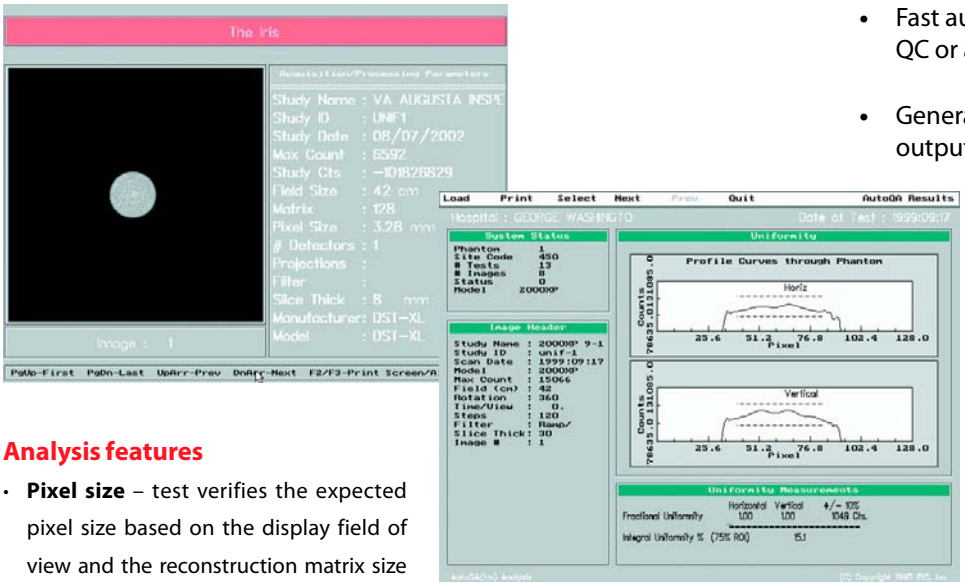
Order online

SPECT PC/AutoQA™ Software

Model 49-804

NM Nuclear Medicine



- Fast automated SPECT analysis for routine QC or acceptance testing[1]
- Generates easy to read results with hardcopy output
- Comprehensive trend analysis
- Can be configured with various vendor phantoms including the Specphan™ Phantom
- DICOM® 3.0 compatible; DICOM storage class provider (SCP) application license provided

Analysis features

- **Pixel size** – test verifies the expected pixel size based on the display field of view and the reconstruction matrix size from the measured set of four calibration pins positioned at a known physical location as specified in the Specphan slice width/resolution section
- **Slice thickness** – is determined from the average full-width at half-maximum (FWHM) of the count profile for the angled ramp pair. A trigonometric conversion is calculated based on the known ramp angle to yield the slice width. The expected slice width is compared with the paired measured ramps values
- **Slice incrementation and localizer/alignment system accuracy** – is evaluated from the slice width section when the paired ramps are at opposing angles. The slice width test outputs a parameter called Table Position Offset, which is an offset in the z-axis relative to the center of the opposing pair of ramps
- **Spatial resolution (FWHM/FWTM and MTF of PSF)** – an x and y profile of the PSF is generated and the FWHM and FWTM values (mm) are determined. The modulation transfer function (MTF) is calculated from the discrete Fourier transform of the average vertical and horizontal LSF's of the point spread function from the point or line source. The program reports the 50%, 10%, and 2% MTF cutoff values
- **% RMS and mean counts** – are calculated from several regions of interest (ROI) positioned over a uniformity phantom section. The number, size and location of these ROI's are variable, but typically five are defined: one at the phantom center and the other four along the axes at the same radius covering a 15 x 15 pixel area
- **Image uniformity** – The Integral Uniformity is determined for a 75% area ROI of the uniformity phantom section. Also vertical and horizontal profiles 10 pixels wide are generated and averaged through the phantom's center. The fractional uniformity of the profile is calculated as the percentage of the pixels within an acceptable range determined by ± 10% of the central mean

[1] *"Recommendations for implementing SPECT instrumentation quality control," Nuclear Medicine Section - NEMA 1999.*

Results output features

- Generates detailed summary and trend analysis reports
- Provides database storage capability

Specifications

Minimum computer requirements Pentium® processor, Microsoft® Windows® 95/NT®, CD-Rom, network connection using TCP/IP protocol, NIC

Available model(s)

49-804 SPECT PC/AutoQA Software

For additional information, please contact Radiation Management Services business of Cardinal Health at 440.248.9300, fax: 440.349.2307, or e-mail: rmsinfo@cardinal.com; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

49-804-ds rev 2 08 jul 03

CardinalHealth

www.cardinal.com/rms

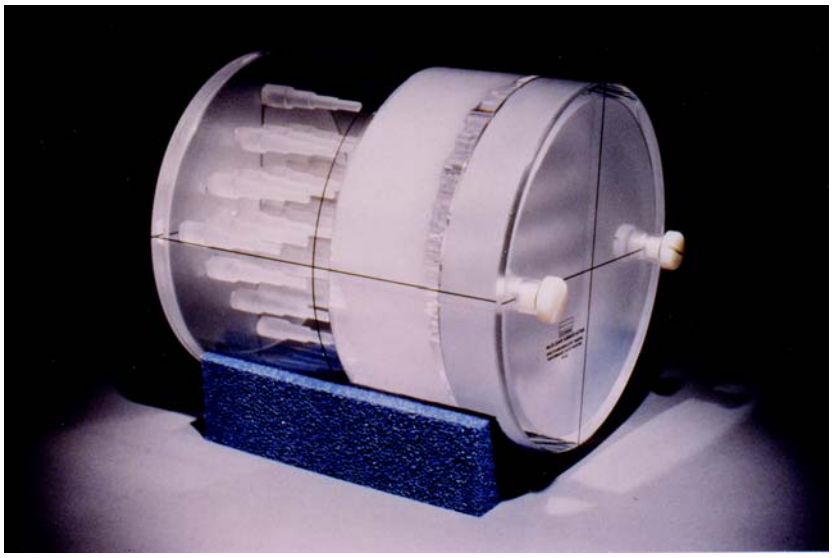
Order online

Nuclear Medicine NM

SPECT, Coincidence, and PET Imaging Performance (SCIP) Phantom

Model 76-442

- Designed for quality control and acceptance test measurements, as well as for evaluating the clinical performance capability of SPECT, coincidence and PET imaging systems
- Is easy to use and fill with radioactivity
- Is economically priced
- Has no parts to assemble
- Is the only phantom designed to evaluate reconstructed sagittal and coronal sections



Specifications

The SCIP Phantom contains 50 orthogonally-arranged test objects in an 8 inch diameter tank; 25 of which result in hot regions, and 25 which result in cold regions. Each test object ranges in size from 6 to 15 mm. Between the hot and cold spot test objects there is a void volume of 1731 cc, to evaluate reconstructed flood field uniformity.

Dimensions 9 (w) x 10 in (d) (23 x 25 cm)

Weight 13.2 lb (6.02 kg)

Optional accessories

Universal Tank Positioner (Model 76-441-6720)

Available model(s)

76-442 SPECT, Coincidence and PET Imaging Performance (SCIP) Phantom, with Universal Tank Positioner

The test objects within the phantom allow the user to evaluate an imaging system's reconstructed spatial resolution from 6 to 15 mm, for both hot and cold spots for SPECT, coincidence, and PET imaging.

In a single imaging session, the phantom allows you to evaluate:

- Reconstructed spatial resolution in the coronal, sagittal, transverse, and oblique planes
- Hot and cold spot imaging
- Coronal, sagittal, transverse, and oblique reconstruction algorithms
- Partial-volume effect
- Reconstructed spatial linearity
- Reproducibility of object shape
- Reconstructed flood field uniformity
- Uniformity of reconstructed spatial resolution

With the SCIP phantom you can investigate the effects that scatter, attenuation correction, resolution recovery and reconstruction algorithms have on image quality.

A Universal Tank Positioner is supplied with the phantom.

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-422-ds rev 1 12 mar 03

CardinalHealth

Order online

Nuclear Medicine Phantom Mixer

Model 76-445

NM Nuclear Medicine

- Minimizes radiation exposure to personnel
- Ensures uniform distribution of radioactivity
- Saves technologist time
- Ideal for use with virtually all cylindrical phantoms
- Simplifies filling phantom
- Small footprint, 10 x 14.85 inch
- Helps keep radiation exposure ALARA as required by state and federal regulations.

Introduction

Now you can achieve a uniform distribution of activity in a cylindrical phantom while minimizing radiation exposure to the technologist and saving technologist time.

The Universal Phantom Mixer can accommodate any cylindrical phantom up to 11 inches in length and 12 inches in diameter.

Applications

It's easy to use. Carefully lay the phantom lengthwise on the rollers of the Nuclear Medicine Phantom Mixer and turn the toggle-switch on. A standard tank phantom will require approximately 10 minutes mixing time. Some types of SPECT, coincidence performance phantoms require between 15 and 20 minutes mixing time. After the phantom has been mixed, simply turn the mixer off. This handy device features single-switch operation for added convenience.

Specifications

Dimensions 15 (w) x 10 (d) x 7.25 in (h) (38.1 x 25.4 x 18.4 cm)

Weight 18 lb (8.18 kg)

Available model(s)

76-445 Nuclear Medicine Phantom Mixer (phantom not included)

Features

Makes performing QC as easy as 1-2-3

- Perform QC requirements faster...saves time
- Reduce radiation exposure...in accordance with ALARA
- Achieve more uniform distribution of radioactivity...for better results

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-445-ds rev 1 12 mar 03

Order online

Nuclear Medicine NM

Orthogonal Tri-Hole Phantom

Nuclear Associates Model 76-837

- One image is all you need
- Minimizes the time needed to perform mandatory weekly quality control to monitor spatial resolution and linearity
- Reduces imaging time
- Single image instead of two or four
- Intrinsic or extrinsic measurement
- Use a point, sheet or fillable source
- One phantom can be used for all cameras

In a single imaging session, this phantom can be used to evaluate:

- Planar spatial resolution over the entire useful field of view
- Planar spatial linearity over the entire useful field of view
- Reproducibility of object shape

Specifications

Hole dimensions 2.5, 3.0, and 4.0 mm in diameter (in an orthogonal cluster pattern)

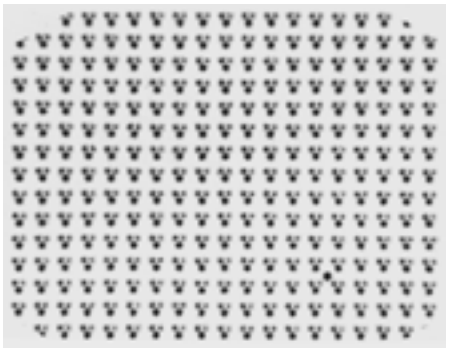
Dimensions 16.94 (w) x 20.94 (d) x 0.09 in (t) (43 x 53 x 0.23 cm)

