged, before moving the cart away from the detector.



**CAUTION**

The gantry is not balanced when there is no collimator mounted on the detector face. The gantry should not be moved, until a collimator has been mounted on the detector.

---

**Changing "Light" Collimators to "Heavy" Collimator Procedure**

1. After removing the "light" collimator (e.g. LEHR, LEGP, LEUHS collimator), assemble the decoy collimator on the detector.
2. Select "**Collimator exchange 2**", click on the [OK] button, and wait for the procedure to complete.
3. Remove the decoy collimator from the detector.
4. Install the "heavy" collimator (e.g MEGP collimator) as usual.

---

**Changing "Heavy" Collimators to "Light" Collimator Procedure**

1. After removing the "heavy" collimator (e.g MEGP collimator), assemble the decoy collimator on the detector.
2. Select "**Collimator exchange 1**", click on the [OK] button, and wait for the procedure to complete.
3. Remove the decoy collimator from the detector.
4. Install the "light" collimator (e.g. LEHR, LEGP, LEUHS collimator) as usual.

---

**Instructions For Use Of The Pinhole Collimator**

The pinhole collimator should be used as follows:

1. Upon loading the pinhole collimator to the camera, position the acquisition computer so the operator is able to stand in front of the detector and still access the keyboard.
2. Press and hold the override button while selecting the Table/Gantry to Home pre-programmed position. Without releasing the button, move the detector to the home position, taking care that it does not collide with the acquisition computer or cart.
3. With the patient already positioned on top of the table, move the table into position and pin to floor. (Take care not to push patient into the collimator).
4. Once positioned, the operator will again hold the override button with one hand and position the collimator and table with the handset in the other

hand.



**CAUTION**

**Pre-programmed motions must not be used once the table is pinned into position or patients are present.**

5. To remove the collimator, un-pin the table and move it away from the gantry; press and hold the override button and select the Collimator Changeout pre-programmed position.

---

## 3 - Axis Table Positioning

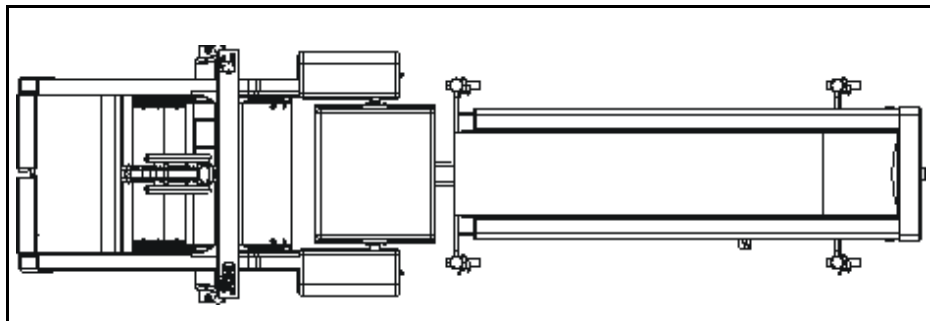
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### Overview

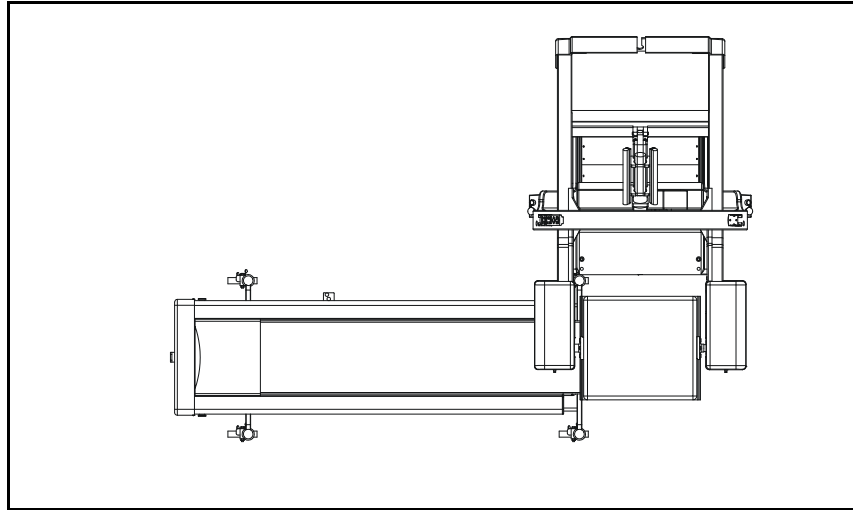
After the appropriate collimator has been loaded on to the detector, the table must be locked into position for the scan.

The Millennium MPR allows the patient table to be located in one of two positions, either:

- In front of the gantry and extending through the gantry ring for tomographic scans. See [Figure 7-14](#), or:
- Perpendicular to the gantry, either on the left or on the right, extending across the gantry ring for whole body scans. See [Figure 7-15](#).



**Figure 7-14.** MPR SPECT System



**Figure 7-15.** MPR Table Positioned for Whole Body Scan

Move the table into the desired position. Use the locking pedals on the table to secure the table to the floor plates. For detailed description of the how to lock, unlock, and position the table, refer to [Table Maneuvering on page 3-27](#).



**WARNING**

The maximum patient weight on the table should not exceed 200 kg (440 lb).

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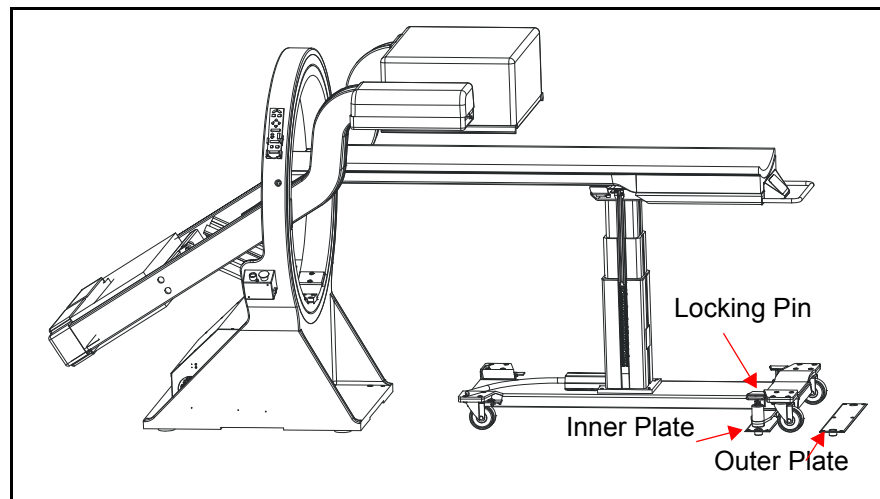
## Single Axis Table Positioning

---

### Overview

After the appropriate collimator has been loaded on to the detector, the table must be locked into position for the scan.

For all types of scans, the Millennium MPS patient table is always positioned in front of the gantry and extending through the gantry ring.



**Figure 7-16.** Single Axis Table and Gantry

The table has two floor locking plates: an inner plate for cardiac studies and an outer plate for all other studies.

The inner and outer plate positions are shown in [Figure 7-16](#).

**Note:** In all illustrations the table extender is used.

### To Position The Single Axis Table

1. Move the table over the locking plates and lock it in the position corresponding with the study being performed.
2. For finer adjustment, slide the table forwards and backwards until the desired position is obtained.

**Note:**

- The table's maximum retractable position, consistent with the room area, is set during installation.
- The table can be moved away from the gantry by releasing the locking pins and moving the table away.

---

## Motorized Table Motions

The motorized motions of the table are normally controlled by the handset. Refer to [Handset on page 3-15](#) for a detailed description of the handset controls.

GENIE Acquisition can also move the table automatically (applies only to the 3-axes table). This can occur when using the pre-programmed motions, or during whole body, tomographic, and gated tomographic acquisitions. See [Gantry and Table Pre-Programmed Positions on page 4-20](#) for detailed information on the pre-programmed motions.

---

## Patient Positioning

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### Overview

Patient positioning depends upon the type of acquisition you are performing, and on the state of patient health. See the following section on Acquisition Types for recommendations on patient positioning for the various types of scans.

If the patient is seriously ill or unable to walk, he or she would certainly need to be transferred from either a gurney (stretcher) or a wheelchair to the table. Some patients may appear quite well and follow your positioning instructions.

A patient positioning strap will normally be used to support the patient's arms during a study, but should not be used to secure the patient to the table. When using Cardial SPECT acquisitions, the arm strap is not used. Arms will usually be positioned above the patient's head.

**Note**

In case the Velcro straps are too short to secure the patient's arms, use the alternate Arm Security Strap PN 46-229450P1/E8004AE.

Since the Millennium MPR/MPS has several moving parts, careful consideration must be given to the placement of IV poles and other equipment which may be attached to the patient. Provisions must be made to assure the integrity of any life-support lines, IV tubes and monitoring equipment cables.

**CAUTION**

To avoid injury to persons or equipment damage, do not use the edge of the detector as lift or rest points. The detector is not intended to support the weight of the patient or operator.

Use the handset or the pre-programmed motions to move the patient into the appropriate position for the type of acquisition you will be performing.

**Note**

When positioning the detector over the patient, using the hand set control, use only SLOW speed if detector is close to the patient. Consider motion is not stopped immediately.

Use appropriate support to minimize patient motion during the acquisition. The part of the patient being imaged should remain motionless while being acquired.

Reassure the patient. Try to help them relax. A relaxed person is much less likely to move during acquisition.



**WARNING**

To avoid collisions and patient injury, always monitor the patient's position during scan procedures.



**CAUTION**

It is the operator's responsibility to avoid collisions during patient set up.


**Pre-Programmed Motions (PPM)**

<b>PPM name</b>	<b>Axes final position</b>	<b>PPM application</b>
Wheelchair Height	Table vertical - Min	Bring table to minimum height to allow easy position on / off the table.
Gurney Height	Table lateral – 0 Table fully retracted Table vertical – 835	Set up table to Gurney height, to allow easy movement of patient from / to table.
Retract Table	Table fully retracted	Fully retract table when system is in opposed mode.
Extend Table	Table fully Extended	Fully extend table, when system is in opposed mode.
Home Position	Radial – 0 Tilt - LVL Table vertical – 760	Bring system to zero position.
Detector Under Table	Radial – 1800 Tilt - LVL Table vertical – 760	Place detector under the table position
Collimator Change	Radial – 250 Rotation – 180 degrees Tilt - 90	Bring system to initial position for Collimator Exchange.
Torso Tomo	Radial – 280 Table long - 840 Rotation – 0 Table lateral – 0 Table vertical – 750	Bring system to initial position for Torso scan.
Cardiac Tomo	Radials – 280 Table long - 800 Rotation – (-45) Table lateral – 0 Table vertical – 750	Bring system to initial position for cardiac scan.
Brain Tomo	Table long - 20 Radial – 280 Rotation – 0 degrees Table lateral – 0 Table vertical – 750	Setup system to initial position for Brain scan.

---

## Physical Positions

With certain types of acquisitions, the patient may be required to lay, stand or sit while being imaged. Standing or sitting positions may be useful when scanning the chest or lower abdominal area. For proper table extender use, refer to [3 - Axes Table Extender on page 3-33](#) and [Single Axis Table Extender on page 3-39](#).

	<p style="text-align: center;"><b>CAUTION</b></p> <p>When "Detector Under Table" PPM is used, the detector may collide with the table.</p>
---	--


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## Lying On The Table

if the patient is positioned laying on the table, then various types of acquisitions may be performed. The set up procedure for a patient laying down follows:

1. Click on the [**Gantry**] icon and select the Table/Gantry to Home preprogrammed position.
2. If the patient is on a gurney (stretcher), click on the [**Gantry**] icon and select the Table to Gurney Height preprogrammed position. Transfer the patient onto the table.
3. If the patient is in a wheelchair or is ambulatory, click on the [**Gantry**] icon and select the Table to Wheelchair Height preprogrammed position. The table is low enough that normally a step stool does not have to be used with the table in this position. Have the patient lay down on the table.
4. Using the handset, position the organ of interest in the field of view. Detailed patient positioning instructions for the various scan types are found later in this chapter.



	<p style="text-align: center;"><b>CAUTION</b></p> <p>The detector is not intended to support the weight of the patient or operator. Do not use the edge of the detector as lift or rest points to avoid equipment damage.</p>
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## Sitting

If the type of acquisition requires that the patient should sit in order to be imaged,

then the procedure is almost identical to that above. The only difference being that he or she sits rather than stands. This position is useful when scanning the chest region since the lungs will hang in their natural position.

Patients should only be positioned sitting on a stool. Chairs with a back should not be used since this may interfere with the image.

## Acquisition Types

There are various types of acquisitions, each with its own positional requirements. With all acquisitions, it is important that you get the detector as close as possible to the patient. This improves the final quality of the image.



### CAUTION

Power interruption during acquisition may result in loss of image data.

## Scan Types

GENIE Acquisition supports a number of basic scan types. Multiple scan studies are built from the basic scan types.

**Table 7-3: Scan Types**

Scan Type	Description
Static	One image frame per energy set acquired over time in one gantry position.
Dynamic	Multiple image frames per energy set acquired over time in one gantry position. Ability to acquire heart beat trigger histogram.
Whole body (MPR only)	One image frame per energy set acquired over the length of the patient.
Gated	Multiple image frames per energy set acquired over the cardiac cycle in one gantry position. Ability to acquire heart rate trigger histogram.
Tomo	Multiple image frames per energy set acquired over rotation of the detector around the patient.
Gated Tomo	Multiple image frames per energy set acquired over the cardiac cycle and rotation of the detector around the patient. Ability to acquire heart rate trigger histogram.
Spectrum	Histogram of counts over detector energy range, used for detector tuning.
Fast Dynamic Option	Multiple image frames per energy set acquired over time in one gantry position with a large number of frames. Ability to acquire heart beat trigger histogram.

---

## Static Acquisitions

The types of static acquisitions include:

- Bone
- Soft Tissue
- Lungs
- Liver and Gastric
- Renal
- Brain
- Thyroid (Neck)

For a static bone, soft tissue, lung, liver, gastric and renal imaging sessions, the patient may be positioned standing, sitting or laying. It depends on the area to be imaged, the condition of the patient and to a certain extent on your personal choice.

When the brain or thyroid is to be scanned, it is advisable to have the patient lay down on the table. You would also be advised to use the head holder to support the patient during the acquisition. See [Head Holder](#) in [Table 10-2 on page 10-49](#) for more information on the head holder.

---

## Dynamic Acquisitions

Dynamic acquisitions may be performed on almost any part of the body. They are often used to determine blood flow through the patient's organs and may be played back as a short 'movie' or cine.

Consequently, after positioning, the patient will normally be injected immediately prior to imaging so that the progress of the blood carrying the radioactivity may be captured 'live'.

Since the detector will remain stationary during a dynamic acquisition, the same patient positioning techniques as described for static acquisitions apply.

---

## Whole Body Acquisitions (MPR only)

These acquisitions are used to obtain whole body images using radiopharmaceuticals such as  $I^{131}$ ,  $Ga^{67}$ ,  $In^{111}$  white blood cell or  $Tc^{99m}$  bone imaging agents. The patient is scanned over the length of his/her body. It is important for the patient to be comfortable during this procedure since any movement will blur the final image.

You should position the patient laying on the table with the feet towards the detector. Additional instructions for positioning patients for whole body acquisitions will be covered later in this chapter.

---

## Multigated Acquisitions

The principle of multi-gated cardiac imaging is well known in Nuclear Medicine imaging. The technique is used to generate a sequence of images of very short duration showing the motion of the contracting and relaxing heart. Each image would typically represent 20 to 40 milliseconds of the cardiac cycle. Multi-gating is necessary because the amount of information obtainable in these very short times is not sufficient to generate a useful image. Averaging over a large number of heartbeats is used to obtain more information.

---

### How Gated Acquisition Works

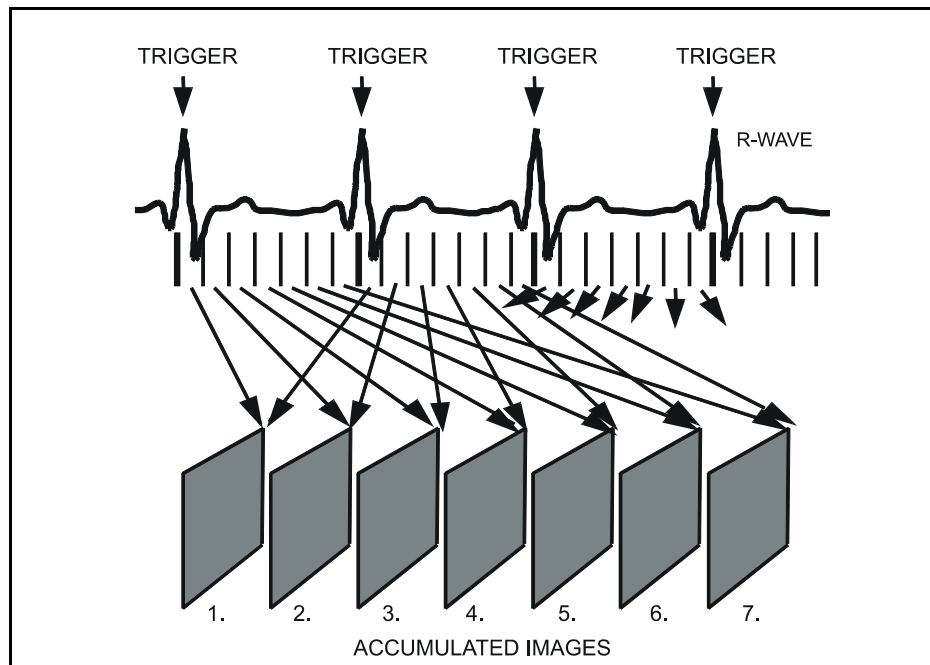
The electrocardiograph (ECG or EKG) is used to synchronize the image formation with the heartbeat. Each heartbeat consists of Systole, the period when the heart contracts and Diastole, when the heart relaxes. When the heart contracts (systole), blood is pumped out of the heart around the body. When the heart relaxes (diastole), the chambers fill with blood ready for the next contraction. The electrocardiograph shows a large spike just as the heart starts its contraction. This large spike, known as the R-wave (or sometimes as the QRS-complex) is the electrical signal which triggers the heart muscle's contraction.

In a multi-gated study, data from the gamma camera is collected over many heart beats, and a single set of pictures is created illustrating the "average" beat of the set. The computer is used to keep track of the information and build the images. Suppose that 24 images are required and each image is to represent 40 milliseconds (one millisecond is one-thousandth of a second) of the heart cycle.

When the acquisition is started the following steps take place:

1. The computer waits until it sees an R-wave on the patient's electrocardiograph (ECG or EKG).
2. As soon as the R-wave occurs one beat is "triggered". The computer begins to collect information from the gamma camera and puts it into frame 1 (which will be the first image of the sequence).
3. After 40 milliseconds the computer stops putting information into frame 1 and instantly starts putting it into frame 2 (which will become the second image of the sequence).
4. After another 40 milliseconds (80 milliseconds after the R-wave) frame 2 will stop and the data will go into frame 3 (refer to [Figure 7-17](#)).
5. This process continues until data has been collected for 40 milliseconds into each of the 24 frames. When that happens, the computer saves no more data but waits for the next R-wave trigger to start it again (as at step 2).
6. When the next R-wave occurs the system again starts putting data into frame 1 (thus data from the first 40 milliseconds of beat 2 is added to the data from the first 40 milliseconds of beat 1).
7. Similarly the data from 40 to 80 milliseconds of beat 2 is added to the data from the same time in beat 1, and so on for each of the 24 frames.
8. The process is repeated for every heart beat until the operator presses the [**Stop**] key, or until a predetermined number of counts or heartbeats have been collected.

At the end of, say 500 heartbeats, frame 1 will contain all the information from the first 40 milliseconds of all 500 beats, frame 2 all the data from the second 40 milliseconds, and so on with frame 24 containing all the data from the 24th 40 milliseconds...i.e. between 920 and 960 milliseconds.



**Figure 7-17.** Gated Cardiac Acquisitions

One important exception occurs if the next R-wave occurs before the 24 frames of the beat have been collected (i.e. the beat is shorter than 960 milliseconds). In this case the computer immediately abandons whatever frame it is on and goes immediately to frame 1 and starts the sequence again. This means the ending frames may contain less counts than the beginning frames. On the image display, you will see a “flicker” of the data during cine display mode.

### **Bad Beat Rejection**

Although the heart rate is usually regular, it will also generate some beats of significantly different length (ectopic beats). An ectopic beat results when the electrical signal which triggers the heart to contract occurs too soon. For example, a resting patient’s heart rate may be about 80 beats per minute. That means there will usually be 750 milliseconds between beats, and the electrical “trigger” (the R-wave) will occur 750 milliseconds after the previous trigger. An ectopic beat occurs when the R-wave happens too soon, perhaps after only 500 milliseconds. This early R-wave causes the heart to contract, possibly before the chambers have filled with blood. It is also common for the heart to take an extended “rest” after an ectopic beat, so the time before the next R-wave after an ectopic may be longer than usual.

---

## Setting the Basic Parameters

When setting up a Gated acquisition it is necessary to define how many frames (images) are required, the duration (milliseconds) of each image, the conditions on which the study should stop, and how the computer should decide which beats are acceptable and which should be rejected.

In practice, the time for each frame is not a useful parameter. Users will normally decide how many images they wish to see in the cardiac cycle, and what fraction of the cardiac cycle they wish to image. The computer is capable of calculating how many milliseconds each frame should be. In most studies the user would expect the whole of the cardiac cycle to be imaged (100%) in 24 or 32 frames. Currently only 100% of The Cardiac Cycle is imaged. This value cannot be changed.

Termination (when the study stops) can be determined by time (collect data for, say 5 minutes), by the number of heartbeats (Number of Triggers), or the total number of counts.

If termination is on a preset count the preset count includes all counts seen by the camera, even those included in rejected beats.

The Rhythm Acceptance window is set by giving the size and position specified as percentages of the average beat duration. If one window is used its center will default to 100% and the width may be set to, say, 20%. This would accept all beats within 10% either side of the average heartbeat.

---

## Setting the Frame Duration

If all heartbeats were exactly the same, then it would be simple to set the frame duration. We would simply divide the time between beats by the number of images required. In the case of the patient with a steady heart rate of 72 beats per minute (833 milliseconds) to get 24 frames we would make each frame  $833/24$  or about 35 milliseconds per frame. However we know that beats may vary by as much as 10% from the average (if we have a 20% acceptance window), and furthermore the average heart rate may change during the study.

At first sight it appears sensible to take every heartbeat, however long or short, and divide into a fixed number of equal segments and use those for the average beat. Then instead of having 24 frames of 35 milliseconds at the end, we would have 24 frames, each being one–twenty fourth of the average heartbeat. If we were studying a mechanical machine this approach would be ideal. The heart doesn't work like that, however. When the heart speeds up or slows down, not all of the motions speed up or slow down equally. For example, the time it takes for the heart muscle to contract does not change very much when the heart is stressed; instead the time spent relaxing is shortened. So if the heart rate goes

from, say 70 to 100 beats per minute, there will be only a small change in the time it takes the heart to contract, but quite a big change in the relaxation part of the heartbeat. Since we are (usually) interested in the contraction of the heart (systole), we usually get better images and data if we keep the “time per frame” the same, even when the heart rate is changing.

We still have to decide what the frame time is. The “10-beat average” is used to control frame time. The 10-beat average is calculated as soon as ten beats have been counted while in The Camera On State. From that moment the 10-beat average is updated every beat, so the average heart rate of the last 10-beats is always known. The computer calculates the frame duration using the 10-beat average at that time. The calculation is:

$$\text{MillisecondsperFrame} = \frac{PxTBA}{100xN}$$

N is the number of frames per cycle (images).

TBA is the current 10-beat average beat duration in milliseconds.

P% is another parameter from the acquisition card; sometimes you may wish to image only a part of the cardiac cycle. If the whole cycle is wanted then P% is 100%. If only 60% of the cardiac cycle is wanted then P% is 60%.

---

### Changes in Heart Rate

What happens if the patient’s heart rate changes during the study? This is a real problem and there is no “correct” answer. The very concept of a multi-gated study requires that all heartbeats are approximately the same, otherwise averaging a large number to get a “typical” beat would be meaningless. In fact, not all beats are of the same duration. The average heart rate changes according to emotional state and in response to exercise or other stress and it can be changed by drugs. Such changes in heart rate usually take place slowly (over 30-50 or more heartbeats).

Aside from such slow changes the heart usually beats at a fairly constant rate, with the duration of each beat being within about 10% of the average, but it will also generate some beats of significantly shorter (or longer) duration. These unusual beats are called “ectopic” beats. In order to generate a good multi-gated study both the unusual “ectopic” beats and slower changes in heart rate must be taken into account.

The problems caused by different beat durations is very real because we can learn so much by observing how the heart responds to stress, and so the Cardiologist will often wish to perform a multi-gated study on a patient while he is being stressed. He can then see how the Ejection Fraction and other parameters change as the heart increases its workload in response to stress,

and relaxes afterwards. When doing this kind of study however, it is important to remember that the result will still be an “average” heartbeat covering a time period when things were changing.

When studying the heart in patients, it is important to get a picture of the “usual” behavior of the heart, ignoring the ectopic beats. (They occur in almost everybody, and are unimportant unless very frequent). Although ectopic beats are usually unimportant in themselves they are so different from normal beats that if they are included in the average they will blur the motion and make estimates of physiological parameters derived from the study (e.g. ejection fraction) inaccurate. For this reason the Millennium MPR/MPS can be made to ignore data from any beat which does not satisfy requirements specified by the operator.

Each beat is accepted or rejected according to the parameters entered on the acquisition cards. There are several different ways in which the operator can define which beats are to be accepted. The simplest is to say that all beats which are within, say, 10% of the average are good, and any others are to be rejected.

---

## Tomographic Acquisitions

Tomographic acquisitions require that the patient lay on the table. The detector needs to be as close as possible to the patient.

Tomographic acquisitions may be made either with a circular detector path or a Programmable Body Contouring (elliptical) path. Generally the elliptical path will provide better resolution, but the circular path requires less positioning time.

<b>Note</b>
-------------

Cardiac imaging typically requires a circular path.

When setting up the Millennium MPR/MPS to do a tomographic scan, it is important to follow the pop-up messages that appear. Additional instructions for positioning patients for tomographic acquisitions will be covered later in this chapter.

Most tomographic studies take 15 to 30 minutes. However, the acquisition time does depend on the ability of the patient to hold still. Ensure the patient is lying comfortably on the table to minimize motion.

## Gated Tomographic Acquisitions

Tomographic acquisitions require that the patient lay on the table. The detector needs to be as close as possible to the patient.

Gated tomographic acquisitions may be made with a circular detector path. A triggered dataset will be acquired at each view and combined during reconstruction to give a gated set of transaxial views.

Since multigated tomographic acquisition differs from standard tomography only by the addition of a trigger file, the same patient positioning techniques as described for gated and tomographic acquisitions apply.

## Fast Dynamics

The fast dynamic option allows dynamic acquisitions with higher maximum frame rates and a higher maximum number of frames. [Table 7-4](#) lists the maximum number of frames and maximum frame rates available with the Fast Dynamic option and [Table 7-5](#) lists the standard specifications.

**Table 7-4: Maximum Frames and Frame Rates (Fast Dynamics Option)**

Image Size	1 Energy Set		2 Energy Sets	
	Max Frames		Max Frames	Rate/sec
64 <sup>2</sup>	1280	33	640	17
128 <sup>2</sup>	320	8	160	4
256 <sup>2</sup>	80	2	40	1

**Table 7-5: Maximum Frames and Frame Rates (Standard)**

Image Size	1 Energy Set		2 Energy Sets	
	Max Frames		Max Frames	Rate/sec
64 <sup>2</sup>	600	33	300	17
128 <sup>2</sup>	150	8	75	4
256 <sup>2</sup>	37	2	18	1

---

## Performing an Acquisition

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### Overview

The following section gives a step by step guide to performing different types of scans. [Chapter 5](#) gives a detailed description of the function of each area within the Acquisition card. Refer to that chapter for more information on any feature you do not understand.

Acquisition and processing parameter cards have been included along with the Millennium MG Operator's Reference Manual and the Millennium MPR/MPS Operator's Guide. The acquisition parameter cards suggest appropriate parameters to use for different types of procedures.

Each time the system is started up, and after every 24 hours of continuous operation (since the last collision sensor test), the operator is prompted to test the collision sensors

---

### Static Acquisition

The step by step procedure for performing a basic static acquisition follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the Scan Selector.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.

7. Click the **STATIC** option. A new Patient Study entry is added in the Scan Selector containing a single scan entry labeled **STATIC**.
8. The **Patient Study Edit** pop-up is displayed in the **Scan Selector**. Enter the appropriate information in the **Patient ID** and **Patient Name** type-in fields. Enter the appropriate **Study Name** type-in field. Click the **[OK]** button to confirm.

Patient ID  
NoID

Patient Name  
NoPatientName

Study Name  
General

OK Cancel

STA  
STATIC

9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new static scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The **[Camera On]** button is displayed in the **Scan Control** area.

1234  
Test Patient  
Example Static

STA  
STATIC

10. If scanning an actual patient, position the table, and then position the patient according to the instructions found earlier in this chapter.



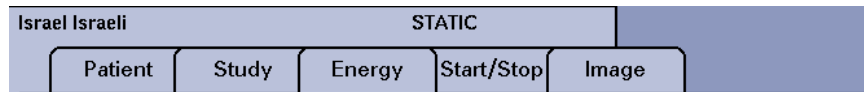
**WARNING**

To avoid patient injury, be sure that the patient is properly secured before starting the scan.

11. Have patients raise their hands over their head if necessary, and use the handset to position the organ of interest or source in the field of view.
12. Click the **[Camera On]** button to display the image currently being received from the detector in the Image Display area. The **<Start>** button is initially unavailable, but changes to being available within a few seconds.



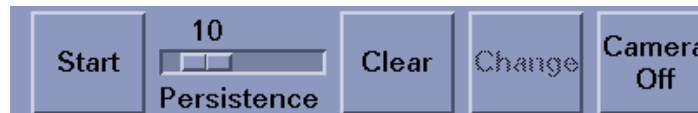
13. Click the **Energy Set** card to bring it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the basic static scan defaults to  $Tc^{99m}$ . Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service.



**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

14. Click the **Start/Stop Set** card to pop it to the front. The default Stop parameter is set to 1 million counts. Change the Start/Stop criteria if desired.
15. Click the **Image Set** and change the default settings if desired.
16. If any parameters were changed, the **[Start]** button will be inactive (gray) and the **[Change]** button will become active. Click the **[Change]** button to send the modified scan parameters to the detector. After a few moments the **[Start]** button will become available again. If no changes were made, the **[Change]** button will not be active.



17. Click the **[Start]** button to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The **Scan Control** area will display a single **[Stop]** button. The **Image Display** area will change to show the image that is being acquired. The **Status** area will show the elapsed acquisition time, the estimated time to end, the total of the counts being acquired and count rate.
18. You may switch to the **Review** card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the **Exam Watch** window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
19. The acquisition will stop and store automatically as soon as it reaches the set Start/Stop counts or time. If the Start/Stop Method was not defined (Stop on Time and Counts were both deselected), you must stop and store the acquisition manually.  
If you need to stop the acquisition early, click on the **[Stop]** button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.
20. The image data acquired for the static scan can now be reviewed or transferred to a Processing and Review workstation. [Reviewing the Acquisition on page 7-85](#) and [Transferring Acquired Studies on page 7-92](#) sections later in this chapter provide details of how to do this.

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## Dynamic Acquisition

The step by step procedure for a performing a basic dynamic acquisition follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the Scan Selector.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **DYNAMIC** option. A new Patient Study entry is added in the Scan Selector containing a single scan entry labeled **DYNAMIC**.
8. The **Patient Study Edit** pop-up is displayed in the **Scan Selector**. Enter the appropriate information in the **Patient ID** and **Patient Name** type-in fields. Enter the appropriate information in the **Study Name** type-in field. Click the **[OK]** button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new dynamic scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The **[Camera On]** button is displayed in the **Scan Control** area.
10. If scanning an actual patient, position the table, and then position the patient either sitting or lying on the table following the instructions found earlier in this chapter ([Patient Positioning](#)). If performing a gated dynamic such as a Firstpass Study, place ECG electrodes on the patient, and then attach R-Wave Trigger leads to the electrodes.



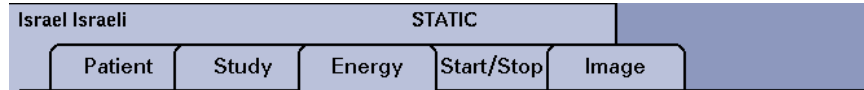
### WARNING

To avoid patient injury, Be sure that the patient is properly secured before starting the scan.

11. Use the handset to position the organ of interest or source in the field of view.
12. Click the **[Camera On]** button to display the image currently being received from the detector in the **Image Display** area. The **[Start]** button is initially unavailable, but changes to being available within a few seconds.



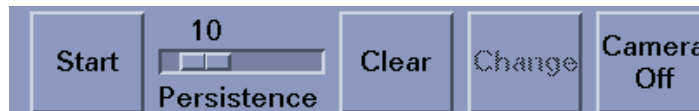
13. Click the **Energy Set** card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general dynamic scan defaults to  $Tc^{99m}$ . Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service. If needed, do this for each detector.



**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

14. Click the **Image Set** card to pop it to the front. The default parameters are set to a single phase acquisition of 60 frames at one second per frame. Change the criteria if desired.
15. If you are performing a gated dynamic, click on the **Trigger Set** card to pop it to the front. Check the trigger histogram and adjust the center and width of the window if necessary. Be sure the **[Acquire]** toggle is selected so that a trigger history is stored with the acquired data.
16. If any parameters were changed, the **[Start]** button will be inactive (gray) and the **[Change]** button will become active. Click the **[Change]** button to send the modified scan parameters to the detector. After a few moments the **[Start]** button will become available again. If no changes were made, the **[Change]** button will not be active.



17. Click the **[Start]** button to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The Scan Control area will display a single **[Stop]** button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed acquisition time, the estimated time to end, the total of the counts being acquired, the count rate, the current frame number, the total number of frames specified, the current phase number, and the total number of phases specified.
18. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the Exam Watch window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
19. The acquisition will stop and store automatically as soon as it reaches the defined phase parameters. If the Start/Stop Method was not defined (Stop on Time and Counts were both deselected), you must stop and store the acquisition manually.  
If you need to stop the acquisition early, click on the **[Stop]** button. Then you can store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.
20. The image data acquired for the dynamic scan can now be reviewed or transferred to a Processing and Review workstation. The Reviewing and Transferring the Acquisition sections later in this chapter provide details of how to do this.

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## Whole Body Acquisition: Manual Mode-MPR

The step by step procedure for a performing a general non-learn mode whole body acquisition with a rectangular detector follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the **Scan Selector**.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Bone** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **Whole Body Bone** option. A new Patient Study entry is added in the Scan Selector containing two scan entries labeled **ANTERIOR** and **POSTERIOR**. The Patient Study and the new anterior scan are automatically selected and the details of the scan are displayed in the Scan Set up area. The [Camera On] button is displayed in the Scan Control area.
8. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the **Patient ID** and **Patient Name** type-in fields. Enter the appropriate name into the **Study Name** type-in field. Click the [OK] button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new anterior scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The [Camera On] button is displayed in the **Scan Control** area.
10. Position the table so that it is perpendicular to the detector following the instructions found in Chapter 2. Be sure to lock the table into position.
11. Add the table extender to the end of the table.

12. Position the patient lying supine on the table with their feet pointing into the ring. Their feet should be on the extender with their heels close to the edge. Follow the instructions found earlier in this chapter ([Patient Positioning](#)) for additional positioning information.



**WARNING**

To avoid patient injury, be sure that the patient is properly secured before starting the scan.

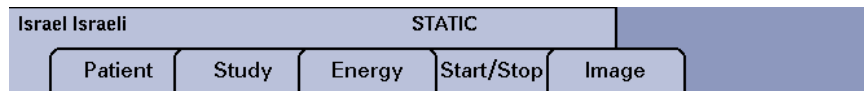
13. Click the **Gantry** icon and select the **Detector /Table to Home** position.
14. Using the handset, move the table longitudinally until the widest (or tallest) part of the patient is beneath the detector. Bring the detector radius in so that the detector is as close as possible to the patient. Double-check to make sure that the detector will clear the patient through the entire scan.
15. Fully extend the table. The patient's skull should be at the top of the field of view.
16. Click the [**Camera On**] button to display the image currently being received from the detector in the Image Display area. Check the patient position. The [**Start**] button is initially unavailable, and will remain unavailable until the set up is complete.



**Note**

An error message may appear indicating insufficient table travel. Ignore this message until the final patient setup is complete (Step 23.)

17. Click the **Energy Set** card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the basic whole body bone scan defaults to Tc<sup>99m</sup>. Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service. Do this for each detector.



**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

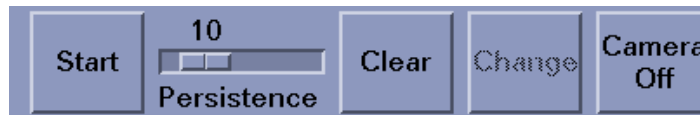
18. Click the **Start/Stop Set** card to pop it to the front. The default parameters are a length of 1.9 meters and a speed of 10 minutes per meter. Therefore the scan should take approximately 23 minutes to acquire. Change the Start/Stop criteria if desired. The length and scan rate should be adjusted as appropriate for the patient being scanned.

Length (m)	Speed Mins/m	Time (Mins)
1.90	10.0	23

19. Click the Image set up card to pop it to the front. The default parameters are set so that GENIE Acquisition will retract the table while scanning. In addition, the default method is Manual, and the default orientation is supine with feet first. This is the recommended scan set up. Change the default settings if desired. Head first means that the scan will start at the head. Therefore, the image in the Image Display area will form from the top down. If the orientation was feet first, the scan would start at the feet, and the image would form from the bottom up.

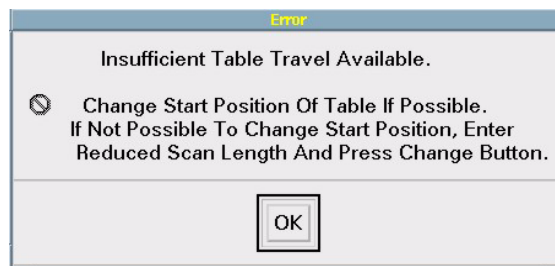


20. If any parameters were changed, the [Start] button will be inactive (gray) and the [Change] button will become active. Click the [Change] button to send the modified scan parameters to the detector. If no changes were made, the [Change] button will not be active.



21. If the detector tilt is not exactly  $0^\circ$ , a pop-up is displayed asking whether the detector tilt should be automatically moved to  $0^\circ$ . Click **<Yes>** to automatically move the detector to  $0^\circ$ , or **<No>** to keep the current detector tilt. In most cases the tilt should be set to  $0^\circ$
22. If the gantry rotation is not exactly at one of the  $-360^\circ$ ,  $-180^\circ$ ,  $0^\circ$ ,  $180^\circ$  or  $360^\circ$ , a pop-up will be displayed asking whether the gantry rotate position should be automatically moved to the nearest  $0^\circ$  or  $180^\circ$  position. Click **<Yes>** to automatically move the rotation to  $0^\circ$ , or **<No>** to keep the current gantry rotate position. For an anterior view, rotate should be set to  $0^\circ$ ,  $-360^\circ$ , or  $360^\circ$ .
23. A further pop-up is displayed asking for the gantry and table to be properly positioned, and the table at the start position. Final adjustments can be made to the table position and the gantry radius to ensure that the scan will start with the patient just within the detector Field of View. Click **<OK>** when the table and gantry are properly positioned to start the scan.
24. If the position of the table longitudinal axis is such that the whole body scan cannot be performed with the length specified on the Start/Stop card or with the direction specified on the Image card, a pop up is displayed. Check that the scan length and direction are correct and, if necessary, adjust the table longitudinal position so that there is sufficient table travel to perform the scan. If the scan length or direction are changed, click the **[Change]** button to set the new scan definition. Click **[OK]** or press the **<Set>** button on the handset to remove the pop up. The gantry and table position pop up will be displayed again. Click **[OK]** on that pop up also.
25. Click the **[Start]** button to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The Scan Control area will display a single **[Stop]** button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed time of acquisitions, the estimated time to end, and the total counts acquired as well as the current and total scan lengths.
26. If the table cannot move far enough to do this scan, a pop-up appears.

**Check  
Screen**



27. Image data is first acquired from the initial detector field of view at a rate appropriate for the speed of the scan defined on the **Start/stop Set** card. The **Status** area at the top of the **Acquisition and Review** screen shows the progress of the scan across the detector field of view.

**Note** During the first phase of a whole body scan the table does not move.

6725341	John Doe	ANTERIOR			
WBODY		Rotate	0deg	Longitud.	-0mm
Time 53 / 09:06		Tilt	0deg	Vertical	750mm
Length 201mm /1900 mrr		Radial	200mm	Lateral	2mm
218.59 kcmt	8.06 kc/s				

28. Once the image in the initial detector field of view has been acquired, the table longitudinal axis will begin to move and the **Status** area will show the changing position of the longitudinal axis.

6725341	John Doe	ANTERIOR			
WBODY		Rotate	0deg	Longitud.	197mm
Time 02:31 / 07:28		Tilt	0deg	Vertical	750mm
Length 569mm /1900 mrr		Radial	200mm	Lateral	2mm
1.52 Mcmt	14.71 kc/s				

29. You may adjust the height of the table using the handset during a whole body scan to keep the detector close to the patient's body. The vertical down motion is limited to the height of the radial actuator.



**CAUTION**

When adjusting the detector height during the whole body scan, care should be taken to avoid contacting the patient or table with the detector and collimator collision pads.

30. The table height is the only axis that should be moved by the operator during the whole body scan. If another handset key is pressed, the acquisition is paused. Data acquired to that point is retained. The **Scan Control** area displays buttons that allow the scan to be resumed, restarted, stored or discarded. It may be necessary to move the table in order to resume the scan. If this is the case, a pop up message will be displayed informing you of this.
31. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the **Exam Watch** window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.

32. The table longitudinal axis stops when the final part of the patient to be imaged moves into the detector field of view. However, all the image data is not yet completely acquired. GENIE Acquisition continues to acquire data across the field of view.

**Note**

During the last phase of a whole body scan, the table does not move.

33. The acquisition will stop and store automatically as soon as it reaches the set scan length. You may stop and store the acquisition manually at any point in the acquisition although the scan will be incomplete.

If you need to stop the acquisition early, click on the **[Stop]** button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Patient Positioning](#) for further details.

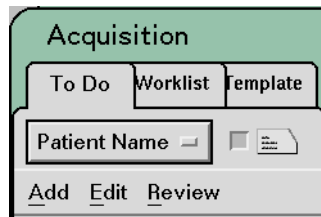
34. The posterior scan entry is automatically selected when the anterior scan completes, and its details are displayed in the Scan Setup area.
35. Click the [Gantry] icon and select the **Detector Under Table** position.
36. Using the handset, move the table under the detector. Bring the detector radius in so that the detector is as close as possible to the table without actually touching.
37. Fully extend the table. The patient's skull should be at the top of the field of view.
38. The posterior scan can be acquired in the same way as the anterior and using the same parameters. Follow steps 15 through 32 above.
39. The image data acquired for the whole body scan can now be reviewed or transferred to a Processing and Review workstation. Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

---

## Whole Body Acquisition: Learn Mode MPR

The step by step procedure for a performing a general learn mode whole body acquisition follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the **Scan Selector**.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Bone** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **Whole Body Bone** option. A new Patient Study entry is added in the Scan Selector containing two scans entries labeled **ANTERIOR** and **POSTERIOR**. The Patient Study and the new anterior scan are automatically selected and the details of the scan are displayed in the Scan Set up area. The [Camera On] button is displayed in the Scan Control area.
8. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the Patient ID and Patient Name type-in fields. Enter the appropriate Study Name type-in field. Click the [OK] button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new anterior scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The [Camera On] button is displayed in the **Scan Control** area.
10. Position the table so that it is perpendicular to the detector following the instructions found in Chapter 2. Be sure to lock the table into position.
11. Add the table extender to the end of the table.

12. Position the patient lying supine on the table with their feet pointing into the ring. Their feet should be on the extender with their heels close to the edge. Follow the instructions found earlier in this chapter (see [Patient Positioning on page 7-25](#)) for additional positioning information.

**WARNING**

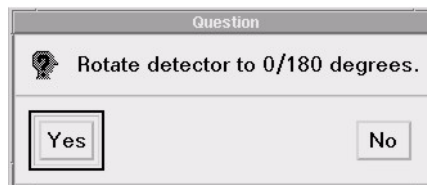
To avoid patient injury, be sure that the patient is properly secured before starting the scan.

13. Click the [**Camera On**] button to display the image currently being received from the detector in the **Image Display** area. Check the patient position. The [**Start**] button is initially unavailable, and will remain unavailable until the set up is complete.

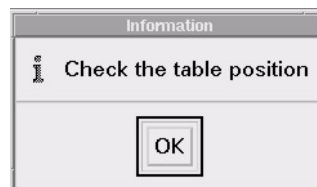
**Note**

An error message may appear indicating insufficient table travel. Ignore this message until the final patient setup is complete (Step 24.)

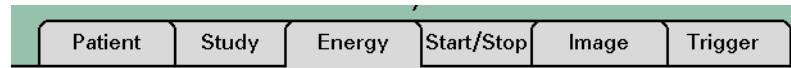
14. If the gantry is moved away from the 0 degrees position, a pop up will be displayed informing you that the gantry will automatically properly position to 0 degrees for wholebody acquisition. Click on [**Yes**] to remove the message and allow the gantry to set itself to 0 degrees.



15. Another popup will also appear to remind you to move the table to the desired position for the acquisition:



- Using the handset, move the table longitudinally until the widest (or highest) part of the patient is in the field of view. Raise the table to its maximum height. Then raise the lower detector to its maximum height. Now vertically position the table as close as possible to the lower detector. Bring the upper detector radius in so that it is as close as possible to the patient. Double check to make sure the detector will clear the patient through the entire scan.
- Click the **Energy Set** card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general whole body scan defaults to Tc<sup>99m</sup>. Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service. Do this for each detector.



**Note**

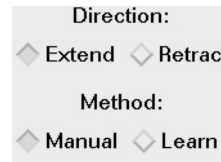
Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

- Click the **Start/Stop Set** card to pop it to the front. The default parameters are a length of 1.9 meters and a speed of 10 minutes per meter. Therefore the scan should take approximately 23 minutes to acquire. Change the Start/Stop criteria if desired. The length and scan rate should be adjusted as appropriate for the patient being scanned.

