AbstractID: 13133 Title: Determination of Tumor Volume using a Joint Motion-PVE Correction Technique in PET/CT Imaging

Objective: 4D-CT has been used to determine the tumor volume (TV) for lung/thoracic radiation therapy treatment planning primarily due to its ability to detect the tumor motion extent and trajectory. However, 4-D CT is usually characterized by high patient radiation exposure. The objective of this abstract is to propose and evaluate an approach that relies on a single static PET/CT scan than can determine the TV by simultaneously correcting for respiratory motion artifact and partial volume effect (PVE) thereby eliminating the need for 4D-CT and reducing patient exposure.

Materials and Methods: The proposed joint correction approach incorporates a model of motion blurring, PVE and object size/shape. A motion blurring kernel (MBK) is then estimated from the deconvolution of the joint model while the TV is derived from convolving the MBK by the object size/shape obtained from the CT image. To test this technique, two studies were performed using 2 spheres of different sizes moving in a 2cm 1D-sinusoidal and 2D-circular waveforms respectively. In both cases, a 4D-CT and a PET/CT of the 2 spheres were acquired. For both studies, the TV from the proposed technique was compared to the maximum-intensity projection (MIP) volume of the 4D-CT. Also a Dice coefficient of the two volumes was calculated.

Results: The TV of the proposed technique was on average 3% different from the MIP volume. The average Dice coefficient was 0.87. The motion trajectory derived from the proposed technique is continuous while that of the 4D-CT is discrete.

Conclusion: Using this approach, a single static PET/CT can replace a 4D-CT to determine the TV. This approach also has the ability to determine the tumor motion extent and trajectory and has the added advantage of reducing patient radiation exposure and determining the tumor locale probability (or MBK) compared to 4D-CT.