AbstractID: 6394 Title: Determination of Electron Output Factors Using an Emperical, Mathematical Model

Purpose: To empirically develop a mathematical method to determine electron output factors with varying energies, source to surface distances (SSD), and irregular cutout shapes used in electron beam therapy.

Method and Materials: Circular Cerrobend cutouts of diameters ranging from 2 cm to cone size, for various cone sizes, were used to measure electron output factors for a Varian 21EX linear accelerator. Measurements were made in a 30 x 30 x 20 cm^3 solid water phantom with a 0.3 cc PTW ion-chamber and a Standard Imaging electrometer. Electrons with energies of 6, 9, 12, 16 and 20 MeV, with SSDs of 100, 105, 110 and 115 cm were measured at the position of maximum dose (Dmax) to determine output factor. The virtual source method was used to model extended SSD conditions. All measured output data from these circular cutouts were fitted with the same linear regression function using Wolfram's *Mathematica* software to predict output factors. The effective radius of a clinical cutout is then matched with the circular cutout data to determine an output factor. The average of twelve measured equiangular radii determines the effective radius for each irregularly shaped clinical cutout. An additional empirical mathematical formula was used to incorporate extreme minimum width and aspect ratio combinations. To validate this empirical mathematical approach, we measured output factors for 100 clinical cutouts of various shapes and sizes, and compared these with predictions.

Results: It is found that the measured output factor differs from prediction by more than 3% in two out of 100 cutouts. In most cases this difference, however, is under 2%.

Conclusion: The empirical method developed in the present study successfully determines electron output factors for various energy, SSD, cone, and irregular shape combinations. This method is a viable alternative to traditional methods of electron output factor determination.