AbstractID: 3462 Title: Using Fluence-separation to account for Energy Spectra Dependence in Computing aS500 Image for IMRT Field with Pencil Beam Method

Purpose: Dosimetric aSi EPID images are typically computed using a convolution of energy fluence with an invariant energy deposition kernel. However, Monte Carlo (MC) studies show a strong dependence of the EPID imager response to energy spectra, which, for highly modulated IMRT fields, severely affects the dosimetric accuracy. To account for this, a method is developed that accounts for the radial-dependence of the energy deposition kernel and considers open field and MLC hardened components of the energy fluence.

Method and Materials: Dosimetric EPID images are created by convolving energy fluence with a radially dependent kernel. The energy fluence at the EPID surface was determined by extracting the terma in water from Pinnacle. For each fluence element, the energy fluence (Ψ) was divided into two parts --- open field energy fluence Ψ_o, and MLC blocked field energy fluence Ψ_c. Ψ_o and Ψ_c were convolved separately with their respective energy-deposition kernels and the results summed. Calculations were compared with measurements for, 3×3-20×20 cm^2 fields, rectangular fields, a 10×10 cm^2 field centered at (5cm,-5cm)), 3×3-12×12 cm^2 MLC-blocked fields, and dynamic MLC sliding window fields which generate 10×10 cm^2 fields with window gaps ranging from 1- to 50-mm .Test cases were compared utilizing profiles and using gamma-analysis for pixels receiving doses >50 % D_{max}. A 3 mm, 3% criteria was used in the gamma analysis.

Results: Measured and computed dose profiles agreed for both in-field and out-of-field regions. For the open field test cases, all points evaluated had $\gamma < 1.0$. For MLC blocked fields ≤10×10 cm^2, >98.5% of points had $\gamma < 1.0$ Over 98% of points passed the gamma-test for most sliding window field.

Conclusion: Accurate aSi dosimetric EPID images can be computed when energy spectra hardening is accounted for during the image calculation.

Conflict of Interest: This work supported in-part by Varian Medical Systems.