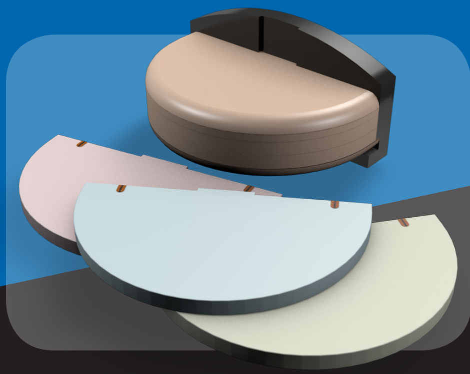
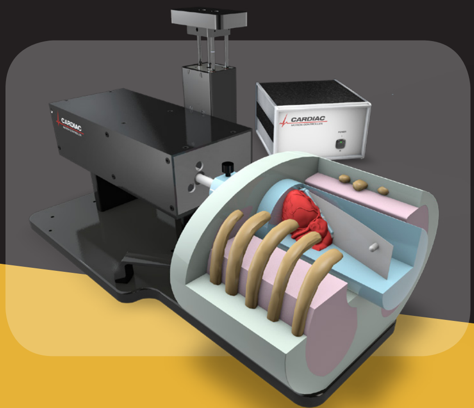
CIRS
Tissue Simulation & Phantom Technology

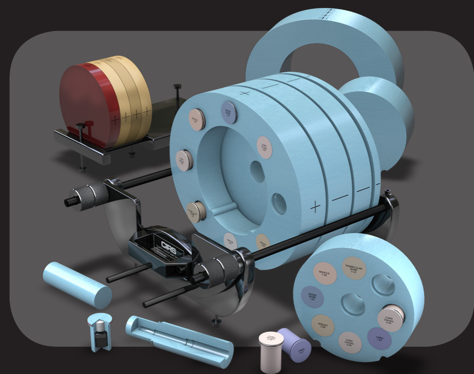
Product Catalog

Improving the art and science of medical imaging and radiation therapy

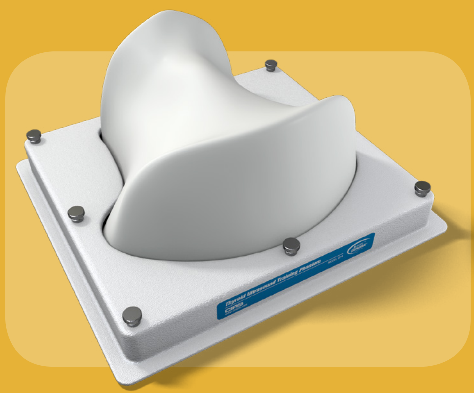


Evaluate image quality and system performance





Test and refine diagnostic and therapeutic procedures



Facilitate hands on teaching and training

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.

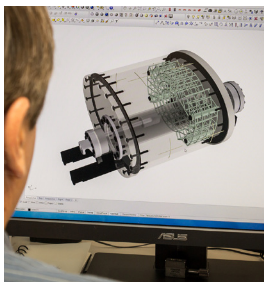
CIRS was first registered to the 1994 standard in 1997. CIRS upgraded to ISO 13485:2016 registration 1000095-MP2016.

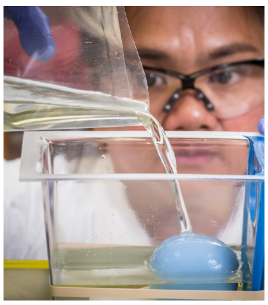
UL® REGISTERED FIRM

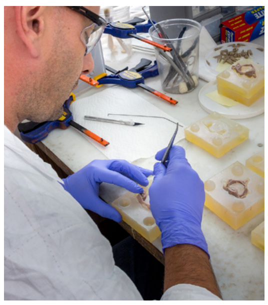
MADE IN THE USA

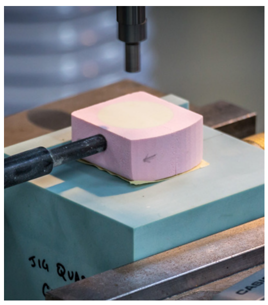
For over 35 years, Computerized Imaging Reference Systems, Incorporated (CIRS) has been recognized as a leader in the manufacture of phantoms and simulators for quality assurance, training and research. Now with an established library of proprietary tissue-simulation materials, our record of achievement 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.









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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.

RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

ULTRASOUND

TRAINING AND DEMONSTRATION

MAMMOGRAPHY

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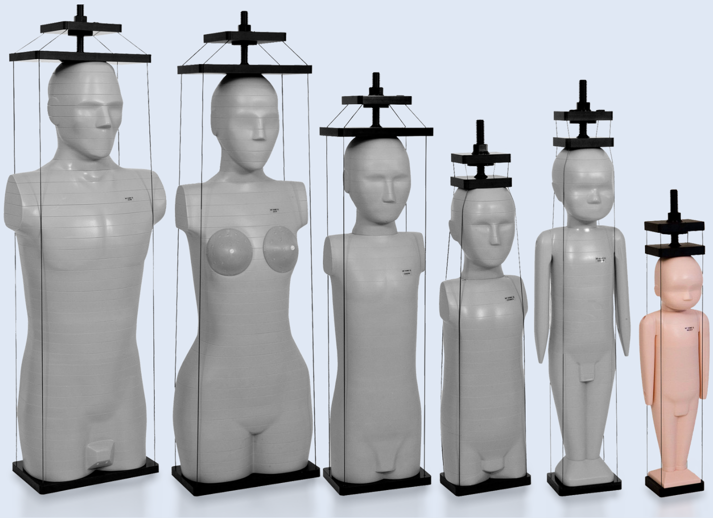
ATOM® Dosimetry Verification Phantoms

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

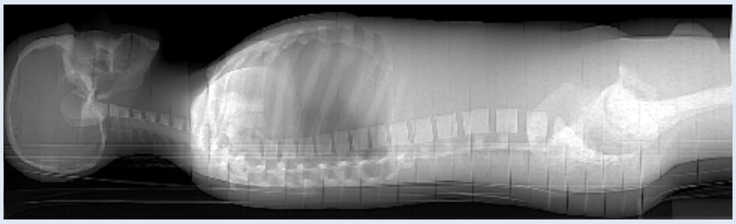
ATOM is the only line of dosimetry phantoms to range in sizes from newborn to adult. Six models are available: newborn, 1-year, 5-year and 10-year old pediatric phantoms as well as adult male and female phantoms.

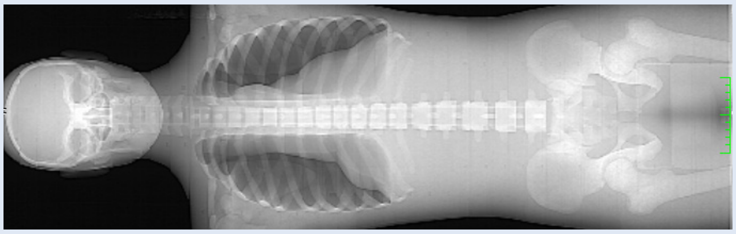
Each phantom is sectional in design with traditional 25 mm thick sections. The sectional surfaces are extremely flat and smooth and do not require any special coatings or treatment. This results in minimal interfaces between the slabs when viewed in a scout or projection X-ray. The ATOM line also differs 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.

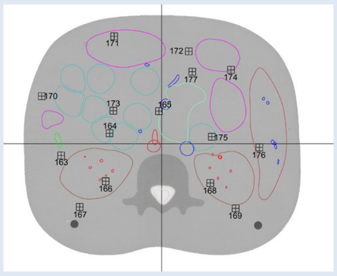
CIRS ATOM phantoms provide the widest variety of options available for whole body cross sectional dosimetry phantoms.

Life-like imaging characteristics



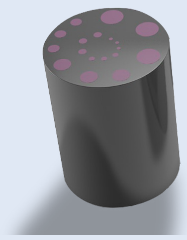


Optimized Organ Dosimetry



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)

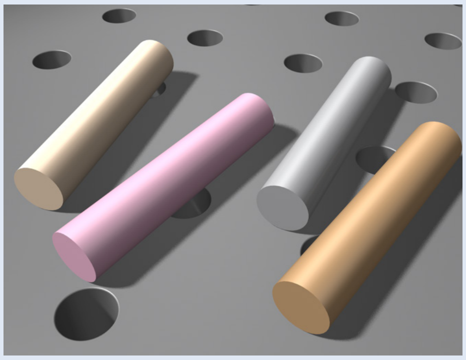
All ATOM Phantoms can be modified to receive the CIRS CT Imaging QA Kit. The four inserts contained in the kit are designed to investigate correlation between the image quality and CT doses. The kit provides various targets for evaluation of two important CT performance parameters: low contrast detectability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

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

RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

Thermoluminescence Dosimetry (TLD)

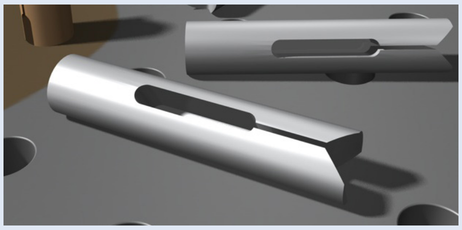
Sectioned and drilled phantoms readily accept TLDs. The end user can cut the tissue equivalent solid plugs so the TLD can be sandwiched between the cut plug and positioned at the appropriate depth within each section. This is especially critical in organ dosimetry and is supported with a table indicating at what depth to place each detector within the sections corresponding to the organ of interest.



Standard Solid TE Plugs

Mosfet Dosimetry

MOSFETs are accommodated by ordering the ATOM MOSFET Cartridge as an accessory. This specially machined plug is available in soft tissue and bone formulations.

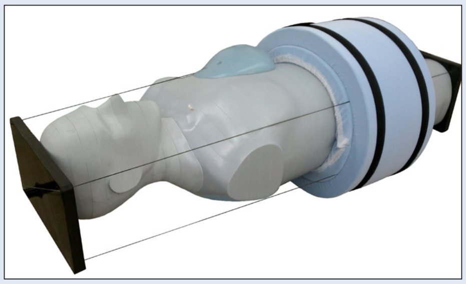


Film

Film dosimetry is supported by ATOM dosimetry phantoms. Both radiographic and radiochromic film may be placed between any two contiguous sections. The sections are then sealed with the black tape provided to prevent any exposure of the film to light.

Fat Layer

To more appropriately assess image quality and dosimetric values for patients, optional ATOM Fat Layers can be applied to Adult Male ATOM phantoms. Fat layers mimic human tissue within 2% by linear attenuation for MV and KV energies and are suitable for CT imaging with Wide Bore and Cone Beam CT scanners.

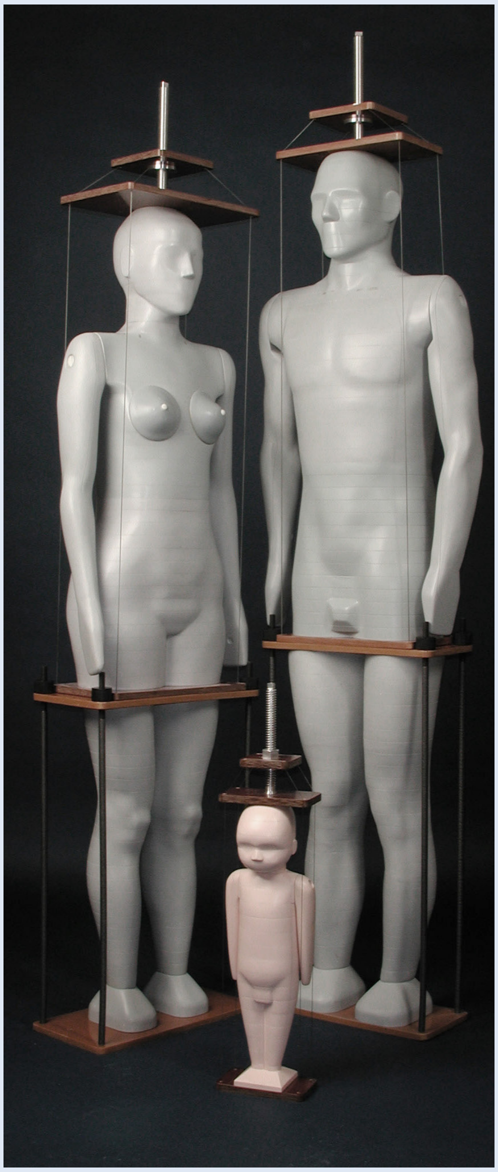


Breast Attachments

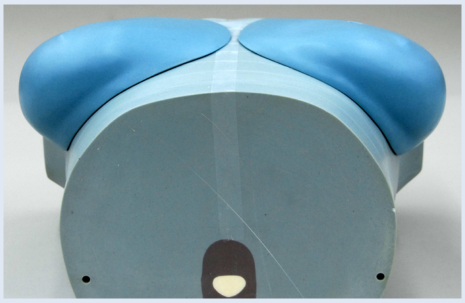
Breast Attachments are an optional accessory for the Adult ATOM male and female phantoms only. ATOM phantoms do not come configured with breast attachments. All breast attachments are manufactured from 50% glandular/50% adipose equivalent material (BR50/50). They are available in two shapes: standard shape (representative of a patient in the upright position) or with supine shape.

Arm & Leg Attachments

Because scattering radiation can give a significant dose contribution to the surrounding tissue, the ATOM newborn and 1-year old are provided with arms and legs as a standard configuration. For all other models, arm and leg attachments are available as an optional accessory.



Female Single Breast Attachments (190cc & 350cc)



Male Medium Single Supine Breast Attachment (800cc)

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MRgRT Motion Management QA Phantom

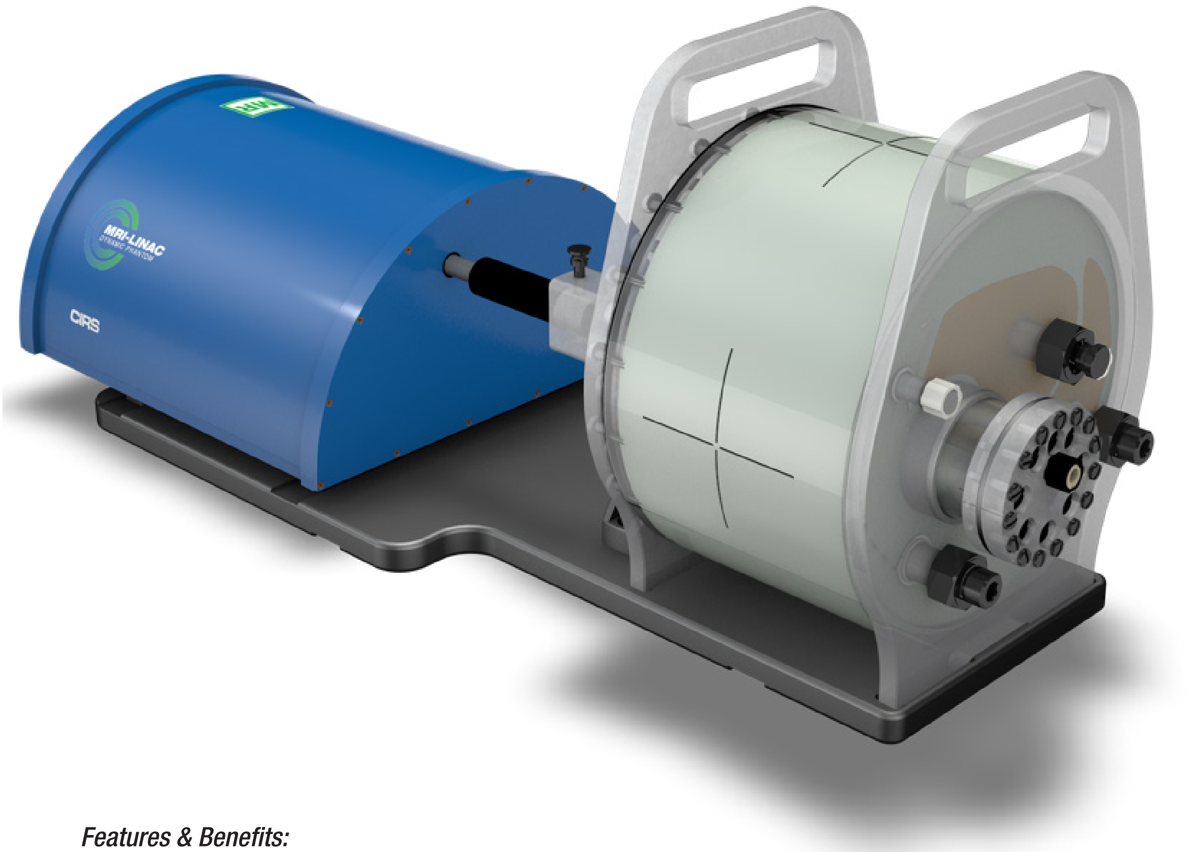


Image Acquisition • Treatment Planning • Dose Delivery

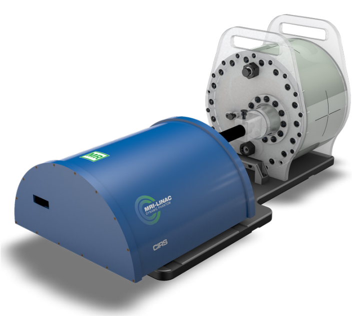
Model 008Z

The integration of MR imaging in radiation therapy facilitates real time motion management.

The CIRS MRgRT Motion Management QA phantom is designed to address such needs. The phantom is MR Safe due to the use of piezoelectric motors and non-ferro-magnetic materials. The two piezoelectric motors move a cylindrical insert, which contain a tracking target, through a gel/liquid fillable body by rotating it independently from the motion in the Inferior-Superior direction.

The moving insert contains an organic shaped target (tumor) filled with gel, which is surrounded by the same background gel used to fill the body. The body represents a heterogenous background due to simulated lungs, liver, kidney and spine. The simulated organs are anatomical in shape and have a life-like spatial relationship. They are filled with gels that provide contrast in CT and MR versus the background gel, which fills the void between the organs. Besides imaging, all organs, except for the lungs, offer ion chamber dosimetry cavities, which allow for completing an entire QA process; from imaging to planning to verification of dose delivered.

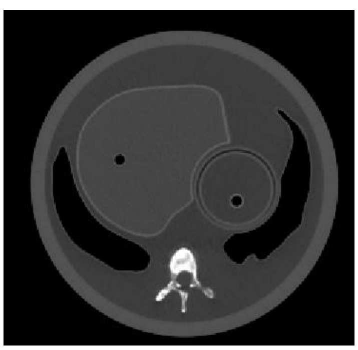
The phantom is designed as a single unit with a piezo actuator fixed permanently to a base plate on which the MRI body “snaps”. This allows for quick setup and removal and filling and storage purposes. The phantom’s base plate has machined slots on the bottom, which allow for the use of bar indexing for precise and repeatable/reproducible phantom-MRI (MRI-Linac) alignment.



Features & Benefits:

- Non-ferromagnetic materials => MR safe
- Shielded for RF interferences
- Allows for positioning within magnetic bore due to piezoelectric motors
- Quick setup & quick indexing to couch
- Organic shaped Organs at Risk and moving target
- Can be imaged in MRI, CT, PET and hybrid systems
- Ion chamber dosimetry in Liver, Kidney, Spine and moving target
- 3D tissue equivalent Spine for bone landmark
- Motion controller sits outside MR vault. Controlled by a PC through 75 feet long Ethernet cable
- Two independently programmable motions for the moving target
- Import, edit save patient specific breathing waveforms in addition to built-in QA waveforms
- Calculate Beam latency for each breathing cycle and as an average of all executed cycles without the need of an external oscilloscope.

IGRT e2e SCAN PLAN LOCALIZE TREAT



CT

MRI

MR

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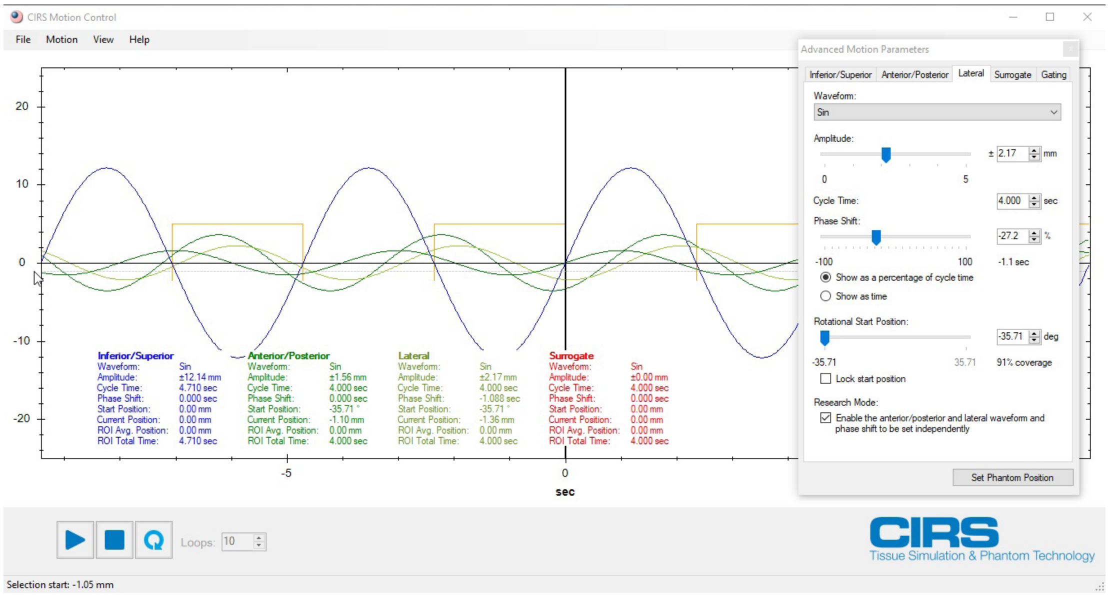
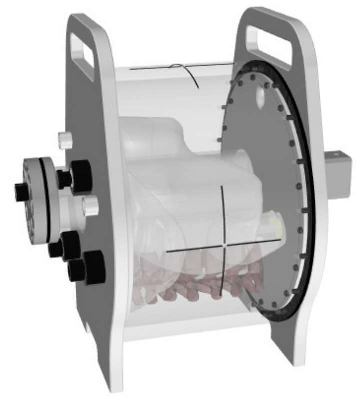
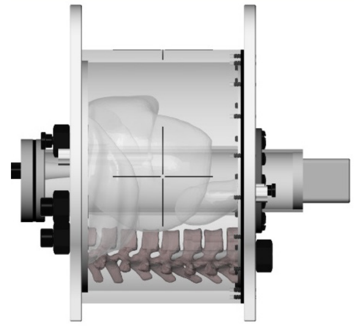
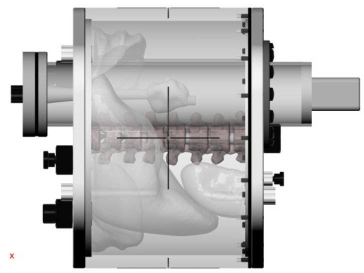
User Friendly Motion Control

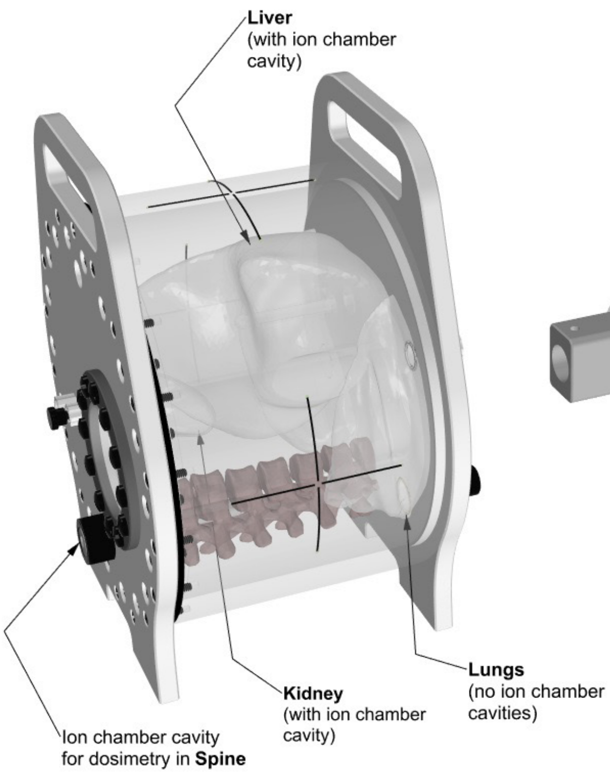
The intuitive graphical user interface provides an unlimited variety of motions while simplifying the operation of the phantom. Patient specific motion profiles are easily imported and there is no need to make hardware adjustments or have special programming skills. Beam latency testing can be performed without the need of an external oscilloscope. Refer to page 12 for more information.

