

AbstractID: 5526 Title: Results of an Optical Fiber-based Dosimetry System for Use in Computed Tomography Characterization

Purpose: Modern multi-detector CT and cone-beam CT offer wide beams, making the concept of CT dose index (CTDI) no longer valid for CT dosimetry. A real-time OSL dosimetry system has been developed and is evaluated for CT dosimetry in this study. Comparisons with a pencil ionization chamber were made.

Methods and Materials: The system utilizes the optically stimulated luminescence (OSL) of KBr:Eu. The size of the KBr:Eu single crystal dosimeter equals approximately 1 mm^3 . The dosimeter was affixed to the terminal end of a plastic fiber cable and placed in the center hole of a plastic cylindrical phantom. The distal end of the fiber cable was attached to OSL reader, containing a 658 nm red laser, and photo-multiplying tube (PMT), and associated optics/ electronics. CT slices of 1 s duration were performed over a range of energies (80-140 kVp) and tube currents (60–350 mA), as well as slice thickness (5 and 10 mm) using a GE LightSpeed Ultra scanner. Gantry tilt dependence was investigated over a range of 40.5° (22° superior to 18.5° inferior). OSL data was obtained before, during, and after the scan at the rate of 10Hz.

Results: Performance was determined in part by normalizing both the initial OSL intensity and the background-subtracted integral OSL to exposure reported previously by an ionization chamber. Good correlation between exposure and OSL data was found. Initial intensity and background-subtracted OSL normalized to exposure show coefficients of variation of ~%5 or less. Significant deviation was observed between the ~10 OSL measurements taken for each slice, presumably as a result of absorption of x-rays by the patient table.

Conclusions: Initial tests have shown that this OSL dosimetry system possesses great potential for faster CT characterization. This system may prove a valuable alternative to CTDI.