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Spatial resolution of a flat panel limited angle TOF-PET scanner

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In time-of-flight positron emission tomography (TOF-PET) excellent coincidence timing resolution (CTR) reduces angular coverage requirements of the scanner, which in turn reduces geometric constraints of the design of the PET scanner. One of the possibilities that this opens is the use of flat panel PET detectors. Such a design would allow a higher degree of modularity and be more compact and cost accessible compared to a conventional ring scanner. Achieving adequate CTR that would allow construction of a flat panel detector that could be used in clinical practice is a considerable challenge and requires improvements at every level of detection. Based on preliminary results from ongoing development of TOF-PET optimized photodetectors and electronics, we expect that CTR of about 75 ps will be achievable on system level in a few years. In this work various designs of flat panel scanners are simulated with point sources and the spatial resolution of resulting reconstructed images is assessed. Simulations were performed using GATE software and image reconstruction was performed using CASToR. The standard methods according to the NEMA standard for determining the spatial resolution, developed for PET scanners with cylindrical geometry, may not be the most suitable for flat panel detectors. A method for flat panel PET scanner spatial resolution estimation is presented. Spatial resolution of simulated flat panel scanners is quantitatively compared to a reference scanner based on current state-of-the-art clinical scanner, Siemens Biograph Vision.

Topic Selection

Technical Advances in brain imaging

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