

Comparison of OSEM and Q.Clear reconstructions for ^{177}Lu SPECT/CT imaging with a CZT ring-shaped SPECT/CT

R. Danieli¹, M. Stella², J. Leube³, J. Tran Gia³, B. Vanderlinden¹, C. Marin¹, H. Levillain¹, N.Reynaert¹, P. Flamen⁴

¹*Department of Medical Physics, Jules Bordet Institute, Université Libre de Bruxelles, Rue Meylemeersch 90, 1070 Anderlecht, Belgium*

²*General Electric (GE) HealthCare*

³*University Hospital Würzburg, Department of Nuclear Medicine, Oberdürrbacher Straße 6, 97080 Würzburg, Germany*

⁴*Department of Nuclear Medicine, Jules Bordet Institute, Université Libre de Bruxelles, Rue Meylemeersch 90, 1070 Anderlecht, Belgium*

Background

Personalised dosimetry after molecular radionuclide therapy relies on **quantitative SPECT/CT**, for which suitable image reconstruction protocols are needed

A new reconstruction algorithm, **Q.Clear** (originally developed for PET), has recently been made available for StarGuide (GE HealthCare), as alternative to the well-established **OSEM**



This study compares the performance of OSEM and Q.Clear for ^{177}Lu **quantitative SPECT/CT** with **StarGuide**



Methods: phantom preparation

Cylindrical phantom
(volume: 5440 ml)



700 MBq

NEMA IEC phantom



1.6 MBq/ml



Methods: image acquisition and reconstruction

SPECT/CT system: StarGuide

Scan time: 15 minutes

Energy windows: 208 keV $\pm$ 6% (emission) and 185 keV $\pm$ 5% (scatter)



For each acquisition:

1. OSEM

2. Q.Clear (RDP, $\beta = 0.005$, $\gamma = 1$)

1 subset
12-576 iterations



16 reconstructions

Attenuation correction, scatter correction, resolution recovery
No post-reconstruction filtering

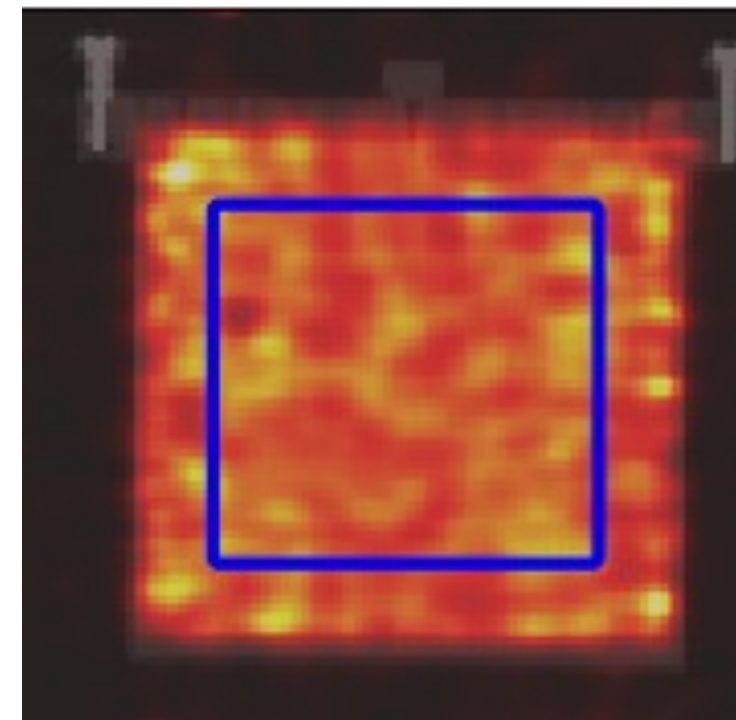
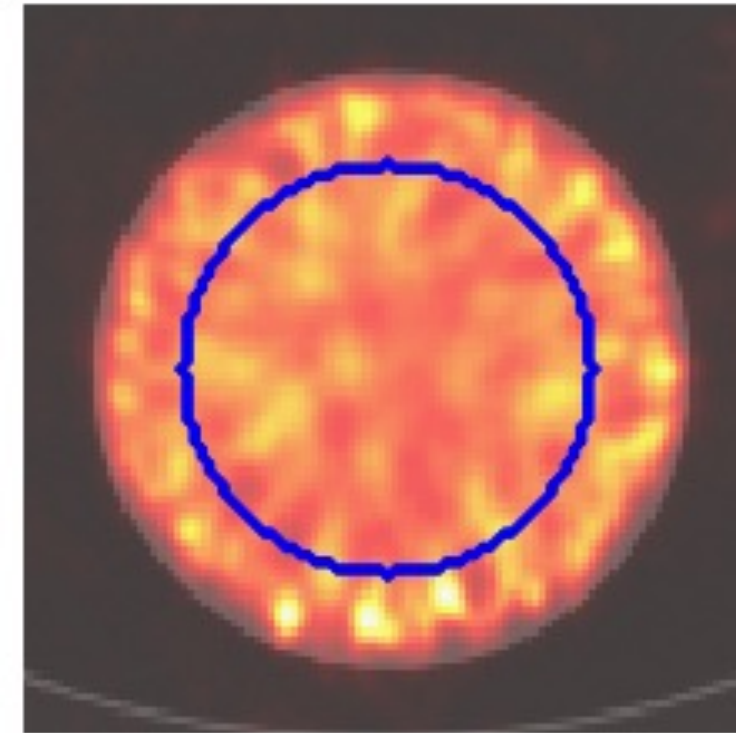


