AbstractID: 10513 Title: Evaluation of an IMRT planning technique to incorporate intrafraction organ motion using rigid-body tumor modeling

Purpose: We have evaluated a technique for incorporating intrafraction organ motion into IMRT treatment planning using Monte Carlo based dose engine that builds the pattern of respiratory-induced anatomical displacement into the dose calculation.

Method and Materials: For the lung cancer patients included in this study, a patient specific 3D tumor trajectory is derived using 4D CT images by modeling the tumor as a rigid body and by performing a parametric fit to the center-of-mass of the tumor volumes. The patient specific tumor trajectories were then used to create the optimized plans. The optimized plans were compared with plans produced using traditional margin expansion. In addition, measurements were performed with a moving phantom programmed for sinusoidal motion to verify the accuracy of this planning approach.

Results: For the three lung patients in this study, significantly improved normal tissue sparing was observed in the plans that incorporated intrafraction organ motion. On average, the motion-based plans provided a 40.8% reduction in the volume of the involved lung receiving 80% or more of the prescribed dose. Verification measurements performed with a moving phantom demonstrated a significant improvement in the agreement between the planned and measured doses.

Conclusion: In contrast to traditional margin expansion, our proposed technique resulted in a significant sparing of critical structures while providing similar target coverage. In addition, the technique obviates the need for gating or tracking.