



Performance evaluation of Point Spread Function reconstruction algorithm on a new PET-CT TOF scanner

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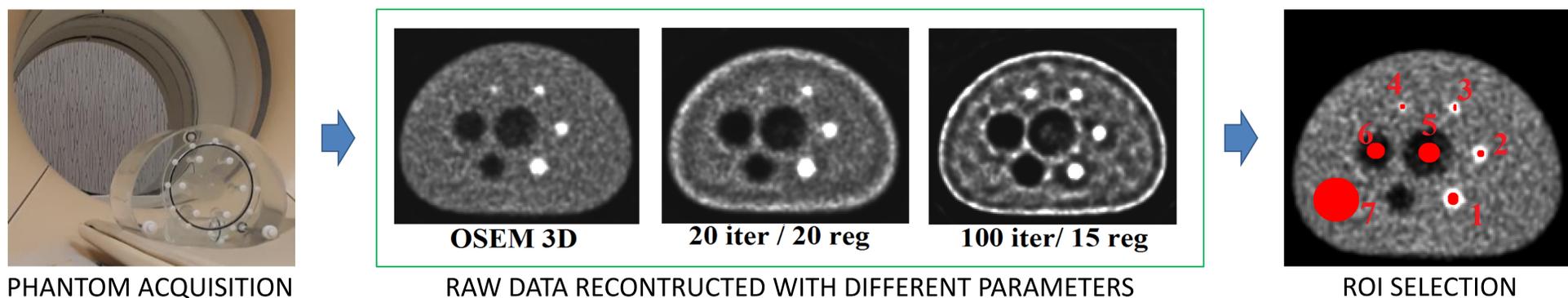
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PURPOSE

Aim of this study was to evaluate the performance of PSF reconstruction algorithm of a new PET-TC TOF scanner. Comparison in term of image quality was performed in order to investigate potentialities and differences between PSF algorithm and the standard OSEM algorithm routinely applied in the clinical use.

METHODS

The phantom NEMA 2012 Body Image Quality (¹⁸F, 213 kBq/ml, Ø 10mm 13mm 17mm 22mm hot spheres (background ratio 4÷1), Ø 28mm 37mm cold spheres) was acquired with Philips Ingenuity TF PET-TC scanner (TOF, AC-SC). Raw data were reconstructed both with standard OSEM 3D and with PSF, using 20 different paired iteration values (1-500) and regularization levels (1-20).



Seven regions of interest (ROIs) were contoured: 4 centered on “hot” spheres, 2 on “cold” spheres and 1 on background. Mean value (MV) and standard deviation (SD) of every ROI were calculated: signal to noise ratio (SNR) and contrast to noise ratio (CNR) were compared. Spatial resolution was evaluated as step of the 10mm-sphere profile.

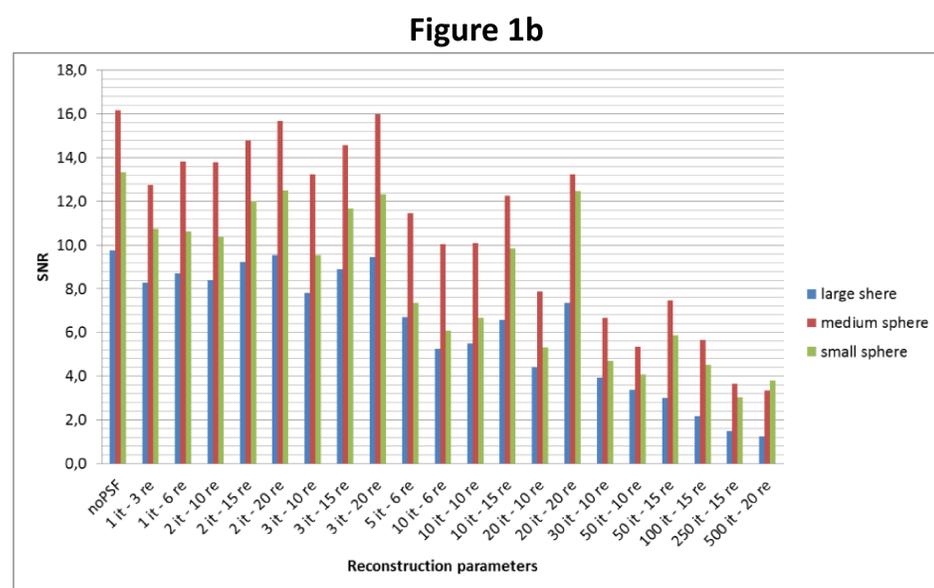
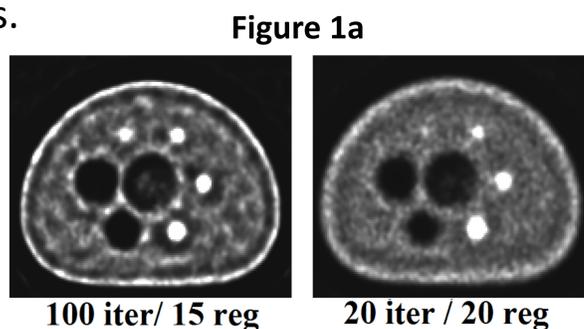
RESULTS

PSF images showed resolution higher (e.g. 3mm for 30 iterations) than the standard OSEM (6 mm). As shown in Figure 1a the more iteration number the higher artifacts presence, especially in the background region.

MV and SD values relative to the “hot spheres” strongly depend on iteration number and regularization level;

Variations up to +1000% were found (500 iterations and 20 regularization) both on MV and SD values. No variations were noticed on background MV, but SD values increase up to +600%.

As consequence SNR (figure 1b) and CNR are affected by reconstruction parameters.



CONCLUSIONS

PSF images showed resolution higher than standard OSEM, but also huge artifacts and unacceptable variations in measured activity (and SUV). The use of PSF reconstruction for quantitative purposes is not recommended and its use should be designed for specific uses.