Length (m)	Speed Mins/m	Time (Mins)
1.90	10.0	23

- Click the **Image Set** card to pop it to the front. The default parameters are set so that GENIE Acquisition will retract the table while scanning. In addition, the default method is **Manual**, and the default orientation is **supine** with **feet first**. This is the recommended scan set up. Change the default settings if desired. In this situation, “Retract” and “Learn” are selected. This means that the “Learn” process will occur when the table is being extended into the gantry and the scan will occur when the table is being retracted away from the gantry. Head first means that the scan will start at the head. Therefore, the image in the Image Display area will form

from the top down. If the orientation was feet first, the scan would start at the feet, and the image would form from the bottom up.



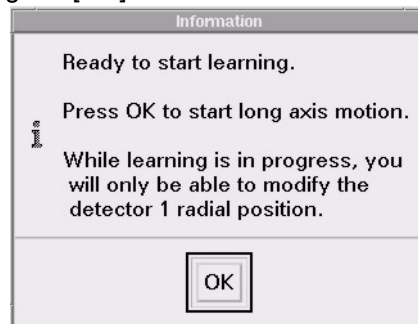
20. If any parameters were changed, the **[Start]** button will be inactive (gray) and the **[Change]** button will become active. Click the **[Change]** button to send the modified scan parameters to the detector. If no changes were made, the **[Change]** button will not be active.



21. If the position of the table longitudinal axis is such that the whole body scan cannot be performed with the length specified on the Start/Stop card or with the direction specified on the Image card, a pop up is displayed. Check that the scan length and direction are correct and, if necessary, adjust the table longitudinal position so that there is sufficient table travel to perform the scan. If the scan length or direction are changed, click the **[Change]** button to set the new scan definition. Click **[OK]** or press the **<Set>** button on the handset to remove the pop up. The gantry and table position pop up will be displayed again. Click **[OK]** or press the **<Set>** button on the handset on that pop up also.



22. Another pop up is now displayed stating that the system is ready to start learning. Clicking the **[OK]** button will start the learning process.



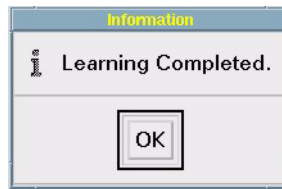
23. The table will learn in the opposite direction from what it will scan. Therefore, since the scan direction is retract, GENIE Acquisition will extend the table while learning. While the table is moving and learning, you will modify the vertical table position using the handset. Try to keep the patient as close to the detector as possible throughout the scan. You are only allowed to press the **[up]** and **[down]** buttons as well as the **[speed]** button for the upper detector. Pressing any other button will cause the learning to stop.



**CAUTION**

When moving the table height during the learning process, care should be taken to avoid contacting the patient or table with the detector and collimator collision pads.

24. When the table has reached the scan length set on the Termination card, a pop up is displayed telling you that the learning procedure is finished. Click **[OK]** to proceed with the actual scan.



25. Click the **[Start]** button to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The Scan Control area will display a single **[Stop]** button. The Image Display area will change to show the image that is being acquired.
26. Image data is first acquired from the initial detector field of view at a rate appropriate for the speed of the scan defined on the Start/Stop set up card. The Status area at the top of the Acquisition and Review screen shows the progress of the scan across the detector field of view.

**Note**

During the first phase of a whole body scan the table does not move.

6725341	John Doe	ANTERIOR	
WBODY	Rotate	0deg	Longitud. -0mm
Time 53 / 09:06	Tilt	0deg	Vertical 750mm
Length 201mm /1900 mmr	Radial	200mm	Lateral 2mm
218.59 kcmt	8.06 kc/s		

27. Once the image in the initial detector field of view has been acquired, the table longitudinal axis will begin to move and the Status area will show the changing position of the longitudinal axis.

6725341	John Doe	ANTERIOR			
WBODY		Rotate	0deg	Longitud.	197mm
Time	02:31 / 07:28	Tilt	0deg	Vertical	750mm
Length	569mm /1900 mm	Radial	200mm	Lateral	2mm
1.52 Mcnt	14.71 kc/s				

28. You may adjust the height of the upper detector using the handset during a whole body scan to keep the detector close to the patient's body. All other handset controls are inactive.



#### CAUTION

When adjusting the detector height during the whole body scan, care should be taken to avoid contacting the patient or table with the detector and collimator collision pads.

29. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the Exam Watch window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
30. The table longitudinal axis stops when the final part of the patient to be imaged moves into the detector field of view. However, all the image data is not yet completely acquired. GENIE Acquisition continues to acquire data across the field of view.

#### Note

During the last phase of a whole body scan, the table does not move.

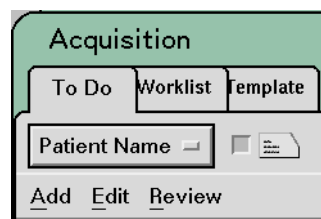
31. The acquisition will stop and store automatically as soon as it reaches the set scan length. You may stop and store the acquisition manually at any point in the acquisition although the scan will be incomplete. If you need to stop the acquisition early, click on the **[Stop]** button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.
32. The image data acquired for the whole body scan can now be reviewed or transferred to a Processing and Review workstation. Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

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## Multigated Acquisition

The step by step procedure for a performing a general multigated acquisition follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the **Scan Selector**.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **GATED** option. A new Patient Study entry is added in the **Scan Selector** containing a single scan entry labeled **GATED**.
8. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the Patient ID and Patient Name type-in fields. Enter the appropriate Study Name type-in field. Click the **[OK]** button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new multigated scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The **[Camera On]** button is displayed in the **Scan Control** area.

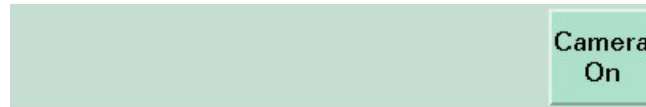
10. If scanning an actual patient, position the table, and then position the patient lying on the table following the instructions found earlier in this chapter. Place ECG electrodes on the patient, and then attach R–Wave Trigger leads to the electrodes.



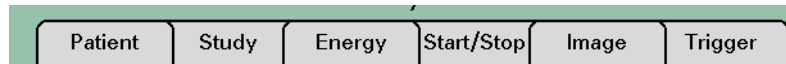
### WARNING

To avoid patient injury, be sure that the patient is properly secured before starting the scan.

11. Use the pre-programmed moves and the handset to position the heart in the field of view.
12. Click the **[Camera On]** button to display the image currently being received from the detector in the Image Display area. The **[Start]** button is initially unavailable, but changes to being available after a ten beat heart rate average is achieved.



13. Click the **Energy Set** up card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general gated scan defaults to  $Tc^{99m}$ . Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service.



### Note

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

14. Click the **Start/Stop** set up card to pop it to the front. The default Stop parameter is set to 500 beats. Change the Start/Stop criteria if desired.
15. Click the **Image** set up card to pop it to the front. The default number of bins is set to 24. Change the default settings if desired.

16. Click on the **Trigger** set up card to pop it to the front. Check the trigger histogram and adjust the center and width of the window if necessary. Be sure the Acquire toggle is selected so that a trigger history is stored with the acquired data.
17. If any parameters were changed, the [**Start**] button will be inactive (gray) and the [**Change**] button will become active. Click the [**Change**] button to send the modified scan parameters to the detector. After a few moments the [**Start**] button will become available again.



18. Click the [**Start**] button to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The **Scan Control** area will display a single [**Stop**] button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed acquisition time, the estimated time to end, and the total of the counts being acquired, the count rate, the average heart rate, and the number of accepted and rejected beats.
19. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the Exam Watch window and a [**Stop**] button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
20. The acquisition will stop and store automatically as soon as it reaches the set Start/Stop counts or time. If the Start/Stop Method was set to None, you must stop and store the acquisition manually.

If you need to stop the acquisition early, click on the [**Stop**] button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted).

21. The image data acquired for the multigated scan can now be reviewed or transferred to a Processing and Review workstation. Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

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## Tomographic Acquisition

**Note**

Two types of tomographic acquisitions may be performed: circular and Programmable Body Contour orbit, also known as elliptical orbit. Please refer to the appropriate section below for the proper procedure to follow.

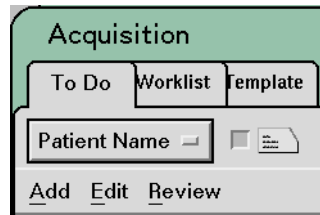
The MPS system can perform circular tomographic acquisitions only.

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### Circular Tomographic Acquisition

The step by step procedure for a performing a general circular tomographic acquisition follows:

1. 1.Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.
3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the Scan Selector.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **TOMO** option. A new Patient Study entry is added in the Scan Selector containing a single scan entry labeled **TOMO**.
8. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the Patient ID, Patient Name and Study Name into type-in fields. Click the **[OK]** button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new tomographic scan are automatically selected and the details of the scan are displayed in the Scan Set up area. The **[Camera On]** button is displayed in the Scan Control area.

10. Remove the table extender from the table, if it is attached.
11. Click on the **[Gantry]** icon and select the Table/Gantry to Home pre-programmed position. This will center the table laterally and vertically with regards to the center of the gantry ring.
12. Position the patient lying supine on the table following the instructions found earlier in this chapter ([Patient Positioning on page 7-25](#)). Their head should be pointing into the ring if the area of interest is at or above the chest. Their feet should be pointing into the ring if the area of interest is at or below the chest.



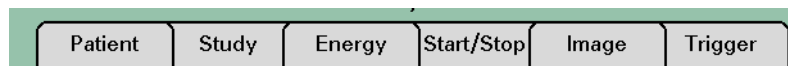
**WARNING**

To avoid patient injury, be sure that the patient is properly secured before starting the scan.

13. Click the **[Camera On]** button to display the image currently being received from the detector in the Image Display area. The **[Start]** button is initially unavailable, but changes to being available after the patient set up is complete.



14. Click the **Energy** set up card, then click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general tomographic scan defaults to  $Tc^{99m}$ . Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service.



**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

15. Click the **Start/Stop** set up card to pop it to the front. The default Stop parameters are set to 20 seconds per view for 32 views. Change the Start/Stop criteria if desired.

16. Click the **Image** set up card to pop it to the front. By default the acquisition is set up for a 360 degree circular rotation clockwise in a 64 x 64 matrix. Change the default settings if desired. Other defaults are Head First and Supine.
17. If any parameters were changed, the [**Start**] button will be inactive (gray) and the [**Change**] button will become active. Click the [**Change**] button to send the modified scan parameters to the detector. If no changes were made, the [**Change**] button will not be active.



18. Rotate the gantry until it reaches 90 or -90 degrees.
19. Have the patient raise their arms over their head if necessary. Center the organ of interest in the field of view.
20. Use the **Gantry Radius** buttons to bring the detector as close as possible to the patient without touching.
21. Rotate the detector around the patient to check that there is clearance throughout the entire orbit.
22. After the patient and computer setup are complete, click on <OK> or press the <Set> button on the handset to remove any information windows.
23. The computer now addresses the Start Angle based on one of the following options:
  - a. If no start angle has been prescribed during the setup and the gantry rotation for Detector 1 is within the limits of rotation for the setup, then click on [**OK**] or press the <Set> button on the handset to close the information popup windows.

<b>Note</b>
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Total rotation limits are from -270 to + 270 degrees.

- b. If no start angle has been prescribed during the setup and the gantry rotation for Detector 1 is NOT within the limits of rotation for the setup, then a message appears that indicated "Insufficient Gantry Travel." Reposition the gantry head to be within limits and click <OK> or press the <Set> button on the handset to remove the information popup windows (repositioning will be based on the type of setup).

- c. If a start angle has been prescribed during the setup and the gantry rotation for Detector 1 is within the limits of rotation for the setup, then click on **[Yes]** or **[No]** to move to the prescribed Start Angle.
- d. If a start angle has been prescribed during the setup and the gantry rotation of Detector 1 is NOT within the limits of rotation for the setup, then a message appears that indicated “Insufficient Gantry Travel.” Reposition the gantry head to be within limits, and then click on **[Yes]** or **[No]** to move to the prescribed Start Angle.

**Note**

For 360 degree tomographic scans, the start angle must be -90 degrees for clockwise acquisitions and +90 degrees for counter clockwise acquisitions.

- 24. After the gantry is at the proper start angle, the **[Start]** button will become available. Click **[Start]** to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The **Scan Control** area will display a single **[Stop]** button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed acquisition time, the estimated time to end, the total of the counts being acquired, the count rate, along with the current and total number of views, and the elapsed and total view time.
- 25. In a step-and-shoot acquisition, once the first view is complete the gantry rotates automatically to the next view position and begins acquiring data in this new position. The status area shows the new gantry rotation. As the scan continues the status area displays the progress so far. In a continuous acquisition, the gantry moves continuously and acquires while it moves.
- 26. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the Exam Watch window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
- 27. If any handset motion key is pressed during a tomographic scan the acquisition is paused and the data acquired to that point is retained. The acquisition **Control** area displays buttons that allow the scan to be resumed, restarted, stored or discarded. If the scan is resumed, it will continue from the point it was interrupted. It may, however, be necessary to re-acquire the view that was interrupted. In addition, if the gantry rotation is moved after the scan is stopped, it may be necessary to reposition the gantry to within 5 degrees of where it stopped in order to resume the acquisition. If this is the case, a pop up message explaining this will be displayed.

28. The acquisition will stop and store automatically as soon as it finishes acquiring the final view.  
If you need to stop the acquisition early, click on the **[Stop]** button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.
29. The image data acquired for the tomographic scan can now be reviewed or transferred to a Processing and Review workstation. Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

---

### Elliptical Tomographic Acquisition [Programmable Body Contour (PBC)] - MPR Only

The set up procedure for a PBC tomographic acquisition allows the system to estimate the outline of the patient and table and to move the detector to a different radial position at each view during the scan, in order to get closer to the patient. Getting closer to the patient results in better spatial resolution in the planar images, and better transaxial images are reconstruction.

During the actual PBC scan, the table is not moved vertically or laterally, but is moved longitudinally to counteract the detector radial motion.

**Important**

**Ensure that the Detector can move freely with no collision before enabling any automatic movement.**

The table lateral needs to be set so that the patient is centered laterally within the detector's field of view. With the patient centered on the table, the table lateral is best left at zero. It is possible to perform a PBC tomographic scan with the table off-center laterally, if required. The table lateral position at the starting gantry angle will be used for the rest of the scan.

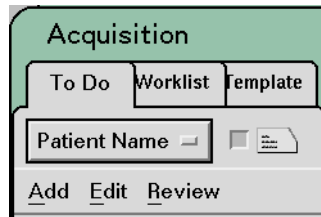
The table's vertical position is best set with the detector at the -90 degree gantry rotate position (the first reference position) or the 90 degree gantry rotate position (the third reference position). The patient should be aligned with the detector, using the lines on the collimator. The table vertical position at the starting gantry angle will be used for the rest of the scan.

**Note**

PBC tomographic acquisitions are not recommended for 180 degree cardiac acquisitions.

1. Display the **Acquisition and Review** screen, and click on the **Acquisition** card to bring it forward.

2. Check that the **To Do** card is at the front by clicking on its tab.



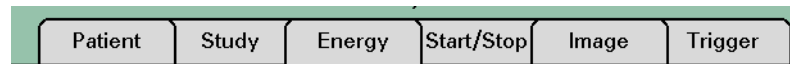
3. Click on the **Add** pull-down menu option at the top of the **Scan Selector**.
4. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
5. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
6. Click the **TOMO** option. A new Patient Study entry is added in the Scan Selector containing a single scan entry labeled **TOMO**.
7. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the Patient ID and Patient Name type-in fields. Enter the appropriate Study Name type-in field. Click the **[OK]** button to confirm.
8. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new tomographic scan are Automatically selected and the details of the scan are displayed in the Scan Set up area. The **[Camera On]** button is displayed in the **Scan Control** area.
9. Remove the table extender from the table, if it is attached.
10. Position the table parallel to the detector arms so that the table will move into the ring of the gantry following the instructions found in Chapter 2. Be sure to lock the table into position.
11. Position the patient lying supine on the table following the instructions found earlier in this chapter ([Patient Positioning on page 7-25](#)). Their head should be pointing into the ring if the area of interest is at or above the chest. Their feet should be pointing into the ring if the area of interest is at or below the chest.



**WARNING**

To avoid patient injury, be sure that the patient is properly secured before starting the scan.

12. Click on the [Gantry] icon and select the Table/Gantry to Home pre-programmed position. This will center the table laterally and vertically with regards to the center of the gantry ring.
13. Click the [**Camera On**] button to display the image currently being received from the detector in the Image Display area. The [**Start**] button is initially unavailable, but changes to being available after the patient set up is complete.
14. Click the **Energy** set up card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general tomographic scan defaults to Tc<sup>99m</sup>. Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service. Do this for each detector.

**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

15. Click the **Start/Stop** card to pop it to the front. The default Stop parameters are set to 20 seconds per view for 32 views. Change the Start/Stop criteria if desired.
16. Click the Image card to pop it to the front. By default the acquisition is set for a 360 degree circular rotation clockwise in a 64 x 64 matrix. Change the type of the acquisition by clicking on the [**Elliptical**] toggle button and select counterclockwise. When this button has been selected, the [**Continuous**] toggle button will become unavailable since only step-and-shoot PBC acquisitions can be performed. You can also change the start angle of the Detector to 180 degrees. Change any other defaults if desired.

**Note**


If the [**Elliptical**] button is disabled, the option is not available on the system and cannot be selected.

For 360 degree tomographic scans using only one detector, the start angle for Detector 1 must be at least -90 degrees for clockwise acquisitions and +90 degrees for counter clockwise acquisitions.

17. If any parameters were changed, the **[Start]** button will be inactive (gray) and the **[Change]** button will become active. Click the **[Change]** button to send the modified scan parameters to the detector. After a few moments the **[Start]** button will become available again. If no changes were made, the **[Change]** button will not be active.



18. A pop up is displayed indicating to pin the table. Make sure the table is indeed pinned, and then click **[OK]**, or press the **<Set>** button on the handset, to make the pop up disappear.
19. A pop up is displayed asking if the system can move to the  $-90$  degree start position for Detector. Click **[OK]**, or press the **<Set>** button on the handset, to move to the first reference position.

	<p style="text-align: center;"><b>CAUTION</b></p> <p>Ensure that the Detector can move freely with no collision before enabling any automatic movement.</p>
---	---

20. Once the move is confirmed, the detector is automatically moved out to its maximum radial position. The detector is then rotated to the correct gantry angle.
21. When marking the first reference position, you need to center the organ of interest in the field of view by moving the table vertically or longitudinally. The lines on the collimator face can help with the alignment. The table should be kept centered laterally.
22. When the detector reaches  $-90$  degrees, another pop up box is displayed requesting you to move the detector close to the patient. Have the patient raise their arms over their head if necessary. Use the Gantry Radius buttons to bring the detector as close as possible to the patient without touching. Click **[OK]** or press **<Set>** to confirm your positioning.



<p style="text-align: center;"><b>CAUTION</b></p> <p>When marking any of the reference points, it should not be necessary to move the table to realign the patient in the detector's field of view. In particular, avoid moving the table towards the detector. Use the gantry radius buttons to get the detector closer to the patient and table.</p>
--

**CAUTION**

Ensure that the Detector can move freely with no collision before enabling any automatic movement.

23. Another pop up is displayed asking if the system can move to the 0 degree position. Click **[OK]**, or press **<Set>**, to automatically move to the next reference position.
24. When the detector reaches 0 degrees again, a pop up box is displayed requesting you to move the detector close to the patient. Use the Gantry Radius buttons to bring the detector as close as possible to the patient without touching. Click **[OK]** or press **<Set>** to confirm your positioning.

**CAUTION**

Ensure that the Detector can move freely with no collision before enabling any automatic movement.

25. A pop up is displayed asking if the system can move to the 90 degree position for Detector. Click **[OK]**, or press the **<Set>** button on the handset, to move to the first reference position.

**CAUTION**

Ensure that the Detector can move freely with no collision before enabling any automatic movement.

26. Once the move is confirmed, the detector is automatically moved out to its maximum radial position. The detector is then rotated to the correct gantry angle.
27. When the detector reaches 90 degrees again, a pop up box is displayed requesting you to move the detector close to the patient. Use the Gantry Radius buttons to bring the detector as close as possible to the patient without touching. Click **[OK]** or press **<Set>** to confirm your positioning.
28. A pop up is displayed asking if the system can move to the 180 degree position for Detector. Click **[OK]**, or press the **<Set>** button on the handset, to move to the last reference position.

29. Once the move is confirmed, the detector is then rotated to the correct gantry angle. Use the Gantry Radius buttons to bring the detector as close as possible without colliding. Click [**OK**] or press <**Set**> to confirm your positioning
30. Lastly, a pop up is now displayed asking if the system can move to the start position. Click [**OK**], or press <**Set**>, to automatically move to the start angle specified on the Image card.
31. After the gantry is at the proper start angle, the <**Start**> button will become available. If you now change any gantry or table position, the system will delay making [**Start**] available since it must recalculate the orbit based on the latest positioning of the gantry and table. It is best not to adjust any gantry or table position after the final reference point has been set.
32. Click [**Start**] to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The Scan Control area will display a single [**Stop**] button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed acquisition time, the estimated time to end, the total of the counts being acquired, the count rate, along with the current and total number of views, and the elapsed and total view time.
33. In a step-and-shoot acquisition, once the first view is complete the gantry rotates automatically to the next view position and begins acquiring data in this new position. The status area shows the new gantry rotation. As the scan continues the status area displays the progress so far.

34. You may switch to the Review card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the **Exam Watch** window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
35. If any handset motion key is pressed during a tomographic scan the acquisition is paused and the data acquired to that point is retained. The acquisition **Control** area displays buttons that allow the scan to be resumed, restarted, stored or discarded. If the scan is resumed, it will continue from the point it was interrupted. It may, however, be necessary to re-acquire the view that was interrupted. In addition, if the gantry rotation is moved after the scan is stopped, it may be necessary to reposition the gantry to within 5 degrees of where it stopped in order to resume the acquisition. If this is the case, a pop up message explaining this will be displayed.
36. The acquisition will stop and store automatically as soon as it finishes acquiring the final view.  
If needed, click on the **[Stop]** button to stop the acquisition early. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.
37. The image data acquire for the tomographic scan can now be reviewed or transferred to a Processing and Review workstation. The Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

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## Multigated Tomographic Acquisition

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### Description

The following section gives a step by step guide to performing a multigated tomographic scan.

Multigated tomography allows the acquisition and reconstruction of tomographic images for precisely defined gated–time intervals. The technique is used to allow tomographic cross–sectional images to be viewed at diastolic and systolic positions in the cardiac cycle.

Multigated tomographic acquisition, as its name implies, involves aspects of both multigated acquisition and tomographic acquisition.

The detector rotates about the patient, as in tomography, but at each camera position a multigated buffered, single–range acquisition is made. However, datasets produced by this method are arranged as sets of **tomographic** data, rather than **multigated** data as might be expected. This allows for ease of tomographic reconstruction. Each tomo dataset corresponds to a particular time interval or multigated frame. If you defined eight cardiac frames for your acquisition, you will have eight tomographic datasets (each one representing 1/8th of the cardiac cycle) for a single detector acquisition (i.e. SGATE\_1E through SGATE\_8E). For dual detector acquisitions, there will be 16 datasets (SGATE\_01E through SGATE\_08E and SGATE\_01F through SGATE\_08F).

**Note**

Two types of tomographic acquisitions may be performed: circular orbit and Programmable Body Contour orbit, also known as elliptical. PBC tomography is an optional feature and is not present on all systems. In addition, PBC tomography is not recommended for 180 degree cardiac acquisitions and therefore will not be explained in this section.

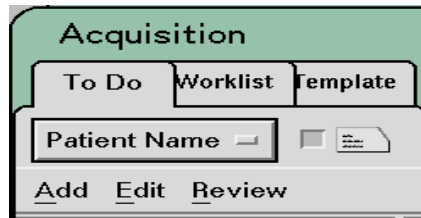
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### Procedure

The step by step procedure for a performing a general circular tomographic acquisition follows:

1. Display the **Acquisition and Review** screen.
2. Click on the **Acquisition** card to bring it forward.

3. Check that the **To Do** card is at the front by clicking on its tab.



4. Click on the **Add** pull-down menu option at the top of the Scan Selector.
5. Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of templates and protocols that are available.
6. Click the **Basic** option under the **SYS** heading. A further sub-menu is displayed with a list of the basic scan types.
7. Click the **GATED TOMO** option. A new Patient Study entry is added in the Scan Selector containing a single scan entry labeled **GATED TOMO**.
8. The **Patient Study Edit** pop-up is displayed in the Scan Selector. Enter the appropriate information in the Patient ID and Patient Name type-in fields. Enter the appropriate Study Name type-in field. Click the **[OK]** button to confirm.
9. The new Patient Study entry now displays the new ID and names entered. The Patient Study and the new gated tomographic scan are automatically selected and the details of the scan are displayed in the **Scan Setup** area. The **[Camera On]** button is displayed in the **Scan Control** area.
10. Click on the **[Gantry]** icon and select the Table/Gantry to Home pre-programmed position. This will center the table laterally and vertically with regards to the center of the gantry ring.
11. If scanning an actual patient, position the table, and then position the patient lying supine on the table following the instructions found earlier in this chapter ([Patient Positioning on page 7-25](#)). Their head should be pointing into the ring if the area of interest is at or above the chest. Their feet should be pointing into the ring if the area of interest is at or below the chest.



#### WARNING

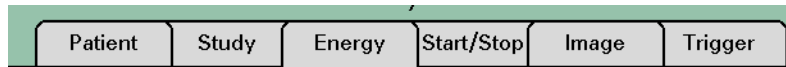
To avoid patient injury, be sure that the patient is properly secured before starting the scan.

12. Place ECG electrodes on the patient, and then attach R-Wave Trigger leads to the electrodes.

**Note**

It is not necessary to use a radioactive source to perform this example scan. However, if no radioactive source is used the image data acquired will not be meaningful.

13. Click the [**Camera On**] button to display the image currently being received from the detector in the Image Display area. The [**Start**] button is initially unavailable, but changes to being available after the patient set up is complete.
14. Click the **Energy** set up card to pop it to the front. Click the **Energy** tab to the right to ensure that the **Energy** card is at the front. If there is a radioactive source or patient in front of the detector, the spectrum will show one or more peaks along with the current window settings. If there is no activity, the spectrum will be quite flat. The peak for the general gated tomographic scan defaults to Tc<sup>99m</sup>. Check that the peak falls within the window. If it does not, change to the energy session of the isotope being used, check that the proper detector corrections are being used, or move the peak or offset of the window. If you must move the window to center the peak, notify Service.



**Note**

Do not define the energy based on a spectrum from a patient. Use a point source or other appropriate source.

15. Click the **Start/Stop** set up card to pop it to the front. The default Stop parameter is set to 25 triggers per view for the Start/Stop method and triggers for the view method. Change the Start/Stop criteria if desired.
16. Click the **Image** set up card to pop it to the front. By default, the type of acquisition is circular, the direction is counterclockwise, and the acquisition is set up for a 180 degree circular rotation in a 64 x 64 matrix with a start angle of +45 degrees. It is also defaulted to 32 views and 8 bins per cardiac cycle. Other defaults are feet first and supine. Change the default settings if desired. If the scan will be with Thallium-201, be sure to set the correct energy session on the Energy card, and change the other defaults appropriately.
17. Click on the **Trigger** set up card to pop it to the front. Check the trigger histogram and adjust the center and width of the window if necessary. Select the Acquire toggle to store a trigger history with the acquired data.

18. If any parameters were changed, the [**Start**] button will be inactive (gray) and the [**Change**] button will become active. Click the [**Change**] button to send the modified scan parameters to the detector. If no changes were made, the [**Change**] button will not be active.



19. Have the patient raise their arms over their head, and center the heart in the field of view.
20. Rotate the gantry until the Detector reaches 90 degrees.
21. Use the **Gantry Radius** buttons to bring the detector as close as possible to the patient without touching.
22. Rotate the detector around the patient to check that there is clearance throughout the entire orbit.
23. The computer now addresses the Start Angle based on one of:
- If no start angle has been prescribed during the setup and the gantry rotation for Detector 1 is within the limits, then click [**OK**] to remove the information popup windows.

**Note**

Total rotation limits are from -270 to + 270 degrees.

- If not start angle has been prescribed during setup and the gantry rotation for Detector is NOT within the limits, then a message appears indicating "Insufficient Gantry Travel." Reposition the gantry head to be within limits and click [**OK**] to remove the information popup windows (repositioning will be based on the type of setup).
- If a start angle has been prescribed during the setup and the gantry rotation for Detector 1 is within the limits of rotation for the setup, then click [**Yes**] or [**No**] to move to the prescribed Start Angle.
- If a start angle has been prescribed during the setup and the gantry rotation of Detector 1 is NOT within the limits, a message appears indicating "Insufficient Gantry Travel." Reposition the gantry head within limits, and then click [**Yes**] or [**No**] to move to the prescribed Start Angle.

**Note**

For 360 degree tomographic scans, the start angle for Detector 1 must be at least -90 degrees for clockwise acquisitions and +90 degrees for counter clockwise acquisitions.

24. After the gantry is at the proper start angle, the **[Start]** button will become available. Click **[Start]** to begin the scan. The scan entry in the scan selector will become gray to indicate that data is being acquired for the scan. The Scan Control area will display a single **[Stop]** button. The Image Display area will change to show the image that is being acquired. The Status area will show the elapsed acquisition time, the estimated time to end, the total of the counts being acquired, the count rate, along with the current and total number of views, the elapsed and remaining times, the average heart rate, and the number of accepted and rejected beats.
25. In a step-and-shoot acquisition, once the first view is complete the gantry rotates automatically to the next view position and begins acquiring data in this new position. The status area shows the new gantry rotation. As the scan continues the status area displays the progress so far.
26. You may switch to the **Review** card to view a previously acquired study, or the Main screen to send another acquired scan to another workstation. In this case, the **Exam Watch** window and a **[Stop]** button will appear in the Status area so you can monitor the progress of the scan and stop it at any time, if necessary.
27. If any handset motion key is pressed during a tomographic scan the acquisition is paused and the data acquired to that point is retained. The Acquisition Control area displays buttons that allow the scan to be resumed, restarted, stored or discarded. If the scan is resumed, it will continue from the point it was interrupted. It may, however, be necessary to re-acquire the view that was interrupted. In addition, if the gantry rotation is moved after the scan is stopped, it may be necessary to reposition the gantry to within 5 degrees of where it stopped in order to resume the acquisition. If this is the case, a pop up message explaining this will be displayed.
28. The acquisition will stop and store automatically as soon as it finishes acquiring the final view.

If you need to stop the acquisition early, click on the **[Stop]** button. Then you can resume the acquisition, store the acquired data, return to the Camera On state (acquired data deleted), or go to the Camera Off state (acquired data deleted). Refer to [Scan Control Area on page 5-40](#) for further details.

29. The image data acquired for this example autotrack tomographic scan can now be reviewed or transferred to a Processing and Review workstation. Reviewing the Acquisition and Transferring the Acquisition sections later in this chapter provide details of how to do this.

---

## Scan Interruptions

The following section gives a step by step guide on what to do when something interrupts a scan.

---

### Loss Of Power

In the event of a power outage or other electrical power loss, turn off the main power switch at the back of the gantry base. When power is restored, follow the System Start up procedure described at the beginning of this chapter.

**CAUTION**

Loss of power during an acquisition may result in some or all image data for that study being lost.

---

### System Reset

In the event of a system fault or failure, consult [Troubleshooting on page 10-53](#).

If the fault is a temporary one, shutdown and then restart the system by following the System Shutdown and Start up procedures described at the beginning of this chapter. If the fault persists, contact a service representative.

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## Emergency Egress

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### Patient Removal During Normal Operation

During normal operation, the table and gantry can be controlled from the handset. The patient can be removed using the handset controls to retract the table, lower the table or raise the detector to clear the patient.



#### CAUTION

Use of the handset motion keys during a computer controlled scan such as wholebody or tomography may cause the acquisition to stop prior to the desired completion criteria.

---

### Patient Removal During Collision Sense

If the patient or table collides with a collimator collision sensor, all motions are stopped and disabled. Motion may be re-enabled by pressing the desired handset motion key while simultaneously holding down one of the [**collision override**] buttons on the back of the detector. As soon as the collision is cleared, motion is enabled without the use of the [**collision override**] button.

---

### Patient Removal With Power Removed Or Interrupted

If either the power is removed or control to the gantry is lost, and the patient is underneath the detector, the table can be unlocked and wheeled away from the gantry. Take care to ease the patient past the detector.

Some room arrangements may not provide for substantial movement of the table. In this case, the operator may need to access the patient with the table in its original position or slide the patient along the table surface.

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## Emergency Stop And Collision Detection

Additional information on emergency stop and collision detection can be found in [Safety Devices on page 1-7](#).

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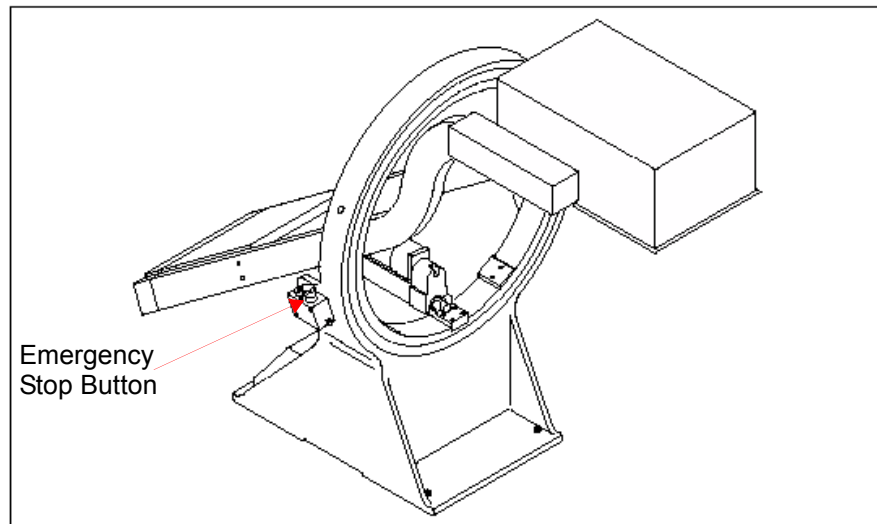
### Emergency Stop

The Millennium MPR MPS system is fitted with four emergency stop buttons which are used to stop all gantry and table motions should circumstances require it.

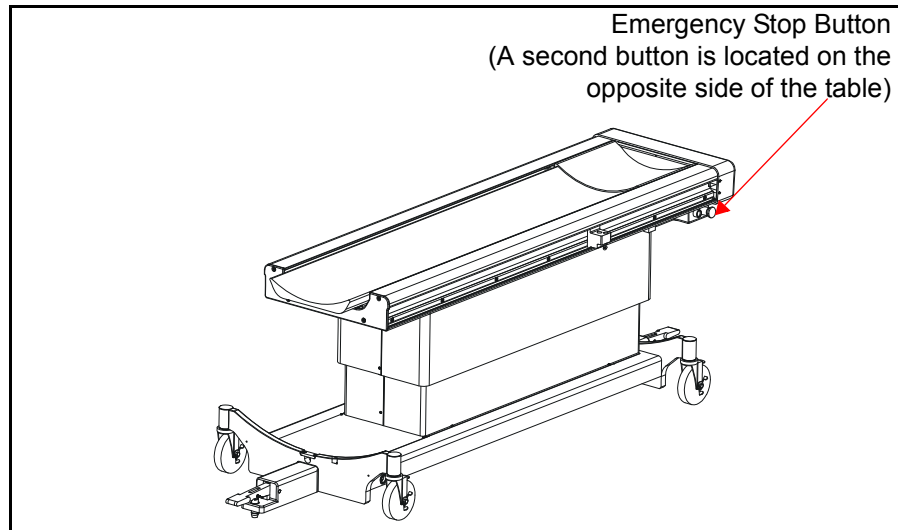
**WARNING**

Do not leave the patient unattended.

The gantry has two emergency stop push buttons located on either side of the gantry ring and two emergency stop push buttons located on either side of the patient table. Pressing any emergency stop button interrupts power to all motors, stopping all motion and engages the brakes on all axes.



**Figure 7-18.** Gantry Emergency Stop Button



**Figure 7-19.** Table Emergency Stop Buttons

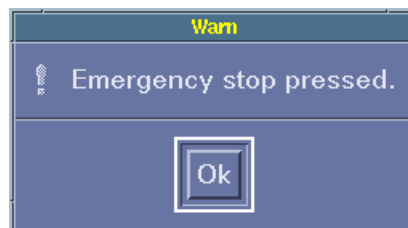


**CAUTION**

Pressing the Emergency Stop Button will cause the current acquisition to stop and any automatic acquisition motion such as for wholebody or tomography to cease.

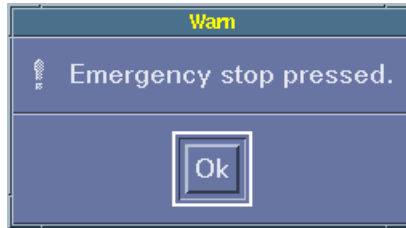
**If the Emergency Stop Button is pressed:**

- The emergency stop buttons do not cut power to the acquisition computer or any peripheral devices connected to the power supply in the gantry base.
- GENIE Acquisition displays an emergency stop/collision warning pop-up.

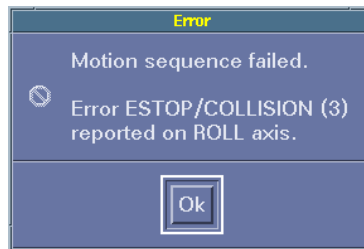


**If the Emergency Stop Button is pressed during an acquisition:**

- The acquisition is paused and any data acquired to that point is retained.



- The emergency stop push button must be released by rotating it counterclockwise before motorized motion can proceed.
- If the Emergency Stop button is released (and power to the rest of the system has not been interrupted), the handset motion will be enabled. However, the acquisition will remain stopped until restarted or resumed by the operator.

**To recover motion after a collision situation, use the following steps:**

- Remove the obstacle (patient or table) from the path of the collision sensor.
- Use the <Collision Override> button (Figure 1-5) if motorized motion is required. See [Collision Detection And Override on page 7-82](#) and.

**Note**

The system will remain in the Collision State even after the obstacle has been removed.

- Press the Handset <CANCEL> button to silence the beep and return the system to IDLE State (no collision).

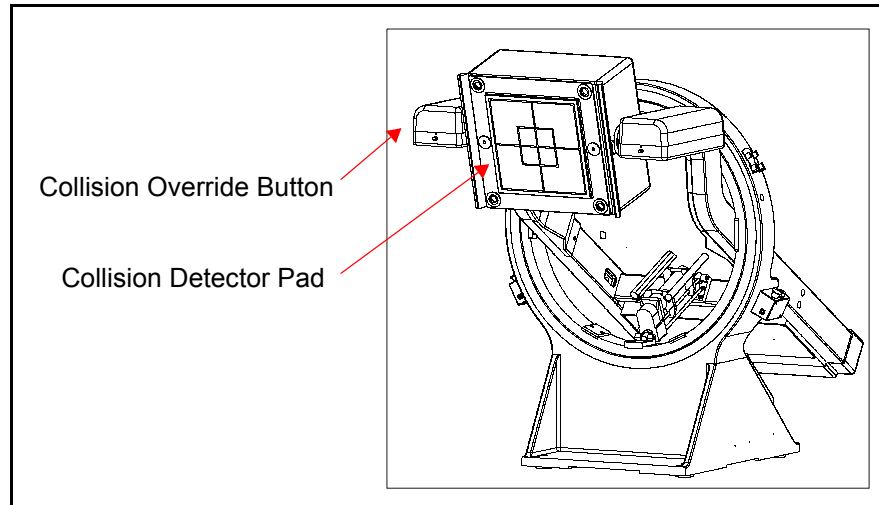
**CAUTION**

Collision sensors should be tested daily and after every collimator exchange

Once motor power is restored, the acquisition can be resumed, restarted, stopped or canceled using the buttons in the **Control** area of the **Acquisition** card as described in [Scan Control Area on page 5-40](#).

## Collision Detection And Override

The Millennium MPR/MPS collimators are fitted with collimator collision pads that automatically stop all gantry and table motions if a collision is detected. Each collimator has a collision pad covering the entire collimator face.



**Figure 7-20.** Collision Detector Pads



### WARNING

The collision detection system is designed to minimize the risk of harm to the patient or damage to the system caused by powered motion. The operator must not rely on the collision detection mechanism or the acquisition computer for safe system operation. It is the operator's responsibility to monitor all gantry and table motions and to make use of the emergency stop buttons, if the situation requires it.

If a collision is detected, power to all motors is interrupted, stopping all motion and engaging the brakes on all axes. The collision detection mechanism does not cut power to the acquisition computer or any peripheral devices connected to the power supply in the gantry base. GENIE Acquisition displays a pop-up indicating that a collision has been detected.



The gantry is fitted with collision override buttons at the back of each detector. Pressing either collision override button enables motorized motion of all axes using the handset.

**WARNING**

Pressing the collision override button disables all collision detection mechanisms. The operator must ensure that the intended motion is safe and will not cause harm to the patient or damage to the equipment before initiating the motion using the collision override button in combination with the handset.

---

**Procedure**

To proceed with any motorized motion the collision condition must be cleared. A collision can be cleared in one of two ways:

- Moving the obstruction away from the collision pad that detected the collision.
- Pressing a collision override button and activating a motion that will clear the collision using the handset.

If a collision is detected during an acquisition, the acquisition is paused and the data acquired to that point is retained. Once the collision is cleared, the acquisition can be resumed, restarted, stopped or canceled using the buttons in the Control area of the Acquisition card as described in [Scan Control Area on page 5-40](#).

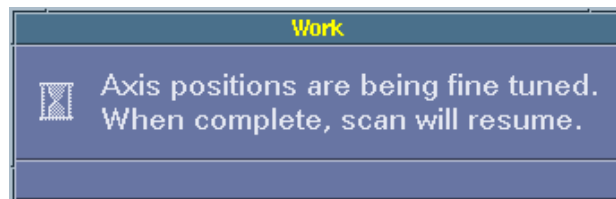
---

## Resuming A Paused Acquisition

An acquisition can be stopped for many reasons. For example, the emergency stop button was pressed, a collision occurred, or a handset motion button was pressed during a whole body or tomographic acquisition. When it is stopped, you are given the options of quitting altogether, storing the scan as is, going back into the camera on state to start the acquisition over, or resuming the scan.

If the table or gantry was moved after the acquisition was stopped, for example in order to clear the collision during a whole body, tomographic or gated tomographic acquisition, it may be necessary to return some of the axes to their previous position in order to resume.

If the gantry or table is a long way from the position required to resume the scan, you must move the axis close to the resume position using the handset buttons. Always ensure that the motion is safe before proceeding. GENIE Acquisition will display a pop-up in this case indicating which axis must be moved and the position required to resume the scan. Once the axis has been moved close to the required position, click **[OK]** on the pop up to have the axis automatically moved to the exact position required to resume the scan. If a collision results from this resume situation, when clearing the collision, take into consideration that the gantry or table returns to their previous position when the acquisition is resumed and try to compensate.



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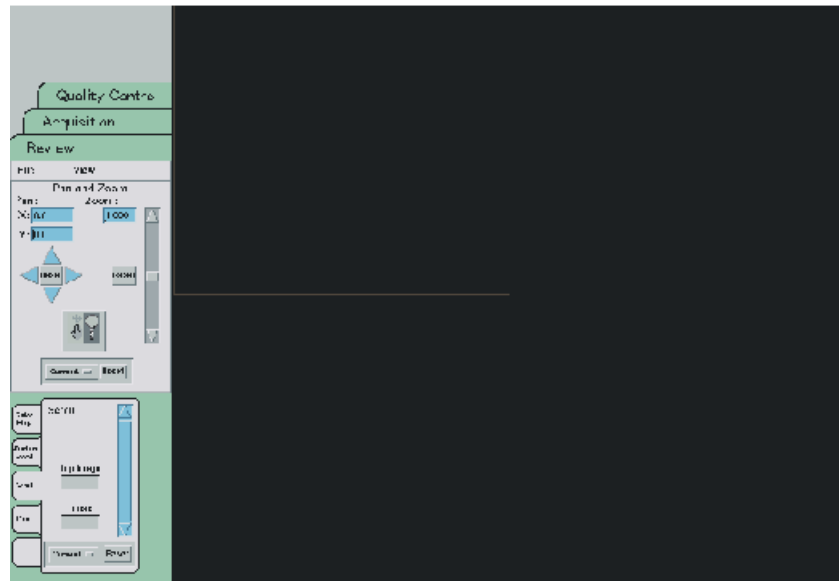
## Reviewing the Acquisition

---

### Overview

The acquisition computer provides a single review card to view image and trigger data once it has been acquired. The image review controls are identical to those on GENIE P&R review cards; however, only a sub-set of the tools are available.

GENIE Acquisition cannot process the acquired data. Data should be transferred to a GENIE Processing and Review station for processing, archiving, and filming. See the [Transferring Acquired Studies](#) later in this chapter for more information.

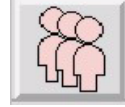


---

## Reviewing Data

The step by step procedure for a reviewing acquired data follows:

1. If the **Main** screen is not displayed, click the **Main** icon at the top left of the screen to bring it to the front.
2. Select one or more Patient Studies, Series or Datasets from the Patient Selector. Clicking on an entry selects that entry and all its contents. If individual files are desired for display, then open the folder by clicking on it to see the specific files.
3. To select another entry, hold down the <Shift> key and click the second entry. To deselect an entry, hold down the <Shift> key and click the entry.
4. Click the <New> button to clear the review card and load your selected entries. The Main Screen will disappear and the Review card will be displayed
5. Use the **Screen Format** option on the **Review** card **View** menu to format the data and to see all the data loaded, if necessary.
6. Use the other available tools to reorient, or pan and zoom an image. Also use the **Image Display Toolkit** to change color maps, and **Window Level**, scroll, and cine the image. See [Color Map Tool on page 6-14](#) and [Window Level Tool on page 6-15](#) for detailed information on these tools.



---

## Auto Processing of Study Data (Ignite)

**Note**

**This feature is an option. To purchase, please contact your local GE agent.**

Ignite is a mechanism that enables an acquisition station to request automatic processing of acquired data that has been sent to a processing station (currently supported by Xeleris).

- When remote stations are configured with the option of auto processing, a list of each station's auto processing protocols is sent to GenieAcq.
- When defining an acquisition protocol or setting up a study, the acquisition station user selects the processing protocols to be applied to a study. After all the required data is acquired and transferred, the acquisition station sends a processing request to the processing station. The request is made using an extension to the DICOM protocol used to send image data.
- This feature is available only on Xeleris stations, which are defined as remote DICOM stations supporting the services of "Storage" and "Send Processing Requests" (see Section 3.4.5 "Network Configuration" in *Direction 2403802-100 Millennium MG&MC System Service Manual*).

