AbstractID: 11365 Title: A Reliable and Accurate Definition of GTV and ITV Using PET/CT in Radiotherapy Planning for Non Small Cell Lung Cancer (NSCLC)

Purpose: To have reliable and accurate definition of GTV and ITV using PET/CT images in radiotherapy planning for NSCLC lesions considering patient-specific pharmacokinetics and location-dependent nodule motion

Method and Materials: Significant variability (>300%) in GTV and ITV delineation was observed in utilization of available methods in "Use of PET and PET/CT for Radiation Therapy Planning: IAEA expert report 2006-2007". To deal with background and scanning time variations, the MIRD Report #19 model was fitted with patient-specific tracer distributions to the brain, lung, heart, liver, kidneys, bladder, and whole body. FDG uptake by the gross tumor was assumed uniform but had location-dependent motion with 3D eclipse trajectories that were derived from comparison of fast-CT and PET images. A point-spread function with a range of 1-mm in tissue and 3-mm in the lung was finally convoluted with the calculated FDG distribution to include the positron transportation effect.

Results: Application of the proposed method on patients with NSCLC had shown that GTV/ITV defined in PET could be directly correlated with the GTV defined from the fast-CT scans if the location-dependent motion were included. The anisotropic blurred edges and non-uniform distribution of the FDG in the lesion were mostly created by the elongated eclipse movements of the nodule elements that stayed longer in these voxels located at the ends of inhalation and exhalation. The maximum SUV to the lesion varied significantly with the pharmacokinetics, lesion size, and amplitude of the nodule motion. Thus, automatic delineation of ITV/GTV from PET has to take those into account.

Conclusion: The comprehensive relationship between GTV and its appearance (ITV) in PET images for NSCLC would ensure accurate and reliable delineation of the target in treatment planning that is particularly useful in stereotactic radiotherapy using 3 to 8 treatment sessions.

Conflict of Interest (only if applicable):