AbstractID: 7409 Title: Using electron beam modifiers in the DPM Monte Carlo code for electron beam treatment planning

Purpose: To investigate the feasibility of modeling patient-specific beam modifiers for electron beams using the DPM MC code.

Methods and material: We investigate the applicability of modeling a beam modifier 'applicator' (vs. a multiple source model or beam fitting approach) inside the DPM code for electron beam dose calculation. DPM is only used for in-phantom calculations; however, we have included beam modifiers such as Jaws, MLCs and now applicators within the code to improve its clinical applicability. Varian 21EX (Type III) was modeled for beam energies (6, 9 and 12 MeV) using the BEAMnrc MC code. The patient-independent components were simulated once and the phase space (PS) is stored just below the ion chamber. As a first approximation, a preliminary model of the applicator blocks all the particles through the applicators but allows those in the open beam region. Verification of the beam modifier model with diode measurements and full PS simulations was performed using percent depth doses (PDDs) and profiles for various energies for the standard 15x15 cm^2 cutout, and for square and rectangular cutouts from 4x4 to 25x25 cm^2 in a homogeneous geometry.

Results: PDD calculations with DPM beam modifiers showed agreement within 2% with measurements and full PS simulation for the 6MeV beam. The 9 and 12 MeV PDD calculations showed discrepancies up to 4% in the surface buildup region, and a slightly larger difference in the tail. A full 3-d simulation currently takes roughly 10mins on 8 processors to achieve a relative uncertainty of less than 1% in voxels > dmax/2 using a 2x2x2 mm^3 voxel size.

Conclusions: Preliminary investigation of dose calculations with beam modifiers in DPM MC code shows good agreement with measurement. Future work will focus on modeling 16 and 20 MeV beams and their verification in a homogeneous and heterogeneous medium.