AbstractID: 9192 Title: Photon Energy Spectrum Prediction of a Medical Linear Accelerator Using Scatter Radiation Analysis

Purpose: To evaluate a system to determine the photon spectrum from a 6 MV linear accelerator using narrow beam scatter measurements, Monte Carlo simulations of the scatter, and linear algebra. **Method and Materials:** The relative number of photons that scatter at specific angles and distances from a polyenergetic narrow beam of photons striking a scattering medium is a small but measurable quantity. The relative number of photons from a monoenergetic beam of photons scattering in similar geometry can be modeled using Monte Carlo techniques. A system of linear equations can be established and solved for the photon energy spectrum if there are an equal number of scatter angle measurements and Monte Carlo modeled photon energies. Measurements were performed using a Farmer chamber and electrometer with an acrylic scatterer on a 6 MV linear accelerator at six scatter angles with a 1.5×1.5 cm field. Monte Carlos simulations were performed at six energies with equivalent geometry. A linear system of the form b=Ax was solved where (b) is the measured data vector, (A) is a mathematical operator matrix that consist of calculated mono-energetic scatter fractions, and x is the unknown flux vector. **Result:** The operator matrix was found to be an ill-posed matrix, so the eigenvalues of the matrix were evaluated and the significantly small eigenvalues were ignored to enhance the accuracy of the results. Errors were estimated by solving the system for b-Ax=0 and Ab-A^2x=0, which theoretically should give a zero answer. The results, while coarse with only six energy bins, are consistent with published data. **Conclusion:** This technique produced reproducible results that can be refined with more scatter angles and energy bins. The results can potentially be applied to any poly-energetic beam.