AbstractID: 3611 Title: Evaluation of a commercial macro Monte Carlo electron dose calculation algorithm

Purpose: To evaluate electron dose distributions calculated by a recently released commercial implementation of the macro Monte Carlo method for complex geometries and in the presence of heterogeneities.

Method and Materials: A set of two-dimensional dose distributions, published for the purpose of evaluating electron dose calculation algorithms, was obtained. The data are comprised of measurements for two energies, 9 MeV and 20 MeV, and five phantom geometries, which, in combination, resulted in fourteen measurement configurations. The data set did not contain sufficient information for the configuration of the algorithm, so measurements of the necessary data were obtained from a dosimetrically equivalent machine. A virtual machine was created in the treatment planning system to model the linear accelerator used to acquire the data set. Synthetic CT data sets and RT structure sets modeling the phantom configurations were created and calculations were performed using a range of algorithm parameter values (accuracy, smoothing, and grid spacing) for all fourteen configurations. The transverse plane containing the central axis was extracted for comparison with the measured distributions and dose difference and distance-to-agreement were calculated.

Results: More than 99.5% of the calculation points were within 3% difference and 3 mm distance-to-agreement for the best set of parameters. The number of points violating the criteria increased with decreasing accuracy. Without smoothing of the dose distribution, points violating the criteria tended to be located throughout the calculation volume. With the addition of smoothing, the number of points increased and became clustered in regions of high dose gradient.

Conclusion: Our evaluation demonstrated that the algorithm performs well in complex geometries in the presence of heterogeneities. In general, agreement was better than 3% and 3 mm. We have investigated the influence of the algorithm parameters on the agreement, which will allow users to make appropriate choices for clinical calculations.