

Proton and X-ray Digital Camera Phantoms

3D and 2D Beam Metrology - Logos Systems International

ARC-200 Features:

- Real-time Proton and X-ray beam profile and position capture
- 190 mm diameter x 55 mm deep cylindrical detector with near tissue equivalence
- 360-degree Gantry Rotation capable, no repositioning
- Effective Resolution 0.2 mm at 8 or 12-bits per pixel
- Flexible fiducial and build-up options
- BeamWorks ARC software includes GUI or script operation
- Individual or integrated frame capture modes
- Advanced beam profile viewing and measurement

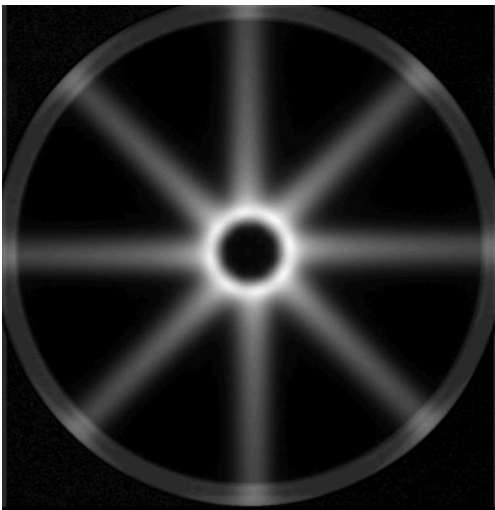


ARC-200 Beam Viewer Phantom

The ARC-200 Beam Viewer combines high-energy radiation detection with precision two-dimensional metrology to form a completely electronic alternative to film-based measurements. The ARC-200 captures and measures the beam profile and integrated dose depth of radiation beams with unmatched speed and accuracy. Single beams and single axis proton spot scans may be directed at the scintillator block from any gantry orientation for capture and measurement. Automation scripts can be used to capture changes in the beam shape, intensity, location, and penetration depth at camera speeds up to 400 frames per second.

Logos Systems Camera Phantoms calibrate proton and radio-surgery systems or industrial radiation sources that must deliver precise amounts of radiation to targeted regions in 3D space. The correct operation of pencil beam scanning or high-density collimators used in these systems can be quickly verified. Beam position and width measurements are accurate to 0.2 mm and beam dose depth measurements can be accurate up to 0.5 mm. Captured images can be exported to ImageJ or other image analysis software.

All operations are controlled by a laptop or desktop PC supplied with the camera phantom. The ARC-200 comes with a 30-meter (100 feet) USB3 power-over-fiber extender cable so that the system PC and operator can be located safely away from the radiation source. The digital camera phantom weighs approximately 7.0 kilograms (15.5 pounds) and is stored in the Pelican case provided as part of the system.



Bragg Peak Star-Shot Delivery Integration



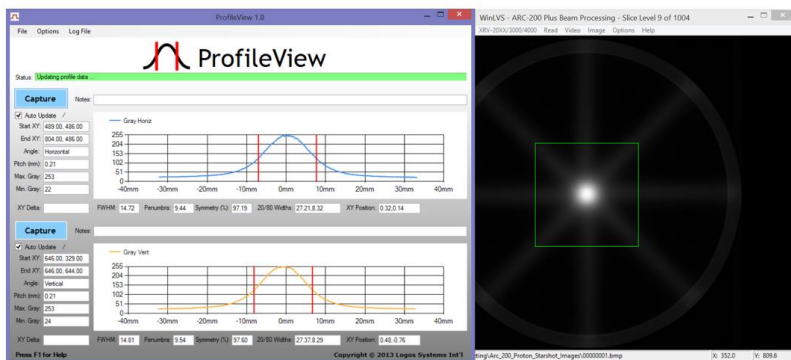
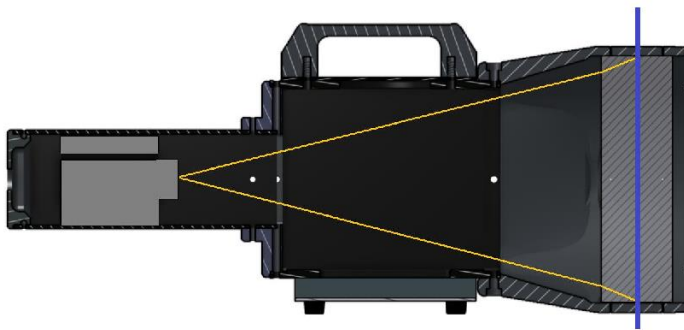
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ARC-200 Operation

