

Phantom Patient for Stereotactic End-to-End Verification



SCAN
PLAN
LOCALIZE
TREAT

MODEL 038



STEEV²TM
STEREOTACTIC END-TO-END VERIFICATION

CIRS

900 Asbury Ave • Norfolk, Virginia 23513 • USA • Tel: 757-855-2765 • WWW.CIRSiNC.COM

OVERVIEW

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 complete system QA from CT Imaging to dose verification.

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PHANTOM DESCRIPTION

The CIRS STEEV Phantom Patient is an anthropomorphic head phantom designed for commissioning and treatment planning system (TPS) verification. It is our most comprehensive and realistic end-to-end SRS/SBRT testing tool. The model 038 has all necessary components for end-to-end testing stereotactic radiosurgery systems.

STEEV's anthropomorphic exterior allows for use of multiple positioning and fixation devices as used in the clinical application. Internal details such as cortical and trabecular bone, brain, spinal cord, teeth, sinuses and trachea provide a realistic clinical simulation to evaluate the challenging effects of complex intra- and extra-cranial anatomies. Geometric and organic target inserts provide a means for comprehensive image QA, geometric machine QA and TPS QA with increased confidence in system performance.

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

SPECIFICATIONS

Model 038 Includes

PART NO.	DESCRIPTION
038	Stereotactic End-to-End Verification Phantom Patient (5.3 kg)
038-15	MRI/CT/PET ISO Center rectangular insert
038-23	Brain Equivalent Spacer (63.5 x 63.5 x 10 mm)
038-24	Brain Equivalent Spacer (63.5 x 63.5 x 20 mm)
038-25	Brain Equivalent Spacer (63.5 x 63.5 x 63.4 mm)
038-17	Solid Ø 12.7 mm posterior plug
038-18	Solid Ø 12.7 mm anterior plug with MRI/CT fiducial
038-16	Neck Alignment Plate
-	Foam-lined case
-	User Guide
-	60 Month Warranty



Solid Posterior plug and solid anterior plug with MRI/CT fiducial.

Two-layer, foam-lined carry case is included with Model 038.

Anatomical Features

Skull
Brain
Sinus Cavities (sphenoid, frontal, maxillary)
Trachea, nasal and oral cavities
Maxillary and Mandibular Nerves
32 Teeth (enamel, dentin, and Root Canals)
Vertebrae C1-C7 (cortical and trabecular bone, spinal disks)
Spinal Cord
Removable Shoulders (soft tissue equivalent, homogeneous) (optional accessory)

All tissue-equivalent materials mimic reference tissues by linear attenuations within 1% from 50keV to 25MeV.

SPECIFICATIONS (CONT.)

Model 038 Optional Accessories

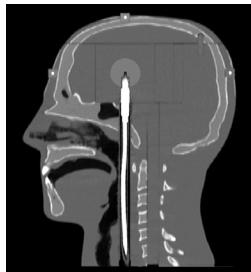
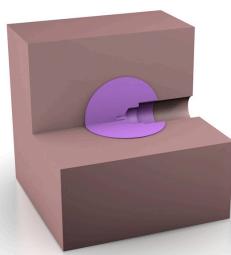
PART NO.	DESCRIPTION
038-01	Shoulders (additional 100 mm width, 5.7 kg)
038-02	ABS Vacuum formed cradle
038-03-CvXX-XX	Ion Chamber Dosimetry Kit: (1) 63.5 mm Cube with Ø30 mm Spherical that accommodates Ion Chamber at the center Cavity, (1) Ø12.7mm Sleeve for adapting Ion chamber, ((1) Solid plug with Ø 2.5 mm aluminum oxide BB in ISO center, (1) Solid plug
038-04-CvXX-XX	Variable Ion Chamber Position Dosimetry Kit: (1) 63.5 mm Cube with central thru hole, (2) Ø12.7 mm Sleeves for adapting Ion chamber, (1) Solid cavity plug with Ø 2.5 mm aluminum oxide BB in ISO center, (1) Solid cavity plug, (1)Spacer plug set to accommodate ion chamber at different positions
038-21	Film Stack
038-05	Film Cube for Single Film Dosimetry with Ø30 mm target
038-06	TLD Dosimetry Cube
038-08	Multiple-OSL Dosimetry Cube with 30 mm target
038-09	Electron Density Cube with Real Water Electron Density plug (Water Equivalent Material Surrounding Removable Ø 1" Vial)
038-10	Winston Lutz Cube with Centroid & Offset Ø5mm targets
038-11	MRI/CT/PET Target rectangular insert with Ø30mm target
038-12	MRI/CT/PET Target rectangular insert with 25 cc Organic target
038-13	MRI/CT/PET Target rectangular insert with 12.5 cc Organic target
038-14	MRI/CT/PET Spatial 3D Distortion rectangular insert
038-20	SRS Frame Support Cups, Set of 4
038-21	Film Stack
038-22	Gel Dosimetry Cassette (includes B6 Gel Container)
038-27-CVXX-xx	Single Slice Film Cube With Fiducials, 30mm Spherical Target & Ion Chamber cavity for Model 038
038-27A-CVXX-xx	Single Slice Film Cube With Fiducials & Ion Chamber for Model 038
038-29	Adapter for Model 038 STEEV and Leksell Frame G
B-6	Dose gel container