Once all the data has arrived at the Xeleris workstation, tasks for processing the data are added to the Xeleris queue within the Physician's In-box. If the Xeleris workstation is configured for auto launch of auto-processing applications, the first application is started. If more than one application is requested (up to 5 different requests may be issued per study), they are each launched, in turn, when the previous application is closed. Otherwise, the applications can be started manually from the In-box (for additional information refer to the Xeleris Operator Manual--Physician In-box).

---

## Auto-processing in Factory Protocols

Auto-processing is currently defined for the factory acquisition protocols shown in [Table 7-6](#).

**Table 7-6:** Auto-processing in Factory Protocols

<b>Clinical Application</b>	<b>Acquisition Protocol</b>	<b>Xeleris Application</b>
Heart	CEqual 1 Day	Myovation
Heart	TI201 SPECT (Cedars-Sinai)	Myovation
Heart	Firstpass Stress	Myovation
Heart	Cedars Planar Thallium	Myovation
Heart	CEqual Thallium	Myovation
Heart	CEqual Dual Isotope	Myovation
Heart	CEqual 2 Day	Myovation
Heart	CEqual 1 Day	Myovation
Heart	Bullseye Thallium	Myovation
Heart	360 Degree Tomo	Myovation
Heart	24 Hr Delay Thallium	Myovation
Bone	Whole Body Bone	WB & Spots Bone Review
Bone	Spot View Bone	WB & Spots Bone Review
Bone	Bone Tomo	Oncology SPECT

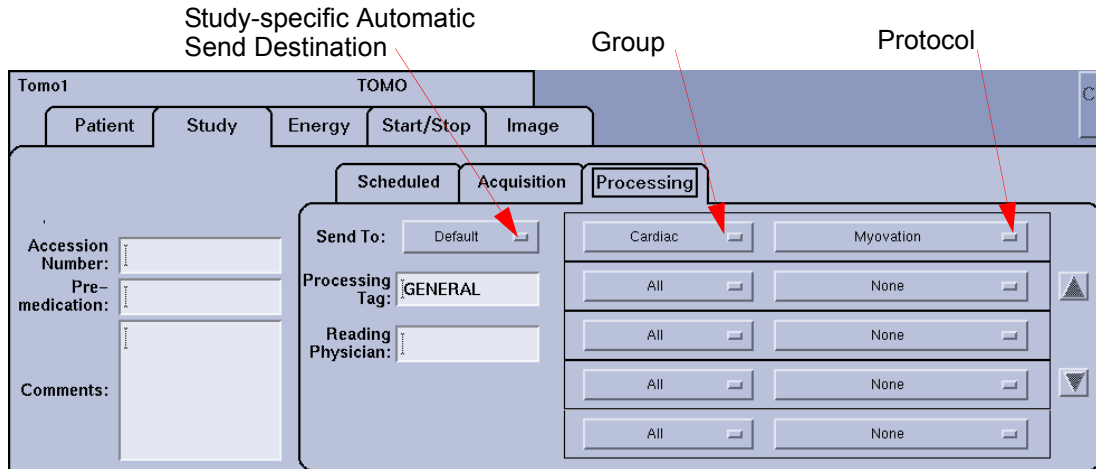
---

## Auto-processing in User Protocols

The user may add Auto-processing to user acquisition protocols using one of the above Xeleris applications. In addition Auto-processing is supported for all Xeleris user applications, as well as the Workspace application (processing card).

## Study Card Auto-processing Protocol Selection

The Processing tab in the Study set up card provides a user interface to define processing protocols for an acquisition template or study.



**Figure 7-21.** Processing Sub-card Layout

Five processing protocol entries are displayed on the Processing sub-card, each having a group and protocol option menu. When the group option menu shows **All** and the protocol option menu shows **None**, no Auto-processing protocols is defined. If a specific group option is selected, the protocol option menu is restricted to the processing protocols within that group. The order of the processing protocol entries determines the order that the protocols are invoked on the processing station.

A study specific automatic send destination is provided to allow acquired data to be automatically sent to a remote Xeleris, in addition to the global automatic send destinations set on the Network Card.

### When can the automatic request be sent?

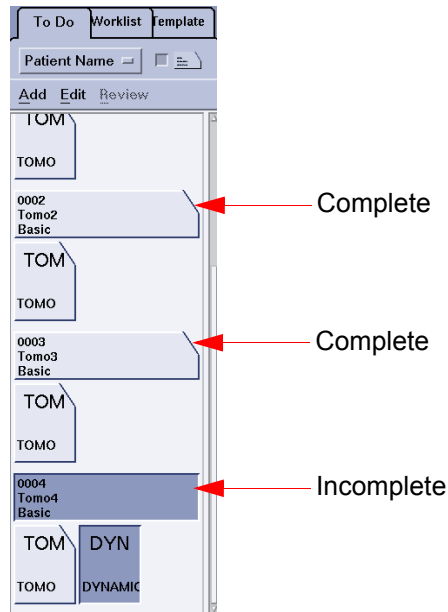
A study can have two different states: complete or incomplete. An acquisition station may only send a processing request for studies, which are in state "complete".

When a new scan is added to a study, its state is automatically switched from "complete" to "incomplete". Once the last scan is acquired, or the last non-acquired scan in the study is deleted, the study state moves back to "complete".

---

## ToDo Card

Figure 7-22 shows complete and incomplete studies in the ToDo card. Complete studies have their study entry trimmed at the upper right corner. Patients “Tomo2” and “Tomo3” are “complete” while patient “Tomo4” is “incomplete” because of its non-acquired second scan.



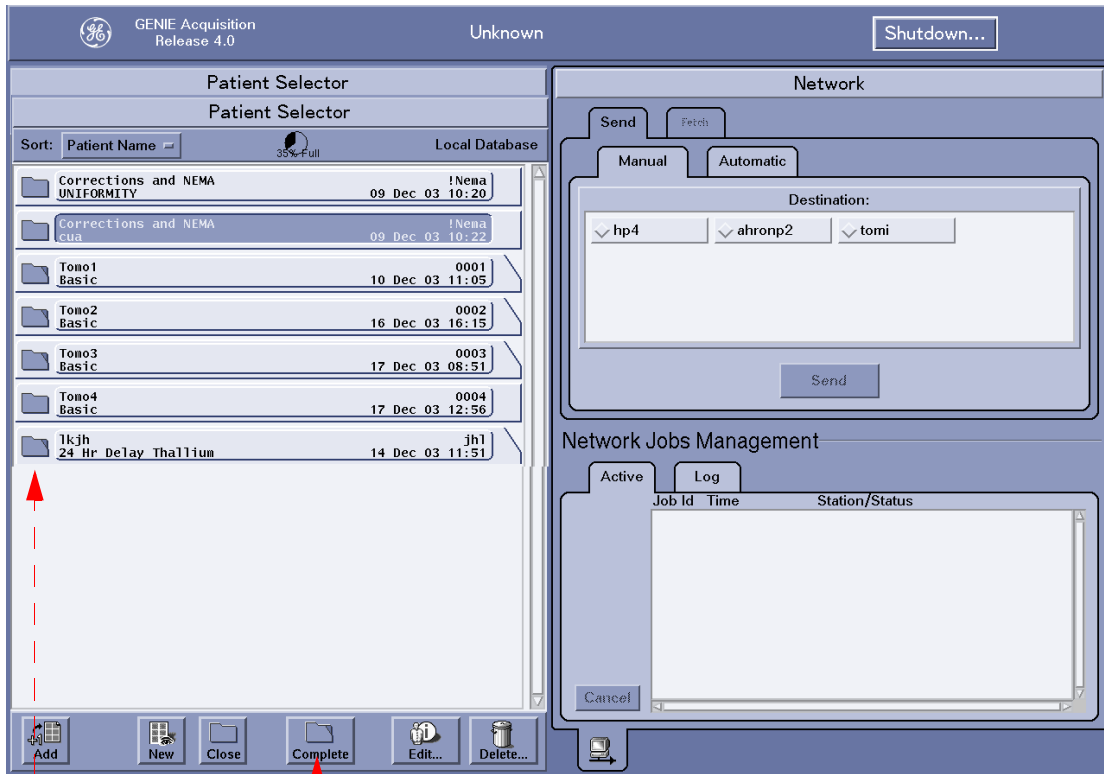
**Figure 7-22.** Complete and Incomplete Studies in ToDo Card

A **Study Complete** option can be selected from the **Edit** menu in the To Do card, which is sensitive when an incomplete study is selected. Selecting the Study Complete menu option sets the study to the complete state even if the study contains non-acquired scans. A clipped top right corner of the study entry marks studies in state complete. Notice in the figure that only patient “Tomo4” is incomplete.



---

## Patient Selector

The Patient Selector (Figure 7-22) shows the completion state of a study in a similar way to the scan selector. The flags in the Patient Selector appearing at the left side of each study also show the state of the studies and datasets.



**Legend:**

-  Study Complete
-  Study Incomplete

Complete Button

**Figure 7-23.** Complete and Incomplete Studies in the Patient Selector.

**Note**

The <Complete> button is available under the list of patient studies in the Patient Selector. The button is only sensitive when a single, incomplete study that contains non-correction, acquired data is selected. When Study Complete is selected, the study status is set to complete and the <Complete> button becomes insensitive (Figure 7-23)

---

## Transferring Acquired Studies

---

### Overview

Data is sent to a Processing and Review workstation using the **Patient Selector Network** card on the **Main** screen. This enables you to process, film and archive the data acquired by GENIE Acquisition.

For additional detailed information on the Network card, see [Network Card on page 4-43](#).

---

### Sending Data to a Workstation

Data is sent to a workstation using the **Patient Selector** and the **Network** card. The data can be sent either **manually** or **automatically** by the system.

Sending data can take some time depending on the size of the data to be sent and the number of other workstations using the network.

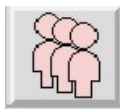
---

### Manual Send

One or more selected patient studies, series or datasets can be sent to another workstation in a single manual send operation. Data is selected using the **Patient Selector**, and a station is selected on the **Network** card. The **[Send]** button is clicked on to actually initiate the transfer operation to the selected station(s). Refer to [Transferring Acquired Studies on page 7-92](#) for more detailed instructions.

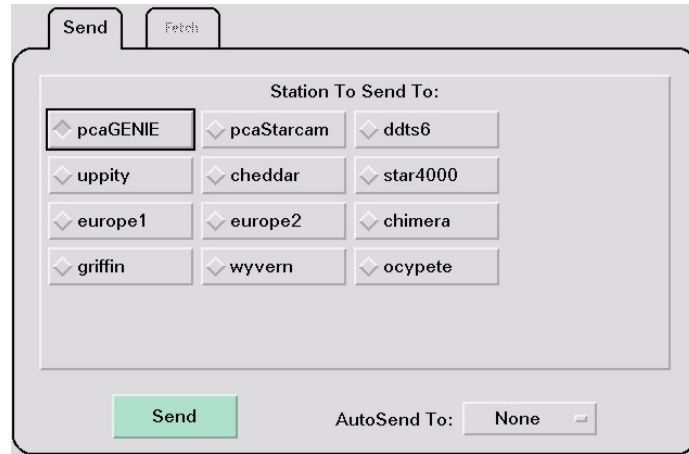
GENIE Acquisition allows new scans to be acquired, and data that has already been acquired to be reviewed while a network send is in progress.

#### To manually send Patient Studies to remote stations:



1. If the **Main** screen is not displayed, click the **Main** icon at the top left of the screen to bring it to the front.
2. Select one or more Patient Studies, Series or Datasets from the Patient Selector. Clicking on an entry selects that entry and all its contents. To select another entry, hold down the **<Shift>** key and click the second entry. To deselect an entry, hold down the **<Shift>** key and click the entry.
3. Click on the **Network** card tab., followed by clicking on the **Manual** Card tab.

4. Click the station name button on the **Send** tab card on the **Network Manual** sub-card to set the destination workstation.



5. Click the [**Send**] button located below the station names to actually send the selected entries.
6. To send the same data to another workstation, click its station name and then click the [**Send**] button again. Sending data can take some time depending on the size of the data to be sent and the number of other workstations using the network.

---

## Sending Data Automatically

The **Network** card can automatically send all data that is acquired to another workstation for processing, filming or archiving. This feature automates network transfers when GENIE Acquisition normally sends data to a single workstation.

**AutoSend** is controlled from the **Automatic** tab card on the **Network** card. The **Network** card can also be used for manual sends to any workstation while **AutoSend** is in operation.

### To begin sending all acquired data to a single workstation:



1. If the **Main** screen is not displayed, click the **Main** icon at the top left of the screen to bring it to the front.
2. Select one or more Patient Studies, Series or Datasets from the Patient Selector. Clicking on an entry selects that entry and all its contents.
3. Click on the **Network** Tab.
4. Click on the **Automatic** Tab.
5. Select the destination P&R station.

All scans that are acquired from now on will be automatically sent to the **AutoSend** destination workstation upon completion.

6. Use the **Log** tab card to find out if the automatically sent data was transferred successfully.

---

## Stopping the Automatic Sent

### To stop sending acquired data automatically:

1. Click on the **Main** screen icon to switch to the **Main** screen.
2. Click on the **Network** Tab.
3. Click on the **Automatic** Tab.
4. Deselect the destination P&R station.

No more data will be sent automatically. Any data that is already in the transfer queue will still be sent unless it is cancelled using the [**Cancel**] button on the **Network** card.

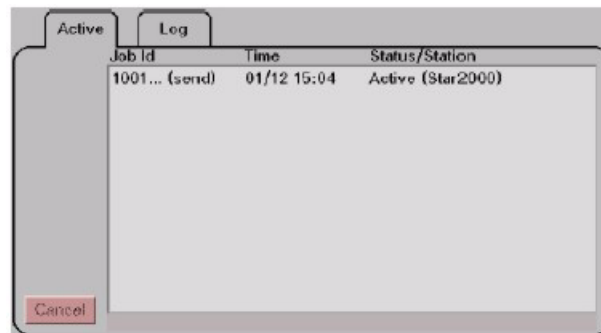
---

## Active and Queued Transfers

The **Active** tab card displays a list of the network send operations that are in progress, and those that are queued and waiting to start.

The **Network** card allows two send operations to two different workstations to be active simultaneously. If more than two network transfers are initiated, the first two will start active and the remainder will be queued in the **Active** tab card **Job Listing** area.

When the send is complete, its entry is removed from the **Active** tab card **Job Listing** area, and the details of the transfer are displayed in the **Log** tab card **Log Listing** area.



**Figure 7-24.** Network Active Tab Card

**To cancel an active or queued network transfer:**

1. Click on the entry in the **Active** tab card **Job Listing** area.
2. Click on the [**Cancel**] button.
3. Cancelling an active transfer will probably mean that the destination workstation will receive some, but not all, of the data that was sent.

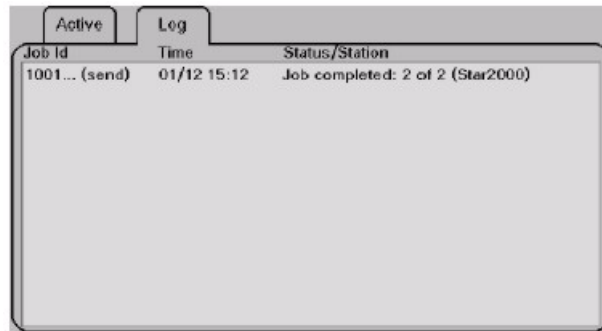
---

## Transfer Log

Completed network transfer operations are listed on the **Log** tab card on the **Network** card. The transfer **Log Listing** area shows details of successful transfers and any errors that occurred. All of the entries in the log may be cleared.

**To remove all entries in the log:**

1. Position the cursor over the log entries and right click (be sure to hold down the mouse button).
2. A popup window appears stating **Clear Entries**.
3. Drag the cursor over **Clear Entries** and release the mouse button.
4. The log entries are now removed.



**Figure 7-25.** Network Log Tab Card

---

## Fetching Data from a Remote Workstation

GENIE Acquisition has DICOM connectivity to eNTEGRA, GENIE P&R, POWERstation, XPert workstations and Starcam computers that query the local patient database and fetch data that they require. This is done without any intervention from the GENIE Acquisition operator.

GENIE Acquisition cannot currently fetch or receive data from another workstation. It can only send data.

If too many workstations perform network query and fetch operations simultaneously, GENIE Acquisition's performance can deteriorate.

---

## The DICOM Worklist

The goal of the GENIE Acq Worklist feature is to automate the loading of the ToDo list and the patient and study set-up cards.

When a user logs in to GENIE Acq the acquisition user interface (AUI) is started. The AUI supports the selection of scans through the ToDo list tab of the scan selector card and also the editing of scans through the set-up cards.

Without the worklist feature an operator must manually load the ToDo list by selecting template procedures from the Add menu using the scan selector menu bar. The procedures are chosen from a set of GE and/or Hospital defined templates. The operator then types the relevant patient and study data into the set-up cards.

The GENIE Acquisition Worklist feature automates this procedure. A worklist received from the worklist provider is displayed on the GENIE Acquisition computer as a list of scheduled procedure steps on the scan selector **Worklist** tab card. See [Figure 7-26](#). The operator need only search this list for an entry that relevant to the patient that is to be scanned.

Selecting the entry and pressing the **Add To Do** button creates a new entry in the **To Do** list using the selected template protocol. The patient and study information received from the worklist provider are automatically entered into the **Patient** and **Study** set-up cards.

## Fetching a Worklist from the Worklist Provider

The **Worklist** tab card displays a list of scheduled procedure steps. Scheduled procedure steps are responses from a *worklist provider* to a *worklist query* from the GENIE Acquisition station.

To define a query you enter matching parameters into the worklist query form located at the top of the **Worklist** tab card.

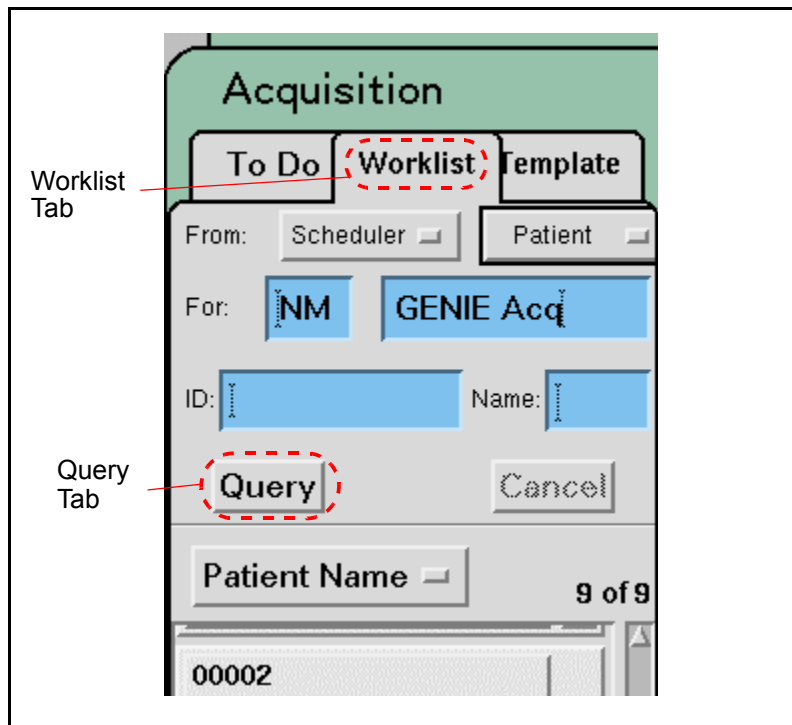


Figure 7-26. Worklist Tab Card

## Worklist Query

The query parameters available are the station name for the worklist provider called “Scheduler”, the modality “NM”, the station for which the entries have been scheduled “GENIE Acq” and the date range to search. See [Figure 7-27](#)

The screenshot shows a software interface for querying worklist data. At the top, there are tabs for 'Quality Control', 'Review', and 'Acquisition'. Under 'Acquisition', there are sub-tabs for 'To Do', 'Worklist', and 'Template'. The 'From:' field is set to 'Scheduler' and 'Patient'. The 'For:' field is set to 'NM' and 'GENIE Acq'. There are fields for 'ID:' and 'Name:'. A 'Query' button and a 'Cancel' button are present. Below the form is a list of patient entries. The entry for 'Smith Jane' is selected and highlighted in black. A red dashed box highlights the details for this entry: 'Accession: 0.0001', 'Scheduled: 30/11/1999 12:30', 'Modality: NM', and 'Physician: Martin O'Neil'. A red arrow points from the text 'Query by Date' to this box. Another red arrow points from the text 'Fetch Status' to the '9 of 9' indicator in the top right of the list area.

**Figure 7-27.** Query by Date form

When satisfied with the selected parameters, start the fetch by pressing the **Query** button.

---

## Monitoring the Status of the Fetch

The status of the fetch is indicated at the top of the **Worklist** scroll bar. Shown is a status of “9 of 9” indicating that nine entries of a possible nine have been fetched. See [Figure 7-27](#). An additional **status line** appears above the “9 of 9”, indicates the progress of the fetch as one of:

*Querying* - A fetch is in progress

*Failed* - A fetch has failed

---

## Worklist Entry (Also Referred to as Scheduled Procedure Step Entries)

The scheduled procedure step entries are shown as entries containing three pieces of information:

- Patient ID
- Patient Name
- Scheduled Procedure Step Description

The displayed list of scheduled procedure steps can be sorted by:

- Patient Name
- Patient Id
- Description

A fetch can be cancelled by pressing the **Cancel** button.

## Customizing the Fetching of Worklists

Table 7-7 describes the parameters that can be used to customize the fetching of worklists.

**Table 7-7: Worklist Parameters**

Parameter Description	Query Form	Label	User Interaction
Worklist Provider	ALL	From:	Selection from menu
Modality	ALL	For:	Set to "NM"
Station Name	ALL	For:	GENIE Acquisition name
From Date	Query by date	From:	dd/mm/yyyy or *
To Date	Query by date	To:	
Patient ID	Query by patient	ID:	No wild cards permitted
Patient Name	Query by patient	Name:	LastName or La*me or LastName^FirstName or Last*me^Fir*Name
Physician's Name	Query by physi- cian	Name:	
Requested Procedure ID	Query by proc ID	Proc ID:	12345 or 12*5
Accession Number	Query by acces- sion	Acces- sion:	12345 or 12*5

The following query forms can be used to customize a worklist fetch:

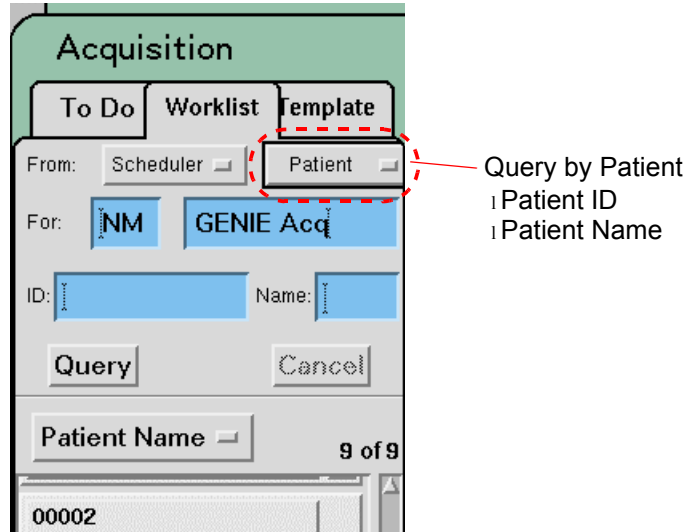


Figure G-28. Query by Patient

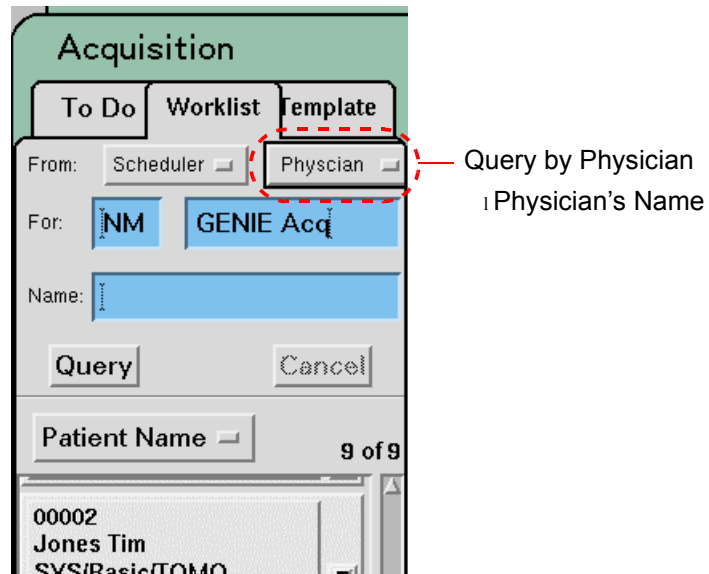


Figure 7-29. Query by Physician

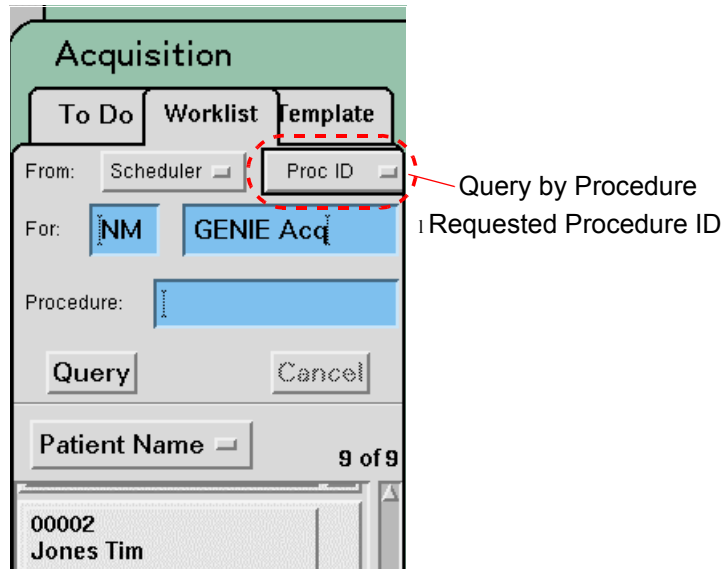


Figure 7-30. Query by Procedure

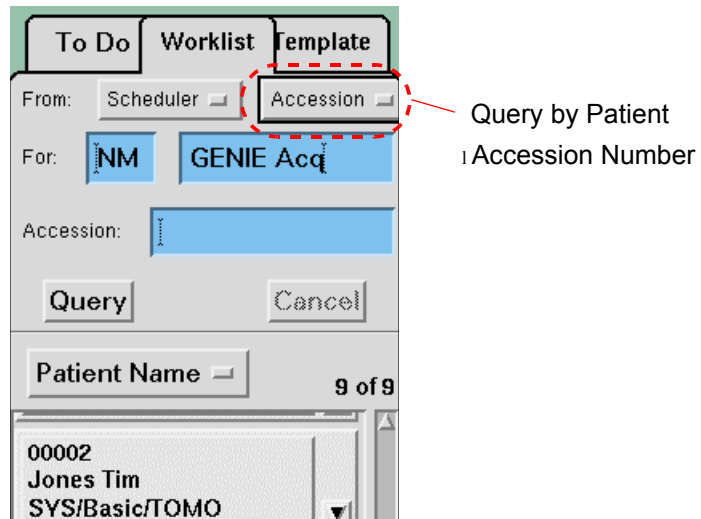


Figure 7-31. Query by Patient Accession Number

---

## Finding a Worklist Entry

The scheduled procedure step browser is the scrollable area within the **Worklist** tab card that displays the worklist entries. A typical way to use the GENIE Acquisition worklist feature would be to query the worklist provider for all procedures to be performed today. When the results are displayed, the worklist can be browsed to find the worklist entry to add to the **To Do** list.

Once a possible match has been found it can be selected and viewed using the patient and study set-up cards. The other set-up cards energy, image, start/stop and trigger are not displayed. The patient and study cards aid the process of finding a worklist entry.

All fields appear grey as they are for reference only and cannot be edited.

[Table 7-8](#) describes the worklist entry parameters that can be displayed on GENIE Acquisition:

---

## Worklist Entry Parameters

**Table 7-8:** Worklist Entry Parameters

Parameter Description	Location	Label
Patient ID	Worklist Entry	
Patient Name	Worklist Entry	
Scheduled Procedure Step Description	Worklist Entry	
Accession Number	Worklist Entry, Study Card	Accession:
Requested Procedure ID	Worklist Entry	Procedure:
Scheduled Procedure Step Start Date	Worklist Entry	Scheduled:
Scheduled Procedure Step Start Time	Worklist Entry	Scheduled:
Modality	Worklist Entry	Modality:
Performing Physician's Name	Worklist Entry	Physician:
Patient's Sex	Patient Card	Sex:
Patient's Birth Date	Patient Card	Date Of Birth:
Ethnic Group	Patient Card	Ethnic Group:
Other Patient Names	Patient Card	Other Names:
Other Patient Ids	Patient Card	Other Ids:
Patient Comments	Patient Card	Patient Comments:
Patient's Age	Patient Card	Age:
Patient's Weight	Patient Card	Weight:
Patient's Size	Patient Card	Height:
Medical Alerts	Patient Card	Alerts:
Special Needs	Patient Card	Special Needs:
Pregnancy Status	Patient Card	Pregnancy State:
Occupation	Patient Card	Occupation:
Additional Patient History	Patient Card	History:

**Table 7-8: Worklist Entry Parameters**

Patient State	Patient Card	State:
Patient Transport Arrangements	Patient Card	Transport:
Requested Procedure Location	Patient Card	Location:
Pre-Medication	Study Card	Pre-Medication:
Referring Physician's Name	Study Card	Referring Physician:
Names Of Intended Recipients Of Results	Study Card	Reading Physician:
Requested Procedure ID	Study Card	ID:
Requested Procedure Priority	Study Card	Priority:
Requested Procedure Description	Study Card	Description:
Reason for the Requested Procedure	Study Card	Reason:
Requested Procedure Location	Study Card	Location:
Requested Procedure Comments	Study Card	Comments:
Scheduled Procedure Step ID	Study Card	ID:
Scheduled Procedure Step Status	Study Card	Status:
Comments On the Scheduled Procedure Step	Study Card	Comments:
Reason for the Imaging Service Request	Study Card	Reason:
Imaging Service Request Comments	Study Card	Comments:

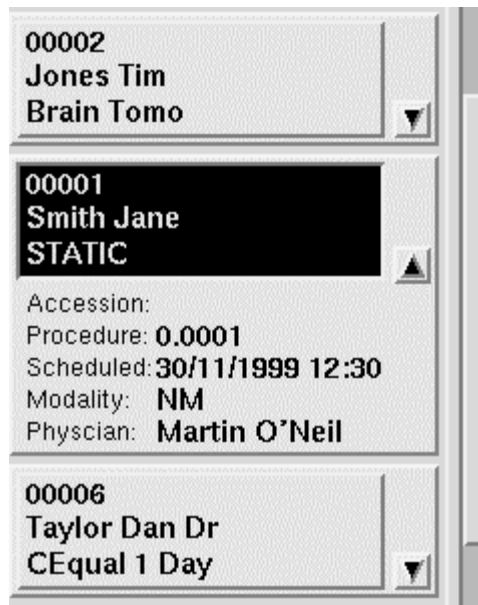
---

## Worklist Entry - (also referred to as Scheduled Procedure Step Entry)

A worklist entry can be expanded to provide more detail. The detail is revealed by clicking the down arrow button located in the bottom right hand corner of a scheduled procedure step entry

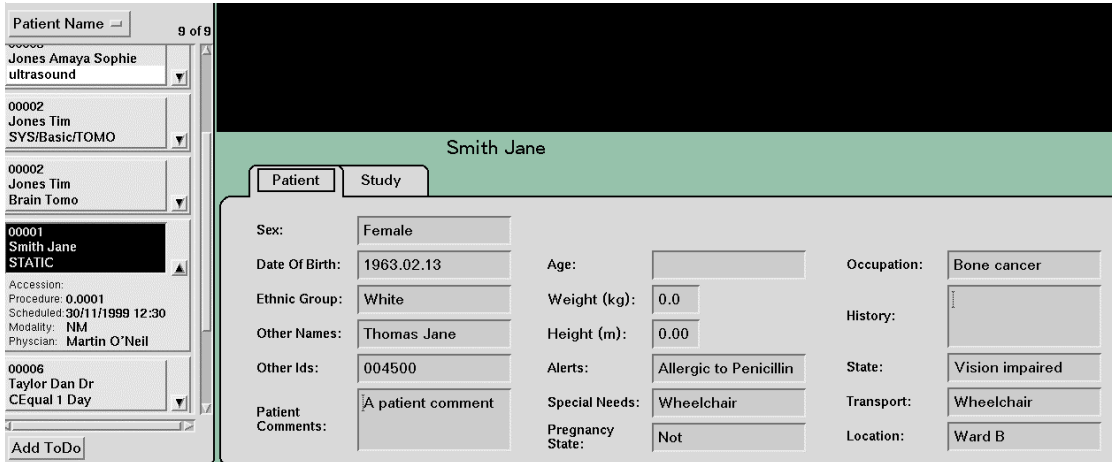
The additional details consist of:

- Accession Number
- Requested Procedure ID
- Scheduled Procedure Step Start
- Date and Time
- Modality
- Performing Physician



**Figure 7-32.** Expanded Worklist Entry

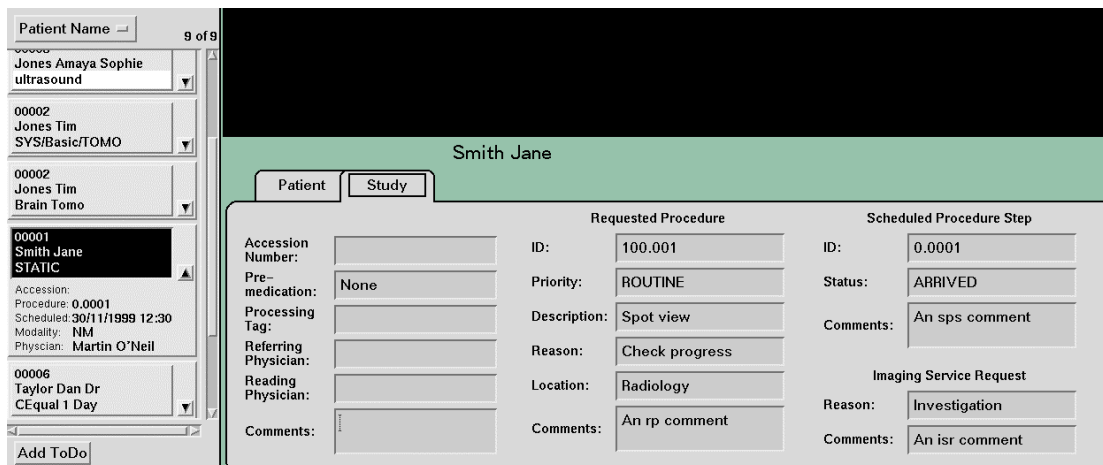
## Patient Card - Expanded View



Patient		Study	
Sex:	Female	Occupation:	Bone cancer
Date Of Birth:	1963.02.13	Age:	
Ethnic Group:	White	Weight (kg):	0.0
Other Names:	Thomas Jane	Height (m):	0.00
Other Ids:	004500	Alerts:	Allergic to Penicillin
Patient Comments:	A patient comment	Special Needs:	Wheelchair
		Pregnancy State:	Not
		State:	Vision impaired
		Transport:	Wheelchair
		Location:	Ward B

Figure 7-33. Expanded Patient Card Entry

## Study Card - Expanded View



Requested Procedure		Scheduled Procedure Step	
Accession Number:		ID:	0.0001
Pre-medication:	None	Priority:	ROUTINE
Processing Tag:		Description:	Spot view
Referring Physician:		Reason:	Check progress
Reading Physician:		Location:	Radiology
Comments:		Comments:	An rp comment
		Imaging Service Request	
		Reason:	Investigation
		Comments:	An isr comment

Figure 7-34. Expanded Study Card Entry

## Creating a To Do List Study from a Worklist Entry

The scheduled procedure step description provides GENIE Acquisition with a mechanism for linking the scheduled procedure step to a template protocol. For example, the first entry for Sean shows a scheduled procedure step description of SYS/Bone/Spot View Bone. This matches the GE defined template protocol in the group "Bone" called "Spot View Bone". If no match can be made the scheduled procedure step description will be shown on a white background.

The **Add To Do** button is used to action the creation of a study on the **To Do** card from a set of selected scheduled procedure steps. Once a scheduled procedure step is added to the **To Do** list it cannot be selected and added again.

The Scheduled Procedure Description returned by a worklist query can be used to control the selection of the GENIE Acquisition protocol. You can vary the Scheduled Procedure Step Description or the names of your template protocols to achieve the same results. The examples shown in [Table 7-9](#) show how different Scheduled Procedure Descriptions can be used to select either a GE or a hospital "Spot View Bone" template protocol.

**Table 7-9:** Schedule Procedure Selections

Scheduled Procedure Step Description	Format	Selection
Spot View Bone	Protocol Name	GE defined protocol
/Bone/Spot View Bone	/Group/Protocol Name	GE defined protocol
/SYS/Bone/Spot View Bone	/Category/Group/Protocol Name	GE defined protocol
/USER/Bone/ Spot View Bone	/Category/Group/Protocol Name	User defined protocol

Care needs to be taken when a category and group are not specified so that the wrong protocol is not selected. To avoid confusion always use formats that uniquely identify protocols or ensure that the protocol names are unique.

---

## Patient Study Mismatch

When you add a scheduled procedure step to the ToDo list a patient study mismatch can occur. A dialog describing the problem and offering a solution will be displayed.

The different types of patient study mismatches that can occur are described in [Table 7-10](#).

**Table 7-10:** Patient Study Mismatches

<b>Mismatch</b>	<b>Description</b>	<b>Resolution</b>
Choose Patient	The SPS Patient ID matches a patient in the local database, but the patient names differ.	The existing patient information is retained and the SPS scans are added to a new study for the patient. The patient is updated to match the SPS and the SPS scans are added to a new study for the patient. The SPS scans are not added.
Move Study	The SPS Study Dictum UID matches a study in the local database, but has a different Patient ID to the patient in the local database.	The SPS scans are added to the existing patient and study. The existing study is moved to the patient specified in the SPS and the SPS scans are added to it. The SPS scans are not added.

## Choose Patient

**Choose Patient**

! A patient name has changed.

Choose the patient for the study.

00001 Thomas Jane	00001 Smith Jane
Sex: Female	Sex: Female
Date of Birth: 1963.02.13	Date of Birth: 1963.02.13
Other Names:	Other Names: Thomas Jane
Other Ids: 004500	Other Ids: 004500

**Spot View Bone**

Accession Number:	Scheduled Date: 1999.11.30
Requested Procedure ID: 100.001	Performing Physician: Martin O'Neil

OK Cancel

**Figure 7-35.** Patient Mismatch

The dialog shown in [Figure 7-35](#) is displayed to allow you to select the correct patient details for the scheduled procedure step. The following options are available:

- Select the GENIE Acquisition patient by clicking the left hand entry (shown above as selected in black).
- Select the SPS patient by clicking the right hand entry.
- Not adding the scheduled procedure step by pressing Cancel.

## Move Study

**Move Study**

The study exists for another patient.

Choose the patient for the study.

<b>004500</b> Thomas Jane Spot View Bone	00001 Smith Jane Spot View Bone
Sex: Female	Sex: Female
Date of Birth: 1963.02.13	Date of Birth: 1963.02.13
Other Names:	Other Names: Thomas Jane
Other Ids:	Other Ids: 004500

Spot View Bone

Accession Number:	Scheduled Date: 1999.11.30
Requested Procedure ID: 100.001	Performing Physician: Martin O'Neil

OK Cancel

**Figure 7-36.** Study Mismatch

The dialog shown in [Figure 7-36](#) is displayed to allow you to select the correct patient details for the scheduled procedure step. The following options are available:

- Select the GENIE Acquisition patient by clicking the left hand entry (shown above as selected in black).
- Select the SPS patient by clicking the right hand entry.
- Not adding the scheduled procedure step by pressing Cancel.

---

## DICOM Storage Commitment

The Dicom Storage Commitment function enables:

- Transfer of images to another station.
- Request of confirmation from the designated station that it has accepted responsibility for the safekeeping of acquired data.

A successful response will allow the user to delete the images knowing that they are still available on the network.

---

## Sending Storage Commitment Requests

Before sending data to another station, it should first be configured for Storage Commitment. The configuration process is described in *Direction 2364309-100 Rev4, MPR/MPS Service Manual Section 3.12.17 – Network Configuration*.

After you select the configured station as the destination for manual and/or auto send and all transfers are successful, a storage commitment request will be generated. GeniAcq can also issue commitment requests to any station on which the data will be permanently archived.

You can track the progress of a storage commitment request by using the **Active** and **Log** tab cards. These are located on the **Network** tab of the **Selector** dialog.

The **Active** card shows the progress of current data transfers. The **Log** card displays the history of transfers. If all of the transfers are successful, Storage Commitment will be requested and the Active card entry will be updated to reflect this.

---

## Storage Commit Flag in Patient Selector

Dataset entries in the Patient Selector are flagged to display their storage commitment status as follows:

- A "**C**" flag before a dataset entry denotes **Committed**.
- A "**P**" flag before a dataset entry denotes **Commit Pending**.
- An additional "**\***" flag before a dataset entry denotes that it is a **Correction**.

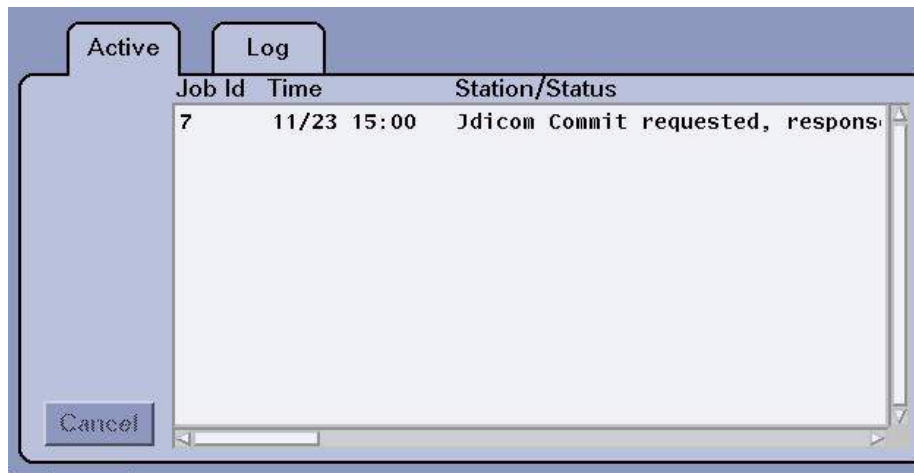
---

## Storage Commitment After Manual Send

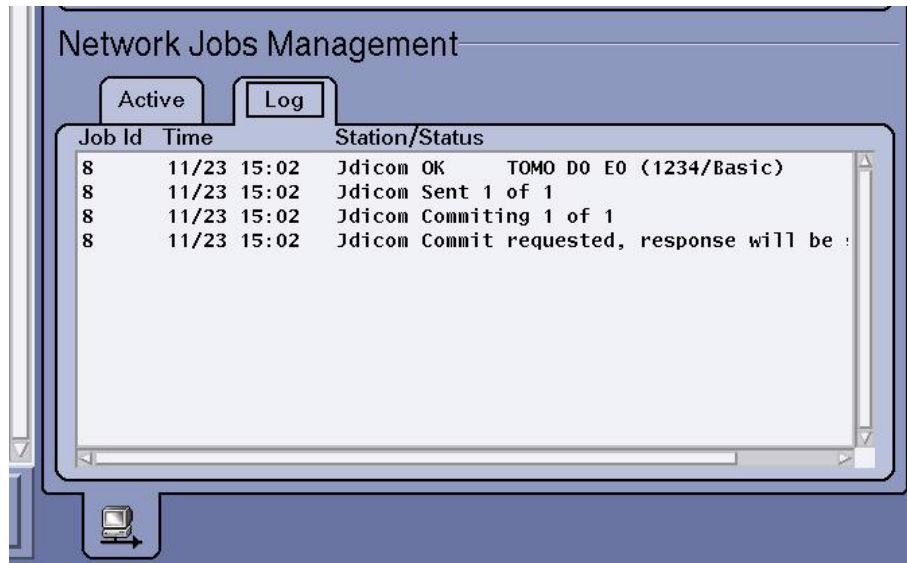
1. Choose a remote station for which storage commitment has been configured.
2. Follow the steps for manually sending data described in [Manual Send on page 7-92](#).

When the transfer completes successfully, a storage commitment request is issued for the group of data that was sent.

3. View the Active and Log tab cards to follow the progress of the storage commit request (see [Figure 7-37](#) and [Figure 7-38](#)).



**Figure 7-37.** Active Storage Commit Request



**Figure 7-38.** Storage Commit Log

4. When a successful Storage Commitment response is received, the Commit flag in the Patient Selector will appear.

---

## Storage Commitment After Automatic Send

1. Choose a remote station for which storage commitment has been configured.
2. Follow the steps for manually sending data described in [Sending Data Automatically on page 7-94](#).
3. Upon completion of each scan, the scan is automatically sent to the designated remote station and a storage commitment request is issued when the transfer completes successfully.
4. When a successful Storage Commitment response is received, the Commit flag in the Patient Selector will appear.

---

## PostScript Printing and Secondary Capture Printing

GENIE Acquisition provides features that allow what is shown on the User Interface to be captured and printed (with the Secondary Capture they can also be archived):

1. By using a PostScript printer designated during system setup.
2. By designating a DICOM remote station as Secondary Capture destination, which gets the captured images and enables to print them to an attached printer or archive them.

---

### PostScript Printing

There are three types of screen captures that can be printed:

- Printing the entire screen (Camera icon)
- Printing the image area (Review card only)
- Printing individual images or graphs

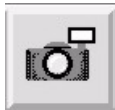


#### CAUTION

Screen captures printed using these features are NOT meant to be used for diagnosis.

---

### Printing The Entire Screen (Camera Icon)



The [**Camera**] icon provides a means to capture the entire screen being displayed and print it from a PostScript printer. This will work on all GENIE Acquisition screens where the [**Camera**] icon appears

#### Note

If the [**Camera**] icon is grey, printing has not been configured.

**To print the entire screen:**

1. Select the desired screen.
2. Left mouse click on the [**Camera**] icon. The [**Camera**] icon will appear to flash and mouse movement will freeze for a few seconds while the screen capture is being processed.  
The screen capture will then be sent to the PostScript printer.

**CAUTION**

Screen captures printed with this feature are NOT meant to be used for diagnosis.

---

**Printing The Image Area (Review Card Only)**

The **Print** option under the **Review** card **File** pull-down menu provides a means to print the Review card image area from a PostScript printer.

**Note**

If the Print option is grey, printing has not been configured.

