AbstractID: 3091 Title: Assessment of a prostate treatment plan using directional brachytherapy sources

Purpose: To evaluate the effect of using newly developed directional sources in a prostate brachytherapy treatment plan.

Method and Materials: Directional sources contain a radiation shield in part of its interior that reduces significantly the intensity of radiation emitted in the shielded direction. They have a similar dose distribution as non-directional sources on the unshielded side. We use an adjoint region of interest based optimization system to generate a plan for 0.546 U non-directional ^{125}I sources to deliver a prescribed dose (D_p) of 145 Gy to the prostate and then manually replace some sources with the same strength of directional sources. The orientation and position of the directional sources have been selected to maximize V100 (percent of prostate receiving 145 Gy and higher), minimize R90Gy (percent of rectum receiving 90 Gy and higher) and minimize V125 and eliminate V150 for the central prostate regions including urethra (percent of volume receiving 125% of D_p (181 Gy) and 150% of D_p (217 Gy), respectively).

Results: V100 of the prostate target region increases from 97.5% to 98.9%, the central prostate region including urethra, receives the full uniform prescribed dose, V125 drops from 61.7% to 49.2% and the V150 of 2.24% is eliminated. There is a large reduction in R90 Gy from 53.7% to 20.6% for the anterior retal wall, which significantly reduces the probability of rectal morbidity. All treatment plan indicators are improved with use of directional sources.

Conclusion: Directional sources can allow the conflicting goals of increasing prostate target V100, decreasing R90Gy, decreasing V125 and eliminating V150 of the central prostate regions including urethra to be independently optimized, yielding a better treatment to the prostate with less rectal and urethral morbidity.