AbstractID: 7055 Title: Respiration Motion Correction in Helical Tomotherapy Imaging

Purpose: In helical tomotherapy, Megavoltage CT (*MVCT*) images are acquired at a rate of one transverse slice per five seconds. The slow acquisition of raw data results in CT images with varying degrees of motion-induced artifacts. In addition, the high energy of the x-ray beam (*4-6 MV*) presents unique challenges for image reconstruction. The purpose of this work was to correct for motion in the superior-inferior (*S/I*) direction using retrospective manipulation of the unprocessed sinogram data.

Method and Materials: A respiratory motion platform with a S/I motion range of 3-cm, and periods of 2, 4 and 6 seconds was used to move an ACR CT accreditation phantom and a anthropomorphic thorax phantom in the superior-inferior direction. The motion of the respiratory platform was measured using the Varian respiratory gating system. Sinogram data was acquired axially with the couch stationary for 5 complete rotations of the gantry. The respiration cycle was synchronized to the projections in the raw sinogram so that the position of the moving object was known in each projection. Motion correction was performed by identifying and extracting projections occurring within a specified respiration phase, correcting for missing projections, and then reconstructing the CT images.

Results: Images acquired with the ACR CT phantom showed considerable improvement with motion correction using temporal re-binning over the uncorrected images. Images acquired with the RANDO phantom suffered from greater image artifacts than the ACR phantom because of the larger variation in the phantom's anatomy over the 3-cm range of S/I motion. Improvement was seen for each period, however only slight improvement was seen for the 2-second period of motion.

Conclusion: Temporal re-binning can successfully reduce S/I motion artifacts in reconstructed MVCT images.

Conflict of Interest (only if applicable): This research is supported by TomoTherapy, Inc.