AbstractID: 2019 Title: Penumbra width correction of clinical high-energy x-ray beams

Accurate knowledge of dose distributions in the penumbral region of clinical high -energy x-ray beams is important for IMRT treatment planning. Ionization chambers used for profile measurements are known to broaden the beam penumbra due to their size effects. The real profile of the beam can be extracted from measured data by using a deconvolution procedure[1]. However, it can introduce some error. A procedure is developed to correct the profiles for the detector size effect by shifting the position of each point of measurement in the dose gradient region without introducing errors in the flat portion of the beam. The amount of shift is determined from the analytical deconvolution formalism[2] of Garcia-Vicente *et. al*. This procedure shortens the penumbra width and corrects the beam profile for the detector size in the penumbral region. The corrected values of the penumbra widths for 6 and 18 MV beams of a Varian Cl-2100C accelerator compare very well with those measured by a beam scanning diode. The effect of penumbra size on dose distributions for IMRT was studied by comparing dose volume histogram of treatment plans with and without the penumbra width correction. A small but significant difference was observed in the dose to target and critical organs. The corrected profiles from ionization chamber measurements are expected to be useful to check the accuracy of the diode dosimetry and vice versa.

1. Higgins, P. *et a*l., Med. Phys. 22, 1663 (1995).
2. Garcia-Vicente, F. *et. al*, Phys. Med. Biol. 45, 645 (2000).