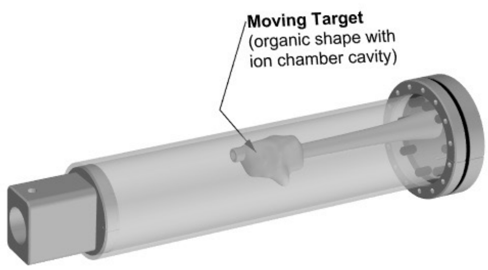












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RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

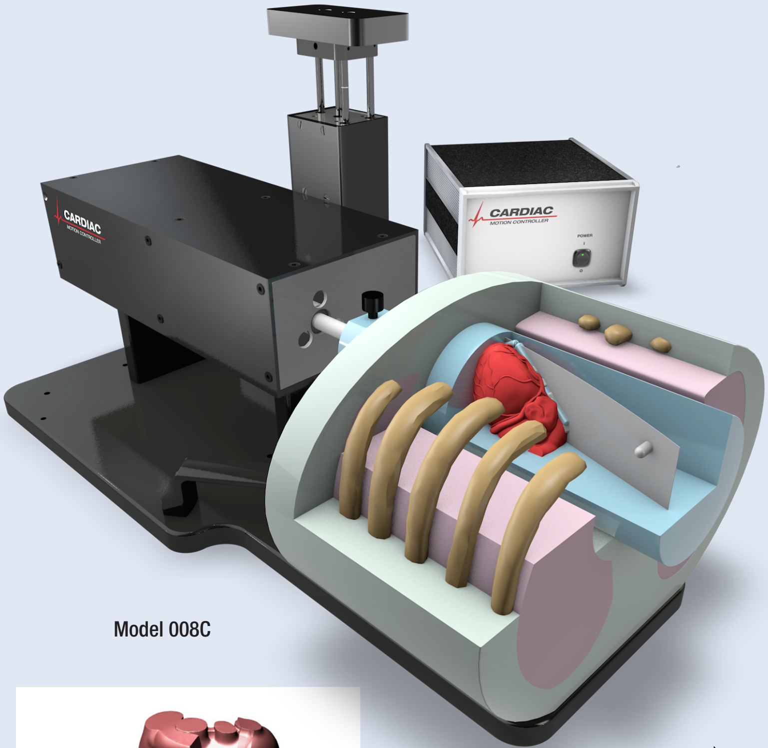
Dynamic Cardiac Phantom

Perform Comprehensive Evaluation of Cardiac Imaging

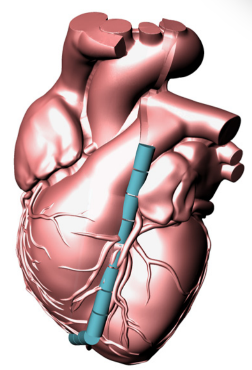
The CIRS Dynamic Cardiac Phantom is a precision instrument that simulates the realistic motion of an average human heart. It provides known, accurate and repeatable 3D motion of a solid heart model inside the tissue-equivalent thorax phantom. The Model 008C-01 rod is designed as a comprehensive image analysis tool for calcification detection, iodine contrast resolution and ECG signal gating.

The cardiac phantom is constructed from the tissue equivalent thorax body, moving rod with the solid tissue equivalent heart inside, motion actuator, motion controller and CIRS Motion Control software.

The phantom body represents an average human thorax in shape, proportion and composition. It contains a fully articulated spine, ribs and lungs. A tissue-equivalent rod containing a tissue-equivalent anthropomorphic solid heart is inserted into the mediastinum of a thorax phantom. The rod is split at an angle along the left coronary artery to provide access to replaceable targets. 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. The body is connected to a Motion Actuator box that induces three-dimensional heart motion through linear translation and rotation of the rod. The movement of the rod is radiographically invisible due to its matching density to the surrounding material, but the movement of the heart and targets, given its density difference, is visible.



Model 008C



Anthropomorphic cardiac tissue equivalent solid heart with replaceable targets mimicking the left coronary artery

PLASTIC WATER® DT

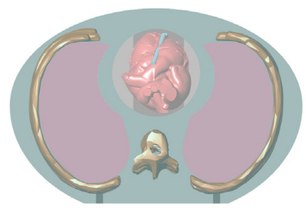
Iodine and Calcification Targets

The target pockets in the moving rod mimic the left coronary artery and posterior interventricular artery and allow for placement of different levels of iodine contrast or calcification density within the heart. The replaceable targets listed in the table at right are provided.

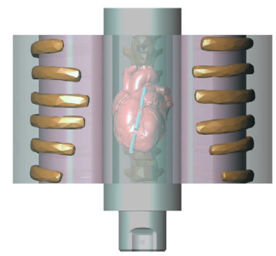
Features:

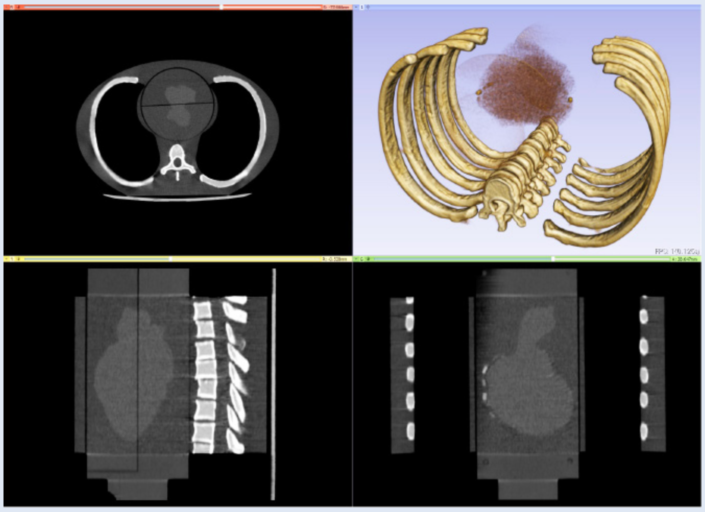
- Anthropomorphic heart inside a thorax body
- Tissue equivalent materials
- Iodine contrast and calcification detection capabilities
- Contrast target interchangeability
- Complex heart motion combined with respiratory motion
- Sub-millimeter accuracy and reproducibility
- Motion software enables different cycles, amplitudes, and wave forms
- Correlated ECG signal with readable output

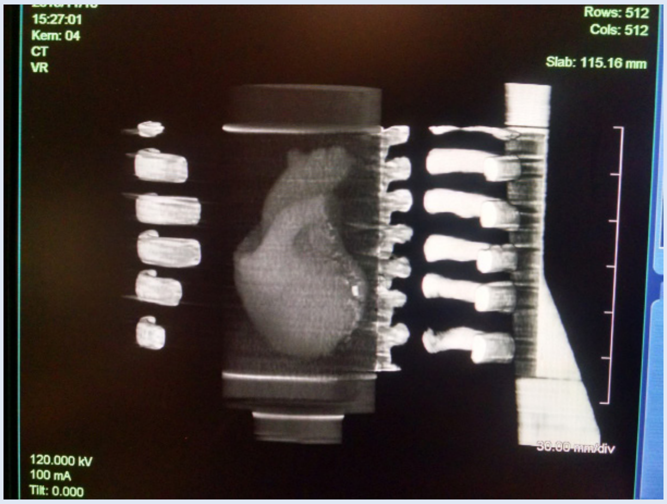
(Back view)



(Top view)



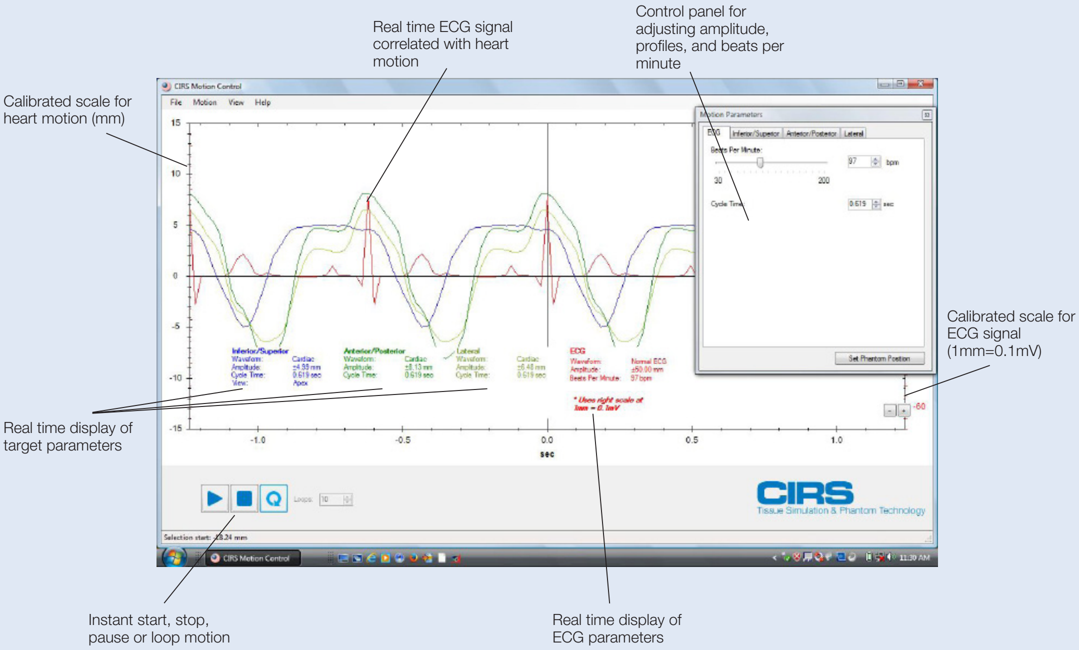




Volume reconstruction and rendering

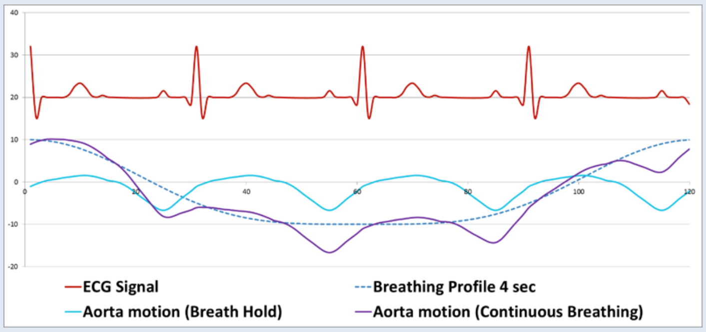
Motion Correlated to ECG

The 3D movement of the heart is controlled by CIRS Motion Control software which is installed on a Windows PC or Laptop. The software comes loaded with three basic motion profiles that are specific to different anatomical parts of the heart and one correlated ECG profile. The one channel (3 leads) ECG signal, is readable with basic cardiac monitoring devices from the snap on connectors installed on the rear side of the Motion Controller. Through the intuitive user interface, users can adjust motion amplitudes and the heart rate. The scale on the left side of the display is calibrated in millimeters and is used to evaluate the physical motion of the heart. The scale on the right side of the display is calibrated to match the ECG signal equivalent with a typical ECG printed on graph paper (1mm =0.1mV). If the mouse is placed on the ECG signal on the main display the user is presented with information about that point of the ECG with respect to time and amplitude (mm/mV).



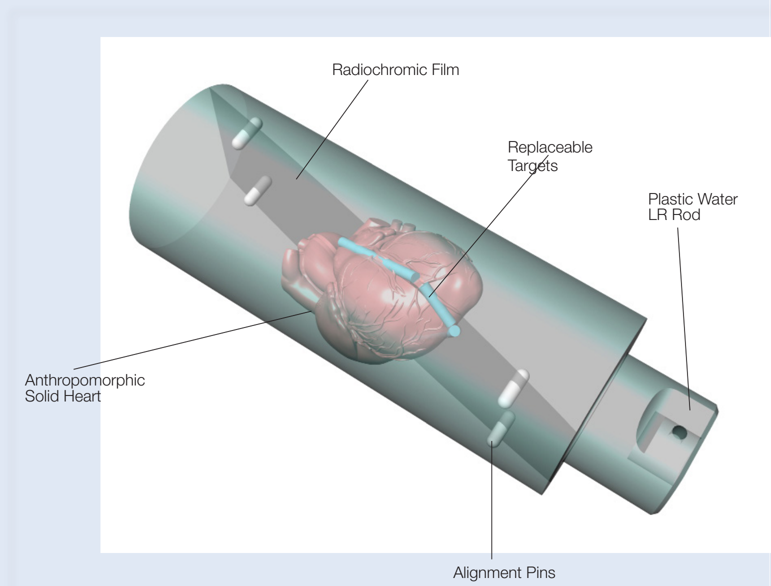
Combined Heart & Respiratory Motion

The software can overlay respiratory motion with cardiac motion to account for total displacement of the heart. The respiratory motion can mimic either breath hold or continuous breathing of a patient. The software allows the user to import patient-specific cardiac and breathing profiles or build their own ECG signals in a comma separated value to simulate abnormal heart beats.



Dose Studies

The model 008C-01 cardiac rod is split at a 13 degree angle along the left coronary artery. It is possible to place radiochromic film between the two halves of the rod for dose verification studies.



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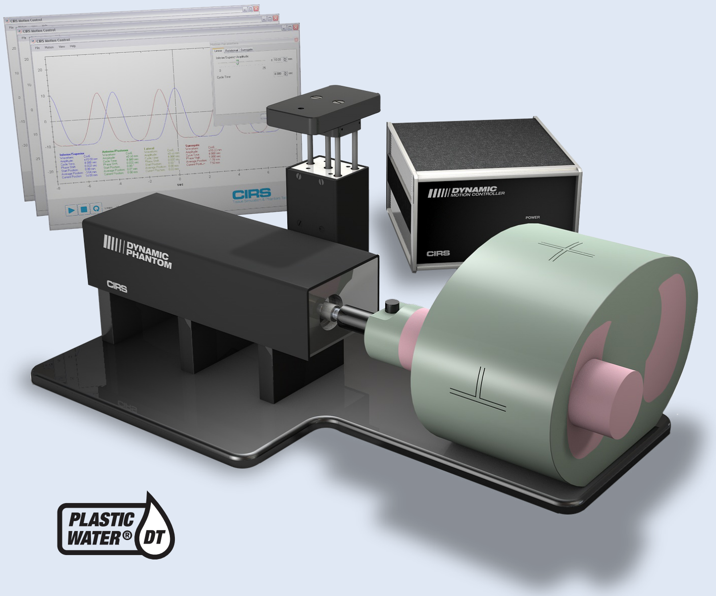
Dynamic Thorax Phantom



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.

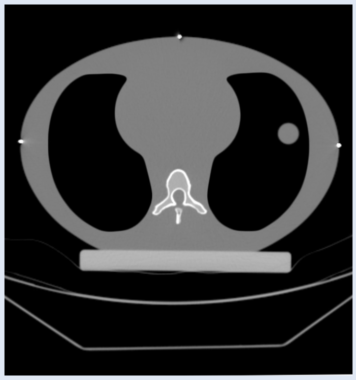
The phantom body represents an average human thorax in shape, proportion and composition. A lung-equivalent rod containing a spherical target and or various detectors is inserted into the lung-equivalent lobe of the phantom. The body is connected to a motion actuator box that induces three-dimensional 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

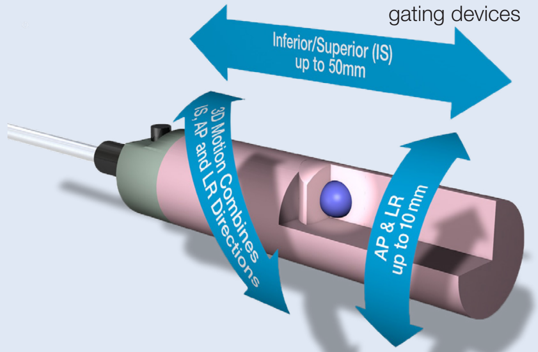
"Strict QA procedures for the imaging, planning and delivery of radiotherapy using respiratory management devices are required to ensure the safe and effective use of test devices." -AAPM TG-76 report, The management of respiratory motion in radiation oncology



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

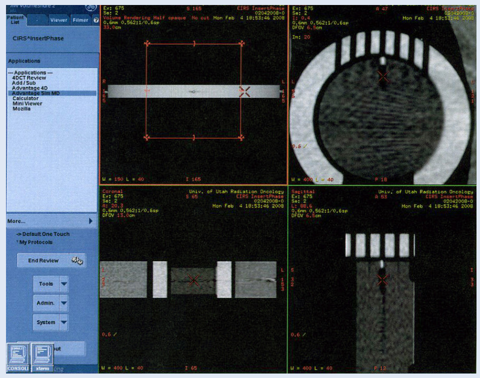
Features:

- 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.

*Elekta® is a registered trademark (Stockholm, SE)

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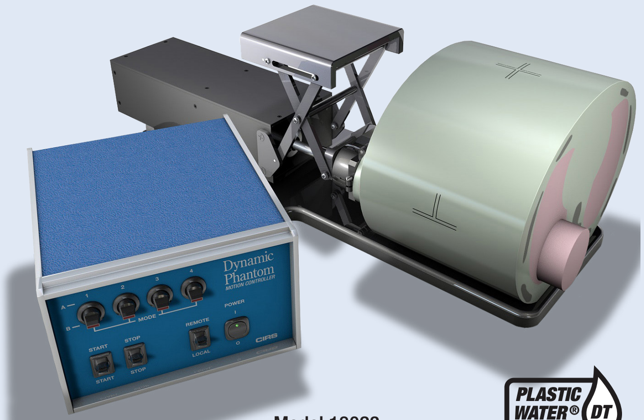
RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

Xsight® Lung Tracking Phantom Kit & 4D Planning Phantom



Model 18023

PLASTIC WATER® DT

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

ACCURAY™

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

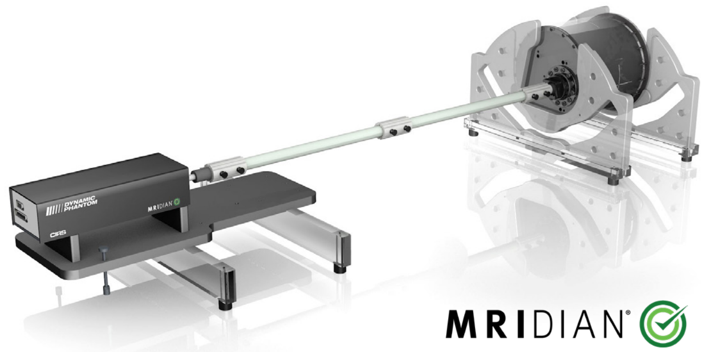
The Model 18023 Xsight Lung Tracking "XLT" Phantom Kit can be upgraded to include the latest features of CIRS Dynamic Thorax Phantom (Model 008A).

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

*Accuray® is a registered trademark (Sunnyvale, CA)

Viewray® Dynamic Phantom



MRIDIAN®

Model 008V

Image Acquisition • Treatment Planning • Dose delivery

The Viewray® Dynamic Phantom is used to validate the unique capabilities of the Viewray System to track and deliver a gated treatment based on real-time MRI imaging. Dosimetry capabilities of the phantom enhance the validation of the Viewray system from the planning phase to the final stage of gated treatment delivery. This phantom was designed in collaboration with Viewray® and complies with Viewray Requirements Specification document RQ-0034 Rev C. Refer to Viewray® protocol FTP-06 Rev B "Functional Test Procedure" for detailed instructions regarding how to use this phantom with the MRIdian system.

The Model 008V body represents an average human thorax and is comprised of a plastic shell with a cylindrical through hole to accommodate a moving rod with simulated target. The embedded MRI/CT target is made of an MRI target gel that provides contrast with respect to the surrounding MRI background gel so as to allow tracking of tumor motion. The target can receive an ion chamber for treatment dose verification. The moving rod is connected to a motion actuator box that induces three-dimensional target motion through linear translation and rotation of the rod. In addition to the dosimetry target, the rod also contains an offset target and a cylindrical region made of MRI target gel to increase the targets' tracking accuracy.

Our Viewray® Dynamic Phantom includes four spherical static targets and a fifth rectangular parallelepiped target to simulate organs at risk.

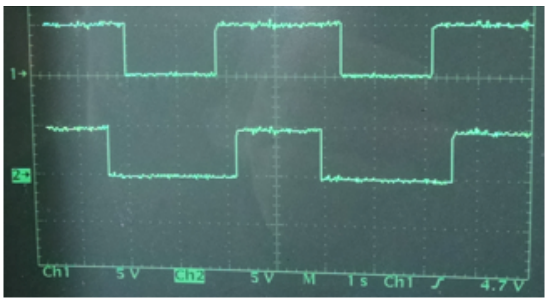
Each of these three targets receives an ion chamber for dosimetry measurements. The body targets, made of MRI target gel, are surrounded by the same MRI background gel used in the moving rod. These targets allow for dosimetry measurements with the same ion chamber as the one used for the moving rod. Also, they can be used to check for the automatic target delineation.

The phantom is equipped with a target motion position output, which provides two square-waves that can be analyzed on an oscilloscope against "Beam On" – "Beam Off" to determine beam latency, which is important in gated treatments.

The phantom comes in two custom hard-sided cases and is equipped with a user guide and one-year warranty.

Features

- Validated specifically for Viewray Systems
- 3D target motion and static targets receive ion chambers
- Adaptive RT plan veri cation
- Voltage output to verify gating
- End-to-end commissioning
- Body & rod filled with gels to eliminate liquid specific image artifacts



*Viewray® is a registered trademark (Oakwood Village, OH)

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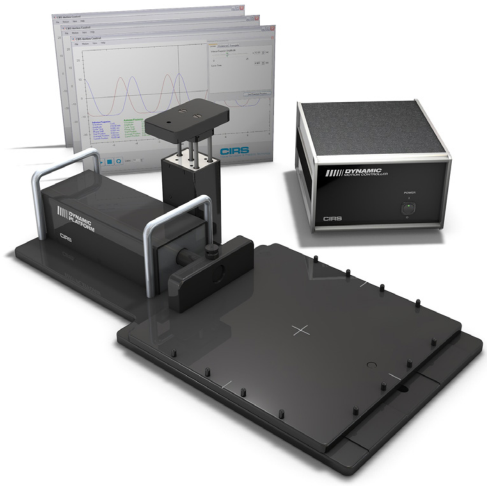
Dynamic Platform



Model 008PL

Programmable motion for any phantom

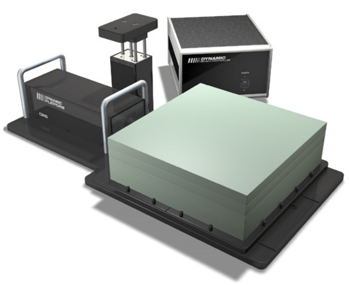
The CIRS Dynamic Platform provides an economical, user-friendly solution for the complex tasks associated with tumor motion and patient positioning in radiation therapy.

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).

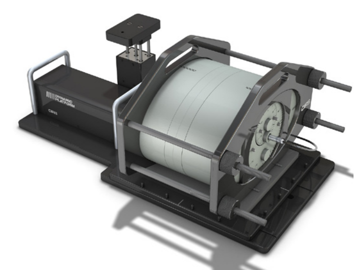
Capabilities

- 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



Model 008PL shown with CIRS Plastic Water-DT stack.

(Phantom available separately)



Model 008PL shown with CIRS Model 002H9K IMRT Head and Torso Freepoint Phantom.

(Phantom available separately)

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.

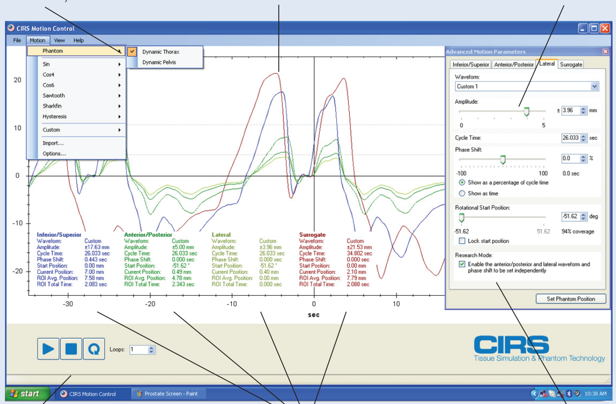
Patient-specific profiles are easily imported and there is no need to make hardware adjustments or have special programming skills.

