AbstractID: 9084 Title: Motion assessment using phase- and amplitude-binned 4D-CT: Comparison with cine CT

Purpose: To determine the accuracy of tumor motion extent measurements derived from phase- and amplitude-binned 4D-CT maximum intensity projections (MIPs).
Method and Materials: Twelve stage I patients (13 lesions) received cine CT scans for 4D-CT radiotherapy simulation. All lesions were in the middle of the lung parenchyma and not adjacent to surrounding tissue. Two 4D-CT image sets were constructed: One sorted by phase, the other sorted by amplitude. MIPs were formed from each 4D-CT image set and from unsorted cine CT data. Lesions were auto-segmented on each image set using a threshold of -225 HU. Using the auto-segmented contours as a guide, three-dimensional motion extent was assessed visually on both 4D-CT MIPs and compared with motion extent assessed on MIP from cine CT. The cine MIP was considered the reference image set because it includes all images at each couch position and therefore more accurately samples the respiratory pattern.
Results: For phase-binned 4D-CT, motion extent was accurately identified on 12 of 13 lesions. For amplitude-binned 4D-CT, motion extent was accurately identified on 11 of 13 lesions. The two patients whose motion extent was missed on amplitude-binned 4D-CT demonstrated a substantial discrepancy near the superior edge of the tumor. Upon further investigation, this discrepancy was found to be caused by lag between the respiratory surrogate and internal anatomy.
Conclusion: Both phase binning and amplitude binning were unable to accurately identify the motion extent for all 13 lesions. Though generally regarded as more artifact-free, amplitude-binned 4D-CT demonstrated increased sensitivity to the correlation between respiratory surrogate and internal anatomy which caused inaccurate assessments of motion extent. MIP processed directly from cine CT should be used in place of MIP processed from 4D-CT (either phase- or amplitude-binned) wherever possible.

Conflict of Interest (only if applicable):