AbstractID: 11300 Title: Utility of Serpentine Curve for Smoothing and Extrapolating Depth Dose Scans

Purpose: To smooth measured data to a function that will permit well behaved extrapolation beyond the limits of measurement. This is of particular interest in extrapolating typical ion chamber scans of depth dose profiles to surface dose for comparison with other results such as Monte Carlo calculations, extrapolation chambers, film, etc. **Method and Materials:** The serpentine curve was chosen as a potential function because it has a general shape in the first quadrant that is similar to a photon depth dose curve. However, it cannot be fit to the data with a simple scaling of axes. The method chosen for variable scaling was to convert the measured percent dose at each depth to a serpentine depth value. A polynomial fit of the relationship between serpentine depth and physical depth was obtained from a Microsoft Excel spreadsheet. The depth dose curve was recomputed based on the polynomial conversion of depth to serpentine depth. **Results:** Depth dose curves ranging from 1x1 to 40x40 cm were analyzed. For extrapolating to surface data up to 5 cm depth was used. Data less than a 5 mm depth was not used to avoid the distortions that occur as the ion chamber becomes only partially rather than fully submerged. Data from 5 cm to 35 cm was separately fit to permit extrapolation to 40 cm depth. The recomputed curves exactly overlay the measured data except for the noise in the measured data and a slight difference at the 5 cm point. They have well behaved extrapolation to surface and deep depth values that compare well with alternate measurements. **Conclusion:** A variable scaling of depth to serpentine depth yields excellent smoothing of data and yields well behaved extrapolation. It may also serve as a good method of interpolating sparse data.