# **3-D BRAIN PHANTOM**



Precise simulation of activity distribution for SPECT, PET and MRI

The Hoffman 3-D Brain Phantom provides the anatomically accurate three dimensional simulation of the radioisotope distribution found in the normal brain. The Phantom allows quantitative and qualitative study of the three dimensional effects of scatter attenuation as they would appear in Iodine-123-IMP or Iodine-123-HIPDM imaging with single photon emission computer tomography or fluorine-FDG-F18 imaging with positron emission computed tomography. The phantom simulates the 4:1 uptake ratio in the gray and white matter, normal in these studies. Ventricles that are normally void of radioactivity are present.

The phantom is compromised of sturdy plastic and a single fillable chamber that eliminates the necessity of preparing different concentrations of radioisotope. Nineteen independent plates stack neatly within the cylindrical phantom for easy disassembly and assembly. The user can easily add his own custom defects to simulate clinical abnormalities.

The Phantom can be filled with the appropriate radioactive material or contrast material for SPECT, PET or MRI applications.

Each of 19 inserts is made up of five thinner slices. Two slices 0.03" thick interspersed in 0.6" thick slices to create a composite slice.

#### **SPECIFICATIONS:**

Cylinder Dimensions: I.D.: 6.9" h x 8.2" dia (17.5 x 20.8 cm) Fillable Volume: ~ 1.2 L Shipping Weight: 23 lb (10.4 kg) NEMA PET SCATTER PHANTOM<sup>™</sup>



- Complies with NEMA 2012 Standard
- Acceptance testing
- Determine the imaging systems relative sensitivity to scatter radiation
- Measure the effects of dead-time and the effects of random events generated at different levels of activity of the line source

#### **SPECIFICATIONS:**

Cylinder Outside Dimension: 20.3 cm dia x 70 cm long Cylinder Hole Size: 6.4 mm Cylinder Hole Offset: 4.5 cm Line Source Dimensions: 5 mm O.D. x 80 cm long Line Source Inside Diameter: 3.2 mm Shipping Weight: 52 lb (23.5 kg)

#### 043-768 Phantom, PET Scatter, NEMA 2012

Performance Measurements of Positron Emission Tomographs, NEMA Standards Publication No. NU2, National Electrical Manufacturers Association (NEMA), Washington, DC - 2012

### NEMA PET SENSITIVITY PHANTOM



Complies with NEMA 2012 Standard
Ideal for PET camera

sensitivity

#### SPECIFICATIONS:

Five internally stacked concentric aluminum tubes - all 700 mm in length 1st Tube Inside Diameter: 3.9 mm Outside Diameter: 6.4 mm 2nd Tube Inside Diameter: 7.0 mm Outside Diameter: 9.5 mm Inside Diameter: 10.2 mm Outside Diameter: 12.7 mm 3rd Tube 4th Tube Inside Diameter: 13.4 mm Outside Diameter: 15.9 mm 5th Tube Inside Diameter: 16.6 mm Outside Diameter: 19.1 mm 6th Innermost Tube (a fillable polyethylene tube)

Inside Diameter: 2 mm Outside Diameter: 3.2 mm Shipping Weight: 3 lb (1.3 kg)

043-769 Phantom, PET Sensitivity, NEMA 2012

Performance Measurements of Positron Emission Tomographs, NEMA Standards Publications No. NU2, National Electrical Manufacturers Association (NEMA), Washington, DC, 2012

043-790 Phantom, Hoffman 3-D Brain

### JASZCZAK **SPECT PHANTOM**

ECT Phantom for PET and SPECT



Deluxe SPECT Phantom is shown





Jaszczak he SPECT Phantom provides consistent performance information for any SPECT or PET system. Multiple performance characteristics of camerabased SPECT sys-

Cold Rods

tems are evaluated from a single scan of the phantom.

On-axis and off-axis transverse line spread function may be easilv measured without removing the cover plate. Measurements of full-width-half (or tenth) maximum can be readily determined, either in air or in water.

