AbstractID: 13550 Title: Investigation of intrafractional prostate rotation and its effect on PTV margin evaluation

Purpose:
The intrafractional prostate rotation has been rarely studied due to the limitation of real-time imaging of the prostate during treatment. The Calypso 4D Localization System provides the capability of real-time tracking of implanted transponders for prostate patients. Based on the transponder locations, intrafractional prostate rotation can be investigated to facilitate prostate PTV margin evaluation.

Method and Materials:
With three transponders implanted in the prostate, the system log file recorded intrafractional 3D coordinates of transponders for 10 fractions of 5 patients enrolled in the study. To minimize noise, the 3D coordinates were first downsampled following a size of 5 median filtering. Based on the transponder positions in the planning CT, the rotational and translational motion of the prostate was calculated using a point-based algorithm. To check the CTV coverage for a particular fraction we overlapped the rotated prostate CTV with the PTV.

Results:
For 9 fractions, the maximum rotation angles around x (Lateral), y (SI) and z (AP) were 7°, 6° and 3°, respectively. Although the prostate may not rotate around all 3 axes simultaneously we tested this worst case scenario and found that the CTV was still covered by the PTV when the prostate rotated by the maximum angles. For one fraction, large rotational angles were observed (39.4°, -22° and 12° in x, y and z) along with large transponder distance variations (>1cm). In this case, 20.5% of the CTV was outside of the PTV. The rotational angles for this patient need further investigation since large transponder migration may affect the rotation calculation significantly as we reported before.

Conclusion:
For most cases, the prostate exhibits relatively small intrafractional rotations and the CTV is covered by the PTV. For patients with larger transponder migration, a CBCT or other imaging modality is recommended for further investigation.