

AbstractID: 2530 Title: Cone Beam Optical CT Scanner for 3D Dosimetry

Purpose: To evaluate the performance of a cone beam optical CT scanner and to evaluate use of the scanner with a 3D solid radiochromic dosimeter.

Method and Materials: The operating characteristics of a cone beam optical CT scanner were investigated using phantoms and solid dosimeters. The scanner acquires projection images (12 degree fan angle, 9 degree cone angle) during a single 360 degree rotation of a sample. 3D Images are reconstructed using Feldkamp backprojection with a Hamming filter. Background attenuation coefficients are removed by subtracting reference (pre-irradiation) images from data (post-irradiation) images prior to reconstruction. Reconstructed images have isotropic 2 mm, 1 mm, or 0.5 mm voxel dimensions in a 10 cm cube. Spatial resolution and image distortion were evaluated with a wire phantom and holes drilled in a solid dosimeter. Solid dosimeters were irradiated with a rectangular field and a complex Tomotherapy field. Profiles from scanned images were compared to profiles in calculated dose maps.

Results: Reconstructed images of the geometry phantoms showed no spatial distortions. Artifacts are similar in appearance to sampling and beam hardening artifacts common in X-ray CT. Attenuation coefficients in neutral density liquids are linear with respect to the spectrophotometer readings. Line profiles through calculated and measured dosemaps show qualitative agreement. Scanning times varied from 3 to 9 minutes. Reconstruction times varied from 2 to 20 minutes. The total time to scan a dosimeter was less than 1 hour.

Conclusion: The optical CT scanner and solid dosimeter form a promising 3D dosimetry tool. Geometric accuracy, spatial resolution and imaging times are within clinical requirements

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