AbstractID: 4697 Title: Determination of Total Scatter Factors for Stereotactic Radiation Fields by Optimized Fitting of Readings from a Small Ion Chamber and a Mini-Diode

Purpose: To determine the total scatter factors (TSF) for small radiation fields on the BrainLab micro-MLC (M3) and cones by fitting the readings from two detectors: a small ion chamber and a mini-diode.

Method and Materials: Outputs were measured for 6MV beams using a small ion chamber (Wellhofer IC3, active volume 28mm^3) and a stereotactic diode (Scanditronix DEB050, active volume 0.017mm^3). It has been reported that ion chambers (IC) underestimate output for small fields (<20 mm) and diodes overestimate output for large fields (>50mm). Herein outputs at intermediate field sizes (20-50 mm) were used to combine data from the two detectors. The output from IC was normalized to a reference 10x10cm field; the output from diode was scaled to match the output from IC at intermediate field sizes. The scaling was determined with modified least square optimization. The final TSF was composed of scaled diode output for small fields, IC output for large fields, and their averages for intermediate fields.

Results: For square fields formed by M3 and secondary jaws, the scaled TSF from diode matched the TSF from IC to within ±0.6% for field sizes 24-60 mm. The diode overestimated TSF of the reference field by 3.2% at depth of 5cm. The IC underestimated TSF by 23%, 5%, 1.4% for 6, 12, 18 mm fields, respectively. Similar results were found for the cones. TSF from diode was 0.702 for the 5mm cone, an improvement of 29% from IC measurement.

Conclusion: We have demonstrated that neither IC or diode alone provides accurate TSF for stereotactic fields of all sizes. The diode is more accurate than IC for fields <20 mm, however, we show that the diode should be cross-compared with an IC using radiation fields of intermediate sizes. A modified least square optimization method is presented for this purpose.