AbstractID: 12639 Title: Experimental and Monte Carlo estimation of dose perturbation around a non-radioactive brachytherapy seed due to 6 and 18 MV photons

Purpose: External beam treatment for patients who have previously had implanted seeds is not standard procedure but an option reserved in salvaging failed prostate brachytherapy treatment. Though small in size, the seeds are many and consist of high-Z metals capable of causing significant dose perturbation in their immediate vicinity.
Methods and Materials: Measurements were done with Kodak XV2 and Gafchromic EBT2 films layered above and below a non-radioactive I-125 seed placed in a grooved Lucite plate. 5-cm buildup and 10-cm backscatter were added at 95-cm SSD. The phantom was irradiated with and without seed for 1x1cm² field with 6 MV photons. DOSXYZnrc simulations were done utilizing same parameters for 1 billion histories. Other measurements using XV films were done comparing the dose perturbation with 18 MV photons and varying depth. Study was further extended to include other non-radioactive seeds (Pd-103 and Cs-131), and other metals of various Z. Films were analyzed obtaining cross-axial profiles of seed and no-seed determining percent dose perturbation.
Results: DOSXYZnrc and EBT2 film verified maximum dose enhancement of +15% upstream and -20% downstream of the I-125 seed surface. XV film showed +6% and -11%. Effect was observed upto ~2-mm upstream and ~5-mm downstream from seed. Dose-perturbation was found to decrease with increasing energy but increase with Z and depth of seed in tissue.
Conclusion: The perturbation of the seeds is highly localized and as with other heterogeneities depends on factors such as energy, depth, and material. Future work seeks to evaluate clinical impact of this effect.