insight to interim PET response assessment. This may guide clinicians in their choice of therapeutic strategy.

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Physics & Instrumentation & Data Analysis: Instrumentation

OP501

G -SPECT-I: a full ring high sensitivity and ultra-fast clinical molecular imaging system with < 3mm resolution

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AIM: We developed G-SPECT-I, a full ring stationary clinical SPECT system designed to enable -for the first time- clinical imaging with isotropic resolution below 3 millimeter and with unique capabilities for low-dose studies and imaging of fast tracer dynamics. The aim of this paper is to present its initial results. METHODS & MATERIALS: G-SPECT-I is based on a stationary ring consisting of nine large field-of-view cameras with 595 × 472 mm NaI crystals, a 3D stage that allows optimal sampling during scanning, and an interchangeable nonagon-shaped collimator containing 54 pinhole apertures and with a bore diameter of 398 mm that makes the system suitable for brain, extremity or pediatric imaging. A proprietary graphical user interface (MILabs, Utrecht, The Netherlands) enables preselection of the field-of-view in three dimensions through optical images of the patient. This allows focusing the pinholes on the desired area of interest, thereby maximizing sensitivity and sampling density for the imaging task at hand. SPECT images are obtained from list-mode data using model-based 3D pixel-based OSEM reconstruction that utilizes PSF models of system blurring and position-dependent sensitivity to increase resolution. Using a Derenzo hot rod phantom containing 45MBq Tc-99m, G-SPECT-I was compared to a Siemens Symbia equipped with Low Energy High Resolution (LEHR) collimators and using Flash3D OSEM reconstruction with resolution recovery. Scan time on both systems was 15 minutes. RESULTS: The smallest hot rods resolved by G-SPECT-I had a diameter of 3 mm while the Siemens Symbia recovered only 7 mm rods. Peak sensitivity of G-SPECT-I was 415 cps/MBq compared to 182 cps/MBq for the Symbia. With G-SPECT-I dynamic imaging with time frames of <10s can be performed for focused scans and ~30s for imaging the entire brain. CONCLUSION: Initial G-SPECT-I images show a excellent isotropic resolution. Given the field-of-view available for this prototype and its unique potential for fast dynamic imaging first ground-breaking applications are expected in brain, bone and pediatric imaging, especially since -next to very high resolution- very fast imaging will be possible.

OP502

Double-Sided Readout with Digital Photon Counters Enables Millimeter Spatial Resolution and 150 ps Time Resolution in 32 mm x 32 mm x 22 mm Monolithic LYSO:Ce Crystals

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Reducing PET scanning times and radiation exposure while improving image quality and quantitative accuracy requires detectors with better detection efficiency, spatial resolution, and time resolution, all at the same time. Digital photon counter (DPC) arrays are fully digital, solid-state single-photon sensors. DPC arrays are almost transparent to 511 keV gamma quanta, opening up new degrees of freedom in PET detector design. This work demonstrates the improvement in spatial and time resolution that can be obtained by reading out a monolithic LYSO:Ce crystal by means of two DPC arrays, coupled to its front- and back surface in so-called dual-sided readout (DSR) configuration, in comparison to conventional back-side readout (BSR).DPC arrays consisting of 8 x 8 DPC pixels and having a total area of 32 mm x 32 mm were optically coupled to commercially available LYSO:Ce crystals having dimensions of 32 mm x 32 mm x 22 mm. Both BSR or DSR configurations were tested. The spatial-, time- and energy-resolutions of both configurations were measured. In conventional BSR configuration, a spatial resolution of ~1.5 mm FWHM and a DOI resolution of ~4 mm FWHM was obtained, averaged over the entire detector area. In DSR configuration, a spatial resolution close to 1 mm FWHM was achieved in combination with a depth-of-interaction (DOI) resolution of < 2.5 mm FWHM. The coincidence resolving time (CRT) in BSR and DSR configurations were ~225 ps FWHM and ~150 ps FWHM, respectively. Compared to BSR, the DSR configuration significantly improves the time-, spatial- and DOI resolutions of the detector. Monolithic scintillator detectors with dual-sided DPC readout appear particularly promising for PET applications in which high spatial resolution, high time resolution, and high detection efficiency all are crucial, such as in neurology and pediatric medicine. This work was supported in part by EU FP7