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

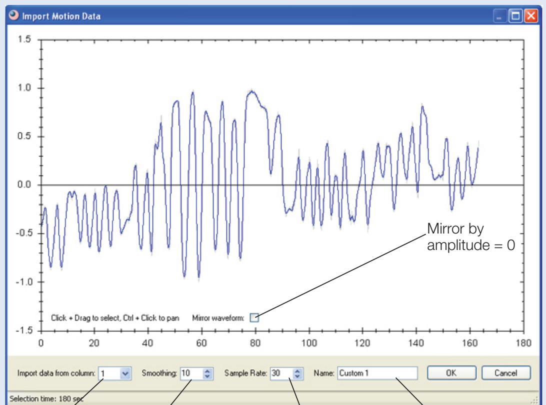
Adjust motion amplitude, cycle time and phase shift with pull down menus and slider bars



Instantly Start, Stop, Pause or Loop motion

Real-time display of target and surrogate motion parameters

Research Mode to import 3D recorded waveforms



Data Column Selection

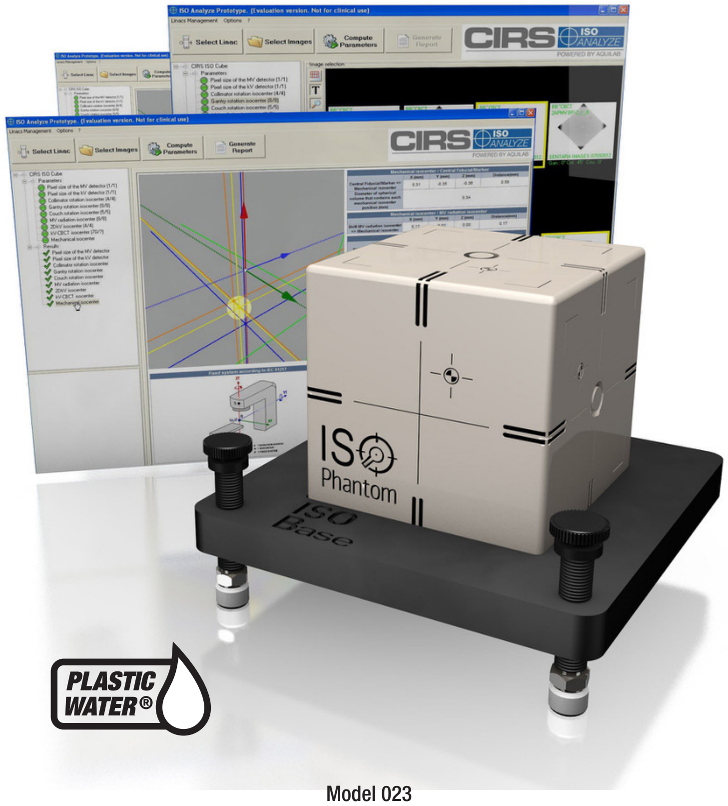
Smoothing (Un-smoothed Data = 0; Maximum Smoothing Degree = 100)

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)

RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

Daily ISO Phantom



Model 023

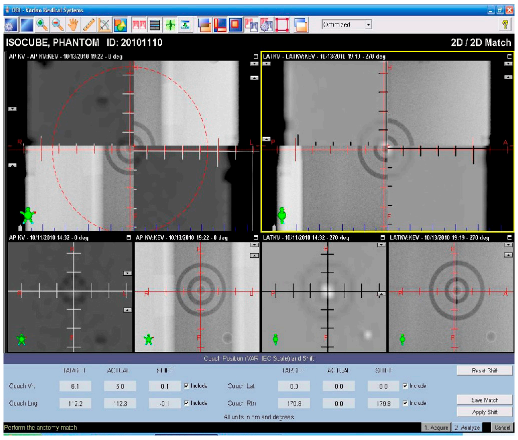
Verify imaging, localization and targeting systems are aligned with the true radiation isocenter on radiation therapy machines

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

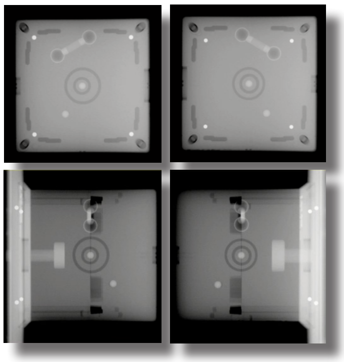
The ISO phantom was designed specifically for daily system checks. The lasers and light field can be tuned to the true radiation isocenter using the engraved markings on the exterior of the ISO phantom. The light field and radiation field alignment can be checked using integral radiographic markers.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



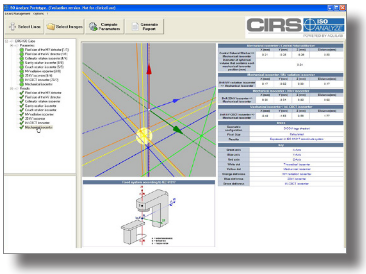
ISO Analyze Software

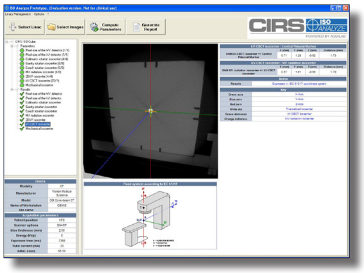


Model 023-03

Affordable turnkey solution for daily machine QA

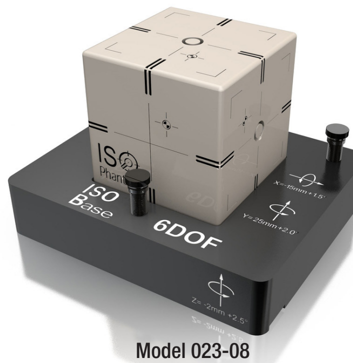
ISO Analyze™ integrates with the Daily ISO phantom and ISO Base™, enabling user-friendly quality control of the LINAC isocenters by analyzing DICOM images acquired with the EPID and CBCT. Controls are run automatically, analyzing images of the phantom and quantifying a large number of evaluation parameters. The software allows users to easily generate, save and print a report for each preceding control.





CIRS ISO ANALYZE
POWERED BY AQUILAB

6DOF ISO Base



Model 023-08

Quickly assess rotation and translation shifts.

Fully compatible with CIRS ISO phantom and ISO Analyze Software

The CIRS 6DOF ISO Base, Model 023-08 is an optional accessory of ISO Phantom. It is designed for positioning and leveling of ISO phantom and quick calculation of complex 3D shifts of RT treatment systems with an integrated robotic couch.

There are two milled pockets on the CIRS 6DOF ISO Base. The ISO alignment pocket can be used to position and level the ISO Phantom on the treatment couch. It contains a set of four Tungsten spheres that are used by ISO Analyze™ Software to calculate the actual Pixel Size for both the MV and kV image detectors.

Features:

- Fully compatible with the ISO phantom and ISO Analyze Software
- 6DOF ISO Base pockets allow easy position of the ISO phantom for ISO Center and Couch shift checks
- Compute kV and MV pixel size with embedded BBs
- Machined in single set up to minimize setup errors
- Integrated leveling feet allow fine alignment adjustments
- Milled slot enables indexing with most localization bars

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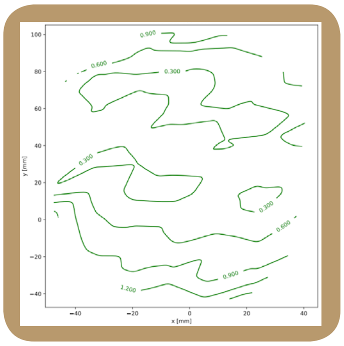
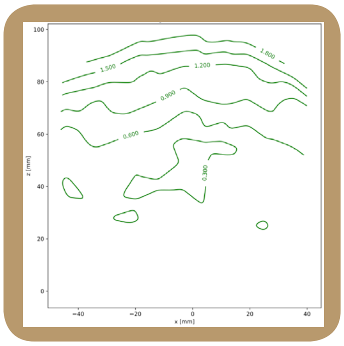
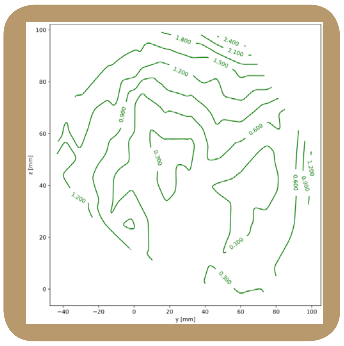
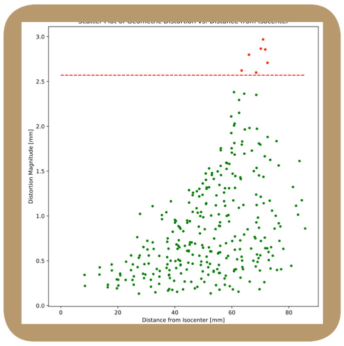
Distortion Check Software

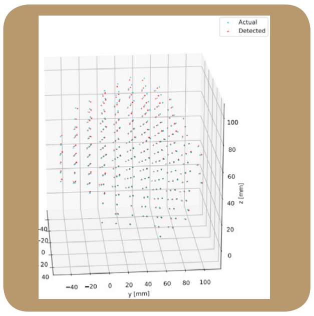
distortion check
SOFTWARE FOR EVALUATION OF IMAGE DISTORTION


Axial Contour Plot


Sagittal Contour Plot

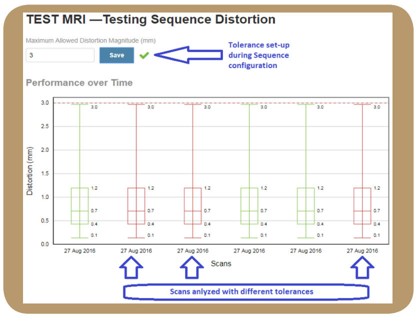

Coronal Contour Plot


Scatter Plot



3D Scatter Plot, all points,
Control vs. Reference


Grid intersections
Detected vs. Reference



Trend Analysis

Automated Analysis of Distortion in MRgRT

Distortion Check is a new, cloud-based solution designed to quickly and automatically quantify distortion in MRI images. Used in conjunction with CIRS MRI Grid phantoms, the software provides the capability to quickly and accurately measure distortion through out the entire image volume.

After detecting all grid intersections, the software registers either a CAD or CT scan ground truth to these MR detected control points. An interpolation is then performed to generate the 3D distortion vector fields.

Results can be reported in a variety of output formats including scatter plots, contour plots, box and whisker plots for trending and DICOM overlays that can be imported to TPS or other 3rd party software. The software algorithms will work with any grid configuration and CIRS employs proprietary 3D printing techniques that enable easy modification of grid phantoms to meet customer requirements.

Features

- Simple, user friendly web interface
- Detect physical control points thru out the 3D image volume
- Web based pdf report in summary or detailed format to NEMA MS 12 standard recommendations.
- Output raw data or DICOM overlay files for use with 3rd party software
- Establish multiple user accounts with different permissions
- Easily analyze and track multiple machines, imaging sequences and phantoms
- Establish distortion tolerance thresholds specific to different imaging sequences
- Re-compute any scans acquired for different tolerance thresholds

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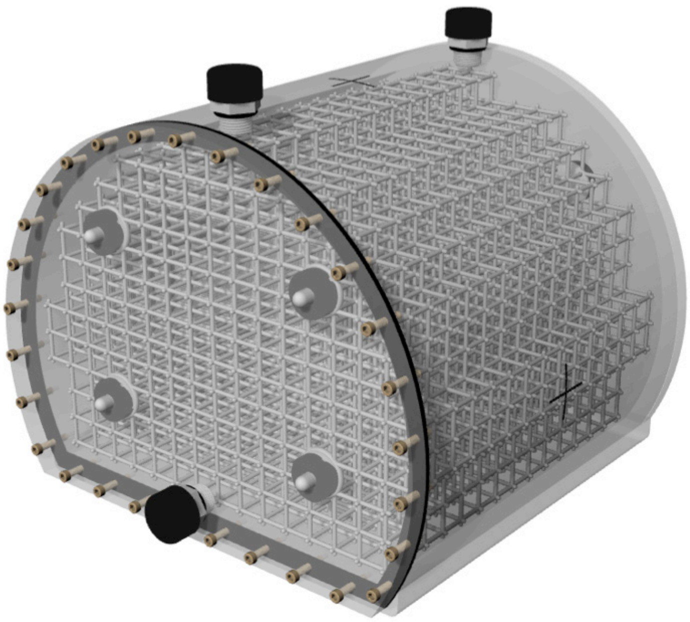
RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

Large Field MRI Distortion Phantom



Model 604

Assess image distortion in large-bore MRI

The Large Field MRI Distortion Phantom, Model 604 is designed for assessment of magnetic resonance imaging distortion caused mainly by the nonlinearity of the magnetic gradients. It can also help quantify MRI image distortion due to chemical shifts and susceptibility due to density differences common in Diagnostic and RT treatment planning.

The phantom's 3D grid of large size and equal spacing in all three orthogonal dimensions makes it suitable for distortion QA of large bore MRI and CT scanning for distortion-free imaging. The phantom can be filled with various signal-generating solutions for use in magnetic resonance imaging. Contrast of the grid-liquid interface varies under computed tomography depending on the liquid used for generating MRI background signal. When empty, the grid-air interface provides good contrast under CT. The phantom images well with all CT techniques and MRI sequences tested to date, including T1 weighted, T2 weighted, 3D Time of Flight, MPRAGE and CISS sequences.

The phantom is comprised of a leak-proof PMMA cylinder and measures 330 mm in diameter by 300 mm long. The entire volume is filled with a unique orthogonal 3D grid of 3 mm diameter rods spaced 20 mm apart to provide complete geometric data throughout the imaging volume. The phantom is marked for ease of alignment to positioning lasers and is designed for use with both curved and flat gantry tables.

Features:

- Large FOV distortion evaluation
- Unique orthogonal grid with equal 3D spacing
- Leak-proof design
- Sub-millimeter precision
- Easy integration and laser alignment
- Ground truth files for grid available in various digital formats
- 2623 control points

MRI Distortion Phantom for SRS

Model 603A

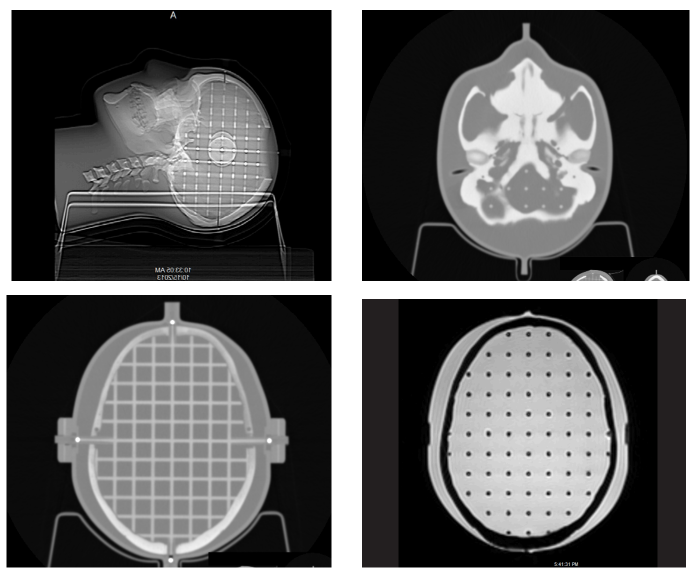
For Rapid Assessment of Image Displacement in Treatment Planning Systems

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 orthagonal 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
- 335 control points



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

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ATOMMax™ Dental & Diagnostic Head Phantom

Model 711-HN

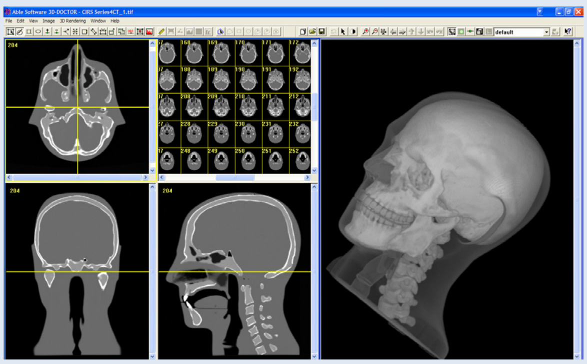
Our most realistic maxillofacial phantom for dental cone beam CT & panoramic x-ray

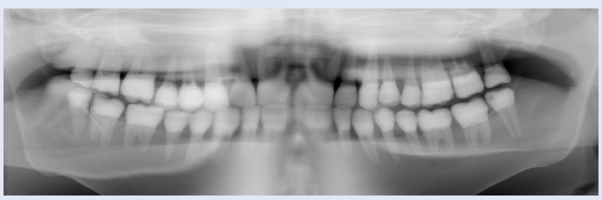
The CIRS Dental and Diagnostic Head Phantom is a standard of reference for diagnostic radiology of the head. The Model 711-HN provides a consistent tool for researchers, clinicians and technologists. It is ideal for determining optimum system settings, commissioning new equipment, monitoring system performance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

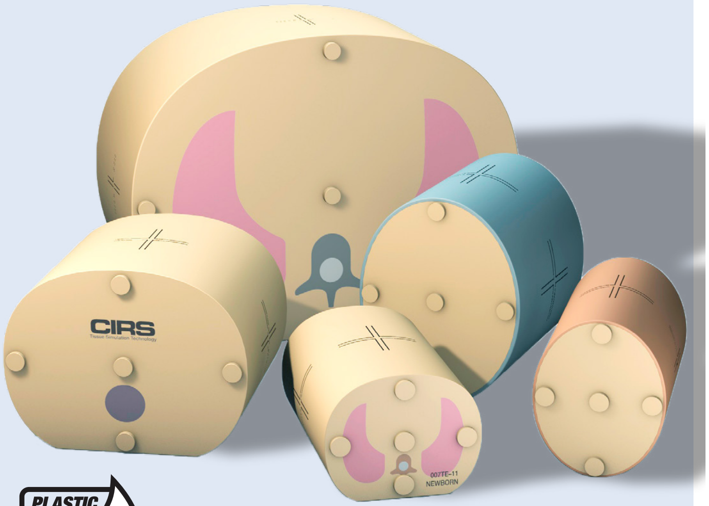
ATOMMax™ is made of tissue simulating resins that mimic the X-ray attenuation properties of human tissue for both CT and therapy energy ranges (50 keV-25 MeV).

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.





Tissue Equivalent CT Dose Phantoms



PLASTIC WATER® LR

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.

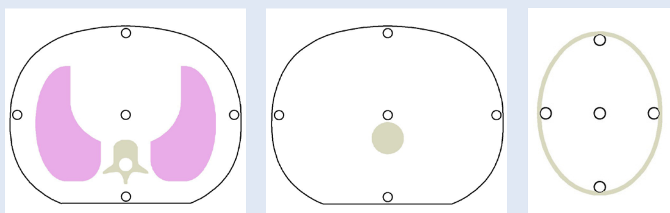
The phantoms are made from proprietary epoxy formulations that faithfully mimic the X-ray absorption and scatter properties of soft tissue or water within 1% in the diagnostic energy range.

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.

Medium Adult Phantoms



Thorax Abdomen Head

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

RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

Stereotactic End-to-End Verification Phantom

STEEV™
STEREOTATCTIC END-TO-END VERIFICATION

Model 038

SCAN
PLAN
LOCALIZE
TREAT

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

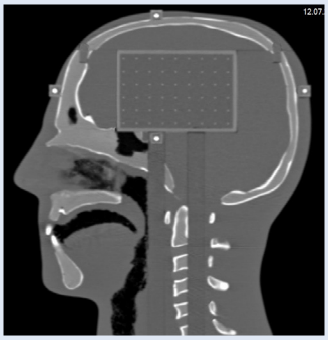
Steev's anthropomorphic exterior allows for use of multiple positioning and fixation devises as used in clinical application. Internal details such as cortical and trabecular bone, brain, spinal cord, teeth, sinuses and trachea provide the most realistic clinical simulation to evaluate the challenging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

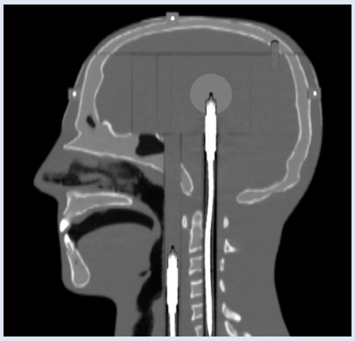
Dose measurements at isocenter and off isocenter positions

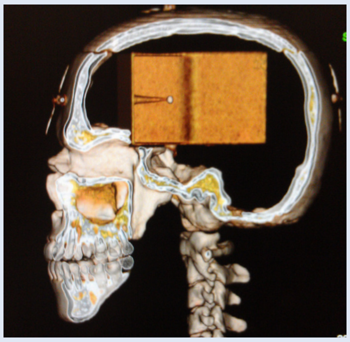
Steev accommodates a variety of interchangeable tissue equivalent inserts suitable for small field dosimetry including: micro- and pin-point ion chambers, film, MOSFET, TLD, OSL (nanoDot™) and 3D gel. When used in concert with the various imaging inserts, Steev provides the most comprehensive end-to-end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

Features:

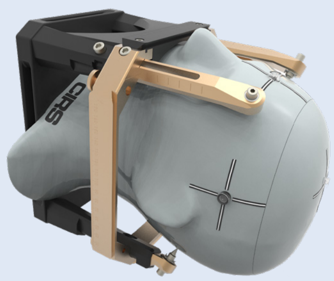
- Tissue-equivalent within 1% actual attenuation of water and bone from 25 kV to 15 MV
- 11 optional Interchangeable cubic inserts
- Suitable for use with MRI, CT, and PET
- Optional shoulder attachments
- Foam-lined Case







Stereotactic Frame Adapter



Fast and repeatable phantom positioning.

The CIRS Stereotactic Frame Adapter is designed to help in positioning of the Model 038 SRS Verification Phantom (STEEV) inside the Leksell® Coordinate Frame. It enables fast, precise and repeatable positioning of the STEEV phantom ISO center with accuracy better than 0.25mm.

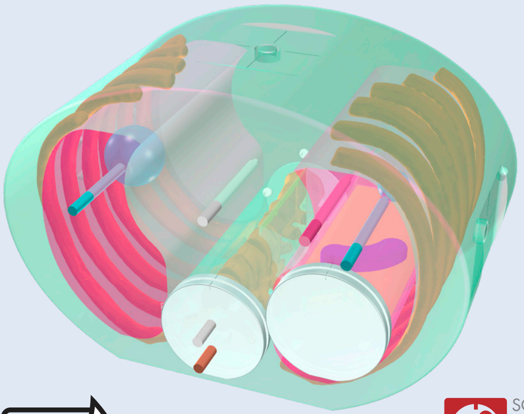
The Adapter is compatible with all optional components of the Leksell Coordinate Frame G, including MRI Adapters, Open CT Indicator and Target Positioner. It is made of MRI-compatible materials and can be safely used during image acquisition and treatment planning.

Benefits:

- Position STEEV in Leksell Coordinate Frame G in under one minute
- Repeatable ISO Center alignment accuracy better than 0.25mm
- Compatible with all Leksell Coordinate Frame G models and accessories

*Leksell® Coordinate Frame G is a registered trademark of Elekta (Stockholm, SE)

E2E® SBRT Phantom



SCAN
PLAN
LOCALIZE
TREAT

Model 036S

"End-to-End" SBRT testing solution

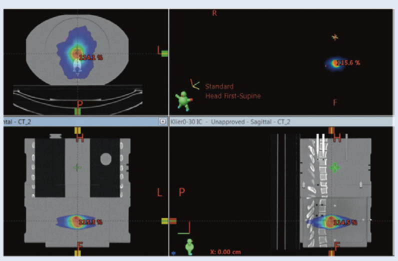
The E2E® SBRT Phantom with removable spine provides a means to check the entire treatment chain during commissioning and routine QA. The Model 036S is an anthropomorphic thorax body containing articulated spine, ribs, and lungs. All mate- rials are suitable for use in kV and MV energies.

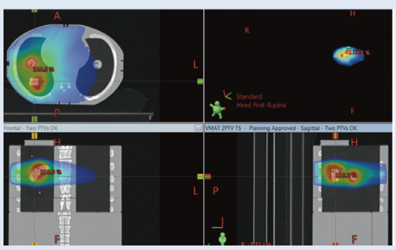
The thorax section contains two lung tumor volumes with ionization chamber cavities in the center of each target*. The phantom also includes a lung insert with an irregu- lar- shaped lung target. The proximity of the lung target to the vertebral body allows clinicians to measure high-resolution dose distribution to the target and dose to the spinal cord in a single delivery.

The Model 036S has more options for dose verification in the spine as an organ at risk, including a removable split spine. The removable spine facilitates the use of radiochromic film in the sagittal orientation in the inferior half of the spine rod. Ion chambers cavities are located in the spinal cord and the vertebrae in the superior half of the removable spine rod. Alignment marks at 0,90, 180 & 270 degrees allow for consistent re-positioning. Precision-cut films with integral registration holes are avail- able for both the lung insert and spine insert.

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.





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

PIRATE Phantom

Model 134200

Articulated maxillofacial phantom for intraoral imaging

The CIRS Phantom for Intraoral Radiography Assessment, Testing & Evaluation (PIRATE) is a standard of reference for diagnostic radiology of the jaw. The phantom is designed to assist technical and clinical staff in the selection, monitoring, training and verification of scanning parameters common to intraoral radiological imaging procedures and other common dental procedures.

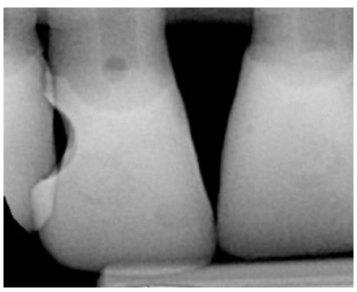
The PIRATE phantom features detailed 3D anthropomorphic anatomy including bone, sinus, maxilla, mandible, mandibular nerve and teeth. The bones contain both cortical and trabecular separation. The teeth include distinct dentine, enamel, root canal and crown. One tooth includes a fracture and a second includes a cavity.