Precision Cut EBT3 Film for Model 038

158200-09-20	Precision Cut EBT3 Film Kit for Model 038-05, 038-21, 002FC, (Set of 20)
158200-09-50	Precision Cut EBT3 Film Kit for Model 038-05, 038-21, 002FC, (Set of 50)

DOSIMETRY INSERTS

Ion Chamber Target Dosimetry Kit



CT of Model 038-03-CVXX-xx

Model 038-03-CVXX-xx

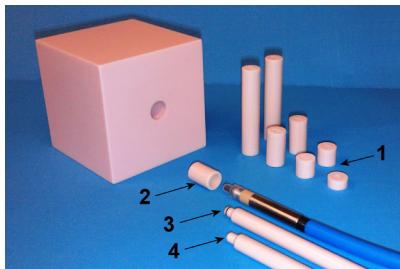
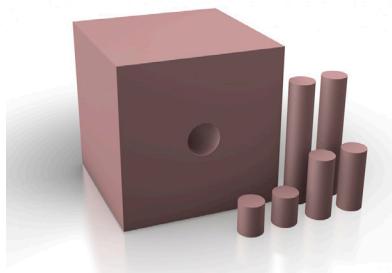
The Ion Chamber Dosimetry Kit includes a brain-equivalent cube containing a tissue-equivalent, 30mm diameter spherical target. The insert is machined with an ion chamber cavity to perform the final dosimetry measurements during end-to-end testing. The 038-03 allows for ion chamber dosimetry in a tissue-equivalent spherical target that matches the MRI/PET/CT Spherical target insert (038-11) by location and dimensions. The included cubic insert can be used in two positions within the head that are spaced at 30 mm in anterior-posterior direction. A solid cavity plug with ceramic BB at ISO center allows for chamber localization during treatment planning. The included soft-tissue-equivalent sleeve helps minimize air gaps around the ion chamber stem.

Model 038-03-CVXX-xx Includes

QTY	DESCRIPTION
1	63.5mm brain-equivalent insert with centrally located Ø 30mm spherical target, contrast 5%
1	Cavity CVXX-xx for the ion chamber or other suitable detector with ISO center in the center of sphere
1	Cavity plug PL-CVXX-xx to fit the cavity, brain equivalent.
1	Cavity plug PL-CVXX-xx to fit the cavity, brain equivalent, ceramic BB diameter 2.5 mm in ISO center.
1	Soft-Tissue equivalent sleeve, with thru hole to accommodate ion chamber.

DOSIMETRY INSERTS

Variable Position Ion Chamber



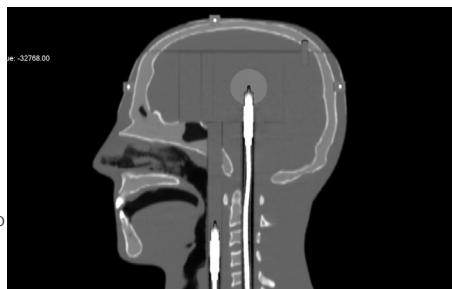
Included with 038-04-CVXX-xx:
1. Spacer Plugs, 2. Drilled cavity spacer, 3. Cavity plug with BB, 4. Solid Cavity plug.

