AbstractID: 12587 Title: Optimal Management of Respiratory Motion Without Motion Management: A Tomotherapy Phantom Demonstration

Purpose: To demonstrate a potential alternative scenario for accurate dose painting (non-homogeneous planned dose) delivery at the 1 cm beam width with helical tomotherapy (HT) in the presence of 1 cm, three dimensional, intra-fraction respiratory motion, but without any active motion management. **Method and Materials:** A model dose painting experiment was planned and delivered to the average position (proper phase of a 4DCT scan) with three spherical PTV levels to approximate dose painting to compensate for hypothetical hypoxia in a model lung tumor. Realistic but regular motion was produced with the Washington University 4D Motion Phantom. A small spherical Virtual Water™ phantom was used to simulate a moving lung tumor inside of the LUNGMAN™ anthropomorphic chest phantom to simulate realistic heterogeneity uncertainties. A piece of 4 cm Gafchromatic EBT™ film was inserted into the 6 cm diameter sphere. The TomoTherapy, Inc. DQA™ software was used to verify the delivery performed on a TomoTherapy Hi-Art II™ device. **Results:** The dose uncertainty in the purposeful absence of motion management and in the absence of large, low frequency drifts (periods greater than the beam width divided by the couch velocity) or randomness in the breathing displacement yields very favorable results. Instead of interference effects, only small blurring is observed because of the averaging of many breathing cycles and beamlets and no other frequency coherence to the modulation, likely in most cases. **Conclusion:** Dose painting during respiration with helical tomotherapy is feasible in certain situations *without* motion management. A simple recommendation is to make respiration as regular as possible without low frequency drifting. The blurring is just small enough to suggest that it may be acceptable to deliver without motion management in many situations when registered to the average position.