

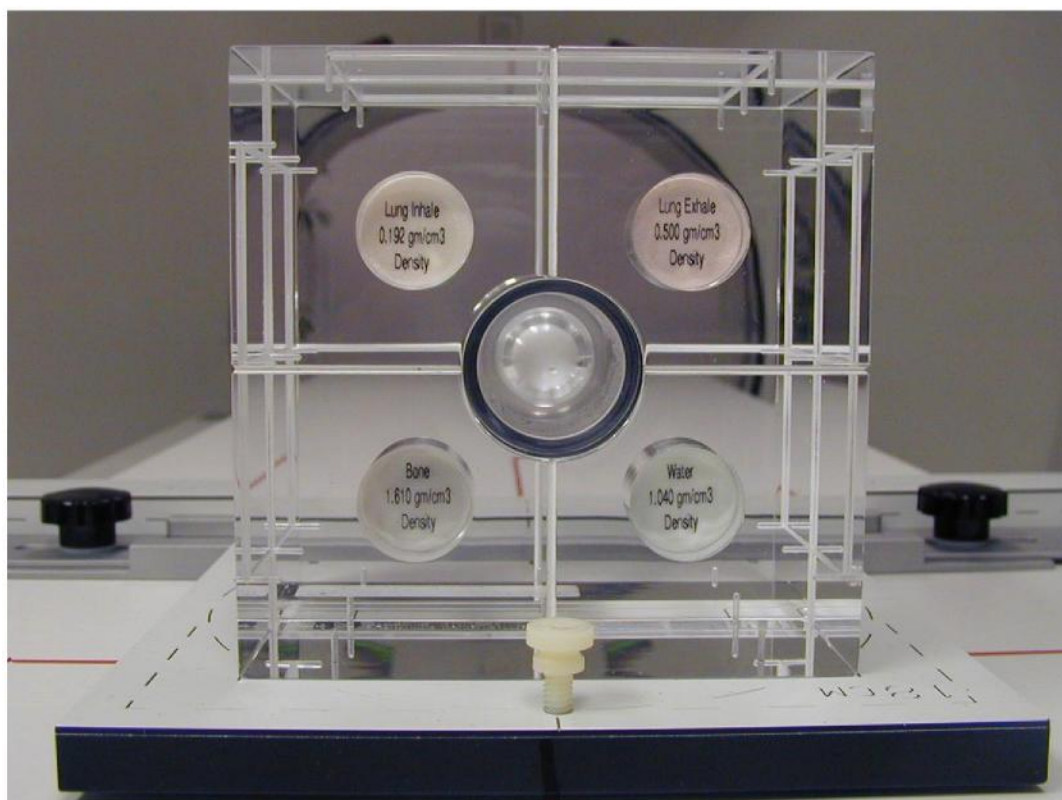


ISIS QA-1

User Applications Guide

ISIS QA-1 Geometric Phantom

**For Laser Alignment, Image Geometric Dose verification for
CT Guided Radiotherapy**



General Information

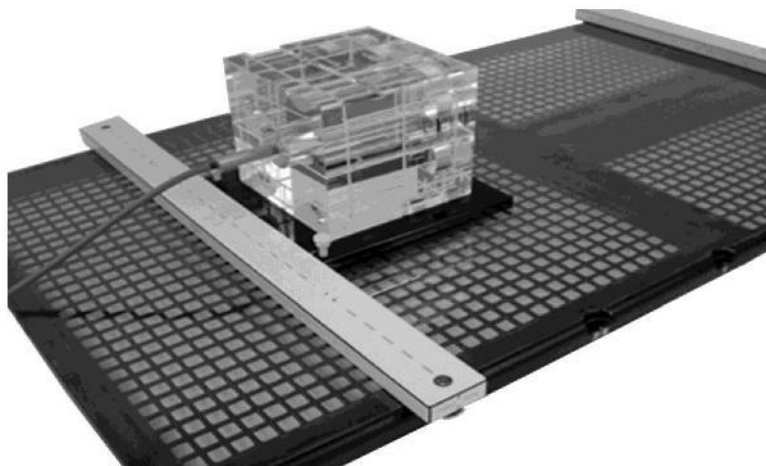
The **ISIS QA-1** provided the user with the ability to verify the geometric error within the radiation therapy department. From your basic laser checks to many sophisticated imaging, RTP, dose checks, etc. The QA manager can routinely monitor the geometric accuracy within the whole treatment process.

