AbstractID: 2779 Title: A New Lung IMRT planning algorithm with dose shaping strategy to compensate for respiratory motion

Purpose: To develop a new lung IMRT planning algorithm that shapes dose distributions to the probability distribution of the tumor over the breathing cycle in order to compensate for respiratory motion, thereby enabling tumor dose escalation.

Method and Materials: We implemented a new optimization algorithm on an in-house IMRT planning system on an Eclipse® workstation (Varian, Palo Alto). Our new dose shaping algorithm makes the dose of each voxel on the 3-D dataset proportional to its probability of being inside the tumor over the respiratory cycle. The maximum dose is set to be the prescription dose multiplied by the ratio of the volume encompassed by the extreme positions of the tumor to the tumor volume. We also implemented two other popular approaches: (1) an optimal margin method in which the margin is generated based on the extreme positions of the tumor; and (2) a convolution method that performs 4-D dose calculations using a modeled tumor motion probability density function. A simulated 4-D CT dataset, which was generated by superimposing the patient's respiratory motion pattern onto one's 3-D CT dataset, was used to evaluate the performance of these three approaches via DVH comparison for the inhale phase of the breathing.

Results: Five-field 6MV beams were used for all plans delivering a total dose of 63Gy in 35 fractions. Comparing to the IMRT plan with optimal margin, the convolution method reduced the mean dose to the ipsilateral lung by 5% while maintaining the same tumor coverage. Compared to the convolution method, our dose shaping method achieved the same lung sparing, but is much faster and has the extra ability to escalate tumor dose: 95% tumor received more than 72Gy.

Conclusion: Dose shaping method is able to spare the healthy lung tissue, and has the capacity to further facilitate dose escalation.