Weight 21.26 lb (9.64 kg)

Available model(s)

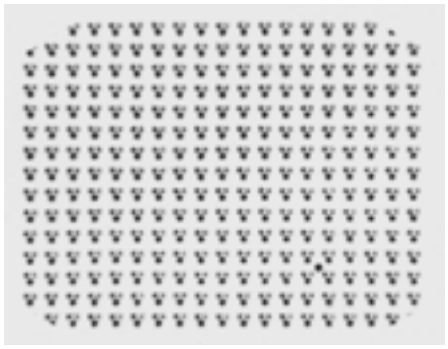
76-837 Orthogonal Tri-Hole Phantom

Intrinsic image



400,000-count intrinsic image of the phantom from a 15 x 20 inch field-of-view camera, using a point source of ^{99m}Tc. A single image provides information to evaluate x-axis and y-axis linearity and spatial resolution over the entire field of view. The phantom's orientation hole can be seen in the lower right-hand quadrant. The phantom holes are 2.5, 3.0, and 4.0 mm

Extrinsic image



800,000-count extrinsic image of the phantom from a 15 x 20 inch field-of-view camera, using a Co-57 flood source. The extrinsic image yields significantly poorer system spatial resolution compared to an image obtained intrinsically. As a result of the unique hole-pattern used in this phantom, no moiré pattern is seen in the extrinsic image as is seen with other hole-pattern phantoms when imaged extrinsically

Extrinsic image

400,000-count extrinsic image of the phantom from a 15 x 20 inch field-of-view camera, using a ^{99m}Tc fillable flood source. The extrinsic ^{99m}Tc flood image yields poorer system spatial resolution as compared to an image obtained intrinsically with a ^{99m}Tc point source

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

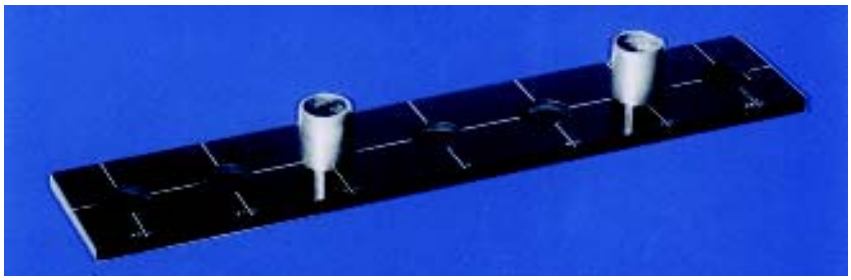
76-837-ds rev 1 12 mar 03

CardinalHealth

Pixel Calibration Phantom

Model 76-829 Order online

NM Nuclear Medicine



- Designed to make pixel size calibration easy and accurate
- Pixel calibration is an essential component of a SPECT quality control program
- Ideal for verifying pixel size stated by camera manufacturer at acceptance testing and as part of a quality control program
- The attenuation correction algorithm uses the pixel dimension, and if in error, the images will be either over or under-corrected

Pixel calibrations should be made for:

- All acquisition matrices used, and in both the "x" and "y" axis
- All zooms clinically used

Verifying pixel size is critical if:

- SPECT imaging is to be performed
- Linear distances or lesion sizes are to be stated in clinical reports
- Quantitative procedures are to be performed (such as quantitative gated cardiac studies)

Specifications

The phantom has seven source locations, with the distance between source locations accurately determined. These distances range from 70 to 440 mm. Two lead source holders, each with a 1.5 mm hole located in the center, are included with the phantom

Dimensions 4 (w) x 20 in (d) (10.2 x 50.8 cm)

Weight 2.54 lb (1.15 kg)

Optional accessories

Lead Source Holders, two (Model 76-829-2000)

Available model(s)

76-829 Pixel Calibration Phantom, with two Lead Source Holders

SPECT Quality Control Kits

Model 76-440 Series Order online

- Enable you to meet the NEMA® recommendations for implementing SPECT instrumentation quality control

SPECT Quality Control Kit #1

(Model 76-440-4837)

Components	Model
SPECT, Coincidence, and PET Imaging Performance (SCIP) Phantom	76-442
Orthogonal Tri-Hole Phantom	76-837
SPECT Tank Phantom	76-440
Pixel Calibration Phantom	76-829
Weight: 51 lb (23 kg)	

SPECT Quality Control Kit #2

(Model 76-440-4890)

Components	Model
SPECT, Coincidence, and PET Imaging Performance (SCIP) Phantom	76-442
(UB) Gamma Camera Test Pattern	76-890
SPECT Tank Phantom	76-440
Pixel Calibration Phantom	76-829
Weight: 51 lb (23 kg)	

SPECT Quality Control Kit #3

(Model 76-440-8837)

Components	Model
PET/SPECT Performance Phantom Source Tank and Inserts	76-823 & 76-824
Orthogonal Tri-Hole Phantom	76-837
SPECT Tank Phantom	76-440
Pixel Calibration Phantom	76-829
Weight: 51 lb (23 kg)	

SPECT Quality Control Kit #4

(Model 76-440-8890)

Components	Model
PET/SPECT Performance Phantom Source Tank and Inserts	76-823 & 76-824
(UB) Gamma Camera Test Pattern	76-890
SPECT Tank Phantom	76-440
Pixel Calibration Phantom	76-829
Weight: 51 lb (23 kg)	

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

 76-829-ds rev 1 12 mar 03

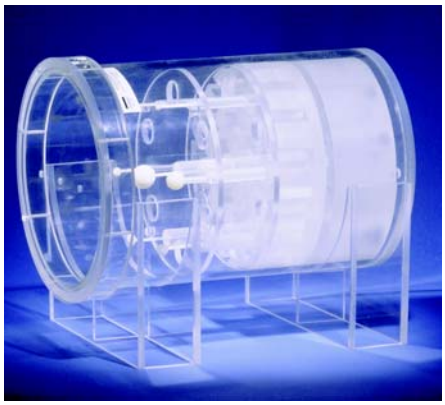
Order online

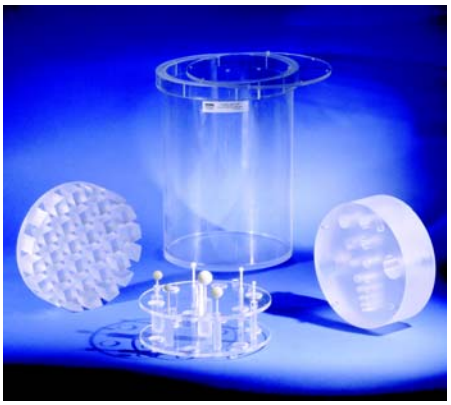
Nuclear Medicine NM

PET/SPECT Performance Phantom*

Model 76-823

- For testing photon emission CT systems
- Measures resolution, linearity and uniformity
- Provides "hot" and "cold" simulated lesions
- Modular inserts fit optional source tank or water tank of Model 76-410-4130 AAPM CT Performance Phantom



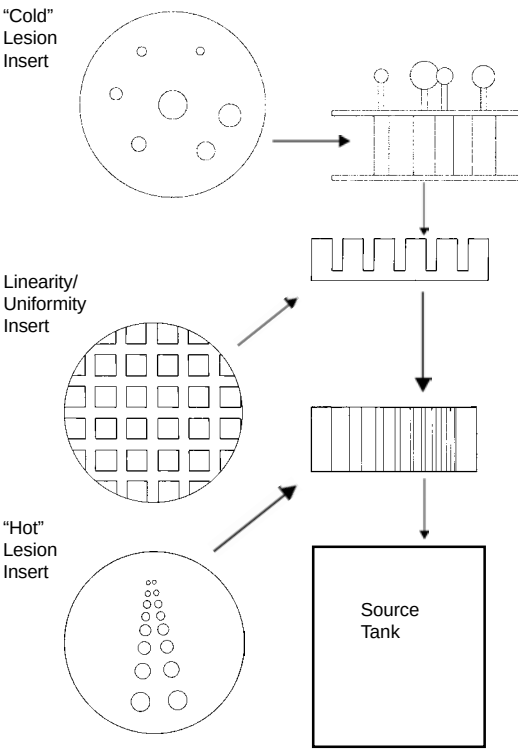


Photon emission computed tomography (PET/SPECT) systems, like any imaging apparatus, require periodic performance testing. This modular phantom is designed to provide the data for such evaluations. It offers a single system for measuring resolution, linearity and uniformity.

All components of the phantom fit into an optional, clear acrylic source tank which can be filled with a ^{99m}Tc-and-water solution similar to that used for routine flood uniformity testing.

Also Available, an optional set of three inserts includes two for resolution (one with "cold" lesions in a "hot" field and one with "hot" lesions in a "cold" field) and one for linearity/uniformity measurements. The visibility of all lesions can be varied by adjusting the concentration of radioisotope in the tank.

Exploded view of phantom



Specifications

Source Tank Made of acrylic, 8.5 inch OD x 8 inch ID x 12 inch long. Resealable, with fill and drain ports. Provides background activity when filled with the desired ^{99m}Tc-and-water solution and includes support blocks

"Cold" Lesion Insert 7.88 inch OD x 3 inch thick. Contains seven plastic rods; each is nominally 25% larger than the next smaller size. Rod diameters are 5.9, 7.3, 9.2, 11.4, 14.3, 17.9, and 22.3 mm. Plastic spheres of the same diameters mounted on metal rods, (supplied) can be attached to this insert. The rods and spheres displace the radioactive solution in the source tank, thereby creating "cold" lesions. Exponential size gradations allow quantitative resolution measurements

Linearity/Uniformity Insert 7.88 inch OD x 2 inch thick. Has a crossed grid of cutout channels in an acrylic block. Scan should show these channels with zero curvature and uniform intensity

"Hot" Lesion Insert 7.88 inch OD x 2.5 inch thick. Contains eight pairs of holes drilled through a solid acrylic block. Hole diameters are 4.7, 5.9, 7.3, 9.2, 11.4, 14.3, 17.9, and 22.3 mm. The diameter of each pair increases nominally by 25% over that of the preceding pair. The solid block creates a "cold" field in which the solution-filled holes appear as "hot" lesions

Weight 15 lb (6.8 kg)

Optional accessories

PET/SPECT Cardiac Insert (Model 76-825). *See next page for details*

Phantom components

76-823 PET/SPECT Phantom Source Tank

76-824 PET/SPECT Phantom Inserts, set of three

** Designed and developed by Ray A. Carlson, Hutzel Hospital, Detroit, MI, and Jeffrey T. Colvin, Texas Oncology PA, Dallas, TX.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-823-ds rev 1 12 mar 03

CardinalHealth

Order online

PET/SPECT Cardiac Insert

Model 76-825

NM Nuclear Medicine

- Provides a multifunction simulation of the heart
- Can be used with various activity levels
- Insert can be swiveled a full 360°
- Provides for “body background” radioactivity

The PET/SPECT Cardiac Insert is used with the PET/SPECT Performance Phantom Source Tank (Model 76-823) to mimic the human heart for myocardial perfusion. The “heart” is approximately 8 cm in diameter by 8 cm high, and has a 1.5 cm thick hollow “wall” which may be filled with a solution containing Thallium-201, or any other desired isotope. The insert is then placed within the source tank, and the tank can be filled with a less concentrated radioactive “background” solution.

