AbstractID: 7474 Title: Real Time Motion Adaptive Delivery—Experimental Validation

Purpose: A real time motion adaptive delivery (MAD) technique to compensate for the effects of intra-fraction respiratory motion in TopoTherapy/TomoTherapy delivery was developed. This technique was evaluated using dosimetric measurements on a TomoTherapy machine with a motion phantom.

Methods: Motion adaptive delivery is a technique that re-uses the planned sinogram by shuffling its projection and leaf indices, based on instantaneous target position. MAD can be implemented using commercial TomoTherapy systems without hardware modifications.

A standard helical plan on a stationary phantom is compared to the same plan on a moving phantom, and a motion adaptive delivery on a moving phantom. The dosimetric differences are measured by delivering plans to film placed on a synchronized motion phantom. The experiment is repeated for different target volume shapes and motion directions.

Results: We measured the MAD to be within 2% of dose of a regular treatment delivered to a stationary phantom. These results are consistent for different IMRT target shapes (spherical, ellipsoid, saddle-shaped), target motions (lateral, inferior-superior), and field sizes (1.0 and 2.5 cm).

Discussions and Conclusions: We present an experimental validation measuring the effects of intra-fraction motion on helical TomoTherapy plans compared to Motion Adaptive Delivery (MAD). The dose measured in motion adaptive deliveries is within 2% of a regular helical treatment dose to a stationary target.