Features

- Detailed anatomical features
- Tissue Equivalent from 50 keV to 25 MeV
- Functioning Mandible
- Tripod with six degrees-of-freedom
- Soft-sided carry case
- 48-month warranty

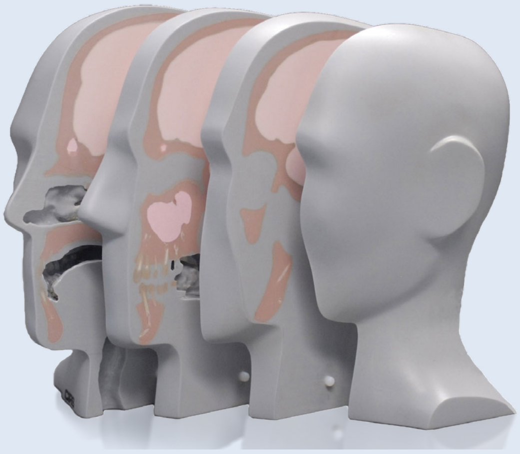
Capabilities and Applications

- Commission intraoral X-ray devices
- Learn how to properly position for optimal images
- Test reconstruction techniques and algorithms for implant planning and maxillofacial reconstruction
- Train and evaluate personnel during implementation of new equipment and techniques
- Validate consistency of image quality



RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

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 system[1].

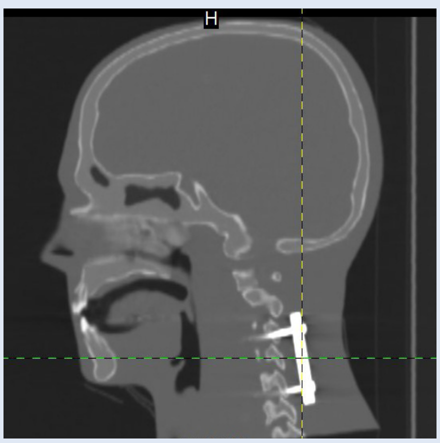
The phantom is constructed of CIRS tissue-equivalent materials, which mimic reference tissues within 1.5% for protons and within 1% for photons from 50 KeV to 25 MeV. The Proton Therapy Head can be used during all standard IMRT procedures from CT image acquisition to proton beam delivery verification[1,3].

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 therapy[2], 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.

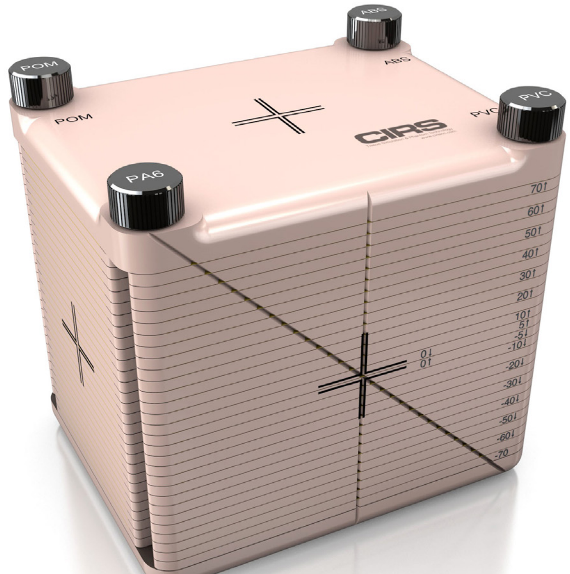
Model 731-HN approximates the average male human head in both size and structure to allow for intuitive set up with any patient positioning or fixation device.

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.



SRS Multi-Lesion Brain QA Phantom



Model 037

Multi-lesion SRS treatment planning QA in brain equivalent phantom

Our Multi-Lesion Brain QA Phantom (Model 037) provides a unique solution for fast, comprehensive film dosimetry for single isocenter plans treating multiple targets simultaneously. The phantom may be used for thorough validation of multi-lesion treatment methods and for patient-specific quality assurance.

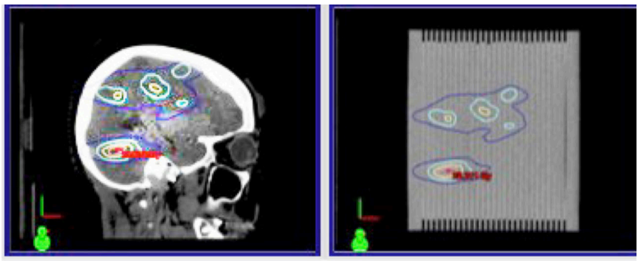
Our phantom is rectangular in shape with rounded corners to minimize CT artifacts and large enough in size to cover brain anatomy variations. Linear attenuation of simulated brain tissue is within 1% of real tissue from 50 keV to 15 MeV.

The Model 037 has two pairs of asymmetrical imbedded fiducial markers and a central fiducial split in half at the phantom isocenter to aid you during pre-irradiation imaging. You can also align the imaged fiducials (from a CBCT, ExacTrac®, or kV images) and compare them to the reference image of the phantom in order to make more accurate shifts of the phantom with the linear accelerator couch top. The phantom receives radiochromic film to as many as 29 locations in 5mm increments. Pre-loaded polyester film sheets allow flexibility in film placement without affecting sensitive geometry. External grooves and marking on the phantom sides helps with easy film positioning at only desired locations to cover specific lesions. Film allows multiple planning target volumes (PTVs) to be reviewed individually.

Four assembly rods, each made of different materials, allows for orientation and registration to ExacTrac® systems

Features

- Receives up to 29 GafChromic films
- Allows dose measurements to multiple targets with single delivery
- Alignment marks for repeatable set up with sub-millimeter accuracy
- Pre-loaded polyester sheets allow flexibility in number and location of films
- Accurate film registration marking for dose distribution to treatment plan verification



Clinical Images of Multi-Lesion Brain QA Phantom for SRS

*ExacTrac® is a registered trademark of Brainlab (Munich, DE)

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.

Precision Cut EBT3 GafChromic Film

PRECISION CUT

Now clinicians and researchers can save valuable time and avoid the tedious task of film preparation. CIRS offers Precision Cut radiochromic film.

For small field dosimetry, Film offers a unique advantage over dosimeters because of it's high spatial resolution and dynamic range[1]. These qualities make film a popular solution in many radiotherapy departments.

FILM CONFIGURATIONS

CIRS Precision Cut Film is laser cut and designed to fit within the constructs of a specified phantom. CIRS currently has film configurations for many phantom models and components:

- E2E SBRT Phantom, Model 036S & 036-01
- SRS Multi-Lesion QA Phantom, Model 037
- Stereotactic End-to-End Verification Phantom, Model 038
- IMRT Phantoms, Model 002 Series

USE OF FILM

Each film package includes six calibration strips, which are manufactured from the same film lot. Film calibration can be done once for all included films.

CARE AND HANDLING

Great care is taken in handling all film, including maintaining film orientation, minimal exposure to UV light, and shielding from skin oils and environmental effects. While film can withstand limited exposure to interior light[2], it is recommended that film be stored in provided envelopes and packaging to avoid noticeable effects.

REFERENCES

1. Martin J Butson, Peter K.N Yu, Tsang Cheung, Peter Met- calfe, Radiochromic film for medical radiation dosimetry, Materials Science and Engineering: R: Reports, Volume 41, Issues 3–5, 25 September 2003, Pages 61-120, ISSN 0927-796X, http://dx.doi.org/10.1016/S0927-796X(03)00034-2.

2. GafchromicTM Dosimetry Media, Type Ebt-3. http://www. ashland.com/Ashland/Content/Documents/ASI/Other- Medical/EBT3_Speci cations. pdf

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
- IBA
- Multidata
- Nuclear Enterprise
- Philips
- Best Medical
- PTW
- Radcal
- RTI
- Scanditronix
- Standard Imaging
- Sun Nuclear
- Thompson Neilson
- Victoreen
- Wellhofer

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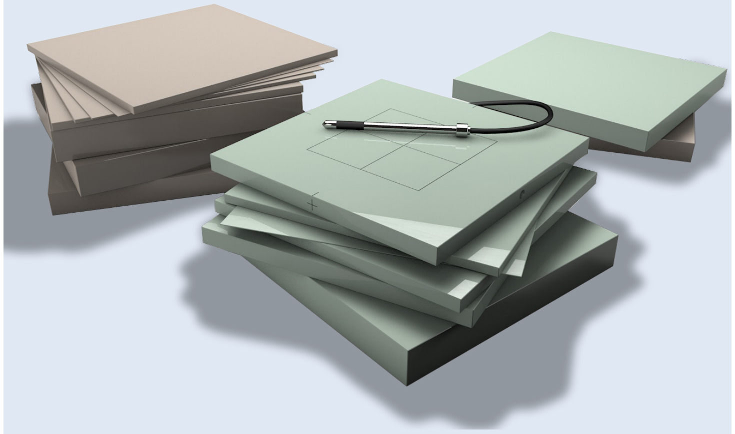
Plastic Water®



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. See page 20 for list of standard cavities. Custom cavities are available to accommodate any ion chamber on the market (simply provide detailed drawings when ordering).

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

Plastic Water LR (15 keV - 8 MeV)- Liquid water equivalency at photon energies for dose evaluation of low energy brachytherapy sources, CT and Radiation Therapy up to 20MV.

PLASTIC WATER®

Plastic Water - Original (150 keV - 100 MeV) - Permits calibration of photon and electron beams within 0.5% of true water dose. Ideal for routine beam constancy checks.

PLASTIC WATER® DT

Plastic Water-DT (50 keV - 20 MeV)- Designed to meet the demands of VMAT/IMRT verification techniques where it is desirable to match attenuation and absorption properties in both the diagnostic (CT) and RT energy ranges up to 30 MV.

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

Tello VM. How water equivalent are water-equivalent solid materials for output calibration of photon and electron beams? Medical Physics. 1995; 22(7)

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

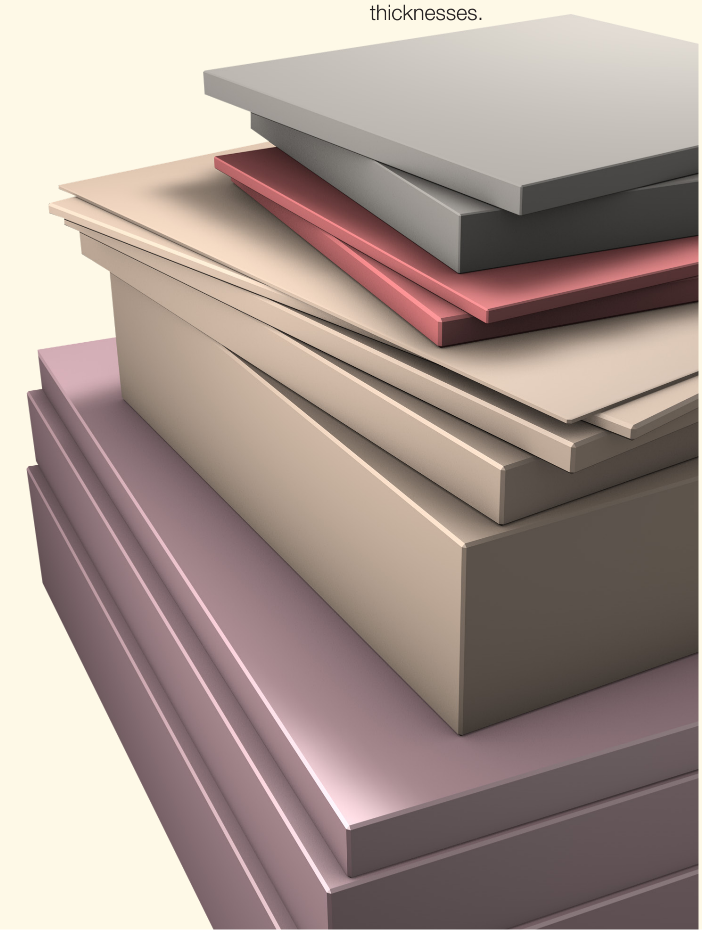
Bone
- Average
- Cortical
- Trabecular

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.



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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/cm^2), 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.

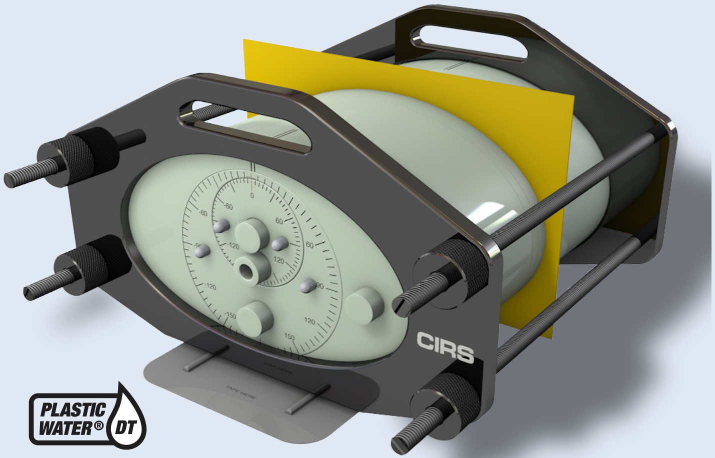
The phantom uses a CHA insert for direct assessment of bone density accuracy. The CHA insert is compliant with FDA guidelines for cross-calibration phantoms for clinical trials. Each insert is machine processed, guaranteeing manufacturing precision.

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.

IMRT Head & Torso Freepoint Phantom



Model 002H9K

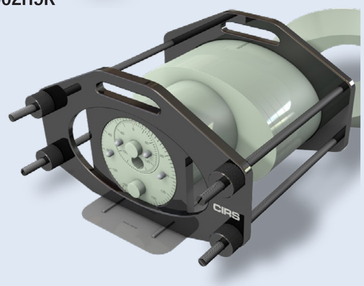
The Model 002H9K can be configured for torso or head and neck set-ups. The phantom simulates the patient through the entire IMRT process from CT data acquisition and planning to delivery and dose verification.

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 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



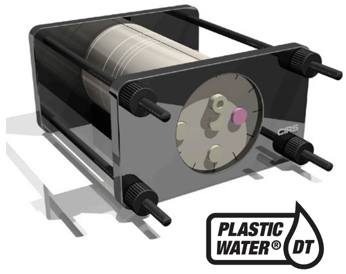
Head and Neck configuration

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

*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.

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, 1cm
1	End slab, 1.6cm
5	Water equivalent solid rod inserts
1	Bone equivalent solid rod insert
1	Alignment base
1	Holding device

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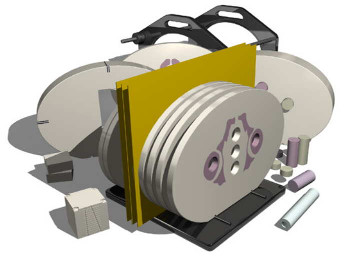
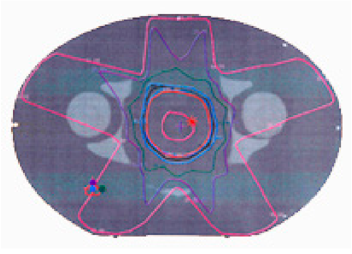
IMRT Pelvic 3D Phantom



Model 002PRA

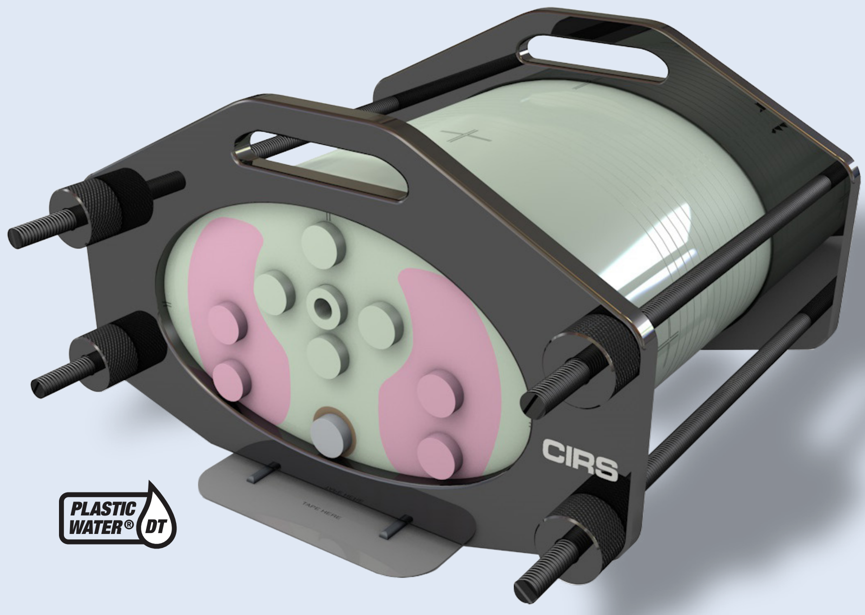
The Pelvic 3D Phantom properly represents pelvic anatomy with a tissue equivalent three-dimensional skeleton. Five rod locations are available in the sensitive areas and up to 10 Ready-Pack films can be positioned within the pelvic region. Rectum balloon can also be represented by empty hole.

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® film [1]. Additional inserts are available to support a variety of other detectors including TLD's, MOSFET, and diodes.

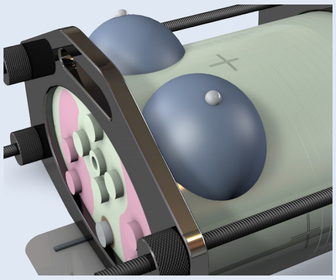
Handling, assembly and proper orientation of the phantom is made easy with the use of a unique alignment base and holding device. The surfaces of the phantom are marked for ease of laser alignment. CT markers are included to ensure accurate film to plan registration on the center film.

Features:

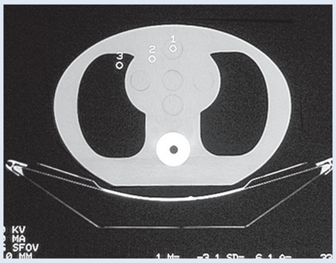
- Verify heterogeneity corrections
- Correlate CTU to electron density
- Check dose distributions in sensitive areas
- Check depth doses and absolute dose
- 2D and 3D isodoses
- Calibrate film with ion chamber & other detectors*
- Verify individual patient treatment plans

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



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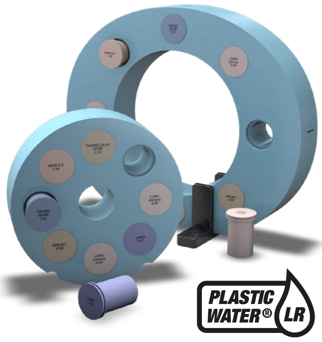
Electron Density Phantom



Model 062M

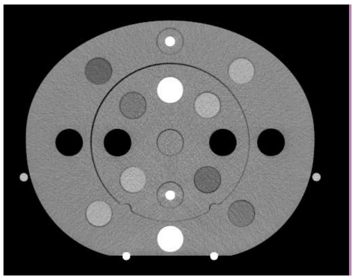
Correlate CT number and tissue electron density

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).

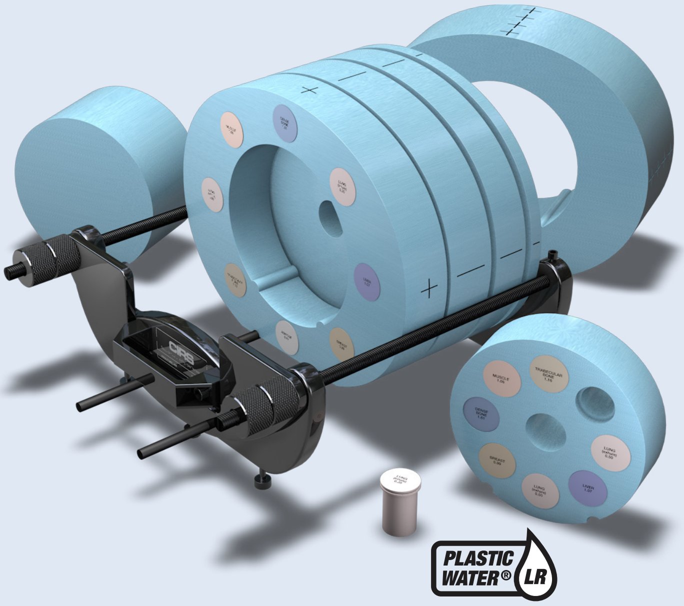
The Model 062M consists of 2 nested disks made from Plastic Water®-LR. They can represent both head and abdomen configurations. Nine different tissue-equivalent electron density plugs can be positioned at 17 different locations within the scan field. Included is a water vial plug that can be filled with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



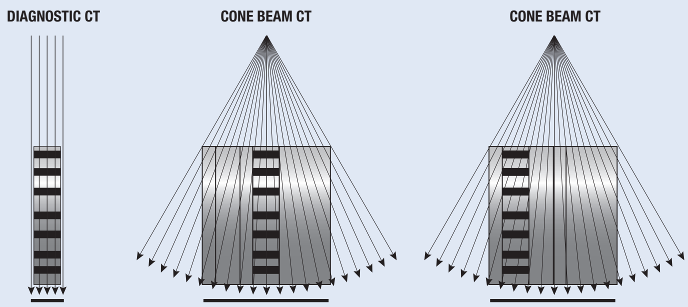
Model 062MA

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 adaptation 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.

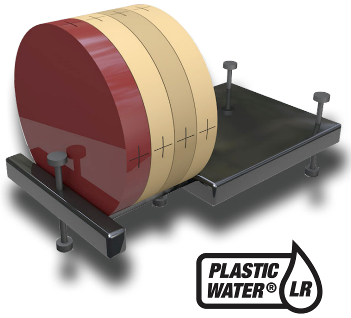
The Model 062MA CBCT Electron Density Phantom's size covers geometries for imagers with dimensions of up to 40 cm x 40 cm. It is made of Plastic Water®-LR and contains the same set of tissue equivalent electron density inserts as the standard Model 062M. Additional interchangeable slabs allow for repositioning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



CBCT Electron Density Phantom Central Axis Configuration

CBCT Electron Density Phantom Offset Configuration

CBCT Image Quality Phantom

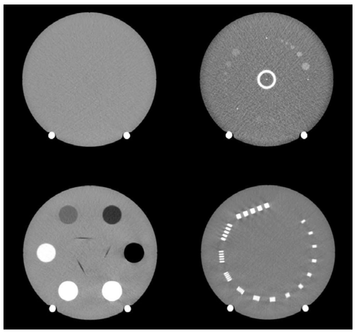


Model 062QA-35

Quality Assurance for Volumetric and Axial CT

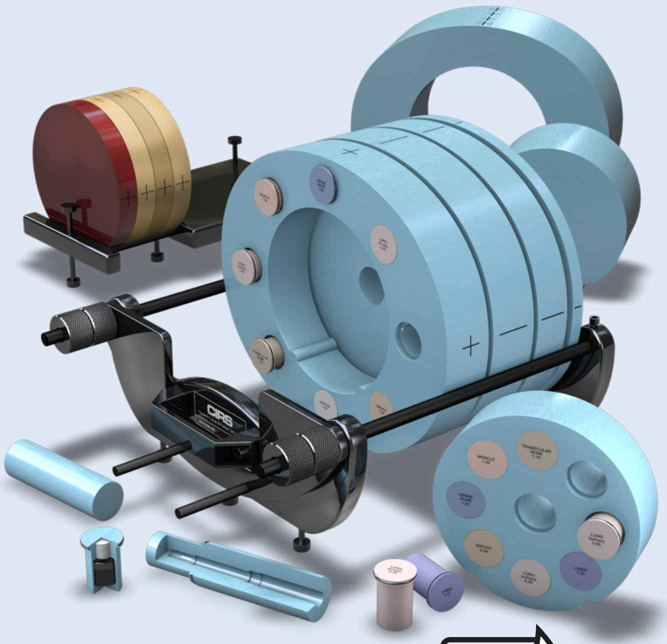
The purpose of image quality measurements is to quantify various image quality indicators for 3D images taken from a selection of acquisition and reconstruction settings representative of clinical practices. Assessment of the image quality parameters over time can show trends in variation of said parameters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



PLASTIC WATER® LR

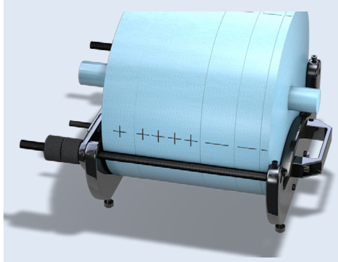
Model 062MQA

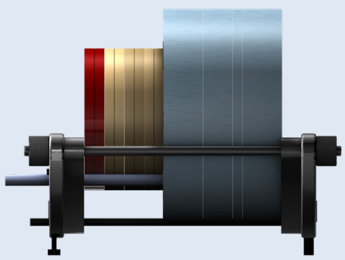
Minimize dose, increase quality and enhance outcomes

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.

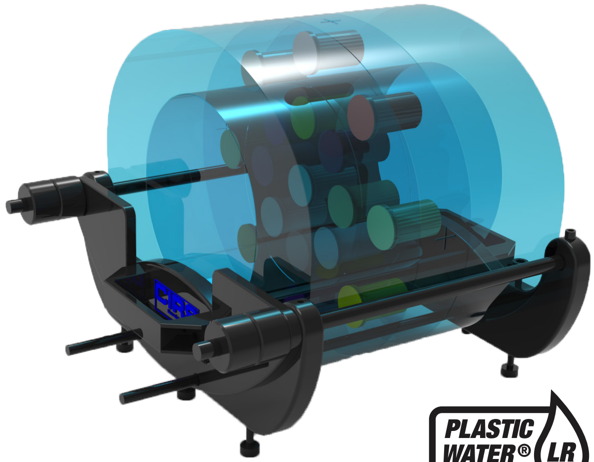
The 062MQA CBCT Electron Density & Image Quality Phantom incorporates 3 phantoms:

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





Multi-Energy CT Phantom (MECT)



PLASTIC WATER® LR

Model 662

Comprehensive QC for Multi-Energy CT

Multi-Energy CT offers a great improvement in advanced recognition, differentiation, quantification of human tissues and different contrast agents based on their linear attenuation at the different X-Ray energies. A Quality Control program using appropriate phantoms, is important to ensure accuracy and reproducibility for ME CT scanner performance.