The PET/SPECT Cardiac Insert is supported on plastic rods, to allow the entire unit to swivel a full 360°, or be rotated to any desired angle, assuming any desired position or attitude.

PET/SPECT Cardiac Insert, shown in PET/SPECT Performance Phantom Source Tank (Model 76-823)

Specifications

Material Acrylic

Construction Sections are sealed with “O” rings for leakproof assembly

Dimensions 8 inch Ø x 6 to 10 in (h) (variable with position of heart)

Weight 3 lb (1.4 kg)

Available model(s)

76-825 PET/SPECT Cardiac Insert

76-823 PET/SPECT Phantom Source Tank

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-825-ds rev 1 12 mar 03

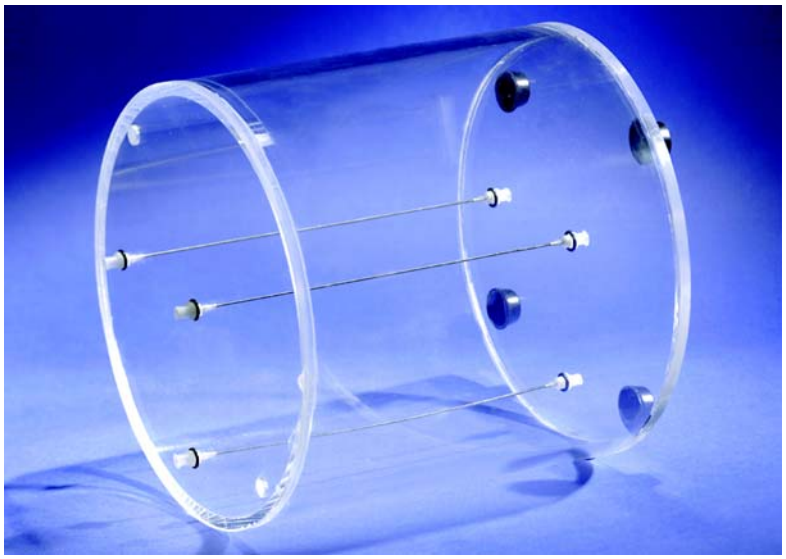
Order online

Nuclear Medicine NM

Spatial Resolution Phantom for SPECT Systems

Model 76-826

- The Spatial Resolution Phantom follows the NEMA® "Recommendations for implementing SPECT Instrumentation quality control"*
- Measures line spread function
- Fits and tests all SPECT systems under clinical conditions
- Built to NEMA specifications



Specifications

Material Acrylic

Tubes Stainless steel; 1 mm Ø

Dimension 8 in Ø x 8 in (d) (20.3 x 20.3 cm)

Weight 2 lb (0.9 kg)

Available Model(s)

76-826 Spatial Resolution Phantom for SPECT Systems

The National Electrical Manufacturers Association (NEMA) has developed standards for making performance measurements of Single Photon Emission Computed Tomography (SPECT) systems. These standards provide a uniform criterion for measuring and reporting SPECT performance parameters by which a manufacturer may specify a device. You may use these standards to make measurements when comparing a device's performance with the manufacturer's specifications, or to compare one device to another.

This phantom meets the specifications for measuring the system's Line Spread Function according to NEMA protocol.

The phantom consists of a cylindrical tank, 8 inch long by 8 inch diameter, with three stainless steel tubes that can be filled with a ^{99m}Tc solution of any desired concentration. The tank can be filled with water to provide proper gamma-ray scattering.

* *NEMA standards publication NU1-1994 "Performance Measurements of Scintillation Cameras" available for purchase by calling IHS 800.854.7179.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-826-ds rev 1 12 mar 03

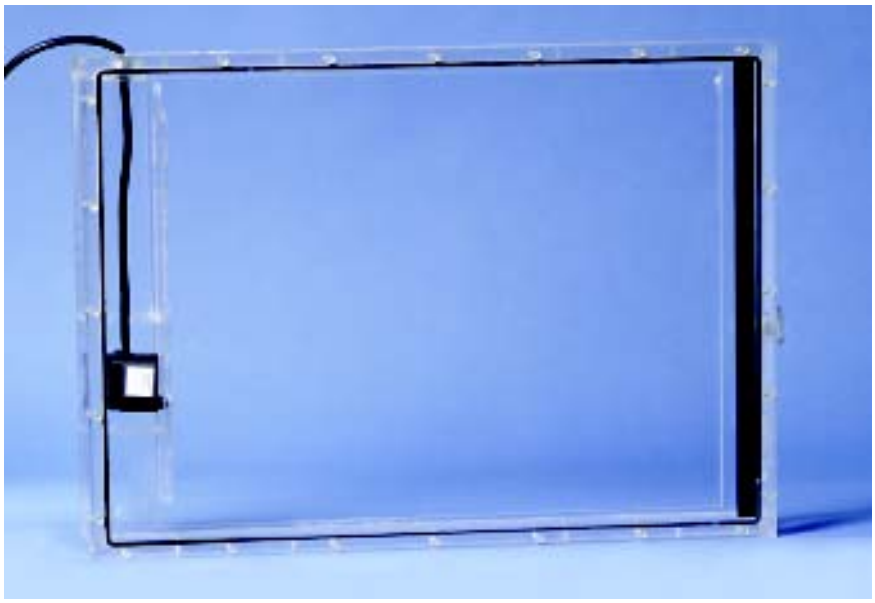
CardinalHealth

Order online

Dynamic Flood Phantom

Model 76-808

NM Nuclear Medicine



- For precise evaluation of the performance of gamma cameras
- Ensures rapid, thorough mixing of the solution...within just 5 minutes
- Improves QC efficiency and minimizes radiation exposure to the user
- Provides control over detector homogeneity and allows for the acquisition of nuclide-dependent correction matrices
- Bubble-free field of view, due to a sealed chamber system with an injection port

Introduction

Improved quality control is made quick and easy by using the Dynamic Flood Phantom with the built-in pump. The pump automatically mixes the radioactive solution, thus eliminating tedious manual mixing that is required when using conventional phantoms.

Applications

The phantom (cold) is first positioned, and the camera made ready for acquisition. Before turning the phantom on, activity is injected via a shielded syringe. Next, the integrated mixing pump is turned on and left running for approximately 5 minutes. Then, an acquisition is started, which can be run overnight.

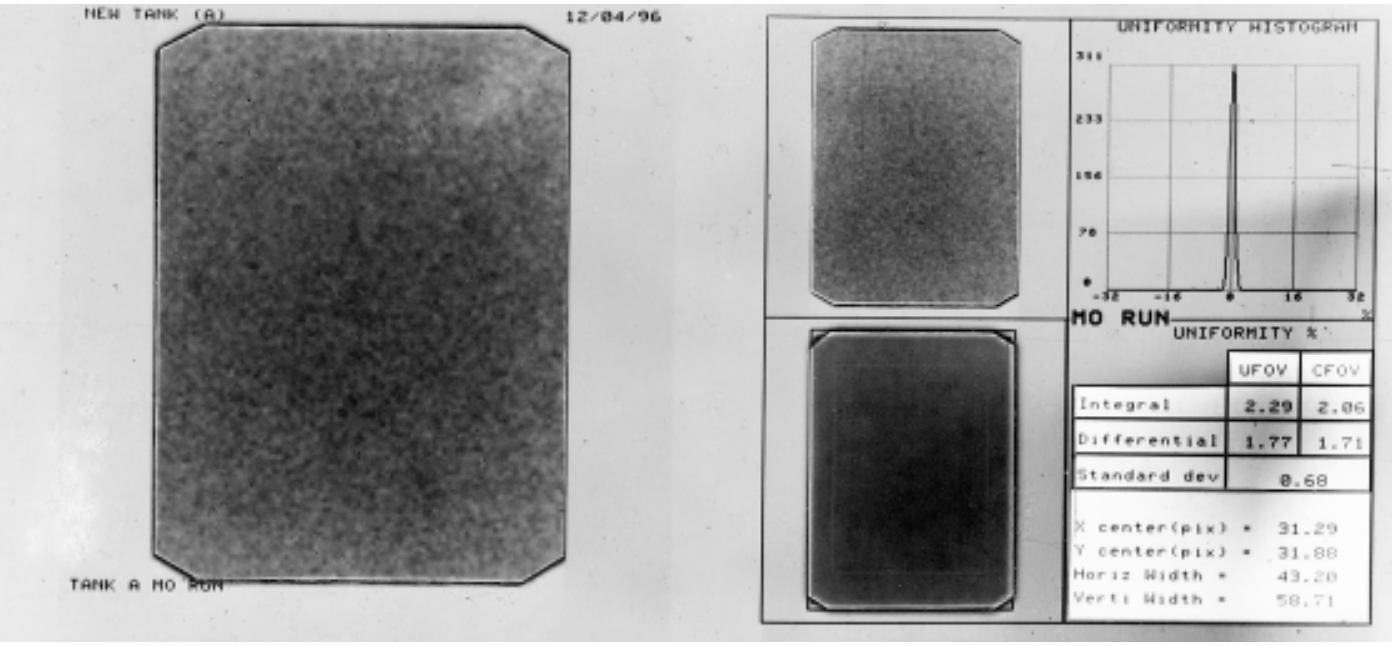
The phantom can be used to replace a ^{57}Co flood source conventionally used to generate and store correction tables used to correct for inhomogeneity. This may eliminate the need to purchase or replace a solid cobalt flood source every 12 to 18 months. A significant savings for your department.

The phantom can be loaded with a tracer having the same energy used in patient studies. It is well known that flood tables acquired at 122 keV (with ^{57}Co) can be altered when the energy window is set from 140 to 80 keV, for example. Using SPECT, any spatial deviation undergoes error propagation with all of the acquired projections. This can result in ring artifacts observed in reconstructed slices.

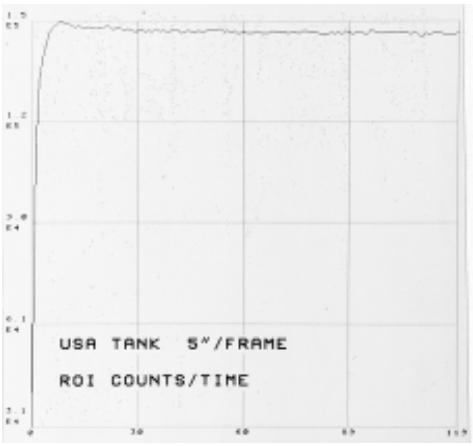
The Dynamic Flood Phantom is a rugged phantom that is manufactured using the highest quality materials, to prevent “bowing.” The injection-port design is useful to facilities that primarily use one isotope for uniformity testing.