#### The Phantom is used for:

- System performance valuation of: Collimator, Artifacts, Calibration, and **Reconstruction Parameters**
- Acceptance testing
- Routine quality, assurance and control
- Evaluation of:
  - Center-of-rotation error
  - Non-uniformity artifact
  - Changes of radius-of-rotation on spatial resolution
  - Reconstruction filters on spatial resolution
  - Attenuation and scatter compensation
- Single slice volume sensitivity
- Total system volume sensitivity
- Lesion detectability

SPECT Phantoms are available in two models. The Deluxe Phantom is used for high resolution cameras. The Standard Phantom is used for lower resolution cameras.

#### SPECIFICATIONS:

Cylinder Interior Dimensions: 8.5" dia x 7.32" h (21.6 x 18.6 cm) Cylinder Wall Thickness: 0.125" (3.2 mm) Volume: 6.9 L Volume With Inserts: 6.1 L Cold Rod Insert Height: 3.46" h (8.8 cm) Height of Spheres From Base Plate: 5" h (12.7 cm)

043-750 SPECT Phantom, Deluxe Cold Rod Dimensions: 4.8 mm, 6.4 mm, 7.9 mm, 9.5 mm, 11.1 mm, 12.7 mm Solid Sphere Diameters: 9.5mm, 12.7 mm, 15.9 mm, 19.1 mm, 25.4 mm, 31.8 mm Shipping Weight: 15 lb (6.9 kg)

043-762 SPECT Phantom, Standard Cold Rod Dimensions: 6.4 mm, 7.9 mm, 9.5 mm, 11.1 mm, 12.7 mm, 16.0 mm Solid Sphere Diameters: 12.7 mm, 15.9 mm, 19.1 mm, 25.4 mm, 31.8 mm, 38 mm

043-750 Phantom, SPECT, Deluxe 043-762 Phantom, SPECT, Standard

**Related:** 

043-763 Phantom Insert, Hollow Spheres 043-730 Phantom Insert, Triple Line 043-777 Phantom Insert, Cardiac Phantom inserts are featured on page 94.

## **HOLLOW SPHERE** INSERTS



- Designed for use in all circular and elliptical SPECT cylinders
- Simulates hot and cold spherical "lesions"
- Quantitative evaluation of spatial resolution/object size, attenuation and scatter effects
- Evaluation of quantitative ECT reconstruction methods

#### **SPECIFICATIONS:**

Set: Six hollow spheres (each individually removable and fillable) Diameter: I.D.: 9.9 mm, 12.4 mm, 15.6 mm, 19.7 mm, 24.8 mm, and 31.2 mm

Volume of Spheres: 0.5 ml, 1.0 ml, 2.0 ml, 4.0 ml, 8.0 ml, and 16.0 ml

043-763 Phantom Insert, Hollow Spheres

#### **Related**:

043-765 Phantom, SPECT, Flangeless 043-750 Phantom, SPECT, Deluxe 043-762 Phantom, SPECT, Standard 043-740 Phantom, Lung-Spine

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## JASZCZAK **FLANGELESS DELUXE** SPECT PHANTOM

ECT phantom for SPECT, meets ACR requirements



Deluxe Flangeless SPECT Phantom





flangeless he PET and SPECT phantoms provide consistent performance information for any PET or highresolution SPECT system. Multiple performance characteristics of camera-

based SPECT systems are evaluated from a single scan of the phantom.

On- and off-axis transverse line spread function may be easily measured without removing the cover plate. Measurements of full-width-half (or tenth) maximum can be readily determined, either in air or in water.

The flangeless phantoms for PET and SPECT meet the requirements set by the ACR.

- System performance evaluation of: Collimator, Artifacts, Calibration, and Reconstruction Parameters

- Acceptance testing
- Routine quality, assurance and control
- Evaluation of:
  - Center-of-rotation error
  - Non-uniformity artifact
  - Changes of radius-of-rotation on spatial resolution
  - Reconstruction filters on spatial resolution
  - Attenuation and scatter compensation
- Single slice volume sensitivity
- Total system volume sensitivity
- Lesion detectability

## ESSER FLANGELESS DELUXE **PET PHANTOM**

ECT phantom for PET, meets ACR requirement



Esser Flangeless PET Phantom<sup>TM</sup>



Flangeless PET Phantom Lid<sup>TM</sup> Image of PET Phantom Lid

PET Phantom Lid Containers

#### **SPECIFICATIONS:**

SPECT and PET Phantoms: Cylinder Interior Dimensions: 8" dia x 7.32" h (20.4 x 18.6 cm) Volume: 6.4 L Cold Rod Insert Height: 3.46" h (8.8 cm) Cold Rod Diameters: 4.8, 6.4, 7.9, 9.5, 11.1 and 12.7 mm Height of Spheres From Base Plate: 5" h (12.7 cm)