**To print the Review card image area:**

1. Select the images to be printed from the just completed acquisition or from datasets listed in the Patient Database on the Main screen.
2. Select **Print** from the Review card File pull-down menu. Mouse movement will freeze for a few seconds while the screen capture is being processed.  
The screen capture will then be sent to the PostScript printer.

**CAUTION**

Screen captures printed with this feature are NOT meant to be used for diagnosis.

## Printing Individual Images And Graphs

Popup menus are available by right clicking within the image area on the Acquisition, Review, and Quality Control cards and provide a means to print individual images or graphs from a PostScript printer.

This feature also allows printing of the energy histogram on the Energy sub-card of the Energy card of an acquisition as well as the trigger histogram on the Trigger card of an acquisition.

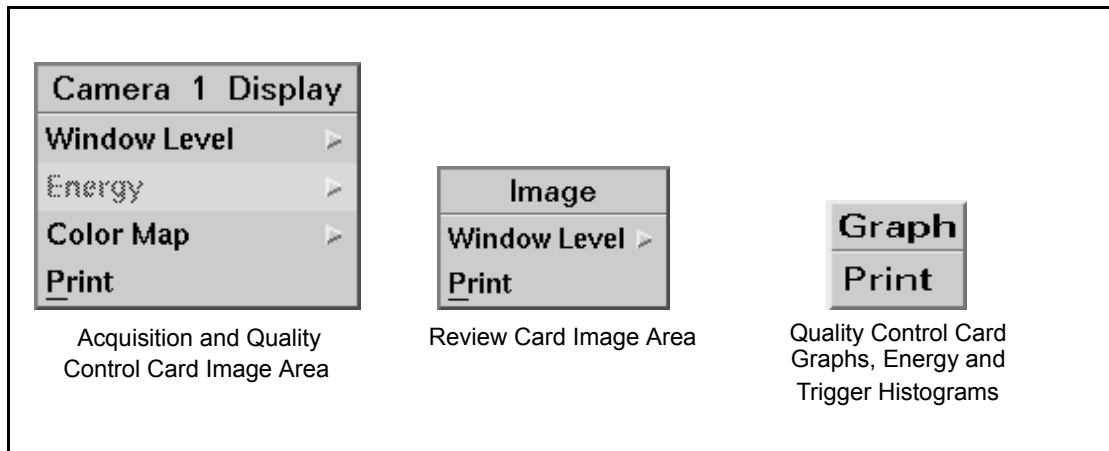


Figure 7-39. Selected Screen Areas

**Note**

If the Print option is grey, printing has not been configured.

### To print individual images or graphs:

1. Select the desired image or graph.
2. Click right over the image or graph to be printed and select **Print** from the popup menu.

Mouse movement will freeze for a few seconds while the screen capture is being processed.

The screen capture will then be sent to the PostScript printer.



### CAUTION

Screen captures printed with this feature are NOT meant to be used for diagnosis.

---

## Secondary Capture Printing

In order to use Secondary Capture, a DICOM remote station should be set as Secondary Capture (see the *Millennium MG/MC System Service Manual, Chapter 3*, in the section *Configuring the Acquisition Computer's InSite Connection* for details).

Once a DICOM station has been designated, the print options will be used to capture specific areas of the User Interface and will be sent automatically to the specified DICOM station.

All the captured images will be saved in the same study at the DICOM station with the following fields:

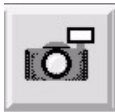
Patient Name = "!Screen Capture"  
Patient ID = [The name of the Acquisition Station]  
Study Name = "!SCREEN CAPTURE"

Four types of screen captures can be sent and printed/archived:

- The entire screen (Camera/Printer icon)
- The image area (Review card only)
- Individual images or graphs (Images of Quality Control in Review card or Quality Control Card)
- The Quality Control results area (Quality Control card only)

---

### Printing the Entire Screen (Camera/Printer Icon)



The [**Camera/Printer**] icon provides a means to capture the entire screen being displayed and send it to the remote station that was designated as Secondary Capture. This will work on all GENIE Acquisition screens where this icon appears.

If the Secondary Capture destination has not yet been configured the [**Camera/Printer**] icon will be disabled.

#### To capture the entire screen:

1. Select the desired screen.
2. Click on the [**Camera/Printer**] icon. (In classic theme, the [**Camera**] icon will appear momentarily).

Mouse movement will freeze for a few seconds while the screen capture is being processed. The screen capture will then be sent to the DICOM remote station that was designated as Secondary Capture.



**CAUTION**

Screen captures printed with this feature are NOT meant to be used for diagnosis.

---

**Printing the Image Area (Review Card Only)**

The **Print** option under the **Review** card **File** pull-down menu provides a means to capture the Review card image area and send it to the DICOM remote station that was designated as Screen Capture.

**Note**

If the Secondary Capture destination has not yet been configured the Print option will be disabled.

**To capture the Review card image area:**

1. Select the images to be printed from the latest completed acquisition or from datasets listed in the Patient Database on the Main screen.
2. Select **Print** from the Review card File pull-down menu.

Mouse movement will freeze for a few seconds while the screen capture is being processed.

The screen capture will then be sent to the DICOM remote station that was designated as Screen Capture.



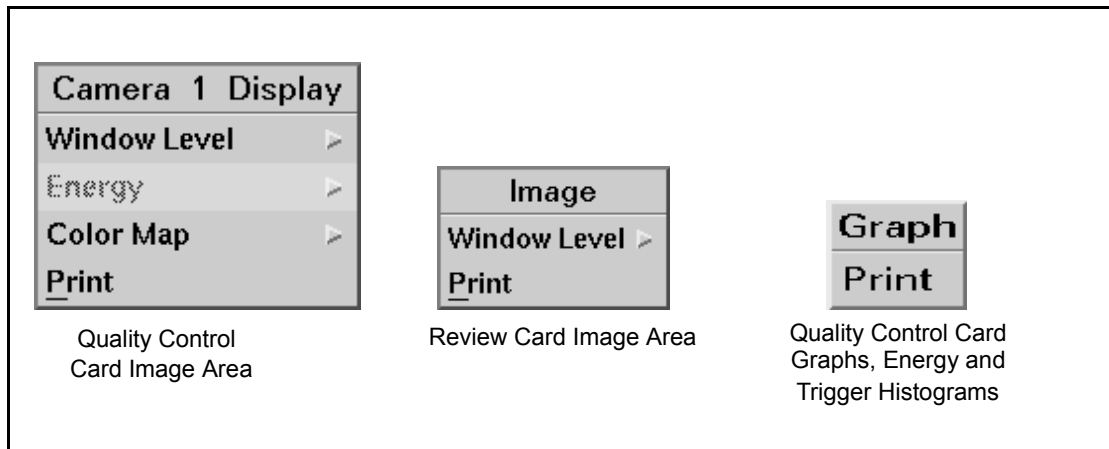
**CAUTION**

Screen captures printed with this feature are NOT meant to be used for diagnosis.

## Printing Individual Images and Graphs (of Quality Control Only)

This function enables printing of quality control images in the Review card or the Quality Control Card

Popup menus are available by right clicking within the Quality Control image/graph area on the Quality Control cards or the Review Card and provide a means to capture individual images or graphs and send them to the DICOM remote station that was designated as Screen Capture..



**Figure 7-40.** Selected Screen Areas

**Note**

If the Secondary Capture destination has not yet been configured the Print option will be disabled.

**To capture individual images or graphs:**

1. Select the desired image or graph.
2. Click right over the image or graph to be captured and select **Print** from the popup menu.

The screen capture of the selected image/graph will then be sent to the DICOM remote station that was designated as Screen Capture.



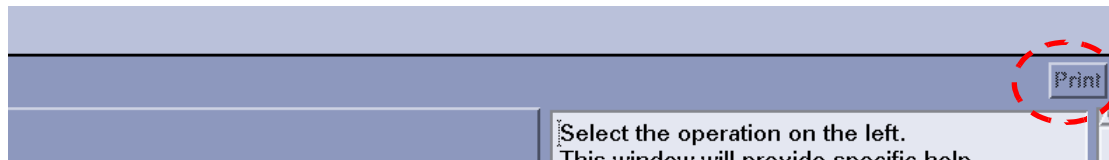
**CAUTION**

Screen captures printed with this feature are NOT meant to be used for diagnosis.

---

### Printing the Quality Control Results Area (Quality Control Card Only)

A **[Print]** button is located at the bottom right of the results area in the Quality Control card. Clicking on this button activates capture of the whole results area of the Quality Control Card and transfer to the DICOM remote station that was designated for Screen Capture.



**Figure 7-41.** Print Button in Quality Control Card

**Note**

If the Secondary Capture destination has not yet been configured the **[Print]** button will be disabled.

**To capture the entire results area of the Quality Control Card:**

1. Select the desired screen.
2. Click on the **[Print]** button at the bottom right of the results area in the Quality Control card (see [Figure 7-41](#)).

The screen capture will then be sent to the DICOM remote station that was designated for Secondary Capture.

---

## Chapter 8 - Acquisition Templates and Energy Sessions

---

### Overview

GENIE Acquisition is supplied with a set of GE template basic scans and multiple scan studies that are used to perform standard acquisition protocols. These templates acquire the data that is required to perform a variety of GE processing protocols. The GE templates are fixed and cannot be customized.

Templates can be copied to create new scans and studies. Templates ensure that the same data is acquired with the same set up parameters each time a scan or group of scans is performed.

The Template tab card provides the means to create and customize user templates. User templates are customized by selecting the scan entry and modifying the scan details in one of the cards in the set up area.

Customizing a scan template has no effect on scans that have already been created in the To Do card. New scans that are created using the corresponding sub-menu option will be copied from the customized scan template.

User templates may only be modified if the user has the Administration privilege. Currently, a login of either `genieacq` or `admin` will allow for templates to be customized. User privilege levels are described in [Maintenance Levels on page 10-46](#).

For additional detailed information on the Template card, refer to [Scan Selector - Templates Card on page 5-54](#).

**Note**

Acquisition templates having in their title the name XPERT, will be used only if the acquired data will be transferred to and processed on an XPERT workstation.

## Creating a New User Template

If you login to GENIE Acquisition using the administration login, see [Different Logins on page 10-47](#) for more details on the different logins. Then select the option to start the GENIE Acquisition software.

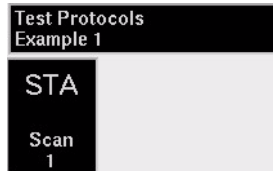
The step by step procedure for creating a user defined template follows. This example creates a user protocol, consisting of a static, dynamic and final static scan, called “Example 1” in a group called “Test Protocols”:

1. Click the **Acquisition** card to bring it to the front.
2. Check the **Templates** card is at the front by clicking its tab.
3. Click the **Add** pull-down menu option at the top of the **Scan Selector**. A menu is displayed under **Add**.
4. Click the **Group** option. A sub-menu is displayed to the right giving the various groups of template scans that are available.
5. Click the **General** option under the **GE** heading. A further sub-menu is displayed with a list of the basic scan types.
6. Click the **STATIC** option. A new group entry is created in the Scan Selector containing a single scan entry labeled **STATIC**. The **Group Edit** pop-up is displayed in the scan selector.
7. Type **Test Protocols** as the name of the new group.
8. Press the <Tab> key to move the text entry highlight to the protocol name field and then type **Example 1** as the name of the new protocol.

The image shows a dialog box titled "Group Name" with two text input fields: "Group Name" containing "NoGroupName" and "Protocol Name" containing "General". Below these fields is a checkbox labeled "Use as Protocol" which is checked. At the bottom of the dialog are "OK" and "Cancel" buttons. Below the dialog box, a list of scan types is visible, with "STA" and "STATIC" highlighted.

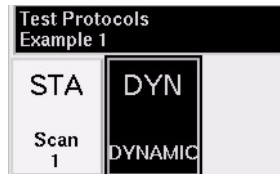
9. Note that the **Use as Protocol** toggle is selected, indicating that this template will be a protocol rather than a grouping of individual scans.

10. Press the <Enter> key to modify the group entry. The entry displays the new group and protocol names entered.
11. Change the name of the first scan to something other than **STATIC**. With the scan entry selected, choose the **Scan Info** option from the **Edit** menu. The scan name edit pop-up is displayed. Edit the name to be **Scan 1** and press <Enter> to set the new name. The new protocol will now appear as an option from the **Add** menu and can be used immediately to create a new patient study with a single static scan on the **To Do** list.

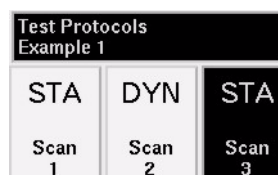


**To extend the protocol further and add a dynamic and static scan:**

1. Check that the **Template** card is at the front by clicking its tab
2. Check that the **Test Protocols, Example 1** group entry is selected.
3. Click the **Add** pull-down menu option at the top of the scan selector. A menu is displayed under **Add**.
4. Click the **Scan** option. A sub-menu is displayed to the right giving the various groups of template scans that are available.



5. Click the **General** option under the **GE** heading. A further sub-menu is displayed with a list of the basic scan types.
6. Click the **DYNAMIC** option. A new scan entry is created in the "Example 1" protocol after the "Scan 1" scan labelled **DYNAMIC**.
7. Click the **Scan Info** option on the **Edit** menu and change the new scan entry name to be **Scan 2**. Press <Enter> to set the new name.
8. Click the **Add** pull-down menu option, followed by **Scan, General** and finally **STATIC**. A third scan entry is created called **STATIC**.



- Click the **Scan Info** option on the **Edit** menu and change the new scan entry name to be **Scan 3**. Press <Enter> to set the new name.

**To use the new user protocol to create a new Patient Study:**

- Check the **To Do** card is at the front by clicking its tab.
- Click the **Add** pull-down menu option at the top of the scan selector. A menu is displayed under **Add**.
- Click the **Patient** option. A sub-menu is displayed to the right giving the various groups of template scans that are available.

The image shows a 'Patient ID' dialog box with three text input fields: 'Patient ID' containing 'NoID', 'Patient Name' containing 'NoPatientName', and 'Study Name' containing 'Example 1'. Below the fields are 'OK' and 'Cancel' buttons. Underneath the dialog box is a scan selector interface with three buttons: 'STA Scan 1', 'DYN Scan 2', and 'STA Scan 3'. The 'STA Scan 1' button is highlighted with a black background and white text.

- Click the **Test Protocols** option under the **User** heading. A further sub-menu is displayed with an entry called **Example 1**. This is the protocol that has just been created.
- Click the **Example 1** option. A new Patient Study entry is created in the Scan Selector containing three scans labelled **Scan 1**, **Scan 2** and **Scan 3**. The patient study edit pop-up is displayed in the scan selector.
- Set the patient ID, patient name and study name as required and then press <Enter> to modify the Patient Study entry.

**Note**

For admin logins only: When you are finished creating protocol templates, shutdown GENIE Acquisition and then select the option to logout of the administration account. This will take you back to the login screen. Login back in with the genieacq user name to continue using the system normally.

---

## Customizing an Existing User Template

Each scan in a user protocol may be customized. When new **To Do** entries are created, they are given the exact set up parameters that exist in the user template scan that was used.

User protocols are customized by modifying the scan set up parameters while the Templates card is displayed. This gives the template creator full control over all scan set up options.

If you login to GENIE Acquisition using the administration login, see [Different Logins on page 10-47](#) for more details on the different logins. Then select the option to start the GENIE Acquisition software.

### To customize a template:

1. Click the **Acquisition** card to bring it to the front.
2. Check the **Templates** card is at the front by clicking its tab.
3. Click on a scan that is part of a user template to select it. The setup cards for that template scan will be displayed in the scan set up area.
4. Modify any of the **Energy, Termination, Image or Trigger** set up parameters. When a new scan entry is created on the To Do card using this modified template, it will use the scan set up parameters that were set for the scan in the template.

<b>Note</b>
-------------

For admin logins only: When you are finished modifying your templates, shutdown GENIE Acquisition and then select the option to logout of the administration account. This will take you back to the login screen. Login back in with the genieacq user name to continue using the system normally.

---

## Customizing Energy Sessions

GENIE Acquisition has a number of GE default energy sessions. An energy session is an isotope specific set up that defines the energy ranges that will be acquired to form one or more image sets as well as energy set names and isotope related detector corrections.

The **Energy** set up card allows the energy session parameters to be modified for the needs of an individual scan in the To Do list. However, it is tedious to have to modify the energy session parameters each time a particular type of scan is performed.

Energy sessions are created and customized from the Scan Selector Templates card. It is possible to either modify GE default energy sessions, or create and modify new user defined energy sessions.

If you login to GENIE Acquisition using the administration login, see [Different Logins on page 10-47](#) for more details on the different logins. Then select the option to start the GENIE Acquisition software.

### To modify an energy session:

1. Click the **Acquisition** card to bring it to the front.
2. Check the **Templates** card is at the front by clicking its tab.
3. Select a scan in any template. The setup cards for the scan will be displayed in the Scan Set Up area.
4. Click the **Energy** set up card tab to bring it to the front. The Energy card will show the name of the current energy session being used by the scan.
5. Remember the current energy session name so that you can set it back later.



The image shows a software interface element consisting of a label 'Session:' followed by a rectangular box. Inside the box, the text 'Tc99m' is displayed, and there is a small square icon on the right side of the box, indicating a dropdown menu.

6. Click on the **[Energy Session]** button. This will bring up a pull-down menu with all of the currently defined energy sessions listed. Choose the GE energy session to be modified. The energy session name will change to the name selected and the energy session parameters will change to those of the selected session.
7. Change any of the energy session parameters on the Energy and Isotope sub-cards to the required values. Any new scans that are created that use

this energy session will have the modified energy session parameters.



A screenshot of a software interface showing a label 'Session:' followed by a dropdown menu. The dropdown menu is open, displaying the text 'Tc99m' and a small square icon to its right.

- Use the **[Energy Session]** button to restore the original energy session for the scan.

**Note**

For admin login only: When you are finished modifying your energy sessions, shutdown GENIE Acquisition and then select the option to logout of the administration account. This will take you back to the login screen. Login back in with the genieacq user name to continue using the system normally.

If you login to GENIE Acquisition using the administration login, see [Different Logins on page 10-47](#) for more details on the different logins. Then select the option to start the GENIE Acquisition software.

**To create a new user defined energy session:**

- Click the **Acquisition** card to bring it to the front.
- Check the Templates card is at the front by clicking its tab.
- Choose a scan that is part of a user template that will use the new energy session. Click the scan to select it. The setup cards for the scan will be displayed in the Scan Setup area.
- Click the **Energy** set up card tab to bring it to the front. The Energy card will show the name of the current energy session being used by the scan.
- Remember the current energy session name so that you can set it back later, if desired.



A screenshot of a software interface showing a label 'Session:' followed by a dropdown menu. The dropdown menu is open, displaying the text 'New' and a small square icon to its right. To the right of the dropdown menu are two buttons: 'New' and 'Remove'.

- Click the **[New]** button to the right of the energy session name. A new energy session is created with the name "New".
- Edit the energy session name in the text field to be "Tc99m 10%" or whatever you wish your new energy session to be named. Use the Energy Session button to bring up the pull-down menu listing all of the GE and user defined energy sessions. Select the new energy session.

1	2			
Emission Name	Image	Peak	Width	Offset
	One	122	20	
Transmission Name				
Mask: Outside	Half Life: 271.80		Day	

**Single mode**

1-4	5			
Emission Name	Image	Peak	Width	Offset
	Many	122	20	0
Transmission Name		Lower	Upper	Images
		110	134	4
Mask: None	Half Life: 271.80		Day	

**Many mode**

8. Change the energy set parameters. In the example, the parameters are set so that there is a single energy set with a single energy window of Peak=140, Width=10 and Offset=0. Name the energy set "Tc99m 10%".
9. Use the Energy Session button to restore the original energy session for the scan.

**Note**

For admin logins only: When you are finished creating your energy sessions, shutdown GENIE Acquisition and then select the option to logout of the administration account. This will take you back to the login screen. Login back in with the genieacq user name to continue using the system normally.

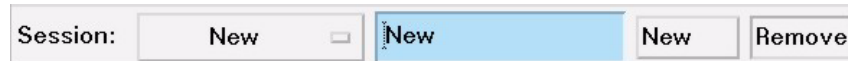
---

## Creating A Multiple Isotope Energy Session

GENIE Acquisition allows you to create energy sessions with more than one isotope.

**To create a new multiple isotope user defined energy session:**

1. Click the **Acquisition** card to bring it to the front.
2. Check the **Templates** card is at the front by clicking its tab.
3. Choose a scan that is part of a user template that will use the new energy session. Click the scan to select it. The setup cards for the scan will be displayed in the Scan Set Up area.
4. Click the **Energy** card to bring it to the front. The **Energy** card will show the name of the current energy session being used by the scan.
5. Remember the current energy session name so that you can set it back later, if desired.



6. Click the **[New]** button to the right of the energy session name. A new energy session is created with the name "New".
7. Edit the energy session name in the text field to be "Tc99m /In111" or whatever you wish your new energy session to be named. Use the Energy Session button to bring up the pull-down menu listing all of the GE and

user defined energy sessions. Select the new energy session.

**Single mode**

**Many mode**

**Note**

Although it is not possible to have predefined menu-selectable energy session names for each set (S1 through S4), you can refer to the settings of known single isotopes and enter the appropriate multiple Peak, Width, and Offset values in each energy set. Energy levels cannot overlap.

8. Change the energy set parameters. In the example, the parameters are set so that there is a double energy set with a double energy window of Peak=140, Width=10 and Offset=0 for set S1 and Peak=171, Width=20, and Offset=0 for set S2. Name the energy session "Tc99m/In111".
9. Use the Energy Session button to restore the original energy session for the scan.

**Note**

For admin logins only: When you are finished creating your energy sessions, shutdown GENIE Acquisition and then select the option to logout of the administration account. This will take you back to the login screen. Login back in with the genieacq user name to continue using the system normally.

---

# Chapter 9 - Accessories

---

## Chapter Overview

This chapter provides a detailed description for the main accessories available with the Millennium MPR/MPS. This includes:

- [Fillable Flood Phantom on page 9-2](#)
- [R-Wave Trigger Unit on page 9-4](#)
- [Brain Tomography Head Holder: 3 Axis Table on page 9-5](#)
- [Other Millennium Accessories on page 9-13](#)

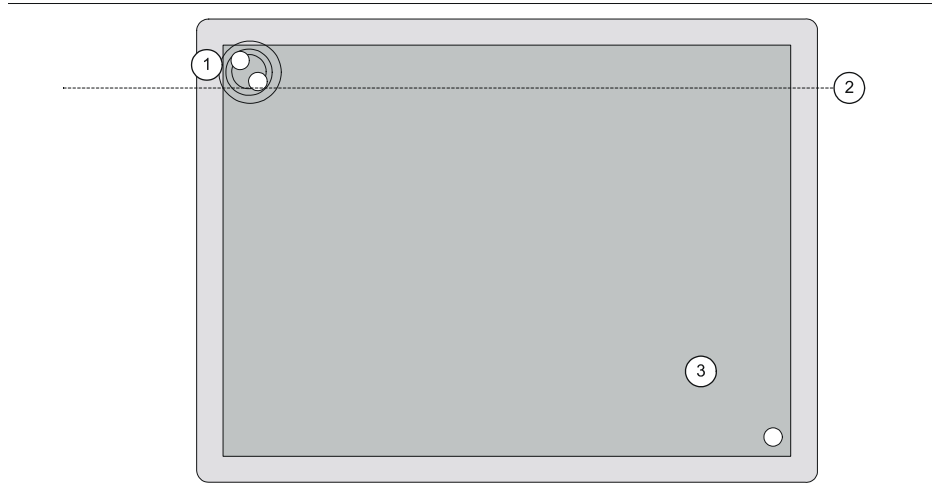
---

## Fillable Flood Phantom

---

### Description

For tests such as flood field uniformity and spatial resolution, a uniform flood source is required. GE provides a refillable source phantom which can be filled with an appropriate liquid radioisotope.



**Figure 9-1.** Fillable Flood Source

**Table 9-1:** Fillable Flood Source Components

No.	Description	Function
1	Filler cap and hole	Seals radioactive source after filling
2	Initial filling level	Refers to proper water level, which allows for adequate fluid mixing.
3	Vent cap and holes	Used to vent air for filling and drain the fluid from the flood.

---

## Filling The Phantom

1. Remove the filler and vent plugs.
2. Fill the phantom with water to approximately 90% of its capacity.
3. Install the vent plug.
4. Add an appropriate isotope to the solution in the phantom (5-10 mCi of  $Tc^{99m}$  is more than sufficient activity).

<b>Note</b>
-------------

Care should be taken when using unsealed radioactive sources.

5. Replace the filler plugs, and rubber "O" rings carefully so that the phantom is properly sealed. Do not over-tighten.
6. Grasp the flood phantom by the edges and rotate it so that the trapped air serves to mix the isotope and carrier solution. Thirty seconds (30 sec.) is sufficient to ensure homogeneity of the mixture.
7. Place the phantom on a flat, horizontal, nearly level surface with the filling fill corner raised a fraction of an inch so as not to trap air.
8. Remove the filler plugs and carefully fill the flood phantom completely. Remove any trapped air by lightly tapping the face of the phantom.
9. Re-install filler plugs in a controlled area and make sure that no leaks are present.
10. If a small bubble remains, raise the filling corner of the phantom by tilting the camera detector about 1/8 to 1/4 inches so the bubble will remain in the side arm of the liquid filled region. The flood is now ready for use.

---

## Emptying The Phantom

1. Place the flood source in a sink appropriate for the disposal of radioactive material, or ensure that all activity has decayed from the flood source.
2. Remove the filler and vent plugs and allow the contents to drain away.

---

## R-Wave Trigger Unit

For complete information on the R-Wave Trigger Unit, refer to the ECG manuals supplied with the ECG Unit:

*ECG + Recorder* (IVY 101R / 2552-00-01) – H2505JT  
*ECG* (IVY 101NR / 2552-01-01) – H2505JS

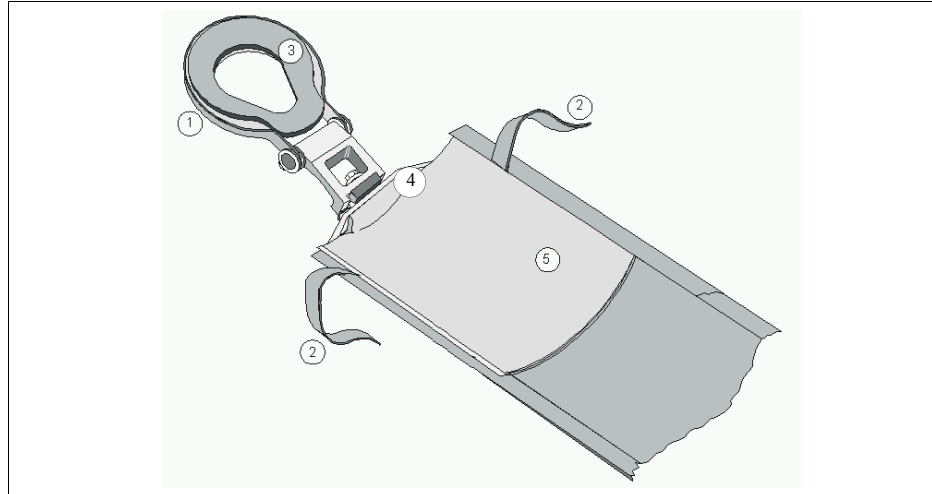
**Or**

*ECG + Recorder* (GE3000MR) – H2505JW  
*ECG* (GE3000MNR) – H2505JY

## Brain Tomography Head Holder: 3 Axis Table

### Description

The Brain Tomography Head Holder is used to support the patient's head in an optimal, stable position during tomographic brain imaging. See [Figure 9-2](#).



**Figure 9-2.** Brain Tomography Head Holder

**Table 9-2:** Brain Tomography Head Holder Components

No.	Description	Function
1	Head Holder	Supports the patient's head.
2	Panel Securing Straps	Secures the head holder to the table.
3	Foam Insert	For patient comfort during imaging.
4	End Bracket	Connects the panel to the head holder.
5	Mounting Panel	Mounts the head holder to the table.

The holder is equipped with a foam insert to maximize patient comfort during this type of imaging. The holder is fully adjustable. This is achieved by loosening the appropriate joints, positioning the patients' head (in the holder) and retightening the nuts.



#### WARNING

The maximum rated load of the brain tomography head holder is 11kg (24 lbs). Do not exceed this load as personal injury and equipment damage can occur.

Collision predict software is unaware of the position of head holder, or other items added to the table. It is the operator's responsibility to define the setup to avoid collision.

---

## Fitting the Head Holder

The procedure for fitting the head holder to the table is as follows:

1. Ensure that the patient table (cradle) is extended at least four inches from its fully retracted position.
2. Loosen the Velcro strap on the mounting panel provided.
3. Slide the panel over the end of the table top, locating the guides on either side of the table.
4. Slide the panel backwards (away from the detector) to the end stop, ensuring that the Velcro strap is looped underneath the table top.
5. The panel securing straps may now be tightened. Check that the head holder end bracket is in contact with the table and the panel securing straps are tight for each patient scanned.

---

## Removing The Head Holder

The procedure for removing the head holder follows:

1. Loosen the panel securing straps beneath the imaging table.
2. Slide the mounting panel forward until the guides are clear of the end of the table.
3. Remove the head holder.

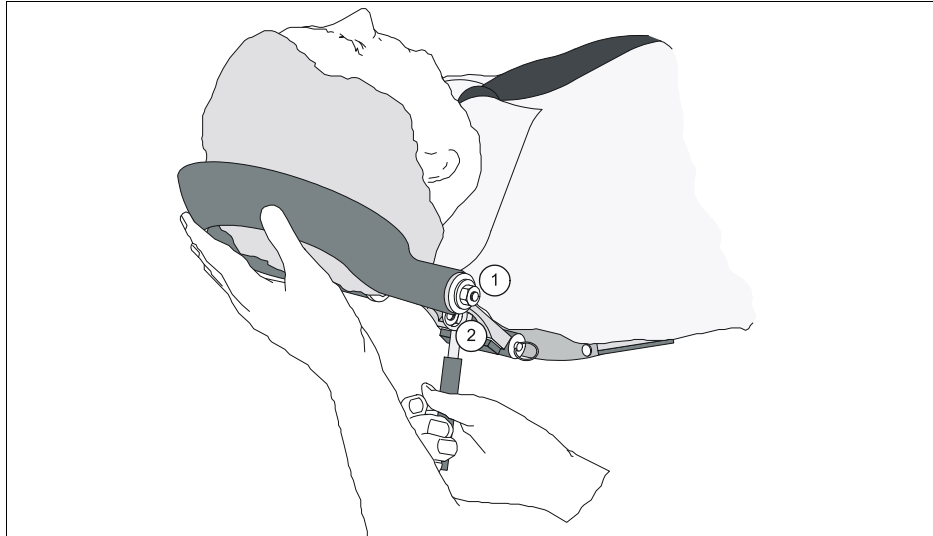


**WARNING**

Failure to follow this procedure may result in patient injury.

## Adjusting The Head Holder

To achieve the required position, the head holder may be adjusted as follows. Refer to [Figure 9-3](#).



**Figure 9-3.** Adjusting the Head Holder

**Table 9-3:** Adjusting the Head Holder Components

No.	Description	Function
1	Adjusting Nut	Adjusts the pivot ring.
2	Adjusting Nut	Adjusts height.

1. Loosen adjusting nut (1) so that you can pivot the ring up and down and also move it in a linear direction.
2. Adjust to the required position and tighten the nut.
3. Loosen nut (2) to adjust the overall height of the head-holder with respect to the table.
4. Adjust to the required position and tighten the nut.
5. Ensure that all nuts are tight before continuing.

Always support the patient's head during adjustment.

There are a range of positions available using the head holder. Two possibilities are shown next.

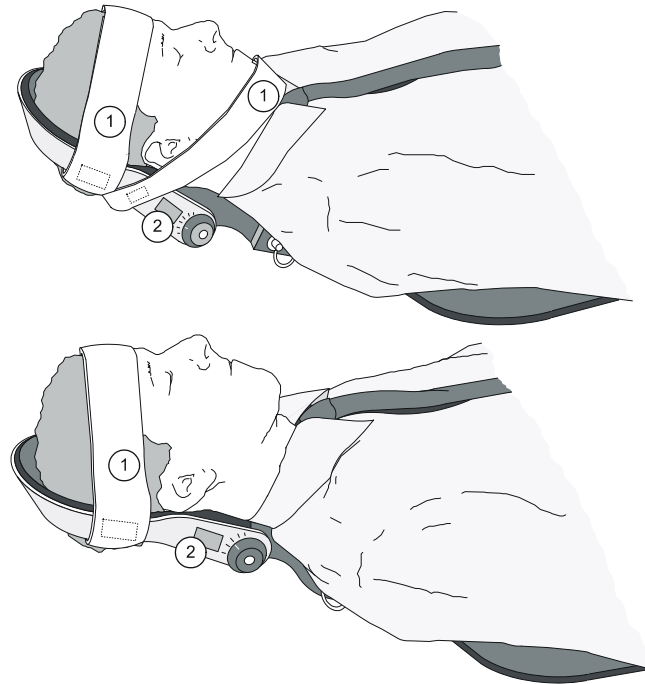
In the first position the head holder is tilted at a sharper angle to tuck in the patient's chin. A second strap should be added as shown. See [Figure 9-4](#).

Adhesive back Velcro pads are supplied. These should be attached to the head holder in the desired positions.



**WARNING**

Do NOT cover the warning label with the Velcro strap on the chin strap.



**Figure 9-4.** Using the Head Holder

**Table 9-4:** Using the Head Holder Components

No.	Description	Function
1	Adhesive Velcro Pads	Supports the patient's head.
2	Warning Label	Rated load 11.3 kg (25 lbs).

---

## Moving The Adjusting Nut

The brain tomography head holder is supplied in its assembled form. However, the adjusting nut may not be in its most convenient position for user access depending on the orientation of the imaging table. If required, the adjusting nut may be transferred to the mirror image position as follows. Refer to [Figure 9-5](#):

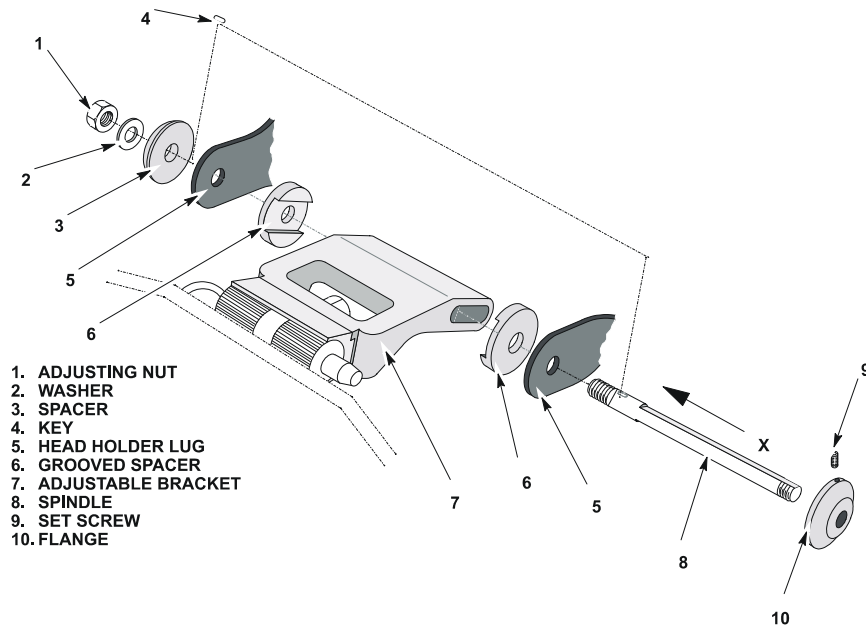
**To move the adjusting nut to the opposite side of the head holder** (refer to [Figure 9-5](#)):

1. Loosen adjusting nut (1), do not completely remove from spindle.
2. Loosen set screw (9) using the Allen key provided, spin flange (10) to remove from spindle.
3. Using adjusting nut (1) as a finger hold pull out spindle (8) completely from the adjustable bracket (7) in the direction of arrow X. Ensure the adjusting nut (1), washer (2), spacer (3) and key (4) are retained with the spindle.
4. Push the spindle (8), complete with items (1), (2), (3) and (4), through from the opposite side of the adjustable bracket (7), aligning the head holder lug (5) and the first grooved spacer (6) with the spindle. Push the spindle through until the end is flush with the side of the adjustable bracket.
5. Align the spindle with the second grooved spacer and the other side of the head holder lug and push through fully.
6. Spin the flange (10) on to the spindle, tighten the set screw (9).
7. Tighten the adjusting nut (1).



### CAUTION

Take care to support the head holder ring and the two grooved spacers (6) as these will be free when the spindle is fully removed.



**Figure 9-5.** Head Holder Adjustment Assembly



**WARNING**

Do NOT attempt to lubricate this assembly.

---

## Brain Tomography Head Holder: Single Axis Table

---

### Fitting the Head Holder

The procedure for fitting the head holder, shown in [Figure 9-6](#), is as follows:

1. Ensure that the patient table is fully extended.
2. Loosen the 4 retaining screws located at the head of the table.
3. Slide the head holder over the retaining screws and tighten the screws to secure the head holder.



**Figure 9-6.** Brain Tomographic Head Holder - Single Axis Table

---

### Removing the Head Holder

The procedure for removing the head holder follows:

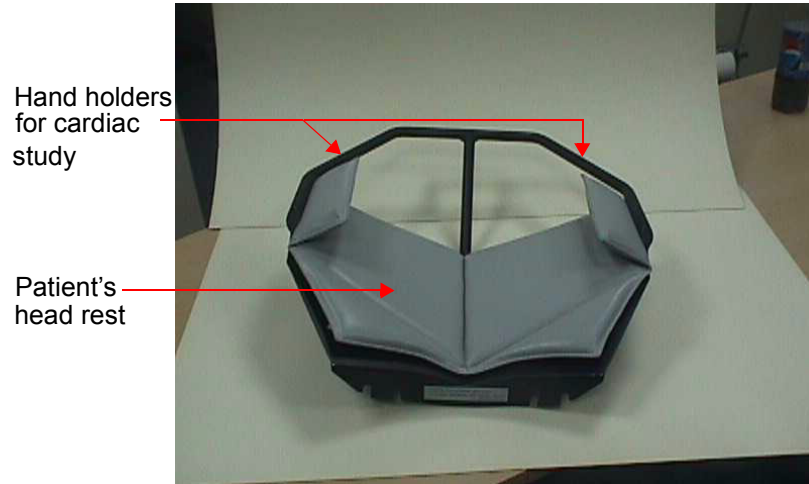
1. Loosen the four retaining screws at the head of the table.
2. Remove the head holder.

---

## Cardiac Tomography Hand Holder: Single Axis table

The procedure for fitting the hand holder, shown in [Figure 9-7](#), is as follows:

1. Ensure that the patient table is fully extended.
2. Loosen the 4 retaining screws located at the head of the table.
3. Slide the hand holder over the retaining screws and tighten the screws to secure the hand holder.



**Figure 9-7.** Cardiac Tomographic Hand Holder

---

## Removing the Hand Holder

The procedure for removing the hand holder is as follows:

1. Loosen the four retaining screws at the head of the table.
2. Remove the hand holder.

## Other Millennium Accessories

**Table 9-5:**

<b>Product</b>	<b>Notes</b>
Additional Millennium Handset	One handset is included in the basic Millennium System.
Mattress Pad – Long	Replacement long mattress pad.
Mattress Pad – Short	Replacement short mattress pad.
IV/Catheter Pole	IV Pole mounts into the accessories holder. Requires an accessories holder, one of which is supplied with the Millennium table. Refer to Chapter 2, for instructions.
Accessories Holder	Replacement or additional, to be used with IV/ Catheter Pole.
Millennium Headholder	Requires mounting panel, E8500JJ.
Patient Straps	Set of two Naugahyde straps with Velcro hook closures. One 3I x 74I, and one 5I x 74I.

The patient straps are used by placing them around the patient and the table top, or only on the patient. The straps may be placed around the table top and remain in place when the top is retracted without damage.



**WARNING**

The patient straps are intended for patient comfort or to reduce patient motion during scanning. They will not prevent the patient from leaving or falling off the table.



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# Chapter 10 - Camera Quality Control and Maintenance

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## Chapter Overview

This chapter contains important information concerning [Camera Quality Control](#) procedures, which need to be performed on a regular basis. In addition, instructions for [Camera Care / Maintenance](#) by user and system administrator is provided. A [Troubleshooting](#) guide is included for quick access reference. A [Backup Procedure](#) is provided to archive critical files required to operate the acquisition system.

The routine maintenance procedures comprise items such as regularly cleaning and disinfecting areas which come into contact with the patient, changing filters on the computer, and cleaning the monitor screens.

Quality assurance procedures to be performed include:

- Evaluating the system performance with flood sources.
- Checking the system resolution with a bar phantom.
- Correcting for system and collimator non-uniformities.
- Checking the center of rotation for tomographic scans.
- Performing camera uniformity analysis.

The procedures which GE Service Representatives will be performing on a regular basis include:

- Obtaining energy corrections.
- Tuning the photomultiplier tubes.

For continued safe performance of this equipment, a preventive maintenance program must be established. GE Medical Systems will be pleased to advise on this.

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# Camera Quality Control

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## Introduction

To maintain confidence that your camera is in good operating condition, a number of quality control procedures should be performed on a regular basis. The quality control chart included with this manual gives an overview of these procedures, their purpose and a how often to perform them. The procedures will indicate the present condition of your camera and may predict coming problems leading to system down situations.

---

## Intrinsic Vs Extrinsic

Flood and bar images may either be taken with the collimator off (intrinsic) or with the collimator on (extrinsic). There are advantages and disadvantages to both methods. The most important consideration is to consistently use the same method so changes can be easily recognized and an acceptable level of performance established.

---

### Intrinsic Floods

- Demonstrates performance of the camera directly without contribution from collimator or source uniformity.
- Uses a small activity source in simple “test tube” geometry.
- Can be used over a large range of source activities.
- Requires a collimator to be removed and source to be held exactly in front of detector at an extended distance.

---

### Extrinsic Floods

- Demonstrates performance of entire imaging system including the collimator and the detector.
- Uses substantial source activity in precise uniform package.
- Source activity is usually preset by available package content.
- Collimator is left on the camera in a patient imaging configuration.
- Measurements through tomo angles can be made by attaching source to camera face.
- Are not recommended because it is of little or no use for resolution because of interaction with the collimator hole matrix.

---

## Daily Floods

---

### Introduction

The “daily flood” is a test of the ability of the gamma camera to produce uniform images. The test is performed by placing a radioactive source in front of the detector and acquiring an image. The resulting image should show a uniform distribution across the entire field of view.

---

### Theory

To show a uniform count distribution across the field of view, it is recommended that 5 million counts be collected in a 256 by 256 matrix for flood images. This matrix size and count is a compromise for the evaluation of image defects with sufficient counts per pixel. As the counts in a flood increase, the resulting image quality improves, permitting more detail to be visualized. To evaluate image quality at the full resolution of this matrix size would require over 30 million counts in the image.

---

### Intrinsic Setup

1. Remove the collimator from the detector.
2. Install the camera protection plates on the detector. This both protects the fragile crystal and provides a collision override to the patient sensor circuit. Locate the plates so that all four latches are in place and the collision circuit override is in place.
3. Move the detector to be faced straight up.
4. Place a Tc99m point source 100 – 300  $\mu\text{Ci}$  (4 – 10 MBq) in the bipod source holder. Alternatively, the source may be carefully positioned at a distance of three meters and centered in the field of view.

### **Extrinsic Setup**

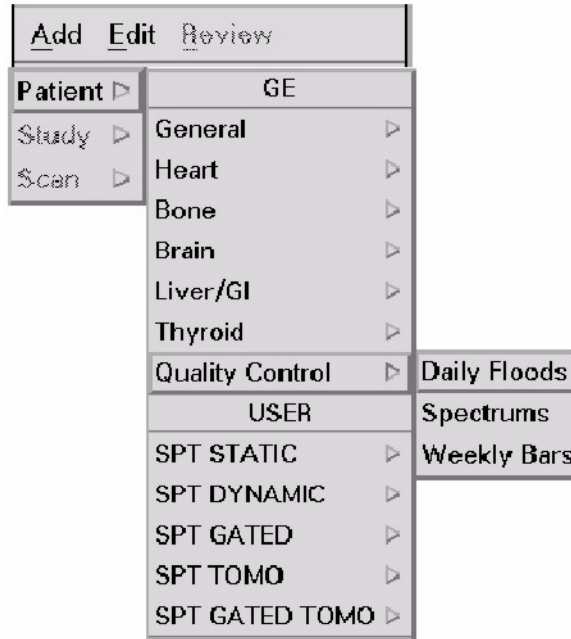
1. Ensure that the collimator which is used most commonly is fitted.
2. Position the detector face up.
3. Place a flat flood source of either  $\text{Co}^{57}$  or  $\text{Tc}^{99\text{m}}$  on top of the detector (the count rate should be between 20 – 50 kc/sec).

<b>Note</b>
-------------

If a uniform source is available that can be used from both sides, then the detector may acquire extrinsic floods at the same time. The source must be located so that the illumination is equal and uniform on the detector.



1. From the Acquisition card, click on Add.
2. Then drag the pointer to patient, then to Quality Control, and finally to Daily Floods.
3. Enter "System QC" (or similar text) for Patient ID and "Quality Control" for Patient Name. The study name will automatically be called Daily Flood.



### Computer Procedure

The following procedure should be done on a daily basis to ensure that the system performance is stable. It is intended to be a visual test and not a quantitative method of assessing uniformity.

1. Set the camera by either the intrinsic or extrinsic method.
2. Select the **Acquisition** card. Make sure the **Locate All** toggle is **ON** so all Patient Studies are displayed.
3. Select the quality control patient by clicking on it.
4. After clicking on **Add**, drag the pointer to **Scan**, then to **Quality Control**, and finally to **Daily Floods**.

A screenshot of a software dialog box for patient selection. It contains four text input fields stacked vertically. The first field is labeled 'Patient ID' and contains the text 'System QC'. The second field is labeled 'Patient Name' and contains 'Quality Control'. The third field is labeled 'Study Name' and contains 'Daily Floods'. The fourth field is highlighted with a thick black border and contains 'Daily Floods'. Below the fields are two buttons: 'OK' and 'Cancel'.

5. It is recommended to edit the dataset file name from Floods to a name that has the current date. To do this, select **Edit** from the **Acquisition** card and drag the pointer to **Scan Info**.
6. In the highlighted type-in field, enter the new name (e.g. F08Aug96).

A screenshot of a software dialog box for scan information. It features a text area at the top containing the text 'System QC', 'Quality Control', and 'Daily Floods' stacked vertically. Below the text area is a label 'STA' and a text input field containing 'F08Aug'. The input field is highlighted with a blue border.

