

Purpose: The accurate localization of lung tumors when performing stereotactic body radiotherapy (SBRT) is challenging because the breathing motion can cause imaging artifacts. To address this motion, an internal target volume (ITV) is created based on maximum intensity projections (MIP) reconstructed from all phases of the respiratory cycle by finding the maximum electron density at every voxel within the 4DCT. To assess whether a target volume created from the average intensity projections (AIP) of electron densities can also aid localization, the visualized tumor in cone-beam CT (CBCT) is compared to the ITV as delineated on the 4DCT using the MIP and the AIP datasets.

Methods: The tumor was delineated on sixty-five kilovoltage CBCT datasets (CBCT ITV). The distances in each dimension were measured and the mean differences between the CBCT and both the AIP and MIP ITV were analyzed.

Results: The mean differences between the CBCT ITV and AIP ITV are 0.06 ± 0.20 cm, -0.10 ± 0.27 cm, and 0.14 ± 0.26 cm in the axial, sagittal, and coronal dimensions respectively. The mean differences between CBCT ITV and the MIP ITV are -0.13 ± 0.19 cm, -0.24 ± 0.31 cm, and -0.06 ± 0.25 cm. In corresponding dimensions, the mean difference between CBCT ITV and AIP ITV is statistically greater than the mean difference between CBCT ITV and MIP ITV (p -value < 0.02).

Conclusions: Accurately aligning the target in the lung is difficult without a method to visualize the intended area of treatment. The CBCT ITV is larger than the AIP ITV in the axial and coronal dimensions and is smaller than the MIP ITV in all dimensions. This indicates that CBCT ITV can be better evaluated using AIP ITV and MIP ITV as lower and higher limits for localization, respectively.