

AbstractID: 3869 Title: Accuracy of a commercial macro Monte Carlo dose calculation algorithm for determination of in-water output factors of clinical electron field shapes

Purpose: To evaluate the accuracy of a commercial implementation of the macro Monte Carlo method for determination of in-water output factors of clinical electron field shapes.

Method and Materials: At our institution, we calculate electron monitor unit settings by measuring the output relative to the calibration condition. For each measurement, the measurement conditions (machine, energy, SSD, and applicator size), the field outline, and the output factor are recorded and maintained in a library. We obtained the output factors for 190 field shapes from our library for three dosimetrically equivalent linear accelerators. Because there were relatively few fields at the largest applicator size and at the two highest energies, 15 and 18 MeV, we selected and measured additional field shapes for each energy/applicator combination that had fewer than four field shapes, resulting in a total of 218 field shapes. Output factors were calculated by digitizing the field shapes into the treatment planning system and calculating the dose at the measurement point using a synthetic CT data set of a flat water phantom. The algorithm parameters were maximum calculation accuracy (1%), calculation grid size such that there were approximately 10 calculation points in the distal falloff of the central axis depth dose, and for no smoothing of the dose distribution. Output factors were remeasured for field shapes for which the disagreement was larger than 2%.

Results: The mean difference between the calculation and measurement was -0.2%, and the standard deviation of the difference distribution was 1.1%. Of the 218 measurements, 124 (56.9%), 211 (96.8%), and 215 (98.6%) were within 1%, 2%, and 3%, respectively. The largest difference was 3.4%.

Conclusion: Our evaluation demonstrated that the algorithm performs well for determination of in-water output factors for clinical field shapes. The majority of calculated output factors were within 2% of measurement.