AbstractID: 10906 Title: Dose Shadowing and Diode Consistency in Small Electron Fields

Purpose: To investigate the appropriateness of using diodes for in-vivo dosimetry for small electron cutouts in terms of output factor accuracy, reproducibility and disturbance of the dosimetry.

Methods and Materials: Electron cutouts with diameters from 1.5cm-4cm in 0.5cm increments were measured using a 6x6 cone for electron energies of 6, 9, 12, 15, and 18MeV. Measurements were obtained by placing a pinpoint ionization chamber in solid water at d_{max} corresponding to the electron energy. The measurements were taken at 100cm SSD to the top of solid water with sufficient solid water to account for backscatter. A diode was placed on top of the solid water in the center of the cutout. Ion chamber readings were collected for 6 cutouts at 5 electron energies with and without the diode in place. A smaller subset of ion chamber measurements for the 1.5cm cutout at all energies was collected by replacing the diode with a MOSFET.

Results: The output factor measured with diode over that with pinpoint chamber fluctuates from 0.07-0.79 for 1.5-2.5cm cutouts. The ion chamber reading was significantly decreased with diode on-top. This effect was greatest for lower energies and smaller cutouts. The percentage decrease ranged from 37%-19% for 6MeV at various cutout diameters and 21%-10% for 18MeV. The MOSFET produced much smaller dose perturbation; with the smallest cutout, the ion chamber measurements decreased by $\leq$5% for all energies.

Conclusions: Using diodes in a clinical setting to measure dose from small electron fields is unlikely to provide consistent results. For small electron fields, the dose behind the diode is significantly decreased for all energies. From these observations, we don't recommend the usage of diodes for in-vivo dosimetry for electrons using cones smaller than 6cmx6cm. Although diode accuracy improves for cutouts >3.5cm, the dose shadowing effect is significant for all cutouts considered.