

AbstractID: 5793 Title: 3D Dose Reconstruction with Megavoltage Cone-beam CT and EPID Exit Dosimetry

Purpose:

The ability to reconstruct the delivered patient dose can help ensure that the integrated doses to important structures faithfully adhere to prescription. The objective of this work is to develop and test a 3D dose reconstruction procedure based on exit-dose measurements at treatment time and MV cone-beam CT.

Methods and Materials:

The proposed dose reconstruction method uses a Megavoltage cone-beam computed tomography (MVCBCT) image acquired on the treatment table prior to treatment, 2D portal images taken with an amorphous-silicon electronic portal imaging device (EPID) during treatment, and an independent validated dose calculation engine. The energy fluence obtained from the EPID is back-projected through the 3D MVCBCT image. A dose calculation engine based on a collapsed-cone convolution algorithm subsequently calculates the dose in each voxel. To test the model, a MVCBCT of a cylindrical solid-water QA phantom was acquired and the MVCBCT numbers mapped to appropriate attenuation coefficients. The phantom was then treated with a 5cmx5cm beam and a portal image acquired. During the treatment, a CC13 ion chamber and MOSFET detectors were used to measure the dose at 21 points to compare with reconstructed dose. A Pinnacle dose calculation using a conventional CT was also performed for comparison.

Results:

The mean difference between reconstructed and measured doses was -0.2% (standard deviation = 2.8%). The reconstructed dose in the inner regions of the cylinder differed less than 2% from the measured, although discrepancies of about 10% occurred at one point in the buildup region and at two other peripheral points. In comparison, the mean difference between Pinnacle calculations and measurements was -2.9% (standard deviation = 1.6%).

Conclusion:

Preliminary calculations of reconstructed dose demonstrated good agreement with experiments. Further refinement of the model and its application to clinical conditions are under investigation.

Conflict of Interest:

Research supported by Siemens.