7. Click on the **Energy** tab and verify that the correct radionuclide energy has been selected. Other parameters such as matrix, counts zoom, etc. have been preset (for additional information on how to change these parameters, refer to [Energy Card on page 5-17](#)).

Detector: 1 only

Session: Co57

Emission Name	Peak	Width	Offset	
<input type="text"/>	122	20	0	<input type="button" value="Set 1"/>
Transmission Name	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Set 2"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Set 3"/>
Mask: None <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Set 4"/>

8. Click on the **[Camera On]** button and check that the entire field of view is exposed. Also, the count rate should be 20 – 50 kc/sec.
9. Click on **[Start]**.

## Inspection of Images

Display the just acquired flood on a 4 image format with the flood from the previous day and the most recent reference flood acquired by service. Adjust the window levels to enhance minor image differences. The best windows are typically Upper Level near 70% and Lower Level near 30% of maximum pixel. (See [Window Level Tool on page 6-15.](#))

Floods taken using the gantry source holder will show a slight (?5%) decrease of activity in the corners due to the small distance between the source and the detector. This decrease does not change with time and can be visually compensated for during image comparison.

Compare the images for rapid and dramatic changes in uniformity. Some minor changes are to be expected due to statistical variation and environment changes. Long term variations that impact clinical imaging should also be identified and action taken. It is strongly recommended that a practice be established of regular collection and storage of the daily floods.

---

## System Resolution

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### Introduction

Spatial resolution is measured by using a device called a bar phantom. This is simply a series of lead bars of a given width and thickness, separated by spaces the same width as the bars. Most bar phantoms are known as “4–quadrant” bar phantoms.



#### CAUTION

Handle all phantoms with care. If the phantom is dropped, it may damage the camera and the phantom or injure the operator.

The GE supplied phantom has bars measuring 2.5, 3.0, 3.5 and 4.0 mm respectively.

How clearly the bars appear depends upon the resolution of your system. If over a period of time the images start to become blurred, then it is an indication that the spatial resolution of the system is degrading and you should contact your GE Service representative.

---

### Theory

Spatial resolution refers to the ability of the camera to separately image two objects. If the two objects are seen as a single blurred spot in the image until they are 5mm apart, the spatial resolution is said to be 5mm. It is recommended that 3 million counts are obtained for a bar phantom. Use a 256 matrix for an extrinsic and 512 matrix for an intrinsic setup. To evaluate image quality at full resolution, the flood acquisition would require over 30 million counts in the image, but this is not practical nor required for normal use.

---

### **Intrinsic Setup**

1. Remove the collimator from the detector.
2. Install the camera protection plates on the detector. This both protects the fragile crystal and provides a collision override to the patient sensor circuit. Locate the plates so that all four latches are in place and the collision circuit override is in place.
3. Move the detector to be faced straight up.
4. Place a Tc99m point source 100 – 300  $\mu\text{Ci}$  (4 – 10 MBq) in the bipod source holder. Alternatively, the source may be carefully positioned at a distance of three meters and centered in the field of view.

---

### **Extrinsic Setup**

1. Position the detector with the collimator facing upwards.
2. Place the bar phantom on the collimator.
3. Place a Co<sup>57</sup> sheet source or Tc<sup>99m</sup> fillable phantom on top of the bar phantom (the count rate should be between 20–50 kc/sec).

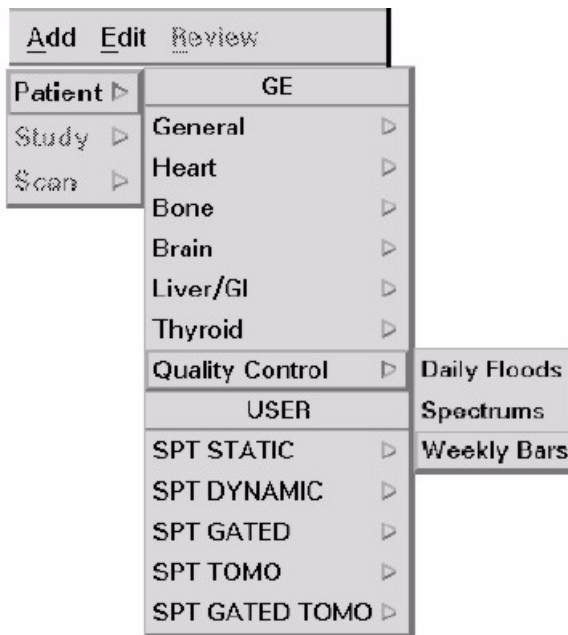
---

## System Resolution Acquisition

### Creating a New Quality Control Patient

With floods there are different ways to use GENIE Acquisition when setting up files for performing system resolution. The following method is just one example. If no quality control patient exists, then it must be created. After it is created, then follow the procedure for system resolution.

1. From the Acquisition card, click on **Add**.
2. Then drag the pointer to **Patient**, then to **Quality Control**, and finally to **Weekly Bars**.
3. Enter "**System QC**" (or similar text) for Patient ID and "**Quality Control**" for Patient Name. The study name will automatically be called Weekly Bars.

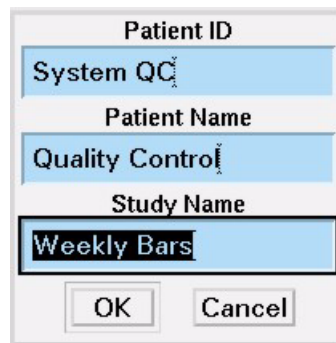


---

### Computer Procedure

The following procedure should be performed weekly.

1. Setup the camera by either intrinsic or extrinsic method.
2. Select the **Acquisition** card. Make sure the **Locate All** toggle is **ON** so all patient studies are displayed.
3. Select the quality control patient by clicking on it.
4. After clicking on **Add**, drag the pointer to **Scan**, then to **Quality Control**, and finally to **Weekly Bars**.



5. It is recommended to edit the dataset file name to a name that has the current date. To do this, select **Edit** from the **Acquisition** card and drag the pointer to **Scan Info**.
6. In the highlighted type-in field, enter the new name (e.g., B08Aug).



7. Click on the **Energy** tab and verify that the correct radionuclide energy has been selected. Other parameters such as matrix, counts zoom, etc. have been preset. For the intrinsic setup, the matrix of 512 is the default. For the extrinsic setup, the matrix should be changed to 256 (for additional information on how to change these parameters, refer to [Energy Card on page 5-17](#)).

Emission Name	Peak	Width	Offset
	122	20	0
Transmission Name			
Mask: None			

8. Click on the **[Camera On]** button and check that the entire field of view is exposed. Also, the count rate should be 20 – 50 kc/sec.
9. Click on **[Start]**.

### Inspection of Images

After completion of the acquisition, review the results. It is good practice to compare the results with previous bar phantom images for variations in image quality. Display the just acquired bar phantom image on a 4 image format with the image from the previous check and the most recent reference image. Adjust the window levels to enhance minor image differences. The best windows are typically Upper Level near 70% and Lower Level near 30% of maximum pixel. (See [Pan and Zoom on page 6-12.](#))

Compare the images for rapid and dramatic changes in uniformity or resolution. Some minor changes are to be expected due to statistical variation and environment changes. Long term variations that impact clinical imaging should also be identified and action taken. It is strongly recommended that a practice be established of regular collection and storage of the bar phantom images.

---

## Center Of Rotation (COR)

---

### Introduction

It is recommended that you acquire a center of rotation correction for each collimator. The COR should be done on each collimator that you intend to use for tomography. There is no check for this performance separate from a recalibration. The **[Quit]** button allows the operator to terminate without saving the new correction.

The recommended frequency of the test is monthly for a site with frequent tomographic usage. A check should also be made when the collimator alignment or gantry motion is questioned.

GENIE Acquisition automatically associates the correction with your selected collimator and detector. It is a good practice to name the correction (at the end of this procedure) after the collimator so the acquisition templates don't have to be changed when you update the correction.

You may use the **[Reset]** button (when it appears) to start the procedure over, in order to change parameter settings.

---

### Theory

To reconstruct tomographic images, it is essential that the multiple views be accurately back projected to the location of origin. Rather than require perfection of mechanical motion, a method is provided to calibrate the projection location based on observed image location. This calibration is referred to as COR correction.

The mm COR value is the difference in millimeters from the measured COR and the theoretical COR. If this value is accepted, it is stored in all subsequent acquisitions and is used in reconstructing the acquired data. Upon completion of the COR procedure, the computer generates the following results (expressed in millimeters):

<b>COR</b>	The X center of rotation correction used in tomographic reconstruction.
<b>COR Variation</b>	The difference between the maximum and minimum amplitudes of the X variation curve.
<b>Y Variation</b>	The difference between the maximum and minimum amplitudes of the Y variation curve.
<b>Mean Y Position</b>	Actual Y position of the point source as positioned by the user, which provides feedback in the setup consistency.

## COR Acquisition and Analysis

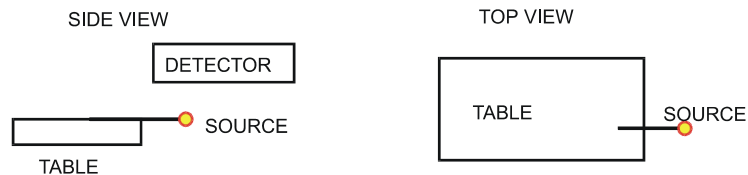
The COR test procedure is used to verify the integrity of the motion of the gantry during tomographic acquisition.

The following section describes the procedure to acquire center of rotation. Each detector is acquired separately.

1. Install the collimator you intend to use on the detector (LEGP LEHR, LEHS etc.).
2. Click on the **[Gantry]** icon to open a selection of positioning functions.



3. Select **Table/Gantry to Home** and click on **[OK]**.
4. The table lateral position should be at 0 mm and the table height should be near 800 mm.
5. Set the radius with the handheld controller to 230 mm.
6. Suspend a  $Tc^{99m}$  point source of approximately 1 mCi (40 MBq) off the end of the cradle. The point source should be as small as possible in volume.



**Figure 10-2.** Setting up the Point Source

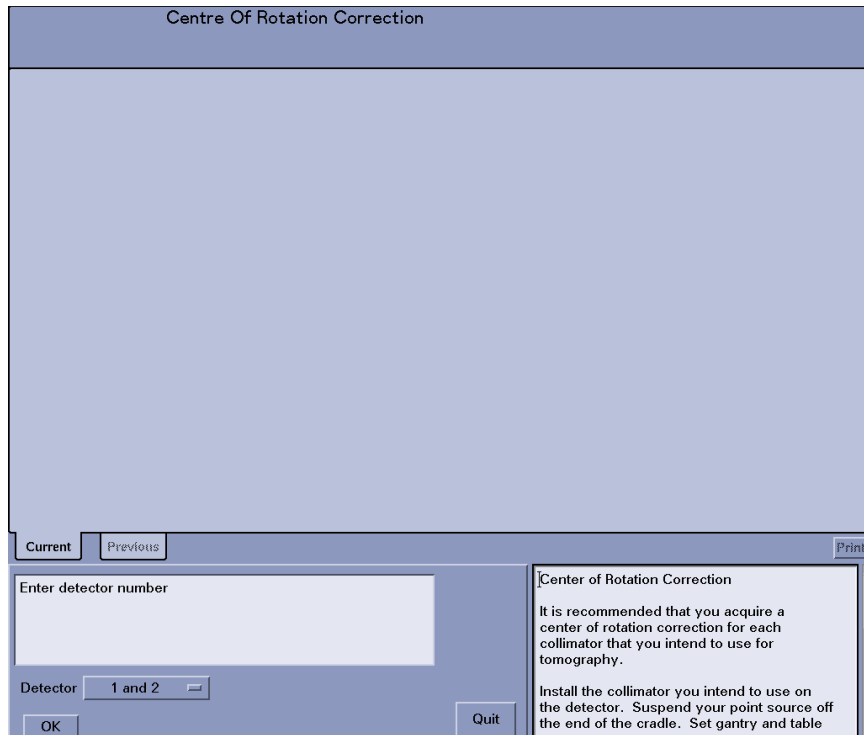
7. Position the source so that it is approximately in the center of the FOV in the Y-direction and a few centimeters off axis in the X-direction.

**Note**

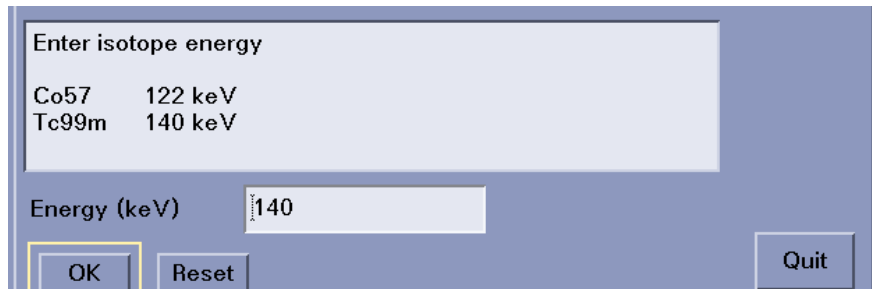
When the detector is rotated, the image of the source should move back and fourth in the X-direction and remain in the center FOV of the Y-direction.

8. Open the **Quality Control** card of the GENIE Acquisition system.

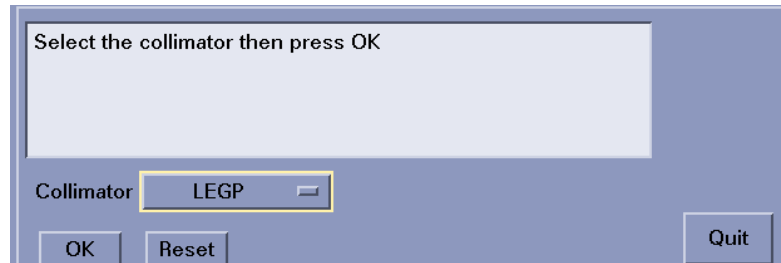
- Click the **COR** Button on the **Quality Control Card**.  
The following screen is displayed.



- Type in the detector number and click the **[OK]** button. The COR must be performed on each detector on the MPR/MPS system.  
The following screen is displayed:



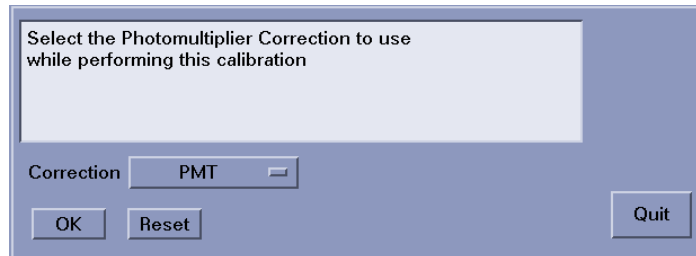
11. Type in the energy peak of the source and click the **[OK]** button.  
The following screen is displayed:



Select the collimator then press OK

Collimator

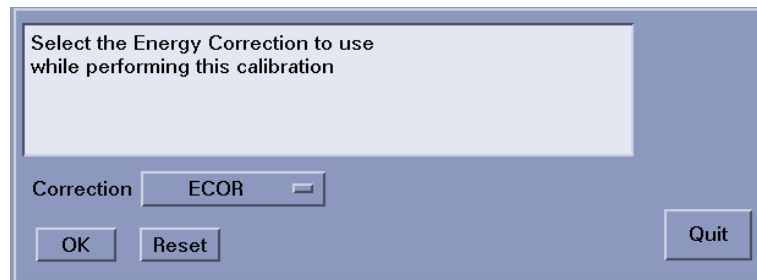
12. Click the **Collimator** pull-down menu and select the collimator used then click the **[OK]** button.  
The following screen is displayed:



Select the Photomultiplier Correction to use while performing this calibration

Correction

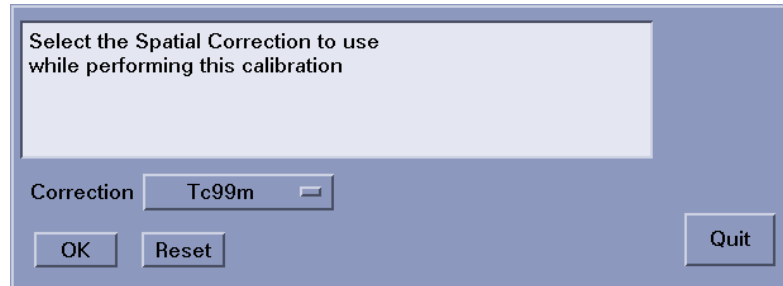
13. Click the **Correction** pull-down menu and select the appropriate tuning file then click the **[OK]** button. **PMT** is the default.  
The following screen is displayed:



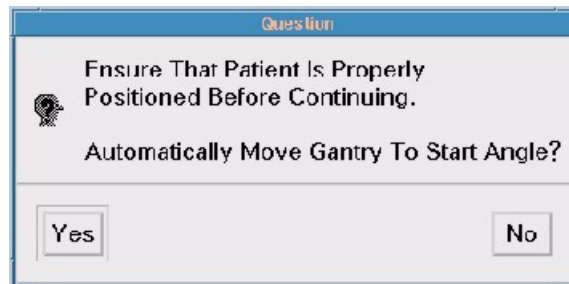
Select the Energy Correction to use while performing this calibration

Correction

- Click the **Correction** pull down menu and select the appropriate energy correction file then click the **[OK]** button. **ECOR** is the default.  
The following screen is displayed:

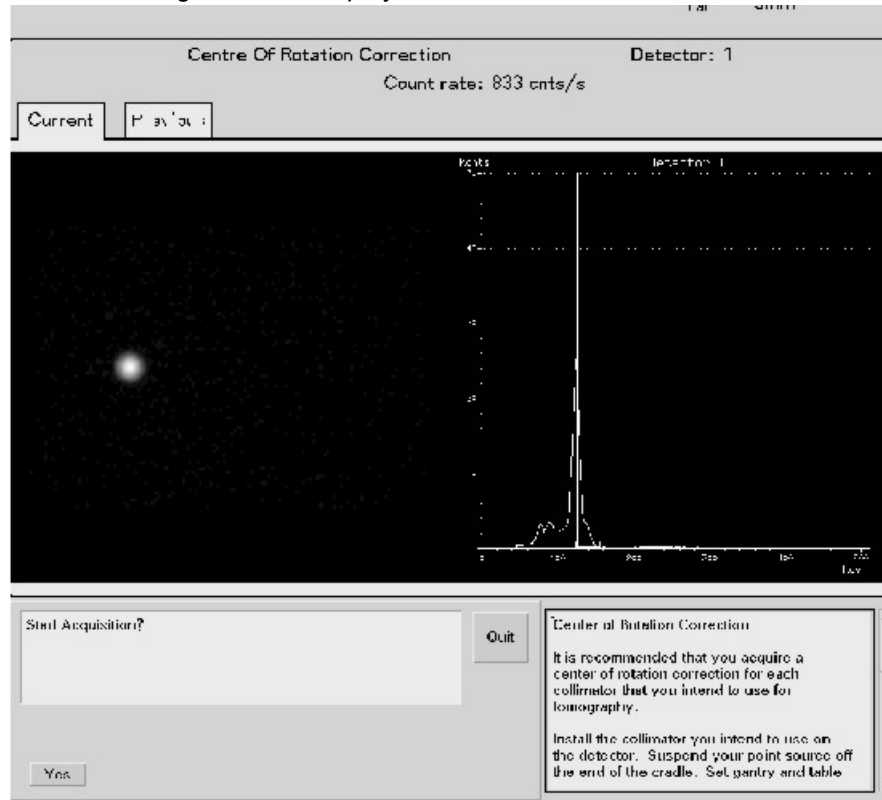


- Click the **Correction** pull-down menu and select the appropriate spatial correction file then click the **[OK]** button. **Tc99m** is the default.  
The following message is displayed over the screen:



- Click the **[Yes]** button to have the detector angle set to the proper starting position.

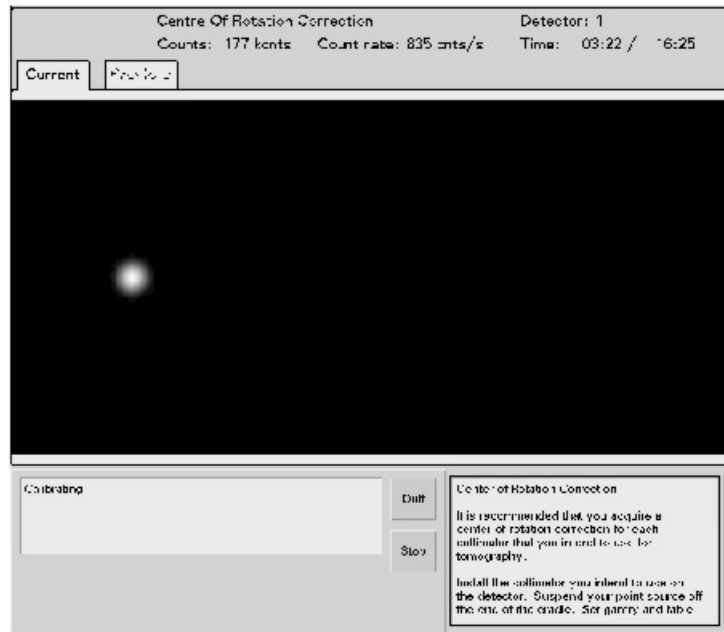
The following screen is displayed:



The above example shows an unacceptable spectrum.

**17.** Click the [Yes] button to start the acquisition.

The following screen is displayed:

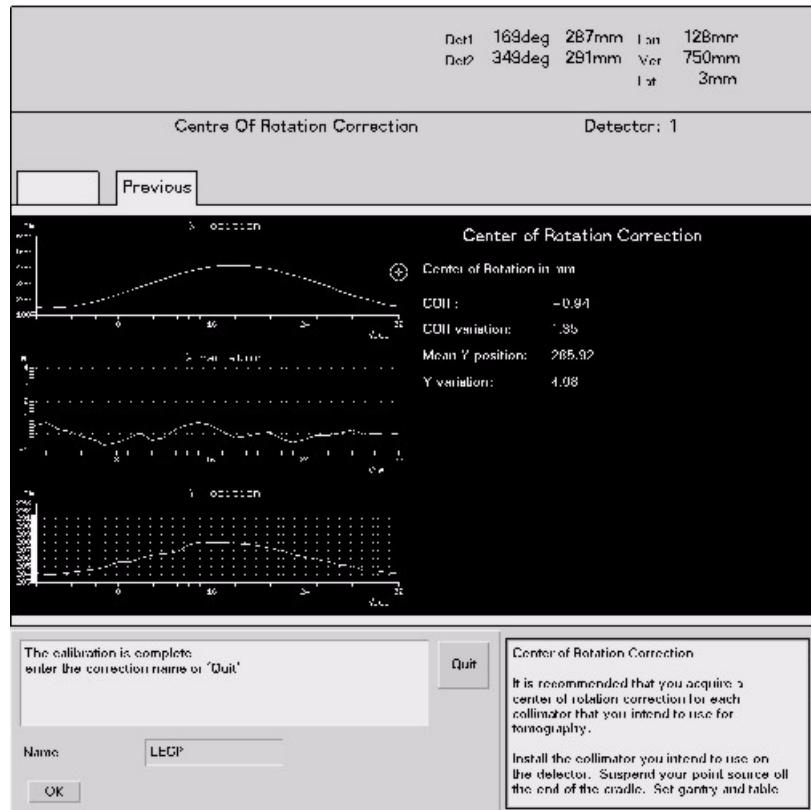


18. The system will now acquire the 32 frames of data required to calculate the COR value.

**Note**

The source should appear as a single clear point in each view. If it does not, a problem exists with either the source itself or the detector. The problem must be corrected prior to proceeding with the calibration.

When the 32 frame tomographic acquisition is complete, the following screen is displayed:



The above example shows a Y COR failure.

**Note**

Press the **[Quit]** button to terminate the calibration without saving the new correction. This termination would be appropriate whenever the results are not as expected or if only a check is intended.

19. Verify that the absolute X COR value displayed is less than or equal to 5 mm.
  - a. If the absolute X COR value is less than or equal to 5 mm, then enter the collimator name (LEGP, LEHR) for the correction name and click the **[OK]** button.

**Note**

If anything other than the collimator name is entered for the correction file, each prescription template will need to be changed when the correction file is changed. Therefore just use the collimator name.

- b.** If the absolute X COR value is greater than 5 mm, click the **[Quit]** button. The reason for the deviation will need to be investigated and corrected. COR will then need to be repeated. If the COR value continues to be greater than 5 mm, call GE Service.
- 20.** The X COR variation and Y variation should both be less than 4 mm. If the value is greater than 4 mm, contact GE service.
- 21.** Repeat the COR calibration for detector 2.

---

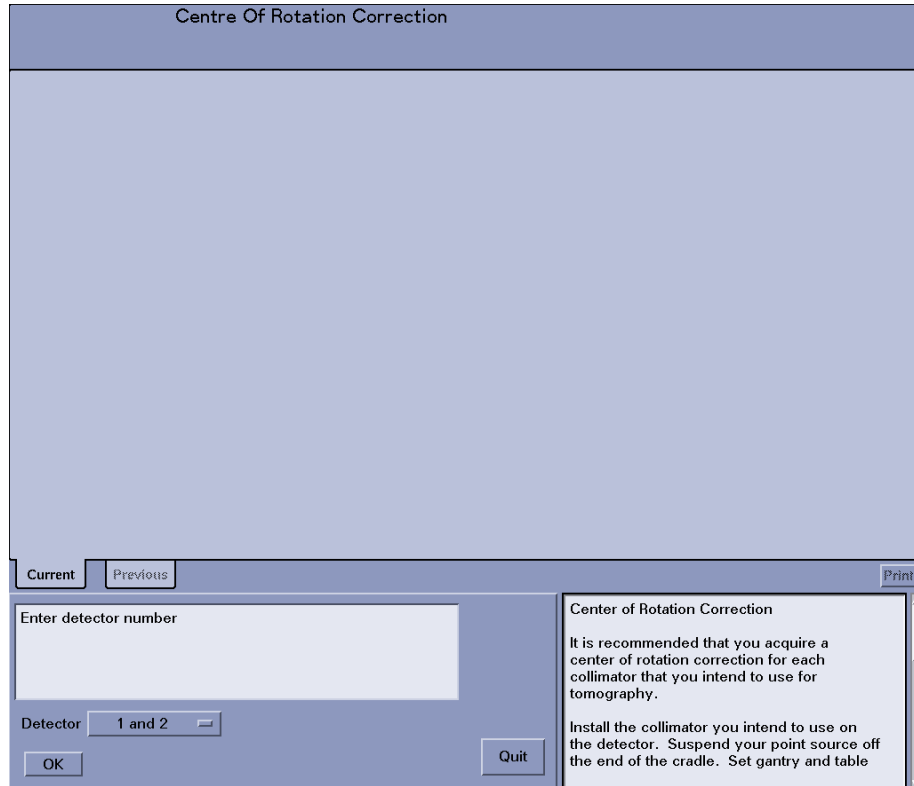
## Image Evaluation

Using Genie P&R or Einstein, the tomographic views can be reconstructed into reconstructed slices. These slices may be reviewed to confirm the validity of the COR corrections.

Examine images in transaxial and sagittal directions. Observe for distortions of known image shapes. Defects may be observed as double spots, rim signs or horseshoe shaped structures. Ignore any rays in background noise. Compare these images to other images taken at time of last update. If defects are found, repeat the procedure before calling a service representative.

### On-line User Help

The COR screen has an on-line user help display area in the lower right hand corner. the illustration below shows where it is.



**Figure 10-3.** COR On-line User Help

The on-line help contains the following text:

#### Center of Rotation Correction

It is recommended that you acquire a center of rotation correction for each collimator that you intend to use for tomography.

Install the collimator you intend to use on the detector. Suspend your point source off the end of the cradle. Set gantry and table to the Home position. Advance the cradle so the source is entirely into the field of view of the selected detector.

GENIE Acquisition automatically associates the correction with your selected collimator and detector. It is a good practice to name the correction (at the end of this procedure) after the collimator so the acquisition templates don't have to be changed when you update the correction.

You may use the Quit button to stop at any time. This will take you completely out of the uniformity flood acquisition procedure.

You may use the Reset button (when it appears) to start the procedure over, in order to change parameter settings.

---

## Uniformity Corrections

---

### Introduction

Part of tomographic imaging involves reconstructing the planar data which is acquired around the patient. This reconstruction process makes the assumption that the detector is uniformly sensitive; that is, it detects the same amount of gamma photons everywhere within the field of view under a uniform flood.

However, few things in life are perfect and the crystal and collimator are no exception. In practice, there are always small variation in sensitivity and these are amplified greatly in reconstruction, giving rise to ring artifacts.

---

### Theory

To overcome non–uniformity artifacts, a correction is applied to the tomographic data. The correction factors are calculated from an acquired uniformity flood source file using the same collimators as the tomographic data. Each time a reconstruction is done, this correction file is referenced to give the optimum results without artifacts.

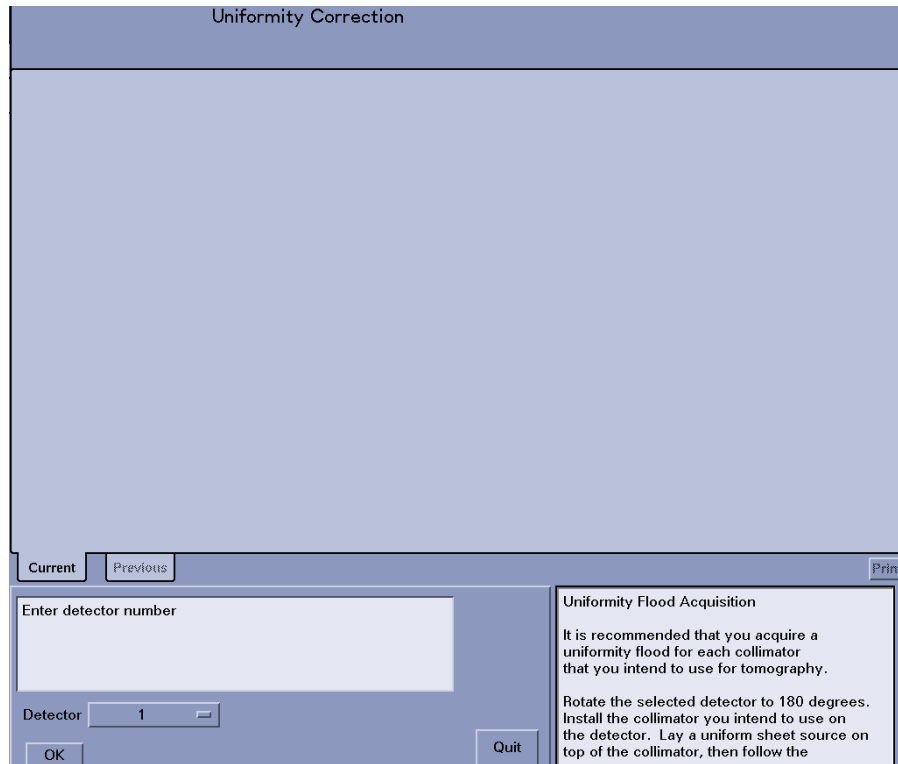
---

### Acquiring Uniformity Correction

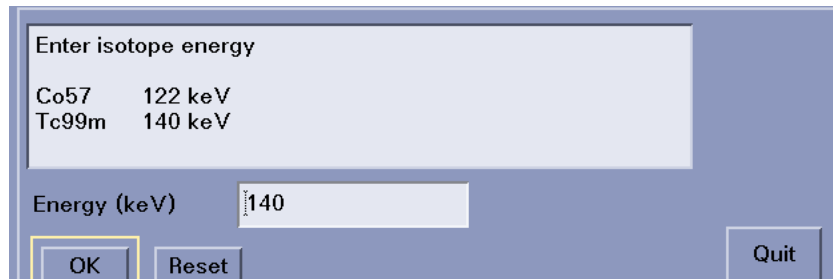
The following section describes the procedure to acquire a collimator uniformity correction flood. It should be repeated for each collimator which you expect to use for tomographic studies. The correction floods should be repeated at monthly intervals.

1. Ensure that the collimator used for tomography is fitted; for example, the Low Energy High Resolution (LEHR).
2. Position the detector such that the collimator to be acquired is face up. The detector to be acquired is rotated to 180° to achieve this position.
3. Place a flat flood source of either Co<sup>57</sup> or Tc<sup>99m</sup> on top of the detector.
4. Open the **Quality Control** card of the GENIE Acquisition system.
5. Click on the [**Uniformity**] button on the **Quality Control** card.

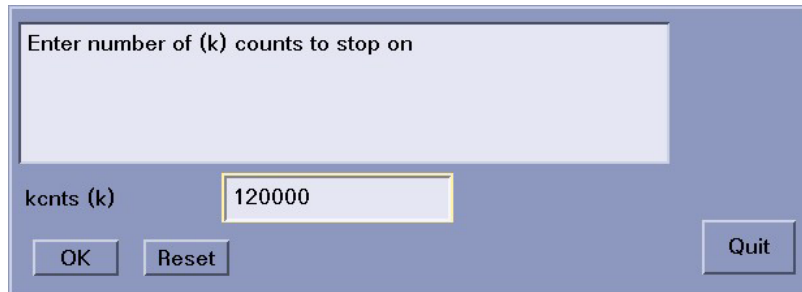
The following screen is displayed:



6. Type in the detector number and click the **[OK]** button.  
The following screen is displayed:



7. Type in the energy peak of the source and click the **[OK]** button.  
The following screen is displayed:



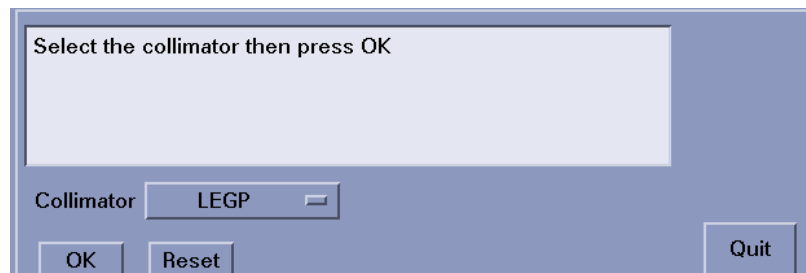
Enter number of (k) counts to stop on

kcnts (k)

8. Change the number of kcnts (from the default of 30,000) to **120,000** and click the **[OK]** button.

**Note**

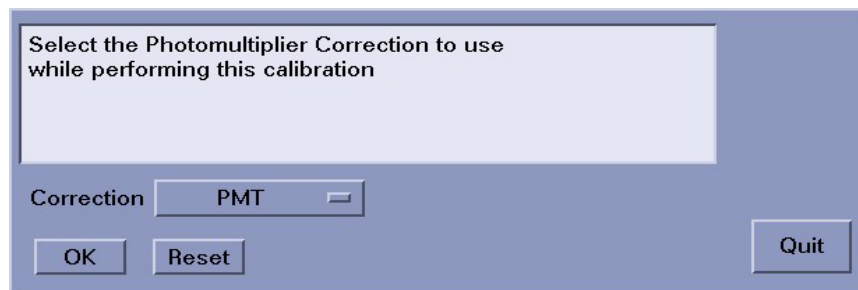
For best quality tomographic images, it is recommended to acquire 120,000 (k) counts for each uniformity correction map.



Select the collimator then press OK

Collimator

9. Click the **Collimator** pull-down menu and select the collimator used then click the **[OK]** button.  
The following screen is displayed:

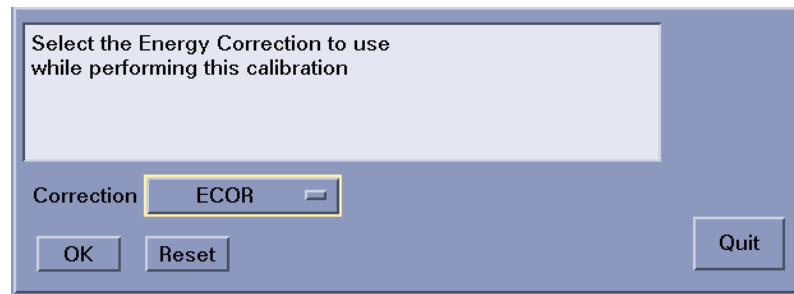


Select the Photomultiplier Correction to use while performing this calibration

Correction

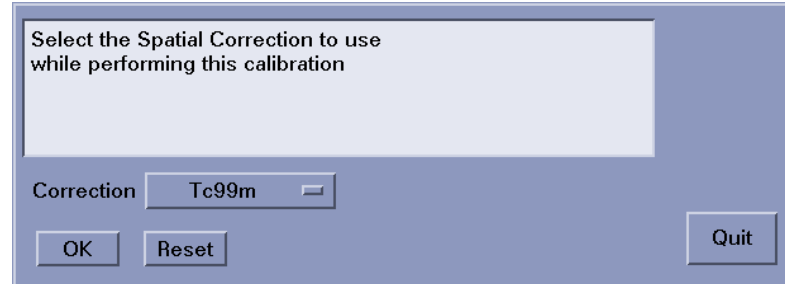
10. Click the **Correction** pull-down menu and select the appropriate tuning file then click the **[OK]** button.

The following screen is displayed:



11. Click the **Correction** pull-down menu and select the appropriate energy correction file then click the **[OK]** button.

The following screen is displayed:



12. Click the **Correction** pull-down menu and select the appropriate spatial correction file then click the **[OK]** button.

The following message is displayed over the screen:

11 Nov 04 15:54:18

Det1 0deg 279mm  
Det2 180deg 279mm Ver 735mm  
Lat -0mm

Uniformity Correction

Detector: 1  
Count rate: 5.11 knts/s

Display:  Image  Energy

Current Previous Print

Start Acquisition

Start  
Clear  
Quit

Uniformity Flood Acquisition

It is recommended that you acquire a uniformity flood for each collimator that you intend to use for tomography.

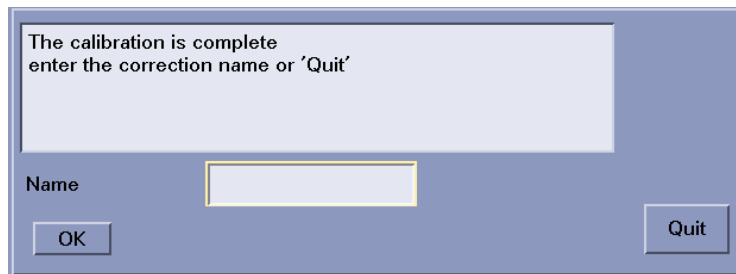
Rotate the selected detector to 180 degrees. Install the collimator you intend to use on the detector. Lay a uniform sheet source on top of the collimator, then follow the

13. Click the [Yes] button to start the acquisition.

When the acquisition is complete, the following screen is displayed:



When the calibration is complete, the following screen is displayed:



14. Enter the collimator name (LEGP, LEHR) for the correction name and click the [OK] button.

**Note**

If anything other than the collimator name is entered for the correction file, each prescription template will need to be changed when the correction file is changed. Therefore, just use the collimator name.

15. Repeat the procedure for the second detector.

---

## Image Evaluation

Examine reconstructed tomographic data for artifacts such as circles, horseshoe shaped structures or smooth curved artifacts of image structures. Images of large uniform objects will be most sensitive to these artifacts. Compare these images to other images taken at time of last update.

If defects are found, repeat the procedure before calling a service representative.

---

## On-line User Help

The Uniformity screen has an on-line user help display area in the lower right hand corner. The on-line help contains the following text:

### Uniformity Flood Acquisition

It is recommended that you acquire a uniformity flood for each collimator that you intend to use for tomography.

Rotate the selected detector to 180 degrees. Install the collimator you intend to use on the detector. Lay a uniform sheet source on top of the collimator, then follow the directions to the left.

GENIE Acquisition automatically associates the flood with your selected collimator and detector. It is a good practice to name the flood (at the end of this procedure) after the collimator to make it easy to identify after the data have been sent to GENIE or StarCam. GENIE will expect the two floods used for a dual detector acquisition to have the same name, for example, both detector 1 and detector 2 might have uniformity floods named "LEGP". In addition, the prescription templates will not need to be changed when the floods are updated.

You may use the Quit button to stop at any time. This will take you completely out of the uniformity flood acquisition procedure.

You may use the Reset button (when it appears) to start the procedure over, in order to change parameter settings.

---

## Camera Uniformity Analysis (CUA)

Camera uniformity analysis is a test of the ability of the gamma camera to produce uniform images. The test is performed by placing a radioactive source in front of the detector and acquiring an image. The resulting image should show a uniform distribution across the entire field of view.

CUA images may also be acquired without removing the collimator from the detector.

When the CUA image is acquired without a collimator (intrinsic setup) the provided bipod is used for data collection to assure consistency of source placement.

When the CUA image is acquired with collimators on (extrinsic setup), a flood source should be placed on the collimator.

The recommended frequency of the test is weekly. A check should also be made when the system has been powered down for extended periods. You may use the Quit button to stop at any time. This will take you completely out of the CUA acquisition procedure. You may use the Reset button (when it appears) to start the procedure over, in order to change parameter settings.

It is recommended that a consistent method of CUA acquisition is maintained so that the same isotope, number of detector, collimator and uniformity setting is used for all measurements. This gives the best trend information for the system.

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## Theory

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### CUA Trend Data

Any CUA performed on the system whose results were saved may be retrieved from the database for display. The two CUA Selection Buttons provide a means to move forward or backward in time and browse previous CUA data. The selected CUA is indicated by the gray cursor placed over the trend curves (this cursor may not be placed to the far right of the curves since that point is the "most recent CUA", displayed automatically in the display area on the left).

The maximum number of data points that may be saved to the database is configurable and is currently set to 60. This is intended to allow a maximum of one year's worth of weekly CUAs to be available instantly for review and comparison. A 'rolling history' is maintained, such that prior to saving the results from the 61st CUA, the results from the 1st CUA are deleted.

The system maintains a sperate CUA trend per-energy session. The user interface displays the trend data and the CUA images.

---

## CUA Images

Two images may be displayed for each CUA data point: the Raw and the Threshold image; each may be selected via radio buttons at the bottom of each display area.

The **Raw Image** is obtained by masking, squeezing and filtering the acquired image and applying the uniformity correction which was selected during CUA setup (the operator can choose not to apply uniformity correction).

The **Threshold Image** depicts the degree of non-uniformity in the raw image. It indicates where in the raw image non-uniformities exist. The value of any pixel in the threshold image will be one of only three possible values: The CFOV mean pixel value, one-half the CFOV mean pixel value or 0.

Any pixel in the Raw Image whose value is within half of the integral acceptance limit of the CFOV mean is set to the CFOV mean. Any pixel whose value is between half of the Integral acceptance limit of the CFOV mean and 10% of the CFOV mean (either above or below) is set to one-half the CFOV mean value. Any pixel in the Raw Image whose value is beyond 10% of the CFOV mean value is set to 0. Therefore a Threshold Image created from a perfectly uniform Raw Image will be completely white (all pixels are set the CFOV mean). Areas, which deviate from the mean are easily identifiable as they will appear darker than the rest of the image.

Note that the Threshold image shows where non-uniformities exist, while the text data presented in the results summary indicates the distribution of pixels whose values are not near the mean. Consequently the number of pixels in the Threshold image whose values are outside the mean (hence darker) may not equal the total number of pixels outside the mean as listed in the text results summary. This is because the results summary is intended to indicate the distribution of pixels outside the mean, so any pixel which is beyond 10% of the mean will also be counted as beyond half of the integral acceptance limit of the CFOV mean of the mean.

The CUA program provides two uniformity values, integral uniformity and differential uniformity. These values are provided for the CFOV and FFOV (see Acceptance Criteria below for satisfactory results). Both uniformity values are based on the following formula:

$$\pm \frac{MAX - MIN}{MAX + MIN} \times 100 \%$$

MAX is the maximum count value and MIN is the minimum count value. Where as the internal values is determined over the entire defined field of view (such as CFOV), the differential is based upon the largest count variation of the five adjacent pixels in a row or column. All CUA images may be window leveled via the mouse in the same way as in detector display areas on the Acquisition tab. (See Window Level/Color Map Popup Menu). Each image type (Raw and Threshold) is window leveled as a pair in order to simplify comparisons between them.

The Acquired Images from CUA acquisitions, can be viewed from the Quality Control card or by selecting them from the Patient Selector (patient name "Corrections and NEMA", study name "cua", image size 512x512) and adding them to the Review Card.

---

### Acceptance Criteria

Once the CUA data has been acquired and processed, a Results Summary is posted. This summary is based on acceptance criteria which determine whether the CUA results are either satisfactory or unsatisfactory. The acceptance criteria represents the maximum degree of non-uniformity with the CFOV which will still yield acceptable camera performance. Acceptance criteria is determined empirically for the specific detector in the system, and is shown as a red horizontal line on each trend graph. Both the integral and differential CFOV uniformity must be below the red horizontal line (FFOV values don't apply).

	CFOV	FFOV
Integral	7.5	8.5
Differential	5.5	6.5

---

**Procedure**

Perform the CUA as follows:

---

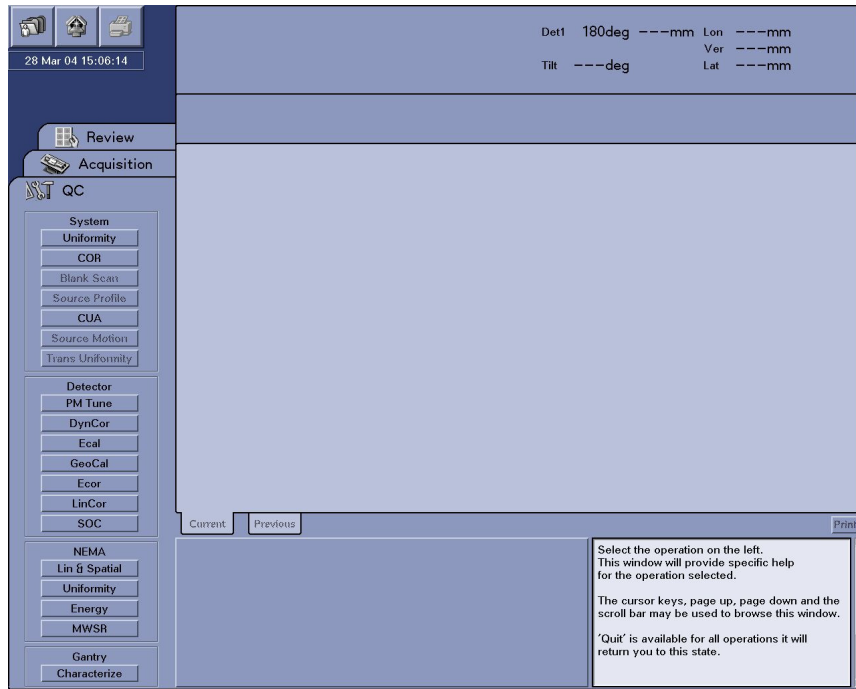
**Intrinsic Setup**

1. Remove the collimators from the detector.
2. Select HOME position from the preprogrammed move options on the acquisition computer.
3. Press the collision override button on the detector and click “**Yes**” on the operator interface to move to the HOME position.
4. Move the detector to be acquired to the 180 degree position so it is facing straight up.
5. Place a Tc99m point source 100 – 300 Ci (4 – 10 MBq) in the source holder on top of the gantry using the bipod setup on page 1–4.
6. Remove the collimators from the detectors and select “**No Collimator**” option.

