AbstractID: 9525 Title: A Surface-Based Respiratory Surrogate for 4D Imaging

Purpose: Real-time acquisition of three-dimensional surface tracking has potential as an external surrogate for respiratory correlated CT imaging and radiation therapy. This study assesses the GateCT surface tracking system (VisionRT, UK) by comparing real patient tracking and phantom imaging output to current surrogate systems.

Materials & Methods: Absolute tracking accuracy was tested using a 4D motion platform (Washington University, St. Louis) programmed with real-patient respiratory trajectories. A cylindrical object was attached to the 4D phantom arm as a GateCT tracking surface. The optical RPM camera system (Varian Medical) and pneumatic bellows device were attached to the phantom arm for simultaneous monitoring of phantom motion. Respiratory traces from each of the three systems were compared against actual phantom motion. Next, a small sphere was placed on the phantom arm and the experiment was repeated while imaging in helical retrospective 4D mode. Three scans were acquired, each using a different surrogate system for reconstruction. All phases were reconstructed and the 0% and 50% phases were contoured. The centroid of each contoured volume was compared to the true phantom position. Finally, real patient respiratory tracking was performed simultaneously with the three systems on two volunteers. Respiratory traces from the three systems were compared for each volunteer to assess relative agreement between the waveforms.

Results: Error for the three surrogate systems was < 0.5mm for phantom tracking. The GateCT system produced a root-mean-squared error of 0.6mm when tracking a moving surface during imaging. Additionally, the position of the contoured sphere on reconstructed 0% and 50% GateCT scans differed by < 0.3mm from scans performed with the other surrogate devices. Respiratory traces from human subjects closely correlated.

Conclusion: The GateCT system produces comparable results to other surrogate devices and may offer additional advantages with its topography based acquisition method.