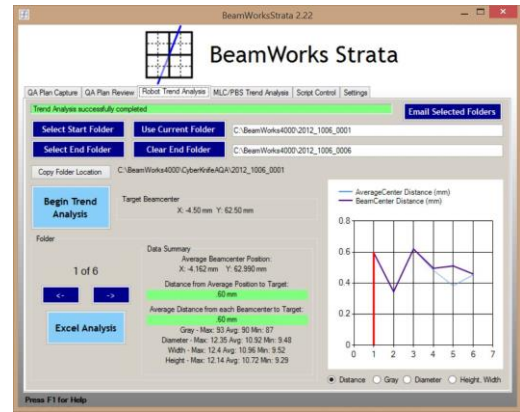
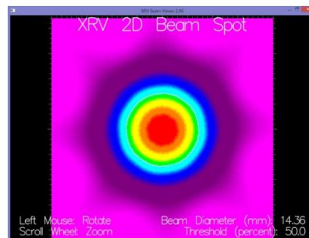
The ARC-200 phantom may first be imaged with a CT scanner so that the fiducials can be used as a target for the treatment volume. Every beam of the test QA plan can then be measured for delivery accuracy. The ARC technology uses a scintillator to turn the invisible X-rays or protons into a path of visible light that accurately represents the location and profile of the beam. A sensitive USB3 camera then digitizes the beam spot and transfers the bitmap to the ARC computer for analysis and storage.

The ArcWorks Strata software is used to acquire, analyze, and archive ARC images. Beam data is displayed in 3D allowing real-time zoom and viewing angle selection. Beam height, width, penumbra and symmetry measurements are available from any angle of gantry rotation. Spreadsheet macros are provided for extended statistical analysis of the captured data. Automated measurements can be made from the graphical user interface (GUI) or customized with an easy-to-use scripting environment.

The 55 x 190 mm plastic disk scintillator turns the X-ray or proton beam (blue) into a visible light (yellow) that is captured by the camera and processed in the ARC-200 software



Fast isocenter and beam diameter measurements



ArcWorks Strata Target Trend Analysis

ARC-200 Specifications:

- Accuracy:** ¹
- XY Beam Center: 0.2 mm
 - Repeatability: ±0.04 mm (typical)
 - Beam Diameter: 0.2 mm
 - Repeatability: ±0.04 mm (typical)
 - Proton Range: 0.5 mm
 - Repeatability: ±0.2 mm (typical)
- Optical System:** ¹
- Resolution: 1280 x 960 pixels with 8 and 12-bits per pixel
2x2 binning optional
 - Capture Rate: 0.1- 400 frames/sec
 - Scintillator Size: 55 x Ø190 mm
 - Lens MTF: Megapixel resolution
 - Camera Interface: USB 3.0
- 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: 24 x 22 x 45 cm
 - Weight: 7.0 kg (15.5 lbs)
 - Enclosure Material: Aluminum and Plastic
- Interface:**
- Capture Trigger: Auto, GUI, Script, or Network watch-file
- Computer Components:**
- Configurable to customer requirements
- General:**
- Electrical Power: 110-220V or battery
 - Environment: 5 to 30 degrees C; 90% humidity, no condensation; minimal vibration

NOTES:

1. Contact us for higher camera resolutions.
2. Contact us for custom shielding requirements. The camera may be replaced for a service fee after approximately 3 years as necessary.
3. Contact us for treatment couch mounting solutions

Preliminary 11/11/2019

