ISSUES IN THE QUANTITATIVE RECONSTRUCTION OF POSITRON EMISSION TOMOGRAPHY STUDIES

M. Abella, J. Vaquero, E. Vicente, J. Sánchez, S. Redondo, M. Desco
Hospital GU Gregorio Marañón, Madrid, SPAIN.

Introduction: In order to make quantitative analysis of positron emission tomography (PET) studies it is necessary to obtain an "exact" reconstructed image. This is not trivial to obtain as each step in the process from list mode data can be a source of bias or artifacts. Sinogram statistical distribution may be altered due to the acquisition process: scatter, decay, dead time, geometrical effects and crystal sensitivity. Subsequent sonogram rebinning may also change this statistical distribution. Finally, FBP may introduce DC component bias and aliasing, depending on the particular implementation used. This work analyzes the whole process to ensure that all these undesirable effects are properly compensated at every point of the reconstruction chain to guarantee a true quantitative reconstruction.

Materials and methods: The study of quantitative reconstruction was applied to a real scanner (rPET, SUINSA). Different theoretical and experimental methods were tested for sinogram correction. Several methods for SSRB statistics recovery and for count recovery and aliasing elimination after FBP were tested. Results were validated on real data using a NEMA-like contrast phantom, considering attenuation and scatter. The linear behavior of detected trues versus activity in the field-of-view was verified. Results and Conclusions: A complete reconstruction algorithm for the rPET system is presented. An experimental correction of the sonogram based on an acquisition of a field flood provided best results. Counts recovering in the SSRB step and adequate slice uniformity have been achieved. Regarding FBP implementation, the Crawford method was selected for compensating DC bias and aliasing after filtering in Fourier domain.