AbstractID: 7542 Title: Model Based Respiratory Motion Compensation Using Static PET Acquisition

Purpose: Model based respiratory motion compensation in PET imaging usually assumes PET data to be acquired in *gated* mode and then models motion during the image reconstruction process (gated-MC). In this abstract we introduce and evaluate a new approach whereby motion compensation is performed on *static* PET data while an overall motion is incorporated into the system model (static-MC).

Method and Materials: A phantom consisting of two hot spheres placed in a warm background was scanned using the GE DST PET/CT scanner. One sphere was stationary while the other moved sinusoidally (2cm excursion, 5sec period) in the axial direction during the scan. A 4D-CT was then performed followed by a list-mode PET scan of 3 minutes, with gating signals injected into the list-data stream. The PET data were then unlisted into a single static as well as 10 gated sinograms. Motion was either estimated by registering the 4D-CT image sequence (RM) or derived from the true sinusoidal motion (TM). Images were reconstructed using OSEM and the following combinations of motion and acquisition schemes were compared: 1) TM+gated; 2) RM+gated; 3) TM+static; 4) RM+static. Evaluation was done by visual inspection and line profiles. In addition, a plot of contrast recovery rate (CRR) versus noise was generated by changing the number of reconstruction iterations.

Results: Both static-MC and gated-MC approaches showed similar CRR at the same noise level. Visual inspection and line profiles showed that when using TM, the Gated-MC and Static-MC had similar image qualities; however with RM, the Gated-MC performed better. Furthermore, the change in CRR when using RM versus TM was larger for the static-MC when compared to the gated-MC approach (3.1% static-MC compared to 0.2% gated-MC).

Conclusion: Motion compensation without gating PET acquisition is feasible. However, the static-MC approach is more sensitive to inaccuracies in motion estimation.