AbstractID: 9161 Title: Verification of a Monte Carlo-based source model for a Varian 10 MV photon beam

Purpose: To apply a measurement-driven source model using the Monte Carlo Dose Planning Method (DPM) dose calculation engine to a Varian 10 MV photon beam.

Method and Materials: A measurement-driven model using the DPM dose calculation algorithm is being extended from a Varian 6 MV photon beam to include Varian 10 MV, Elekta 6 MV and 10 MV, and Siemens 6 MV and 10 MV photon beams. The present work details the model commissioning for the Varian 10 MV photon beam. The multi-source model consists of a primary photon point source, an extra-focal exponential disk source, and an electron contamination uniform disk source. The model accounts for fluence and off-axis energy effects due to the flattening filter. The photon energy spectra for the primary and extra-focal sources are modeled by the statistical fatigue-failure function combined with a Fermi-cutoff function. The energy spectrum of the electron contamination source is modeled as an exponential distribution. Model parameters are determined by an optimization process that minimizes the differences between measurement and calculation. The set of standard measurements used for optimizing consists of the percent depth dose (PDD) and dose profiles in water for 10x10 cm^2 and 40x40 cm^2 field sizes.

Results: Comparisons between calculation and measurement of the PDD and dose profiles for the 10x10 cm^2 field size show agreement within ±2%/2 mm except for the off-axis low dose regions where calculations underestimate the dose by up to 3% of d_{max}.

Conclusion: This work demonstrates that the model, previously shown to be accurate for the Varian 6 MV beam, can be successfully extended to the Varian 10 MV photon beam. Work is ongoing to further refine and validate the model to include Elekta and Siemens linear accelerators.

Conflict of Interest: Work supported by PHS CA010953, CA081647, and R01 CA85181 awarded by NCI, DHHS