The **ISIS QA-1** system provides single CT slice offset check on your CT Sim for table and gantry alignment. to a full scan series to create a RTP plan and verify the marking laser position accuracy on the CT Simulator. Then you can measure the expected beam isocenter dose on your linear accelerator for each beam planned and treated.

With the precision two-millimeter grooves, precision cut 10 x 10 fields including a geometrically accurate 2.54 mm round ball you are able to quickly QA various system mechanical movements. These checks include lasers (fixed and movable), table movements up/down, table in/out, etc.. Also provided are imaging QA features that include the four certified density plugs for monthly RTP image verifications.

With the user installed tungsten pins, you are able to test for gantry sag on the treatment machine and the standard conventional X-Ray simulator.

Whether it's a CT Sim, a conventional simulator, RTP system or a treatment machine (with or without MLC -IMRT) the **ISIS QA-1** allows you to perform a top to bottom geometric check within your radiotherapy department.



ISIS QA-1 Tests Listed by Radiotherapy Machine

The **ISIS QA-1** phantom was designed for Daily / Weekly / Monthly / Annual QA by the physicist, Dosimetrist, and therapist. The **ISIS QA-1** further provides geometric QA testing to be preformed by the Installation Engineer and Maintenance Engineer. This phantom provides “Machine to Machine” geometric QA for the CT Simulator, Conventional Simulators, Treatment Planning systems, and Treatment Machines.

CT-Simulator

CT image scan plane alignment geometry for gantry tilt
 Patient table parallel to scan image plane
 Increment test for table in / out movement
 Increment test for table up / down movement
 Image QA test for electron density testing (five measurable calibrated values) Fixed room lasers daily / monthly / annual / installation-maintenance test Movable laser(s) daily / monthly / annual / installation-maintenance test Image export and laser position data import verification
 Patient table bed centering to image scan plane (left to right)
 Patient table level verification
 Quick single slice laser offset test
 Quick daily room laser alignment verification to system central geometry

Conventional Simulator

Geometry QA for gantry rotation (0, 90, 180, 270 degrees)
 Geometry QA for table rotation (90, 0, 180 degrees) Increment QA for table in / out movement Increment QA for table up / down movement
 Increment QA for table left / right movement
 Image QA for x-ray digital films and or image intensifier
 QA for digital readout for table, collimator, gantry, and field size
 Fixed room lasers daily / monthly / annual installation-maintenance QA

Treatment Machine

Geometry test for gantry rotation for 0, 90, 180, 270, and 360 degrees

Geometry test table rotation for 90, 0, 180 degrees Increment test

for table in / out movement Increment test for table up / down

movement Increment test for table left / right movement

QA for digital readout for table, collimator, gantry, and field size

Fixed room lasers daily / monthly / annual / installation-maintenance tests

RT dose plan verification (four opposite field angles) when using a Farmer chamber.* Radiation field /

RT plan geometry verification with port film and or digital port imaging system by using tungsten pin inserts at known locations on the **ISIS QA-1**.

*Farmer chamber not supplied by RPD (customer supplies specifications of chamber used with order of the **ISIS QA-1**)

Radiation Therapy Planning System

Image geometry data import verification and export verification

DRR reconstruction geometry verification with three known 10cm x 10cm fields RT plan data

export for multi-leaf / block system verification (Treatment Machine) Room lasers test for Isocenter

marking geometry (CT Simulator)

Electron density verification on four known calibrated electron density values Object treatment

