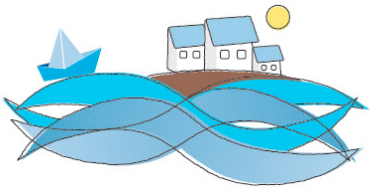

Mediterranean Thematic Workshops in Advanced Molecular Imaging

Contribution ID: **49** Type: **Oral**

Inflammation Imaging with High Sensitivity Panel TOF PET Detectors

Saturday 25 May 2024 12:30 (5 minutes)

Traditional PET scanners, with their full-ring design, have been invaluable in clinical diagnosis and research. However, it is evident that the ring geometry, with its relatively large radius, cannot always be the optimal choice for detector placement across all applications. Our interest lies in making PET systems flexible and modular, allowing their design to be tailored to both patient-specific needs and the specific objectives of the PET scan. Our previous work demonstrated that a simple 2-panel (30 x 30 cm) configuration can produce high-quality, distortion-free images suitable for practical applications, all while using significantly less detector material compared to conventional PET scanners. This work focuses on the modular aspect of panel detectors and the anticipated performance of 2 flat-panel detectors of size 120 x 60 cm based on 3 x 3 x 20 mm L(Y)SO crystals. A Monte Carlo study using GATE software and large HPC clusters evaluates the systems' performance, featuring Time of Flight (TOF) resolution down to 70 ps and Depth of Interaction (DOI) resolution down to 1.25 mm. Various phantoms (NEMA, XCAT, Derenzo) were used for performance evaluation, with the Siemens Biograph Vision PET/CT scanner serving as a reference. Transitioning to larger panels increases the Noise Equivalent Count Rate (NECR) by about a factor of 12. We demonstrate that panel detectors are modular, capable of producing images without distortion or artifacts, where excellent TOF is essential, and enhanced DOI contributes to image sharpness. Flexibility is an important feature of panel detectors, and sensitivity can increase by over threefold when panels are shifted from a panel-panel distance of 80 cm to 40 cm. The enhanced sensitivity and cost-effectiveness of panel detectors could significantly improve total-body inflammation imaging. This method could enable accurate localization and detailed characterization of inflammatory processes with substantially lower radiation exposure.

Authors: Dr GIACOMO GOLA, Alberto (Fondazione Bruno Kessler, Trento, Italy); Prof. GASCON, David (University of Barcelona, Institute of Cosmos Sciences (ICCUB), Barcelona, Spain); RAZDEVSEK, Gasper (Jozef Stefan Institute (SI)); Prof. EL FAKHR, Georges (Yale University, New Haven, Connecticut, USA); OREHAR, Matic; DOLENEC, Rok (Jozef Stefan Institute (SI)); PESTOTNIK, Rok (Jozef Stefan Institute (SI)); Prof. MAJEWSKI, Stan (University of California Davis, Davis, USA); Dr MARIN, Thibault (Yale University, New Haven, Connecticut, USA); Dr CHEMLI, Yanis (Yale University, New Haven, Connecticut, USA)

Presenter: RAZDEVSEK, Gasper (Jozef Stefan Institute (SI))

Session Classification: Contributed talks