AbstractID: 13807 Title: Evaluation of various MIP CT images for target volume delineation

Purpose: To compare iGTV delineations of NSCLC with four maximum intensity projection (MIP) CTs with and without respiratory gating. **Method and Materials:** We identified 26 NSCLC patients whose tumors exhibited respiratory-induced motion of \geq 1cm. Each patient had a four-dimensional computed tomography (4D-CT) therapy simulation scan on a GE PET/CT scanner with Varian RPM respiratory surrogate. For each patient, we used an in-house 4D-CT sorting software to create MIP images using three different binning methods: 1) raw RPM phase-binned 2) phase-corrected (PC, force 0% to end inspiration and 50% to end expiration) phase-binned, and 3) amplitude-binned. Additionally, we created a MIP from the entire unsorted cine CT image set. All four MIP data sets were sent to Pinnacle 8.1w treatment planning software and visible tumor motion envelope (iGTV, internal gross target volume) was auto-contoured using a lower threshold of 600. **Results:** In all cases, the cine iGTV without respiratory gating was the largest. Expressed as a percent of cine iGTV, our 4D-CT iGTV ranged from 83.8% to 99.1%; the largest average 4D-CT iGTV was from the PC dataset, followed by the phase-binned dataset. Expressed as a percentage of cine PTV, the 4D-CT PTV ranged from 90.0% to 99.9%. In regions of the respiratory waveform corresponding to high time rate of change in phase or amplitude, duplicate image selection can occur; duplication was most frequent with amplitude and PC binning methods. Contrary to previous studies, the image corresponding to the extreme respiratory amplitude did not inherently exhibit the full tumor motion extent, suggesting a phase delay between the internal tumor motion and the external respiratory surrogate. **Conclusion:** This work identifies quantitative differences and probable causes of the incomplete capture of tumor motion extent when using 4D-CT based MIPs, and demonstrated a potential application of cine CT MIP without respiratory gating.