Methods: image analysis

For each reconstructed image of the cylinder:

$$Noise = \frac{\text{standard deviation } C}{\text{mean } C} [\%]$$

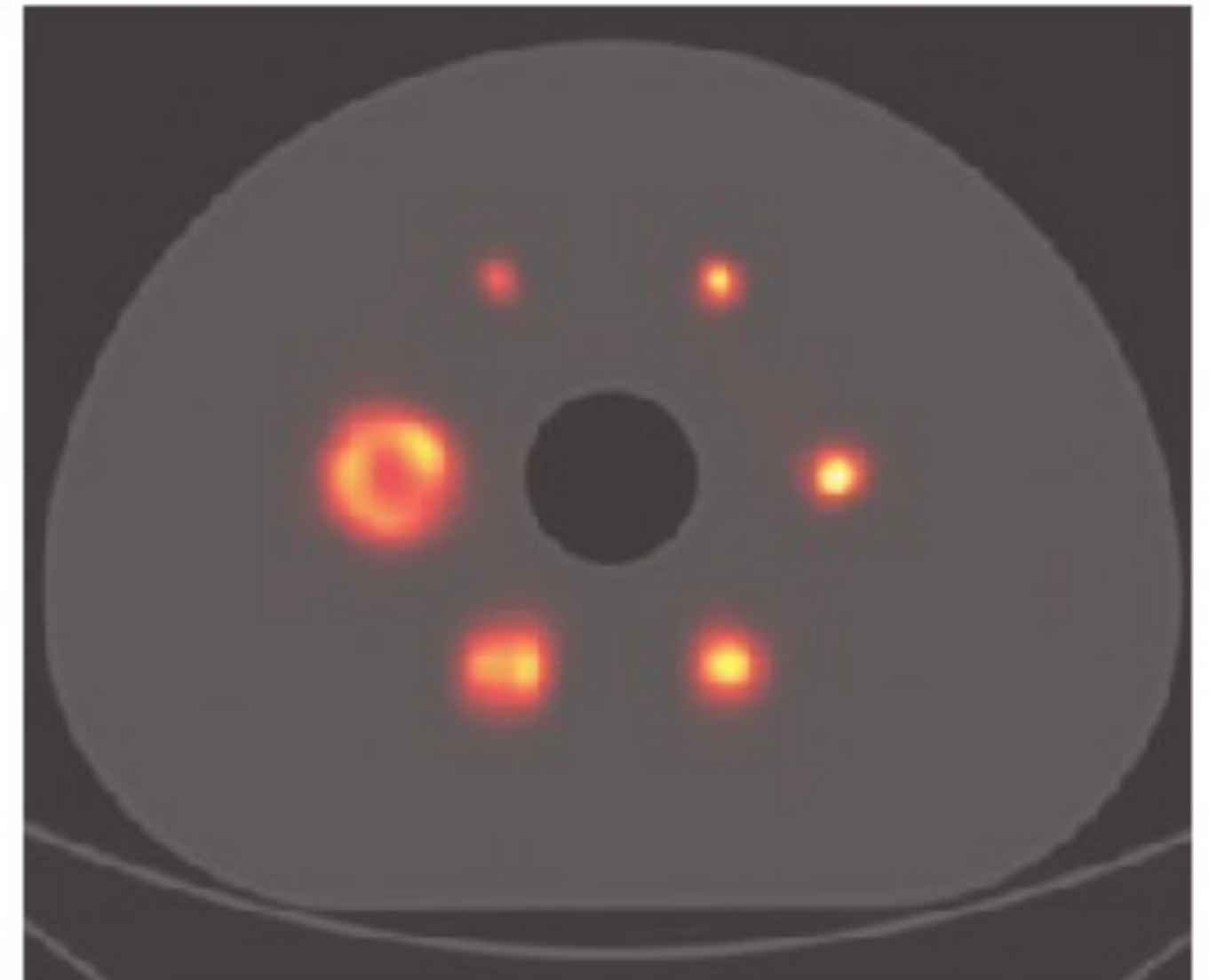
C = counts inside VOI_{inside}



Methods: image analysis

For each reconstructed image of the NEMA IEC:

