

AbstractID: 6947 Title: A Simple Algorithm to Account for Inter-seed Effects in the Dose Calculation of Prostate Implant Brachytherapy

**PURPOSE:**

For multi-seed implant, dose calculation (TG-43) is based on the superposition of doses from each source, i.e. attenuations of neighboring seeds are neglected. Monte Carlo (MC) and measurements showed that inter-seed effects reduce dose coverage by up to 10%. However, MC is too time-consuming for clinical practice. We developed a simple algorithm to include inter-seed effects.

**METHOD:**

Seed is treated as a three-segment line with different attenuations in the center and edge segment. Attenuation of an active source by a neighboring seed exists in the triangular shadow formed by the seed (line) and the source center (point). Effective lengths and attenuations for each segment ( $L_C$ ,  $L_E$ ,  $\mu_C$ ,  $\mu_E$ ) are obtained through best fit to published MC data.

I-125 seeds (model 6702 and 6711) are investigated. For the fit, four parallel coplanar seeds are configured 0.75cm apart, one as active source and other three as neighboring seeds. Doses at forty-eight grid points are calculated and fitted. To test the generality of fit results, another configuration of four seeds 0.5cm apart is calculated and compared.

**RESULTS:**

For 6711,  $L_C=0.38\text{cm}$  &  $L_E=0.11\text{cm}$  and  $\mu_C=0.47$  &  $\mu_E=0.81$ . Total effective length (0.60cm) is slightly longer than its physical size (0.46cm) due to perturbation at edge. Averaged over all points, calculated inter-seed factor is 0.77 as compared with 0.80 from Monte Carlo.

For 6702,  $L_C=0.12\text{cm}$  &  $L_E=0.23\text{cm}$  and  $\mu_C=0.83$  &  $\mu_E=0.71$ . In contrast to 6711, center segment is shorter and less attenuating because 6702 uses three small spheres while 6711 uses a 3mm wire. Averaged inter-seed factor is 0.88 (algorithm) as compared with 0.87 (MC).

For 0.5cm configuration, fit results lead to inter-seed factor of 0.64 (0.61 MC) and 0.80 (0.77 MC) for 6711 and 6702 respectively.

**CONCLUSION:**

Neglecting inter-seed effects may significantly overestimate dose. A simple algorithm was developed and reasonable accuracy is achieved.