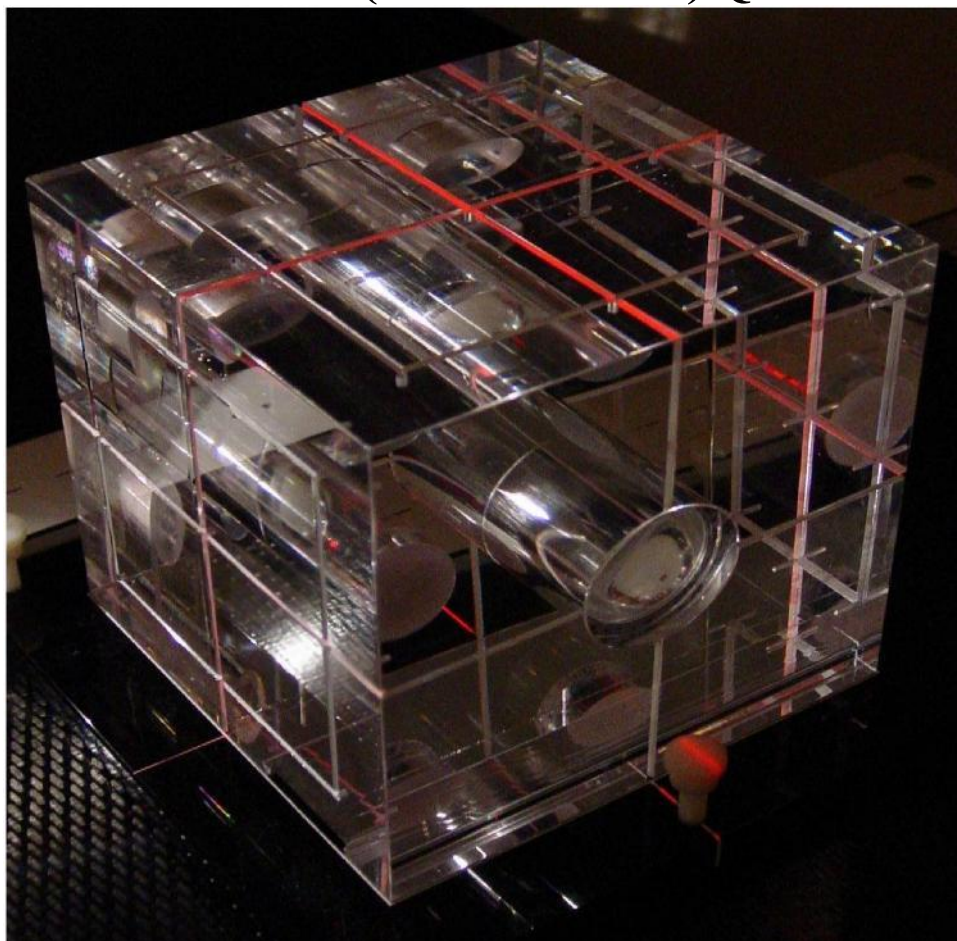
plan for use in laser marking verification (CT Simulator) Object treatment plan dose

verification (Treatment Machine)

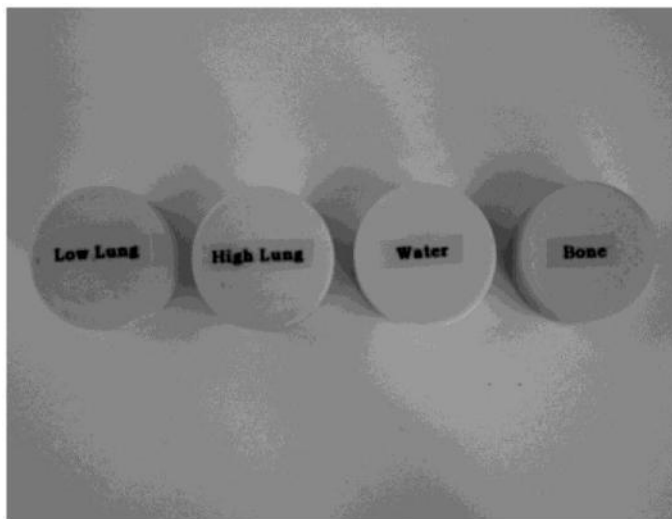
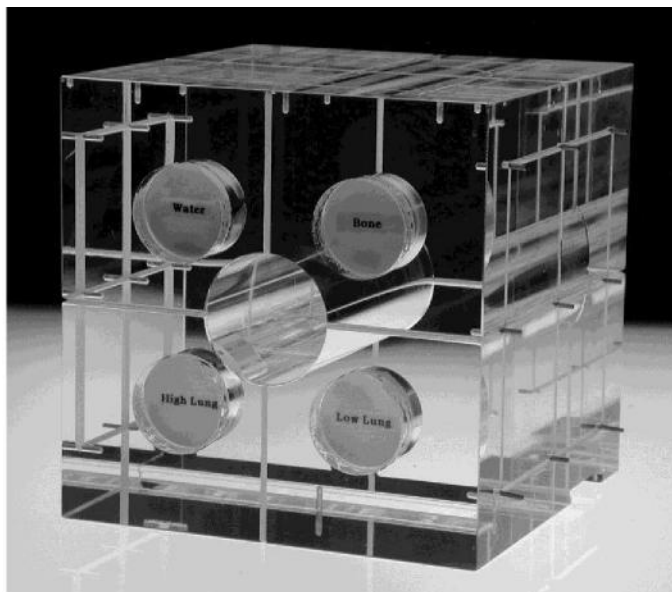
Object treatment plan patient dose verification (Treatment Machine)

The **ISIS QA-1** helps standardize the QA program for installation engineer, maintenance engineer, therapist, dosimetrist and or physicist. These QA tasks are accomplished by using a common single QA alignment / verification tool. This provides a common geometric theme within the radiation therapy department prior to implementation of an IMRT – IGRT or standard external beam treatment program. The continuing review of the geometric accuracy between all department systems is important with using today's high quality and technical treatment protocols.