- Presence of artefacts
- Spatial resolution by a matched-filter analysis [1]



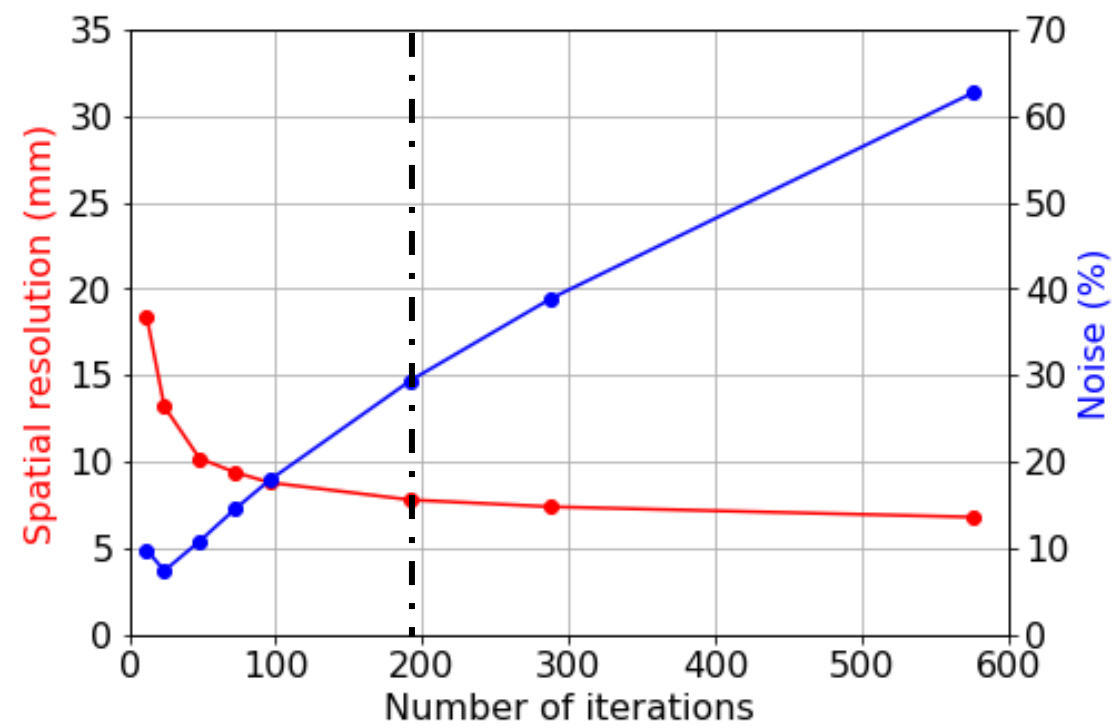
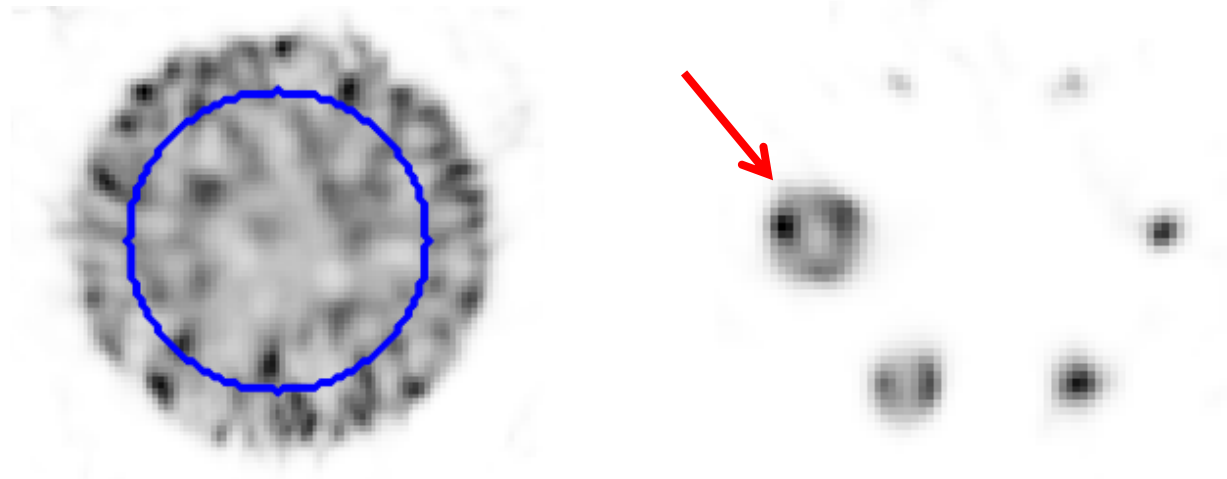
[1] Tran-Gia J, Lassmann M. Characterization of Noise and Resolution for Quantitative ^{177}Lu SPECT/CT with xSPECT Quant. J Nucl Med. 2019;60(1):50-59. doi:10.2967/jnumed.118.211094



