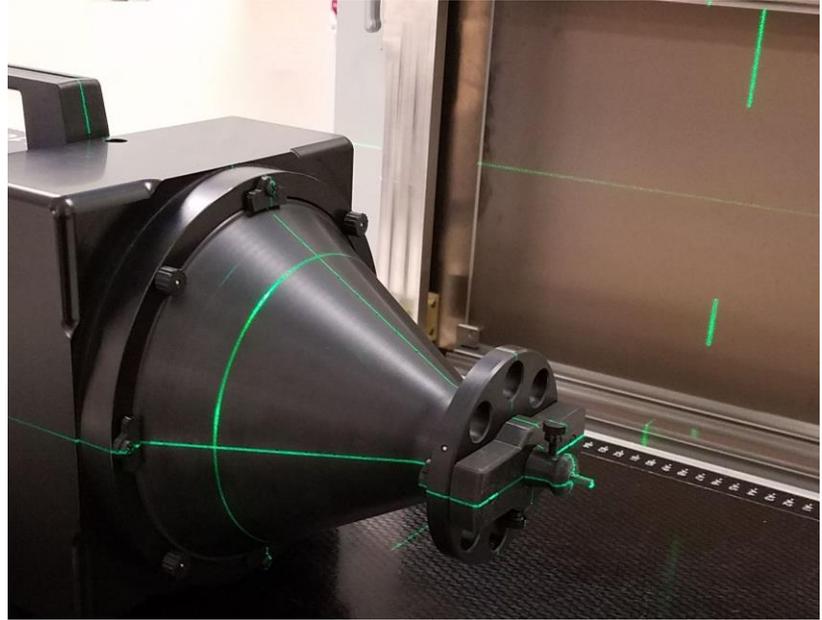


Proton and X-ray Digital Camera Phantoms

3D and 2D Beam Metrology - Logos Systems International

XRV-100 Features and Benefits:

- Filmless gantry, collimator, and linear accelerator Quality Assurance
- Real-time 3D beam vector and profile capture
- Proton beam compatible
- 4 – 40 mm beam widths over 360 degrees
- 80 mm long field of view
- Quickly verifies image guidance, gantry, and radiation isocenters with room lasers
- Daily CyberKnife Robot and Iris QA, Iris or MLC QA
- BeamWorks software includes trend analysis and graphing of distance to plan, beam diameter, and beam intensity
- Archives all data for later review with optional export to Excel
- Computer, software, and cables included

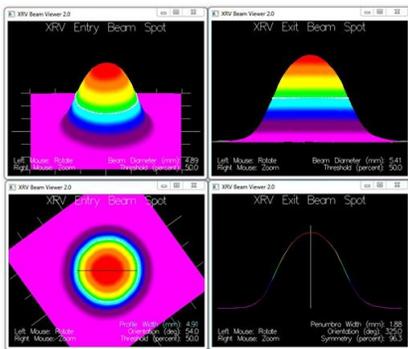


XRV-100 Digital Camera Phantom

The XRV family of X-ray and proton beam inspection systems combines precision metrology with high-energy radiation detection to form a completely electronic alternative to film-based measurements. The XYZ location and vector of pencil-thin beams of ionizing radiation can now be measured with unmatched speed and accuracy. Beam vector, profile, and divergence can be obtained in seconds rather than hours. Automation scripts can be used to capture changes in the beam shape, intensity, location, and direction over time for use in later analysis or 3D volumetric reconstruction.

XRV systems verify that the proton and X-ray therapy subsystems (robot, collimator, radiation source, and kV imagers) are working together to accurately deliver radiation to the irregularly shaped lesion volume. Beam position measurements are accurate to 0.2 mm and measurement repeatability is typically 0.02 mm. Vector and beam viewing software enables real-time any-angle viewing of the captured data. Up to 4,000 frames of video can be captured real-time at rates from 1 to 30 frames per second.

All operations are controlled by a laptop or desktop PC supplied with the detector phantom. The XRV comes with a 30 meter (100 feet) USB2 power-over-CAT6 cable system so that the system PC and operator can be located safely away from the treatment room. The detector phantom weighs approximately 8 kilograms (17 pounds).