CT Simulator and Treatment room laser ceiling and wall mounted lasers (fixed / movable) QA verification.



Electron Density Calibrated Plugs

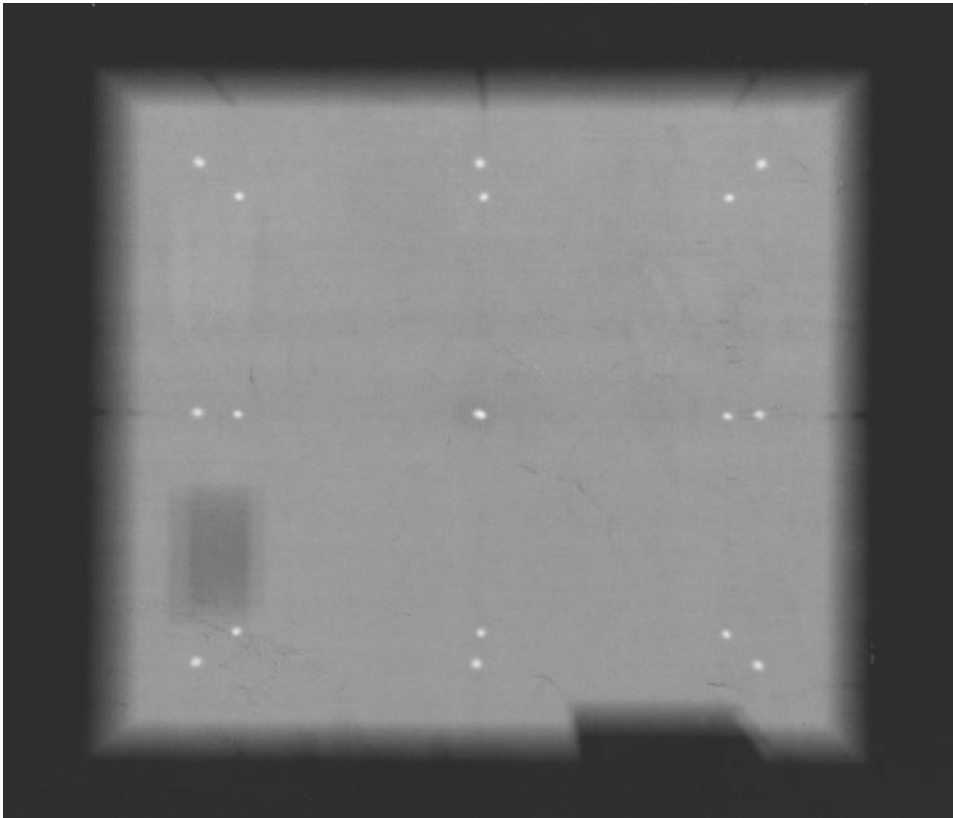


Provides the dosimetry department the ability to quickly to verify the imaging CT scanner is providing correct image values.

(Customer to record actual density readings at time of first setup for future caparisoning verifications)