Solid Sphere Diameters: 9.5, 12.7, 15.9, 19.1, 25.4 and 31.8 mm

Flangeless Esser PET Phantom Lid<sup>TM</sup> Refillable thin-walled cylinders: 8,12,16,25 (x3) mm Solid cylinder (Teflon®): 25mm Cylinder height: 1.5 in Lid Closure: Bayonet-Style with Lock Screw

043-765 Phantom, SPECT, Flangeless, Deluxe 043-772 Phantom, PET, Flangeless, Esser 043-757 Phantom, PET/SPECT, Flangeless Includes PET and SPECT phantom lids

#### Related:

043-763 Phantom, Hollow Spheres Set (6) 043-730 Phantom Insert, Triple Line 043-777 Phantom Insert, Cardiac

Phantom inserts are featured on page 94.

## **PET-CT PHANTOM**



PET-CT Phantom<sup>TM</sup>

The PET-CT Phantom<sup>™</sup> includes internal structures (three rods and six spheres) which, when imaged with both modalities, can demonstrate how accurately the two image sets are aligned.

In addition, a single sample of radioactive water is attenuated by water, bone and CT contrast material (as well as air only) to determine how accurately the CT-based PET attenuation correction works.

#### The Phantom is used for:

- Acceptance testing of PET/CT and SPECT/CT systems
- Routine quality evaluation of PET/CT and
- SPECT/CT systems – Evaluation of new image fusion software
- Evaluation of new attenuation correction algorithms
- Aluminum tubes are for registration
- The outer 2" OD micro cylinder is for comparing attenuation region to non attenuation region
- The 6" ring is for contrast solution
- Research

#### SPECIFICATIONS:

#### Main Cylinder:

Interior length of phantom: 180 mm Fillable spheres (5) inner diameter: 10 mm, 13 mm, 17 mm, 22 mm, and 28 mm. Distance from sphere plane to inside wall: 70 mm Volume of empty cylinder: 9.7 liters Main Cylindrical insert dimension: Outside diameter: 51 mm Length: 180 mm Top Cylinder: Cylinder outside diameter: ~5.1 cm Cylinder inside diameter: ~4. cm Cylinder inside height: ~8.2 cm Cylinder outside height: ~12.0 cm Volume of empty cylinder: 408 cm<sup>2</sup> Three Aluminum Tubes: One 5 inch long: ~1.7 cc Two 7 inch (ea): ~ 2.5 cc Stepped Bone Ring: Pre-filled with liquid bone composition, not to be opened The volumes for the bone ring are: Outer volume: 15.6 cu inch: ~256 cc Inner volume: 6.7 cu inch: ~110 cc

**043-771** Phantom, PET-CT

### NEMA 2012/IEC 2008 PET PHANTOM



- Complies with NEMA 2012 Standard
- Simulation of whole-body imaging using PET and camera-based coincidence imaging techniques
- Evaluation of reconstructed image quality in wholebody PET and camera-based coincidence imaging
- Determination of the coincidence count rate characteristics in brain and cardiac imaging
- Evaluation of the relationship between true coincidence count rate and radioactivity
- Determination of the address errors caused by address pile up
- Evaluation of the count loss correction scheme

#### SPECIFICATIONS:

Dimensions: 9.5" h x 12" w x 9.5 depth (24.1 x 30.5 x 24.1 cm) Interior Length of Phantom: 180 mm Fillable Spheres (six) Inner Diameter: 10 mm, 13 mm, 17 mm, 22 mm, 28 mm and 37 mm Distance From Sphere Plane to Inside Wall: 70 mm Volume of Empty D Shaped Cylinder: 9.7 L Cylindrical Insert Dimension: O.D.: 51 mm dia x 180 mm length Shipping Weight: 11 lb (4.9 kg)

#### 043-767 Phantom, PET, NEMA 2012/IEC 2008

Performance Measurements of Positron Emission Tomographs, NEMA Standards Publication No. NU2, National Electrical Manufacturers Association (NEMA), Washington, DC, 2012