Model 038-04-CVXX-xx

The Variable Position Ion Chamber Dosimetry Kit allows for dosimetry measurements at different locations through the brain and neck during patient treatment plan QA. This can be achieved using two parallel channels that are drilled through the phantom 30mm apart in the Inferior-Superior direction. The Posterior channel runs through the spinal cord and anterior hole is drilled in the challenging, heterogeneous, high dose-gradient region between the spine and trachea. The central hole in the included brain-equivalent cube can be aligned with anterior or posterior channels by positioning accordingly in the brain cavity. Dosimeters can be placed in one channel through the neck and brain and inside the other channel through the neck only. In this configuration, two dosimeters could be used simultaneously for tumor and organ-at-risk dosimetry. A set of the brain-equivalent spacers, designed to fit through the channels, helps to minimize air influence during the dosimetry measurements. Spacers measure between 50mm and 5mm long to allow 5mm incremental detector positioning. The set of spacers includes one spacer with tip drilled for customer-specified chamber to provide the best measurements conditions around detector's sensitive volume.

Two dosimeters could be used simultaneously for tumor and spare organ dosimetry. See CT reconstruction picture.

A cavity plug with a ceramic BB in ISO center, which can be identified by a black ring around the tip of the plug, allows for chamber localization during treatment planning. Two soft-tissue-equivalent sleeves also help to minimize air gaps around the ion chamber stem and cable for measurements outside the brain. A solid cavity plug can be used to fill the cavity if BB in the ISO center not needed.

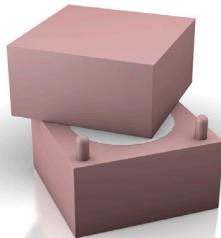


Model 038-04-CVXX-xx Includes

QTY	DESCRIPTION
1	63.5 mm Cubic brain-equivalent insert with centrally located thru hole to accommodate the ion chamber
8	Spacers of different length including 15 mm long spacer that accommodates a tip of the chamber CVXX-xx. Spacers: 50 mm – 2 pcs, 20 mm – 2 pcs, 10 mm – 2 pcs, 5 mm – 1 pc and 15 mm CVXX-xx – 1 pc.
1	Cavity plug PL-CVXX-xx to fit the cavity, brain equivalent.
1	Cavity plug PL-CVXX-xx to fit the cavity, brain equivalent, ceramic BB diameter 2.5 mm in ISO center.
2	Soft-tissue equivalent sleeves, with thru hole to accommodate ion chamber

DOSIMETRY INSERTS

Single Film Target Dosimetry Insert

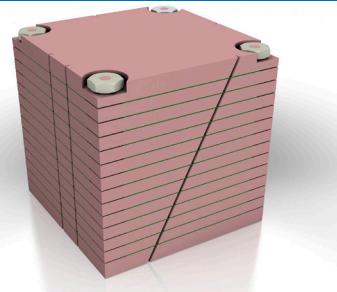


Model 038-05

The brain-equivalent cubic insert includes a Ø30 mm spherical target (+5% contrast) and receives a single piece of radiochromic film through the center plane of the sphere. CIRS now offers Precision Cut EBT3 film for this insert. Refer to page 3 for model number. The cube can be positioned in the axial, sagittal or coronal orientation and allows for the presence of a target volume thru all stages of the treatment process.

Cube is assembled using four pinholes with an off-set arrangement that allows for consistent assembly. External grooves machined outside both halves make it easy to mark film for accurate image registration. This also helps for easy assembly.

Film Stack Dosimetry Insert



Model 038-21

Radiochromic film can be used with the Film Stack Insert for small-volume dose mapping. CIRS now offers Precision Cut EBT3 film for this insert. Refer to page 3 for model number. The brain-equivalent film stack measures 63.5x63.5x63.5 mm and accommodates 13 layers of film with 4 mm thick brain-equivalent spacers in between each film. The insert is pre-filled with 15 plastic film dummies, 2 in the first location, 1 in each middle location and 2 in the last film location. This is to achieve the 63.5mm overall height specification of the insert. Place one or a desired number of films between spacers in place of film dummies. Assemble the stack and use the film dummies to keep vertical dimension of the film stack within 63.5 mm. Please note that film stack is designed to accommodate different types of films. And due to the variations in thicknesses of different films the assembled film stack vertical dimension could be smaller than a specification and requires some adjustments during treatment plan verification. Use a sharp permanent marker to score the edges of the film using the grooves along the sides of the stack. This enables x, y and z orientation when viewing individual films. Three single grooves on the sides of the Film Stack provide projections of the central z-axis while a diagonal groove prevents films from being flipped over upon removal and defines the film order in the stack. Place the film stack inside the head cavity in any orientation preferred.

