AbstractID: 12971 Title: Multi-Slice Computed Tomography Dose Profile Measurements using LED-based Optically Stimulated Luminescence System

Purpose: To demonstrate the feasibility of LED-based Optically Stimulated Luminescence (OSL) system for measuring entire dose profile and to evaluate its feasibility and reproducibility in the CT x-ray energy range.

Materials and Methods: The OSL strips consisting of Al_2O_3:C powder detector layer incorporated in a plastic tape were used. The strips were 150 mm long with width of 4-5 mm and thickness of 0.3 mm. The 64-slice CT dose profiles were measured by irradiating OSL strips placed inside an extended PMMA head and body phantom at different scan conditions by varying kVp settings (100, 120 and 140 kVp) and collimated beam widths (5, 10, 20 and 40 mm). The exposed strips were then read out using a custom built LED-based reader system and corrected with field-specific conversion factors. The OSL strip was scanned for 150 mm in 0.25 mm steps, providing 600 data points along the OSL strip. Each point measurement of the OSL strip takes 0.1 s and the entire OSL strip can be scanned in 60 sec.

Results: Dose profiles measured with OSL strips along the z-axis were obtained at the center and periphery of head and body phantom, respectively. The dose profiles clearly show the angular distribution of the primary x-ray beam due to heel effect. The scatter tails were detected in a wide range showing fall off exponentially with distance from the primary beam section.

Conclusions: The LED-based OSL system was found to have good sensitivity and dose response over a wide range of CT x–ray beam energy. The OSL dose profiles showed good reproducibility and accuracy at various clinical scan conditions. Combined with the simple calibration, it gives this work a great potential to be used in routine clinical quality assurance check and scan protocol optimization.