Abstract ID: 17036 Title: Investigation and Development of Point-based Image Reconstruction Algorithm Capable of Handling non-rigid Motion

Purpose:
To evaluate PET image reconstruction algorithm capable of handling moving, deformable objects, particularly unrestrained conscious rodents.

Methods:
The proposed point-based image reconstruction algorithm is based on 2D filtered back-projection. Reconstruction took place in 2D virtual space filled with dimensionless sampling points. During the backprojection, points acted as spatial count bins, accumulating values of the backprojected LORs. To correct for motion, sampling points in the image space were moved in accord with the scanned object. Thus, motion correction and deformation correction were performed via image bin repositioning. After the backprojection step, images of activity distributions were obtained by fitting a smooth surface over the sampling points.

Results:
To evaluate the performance of the image reconstruction algorithm, stationary and moving NEMA image quality phantoms were scanned on Siemens Focus 120 microPET scanner, and data was reconstructed using conventional 2D filtered back-projection and point-based algorithms. Images obtained using two reconstruction algorithms were in remarkable quantitative agreement, with deviations mostly in the background and on the order of few percent. The location of points during reconstruction had little influence as long as Nyquist sampling criteria was satisfied. For the point-based reconstruction, motion-corrected images preserved quantification and demonstrated good performance in removing the motion artifact. The SNR of motion-corrected images also improved compared with shorter but motion-free frames.

Conclusions:
It had been demonstrated that point reconstruction can provide accurate, quantitative PET images. As opposed to voxels, points can be moved freely relative to one another. By moving points during the backprojection process, almost any kind of deformation can be taken into account. Plans for the future include further method development of the method to enable full 3D list-mode reconstruction, which could ultimately lead to unrestrained conscious rodent imaging.