3D Beam Profile Viewing

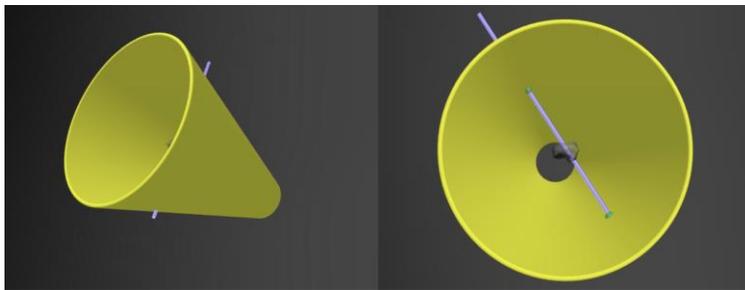


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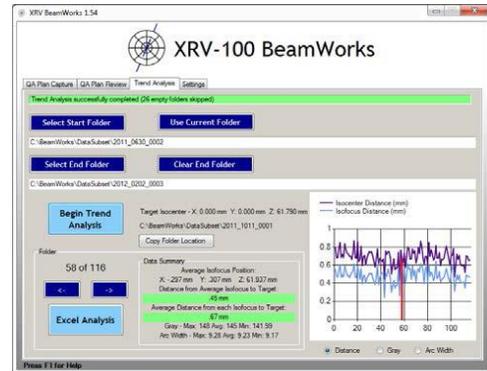
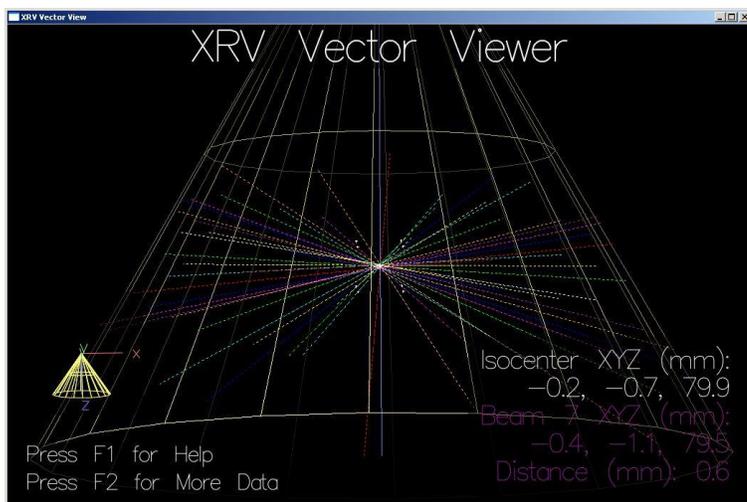
XRV Operation

The XRV phantom is first imaged with a CT scanner so that the fiducials can be used to establish the treatment dose volume. Every beam of the treatment plan can then be measured for delivery accuracy. The patented XRV technology works on the principle of the hodoscope: the X-ray or proton beam creates entry and exit beam spots on the surface of a scintillator cone located within the phantom. A sensitive CCD camera then digitizes the beam spots and transfers the bitmap to the XRV computer for reconstruction into a 3D vector and profile.

The BeamWorks software is used to acquire, analyze, and archive XRV images. Beam vector and shape data are displayed in 3D allowing real-time zoom and viewing angle selection. Beam diameters can be measured at any vertical slice of the beam for easy penumbra calculations. Spreadsheet macros are provided for extended statistical analysis of the captured data. Measurements can be made from the GUI or customized with an easy-to-use scripting environment.



Shown above is a representation of X-ray beams striking the XRV-100 scintillator cone from various angles. Once the entrance and exit spots for each beam are measured, the 3D path can be precisely calculated and displayed in the Vector Viewer application below.



Beamworks Trend Analysis

XRV-100 Specifications:

Accuracy: ¹

XYZ Beam Center:	0.2 mm
Repeatability:	+/-0.02 mm (typical)
Vector Theta/Phi:	0.2 degree
Repeatability:	+/-0.05 degree (typical)

Optical System: ¹

Resolution:	1280 x 960 pixels binned to 640 x 480 pixels
Capture Rate:	1 - 30 frames/sec
Cone Angle:	60 degrees
Usable Cone Area:	80 mm over 360 deg. Width: 15 - 40 mm
Lens MTF:	Megapixel resolution
Camera Interface:	USB

Camera Shielding: ²

Camera top and sides:	12.7 mm lead alloy or bismuth composite
CCD Lifetime:	~1,500 beam hours

Camera Module Physical:

H x W x D:	26.6 x 19.1 x 58.4 cm
Weight:	7.8 kg (17.2 lbs)
Enclosure Material:	Aluminum and Plastic

Interface:

Capture Trigger:	Auto, GUI, Script, or Network watch-file
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Computer Components:

Configurable to customer requirements

General:

Electrical Power:	110V, 2 or 4A
Environment:	5 to 30 degrees C; 90% humidity, no condensation; minimal vibration

NOTES:

- Contact us for higher camera resolutions.
- Contact us for custom shielding requirements. The camera may be replaced for a service fee after approximately 3 years if necessary.