AbstractID: 9446 Title: Treatment Verification of Hypo-Fractionated Lung Radiotherapy Using Cine EPID

Purpose: To develop an online method of monitoring hypo-fractionated lung treatment.

Methods and Materials: For hypo-fractionated 3D conformal lung treatment, tumors are often small and visible with the use of an electronic portal imaging device (EPID). Portal images in cine mode were acquired from a Varian Trilogy machine to assess tumor position. This assessment was done using a modified, normalized cross-correlation function which utilized both EPID cine and the digitally reconstructed radiographs (DRR). The modifications to the established cross-correlation equation were made in order adapt this function to the spatial and geometrical properties of these images. The output of the algorithm was then used to find the displacement of the tumor from its intended position relative to the beam aperture, and thus monitor the accuracy of treatment.

Results: Preliminary results from two patients show a mean correlation of 0.6 for an adaptive search region parameterized by the cross-sectional length of the treatment beam. The highest correlations were found both near the center of the tumor and occasionally in other regions which strongly resembled the tumor. High scores also appear to be associated with treatment field geometry. We developed a sorting algorithm to pick the true position based on the correlation score and location. This method generated few false positives for visible tumors. Substantial spatial precision was observed for different fractions of the same field.

Conclusion: The modified, normalized cross-correlation procedure developed here has shown great potential for verifying treatment on patients with tumors visible on EPID. This method can produce verification results well within the time of treatment. With small improvements such as weighting, filtering, and sufficient computing resources, this algorithm could potentially be used to stop the treatment when beam moves out of beam aperture.