AbstractID: 12718 Title: Three-Dimensional Dose Reconstruction using Non-Transmission Portal Dosimetry and Monte Carlo Calculations

Purpose: To evaluate a convolution and Monte Carlo based non-transmission portal dosimetry method used to reconstruct a 3D dose distribution.

Method and Materials: Raw images acquired by an amorphous silicon electronic portal imaging device (EPID) were deconvolved with a scatter kernel to determine a 2D primary energy fluence distribution. The scatter kernel was characterized by two components: a Monte Carlo simulated dose deposition kernel scored in the scintillation screen, and an iteratively optimized optical photon-spreading (or "glare") kernel initialized by the tail of a measured in-air fluence profile. The derived primary energy fluence was converted into a phase space file and used as a source input for the Electron Gamma Shower (EGS) user code DOSXYZnrc for Monte Carlo calculation. The reconstructed 3D dose distribution was verified by comparison with a measured beam profile and *PDD* data.

Results: The glare kernel was determined to be the dominating component of the scatter kernel, while the dose kernel correction exhibited longer-range radial extent from the central axis of the beamlet. The derived primary energy fluence demonstrated a similar trend as the in-air fluence measurement, and was in good agreement with the penumbra tails. The reconstructed beam profile and *PDD* for a 10x10 cm^2 open-field were in excellent agreement with photodiode and ionization chamber measurements.

Conclusion: This study demonstrates the potential for pretreatment IMRT verification using the primary fluence extracted from an EPID to reconstruct a Monte Carlo calculated 3D dose distribution in a patient's planning CT-scan. Future work will include dose normalization and a more comprehensive validation measurement scheme before moving to a comparison of a 3D dose volume between treatment planning system and EPID reconstruction.