Single Slice Film Insert with Fiducials



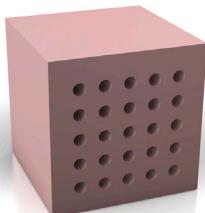
Model 038-27-CVXX-xx

The brain-equivalent cubic insert includes a 30 mm diameter spherical target with +5% contrast. It receives a single piece of radiochromic film through the center plane of the sphere. A pin-point ion chamber cavity is machined into half of the target sphere allowing simultaneous measurements of absolute dose & dose distribution inside the cube for easy positioning. This can be done jointly with CT fiducials allowing accurate and quick film registration.

Load the film and close the cube. Position the cube in the anterior or posterior position inside the brain cavity and insert the ion chamber through the appropriate channel for film / chamber measurement.

DOSIMETRY INSERTS

TLD Dosimetry Insert

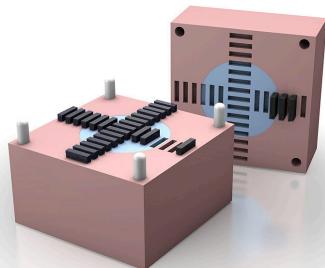


Model 038-06

TLD Dosimetry Insert consists of a brain-equivalent cube drilled in a $1 \times 1 \text{ cm}$ grid of Ø5 mm through holes. Each hole is filled with Ø5mm, brain-equivalent solid plugs for use for TLDs placement, which allow for 2D or 3D dose verification.

Plugs can be cut so the TLD can be sandwiched between the cut plug and positioned at the appropriate depth within each section. Tissue-equivalent plugs cast to precisely receive TLD chips, rods, bars and cubes are an available accessory (700-01-BT). TLD disks use the standard TE plug provided with the phantom.

Multiple-OSL Dosimetry Insert



Model 038-08

The Multiple-OSL Dosimetry Target Insert enables 2D point-to-point dosimetry in two orthogonal directions both inside the target and penumbra using Landauer nanoDots™. By rotating the insert in 3 orthogonal directions, it also enables 3D dosimetry.

Model 038-08 consists of a brain-equivalent cubic insert with a 30 mm diameter spherical target with $\pm 5\%$ contrast. The insert receives 27 OSL dosimeters through the center plane of the sphere. Cube is assembled using four pin-holes with an off-set arrangement that allows for consistent assembly. External marks machined outside both halves make it easy to align when assembled.

*NanoDot™ is a trademark of Landauer (Glenwood, IL)

Gel Cassette Insert



Model 038-22

The brain-equivalent cubic insert accommodates a removable BAREX™ container (CIRS B6 Gel Container included) approximately Ø5 cm x 5cm L that can be filled with a 3D gel polymer or other liquids.

Simply fill the disposable container (max diameter 50 mm, height 63.5 mm) in accordance with gel supplier's instructions. Then place the container within the cassette and position as desired within the head cavity.

MULTI-MODALITY IMAGING INSERTS

MRI/PET/CT ISO Center Rectangular Insert



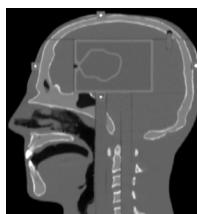
Model 038-15

This insert comes standard with STEEV.

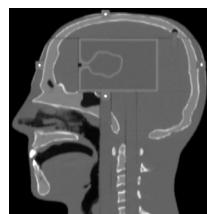
The insert must be filled with MRI or PET compatible liquids. It features a Ø3.2 mm ceramic BB fiducial at ISO center aligned to the phantom's external CT/MRI fiducials. The insert generates adequate MRI signal strength to resolve the external phantom fiducials and can be used alone or in combination with other imaging inserts to evaluate image fusion functions of treatment planning systems.

Drain and dry after each use.