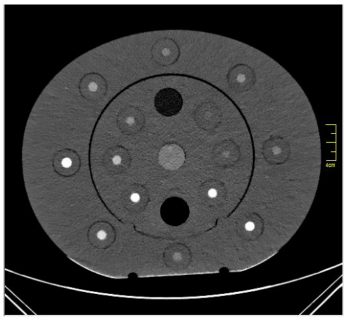
The CIRS Multi-Energy CT (MECT) phantom is designed to assure accurate performance and consistency of Multi-Energy CT scans. The phantom facilitates evaluation of scanner performance allowing users to verify the quantitative accuracy of multi-energy scans, check for artifacts in an extended field-of-view and compare the consistency and stability across different scanners.

Our phantom consists of nested disks made from CIRS Plastic Water® -LR, representing both head and abdomen configurations. Two 10 cm thick sections surround a 5 cm target section for proper scattering conditions.

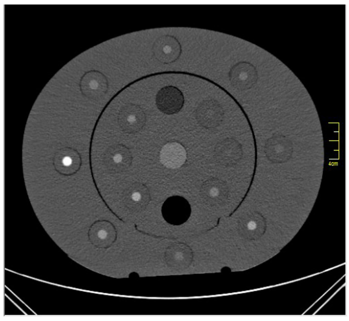
A holder/support stand (062MA-30) that allows for adding additional sections from CIRS model 062 phantom and a soft carry case are also included with our phantom.

Features:

- Iodine, calcium, blood, & adipose inserts allow for testing tissue discrimination
- Verify quantitative accuracy & clinical protocols
- Verify performance reproducibility for a single scanner and across departments
- High accuracy in Iodine and Calcium inserts by minimizing “beam hardening”
- Allows for variable insert positioning
- Various inserts from CIRS 062M/MA can be used for extensive testing
- Imaging QA Phantom (CIRS 062QA-35) can be nested inside scattering section



MONO-ENERGETIC 50 KEV SCAN



MONO-ENERGETIC 100 KEV SCAN

Phantom Patient for VMAT & IMRT

SHANE
SHOULDERS, HEAD AND NECK, END-TO-END

SRS/SRT
SCAN
PLAN
LOCALIZE
TREAT

Model 136500

The CIRS Shoulder, Head and Neck End-to-End Verification Phantom (SHANE) is designed for end-to-end testing of treatment planning systems. The phantom can be used for every step in this process from imaging acquisition to dosimetry verification and patient-specific QA during head-and-neck VMAT and IMRT procedures.

The head and shoulders are cut in the coronal plane to receive large radiochromic or radiographic film for treatment plan verification. The phantom also receives ion chambers or other detectors, which can be positioned in four parallel holes drilled through the phantom in Inferior-Superior direction.

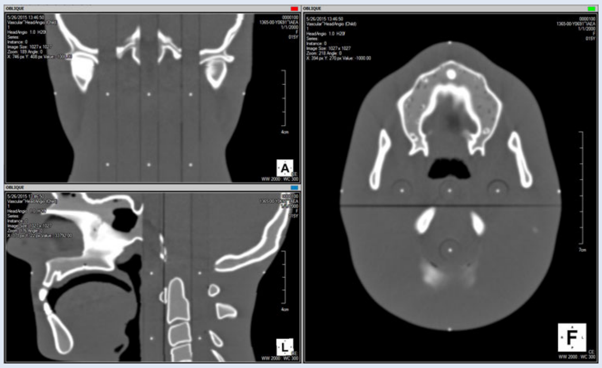
The high-fidelity anthropomorphic design contains complex internal anatomy that provides a realistic clinical simulation to evaluate the challenging effects of intra- and extra-cranial anatomies.

Head and shoulder portions are manufactured as a single piece to enable use with various fixation devices. The shoulder portion contains thoracic vertebras, which enable TPS verification to the level of T2 vertebra. Shoulders also include tissue inserts for electron density calibration.

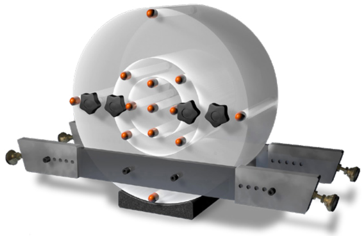
The phantom comes with carry case and 48-month warranty.

Benefits

- High fidelity phantom-patient
- Suitable for use with various commercially available fixation devices
- Enables dose measurements in large regions of head and neck through use of radio-graphic film
- Allows dose measurements with ion chambers
- Performs Electron Density calibration in shoulders



CT Dose Phantom



Model 007A

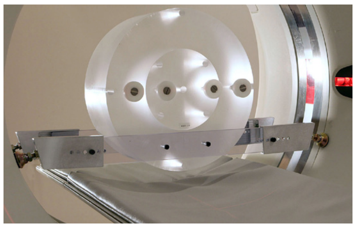
Comply with FDA performance standard

For all computed tomography systems, the FDA recommends measuring the CT Dose Index (CTDI). With this in mind, each section of our CIRS CT Dose Phantom can provide separate dose information. The user can also measure maximum, minimum and mid-range values of the nominal tomographic section thick-ness when performing dose profile measurements.

The phantom consists of a 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. Our Model 007A additionally 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, and acrylic rods are pro-vided to plug the holes when not in use. The acrylic rods are machined to receive 1 mm diameter TLD rods.

The Model 007A is manufactured to comply with the FDA's performance standard, 21 CFR 1020.33 that de-tails 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.

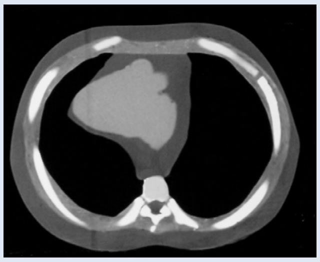
3D Sectional Torso Phantom

Model 600

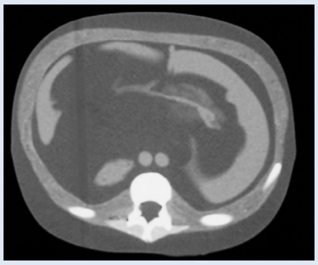
Includes 12 internal organ tissues

The CIRS Model 600 Anthro-pomorphic Torso Phantom is designed to provide an accurate simulation of an average torso (22 cm posterior-anterior thick-ness) 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).

The Model 600 includes internal organ structures such as the lungs, heart, liver, kidneys, spleen and pancreas. All simulated or-gans match the tissue density of actual organs and can be clearly visualized.



CT of Heart Level Section



CT of Liver Level Section

CT of Kidney Level Section

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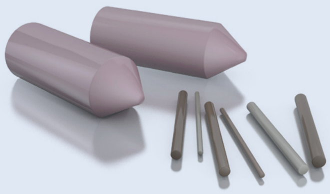
RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

MicroMouse™ Phantoms



Model 090 & 092 Kit

Standard of reference for Micro-CT scanners

Micro-CT systems deliver precise, accurate and high-resolution measurements. The field of view of these systems requires appropriately scaled QA phantoms. The CIRS Model 090, MicroMouse™, provides 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.

The MicroMouse Phantom contains 11 rods of varying mineral loading and dimension. It 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 11 Micro-CT rods used in Model 090 are also available to purchase separately as the Model 092 as a kit of individually packaged rods.

Gillian QA Phantom

Model 802

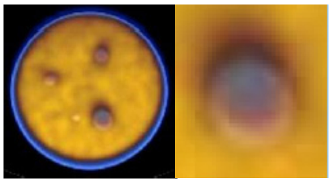
Evaluate image distortion and alignment

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:

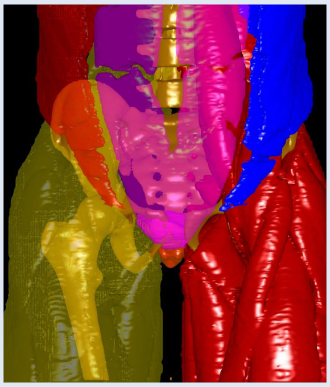
King's College Hospital NHS
NHS Foundation Trust

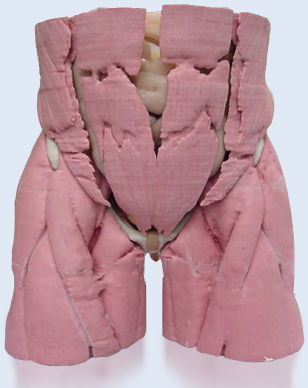
Virtual Human Male Pelvis Phantom

Model 801-P

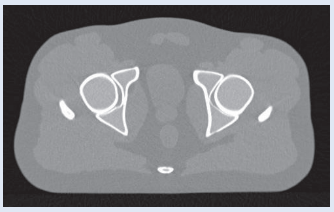
Validate IGRT Systems

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.



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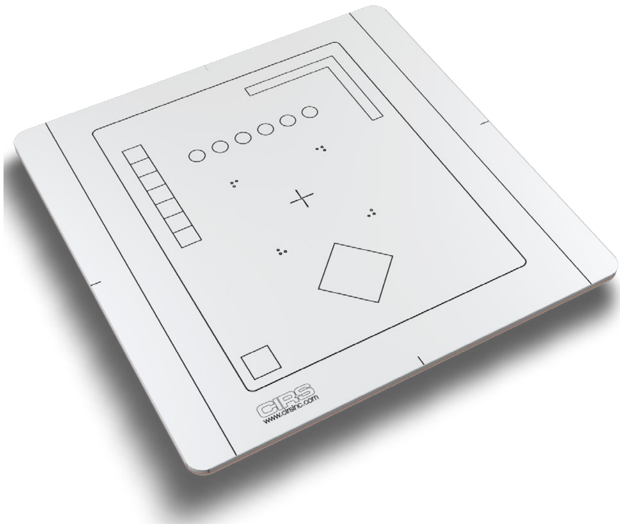
DR QC Phantom



Model 139702

Quality Assurance for DR systems

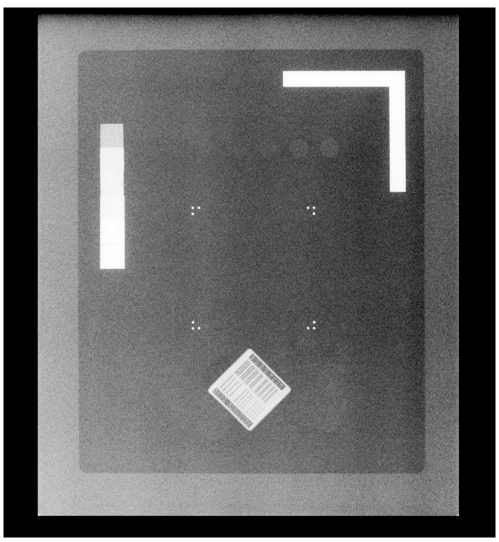
The CIRS DR QC Phantom allows comprehensive quality assurance testing for DR Detectors and associated software.

The phantom enables seven quality assurance assessments for monthly and semi-annual evaluation, including exposure linearity and sensitivity, high and low contrast reproducibility, artifact and residual image detection, image resolution, collimator beam alignment, measurement tool accuracy, and display jitter QA testing. The linepair target, 0.10 mm Pb thickness, allows for more comprehensive high contrast resolution assessment.

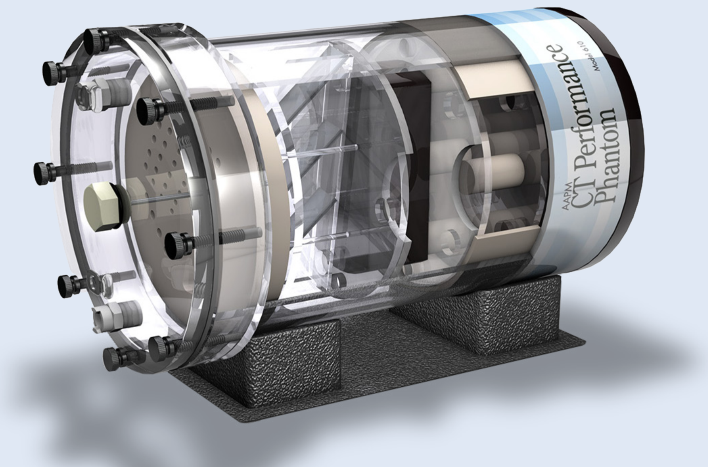
The CIRS DR QC Phantom measures 17” x 17” x 0.5” and allows for quick checks on 14”x 17” or 17” x 17” DR systems. Lead content has been minimized to meet European regulations.

Features

- Allows testing of 14”x17” (35 x 43 cm) and 17”x17” (35 x 35 cm) DR systems
- Includes test objects for seven quality assurance tests
- Complies with German standards DIN 6868-58 and DIN 6868-13
- Contains DIN Type 38 Linepair target
- Minimized lead content to meet European regulations
- No moving parts
- Testing parameters and QC Report forms provided



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.”

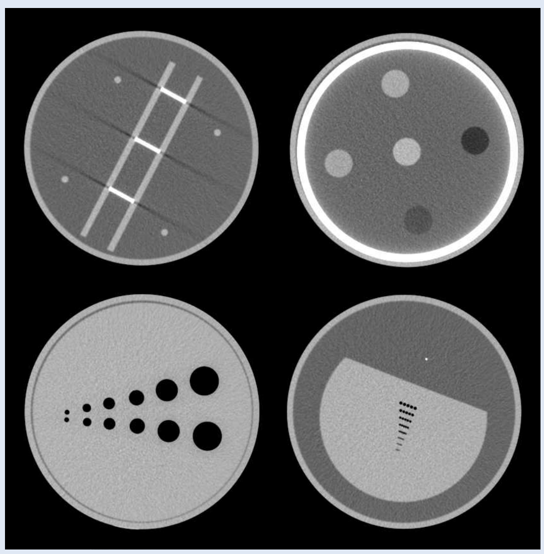
A CT number linearity insert, high contrast resolution insert and slice width insert are housed in an 8.5” diameter PMMA water tank with quick disconnect valves for ease of filling and draining between use. Also included is a 0.25” bone equivalent ring that can be fit over the inserts to evaluate the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



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RADIATION THERAPY, DIAGNOSTIC CT, X-RAY & FLUOROSCOPY

NEMA SCA&I Cardiovascular Fluoroscopic Benchmark Phantom

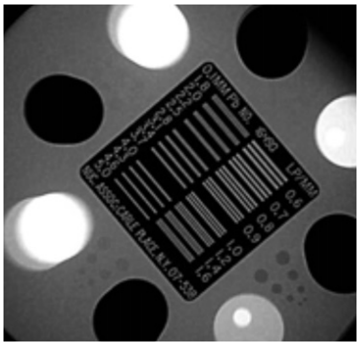
Model 901

For voluntary compliance with NEMA XR 21

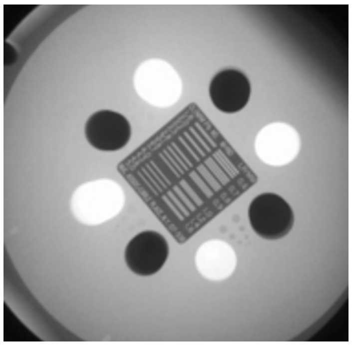
The NEMA-SCA&I phantom is designed to evaluate and standardize catheterization image quality. It is the result of collaborative efforts between the Society for Cardiac Angiography and Interventions and the National Electric Manufacturers Association. The phantom specifically enables voluntary compliance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

Radiography Fluoroscopy QA Phantom

Model 903

Solid assessment tool for x-ray image quality programs

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

The Radiography / Fluoroscopy 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 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 & Fluoroscopy 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

Includes:

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

Options:

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

Multi-Purpose Multi-Tissue Ultrasound Phantom

Model 040GSE

The Standard for Ultrasound Quality Assurance

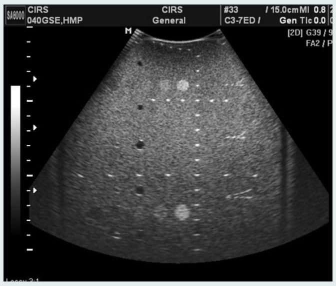
The CIRS Model 040GSE Multi-Purpose, Multi-Tissue Ultrasound Phantom is the most complete solution available for performance and quality assurance testing. Its dual frequency design and detachable water wells allows testing of most transducer shapes – including curvilinear and endocavity – and frequencies. It is also the only QA phantom on the market that provides both elasticity targets and all the standard B-mode imaging test objects.

The phantom is made of CIRS' proprietary Zerdine® hydrogel polymer, which has been formulated to provide tissue mimicking properties including compatibility with harmonic imaging. To maximize phantom lifetime, this gel is contained in a rugged ABS plastic housing with a Saran-based laminate membrane.

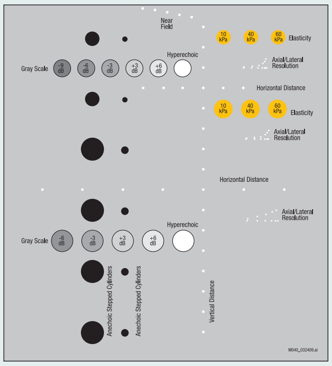
Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Elevational Resolution
- Contrast Resolution
- Grayscale Contrast Sensitivity
- Elasticity Sensitivity
- Dead Zone Assessment

(1) US Patent # 5196343



Overall Ultrasound image of Model 040GSE



Multi-Purpose Phantom

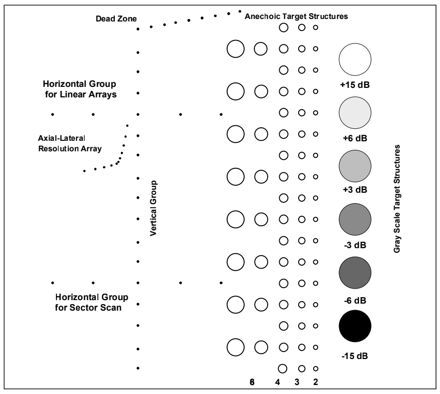
Model 539

The Model 539 Multipurpose phantom is an easy, comprehensive means of evaluating imaging systems over most clinical imaging frequencies (approximately 2-20 MHz).

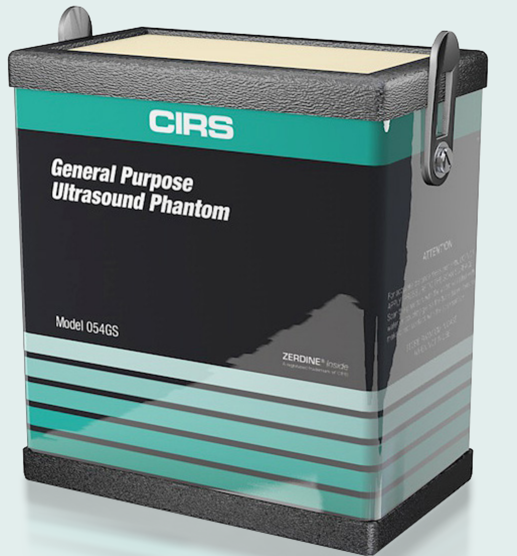
The phantom is designed with a combination of monofilament line targets for distance measurements and tissue mimicking target structures of varying sizes and contrasts. Cystic-like target structures are positioned in-line vertically, thereby permitting an entire target group to be displayed in one view. Due to the acoustic similarity of the background material and the target structures, artifacts caused by distortion, shadowing or enhancement have been eliminated. Six gray scale targets ranging in contrast from +15 to -15 dB are provided to evaluate the system's displayed dynamic range and gray scale processing performance. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Elevational Resolution
- Contrast Resolution
- Grayscale Contrast Sensitivity
- Dead Zone Assessment



General Purpose Ultrasound Phantom



Model 054GS

Exceed ACR Accreditation Requirements

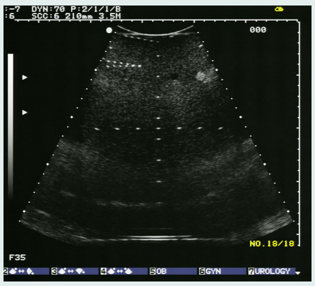
The CIRS Model 054GS General Purpose Ultrasound Phantom contains gray scale targets and improved sensitivity targets that exceed the phantom requirements outlined in the ACR accreditation program.

The phantom is made of CIRS' proprietary Zerdine® hydrogel polymer, which has been formulated to provide tissue mimicking properties including compatibility with harmonic imaging. To maximize phantom lifetime, this gel is contained in a rugged ABS plastic housing with a Saran-based laminate membrane.

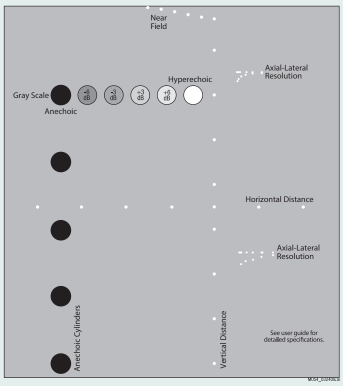
(1) US Patent # 5196343

Key Tests:

- 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



Multi-Purpose Endoscopic Phantom

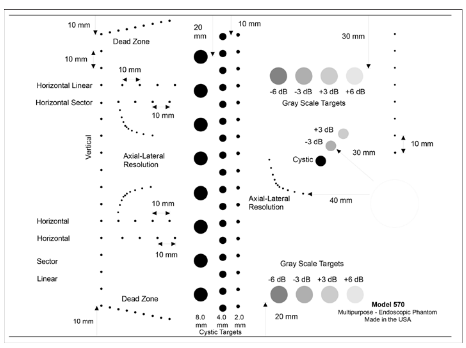
Model 570

The Model 570 Multipurpose & Endoscopic phantom is an easy, comprehensive means of evaluating imaging systems over most clinical imaging frequencies (approximately 2-20 MHz). The phantom is designed with a combination of monofilament line targets for distance measurements and tissue mimicking target structures of varying sizes and contrasts. Due to the acoustic similarity of the background material and the target structures, artifacts caused by distortion, shadowing and enhancement have been eliminated. Four gray scale targets ranging in contrast from +6 to -3 dB are provided to evaluate the system's displayed dynamic range and gray scale processing performance.

The Model 570 offers a new and improved scan surface design to easily accommodate linear, sector, endoscopic probes and mechanical sector probes such as used for rectal scanning. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Measurement Calibration
- Horizontal Measurement Calibration Linear
- Axial and Lateral Resolution
- Horizontal Measurement Calibration Sector
- Contrast Resolution
- Grayscale Contrast Sensitivity
- Dead Zone Assessment



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ATS LABORATORIES A CIRS COMPANY

ATS Laboratories Is Now Part of CIRS

CIRS, Inc. has acquired ATS Laboratories, of Bridgeport, Connecticut. The merger brings together both company's technologies, providing a new level of choice in ultrasonic tissue mimicking materials while maintaining the same level of quality and customer service that ATS and CIRS customers have come to expect.

Features of Zerdine® Hydrogel and ATS Urethane Rubber

Speed of Sound

All ultrasound machines use the speed of sound to convert time that an echo returns to a probe into a distance measurement. Most machines assume a sound velocity of 1540 m/s, the average speed of sound through human soft tissue, to make this conversion. The standard formulation of ATS Urethane Rubber has a sound velocity of 1450 m/s at room temperature (23 C), while a standard Zerdine® formulation has a sound speed of 1540 m/s at room temperature.

Because the speed of sound in ATS Urethane Rubber does not match the assumed speed of sound, the design of rubber phantoms must compensate for this difference. Adjusting the physical position of line targets and anechoic target structures allows users to make horizontal and vertical distance accuracy measurements. Unfortunately, the sound speed difference also results in a loss of image resolution, because most diagnostic imaging systems use the tissue-average sound speed to calculate where to send and focus ultrasound beams when forming images. Some newer ultrasound systems have a feature called aberration correction that provides better image quality in fatty tissue; this feature can be used with ATS Urethane Rubber to eliminate this loss of resolution. In Zerdine®-based phantoms, these corrections are not necessary.

Stability

Zerdine® is the most stable hydrogel material on the market, and many Zerdine phantoms provide over a decade of useful service. The main failure mode with Zerdine® is water vapor loss through the membrane (or through a damaged housing). CIRS recommends periodically weighing your Zerdine phantom to check for signs of desiccation. Early signs of water loss (about 1%) can easily be corrected by adjusting storage conditions. Phantoms with water vapor loss exceeding 2% should be returned to CIRS for evaluation. In most cases, these phantoms can be repaired.

Urethane rubber has no such concerns with water vapor loss. The acoustic properties of ATS Urethane Rubber production batches have been continually tested since 1995, and in all cases these batch samples have remained within tolerance (± 1% for speed of sound, ±10% for attenuation). Mechanical damage to a phantom housing will not cause the ATS Urethane Rubber to change properties, and damaged phantoms can usually be repaired.

