AbstractID: 6423 Title: Dosimetric uncertainty of small cutouts in electron radiotherapy: Monte Carlo dosimetry evaluation

Purpose: To evaluate the dosimetric uncertainty when using small electron cutouts in electron radiotherapy. Monte Carlo simulation verified by measurement was used to predict the variations of d_m, R_{90}, R_{80} and relative output factor (ROF) for small electron cutouts with field centers shifted away from the beam central beam axis (CAX).

Methods and Materials: EGSnrc-based codes (BEAMnrc and DOSXYZnrc) were used to predict the beam profiles and percent depth doses (PPDs) of a 4 cm diameter cutout with field center shifted 0, 2, 4, 6, 8 and 10 mm from the CAX. Electron beams with energies of 4, 9 and 16 MeV produced by a Varian 21 EX linac were used. The Monte Carlo simulation was verified by measurement using a big scanning water tank and diode. The measured beam profiles and PDDs agree well with simulation results within ± 2%. The dependences of d_m, R_{90}, R_{80} and ROF on the shifted distance from the CAX were calculated and measured by the Monte Carlo simulation and diode, respectively.

Results: d_m, R_{90} and R_{80} do not change with the shifted off-axis distance for the 4 MeV electron beams. However, these parameters decrease with increase of the shifted distance for the 9 and 16 MeV beams. This may be due to the relatively shorter electron path length of the 4 MeV beam compared to the dimension of the circular field. The ROFs decrease with increase of the shifted distance for all electron beam energies. Both measured and Monte Carlo simulated results agree well within ± 2%.

Conclusions: Monte Carlo simulation is proved to be useful to predict the variations of dosimetric parameters such as d_m and ROF when the small cutout center is shifted away from the CAX in the electron radiotherapy. This avoids time-consuming measurement in the dosimetric QA.