AbstractID: 7086 Title: Assessment of treatment site-specific setup accuracy and reproducibility in patient positioning using daily MVCT imaging

Purpose: To assess treatment site-specific corrections in patient positioning from TomoTherapy Hi-ART® megavoltage images.

Method and Materials: Initial positioning corrections, determined by fusion of daily pre-treatment MVCT to planning CT images, were analyzed for different anatomical treatment sites. Over 600, 1400, and 1200 fractions of head and neck (H&N) and brain, lung, and prostate tomotherapy treatments, respectively, were assessed. Translational and rotational, per-fraction setup corrections were retrospectively compiled from individual patient archive files. Setup corrections were compared amongst anatomical treatment sites. Setup reproducibility was assessed by analyzing standard deviations and histograms of setup corrections. Setup accuracy was also assessed by analyzing 3D vector lengths and magnitudes of corrections.

Results: Large variations in setup corrections were seen in all three disease sites. H&N treatments had a significantly smaller ($p<0.001$) vector length standard deviation of 2.54 mm compared with 6.99 mm and 6.46 mm for lung and prostate treatments, respectively, but had no significantly different standard deviation in roll rotations. The frequency of translations of vector lengths $\geq$ 10 mm were 48.9% and 48.1% of all lung and prostate treatments, respectively, whereas corrections of that magnitude occurred in only 1.56% of H&N treatments. Frequencies of roll rotations were more comparable among the three disease sites.

Conclusions: Analysis of patient positioning corrections indicates large variations between patients and treatments, suggesting a role for imaging every patient per-fraction to ensure the most accurate reproducibility. H&N treatments had a higher setup reproducibility and accuracy in the lateral, longitudinal, and vertical directions. Even so, they were not significantly different rotationally than prostate and lung treatments, suggesting a role for daily imaging in all three treatment sites. In quantifying site-specific positioning reproducibility and accuracy, this work may be useful for assessing new treatment planning margins for image-guided procedures or for developing adaptive radiotherapy techniques.