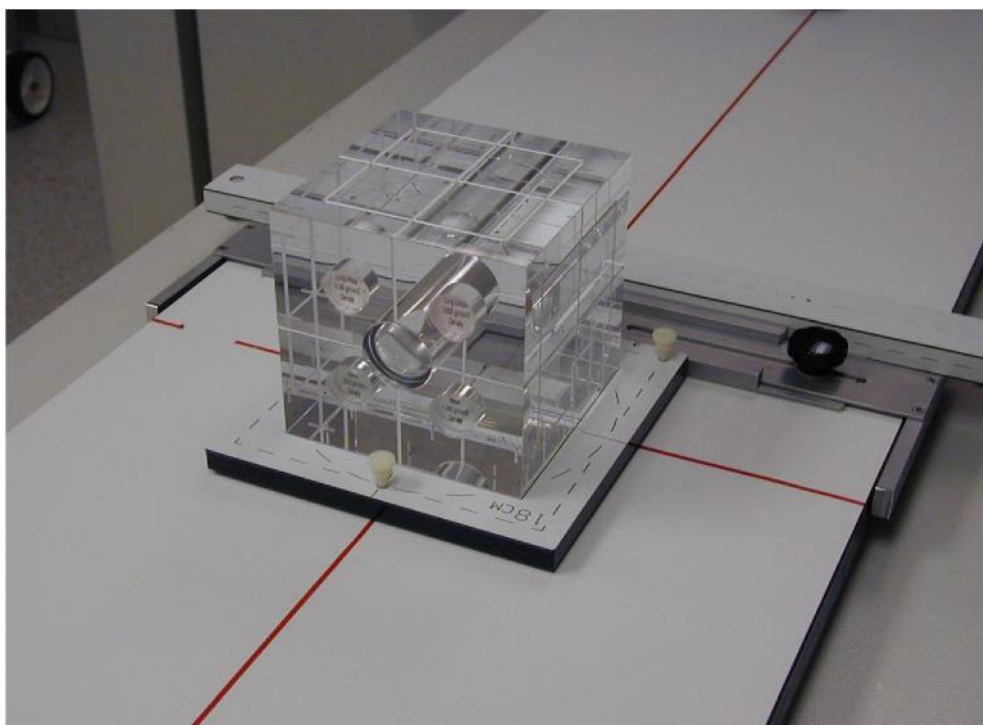
Portal Imaging Geometric Alignment Verification

Placing the provided tungsten pins in two opposite surfaces for test of mechanical gantry sag. By rotating the gantry head to 0,90 180, and 360 degrees and exposing film or digital portal viewing system you can visualize the mechanical beam distortion at each position. By comparing the inner field pins to the outer non-divergent field pins you see if there is any distortion. The picture below shows a slight distortion in the vertical and horizontal axis.



Port Film though the **ISIS** QA-1

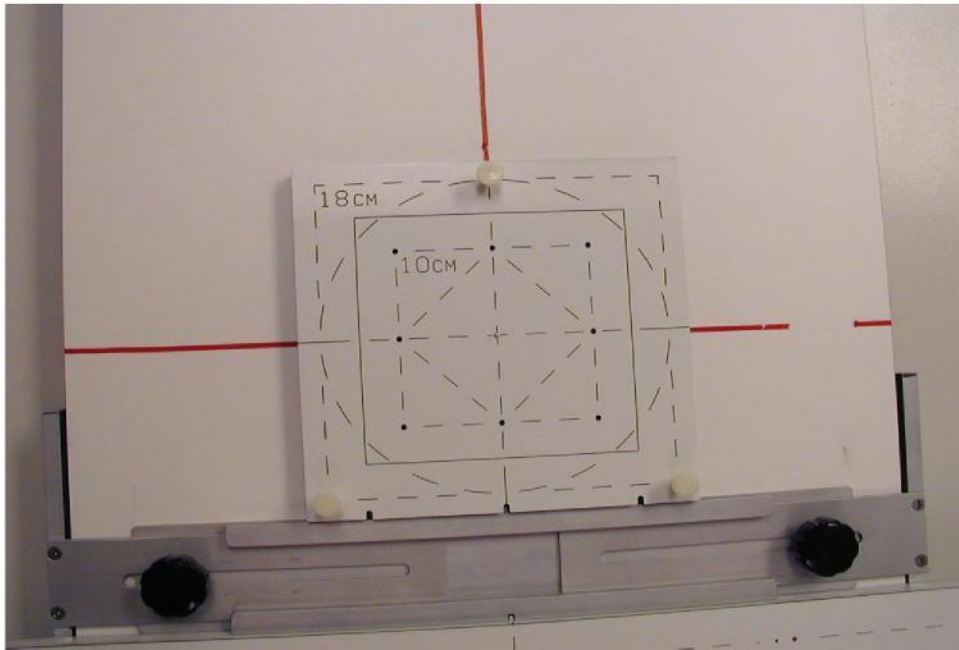
Generic Machine Table Alignment Tool *



*Shown with optional machine table alignment tool

This tool allows the user the ability to use the **ISIS QA-1** QA system on non-standard couch tops.

Treatment machine and standard simulator Light Field vs. Radiation Field verification imaging plate.