International Standard: Radionuclide imaging devices-Characteristics and test conditions - Part I: Positron Emission Tomographs, International Electrotechnical Commission (IEC), 61676-1, Geneva, Switzerland, 1998 and IEC 61675-1 1.1 (2008)

## SPECT ANTHROPOMORPHIC TORSO PHANTOM



Frontal view - shown with optional Cardiac Insert

- Evaluation of cardiac and lung ECT data acquisition and reconstruction methods
- Evaluation of non-uniform attenuation and scatter compensation methods

The Anthropomorphic Torso Phantom is used for the evaluation of non-uniform attenuation and scatter compensation methods. The phantom consists of a large, body-shaped cylinder with lung, liver and spine inserts. The phantom simulates the anatomical structures of radioactivity distributions for the upper torso of average to large male/female patients. Lung



Top view – shown with optional Cardiac Insert

inserts can be filled with Styrofoam® beads and water to simulate lung tissue density.

When used with the optional Cardiac Insert, cardiac ECT data acquisition and reconstruction methods may also be evaluated.

#### **SPECIFICATIONS:**

Dimensions: O.D.: 10.25" anterior-posterior x 15" lateral (26 x 38 cm) I.D.: 9.5" anterior-posterior x 14.2" lateral (24 x 36 cm) Wall Thickness: 0.37" (9.5 mm) Volumes: Left Lung (w/o Styrofoam® beads): ~ 0.9 L Right Lung (w/o Styrofoam® beads): ~ 0.36 L Right Lung (w/ Styrofoam® beads): ~ 0.36 L Right Lung (w/ Styrofoam® beads): ~ 0.44 L Liver: ~ 1.2 L Background: ~ 10.3 L Cylinder w/ Lung-Spine Insert: ~ 7.4 L

#### 043-795 Phantom, Anthropomorphic Torso

#### **Related:**

**043-777** Cardiac Insert *Phantom inserts are featured on page 94.* 

### SPECT LUNG-SPINE PHANTOM



Lung-Spine Phantom shown with Cardiac Insert in place and Elliptical Cylinder

- Evaluation of cardiac and lung ECT data acquisition and reconstruction methods
- Evaluation of non-uniform attenuation and scatter compensation methods

The Lung-Spine Phantom consists of two chambers that are shaped to simulate the lungs. The chamber can be filled with Styrofoam<sup>®</sup> beads and water that mimics the lung tissue. When filled with Styrofoam<sup>®</sup> beads and a radioactive solution, the lung chambers simulate lung tissue with density of ~ 0.3 gm/cm<sup>3</sup> and with any desirable radioactivity concentration. The Lung-Spine Phantom can be used with the optional Cardiac Insert (as shown) to realistically simulate the attenuation coefficients of any radioactivity uptake in various tissue in the human upper torso. Cardiac Insert is available separately.

#### SPECIFICATIONS:

Inside Diameter Elliptical Shape: Dia Along Major Axis: 12.2" (30.5 cm) Dia Along Minor Axis: 8.7" (22.1 cm) Inside Height: 7.3" (18.6 cm) Volume: Empty Cylinder: ~ 9.4 L Left Lung (w/o Styrofoam® beads): ~ 0.9 L Right Lung (w/o Styrofoam® beads): ~ 0.1 L Left Lung (w/ Styrofoam® beads): ~ 0.36 L

Right Lung (w/ Styrofoam<sup>®</sup> beads): ~ 0.44 L Shipping Weight: 11 lb (4.9 kg)

043-740 Phantom, Lung-Spine

Related: **043-763** Phantom Insert, Hollow Spheres **043-730** Triple Line Insert **043-777** Cardiac Insert *Phantom inserts are featured on page 94.* 

## **TRIPLE LINE INSERT**



- Center-of-rotation error evaluation
- Evaluation of changes of radius-of-rotation on spatial resolution
- Spatial resolution measurement in air and in water, if mounted in cylinder
- Quantitative evaluation of reconstruction filters and scatter compensation method

The Triple Line Insert is used to produce three 1 mm diameter parallel lines of tracer material spaced 7.5 cm apart. The locations of the fillable tubes are based on the recommendations in the NEMA Standards Publication for Performance Measurements of Scintillation Cameras, 1986.