Results

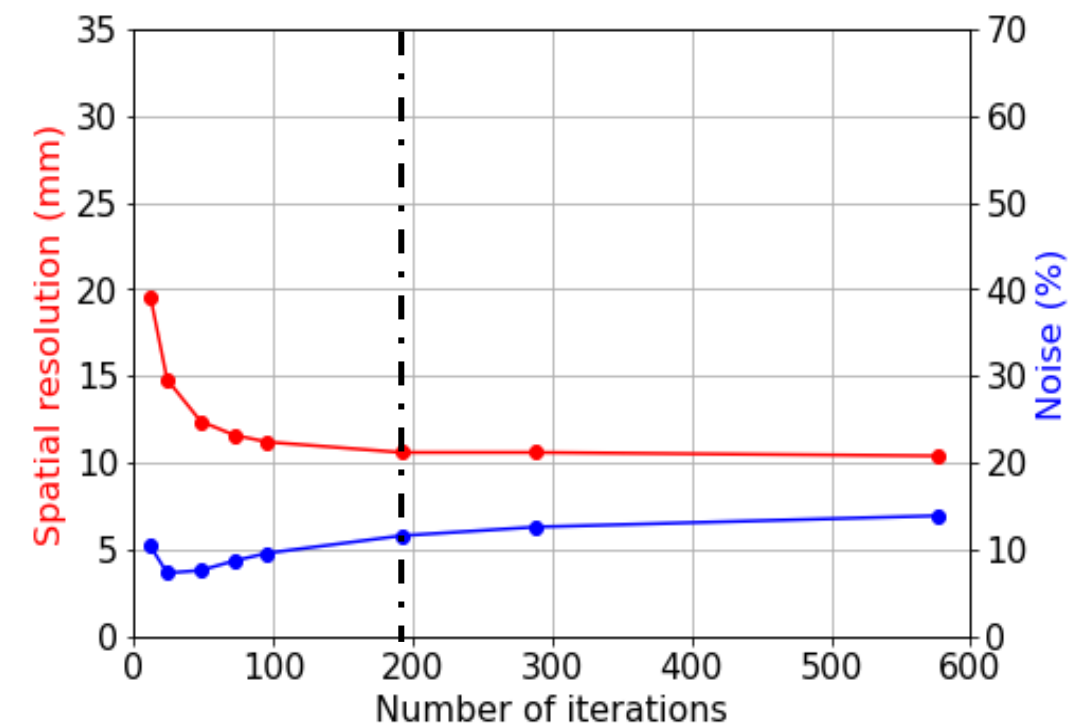
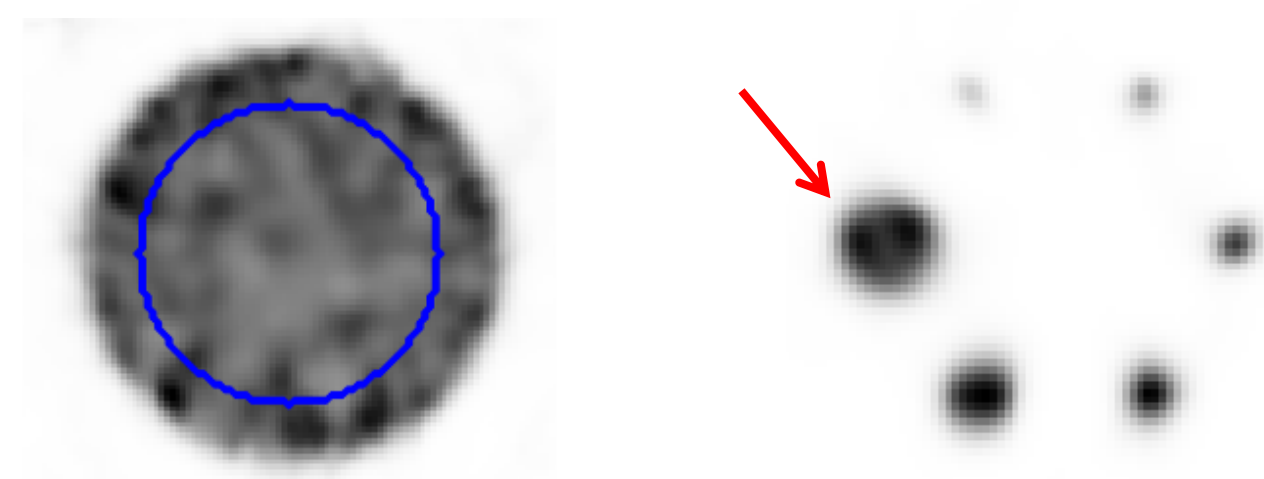
OSEM

