AbstractID: 11244 Title: Rapid dose calculation for IMRT fields

Purpose: To develop a fast algorithm to calculate patient specific 3D dose distribution for megavoltage photon beams.

Method and Materials: In our PC-based convolution algorithm, the ratio of scatter-to-primary dose, D_s/D_p, for a 2-D non-uniform field is calculated as a 3D convolution:

$$SPR(x,y,d) = \int\limits_{x'}\int\limits_{y'}\int\limits_{z'} \frac{IM(x',y')}{IM(x,y)} \cdot \frac{aw((z-z')+d_0)}{(w\cdot r+z-z'+d_0)^3} \cdot \frac{A(z')A(z-z')}{A(z)}\, dx'\, dy'\, dz' ,$$

with $r = \sqrt{(x-x')^2+(y-y')^2}$ and $IM(x,y) = \sum_i fMU_i\, p_i(x',y')$ is the 2D intensity profile within the IMRT field, p_i is 1 inside field and 0 outside field collimation for segment field i of the IMRT field. $A(z)$ is the attenuation function. This convolution is calculated using a Fast Fourier Transform. The parameters a, w, and d_0 characterize the phantom scatter properties and can be determined from measured *PDD* and S_p. In a CT phantom, fast ray-tracing is used to calculate radiological depth for the attenuation function.

Results: *SPR* calculated using MC simulation for 6 and 15 MV Mohan Spectrum is compared with the FFT convolution algorithm. They agree very well for depths beyond electron contamination. Agreement is also compared between FFT convolution and MC simulation in a heterogeneous phantom. They agree to within 1%, relative to the primary dose.

Conclusion: This algorithm is ideally suitable for calculating patient-specific MU for quality assurance of patient specific IMRT fields for photon beams. The major attraction is the fast speed, which allows potential real-time applications.