

AbstractID: 5140 Title: Preliminary investigation of multi-pass respiratory gated helical tomotherapy (MRG-HT)

Purpose: To investigate the feasibility of multi-pass respiratory gated helical tomotherapy (MRG-HT) technique by measuring the dosimetric degradation caused by target motion, and the resulting dosimetric improvements made by the MRG-HT technique

Method and Materials: MRG-HT was simulated on the HT unit (Tomotherapy Inc.) by delivering a sequence of HT plans modified by blocking beam projections remaining outside the gating window (50 % duty cycle, end-expiration gating). After each plan delivery, the couch was reset and the succeeding plan was commenced at a different respiratory phase to allow the previously "blocked" beam projections to fall within the gating window. EDR2 film was placed inside a moving phantom (Modus Medical Devices Inc.), which was driven sinusoidally in the longitudinal direction. For each of the two scenarios with different experimental parameters, the resulting dose profiles along the axis of gantry rotation were obtained for a stationary target treated with the original plan, a moving target treated with the original plan, and a moving target treated with the MRG-HT technique.

Results: In the first scenario, target motion led to underdosing 7.5 ± 0.5 mm of the target and overdosing additional 2.0 ± 0.5 mm of normal tissues. With the gating technique, these values were reduced to 4.5 ± 0.5 mm and 1.0 ± 0.5 mm, respectively. Further improvement could be achieved using a smaller gating window. In the second scenario, selected parameters caused significant dose modulations of 8.5 ± 1.0 % inside the target, which was effectively eliminated by the MRG-HT technique.

Conclusion: MRG-HT seems to be a very promising technique for gated HT. Its dosimetric improvement was demonstrated in the form of reducing target underdosing and dose modulations. In future, more sophisticated experiments will be made to simulate lung cancer treatment, including the effect of non-sinusoidal motion and lung inhomogeneity.