Deformable Image Registration MRI/PET/CT Organic Target Inserts



25cc Organic Target CT



12.5cc Organic Target CT

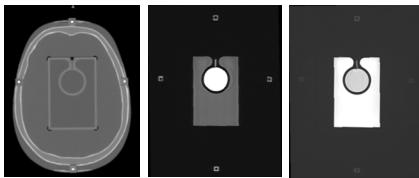
Model 038-12 & 038-13

Two MRI/PET/CT Organic Target Inserts are available for experimental testing of TPS deformable image registration algorithms. Each insert contains an organically shaped target within rectangular insert to fit STEEV's brain cavity. Both the organically shaped target volume and rectangular insert volume must be individually filled through separate fill ports using MRI or PET compatible liquids. One insert contains an organic shaped target of 25cc internal volume. The other insert contains the target isotropically reduced to 12.5cc internal volume. Both targets contain the same central position relative to the phantom external fiducials.

Drain and dry after each use.

MULTI-MODALITY IMAGING INSERTS

MRI/PET/CT Spherical Target Insert



CT Axial Recon.

MRI TSE-T1

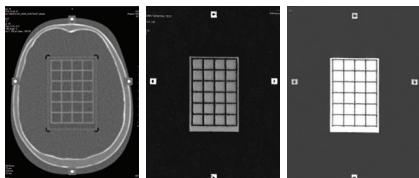
MRI TSE-T2

Model 038-11

The MRI/PET/CT Spherical Target insert provides an MRI/PET/CT image reconstruction test tool. Its precise Ø30 mm, spherical tumor volume allows for assessment of image and reconstruction integrity when images are moved among different imaging systems. This insert is designed to work together with the "matching target" in the Ion Chamber Target Dosimetry Kit (038-03-CVXX-xx), Single Film Target Dosimetry Insert (Model 038-05) and the Multiple-OSL Dosimetry Insert (Model 038-08). This series of interchangeable inserts enables enhanced end-to-end testing of image acquisition, planning and delivery. Both the spherical target volume and rectangular insert volume must be individually filled through separate fill ports using MRI or PET compatible liquids.

Drain and dry after each use.

MRI/PET/CT Spatial 3D Distortion Insert



CT Axial Recon.

MRI TSE-T1

MRI TSE-T2

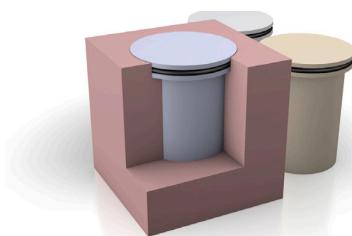
Model 038-14

The MRI/PET/CT Spatial 3D Distortion insert contains a 3D grid (13 x 13 mm spacing) of Ø 1.6 mm high contrast wire (more than 200HU). The insert must be filled with MRI or PET compatible liquids. It provides a single, precise tool to check image fusion and image distortion across multiple modalities. To align internal grid with external MRI/CT fiducials, please position insert with fill ports facing back of head.

Drain and dry after each use.

CT LINEARITY INSERT

Electron Density Cube with Removable Vial



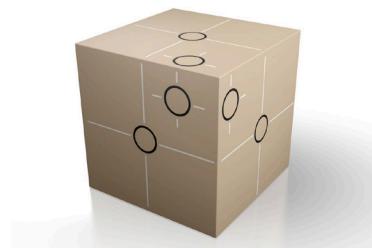
Model 038-09

Brain-equivalent cube receives a tissue-equivalent electron density reference plug as featured in Model 062M (Electron Density Phantom). The cube comes standard with the 062MA-39 Electron Density plug, made of Plastic Water-LR, that contains a Ø 1" Vial fillable with Real Water or other liquids. Additional Electron Density plugs, including high HA content, can be purchased separately.

Vial comes empty from the factory and can be removed for water filling. Please use non sharp round rod around 3 mm in diameter to push vial from the plug through the hole on the bottom of the plug.

POSITIONING AND LOCALIZATION INSERT

Winston Lutz Cube with Ø5 mm Centroid & Offset Targets



Model 038-10

The brain-equivalent cubic insert contains a Ø5 mm tungsten BB fiducial at the centroid and additional Ø5 mm target that is offset from the center of the cube in three orthogonal planes at x-y-z distances of 15 mm, 20 mm, and 25 mm respectively. The insert is designed to aid in Winston-Lutz tests for isocenter verification and localization/repositioning with couch shift. The Model 038-10 can be used for "blind" Winston Lutz test inside the head or by itself.

STEREOTACTIC FRAME ADAPTER

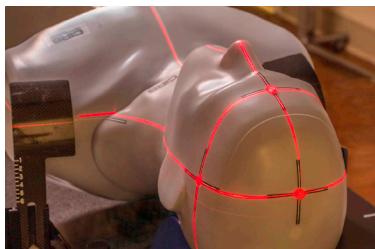


Model 038-29

Please refer to separate user guide for detailed instructions.

