AbstractID: 11060 Title: Improved Monte Carlo simulation of small electron fields

Purpose: To validate the use of improved source and geometry parameters, derived from Monte Carlo simulation of a Siemens Primus accelerator at maximum field size (40×40 cm^2), for clinically relevant small electron fields.
Method and Materials: Measurements were performed on a Siemens Primus linear accelerator for electron energies 6-21 MeV with open applicators and circular cerrobend inserts ranging from 1 cm to 5 cm in diameter. For the open applicators, relative output factors (ROF), depth penetration and off-axis profiles were measured with parallel-plate (Roos) and small volume thimble (CC13) chambers. For the cerrobend insert collimated fields a diode (EFD) was used for high spatial resolution. Off-axis profiles were measured at 0.5 cm, d_{max}, in the fall-off and in the bremsstrahlung tail of each beam. Monte Carlo simulations were performed using the EGSnrc accelerator simulation code BEAMnrc. The source and geometry parameters used were obtained from a previous study following disassembly of the treatment head, for maximum field size and no electron applicator, which resulted in an unprecedented match to measurement.
Results: Good agreement was found between measured and calculated off-axis profiles and percentage depth dose curves, to 2 % / 1 mm or better. The normalized off-axis profiles in the bremsstrahlung tail matched to 2 – 3 %. Calculated relative output factors were within 1 % of those measured with the Roos chamber.
Conclusion: This work has shown that a recent methodology used to extract accurate details on the source and geometry of the treatment head for maximum field size, is applicable for clinically relevant small electron fields. The need for careful measurements and accurate knowledge on the source and geometry of the treatment head as a precursor to accurate fluence and dose calculation is highlighted .