

AbstractID: 11239 Title: Validation and Implementation of Semi-Empirical Methods to Remove Detector Averaging from Profiles for Treatment Planning System Photon Beam Modeling

Purpose:

Measured beam profiles may not accurately represent 'true' penumbræ due to the response of the detector, which causes a volume averaging effect. The purpose of this work is to validate a recently published semi-empirical method that removes the averaging effect from measured profiles and to determine to what degree these corrected profiles improve the agreement of treatment planning system beam models with measurements.

Method and Materials:

Profiles were measured for 10x10 and 3x3 fields for both 6 and 18 MV photon beams at multiple depths. Field sizes were defined by both jaws and MLCs and measured with two different types of ion chambers, Scanditronix-Wellhofer CC04 ($r = 2$ mm) and CC01 ($r = 1$ mm), with a SFD diode ($r = 0.3$ mm), and with EDR2 film. The volume averaging effect was removed from the profiles, and those measured at 10 cm depth were compared.

Preliminary Results:

The CC01 and CC04 corrected 80%-20% penumbra widths agreed within 0.6 mm or less with each other. The slight disagreement could be caused by the steel electrode in the CC01 chamber. Penumbra widths measured with the SFD diode agreed reasonably well with the CC04 corrected penumbra widths for the 3x3 field at shallower depths, but less so at the larger fields and deeper depths, perhaps due to the diode's energy dependence. EDR2 penumbra widths also showed reasonable agreement, considering the limitations of film. Follow-up measurements with Gafchromic film are underway, and corrected profiles are being compared with Monte Carlo profiles.

Conclusion:

It appears thus far that profiles measured with an ion chamber such as the CC04 can be appropriately corrected for volume averaging using semi-empirical methods. The energy dependence effects of detectors such as diodes and film can influence the measured penumbra, and should not be neglected when selecting a detector.