AbstractID: 6493 Title: Improvement in the Daily Alignment of Mobile Lung Tumors using Implanted Fiducials

Purpose: The purpose of this work is to develop, validate, and implement a technique in which imaged-guided patient setup using gated kV images of implanted fiducials can be implemented for mobile lung tumors.

Method and Materials: Software for matching markers by comparing 2D images with projections of 3D CT data sets was validated by acquiring respiratory-gated kV images of a phantom on a moving platform. The procedures were implemented for patients in our clinic who have mobile lung tumors with fiducials implanted in the periphery of the tumors. Treatment was delivered using respiratory gating, and cine images of each of the gated treatment fields were acquired each treatment to examine uncertainties in tumor location after gated image guided alignment.

Results: For the phantom study, the 2D-3D marker matching software is accurate to within 1 mm. This accuracy is limited by the ability to locate the fiducials in the CT images (slice thickness 2.5 mm). Setup errors were reduced from 4 to 1 and 6 to 2 mm in the LR and SI directions ($p<0.001$ f-test) respectively for our first patient. Shifts larger than 7 mm (PTV margin used to account for setup uncertainties) were observed on 13 of the 33 fractions for our first patient. Similar results were obtained for the other fiducial patients.

Conclusion: Large variations in daily tumor position were observed and corrected for by acquiring gated kV images using the fiducials in these images for daily alignment. Respiratory gating in conjunction with image guided patient setup (planar kV imaging) using fiducials implanted near mobile lung tumors is an effective method of accurately aligning tumors without acquiring higher-dose volumetric CT scans. This technique can be implemented using both kV imaging and standard MV portal imaging.