192 iterations
1 subset



Q.Clear

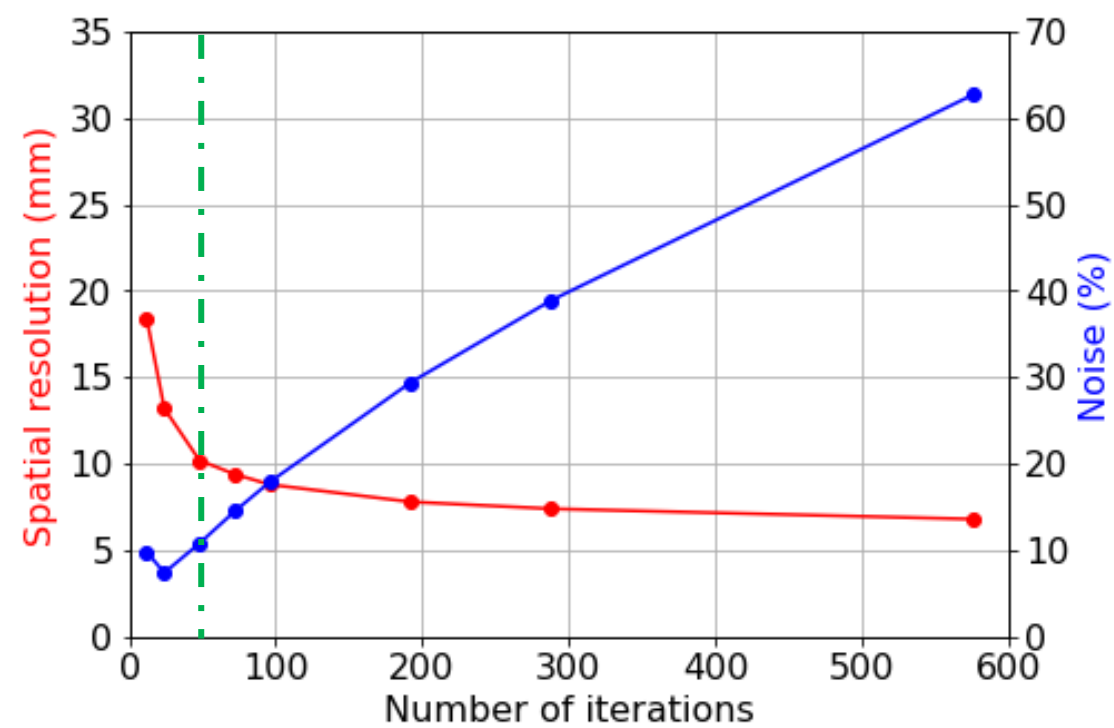
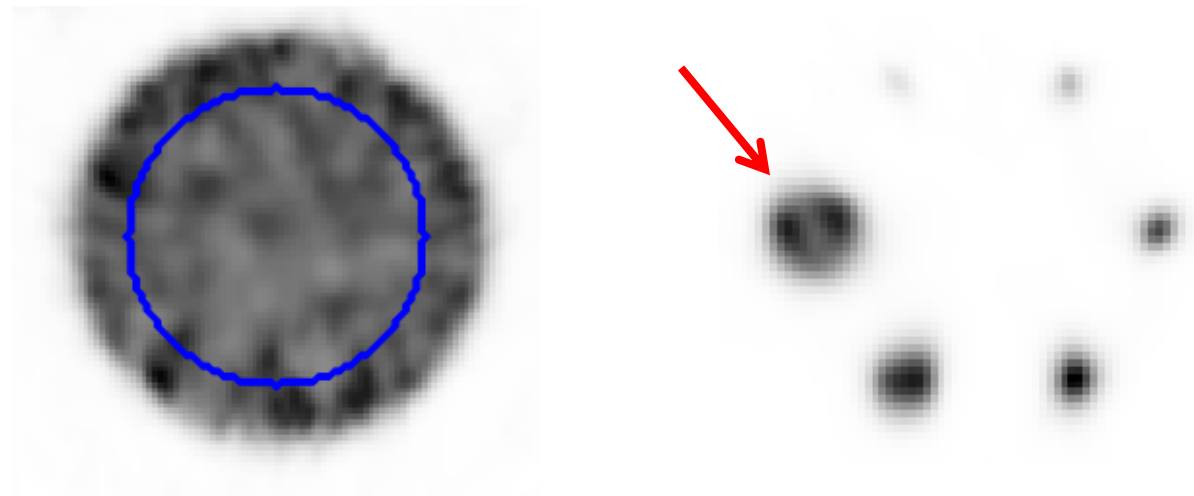
192 iterations
1 subset



