A New Method to Measure the Lateral Scatter of Electron Beams

Measured lateral electron standard deviations (sigma-x) are often used as input data for electron beam treatment planning, calculation of electron output, verification of electron beam algorithm performance, and in the evaluation of Monte Carlo simulation of clinical beams. The current methods described in the literature involve fitting the distance from two points at the edge of a broad electron beam (i.e. 20% to 80% of the maximum as described by Hogstrom et al, Phys. Med. Biol. 1981), or measuring the slope of the dose gradient at the inflection point (normalized to the maximum dose as described by Sandison et al Med. Phys. 1989). In the method described here, the dose distribution profile is differentiated around the edge of the beam. This differential can then be fit to a pure gaussian distribution, or a function describing large angle scattering separately. No normalization to the flat portion of the profile is required. A process for rapidly generating sigma-x values vs. depth was developed by automating this procedure into a computer program which converts film density to dose, differentiates those values, then performs a non-linear least squares regression to a gaussian function.