

CIRS

Tissue Simulation & Phantom Technology

P R O D U C T C A T A L O G



RADIATION THERAPY



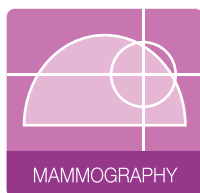
DIAGNOSTIC CT



X-RAY / FLUORO



ULTRASOUND



MAMMOGRAPHY



ELASTOGRAPHY

Proudly Partnering with **Radiology & RT Professionals** for Over 30 Years

Q U A L I T Y A S S U R A N C E T R A I N I N G R E S E A R C H

The Leader In Tissue Simulation Technology

Quality Assurance

CIRS business is Quality Assurance. We were an early adopter of ISO 9000, an internationally recognized quality management system.

CIRS was first registered to the 1994 standard in 1997. CIRS upgraded to ISO 9001: 2008 registration in April 2009 (UL DQS 10000905 QM08).



For over 30 years, Computerized Imaging Reference Systems, Incorporated (CIRS) has been recognized as a leader in the manufacture of phantoms and simulators for quality assurance, training and research. Now with an established library of proprietary tissue-simulation materials, our record of achievement continues as CIRS develops new products for conventional and emerging technologies in medical imaging and radiation therapy. In addition to our extensive collection of standard products, CIRS is uniquely qualified to develop custom solutions.

CIRS employs a diverse group of people with specific knowledge in physics, computational modeling, chemistry, computer-aided design, bio-modeling, 3D printing, tool and mold design, pattern making, resin casting, plastics fabrication, machining, electronics engineering and software development. Each of these specialists plays a key role in helping CIRS reach its ultimate goal of improving the art and science of medicine to better patient outcomes.



Welcome To Our Full Line Catalog

The CIRS full line catalog is a unique resource for medical imaging phantoms and tissue simulation products. It offers cutting edge solutions for today's evolving modalities as well as a wide selection of items for quality assurance throughout the medical imaging community.

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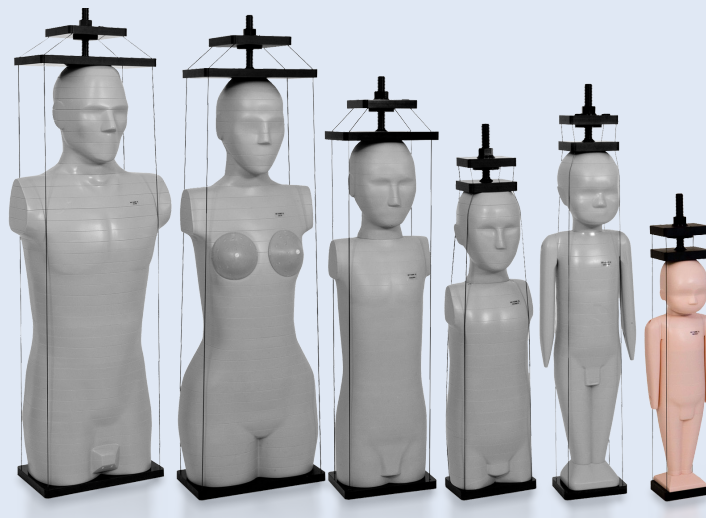
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ATOM® Dosimetry Verification Phantoms

CIRS ATOM® phantoms are anthropomorphic, cross sectional dosimetry phantoms designed to investigate organ dose, whole body effective dose as well as verification of delivery of therapeutic radiation doses.



Models 700 - 706

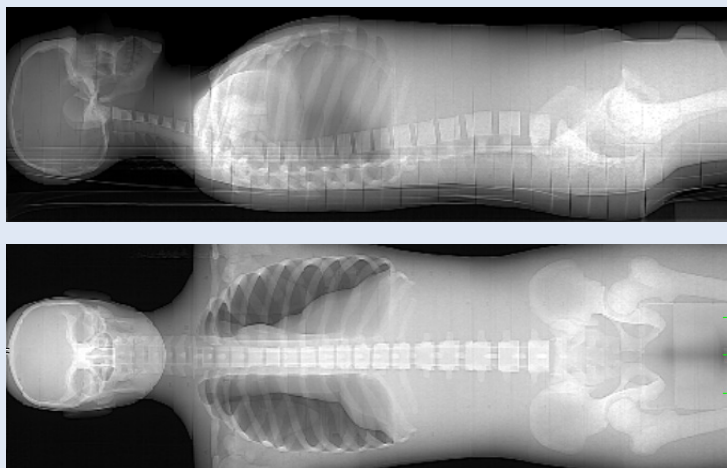
ATOM is the only line of dosimetry phantoms to range in sizes from newborn to adult. Six models are available: newborn, 1-year, 5-year and 10-year old pediatric phantoms as well as adult male and female phantoms.

Each phantom is sectional in design with traditional 25 mm thick sections. The sectional surfaces are extremely flat and smooth and do not require any special coatings or treatment. This results in minimal interfaces between the slabs when viewed in a scout or projection X-ray. The ATOM line also differs from other dosimetry phantoms by providing an optional configuration with optimized locations specific to 21 internal organs.

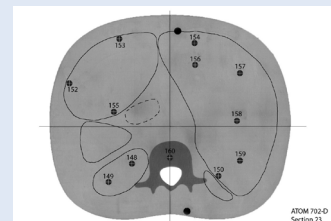
Tissue-equivalent epoxy resins are used in all aspects of the phantom. CIRS technology offers superior tissue simulation by covering a wider range of energy levels from diagnostic to therapeutic. In addition, all bones are homogenous and are formulated to represent age appropriate, average bone composition. CIRS bone formulations offer distinct advantages over natural skeletons and other types of simulated bone.

CIRS ATOM phantoms provide the widest variety of options available for whole body cross sectional dosimetry phantoms.

Life-like imaging characteristics



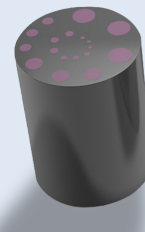
Optimized Organ Dosimetry



Model 702-D
Section 23 Organ Map

CIRS is the only manufacturer that offers organ hole locations specific to 21 radiosensitive internal organs that are optimized for precise calculations using the minimum number of detectors necessary. (D & G configurations only)

CT Imaging QA Kit for ATOM® Phantoms



Model 700-QA
(Low Contrast Insert shown)

All ATOM Phantoms can be modified to receive the CIRS CT Imaging QA Kit. The four inserts contained in the kit are designed to investigate correlation between the image quality and CT doses. The kit provides various targets for evaluation of two important CT performance parameters: low contrast detectability and spatial resolution in soft tissues and lung regions.



CIRS Model 705 with 700QA insert in brain. Image by Xyauwei (Winie) Zhu, MSc

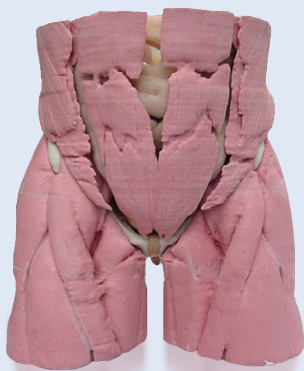
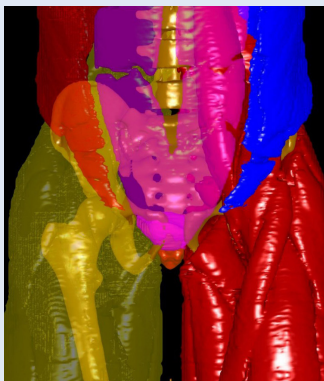
Virtual Human Male Pelvis Phantom



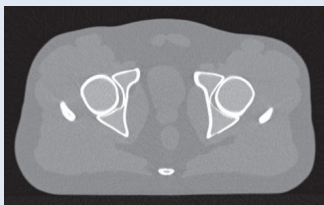
Model 801-P

Validate IGRT Systems

The Virtual Human Male Pelvis Phantom is the most realistic, tissue equivalent phantom available. It contains anatomically precise bone, cartilage, spinal cord, vertebral disks, muscle, intestines, bladder, prostate, rectum and interstitial fat. The phantom is made from proprietary epoxy materials that mimic the density and radiation attenuation properties of human tissue within 1% from 50 keV to 25 MeV.



Anatomical dimensions of the phantom are based on The Visible Human Project data sets that serve as a reference for the study of human anatomy.



ATOMMax™ Dental & Diagnostic Head Phantom



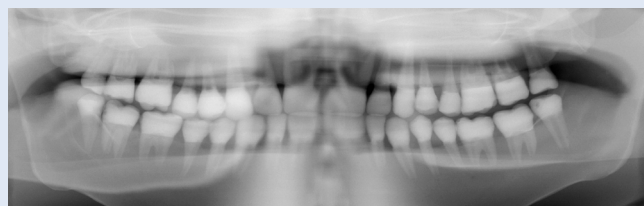
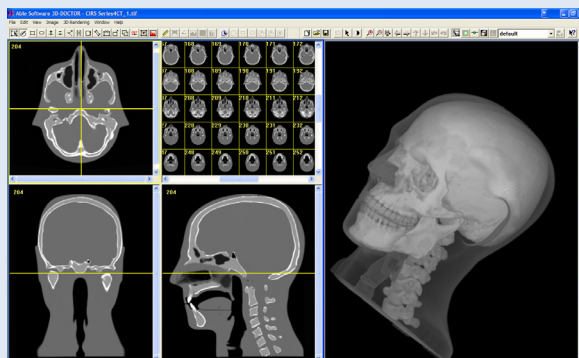
Model 711-HN

The CIRS Dental and Diagnostic Head Phantom is a standard of reference for diagnostic radiology of the head. The Model 711-HN provides a consistent tool for researchers, clinicians and technologists. It is ideal for determining optimum system settings, commissioning new equipment, monitoring system performance and training in dental X-ray, panoramic X-ray, CT and cone beam CT procedures.

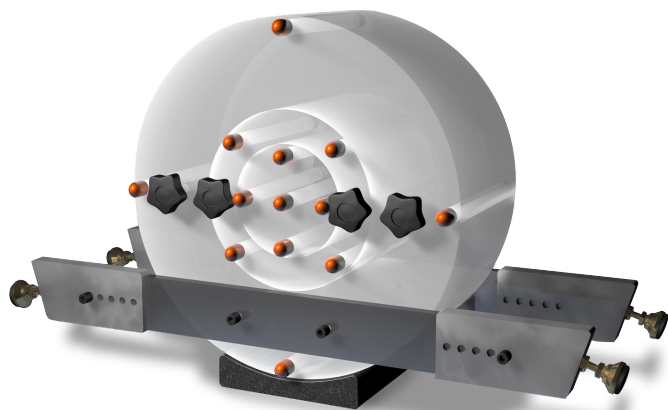
The jaw of the phantom is slightly opened and front teeth are vertically aligned to replicate correct positioning with a bite guide. Please note that an actual bite guide can not be positioned in this product.

ATOMMax™ is made of tissue simulating resins that mimic the X-ray attenuation properties of human tissue for both CT and therapy energy ranges (50 keV-25 MeV).

The Model 711-HN approximates the average male human head in both size and structure. The phantom includes detailed 3D anthropomorphic anatomy including brain, bone, larynx, trachea, sinus, nasal cavities and teeth. The bones contain both cortical and trabecular separation. The teeth include distinct dentine, enamel and root structure including the nerve. The sinus cavities are fully open.



CT Dose Phantom



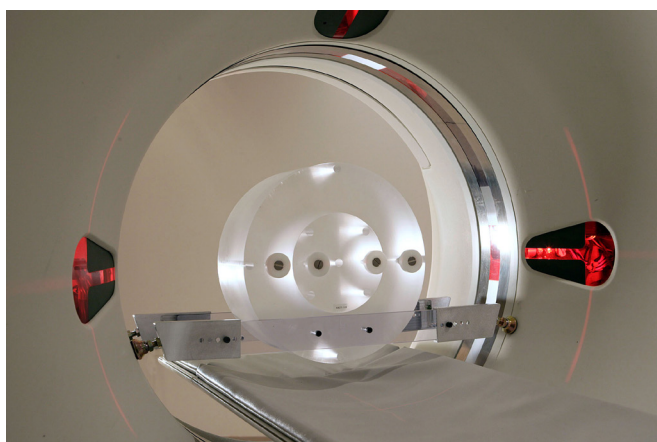
Model 007A

**Comply with FDA
performance standard**

For all computed tomography systems, the Food and Drug Administration recommends measuring the CT Dose Index. Each section of the CIRS CT Dose Phantoms can provide separate dose information. The user can also measure maximum, minimum and mid-range values of the nominal tomographic section thickness when performing dose profile measurements.

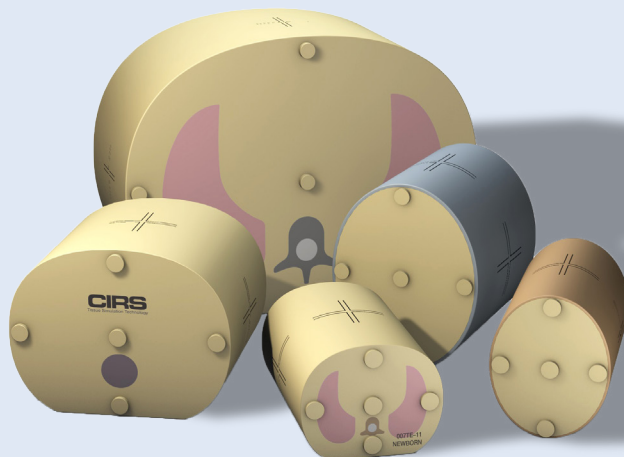
Each phantom consists of set of nesting 15 cm thick solid PMMA disks measuring 16 cm (head) and 32 cm (body) in diameter. The adult head disk is also suitable for pediatric body measurements. The Model 007A includes a third nesting disk measuring 10 cm in diameter for pediatric head measurements. Handles on the body and head are provided for ease in handling and maneuverability.

Through holes measuring 1.31 cm in diameter will accommodate standard CT probes. Acrylic rods are provided to plug the holes when not in use. The acrylic rods are machined to receive 1 mm diameter TLD rods. The Model 007 and 007A CT Dose Phantoms are manufactured to comply with the FDA's performance standard, 21 CFR 1020.33, which details the measurement requirements.



Model 007 shown with an optional Support Bracket, Model 007-01, can be used to suspend the CT Dose Phantoms above the imaging couch and align it along the axis of X-ray tube rotation.

Tissue Equivalent CT Dose Phantoms



Model 007TE

**Accurate dose measurements
for infants to large adults**

The CIRS Tissue Equivalent CT Dose Phantoms are designed to more accurately simulate the range of patient sizes from small infants to large adult patients rendering more accurate and reliable CT dose data.

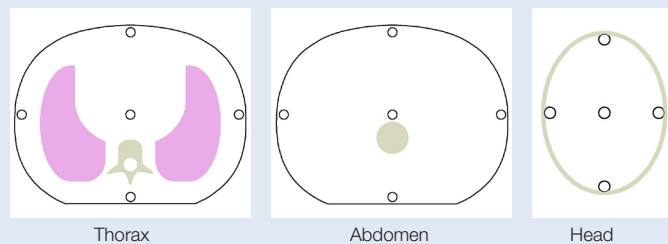
The phantoms are made from proprietary epoxy formulations that faithfully mimic the X-ray absorption and scatter properties of soft tissue or water within 1% in the diagnostic energy range.

There are eight abdominal, eight thorax and four head phantoms in different sizes/ages available. Each phantom includes an embedded vertebral bone-equivalent rod that is specifically formulated to mimic the appropriate density for patient size/age.

All phantoms have five through-holes with an inside diameter of 1.30 cm to accommodate standard CT dose probes and five tissue-equivalent rods to plug the holes not in use. One hole is at center hole and four are around the perimeter, 90° apart and 1 cm from center to the outside edge of the phantom.

Model 007TE Phantoms can be modified to receive the CIRS CT Imaging QA Kit. The kit provides various targets for evaluation of two important CT performance parameters: low contrast detectability and spatial resolution in soft tissues and lung regions (see page 4).

Medium Adult Phantoms



Thorax

Abdomen

Head

Contact CIRS engineering department for an extended list of sizes, external fat-layers and other customizations.

3 Dimensional Torso Phantom



Model 602

Complete with removable organs

The 3D Anthropomorphic Torso Phantom is designed to provide an accurate simulation of an average male torso for medical imaging applications. The removable organs enable flexibility in the placement of TLD's, contrast agents, etc. The epoxy materials used to fabricate the phantom provide optimal tissue simulation in the diagnostic and therapy energy range (50 keV to 20 MeV).

The phantom will accurately simulate the physical density and linear attenuation of actual tissue to within 2 percent in the diagnostic energy range.

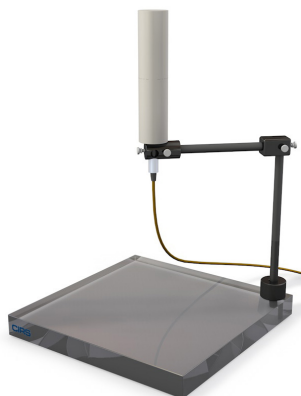
Each phantom contains removable organs. Included organs are lungs, heart, liver, pancreas, kidney, and spleen. The lower portion of the phantom contains a removable soft bolus material simulating a mix of 50 percent adipose and 50 percent muscle tissue. This insert is used to maintain the position of the organs when the phantom is placed upright.

The exterior envelope simulates a mix of 30 percent adipose and 70 percent muscle tissue. The phantom is sealed at the bottom by an acrylic plate.

Water or blood mimicking fluid can be used to fill all the interstitial voids.



Water Equivalent Mini Phantom



Model 670 & 670-S

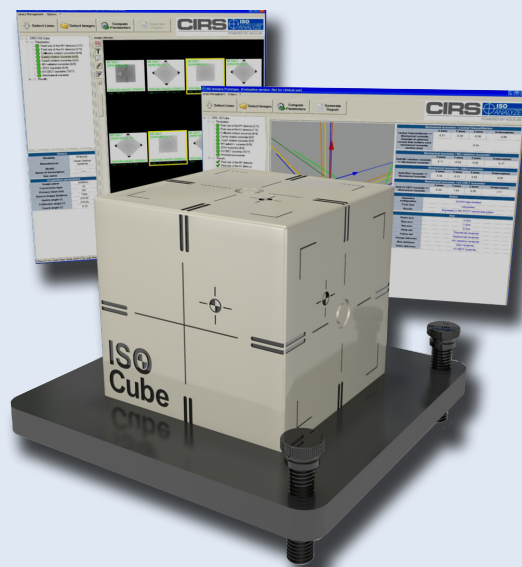
Permits precise evaluation of scatter

The Water Equivalent Mini Phantom for Radiotherapy eliminates scatter radiation and X-ray beam electron contamination during the ion chamber measurements at a reference depth of 10 cm. Phantom material is Plastic Water® and precise machining improves the dosimetric accuracy and reliability of LINAC beam MU calibrations.

The phantom satisfies the requirements of ESTRO Booklet 3 "Monitor unit calculation for high energy photon beams" for Output, Volume-Scatter and Scatter-Primary Ratio measurements.

The Model 670 provides excellent tissue simulation and opportunity of true dose comparison with the 30 x 30 cm Plastic Water® slab phantom. By positioning the ion chamber at a reference depth of 10 cm, the Mini Phantom allows the physicist to isolate and investigate the influence of scatter radiation on a reference dose measured in a slab phantom. The Model 670-S Mini-Phantom stand allows for vertical or horizontal positioning of a 0.6cc Farmer and smaller diameter chambers. Precise three axis rotation improves measurement accuracy.

ISO Cube Daily QA Phantom



Model 023

Verify imaging, localization and targeting systems are aligned with the true radiation isocenter on radiation therapy machines

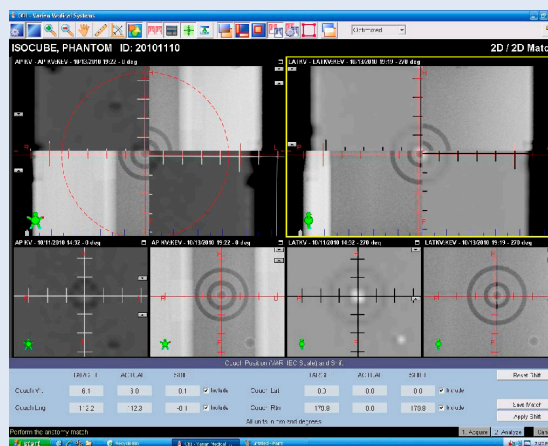
The CIRS Model 023 ISO Cube Daily QA Phantom provides a cost-effective, quick and accurate means of testing radiation isocenter coincidence with the isocenters of the image guidance systems.

both the ODI and the EPID can be checked for true spatial alignment and coincidence with that of the treatment beam.

Optional Accessories:

- Stereotactic Target Frame Adapter
- ISO Align Platform
- ISO Analyze Software
- ISO Opt & ISO Base

The ISO Cube was designed specifically for daily system checks. The lasers and light field can be tuned to the true radiation isocenter using the engraved markings on the exterior of the ISO Cube. The light field and radiation field alignment can be checked using integral radiographic markers. More importantly, the isocenters of



Stereotactic End-to-End Verification Phantom

STEEVTM
STEREOTACTIC END-TO-END VERIFICATION



Model 038

Comprehensive testing for stereotactic radiosurgery systems



Commissioning and treatment verification

Stereotactic Radiosurgery (SRS) necessitates a high degree of accuracy in target localization and dose delivery. Small errors can result in significant under treatment of portions of the tumor volume and overdose of nearby normal tissues. The CIRS Stereotactic End-to-End Verification Phantom "Steev" provides a means to check every step the patient will undergo in the treatment process-- from diagnostic imaging with CT, MR and PET, to treatment plan verification.

