

AbstractID: 4867 Title: Estimation of Lung Tumor Setup Uncertainties Using Bony Landmarks and Implanted Fiducials

Introduction. Setup uncertainties require margins to be placed around the internal target volume (ITV) so that the tumor stays within the treatment portal during the course of treatment. The purpose of this work is to estimate setup uncertainties for lung tumors using both bony anatomy and implanted fiducials as surrogates for tumor position.

Methods and Materials. Fiducials were implanted in the periphery of lung tumors of 4 patients who were treated using respiratory gating. Setup uncertainties were quantified using the fiducials in the gated images (acquired from the electronic portal imaging device (EPID) operated in cine mode) each day, using the fiducials in the repeat 4D image acquisitions, using the bony anatomy in the repeat 4D image acquisitions. Standard deviation (SD) of population systematic uncertainty (Σ), and SD of random uncertainty (σ) were determined (in cm) from each patient's mean systematic and random setup uncertainties.

Results. For the Left/Right (LR), Superior/Inferior (SI), Anterior/Posterior (AP) directions, respectively, using implanted fiducials during treatment, Σ was 0.41, 0.70, 0.47, and σ was 0.34, 0.45, 0.43. For the LR, SI, and AP directions measured using implanted fiducials on the repeat 4DCTs, Σ was 0.26, 0.26, 0.42, and σ was 0.29, 0.27, 0.45. For the LR, SI, and AP directions measured using bony anatomy on the repeat 4DCTs, Σ was 0.08, 0.36, 0.27, and σ was 0.24, 0.33, 0.43.

Conclusions. We were able to quantify setup uncertainties using two surrogates for lung tumors using repeat 4DCT image acquisitions and gated EPID images. The SD of the systematic and random components of setup uncertainties varied up to 4.5 mm as measured on 4DCT and up to 7 mm as measured on EPID images suggesting that setup uncertainties can be significant.