Effect of Temperature

The acoustic properties of all materials are affected by changes in temperature. Most diagnostic imaging systems and tissue-mimicking phantoms are calibrated at average room temperature (23 C). The speed of sound in ATS Urethane Rubber is more strongly influenced by temperature changes than Zerdine, and so all ATS Urethane Rubber phantoms include a thermometer strip affixed to the outside of the housing to indicate actual room temperature.

If a phantom is left in extreme temperatures for extended periods, wait approximately 24 hours for the phantom to reach room temperature to ensure the full phantom interior has reached room temperature.

Exposure to extreme temperatures will not damage urethane rubber phantoms. Zerdine® hydrogel phantoms may be damaged by the freeze/thaw cycle if allowed to freeze. High temperatures will not cause Zerdine® to melt (unlike other hydrogels), but they will cause the phantom to dry out faster than normal.

Specifications	Zerdine® Hydrogel	ATS Urethane Rubber	Notes
Speed of sound	1540 m/s	1450 m/s	See "Speed of Sound"
Elastography and multi-modality formulations	Excellent	Limited	Zerdine® is easily formulated to provide a range of elasticities. It can also be formulated for tissue-mimicking contrast in MRI and CT applications.
Desiccation	Yes	No	Zerdine® phantoms come with durable vapor barrier membranes that protect from desiccation; airtight carry cases provide additional protection. Phantoms must still be handled with care.
Durability	Very good	Excellent	See Stability
Warranty	4 years	10 years	
Effect of Temperature	May freeze with exposure to low temperatures	Durable, measurements sensitive to temperatures	See "Effect of Temperature"

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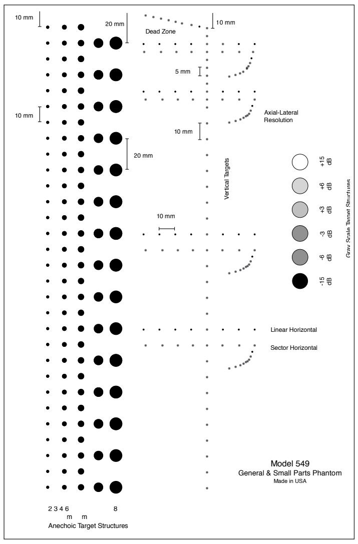
General & Small Parts Phantom

Model 549

The Model 549 General & Small Parts phantom combines a 30cm depth of field needed to test lower-frequencey imaging probes (2-7.5 MHz) with small features in the first 6 cm to test small parts probes (7.5-20 MHz).The scanning wells when filled with water provide an ideal means to evaluate endoscopic probes. Simply lie the active area of the transducer onto the surface of the phantom. The procedure is the same as for any standard linear transducer.

The Model 549 is designed with a combination of monofilament line targets for distance measurements and tissue mimicking target structures of varying sizes and contrasts. One hundred and twenty (120) cystic-like target structures are positioned in-line vertically, thereby permitting an entire target group to be displayed in one view. Due to the acoustic similarity of the background material and the target structures, artifacts caused by distortion, shadowing or enhancement have been eliminated.

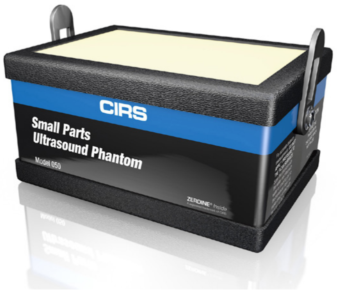
Six gray scale targets ranging in contrast from +15 to -15 dB are provided to evaluate the system's displayed dynamic range and gray scale processing performance. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.



Key Tests

- Uniformity
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Elevational Resolution
- Contrast Resolution
- Grayscale Contrast Sensitivity & Displayed Dynamic Range
- Dead Zone Assessment

Small Parts Ultrasound Phantom



Model 050

QA standard for high frequency probes

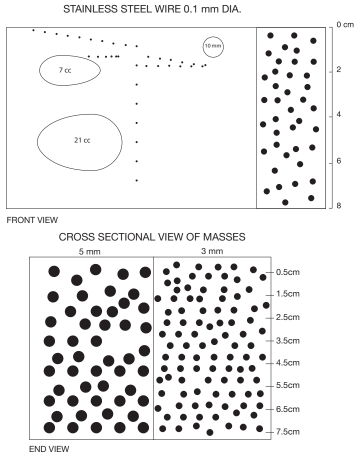
The CIRS Small Parts Ultrasound Phantom features a compact design ideal for high-resolution imaging systems with limited depth of penetration.

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. These masses are made from Zerdine with a different contrast and attenuation relative to the background material.

[1] US Patent # 5196343



Small Parts Phantom

Model 551

Model 551 provides a comprehensive means of evaluating the performance of higher frequency (approximately 7.5- 20 MHz) ultrasound systems designed to detect small anatomic features.

The Small Parts Phantom is designed with a combination of monofilament line targets and tissue mimicking cylindrical targets of varying sizes and contrasts. The monofilament line targets have a diameter of 0.05 mm, to optimize the displayed image at frequencies of 7.5 MHz or greater. Four groups of line targets are provided to evaluate the vertical and horizontal calibration measurements, dead zone and axial-lateral resolution. The model 551 provides enhanced axial-lateral resolution targets (down to 0.25mm spacing) over the standard axial-lateral targets over the 551.

The Model 551 is constructed of our rubber-base tissue mimicking material to provide a phantom which is accurate, durable and maintenance free. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years

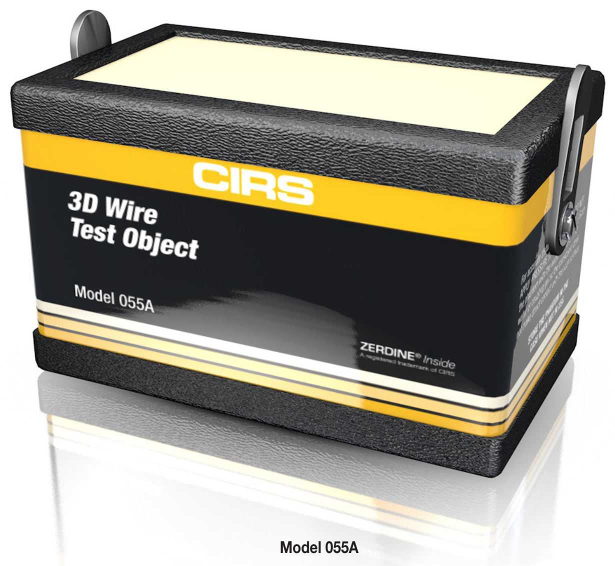
Key Tests

- Uniformity
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Elevational Resolution
- Contrast Resolution
- Grayscale Contrast Sensitivity
- Dead Zone Assessment

2D & 3D Volumetric Evaluation Ultrasound Phantom

2D & 3D Wire Target Evaluation Ultrasound Phantom

Model 055



Model 055A

Designed for Compliance with AIUM Standards

The CIRS Model 055 3D Ultrasound Calibration Phantom and 055A 3D Wire Test Object, may be used to perform the following tests of the accuracy of spatial measurements, which is especially for 3-D and 4-D ultrasound systems equipped with spatial encoding algorithms.

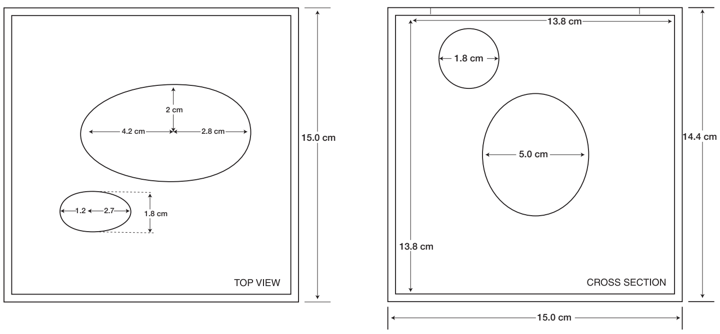
In the Model 055, these tests are performed with the aid of three volumetric targets, while in the Model 055A they are performed using wire targets. The test methodology is described in the AIUM publication "Standard Methods for Calibration of 2-Dimensional and 3-Dimensional Spatial Measurement Capabilities of Pulse Echo Ultrasound Imaging Systems," which is provided with the phantoms. The phantoms may be purchased separately or as part of a set, and may also be used to perform Image uniformity and depth of penetration tests.

Both phantoms are made of CIRS, proprietary Zerdine® hydrogel polymer, which has been formulated to provide tissue mimicking properties including compatibility with harmonic imaging. To maximize phantom lifetime, this gel is contained in a rugged ABS plastic housing with a Saran-based laminate membrane.

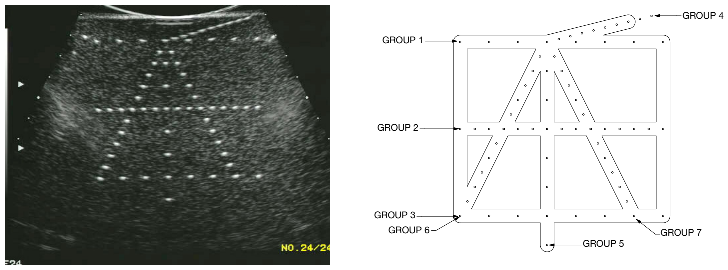
CIRS ultrasound QA phantoms come standard with a robust housing, carry case, 48-month warranty, and user guide.

Key Tests with Models 055 & 055A

- Linear Distance
- Perimeter
- Area
- Surface Area
- Volume



Model 055



Model 055A

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3D Calibration Phantom

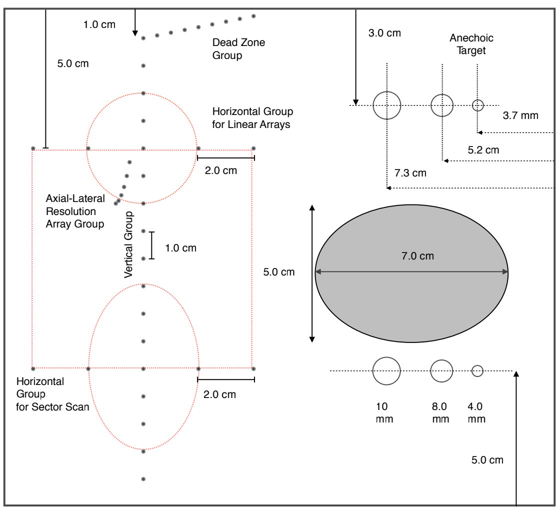
Model 560H

The Model 560H rubber-based, tissue-mimicking (TM) phantom provides a basic means of evaluating an imaging system's performance along with its 3D volumetric measurements.

The phantom combines monofilament line targets, six non-echogenic cylindrical targets of varying sizes and a 3D egg-shaped target structure. The monofilament targets have a diameter of 0.12 mm and are arranged in four groups of line targets to evaluate the vertical and horizontal calibration measurements, axial-lateral resolution and the dead zone. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Contrast Resolution
- Volume Measurements
- Dead Zone Assessment



Brachytherapy QA Phantom

Model 045A

Perform QA on sidefire transrectal probes

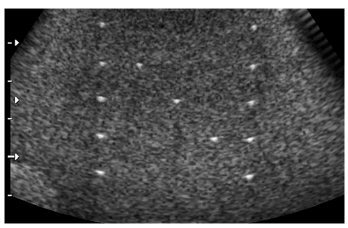
A robust quality assurance prostate brachytherapy QA program is essential to ensure accurate image-guidance and dosimetry calculations. The CIRS Model 045A, offers a complete solution for implementing a QA program specific to transrectal ultrasound used for guidance of prostate brachytherapy, as recommended by AAPM Task Group 128[1].

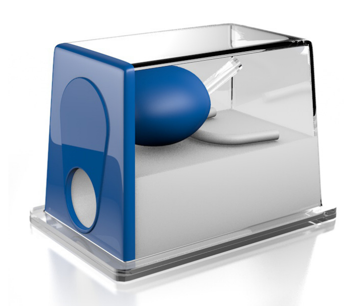
The phantom is made of CIRS' proprietary Zerdine®2 hydrogel polymer, which has been formulated to provide tissue mimicking properties including compatibility with harmonic imaging. To maximize phantom lifetime, this gel is contained in a rugged ABS plastic housing with a Saran based laminate membrane.

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

Consistency Measurements:

- Depth of Penetration
- Axial and Lateral Resolution
- Distance Measurement Accuracy
- Area Measurements
- Volume Measurements
- Geometric Consistency with the treatment-planning computer





Complete your QA solution by also purchasing the Model 053 to verify alignment of the physical needle template with the electronic grid (see page 43).

Shear Wave Liver Fibrosis Phantoms

Model 039

Measure known tissue elasticities with shearwave systems

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. The design of the Shear Wave Liver Fibrosis Phantom, Model 039, was developed and validated in a joint study sponsored by the Quantitative Imaging Biomarker Alliance, and serves as the standard reference tool for determining sources of variance in shear wave elasticity measurements (see references on next page).

The Model 039 consists of four phantoms – each filled with Zerdine® gel formulated with differing values of Young's modulus, a tissue-average speed of sound of 1540 m/s and speckle contrast levels matching that of a healthy liver.

Certification of shear wave speed will be provided with each phantom, with tests run on Verasonics Vantage™ research platform running open source code developed for the Quantitative Imaging Biomarkers Alliance (QIBA) Ultrasound Shear Wave Speed Committee. The certification sheet provides the full dispersive analysis of shear wave speed, allowing performance assessment at different frequencies.

Key Features

- Set of 4 phantoms, each with a different stiffness (Young's modulus ranges from 3 – 48 kPa)
- Enables quantitative assessment of shear wave speed measurements used in the diagnosis of diffuse liver disease
- Certified measurement of shear wave speed according to protocol developed by Quantitative Imaging Biomarkers Alliance Ultrasound Shear Wave Speed committee
- Re-certification of phantoms available

Hall TJ, Milkowski A, Garra B, et al. RSNA/QIBA: Shear wave speed as a bi marker for liver fibrosis staging. Prague. IEEE Int Ult Symp; 2013..

Elasticity QA Phantom

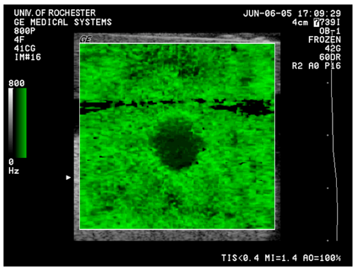
Model 049 & 049A

Developed to provide users with acoustic targets of discrete known stiffness

The Model 049 and 049A Elasticity QA Phantoms are tools developed for both shear wave and compression elastography. These are the only phantoms commercially available for sonoelastography quality assurance. The phantoms contain targets of known stiffness relative to the background material and range in stiffness, diameter and depth.

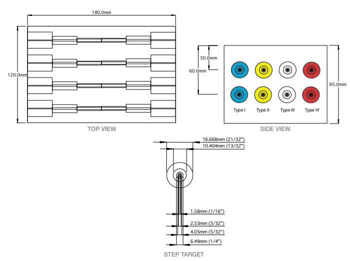
The Model 049 is a basic QA phantom as it contains two sizes of spheres positioned at two different depths. At each depth there are two spheres that are softer than the background and two that are harder than the background.

For a broader range of target sizes, the Model 049A phantom has stepped mass targets instead of spheres. Each stepped mass consists of six diameters so that you can evaluate the ability to visualize targets that are located at the same depth and have the same relative stiffness but vary in diameter.

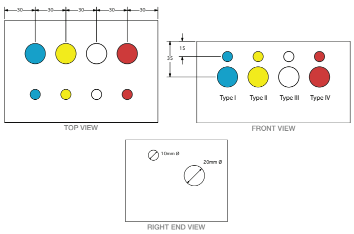


Suitable for

- Determining dynamic range
- Checking system performance over time
- Training and demonstrating of system features
- Research and development



Model 049A-Stepped Cylinder



Model 049-Spherical Cylinder

Resolution & Penetration Phantom

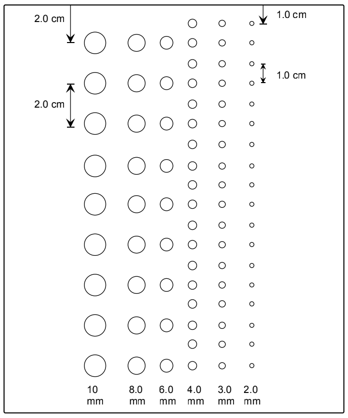
Model 534

Model 534 tissue-mimicking (TM) phantom are designed to evaluate the performance of diagnostic ultrasound imaging systems.

The phantom contains 81 anechoic, cylindrical target structures of varying sizes. The targets are positioned in-line vertically, to permit an entire target group to be displayed in one view. Due to the acoustic similarity of the background material and the anechoic targets, artifacts caused by distortion, shadowing or enhancement have been eliminated. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Contrast Resolution



Resolution & Penetration Phantom

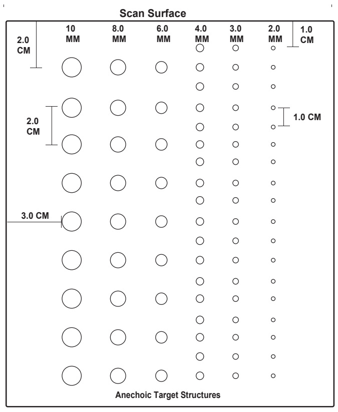
Model 504

Model 504 is designed to evaluate the performance of diagnostic ultrasound imaging systems.

These phantoms contain 81 anechoic, cylindrical target structures of varying sizes. The targets are positioned in-line vertically, to permit an entire target group to be displayed in one view. Due to the acoustic similarity of the background material and the anechoic targets, artifacts caused by distortion, shadowing or enhancement have been eliminated. The Model 504 is manufactured using a Zerdine® hydrogel and has a warranty of one-year.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Contrast Resolution



Beam Profile & Slice Thickness Phantom 538N

Model 538N

The model 538N can measure the beam profile and slice thickness of ultrasound imaging systems by evaluating the appearance of a thin plane of echogenic material against an anechoic background.

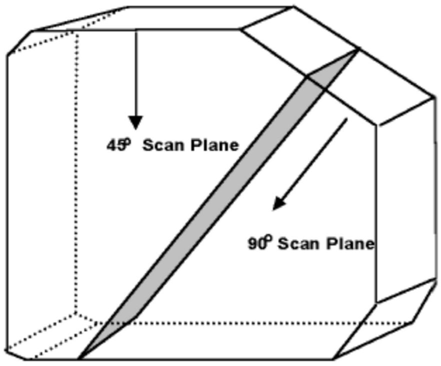
Scanning the scattering plane from one surface, perpendicular to the thin plane, obtains an image of the beam profile at varying depths of the 538N. This image contains a great deal of information about the sound beam as it propagates through the tissue-mimicking media such as the focal length, focal zone, beam width, side and grating lobes, and far-field beam divergence. In addition, the near field region of the beam can be easily distinguished from the far field as varying degrees of brightness close to the scan surface versus the homogeneous amplitude further down.

Scanning the scattering plane from a second surface, 45 degrees from the scattering plane, allows users to evaluate the slice thickness of an imaging system at varying depths.

Slice thickness or elevational resolution, the third component of spatial resolution, displays reflections produced by structures in front of or behind the beam's main axis. The effect of changes in the slice thickness is identical to those seen with axial and lateral resolution. The thinner the slice thickness, the better the resolution: as the slice thickness increases, the degree of spatial resolution decreases. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Beam Profile Slice Thickness
- Uniformity
- Tissue Harmonic Imaging Compatibility



Basic QA Phantom

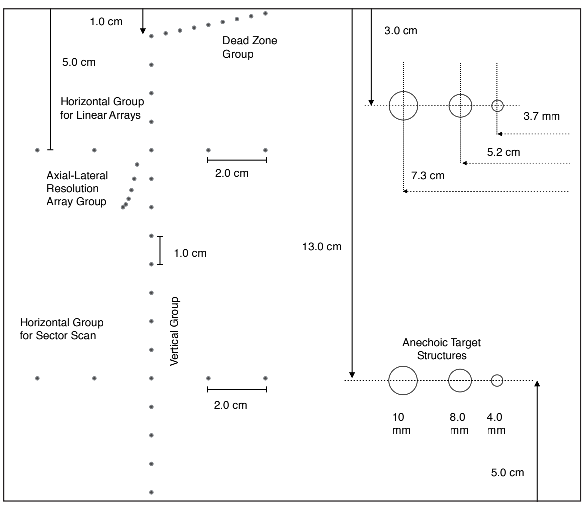
Models 535H

The Model 535 rubber-based, tissue-mimicking (TM) phantom is designed to fulfill the basic testing requirements of a Quality Assurance Program.

The phantom is designed with a combination of monofilament line targets and six tissue mimicking cylindrical targets of varying sizes. The monofilament line targets have a diameter of 0.12 mm, to optimize the displayed image at frequencies ranging from 2.25 to 7.5 MHz. Four groups of line targets are provided to evaluate the vertical and horizontal calibration measurements, axial-lateral resolution and the dead zone. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Depth of Penetration
- Beam Profile/ Focal Zone/ Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial and Lateral Resolution
- Contrast Resolution
- Dead Zone Assessment



Accreditation Phantom for Uniformity

Model 551

Essential component of a routine QC Program

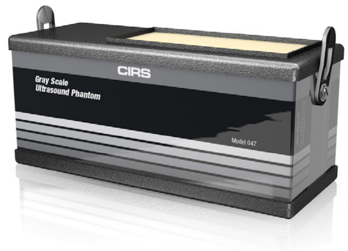
A continuous QC program identifies problems before they impact the diagnostic value of ultrasound exams and assures equipment is functioning properly. Research has demonstrated that the most common failure in the ultrasound imaging system is the transducer as they are easily damaged by stress, dropping and kinked cables[1]. Accreditation programs now recommend all scanners and all transducers be tested quarterly and must be tested at least semiannually by performing an image uniformity and artifact survey[2].

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.

Accreditation Phantom for Uniformity ultrasound image with dead element.

Gray Scale Ultrasound Phantom



Model 047

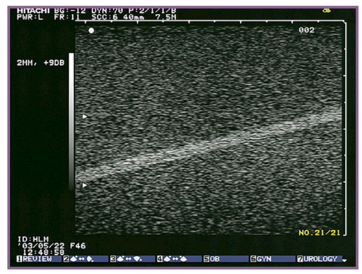
Evaluate resolving power as a function of depth, size and contrast.

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.

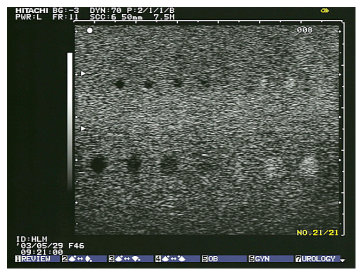
The Model 047 is usable on all diagnostic ultrasound machines allowing user evaluation of gray scale sensitivity with a wide range of transducer frequencies. This phantom is an ideal training tool for learning optimum system setup and evaluating system performance.

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

(1) US Patent # 5196343



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



Model 047 Gray Scale image

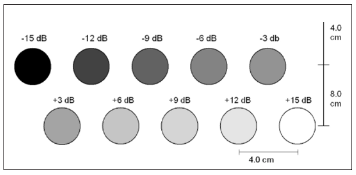
Gray Scale Phantom

Model 531

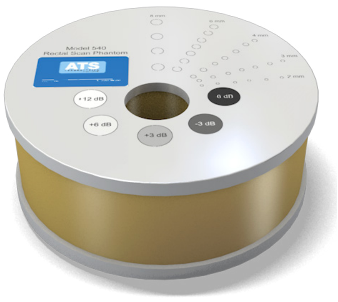
The Model 531 Gray Scale phantoms is designed to test an imaging system's gray scale processing and displayed dynamic range. The phantom provides a set of ten different gray scale targets, each 10 mm in diameter, that range in gray scale brightness contrast from -15 to +15 dB relative to the background material. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years. .

Key Tests

- Gray Scale



Rectal Scan Phantom



Model ATS 540

Model 540 is a rubber based tissue-mimicking rectal scan phantom. It is suited primarily for performance testing of rotary-type transducers, resulting in a displayed image of a full 360° and may also be used to evaluate the performance of bi-planar transducers.

The Model 540 is contained in a protective housing. An internal scan well permits insertion of the transducer directly into the body of the phantom, thereby mimicking the application. The phantom contains five groups of cystic-like targets of varying sizes and depths, and five levels of gray scale. The target structures are arranged in a radial pattern from the center of the scan well. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Beam Profile/ Focal Zone/ Lateral Response Width
- Displayed Dynamic Range
- Contrast Resolution
- Grayscale Contrast Sensitivity

Contrast Detail Resolution Phantom

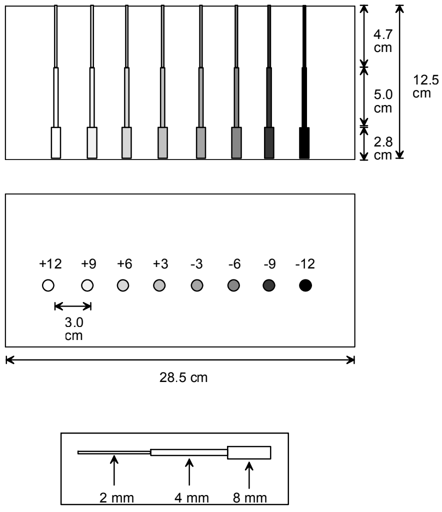
Models 532 A&B

The Models 532A and 532B Contrast Resolution phantoms are composed of a rubber-base tissue-mimicking material. These models are provided with a built-in scanning well to permit the use of water or a low viscosity gel as a coupling medium.

