

AbstractID: 4478 Title: Comparison between CT-based and ultrasound-based localization for prostate patients

Purpose: Prostate cancer is often treated with intensity-modulated radiation therapy (IMRT) that provides very steep dose fall-off outside of the target volume and therefore requires precise alignment. In this report, we compare ultrasound (U/S) and CT localization, and evaluate the uncertainties of the two modalities.

Method and Materials: A total of 19 prostate patients (275 alignments) were included in the study. The prostate was localized with the BAT U/S system (Nomos, Cranberry, PA). CT scans were performed with the Primatom CT-on-Rails system (Siemens, Concord, CA). The two alignment techniques were identical: the simulation contours of the prostate, proximal seminal vesicles, bladder, and rectum were aligned with a pre-treatment image. The random uncertainty of the CT system was estimated based on intra-user variability, and a simple mathematical model of the motion of radio-opaque markers. Then the random error of the ultrasound alone was calculated.

Results: The systematic differences between (U/S) and CT alignments were (in mm): 0.3 (lateral), 0.4 (AP) and 0.3 (longitudinal). The random differences between the two modalities (one standard deviation) were (in mm): 2.2 (lateral), 2.2 (AP) and 2.4 (longitudinal). The estimated ranges of random uncertainties of the CT alignments (one standard deviation) were (in mm): 0.9 to 1.2 (lateral), 0.7 to 1 (AP), and 1.2 to 1.5 (longitudinal). Based on these results, the calculated ranges of random uncertainties of the U/S alignments were (in mm): 1.8 to 2.0 (lateral), 2.0 to 2.1 (AP), and 1.9 to 2.1 (longitudinal).

Conclusion: There was a strong correlation between the extent of prostate inter-fraction alignments using ultrasound and CT. The localization of the prostate had a total uncertainty (two standard deviations) of 2 to 3 mm when using the Primatom CT-on-Rails and around 4 mm when using the BAT system.