Features

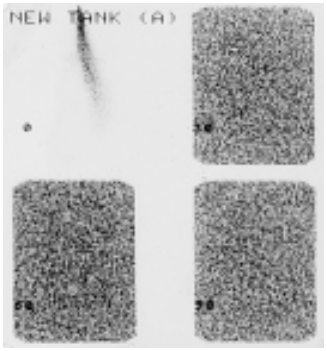
- High geometric stability, due to defined expansion volume of the solution
- High-quality materials and construction prevent “bowing” of the phantom
- Suitable for large field of view cameras
- For performing uniformity quality control checks of gamma cameras at the same energy level as patient scan
- Versatile...different isotope solutions can be used



10 million count flood. Image demonstrates complete homogeneity of the flood field



Graph illustrates consistent uniformity through the whole field after injection of ^{99m}Tc



The Dynamic Flood Phantom promotes consistent uniformity of solution during continuous acquisition of activity

Specifications

Effective field of view 15.6 x 20.8 in (39 x 52 cm)
Field of view 17.2 x 22.4 in (43 x 56 cm)
Dimensions of the cuvette 26.5 x 19.2 x 3.2 (66.3 x 48 x 8 cm)
Wall thickness 0.8 in (2 cm)
Filling volume 2.86 gal (11 liters)
Filling medium Distilled water
Power supply 110 V plug-in
Weight 34 lb (15.3 kg)
Available model(s)

76-808 Dynamic Flood Phantom, 110 V

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-808-ds rev 1 12 mar 03

CardinalHealth

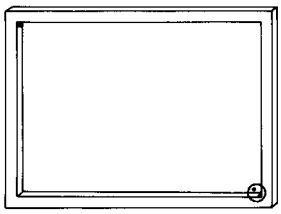
Order online

Flood Phantoms

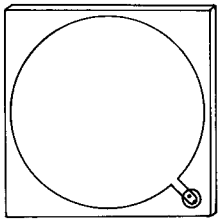
Model 76-801 to 76-807

NM Nuclear Medicine

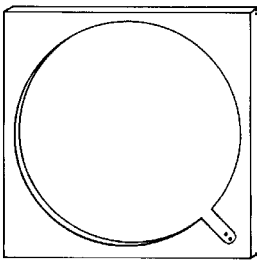
- For checking uniformity of response
- Horizontal filling prevents “bulging”
- Four flood phantoms are available: Rectangular, Extra-Large Rectangular, Jumbo, and Gigantic



Rectangular Flood Phantom (Model 76-801)



Jumbo Flood Phantom (Model 76-804)



Gigantic Flood Phantom (Model 76-807)

Introduction

Flood Phantoms offer a simple, efficient means of obtaining optimum camera performance with respect to uniformity of response over the entire crystal area. They consist of plastic forms that contain a watertight central cavity into which a radioactive solution is introduced (via a filling port) and then mixed thoroughly. After the activity has been distributed evenly, the camera’s uniformity of response can be checked.

Applications

When evaluating SPECT (ECAT) equipment, flood uniformity is essential to prevent the formation of artifacts in the image. For this purpose, we have developed special flood phantoms which, unlike conventional versions, are filled in the horizontal (flat) position. This prevents the slight bulging caused by water pressure during vertical filling. By reducing variations in cavity thickness, better uniformity in distribution of activity can be achieved. An air bubble trap is built in.

Four flood phantoms are available: Rectangular, Jumbo, Gigantic, and Extra Large Rectangular. Filler and vent ports are located on the face. Shipped empty; radioactivity is not included.

Specifications

Rectangular Flood Phantom

Dimensions 18 x 23 x 1 in (t)
(45.7 x 58.4 x 2.5 cm)

Cavity Dimensions 16 x 21 x 0.5 (d)
(40.6 x 53.3 x 1.3 cm)

Weight 10 lb (4.5 kg)

Extra-Large Rectangular Flood Phantom

Dimensions 20.5 x 28 x 1.25 in (t)
(52 x 71 x 3.2 cm)

Active Area 18.5 x 26 x 0.5 in (t)
(47 x 66 x 1.3 cm)

Weight 30 lb (13.64 kg)

Jumbo Flood Phantom

Dimensions 18 x 18 x 1 in (t)
(45.7 x 45.7 x 2.5 cm)

Cavity Dimensions 17 in Ø x 0.5 in (d)
(43.2 x 1.3 cm)

Weight 9 lb (4.1 kg)

Gigantic Flood Phantom

Dimensions 23 x 23 x 1 in (t)
(58.4 x 58.4 x 2.5 cm)

Cavity Dimensions 22 in Ø x 0.5 in (d)
(56 x 1.3 cm)

Weight 13 lb (5.9 kg)

Available model(s)

76-801 Rectangular Flood Phantom
76-801-1926 Extra-Large Rectangular Flood Phantom
76-804 Jumbo Flood Phantom
76-807 Gigantic Flood Phantom

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-801-ds rev 1 12 mar 03

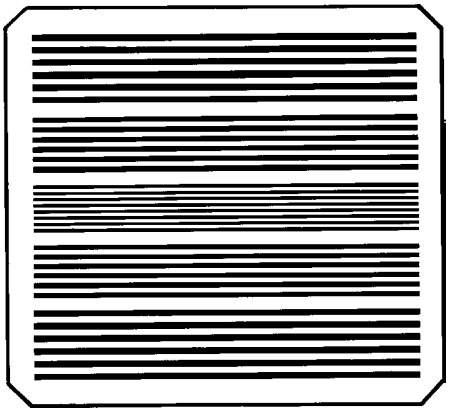
Nuclear Medicine NM

Bar Phantoms and Test Patterns

Models 76-802 to 76-890 Order online

- For checking scintillation camera performance

These test tools provide a simple and effective means of checking a scintillation camera's intrinsic resolution, collimator spatial resolution, field size and linearity. The model selected should conform to the best resolution of your camera. By checking your camera's performance regularly with one or more of these reference standards, adjustments can be made immediately to ensure that the quality of the data being taken is the maximum available from the system.



Hine-Duley Bar Phantom Order online

- Allows accurate determination of field size
- Checks intrinsic, collimator and spatial resolution, using only two scintiphotos

This phantom consists of five groups of parallel bars, embedded in a 16 x 16 x 0.5 inch plastic holder. The center group has eight bars, each 0.16 inch wide, located between two sets of six 0.19 inch wide bars. The two outer groups contain six 0.25 inch bars each.

Spaces between the bars in each group are equal to the width of the bars. Each set of bars is 0.5 inch away from the adjacent group. The two outer groups (0.25 inch bars) are 8.5 inch apart. This arrangement of bars and spaces allows an accurate measure of true field size (by adding the visible 0.25 inch bars and 0.25 inch spaces to the 8.5 inch that separates them).

Weight 16 lb (7.3 kg)

Available model(s)

76-810 Hine-Duley Test Pattern

Quadrant Bar Phantoms Order online

- Four scintiphotos measure the following camera parameters: intrinsic resolution and collimator system spatial resolution
- Choice of standard, jumbo, or extra-large rectangular model

Jumbo Bar Phantom

- For all large-field gamma cameras

Each phantom has four sets of lead bars (effective area 16 x 16 inch) encased in an 18 x 18 inch plastic holder.

Weight 15 lb (6.8 kg)

Model	Designation	Bar widths
76-814	Standard resolution	0.125, 0.19, 0.25, and 0.4 inch

Standard Bar Phantom

- For crystal sizes up to 14 inch diameter

Contains four sets of lead bars (effective area 14 x 14 inch) embedded in a 16 x 16 inch plastic holder.

Weight 12 lb (5.4 kg)

Model	Designation	Bar widths
76-818	High resolution	0.1, 0.19, 0.25, and 0.4 inch

Extra-Large Rectangular Bar Phantom

Contains four sets of lead bars (effective area 25 x 17 inch) embedded in a 27 x 17 x 0.5 inch thick plastic holder.

Weight 25 lb (11.3 kg)

Model	Designation	Bar widths
76-820	Standard resolution	2.5, 3.0, 3.5, and 4.0 mm

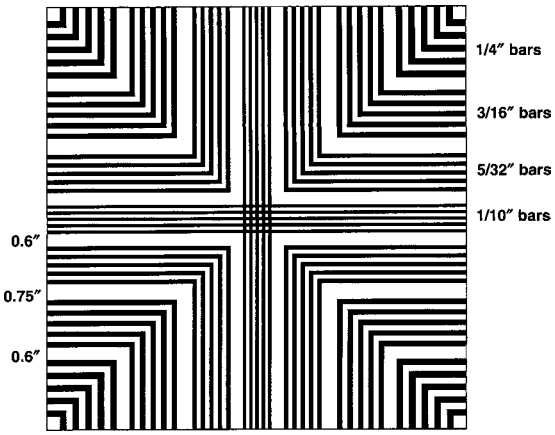
CardinalHealth

(UB) Gamma Camera Test Pattern

Order online

- The most cost-effective means of performing routine quality control checks of gamma camera resolution or linearity on the market today
- One image per detector head is all that's needed to equally and effectively test all quadrants of the gamma camera
- Save time and money. Perform routine quality control tests of gamma camera spatial resolution and spatial linearity in approximately one quarter of the time presently spent...

  Time savings = cost savings!
- Quickly and easily perform extrinsic testing and intrinsic visual evaluation
- Outperforms any 90° bar phantom, single-frequency Parallel-Line Equal-Space (PLES), Hine-Duley or orthogonal hole test pattern
- Satisfy mandatory state quality control requirements
- Optimized for dual and triple-head gamma cameras
- Ideal for large detectors...its large size covers UFOV
- Increase patient throughput



Introduction

Routine quality control tests are required to show that a nuclear imaging gamma camera is operating within the manufacturer's design specifications. Therefore, it is recommended that spatial linearity and spatial resolution testing be performed weekly on each gamma camera in an active nuclear medicine clinic.

Typically, extrinsic testing (collimator in place) of the camera's linearity and resolution is tested with one of three types of transmission test patterns: a four-frequency, equal-spaced bar pattern, usually referred to as a "90° bar phantom," a single-frequency parallel-line equal-space (PLES) test pattern, or a single-frequency orthogonal hole test pattern. Unfortunately, none of these test patterns can quickly and easily provide all of the information you need, but the UB Gamma Camera Test Pattern can.

You need the UB Gamma Camera Test Pattern because:

The UB Gamma Camera Test Pattern provides all of the benefits of a 90° bar phantom, with an important added benefit: The uniquely-designed UB Gamma Camera Test Pattern requires that only one image per detector head be acquired in order to equally test all quadrants of the gamma camera for visual evaluation of spatial resolution and spatial linearity during quality control testing. Because only one image is required, quality control testing time can be reduced to approximately one quarter of the time typically required. Its versatility also makes it superior to PLES and orthogonal hole test patterns.

