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# Innovative $^{99m}\text{Tc}$ - and $^{177}\text{Lu}$ -Phantom-based evaluation of three 360° CZT-SPECT/CT cameras' performance

Christopher Hoog<sup>\*1</sup>, Pierre Malick Koulibaly, Ludovic Ferrer, Laetitia Imbert, and Gilles Le Rouzic

<sup>1</sup>Centre de Lutte Contre Le Cancer de Reims - Institut Godinot (CLCC Reims - IG) – Institut Godinot  
– 1 rue du général Koenig, 51100, Reims, France

## Résumé

### *Purpose*

Three currently available 360° CZT-SPECT/CT cameras were compared considering clinical conditions using phantom-based measurements.

### *Methods*

A  $^{99m}\text{Tc}$ - and a  $^{177}\text{Lu}$ -customized NEMA IEC body phantom were imaged with three different cameras, Starguide (GE Healthcare), VERITON-CT 200 (V200) and 400 (V400) (Spectrum Dynamics Medical) under the same clinical conditions. Energy resolution and volume sensitivity were evaluated from energy spectra. Vendors provided the best reconstruction parameters dedicated to visualization and/or quantification, based on their respective software developments. For both  $^{99m}\text{Tc}$ - and  $^{177}\text{Lu}$ -phantoms, noise level, SUV, CNR and recovery coefficient were performed with 3DSlicer. Innovative task-based image quality assessment was performed with iQMetrix-CT on  $^{99m}\text{Tc}$  visual reconstructions to assess, through spatial frequencies, noise texture in the background (NPS) and contrast restitution of a hot insert (TTF). A radial spatial resolution index was calculated as  $\text{SRTB}=1/f(\text{TTF}50\%)$

### *Results*

VERITON cameras were more sensitive than Starguide and V400 provided enhanced energy resolution (3.2 % – 140 keV; 5.2 % – 113 keV; 3.6 % – 208 keV). Image quality and quantification capabilities of reconstructed images were highly dependent on vendors' reconstruction algorithms and parameters, with a major impact of scatter correction and noise processing. Regarding  $^{99m}\text{Tc}$  imaging, we particularly highlighted on Starguide a difference of image quality between visual and quantitative reconstructions, as well as a quantitative image optimization approach based on RCmean (0.9 for StarGuide vs 0.5 for V200 and V400 – Ø37mm). SRTB (26.2 mm, 23.7 mm, 24.7 mm respectively for Starguide, V200 and V400) helped comparing spatial resolution of the different reconstructed images. For  $^{177}\text{Lu}$  imaging, V200 and V400's 113 keV imaging showed high performances while Starguide and V400 have better potential combining signal from both 113 and 208 keV peaks.  $^{177}\text{Lu}$  quantification was optimized according to RCmax for all cameras and reconstructions ( $1.07 \pm 0.09$  –

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\*Intervenant

Ø37mm).

*Conclusions*

The three cameras have equivalent potential considering  $^{99m}\text{Tc}$ , while for  $^{177}\text{Lu}$  imaging StarGuide and V400 have higher potential. Dedicated visual or quantitative reconstructions offer better specific performances compared to the unified visual/quantitative reconstruction. The task-based approach appears to be promising for in-depth comparison of images in a context of system characterization/comparison and protocol optimization.

**Mots-Clés:** Camera CZT, Veriton, Starguide, Task based phantom