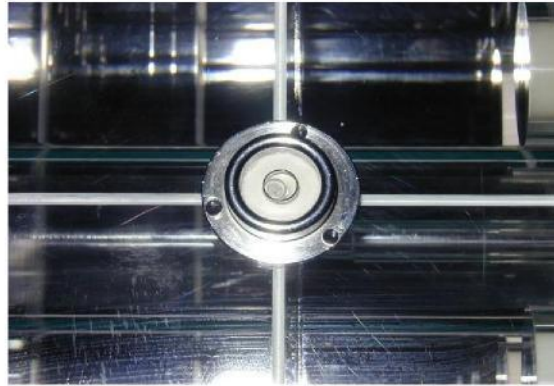


**Shown with optional machine table alignment tool*

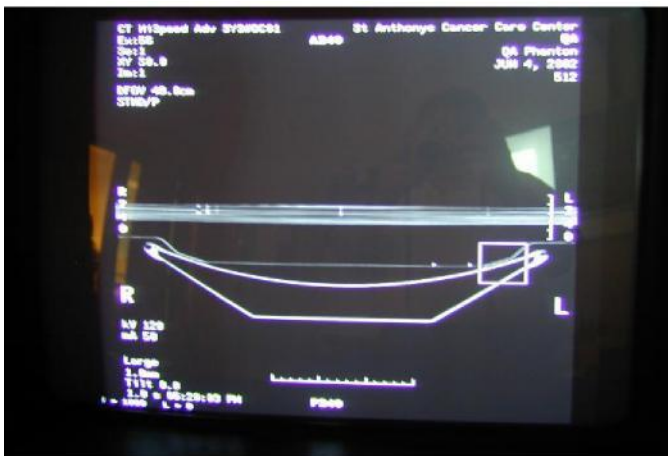
By setting the machine SSD to the isocenter the user can verify various field light sizes. For example square fields of 14 cm x 14 cm, 10 cm x 10 cm, 20 cm x 20 cmand a MLC circle field size of 20 cm. This ability is very important for light field vs. radiation field verifications.**

**** The current supplied leveling pad is designed for a standard 20 x 20 cm field.**

Round Bubble Level for user level setup verifications. Also included is a 9" level for this purpose.



Lateral Laser verification with the alignment bar. Also notice the center dot. Behind this dot on both sides is a Tungsten Pin that the user can take a long port film to check for gantry sag on 90 degree rotation angles.



Notice the seven (7) Aluminum BB's shown by the CT image of the alignment bar. When seeing all BB's equally you are assured of proper table (bed) alignment to the CT image acquisition process.

BB Sizes are:

1/32" (.8mm)

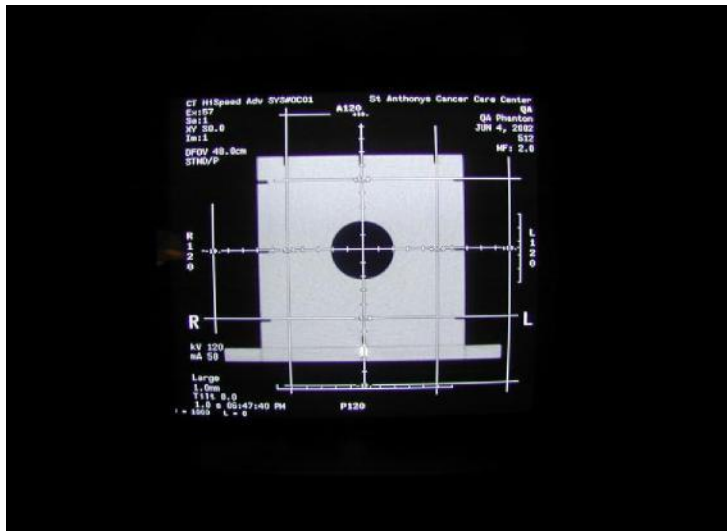
1/16" (1.6mm)

3/32" (2.4mm)

CT Simulator internal laser alignment verification



By scanning to this bar you can verify the internal laser alignment to the CT image plane. You should see all seven Aluminum BB's on the image screen.



This picture shows the vertical and (left to right) image alignment on scan image reconstruction center. The patient table is centered perfectly left to right.

ISIS QA-1 setup for quick laser verification



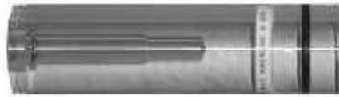
ISIS QA 1 complete package includes:

ISIS Phantom Cube, Leveling Plate, Round Bubble Level, 9" Level, 50 cm ruler, Alignment Bar, Object Insert, Dose Verification Insert, Tungsten Pins, and Case.



