AbstractID: 13396 Title: Disparity between 4DCT and CBCT reconstruction of internal target volumes

Purpose: Internal target volumes (ITVs) generated from different imaging modalities may not be identical. These differences could be due to inherent limitations in image reconstruction, and in this study we investigate the differences between 4DCT-MIP generated ITVs and CBCT reconstructions of moving targets. **Methods/Materials**: A cork lung phantom with three embedded targets was attached to a programmable motion platform to simulate lung and tumor motion. Ideal sinusoidal motion and other simulated patterns were used to compare ITV dimensions reconstructed from 4DCT and CBCT. Four 4DCT and ten CBCT generated ITVs from four lung cancer patients were also compared using a physician's contour as ground truth. **Results**: CBCT targets along the direction of motion were consistently smaller than the 4DCT equivalents (by 0.49 +/- 0.50 cm) in the phantom measurements. The amplitude was varied during a single scan from 1 to 4 cm, and both 4DCT and CBCT under-represented the ground truth dimension by 2.13 (+/-0.64) cm and 2.69 (+/-0.50) cm. Patient lung tumors did not reveal a similar pattern of smaller ITVs from CBCT. Lateral motion due to proximity to the heart resulted in lateral discrepancies for two patients, with CBCT ITV 0.32 cm and 0.68 cm larger than the 4DCT ITV. For the two other patients, the CBCT ITV was larger along the tumor's primary direction of motion. **Conclusions**: Even under ideal periodic motion, CBCT generated ITVs can deviate from their 4DCT counterparts. These variations are often assumed to be due to physiological changes, but may actually occur due to limitations in CBCT reconstruction. If irregular motion in actual patient cases is observed, the discrepancy between the 4DCT ITV and the CBCT counterpart can be greater than 5mm and adaptive re-optimization based on CBCT ITV may not be beneficial.