AbstractID: 13930 Title: External beam dose perturbation from non-radioactive I-125 seeds: film and Monte-Carlo measurements

Purpose: Large numbers of radioactive seeds are often used in prostate brachytherapy procedures. External beam radiotherapy is often used to salvage failed brachytherapy treatments ignoring their presence. Present study attempts to quantify the dose perturbation due to these seeds as a function of energy, depth, field size, number of seeds, etc. during external beam treatments. **Method and Materials:** A number of non-radioactive I-125 seeds were procured. Film measurements were primarily carried out using Kodak XV2 layered above and below an I-125 seed placed in a groove on a Lucite plate with 5-cm buildup and 10-cm backscatter at 95-cm SSD. The phantom was irradiated with and without seed with 6 MV photons with a 1x1cm² field-size. Monte-Carlo simulations were done using DOSXYZnrc and compared with Gafchromic-EBT2 film. Effect of energy, depth, and field size including metals of various Z of the seed's dimensions was also studied. Study also looked into effect of 3 seeds spaced 0.5-cm vertically with single and with two opposing fields. **Results:** XV film measurements for a single and three I-125 seeds show a localized dose enhancement of 6.3% upstream but reduction of 10.9% downstream. With two opposing fields, a cold spot around the seed of ~3 percent was observed. Increasing beam energy and field size decreased the effect. Use of higher Z of materials greatly increased perturbation. At higher depths, a slight increase was noticed. DOSXYZnrc and EBT2 film verified maximum dose enhancement of 15% upstream and -20% downstream of the I-125 seed surface. In general, the range of the dose perturbation was noticed up to ~2-mm upstream and ~5-mm downstream. **Conclusion:** Presence of I-125 seeds causes dose perturbation which depends on energy, field size, depth, and material. With multiple seeds spaced apart and multi-fields external beam radiotherapy, the net perturbation may not be clinically significant.