ISIS QA-1 Optional Accessories

INSERT, FARMER STYLE CHAMBER



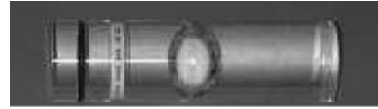
This insert holds a farmer style chamber (without build-up cap) with the center of the collection volume at the center of the phantom cube.

The Farmer Chamber Insert accommodates the following chambers:

PTW: 23333, 30001, 30002, 30004, 30006, 30010, 30011, 30012, 30013
Bicron/NE 2571, 2581, 2505/3 (A or B), Nuclear Associates 30-351,

Item #	Description
681-104	Insert, Farmer Style Chamber

INSERT WITH 2.54 CM DIAMETER TEFLON B

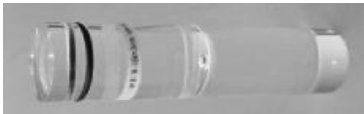


This insert has a 2.54 cm Teflon ball centered in the insert. The Teflon Ball inset is used as tumor value to verify measurement accuracy on the CT / CT Simulator lasers and treatment planning system for geometric tests. Density: 2.13 - 2.2 g/cm³

Item #	Description
681-101	Insert with 2.54 cm Diameter Teflon Ball

All inserts are 4 cm in diameter and 14 cm long. They are made of clear acrylic with a rubber O-ring at one end to keep the insert snug in the phantom cube. Each insert is labeled with the item number, description and density.

INSERT, TUNGSTEN BALL



This insert has a tungsten ball with a diameter of 5.5 mm (7/32") in the center of the insert.

Item #	Description
681-106	Insert, Tungsten Ball - 5.5 mm Diameter

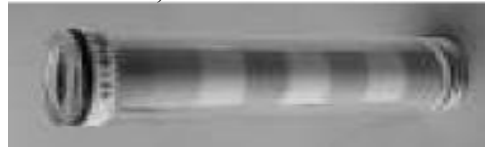
INSERT, LIQUID FILLABLE



This insert has a 2.5 cm hollow space in the center of the ISIS insert for liquid filling of the customer's choice. There are two fill / retraction holes drilled at an angle. Each fill hole has an O-ring and screw to hold the liquid in place.

Item #	Description
681-108	INSERT, Liquid Fillable

INSERT, MULTI-DENSITY HOLDER



The Multi-Density holder insert accommodates 8 density plugs (2.5 cm diameter x 1.5 cm thick). An acrylic end plug and O-ring on each end holds the density plugs in place. This insert is custom made - the customer must specify material densities needed and the order of placement in the insert when ordering. See ordering chart below: The density plugs are sold separately.

Item #	Description	Physical Density (g/cm ³)	Electron Density (g/cm ³)	Electron Density Relative
681-107-6	Lung Inhale	0.20	0.634	0.190
681-107-7	Lung Exhale	0.50	1.632	0.489
681-107-8	Bone 800 mg/cc	1.53	4.862	1.456
681-107-9	Water	1.01	3.346	1.002
681-107-10	Adipose (Fat)	0.96	3.170	0.949
681-107-11	Breast (50% Gland / 50% Adipose)	0.99	3.261	0.976
681-107-12	Muscle	1.06	3.483	1.043
681-107-13	Liver	1.07	3.516	1.052
681-107-14	*Trabecular Bone - 200 mg/cc	1.16	3.730	1.117
681-107-15	*Dense Bone - 1000 mg/cc	1.66	5.243	1.570
681-107-16	*Dense Bone - 1250 mg/cc	1.83	5.718	1.712
681-107-17	*Dense Bone - 1500 mg/cc	2.00	6.209	1.859
681-107-18	*Dense Bone - 1750 mg/cc	2.17	6.698	2.005
681-107-19	*Cortical Bone	1.93	5.956	1.780
681-107-20	**Titanium	4.51	12.475	3.735
681-107-21	***Aluminum	2.718	--	--

All bone references 10 mm diameter in H₂O – Titanium references 6 mm diameter in H₂O
Aluminum references 9.5 mm diameter in H₂O

Please note: All density values are estimates. Exact density values vary by production batch. Density plugs are labeled with exact density values on the plug itself for your calculations.

