AbstractID: 5697 Title: Evaluation of an electron Monte Carlo dose calculation algorithm for electron beam radiotherapy

**Purpose:** To systematically evaluate the electron Monte Carlo (eMC) dose calculation algorithm of the Eclipse treatment planning system and to identify factors that affect its calculation accuracy.

**Method and Materials:** Percent depth dose (PDD) and profiles for each electron energy/applicator/depth combination were measured for four Varian Clinac 21EX Linacs. Cutout factors for various cutout sizes down to $3\times3$ cm$^2$ were also measured. Statistical comparison between eMC calculation and measurement was performed for parameters such as shift in depth of PDD curves, field size, penumbra width, average dose difference within 80% of field size, beam symmetry, Bremsstrahlung dose, and cutout factor. Analysis of variance was used to identify factors that have significant influence on the observed discrepancies.

**Results:** The agreement between measured and calculated 50% PDD depth was within $\pm2$ mm for nearly all machine/energy/applicator combinations except the 6x6 6 MeV beams on three machines where maximum difference was 3.8 mm. The calculated field width was larger than that of measured in most of the cases but within 3%. The differences between calculated and measured penumbra were also within 3%. The calculated Bremsstrahlung doses were smaller than measurements, with a few exceptions. Analysis of variance identified machine as a significant variable for the observed discrepancies in PDD, field width, and penumbra, suggesting possible variations among linacs or the quality of measured data. Calculation grid size was found to have significant effect on calculation accuracy. Using grid size of 5 mm resulted in approximate 10% discrepancies. Reducing grid size yielded significant improvement on the calculated cutout factor: from 5% discrepancy to less than 3% when grid size of 1 mm was used.

**Conclusion:** The overall agreement between the eMC calculation and measurements was acceptable. Calculation grid size of 2.5 mm or smaller is recommended for all field sizes for eMC algorithm.