AbstractID: 9464 Title: Study of the effect of size of the beam scanning diodes on measurement of beam profiles of the clinical high energy photon beams

Purpose:
Diodes are sometimes used for measuring the therapeutic radiation beam profiles due to their small sizes or good spatial resolution as compared to many commonly used ionization chambers. The size of the detectors is known to perturb the real profile, especially in the penumbra region and corrections need to be applied to derive the real profile. The penumbra width is observed[1] to be linearly dependent on the radius of the active volume of ionization chambers. The purpose of this study is to examine the applicability of this observation to diode detectors.

Method and Materials:
Three ionization chambers with cavity radius of 2.75 mm, 2 mm and 1 mm, a stereotactic diode (0.3 mm radius), and a PFD^{3G} diode (1 mm radius) were used to measure the beam profiles of 10 cm x 10 cm field of a 6 MV x-ray beam. The 80%-20% and 90%-10% penumbra widths of the profiles at 1.5 cm depth were compared to study the relationship between the penumbra width and radius of the detector.

Results:
The size corrected penumbra widths (PW) with the small stereotactic diode agrees well with the expected penumbra widths of the real profiles derived from the ion chamber measurements, but PW of the PFD^{3G} diode show a significant deviation from the expected values. The difference can be attributed to the energy dependence of the diodes. Both size and energy dependent detector response kernel is needed to determine the real profiles with these detectors.

Conclusion:
The linear relationship between the penumbra width and detector size observed for ion chambers may not be applicable to some diodes. Additional correction for other properties of the detector affecting its response needs to be included to derive the real profiles.

[1]D. J. Dawson *et. al*, Med. Phys. **13**, 101-104 (1986).