**CAUTION**

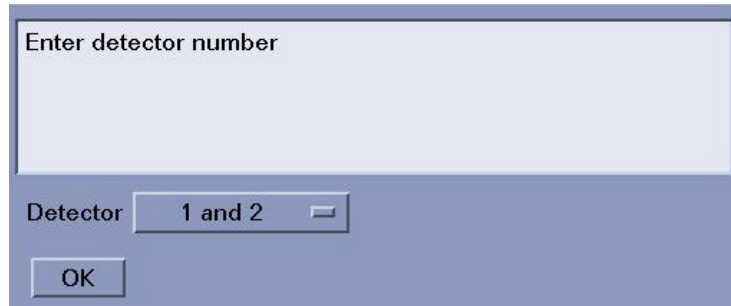
Remember to use the provided plastic plates whenever the collimators are removed to prevent accidental crystal damage.

- Open the **Quality Control** card of the GENIE Acquisition system.

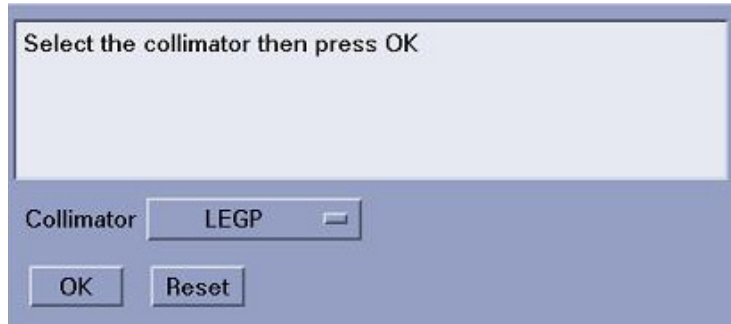


**Figure 10-4.** Quality Control Card

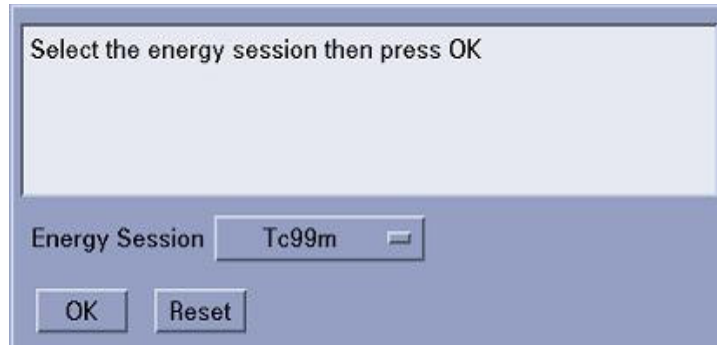
- Click the [**CUA**] Button on the Quality Control card. The following screen is displayed.



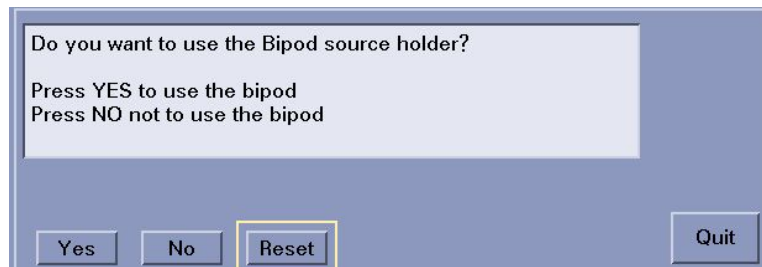
9. Select the detector number 1 and click **[OK]**  
The following screen is displayed:



10. Select '**No Collimator**' and click **[OK]** .  
The following screen is displayed:



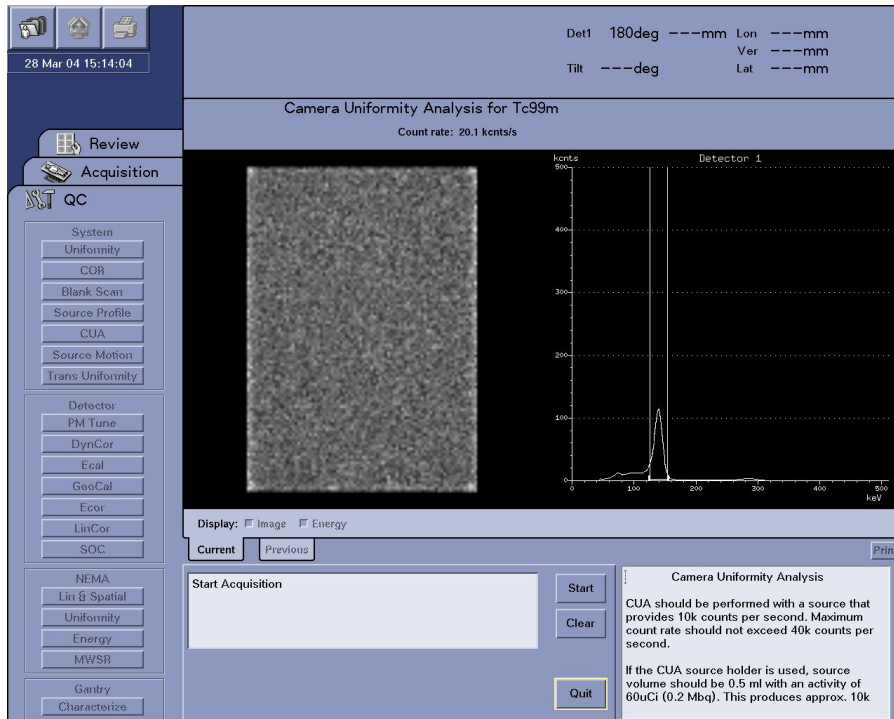
11. Select the energy session and click **[OK]**.  
The following screen is displayed:



12. Click **[Yes]** to use the bipod.

**Note** If **[No]** is selected, the source must be placed five times full field of view (FFOV) from the detector. The specific distance is automatically calculated for the current detector and viewable in the on-line help.

The following screen is displayed:

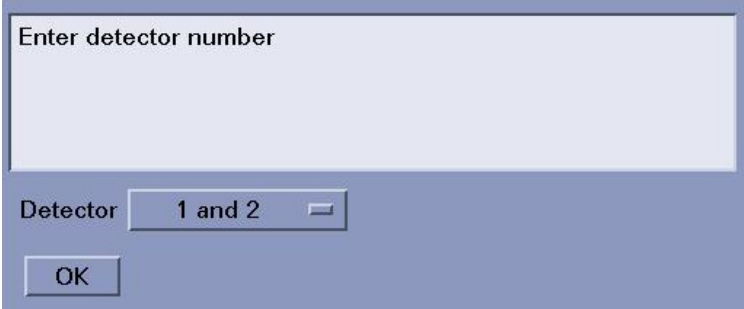


---

## Extrinsic Setup

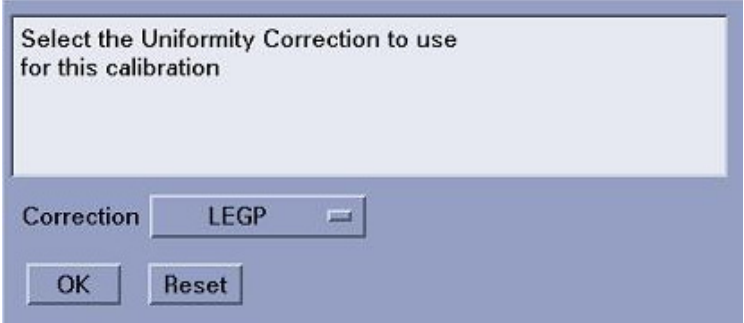
The extrinsic setup enables CUA image acquisition without removing the collimator from the detector. The acquisition can be performed for two detectors simultaneously as well as one detector at a time. The CUA analysis can be performed either on a uniformity corrected image or a non-corrected image

1. Move the detectors to home position (H mode in 180 degree position).
2. Place a flood source 100 – 300 microCi (4 – 10 MBq) (normally Co57) on the collimator so that its surface is parallel to the collimators surface.



The screenshot shows a dialog box with a light blue background. At the top, there is a text input field containing the text "Enter detector number". Below this field, there is a label "Detector" followed by a dropdown menu showing "1 and 2" and a small downward arrow. At the bottom left of the dialog, there is an "OK" button.

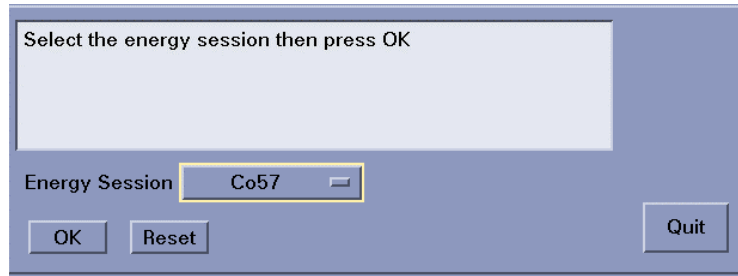
3. Select the collimator type and click [OK].  
The following screen is displayed:



The screenshot shows a dialog box with a light blue background. At the top, there is a text input field containing the text "Select the Uniformity Correction to use for this calibration". Below this field, there is a label "Correction" followed by a dropdown menu showing "LEGP" and a small downward arrow. At the bottom left of the dialog, there are two buttons: "OK" and "Reset".

A list of uniformity corrections acquired for the selected collimator and 'No correction' option are displayed. If a uniformity correction map was selected, the acquired data is corrected using the selected uniformity correction before the uniformity analysis is performed. You can also select 'No Correction' if you want the CUA analysis to be run on the uncorrected image.

4. Select the uniformity correction to use for this calibration and click [OK] button.  
The following screen is displayed:



5. Select the energy session and click [OK].  
The CUA Acquisition screen is displayed (Figure 10-5):

## CUA Acquisition

1. Click [Start] to start the acquisition.  
The following screen is displayed (see Figure 10-5):



Figure 10-5. CUA Acquisition Screen

- At the completion of the acquisition, data can be evaluated in the following screen:

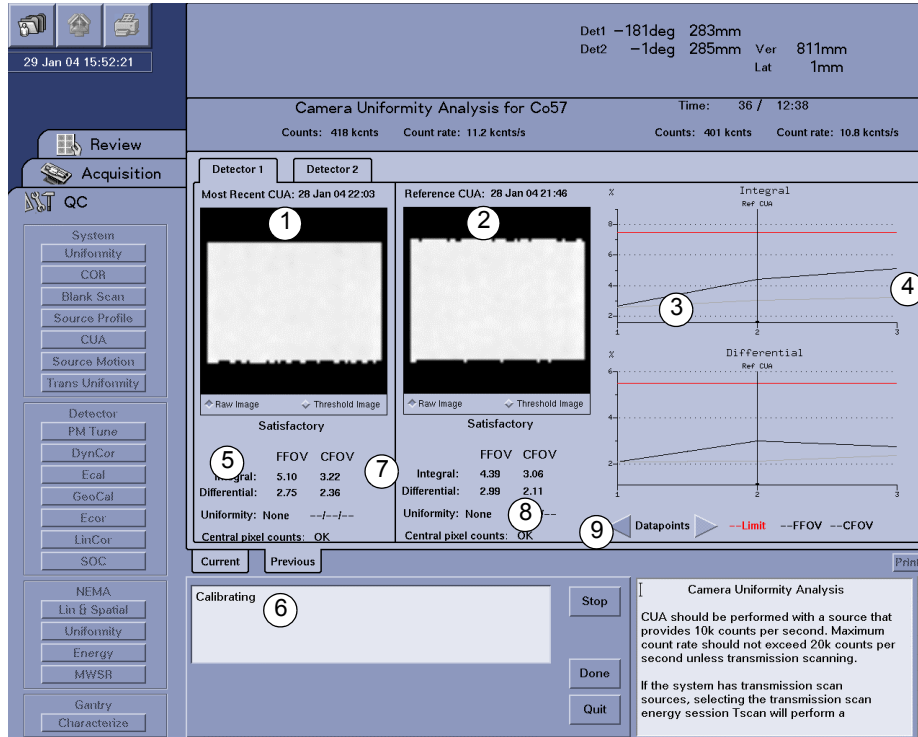


Figure 10-6. CUA Data Evaluation

**Table 10-1: CUA Data Evaluation**

No.	Area of Screen	Function Description
1.	Most Recent CUA	Displays image results of the most recent CUA analysis.
2.	Reference CUA Image	Displays image results of the selected CUA analysis.
3.	Uniformity Trend Curves	Shows how current and past integral and differential FFOV and CFOV uniformity results relate to the acceptance limit.
4.	Current CUA Selection Cursor	Shows where the displayed Most Recent CUA Image is located in the trend curve.
5.	Image Select toggles	Selects the Raw or Threshold image to be displayed in the CUA Image Display Areas.
6.	Last CUA performed	Shows the status of the Referenced CUA performed.
7.	Selected CUA	Shows the status of the current CUA performed.
8.	CUA Data point selection buttons	Steps through the recorded CUA results to be displayed.

**3.** If the results are:

- Satisfactory, click **[Yes]** to save the results and add them to the database.
  - Unsatisfactory, click **[No]**. The results will not be saved and you will be returned to Step 2. You can then rerun the test to verify that the results are unsatisfactory. Unsatisfactory results should not be saved to prevent corrupting trend data.
  - “No acceptance Criteria” – no criteria or incompatible acceptance criteria.
- 4.** After performing test on one detector, repeat the procedure for the second detector.
- 5.** If the test was performed on dual detectors, each detector’s results appear in a separate detector tab card. Both are enabled and selectable.

---

## Data Evaluation

CUA results are presented immediately at the conclusion of the CUA acquisition.

Note that trend curves will not be displayed until two or more CUA datapoints have been saved for the energy session chosen.

For the CUA Results to be considered satisfactory, the following must be true of the Raw Image:

1. The CFOV Integral Uniformity must be less than the acceptance criteria.
2. The CFOV Differential Uniformity must be less than the acceptance criteria
3. The total number of pixels with values greater than half of the integral acceptance limit but less than or equal to 10% *above* the CFOV mean AND whose values are less than half of the integral acceptance limit but greater than or equal to 10% *below* the CFOV mean, must be less than half of the integral acceptance limit of the total number of non-zero pixels.  
and
4. The total number of pixels with values 10% above and 10% below the CFOV mean must be less than 10 pixels.

If any of the above rules do not hold, the CUA will judge “Unsatisfactory”. If there are obvious non-uniformities in the image, further steps must be taken, regardless of whether the final results are posted as “Satisfactory”. Specifically:

- If the posted results are “Satisfactory” but the uniformity image is NOT satisfactory, call your GE service engineer.
- If the posted results are “Unsatisfactory” and the uniformity image is also unsatisfactory, call your GE service engineer.
- If the posted results are “Unsatisfactory” but the uniformity image **is** satisfactory, do the following:
  - a. Do not save the uniformity results when asked (otherwise the trends will contain bad data).
  - b. Check the source holder to ensure that liquid is not adhering to the side, and repeat the CUA to determine if the results were a statistical fluke.
  - c. If the result of the second CUA is again out of limits, perform a new energy correction for the appropriate isotope. Then perform a third CUA. In case uniformity correction was applied, consider to reacquire the used uniformity map.
  - d. If the results of a second or third CUA are “Satisfactory” then the camera may continue to be used as normal. If the results are still “Unsatisfactory”, contact your GE service engineer.

## On-line User Help

The CUA screen has an online user help display area in the lower right hand corner.

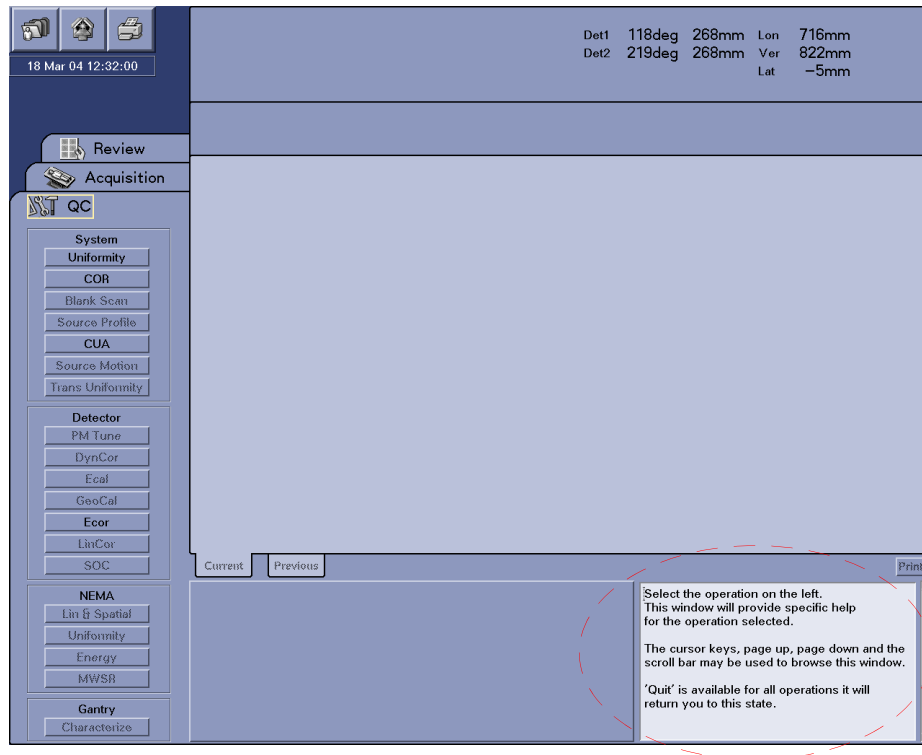


Figure 10-7. CUA Online Help

The on-line help contains the following text:

### Camera Uniformity Analysis

- CUA should be performed with a source that provides 10k counts per second. Maximum count rate should not exceed 20k counts per second unless transmission scanning.
- If the system has transmission scan sources, selecting the transmission scan energy session Tscan will perform a transmission scan. In this case no source is required.
- CUA can be acquired for two detectors simultaneously, or one detector at a time.
- Both for single and dual detector acquisition the collimators can be either removed or not.
- For dual detector acquisition place the detectors in Home Position, leave the collimators on and place a flood source between the detectors.
- If a uniformity correction map was selected, the acquired data is corrected using the selected uniformity correction before the uniformity analysis is performed.
- In order to get consistent data from trend analysis for uniformity correction, it is advisable to always use the same options when performing the CUA acquisition (i.e. with and without collimator, collimator type, uniformity corrected or not, single and dual detector acquisition).
- If the CUA source holder is used, source volume should be 0.5 ml with an activity of 60uCi (0.2 Mbq). This produces approx. 10k counts per second, yielding an acquisition time of about 6 to 15 minutes per detector (depending on detector size).

If there are obvious non-uniformities in the image, further steps must be taken, regardless of whether the final results are posted as "Satisfactory". Specifically:

- If the posted results are "Satisfactory" but the uniformity image is NOT satisfactory, call your service engineer.
- If the posted results are "Unsatisfactory" and the uniformity image is also unsatisfactory, call your service engineer.
- If the posted results are "Unsatisfactory" but the uniformity image IS satisfactory, do the following:

1. Do not save the uniformity results when asked (otherwise the trends will contain bad data).
2. Check the source holder to ensure that liquid is not adhering to the side, and repeat the CUA to determine if the results were a statistical fluke.
3. If the result of the second CUA is again out of limits, perform a new energy correction for the appropriate isotope. Then perform a third CUA.

In case uniformity correction was applied, consider to reacquire the used uniformity map.

4. If the results of a second or third CUA are "Satisfactory" then the camera may continue to be used as normal. If the results are still "Unsatisfactory", contact your service engineer.

---

## Camera Care / Maintenance

---

### General Camera Care

The power to the detector should be left on at all times to maintain stability of detector images. If the detector is turned off, it should be allowed to return to a stable temperature prior to patient use. A power save switch is provided that allows the motor drives and computer system to be powered off without disturbing the detector.

In order to reduce the likelihood of equipment damage, always leave collimators mounted on the imaging detector to provide protection from mechanical damage and to minimize temperature affects.

---

### Maintenance Levels

There are three system maintenance levels:

- [User Maintenance on page 10-47](#)
- [System Administrator Maintenance Tasks on page 10-51](#)
- [Qualified Service Planned Maintenance on page 10-52](#)

Each level is assigned a specific login level, as described in [Different Logins](#) section, below.

If you encounter any malfunction, refer to [Troubleshooting on page 10-53](#).

---

## Different Logins

GENIE Acquisition uses three different logins. Each login allows different privileges. Users with a lower privilege cannot perform functions that require a higher user privilege level.

The logins along with their associated privileges are shown below:

Login	Privilege	Level	Description
genieacq	operator	Lowest	Perform all normal user actions.
admin	administrator	Intermediate	Perform all normal user actions. Create and modify user templates. Create and modify energy sessions.
service	service	Highest	Perform all normal user actions. Create and modify GE templates. Create and modify energy sessions. Perform service specific detector corrections. Perform service specific gantry and table characterization.

The `genieacq` login can be configured to operate at either the operator or administrator privilege level.

---

## User Maintenance

It is a good housekeeping exercise to keep any piece of medical equipment clean, and particularly one which comes into contact with unsealed radioactive sources.

Cleanliness is a prime rule in maintaining equipment. At least once a month, external metallic surfaces should be wiped with a moistened clean towel and mild detergent, to remove any foreign material that may have accumulated.

Enameled surfaces should be cleaned using a clean cloth moistened slightly with a good quality mild cleaner and polish acceptable for such use.

The monitor screens on the system are used for operator feedback and image review. These screens should be kept clean and mark free for optimal performance.

Clean up of radionuclide spilled on the device may be done using standard radioactive decontamination solutions. However, strong cleaners or solvents should be used with caution as they may damage painted surfaces. Refer to your Nuclear medicine department's radioactive decontamination procedures.

Aside from routine maintenance, any abnormal noise, vibration or unusual performance should be reported immediately to a GE Medical Systems service representative. Before calling for service however, ensure the equipment is being operated in accordance with the instructions in this manual.

---

## **Disinfection**

It is important at all times that any areas which come into direct contact with the patients should be regularly cleaned and disinfected. This applies particularly to the imaging table. All surfaces should be wiped with a mild disinfecting agent, such as alcohol or Chlorhexidine (2% solution in water) daily.

---

## **Reference Images**

Whenever major service or maintenance is performed on the camera, a set of reference images should be collected for later comparison. These images must be collected in the same geometry and with the same isotopes as used for the daily QC check. These images will be compared to the periodic tests and provide a reference of optimal obtainable performance.

## Visual Inspection and Safety Device Tests

Visual inspection performed by the user is essential to discover damage to the system which might lead to costly and inconvenient emergency repairs. The following table lists the type of inspections performed by the operator as the system is being routinely used.

**Table 10-2:** System Inspection

Description	Function
Cables	Check cables connected to the table. Check for damage to insulation especially around cable clamps.
	Check cables connected to the PC cart. Check for damage to insulation especially around cable clamps.
	Check that all external cables are secured in connector clamps where applicable.
Panels	Check security and condition of all external panels on gantry and table.
	Check operation and airflow paths of the cooling fans on each side of the gantry power supply and on the PC.
Collimators	Check all collimators for damage to septa and to locking mechanism.
Collimators Carts	Check locking mechanism on all collimator carts.
Handset	Check the handset for cracks and damage and check the connection points on the handset and on the gantry/table.
Table	Check the table top for cracks and damages.
	Check the <b>headholder</b> for damage. Check that the head holder bracket is firmly tightened to the headholder mounting panel.
E-Stops	Verify operation of the E-stop circuit. Use the handset to start a system motion and press an E-stop. Motion should stop immediately. Check this daily.
Collision Sensors	Verify operation of the collision sense circuit. Use the handset to start a system motion and press one of the collision sensors. Motion should stop immediately. Check this daily.

The proper operation of the collisions sensors and E-stops should be checked daily. The checks should include the following tests:

1. Verify operation of the collision-sense circuit on the detector. Use the handset to start a system motion and press the collision sensor. Motion should stop immediately when sufficient pressure is applied. Repeat for both sensors.
2. Verify operation of the E-stop circuit. Use the handset to start a system motion and press an E-stop. Motion should stop immediately. Repeat for each E-stop.



**CAUTION**

If damage or malfunction is found, the device should be removed from use and trained service personnel contacted.

---

## System Administrator Maintenance Tasks

Additional functions are available on the GENIE Acquisition computer. To gain access, a special login is required. Type "admin" and press the <Enter> key. Then type "admin.genieacq" for the password and press the <Enter> key. All typing must be in lower case letters. If additional password security is desired, check with a GE Service representative for changing the password. When the administration login is used, a menu is displayed instead of the acquisition and review screens. After logging in, the Administration menu has several options:

- Start GENIE Acquisition for Administration
- Perform Site Specific Backup
- Run Database Inventory Check
- Go to UNIX shell
- Display Help Screen
- Logout of Administration Account

---

### Start GENIE Acquisition For Administration

Selecting this option allows for the operation of the GENIE Acquisition software that normally occurs when using the *genieacq* login. However, creation and modification of user defined templates and energy sessions are also allowed.

---

### Perform Site Specific Backup

This option provides for a backup of important files maintained on the computer such as correction files and user templates. Additional details on the backup procedure are found in Chapter 5 under Backup and Restore Procedure.

---

### Run Database Inventory Check

This procedure is used to check the database file structure in case of possible corruption. This check is normally performed by a GE Service representative.

---

### Go To UNIX Shell

This selection opens a UNIX shell window for using UNIX commands. A knowledge of the UNIX operating system is required for use.

---

## **Display Help Screen**

The Help Screen provides details on the use of the Administration functions.

---

## **Logout Of Administration Account**

Logout exits you from the Administration Menu and will return you to the login screen.

---

## **Qualified Service Planned Maintenance**

Safe equipment performance also requires the use of service personnel specially trained on medical apparatus. GE Medical Systems is a world-wide organization from which skilled service may be obtained. If desired, arrangements can usually be made for preventive and/or emergency service to be done on a contract basis.

The Service Planned Maintenance schedule can be found in the Millennium MPR/MPS Service Manual.

---

## **In Case Of Difficulty**

If a malfunction occurs, check that all the controls have been correctly set; if the fault persists, a service visit will probably be required.

Some of the main problems which will require a service visit are:

- a drifting energy spectrum
- a very spotty or uneven looking flood field
- a flood field with a hole or a void at its edge
- a flood field with a jagged crack across it

Any queries regarding the camera or its use can be answered by contacting a GEMS service representative or GEMS applications personnel.

---

## Troubleshooting

This section provides a troubleshooting table to use in case of equipment malfunction. The table provides a list of symptoms, possible causes, and solutions.

If a malfunction occurs, check that all the controls have been correctly set. Identify the problem and perform the recommended checks and operations as specified in [Table 10-3](#); if the fault persists, a service visit will probably be required.

Some of the main problems which will require a service visit are:

- a drifting energy spectrum
- a very spotty or uneven looking flood field
- a flood field with a hole or a void at its edge
- a flood field with a jagged crack across it

Any queries regarding the camera or its use can be answered by contacting a GEMS service representative or GEMS applications personnel.

**Table 10-3:** Troubleshooting Guide

<b>Symptoms</b>	<b>Possible Cause</b>	<b>How to Check</b>	<b>How to Fix</b>
No monitor display. No keyboard response. All power indicators and LED displays OFF.	Circuit breaker on IPS OFF. Power inlet fuse blows	Visual check circuit breaker.	Reset the circuit breaker.
	Poor Power connections:	Visual check connection of power cables.	Insert power cables connectors.
	Failed Gantry IPS. Acquisition unit will also have no Power.	Check mains power. Visual check power indicators on IPS.	If mains power is OK and power indicator is OFF call GE service.
No monitor display. No keyboard response. Acquisition unit power indicators and LED displays OFF.	Acquisition unit power OFF.	Visual check power switch on acquisition unit.	Cycle power switch. Acquisition unit has a “soft landing” power switch, which requires a discharge time. Do not reactivate until Power saving light on the monitor is OFF.
	Poor connection: Acquisition unit	Visual check power cables for acquisition unit.	Insert power cables connectors.
	Failed Acquisition unit	Perform above checks to eliminate other possible problems.	Call GE service.
Acquisition unit power indicator ON, LED displays OFF.	Failed Acquisition unit.	Visual check LEDs.	Call GE service.
No monitor display. Acquisition unit power indicators and LED displays ON. Monitor power indicator OFF.	Monitor power OFF.	Visual check power switch.	Cycle power switch.
	Poor connection: Monitor	Visual check cables to monitor.	Insert cables connectors.
	Failed Monitor.	Perform above checks to eliminate other possible problems.	Call GE service.

**Table 10-3: Troubleshooting Guide (Continued)**

<b>Symptoms</b>	<b>Possible Cause</b>	<b>How to Check</b>	<b>How to Fix</b>
No monitor display. Monitor power indicator ON.	Monitor power OFF.	Visual check power switch.	Cycle power switch.
	Contrast Brightness not adjusted.	Change Contrast and Brightness settings.	If display appears, adjust for best image.
	Failed Monitor.	Perform above checks to eliminate other possible problems.	Call GE service.
Keyboard and mouse inactive. Normal monitor display. Acquisition unit LEDs ON.	Poor connection: Keyboard Adapter Module.	Visual check cables for keyboard.	Insert cables for keyboard.
	Failed Keyboard Adapter Module.	Perform above check to eliminate other possible problems.	Call GE service.
Mouse inactive or no screen cursor. Normal keyboard operation.	Poor connection: Mouse.	Visual check cables for mouse.	Insert cables for mouse.
	Failed mouse.	Perform above check to eliminate other possible problems.	Replace mouse.
Mouse operation is not smooth.	Dirty track ball.	Try the fix.	Clean the track ball.
	Failed mouse	Perform above check to eliminate other possible problems.	Replace mouse.
System fails to boot fully to login screen.	Anomaly	Reboot system.	Reboot by cycling the Acquisition unit power switch.
	Error detected by system.	Look for error codes on monitor and check system LED's.	Call GE service and report any error codes.
	Files on hard disk corrupted.	Indicated during file check (fsck) sequence of boot-up process.	Call GE service.

**Table 10-3: Troubleshooting Guide (Continued)**

<b>Symptoms</b>	<b>Possible Cause</b>	<b>How to Check</b>	<b>How to Fix</b>
System fails to respond fully to root login.	Improper login attempt.	Repeat Login.	Repeat root login. Be careful to use correct case and password.
	Error detected by system.	Look for error codes.	Call GE service and report any error codes.
	Files on hard disk corrupted.	Perform above checks to eliminate other possible problems.	Call GE service.
	Files on hard disk corrupted.	Perform above checks to eliminate other possible problems.	Call GE service.
GENIE environment does not boot fully.	Incorrect setup parameters or licenses.		Call GE service.
	Poor connections or termination on network.	Reboot system using Network Loopback transceiver.	Check network bus termination and all connections. If the system still fails call GE service.
	Files on hard disk corrupted.	Perform above checks to eliminate other possible problems.	Call GE service.

---

## Backup Procedure

This section describes the method used to backup important files from the GENIE Acquisition computer. A secondary hard disk is used to save these files. The files that will be saved are system configurations files, spatial corrections, energy corrections, uniformity corrections, PMT tuning files, COR values, user defined energy sessions, and user defined protocols. In order to maintain current files, it is recommended that the backup procedure be performed monthly or after a visit by a service representative.

### To perform the backup procedure:

1. From the **Login** screen, enter a login of **admin** and **admin.genieacq**. in lower case letters as the password.
2. After login, the computer displays an **Administration** menu. From the **Administration** menu, select the option **Perform Site Specific Backup** by entering the corresponding number followed by the <Enter> key.
3. The computer will display the following messages:

*Ready to begin backup  
Backup media selected is internal Hard Disk /dev/rhd3a  
Press Enter to check media, "Q" to quit backup*

4. Press <Enter>. After checking the hard disk the computer will now backup the files.

**Note**

If the system finds an existing archive, the user is given the choice of keeping or overwriting it.

5. After the backup has been completed, a computer message indicates:

*Operation complete. Press Enter to continue.*

6. Press <Enter>. The computer returns to the **Administration** Menu.
7. From the menu, select the option **Logout of Administration Account** by entering the corresponding number followed by the <Enter>. The computer returns to the **Login** screen.

**Note**

A GE Medical Systems service engineer will restore the files back to your system if needed. For additional security, the password may be changed. Contact your GE Service Representative.



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# Chapter 11 - System Specifications

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## Chapter Overview

This chapter provides a detailed description and listings of the system specifications. This includes:

- [System Requirements on page 11-2](#)
- [Technical Specification on page 11-6](#)
- [Additional Information on page 11-8](#)

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## System Requirements

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### Power Requirements

Electrical power is supplied to the Millennium MPR/MPS systems from a single phase, hospital grade, grounded power line. The single power lead plugs into the power supply in the gantry base which distributes it, in appropriate form, to the other system components.



#### CAUTION

The power for the acquisition computer is supplied from a power supply located in the gantry. The acquisition computer should only be used with the provided power supply.

#### Note

The power on / off switch on the computer cabinet only supplies power to the computer.

---

### Electrical Installation

In accordance with EN60601, General Electric Medical Systems only accepts responsibility for safety, reliability and performance of this equipment if the relevant room complies with local laws and regulations concerning electrical installations.

---

### Use of Equipment

This equipment is designed for use in health care facilities and is to be used by qualified personal only. Read and understand all instructions in this Operator's Manual before attempting to use the equipment and request training assistance from General Electric Medical System if needed.

General Electric Medical System accepts responsibility for safety, reliability and performance only if this equipment is used in accordance with the instructions for use as laid down in this Operator's Manual.

---

## **System Classification**

CLASS 1 TYPE B according to EN60601 safety standard – This equipment requires a reliable protective earth connection.

GROUP 1, CLASS A according to EN55011 concerning radiofrequency emission for ISM equipment.

Class IIA according to DIRECTIVE 93/42/EEC concerning medical devices.

---

## **Ambient Temperature**

Do not allow the detector to experience a temperature change of more than 3°C (5°F) per hour. Limits of low and high recommended operating temperature ranges are 13°C to 27°C (55°F to 80°F).

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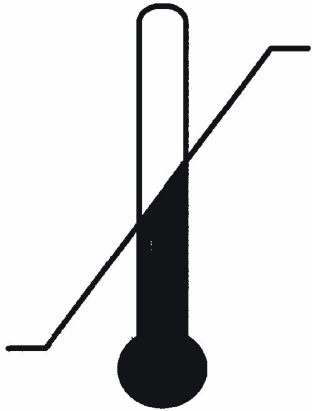
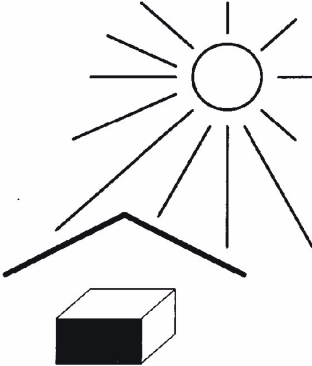
## **Humidity Environment**

To protect equipment from corrosion, and assure a safe operating environment, the humidity for storage and use should be maintained between 20% and 80% and noncondensing.

---

## **Shipping and Storage Requirements**

The following labels are applied to the shipping container to show the restrictions on transport environment. This restrictions should be continued to be applied for any storage or transport situation.

 <p><b>PROTECT AGAINST FROST.</b> Maximum 7°C (45°F)</p>	 <p><b>PROTECT AGAINST EXCESSIVE HEAT.</b> Maximum 30°C (86°F)</p>
<p><b>TEMPERATURE-TIME GRADIENT MAXIMUM 5°C (9°F) / Hour</b> <b>KEEP AT ROOM TEMPERATURE FOR AT LEAST 24 HOURS BEFORE UNPACKING</b> <b>KEEP AT HUMIDITY BETWEEN 40 AND 80% NONCONDENSING</b></p>	

## External Connections



### CAUTION

In order to maintain electrical safety, only the peripherals listed below, or others subsequently approved by the General Electric Company may be powered directly from the Millennium MPR/MPS gantry.

<b>Power to External Peripherals</b>	Isolated 120 V @ 4.5 A, 50 Hz / 60 Hz supply, fused at 5 A.
<b>Acquisition Computer</b>	Isolated 120 V AC.
<b>Monitor</b>	Isolated 120 V AC.
<b>Gantry</b>	Isolated 120 V DC, limited at 10 A.
<b>Detector</b>	Isolated 24 V DC, limited at 5 A.
<b>3-Axes Patient Table</b>	Isolated 65 V DC.
<b>Single Axis Patient Table</b>	Isolated 120 V DC, limited at 7 A.

The external peripheral power should only be used with listed or certified electrical medical equipment approved by GE and installed by their engineers.

Other peripherals connected to the system shall:

- be independently powered and earthed
- for USA and other 120 V, 60 Hz installations carry a test lab listing (for example: UL, ETL, etc.) appropriate to its application and place of use. For use in patient accessible places this listing should be under "Medical and Dental Equipment Professional."
- for European or other 50 Hz installations carry a certificate of compliance with the DIRECTIVE 93/42/EEC concerning medical devices and other CENELEC IEC safety standard appropriate to its application and place of use. For use in the PATIENT ENVIRONMENT this certification should be made under EN60601 or an appropriate IEC 601–2 standard

Installation of any peripheral should be performed by a General Electric Service Engineer or other qualified biomedical engineer. If the peripheral is not on the General Electric approved list, the installation should be checked to the appropriate safety standard for protective earth impedance (ground impedance) and for leakage current.

## Technical Specification

<b>Model Identification</b>	<b>Millennium MPR/MPS Gantry</b>
System Identification	Millennium MPR/MPS Systems
Operating Voltage	120 V ±10% @ 10 A, 50 Hz or 60 Hz AC 220 V ±10% @ 6 A, 50 Hz or 60 Hz AC
Weight	1200 Kg
Heat Dissipation	2000 BTU

## Dimensions – Gantry, Detector, And Table

**Table 11-1:** Physical Dimensions Gantry and Table

<b>System Component</b>	<b>Installed Dimensions</b>	
	<b>L x W x H in mm</b>	<b>L x W x H in inches</b>
Gantry including IPS and Detector	1900 x 1118 x 1465	75 x 44 x 58
3 Axes Table	2600–4200 x 860 x 600–900	100–165 x 52 x 24–36
Single Axis Table	2140 x 614 x 730 - 990	84 x 24 x 39 - 39

---

## Dimensions – Mobile Stand

**Table 11-2:** Physical Dimensions Mobile Stand

System Component	Installed Dimensions	
	L x W x H in mm	L x W x H in inches
Mobile Stand including Monitor.	800 x 800 x 1350–1560	32 x 32 x 53–62

---

## Motorized Speeds

The following table defines the speeds that each axis moves at when controlled from the handset. Instructions for using the handset to control motion are given in [Handset on page 3-15](#).

**Table 11-3:** Motorized Speeds

Axis	Acquisition Speed	Handset Speed	
		Low	High
Gantry Rotation	0.6 rpm	0.2 rpm	1 rpm
Gantry Radius	–	5 mm/s	20 mm/s
Detector Tilt	–	0.2 rpm	1 rpm
3 Axes Table Vertical	0.1 mm/s	5 mm/s	10 mm/s
3 Axes Table Lateral.	–	3 mm/s	40 mm/s
3 Axes Table Longitudinal	–	10 mm/s	40 mm/s
Single Axis Table	–	18 mm/s	18 mm/s

---

## Additional Information

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### Service Documentation

Service instructions and schematic diagrams are provided in the Service Manual (No 2286308–100).

There are no user serviceable parts on this system. All servicing must be performed by suitably trained and qualified persons.

---

### Responsibility

In accordance with International Safety Standard EN60601 (BS 5724) the manufacturer cannot accept responsibility for any consequences resulting from:

- assembly operations
- extensions
- re-adjustments
- modifications or repairs

carried out by persons not authorized to do so by General Electric Medical Systems or their representatives.

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### Further Details

For additional details of system specifications or information, please refer to site installation or service documentation.

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### Contacts

If you have questions, contact your local area office or:

*General Electric Company  
Medical Systems Division  
P.O. Box 414  
Milwaukee, Wisconsin 53201  
USA*

Tel: 1 800 NUCLEAR or 1 800 682-5327



## Chapter 12 - Clinical Radionuclides

The table below shows only the emissions that are of practical use for imaging with the Millennium gamma camera. Other emissions which may contribute significantly to the radiation dose to the patient or bystanders have NOT been tabulated here.

The primary reference for this table is from Chart of the Nuclides, 14th Edition, published by Walker, Parrington, Feiner, General Electric, 1989. The abundance reference is from Table of Isotopes, 7th Edition, Lederer, Shirley, 1978.

**Table 12-1: Radionuclides**

Nuclide	PRINCIPAL GAMMA ENERGY (KeV)		Half Life
	Energy (KeV)	Abundance (%)	
67 Gallium	93	70%	78 hours (3.3 days)
	184	22%	
	300	19%	
81m Krypton	190	65%	13 seconds
81m Krypton	190	65%	13 seconds
99m Technetium	140	100%	6.0 hours
111 Indium	171	100%	2.8 days
	245	100%	
123 Iodine	159	98%	13.2 hours
131 Iodine	364	82%	8.0 days
133 Xenon	81	99%	5.3 days
201 Thallium	68–80 (X–Rays)	94.5%	73 hours (3 days)
	135	9%	
	167	27%	

**Table 12-2:** Radionuclides used for Calibration Only

<b>Nuclide</b>	<b>PRINCIPAL GAMMA ENERGY (KeV)</b>		<b>Half Life</b>
57 Cobalt	122	89%	272 days
	136	11%	
133 Barium	356	74%	10.5 years
	81	81%	
137 Cs (137mBa)	662	95%	30.2 years

**Table 12-3:** Pet Radionuclides

<b>Nuclide</b>	<b>PROBABILITY DECAY by <math>\beta^+</math></b>	<b>HALF LIFE (MINUTES)</b>
11 Carbon	.99	20.4
13 Nitrogen	1.00	9.96
15 Oxygen	1.00	2.04
18 Fluorine	.97	110
82 Rubidium	.96	1.26

**Tc<sup>99m</sup> Decay Chart****Table 12-4:** Radionuclides used for Calibration Only

Hours	Minutes					
	10	20	30	40	50	
	1.00	.981	.962	.944	.926	.908
1	.891	.872	.857	.841	.825	.809
2	.794	.778	.764	.749	.735	.721
3	.707	.693	.680	.667	.655	.642
4	.630	.618	.606	.595	.583	.572
5	.561	.550	.540	.530	.519	.509



---

## Chapter 13 - Environmental Protection

GE is committed to the protection of the environment and natural resources. Our devices are manufactured under strict guidelines to prevent contamination of the surrounding water, ground and air.

The packing materials you received your product in, are recyclable. Please ensure that all packing materials are either reused, recycled or disposed of properly.

The majority of the materials in this product (for example metals, covers, electronics, etc.) are recyclable. GE encourages its customers to dispose of the product at the end of its life, for recycling according to the local regulations.

**The following parts are hazardous to the environment. They must be segregated and disposed of properly, according to local regulations:**

- Batteries
- Lead from Detector Head Containers
- Scintillation Crystals from Detectors
- CRT Monitor

**Please contact your nearest GE office for assistance.**



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# Appendix A - ACR Accreditation User's Guide

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## General

This document is for the use of the facility applying for ACR accreditation of Millennium MG cameras, which are used for performing both planar imaging and SPECT examinations.

The intention is to help the MG system user to perform SPECT images of the ACR approved phantoms at the highest level that the MG-systems are capable of providing.

Basic acquisition parameters, as well as SPECT reconstruction method, are defined in relevant ACR documentation, which is delivered with the accreditation programs.

This document is complementary to ACR accreditation instructions, and focuses on optimizing the acquisition and reconstruction parameters, that are specific to the MG-systems.

The ACR approved phantom which is used for evaluating SPECT images quality is the Jaszczak "Deluxe" phantom. In a case the facility has a Jaszczak "Standard" phantom, it may also be used in place of the ACR approved one.

---

## SW Version Prerequisite

To obtain best results, it is recommended to use GeniAcq SW version 4.0 and up.

To find out if upgrading is required, use the **System Uniformity** command under the **QC** folder to create a collimator uniformity correction map. During map setup, verify whether the system allows selecting **Total Counts** for the map acquisition. If this feature is **not supported**, upgrade is required.

To upgrade, please call service.

- Systems with SW version **lower than 4.0** need to perform upgrade using **UGP001613**.
- Systems with **SW version 4.0 already installed but with Total Count feature not available**, need to use **UGP001609**.

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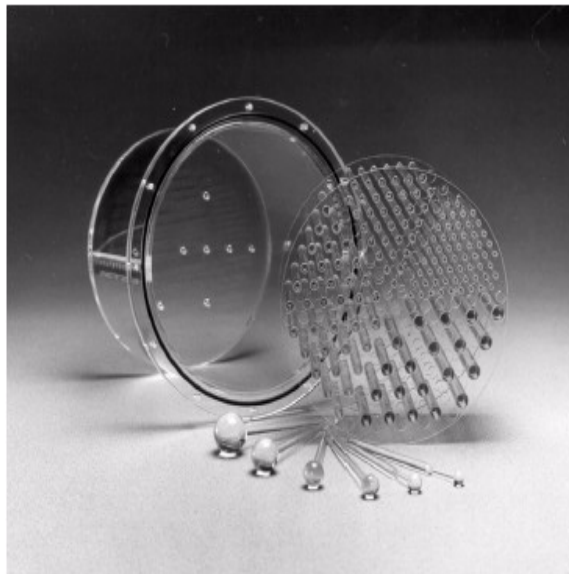
## Reference Documents

1. *Millennium MG Operator's Reference Manual.*
2. *ACR instructions for SPECT resolution, uniformity and contrast phantom imaging* (supplied upon an accreditation program subscription).

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## Phantoms Description

Both the Deluxe and the Standard phantoms are Acrylic cylinders with protruding flanged top and with 3.2 mm wall thickness. The cylinders have an internal diameter of 21.6 cm, and internal height of 18.6 cm. (see [Figure 0-1](#), [Figure 0-2](#)).