The UB Gamma Camera Test Pattern is an economical, timesaving, easy-to-use product that will revolutionize gamma camera quality control... while saving the average nuclear medicine facility thousands of dollars each year!

Applications

The pattern's shadows are used to evaluate the camera's spatial resolution (the ability to see small objects) and spatial linearity (the ability to correctly position image data).

Specifications

The UB Gamma Camera Test Pattern consists of four frequencies of parallel-line equally-spaced bars (0.25, 0.19, 0.16, and 0.1 inch) arranged in an "L-shaped" configuration in each of its quadrants. Each of the four sets of equally-spaced parallel lines is precisely machined onto a 20 x 20 x 0.38 inch Lexan® plastic sheet. The machined line sets are filled (cast) with Cerrobend® a high atomic numbered, high-density metal alloy. This alloy is used to attenuate gamma radiation when the pattern is placed between the gamma camera detector and a radioactive point or "flood" source.

Dimensions 20 x 20 x 0.38 in (50.8 x 50.8 x 0.965 cm)

Weight 24 lb (11 kg)

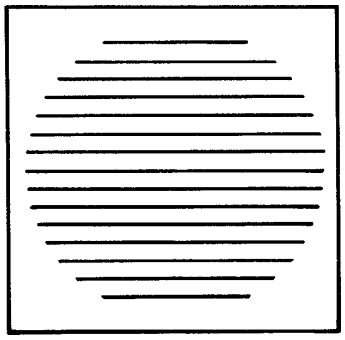
Available model(s)

76-890 UB Gamma Camera Test Pattern

Gamma Camera Resolution/Linearity Test Pattern

Order online

- Follows NEMA® standards measurements*
- For measuring intrinsic spatial resolution and linearity per NEMA standards
- Follows NEMA specifications
- Fits most scintillation cameras



Introduction

The National Electrical Manufacturers Association (NEMA) has developed standards for making performance measurements of scintillation cameras, in order to provide a uniform criterion for measuring and reporting the parameters by which a manufacturer may specify a device. Our test pattern follows these specifications for checking a camera's intrinsic spatial resolution and linearity according to NEMA protocol.

Applications

The test pattern consists of a 0.13 inch thick lead sheet, 22 inch square, sandwiched in protective plastic. A series of parallel 1 mm wide slits in the lead, 3 cm (center-to-center) apart, are arranged so that the ends of the slits form an 18 inch diameter circle, large enough to be compatible with most gamma cameras. The 0.125 inch lead thickness completely shields the areas between the slits from the 140 keV photons from ^{99m}Tc.

This test pattern is used with two limiting rings with outside diameters of at least 18 inch and with inside diameters equal to the Useful Field of View (UFOV) and the Central Field of View (CFOV; 75% of the UFOV diameter) of the camera. The rings are not included, but can be constructed using our Lead-Vinyl.

Specifications

Weight 29 lb (13.2 kg)

Available model(s)

76-836 Gamma Camera Resolution/Linearity Test Pattern

* *NEMA standards publication NU1-1994 "Performance Measurements of Scintillation Cameras." Available for purchase by calling IHS at 800.854.7179.*

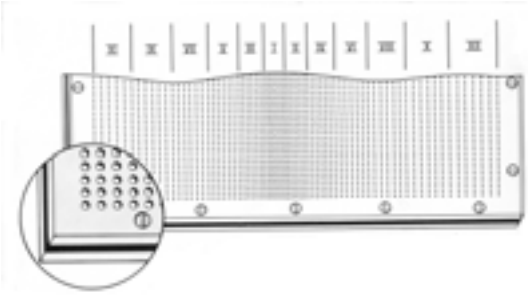
BRH Test Pattern

Order online

- For comprehensive evaluation of gamma camera performance
- A single transmission image of this orthogonal-hole test pattern provides precise data for any gamma camera:
  - Intrinsic resolution
  - Field uniformity
  - Spatial distortion
- Quantitative evaluation of the transmission images is most suited for gamma camera:
  - Long-term quality control
  - Acceptance testing of new instruments
  - Performance testing for different operating conditions (window width, asymmetric window, etc., for sources of various photon energies)
  - Checking of tuning and service procedures

Introduction

The BRH Test Pattern consists of an orthogonal array of 2.5 mm diameter holes in a 3.2 mm thick lead plate, 52.4 x 52.4 cm. The columns of holes have a center-to-center hole spacing of 4 mm, increasing to 9.5 mm. After removal of the collimator, the test pattern is positioned in contact with the detector face. A source of several millicuries (in a syringe or small vial) is placed at least two meters from the center of the test pattern. A few million counts are registered within a short time.



^{99m}Tc (140 keV), ^{133}Xe (81 keV), ^{201}Tl (69-80 keV) or other radionuclides may serve as sources.

A particular camera's performance depends on the radiation source and the operating conditions of the instrument. The group of holes with the closest spacing that appears still resolved on the transmission image of the BRH Test Pattern is a measure of the camera's intrinsic resolution. Non-uniformities superimposed on the hole pattern are recognized more clearly than on a flood image. Spatial distortions appear as displacements of the hole images from the orthogonal grid. All three performance parameters are less clearly displayed by a quadrant-bar image.

Specifications

Weight 29 lb (13.2 kg)

Available model(s)

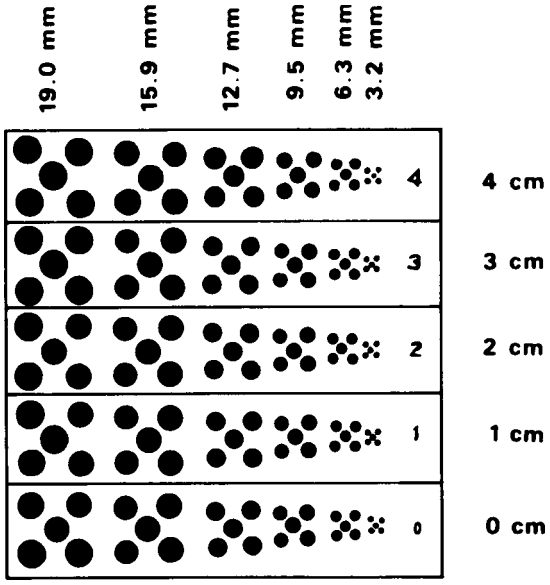
76-835 BRH Test Pattern

CardinalHealth

Enos Performance Phantom

Order online

- This multipurpose phantom allows evaluation of spatial resolution at different depths, with and without scattering medium, and with varied input contrast
- Simulates actual clinical conditions. Introduces clinical parameters not taken into account by most other phantoms.
- Ideal for checking resolution uniformity, spatial resolution at depth, count efficiency, image distortion, and almost everything one needs to know about a gamma camera system
- Valuable for generating imaging techniques
- Aids in optimizing low-contrast/in-depth lesion detection
- Demonstrates collimator-design-dependent depth resolution and sensitivity



Introduction

The Enos Performance Phantom is a multipurpose quality control tool which simulates clinical parameters in the evaluation of total gamma camera system performance. It is large enough to check the entire field of view of large-field systems. It shows the presence of linearity problems, image distortion and resolution changes affected by contrast, depth and scatter. In addition, it is valuable in generating the optimal photo contrast levels for lesion definition.

Applications

The phantom consists of a Lucite® enclosure, 32.4 x 32.4 x 7.62 cm with 0.635 cm walls. Lead discs, 0.79 mm thick, are located on five 1-cm-interval steps within the phantom, at depths of 0 to 4 cm (3 to 7 cm when the phantom is inverted). Each step contains six groups of five discs of uniform diameter, starting with 3.2 mm for the smallest group and increasing (in 3.2 mm steps) to 19 mm for the largest. Every set of five equally-sized discs forms a rosette pattern to evaluate spatial resolution, and each disc represents three half-value layers of attenuation for 140 keV photons, a condition providing an initial object contrast of 0.875 when ^{99m}Tc in a transmission or flood phantom is used as the activity source.

Specifications

Phantom material Lucite

Dimensions 32.4 x 32.4 x 7.62 cm (d) x 0.635 (t)

Weight 6.64 lb (3 kg)

Available model(s)

76-802 Enos Performance Phantom

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-802-ds rev 1 12 mar 03

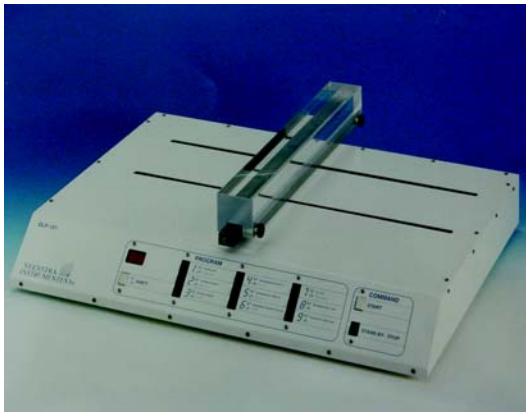
Order online

Nuclear Medicine NM

Computerized Dynamic Line Phantom

Model 76-838

- A breakthrough in gamma camera quality control
- Makes current flood/phantom QC testing of gamma camera systems old-fashioned
- Eliminates the need for most conventional phantoms
- Greatly reduces personnel exposure during QC testing



The Computerized Dynamic Line Phantom will provide a true and accurate flood uniformity test for gamma cameras, a necessity in SPECT imaging.

This phantom uses the principle of a thin line source transversing the camera. Using microprocessor technology, it can simulate a number of different phantoms. It can also provide direct measurement of the modulation transfer function, evaluate collimator operation and check the complete imaging system: camera, interface, processing, display.

The computerized Dynamic Line Phantom consists of a long, slender line source on a movable source holder. A microprocessor generates a sequence of pulses which drives a stepping motor that moves the source holder across the phantom. The line source can be filled with any isotope, and tests can also be accomplished using gases such as krypton or xenon.

Because the radiation intensity is inversely proportional to the velocity of the line source, different test patterns can be generated by different pulse sequences. Conventional phantoms such as flood, quadrant bar, PLES, orthogonal hole, flood sources, Hine-Duley, BRH test patterns, and others, have been incorporated into the Computerized Dynamic Line Phantom which is preprogrammed to perform nine quality control tests.

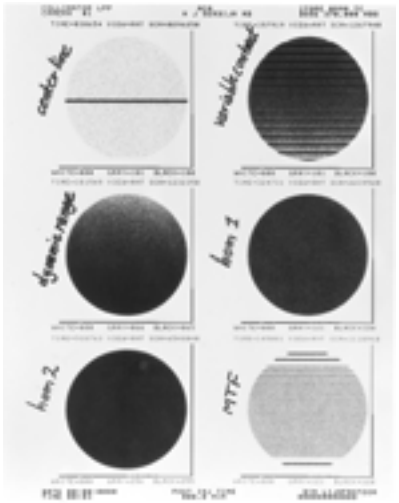
The phantom will significantly reduce the amount of time now being spent performing QC testing. It will provide fast, accurate, cost-effective results. And since the radioactive material is concentrated into a thin line (as compared to the large surface of a conventional flood source or phantom), exposure to personnel is dramatically reduced.

