AbstractID: 11625 Title: The Use of Beam Fluency to Assure Image-Guided Radiosurgery Accuracy

Purpose:
The purpose of this study was to accelerate and improve the measurement process of Cyberknife individual beam accuracy using a novel detector (XRV-100, Logos Systems, Scotts Valley, CA) consisting of a three-dimensional scintillator screen geometry and real-time CCD camera monitoring.

Method and Materials:
The XRV-100 hardware consists of a 60 degree cone laminated with conventional Gadox X-ray scintillator phosphor. As an x-ray beam passes through the cone, two spots of visible light are formed by Compton scattering at the entry and exit points. These two spots of light define not only the path of the radiation through three-dimensional (3D) space but also the energy profile of the beam fluence.

While QA treatment plans are administered by the radiosurgery system, the CCD camera and monitoring software view the interior of the scintillator cone and record the position of each beam in real-time. Fiducial spheres mounted in proximity to the scintillator allow the Cyberknife system imaging system to precisely target treatment plans within the cone volume.

Several Cyberknife beam collimators were profiled with the XRV system and the fluency data was compared with historical dose data taken with traditional water tank systems. AQA and isocenter end-to-end treatment plans were also performed on the XRV detector.

Results:
Beam fluency field widths and penumbras captured with the XRV using the Cyberknife 10 mm collimator at a SAD of 75 cm compare within 2% of water tank dose data taken at a depth of 50 cm. The AQA vector results confirmed Cyberknife submillimeter accuracy.

Conclusion:
The XRV results demonstrate that 3D beam fluency metrology can be accurate, fast, and a powerful adjunct to existing radiosurgery QA systems. This detector system is independent of the laser-beam CAX alignment and improves the measurement methodology by measuring the delivery accuracy of the x-ray beams directly.