AbstractID: 11293 Title: Impact or no impact of respiratory motion on Helical Tomotherapy dose delivery

Purpose: In this work, the dosimetric consequences of respiratory motion on helical tomotherapy (HT) treatment delivery are comprehensively investigated. The dependence of dose errors on respiratory-motion parameters: amplitude, period, phase, and motion direction is examined. The impact of characteristic breathing-motion induced offsets and drifts on dose errors is also scrutinized, and the influence of target margin and field size on the results evaluated.

Method and Materials: Treatment delivery into a moving patient was simulated by incorporating synthetic motion data in the HT dose calculation engine, which includes all relevant treatment dynamics such as MLC opening times, gantry rotation, and couch translations. This allowed for a realistic evaluation of the dosimetric sensitivity of over 12 HT plans (3 margins, 2 field sizes, two clinical lung cancer cases), retrospectively. The prescription dictated a minimum dose of 50 Gy delivered to 95% of the planning target volume (PTV).

Results: For PTV equal to the internal target volume (ITV) (which, takes only breathing motion amplitude into account), the results show that mean regular breathing amplitudes engender GTV $D_{95\%}$ errors less than 1.5 %, regardless of period, phase or motion direction. Meanwhile, average practical offsets generate less than 3.6 % GTV $D_{95\%}$ errors. Results also show that for SI breathing motion, the GTV $D_{95\%}$ dose error is virtually the same regardless of margin size. If the gantry period to breathing period ratio is an integer, GTV (or PTV) dose errors may sometimes be sensitive to the breathing phase. Overall, the dose error magnitude is plan specific, increases with increase in amplitude, offset or drift, and depends on motion direction and field size.

Conclusion: The dosimetric impact of respiratory motion on HT treatment delivery is plan specific. However, for non phase-sensitive plans with PTV equal ITV, average regular breathing motion and offsets engender insignificant dosimetric consequences.