AbstractID: 4667 Title: A semiempirical procedure for correcting detector size effect on clinical MV x-ray beam profiles

Purpose:
To develop a procedure to determine the real profiles of high-energy x-ray beams by removing the detector size effect from the measured profiles.
Method and Materials:
The proposed procedure is based on the combination of analytical deconvolution formalism of Garcia-Vicente *et al*. [1] to determine real profile and the experimental observation of the linear relationship between the penumbra width and the inner radius (r) of the detector by Dawson *et al*. [2]. Measured profiles can be corrected by shifting the position of each measurement point by a specific amount determined from available theoretical and experimental knowledge. The measured dose by the detector is related to the second derivative of the dose at that point. Therefore, the amount of shift can be considered to be proportional to the second derivative of the real profile at that point. The value of the shift at the 90% or 80% dose level is experimentally known [2] to be equal to 0.5r. The constant of proportionality can thus be determined from the value of this shift and the second derivative of real profile at the corresponding location, which can be obtained by using the analytical expression for the profile and the measured dose at the shifted location. The procedure was tested by correcting the profiles of 6 MV x-ray beams measured by a chamber with cavity radius of 2 mm.
Results:
The corrected profiles match very well with that measured with a stereotactic diode, and the corrected penumbra widths agree with the results of earlier investigations.
Conclusion:
The proposed procedure is found to be accurate and can be used to derive the real profiles of clinical high-energy x-ray beams.

[1] Garcia-Vicente, F. *et al*., Phys. Med. Biol. 45, 645 (2000).
[2] Dawson, D. J. *et al*., Med. Phys. 13, 101 (1986).