

Comparison of preclinical PET scanners performance with varying axial fields-of-view (Preliminary)

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In preclinical Positron Emission Tomography (PET) imaging, understanding a PET system's performance is crucial for comparing its results with other systems'. In multicentre studies, the performance of the participating systems is essential when planning the experiments [1,2]. In this study, a comprehensive performance evaluation of three PET systems was carried out.

The Mediso PET systems were installed in 2023, 2022, and 2014. The newest system is a three-ring system, with 150 mm axial field-of-view (FOV), while the others are two-ring systems. The reconstruction software has undergone multiple updates over time for each system. Other hardware specifications and the crystal matrix are consistent across the three systems. The NEMA NU-4 2008 assessments [3], and linearity measurements were performed.

The resolution was similar across the three systems, with filtered-back-projection (FBP) and with iterative reconstruction at the centre of the FOV. The absolute sensitivity within the 250-750 keV range was highest in the newest 3-ring system, while it was similar with the other 2-ring scanners. The mouse 250-750 keV NEC peak was considerably higher with the newest system. Image quality results are presented in Figure 1. The linearity of all systems was within acceptable limits in the 0.5-120 MBq range. All results of the newest system are preliminary, before publication.

The greatest differences arose from the extended FOV of the newest system. The impact of software advancements and system ageing is evident in our results, particularly in the image quality phantom.

Although the systems are similar, their performances vary significantly. When designing a study involving these systems, factors such as ageing, software version, and the length of the FOV must be considered.

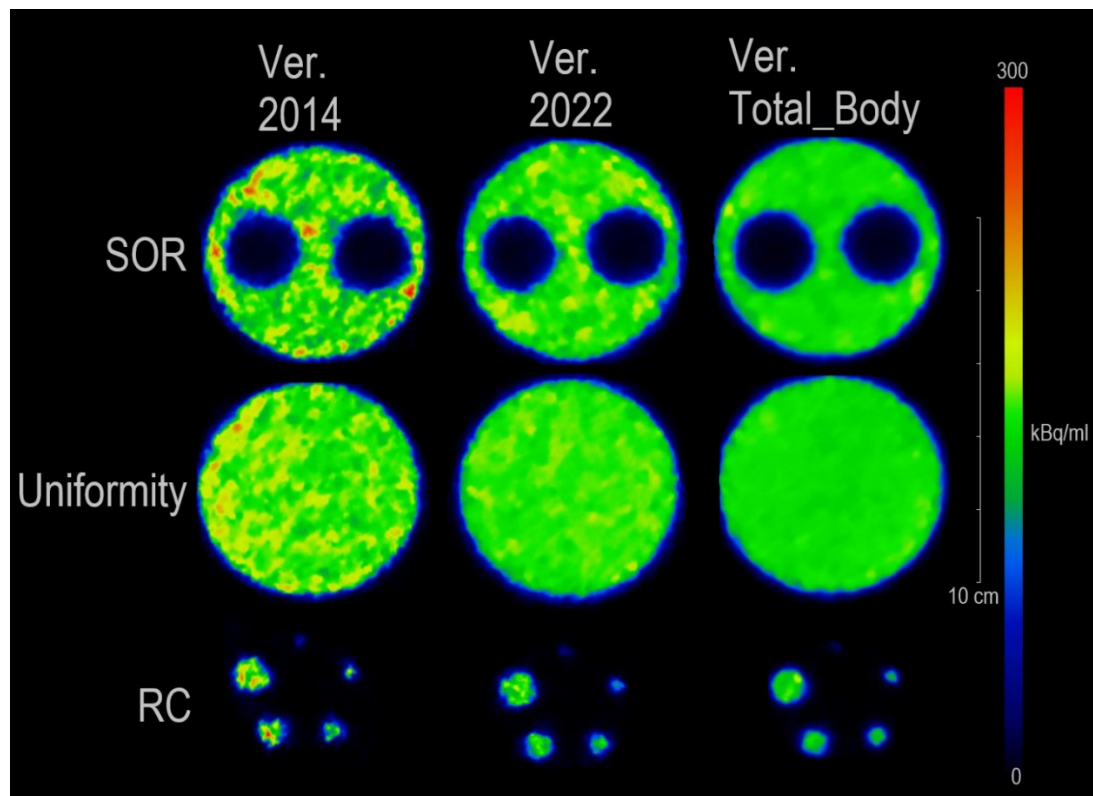


Figure 1. Image Quality phantom using the three PET/CT systems. The Ver.Total_Body refers to the system which was installed in 2023.

References:

- (1) Cañadas, M., et al., *NEMA NU 4-2008 Performance Measurements of Two Commercial Small-Animal PET Scanners: ClearPET and rPET-1*. IEEE Transactions on Nuclear Science, 2011. **58**(1): p. 58-65. doi: [10.1109/TNS.2010.2072935](https://doi.org/10.1109/TNS.2010.2072935).
- (2) McDougald, W., et al., *Standardization of preclinical PET/CT imaging to improve quantitative accuracy, precision, and reproducibility: a multicenter study*. Journal of Nuclear Medicine, 2020. **61**(3): p. 461-468. doi: [10.2967/jnumed.119.231308](https://doi.org/10.2967/jnumed.119.231308).
- (3) NEMA, Performance Measurements of Small Animal Positron Emission Tomographs. 2008: National Electrical Manufacturers Association.