

## AbstractID: 6762 Title: Fast On-line Prostate Positioning with Stereographic Targeting on kV/MV Image Pairs

**Purpose:** For on-line positioning corrections based on fiducial markers we have developed Stereographic Targeting (SGT). SGT is described and clinical results for prostate patients are reported.

**Method and Materials:** SGT entails (1) acquisition of a MV and orthogonal kV image in rapid succession without gantry rotation, (2) marker detection and calculation of center of mass (COM) translation and rotations, (3) correction execution by remote couch control and (4) optional repetition of previous steps for verification. MV images are acquired with 2-6 MU of a treatment beam and kV images with Elekta Synergy<sup>®</sup>. Performance was measured for 10 prostate patients with 3-4 markers who had daily SGT with verification imaging plus an extra kV image at the end of each fraction to study intrafraction motion.

**Results:** Compared with manual analysis, automatically determined marker positions in SGT were accurate within 0.5, 0.2, and 0.3 mm (SD) for the lateral (LR), cranial-caudal (CC), and anterior-posterior (AP) directions respectively and within 1°(SD) for rotations. SGT added < 1 min to treatment time while it reduced COM systematic errors ( $\Sigma$ ) from 4 mm to 0.5 mm (SD) and random errors ( $\sigma$ ) from 3 mm to < 0.8 mm on all axes. The largest prostate rotations were about the LR axis:  $\Sigma = 3.4^\circ$  and  $\sigma = 4.5^\circ$ . The start-to-end intrafraction motion was 0.5 mm ( $\Sigma$ ) and 1.5 mm ( $\sigma$ ) for AP and 0.5 mm ( $\Sigma$ ) and 1.4 mm ( $\sigma$ ) for CC.

**Conclusion:** SGT allows for fast, precise positioning (3D deviation < 3 mm within one minute) and is now routinely used for our prostate treatments. Taking into account rotations and the mainly random intrafraction motion, planning margins  $\leq 5$  mm are obtained. While intrafraction motion can be reduced by repetitive SGT within one fraction, we develop a strategy to counter rotations as well.