AbstractID: 13931 Title: Investigation of MIP PET in Motion-Encompassing Methods to Account For Respiratory Motion in Radiotherapy

Investigation of MIP PET in Motion-Encompassing Methods to Account For Respiratory Motion in Radiotherapy

Purpose: Radiation treatment planning with PET/CT has been shown to be beneficial and leads to smaller variations in target delineation than using CT only. This study investigates the 3D maximum intensity projection (MIP) PET images derived from respiratory-gated 4D PET as a complement to the MIP CT derived from a 4D CT dataset and their use in treatment planning as a means to account for respiratory motion in free-breathing radiotherapy for lung and abdomen tumors.

Methods and materials: 21 PET/CT patient datasets with 31 lesions were acquired. The patient respiratory motion was monitored by the Real-time Position Management system. PET listmode data were phase-binned into 5 frames and reconstructed. 3D MIP PET images were derived from the 5-bin 4D PET datasets. Tumor volumes were determined by an automatic segmentation method and compared for the MIP PET and static PET images. The tumor motion amplitude was determined by measuring the centroid in phase-gated images. The impact of tumor size and motion amplitude were investigated. In addition, PET data were binned into 10 frames to study the noise change in MIP PET. The comparison between the MIP PET and MIP CT is under study.

Results: Compared to static PET, the tumor volumes in the MIP PET increased by 10%±14%, with a maximum increase of 44%. The volume increases are larger for the smaller tumors sizes and larger motion amplitudes. The image noise of the MIP PET is higher than in static PET and increases with number of phase bins.

Conclusion: The MIP PET has a potential to complement MIP CT to inform the radiation treatment planning for motion-encompassing radiotherapy by accounting for respiratory motion.