AbstractID: 7153 Title: Simulation of Respiratory Motion Gating Using GATE and NCAT

Purpose: Respiratory motion is a source of artifacts and reduced image quality in PET scanning. Gating techniques are usually able to compensate for the respiratory motion and hence improve image quality. We aimed at developing a data-driven gating method that utilizes the geometric sensitivity properties of 3D PET. The geometric sensitivity gating (GSG) method is to be simulated using GATE (GEANT4 Application Tomographic Emission) and NCAT (NURBs(Non Uniform Rational B-Splines) CArdiac Torso) software packages.

Method and Materials: With geometric sensitivity gating method, the respiratory motion phases could be gated from list-mode data in terms of the distribution of counts of coincidences. The simulation processing has five steps: first, setting up GATE in terms of Allegro PET detection characteristics and the NCAT phantom parameters; second, running GATE to obtain the phantom projection data as list-mode data; third, gating list-mode data into one frame by proposed method; next, converting the gated frame data into UGM sinogram format; last, obtaining reconstruction from sinogram data. All simulations were made for a source of a 37MBq total activity in the phantom. In addition, GSG method has also been tested on list-mode data acquired from the clinical acquisition.

Results: Simulated results are presented as reconstructed images. Geometric and NCAT plotting curves of frame counts with the static and the motion are clearly different due to geometrical sensitivity distribution. When phantom with no respiratory motion is simulated the frame counts are constant whilst when simulated with the respiratory motion, the frame counts exhibit an oscillatory trend consistent with the respiratory motion parameters consistent with the clinical data.

Conclusion: Computer simulations show that GSG data-driven method can compensate simulated respiratory motion and that the reconstructed images are improved. The results of simulation show good agreement with GSG testing on the clinical acquisition.