Purpose: The purpose of this work is to develop a test to determine how well propagated ROIs match the associated tumor position for tumors located in the periphery of the lung.

Method and Materials: Two test parameters were created; one determined the ratio of voxels with a CT-number greater than a threshold value to the total number of voxels within a ROI. The other determined a similar ratio for voxels surrounding the given ROI. The ratios for the propagated ROIs were compared with the ratios for the primary ROI. When the difference in ratios between primary and propagated ROIs exceeded a threshold value, the propagation was considered incorrect. Analysis was performed for five 4D-CT data sets.

Results:
Incorrect fits were found for 20 of 45 propagated ROIs. No incorrect placement was determined for one 4D-CT data set with a phase binning error of 8%. In the other cases, the ratio of incorrect to correctly placed ROIs was 5:4, 5:4, 5:4, and 6:3 with phase binning errors of 10%, 15%, 20%, and 29%, respectively. 4D-CT data sets were also visually inspected for image artifacts. Many of the incorrect fits were attributed to 4D-CT phase binning error or motion artifacts.

Conclusion: Although incorrect ROI placement was largely due to image artifacts, it illustrates the ability of this test to find instances where the propagated ROI does not match the tumor location in the peripheral lung. This test can be helpful in determining which of the propagated ROIs of a 4D-CT need to be reconformed to fit the tumor either by use of an algorithm that automatically adapts the existing ROI to better fit the lung tumor or by manually recontouring the tumor in the various phases.

Conflict of Interest (only if applicable): Research sponsored by Philips Radiation Oncology Systems.