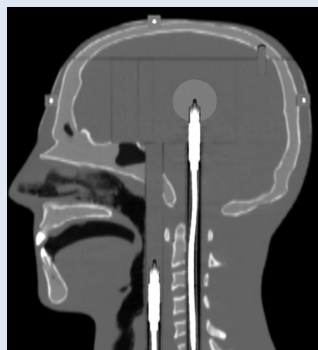
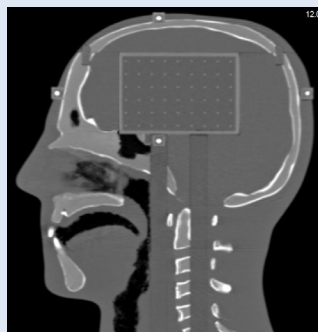
Accurate patient simulation

Steev's anthropomorphic exterior allows for use of multiple positioning and fixation devices as used in clinical application. Internal details such as cortical and trabecular bone, brain, spinal cord, teeth, sinuses and trachea provide the most realistic clinical simulation

to evaluate the challenging effects of complex intra- and extra-cranial anatomies. Geometric and organic target inserts provide means for comprehensive image QA, geometric machine QA and TPS QA for increased confidence in system performance.

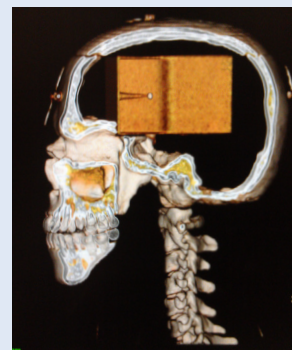
Dose measurements at isocenter and off isocenter positions

Steev accommodates a variety of interchangeable tissue equivalent inserts suitable for small field dosimetry including: micro- and pin-point ion chambers, film, MOSFET, TLD, OSL (nanoDotTM) and 3D gel. When used in concert with the various imaging inserts, Steev provides the most comprehensive end-to-end testing and QA solution for SRS systems.

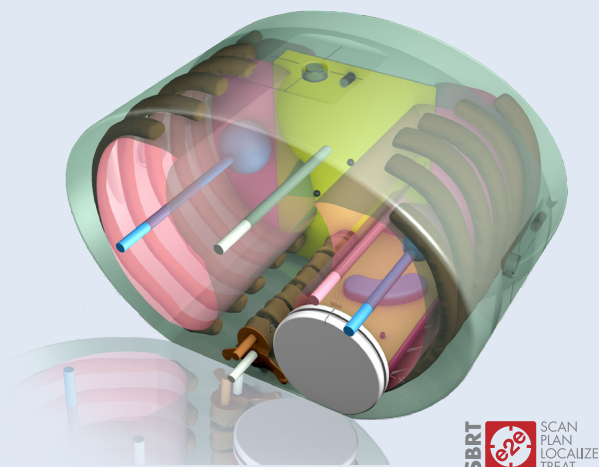


Features:

- Tissue-equivalent within 1% actual attenuation of water and bone from 25 kV to 15 MV
- 11 optional Interchangeable cubic inserts
- Suitable for use with MRI, CT, and PET
- Optional shoulder attachments
- Foam-lined Case



E2E® SBRT Phantom



Model 036A

“End-to-End” SBRT testing solution

The high dose per fraction associated with SBRT necessitates a high degree of accuracy in target localization and dose delivery. The E2E® SBRT Phantom provides a means to check the entire treatment chain during commissioning and routine QA.

The Model 036A* is an anthropomorphic thorax body containing articulated spine, ribs, and lungs. All materials are suitable for use in kV and MV energies.

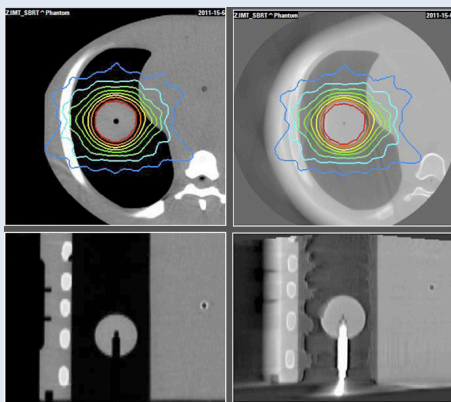
The thorax section contains two lung tumor volumes with ionization chamber cavities in the center of each target. The phantom also includes a lung insert with an irregular-shaped lung target. The proximity of the lung target to the vertebral body allows clinicians to measure high-resolution dose distribution to the target and dose to the spinal chord in a single delivery. A transversal slice of the thorax enables high-resolution dose distribution measurements to the vertebral body and vertebral chord.

The surface of the thorax body is machined with concentric circle targets and alignment marks for daily system checks.

An optional abdominal section (Model 036-01) with 3D spine anatomy for film and nanoDot™ dosimetry is available separately. It can also accommodate the CBCT Image Quality phantom (Model 062QA-35).

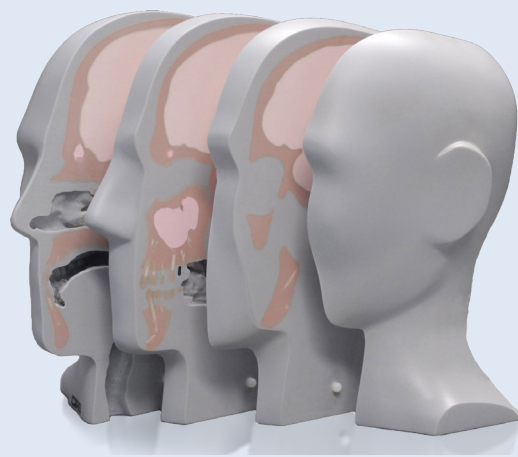
Features:

- High Resolution Anthropomorphic Characteristics
- Center point fiducial and offset target for daily system checks
- Ideal for commissioning an SBRT program
- Excellent test environment for Monte Carlo dose calculation verification
- Facilitates SBRT planning and delivery for Lung, Liver, and Spine treatments



* Customer must specify chamber at time of purchase. Refer to CIRS cavity codes at www.cirsinc.com/support for corresponding CV number.

Proton Therapy Dosimetry Head



Model 731-HN

Tissue Equivalent for Proton and Photon Therapy

The CIRS Proton Therapy Dosimetry Head is an anthropomorphic head phantom designed for commissioning and treatment planning system (TPS) verification with any conformal or IMRT Proton Therapy system¹.

The phantom is constructed of CIRS tissue-equivalent materials, which mimic reference tissues within 1.5% for protons and within 1% for photons from 50 KeV to 25 MeV. The Proton Therapy Head can be used during all standard IMRT procedures from CT image acquisition to proton beam delivery verification^{1,3}.

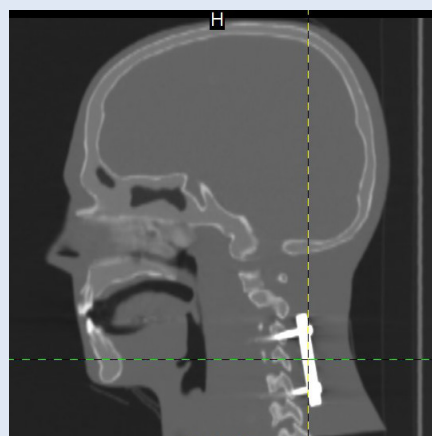
Tissue equivalency of detailed internal structures makes the phantom ideal for treatment plan evaluation in high density-gradient locations, which are specifically important in proton therapy², such as air cavity vs. bone structures. Internal structures include brain, bone with cortical and trabecular distinction, larynx, trachea, fully-open sinus

cavities, nasal and mouth cavities, and teeth with distinct dentine, enamel and root structure.

Model 731-HN approximates the average male human head in both size and structure to allow for intuitive set up with any patient positioning or fixation device.

One half of the phantom is sectioned in 2cm increments for three film locations in the cranio-caudal direction starting from the approximate center of the sagittal plane. Because slices are orthogonal to the CT axial plane, artifacts caused by residual air gaps are noticeably reduced compared to standard axial slices.

Proton system commissioning is enhanced by placement of a tungsten BB in a molar and a titanium prosthesis attached by two screws at C3 and C5 vertebra.



MRI Distortion Phantom for SRS



Model 603A
For Rapid Assessment of Image Displacement in Treatment Planning Systems

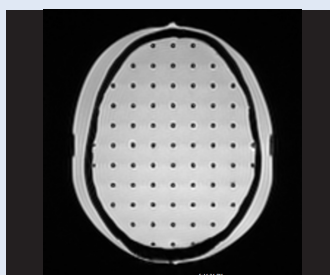
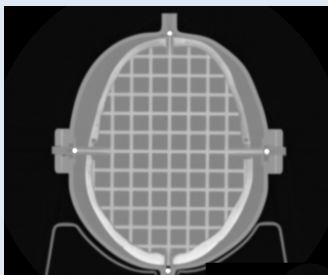
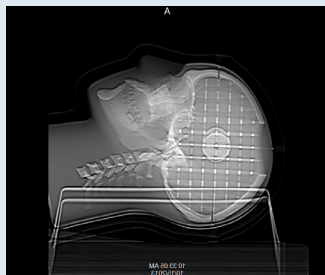
The CIRS 3D Anthropomorphic Skull Phantom is made from materials that can be imaged using X-ray, Computed Tomography and Magnetic Resonance Imaging. It images well with all MRI sequences tested to date, including T1 weighted, T2 weighted, 3D Time of Flight, MPRAGE and CISS sequences.

The entire cranial portion of the skull volume is filled with a orthogonal 3D grid of 3mm diameter rods spaced 1.5 cm apart. Five extended axis-rods intersect at the reference origin of

the grid. The end of each extended axis is fitted with CT and MR markers allowing for accurate alignment with laser-light as well as image co-registration.

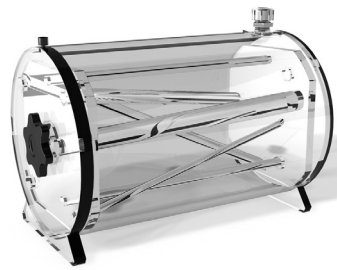
Features:

- Images well on T1, T2 and 3D TOF MRI acquisitions
- Images well on CT scans
- Protective pad for use with Stereotactic Frame
- Images can be imported into stereotactic localization program
- CT scans can be used to assess MRI accuracy



Three dimensional orthogonal acrylic rod matrix through cranial volume enables assessment of image distortions

Gillian QA Phantom



Model 802

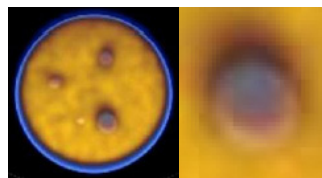
Evaluate image distortion and alignment

Hybrid scanning systems such as SPECT/CT, PET/CT and CT/MRI are increasingly being used to improve tumor identification, treatment delivery and monitor treatment effectiveness. Proper alignment of the fused images is an ongoing concern.

The Model 802 Gillian QA phantom provides a simple and cost effective solution to verify image alignment and distortion. The phantom consists of a water tight acrylic cylinder that can be filled with a variety of fluids. Four non-parallel rods of varying diameter run the entire length of the cylinder. Images produced with the phantom can quickly and clearly show if there is any misalignment in the fused images.

Features:

- Compatible with SPECT/CT, PET/CT and MRI
- Check alignment and distortion across the entire imaging field
- Easy to fill and drain
- Allows for independent assessment of equipment function
- Simple geometry allows for quick visual interpretation



Misalignment detail

Manufactured under license from:
King's College Hospital **NHS**
NHS Foundation Trust

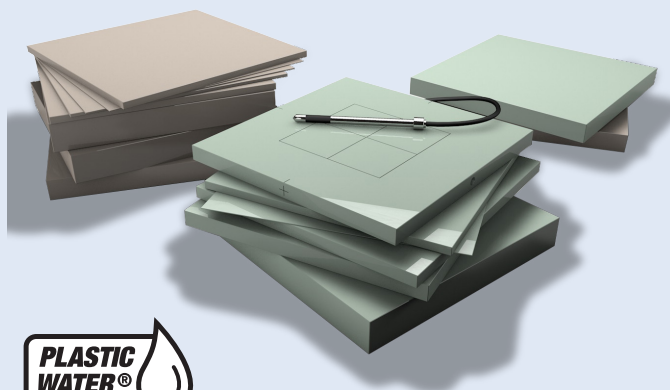
Chamber Cavities for Plastic Water® and other CIRS Dosimetric Phantoms

CIRS offers a variety of dose phantoms that accommodate common ionization chambers. Solid plugs are also available to fill cavities not in use. When ordering a phantom for use with an ionization chamber, the Chamber Cavity Rods are not included with the phantom and must be purchased as a separate line item. CIRS assigns a CIRS cavity code that will accommodate a wide variety of ion chambers. Please specify the exact chamber you are using and the corresponding CIRS Cavity Code when ordering. CIRS Cavity Codes are available at www.cirsinc.com/support.

CIRS accommodates Ionization chambers from

- Applied Engineering
- Attix
- Capintec
- Exradin
- Farmer
- Far West
- Fluke
- Innovision
- Multidata
- Nuclear Enterprise
- Philips
- Best Medical
- PTW
- Radcal
- RTI
- Scanditronix
- SFD
- Standard Imaging
- Sun Nuclear
- TN MOSFET
- Victoreen
- Wellhofer

Plastic Water®



Calibrate photon and electron beams within 0.5% of true water dose

Unlike other water-equivalent plastics on the market, Plastic Water® is flexible and resists breakage under impact. Plastic Water® is the only calibration material available in 1 mm thicknesses. Plastic Water® is the only material which agrees with true water within 0.5% above 7 MeV.

Custom cavities are available to accommodate any ion chamber on the market (simply provide detailed drawings when ordering).

CIRS can simulate any tissue found in the human body and many phantoms contain multiple tissue substitutes. Water, however, is the most important reference material in Medical Physics. To accurately simulate water over all energies from 10 keV to 100 MeV with a singular solid material is one of the more challenging tasks in the field of Tissue Simulation. CIRS water-equivalent materials are formulated to mimic within 1% or better for specific energy ranges.

Plastic Water-LR is formulated for liquid water equivalency at photon energies and is useful in the evaluation of the dosimetry of low energy brachytherapy sources. It has been shown to be an excellent water substitute at low energy.

Plastic Water-DT is designed to meet the demands of IMRT verification techniques where it is desirable to match attenuation and absorption properties in both the diagnostic and therapy energy ranges.

All plastic water formulations exhibit excellent durability and mechanical properties and are easily machined.

Plastic Water® DT	Plastic Water® LR	Plastic Water® (The Original)
50 keV - 15 MeV	15 keV - 8 MeV	150 keV - 100 MeV

CIRS Tissue Equivalent Materials

Simple, convenient and accurate simulations for therapy dose determinations

CIRS Tissue Equivalent Materials have a variety of uses in both diagnostic and therapeutic medical physics.

They allow simple, convenient and accurate simulations for therapy dose determinations. These materials have the absorption and scattering properties within 1% of living tissue. Tissue Equivalent Materials are user friendly and provide adequate simulations for electron and photon applications between 0.01 and 100 MeV.

CIRS Tissue Equivalent Materials are available with slab sizes ranging from 10 x 10 cm to 40 cm x 40 cm and thicknesses of 0.1 cm through 7 cm. Slabs can be manufactured to accept detectors in standard or custom locations.

Materials are easily machined and can be glued together to create thicker bolus of material.

CIRS Standard Tissue Equivalent Materials

Bone

- Average
- Cortical
- Trabecular

Lung

- Inhale
- Exhale
- Medium

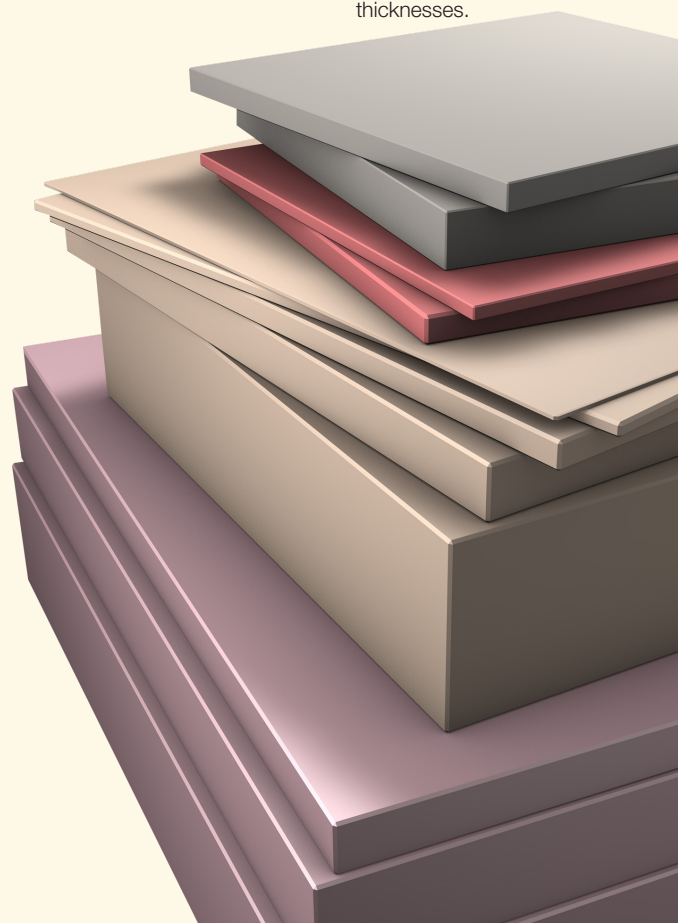
Breast Soft Tissue

- 100% Glandular
- 100% Adipose
- 30% Gland/70% Adipose
- 50% Gland/50% Adipose
- 70% Gland/30% Adipose
- BR12

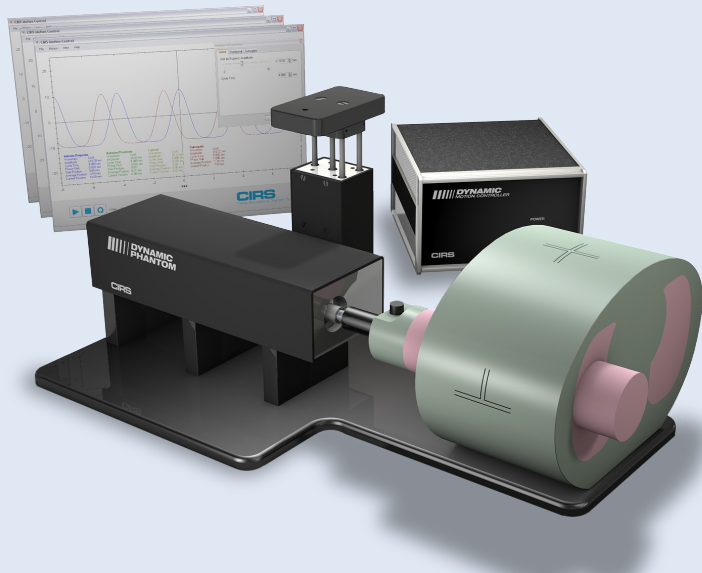
Organ Soft Tissue

- Muscle
- Liver
- Adipose
- Kidney
- Brain
- Average Soft Tissue
- Prostate

Other formulations are available upon request. Not all tissue equivalent materials are available in all thicknesses.



Dynamic Thorax Phantom



Model 008A

Image Acquisition • Treatment Planning • Dose Delivery

The CIRS Dynamic Thorax phantom is an easy-to-use, precision instrument for investigating and minimizing the impact of tumor motion inside the lung. It provides known, accurate and repeatable three-dimensional target motion inside the tissue-equivalent phantom. It is designed for comprehensive analysis of image acquisition, planning and dose delivery in image guided radiation therapy.

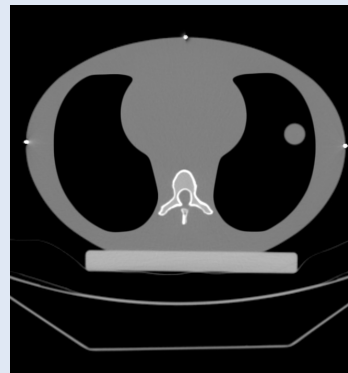
The phantom body represents an average human thorax in shape, proportion and composition. A lung-equivalent rod containing a spherical target and or various detectors is inserted into the lung-equivalent lobe of the phantom. The body is connected to a motion actuator box that induces three-dimensional target motion through linear translation and rotation of the lung-equivalent rod. Motion of the rod itself is radiographically invisible due to its matching density with the surrounding material. The target and its motion, given its density difference, can be resolved.

Target and surrogate motion are independently controlled with CIRS Motion Control Software. The graphical user interface provides an unlimited variety of motions

while simplifying the operation of the Dynamic Thorax Phantom to the intuitive level. Patient specific profiles are easily imported while there is no need to make hardware adjustments or have special programming skills.

