RESOLUTION IMPROVEMENT OF SMALL ANIMAL POSITRON EMISSION TOMOGRAPHY IMAGES USING A STEP AND SHOOT ROTATING SCANNER

S. España[1], J. L. Herraiz[1], E. Vicente[2], J. J. Vaquero[2], M. Desco[2], J. Udias[1]

[1]Universidad Complutense Madrid, Madrid, SPAIN, [2]HG Gregorio Marañón, Madrid, SPAIN.

High cost of positron emission tomography (PET) scanners led to designs with reduced number of detectors, at the expense of sensitivity loss. Complete angular sampling is achieved rotating the detectors. The current generalization of iterative statistical methods of reconstruction, together with the fact that iterative methods are more tolerant to incomplete angular sampling allows us to explore different rotation schemes (i.e. continuous vs. step and shoot) of the detectors to obtain the best image resolution within the minimum reconstruction time. PET data are often arranged in sinograms, subsequently employed for analytical reconstruction methods, or in LOR-histograms, where the number of counts in every line of response is considered.

This latter arrangement of data is better suited for iterative reconstructions, because the physical characteristics of the scanner are related to the nature and placement of the detectors that define every LOR, rather than by their corresponding position inside the sinogram. In general, the best way to reconstruct using iterative methods is LOR histograming, which allows for optimal evaluation of the response matrix of the system. Using Monte Carlo methods, we obtained simulated PET rotating scanner data which were reconstructed by 3-D-OSEM, and compare the resolution achieved and reconstruction time when employing sinograms, LOR histograms and LIST mode acquisitions. Different rotation strategies, such step-and-shoot with different overlaps or continuous mode rotation were compared. Our results show that resolution can be improves by up to 30 % just by modifying the configuration of the rotation motion and the histogramming method.