# AbstractID: 4915 Title: Focal Source Size Measurement for Monte Carlo Simulations of Percentage Depth Doses in Very Small Photon Fields

**Purpose:** To measure the focal spot of a 10-MV Clinac-18 linac for use in Monte Carlo (MC) calculation of percentage depth doses (PDDs) in a very small (1.5 mm diameter) field.

**Methods and Materials:** A technique using a translational slit-assembly system was developed to measure the linac focal spot. The assembly consists of two lead blocks fastened together to produce a 300 μm wide slit. A small field diode was centered below the slit, reading radiation signals transmitted through the slit while the system (mounted at a distance of 65 cm from the target) was translated linearly across an open beam. The linear translation was achieved through a screw driving mechanism and the position of the slit was measured with a digital caliper. The source dimension was estimated from the FWHM of the Gaussian fit to scanned profiles corrected for background transmission signal.

**Results:** Scans in various angular orientations perpendicular to the beam central axis show that the linac focal spot is elliptical with principal axes of (1.1 ± 0.1) mm and (2.1 ± 0.1) mm. Isodose distribution measured on the solid water phantom surface in a plane perpendicular to the beam central axis for the 1.5-mm diameter, 10 MV photon beam is also elliptical and oriented in accordance with the measured source shape. A circular Gaussian source model with a FWHM of 1.5 mm, approximating the measured focal spot, was used in the MC calculation of PDDs for the 1.5 mm beam. The MC-calculated PDDs agree within 2% with measured data.

**Conclusions:** In contrast to standard radiotherapy fields, MC-calculated PDDs for very small fields show a strong dependence on source dimension. The good agreement between the measured and MC-calculated PDDs for the 1.5 mm diameter 10 MV beam validates the MC simulation technique using appropriate focal source size.