Capabilities:

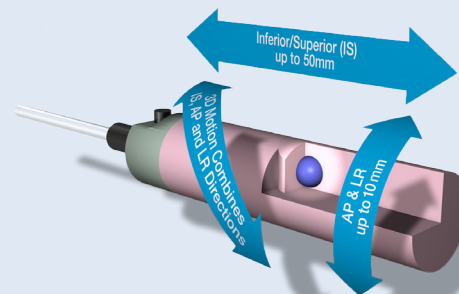
- Commission 4D imaging and 4D radiotherapy systems
- Quantify volumetric and positional aliasing of CT in the presence of 3D target motion
- Evaluate static and dynamic target localization accuracy of onboard imaging systems
- Test accuracy and consistency of tumor tracking and respiratory gating devices
- Assess dosimetric accuracy of temporally modulated radiation therapy
- Train and evaluate personnel during implementation of new equipment and techniques



Tissue equivalent phantom body with anthropomorphic spine, external alignment marks and CT fiducials for phantom image registration

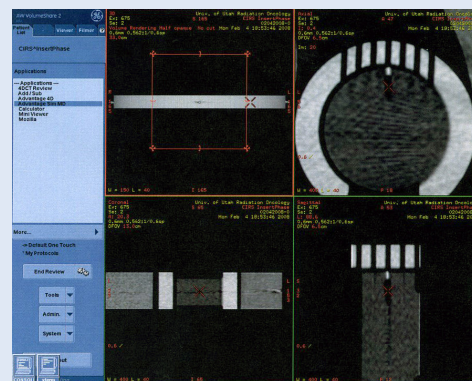
Features:

- Complex 3D tumor motion within the lung
- Sub-millimeter accuracy and reproducibility
- Motion software enables different cycles, amplitudes and wave forms
- Tissue equivalent from 50 keV to 15 MeV
- Compatible with TLD, MOSFET, Dose Gel, micro-chamber, NanoDot OSL, PET/ CT targets and film.
- Surrogate breathing platform accommodates numerous gating devices



Within the CIRS Motion Control software, the user inputs desired range of target motion in the inferior-superior (IS), anterior-posterior (AP) and the left/right (LR) directions. Using these inputs, the software computes the rotational angles based on known distance of the target center relative to the central axis of the rod. Rotation instruction is sent to the actuator by the software.

- Maximum IS motion is 50 mm
- Maximum AP/LR motion is 10 mm via rotation
- Minimum cycle time is 1 second
- Maximum cycle time is unlimited



The 4D CT QA insert option provides a quantitative quality control method for the 4D CT scanner's image binning function. Using the 4D CT QA insert, users can optimize safety margins during treatment planning of moving tumors by identifying misalignments in 4D CT binning as small as 0.5 mm.

"Strict QA procedures for the imaging, planning and delivery of radiotherapy using respiratory management devices are required to ensure the safe and effective use of test devices." -AAPM TG-76 report, The management of respiratory motion in radiation oncology

Motion Control Software

CIRS Motion Control Software is used with all CIRS Dynamic Phantoms. The graphical user interface provides an unlimited variety of motions while simplifying the operation of CIRS Dynamic Phantoms to the intuitive level.

Patient-specific profiles are easily imported and there is no need to make hardware adjustments or have special programming skills.

To schedule a live demonstration of the CIRS Motion Control Software, please contact sales@cirsinc.com.

Dynamic Phantom Motion Control Selection (Thorax or Pelvis)

Graphical user interface simplifies operation of the Model 008A

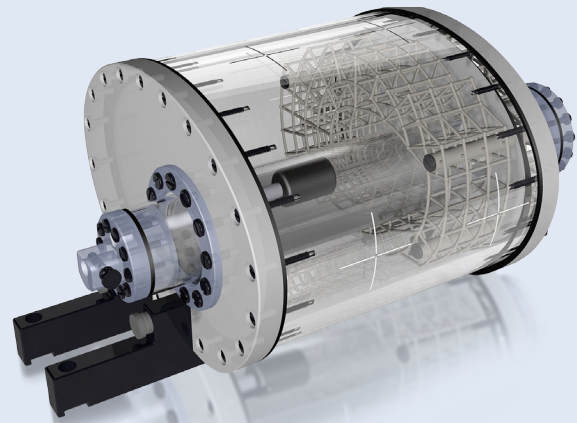
Adjust motion amplitude, cycle time and phase shift with pull down menus and slider bars

Instantly Start, Stop, Pause or Loop motion

Real-time display of target and surrogate motion parameters

Research Mode to import 3D recorded waveforms

MRI-LINAC Dynamic Phantom



Model 008M

Image Acquisition • Treatment Planning • Dose Delivery

The CIRS MRI Dynamic Phantom is a precision instrument for assessing MRI image quality and testing tumor localization and motion-capturing capabilities in modern radiation therapy departments utilizing stand alone MRI simulators or integrated systems for IGRT, Adaptive IMRT and VMAT.

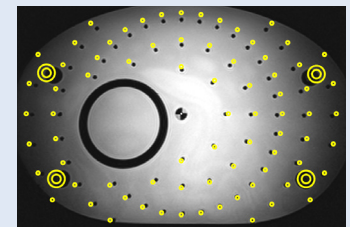
Model 008M provides known, accurate and repeatable three-dimensional target motion inside an MRI-compatible phantom body. It is designed for analysis of image acquisition, planning and dose delivery as MRI emerges as a useful tool in radiation therapy procedures.

The phantom approximates an average human body with a cylindrical thru hole to accommodate a moving rod and simulated target. The target and moving rod are filled with proprietary MRI signal-generating gels that provide contrast with respect to background.

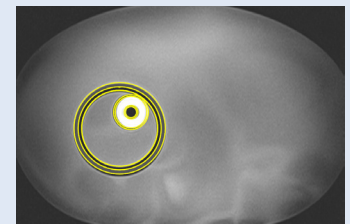
The CIRS MRI Dynamic Phantom can also be used to assess spatial distortion and field homogeneity and to perform ISO center coincidence checks.

Features:

- MRI-CT-LINAC Compatible
- Gated and adaptive RT plan verification
- End-to-end commissioning
- 3D target motion
- MRI QA



MRI Image vs. CAD Model of grid shows MRI distortion



MRI Image vs. CAD Model of target insert shows MRI distortion

Click = Drag to select, Ctrl + Click to pan

Mirror waveform: Mirror by amplitude = 0

Import data from column: 1 Smoothing: 10 Sample Rate: 30 Name: Custom 1

Selection time: 100 sps

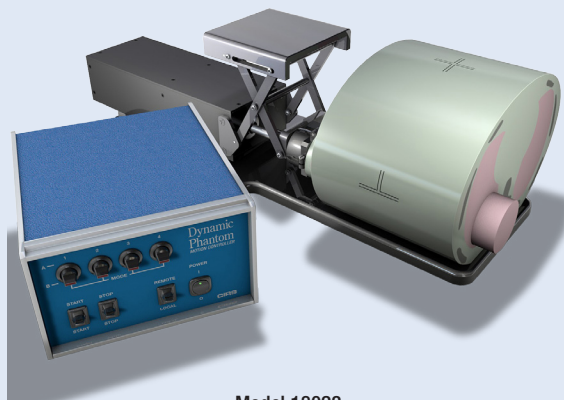
Data Column Selection

Smoothing (Un-smoothed Data = 0; Maximum Smoothing Degree = 100)

Sampling rate of recorded data by Motion Control Software (Used to reconstruct waveform) Range 1 to 100

Name of imported waveform (User or software assigned)

Xsight® Lung Tracking Phantom Kit & 4D Planning Phantom



Model 18023

Quality Assurance and E2E testing on Cyberknife® Systems

The CIRS Model 18023 Xsight® Lung Tracking “XLT” Phantom Kit and Model 18043 4D Planning “4DP” Phantom have been verified and validated by Accuray for use with CyberKnife systems and both are designed to work in conjunction with the Synchrony System.

The XLT phantom body, Model 18023, represents an average human thorax in shape, proportion and composition.

Features:

- 3D anthropomorphic spine with cortical and trabecular bone, ribs, and lung lobes
- Lung Ball Cube Rod with tumor-simulating target and radiochromic film
- Pre-programmed motion controller, motion actuator box for linear target motion, and surrogate platform

“Strict QA procedures for the imaging, planning and delivery of radiotherapy using respiratory management devices are required to ensure the safe and effective use of test devices.”

AAPM TG-76 report
The management of respiratory motion in radiation oncology



The 4DP phantom, Model 18043, can be interchanged with the XLT body and connected to the motion actuator box.

The 4DP pre-programmed motion has a start position 90° clockwise from the XLT motion.

Features:

- Modified phantom body with lung lobes and spine
- High-density Lung Ball Cube Rod with tumor-simulating target and radiochromic film
- Rotating (manual) trabecular bone-equivalent spine with film insert

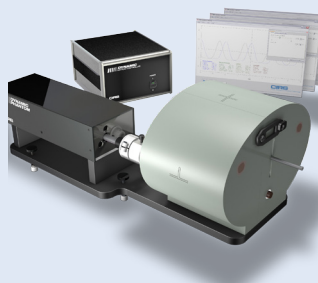
The Model 18023 Xsight Lung Tracking “XLT” Phantom Kit can be upgraded to include the latest features of CIRS Dynamic Thorax Phantom (Model 008A).

These features include: 3-axis controller, independently controlled linear, rotational and surrogate motion and CIRS Motion Control Software, a user-friendly graphical user interface that can be installed on any computer running Windows XP or later.



Model 18043

Dynamic Pelvis Phantom



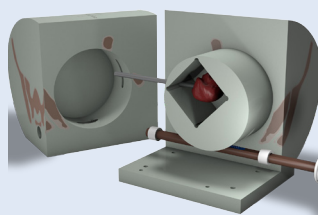
Model 008P

Image Acquisition • Treatment Planning • Dose Delivery

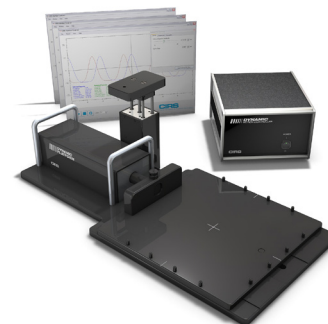
The CIRS Dynamic Pelvis Phantom is a precision instrument for investigating and minimizing the impact of prostate motion inside the pelvis. It provides known, accurate and repeatable two-dimensional target motion inside a water-equivalent phantom. It is designed for end-to-end analysis of image acquisition, planning and dose delivery in image-guided radiation therapy.

The phantom body represents an average human pelvis in shape, proportion and composition. A water-equivalent cube containing a prostate gland and/or various detectors is inserted into the pelvic cavity of the phantom. The cube is connected to a motion actuator box that induces two-dimensional target motion through rotation of the cube insert. Motion of the cube itself is radiographically invisible due to its matching density with the surrounding material. The prostate and its motion, given its density difference, can be resolved.

Prostate motion is independently controlled with CIRS Motion Control Software. The graphical user interface provides an unlimited variety of optimized motion profiles while simplifying the operation of the Dynamic Pelvis Phantom to an intuitive level.



Dynamic Platform



Model 008PL

Programmable motion for any phantom

The CIRS Dynamic Platform provides an economical, user-friendly solution for the complex tasks associated with tumor motion and patient positioning in radiation therapy.

The platform is made from stiff, low-density plastics. The device enables precisely controlled inferior-superior motion up to 50 mm for any phantom up to 70 lb. A removable pin system in the main platform allows consistent placement and fixation of almost any phantom and traditional laser alignment marks enable accurate positioning of the entire device. An independently controlled smaller platform provides Posterior-Anterior surrogate chest wall motion.

The CIRS Dynamic Platform is operated using CIRS Motion Control Software, a user-friendly graphical user interface that can be installed on any computer running Windows XP or later (both 32 and 64 bit).

MicroMouse™ & Water-Filled Mouse Phantoms



Models 090, 091 & 092

Standard of reference for Micro-CT scanners

The CIRS Model 090 MicroMouse™ and Model 091 Water-Filled Mouse Phantoms provide tools for quantifying calcium and bone density with respect to X-ray attenuation and absorption properties. Hydroxyapatite (HA), the principal constituent of teeth and bones within mammals, is the most appropriate reference for mineral density evaluations. CIRS blends HA in a soft-tissue equivalent, polymer background to provide references which can range in HA loading between 0 mg/cc and 750 mg/cc. Hydroxyapatite grain size and homogeneity of the rods are optimized for use in Micro-CT.

Both the solid MicroMouse Phantom and the Water-Filled Mouse phantom contain 11 rods of varying mineral loading and dimension. They can be used to evaluate Micro-CT scanners as you would standard whole body scanners. The targets are suitable for determining contrast detectability and estimating low-contrast resolution.

In the MicroMouse Phantom the rods are embedded in soft tissue equivalent epoxy material that is of the size and shape of a small rodent.

The Water-Filled Mouse Phantom contains the 11 rods in a water-tight, polycarbonate housing which is very durable and resistant to many chemicals. The Model 091 housing can easily be filled with a variety of liquids to vary the contrast between the rods and the surrounding liquid.

DEXA Phantom



Model 026

The "Bona Fide Phantom" (BFP) ⁽¹⁾

BioClinica's "Bona Fide Phantom" (BFP), is a quality control tool for Dual-Energy X-ray Absorptiometry (DEXA) instruments, which features an acrylic-embedded calcium hydroxyapatite (CHA) step-wedge. Advanced design features make it the best choice for assessing DEXA instrument stability. You can successfully use the BFP on all mainstream DEXA instruments.

The BFP offers a range of densities (0.7 - 1.5 g/cm²), to verify instrument function over the clinically relevant range, not just at a single, "healthy" BMD. Linearity of BMD over the clinically relevant range is critical for full instrument evaluation.

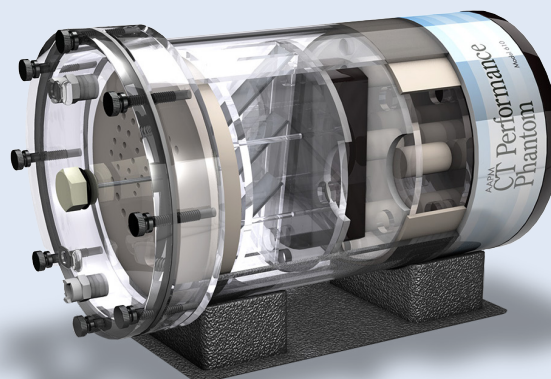
The phantom uses a CHA insert for direct assessment of bone density accuracy. The CHA insert is compliant with FDA guidelines for cross-calibration phantoms for clinical trials. Each insert is machine processed, guaranteeing manufacturing precision.

The BFP is cast in acrylic and comes with its own carry case for easy handling. The tote remains on the phantom during scanning and does not affect BMD readings, allowing rapid placement and removal for the phantom from the bed. A flight case is available as an option.

Note: Various DXA scanner manufacturers have developed and published cross-calibration formulas for use in data comparison.

⁽¹⁾ BFP design is the property of BioClinica, Inc.

AAPM CT Performance Phantom



Model 610

Meets guidelines in AAPM Report #1 "Performance Evaluation and Quality Assurance of CT Scanners"

The CIRS Model 610 AAPM CT Performance Phantom offers the user a single test object that measures ten distinct CT performance parameters. The phantom design is based on the guidelines presented in Report #1 of the American Association of Physicists in Medicine Task Force on CT Scanner Phantoms. The goals of Report #1 were to "(1) define 'performance' of a CT scanner and (2) describe methods of performance testing through utilization of particular phantoms."

A CT number linearity insert, high contrast resolution insert and slice width insert are housed in an 8.5" diameter PMMA water tank with quick disconnect valves for ease of filling and draining between use. Also included is a 0.25" bone equivalent ring that can be fit over

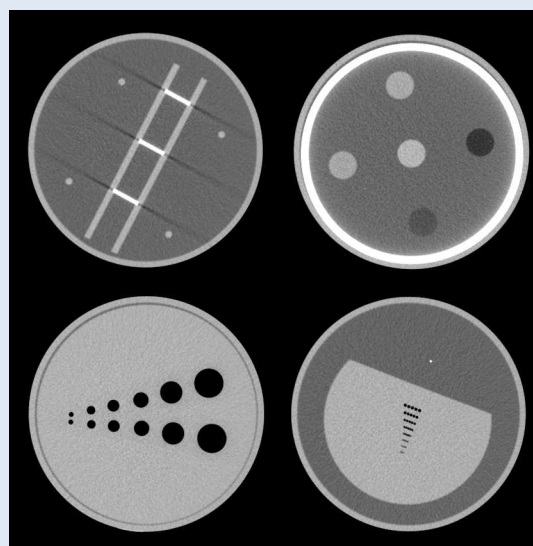
the inserts to evaluate the effects of beam hardening.

A contrast test object is adhered to the bottom of the tank that includes two rows of cavities from 1 to 0.125" diameter. The cavities can be filled with various solutions for contrast evaluation. An aluminum alignment insert is incorporated in the lid of the tank and can be interchanged with a polystyrene TLD insert for dose measurements.

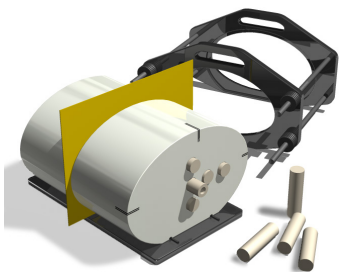
A user's guide, holding cradle, filling tubes and other accessories are included.

Optional items:

Low contrast inserts, whole body resolution/noise ring, TLD insert, Low contrast insert - spherical targets and carry case.



IMRT Homogeneous Phantom



Model 002H5

The IMRT Homogeneous Phantom allows quick checks of patient plans using one 10" x 12" Kodak Ready-Pack film. It has five interchangeable rod locations and one set of CT film fiducial markers. The phantom measures 30 cm wide x 30 cm long x 20 cm thick.

Qty	Description
2	Tissue equivalent sections, one drilled to accommodate solid rod inserts
1	Set of CT to film fiducial markers
5	Water equivalent solid rod inserts
1	Alignment base
1	Holding device

IMRT Cube 20 Phantom

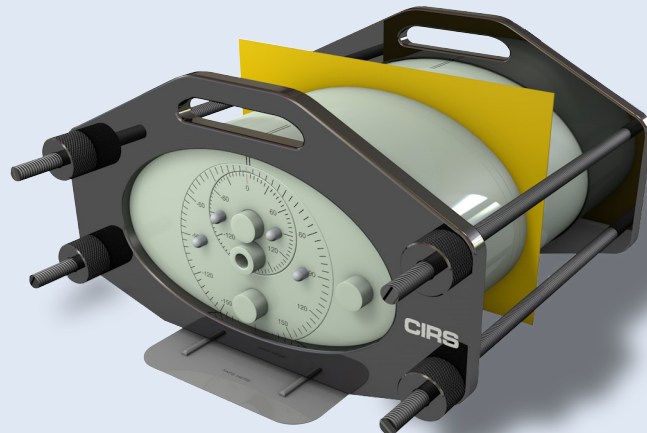


Model 009

The IMRT Cube 20 Phantom is designed for routine QA in RT and IMRT applications. Chamber, diode or MOSFET detectors are easily positioned at isocenter of the cube and laser alignment marks on all sides facilitate precise positioning of the phantom. Detector position can be adjusted longitudinally and lateral and elevational adjustments.

Ready-Pack film can be inserted in the Cube. By rotating the cube, the film is easily set in sagittal, coronal or transverse orientations. Stainless steel fiducials are clearly resolvable on CT images and leave small indentations on the film for precise film to plan registration.

IMRT Head & Torso Freepoint Phantom



Model 002H9K

The Model 002H9K can be configured for torso or head and neck set-ups. The phantom simulates the patient through the entire IMRT process from CT data acquisition and planning to delivery and dose verification.

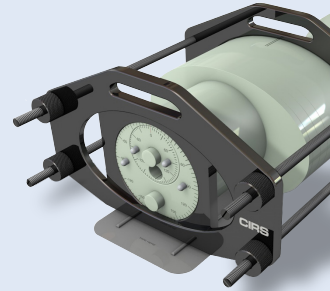
The Freepoint phantom allows any point dose location to be selected within a diameter of 11.2 cm by adjusting two rotating cylinders. Lung and bone equivalent rods can be positioned at any location within the circular area for assessment of heterogeneity correction.

The Model 002H9K was designed in collaboration with David D. Loshek PhD.

Model 002H9K Includes:

Qty	Description
1	Water equivalent homogeneous torso section with cylindrical inserts (15 cm)
2	Spacer slabs, 2 cm
1	Spacer slab, 1 cm
1	Spacer slab, 10 cm
4	Water equivalent solid rod inserts
1	Bone equivalent solid rod insert
1	Set of CT to film fiducial markers
1	Alignment base
1	Holding device

*Customers are encouraged to complete their order with the purchase of optional inserts. Refer to separate CIRS cavity and plug code list for available chamber cavities.

