AbstractID: 10542 Title: Marker-less verification of respiratory-gated radiotherapy for lung cancer

Purpose: To maximize the potential benefit of respiratory gating for lung tumors, a method of image-guided verification is necessary. We propose using the MV EPID in cine mode during respiratory-gated radiotherapy to verify the location of the tumor without the aid of implanted fiducials. **Method and Materials:** The verification procedure to be studied is as follows: prior to each fraction of gated radiation therapy, a gated radiograph is acquired for each of the therapy beam angles. This reference image is then compared to cine EPID images acquired during respiratory-gated radiotherapy. The target can be visualized in the images and the deviation from the reference position calculated. Phantom studies were performed using a dynamic phantom and internal respiratory traces derived from patients undergoing lung SBRT treatments. Setup images were taken when the external surrogate signal was in the reference (exhale) position and gated radiotherapy was simulated using clinically realistic fields. The reference and treatment images were loaded into offline research software and the location of the target relative to the reference was calculated using a template matching algorithm. Clinical patient data has also been used to demonstrate the feasibility of the technique for an oblique treatment beam. **Results:** Preliminary phantom and clinical studies demonstrate that the target can be tracked through a series of MV cine EPID images. From both studies, accuracy was assessed to be better than 1 mm. **Conclusion:** A procedure for confirming the target location during lung cancer respiratory-gated radiotherapy without the aid of internal fiducials has been defined. Although the proposed procedure is demonstrated retrospectively, in principle, in could be performed in real-time.