

AbstractID: 13347 Title: Feasibility of low-dose single-view real-time 3D tracking concurrent with external beam delivery

Purpose: Existing on-board x-ray imaging chains orthogonal to the delivery beam cannot recover 3D target trajectories from a single view in real-time. This limits their utility for real-time motion management concurrent with beam delivery. We investigate the feasibility of an alternative inverse-geometry “single-view” Scanning Beam Digital X-ray (SBDX, NovaRay Medical, Inc.) system for real-time 3D intra-delivery tracking. **Method and Materials:** A chest phantom (Standard Imaging, WI) comprising a posterior wall, a central lung volume and an anterior wall was used for the investigations. The lung contained a mediastinal volume isodense with the chest. Along the mediastinum, two fiducials were placed: a 1 mm diameter steel sphere superiorly and a gold cylinder (2.6 x 0.9 mm) inferiorly. The phantom was placed on a linear motion stage (Standard Imaging, WI) which moved sinusoidally with peak-to-peak displacement of 2 cm, and a period of either 3.5 sec or 5 sec. The stage motion was substantially along the source-detector (z) axis of the SBDX system. The system operated at 15 frames per second, 100 kVp, providing good apparent conspicuity of the fiducials. With the stage moving, detector data were acquired and subsequently reconstructed using digital tomosynthesis into 15 planes with spacing of 12 mm. Tracking was performed on the plane data for each (temporal) frame to yield the position of each fiducial in 3-space versus time. **Results:** Tracking data for the z-coordinate agreed with the trajectory calculated from the known amplitude and frequency of the motion and with an adjustable phase and z-offset to within an RMS error of 1.05 mm for the gold cylinder and 0.61 mm for the steel sphere. **Conclusion:** Tracking with sub-millimeter accuracy appears to be feasible with “single-view” SBDX, supporting its use to guide radiotherapy. **Conflict of Interest:** Brian Wilfley has a financial interest in NovaRay Medical, Inc.