

## AbstractID: 11544 Title: Comparison of five manual and automatic 4D CT registration methods for lung SBRT image guidance

**Purpose:** 4D CT is now widely used in radiation therapy for generating accurate ITV's or for facilitation of gated treatment delivery. It is, as yet, relatively unexplored for use as a potential tool for image guidance of SBRT of lung. Use of 4D imaging for image guidance in SBRT requires that we determine an acceptable method for fusing 2 4D data sets.

**Method and Materials:** We compare five different manual and/or automatic 4D registration methods and present the comparison results for phantom and patient data: Individual phase-to-phase registration; Average of phase to phase; MIP-to-MIP; Average Intensity Projection; Auto-segmentation with centroid; Manual GE SimMD methods. Phantom studies were performed using the CIRS Dynamic Thorax phantom (CIRS, Norfolk, VA). A 2-cm target was set into motion with a periodic sinusoidal 3D motion inside the anthropomorphic phantom. The baseline motion envelope of the target for simulation day movement was 4.2 mm L/R, 6.0 mm A/P, and 14.0 mm I/S. The target was then re-programmed to move with the same motion envelope, but shifted away from the simulation motion envelope centroid, for three scenarios: a) Axial (L/R and A/P) only shift; b) Longitudinal only shift; and c) combination of axial (L/R & A/P) and longitudinal shift.

**Results:** Individual phase-to-phase fusions were within 2.4 mm for all phases, with some phases performing better than others. The average and AIP methods were seen to perform very similarly, and this seems reasonable when we consider that both are, essentially, averaging methods. The MIP-to-MIP and Manual fusion methods were least accurate, but still likely to be considered clinically acceptable.

**Conclusion:** Multiple methods have been explored for registration of 2 4D data sets. The averaging methods were seen to perform best, but all performed within what would reasonably be considered clinically acceptable limits. The centroid method performed particularly well.