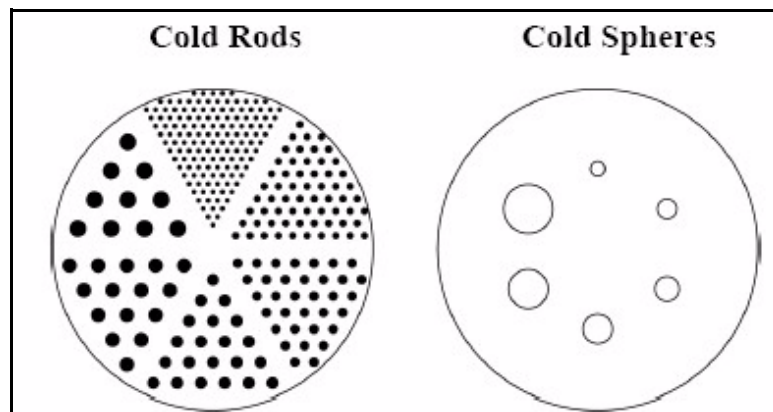


**Figure 0-1.** Components of ACR approved phantom.



**Figure 0-2.** ACR approved phantom assembly.

The phantoms include six sets of “cold” rods, and six “cold” spheres of different diameters, as shown in [Figure 0-3](#).



**Figure 0-3.** Phantoms inserts.

The rods and spheres diameters are specified in [Table 0-1](#).

<b>ACR approved (Jaszczak “Deluxe”)</b>	Rods diameters, mm	4.8	6.4	7.9	9.5	11.1	12.7
	Spheres diameters, mm	9.5	12.7	15.9	19.1	25.4	31.8
<b>Jaszczak “Standard” phantom</b>	Rods diameters, mm	6.4	7.9	9.5	11.1	12.7	16.0
	Spheres diameters, mm	12.7	15.9	19.1	25.4	31.8	38

**Table 0-1:** Phantoms Inserts Dimensions

---

## System Preparation

Before acquiring the images to be submitted, make sure that the system is in an optimal state. Perform the following calibrations and quality tests - (See “[SW Version Prerequisite](#)” on page -1.):

1. Assemble collimators with which accreditation images will be acquired.
2. Perform the **Daily Flood test** procedure as detailed in the “Millennium MG Operator’s Reference Manual”, Chapter 10, **Camera Quality Control and Maintenance**, Section **Daily Flood**. Use the extrinsic setup with either Co-57 or Tc-99m flat source. Verify that there are no visible artifacts and any variations capable of impacting the image quality.
3. Perform the COR calibration procedure for both detectors of the system, following step-by-step instruction in the “Millennium MG Operator’s Reference Manual”, Chapter 10, **Camera Quality Control and Maintenance**, Section **COR Acquisition and Analysis**. Verify that the calibration is completed successfully (absolute X-COR values displayed are less or equal to 5 mm). Record the calibration data for further reporting.
4. Perform the Uniformity Correction procedure following instructions in the “Millennium MG Operator’s Reference Manual”, Chapter 10, **Camera Quality Control and Maintenance**, Section **Uniformity Corrections**. When prompted (in SW versions 4.0 and higher), set **number of kcounts to stop on** as large as **120000K**.
5. Perform the System Resolution test with a bar phantom, following instructions in the “Millennium MG Operator’s Reference Manual”, Chapter 10, **Camera Quality Control and Maintenance**, Section **System Resolution**. Verify that there is no noticeable degradation of resolution on both the system detectors.
6. Perform the Camera Uniformity Analysis (CUA) procedure test, following instructions in the “Millennium MG Operator’s Reference Manual”, Chapter 10, **Camera Quality Control and Maintenance**, Section **Camera Uniformity Analysis (CUA)**. In SW version 4.0 and higher, use the extrinsic setup and perform the CUA analysis on uniformity corrected images. To do so, select the uniformity correction available for the collimators in use. Verify that all the uniformity parameters are within tolerances. Record the calibration data for further reporting.

---

## Jaszczak Phantom Preparation

Since the applicant can be requested to submit in addition to Tc-99m, also either Tl-201 or Ga-67 images, it is recommended first to fill the phantom with Tc-99m solution, perform the images requested, remove the solution, clean the phantom, leave the residual Tc-99m to decay about 12 hours and then to fill the phantom with Tl-201 or Ga-67 solution.

Recommended amounts of the sources activity are represented in the [Table 0-2](#).

Collimator	Activity, mCi		
	Tc-99m	Tl-201	Ga-67
LEGP	7 - 10	5 - 8	
LEHR	10 - 20	12 - 15	
MEGP			8 - 12

**Table 0-2:** Recommended Sources Activities

To fill the phantom with a source solution, proceed as follows:

1. Remove the phantom flange.
2. Fill the phantom with water, leaving about 3 – 5 cm<sup>3</sup> of its volume free.
3. Prepare 1 – 2 cm<sup>3</sup> of the source of required activity and add it to the phantom.
4. Thoroughly stir the solution.
5. Close the phantom hermetically with the removable flange.
6. Open the filling point (closed with a plastic screw) on the flange and add water until the phantom is completely full.
7. Close the filling point.
8. Shake the phantom well for a few minutes.
9. Open the filling point once again and let residual air escape. Close the filling point.
10. Shake the phantom a little to make sure that there are no air bubbles inside. Repeat items 8, 9 if needed.

---

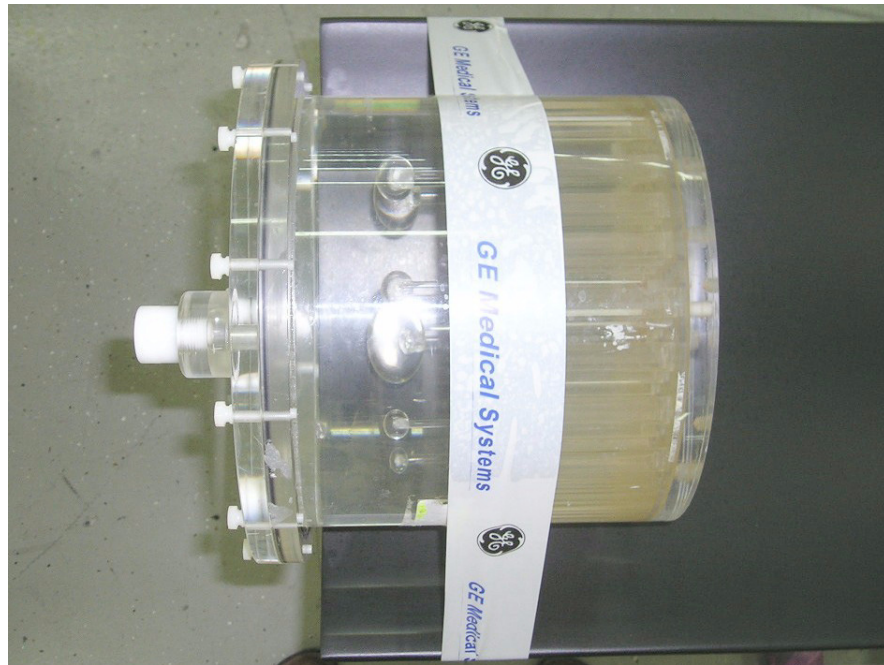
## SPECT Images Acquisition

---

### Phantom Adjustment

1. Place the phantom on its cylindrical surface along the primary patient axis at the end of the stretcher (see [Figure 0-4](#) and [Figure 0-5](#)). Position it in such a way that biggest "cold" sphere is placed at the bottom of the phantom, next to the stretcher.

The phantom flange must hang over the stretcher edge. The cylinder axis must be equidistant from the stretcher sides.



**Figure 0-4.** Jaszczak Phantom Position On The Stretcher

Relative to the camera gantry the phantom must be positioned so that:

- its flange is perpendicular to the gantry axis of rotation
- the cylinder axis is close to the gantry axis-of-rotation so that the distance from the face of the collimators to the phantom does not change significantly during rotation
- the phantom is located centrally between the detectors so that its entire body will be screened



**Figure 0-5.** Jaszczak Phantom Position Relative to the Gantry

1. In order to comply with these requirements it is recommended to use a ruler, a laser pointer etc., as well as to observe the phantom images in persist mode with different angular positions of the detectors.

**Important**

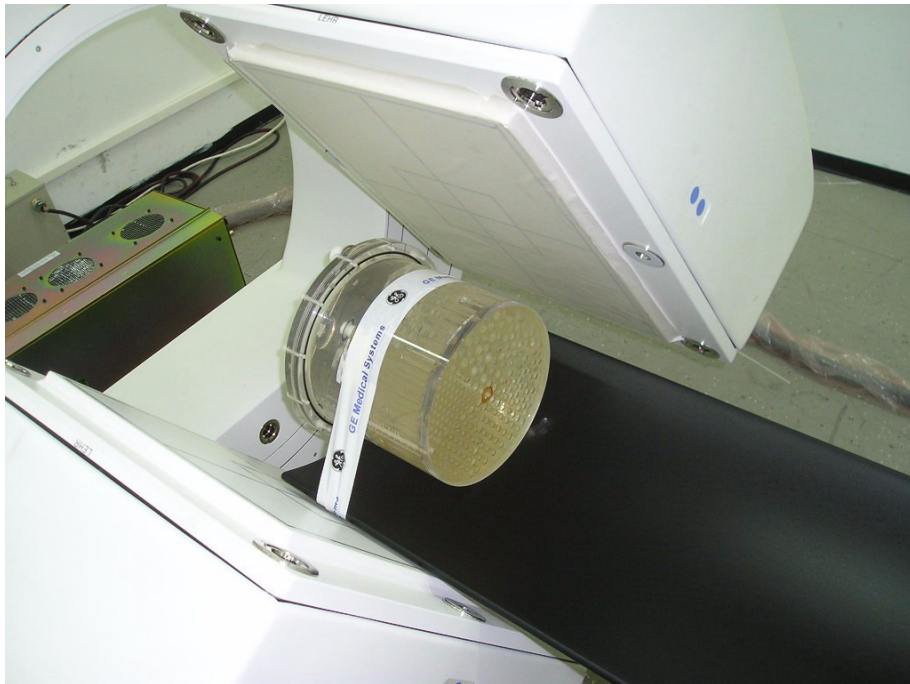
**Make sure that the stretcher is parallel to the camera rotation axis.**

2. After the positioning is completed, fasten phantom to the stretcher with a strip of packing tape.

---

## Gantry Setup

1. Set detectors radiuses of rotation to 20 cm.
2. Carefully rotate the detectors to make sure that there are no collisions of either phantom or stretcher with the detectors (see [Figure 0-6](#)). In a case of collision, try to move slightly the stretcher left-right or up-down in order to position it symmetrically between the detectors.



**Figure 0-6.** Detectors radiuses adjustment.

3. If necessary, enlarge the radiuses by few millimeters (but keep them equal to each other). If needed, repeat the operation several times to make sure that an optimal mutual position of the phantom/stretcher and the detectors is achieved.

Do your best to adjust the radiuses as small as possible (205 mm or less).

---

## SPECT Acquisition

1. Create a basic TOMO study and set the following acquisition parameters:
  - Isotope: Tc-99m
  - Energy peak: 140 keV
  - Energy window width: 20%
  - Collimator: LEHR (or LEGP, if LEHR is not in use in the site)
  - Uniformity correction: as it was prepared for these collimators (with total counts of 120 Mcnts)
  - Matrix size: as specified in ACR instruction or 128x128 if not specified
  - Zoom: as specified in ACR instruction or 1.33 if not specified
  - Clockwise rotation, no cardiac
  - Number of views: 120
  - 360° circular rotation; start angle: -90°
  - Other parameters are default.
2. Click on the [**Camera On**] button. Verify that the count rate does not exceed 30 kcnts/sec.
3. Calculate the **seconds per view** as  $T_{\text{view}} = N_{\text{total}} / (2 * 120 * R)$ , where  $N_{\text{total}}$  is a total count for the sum of all projection images as specified in the ACR instructions,  $R$  is the current count rate in kcnts/sec observed in persist mode. Round the calculated value up.
4. Set the calculated **seconds per view** parameter. Click the [**Change**] button to accept the changes.
5. Click the [**Start**] button to start the acquisition.
6. Upon completion of the scan, transfer the study to a workstation.
7. Remove the Tc-99m solution from the phantom, clean it and let the residual Tc-99m decay for about 12 hours.
8. Fill the phantom with either Tl-201 or Ga-67 solution.
9. Repeat steps 1– 6, selecting the corresponding isotope in setup.

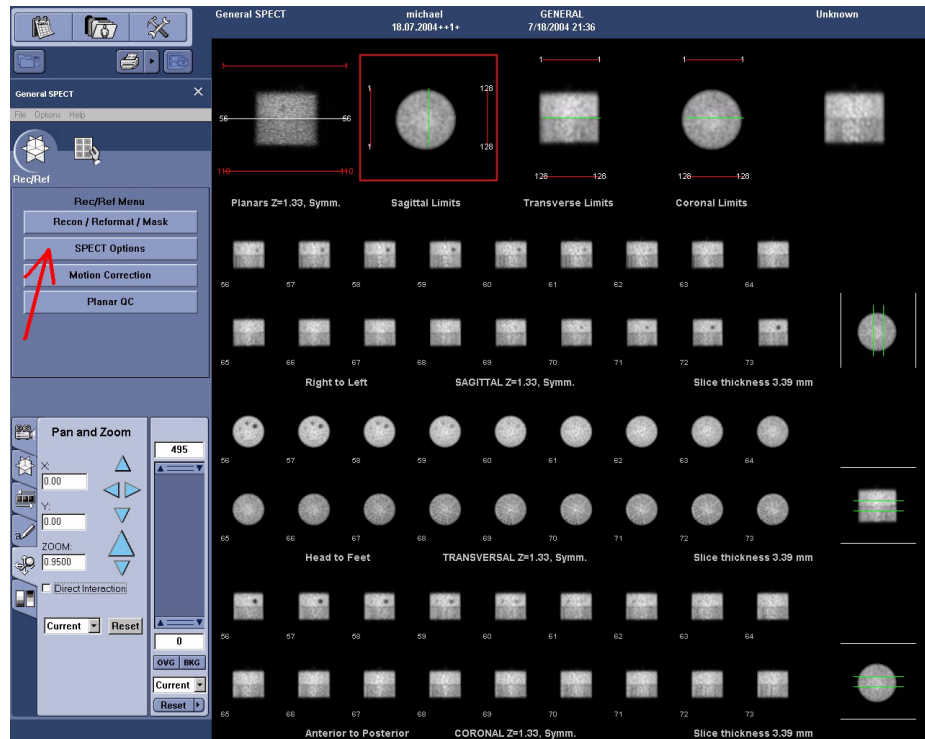
---

## SPECT Reconstruction and Analysis.

The procedure below assumes that a Xeleris workstation is used for the data reconstruction and analysis. The figures below illustrate a step-by-step procedure of reconstruction and processing of SPECT images of a "Deluxe" Jaszczak phantom

Proceed as follows:

1. Select the study from the list.
2. From the applications list, select the **General SPECT** option and run it.
3. When reconstruction is completed and resulted images are represented on the screen (see [Figure 0-7](#)), select SPECT options from the menu in the left side of the screen (indicated by a red arrow).



**Figure 0-7.** General SPECT Reconstruction Images

- From the opened Filtering and Attenuation parameters setting boxes (see Figure 0-8) select **pre-filter type** (Hann, Butterworth, Metz, Wiener etc.) and set its **critical frequency** as recommended by the ACR instruction.

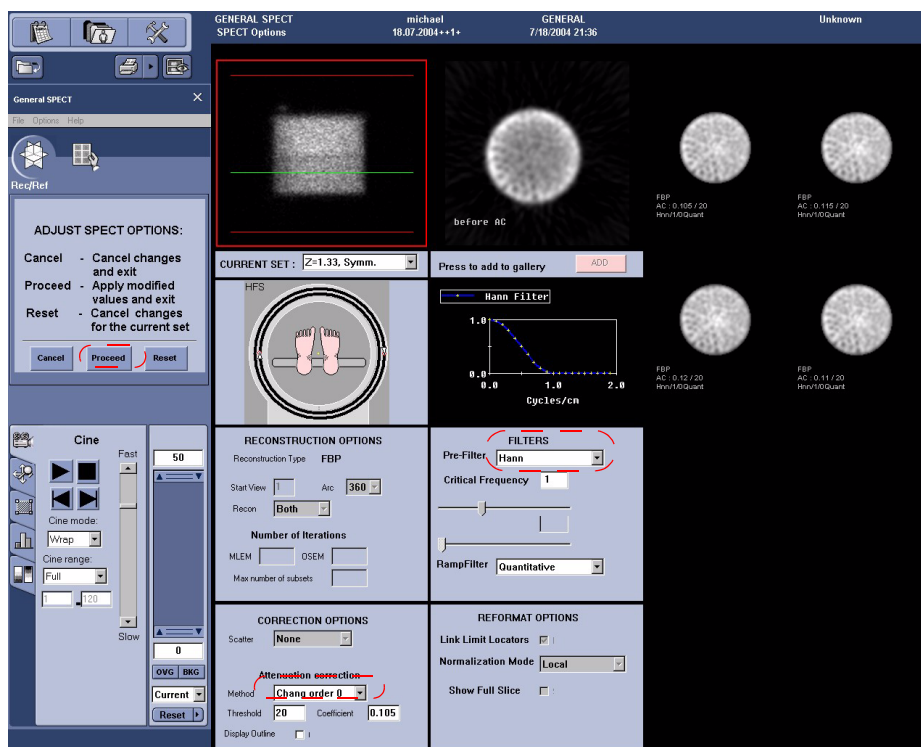


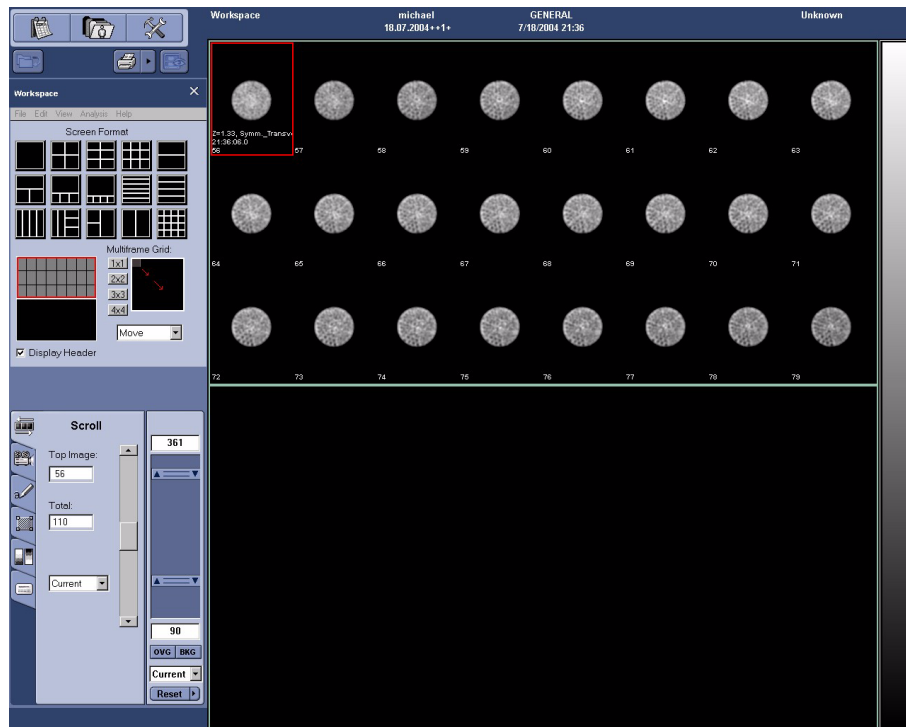
Figure 0-8. Filtering and Attenuation Parameters Adjustment

- Select Attenuation Correction method **Chang order 0**.
- Adjust attenuation **Threshold and Coefficient** parameters until an optimal attenuation correction is achieved. That means that resulting transaxial projection looks uniform, without "hot" central spot and/or edges.

For the user's reference:

- In the considered case (which is illustrated here) optimal attenuation conditions for Tc-99m were achieved with Threshold=20 and Coefficient=0.105 setting.
  - Good results were also obtained with Threshold=15 & Coefficient=0.11 combination for Tc-99m, and Threshold=20 & Coefficient=0.08 for Tl-201.
- Click the [**Proceed**] button; to save the setup, open **File** menu and select **Save and Exit**.

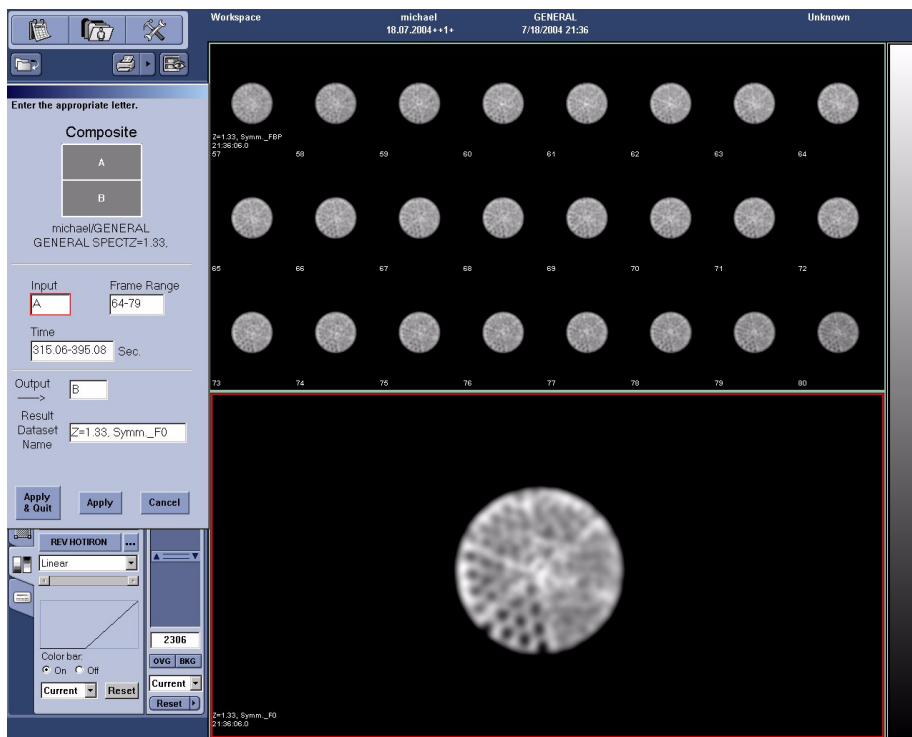
8. From the database list, select **saved Results Series\TRANSAXIAL** group and open it.
9. Arrange the screen as shown in [Figure 0-9](#), so that all slices from the cold rods region of the phantom are represented on the upper sub-screen.



**Figure 0-9.** Screens Arrangement for Resolution Analysis

10. Following the ACR instruction, select from the region a recommended number of slices, which look similar. Record the first and last numbers of selected slices.
11. Combine selected slices using **Analysis → Image Processing → Reframe → Composite** option.

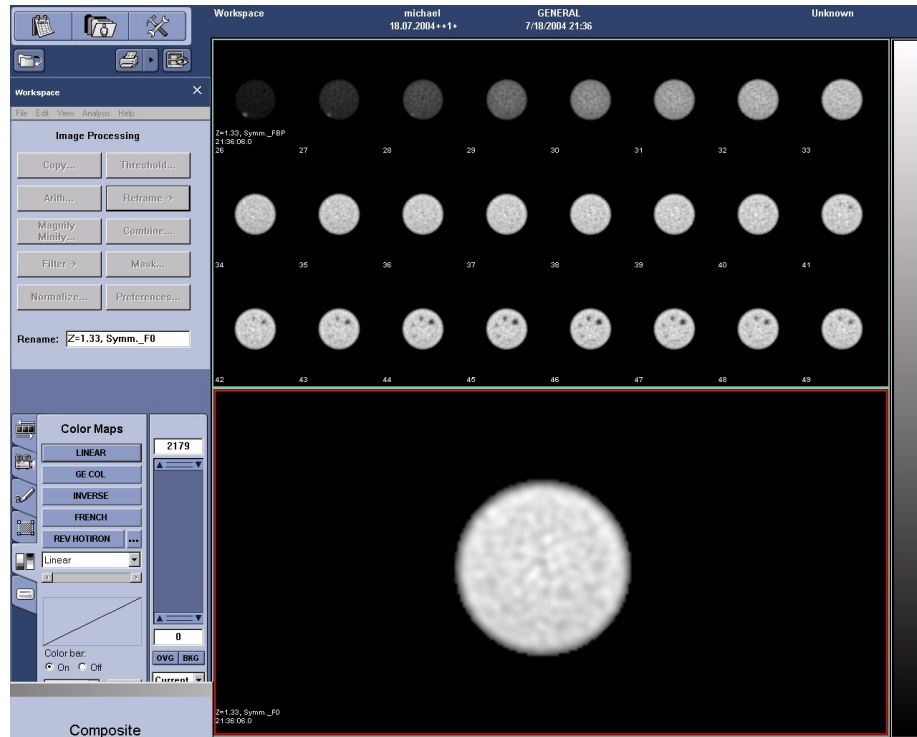
- Adjust windowing levels for optimal visualization of the rods on the composed image (see [Figure 0-10](#)).



**Figure 0-10.** Combined Resolution Image

- Select the resulting image. From the **File** menu select **Save**, name the image as **RESOLUTION** when prompted, and save it.
- Arrange the screen as shown in [Figure 0-9](#), but so that slices from the center of region with a uniform solution (without spheres or rods) are represented on the upper sub-screen.
- Following the ACR instruction select from the region a recommended number of slices, which look similar. Record the first and last numbers of the selected slices.

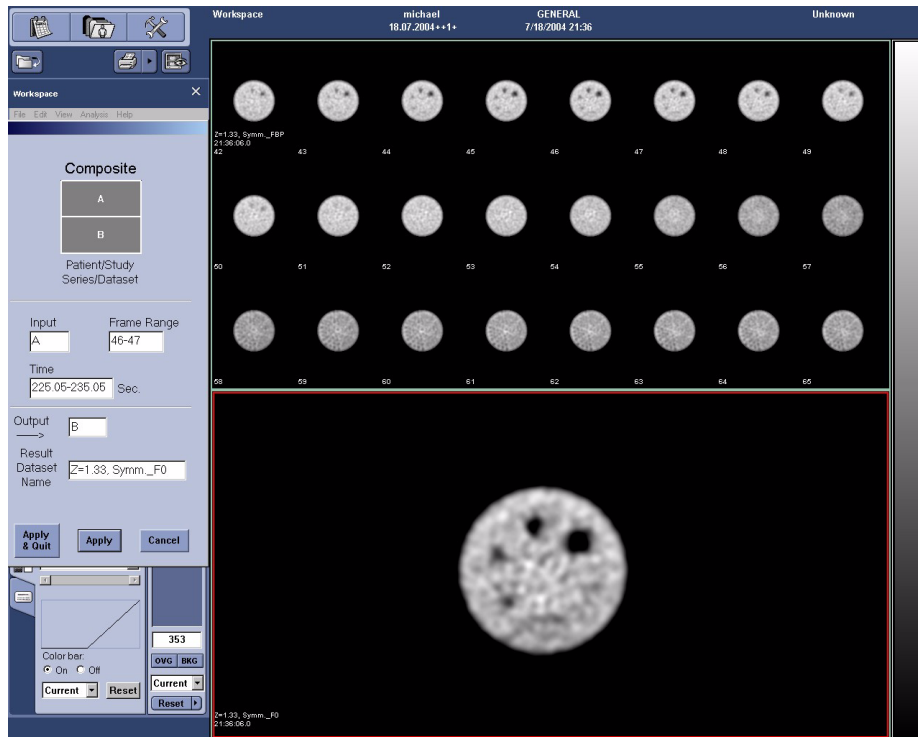
16. Combine selected slices using **Analysis** → **Image Processing** → **Reframe** → **Composite** option (see [Figure 0-11](#)).



**Figure 0-11.** Composed UNIFORMITY Image

17. Optimize the windowing levels of the composed image.
18. Select the resulting image. From the **File** menu select **Save**, name the image as **UNIFORMITY** when prompted, and save it.
19. Arrange the screen as it is shown in [Figure 0-9](#), but so that slices that contain the spheres are represented on the upper sub-screen.
20. Following the ACR instruction select from the region a recommended number of slices, which look similar. Record the first and last numbers of selected slices for further reporting.

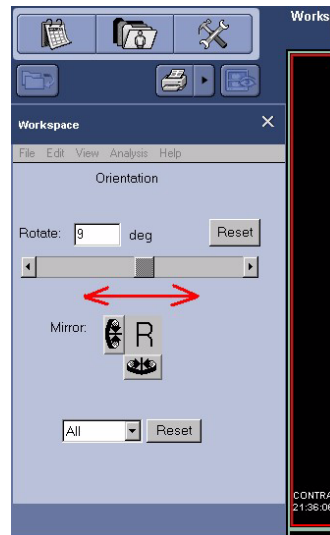
21. Combine selected slices using **Analysis** → **Image Processing** → **Reframe** → **Composite** option (see [Figure 0-12](#)).



**Figure 0-12.** Composed CONTRAST Image

22. Optimize the windowing levels of the composed image.

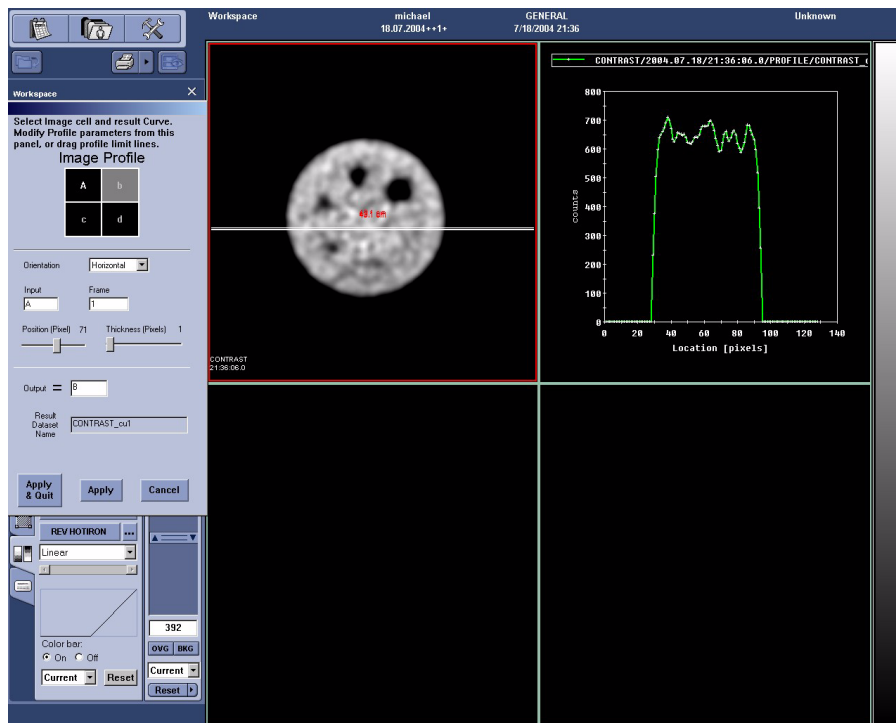
23. Verify that it is possible to put a horizontal line across the image (passing through its center) so that it does not touch any of the "cold" spheres. If needed, rotate the image a little using the **Orientation** option from the **View** menu, as it is illustrated in [Figure 0-13](#). Use the scroll-bar marked on the illustration by red arrows.



**Figure 0-13.** CONTRAST Image Adjustment by Rotation

24. Select the resulting image. From the **File** menu select **Save**, name the image as **CONTRAST** when prompted, and save it. Close the workspace.
25. Re-open saved **CONTRAST** image and arrange 2x2 screen format.
26. From the **Analysis** menu, select **Curve Processing** → **Profile** option.

27. Set profile parameters as shown on [Figure 0-14](#):  
Input window: **A**,  
Output window: **B**,  
Thickness (pixels): **1**.  
Using **Position** (pixels) scroll-bar place the profile line across the center of the **CONTRAST** image without intersecting any sphere. The profile line should extend well outside the phantom on both sides.



**Figure 0-14.** Profile Parameters Setting

28. Estimate and record the average counts number inside the phantom on the profile data, (about 650 counts in this example).
29. Close the option by clicking the [**Apply & Quit**] button.

30. Re-open the **Profile** option. Set profile parameters as shown on [Figure 0-14](#): Input window: **A**  
Output window :**C**  
Thickness (pixels): **1**  
Using **Position** (pixels) scroll-bar place the profile line so that it crosses the center of biggest "cold" sphere. Estimate and record the minimum number of counts in the profile within the phantom (about 200 counts in this example).

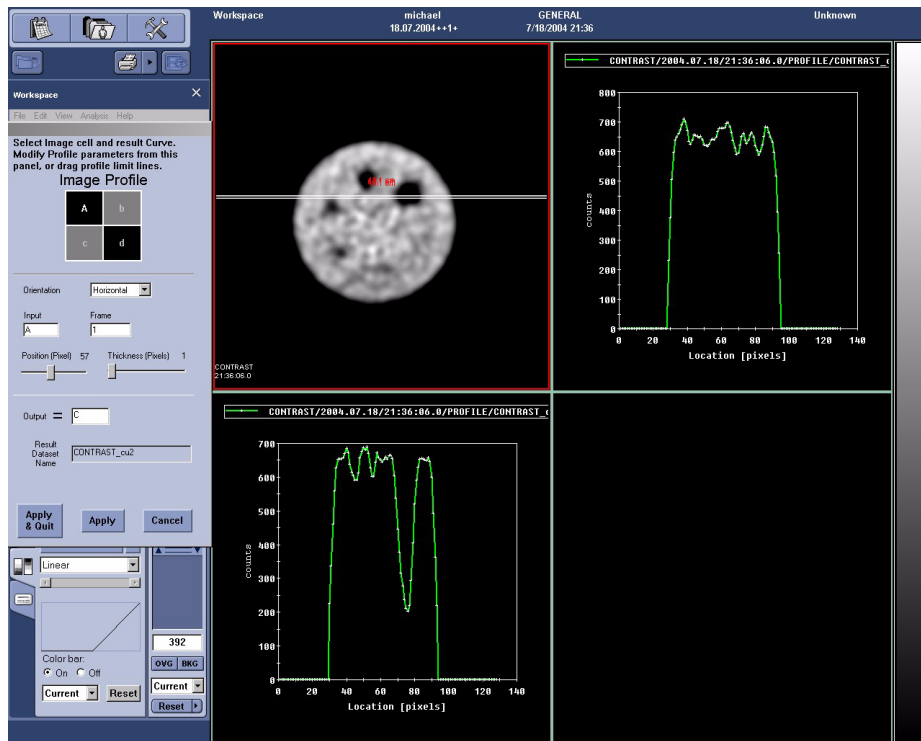


Figure 0-15. Contrast Measurements

31. Calculate the contrast as:  
**Contrast=(Average\_Cnts - Minimum\_Cnts)/Average\_Counts**  
Record calculated contrast value for further reporting.
32. Repeat steps 1 -31 for the SPECT data obtained with the Jaszczak phantom filled with Tl-201 or Ga-67.
33. Submit images and additional required data according to ACR instructions.

---

## Appendix B - System Without Table (MPR TL)

This Appendix covers the operating instructions for MPR systems without a table (MPR TL).

---

### Overview

The MPR Without Table configuration (MPR TL) is a variant of the Millennium MPR system. It utilizes the same detector, gantry and GENIE Acquisition software as an MPR system with a patient table, but no patient table is provided with the system.

The MPR TL has a reduced set of features, providing the capability for planar imaging only. Patients are scanned in a standing position or by using an appropriate support, such as a chair or gurney (stretcher).

Many features are fully functional for the MPR TL, including all network, database and review features. All necessary detector and system quality control procedures are supported, including Camera Uniformity Analysis and NEMA linearity, spatial resolution, uniformity, energy resolution and multi-window spatial registration measurements.

## Limitations

For an MPR TL, the following features are either not supported or operate with a reduced capability.

**Table B-3: IEC Symbols Used**

Feature	Capability
<b>Scan Types</b>	Only static, dynamic, gated and spectrum scan types are supported. Whole body, tomo and gated tomo scans are not supported.
<b>Scan Set Up</b>	No pre-programmed moves are provided that can be used to automatically position the gantry or detector during scan set up.
<b>Scan Status</b>	The Acquisition Card status area displays the positions of the gantry rotation, radius and detector tilt axes only. No patient table axis positions are displayed.
<b>Scan Resume</b>	Resuming a scan that is interrupted by moving an axis restores the positions of the gantry rotation, radius and detector tilt axes only.
<b>Handset Buttons</b>	The handset can be used to position the gantry rotation, radius and detector tilt axes only. The handset table vertical, longitudinal and lateral buttons are non-functional. All other handset buttons operate normally.
<b>Axis Calibration</b>	After the system is powered on, only the gantry rotation, radius and detector tilt axes are calibrated.
<b>Pre-Programmed Positions</b>	Only Home Position, Collimator Change 1 and Collimator Change 2 pre-programmed positions are provided. Prompts that are displayed for pre-programmed positions do not refer to the patient table.
<b>Centre of Rotation</b>	The Centre of Rotation correction is not required. The Quality Control Card function is not available.
<b>Clinical Protocols</b>	A reduced set of clinical protocols are provided. No clinical protocols that use whole body, tomo or gated tomo scans are available from the ToDo card Add menu. Basic scan templates for all scan types are defined, allowing any scan type to be created in the ToDo or Template lists. However, the Camera On button is not available for whole body, tomo and gated tomo scans, preventing such scans from being set up or started.
<b>User Templates</b>	User templates for whole body, tomo or gated tomo scans can be loaded into the database. User templates for all scan types can be loaded, allowing any scan type to be created in the ToDo or Template lists. However, the Camera On button is not available for whole body, tomo and gated tomo scans, preventing such scans from being set up or started.
<b>Accessories</b>	User Millennium accessories for the 3-Axis and Single Axis tables are no appropriate.

---

## Non Applicable Issues

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### Overview

Unless otherwise stated, all descriptions and operating instructions for the use of the 3-Axis or Single Axis patient table should be ignored for an MPR TL.

All descriptions and operating instructions on the set up, use and performance of whole body, tomo and gated tomo scans should be ignored for an MPR TL. Only static, dynamic, gated and spectrum scan types are supported.

---

### Chapter 1

**Ignore Chapter 1.**

Instead, use section [Safety and Regulatory Information on page B-6](#).

---

### Chapter 2

**Ignore all references to Table in this chapter.**

---

### Chapter 3

**Ignore all references to Table and Table extender in this chapter.**

**Note**

•The handset has 3 buttons dedicated to the 3-axis Table Operation ([Table 3-7 on page 3-17](#)). These buttons are non-operative in MPR TL. Activating these buttons will have no effect.

•The [IV Pole Holder on page 3-35](#) is designed to be mounted on the 3 axis Table. Users are required to provide their own holders for MPR TL.

---

## Chapter 4

**Ignore all references to Table in this chapter.**

**Ignore all references to Whole Body Tomography and Gated Tomography scans, as these scans are not available in MPR TL.**

Pre-programed Positions ([Table 4-3 on page 4-22](#) and [Table 4-4 on page 4-24](#)): Only 3 pre-programmed positions are available in MPR TL operation: Home Position, Collimator Change 1 and Collimator Change 2. These are described in [Table 4-4 on page 4-24](#).

[Acquisition and Review Screen on page 4-16](#): Only the Radial and Tilt position information is provided in MPR TL configuration..



**Figure B-16.** Acquisition and Review Screen

---

## Chapter 5

**Ignore all references to Whole Body Tomography and Gated Tomography scans, as these scans are not available in MPR TL.**

[Including a Pre-Programmed Position into an Acquisition on page 5-22](#): No pre-programmed positions are available on an MPS system with a Single Axis table or on MPR TL.

[Scan Control Area on page 5-40](#): The Camera On button text appears grey when it is unavailable. Clicking the unavailable button has no effect. Camera On is unavailable if the selected scan is already acquired, if there is an error indicated in a Set Up card or if the type of the selected scan is not supported on this system.

---

## Chapter 7

**Ignore all references to Whole Body Tomography and Gated Tomography scans, as these scans are not available in MPR TL.**

All the listed [Pre-Programmed Motions \(PPM\) on page 7-27](#) are not available in MPR TL.

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## Chapter 10

[Center Of Rotation \(COR\) on page 10-14](#) is irrelevant for MPR TL and can be ignored.

---

## Chapter 11

**Ignore all references to Table in this chapter.**

---

## Safety and Regulatory Information

The safety precautions and regulatory information included in this chapter are provided in the following sub-sections:

- [Safety Definitions and Symbols Used on page B-9](#)
- [Safety Devices on page B-11](#)
- [Patient Safety and Emergency Egress on page B-17](#)
- [Data Safety on page B-19](#)
- [Safe Operation Guidelines on page B-20](#)
- [Safety Labels and Rating Plates on page B-22](#)
- [Regulatory Information on page B-27](#)

---

### General Safety

1. This product was designed and manufactured to ensure maximum safety of operation. It should be operated and maintained in strict compliance with the safety precautions, warnings and operating instructions contained herein, and in all other documentation specific to the product.
2. The system has been designed to meet all the safety requirements applicable to medical equipment. However, anyone attempting to operate the system must be fully aware of potential safety hazards.
3. There are no user serviceable parts in this system. The product should be installed, maintained and serviced by qualified service personnel according to procedures laid down in the product service manuals.
4. The system in whole or in part should not be modified in any way without prior written approval by GE Medical Systems.
5. The owner should make certain that only properly trained, fully qualified personnel are authorized to operate the equipment. An authorized operators list should be maintained.
6. It is important that this manual should be kept at hand, studied carefully and reviewed periodically by the authorized operators.

7. The manufacturer or Vendor of the equipment makes no representation, however, that the act of reading this manual renders the reader qualified to operate, test or calibrate the system.
8. Unauthorized personnel should not be allowed access to the system.
9. Do not leave the patient unobserved at any time.
10. If the product does not operate properly or if it fails to respond to the controls as described in this manual, the operator should:
  - First ensure the safety of the patient and then the protection of the equipment.
  - In any potentially unsafe situation, the patient should be evacuated from the area as quickly as possible.
  - Freeze the situation and prevent any changes.
  - Contact the service office immediately, report the incident and await further instructions.

11. The images and calculations provided by this system are intended as tools for the competent user. They are explicitly not to be regarded as a sole incontrovertible basis for clinical diagnosis. Users are encouraged to study the literature and reach their own professional conclusions regarding the clinical utility of the system.
12. The user should be aware of the product specifications, system accuracy, and stability limitations. These limitations must be considered before making any decision based on quantitative values.  
In case of doubt, please consult your sales representative.
13. Preventative maintenance must be carried out regularly to ensure safe operation of the equipment
14. For user maintenance of the system and performance tests, refer to maintenance and QC sections, respectively.
15. **Electrical Shock Hazard** - do not remove or open system covers or plugs. Internal circuits use high voltage capable of causing serious injury. An electrical hazard may exist if any light, monitor or visual indicator stays on after the system is shut down. To prevent possible injury, turn off the mains power supply wall switch, and contact your service office immediately. Fuses blown within 36 hours of being replaced may indicate malfunctioning electrical circuits within the system. Have the system checked by qualified service personnel, and do **not** attempt to replace any fuse. The 120VAC power distribution unit, used for the computer and monitor power supply, should not be placed on the floor.
16. **Electrical Fire** - conductive fluids that seep into the active circuit components of the system may cause short circuits that can result in electrical fires. Therefore, do not place any liquid or food on any part of the system.  
To avoid electrical shocks or burns caused by the use of wrong type of fire extinguisher, make sure that only fire extinguisher approved for use on electrical fires are used.
17. **Explosion Hazard** - do not operate the equipment in the presence of explosive liquids, vapors or gases. Do not plug in or turn on the system if hazardous substances are detected in the environment. If hazardous substances are detected after the system has been turned on, do not attempt to turn off or unplug the system until the area has been evacuated and ventilated.
18. **Implosion Hazard** - do not subject the system to serious mechanical shock, as the Cathode Ray Tube (CRT) can fracture if struck or jarred. This may result in flying pieces of glass and Phosphor coating, that can cause serious injury.
19. **Overheating** - Do not block the ventilation ports of the electronic equipment. Always maintain at least 6 inches (12 cm) clearance around the ventilation ports to prevent overheating and damage to the electronic hardware.

---

## Safety Definitions and Symbols Used

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### Safety Definitions

The safety instructions contained in this manual are for the protection of the patient, operator and service personal. They identify hazards that will or may occur if instructions are ignored.

The identified hazards are defined and classified as follows:



#### **DANGER**

**Danger** is used to identify conditions or actions for which a specific hazard is known to exist. These hazards **will** cause severe personal injury, or result in damage to property if the relevant instructions are ignored.



#### **WARNING**

**Warnings** are used to identify conditions or actions for which a specific hazard is known to exist, which **may** cause severe personal injury, death or substantial property damage if the instructions are ignored.













#### **CAUTION**

**Cautions** are used to identify conditions or actions for which a potential hazard may exist, which will or can cause minor personal injury, or property damage if the instructions are ignored.

**IEC Symbols Used**

The system may have labels with one or more of the following symbols. These symbols indicate the IEC standards to which the system conforms.

**Table B-4: IEC Symbols Used**


Symbol	IEC Standard
	Alternating Current
	Protective Earthing Point
	ON / Power
	OFF / Power OFF
	Input Power
	Output Power
	Functional Earth Ground
	Warning, Caution - consult accompanying documents
	Electrical Shock Hazard
	Type B Equipment

---

## System Safety Symbols

The system includes labels with one or more of the following symbols.

**Table B-5:**

Symbol	Meaning
	Do not insert fingers or hands

---

## Safety Devices

The imaging system has 3 basic types of safety devices:

- [Safety Devices on page B-12](#) – used by the operator to halt the motorized system motions in cases where there is any possibility of danger to the patient.
- [Safety Devices on page B-14](#) – serve to protect against an inadvertent collision or contact between the patient and the detector during imaging procedures
- [3-Axes Patient Table – Lock/Unlock Pedals on page 1-15](#) – used by the operator in emergency situations to evacuate patients
- [Single Axis Patient Table – Lock/Unlock Pedals on page 1-16](#) – used by the operator in emergency situations to evacuate patients

**Important**

The operator must be familiar with the location and operation of all safety devices.



**WARNING**

If there is any possibility of danger to the patient, press one of the emergency stop buttons to halt the motion.

**Important**

The Safety Devices must be maintained and tested on a regular basis.