SET UP

Alignment Marks And Fiducials

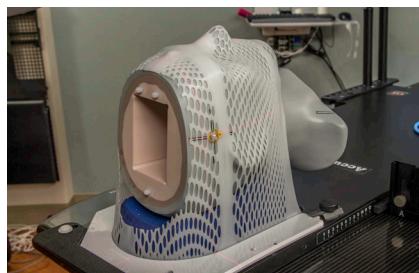


STEEV comes standard with a number of features that facilitate fast and easy set up. Both the head and neck have black cross hairs with white filling for better phantom alignment to lasers, including when the Model 038 is positioned in an SRS mask. Additionally, there are four MRI/CT fiducials positioned at the cross-hair centers in an axial plane and one at the vertex of the head. Another fiducial is embedded into the anterior rod and aligned with the vertex fiducial when it is plugged to the anterior hole. Together all six fiducials create an orthogonal

three-axis system of coordinates with the coordinate origin matching the targets' anterior location in the rectangular cavity. MRI/CT fiducials are 10 mm in length and hold 3.2 mm BB at the center surrounded by MRI signal generating gel.

STEEV contains a rectangular cavity positioned inside of the brain and parallel to the clinically relevant Frankfort Plane (FP). When aligned with lasers, the FP matches with the axial plane inside the gantry.

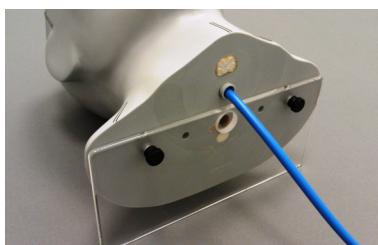
Set Up Configurations



STEEV's anthropomorphic exterior allows for intuitive positioning with any frame, mask, or frameless fixation device used in SRS. Removable skull vertex allows for the phantom to remain positioned on the treatment couch while interchanging inserts.

Neck Alignment Plate

The Neck Alignment Plate comes standard with the phantom and allows for phantom positioning and alignment with the lasers, on a hard couch top. It is attached to the neck with two nylon thumb screws.





Shoulders

The optional Shoulders are made of homogeneous, soft-tissue-equivalent material. They are anthropomorphic and contain external anatomical landmarks such as clavicles. The shoulders allow use of different fixation devices including shoulder masks and shoulder brackets. Shoulders are attached to the neck using nylon threaded rods and nuts and have two cylindrical holes that match with the holes in the neck for the ion chamber access.

Positioning Cradle

The optional Positioning Cradle allows for phantom position and storage. Additional alignment shims might be required for proper head alignment with the equipment lasers. The positioning cradle allows users to gain access to the brain cavity to interchange inserts without compromising phantom set-up.



HANDLING AND CARE

Your phantom is manufactured from epoxy resin. Various other chemicals and fillers have been added to the resin using proprietary CIRS tissue simulation technology. See appendix for simulation data. As with most other epoxy plastics, your phantom may discolor slightly over time. This process can be accelerated by direct exposure to sunlight or extreme temperatures. It is recommended that when not in use, the phantom be stored in a dark, fully climatized storage area. Epoxy is quite durable, but can still be damaged if it is dropped on a hard surface so handle with care! Most phantoms can be easily repaired. If damaged, contact CIRS. It is recommended that the phantom only be cleaned with mild detergent and water. Avoid solvent based or abrasive cleaning agents.

Note: Two rubber bands are included with the phantom's accessories. They can be used to prevent the top cap of the head from falling off when the phantom is not in its storage case like in the image shown to the right.

Engineers and physicists at CIRS are available to answer specific questions regarding the materials, design and technical specifications of the phantom. Specific questions regarding quality assurance protocols should be directed toward the appropriate equipment manufacturers and experts in the field.



INTERCHANGING INSERTS

The phantom cavity can be opened and inserts can be interchanged in the vertical position or on the treatment couch. Use the provided suction cups to open the phantom cavity and remove interchangeable inserts. Use both hands to avoid dropping and damaging the phantom.