Results

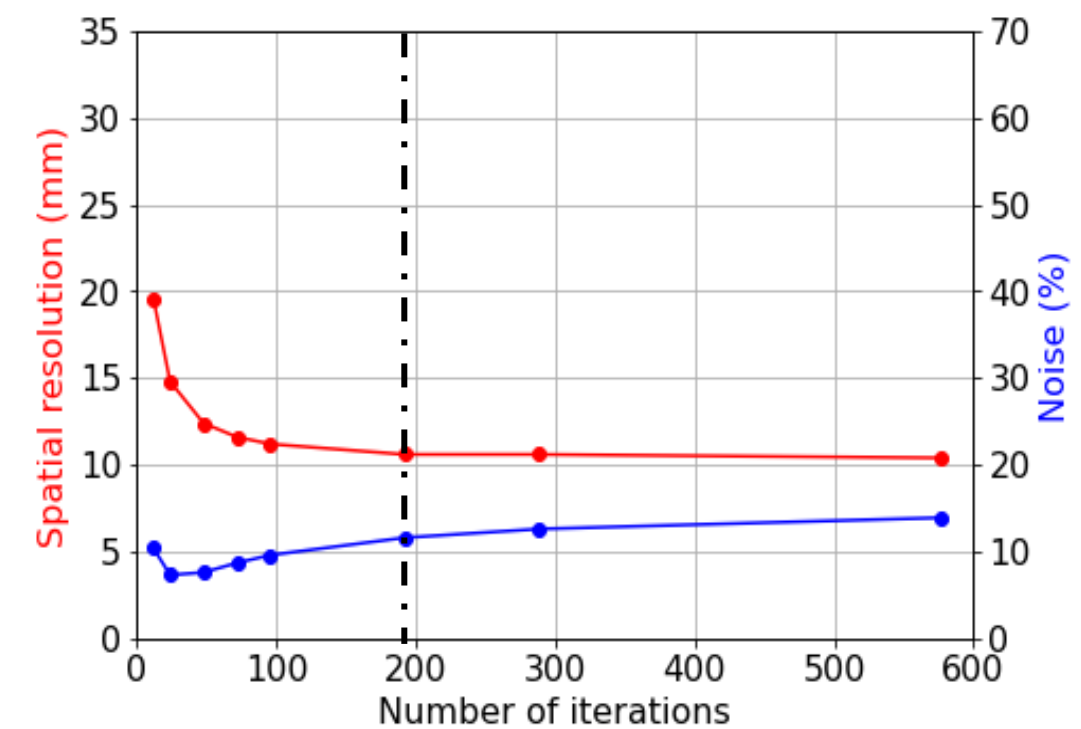
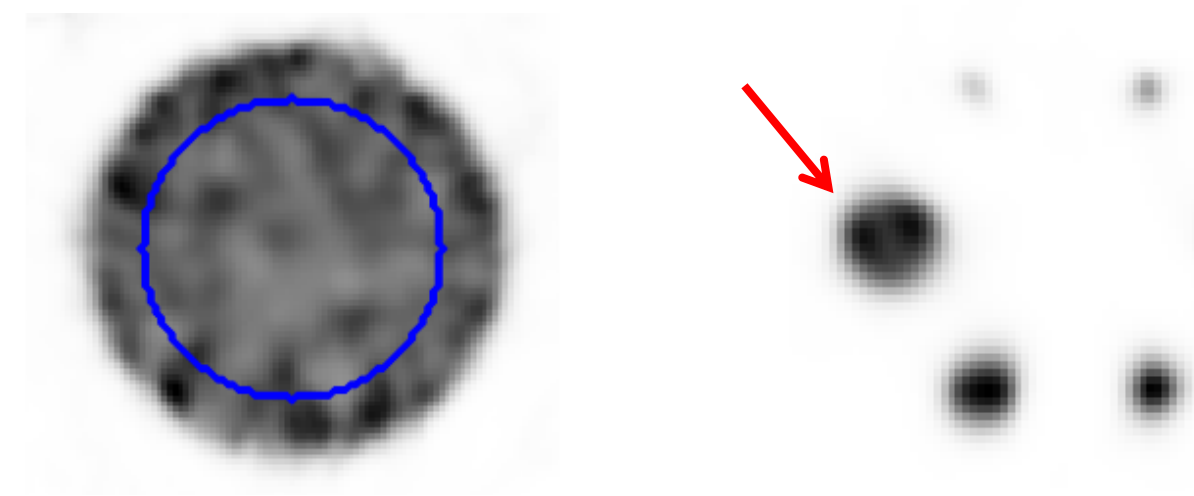
OSEM

