AbstractID: 7198 Title: Sensitivity analysis of a non-cylindrically symmetric Monte Carlo beam model of a Siemens Primus accelerator

Purpose: To facilitate the development and commissioning of radiotherapy accelerator beam models by studying the impact of the variation of geometric and electron beam parameters on photon dose and fluence output for a Siemens Primus accelerator. In particular, the impact of lateral offsets of linac components and lateral and angular offsets of the electron beam were examined.

Method and Materials: We have performed a sensitivity study examining the effect of varying beam and geometric parameters of a Monte Carlo model of a Siemens Primus accelerator. The accelerator and dose output were modeled using BEAMnrc and DOSXYZnrc, respectively. The BEAMnrc package was modified to allow for linear offsets of individual accelerator components, and lateral and angular offsets of the incident electron beam. Dose distributions were studied for 40 x 40 cm^2 fields. Flatness, symmetry, OAR, and profile slope were studied.

Results: The electron beam parameters having the greatest effect on the resulting dose distributions were found to be electron energy and angle of incidence, as high as 5% for a 0.25^o deflection, with lateral offset of the electron beam and spot size having a smaller impact. Variations in target thickness were found to have a lesser effect than found in previous studies for electron beams. Small (~2 mm) lateral offsets of the flattening filter altered the OAR by 5% for 6 MV and as much as 25% for 18 MV.

Conclusion: Using large fields allows treatment head details to be more easily extracted. Lateral and angular offsets of beam and accelerator components have strong effects on dose distributions, and need to be included in any high-accuracy beam model. Having a table cataloging the impact of model parameters on dose output can greatly facilitate beam model commissioning.

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