**WARNING**

Do not place high activity sources close to an uncollimated detector. Sources greater than 0.5 mCi (18.5 MBq) placed within 0.5 m of an uncollimated detector may cause long term image quality defects

---

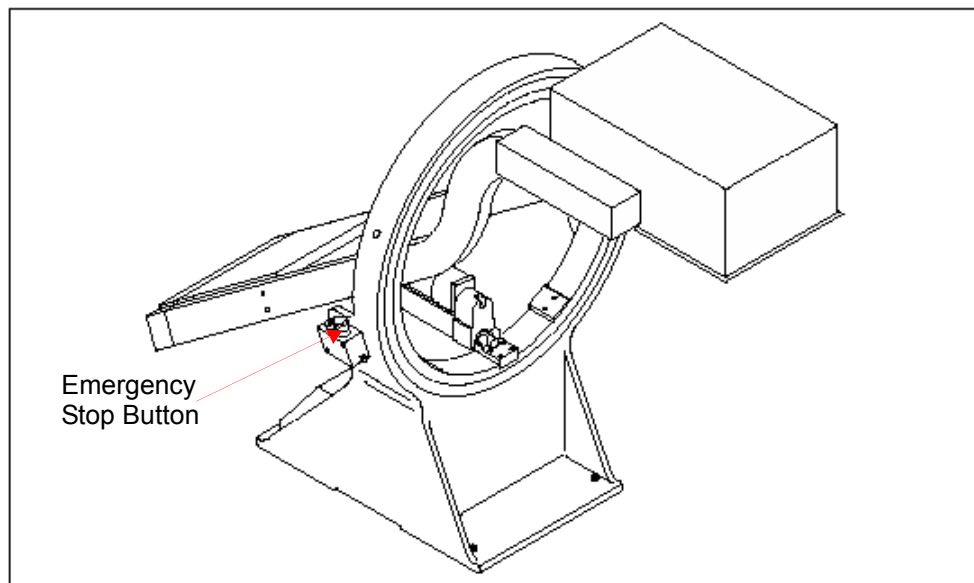
**Emergency Stop Buttons**

The system is fitted with 3 emergency stop buttons (E-stop), two on the gantry and one on the wall.

---

**Gantry E-stop Buttons**

The gantry is fitted with two red E-stop buttons located on either side of the gantry ring as shown in [Figure B-17](#).



**Figure B-17.** Location of the Gantry E-stop Buttons

Pressing either of the E-stop buttons interrupts power to all motors, stops all motion, and engages the brakes on the motors.

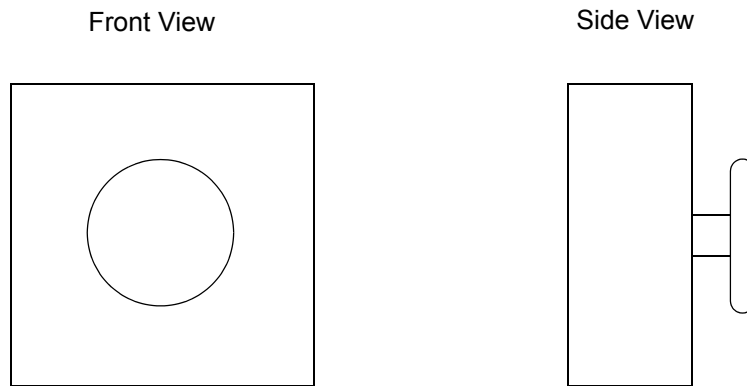
A warning message: **E-Stop Depressed** is displayed.

The [Emergency Stop Buttons](#) is described on [page B-13](#).

---

### External E-stop Button for MPS System

The MPR TL has an external emergency stop (E-stop) button, which should be mounted on the wall next to the operator console.

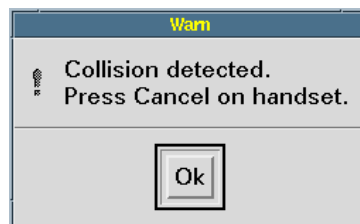


**Figure B-18.** Wall Mounted E-stop for MPS Systems

---

### E-stop Recovery Procedure

After the emergency stop button has been pressed, a warning message is displayed on the screen of the acquisition computer.



**Figure B-19.** E-Stop Warning Message

To restore functionality to the system:

1. Clear the emergency condition before proceeding, including clearing any potential collisions or removing the patient from the system.

2. Reset the emergency stop button by rotating counterclockwise or pulling (depending on the type of E-stop button fitted) until you feel it release.

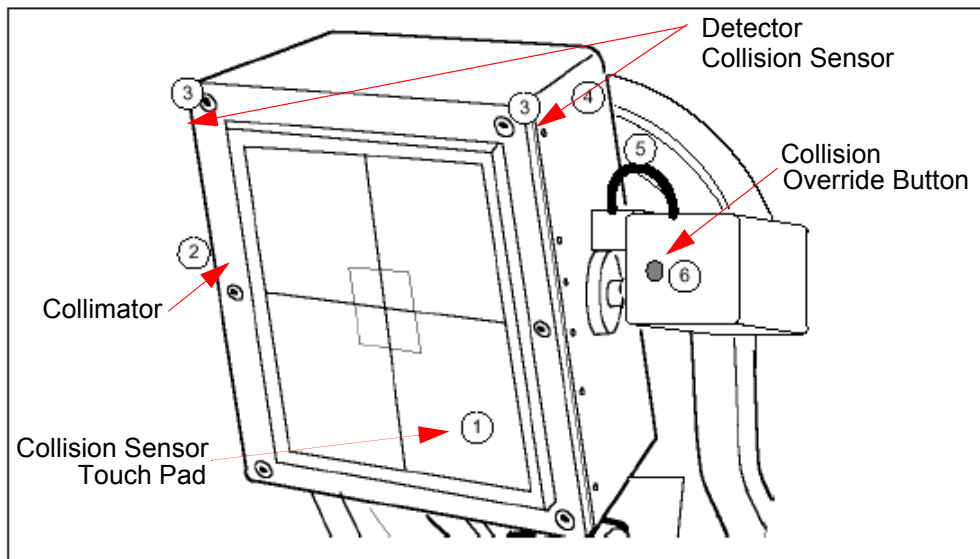
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## Collision Sensors

### Collimator Touch Pad Collision Sensor

The collimator attached to the Millennium MPR/S detector is fitted with a touch pad Collision Sensor which covers the entire front surface and both sides of each collimator. See [Figure B-20](#)

The collision sensors are designed to protect against an inadvertent collision or contact between the detector and patient (or any other object in the path of the detector) during imaging or detector orientation procedures



**Figure B-20.** Detector and Collimator Collision Sensors

No.	Description	Function
1	Collimator Collision Touch Pad	Stops all gantry and table motion, upon collisions.
2	Collimator	Shield the detector from scatter radiation
3	Detector Collision Sensors	Stops all gantry and table motions upon collision
4	Detector casing	Protects crystal/detector electronics
5	Detector Cable	Houses electronic wiring

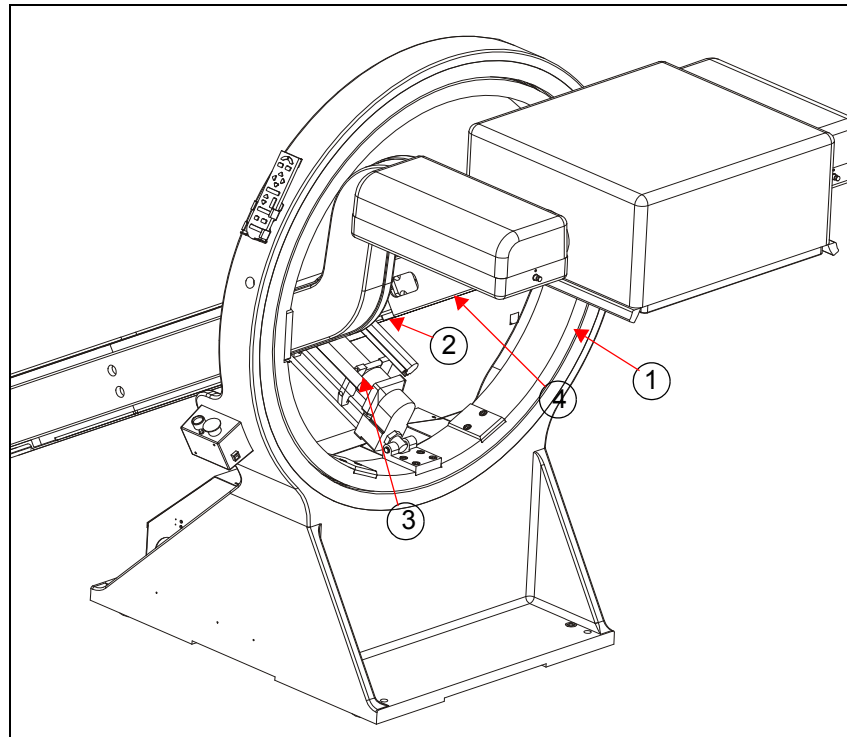
No.	Description	Function
6	Collision Override Button	Permits gantry movement, upon collisions.

### **Gantry Collision Touch Pad Sensors**

There are two collision touch pads mounted on the gantry arms in front of the ring as shown in. These pads cover the parts of the gantry most likely to collide with the patient or table.

The Actuator and Tilt Axis covers are also fitted with collision touch pads.

See [Figure B-21](#)

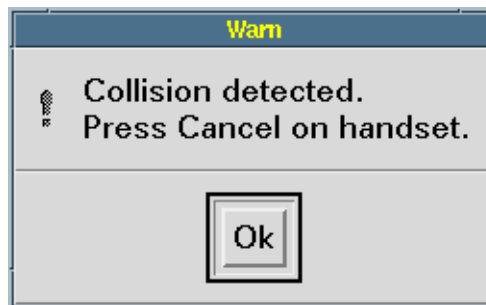


**Figure B-21.** Collision Sensors

No.	Description	Function
1	Detector Sensors	When depressed, stops the gantry and table movements.
2	Gantry Arm Sensors	
3	Actuator Sensors	
4	Tilt Axis Cover Sensors	

**Important** Collision sensors do not eliminate the need for proper patient positioning. The patient and system must be constantly monitored for possible collisions during all procedures.

If the patient or table comes into contact with one of the collision sensors, power is interrupted and all motion is stopped. A warning message appears. See [Figure B-22](#)



**Figure B-22.** Collision Warning

In addition, a buzzer will sound, and the collision activator latches in the **Collision** state.

**Note** Once latched in the *collision state*, subsequent collision activations have no effect on the system

---

### Collision Recovery Procedure

To recover motion after a collision situation, use the following steps

1. Remove the obstacle (patient or table) from the path of the collision sensor.
2. If motorized motion is required, press the **<Collision Override>** button (see [Figure B-20](#)) and then press the required key on the Hand-held Controller.

**Note**

The system will remain in the Collision State even after the obstacle has been removed.

3. Press the Handset **<CANCEL>** button to silence the beep and return the system to IDLE State (no collision).



**CAUTION**

Collision sensors should be tested daily and after every collimator exchange

---

**Collision Sensor Testing**

1. Using the handset, set the Gantry in motion and apply pressure to one of the Collision Sensors  
Contact with the Collision Sensor should cause all motion to stop, a buzzer to sound, and the collision activator to latch in the *collision* state.
2. Press the <**Collision Override**> button (see [Figure B-20](#) on [page B-14](#)) and then press the required key on the Hand-held Controller; verify that all motions can be activated (the system is still in Collision State).
3. Press the Handset <**CANCEL**> button to silence the beeper and return the system to the IDLE State (no collision).



**WARNING**

If for any reason the collision sensors are not functioning correctly, the system should **not** be used until repairs have been carried out.

---

**Patient Safety and Emergency Egress**

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**Patient Handling**

1. All MPR TL studies are static. Nevertheless, the operator must monitor the patient during the entire study, to ensure that there is no unintended gantry or head motion.



**CAUTION**

The patient and operator should remain clear of the gantry during all transitions. As the detector may be rotate care must be taken that nothing obstructs its path.



**WARNING**

Unintended motion could cause Injury. Never leave the patient unattended and always monitor the position of the patient and equipment during scan procedures

2. Potential Pacemaker Hazard - though the possibility of interference with pacemakers is small, the operator should be alert to such a potential hazard from any equipment using high frequency electrical signals
3. Never exceed the rated load of patient handling devices.
4. The user should be aware of system limitations regarding particularly large or overweight patients. Please be aware of any particular system limits or safety precautions and labels regarding large or overweight patients. In case of doubt, please contact your Vendor.



**CAUTION**

Large or overweight patients may encounter difficulties with the physical clearance of the system



**WARNING**

Never exceed the rated load of patient handling devices as this may cause damage to equipment and possible injury.

---

**Patient Positioning**

The operator should:

- Ensure that patients do not move their bodies during scans.
- Ensure that obstacles do not interfere with the movement of the detector head.
- Advise the patient not to move during the positioning and study procedures.



**WARNING**

Make sure that any patient connected lines, tubes etc. are long enough to allow for the full travel of the system, without pulling or restricting

## **Emergency Egress**

System operation may be stopped due to power failure or a safety event (something coming into contact with the collision sensors), or the system may be halted by the operator in response to emergency conditions.

In any case, the operator must first ensure that the patient is safely removed using the appropriate removal procedure.

---

## **Patient Removal During Normal Operation**

During normal operation, the gantry can be controlled from the handset. The patient can be removed using the handset controls to raise the detector to clear the patient.

---

## **Patient Removal During Collision State**

If the patient collides with a collision sensor, all motions are stopped

and disabled. Motion may be re-enabled by pressing the desired handset motion key while simultaneously holding down one of the white **<collision override>** buttons on the detector. As soon as the collision is cleared, motion is enabled.

---

## **Data Safety**

---

### **General**

- Verify and record the patient's identification before starting a scan.
- Observe and record the patient's orientation, position and anatomical landmarks before starting a scan. Ensure that the patient is positioned within the scan parameters.

---

### **Connectivity**

Always verify that the data transferred to another system has been correctly received.

---

## Safe Operation Guidelines

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### Moving the System Components

Always check for obstructions before moving the Operator Console or the Collimator Cart. Special care should be taken not to move these units over cables connected to the Gantry, Patient Table, or Operator Console.

---

### Collimator Exchange

Collimators should be properly installed and firmly secured.

Each time after loading a new set of collimators onto the Head and **before** performing any study, rotate the Gantry for a full rotation (360°) at least, without a patient on the Table, to verify that the collimators are firmly anchored in place.

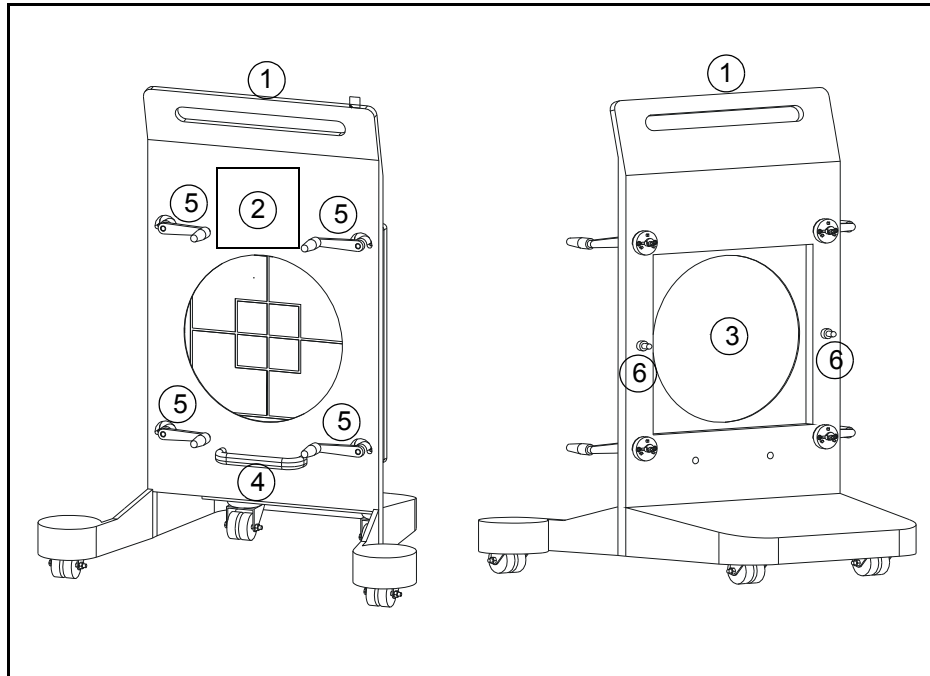


**CAUTION**

Collision sensors should be tested after every collimator exchange

## Collimator Carts

Collimators are supplied mounted on a collimator cart, which provides the means to transport the collimator to and from the gantry and store collimators that are not in use. The collimator cart is very heavy. It is important to follow the instructions on the CAUTION notice attached to the cart



**Figure B-23.** Collimator Cart

No.	Description	Function
1 & 4	Maneuvering Handle for hand operation	Used to dock cart to detector head
2	Operating Instructions	Step-by-step procedure for collimator changing
3	Collimator	Shield the detector from scatter radiation
5	Collimator Locking Handles	Lock or release collimator to/from cart
6	Guide pins	Align collimator and cart

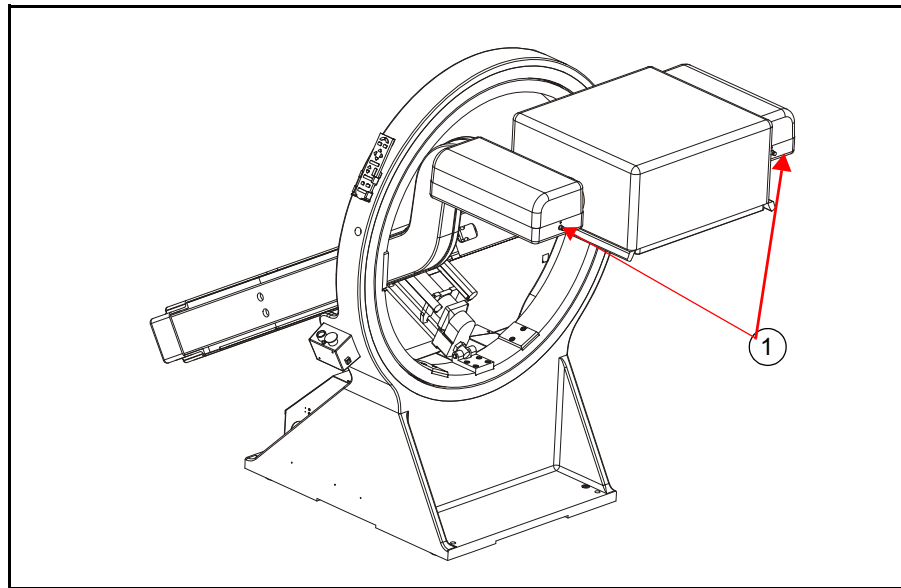
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## Safety Labels and Rating Plates

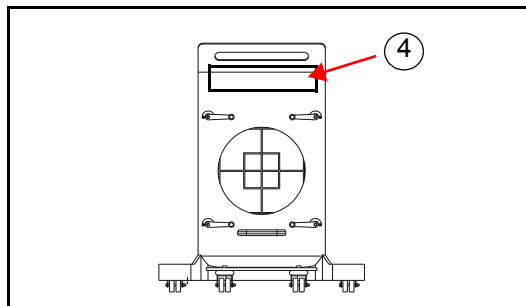
Safety labels and rating plates are located on various parts of the equipment as shown in the following figures:

- [Figure B-24](#)– depicts the safety labels and rating plates on the gantry
- [Figure B-25](#) – depicts the safety labels located on the collimator cart
- [Figure B-26](#) – depicts the rating plate located on the monitor cart.

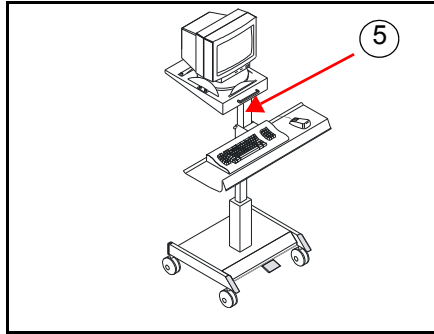
The various safety labels and rating plates are specified in [Table B-6](#) according to the numbers assigned in the figures listed above.



**Figure B-24.** Warning Labels and Rating Plate Locations on MPR Systems


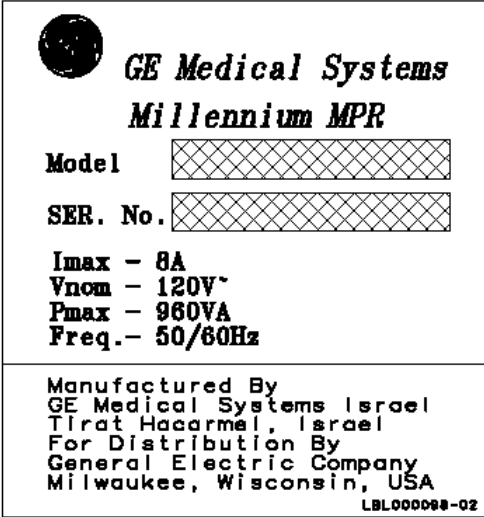
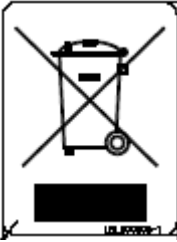


**Figure B-25.** Warning Label Location on the Collimator Carts



**Figure B-26.** Rating Plate Location on Mobile Cart

**Table B-6:** Warning Labels and Rating Plates

Label No.	Label
<p>1. Collision Override</p> <p>(Collision override on gantry tilt covers)</p>	 MOTION ENABLE
<p>2. Gantry Rating Plate for MPR</p>	
<p>3. WEEE Label</p>	

**Table B-6:** Warning Labels and Rating Plates

<p>4. Collimator Cart</p>	<p style="text-align: center;"><b>WARNING</b></p> <p><b>THESE HANDLES RELEASE THE COLLIMATOR</b></p> <p>Failure to follow the operating instructions could cause the collimator to fall and cause serious injury. Before moving, verify that all four latches are engaged.</p> <p style="text-align: center;"><b>CAUTION</b></p> <p><b>THIS UNIT WEIGHS UP TO 140 KG (310 LBS)</b></p> <p>Care must be used when transporting from one area of use to another. Failure to follow these precautions could result in uncontrolled motion and injury to the operator or others.</p> <p><b>ALWAYS:</b></p> <ol style="list-style-type: none"> <li>1. Be sure the pathway is clear.</li> <li>2. Limit the movement to a slow careful walk.</li> <li>3. Use at least two people when moving on inclines.</li> </ol>
<p>5. Mobile Cart</p>	<p style="text-align: center;"><b><u>IMPORTANT</u></b></p> <p>OPERATING INSTRUCTIONS – THE PNEUMATIC CYLINDER IN THIS UNIT IS DESIGNED AS AN <u>ASSIST</u> IN RAISING AND LOWERING, IT IS NOT INTENDED TO PROVIDE FINGER TIP CONTROL. TO ACTIVATE THE AIR CYLINDER, PLACE BOTH HANDS ON THE KEYBOARD SHELF, SQUEEZE ACTIVATING LEVER, THEN RAISE UNIT TO DESIRED HEIGHT.</p>

**Table B-6:** Warning Labels and Rating Plates

<p>6. IPS Rating Plate</p>	<div style="border: 1px solid black; padding: 10px;"><p style="text-align: center;"><b>Millennium Integrated Power Supply</b></p><p>Serial Number: <input type="text"/></p><p>Date Code: <input type="text"/></p><p>Weight: 125 LBS / 57 KG</p><p>Input Voltage: 100/120/200/220/240 VAC</p><p>Frequency: 50/60 HZ</p><p>Phase: Single</p><p>Power: 968 VA</p><p style="text-align: right; font-size: small;">LBL 000693-AA</p></div>
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## Regulatory Information

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### Standard Compliance

The equipment complies with the IEC 601-1 standard. It is classified as Class 1 Type B equipment, Mode of Operation: Continuous.

This equipment generates and can radiate radio frequency energy. The equipment may cause radio frequency interference to other medical and non-medical devices and to radio communications. To provide reasonable protection against such interference, the camera complies with the emission limits for a Group 1, Class A Medical Devices as stated in EN 60601-1-2. However, there is no guarantee that interference will not occur in a particular installation.

If the equipment is found to cause interference (which may be determined by turning the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem by one or more of the following measures:

- Re-orient or relocate the affected device(s);
- Increase the separation between the equipment and the affected device;
- Power the equipment from a source different from that of the affected device;

and/or

- Consult the point of purchase or service representative for further suggestions

The manufacturer is not responsible for any interference caused by using other than recommended interconnect cables or by unauthorized change or modifications to this equipment.

Unauthorized change or modifications could void the user's authority to operate the equipment.

Do not use devices which intentionally transmit RF signals (cellular phones, transceivers, or radio-controlled products) in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

The medical staff in charge of this equipment is required to instruct technicians, patients, and other people who may be around this equipment to fully comply with the above requirement.

To comply with the regulations on electromagnetic interference for a Group 1, Class A Medical Device, all interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio frequency interference in violation of the local regulations.

Due to installation in less favorable environment, this equipment may be exposed to electromagnetic and electrostatic interference. To ensure a high level of reliability when exposed to such interference, this equipment complies with the immunity requirements as stated in EN60601-1-2. for immunity Class 1. The operating conditions are classified on the basis of performance criteria as defined in IEC 801-2.

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## **CE Conformity**

This product conforms with the requirements of council directive 93/42/EEC concerning Class IIA medical devices, and therefore bears the CE mark of conformity:



The name and address of the CE Representative appears on the back of the front page of this manual.

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## **USA Regulations**

- The system was cleared for sale in the USA by the FDA.
- Caution: Federal US law restricts this device for sale by or on the order of a physician.
- In the USA, this system should only be used with FDA-approved radiopharmaceuticals.

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# Glossary

**Acquisition:** Intake of data to the computer which can then become processed, displayed and/or stored.

**Activity:** A synonym for radioactivity. In *absolute* units, it relates to the number of radioactive atoms decaying per unit of time and is usually expressed in curies, millicuries, or counts per unit time.

The average number of spontaneous nuclear transitions from a particular energy state occurring in an amount of radionuclide over a small time interval. The SI unit of activity is the becquerel (Bq); the non-SI unit is the curie (Ci).

1 Bq = 1 disintegration/sec

1 Ci =  $3.7 \times 10^{10}$  Bq

**Address:** Label, name, or number that designates a location where information is stored.

**Akinesis:** An area of the heart wall that does not move.

**Algorithm:** An explicitly defined process made up of a number of discrete steps or instructions designed to solve a particular problem; these instructions are frequently coded using computer languages.

**Alphanumeric (A/N):** Keyboard letters, numbers, and symbols.

**Amplitude Image:** This image gives an indication of the stroke volume associated with each pixel.

**Amplitude Of Wave:** A measure of the maximum displacement or height of a wave crest from its undisturbed position.

**Analog:** A physical quantity that is measured as a continuous range of values as opposed to digital quantities that can have only discrete values; (e.g., signals from a  $\gamma$  camera).

**Analog-Digital Converters (ADC):** Electronic device used to convert an analog signal such as a pulse height into digital information recognizable by a computer.

**Aneurysm:** A weak or dyskinetic area of the heart wall.

**Annotation:** System-supplied text which accompanies an image when it is displayed on-screen, describing when and how that image was acquired, with what parameters; plus text or graphics added by the user.

**Anterior:** Used in reference to the front or forward part of a body or organ.

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**Anterior Projection (Cardiac Imaging):** Patient position used in qualitative wall motion evaluation of anterolateral wall and apical region.

**Archive:** To store files somewhere other than on the system's main disk, e.g., storage on floppy disk, magnetic tape, or optical disk.

**Array Processor:** A specialized processor used to perform high speed arithmetic operations. This processor is used in tomographic reconstruction.

**Artifact:** An error in the reconstructed image that does not correspond to the patient or represent real data.

**Attenuation:** The decrease in the intensity of radiation caused by the absorption and scattering of the radiation as it passes through matter.

**Axial Plane:** Any plane that divides the body into superior (head) and inferior (feet) aspects. Also called the Transverse or Transaxial Plane.

**Background Counts:** Unwanted counts recorded usually due to low level radiation other than those arising from the primary radioactivity being detected.

**Background Subtraction:** Method employed for subtracting background activity from the heart. Necessary for accurate EF calculation.

**Back-Projection:** A method of summing the pixel values in each transaxial slice of tomographic data and using the results to provide a three dimensional representation of an image.

**Basic:** A very high level programming language. BASIC stands for Beginners All-purpose Symbolic Instruction Code. While easy to learn, BASIC lacks the power, speed and flexibility of more sophisticated programming languages.

**Batch Filming:** A group of datasets waiting to be filmed.

**Batch Operation:** Computer operations that runs consecutively without operator intervention.

**Binary:** Refers to number of the base 2. Such numbers can be composed of only the digits 0 and 1: numbers are thus strings of 0s and 1s, in which each digit position toward the left represents an increasing power of 2. Computers use binary numbers because such numbers are easy to represent on and off states in simple circuits and because they are easy to process.

**Bit:** Constructed from the words *B*inary *d*igi*T*, the term refers to a single digit of a binary number. Its value is either one or zero. For example, the binary number 101 is composed of three bits.

**Board:** A rectangular sheet on which the circuits of a computer are mounted. The board, in turn, is mounted on a chassis in a computer box.

---

**Boot:** To start a computer's operation system.

**Brightness:** A camera control which regulates the amount of light permitted in the exposure process. As it is increased, the density of the filmed image decreases.

**Bus:** A set of wires along which digital information travels between the units that comprise a computer.

**Byte:** Eight consecutive bits treated and stored as a group.

**Byte Mode:** Method of storage used for images in which the value for one pixel is stored in one byte (8 bits = 1/2 word) and has value between 0 and 256.

**Card:** Functions required to perform image manipulations grouped together on graphical menus analogous to paper note cards.

**Cassette:** A holder for individual films, used in the Manual Filming.

**CD-ROM:** Compact Disk Read Only Memory.

**Central Processing Unit (CPU):** The part or parts of computer hardware that carry out data manipulation (processing or moving data) and control the sequence of operations performed by the computer that interpret and execute instructions. One important part of the CPU is the arithmetic unit, which performs math operations. Another part is the control unit that supervises the sequencing of operations. The internal memory contains the instructions (programs) that determine what is to be done in what sequence.

**Chip:** Chips are tiny circuits. Thousands of microscopic electronic components are etched on the chip's surface, forming what is known as an integrated circuit. Each component on the chips can represent a single binary digit as an on or off voltage. Because there are so many components on the chip, the chip can process thousands of pieces of information per second.

**Cine:** Software that animates dynamic datasets for sequential viewing.

**"Cold":** A colloquial term meaning little or no radioactivity. A "cold" spot or "cold" lesion would be an abnormal area of decreased radioactivity relative to the amount of radioactivity present in the surrounding tissue.

**Color Bar:** A bar on the right side of the Data Display screen showing the relative brightness of each color represented in an image. This bar is used as a reference color guide for verifying color accuracy on more than one monitor or on hard-copy film.

**Collimator:** A device used on a gamma camera consisting of a thick lead plate with thousands of holes through it, designed to allow only those gamma rays traveling in a certain direction to strike the detector. Analogous to a lens on a photographic camera.

---

**Color Map:** Predefined settings used for specific color emphasis.

**Command:** A keystroke or a line of input that entered to make an application program work.

**Compile:** To produce a binary-code program from a program written in source (symbolic) language, by selection of appropriate subroutines from a subroutine library.

**Compiler:** Program used to compile assembly code or source code.

**Compton Effect:** Absorption or attenuation effect observed for x- and  $\gamma$  radiation in which incident photons interact with orbital electrons and released photons of energy less than the incident photons. When  $\gamma$  rays fall on a scintillation crystal, they generally produce a spectrum that corresponds to the energy distribution. This is generally called the Compton spectrum of the  $\gamma$  rays.

**Computer Languages:** Rather than operating in tedious machine language (the binary code of "0" and "1"), a programmer can talk to the computer in a high level language (which is close to English). Examples are BASIC, Pascal, Mentor, C-Plus.

**Computer Program Contrast:** A series of coded instructions for solving a problem by means of a computer. The difference between the image of an object and the surrounding background.

**Contrast:** In filming, camera control that increases or decreases the density of the darker areas in a filmed image, relative to the density of its lighter areas.

**Control Character:** A character entered by holding down the CTRL key and pressing a typing key. Many application programs allow to enter control characters for such functions as moving the cursor and manipulating data. When they must be represented in writing, they are prefixed with a caret (^) or with the word CTRL.

**Control Point:** Small squares surrounding region of interest shapes used to change their size or shape.

**CPU:** Refer to Central Processing Unit.

**Coronal:** The horizontal plane along the longitudinal axis of the body dividing it into anterior (front) and posterior (back) halves.

**Cursor:** A symbol on a computer's display that marks the place where the next thing to type will appear.

**Curve:** A plot of an x-, y- based grid which displays a specific relationship among data. Usually generated from a selected region of interest applied to a series of images (e.g., time-activity curve).

---

**Curve Generation:** There are several techniques in which nuclear medicine image data are displayed in the form of curves. One method is the generation of a profile across an image, with the subsequent formation of a curve that reflects the change in counts with spatial position. Another technique is to use a region of interest (ROI) to monitor the change of counts with time within a restricted area of a “dynamic” set of images.

**Cycle Acceptance Window:** The range of cardiac cycle times (R to R interval times) that will be accepted in a multigated acquisition.

**Database:** A structured, organized collection of patient data.

**Default:** A default value, default image, or default operation is the one that is used by a computer unless another one becomes specified by the operator.

**Density:** A camera control which regulates exposure time as you film images.

**Destination:** In networking, the station to which an image is transferred, whether it is transmitted or retrieved.

**Digital:** In direct contrast to analog signals, digital information can assume only a finite number of discrete values.

**Digital Archive Tape:** Also, abbreviated as DAT. Long term storage tape.

**Digital Camera:** A camera in which the spatial position of the output of each event is adjusted according to a predetermined matrix. This matrix is a map of the response to a narrow point source for each location over the detector’s field of view.

**Directory:** An area on a disk that records the names and locations of the files on the computer disk.

**Discriminator:** A circuit used to eliminate pulses greater/less than a specified height. The instrument is useful in reducing noise and low pulse–height background.

**Disk:** Memory based on a rotating disk, similar to a music record, which is often covered with a magnetic ferric coating. Binary numbers of computer data are recorded as patterns of magnetization on the disk surface. Floppy disks are small, flexible, plastic disks that can be slotted into a disk drive for transfer of data. Winchester disks are rigid disks of large capacity. The size of a disk is usually expressed in terms of megabytes of storage capacity.

**Disk Drive:** A generic name for “hardware” having moving mechanical parts and designed to store data on magnetic media.

**Display matrix:** The number of pixels in a displayed image, expressed in terms of number per axis, such as 256 x 256.

---

**Distal:** Remote; farther away from a given point of reference.

**Distortion:** The deviation of the image from the true pattern of the object being imaged.

**Diverging Hole Collimator:** The diverging hole collimator has been principally used with small field of view gamma cameras to enable large organs to be visualized on a single image.

**Dynamic:** Changing rapidly, such as a flow study. Dynamic studies are performed during administration of a radiopharmaceutical to image its progress.

**Dynamic Acquisition:** A dynamic acquisition is a series of images that are recorded to reflect changes within the radioactive distribution with time. The acquisition may monitor changes in concentration of the radiopharmaceutical, transfer of radioactivity, changes in shape or volume of organs, transient perfusion effects, or the excretion of a radionuclide. Also called a “flow” study.

**Ejection Fraction:** A measure of the ability of a ventricle to expel blood. The ejection fraction equals the stroke volume divided by the end-diastolic volume. A normal left ventricular ejection (LVEF) fraction is approximately 0.67, a value that indicates that the left ventricle can expel two thirds of its volume into the aorta with each contraction.

**Energy Resolution:** The ability of the detector to discriminate between photons of adjacent energies.

**Extrinsic:** Acquisition measurements and evaluations made with a collimator on the camera.

**Fetch:** A command to take the next instruction from a computer memory.

**Field Nonuniformity:** Uniformity requirements for SPECT are more stringent and require further correction than for static imaging. The greatest sources of image field nonuniformities in SPECT are “imperfect” collimators.

**Filter:** An image process used to reduce the statistical noise inherent in nuclear medicine images.

**Filtering:** A process used to smooth image data, reduce statistical noise, enhance edges for edge detection, and to process image data during tomographic reconstruction.

**Floppy disk drive:** The storage medium is somewhat like a small record sealed inside a card sleeve with a window to allow the tracks of the disk to be read or written on by a read/write head moving radially across the tracks.

**Frequency:** The number of events occurring per unit of time (e.g., a hertz or 1 cycle per second).

---

**Functional Imaging:** Method of expressing high density information in one picture. Functional imaging shows local changes in function analyzed pixel by pixel and provides an outline of areas of abnormality.

**Gamma Correction Factor:** Color filters designed to adjust color brightness settings to correct for monitor color distortion during filming.

**Gantry:** The cylindrical opening located at or near the center of an imaging scanner into which a patient is placed.

**Gated Image:** An image made from data acquired over a brief, selected, physiologic interval, usually a selected portion of the cardiac cycle, such as end-systole or end-diastole. The image data acquisition is triggered or gated by the R wave. Sufficient cycles are repetitively gated to build up data for a diagnostic image.

**Gating Device:** Hardware used to detect the R-wave trigger as input into the computer system.

**Graphical User Interface:** Software controls that allow the user to operate the workstation by using graphic objects such as menus, tabs, and scroll bars.

**GUI:** Refer to Graphical User Interface.

**Half-Life ( $T_p$  or  $T_{1/2}$ ):** The time during which an initial activity of a radionuclide is reduced to one half.

**Hard Copy:** A printed copy on some kind of paper and generally in readable form. Can also refer to an image recorded on film, videotape, magnetic tape, or disk, as opposed to being displayed on a video screen.

**Hard Disk Drive:** The storage medium is a sealed hard disk storing considerably more data than the floppy disk and having a longer life. They can be read or written onto at much greater speeds than in the case of the floppy disk. A commonly mentioned hard disk is the Winchester disk.

**HEGP:** High Energy General Purpose collimator. This is usually used with high energy radionuclides such as I-131.

**Histogram:** A graph representing the frequency distribution of various parameters (e.g., number of triggers).

**Hot Spot:** Focal area of increased activity on an image.

**Hypokinesis:** An area of the heart wall that exhibits sluggish movement.

**Image Memory:** A large block of memory made up of random-access memory (RAM) in which images are temporarily held for viewing and/or processing.

---

**Image Processor:** The image processor is resident in the electronics cabinet. This unit is concerned primarily with the processing and display of images on the image monitor from data acquired by the detector head.

**Inferior:** Situated below or directed downward.

**Information Density:** A measure of the number of recorded events per unit area, such as the number of counts per square centimeter, that are recorded in the field of interest within a particular image.

**Initialize:** To set counters, switches, addresses or variables to zero or other starting values.

**Interactive Mode:** A method of computer use in which the computer responds promptly to the user's commands so that a "dialogue" can be set up between computer and user.

**Intrinsic Energy Resolution:** Intrinsic energy resolution is a parameter of a scintillation camera which characterizes its ability to accurately identify the photo peak events. This test is performed without a collimator on the camera.

**Intrinsic Spatial:** Spatial linearity is a parameter of a scintillation camera which characterizes the amount of positional distortion caused by the camera with respect to incident gamma events entering the detector.

**In Vitro:** In an artificial environment. Taking place outside a living organism.

**In Vivo:** Within living organism.

**Lateral:** Indicating a position farther away from the midline of a body or structure; pertaining to a side.

**LEGP:** Low Energy General Purpose collimator. Average sensitivity with average spatial resolution. Usually the collimator used in multigated acquisitions.

**LEHR:** Low Energy High Resolution collimator. Excellent spatial resolution at the expense of sensitivity. Alternative collimator for use in studies where high resolution is desired such as poorly defined ventricular septum. Extra imaging time is necessary due to decreased sensitivity.

**LEHS:** Low Energy High Sensitivity collimator. Excellent sensitivity at the expense of spatial resolution. Alternative collimator for use in count limited studies such as exercise multigated acquisitions.

**Matrix:** Depending on the type of scanner, the image matrix may be composed of 64 x 64, 128 x 128, 256 x 256, or 512 x 512 picture elements, or pixels, arranged in rows and columns. The individual pixels are defined by a coordinate system. By general agreement, pixels on the axes (x, y) are counted from the top left-hand corner of the matrix.

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**Matrix Storage – Byte Mode:** A manner of image storage in which 8 bits (one byte) are used to represent up to 256 ( $2^8$ ) shades of gray (color) or count levels.

**Matrix Storage – Word Mode:** A manner of image storage in which 16 bits (one word) are used to represent up to 65,536 ( $2^{16}$ ) shades of gray (color) or count levels.

**Medial:** Closer to the midline of a body or structure.

**MEGP:** Medium Energy General Purpose collimator. This is usually used with medium energy radionuclides such as In-111 and Ga-67

**Mod:** Magneto – Optical disk. Optical disk which can have a storage capacity of up to 1,000 MBytes. This type of disk can be revitalized for revise.

**Multi-Channel Analyzer:** A number of pulse height analyzers may be operated in parallel and the results collected by a multichannel analyzer show the count rates from a number of isotopes simultaneously.

**Multi-Gated Acquisition:** Image acquired over R to R interval; the image data acquisition is triggered or gated by the patient's R-wave. The R to R interval is divided into a predetermined number of frames. Each frame represents its portion of the cardiac cycle. Cycles are repeatedly gated to build up sufficient counting statistics resulting in a representative cardiac cycle.

**Nonuniformity:** Variations in image intensity observed when flooding the gamma camera crystal with a point or uniform source of radiation.

**Parallel Hold Collimator:** The parallel hole collimator is essentially a disk of lead or heavy metal alloy in which a number of parallel holes have been drilled or cast. The cross section of the holes can be square, hexagonal, or circular. Those g-rays which enter the collimator parallel to the holes pass through and can interact with the detector, while those traveling in any other direction hit the walls and are absorbed. The distribution of scintillations in the crystal is therefore a parallel projection of the distribution of emissions of g-rays from the object being imaged. The area of the holes, the wall thickness, and the length of the holes are carefully chosen to obtain the best compromise between spatial resolution and sensitivity.

**Phantom:** A device used to simulate a naturally occurring structure and to measure the performance of an imaging system. (A "bar phantom" is specifically constructed to measure the resolution of an imaging system.)

**Photomultiplier Tube:** A device used to collect light from a scintillation crystal. The PM tube converts the light to an electrical signal and then amplifies this electrical signal for further processing.

**Posterior:** Used in reference to the back or dorsal part of a body or organ.

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**Pixel:** Acronym for a picture element; the smallest discrete part of a digital image display. Digital images are composed of a grid of picture elements (pixels). Each pixel is characterized by its position in the grid and by the density or color it will display.

**Profile:** A curve representing the distribution of counts in a horizontal or vertical strip across an image.

**Prompt:** Any chosen symbol (usually a keyboard character) that lets the user know at which level the computer is operating and also lets the user know it is waiting for an input.

**Prone:** Lying face downward.

**Protocol:** A series of steps or computer command that are linked together in a specified sequence by the operator. A step-by-step acquisition or processing sequence that prompts the operator for input every step of the way.

**Proximal:** Nearest; Closer to any point of reference.

**Pulse Height Analyzer:** A pulse height analyzer is an electronic device employed to identify and select those pulses falling between two preset amplitude settings and rejects pulses due to scattered radiation above and below the settings. The range of energies which are accepted constitutes the window of the analyzer or discriminator.

**Ramp:** The display of all 256 translation table levels in a fixed portion of the video screen; i.e., shows screen contrast and visual levels (color or black and white). Also refers to a filter function that resembles an incline plane in frequency space.

**Read/Write Head:** Electromagnetic device that reads, records, or erases information on magnetic tape, disk, or drum.

Real Time:

- 1) Pertaining to the actual time during which a physical process takes place.
- 2) Taking place fast enough that the observer does not perceive any delay.

**Reframe:** To combine several frames of a multi-image file into a singular frame.

**Region of Interest (ROI):** Outlined area on a computer-processed image, defined automatically or manually with a joystick or light pen.

**Register:** A temporary electronic storage location in which instructions or data are placed while being subject to some arithmetic or other processing operation.

**R-Wave:** A peak in the ECG signal which corresponds to the end of diastole and marks the beginning of systole.

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**Sensitivity–(Relative):** The ability of the detector device to register the gamma rays emitted from a radioactive source.

**Signal–to–Noise Ratio:** In general, the ratio of signal pulse heights to that of noise pulse heights.

**Single Photon Emission Computerized Tomography (SPECT):** Acquired tomographic data are a series of planar images taken at different angles around the patient. The data then is processed by a computer for tomographic reconstruction in a variety of planes: transaxial, coronal, sagittal, oblique.

**Spatial Resolution:** Spatial resolution refers to the ability of an instrument to image two separate line or point sources of radioactivity as separate entities. The smaller the distance between the two sources that can be imagined, the better the spatial resolution.

**Standard Deviation:** The statistical variation observed in a population or series of measurements.

**Static:** Procedures involving stationary or unchanging patterns of activity.

**Static Acquisition:** The radioactive distribution in the organ is essentially constant both in radioactivity and spatial location. Radionuclide imaging of static distributions usually entails acquiring several views of an organ such as anterior, posterior, and lateral projections.

**Storage Capacity:** The quantity of data that can be stored in computer memory and may be expressed in multiples of 1K bytes (where K is a symbol for 1024) or in megabytes (1 million bytes).

**Subroutine:** A small computer program or section of a program which performs a specific operation. May be used separately and called by several programs when needed. Also used to break larger programs up into smaller segments, thus aiding in program coding and eliminating errors.

**Superior:** Situated above or directed upward.

**Supine:** Lying with the face upward; lying on the back.

**Tab:** A menu selection tool analogous to paper file marker tabs.

**Tomographic Orientation:** The standard orientation for the presentation of tomographic diagnostic images is transaxial, coronal, and sagittal. Oblique orientation of tomographic images is vertical long axis (VLA), horizontal long axis (HLA), and short axis (SA). The oblique presentation is used in cardiac tomography.

**Tomography:** The term that describes all types of body section techniques. Computer processing of the data is usually employed in order to assist in generating the image.

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**Triggering (Gating):** A physiological trigger (R-wave) signals the computer to acquire a series of images over a specified period of time (e.g., a cardiac cycle) and is used in a multi-gated acquisition.

**Uniformity:** Uniformity refers to the ability of a scintigraphic instrument to reproduce with an image of a uniformly distributed radioactive source. Deviations from uniform count densities across the field of view of less than 8% should generally not be discernible.

**Uniformity Correction:** Adding or subtracting counts from an image to correct for irregularities such as those found in collimators. This process is often performed during tomographic reconstruction.

**Window:** A term used to describe the range of energies to be accepted by the gamma camera and utilized to form an image. Also referred to as pulse height discrimination or energy discrimination.

**Word Mode:** In this mode the depth of each pixel is 16 bits; i.e. it can hold 16 binary digits or a decimal count of 65536.

**Worm:** Write Once, Read Many; Optical disk which can have storage capacity of up to 1000 MBytes. Once data is stored on a worm disk, it cannot be removed.

**Write:** To record data on a computer memory device.

**Write-Enabled:** The condition of a volume that allows information to be written on it.

**Write-Protected:** The condition of a volume that protects the volume against information being written on it.

**X-Axis:** The horizontal coordinate of a graph (Abcissa).

**Y-Axis:** The vertical coordinate of a graph (Ordinate).

**Zoom:** To magnify or reduce the apparent size of an image.

**Z-Pulse:** A signal proportional to the total g-ray energy absorbed by the crystal. The pulse-height analyzer determines whether or not the gamma event becomes accepted during acquisition.