AbstractID: 3761 Title: Modeling Thick-Target Bremsstrahlung Production by Compound-Poisson-Process Electron Multiple Scatter

Purpose: To develop an accurate analytic algorithm to model bremsstrahlung production in a linac target and to calculate the angular distribution of the primary photon energy spectrum. This provides an alternative to Monte Carlo calculation of the primary photon spectrum.

Method and Materials: The Compound-Poisson-Process (CPP) method is used to calculate the directional distribution of electrons in the target at each depth, explicitly including multiple scatters at large angles. This CPP method is modified to include the electron loss of energy at depth in the thick target. The Schiff integral formula is used to compute the bremsstrahlung spectrum produced at each angle and depth, and the contributions are integrated over depth to yield the photon energy fluence spectrum as a function of polar angle. This formula makes no small-angle approximations, so it should be accurate at all angles.

Results: The primary (and attenuated first-scatter) photon energy fluence distribution was computed for a 15 MeV electron beam incident on a thick lead target and compared to a measurement in the same geometry.

Conclusion: It is hoped that an accurate analytic calculation of the bremsstrahlung energy fluence distribution emerging from a linear accelerator treatment head will provide a quick and useful alternative to Monte Carlo calculations of this same distribution.

Conflict of Interest (only if applicable): None.