AbstractID: 8552 Title: Design of a leakage-reducing electron applicator retrofit

Purpose: Design a retrofit to Siemens electron applicators meeting IEC leakage standards with minimal effect on treatment field.

Method and Materials: Dose to air measured on a Siemens Oncor linac with electron applicators, both at the patient plane and outside the applicator enclosure, by scanning an ion chamber and with film. Material added to applicator and change in dose measured. Monte Carlo simulations of modifications done to guide measurement, using either a virtual CT of the applicator or a new applicator component module. Both these methods allow addition of extra shielding outside the existing applicator. Measurements and simulation were done at 6 energies from 6 to 21 MeV, and 4 applicator sizes, from 10 to 25 cm.

Results: Leakage is predominantly scatter from the stainless/aluminum scraper bar and from the top of the Al sidewall. A 1 cm thick Al shield over the entire side of the applicator, although not practical, reduces leakage to nearly acceptable levels while only affecting the treatment field at the 1% level. Shielding around the outside of the stainless/aluminum scraper and at the top of the sidewall is sufficient for some applicators. For the 15 cm applicator, with its thinner sidewall, additional shielding is necessary. It is not necessary to shield the air gaps in the applicator. A discrepancy exists between simulation and data, with measured leakage values several percent greater than simulation.

Conclusions: A retrofit design is presented such that the applicators meet IEC specifications without requiring recommissioning. Minimization of material used, for esthetic and practical reasons, is ongoing.

Conflict of interest: Support from Siemens and NIH R01 CA104777-01A2.