AbstractID: 3589 Title: Determination of appropriate lung volume for dosimetric planning and analysis from 4D CT

Purpose: Lung volumes at different breathing phases are substantially different from each other based on 4D CT. They are also different from the lung volume based on conventional 3D ungated CT. However, the dosimetric criteria and lung toxicity data used in the current planning process are based on the conventional 3D CT lung volume. Determining appropriate lung volume from 4D CT for treatment planning of lung cancer is the purpose of this work.

Method and Materials: We obtained 4D CT scans of 10 patients using a GE LightSpeed RT scanner in combination with the Varian RPM respiratory gating system. For two of these patients, we have also obtained conventional 3D CT scans. The 4D CT scans were reconstructed into 10 breathing phases, as well as maximum, minimum, and average intensity projections. The lungs were then contoured for each phase and intensity projection, as well as for the 3D scans, and volumes for these contours were obtained.

Results: We find that the average intensity projection (AveIP) is the most consistently close to the 3D CT volume, differing at most by about 3% of the total lung volume. The phase volume most closely approximated by the AveIP is the 20% phase (mid-exhalation) or the 80% phase (mid-inhalation), differing from the AveIP on average by 1.8±2.2% and -1.2±1.7%, respectively. The lung volume from the maximum intensity projection (MIP) is on average less than the AveIP volume by 11.4±2.3%.

Conclusion: The lung volume from the 20% or 80% phases or the AveIP based on 4D CT should be used in the treatment planning for lung cancer. While the MIP is useful for ITV determination, it underestimates the lung volume compared to the conventional 3D CT.