48 iterations
1 subset

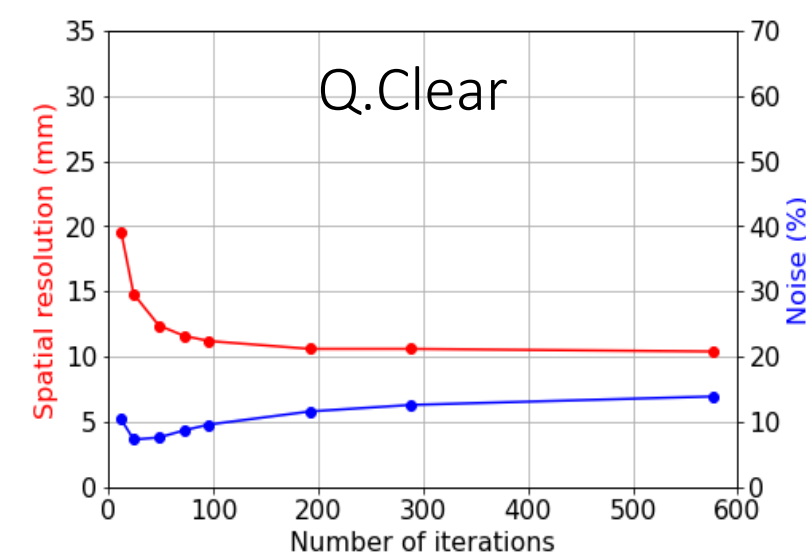
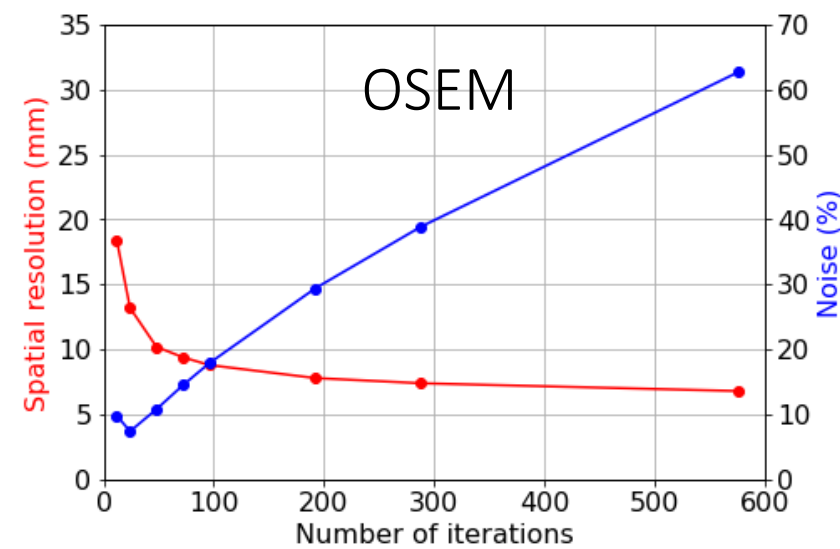


Q.Clear

192 iterations
1 subset



Conclusions



Q.Clear succeeds considerably better than OSEM in reducing the accumulation of noise for a growing number of iterations, while also reducing Gibbs-like artefacts

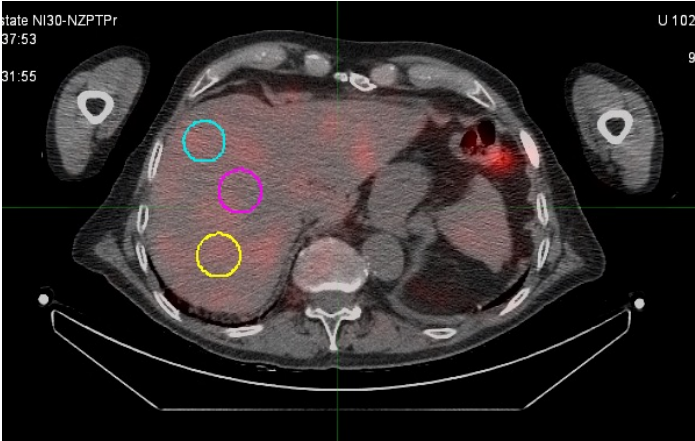
If the reconstruction parameters are chosen with care, comparable image quality, noise and spatial resolution can be obtained with OSEM and Q.Clear

Further investigations are ongoing to assess the equivalence of OSEM and Q.Clear in a clinical scenario

