# AbstractID: 7341 Title: PET free breathing motion artifact reduction using list-mode data

**Purpose**: To show feasibility of a method for acquiring free-breathing thoracic PET images without breathing motion artifacts but with full statistics.

**Method**: Data were collected using a Philips Brilliance and Siemens Biograph PET/CT scanners using list mode. Patient-modeled tumor trajectories were provided using a custom-fabricated 4D motion phantom. To synchronize the phantom and PET acquisition, a TTL synchronization signal was fed to the cardiac trigger channel. The trigger was activated when the phantom passed a user-determined spatial threshold and therefore provided an irregular but well-determined time pattern. The list mode was queried to determine the relative time of the cardiac triggers and this was used to synchronize the phantom position and the list mode data. The known phantom positions were subdivided into 10 bins of 8 mm width. PET events were selected from the list mode file according to which bin the phantom was in at the time of the PET event. This created 10 separate list mode files. Those list mode files were submitted to the commercial reconstruction software to reconstruct images using only events occurring in the corresponding bins. The reconstruction images were shifted by the known phantom displacement and summed. The subsequent image was compared against the known phantom shape to determine if the reconstruction was successful.

**Results**: The gated reconstructions were compared against the ungated (original list mode file) reconstructions, showing significant improvement in the reconstructed phantom shape. Residual deformation was noted, consistent with the 8 mm wide gating window.

**Conclusions**: This method suggests that the list-mode based respiratory gating is feasible and may provide an effective method in eliminating the artifacts caused by breathing motion from PET images. The process should be supported by modern multislice PET/CT scanners. This work supported in part by NIH R01CA96679.