AbstractID: 5017 Title: Effect of tumor motion on the use of PET images for target volume delineation in radiation treatment planning

Purpose: To assess the effect of both motion and medium heterogeneity on automatic PET target delineation fused with CT images for radiation treatment planning of lung tumors.

Method and Materials: The data were acquired on Philips Gemini PET-CT scanner. A movable lung phantom was built using the NEMA IEC body phantom containing 6 hollow spheres with diameters ranging from 10 to 37 mm. The phantom volume was packed with Styrofoam beads and filled with water to reach the density close to the density of lung 0.3g/cc. The tumor motion was simulated by a movable acrylic table that provided variable amplitudes and frequencies of movement to the phantom. The spheres were filled with 1.14 mCi/ml of FDG. There was no background activity in the body phantom outside of the spheres. Scans were performed for variable amplitudes ranging from 0.5 to 2 cm. CT and PET images were auto-contoured on Pinnacle workstation using variable thresholds relative to the maximum SUV. The threshold that best measured the volume of each sphere in static mode and the effective volume in dynamic mode was assessed.

Results: The SUV threshold that best defines the target volume in static mode and the effective volume in dynamic mode when no respiratory gating is applied depends on the motion amplitude. The small spheres are more sensitive to the inhomogeneity of the medium, most probably because the positron range is greater in lung equivalent medium then in water.

Conclusions: The study shows that it is not accurate to apply a constant threshold for target volume delineation in radiation therapy for all tumor sizes and variable tumor movement. The change of target delineation threshold is more due to the increase of the partial volume effect when the tumor activity is spread over a large volume proportional to the magnitude of movement.