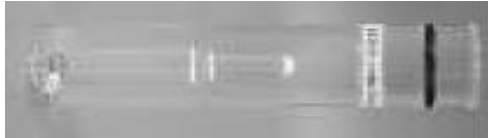
ISIS QA-1 Optional Accessories continued

RT TABLE ADAPTER BAR

Item# 681-169 RT Table Top Adapter Bar for RT Centering Bar
(RT table top manufacture supplied with the RT Table top purchase). (No Picture)

Item #	Description
681-169	RT Table Top Adapter Bar

INSERT, EXTRADIN A12 CHAMBER



Item #	Description
681-104-A12	INSERT, EXTRADIN A12 CHAMBER

INSERT, EXTRADIN A14SL Chamber



Item #	Description
681-104-A14SL	INSERT, EXTRADIN A14SL CHAMBER

INSERT, ISOTOPE IN CENTER



This insert accommodates a holder for the NA-22 Isotope.
This insert holder keeps the NA-22 Isotope in the center of the insert.

Item #	Description
Item #	Description
681-109	Insert, Holds Isotope In Center
681-114	Holder for NA-22
681-115	NA-22 Isotope (requires user material handling license)

INSERT, CUSTOM DESIGN FOR ION CHAMBER

The Custom Chamber Inserts are made to order per customers required design specifications. The customer must specify the ion chamber manufacturer, model number and description that insert is to be custom drilled for.

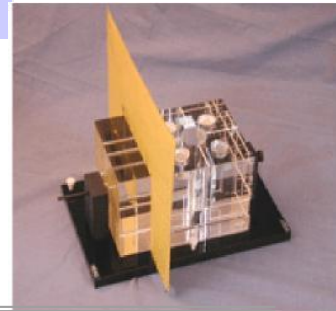
Item #	Description
681-xxx	Insert, Custom Ion Chamber

ISIS QA-1 Optional Accessories continued

FILM PHANTOM ASSEMBLY

Item #	Description
681-130	Film Phantom Assembly

The film phantom unit includes a film phantom base, 1.5 cm and 5.0 cm acrylic phantom blocks and a steel marker pin. The phantom cube and the 1.5 cm and 5.0 cm phantom blocks are placed on the film phantom base. A ready pack film is placed between the 1.5 cm and 5.0 cm phantom blocks and the steel marker pin is used to mark film for orientation. Once in the correct position, the film is exposed several times at different gantry angles which produces a star pattern on the film for verification of the machine isocenter.



MINI PHANTOM

Item #	Description
681-180	Mini Phantom

This Optional Mini Phantom can be used with the Alignment Bar or the Adjustable Table-Centering Bar to verify the coincidence of the lasers and the crosshairs and to check for gantry sag and optical back pointer position when the gantry is rotated $\pm 90^\circ$. The phantom can be used in the flat or vertical position. It has a "L-shaped" pin groove that sits on the alignment pin on either bar. It is scribed on four sides with 2 mm white painted lines. There are holes for tungsten pins on four sides of the phantom. Four 1.5 mm dia tungsten pins are included.

Specifications: Material: Clear Acrylic, Dimensions: 15cm x 15cm x 5cm thick



ELECTRONIC SELF-LEVELING 5-BEAM LASER

Item #	Description
710 - 850	Electronic Self-Leveling 5 Beam Laser

This unit has 5 self-leveling, orthogonal (90 degree) beams that provide simultaneous plumb, level and square reference points. Used for laser alignment checks.



HIGH PRECISION GANTRY LEVEL

Item #	Description
352-200	High Precision Four-Sided Gantry Level
352-201	Vinyl Case for High Precision Gantry Level

The four-sided High Precision Gantry Level is used to check the gantry angle indicators at four angle indicators at four locations: 0, 90, 180, and 270 degrees, with accuracy to 1/40 of a degree.



ADJUSTABLE TABLE CENTERING BAR

Item #	Description
681-161	Adjustable Table Centering Bar

This bar is used on couches other than the Varian EXACTTM or Med-Tec IPPSTM for proper alignment of the phantom cube. It is adjustable from 37 cm to 68 cm wide. There is a scale on the bar with zero at center. The scale has mm and cm markings on both sides of zero. T-squares at each end of the bar are placed on the side of the couch and adjusted so each side is equal distance from zero on the scale. Knobs at both ends of the bar are loosened and tightened to make adjustments. There is an alignment pin on one side of the bar to connect it to the leveling plate. An alignment groove on the other side bar is to connect the alignment bar to the table centering bar.

Option Issue Date: 04/09/12 Specifications subject to change without notice.