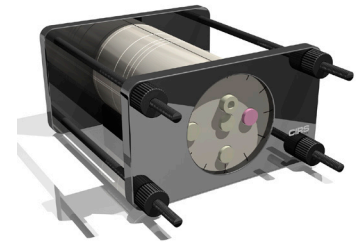


Head and Neck configuration

Features:

- Ionization chambers, TLD, MOSFET and Diodes easily positioned using interchangeable rods*
- Choose any point dose location by rotating the cylinders
- Use radiographic Ready-Pack film or GAFCHROMIC®
- Close placement of detectors to film improves film calibration
- CT-film markers ensure accurate film to plan registration
- Surfaces are marked with indices for precise alignment
- Configure with or without heterogeneities

IMRT Head and Neck Phantom



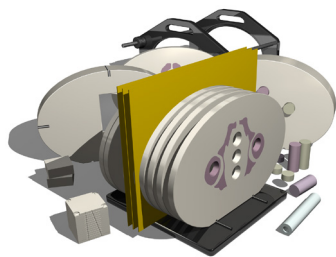
Model 002HN

The Head and Neck phantom approximates the average cranial diameter of 16 cm. A bone equivalent rod can simulate the c-spine and an empty hole can simulate the trachea. The phantom has film cassettes for radiographic or radiochromic film.

Model 002HN Includes:

Qty	Description
1	Water equivalent homogeneous section drilled to accommodate rod inserts (15 cm)
2	Film slabs, 1 cm, film cavity 10 x 10 cm with a set of film to fiducial markers.
1	Cavity slab, 6.4 cm, to accommodate film stack or gel cassette
1	Film stack for small volume 3D image reconstruction
2	Spacer slabs, 1 cm
1	Spacer slab, 2 cm
1	End slab, 1 cm
1	End slab, 1.6cm
5	Water equivalent solid rod inserts
1	Bone equivalent solid rod insert
1	Alignment base
1	Holding device

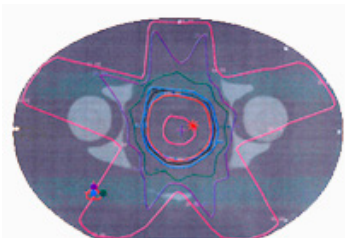
IMRT Pelvic 3D Phantom



Model 002PRA

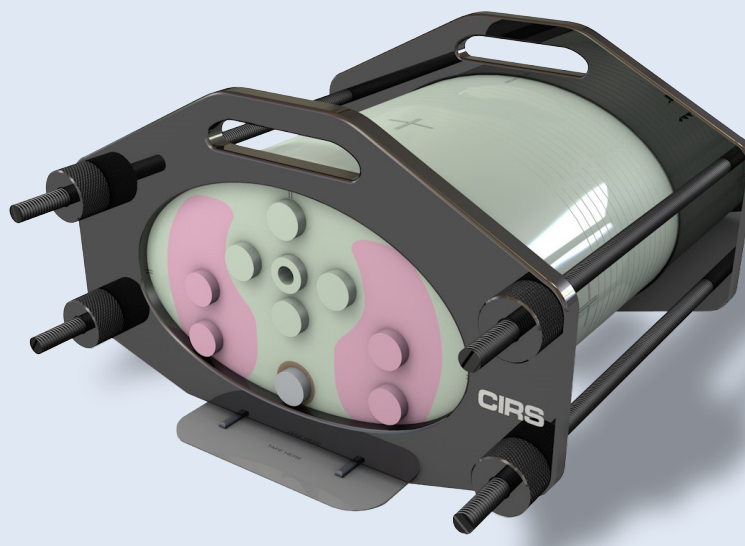
The Pelvic 3D Phantom properly represents pelvic anatomy with a tissue equivalent three-dimensional skeleton. Five rod locations are available in the sensitive areas and up to 10 Ready-Pack films can be positioned within the pelvic region. Rectum balloon can also be represented by empty hole.

Qty	Description
1	5 cm tissue equivalent reference section for interchangeable ED inserts
10	1 cm thick contiguous 3D pelvic sections each drilled to accommodate rod inserts
1	Homogeneous section that accommodates 002FC or 002GC cassettes
1	Film stack for 3D reconstruction
5	Water equivalent rods, 2.5 cm Ø x 5 cm long
20	Bone equivalent solid disks, 2.5 cm Ø x 1 cm thick
30	Water equivalent solid disks, 2.5 cm Ø x 1 cm thick
1	Electron density reference plugs, set of 4 (lung, bone, muscle, adipose)
1	Alignment base
1	Holding device
1	Set of CT to film fiducial markers



Dose distribution shown on CIRS Model 002PRA

IMRT Thorax Phantom



Model 002LFC

Recommended in International Atomic Energy Agency Publication IAEA-TECDOC-1583

The CIRS Model 002LFC IMRT Thorax Phantom for Film and Ion Chamber Dosimetry is designed to address the complex issues surrounding commissioning and comparison of treatment planning systems while providing a simple yet reliable method for verification of individual patient plans and delivery.

The 002LFC is elliptical in shape and properly represents an average human torso in proportion, density and two-dimensional structure. It measures 30 cm long x 30 cm wide x 20 cm thick. The phantom is constructed of proprietary tissue equivalent epoxy materials. Linear attenuations of the simulated tissues are within 1% of actual attenuation for water and bone, and within 3% for lung from 50 keV to 15 MeV.

Tissue equivalent interchangeable rod inserts accommodate ionization chambers allowing for point dose measurements in multiple planes within the phantom.* Hole placement allows verification in the most critical areas of the chest. One half of the phantom is divided into 12 sections, each 1 cm thick, to support radiographic or GafChromic® film¹. Additional inserts are available to support a variety of other detectors including TLD's, MOSFET, and diodes.

Handling, assembly and proper orientation of the phantom is made easy with the use of a unique alignment base and holding device. The surfaces of the phantom are marked for ease of laser alignment. CT markers are included to ensure accurate film to plan registration on the center film.

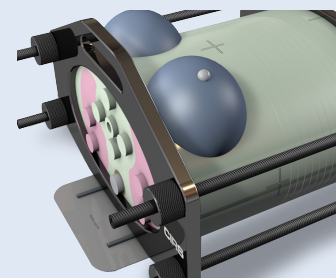
Features:

- Verify heterogeneity corrections
- Correlate CTU to electron density
- Check dose distributions in sensitive areas
- Check depth doses and absolute dose
- 2D and 3D isodoses
- Calibrate film with ion chamber & other detectors*
- Verify individual patient treatment plans

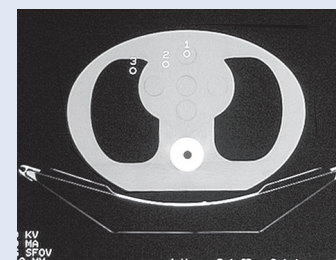
*Customers are encouraged to complete their order with the purchase of optional inserts. Refer to separate CIRS cavity and plug code list for available chamber cavities.

Model 002LFC Includes:

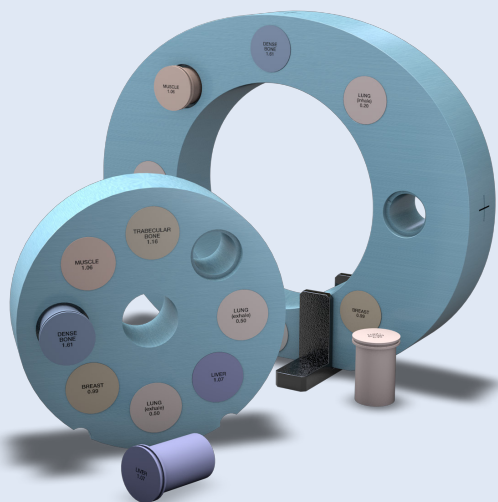
Qty	Description
1	Thorax section drilled to accommodate rod inserts
12	1 cm thorax sections
1	3 cm end section
1	Alignment base
1	Holding device
5	Water equivalent solid rod inserts
1	Bone equivalent solid rod insert
4	Lung equivalent solid rod inserts
1	Set of CT to film fiducial markers



Optional breast attachments



Electron Density Phantom



Model 062M

Correlate CT number and tissue electron density

The Electron Density Phantom, Model 062M, is used to correct for tissue inhomogeneities in radiotherapy treatment planning. The phantom is used with a CT scanner to provide precise correlation between electron density of tissues and their CT number in Hounsfield units (HU).

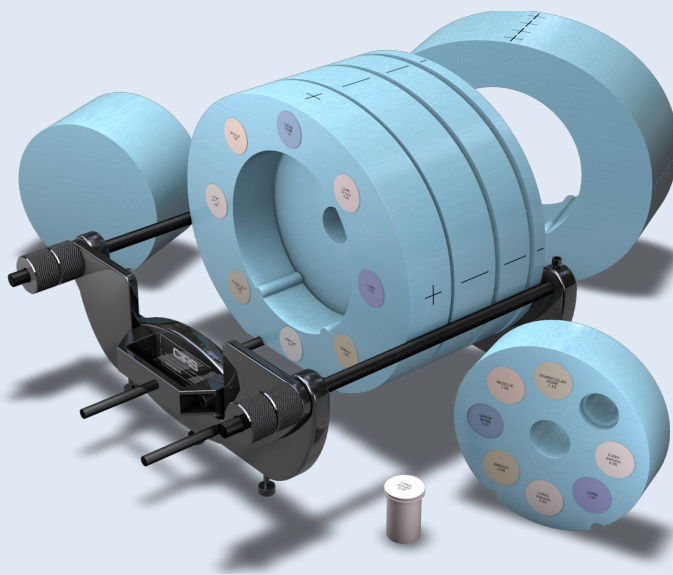
The Model 062M consists of 2 nested disks made from Plastic Water®-LR. They can represent both head and abdomen configurations. Nine different tissue-equivalent electron density plugs can be positioned at 17 different locations within the scan field. Included is a water vial plug that can be filled with any fluid or solid material.

Optional distance marker plugs enable quick assessment of the CT scanner's distance measurement accuracy.

Features:

- Evaluate CT scan data
- Correct for inhomogeneities
- Document relationship between CT number and tissue electron density
- Simulate indicated tissue within the diagnostic energy range
- Quick assessment of distance registration

CBCT Electron Density Phantom



Model 062MA

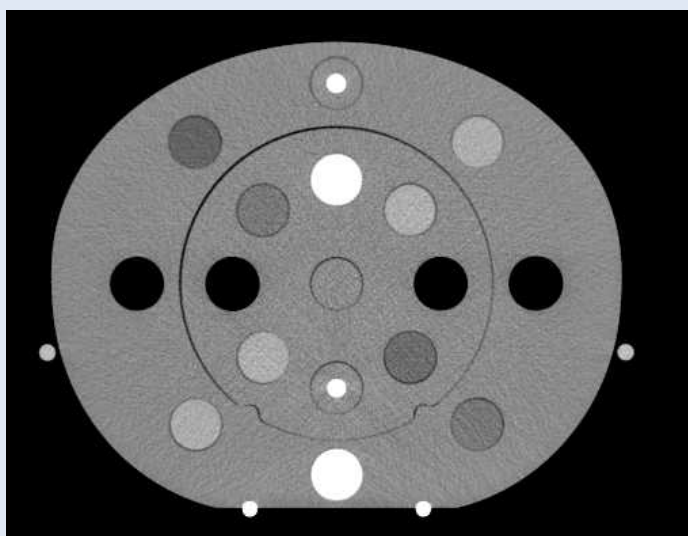
Increase HU value confidence for adaptive Radiation Therapy

The Cone Beam (CBCT) Electron Density Phantom is an extended version of the CIRS Model 062M Electron Density Phantom and is specifically designed for Cone Beam CT Imaging systems. Preliminary data shows that there may be differences between the HU readings for Diagnostic CT and Cone Beam CT. The geometry of the Cone Beam CT requires additional material and suggests that off central axis measurements should be taken.

The phantom is a valuable tool for CT number to electron density calibration in volumetric imaging. Reliable CT calibration curves help enable treatment plan adapta-

tion directly from Cone Beam CT data. Additionally, the phantom can accommodate most any ion chamber for dose measurements and validation of heterogeneity correction based on the corrected CT calibration curve.

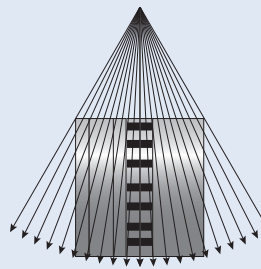
The Model 062MA CBCT Electron Density Phantom's size covers geometries for imagers with dimensions of up to 40 cm x 40 cm. It is made of Plastic Water®-LR and contains the same set of tissue equivalent electron density inserts as the standard Model 062M. Additional interchangeable slabs allow for repositioning of the electron density section.



DIAGNOSTIC CT

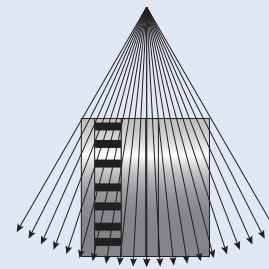


CONE BEAM CT



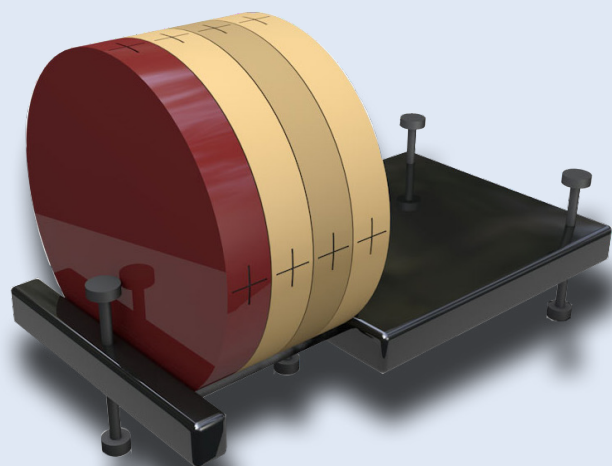
CBCT Electron Density Phantom Central Axis Configuration

CONE BEAM CT



CBCT Electron Density Phantom Offset Configuration

CBCT Image Quality Phantom



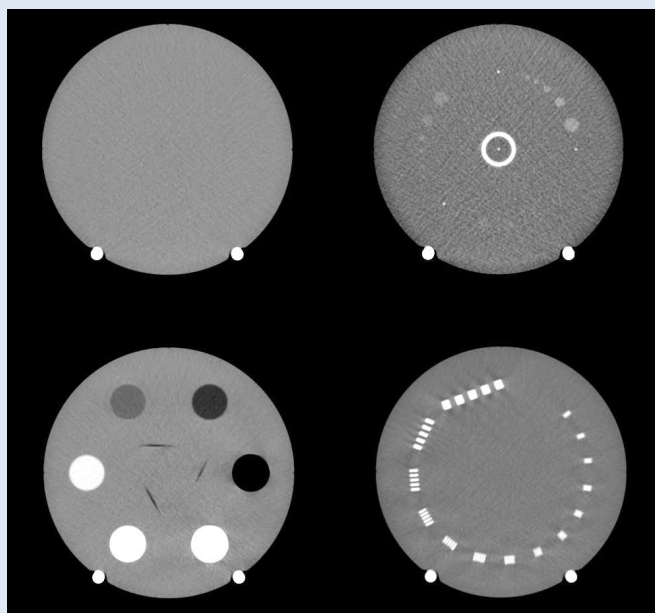
Model 062QA-35

Quality Assurance for Volumetric and Axial CT

The purpose of image quality measurements is to quantify various image quality indicators for 3D images taken from a selection of acquisition and reconstruction settings representative of clinical practices. Assessment of the image quality parameters over time can show trends in variation of said parameters helping the user

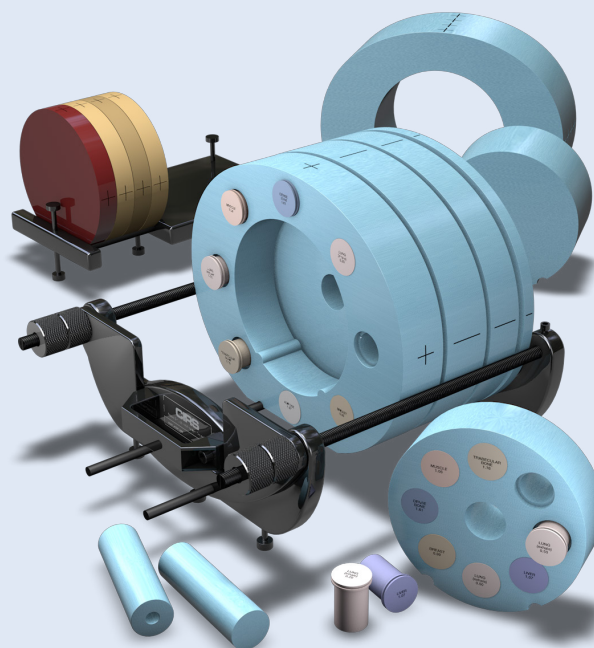
to decide whether or not recalibrations of the imaging system are necessary.

The Image Quality Phantom (062QA-35) is composed of four layers: spatial resolution, CT number linearity/slice thickness, low contrast/magnification and uniformity.



Uniformity, low contrast/magnification, CT number linearity/slice thickness and spatial resolution layers

CBCT Electron Density and Image Quality Phantom



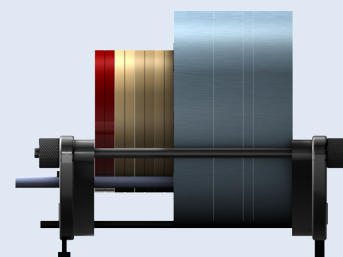
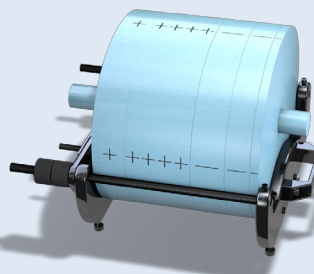
Model 062MQA

Minimize dose, increase quality and enhance outcomes

The Model 062MQA phantom provides a comprehensive tool that can be used for both electron density calibration and image quality assessment of Cone Beam CT systems integrated in radiation therapy devices. The electron calibration function of the phantom enhances the outcome of the adaptive radiation therapy while the image quality features address the fine balance between optimizing image quality while minimizing radiation dose.

The 062MQA CBCT Electron Density & Image Quality Phantom incorporates 3 phantoms:

1. Electron Density Phantom
2. CBCT Electron Density Phantom
3. CBCT Image Quality Phantom



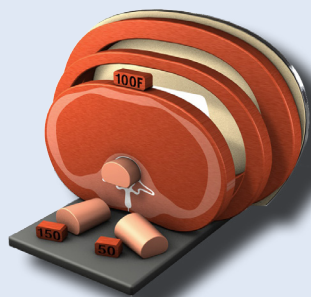
CT Simulator For Bone Mineral Analysis

Simple • Effective • Accurate

Change in trabecular bone mineral content is an early indicator of change in metabolic function. CT, with its superior contrast discrimination, is a major tool in the evaluation of trabecular bone in the central skeleton. All CT scanners require a standard of reference to properly perform quantitative tissue analysis.

The CIRS Model 004 CT Simulator for Bone Mineral Analysis is designed to take into account all the known sources of variance affecting the measurement of density in the vertebral area by simulating the average patient's anatomy in terms of shape and density by using materials essentially equivalent to human tissues as far as X-ray interactions are concerned, including age-related variations in vertebral composition.

The design of the system permits reduction of all sources of error within acceptable limits. The basic principle of operation is to sufficiently simulate the patient's anatomy, and then to scan the patient and the phantom in succession with identical technical factors.



Model 004

Features:

- Use immediately on any CT scanner
- Monitor effects of therapy on trabecular structure
- Directly measure calcium hydroxyapatite content
- Accurate correlation for quantitative studies
- Age-related variable corrections for marrow fat and mineral content
- Simulates the size, shape and CT density of human tissue
- Requires no special scanner software
- PC based report software

NEMA SCA&I Cardiovascular Fluoroscopic Benchmark Phantom



Model 901

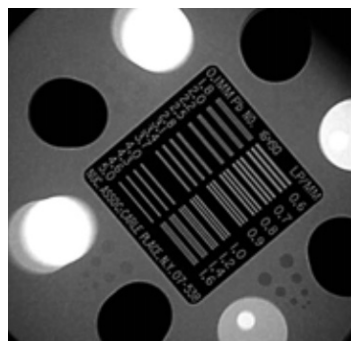
For voluntary compliance with NEMA XR 21

The NEMA-SCA&I phantom is designed to evaluate and standardize catheterization image quality. It is the result of collaborative efforts between the Society for Cardiac Angiography and Interventions and the National Electric Manufacturers Association. The phantom specifically enables voluntary compliance with the recently published performance standard NEMA XR 21.

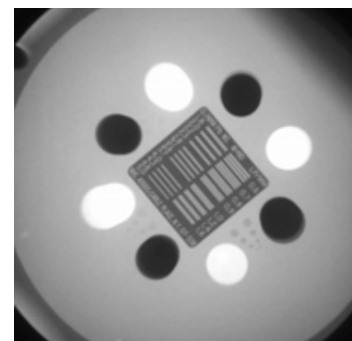
The Model 901 is manufactured from PMMA with X-ray absorption properties similar to soft tissue at

diagnostic energies. It contains a variety of static and dynamic test targets for objective assessment of resolution, motion unsharpness and radiation exposure. The sectional design allows for configuration in a wide range of thicknesses from 5 cm to 30 cm simulating PA thicknesses from infants to large adult patients.

The phantom is ideal for routine assessment of the entire imaging system.