Radioactive tracer liquid can be inserted into the line sources through surgical grade, stainless steel valves located at the ends of each line tube.

The cylinder can be filled with water to simulate the surrounding attenuating medium.

Quantitative measurements of on-axis and off-axis reconstructed line source resolutions can be performed in air by placing the triple line insert directly on the scanning bed.

The triple line insert provides accurate, reproducible images to quantitatively evaluate the effects of errors in center-ofrotation and radius-of-rotation on scanners. Using the insert, the influence of the type of reconstruction filter on SPECT spatial resolution measurements can be evaluated.

#### SPECIFICATIONS:

Useful Height of Line Sources: 2.76" (7 cm) Diameter of Insert: 7.3" (18.6 cm) Diameter of Line Sources: ~1 mm Spacing of Line Sources: 2.95" (7.5 cm) Shipping Weight: 3 lb (1.3 kg)

043-730 Phantom Insert, Triple Line

Related:

**043-765** Phantom, SPECT, Flangeless **043-772** Phantom, PET, SPECT, ACR

- **043-750** Phantom, SPECT, Deluxe
- **043-762** Phantom, SPECT, Standard
- **043-740** Phantom, Lung-Spine

## CARDIAC INSERT



- Evaluation of cardiac ECT data
- Evaluation of attenuation and scatter
- Simulates normal and abnormal myocardial uptake
- Solid inserts simulate transmural and non-transmural cold abnormalities
- Fillable inserts simulate transmural and non-transmural cold or bot abnormalities

This insert provides a multi-function simulation of the left ventricle, and can be used to evaluate SPECT imaging of cold defects within the "myocardium." Two solid acrylic sectors (45 and 60 degrees) are supplied with the insert, each one cm thick and two cm long. These non-filling defects may be placed at various positions within the "ventricle wall", either anteriorly or posteriorly. The long axis of the "ventricle" is adjustable from 30 to 60 degrees from the long axis of the cylinder. Four fillable defects are also included.

#### SPECIFICATIONS:

"Ventricle" Overall Dimensions: 3.7" 1 x 2.4" dia (9.3 x 6.1 cm)
"Ventricle" Volume: ~ 60 ml
"Myocardium" Thickness: 0.4" (1.0 cm)
"Myocardium" Volume: ~ 110 ml
Solid Defect Set (three pieces):
1. 60° x 2 cm (h) x 10 mm (thick)
2. 45° x 1.53 cm (h) x 10 mm (thick)
3. 60° x 2 cm, with 5 mm wall thickness (non-transmural defect)
Fillable Defect Set (four pieces):
1. 180° x 2 cm (h) x 10 mm (thick) / Vol ~ 13 ml
2. 90° x 2 cm (h) x 10 mm (thick) / Vol ~ 5.4 ml
3. 45° x 2 cm (h) x 10 mm (thick) / Vol ~ 3.8 ml
4. 45° x 2 cm (h), with 5 mm thick chamber / Vol ~ 1.4 ml
O43-777 Phantom Insert, Cardiac Includes: Defect Set
Related:

043-765 Phantom, SPECT, Flangeless
043-772 Phantom, PET, SPECT, ACR
043-750 Phantom, SPECT, Deluxe
043-762 Phantom, SPECT, Standard
043-740 Phantom, Lung-Spine
043-795 Phantom, Anthropomorphic Torso

## **BAR PHANTOMS**

Determines resolution of scintillation cameras



**F**our-quadrant Bar Phantoms offer precise determination of camera intrinsic resolution, collimator spatial resolution, field size and linearity. We offer a range of sizes manufactured to the highest quality standards.

