

AbstractID: 11679 Title: Assessment of Lung Tumors Treatment Accuracy using CyberKnife Synchrony Model

Purpose: The Synchrony Respiratory Tracking System treats moving targets with much tighter margins. Due to the complex and erratic breathing motion of lung tumors, it is a challenging task to build a reliable internal/external correlation model and predictive algorithm. This study is to assess the treatment accuracy of lung tumors using the Synchrony system.

Method and Materials: 21 lung patients with 97 fractions treated by a Synchrony system were studied. Available treatment data includes (i) tumor positions from sparsely acquired x-ray image pairs; (ii) three surface LED markers motion continuously tracked by three Infrared detectors; (iii) the modeled motion calculated using the LED motion and the internal-external correlation model and (iv) the predicted motion to compensate system latency. The correlation models can be validated by comparing the x-ray image pairs determined tumor positions and the calculated modeled motion. The prediction precision can be evaluated using the modeled and predicted motion. The comparison of the x-ray image pairs determined tumor positions and the predicted motion will assess the treatment effectiveness and provide feedback for the optimized margin expansion, computed using either a rolling ball method or un-even margin expansions in X, Y, and Z directions.

Results: Preliminary analysis showed the predictive model worked well with fast motion during inhale and exhale and decreased at the end of inhale and the end of exhale, especially at the reflection points. The fidelities of the correlation model changes over time, with correlation error up to 11.5mm in 3D distance for some fraction. The margin expansions required for different coverage percentages were calculated using both the rolling ball approach and un-even expansion for each treatment direction.

Conclusion: Evaluation of the correlation model, predictive results, and margin expansions were performed and the results are important to improve lung tumor treatments using the Synchrony System.