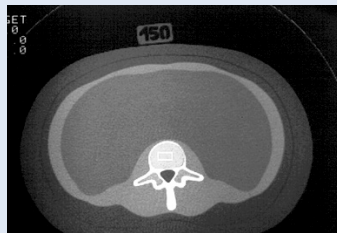
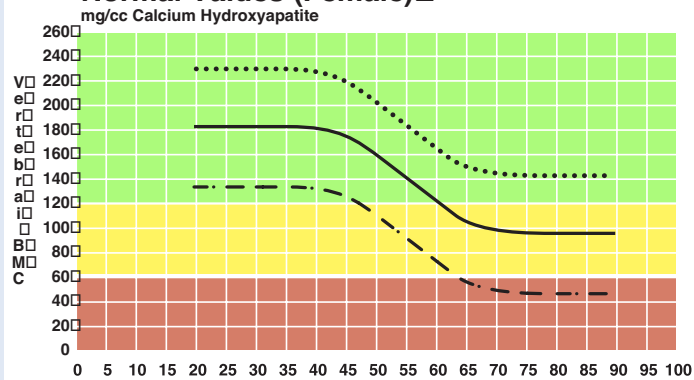


Display tuned to iodine



23 cm FOV

Normal Values (Female) □



Phantom image



Patient image

3D Sectional Torso Phantom



Model 600

Includes 12 internal organ tissues

The CIRS Model 600 Anthropomorphic Torso Phantom is designed to provide an accurate simulation of an average torso (22 cm posterior-anterior thickness) for medical imaging and dosimetry applications. The epoxy materials used to fabricate the phantom provide optimal tissue simulation between the Diagnostic and Therapy energy range (40 keV to 20 MeV).

Unlike other cross-sectional dosimetry phantoms, the Model 600 includes internal organ structures such as the lungs, heart, liver, kidneys, spleen and pancreas. All simulated organs match the tissue density of actual organs and can be clearly visualized.

The lower portion of the phantom contains a soft bolus material simulating a mix of 30 percent adipose and 70 percent muscle tissue. Simulated muscle material layers the rib cage and vertebral column. The exterior envelope simulates a mix of 43 percent adipose and 57 percent muscle tissue.



CT of Heart Level Section

Features:

- Includes internal organ structures
- Ideal for calibration, QA and training purposes when specific internal organs are of interest
- Can be configured to accommodate variety of dosimeters
- Usable on any X-ray imaging or treatment device



CT of Liver Level Section



CT of Kidney Level Section

Radiography Fluorography QA Phantom



Model 903

Solid assessment tool for x-ray image quality programs

The CIRS Model 903 Radiography/ Fluorography QA Phantom is designed to provide physicians with an opportunity for a comprehensive review of their Radiography / Fluorography facility, image quality programs.

The Radiography / Fluorography QA Phantom can be used for initial QA assessment and routine monthly QA testing to help ensure patients are receiving the best possible X-ray examinations.

The CIRS Model 903 is manufactured from PMMA-equivalent epoxy that offers the same X-ray attenuation properties as acrylic with significantly greater durability.

The overall phantom measures 25 cm wide x 25 cm long x 20.7 cm high and consists of three attenuation plates, one test object plate and a detachable stand for easy, reproducible set-up. Test objects include high-resolution copper mesh targets from 12 – 80 lines

Includes:

- Test Object Plate
- 4.1cm Block with Lead Markers
- 7.6 cm Block with Aluminum Plate & Detachable Support Legs
- 7.6 cm Block

per inch and two separate contrast-detail test objects.

Optional accessories are available to evaluate iodine contrast visibility and linearity as well as digital subtraction effectiveness under various conditions.

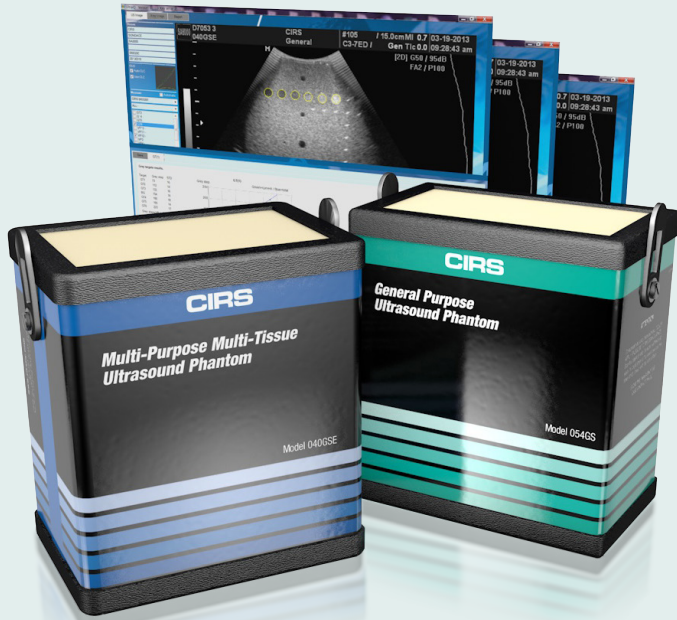
Features:

- Suitable on CR, DR & Fluorography systems
- Durable PMMA-equivalent epoxy
- Multiple configurations
- Assesses:
 - Entrance skin dose
 - Minimum detectable contrast (%)
 - Low-contrast resolution
 - Optical density
 - High-contrast resolution
 - DSA function and arterial visibility

Options:

- Artery Slot Block
- Artery Block with Iodine (15 mg/mL)
- Artery Block with Iodine (150 mg/mL)
- Bone Block

UltraIQ



Models 040GSE-078 & 054GS-078

Automated Phantom Analysis for Diagnostic Ultrasound

Ultrasound quality assurance ensures system performance over time and catches degradation in image quality before it affects the diagnostic value of the clinical ultrasound exam. Yet, establishing a QA program can be time consuming and cumbersome. Worse, many system parameters must be subjectively measured, resulting in a high degree of inter-observer variability.

UltraIQ solves these problems with easy-to-use software that can be purchased with either the CIRS Model 040GSE or Model 054GS. It objectively measures ultrasound image QA parameters and provides faster, more accurate assessments. UltraIQ quantitatively and automatically evaluates dynamic range, axial resolution, lateral resolution, caliper distance, dead zone, and depth of penetration.

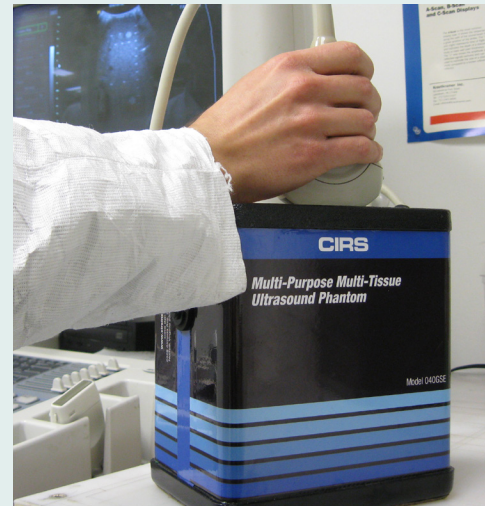
UltraIQ Software can be used with any ultrasound system. Customized reporting and trending functions make it easy to monitor system performance over time. The intuitive user interface provides guidance for making measurements. After the initial setup, subsequent measurements can be automatically performed within minutes.

Features:

- Perform objective assessment of critical system parameters in minutes
- Fully compatible with CIRS Model 040GSE and Model 054GS
- Report system performance over time to identify trends
- Provide accurate, quantifiable system measurements
- Discover problems before major equipment malfunctions occur and patient scans are compromised

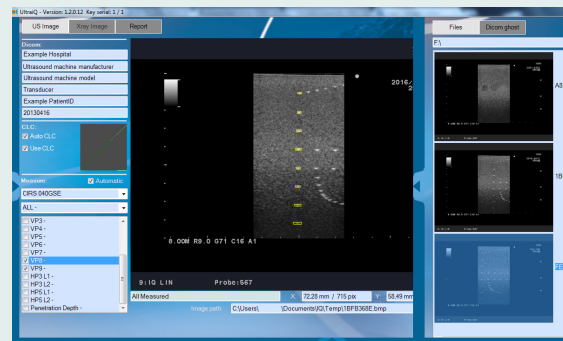
Automated Ultrasound QA In 3 Easy Steps

1. Acquire



Phantom images required for a complete QA assessment can be acquired in less than five minutes.

2. Measure



UltraIQ supports DICOM, BMP and JPEG file formats. For DICOM images, metadata files are used to collect data about the ultrasound device, transducer and image calibration. Measurements are displayed in numeric and graphical form.

3. Report



Graphs are automatically updated using the Excel export function of UltraIQ. Reports can be archived, printed or exported as either a PDF, Excel, or a CSV file.

Multi-Purpose Multi-Tissue Ultrasound Phantom



Model 040GSE

The New Standard for Ultrasound Quality Assurance

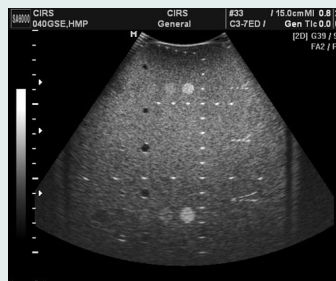
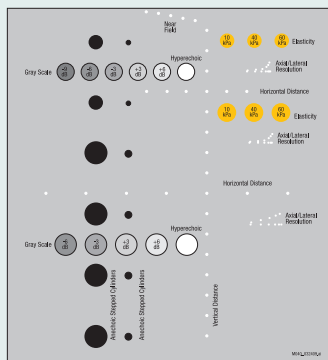
The CIRS Model 040GSE Multi-Purpose, Multi-Tissue Ultrasound Phantom contains nine performance measurements, including gray scale targets, anechoic stepped masses and elasticity targets. The CIRS Multi-Purpose, Multi-Tissue Ultrasound phantom exceeds ACR accreditation requirements, making it the only phantom of its kind designed to meet the ultrasound QA challenges of today and tomorrow.

The unique dual attenuation of the background gel allows for evaluation of transducers that range from 2 MHz - 15 MHz. A removable water well and endocavity cover extends the use of the phantom by allowing evaluation of all transducer configurations: linear, curvilinear and intercavity.

CIRS ultrasound QA phantoms come standard with a robust housing, rugged carry case, 48-month warranty, and user guide.

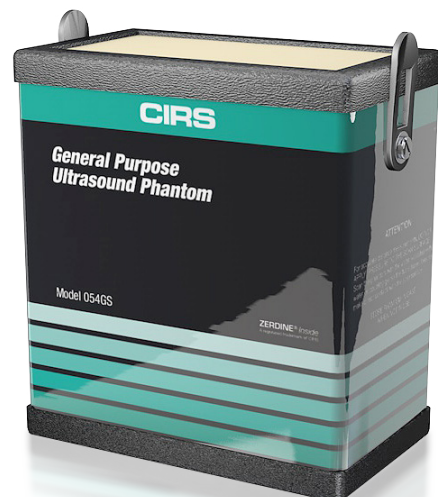
Features:

- Performs nine performance measurements
- Contains dual attenuation for thorough evaluation
- Compatible with all transducer configurations
- Exceeds ACR accreditation requirements
- Made from Zerdine® to simulate acoustic properties of human soft tissue
- Housed in rugged ABS plastic for added durability



Overall Ultrasound image of Model 040GSE

General Purpose Ultrasound Phantom



Model 054GS

Exceed ACR Accreditation Requirements

The CIRS Model 054GS General Purpose Ultrasound Phantom contains gray scale targets and improved sensitivity targets that exceed the phantom requirements outlined in the ACR accreditation program.

The Model 054GS is constructed from a patented solid elastic material, Zerdine® (1). A removable water well and endocavity cover extends the use of the phantom by allowing evaluation of all transducer configurations, including linear, curvilinear and intercavity.

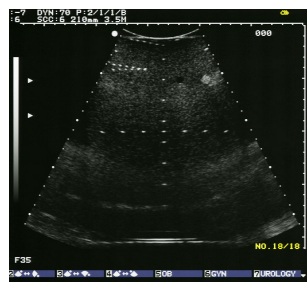
CIRS ultrasound QA phantoms

(1) US Patent # 5196343

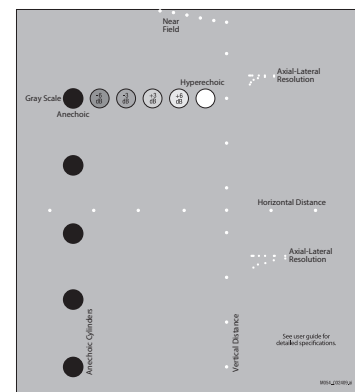
all come standard with a robust housing, foam-lined carry case, 48-month warranty, and user guide.

Performance Measurements:

- Dead Zone
- Horizontal Distance Accuracy
- Vertical Distance Accuracy
- Depth of Penetration
- Image Uniformity
- Axial Resolution
- Lateral Resolution
- Anechoic Mass Resolution
- Gray Scale Contrast Resolution



Ultrasound image of Model 054GS



Ultrasound Phantoms for 2D & 3D Evaluation



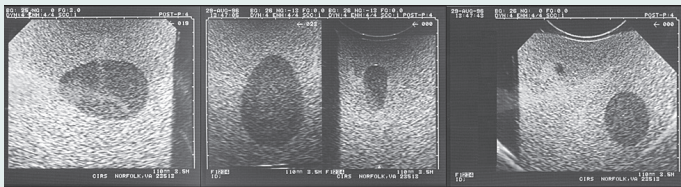
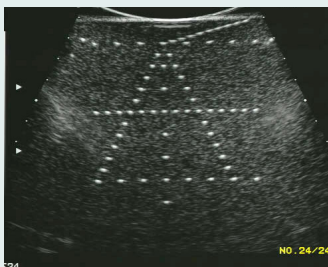
Model 555 SET

Designed for compliance with AIUM standards

The 2D & 3D Evaluation Set evaluates measurements taken on ultrasound systems using newer spatial encoding algorithms. This is especially important for current 3-D and 4-D ultrasound systems.

The set consists of two phantoms, the 3D Ultrasound Calibration Phantom Model 055, and The 3D Wire Test Object Phantom Model 055A. Both phantoms contain Zerdine® and are in ABS containers that minimize desiccation.

The test procedures using both phantoms are described in the



AIUM publication "Standard Methods for Calibration of 2-Dimensional and 3-Dimensional Spatial Measurement Capabilities of Pulse Echo Ultrasound Imaging Systems".

The Model 055 3D Ultrasound Calibration Phantom is a volumetric target phantom and contains a small egg and a large egg. There are two scanning surfaces and the targets are off centered within the background material. Depending on the side scanned, the test objects are located at distances ranging from 2 to 6 cm from the scanning surface.

The Model 055A 3D Wire Test Object is a wire-target phantom used to measure linear and curved dimensions as well as perimeters, volumes and surface areas. It may also be used to determine image uniformity and depth of penetration.

Models 055 and 055A can be purchased separately.

Small Parts Ultrasound Phantom



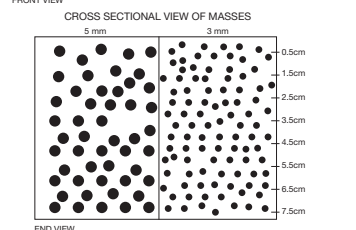
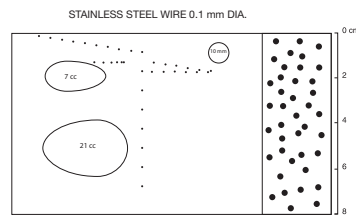
Model 050
QA standard for high frequency probes

The CIRS Small Parts Ultrasound Phantom features a compact design ideal for high-resolution imaging systems with a limited depth of penetration. The phantom allows for repeatable, qualitative assessment of uniformity, dead zone, depth of penetration, beam profile/focal zone/lateral re-sponse width, vertical distance measurement accuracy, axial resolution, lateral resolution, anechoic masses, high contrast masses, volumetric measurement accuracy, and focal lesion detectability.

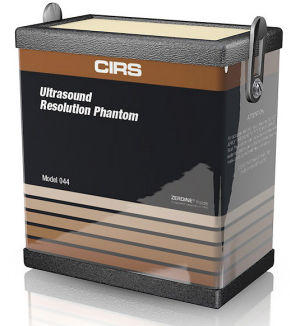
Model 050 is made up of a proprietary tissue-simulating material called Zerdine® (1), which accurately simulates the ultrasound characteristics found in human liver.

A series of wire targets included in the Model 050 will appear as bright dots or lines on the ultrasound image. These targets are made from nylon with a diameter of 0.1 mm.

The phantom also contains two known volumes, a 10 mm combination cyst-like/hyperechoic mass and anechoic focal lesions embedded within the phantom.



Ultrasound Resolution Phantom



Model 044

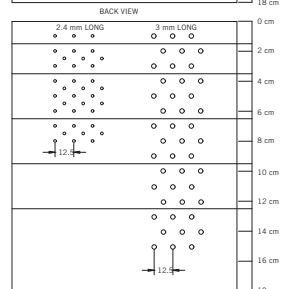
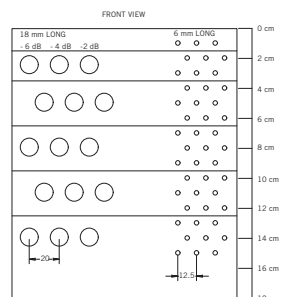
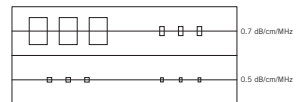
Designed for evaluating system resolution

The Resolution Phantom is ideal for simultaneous assessment of axial, lateral and elevational resolution.

The Model 044 consists of two planes of short cylinders. One plane has an attenuation coefficient of 0.5 dB/cm-MHz while the other is 0.7 dB/cm-MHz. Each plane has two groups of targets.

The 12 mm diameter test objects have three contrasts with respect to the background enabling low contrast resolution assessment at many depths. All other targets have a -15 dB contrast.

To facilitate proper probe alignment, the Model 044 contains a series of nylon targets.



Accreditation Phantom for Uniformity



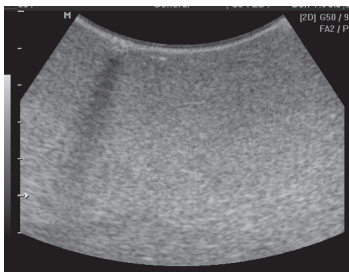
Model 551

Essential component of a routine QC Program

The CIRS Model 551, Accreditation Phantom for Uniformity, aids appropriately trained personnel in identifying the presence of lateral and/or axial streaks, i.e. artifacts, on any ultrasound transducer. Presence of artifacts is an indication of transducer damage and triggers corrective action.

The phantom consists of a uniform block of Z-Skin™ that is elastic enough to conform to any shape transducer. Z-Skin is durable enough to withstand the probe pressure to maintain coupling with all the elements of even the tightest curvilinear arrays. It requires no special handling and includes a 48-month warranty.

The 551 is a compact, cost-effective solution for implementing a continuous QC program that complies with accreditation requirements.



Accreditation Phantom for Uniformity ultrasound image with dead element.

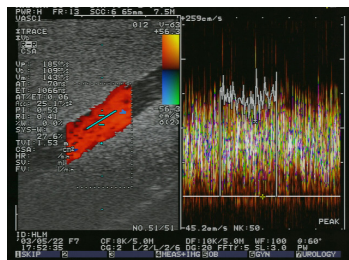
Blood Mimicking Fluid



Model 046

Blood Mimicking Fluid is intended for use in any flow phantom and with any type of pumping mechanism. It was formulated to simulate the acoustic and physical characteristics of blood, thus providing a stable and reliable fluid for Doppler studies and system evaluations.

The fluid is non-hazardous and is formulated to meet the requirements for recommended blood-mimicking fluid as described in the IEC 1685 draft specifications. In addition, the scatters are neutrally buoyant, thus minimizing clumping and settling of the particles. Each batch of fluid is tested for speed of sound, attenuation, density and viscosity traceable to NIST.



Doppler String Phantom



Model 043

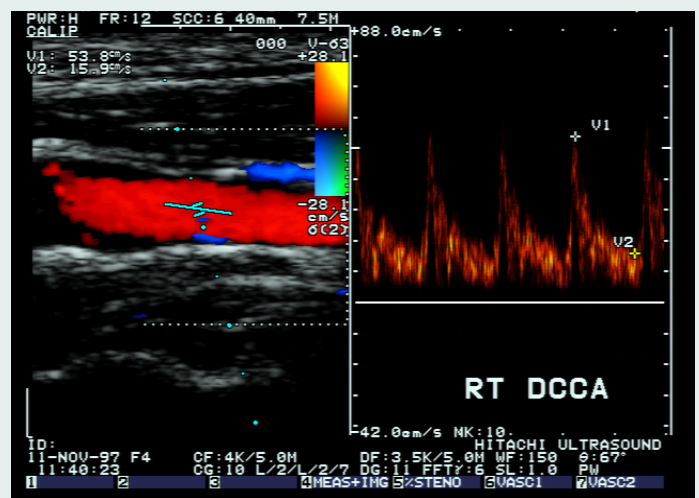
Accurately simulates 16 physiological and test waveforms

The CIRS Model 043 Doppler String Phantom is an essential tool for Doppler Ultrasound users. The crystal controlled motor accurately generates sixteen pre-programmed waveforms using advanced string target technology. The speed is adjusted 1000 times every second for precise and repeatable readings.

