

AbstractID: 2858 Title: The diode volume averaging effect and corrections in very small photon fields

Purpose: To evaluate the volume effect of diode dosimeters. Two p-type silicon diodes, one with a sensitive volume diameter of 0.6 mm (small diode) and the other with a diameter of 2.5 mm (large diode), were used to measure percentage depth doses and profiles of very small 10 MV radiation beams with diameters of 1.5 and 3 mm. Because of the volume averaging effect, responses of the two diodes differ significantly. In this presentation we describe techniques suitable to correct for the volume effect exhibited by the large diode.

Methods and Materials: Volume effect corrections to PDD measurements include: (1) simulating diode measurements by Monte Carlo (MC) technique and determining the central axial geometry factors associated with the diode active areas and (2) changing the measurement setup from SSD to SAD followed by converting the large diode TMR data to PDD with the inverse square law. Volume effect corrections to profile measurements include: (1) applying an inverse gradient algorithm to de-convolve the broadened large diode profile and (2) simulating the diode profiles by film measurements and determining the lateral geometry factors for de-convolution with image analysis of the film.

Results: For the 1.5 mm field, significant decreases in relative errors between the large diode PDD and the (reference) small diode data are observed after applying either MC correction or TMR conversion. In the 3 mm field at the depth of dose maximum, the inverse and film de-convolution techniques reduce the FWHM of the large diode profile from 3.8 mm to 3.2 mm and 3.0 mm, respectively.

Conclusion: The correction techniques we apply to large diode data result in reasonable agreement between the large and small diode data, allowing the use of large diodes for PDDs and beam profiles in very small radiation beams.