AbstractID: 9505 Title: Correction of respiration-induced cardiac motion in SPECT myocardial perfusion imaging

Purpose: **Displacement of the heart due to respiration introduces blur into myocardial perfusion images. Similar to ECG-gating of the cardiac cycle, a respiratory monitoring device may be used to bin events according to respiratory phase. The images may then be compensated with an estimate of the frame-to-frame motion. We have found that the accuracy of these motion estimates can be highly dependant on the degree of segmentation of the heart from other organs. The purpose of this work was to investigate several proposed respiratory motion estimation methods for cardiac SPECT.**

Method and Materials: **High-count respiratory-gated projection data modeling scatter, attenuation, and detector response were obtained from a mathematical phantom which modeled respiration. After scaling, Poisson noise was simulated for a total of 10 noise realizations. Reconstruction was performed using OSEM. A variety of Butterworth filters and intensity thresholds were used to generate many different segmentations of the myocardial activity. Four rigid-body motion estimation methods were tested on the segmented images: [1] a 3D center-of-mass-shift (3-DOF), [2] an iterative estimation of the translational motion (3-DOF), [3] the principle axes transformation (6-DOF), and [4] an iterative estimation of the rotational and translational motion (6-DOF). Iterative methods minimized the sum-of-squared-errors (SSE) between the segmented image frames using the conjugate gradient method. Accuracy and robustness were quantified as the mean and standard deviation of the phantom-matching-error (PME) over the segmented images. The PME is the SSE for the original phantom frames (myocardial activity only), given the current motion estimate.**

Results: **Iterative methods had an average PME of 1334.2 ± 97.6 and 648.8 ± 389.7, for 3- and 6-DOF methods, respectively. Analytical methods had an average PME of 1715.6 ± 534.5 and 4011.8 ± 2405.16, for 3- and 6-DOF methods, respectively.**

Conclusion: **Iterative methods were found to have superior accuracy and robustness to analytical methods.**