The Model 043 can be set for use with water or velocity-corrected fluid. With water, it adjusts the string speed accordingly so the different

speed of sound in water does not affect tests. And unlike fluid-flow phantoms, the target never changes: you know what your test results should be every time.

All CIRS Ultrasound phantoms, including the Model 043, are sold with a user manual and a rugged carry case. Additional options include custom programming of special waveforms.



Gray Scale Ultra- sound Phantom



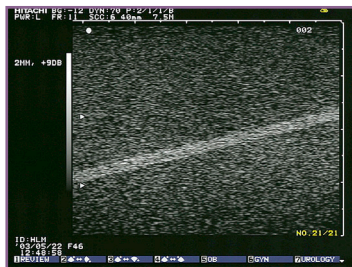
Model 047

Evaluate resolving power as a function of depth, size and contrast.

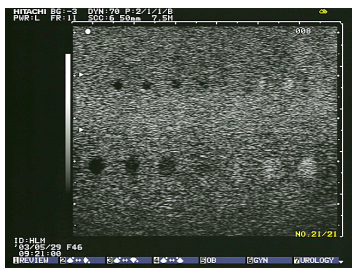
The Gray Scale Ultrasound Phantom is a single simple tool to assess resolution of masses varying in size, depth and contrast. This is a new design using proven, patented materials to permit rapid visualization of gray scale resolution power at continuous depths from 1 to 12 cm.

The Model 047 is usable on all diagnostic ultrasound machines allowing user evaluation of gray scale sensitivity with a wide range of transducer frequencies. This phantom is an ideal training tool for learning optimum system setup and evaluating system performance.

Masses may be viewed with either a circular or elliptical cross-section.

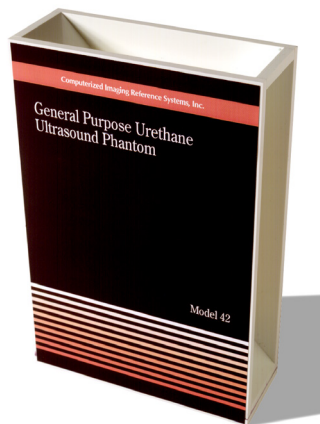


Masses are angled for continuous assessment over a range of depth.



Model 047 Gray Scale image

Urethane Ultra- sound Phantom

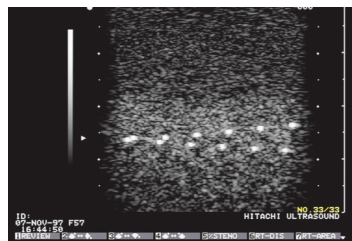


Model 042

Three scan-surfaces

The CIRS series of ultrasound phantoms, unlike human subjects or random scannable materials, offer a reliable medium which contains specific, known test objects. The CIRS line of ultrasound phantoms enables repeatable, qualitative assessment of ultrasound scanner performance over time.

The Model 042 is constructed from a proprietary urethane matrix, housed within a rigid PVC container with three separate scanning windows. It allows for depth of penetration, uniformity, distance calibration, resolution and lesion detectability assessment. The Model 042 is sold with a 48-month warranty, user manual and carry case.



Axial Resolution Target of Model 042

Brachytherapy QA Phantom



Model 045A

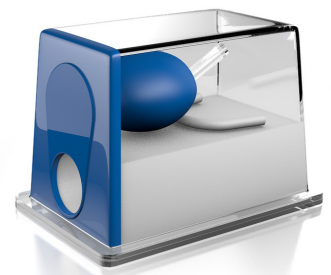
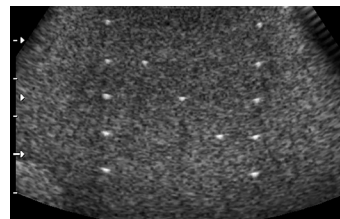
Perform QA on siderefire transrectal probes

A robust quality assurance prostate brachytherapy QA program is essential to ensure accurate image-guidance and dosimetry calculations. The CIRS Model 045A, used in conjunction with the CIRS Model 053 or 070 Ultrasound Prostate Phantom, offers a complete solution for implementing a QA program specific to transrectal ultrasound used for guidance of prostate brachytherapy as recommended by AAPM Task Group 128¹.

The Model 045A enables users to check key imaging parameters such as depth of penetration, axial and lateral resolution, distance measurements, area measurements, volume measurements and geometric consistency with the treatment-planning computer.

When scanning towards the top of the phantom, a partial grid of wires appears. This N-shaped pattern should align with the electronic grid that appears on your screen to ensure correct vertical and horizontal distance measurements. This target group can also be used to assess axial and lateral resolution of the system. Five cross wires are embedded within the phantom to determine if the probe is being retracted by the stepper system by the specified distance.

Turn the probe 60 degrees to the right or left to visualize and measure the volume of three different calibrated objects, one of which is non-spherical.



Complete your QA solution by also purchasing the Model 053 or 070 to verify alignment of the physical needle template with the electronic grid (see page 33).

Elasticity QA Phantom

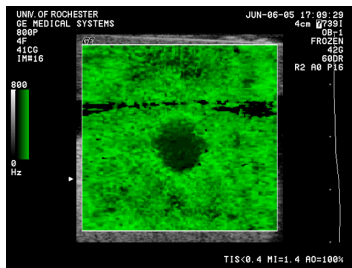


Model 049 & 049A

Developed to provide users with acoustic targets of discrete known stiffness

The Model 049 and 049A Elasticity QA Phantoms are tools developed for sonoelastography systems. These are the only phantoms commercially available for sonoelastography quality assurance. The phantom contains targets of known stiffness relative to the background material and range in stiffness, diameter and depth.

The Elasticity QA Phantoms are suitable for determining the dynamic range of the system, checking system performance over time, demonstrating system features and training personnel and customers on this rapidly growing field. The phantoms can also be used by researchers developing and verifying new techniques.



Breast Elastography Phantom



Model 059

The perfect demonstration tool for sonoelastography

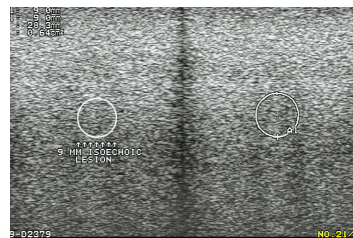
The Model 059 accurately mimics the ultrasonic characteristics of tissues found in an average human breast. The size and shape of the phantom simulates that of an average patient in the supine position.

A special holding tray facilitates proper hand position during the training procedures.

Protected by a membrane, the phantom is made from Zerdine^{®(1)}, which simulates needle resistance.

The phantom contains several solid masses that appear isoechoic to the simulated breast tissue under normal ultrasound, but the lesions are 3 times stiffer than the background so they can be detected on elastograms. Lesions range in size from 2 mm to 10 mm diameter and are randomly positioned throughout the background.

⁽¹⁾ US Patent # 5196343



Normal Ultrasound Image

Shear Wave Liver Fibrosis Phantoms



Model 039

Measure known tissue elasticities with shearwave systems

The Shear Wave Liver Fibrosis Phantoms provide a set of reference standards for performing quantitative measurements of tissue stiffness. Shear wave elasticity imaging is an emerging biomarker with many possible applications, most prominently for determining the stage of liver fibrosis in a patient without the need for invasive biopsies.¹

Model 039 includes four separate phantoms of varying stiffness: 3, 12, 27, and 48 kPa. The elasticity of the phantoms was chosen based on average tissue elasticity at various stages of liver fibrosis. Stiffness of 3 kPa represents elasticity of healthy tissue, while 48 kPa represents elasticity of tissue with

stage-five liver fibrosis. Phantoms can also be manufactured according to user requirements with custom stiffness ranging from 1 to 100 kPa.

Features:

- Young's modulus ranging from 3 to 48 kPa
- Custom stiffness from 1 to 100 kPa available according to user requirements
- Certification of Young's modulus with each phantom
- Tissue-mimicking material with acoustic properties of human liver

1. TJ Hall, et al. "RSNA/QIBA: Shear wave speed as a biomarker for liver fibrosis staging." Poster presentation, 2013 IEEE International Ultrasonics Symposium. July 21-25. Prague, Czech Republic.

Pediatric Anthropomorphic Training Phantoms



Model 715

SPORT™ The world's first pediatric radiography trainer

An ideal addition to any imaging department or Radiologic Technology training program, the CIRS Model 715 Series can assist in the monitoring, training and improvement of parameters and protocols common to most pediatric imaging procedures.

SPoRT™ is designed to aid teaching and improvement of patient positioning, collimation and anatomical comprehension and it's wide range of features facilitate effective instruction of safe, high quality, pediatric imaging.

The phantom represents a typical 5-year old in both size and structure, making it portable and easy to position. The full body with head, arms and legs measures 110 cm (43 in) tall and weighs 20 kg (44 lb). The series consists of six sectional phantoms available separately or as a complete set.

Right appendages are available in extended or flexed configurations. Left arm and leg are available with or without embedded fractures. The fracture versions contain the most common pediatric fracture types, including buckle fracture to tibia and common fracture to fibula; fracture to first metatarsal; radius fracture with open reduction and hardware and a common fracture to second intermediate phalange.

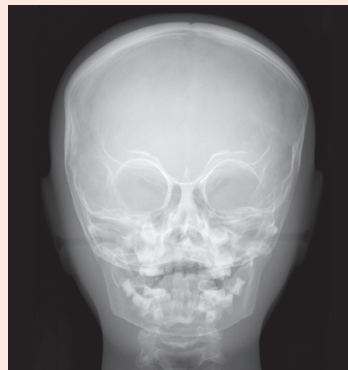
Components are made from proprietary urethane and epoxy materials that mimic X-ray attenuation proper-

ties of human tissues for both diagnostic and therapy energy ranges (50keV-25MeV). The materials are durable, impact resistant and suitable for continuous handling. Transparent soft tissue facilitates visual instruction of anatomical landmarks.

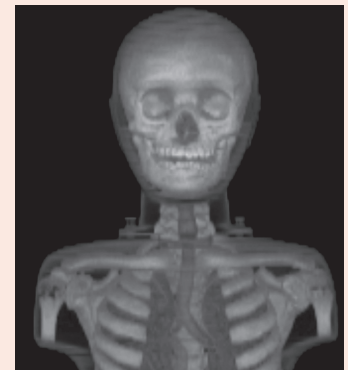
SPoRT™ can be used in film radiography, CR, DR and Computed Tomography.

Features:

- Deciduous and descending teeth with distinct dentine and enamel
- Fully open sinus cavities
- Anthropomorphic lung structure and vasculature
- Bones contain cortical/trabecular distinction, growth plates and ossifications typical to a 5-year old
- Certain bones of the spine and pelvis are atypical to a healthy 5-year old.
- Translucent soft tissue to enable visualization of bony anatomy
- Five most common fractures present in left extremities
- Additional fractures or pathologies can be custom manufactured upon request
- Optional large positioning stand and carry case available



AP Skull



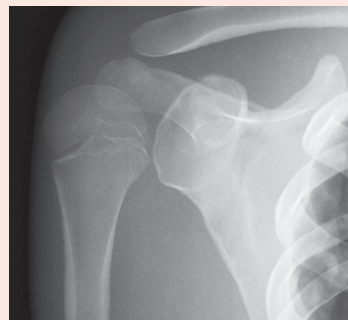
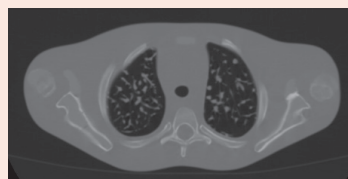
3D Reconstruction



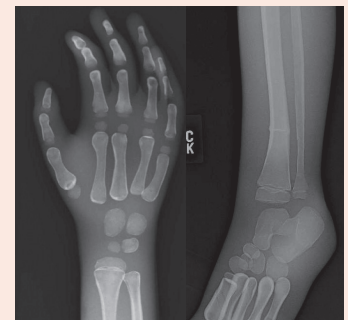
Lateral Skull



Lateral Lumbar Spine



AP Shoulder



Right Oblique Hand & Oblique Ankle



AP Chest



AP Pelvis

Fetal Ultrasound Training Phantom



Model 065-20 & 065-36

Demonstrate 2D and 3D ultrasound

CIRS fetal phantoms can be used for ultrasound scanning demonstrations, 3D reconstructions, surface rendering and a variety of other applications. Materials are tissue equivalent, and the phantom is available in 20 weeks or 36 weeks gestational age.



3D Image from 36 week model



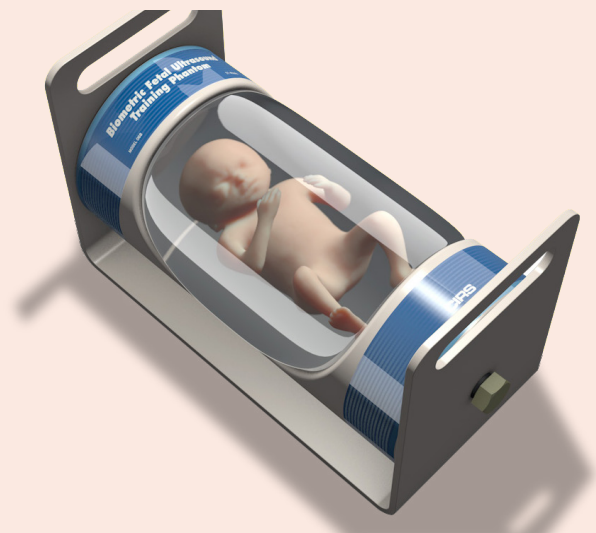
3D image from 20-week model



2D Facial Profile of Model 065-36



Fetal Ultrasound Biometrics Phantom



Model 068

Instruct and develop ultrasound examination techniques

The CIRS Model 068 Fetal Ultrasound Biometrics Phantom facilitates teaching and demonstration of fetal ultrasound examination techniques in a non-stressful situation. A tissue-equivalent, full fetal model is suspended in a non-echoic, amniotic fluid like environment.

Model 068 Includes:

- Complete external fetal anatomy and surrounding non-echoic medium
- Asymmetric head with upper portion of the skull
- Right and left brain lobes
- Lateral and third ventricles
- Right and left femoral shafts with distal epiphysis

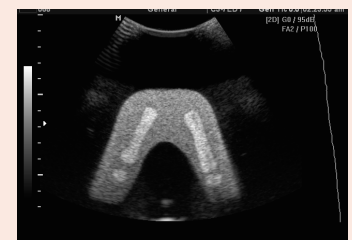
Transabdominal measurements of biparietal diameter (BPD), anterior/posterior diameter (APD), femur length, abdominal circumference and crown to rump length can be taken. Because the phantom is housed in a rotatable cylinder, a variety of fetal and transducer orientations can be achieved for more challenging examinations. All anatomies are based on published biometric data at normal fetal growth rates for a gestational age of 21 weeks. This enables assessment of composite measurement techniques and biometric analysis programs common to most ultrasound scanners. The phantom can also be used for 3D reconstructions, surface rendering and a variety of other applications.



Axial Brain & BPD Measurement



Sagittal Brain



Longitudinal measurements of femur length



3D Reconstruction

Needle Breast Biopsy Phantom



Model 052A

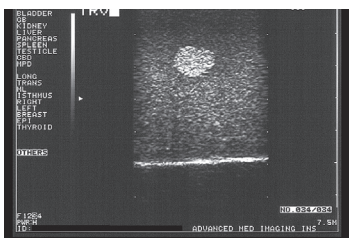
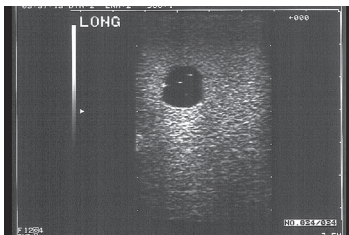
A training device for ultrasound guided needle biopsy procedures

The Model 052A accurately mimics the ultrasonic characteristics of tissues found in an average human breast. The size and shape of the phantom simulates that of an average patient in the supine position.

A special holding tray facilitates proper hand position during the training procedures.

Protected by a membrane, the phantoms flesh-like consistency, simulates needle resistance. Each cystic mass may be aspirated once while each solid mass may be biopsied multiple times. Cyst material is stained green and solid masses are black for easy identification.

The Model 052A Ultrasound Needle Biopsy Phantom was developed by those skilled in the art of ultrasound-guided needle biopsy procedures and is the ideal training device.



3D Image from 20 week model

Vascular Access Training Phantom



Model 072

Develop skills for ultrasound guided injection and venipuncture techniques in a non-stressful environment

The Model 072 Vascular Access Training Phantom Kit is designed to provide realistic training medium for needle insertion. The phantom is made from Z-Skin™, which mimics the tactile feel and puncture resistance of soft tissue. This material has realistic acoustic properties allowing imaging of the simulated vessels under ultrasound. The phantom includes one bifurcated vessel and 2 straight vessels at a variety of depths and diameters to simulate a range of challenges often encountered in the clinical environment.

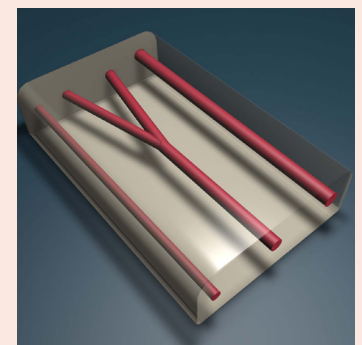
The phantom can be easily replenished using a syringe and will not dry out. The phantom is supplied with a start up accessory kit.

Features:

- Teach vein recognition through palpation
- Teach ultrasound scan techniques
- Develop hand-eye coordination in non-stressful environment
- Demonstrate and practice various insertion techniques
- Experiment with new procedures and evaluate new devices



Cross-section of vessels - Phantom



Internal Layout

Triple Modality 3D Abdominal Phantom



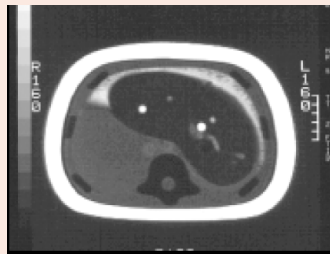
Model 057A

Image Fusion/Registration • Scanning Techniques • Biopsy

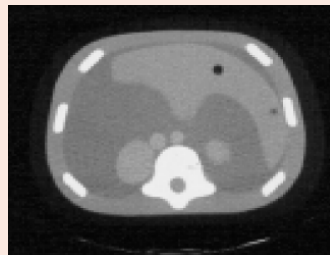
The CIRS Triple Modality 3D Abdominal Phantom is constructed of a self-healing formulation of Zerdine® that allows multiple biopsy insertions with minimal needle tracking, and is ideal for demonstrating image-guided navigation technologies. The phantom is representative of a small adult abdomen and can be imaged under CT, MR and ultrasound. This feature makes the phantom a useful tool for applications such as image fusion studies; imaging protocol developments; scan technique training; and system testing, validation and demonstration.

The Model 057A simulates the abdomen from approximately the thorax vertebrae (T9/T10) to the lumbar vertebrae (L2/L3) using simplified anthropomorphic

geometry. The materials provide contrast between the structures under CT, MR and ultrasound. Internal structures include the liver, the portal vein, two partial kidneys, a partial lung, the abdominal aorta, the vena cava, a simulated spine and six ribs.



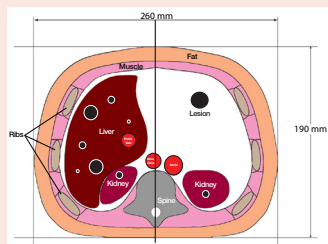
MRI



CT



Ultrasound



Features:

- Demonstrate CT, ultrasound and MRI scan techniques
- Assess image-fusion algorithms
- Test new equipment
- Optimize imaging protocols
- Improve performance of free-hand abdominal biopsies

Image-Guided Abdominal Biopsy Phantom



Model 071A

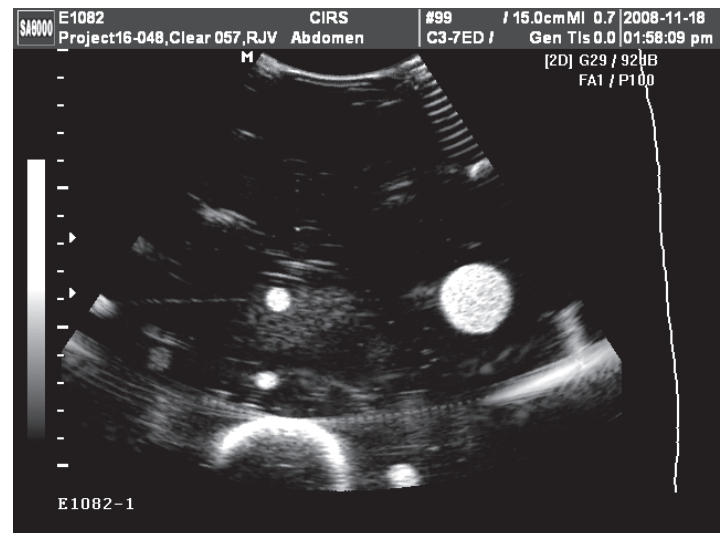
Transparent for demonstrations and for visual identification of needle placement

The Model 071A Image-Guided Abdominal Biopsy Phantom is a simplified abdominal phantom suitable for training and demonstrating image-guided needle biopsy navigation tools or procedures that require a constant visual reference for needle placement. Because it is constructed of a self-healing formulation of Zerdine®, the phantom will allow multiple biopsy insertions with minimal needle tracking.