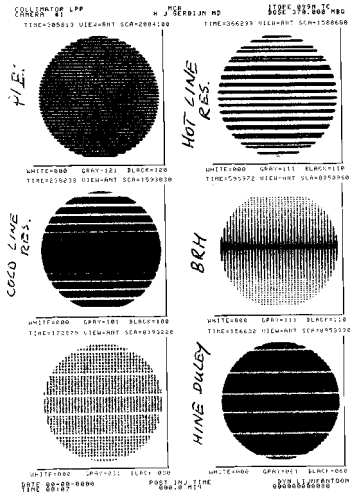
Features

Programmed to perform nine quality control tests, including:

- Parallel Lines Equally Spaced (PLES)
- Flood Field
- Modulation Transfer Function
- Variable Contrast
- Resolution (hot and cold lines)
- Dynamic Range
- Linearity
- Homogeneous Field at two different fields of view (500 x 500 mm and 300 x 500 mm)

One phantom provides nine physical tests under two different fields of view





Specifications

Line source

Length 500 mm
Inside diameter 1 mm
Wall thickness 0.3 mm
Volume 0.4 ml
Material Stainless steel

Source holder

Dimensions
560 x 25 x 12 mm
Material Aluminum

Leadmask

Dimensions
500 x 25 x 4 mm
Lead thickness 1 mm
Hole diameter 2 mm
Hole separation 10 mm

Scatterblock

Dimensions
500 x 60 x 60 mm
Effective thickness
42 mm
Material Acrylic

Position accuracy

Within 25 µm

Phantom

Dimensions 26.3 (w) x 19.8 (d) x 3.3 in (h)
(670 x 505 x 85 mm)
Weight 42 lb (19 kg)
Available Model(s)

76-838 Computerized Dynamic Line Phantom

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

76-838-ds rev 1 12 mar 03

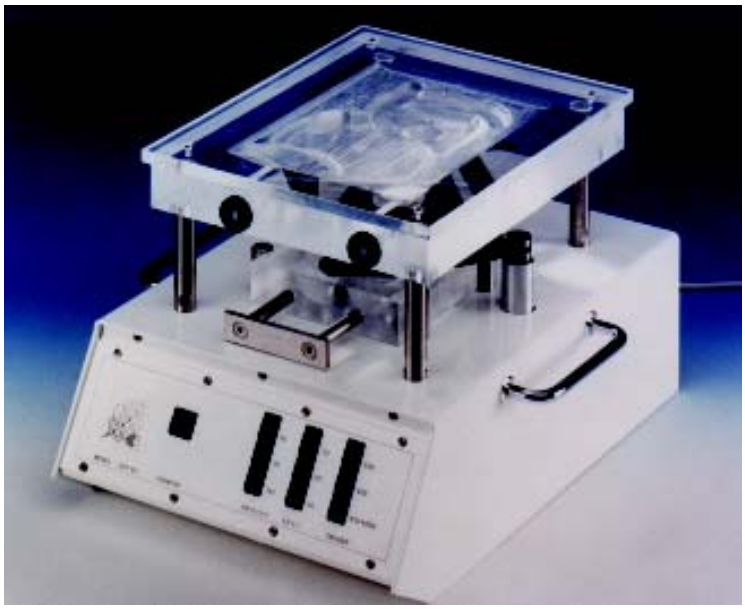
CardinalHealth

Order online

Dynamic Cardiac Phantom

Model 74-347

NM Nuclear Medicine



- Offers the most versatility for quality control in acquiring and processing gated blood pool studies
- Mimics the anatomical and physiological characteristics of the heart
- Provides excellent simulation of left and right ventricle wall motion and volume changes, with constant background activity, to test gated radionuclide ventriculography hardware and software
- Allows acceptance and QC testing for data acquisition instruments, data processing software and overall cardiac systems
- Renders realistic radionuclide ventriculogram and cardiac volume trace
- Features adjustable heart rate and ejection fraction levels
- Easy to load and operate
- Provides reproducible data
- Makes an excellent training aid for physicians, technologists, and all nuclear cardiology personnel

Introduction

It has become routine for most nuclear medicine departments to perform gated blood pool studies for non-invasive determination of ventricular ejection fraction. The Dynamic Cardiac Phantom was developed to facilitate the quality control needed for these studies.

Applications

The Dynamic Cardiac Phantom provides an excellent means of determining the accuracy of clinical EF measurements and confirming operation techniques. It is particularly useful for hospitals without cardiac catheterization facilities. This phantom is also ideal for use as a training aid for physicians and technologists.

Operation

The easy to use Dynamic Cardiac Phantom consists of three sections: the Mechanical Unit, a Cardiac Ventricle Phantom, and a Background Phantom. The Cardiac ventricle Phantom has a hollow cardiac chamber that when filled with a radioactive solution, simulates the right and left ventricles. Wall motion and stroke volume changes are achieved by the movement of metal jaws above the cardiac chamber. The jaws open and close, simulating the beating heart. This movement attenuates the peripheral activity of the chambers.

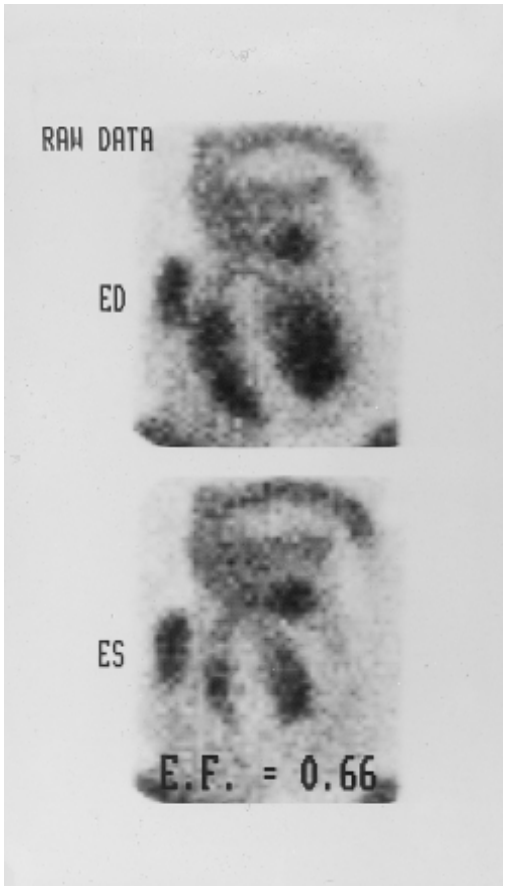
Adjustments and calibrations

Any of three values of ventricular ejection fractions is push-button-selected, and each can be easily adjusted to any desired value between approximately 30 and 80%. Similarly, pushbuttons select any one of three heart rates, each of which can be adjusted from 40 to 160 bpm. Stopping the jaw motion and measuring activity at end diastole and end systole provides accurate EF calibration for each of the selectable values.

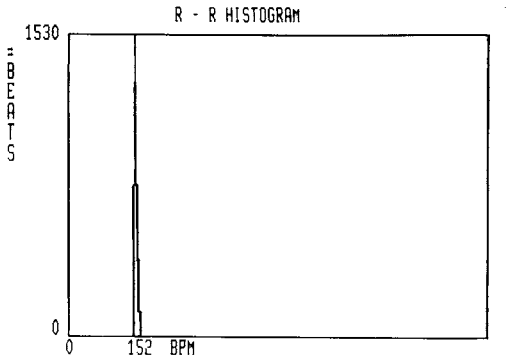
The background phantom for QC testing

For QC testing of equipment, the hollow background chamber can be filled with additional radioactive fluid to simulate the lung, atria, and large vessel activity. The background chamber is positioned above the cardiac chamber and jaws, and is unaffected by “ventricular” motion.

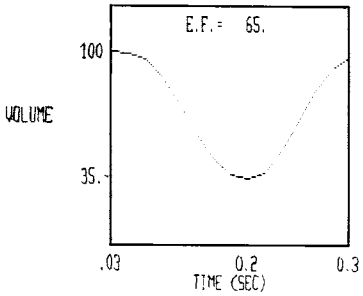
Two trigger pulses are available: a 0 to 5 volt pulse (adjustable as to height, width and polarity) for direct input into the computer, and a millivolt-level signal for input into the ECG monitor. Pushbuttons are used to select pulse position at end systole, and end diastole, or both. The data produced can be analyzed as a representative patient study.



b



c



The images above illustrate typical data from operation of the Dynamic Cardiac Phantom:

A. End diastole and end systole frames MUGA

B. Histogram of R-R time period showing temporal stability

C. Cardiac volume graph from phantom operation

Specifications

Ejection fraction Three values are pushbutton-selectable; adjustable from 30% to 80%

Heart rate Three values (40, 60 and 80 bpm) are pushbutton-selectable

Heart ventricle phantom 100 cc capacity; acrylic block

Background phantom 300 cc capacity; acrylic block

Power requirements 110 V/60 Hz (220 V/50 Hz)

Dimensions overall 11 (w) x 18.38 (d) x 10.88 in (h) (29 x 46.5 x 27.5 cm)

Ventricle phantom dimensions 5.38 x 5.15 x 1.38 in (13.5 x 13 x 3.5 cm)

Background phantom dimensions 12 x 9.5 x 2 in (30 x 24 x 5 cm)

Weight Approximate 41 lb (18.6 kg)

Available model(s)

74-347 Dynamic Cardiac Phantom, 110 V

74-342 Dynamic Cardiac Phantom, 220 V

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

74-347-ds rev 1 12 mar 03

CardinalHealth

Order online

Heart/Thorax Phantom for Cardiac SPECT, PET, MRI, and Scintimammography

Model 76-502

NM Nuclear Medicine

- Fully tissue-equivalent anthropomorphic phantom
- Accurate anatomic heart model obtained from patient data
- Ideal for evaluation of detectability, extent and severity of myocardial infarcts in male and female patients
- Tests reconstruction techniques, nonuniform attenuation and scatter-correction methods using different radionuclides under realistic conditions
- Tests scintimammography techniques

Introduction

The fully tissue-equivalent anthropomorphic heart/thorax phantom is designed for cardiac SPECT, PET, MRI, and scintimammography. The phantom can be filled with radioactive or MRI-signal-producing solutions. Radiopharmaceuticals such as ^{201}T1, ^{99m}Tc sestamibi, ^{13}N ammonia and ^{18}F FDG (fluorodeoxyglucose), are routinely used to assess myocardial viability, infarct size and effectiveness of treatment.

The phantom includes: heart, perfusable lungs, liver, basic thorax, thorax overlay, removable breasts with tumors, and fillable external markers.

