AbstractID: 8619 Title: Positron Emission Tomography Phantom Studies for Radiation Therapy Target Delineation

Purpose: To create and employ a PET threshold model to contour NSCLC nodules and compare the results to a standard threshold method. **Method and Materials:** 8 FDG PET/CT scans were obtained of a cylindrical phantom containing 6 spheres of various volumes (16cc – 0.5cc) at various signal to background ratios (18 – 1.67). The peak activity of each spherical target and background activity was obtained (µCi/cc). The threshold that matched the PET target volume to the known volume was recorded for all scans, and threshold models were created for various target volumes and signal to background ratios. These models were then retrospectively applied to 3 NSCLC tumors treated with SBRT. Three tumor volumes were contoured using CT, our PET threshold model, and a constant 42% threshold. The conformity of all PET volumes to the CT volume was calculated. **Results:** The CT volumes for the NSCLC tumors were 7.2cc, 2.4cc, and 3.0cc. The threshold model produced PET thresholds of 37%, 34%, and 34% for the 3 NSCLC tumors. The resulting tumor volumes were 3.1cc, 2.8cc, and 2.4cc. Using the 42% threshold produced tumor volumes of 2.5cc, 2.1cc, and 1.8cc. The threshold model PET volumes spatially matched the CT volumes better than the PET volumes based upon the 42% threshold. **Conclusions:** A threshold model that varies with signal to background ratio and volume has been created. This study reveals the ability of the PET threshold model to improve NSCLC PET tumor contouring. PET volumes based upon the threshold model more closely match the CT volume than PET volumes based upon a constant threshold. In the future complex non-spherical phantoms will provide further threshold models for PET target delineation, and this work is in progress with preliminary results.