The phantom contains 11 randomly positioned lesions, with sizes ranging from 8 to 12 mm. It also includes simulated spine, ribs, and a 25 mm lesion near the vertebrae.

The lesions and spine are visible under ultrasound and CT. The solid polymer gel background is anechoic and will not leak when punctured.*

US Patent #5196343



Ultrasound

* Some permanent tracking may be evident if debris and air bubbles are entrained in the gel during the biopsy procedure. To extend the lifetime of the phantom, the use of higher gauge needles that have been wetted and de-aired prior to insertion is recommended

Lumbar Training Phantom



Model 034

Practice interventional pain management procedures

The CIRS Model 034 Lumbar Training Phantom provides a realistic puncture practice phantom for use with fluoroscopic image guidance.

Phantom contains realistic anatomy to facilitate eye/hand coordination in a training environment.

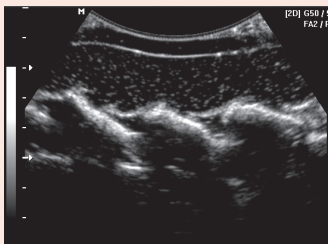
Phantom can also be imaged under CT, MR, and ultrasound.

Features:

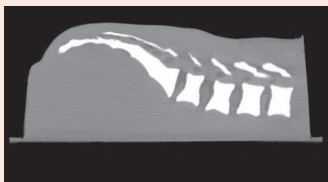
- Anthropomorphic L-spine anatomy
- Self-Healing puncture membrane
- Ligaments, spinal cord, discs, skin, and soft tissue have differing softness to permit trainee to "feel" the way to the injection site.

Practice:

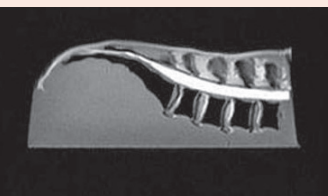
- Lumbar epidural
- Caudal epidural
- Facet and nerve blocks
- Sacroiliac joint injection
- Lumbar diskography



Ultrasound



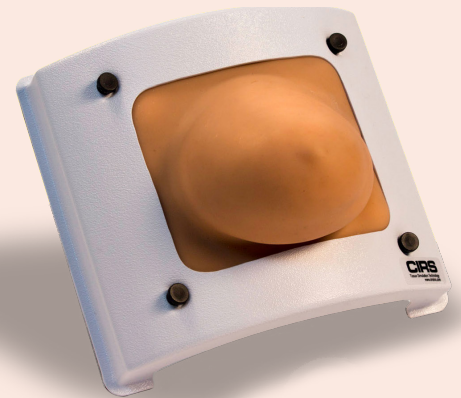
CT



MRI



Multi-Modality Breast Biopsy and Sonographic Trainer



Model 073

Durable Training Phantom for Ultrasound, Mammography, X-Ray and MRI

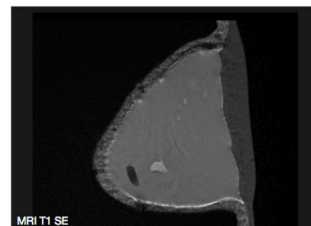
The Multi-Modality Breast Biopsy and Sonographic Trainer Phantom accurately mimics the heterogeneous appearance of breast tissue under ultrasound, mammography and MRI, and has cystic and dense lesions embedded within the breast background. Half of the dense lesions are spherical and have a 100-300 micron microcalcification embedded within it, while the other half have a spiculated shape. In addition to helping users identify different types of masses in the complex structure of the breast, the calcifications are useful markers for image registration between modalities.

The phantom includes a flexible Z-Skin™ membrane that simulates the look and feel of skin during scanning and biopsy. The skin material closes up on itself after puncture with a needle, providing good protection from dessication.

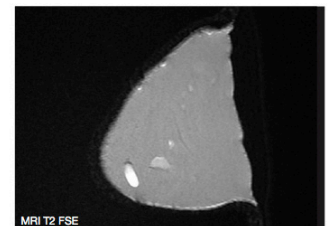
The material inside the phantom is formulated to minimize the effect of needle tracks while practicing biopsy techniques on the embedded masses. This material also has remarkable self-healing properties. Each cystic mass may be aspirated once and each dense mass may be biopsied multiple times.

Features:

- Compatible with X-ray, Ultrasound, and MRI
- Heterogeneous tissue to simulate imaging of human breast
- Encased in flexible membrane for increased durability
- Self-healing material for extended phantom use
- Cystic, dense, high stiffness and attenuative masses for biopsy training



MRI T1 SE



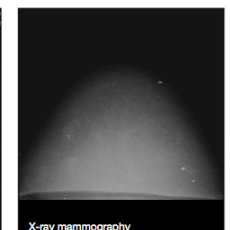
MRI T2 FSE



Ultrasound

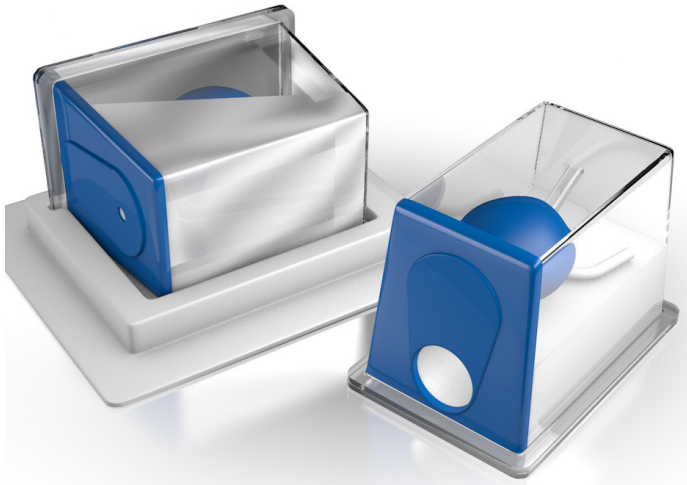


Ultrasound



X-ray mammography

Tissue Equivalent Ultrasound Prostate Phantom



Model 053S & 053L

Tissue Equivalent Ultrasound Prostate Phantom

The CIRS Ultrasound Prostate Training Phantom is a multi-modality disposable phantom developed for practicing procedures which involve scanning the prostate with a rectal probe.

Gel formulations within the Model 053S, 053L and 053L-EF are designed to minimize needle tracking and to provide imaging contrast under CT, MRI, ultrasound and Elastography.

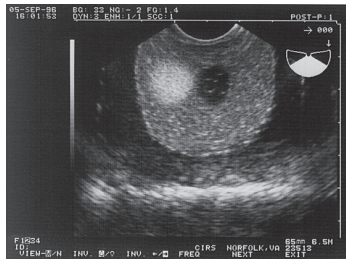
The prostate along with structures simulating the rectal wall, seminal vesicles and urethra is contained within an 11.5 x 7.0 x 9.5 cm clear acrylic container. A 3 mm simulated perineal membrane enables various probes and surgical tools to be inserted into the prostate.

This phantom is an ideal training device for ultrasound guided cryosurgery, radioactive seed implantation, and needle biopsy.

The phantom is available with lesions (053L) and without lesions (053S) and can be ordered in either the standard side-fire configuration or an alternate geometry optimized for end-fire probes (053L-EF).

Model 053S/053L Includes:

- Includes rectal wall, seminal vesicles, perineal membrane and urethra
- Train for ultrasound-guided cryosurgery, seed implantation and needle biopsy with one phantom
- Compatible with various probes and surgical tools
- Structures visible under CT, MRI, ultrasound and Elastography
- Gel designed to minimize needle tracking



Prostate Training Phantom



Model 070S & 070L

The Ideal Training Device For Image-Guided Procedures

The Model 070S and 070L is a realistic and durable prostate training phantom for both diagnostic and interventional procedures.

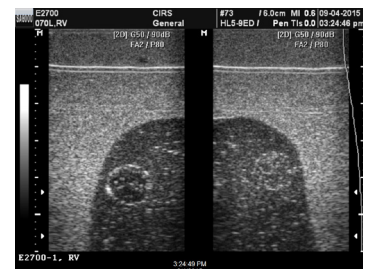
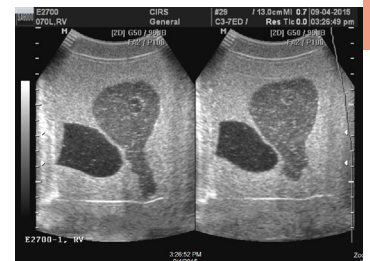
Enhanced realism has been achieved with a Zerdine® gel formulation that better simulates the ultrasound contrast between the prostate and background tissue. The gel formulations provide CT, MR and Elastography contrast for multi-modality imaging. CIRS' proprietary Z-Skin™ formulation more accurately simulates the rectal wall, providing a more realistic scanning environment.

Z-Skin™ provides perineal access for interventional procedures, and closes up on itself after it is punctured so that the Zerdine® gel inside the phantom is not exposed to air during scanning. Minimal air exposure better protects the gel from drying out, thus increasing the phantom's useful life. In addition, Z-Skin is extremely stretchable and will protect the gel inside the phantom from tearing when the rectal probe is manipulated at severe angles. The phantom accommodates both end-fire and side-fire ultrasound transducers. Zerdine® is specially formulated to minimize tearing when punctured, providing a self-healing capability that dramatically extends the life of the phantom during interventional procedures.

The phantom is available in two configurations: one with embedded lesions (Model 070L), and one without embedded lesions (Model 070S).

Model 070S/070L Includes:

- Includes rectal wall, seminal vesicles, perineal membrane and urethra
- Enhanced realism available with the inclusion of a bladder, plus digitally modeled prostate gland and seminal vesicles.
- Phantom available with and without lesions
- Train for ultrasound-guided seed implantation, cryosurgery and needle biopsy in one phantom
- Compatible with various probes and surgical tools



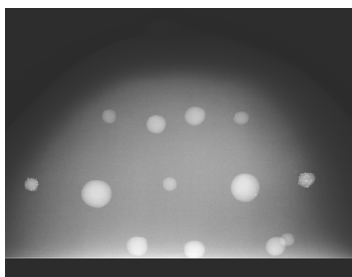
Stereotactic Needle Biopsy Training Phantom



Model 013

A tissue equivalent, compressible biopsy training phantom, that won't leak!

The CIRS Stereotactic Needle Biopsy Training Phantom is a disposable training tool and practice medium for mammographic needle biopsy procedures. The phantom also serves as an excellent quality assurance device for stereotactic systems and should be used whenever a new system is installed or repaired to insure accurate needle placement. The phantom can be used to perform the localization accuracy test in the American College of Radiology's stereotactic breast biopsy accreditation program. The stereotactic training phantom offers an easy, low cost option to create a relaxed learning environment. The phantom can be reused multiple times with no special storage requirements.



Mammography image of Model 013

Scrotal Ultrasound Training Phantom



Model 504A

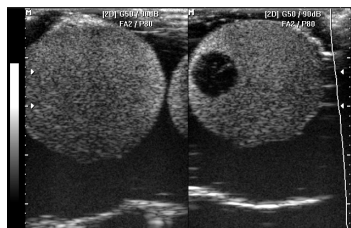
Testicular ultrasound is the primary imaging method for evaluating disorders of the testicles caused by cystic and solid masses, trauma, inflammation and torsion. Testicular ultrasound is also used to evaluate causes of infertility and locate undescended testis.

The CIRS Model 504A Scrotal Ultrasound Training phantom provides an anatomically accurate phantom for hands-on training on testicular ultrasound exams without the need for live volunteers. The phantom allows students to gain valuable practice time in a non-stressful setting.

Using the Scrotal Ultrasound Training phantom, the testicles and epididymis can be examined by moving the ultrasound transducer over the scrotum. The phantom also includes a 10 mm intratesticular mass to provide trainees with experience in identifying masses.

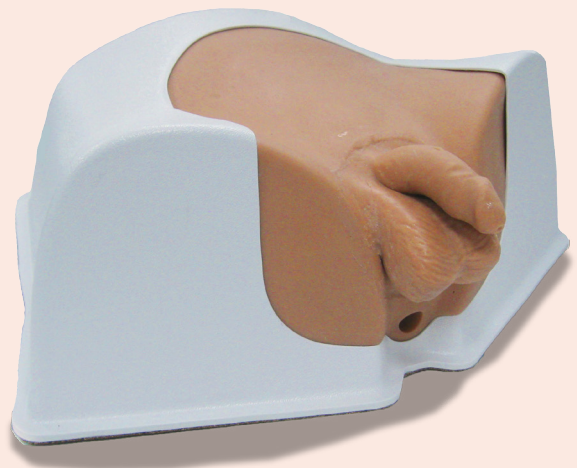
Features:

- Teaching tool for diagnostic scanning of the testicles
- Anatomically accurate model of penis, scrotum, testicles and epididymis
- Intratesticular mass
- Internal and external anatomical landmarks



Testicle with intratesticular mass

Multi-Modality Pelvic Phantom



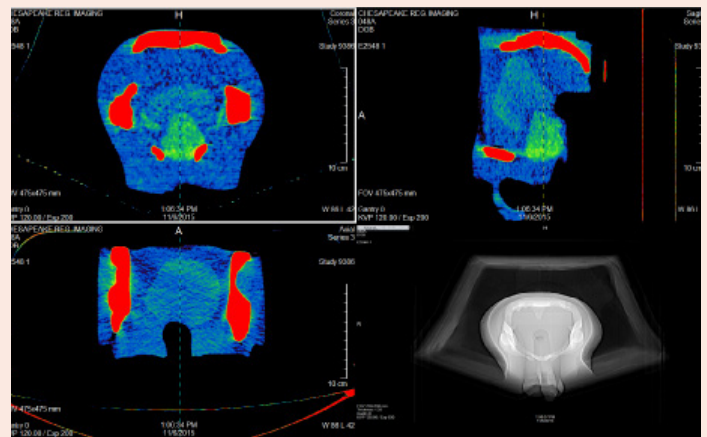
Model 048A

Realistic Abdominal Imaging of the Male Bladder and Prostate

The Multi-Modality Male Pelvic Phantom was designed for realistic abdominal and transrectal ultrasound scanning of the bladder and prostate. The phantom includes pelvic bones, anechoic bladder, prostate, urethra, seminal vesicles and rectum enclosed in a pelvic-shaped plastic housing with a Z-Skin™ membrane. The self-healing qualities of Z-Skin make this design ideal for the demonstration of biopsies and other image-guided procedures.

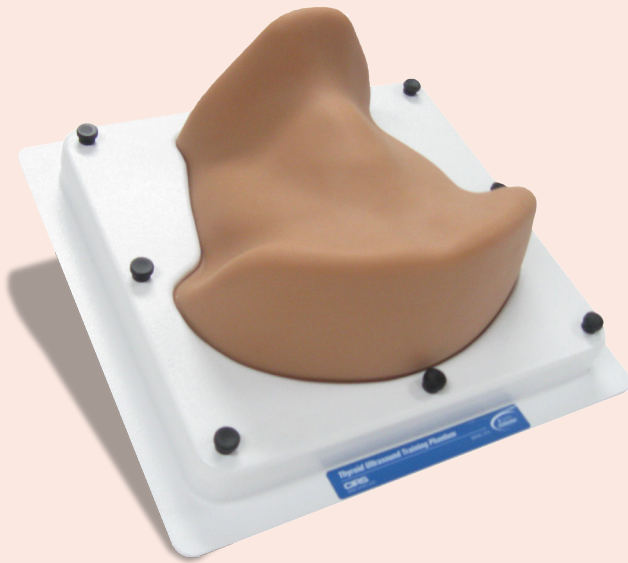
The phantom is made from materials that can be imaged under ultrasound, MRI and CT making the phantom useful for applications that require multiple modalities such as radiation treatment planning. The phantom is provided with certified prostate and bladder volumes to enable assessment of volumetric measurement accuracy. Modifications are available such as permanently embedded brachytherapy "dummy" seeds or gold fiducial markers for demonstration of target visualization.

Each phantom is sold with a certificate of compliance. To accommodate image fusion techniques, CIRS can offer value added services such as phantom specific CMM, reference CT or MRI data sets, attachment of customer specific registration devices and inclusion of special point markers.



Sample CT and SCOUT image

Thyroid Ultrasound Training Phantom



Model 074

Teach • Train • Practice

Thyroid nodules occur in 50% of the world's population with incidence increasing with age. Ultrasound guided biopsies of the thyroid yield more accurate results than free-hand techniques.

The CIRS Thyroid Training Phantom is a disposable training tool and practice medium for ultrasound guided thyroid biopsy procedures. The phantom also serves as an excellent teaching tool for identification of various types of thyroid nodules and training on proper thyroid scanning techniques.

The phantom can be punctured numerous times, will not leak and requires no special storage.

The Thyroid Training Phantom creates a relaxed learning environment in which to develop skills.

Features:

- Train how to perform thyroid ultrasound examination
- Practice ultrasound guided biopsy procedures
- Internal and external anatomical landmarks
- Ultrasonically realistic materials

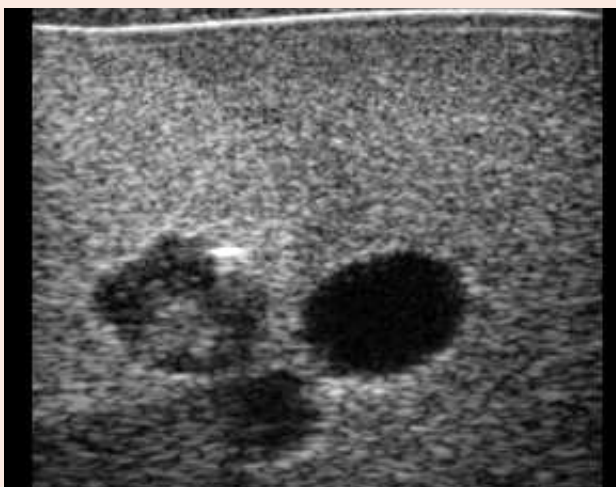


Image of thyroid containing complex nodule with calcifications

Female Ultrasound Training Pelvis



Model 404A

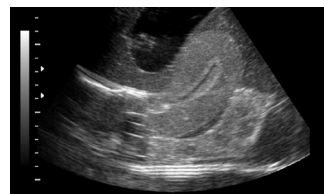
The gynecological ultrasound exam is an important diagnostic tool. Students gain competency with hands-on practice. Unfortunately, access to patients can be limited. The Model 404A Female Ultrasound Training Pelvis facilitates teaching and demonstration of gynecological ultrasound techniques in a non-stressful situation.

The Model 404A consists of an external female pelvic model containing a uterus, fallopian tubes, ovaries, bladder and rectal landmarks useful for scanning. The phantom has both abdominal and vaginal scanning access allowing a variety of transducer orientations.

The Female Ultrasound Training Pelvis creates a relaxed learning environment for teaching and developing ultrasound examination skills and techniques as well as demonstrating 3D ultrasound capabilities.

Features:

- External anatomy
- Abdominal and vaginal scanning access
- Uterus with endometrium and myometrium
- Ovaries with follicles
- Full bladder
- Rectal landmarks
- Realistic Scanning



Trans-vaginal of uterus, bladder and rectum



CIRS developed a skin and tissue-mimicking combination, which simulates the tactile feel of human tissue for ultrasound and image-guided interventional procedures.

CIRS ultrasound phantoms are made from Zerdine®, a patented tissue-equivalent polymer. Zerdine produces an ultra-fine speckle pattern with minimal backscatter and its elastic properties allows pressure to be applied to scanning surfaces without damage to the phantom. The newest self-healing formulation of Zerdine was developed for interventional procedures, minimizing needle tracks immediately after puncture and becoming increasingly less visible over time.

Training phantoms are encased in CIRS' proprietary Z-Skin™ material to protect the phantom from desiccation and provide the look, feel and puncture resistance practitioners expect.

TE Phantom for Mammography



Model 010 and 011A

A Refined Quality Assurance Tool for Advanced Imaging Systems

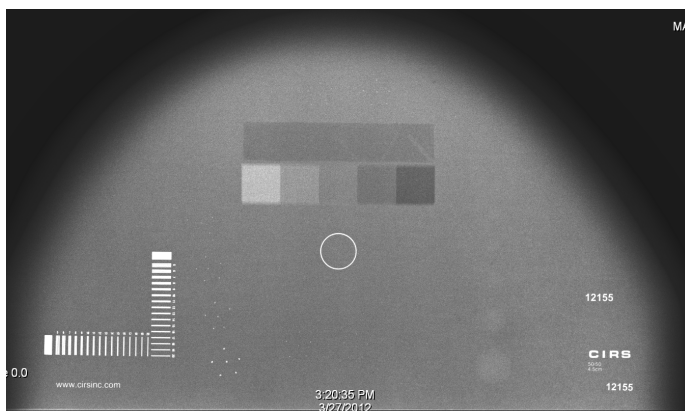
The Tissue Equivalent Phantom for Mammography tests performance of screen film and full field digital mammographic systems. Objects within the phantom simulate calcifications, fibrous calcifications in ducts and tumor masses. Test objects within the phantom range in size from those that should be visible on any system to objects that will be difficult to resolve on the best mammographic systems.