Assembled phantom

Heart

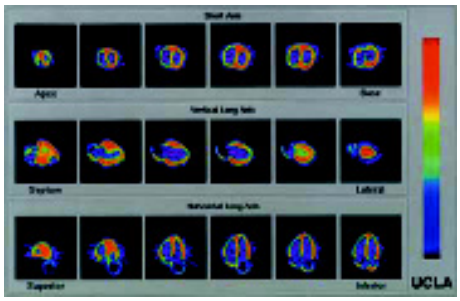
An anatomically-correct heart model is based on vacuum-formed shells. It was designed using high resolution, contrast-enhanced, ultrafast CT data from a normal patient, slightly modified to facilitate its use.

The left and right chambers are connected at the atrium region to make a single compartment which can be filled and flushed independently, using two ports labelled HC (heart chamber). The right ventricle is slightly modified to allow air to escape during filling. The myocardial wall (MW) has two ports for flushing and independent filling. The volume of the heart chambers is 284 ml; the volume of the myocardial wall is 238 ml, without inserted defects.

The standard model includes three defects with volumes of 8.9, 13.5, and 41.7 ml. Each of the defects can be filled separately.

Defects of different dimensions can be ordered (prices on request). A disassembled heart is available on request, so that dimensions of a special set can be established.

Note: *different defects can be retrofitted in the assembled heart.*



PET images of the Heart Phantom filled with 0.5 mCi of F-18-FDG placed in the Thorax Phantom. The images were acquired on a PET system in 3-D mode (septa out) at the University of California at Los Angeles (UCLA), courtesy of Magnus Dahlbom, Ph.D. The emission scan contained 25 million counts and was reconstructed using a Hann filter, resulting in a final image resolution of approximately 5.5 mm FWHM. The data were corrected for scatter and attenuation prior to reconstruction

Disassembled heart with standard defects

Lungs

Perfusable lungs are molded in hollow, vacuum-formed shells, filled with polystyrene beads. The final mass density of 0.30 g/cc can be attained by varying the volume of radioactive solution through a filling port at the top of each lung shell. Extra sets of lungs can be furnished for work continuity. The volumes of the left and right lung shells are 907 and 1,134 ml, respectively.

Liver

A liver with a volume of 980 ml is included to evaluate the effect of its uptake on quantitative myocardial imaging. It is a vacuum-formed shell, mounted on perforated nylon tubes. The liver is filled with a radioactive solution and is about 5 mm from the heart.

Basic thorax

The thorax is molded of polyurethane, modified for tissue-equivalence with a mass density of 1.10 g/cc. The narrow beam linear attenuation coefficient measured at 140 keV (^{99m}Tc) is 0.160 cm^{-1}.

The skeleton, embedded in the soft tissue, extends from the suprasternal notch down to L2. The materials meet the standards of the International Commission on Radiation Units and Measurement (ICRU) Report No. 44 (Tissue Substitutes in Radiation Dosimetry and Measurement, 1989) for both the cortical and spongiosa components of the human skeleton. The mass densities of the cortical bone are 1.86 g/cc and the spongiosa 1.16 g/cc, respectively. The narrow beam linear attenuation coefficient for the cortical component, measured at 140 keV is 0.280 cm^{-1}.

The volume of the thoracic cavity, when all organs (heart, lungs and liver) are inserted, is about 8,200 ml. It is filled from the top, with either an inert or a radioactive solution, to simulate the thoracic background.

A valve is installed at the base for convenient draining of the phantom. The residue on the walls of the cavity and organs may be flushed with running water, supplied by a hose attached to the larger fitting at the top of the phantom. A smaller fitting at the top is an air-bleed, opened during filling and closed during imaging.

Chest overlay, removable breasts, and breast tumors

The thoracic phantom without overlay, simulates an average male patient. The overlay with or without breasts corresponds to a large female and a larger male patient, respectively. Using these features it is possible to evaluate the effect of additional attenuation and scatter on quantitative myocardial imaging.

Disassembled phantom

The volume of each vacuum-formed breast is 972 ml. A tumor filled with radioactivity can be inserted to evaluate planar and tomographic imaging techniques used for scintimammography. A set of breast tumors in the following diameters: 3, 5, 7, 9, 13, and 15 mm are included. The tumors are supported by thin, threaded nylon rods which pass through ports and are sealed by O-rings.

Fillable external markers

A set of fillable capsules with about 1 ml volume is provided to be used as external markers. Capsules can be filled with a radioactive solution or $CuSO_4/NiCl_2$ and attached to the external surface of the phantom. It is then imaged using any combination of SPECT, PET, MRI modalities to compare image registration techniques.

Assembly producedures

The thorax is mounted on a baseplate which has an O-ring seal and four rubber feet (to provide space under the phantom for drain fittings). The baseplate is held by screws which are removed to provide access to the interior of the phantom. The liver is attached to the baseplate so it is removed together with the baseplate.

Chest overlay with breasts. Also shown are tumors and rods

A knob at the top of the neck secures a rod which passes through the neck to the heart/lung subassembly. The heart is removed first, then the pair of lungs. The registrations of the heart and lungs are positive, so that upon assembly their correct internal positions are maintained.

Specifications

Weight 53 lb (24.4 kg)

Optional accessories

Non-Perfusable Lungs, pair (Model 76-502-2000)

Phantom components (Model 76-502)

Thoracic Cavity with Bottom Plate (Model 76-502-1000)

Fillable Markers, set of 10 (Model 76-502-1100)

Perfusable Lungs, pair (Model 76-502-3000)

Heart (Model 76-502-3000), with three hollow defects in myocardial wall (standard sizes or to customer specifications)

Liver, shell only (Model 76-502-5000)

Chest Overlay (Model 76-502-6000)

Removable Breasts with Set of Tumors (Model 76-502-7000)

Tumor Support Rods, set of 10, threaded nylon (Model 76-502-9000)

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

76-502-ds rev 1 12 mar 03

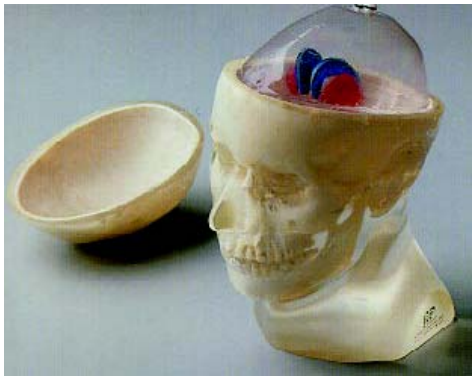
CardinalHealth

Order online

Striatal Phantom for SPECT, PET, and MRI

Model 76-501

NM Nuclear Medicine



- Fully tissue-equivalent anthropomorphic phantom
- Anatomically accurate model of human striatum and head
- Evaluates quantitative striatal imaging

Introduction

This fully tissue-equivalent anthropomorphic striatal phantom is designed for evaluation of quantitative striatal imaging using SPECT, PET or MRI. The phantom can be filled with radioactive or MRI-signal-producing solutions. Ligands labelled with ^{11}C, ^{18}F, or ^{123}I are routinely used for evaluation of human neurodegenerative diseases such as Parkinson's disease.

The phantom allows the effects of the imaging system on receptor quantification to be investigated under conditions very similar to those in a patient.

Applications

It can be used to optimize the imaging system for patient imaging and to examine many important issues related to receptor studies including:

- Quantification as a function of uptake ratio
- Partial volume effects
- Effects of scatter and scatter correction
- Effects of attenuation-correction schemes
- Detectability threshold for changes in uptake
- Comparison of different acquisition modes (e.g., 2-D vs. 3-D PET)
- Design of different reconstruction strategies
- Testing and validation of image registration techniques
- Design of imaging protocol for patients
- Multi-center studies

The phantom includes: a transparent brain shell contained inside an accurately-modeled human head, and a set of fillable external markers.

Brain shell

The brain shell has five compartments which can be filled separately: left and right nucleus caudate, left and right putamen, and the rest of the brain. This allows different nucleus caudate to putamen ratios, as well as different striatal to background ratios to be obtained; this also permits differences in the left and right striatal activity to be examined.

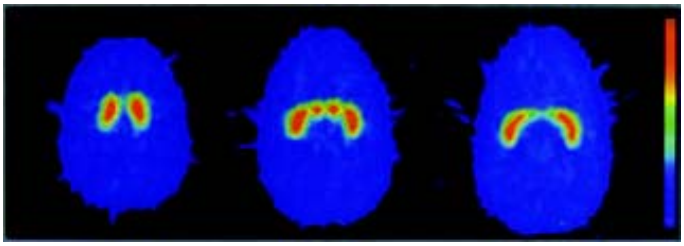
The volumes of the nucleus caudate, putamen and the rest of the brain shell are 5.4, 6.0, and approximately 1,250 ml, respectively.

Head phantom

The modeled human head includes both the soft-tissue substitute and the skull. The soft-tissue substitute is polyurethane, modified for tissue-equivalence, with a mass density of 1.10 g/cc. The narrow beam linear attenuation coefficient measured at 140 keV (^{99m}Tc) is 0.160 cm^{-1}.

The bone substitutes meet the standards of the International Commission on Radiation Units and Measurement (ICRU) Report No. 44 (Tissue Substitutes in Radiation Dosimetry and Measurement, 1989). The cortical bone has a mass density of 1.86 g/cc. The narrow beam linear attenuation coefficient measured at 140 keV is 0.280 cm^{-1}.

The nasal cavity and maxillary sinuses are filled with foam with a mass density of 0.23 g/cc.



PET images of the Striatal Phantom filled with 0.8 mCi of FDG were acquired on a PET system in 2-D mode, at the University of California at Los Angeles (UCLA), courtesy of David Stout. The emission scan contained 43 million counts and was corrected for attenuation and reconstruction with a Hann filter, resulting in a final image resolution of approximately 7.6 mm FWHM

Fillable external markers

A set of fillable capsules with about 1 ml volume is supplied for use as external markers. Capsules can be filled with a radioactive solution or $CuSO_4/NiCl_2$ and attached to the external surface of the phantom. The Phantom is then imaged using any combination of SPECT, PET, or MRI modalities to compare image registration techniques.

