

AbstractID: 7361 Title: The effects of anatomy motion on dose distribution

Purpose: To evaluate the effects of respiration-induced anatomy motion on dose distribution.

Method and Materials: We have implemented a 4D Monte Carlo dose calculation system. It produces dose distribution on each of the respiratory phases. Deformable registration based on B-spline optimization is used to register lung 4DCT data from other phases to the end-exhalation (EEH) phase. The dose maps are then all warped to the EEH phase and time-weighted accumulated dose distribution is computed. Dose distribution based on free-breathing CT is also calculated to simulate the case when organ motion was not taken into account. This study presents the preliminary analysis of the DVH differences among the accumulated doses with and without registration as well as different time-weights on one patient IMRT plan.

Results: For the patient case, treatment was planned with 3 ITV. We implemented two time-weighting functions: 1. Dividing the respiratory cycle equally into 5 phases and summing up the dose with equal weights; 2. Accumulating the dose with 70% weight on EEH and 30% on end-inhalation (EIH). The registration and time-weighting functions did not make significant difference of the DVH in lungs. While the discrepancies between the two time-weighting functions in the ITVs are small, the disparities to the free-breathing are more prominent. For one of the 3 ITVs, 95% volume received 2.8Gy less dose than the static plan, which is more than one fraction.

Conclusion: This preliminary study suggests that using 2 phases (EIH and EEH) to calculate the accumulated dose may be sufficient for estimating the effect of motion on a DVH. Respiration-introduced organ motion may cause significant dose discrepancy, especially for tumors that have a large magnitude of motion. Hence, it is desired to incorporate the motion into dose calculation.