- Clean the suction cup and phantom surface of dust and debris.
- Place the suction cup toward the back of the removable skull vertex and pull up slowly.
- Once skull portion has been removed, use the suction cup to remove insert. If the insert is too tight to remove with the suction cup alone, use the tissue-equivalent rod to gently push from the neck side.
- **TO MINIMIZE AIR GAPS, TOLERANCES BETWEEN INSERTS AND PHANTOM ARE INTENTIONALLY TIGHT. TO MAINTAIN PRECISE FIT, IT IS RECOMMENDED THAT USERS STORE PHANTOM AND INSERTS IN THE SAME AMBIENT ROOM TEMPERATURE.**

FILLING AND MULTI-MODALITY INSERTS

- Each Multi-Modality Insert is fillable with the user's liquid of choice. CIRS recommends distilled water and its solutions to avoid organic growth inside.
Do not use alcohol or other solvents for filling or cleaning the inserts.
- If the insert contains a hollow target, this target may also be filled.
- CIRS recommends user fill the inserts using a syringe and needle no larger than 14 gauge.
- During filling process, use one filling port for a needle insertion and a second port to release air. Tilting the insert during filling may help to drain almost all residual air.
- Care must be taken during filling and draining processes to avoid damaging insert interior. Damage caused by needle insertion is not covered by warranty.
- After filling the insert, seal with provided screws and gaskets using the 1/8" hex wrench. Do not over-tighten. Over-tightening could result with lock of the screw inside the threaded hole and damaging screw during removal.
- **USERS SHOULD ALWAYS DRAIN INSERTS AFTER USE. INSERT DIMENSIONS MAY BE AFFECTED IF EXPOSED TO WATER AND WATER SOLUTIONS FOR LONGER THAN 24 HOURS. ADDITIONALLY, INSERTS SHOULD BE DRIED COMPLETELY TO AVOID ORGANIC GROWTH.**



Using the provided hex wrench, remove set-screw to fill Multi-Modality Inserts.

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.

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 or your local distributor prior to returning the product. Visit <https://www.cirsinc.com/distributors/> to find your local distributor. 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 Ave,
Norfolk, Virginia, 23513 USA

PRODUCT	WARRANTY PERIOD
Model 038- STEEV Stereotactic End-to-End Verification Phantom Patient	60 Months
Inserts 038-11, 038-12, 038-13, 038-14, 038-15 and MRI/CT Fiducials	12 Months

APPENDIX

Linear Attenuation Coefficients in CM⁻¹ for tissue Substitutes

ENERGY- MEV	SPINAL CORD REFERENCE	SPINAL CORD, CIRS	RATIO, %
0.04	0.2769	0.2768	99.96
0.06	0.2125	0.2124	99.95
0.08	0.1895	0.1894	99.95
0.10	0.1762	0.1761	99.94
0.20	0.1414	0.1413	99.93
0.40	0.1095	0.1095	100.00
0.60	0.0924	0.0924	100.00
0.80	0.0812	0.0811	99.88
1.00	0.0730	0.0729	99.86
2.00	0.0510	0.0510	100.00
4.00	0.0351	0.0350	99.72
6.00	0.0285	0.0285	100.00
8.00	0.0249	0.0249	100.00
10.0	0.0227	0.0227	100.00
20.0	0.0185	0.0185	100.00
30.0	0.0174	0.0174	100.00
El. Density, x10 ²³ , cm ⁻³	3.449	3.488	99.97
Density, gcm ⁻³	1.04	1.07	-

ENERGY- MEV	AVERAGE SOFT TISSUE REFERENCE	AVERAGE SOFT TISSUE, CIRS	RATIO, %
0.04	0.2679	0.2678	99.96
0.06	0.2087	0.2091	100.19
0.08	0.1871	0.1876	100.27
0.10	0.1742	0.1748	100.34
0.20	0.1401	0.1406	100.36
0.40	0.1086	0.1090	100.37
0.60	0.0917	0.0920	100.33
0.80	0.0805	0.0808	100.37
1.00	0.0724	0.0726	100.28
2.00	0.0505	0.0507	100.40
4.00	0.0347	0.0348	100.29
6.00	0.0282	0.0282	100.00
8.00	0.0247	0.0247	100.00
10.0	0.0225	0.0225	100.00
20.0	0.0182	0.0181	99.45
30.0	0.0171	0.0170	99.42
El. Density, x10 ²³ , cm ⁻³	3.421	3.434	100.38
Density, gcm ⁻³	1.03	1.055	-

