

AbstractID: 3017 Title: Determination of Output Factors for small Photon Beams

Purpose: Due to the strong field size dependence and differences in response of different detectors, the determination of output factors for small fields is still ambiguous. By means of careful measurements and a sophisticated analysis of the values, the uncertainty was minimized.

Method and Materials: For beams of 6 and 10 MV collimated with the Elekta Beam Modulator the output versus field size was measured with different detectors. Field sizes were from 4*4mm² to 160*210mm². An analytical curve comprising a sigmoidal part for

the primary dose and an asymptotic exponential for the scatter part was fitted to the measured values: $D = P_{\infty} \frac{r^n}{k^n + r^n} + S_{\infty} (1 - e^{-br})$.

The ratios with respect to the ionization chamber measurement for large fields (>50*50mm²) were linearly extrapolated. The measured values for small fields were corrected with these ratios.

Results: The measured data could be fitted very well with the proposed function. The statistical uncertainty was small enough to clearly demonstrate the differences of the different detector signals. For large fields the slope of an unshielded mini diode was highest, followed by the MOSFET and the Pinpoint chamber curves. The diamante detector, the shielded diode and the 0.125ccm chamber showed approximately the same slope of the output function. Due to their size, the chambers measured a too low output at field sizes below 20*20mm². The other detectors agreed within 5%. Correcting with the sensitivity ratio this spread could be reduced to 1.6%.

Conclusion: A physically meaningful function was proposed and successfully tested, to describe the photon output for all field sizes. The Pinpoint chamber is not suitable for small field measurements. For the MOSFET we used the signal was too noisy. All other detectors give the same output down to field sizes of 4*4mm², if the proposed correction is performed. The shielded Si-diode may be used without further correction.