CIRS resin material mimics the photon attenuation coefficients of a range of breast tissues. Average elemental composition of the human breast being mimicked is based on the individual elemental composition of adipose and glandular tissue reported by Hammerstein.

The Model 011A Breast Phantom contains targets that are engineered to test the threshold of the new generation of mammography machines. The Model 011A is 4.5 cm thick and simulates an average glandular tissue composition.

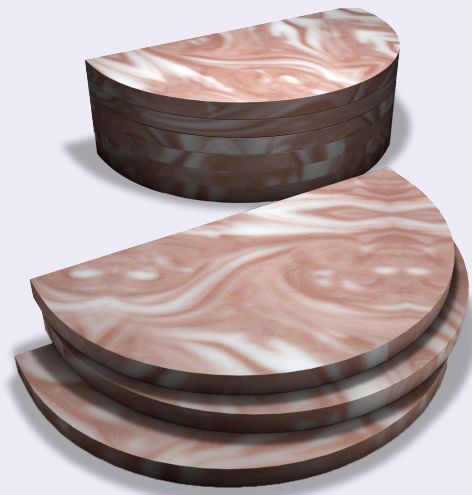
The Model 010 phantoms contain the same detail plates as the 011A but are manufactured in 4 cm, 5 cm and 6 cm thicknesses with various glandular equivalencies.

The methodology and design of these phantoms was developed by Dr. Panos Fatouros and his associates at the Medical College of Virginia to satisfy requirements of NCRP Report No. 95



Mammography Image

BR3D Breast Imaging Phantom



Model 020

Tomosynthesis and Breast CT

The CIRS Model 020 BR3D Breast Imaging Phantom is designed to assess detectability of various size lesions within a tissue equivalent, complex, heterogeneous background. This phantom provides more realistic challenges for standard screen and FFDM mammography systems as well as tomosynthesis and breast computed tomography.

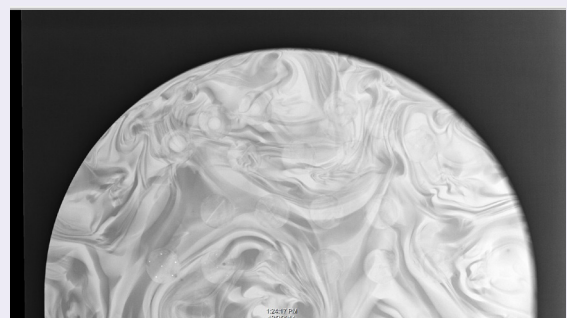
The phantom consists of a set of 6 slabs made of heterogeneous breast equivalent material that exhibits characteristics of real breast tissue and demonstrates how underlying targets can be obscured by varying glandularity. Each slab contains two tissue equivalent materials mimicking 100% adipose and 100% gland tissues "swirled" together in an approximate 50/50 ratio by weight. One of the slabs

contains an assortment of microcalcifications, fibrils and masses.

Each semicircular shaped slab measures 100 x 180 x 10 mm. Each slab, with its unique swirl pattern, provides varying backgrounds when arranged in multiple combinations and thicknesses.

Benefits:

- Tests Tomosynthesis and Breast Computed Tomography
- More representative than standard homogenous phantoms
- Complex background provides greater challenge for target detection
- Slab configurations provides range of thicknesses with or without targets



Screen film mammography image of the target slab.

Contact the engineering department for different gland/adipose swirl ratio such as 80/20, 70/30, 30/70, 20/80 and others. Different iodine concentration targets for subtraction angiography are available on a custom order basis.

Mammography Research Set



Model 012A

Encompasses the full range of size, glandularity and thickness in clinical mammography

The CIRS mammography research set includes tissue equivalent phantoms 4, 5 and 6 cm thick. Each phantom contains identical embedded details (see map 011A). The glandular content of each phantom is 50%, 30% and 20% respectively. Also included are phototimer compensation plates enabling a range of thickness from 0.5 cm to 7 cm with a glandular content of 30%, 50% and 70%.

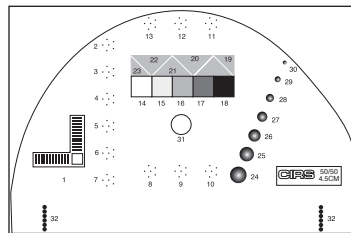
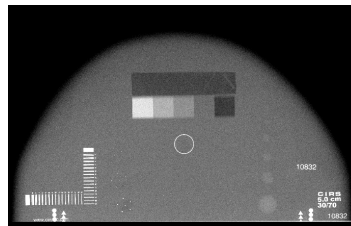
One compensation plate contains embedded details for evaluation of image quality. A hand held microscope and heavy duty foam lined carry case are included.

CIRS resin material mimics the photon attenuation coefficients of a range of breast tissues. Average elemental composition of the human breast being mimicked is based in the individual elemental composition of adipose and glandular tissue reported by Hammerstein.

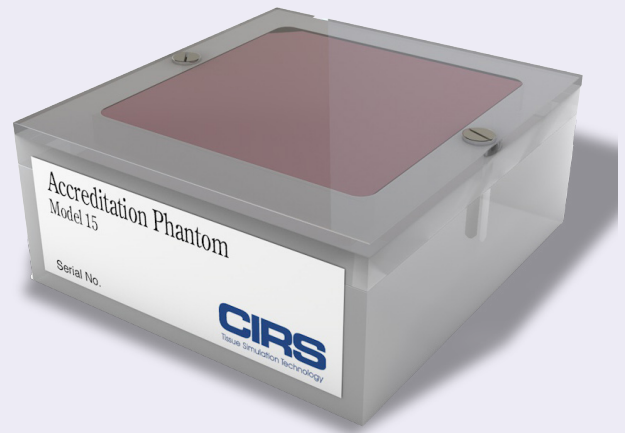
Attenuation coefficients are calculated by using the "mixture rule" and the Photon Mass Attenuation and Energy Absorption Coefficient Table of J.H. Hubbell.

Features:

- Enable evaluation of image quality under varying degrees of thickness and glandularity
- Provides accurate reliable test for radiation dose
- Ensures consistent production of diagnostically useful images



Mammographic Accreditation Phantom



Model 015

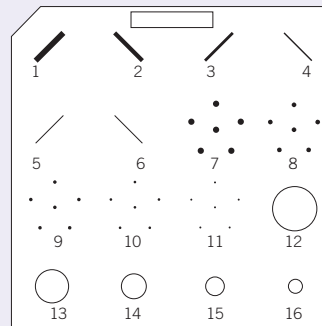
Required for MQSA program

The Mammographic Accreditation Phantom tests the performance of a mammographic system by a quantitative evaluation of the system's ability to image small structures similar to those found clinically. Objects within the phantom simulate calcifications, fibrous calcifications in ducts, and tumor masses. The Phantom determines if mammographic systems can detect small structures that are important in the early detection of breast cancer.

The 4.4 cm thick phantom is made of a 7 mm wax block insert containing 16 sets of test objects, a

3.4 cm (approx. 1-3/8") thick acrylic base, and a 3 mm (1/8") thick cover. All of this together approximates a 4.2 cm compressed breast of average glandular /adipose composition. Included in the wax insert are aluminum oxide (Al₂O₃) specks to simulate micro-calcifications. Six different size nylon fibers simulate fibrous structures and five different size lens shaped masses simulate tumors.

Phantom includes a 4 mm acrylic step wedge, operating instructions, faxitron X-ray image and magnifying lens.



Target Map



Mammography Image

Mammography Artifact Evaluation Phantom



Models 014C & 014E

Quickly detect artifacts

The American College of Radiology and MQSA recommend a uniform 4 cm thick "high grade" cassette sized phantom for evaluation of mammography artifacts as it is often difficult to identify artifacts based on clinical or standard phantom images.

CIRS has designed two phantom sets to meet these recommendations.

Each set contains 2 slabs. The Model 014C slabs each measures 18 X 24 X 2 cm thick. The Model 014E slabs each measures 24 X 30 X 2 cm thick.

Mammography Phototimer Consistency Testing Slabs



Models 014A, 014AD, 014B & 014F

Better than PMMA for AEC calibration

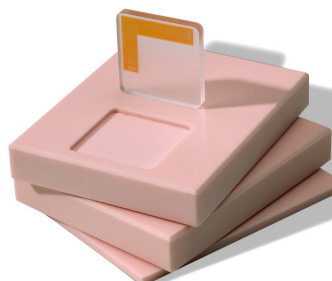
CIRS Phototimer Consistency Testing Slabs are designed for precise assessment of AEC system performance in accordance with American College of Radiology and MQSA recommendations. BR-12 (47% water/ 53% adipose) is most commonly used but other glandular equivalencies are available. Unlike acrylic, these testing slabs are manufactured with very tight thickness tolerances and more accurately simulate real breast tissue over the range of energies used in mammography.

The Model 014A consists of a set of: (6) 10 cm X 12.5 cm slabs: (3) 2 cm thick, (2) 1 cm thick and (1) 0.5 cm thick. Other sets are available with different granularities and total thickness. Some sets include a slab with an embedded detail plate.

Available Configurations:

Model	Description
014A	BR12 Slabs - Set of (6) 10 cm X 12.5 cm slabs: (3) 2 cm thick, (2) 1 cm thick, (1) 0.5 cm thick
014AD	BR50/50 Slabs - Set of (6) 10 cm X 12.5 cm slabs: (1) 2 cm thick with embedded detail plate, (2) 2 cm thick, (2) 1 cm thick, (1) 0.5 cm thick
014B	BR12 Slabs Set of (4) 10 cm X 12.5 cm slabs: (4) 2 cm thick
014F	BR50/50 Slab Set of (1) 10 cm X 12.4 cm X 2 cm thick with embedded detail plate

Single Exposure High Contrast Resolution Phantom



Model 016A

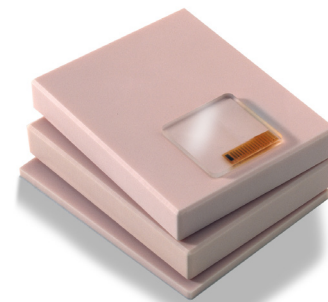
Perform QC inspections of Mammography system resolution with just one exposure!

The CIRS Model 016A incorporates two 17.5 micron thick gold-nickel alloy bar patterns. These bar patterns are positioned at 90 degrees to allow assessment of resolution perpendicular and parallel to anode-cathode axis in just one exposure! The targets have 17 segments from 5 lp/mm to 20 lp/mm and are equivalent to 25 microns of lead or 2.6 mm of aluminum at 20 keV.

The patterns are permanently embedded in a thin acrylic wafer to protect them from wear or damage.

The phantom body is available in BR12 or BR50/50. It enables consistent, reproducible positioning at 4.5 cm above the breast support plate and 1 cm from the chest wall, centered laterally (as recommended by the American College of Radiology).

Ultra High Contrast Resolution Phantom



Model 016B

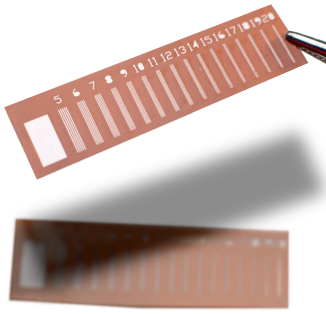
Up to 28 line pair/mm

The CIRS Model 016B incorporates a 17.5 micron thick gold-nickel alloy bar pattern. Each bar pattern is positioned at 90 degrees to allow assessment of resolution perpendicular and parallel to anode-cathode axis in just one exposure. The 016B high resolution target has 18 segments from 5 lp/mm to 28 lp/mm. The target is equivalent to 25 microns of lead or 2.6 mm of aluminum at 20 keV.

The bar pattern is permanently embedded in a thin acrylic wafer to protect it from wear or damage.

The phantom body is available in BR12 or BR50/50. It enables consistent, reproducible positioning of the bar pattern at 4.5 cm above the breast support plate and 1 cm from the chest wall, centered laterally (as recommended by the American College of Radiology).

Test Targets



Models 019-500, 019-501,
019-400 & 019-523

The 019-400 is a 17.5 micron thick gold-nickel alloy bar pattern with 18 segments from 5 lp/mm to 20 lp/mm. The target is equivalent to 25 microns of lead or 2.6 mm of aluminum at 20 keV. This target is used in the CIRS Model 016B.

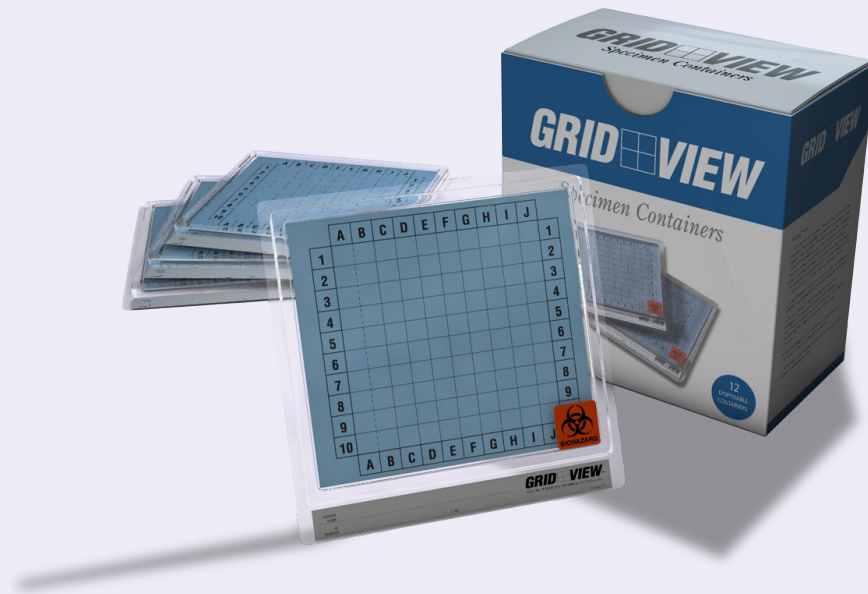
The 019-500 is a 17.5 micron thick gold-nickel alloy bar pattern with 17 segments from 5 lp/mm to 20 lp/mm. The target is equivalent to 25 microns of lead or 2.6 mm of aluminum at 20 keV. This target is used in the CIRS Model 016A.

The 019-501 is a 0.1 mm thick lead bar pattern with 16 segments from 1.0 lp/mm to 4.8 lp/mm.

The 019-523 is a 0.1 mm thick lead bar pattern with 1 target group from 0.5 lp/mm to 5.0 lp/mm.

Models 019-501 & 019-523 are suitable for general x-ray only.

Specimen Imaging and Transport Container

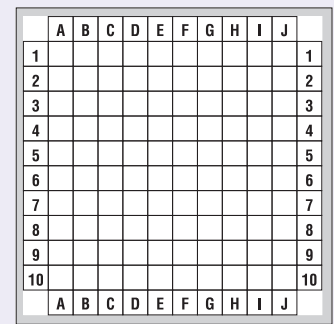
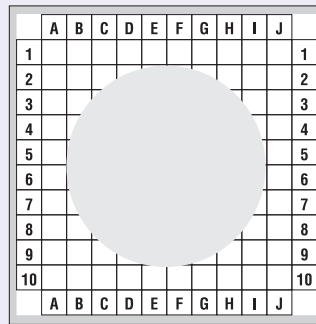
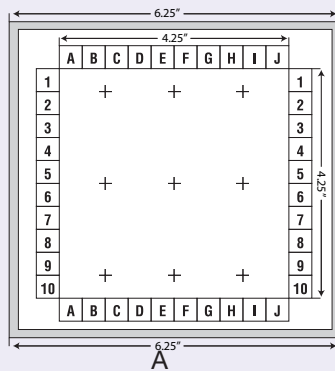


Model 240

An efficient system for imaging, transporting and identifying breast biopsies and multiple core specimens

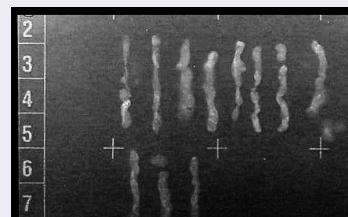
GRID-VIEW® address inadequacies which exist in post operative handling of surgical breast biopsy specimens and multiple core biopsy specimens. The clamshell design and radio-opaque grid provide an efficient system for imaging, transporting and identifying breast biopsies. Disposable GRID-VIEW containers accommodate the largest surgical specimens without compromising performance or convenience. A variety of grid patterns are available.

Grid-View can now be purchased in cartons of 12 units or a case quantity of 12 cartons. (144 units) When Ordering specify CIRS Part Number (i.e. 240A for Carton of 12 units Grid-View "A")

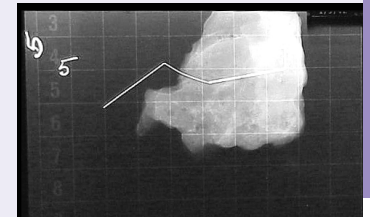


Benefits:

- Reduces surgery time through improved imaging turn around
- Improves communication between surgery, radiology and pathology
- Eliminates physical handling of specimens in radiology
- Eliminates the need for needles or wires
- Reduces risk of exposure to blood-borne pathogens



Multiple Core Specimens



Surgical Specimen

GRID-VIEW

Taylor an existing product to your exact requirements or create a totally new product.



ADVANCED TISSUE SIMULATION

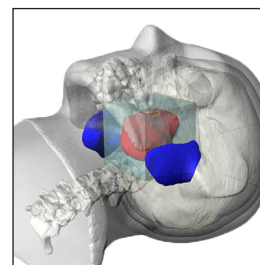
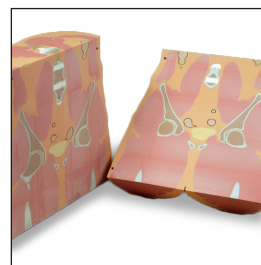
CIRS Tissue Simulation Technology (TE) has been validated through specific testing, continuous monitoring of manufacturing applications and worldwide use and acceptance of products for over 30 years. CIRS proprietary (TE) materials can simulate any tissue in the human body. CIRS materials are suitable for all modalities.

TEAM ENGINEERING AND DESIGN

Physicists, biomedical engineers and skilled craftsmen are available to work with you to modify existing products or to manufacture custom phantoms for emerging modalities or special requirements. From concept to finished component, the CIRS team of dedicated professionals works to ensure excellence in the products we deliver.

STATE OF THE ART MANUFACTURING

The CIRS manufacturing facility is dedicated to highly reliability products for Radiology and Radiotherapy. The facility operates utilizing the latest CAD, CNC and other advanced processes for rapid prototyping and precision products. Unique product offerings are possible because of constant updates to equipment the dedication of technicians and artists attention to detail.



Warranty

All standard CIRS products and accessories are warranted by CIRS against defects in material and workmanship for a period as specified below. During the warranty period, the manufacturer will repair or, at its option, replace, at no charge, a product containing such defect provided it is returned, transportation prepaid, to the manufacturer. Products repaired in warranty will be returned transportation prepaid.

There are no warranties, expressed or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description on the face hereof. This expressed warranty excludes coverage of, and does not provide relief for, incidental or consequential damages of any kind or nature, including but not limited to loss of use, loss of sales or inconvenience. The exclusive remedy of the purchaser is limited to repair, recalibration, or replacement of the product at manufacturer's option.

This warranty does not apply if the product, as determined by the manufacturer, is defective because of normal wear, accident, misuse, or modification.

PRODUCT	WARRANTY PERIOD
Non-Standard or Customized Products	3 Months
Training Phantoms and Disposable Products	6 Months
Electrical Products and Dynamic Phantoms	12 Months
All other Standard Products	48 Months
Plastic Water	60 Months

NON-WARRANTY SERVICE

If repairs or replacement not covered by this warranty are required, a repair estimate will be submitted for approval before proceeding with said repair or replacement.

RETURNS

If you are not satisfied with your purchase for any reason, please contact Customer Service prior to returning the product. Call 800-617-1177, email rma@circsinc.com, or fax an RMA request form to 757-857-0523. CIRS staff will attempt to remedy the issue via phone or email as soon as possible. If unable to correct the problem, a return material authorization (RMA) number will be issued. Non-standard or "customized" products may not be returned for refund or exchange unless such product is deemed by CIRS not to comply with documented order specifications. You must return the product to CIRS within 30 calendar days of the issuance of the RMA. All returns should be packed in the original cases and or packaging and must include any accessories, manuals and documentation that shipped with the product. The RMA number must be clearly indicated on the outside of each returned package. CIRS recommends that you use a carrier that offers shipment tracking for all returns and insure the full value of your package so that you are completely protected if the shipment is lost or damaged in transit. If you choose not to use a carrier that offers tracking or insure the product, you will be responsible for any loss or damage to the product during shipping. CIRS will not be responsible for lost or damaged return shipments. Return freight and insurance is to be pre-paid.

With RMA number, items may be returned to:

CIRS
 Receiving
 2428 Alameda Avenue, Suite 218
 Norfolk, Virginia 23513 USA

ORDERING

CIRS welcomes orders by phone, fax or email. When ordering, please specify the quantity and model number and describe the item in detail. Be sure to include shipping and billing address (if different). CIRS requires a minimum order of \$150.00.

CONTACTING CIRS

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Telephone: (757) 855-2765

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Business Hours: Monday-Friday 8:30am - 5:00pm EST

Customer Service: admin@circsinc.com

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Publication: CIRSFL011816

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