Optional accessories

Transparent Brain Shell (Model 76-501-1000)

Available model(s)

76-501 Striatal Phantom for SPECT, PET, and MRI, includes head with transparent brain shell and one set of fillable markers. Weight: 15 lb (7 kg)

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-501-ds rev 1 12 mar 03

Order online

Nuclear Medicine NM

Multicontrast/ Resolution Phantom*

Model 74-345

- Liver-shaped phantom checks the total clinical detection capability of gamma cameras
- Measures the effect of different sizes and contrasts on a target's detectability
- Ideal for QA programs and for optimizing all adjustable operating parameters

Specifications

Material Acrylic (radionuclide not included)

Defects 16 total: 8, 14, 20, and 26 mm long, with 8, 12, 16, and 20 mm diameters; all combinations are included

Chamber dimensions 10.5 x 10 x 2 in (26.5 x 25.5 x 5 cm)

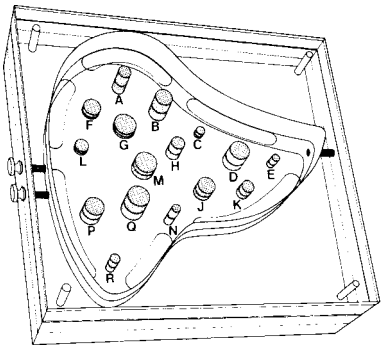
Dimensions 12 x 11 x 3.5 in (30 x 28 x 8.9 cm)

Weight 13 lb (5.9 kg)

Available model(s)

74-345 Multicontrast/Resolution Phantom

Location and sizes of defects



* *Designed by Gerald J. Hine, Ph.D., Consultant, Nuclear Medicine Instrumentation, and Peter Paras, Ph.D., Center for Devices and Radiological Health, Rockville, MD.*

Results obtained with previously-available camera test patterns show areas of high radiation intensity alternating with regions having no radiation. A clinical image, however, has areas with varying degrees of intensity. Even small areas of slightly increased or reduced intensity may be important for image evaluation. Therefore, subtle effects due to film characteristics or computer settings may mask or expose a clinically-important detail.

The Multicontrast/Resolution Phantom is a liver-shaped phantom that tests the effects of size and contrast on the detectability of "defects" in a uniform image. It consists of a large liver-shaped chamber with 16 different cylinder defects of various lengths and diameters. The defects are attached to a 0.06 inch thick plastic plate that is positioned along the center plane of the chamber.

When the phantom is filled with a ^{99m}Tc-water solution and imaged, the defects appear as cold areas in the image. Since the cylinder lengths differ, the amount of radioactive solution above and below each cylinder is a varying fraction of the chamber's 5 cm total depth. The contrast afforded by the cylinders ranges from about 20% to 60%. Because the cylinder diameters also vary, the detectability will depend on size and contrast.

One side of the phantom has a 1.25 inch thick sheet of plastic that simulates the absorption and scattering of the tissue overlying the liver. When imaged from the opposite side, this layer of scatter material is absent. The phantom is also large enough to serve as a flood source for checking camera uniformity.

Key	D x L (mm)	Key	D x L (mm)	Key	D x L (mm)	Key	D x L (mm)
A	12 x 26	E	8 x 14	J	16 x 14	N	8 x 26
B	16 x 26	F	16 x 8	K	12 x 14	P	16 x 20
C	8 x 8	G	20 x 8	L	12 x 8	Q	20 x 26
D	20 x 20	H	12 x 20	M	20 x 14	R	8 x 20

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

74-345-ds rev 1 12 mar 03

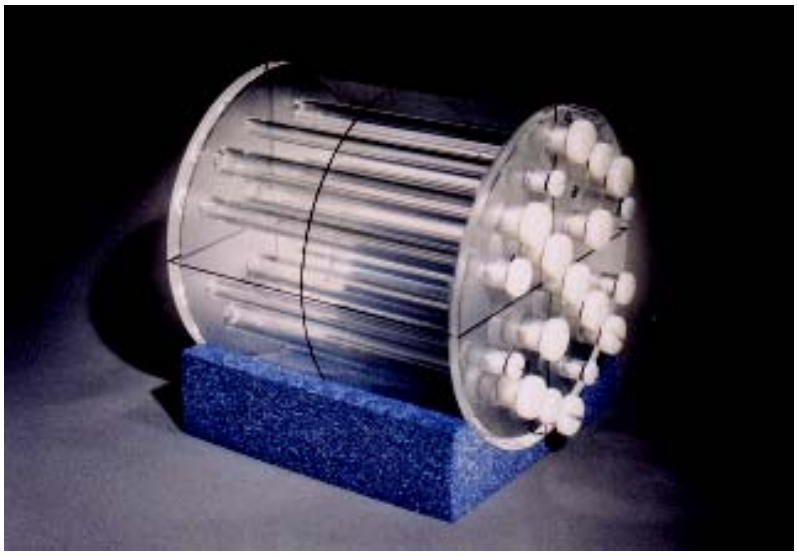
CardinalHealth

Order online

Quantitative Imaging Performance (QIP) Phantom

Model 76-441

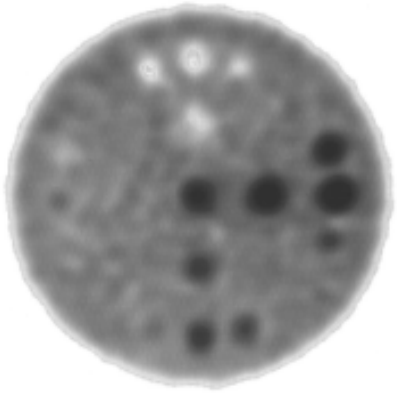
NM Nuclear Medicine



- Clinically, this phantom can provide estimates of detectable lesion-to-background ratios as a function of lesion size and depth
- Is easy to use and fill with radioactivity
- Is economically priced
- Has no parts to assemble

Introduction

The QIP Phantom is designed for the user who wants to quantify SPECT, coincidence, and PET imaging. It consists of an 8 inch diameter tank that is penetrated by 17 cylinders that protrude through the top of the tank. The inside diameters of these cylinders are 0.25, 0.38, and 0.5 inch. The tank can be filled with a specified concentration of radioactivity. Each cylinder may contain a different concentration of radioactivity or radionuclide. Thus, the QIP Phantom allows the user to determine object contrast at different depths for various combinations of target-to-background ratios, both greater than and less than one.



Transverse section through the QIP Phantom. The tank was filled with 1 µCi ^{99m}Tc/ml. The group of cylinders at 3 o'clock was filled with 8 µCi ^{99m}Tc/ml; at 6 o'clock, 4 µCi ^{99m}Tc/ml; at 9 o'clock, 2 µCi ^{99m}Tc/ml, and at 12 o'clock, 0.25 µCi ^{99m}Tc/ml. The cylinders on the horizontal and vertical axes are 0.5 inch ID. The other cylinders are 0.375 and 0.25 inch ID. This image demonstrates that contrast ratios less than one ("cold spot") and greater than one ("hot spot") can be simultaneously evaluated along with response to depth in the phantom. The hot spot at 9 o'clock is for the 0.5 inch ID cylinder. However, the smaller cylinders on either side of the 0.5 inch ID cylinder can't be visualized; nor can the 0.5 inch ID cylinder that is located at a depth midway in the phantom. Also, the 0.25 inch ID cylinder to the left of the 0.5 inch ID cylinder at 6 o'clock is just visible, with a calculated contrast ratio of 4

In a single imaging session, the phantom allows you to evaluate:

- Object contrast as a function of: target-to-background ratio and target size and depth
- Hot and cold spot imaging
- Partial-volume effect
- Dual-radionuclide imaging

With the QIP Phantom you can investigate the effects that scatter, attenuation correction, resolution recovery, and reconstruction algorithms have on quantitative imaging.

A Universal Tank Positioner is supplied with the phantom.

Specifications

Dimensions 8.5 (w) x 8.5 in (d) (21.6 x 21.6 cm)

Weight 5.2 lb (2.34 kg)

Optional accessories

Universal Tank Positioner (Model 76-441-6720)

Available model(s)

76-441 Quantitative Imaging Performance (QIP) Phantom, with universal tank positioner

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

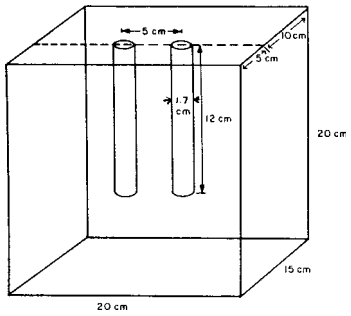
76-441-ds rev 1 13 mar 03

Order online

Nuclear Medicine NM

Dual-Source Scatter Phantom
Model 76-840

- For deadtime measurements
- Simulates in-vivo scatter conditions needed to measure gamma camera deadtime



Deadtime is a time interval during which a radiation counting instrument that is processing incident radiation is insensitive to additional radiation. At higher count rates, losses caused by deadtime limitations degrade quantitative data. Absolute count-rate accuracy requires mathematical corrections for deadtime losses.[1]

Under clinical conditions, the deadtime of a scintillation camera is a function of radiation scatter within the source and its surroundings. Therefore, a scatter phantom which simulates in-vivo forward and backscatter characteristics of ^{99m}Tc gamma rays is required for the extrinsic measurement of a scintillation camera's deadtime. The Dual-Source Scatter Phantom produces a spectrum typical of that observed from ^{99m}Tc in the myocardium. Note the excellent reproduction of in-vivo scatter conditions (see Figure 1).

A deadtime measurement can be accomplished easily in about 15 minutes. Equipment required include the phantom and two ^{99m}Tc test tube sources for which accurate calibration is not necessary. After measuring the count rates of the sources, individually and combined, the deadtime can be determined by using a calculator with natural log functions.

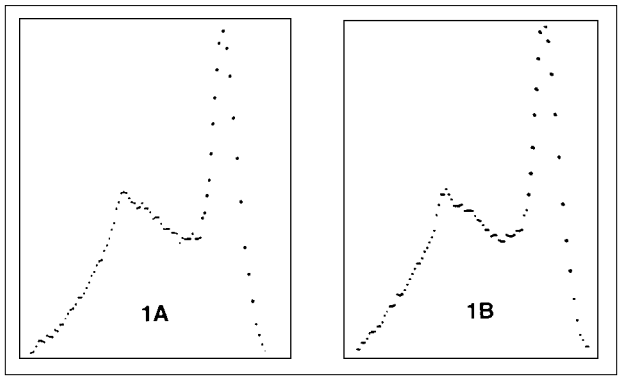


Figure 1. **Similarity of spectra obtained from in-vivo and phantom scatter measurements**

Figure 1A. **Spectrum from ^{99m}Tc-labeled microspheres in myocardium, LAO 30° view**

Figure 1B. **^{99m}Tc spectrum from Dual-Source Scatter Phantom**

Specifications

Material Acrylic

Dimensions 6 (w) x 8 (d) x 8 in (h)
(15 x 20 x 20 cm)

Hole dimensions 1.7 cm Ø x 12 cm deep. The two holes are used to hold the radioactive sources and are spaced 5 cm apart (center-to-center) at a distance of 5 cm from the face of the phantom

Weight 16.4 lb (7 kg)

Available model(s)

76-840 Dual-Source Scatter Phantom

References

1. Ralph Adams, Gerald J. Hine, and C. Duane Zimmerman, "Deadtime Measurements in Scintillation Cameras Under Scatter Conditions Simulating Quantitative Nuclear Cardiography," *The Journal of Nuclear Medicine*, 19 (1978), 538-544.

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

76-840-ds rev 1 13 mar 03

CardinalHealth