

Abstract ID: 9524 Title: Validation of calculation for electrons and feasibility study of penumbra generator utilizing electron Monte Carlo Algorithm

Purpose: To evaluate the performance of a commercial TPS equipped with Monte Carlo algorithm for electron beam calculations. This study also tests the feasibility of the design of penumbra generator by the Monte Carlo algorithm.

Method and Materials: Different size cutouts (circular aperture with diameters range 3.8 -10cm) and circular inserts (block shield with diameters range 3.8-8cm) were created for the cutout factors, of axis point dose, PDD, electron beam energy profiles (9MeV and 16MeV) and varying SSD (100 cm and 115cm). Measurements were done in water tank for those cutout and block inserts for PDD and profiles for 9MeV and 16MeV on Varian's Trilogy. Measurements were done with 100cm and 115cm SSD. Monte Carlo calculations with Eclipse were compared with measurements. Different materials (range 0HU -2600HU) were designed for simple tapered wedges shape and combined with air to simulate penumbra generator through the Monte Carlo calculation.

Results: For cutout <4cm, the dose output calculation accuracies were up to $\pm 7\%$. For cutout ≥ 6 cm, the output accuracies were within $\pm 2\%$. The point dose accuracy of off-axis positions with different inserts were within 3.5%. At extended SSD (115cm) the calculations slightly increase the error by 1%. The calculated vs measured profiles at different depths for different inserts agreed well. At 115 cm SSD, the profiles with in field still matched well, profiles around or under the block were slightly off (<5%). The PDD beyond max match distance within 1mm. The calculated surfaces do show a slight lower. Different materials with air have different penumbra effects, which show the feasibility of the MC simulation for the design of penumbra generator.

Conclusion: The current beam model needs to be modified for cutout smaller than 4 cm. For larger cutouts, Monte Carlo electron dose algorithm produced reasonable results to compare with measurements. Further measurements are warranted for the validation of the penumbra generator.