#### **RECTANGULAR BAR PHANTOM**

Dimensions: 22.25" l x 17" w x .5" h (56.5 x 43.2 x 1.27 cm) Lead Bar Widths: .079", .098", .118" and .138" (2, 2.5, 3 and 3.5 mm) Field Across Bar Configurations: 21" l x 15.9" w (53.3 x 40.5 cm) Shipping Weight: 21 lb (10 kg)

243-935 Bar Phantom, Rectangular

#### STANDARD HIGH RESOLUTION BAR PHANTOM

 $\begin{array}{l} \textbf{Dimensions: } 16.875" \ l x \ 16.875" \ w \ x \ .5" \ h \ (43 \ x \ 43 \ x \ 1.28 \ cm) \\ \textbf{Lead Bar Widths: } .25", \ .187", \ .156", \ and \ .125" \ (6.4, \ 4.8, \ 4 \ and \ 3.2 \ mm) \\ \textbf{Field Across Bar Configurations: } 15.875" \ l \ x \ 15.875" \ w \ (40.3 \ x \ 40.3 \ cm) \\ \textbf{Shipping Weight: } 14 \ lb \ (6 \ kg) \end{array}$ 

**243-800** Bar Phantom, Standard, High Resolution

#### SYMBIA AND E-CAM BAR PHANTOM

Includes two removable screw knobs for insertion/removal of phantom from camera head.

 $\begin{array}{l} \label{eq:Dimensions: 16" l x 21.4" w x .5" h (40.6 x 54.4 x 1.27 cm) \\ \mbox{Lead Bar Widths: .079", .098", .118" and .138" (2, 2.5, 3 and 3.5 mm) \\ \mbox{Field Across Bar Configurations: 20.3" l x 14.875" w (51.6 x 37.8 cm) \\ \mbox{Shipping Weight: 19 lb (8.7 kg)} \end{array}$ 

243-986 Bar Phantom, Symbia and E-Cam

#### CARDIAC BAR PHANTOM

 $\begin{array}{l} \textbf{Dimensions:} 15.5" \mid x \; 9.25" \; w \; x \; .5" \; h \; (39.4 \; x \; 23.5 \; x \; 1.27 \; cm) \\ \textbf{Lead Bar Widths:} \; .079", \; .098", \; .118" \; and \; .138" \; (2,\; 2.5,\; 3 \; and \; 3.5 \; mm) \\ \textbf{Field Across Bar Configurations:} \; 14.5" \mid x \; 8.25" \; w \; (36.8 \; x \; 21 \; cm) \\ \textbf{Shipping Weight:} \; 15 \; lb \; (6.80 \; kg) \end{array}$ 

**243-955** Bar Phantom, Cardiac, High Resolution

#### TRIPLE HEAD RECTANGULAR BAR PHANTOM

Dimensions: 11" l x 18" w x .5" h (28 x 45.7 x 1.27 cm) Lead Bar Widths: .079", .098", .118" and .138" (2, 2.5, 3 and 3.5 mm) Field Across Bar Configurations: 10" l x 17" w (25.4 x 43.2 cm) Shipping Weight: 19 lb (8.7 kg)

243-975 Bar Phantom, Rectangular, Triple Head

### THYROID UPTAKE NECK PHANTOM

#### Designed to simulate a patient's neck



The Neck Phantom is designed to simulate a patient's neck. The phantom is constructed of lucite. It has a two part insert that allows counting from a bottle, vial or capsule. A capsule holder is supplied to enable the user to count capsules directly, without having to dissolve them. The phantom's cylinder and carrier have scribelines for accurate alignment. A flat surface on the cylinder allows either vertical or horizontal positioning. Twelve 30 ml bottles are included with the phantom.

Proposed by the International Atomic Energy Agency (I.A.E.A.) and the American National Standards Institute

#### **SPECIFICATIONS:**

Dimensions: 5" h x 5" dia (127 x 127 cm) I.D.: 4" h x 2" dia (10 x 5 cm)



**Replacement:** 

043-361 Polyethylene Bottles, 30 ml, 50/pkg

## FLOOD PHANTOMS



Determines field uniformity of scintillation cameras

**P**lood Phantoms provide a means of lighting scintillation camera's crystal to determine response uniformity over the entire field.

Our Flood Phantoms feature extra strength side walls and clear lucite for easy positioning. Easy to fill and easy to drain, the phantoms are leak proof and are excellent for transmission imaging.

#### SPECIFICATIONS:

Dimensions: 20.5" x 28" x 1.25" thick (52 x 71.1 x 3.2 cm) Cavity: 16.5" x 24" x .5" (41.9 x 60.9 x 1.3 cm)



**043-054** Flood Phantom, Rectangular *Screws directly into the flood phantom for safe, easy, fast filling* 

131-010 Phantom Funnel, Flood