AbstractID: 4774 Title: Dose Verification in Moving Targets During Helical Tomotherapy Beam Delivery

Purpose: To compare dose distributions from stationary and moving targets subject to simulated intra-fraction motion during treatment deliveries on a helical tomotherapy unit.

Method and Materials: We have constructed an in house platform that moves in the superior-inferior direction in a controlled manner. Using a stationary CT scan of a thorax phantom, a fictitious target volume was defined and a helical tomotherapy plan was generated. The phantom was placed on top of the moving platform and set in motion at a frequency of 16.7 cycles/min and 20 mm peak-to-trough excursion. An IMRT plan was delivered while the phantom was in motion and when it was still. Ion chamber readings were recorded at the center of the target. Different phases were artificially introduced by starting the platform motion at different times before the start of irradiation. In each delivery a film was placed in the coronal plane inside the phantom to register 2D dose.

Results: Profiles along the direction of motion from the co-registered images of moving and stationary deliveries have shown dose differences as large as 70% in the penumbra region. Gamma function maps for different dose and distance to agreement criteria revealed the regions at which the gamma criteria fails and was shown to be a strong function of initial motion phase. Ion chamber point measurements recorded insignificant differences between still and moving deliveries.

Conclusions: We have shown that there is a significant difference in 2D dose distributions in the penumbra region both in the inferior-superior and transverse directions between stationary and moving deliveries that simulate breathing motion. Our results indicate that the differences are highly dependent on the breathing motion initial phase. The phantom motion had little effect on the delivered dose at the central target region.