The Contrast Resolution phantoms are designed to evaluate an imaging system's gray scale processing and displayed dynamic range. Both models provide three target sizes at eight levels of contrast, ranging from -12 to +12 dB relative to the background material. The difference between the models is the size of the targets. The Model 532A contains 2, 4 and 8 mm diameter cylindrical targets. Model 532B contains cylindrical targets 5, 10 and 20 mm in diameter. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Uniformity
- Displayed Dynamic Range
- Contrast Resolution
- Grayscale Contrast Sensitivity
- Tissue Harmonic Imaging Compatibility



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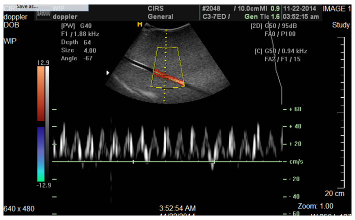
Doppler Ultrasound Flow Simulator

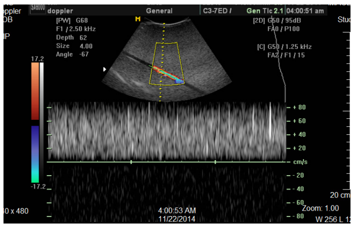
Model 069

Perform sensitivity & velocity QA on doppler ultrasound

The Doppler Ultrasound Flow Simulator is designed to simulate blood ow in a tissue mimicking phantom, and may be used to perform quality assurance testing of Doppler ultrasound devices. The two most common tests are sensitivity and velocity accuracy, but a number of other useful tests are also described in the literature (see references).

The simulator includes a tissue-mimicking flow phantom with a blood-vessel-simulating, ultrasound-compatible tube that enters the phantom at an angle. The phantom has both a top and bottom scanning surface that allows testing at varying depths and angles of orientation.





Doppler Test Fluid

Model 069-DTF & ATS707-DTF

CIRS Doppler Test Fluids are reliable, stable and non-hazardous fluids formulated to mimic the acoustic and physical properties of human blood. They are intended to be used in conjunction with ultrasound Doppler Flow phantoms and pumping systems used to evaluate the system performance of a Doppler imaging system. Two formulations are available, the ATS 707-DTF and the 069-DTF. Both come in a one-gallon container.

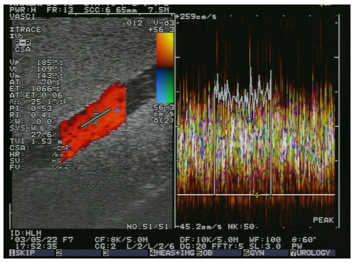
The 069-DTF formulation is based on published standards and is the better match to the acoustic properties of blood.

The ATS 707-DTF is optimized for use with the ATS 700-D Doppler Flow Digital Pumping System.

Both are fully degassed prior to packaging to minimize noise from air bubbles. Both fluids are tested for speed of sound, attenuation, density and viscosity using test equipment traceable to NIST.

Benefits:

- Evaluates system performance of doppler imaging systems
- Mimics acoustic and physical properties of blood
- Used in conjunction with CIRS Doppler Flow phantoms
- Available in two formulations
- No refrigeration necessary



Doppler String Phantom

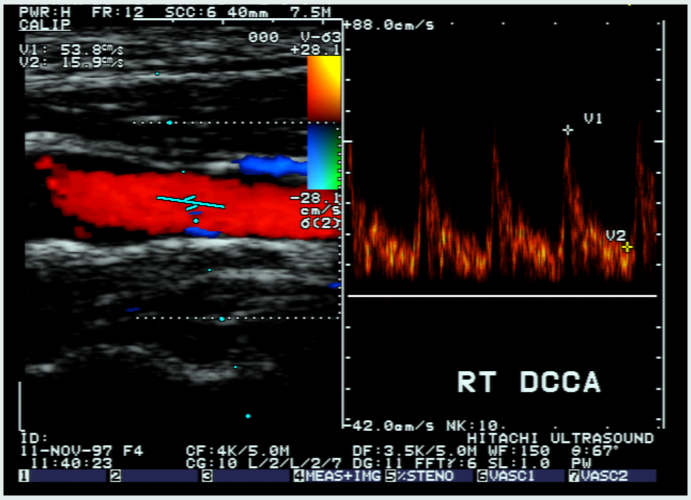
Model 043

Accurately simulates 16 physiological and test waveforms

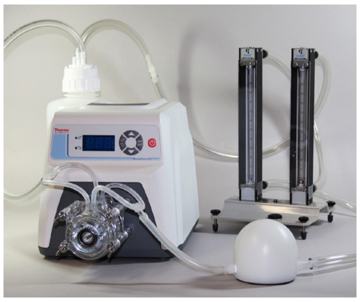
The CIRS Model 043 Doppler String Phantom is an essential tool for people who work with Doppler Ultrasound. The crystal controlled motor accurately generates sixteen pre-programmed waveforms using advanced string target technology. Since the speed is adjusted 1000 times every second, you know it's precise and repeatable.

The Model 043 can be set for use with water or velocity-corrected fluid. If you're using water, it adjusts the string speed accordingly so the different speed of sound in water won't affect your tests. And unlike fluid-flow phantoms, the target never changes; you know what your test results should be every time.

The Model 043 includes a user's manual and a rugged carrying case. Additional options include custom programming of special waveforms..



Doppler Flow Controller & Digital Pumping System



Model 700-D

The Model 700-D, Doppler Flow Digital Controller and Pumping System, combined with an ATS Doppler Flow phantom provide an easy and accurate means of evaluating an ultrasound Doppler imaging system's ability to detect sensitivity at varying depths, maximum penetration, flow velocity, location and directional discrimination.

The System provides steady-state flow ranging from 9.6 to 960 ml/minute. Higher flow rates are available upon request. The pump speed (RPMs) is controlled by the keypad on the front panel. Two In-line flow meters continuously monitor the flow rate of the blood mimicking test fluid through the phantom during the test procedure. The large capacity test fluid reservoir insures the fluid pumped through the phantom will be free of air bubbles even after hours of continuous use.
The Model 700-D system is designed to be used in conjunction with the ATS Doppler Flow Phantoms Models 523, 523A, 524, 525 and 527 (purchased separately) and the Doppler Test Fluid.

Features

- Simple keypad controls.
- Digital display of RPMs
- Keypad "lock" and "unlock" feature
- Flow direction control
- Accurate, reliable control digitally controlled flow rate
- Universal voltage. Unit accepts power cord set with IEC320 plug to adapt to local power.

Cardiac Doppler Flow Phantoms

Models 523 & 523A

The Models 523 and 523A rubber based tissue mimicking Doppler flow phantoms contain four flow channels of various diameters (normally 2, 4, 6, and 8mm diameter) simulating the deep vasculature of the cardiac and abdominal vessels.
Two fixed-angled scan surfaces maintain a constant angle between the sound beam and the Doppler Test Fluid flowing through the phantom. The scan surfaces of the Model 523 are angled at 45° and 60°, permitting continuous scanning at depths ranging from 5 to 18 cm. In the Model 523A, the scan surfaces are angled at 18° and 56°, permitting continuous scanning at depths ranging from 3 to 17 cm. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Sensitivity
- Flow Velocity
- Flow Location
- Penetration
- Uniformity

Doppler Flow Directional Discrimination Device

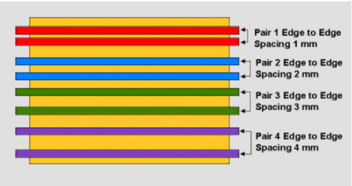
Model 527

The Model 527 rubber-based tissue mimicking phantom is designed to test the ability of color Doppler flow imaging systems to discriminate the direction of flow in small, closely spaced vessels at varying depths.

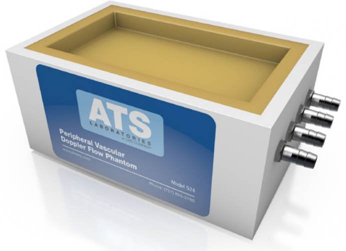
Our phantom contains four pairs of 2 mm flow-channels. The edge-to-edge spacing between each pair of flow-channels progressively increases from 1 mm to 4 mm. If greater distances are desired, a combination of two flow-channel pairs can be used. Two fixed-angle scan surfaces of 18° and 56° maintain the sound beam and the Doppler Test Fluid flowing through the phantom. These angles permit continuous scanning at depths ranging from 3 to 17 cm. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Directional Discrimination
- Flow Velocity
- Sensitivity at varying depth
- Maximum Penetration
- Location of Flow.



Peripheral Vascular Doppler Flow Phantom



Models 524 & 525

The Models 524 and 525 tissue mimicking Doppler flow phantoms contain four flow channels simulating superficial vasculature. The simulated vessels are located 15 mm below the scan surface. Built-in scanning wells are provided to permit the use of water or a low viscosity gel as acoustic coupling agents.

The two models are distinguished by different structures. The Model 524 has four constant diameter channels, 2, 4, 6 and 8 mm. The Model 525 mimics a vascular stenosis by narrowing at the middle from an entrance diameter of 8 mm to varying stenosis levels (0, 50, 75 and 90%).

If the user requires depths greater than 15 mm, we recommend the use of our Model 528 scanning wedge. The wedge is constructed of the same tissue mimicking material as the Doppler flow phantoms and provides an additional 50 mm of scanning depth. All ATS urethane phantoms are guaranteed for the useful life of the phantom, defined as 10 years.

Key Tests

- Flow Velocity
- Sensitivity
- Maximum Penetration
- Flow Location
- Demonstration of the effects of stenosis (Model 525)

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.

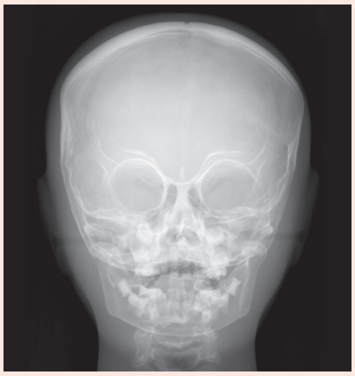
Right appendages are available in extended or flexed configurations. Left arm and leg are available with or without embedded fractures. The fracture versions contain the most common pediatric fracture types, including buckle fracture to tibia and common fracture to fibula; fracture to first metatarsal;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

Components are made from propriety urethane and epoxy materials that mimic X-ray attenuation properties 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:

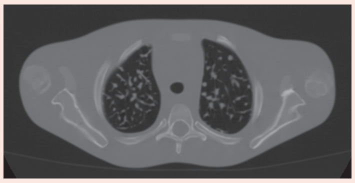
- Deciduous and descending teeth with distinct dentine and enamel
- Fully open sinus cavities
- Anthropomorphic lung structure and vasculature
- Bones contain cortical/trabecular distinction, growth plates and ossifications typical to a 5-year old
- Certain bones of the spine and pelvis are atypical 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



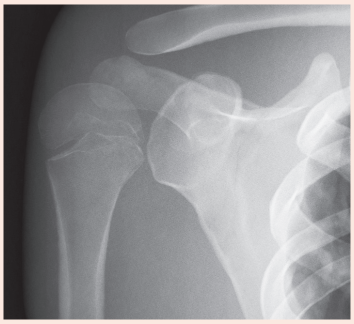
AP Skull

3D Reconstruction

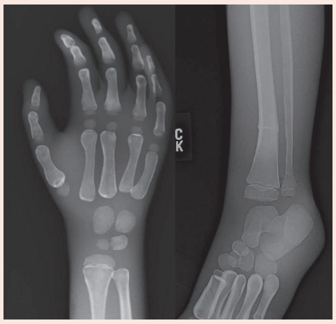
Lateral Skull



Lateral Lumbar Spine



AP Shoulder



Right Oblique Hand & Oblique Ankle

AP Chest

AP Pelvis

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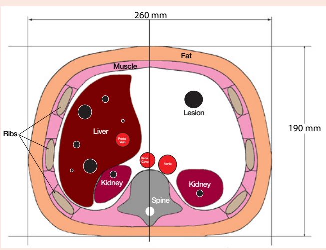
Triple Modality 3D Abdominal Phantom

Model 057A

Image Fusion/Registration • Scanning Techniques • Biopsy

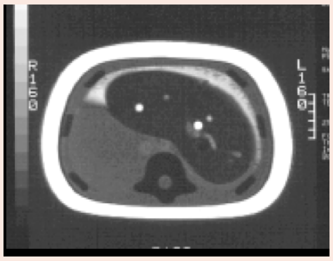
The CIRS Triple Modality 3D Abdominal Phantom is constructed of a self-healing formulation of Zerdine® that allows multiple biopsy insertions with minimal needle tracking, and is ideal for demonstrating image-guided navigation technologies. The phantom is representative of a small adult abdomen and can 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.

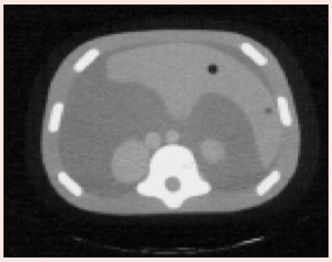


Features:

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



MRI



CT

Ultrasound

[1] US Patent # 5196343

Image-Guided Abdominal Biopsy Phantom

Model 071B

CT/Ultrasound/MRI Image Fusion • Live Scanning • Biopsy Training

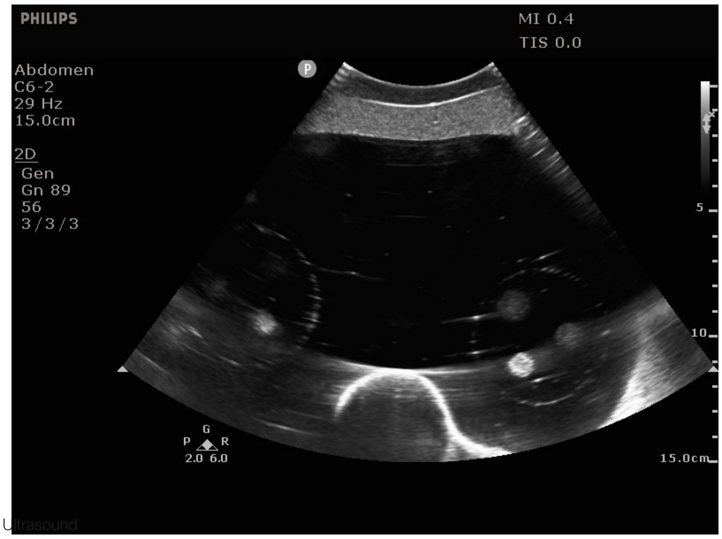
The Model 071B, Image-Guided Abdominal Biopsy Phantom is a simplified abdominal phantom suitable for training and demonstrating image-guided needle biopsy navigation tools or procedures that require a constant visual reference for needle placement. Because it is constructed of a self-healing formulation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

The phantom contains 12 lesions, 5-12 mm in diameter, positioned in groups of three in consistent locations within the phantom. It also includes simulated spine and ribs, and an "H" marker within the spine to assist in determining the head side within a CT image

The lesions and spine are visible under ultrasound, CT and MRI. The solid polymer gel background is anechoic and will not leak with puncture.*

For users interested in image fusion studies, the phantom can be purchased as a kit to include a serial-number special CT DICOM Data set for reference. CIRS can also offer value-added options and services such as phantom specific CMM, attachment of customer specific registration devices and inclusion of special point markers.

[1] 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

TRAINING AND DEMONSTRATION

Fetal Ultrasound Training Phantom

Model 065-20 & 065-36

Demonstrate 2D and 3D ultrasound

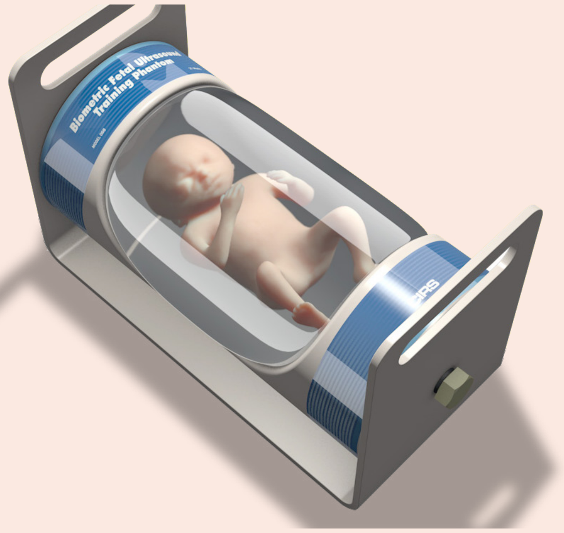
CIRS fetal phantoms can be used for ultrasound scanning demonstrations, 3D reconstructions, surface rendering and a variety of other applications. Materials are tissue equivalent, and the phantom is available in 20 weeks or 36 weeks gestational age.

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

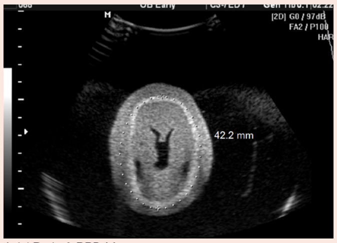
Instruct and develop ultrasound examination techniques

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.

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.

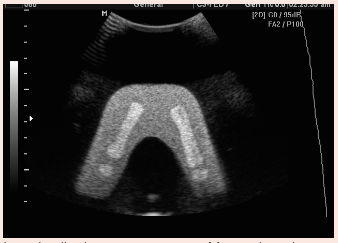
Features:

- Demonstrate system capabilities
- Teach imaging protocols to estimate gestational age
- Practice 2D, 3D & 4D fetal scan techniques
- Measure CRL, BPD, FL and AC
- Gain competency in performing prenatal ultrasound



Axial Brain & BPD Measurement

Sagittal Brain



Longitudinal measurements of femur length

3D Reconstruction

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Breast Elastography Phantom

Model 059

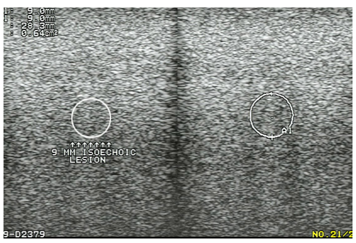
The perfect demonstration tool for sonoelastography

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. Protected by a membrane, the phantom's Zerdine®[1] simulates needle resistance.

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

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

(1) US Patent # 5196343



Normal Ultrasound Image

Needle Breast Biopsy Phantom

Model 052A

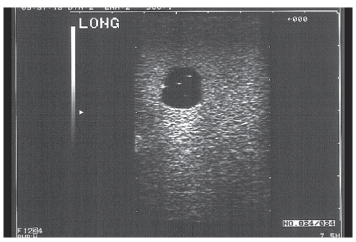
A training device for ultrasound guided needle biopsy procedures

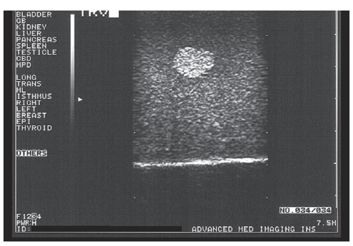
The Model 052A accurately mimics the ultrasonic characteristics of tissues found in an average human breast. The size and shape of the phantom simulates that of an average patient in the supine position.

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.





Multi-Modality Breast Biopsy and Sonographic Trainer

Model 073

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

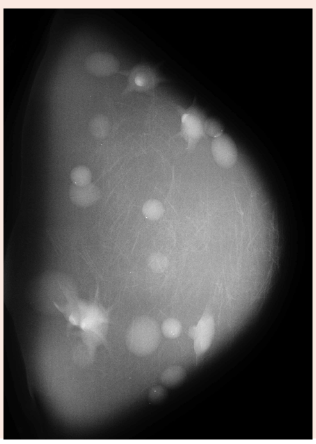
The Multi-Modality Breast Biopsy and Sonographic Trainer is designed to train users in various aspects of breast imaging and image-guided interventional procedures. The phantom accurately mimics the heterogeneous appearance of breast tissue under ultrasound, mammography and MRI, and has cystic and dense 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.

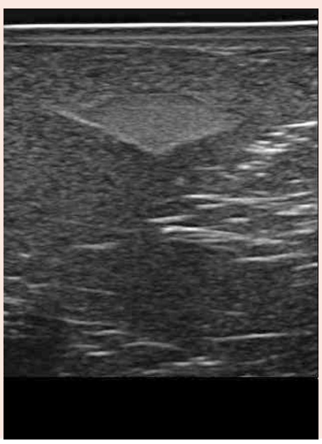
The phantom includes a patent-pending[1] Z-Skin™ membrane that simulates the look and feel of skin during scanning and biopsy. The skin material closes up on itself after puncture with a needle, providing good protection from desiccation even after multiple training sessions.

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, and tracks will usually disappear within minutes (sometime seconds) of needle removal. Each 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





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Female Ultrasound Training Pelvis

Model 404A

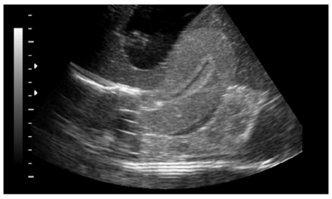
The gynecological ultrasound exam is an important diagnostic tool. Students gain competency with hands-on practice. Unfortunately, access to patients can be limited. The Model 404A Female Ultrasound Training Pelvis facilitates teaching and demonstration of gynecological ultrasound techniques in a non-stressful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

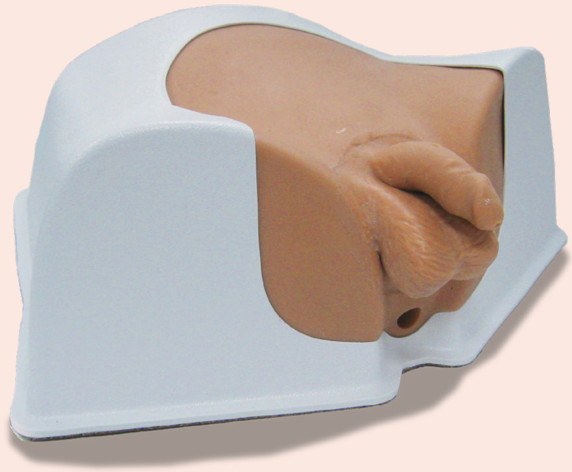
Features:

- 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

Multi-Modality Pelvic Phantom



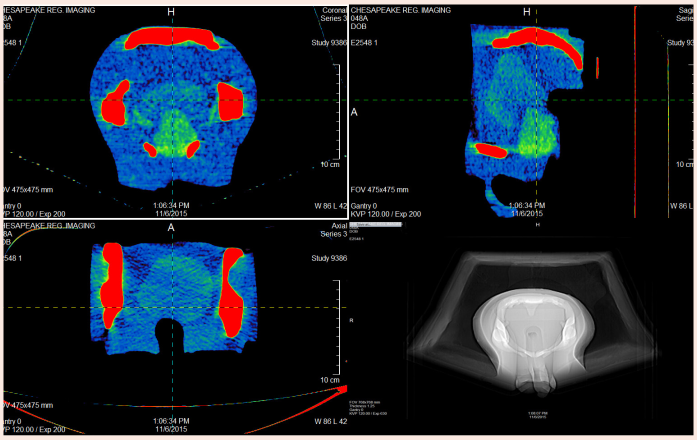
Model 048A

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

Scrotal Ultrasound Training Phantom

Model 504A

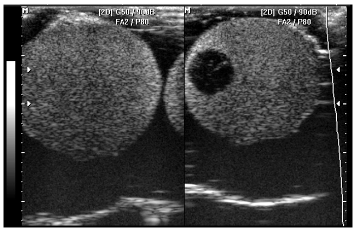
Testicular ultrasound is the primary imaging method for evaluating disorders of the testicles caused by cystic and solid masses, trauma, inflammation and torsion. Testicular ultrasound is also used to evaluate causes of infertility and locate undescended testis.

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.

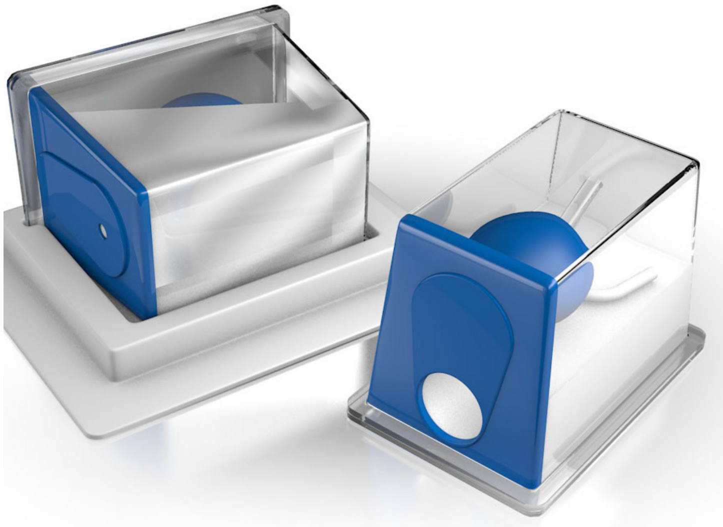
Features:

- 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

Tissue Equivalent Ultrasound Prostate Phantom



Model 053S, 053L & 053L-EF

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.

