AbstractID: 8392 Title: The Errors in Determining Lung Tumor ITV from Time Resolved Image Reconstruction

Purpose: We have reported that the maximum intensity projection (MIP) of lung tumor determined from time resolved image modalities, such as 4DCT, may be inaccurate because of the patient breathing variability. Nevertheless, the MIP is often regarded as an overestimation of the internal target volume (ITV) and average intensity projection (AIP) is used for contouring. We created AIPs and their colorized presentation, color intensity projections (CIP), from dynamic MRIs and determined their dependency on respiratory variability and tumor size.

Methods and Material: Low temporal resolution images in the superior/inferior direction were reconstructed from dynamic MRIs with high temporal resolution in the same direction. The reconstruction, referred as redCAM, used 4D-CT time resolving methods with synchronizing to the internal region of interest (ROI). CIP and AIP were reconstructed based on the probability of a certain position being occupied by the tumor. These two parameters of redCAM were analyzed as a function of respiratory variability, which was defined as the average of the standard deviation in the maximal and minimal amplitude displacements.

Results: The error between AIP, MIP and CIP are strongly dependent on the percentage of CIP. Smaller errors were observed with lower percentage CIPs. The MIP derived from redCAM is closer to the 10% CIP instead of the MIP of the real time image, which is 0% CIP. The error of AIP and MIP is fit well as a quadratic function of the respiratory variability for given tumor size, indicating accelerated increase in the error with variability.

Conclusions: AIP and MIP are commonly used in lung radiation therapy with 4DCT simulation. However, their accuracy is affected by the patient respiratory variability and tumor size. Our study provides a formula to include these uncertainties into the PTV.