

AbstractID: 6424 Title: A Projection Point Tracking Method for Gated 4DRT Validation

Purpose: To test the use of projection point tracking as an alternative to strain gauges for respiratory phase determination.

Method and Materials: Projection point tracking uses 2D projection images acquired for the localization MV cone-beam CT. A point, e.g. the top of the diaphragm under the ipsilateral lung, can be identified in each projection. In views where the top point of a surface is on a plateau, it is difficult to determine such points. By identifying the tracking point in two projections, near full exhale, separated by about 90 degrees, the location of the point in the patient can be calculated and subsequently projected onto every view, providing guide points. The tracking points on full exhale views are the guide points. Since tracking points have minimal motion between adjacent views, the tracking point on a view can be inferred from the one on the previous view and the view's guide point. A plot of the tracking point's coordinates versus view angle provides the projection track. For constant gantry rotation speeds, the projection track provides a plot of the respiratory phase.

Results: An examination of projection tracks for a trained patient revealed 1) good agreement with strain gauge measurements, 2) inter-fraction variation of tumor range of motion, and 3) inter-fraction reproducibility of phase cycle. Two of the fractions were 180 degrees out of phase, raising the possibility of combining "near-full-exhale" projections to reconstruct a "full-exhale" MV CT. With enough projection sets, it may be possible to reconstruct a 4D MV CT. The projection tracks could be used to select the appropriate views for each phase.

Conclusion: Compared to strain gauges that only provide phase, projection point tracking is a more powerful method of characterizing respiration, since the amplitude of motion is also determined.