AbstractID: 3424 Title: Dosimetry of (< 3 cm diameter) 6 MeV circular field electron beams for a Varian 21EX linac

Purpose: Small ($\leq$ 3 cm diameter-ϕ) 6 MeV electron beam circular fields present complex dosimetry. This work provides absorbed dose rates in water at d_{max}, percentage depth doses (PDD), profile coverages, penumbra widths, uniformity and homogeneity indices for these fields for clinical treatments.

Method and Materials: Circular (2 cm to 3 cm in 0.2 cm diameter increment) cerrobend cutouts were mounted in 6-cm x 6-cm cone. Central-axis depth-ionizations were measured with NACP parallel-plate ionization chamber in a solid water phantom. PDD were obtained using the TG-51 protocol. Cross-beam profiles at d_{max} of each cutout were measured with XV film in solid water phantom. Absorbed dose rates in water were determined as the ratio of maximum central-axis absorbed doses for each cutout, corrected for TG-51 parameters, to that of the 10-cm x 10-cm reference field.

Results: As cutout ϕ decreases, the build-up portions of the PDD curves shift toward the phantom surface, and the d_{max} decrease from 1.2 cm to 0.6 cm. The dose gradient, G_o, an ICRU 35 measure of the steepness of the descending portion of the PDD, decreases from 2 to 1.5, but the practical ranges, R_p, remain constant. The absorbed dose rate decreases linearly with decreasing ϕ, but surface absorbed dose remains constant. 90% profile coverages (= width of 90% over cutout ϕ at d_{max}, 55%, and 80% coverages, 72%; homogeneity coefficients, 0.70, and the uniformity indices, 0.53 remain reasonably constant. The 80-20% penumbra to diameter ratios increase from 0.52 to 0.62 as diameter decreases.

Conclusion: These data for $\leq$ 3 cm diameter circular fields facilitate routine clinical treatments. The absorbed dose rates and other data for small cutouts can be quickly obtained for patient treatments rather than performing measurements for individual patients.

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