ENERGY- MEV	TRABECULAR BONE REFERENCE	TRABECULAR BONE, CIRS	RATIO, %
0.04	0.4546	0.04536	99.8
0.06	0.2802	0.2806	100.1
0.08	0.2296	0.2303	100.3
0.10	0.2058	0.2065	100.3
0.20	0.1588	0.1596	100.5
0.40	0.1223	0.1229	100.5
0.60	0.1031	0.1036	100.5
0.80	0.0905	0.0909	100.4
1.00	0.0813	0.0817	100.5
2.00	0.0568	0.0571	100.5
4.00	0.0393	0.0395	100.5
6.00	0.0322	0.0323	100.3
8.00	0.0284	0.0284	100.00
10.0	0.0260	0.0260	100.00
20.0	0.0216	0.0215	99.5
30.0	0.0206	0.0205	99.5
El. Density, $\times 10^{23}$, cm $^{-3}$	3.844	3.863	100.5
Density, gcm $^{-3}$	1.18	1.20	-

ENERGY- MEV	CORTICAL BONE REFERENCE	CORTICAL BONE, CIRS	RATIO, %
0.04	1.2783	1.2693	99.3
0.06	0.6046	0.6025	99.7
0.08	0.4282	0.4273	99.8
0.10	0.3561	0.3560	100.0
0.20	0.2517	0.2513	99.8
0.40	0.1903	0.1903	100.0
0.60	0.1600	0.1601	100.1
0.80	0.1403	0.1404	100.1
1.00	0.1260	0.1261	100.1
2.00	0.0884	0.0885	100.1
4.00	0.0626	0.0624	99.7
6.00	0.0525	0.0523	99.6
8.00	0.0473	0.0471	99.6
10.0	0.0444	0.0441	99.3
20.0	0.0397	0.0391	98.5
30.0	0.0394	0.0387	98.2
El. Density, $\times 10^{23}$, cm $^{-3}$	5.952	5.956	100.1
Density, gcm $^{-3}$	1.92	1.93	-

APPENDIX (CONT.)

ENERGY- MEV	AVERAGE BRAIN REFERENCE	AVERAGE BRAIN BRDT, CIRS	RATIO, %
0.04	0.2791	0.2791	100.00
0.06	0.2135	0.2138	100.14
0.08	0.1902	0.1907	100.26
0.10	0.1767	0.1772	100.28
0.20	0.1418	0.1422	100.28
0.40	0.1098	0.1102	100.36
0.60	0.0927	0.0930	100.32
0.80	0.0814	0.0817	100.37
1.00	0.0731	0.0734	100.41
2.00	0.0511	0.0513	100.39
4.00	0.0352	0.0352	100.00
6.00	0.0286	0.0286	100.00
8.00	0.0251	0.0250	99.60
10.0	0.0229	0.0228	99.56
20.0	0.0186	0.0185	99.46
30.0	.0.176	0.0174	98.86
El. Density, $\times 10^{23}$, cm $^{-3}$	3.458	3.470	100.35

SPINAL DISKS

EN, MEV	REF.1	CIRS	RATIO, %
0.04	0.3096	0.3097	100.03
0.06	0.2287	0.2288	100.04
0.08	0.2014	0.2015	100.05
0.10	0.1862	0.1863	100.05
0.20	0.1486	0.1487	100.07
0.40	0.1150	0.1151	100.09
0.60	0.0971	0.0971	100.00
0.80	0.0852	0.0853	100.12
1.00	0.0766	0.0767	100.13
2.00	0.0535	0.0536	100.19
4.00	0.0369	0.0369	100.00
6.00	0.0301	0.0301	100.00
8.00	0.0265	0.0265	100.00
10.0	0.0242	0.0242	100.00
20.0	0.0199	0.0199	100.00
30.0	0.0189	0.0188	99.47
El. Density, $\times 10^{23}$, cm $^{-3}$	3.621	3.624	100.08

CIRS
COMPUTERIZED IMAGING
REFERENCE SYSTEMS, INC.
900 Asbury Ave
Norfolk, Virginia 23513 • USA

TOLL FREE 800.617.1177

TEL: 757.855.2765

FAX: 757.857.0523

EMAIL: admin@cirsinc.com

www.cirsinc.com

Technical Assistance
1.800.617.1177

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Publication: 038 UG 110520



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