AbstractID: 7276 Title: Monte Carlo investigation of electron beams collimated by an electron-specific MLC for modulated electron radiotherapy

Purpose: This work investigates clinical electron beams collimated by an electron multileaf collimator (eMLC) for modulated electron radiotherapy (MERT) treatment optimization and dose calculation.

Material and Method: In this work we used MCBEAM and MCSIM codes for accelerator simulation and phantom/patient dose calculation, respectively. Particle phase space files at a plane directly above the eMLC were generated using MCBEAM. For each energy we first simulated with several monoenergetic electron beams .Then a previously developed optimization code was used to derive the energy spectra of the clinical electron beam to match the measured percent depth doses (PDD). The derived spectrum was used in the MCBEAM to generate the phase space file. Simulations were done to generate phase space files for all the energies available 6, 9, 12, 16, and 20MeV. The MCSIM code was used to simulate the eMLC using the generated phase space files as the source to calculate the dose distribution in a water phantom. Regular and irregular shapes were formed by positioning leaves of the eMLC. Selected shapes were then simulated. Monte Carlo simulated dose distributions were compared with measurements.

Results: Good agreement (2%/1mm) was achieved between Monte Carlo simulations and measurements for PDDs collimated by both electron applicators/cutouts and by the eMLC for all electron energies and square fields. The Monte Carlo dose distributions resulting from multiple static electron fields collimated by the eMLC agreed to 3%/2mm with ion chamber and film measurements.

Conclusion: In this study we have, through extensive verification, shown that our Monte Carlo code with the source represented by phase space files is capable of accurately modeling electron beam delivery with the eMLC.