AbstractID: 9139 Title: Evaluation of the internal target tracking algorithms in a commercial research fluoroscopic toolkit

Purpose: A means of tracking internal target or structure motion in x-ray images is important for monitoring motion at treatment. We evaluate the accuracy and robustness of several tracking algorithms in a commercial research toolkit with patient images.

Method and Materials: Anterior/posterior view fluoroscopic images (10/s) over several respiratory cycles in the thorax or abdomen are acquired with a gantry-mounted kV imaging system immediately after radiation treatment. We compare three tracking algorithms available in the research toolkit with manual tracking: single implanted fiducial or surgical clip, diaphragm, and markerless tracking of tumor in lung. The latter mode provides separation of moving features from stationary features in the images, for improved extraction of motion signals. For each algorithm, the position of the object in the superior-inferior direction is compared to the manually determined one in each image in the sequence. We also determine the mean and variance discrepancy between algorithm and manual tracking. Intra-observer variability is determined from repeated manual tracking of a subset of fluoro sequences. The percentage of images in which discrepancy is <5mm is taken as a measure of algorithm robustness.

Results: The mean and standard deviation of the algorithm-manual difference were: Single Marker μ=0.53 mm, σ=0.92 mm, Diaphragm μ=0.88 mm, σ=1.4 mm, and markerless μ=2.06 mm, σ=1.68 mm. This compares with an intra-observer variability mean of ≤ 1 mm, 2 mm, and 3.5 mm respectively. The discrepancy between algorithmic and manual tracking exceeding the robustness threshold occurred 0%, 2%, and 3% of the time of the three algorithms respectively.

Conclusion: For the algorithms examined, the toolkit agreement with manual tracking is consistent with or less than intra-observer variation. Future plans are to evaluate the toolkit's performance with multiple fiducials in close proximity, and at other gantry orientations.