

**Purpose:** To report the inter-transponder distance variation and its effect on prostate IMRT for transponder-based target localization.

**Materials and Method:** Real-time electromagnetic tracking systems, such as the Calypso 4D localization system, monitor the prostate motion by tracking the positions of implanted transponders. Three transponders were usually implanted in the prostate gland one week before the CT simulation. The inter-transponder distances detected by the system at the first and last treatment were compared with those obtained from the simulation CT scans for 105 patients. Cone beam computerized tomography (CBCT) has been taken for some patients to verify the inter-transponder distance change and the prostate deformation.

**Results:** Comparing with the simulation CT, the average changes of the distance from the transponder at apex to the one at right base and to the one at left base, and from the right to the left base are -0.84, -0.88, -0.23mm at the first treatment and -1.72, -2.0, -1.27mm at the last treatment, respectively. The inter-transponder distances can increase by 7mm or decrease by 16mm while most changes are from -5mm to 3mm. The percentages of patients have inter-transponder distance variation more than 2, 4 and 6mm at the last treatment are 58%, 24% and 5%. The distance changes continuously during the treatment for most patients and the change varies between -4mm and 2mm from the first to the last treatments for most patients and the maximum changes are -6.6mm and 7.3mm. The inter-transponder distance has been confirmed by CBCT and the potential causes are transponder migration, prostate shrinkage and deformation due to rectal/bladder fillings. The effect on the centroid position and thus the isocenter accuracy is within 2.5mm for most patients.

**Conclusions:** The inter-transponder distance changes significantly for some patients and its effect need to be considered clinically for transponder-based target localization.