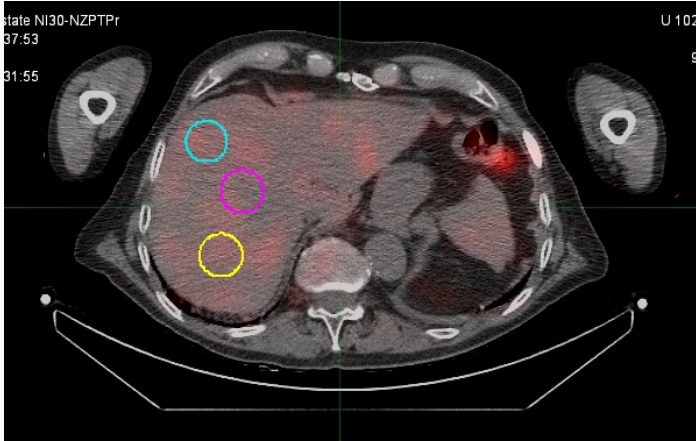
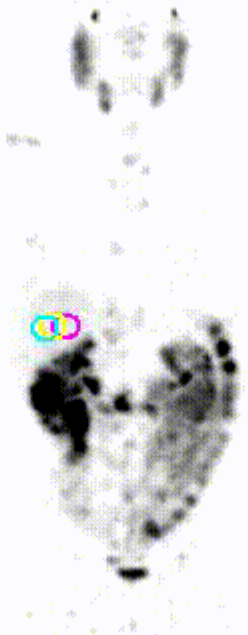


Ongoing investigation

OSEM
48 iterations
1 subset



Q.Clear
192 iterations
1 subset



Noise in the liver: 17%



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^{177}Lu -PSMA

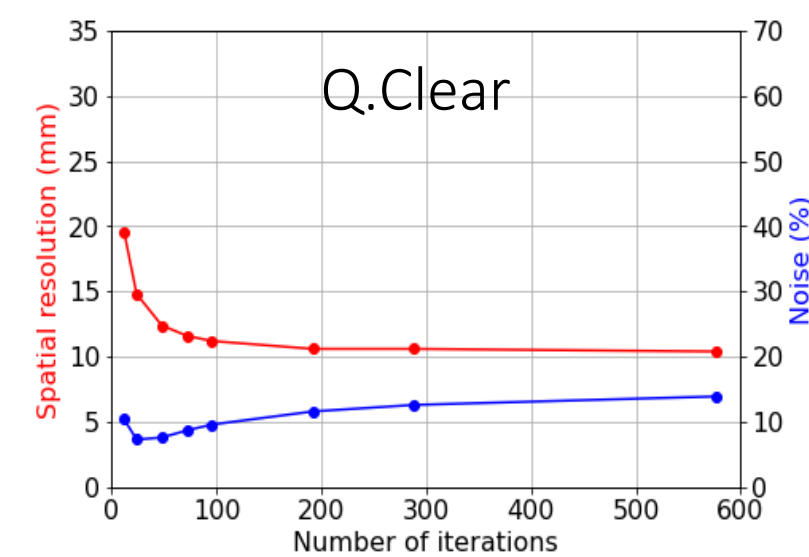
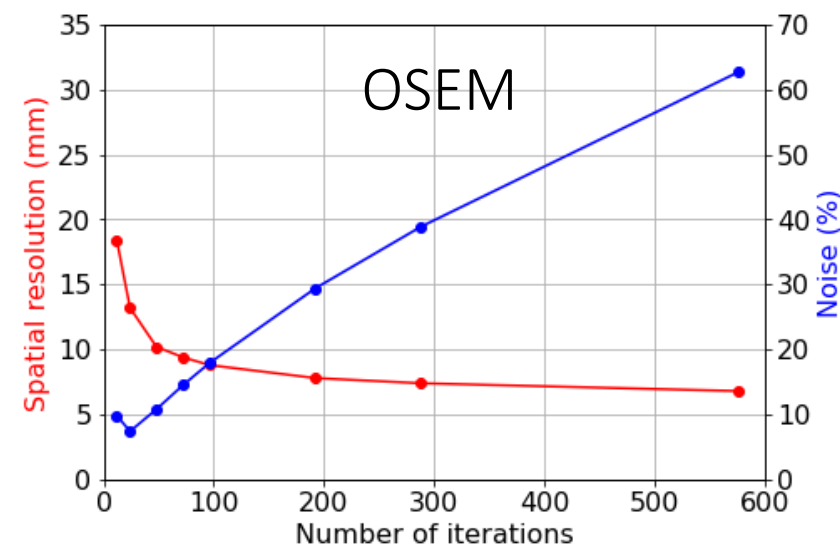


Thank you for your attention

rachele.danieli@hubruxelles.be



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