

AbstractID: 4926 Title: Dosimetry of Very Small (1.5 and 3 mm diameter) Photon Beams: Diode and Film Measurements versus Monte Carlo Calculations

Purpose: To measure the dosimetric parameters of 10 MV photon beams in 1.5 and 3 mm diameter fields with a small-field diode, radiographic XV film, and radiochromic HS film, and to compare measured data with the same parameters calculated by Monte Carlo (MC) simulations.

Methods and Materials: A 10-MV Clinac-18 linac was used as the radiation source and the very small diameter fields were set up with radiosurgical collimators. PDDs, profiles, and output factors of the very small photon beams were measured with diode/water tank and film/scanner techniques. The measured parameters were compared against those calculated by MC simulations using an experimentally determined circular source diameter of 1.5 mm in beam modeling. For improved accuracy, the PDDs were measured with the diode and the water tank using beam profile scans. A document scanner was used as film densitometer to offer high spatial resolution (254 lpi) required in very small photon field dosimetry.

Results: PDDs measured by the diode agree well with the MC-calculated results, within $\pm 2\%$ and $\pm 3\%$ in 3 and 1.5 mm fields, respectively. Lateral profiles measured by the diode and film generally agree with MC calculations, but significant discrepancies are observed in the tail portion of the 1.5-mm beam profile. Relative dose factors obtained by averaging the diode, HS film, and MC results are 0.22 ± 0.01 and 0.43 ± 0.01 for the 1.5 and 3 mm fields, respectively.

Conclusion: Based on the good agreement between the measured and MC-calculated dosimetric parameters for the 1.5 and 3 mm diameter, 10 MV beams, we conclude that MC calculations can be used in general for dosimetry of very small photon fields, provided that the physical source size of the linac is correctly measured and used in the MC simulations.