AbstractID: 7334 Title: Dosimetry verification for Pencil beam, Clarkson and Equivalent square dose calculation algorithms

Purpose: To study the accuracy of Brainlab pencil beam and Clarkson algorithms in homogeneous phantoms and heterogeneous geometries.

Materials and method: In this study PMMA was used as the homogenous phantom. Different heterogeneous geometries were designed by introducing different materials between the PMMA slabs. In each situation one material is used with different thicknesses: (a) thickness of 2.7 cm and 8.1cm low-density material and (b) thickness of 3.8 cm and 7.6 cm of high-density material. The low- and high-density material is placed beneath 6 cm of PMMA. All the phantoms were CT scanned. Six different irregularly shaped beams were designed using a Brainlab multileaf collimator. Calculations were performed for these beams in the homogenous phantom using the Brainlab pencil beam, Clarkson, Modified Clarkson and equivalent square dose calculation algorithms. The percentage depth doses based on different models were compared to measurements. A dose of 150 cGy was specified to a point beneath the inhomogeneous material for the heterogeneous cases. Modified Clarkson, pencil beam and equivalent square algorithms were used to calculate the dose and then compared to measurements.

Results: All the models agreed well with measurements; the equivalent square method showed the highest average deviations of 0.55% from measured dose values. In heterogeneous geometries the equivalent square method gave very large deviations (up to 17 %). Clarkson and pencil beam algorithms disagreed with measurements by 4.8 % and 3.8 % for the low-density material of 2.7 cm thickness, and by 8 % and 6.9 % for the low-density material of 8.7 cm thickness, respectively.

Conclusion: All Brainlab dose calculation models are reliable for homogeneous phantom but some may differ significantly from measurements in heterogeneous geometries, especially in low-density issues.