AbstractID: 10768 Title: Segmentation of moving targets in PET: Threshold dependence on lesion size, motion extent, and signal-to-background

Purpose: To determine optimal PET activity concentration thresholds for lung lesions as a function of lesion size, motion extent, and signal-to-background ratio.

Method and Materials: The background tank of the NEMA IEC phantom was filled with water and the 6 spheres were kept empty. The phantom was placed on a motion platform positioned on the PET/CT scanner bed. The platform moves sinusoidally at 0, 1, 2, and 3 cm amplitudes and a 4-second period. Cine CT scans were taken at each amplitude and minimum intensity projections were formed to determine the "motion envelope" of the empty spheres. This volume served as the reference volume. The 6 spheres and background tank were filled with activity to create two signal-to-background ratios (SBR): Infinite (no background) and 10:1. At each motion extent and SBR, the phantom was scanned for 6 minutes in 3-D mode. Thresholds of varying percentages of maximum activity concentration were applied to the PET images to determine which threshold best fit the reference CT contour for each motion condition, sphere size, and SBR. Optimization was performed by minimizing the separation between the CT and PET threshold surfaces.

Results: For all spheres in the "no background" condition, the optimal threshold dropped substantially to less than 15% of maximum activity concentration beyond 1 cm of motion. For SBR of 10:1, thresholds for all spheres and all motion extents increased, especially for smaller spheres where the maximum value was degraded due to motion.

Conclusion: Though motion and size had a measurable impact on the optimal threshold, SBR seemed to be the dominant factor in optimal threshold determination. Additional analysis will include scans at finer motion amplitudes (every 0.5 cm), repeated PET imaging at each amplitude, and optimal threshold analysis for over 30 patient studies.

Conflict of Interest (only if applicable):