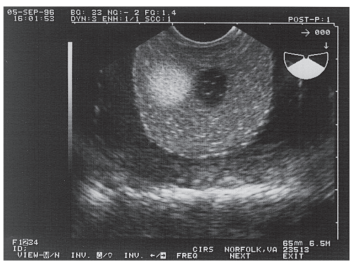
The prostate along with structures simulating the rectal wall, seminal vesicles and urethra is contained within an 11.5 x 7.0 x 9.5 cm clear acrylic container. A 3 mm simulated perineal membrane enables various probes and surgical tools to be inserted into the prostate.

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 070L

The Ideal Training Device For Image-Guided Procedures

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

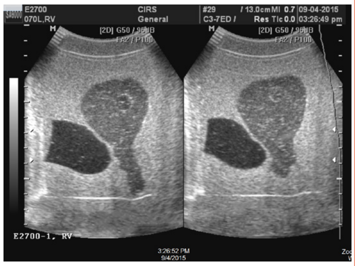
Enhanced realism has been achieved with a Zerdine® gel formulation that better simulates the ultrasound contrast between the prostate and background tissue. The gel formulations provide CT, MR and elastography contrast for multi-modality imaging. CIRS' proprietary Z-Skin™ formulation more accurately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

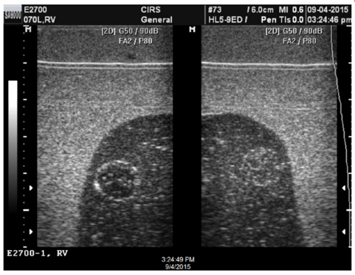
Z-Skin™ provides perineal access for interventional procedures, and closes up on itself after it is punctured so that the Zerdine® gel inside the phantom is not exposed to air during scanning. Minimal air exposure better protects the gel from drying out, thus increasing the phantom's useful life. In 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 contains embedded lesions. For users interested in image fusion studies, the phantom can be purchased as a kit to include a serial-number specific CT DICOM Data set for reference.

Model 070L Includes:

- Includes bladder rectal wall, perineal membrane and urethra plus digitally modeled prostate gland and seminal vesicles.
- Phantom contains lesions
- Train for ultrasound-guided seed implantation, cryosurgery and needle biopsy in one phantom





TRAINING AND DEMONSTRATION

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Vascular Access Training Phantoms

Model 072 Series

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

The CIRS Vascular Access Training Phantoms are designed to provide a realistic training medium for needle insertion. The phantoms are made from a durable elastometric compound mimicking the tactile feel and puncture resistance of soft tissue. This material has realistic acoustic properties allowing imaging of the simulated vessels under ultrasound.

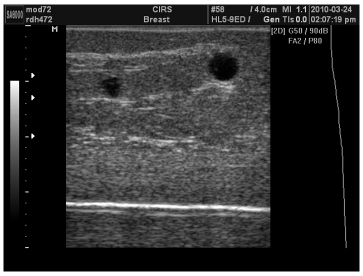
The vessels can be accessed from top and bottom surfaces and can be easily replenished using a syringe.

The phantoms require no special handling and will not dry out. The phantoms also include start up accessories.

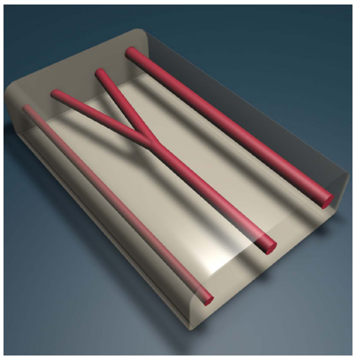
CIRS offers three Vascular Access models with varied feature sets to best serve your needs. For assistance in choosing between models, refer to the comparison chart on data sheet.

Benefits:

- Teach ultrasound scan techniques
- Demonstrate and practice various insertion techniques
- Experiment with new procedures and evaluate new devices
- Teach vein recognition through palpation

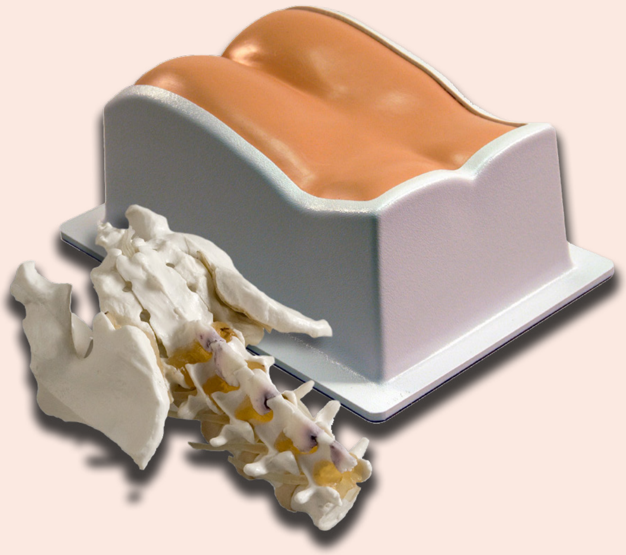


Cross-section of vessels - Phantom



Internal Layout

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.

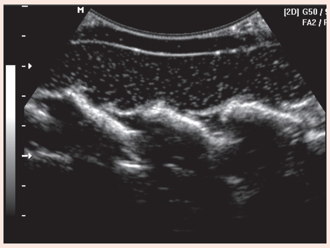
The realistic anatomy of the The Lumbar Training Phantom facilitates hand-eye coordination and can be used to train many spinal procedures including sacroiliac joint injection, lumbar and caudal epidurals, diskography, block nerves, and facet blocks.

Ligaments, spinal cord, discs, skin and the simulated soft tissue have differing softness to allow trainees to "feel" their way through to the injection or target site.

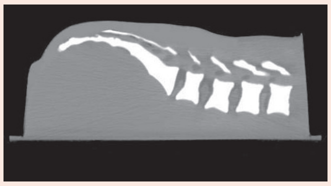
In addition to fluoroscopy, the phantom can be imaged under CT, MR, and ultrasound.

Features:

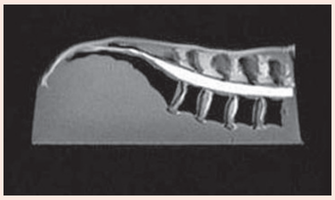
- Realistic needle resistance of each tissue to allow trainee to "feel" the injection site
- Allows for multiple biopsies per injection site
- Contains anthropomorphic ilium, sacroiliac joint, sacrum plus L2- L5, superspinous ligament, interspinos ligament, ligament flavum, discs (anulus fibrosis and nucleus pulposis)
- Allows training for six different spinal procedures



Ultrasound

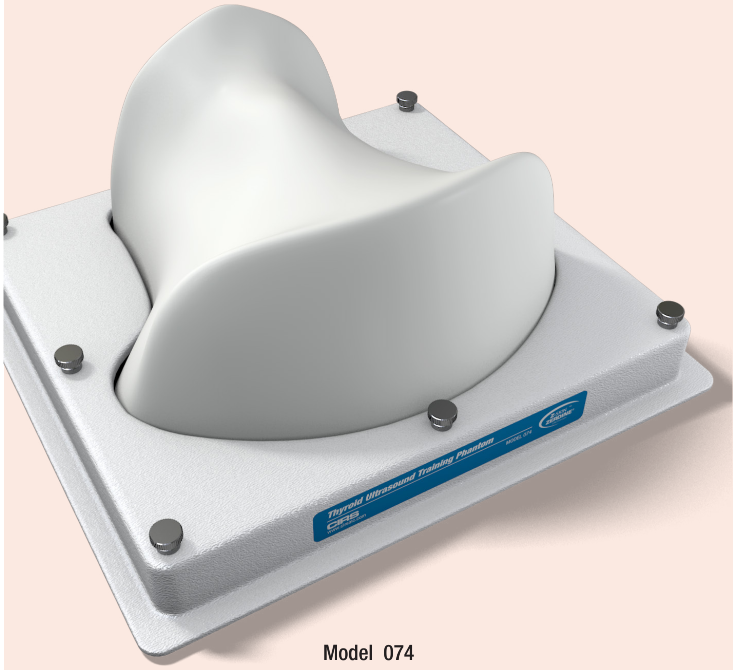


CT



MRI

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

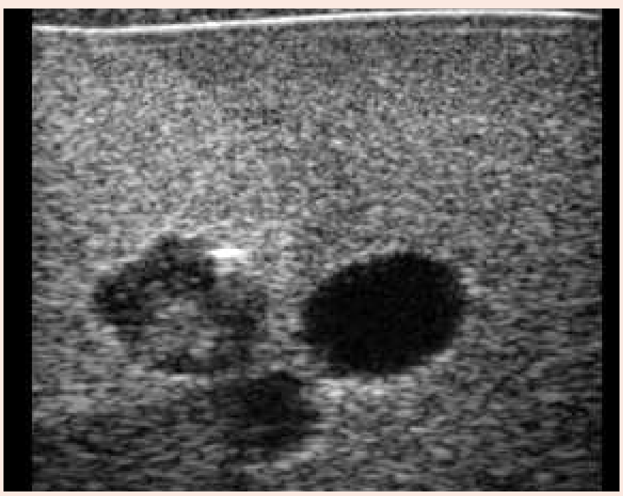


Image of thyroid containing complex nodule with calcifications

Endoscopic Ultrasound Training Phantoms

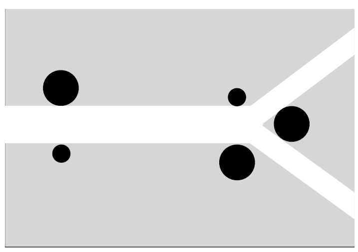
Model GIETP, TEUTP & TEUS-B

Our endoscopic ultrasound training phantoms allow users to gain essential skills in how to:

- Guide the flexible endoscope through a tissue mimicking channel
- Insert a biopsy needle into a target under ultrasound guidance
- Identify simulated target structures

The phantoms include spherical target structures contained within a soft rubber-based tissue mimicking material. The number, placement and contrast of these spheres varies between the three models offered.

Our training phantoms are semi-disposable. During normal usage each needle puncture creates a track within the phantom. Ultimately, the number of tracks will interfere with the ability to obtain a clear image.



Non-Echogenic target structures
20 & 10 mm diameters with approximate placement as shown above

Z-SKIN™ ZERDINE®
CIRS Trademarks

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

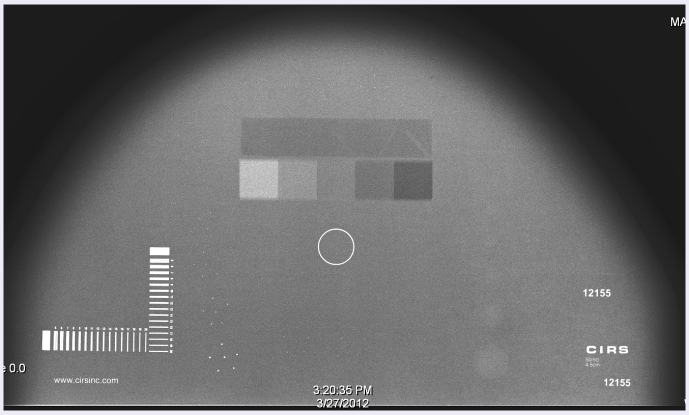
Model 011A

A Refined Quality Assurance Tool for Advanced Imaging Systems

Model 011A is a tissue-equivalent, anthropomorphic phantoms designed to test performance of any mammographic system. Simulated calcifications, fibrous ducts, and tumor masses are embedded into the phantom as test objects. Test objects range in size to allow system checks at varying levels of difficulty.

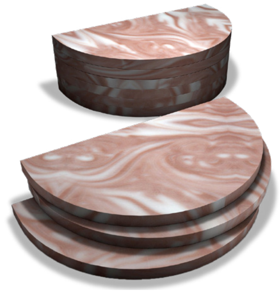
CIRS resin material mimics the photon attenuation coefficients of a range of breast tissues. The average elemental composition of the mimicked tissue is based on the individual elemental compositions of adipose and glandular tissues as reported by Hammerstein.

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



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 micro-calcifications, fibrils and masses.

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.

Contrast Enhanced Spectral Mammography Phantom

Model 022

A comprehensive phantom for routine CESM QA

The CIRS Contrast Enhanced Spectral Mammography (CESM) Phantom address the need for QC of CEDM systems. The phantom demonstrates the presence and absence of iodine in tissues by containing different iodine concentrations and non-iodine breast tissue substitutes. .

The phantom consists of four slabs. A target slab is made from breast-equivalent material in 50/50 ratio of gland and adipose tissue. The slab contains two sets of four plugs, each plug having an iodine concentration of 0.2, 0.5, 1.0 and 2.0 mg/cm^2. These concentrations have been chosen to cover the clinical range of iodine concentrations. A fifth plug is made of 100% glandular tissue equivalent material. This plug is positioned in the center of each plug group to mimic a glandular lesion. The contrast slab consists of half 100% adipose material and half 100% glandular material to test iodine separation from the background over a wide range of densities.

Benefits:

- Daily and routine QC
- Tests performance and stability of CESM
- Contains clinically relevant iodine concentrations
- Represents both dense and fatty breasts
- Background provides clinically relevant challenge for target detection

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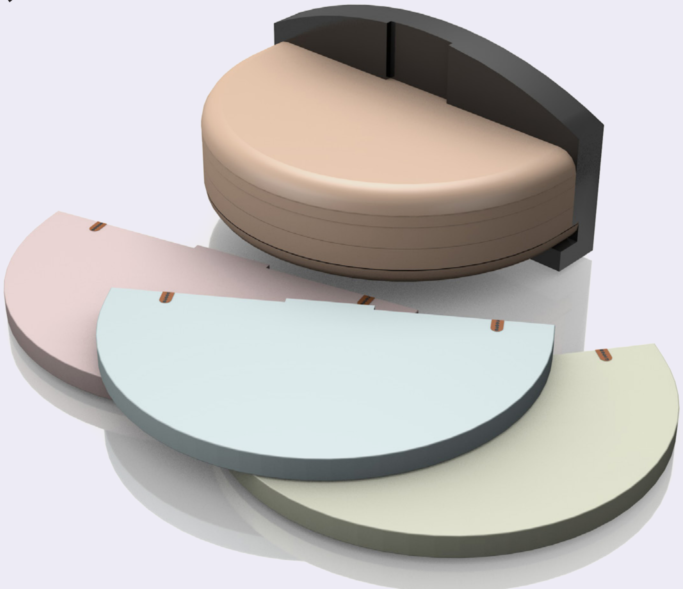
Digital Breast Tomosynthesis QC Phantom



Model 021

Assess breast tomosynthesis image quality

The CIRS Digital Breast Tomosynthesis QC Phantom is designed to address quality control for Digital Breast Tomosynthesis systems (DBT). The phantom can be used for software analysis and "traditional" visual tests.

The phantom consists of eight homogeneous slabs made from breast-equivalent material in 50/50 ratio of gland and adipose tissue (BR50/50). Optional swirled slabs, that can be purchased separately, are comprised of 100% adipose and 100% gland tissues together in an approximate 50/50 ratio by weight. Three homogeneous slabs include imaging targets. Each semi-circular shaped slab measures 100 x 180 x 10 mm. This allows for using a combination of homogeneous and swirled slabs to test the influence of scatter radiation on image quality in more clinically-relevant, inhomogeneous conditions.

The phantom includes a positioning holder with magnetic fixation for repeatable alignment and positioning on the DBT scanner.

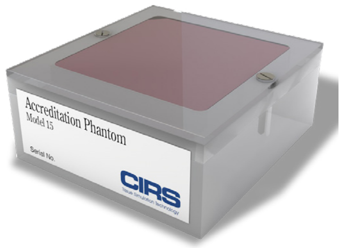
Measured Parameters

- Volume coverage missing tissues
- Pixel Value Uniformity
- Noise: SNR & SDNR
- Resolution in X, Y and Z directions (MTF, ESF & PSF)
- Geometric accuracy 3D
- Artifact assessment
- Visual detectability: specs, masses & fibers
- Complex background for clinically relevant measurements

Benefits

- Acceptance testing, daily and routine QC
- Tests image quality and stability of DBT systems
- Consistent and repeatable targets in homogeneous background
- Optional complex background provides clinically relevant challenge for target detection
- Slab configurations provides range of thicknesses with or without targets
- Developed to meet WIP requirements of EUREF and AAPM TG245

Mammographic Accreditation Phantom



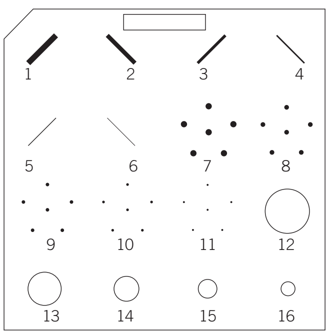
Model 015

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.

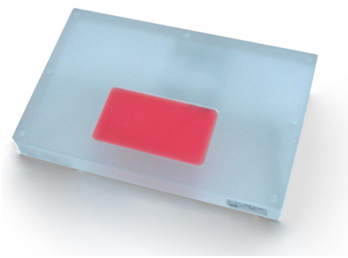
The 4.4 cm thick phantom is made of a 7 mm wax block insert containing 16 sets of test objects, a 3.4 cm (approx. 1-3/8") thick acrylic base, and a 3 mm (1/8") thick cover. All of this together approximates a 4.2 cm compressed breast of average glandular /adipose composition. Included in the wax insert 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

ACR Digital Mammography Phantom



Model 086

Evaluate FFDM System Performance

The CIRS Model 086, ACR Digital Mammography (DM) Phantom was designed under the sponsorship of the American College of Radiology (ACR) to test the performance of FFDM systems. Objects within the phantom simulate calcifications, ducts and tumor masses. The phantom is designed to determine if your DM system can detect small structures that are important in the early detection of breast cancer.

The critical component of the phantom is a 7 mm thick wax insert positioned within a matching cavity milled out in a polymethylmethacrylate (PMMA) block. The total attenuation under the wax insert is matched with the 4.1 cm thick surrounding PMMA by the use of a 0.23 mm "compensator" placed under the wax insert. The wax insert contains targets as per map (Figure 2). Fibers are monofilament nylon, simulated calcifications or "specks" are made of spherical glass and the masses simulate 10% adipose - 90% glandular breast tissue.

Features:

- Finer gradations & smaller size test objects to evaluate performance of FFDM systems\
- Provides view of entire detector for artifact evaluation
- Provides basis for monitor and printer QC
- Reviewers can see scores & artifacts on single image submission without need for different WW/WL settings

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%.

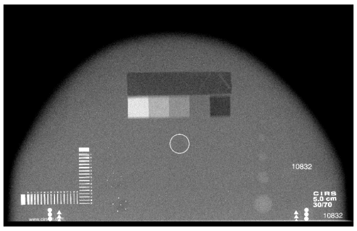
One compensation plate contains embedded details for evaluation of image quality. A hand held microscope and heavy duty foam lined carry case are included.

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



Mammography Phototimer Consistency Testing Slabs

Model 014A

Better than PMMA for AEC calibration

The American Cancer Society and American College of Radiology guidelines for the screening of asymptomatic women have made over 50 million women candidates for mammography. In light of the staggering numbers involved, it's critically important that simple but reliable methods be developed to assess system performance and assure consistent production of diagnostically useful images.

CIRS Phototimer Consistency Testing Slabs are designed for precise assessment of AEC system performance in accordance with American College of Radiology and MQSA recommendations. 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. BR-12 (47% glandular / 53% adipose) is most commonly used.

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 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 (Model 016AW) to protect them from wear or damage.

The phantom body consists of breast equivalent materials and features a cavity for the acrylic wafer. This design 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).

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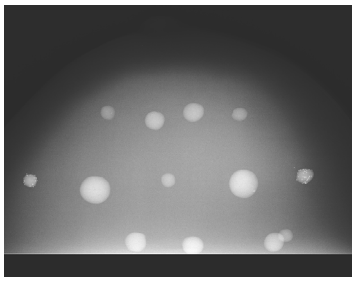
Stereotactic Needle Biopsy Training Phantom

Model 013

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

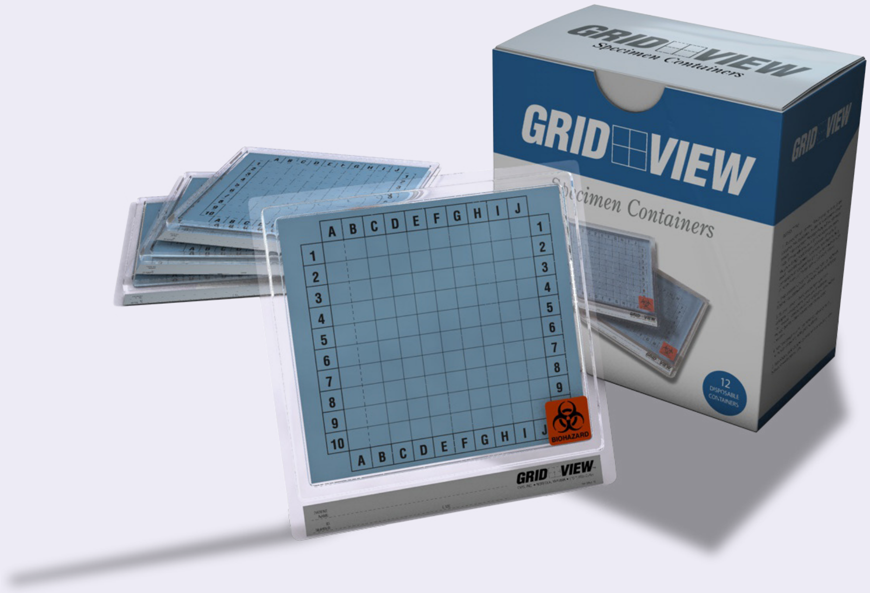
The CIRS Stereotactic Needle Biopsy Training Phantom is a disposable training tool and practice medium for mammographic needle biopsy procedures. The phantom also serves as an excellent quality assurance device for stereotactic systems and should be used whenever a new system is installed or repaired to ensure 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 phantom body is shaped to represent a partially compressed breast, and is made from a proprietary gel with a physical consistency similar to human tissue, surrounded by an elastic skin-like membrane. The material is easily compressed for optimum imaging. Embedded dense masses and microcalcifications vary in size and are colored for easy visualization. Masses and calcifications can be biopsied multiple times.



Mammography image of Model 013

Specimen Imaging and Transport Container

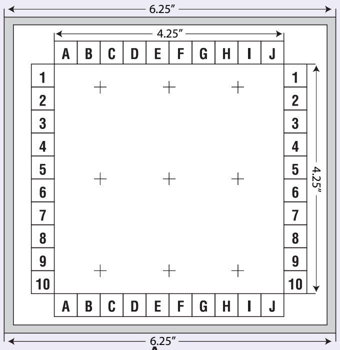


Model 240

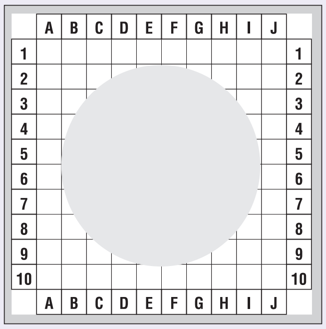
An efficient system for imaging, transporting and identifying breast biopsies and multiple core specimens

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")



A



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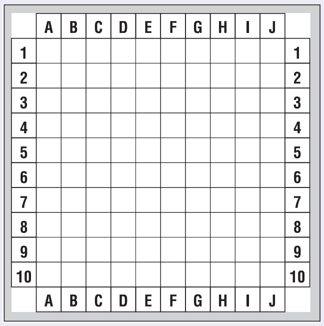
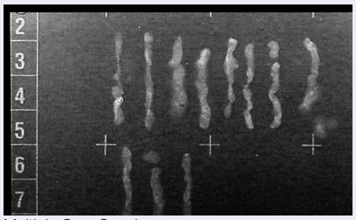


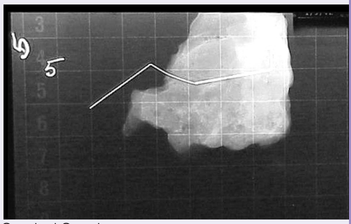
C

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

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MAMMOGRAPHY

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

ADVANCED TISSUE SIMULATION

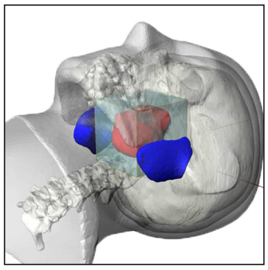
CIRS Tissue Simulation Technology (TE) has been validated through specific testing, continuous monitoring of manufacturing applications and worldwide use and acceptance of products for over 35 years. CIRS proprietary (TE) materials can simulate any tissue in the human body. CIRS materials are suitable 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 reliable 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@cirsinc.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
900 Asbury Avenue
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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Norfolk, Virginia 23513 USA

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Customer Service: admin@cirsinc.com

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Computerized Imaging Reference Systems Inc. has been Certified by UL DQS Inc. to (ISO) 13485:2016. Certificate Registration No. 10000905-MP2016

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