AbstractID: 7272 Title: The use of Advanced Imaging Techniques for Improvement in IMRT Plan Homogeneity and Delivery Efficiency

Purpose: Current RTOG protocols allowing IMRT delivery for prostate cancer limit the hot spot such that <2% of the PTV volume receives 110% of the prescription dose. The purpose of this work was to evaluate the effect of PTV volume on this limit.
Methods & Materials: A series of 6 prostate CT data sets was chosen for varying CTV volume. The original, clinically used plans were compared to those generated by decreasing the PTV margins from our standard 8mm (5mm posteriorly) to uniform 5mm and 3mm expansions. Additional plans were generated with a reduction in the number of beam directions as well as decreased input constraints for the rectum. Our routine clinical acceptance criteria were applied to all. All plans were evaluated with respect to hot spot as well as number of segments and MU.
Results: PTV reduction alone had little effect on hot spot. Reducing PTV volume and rectal input constraints decreased the hot spot for 3mm PTV expansion to approximately 2% while the additional reduction in the number of beam directions decreased the number of segments and MU on average by 30% and 23%, respectively. A review of our initial data for patients implanted with Calypso transponders indicates that the prostate drifts during treatment by >5mm and >3 mm for 19 and 103 seconds per average treatment (8-17 minutes), respectively.
Conclusions: Hot spot generation appears to be a complex function of PTV volume, the number of beam directions and subsequent overlap, and the penalties applied to nearby critical structures during optimization. PTV volume alone contributes minimally for the range of volumes in this study. It is possible to deliver a more efficient and homogeneous plan through localization and PTV reduction and/or active tracking since the prostate migrates out of the volumes studied with minimal frequency.