AbstractID: 4890 Title: A motion phantom study on Helical Tomotherapy: the dosimetric impacts of delivery technique and motion

Purpose: To determine the optimal delivery technique for treating moving targets with Helical Tomotherapy (HT) we measured the dosimetric effects of various motion and Tomotherapy plan parameters using a lung motion phantom.

Method and Materials: A motion phantom system was constructed using a programmable motor driving a moving platform. Tomotherapy plans were delivered to a phantom which mimicked lung heterogeneity by using wood inserts with the density of lung tissue and a 3.3cm spherical tissue density material as tumor. A cylindrical planning target volume (PTV) was used with a length and diameter of 3.3cm including the sphere. Treatment plans were created using jaw sizes of 1.04 and 2.47cm with incremental gantry rotation times ranging from (10s) to (60s). Treatments based on these plans were delivered to the phantom with motion periods of 3 and 5 seconds, and amplitudes of +/-6 and 10mm. All plans were normalized to 2.0 Gy fractional doses to 95% of the PTV and Kodak EDR-2 film was used for 2-D dose measurements. Axial dose profiles and cumulative dose volume histograms (DVH) of plans for moving and static phantom conditions were compared.

Results: Target edge under-dosing is less with a jaw size of 2.47cm than 1.04cm in this experimental system. Shorter motion periods (3s) and greater gantry rotation (>5 times motion period) resulted in better PTV coverage referenced to static phantoms. Greater than 90% of the PTV received the prescription dose even when the phantom moves +/-10mm. When the gantry rotation time to motion period ratio approached 3 PTV coverage was compromised.

Conclusions: PTV expansions smaller than motion excursion may be possible for lung tumor treatment by HT. Larger jaw width provides better target coverage because of the wider inferior/superior penumbra. Increasing the ratio of the gantry rotation time to the motion period improves target edge coverage.