

First Mediterranean Thematic Workshop on Advanced Molecular Brain Imaging with Compact High Performance MRI-Compatible PET and SPECT Imagers –Potential for a Paradigm Shift

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Dedicated PET-MRI-fMRI detectors for brain

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Abstract. After more than 10 years of experimental developments towards simultaneous PET/MRI especially for small animals, first prototype scanners for PET/MRI of the human brain have been realized. At the Forschungszentrum Juelich, one of four prototypes delivered by Siemens worldwide combines a commercial 3 T MRI with a newly developed BrainPET insert allowing simultaneous data acquisition with PET and MRI. The BrainPET is equipped with LSO crystals of 2.5 mm width and Avalanche photodiodes (APD) as readout electronics. A second BrainPET detector is available at our institute to be operated in a 9.4 T whole-body MRI. Here we describe the technical, methodological and performance characteristics of the BrainPET and report on BrainPET/MRI studies of various patients. As radiotracers [18F]-fluoro-deoxy-glucose (FDG), [18F]-fluoro-ethyl-tyrosine (FET), [11C]-flumazenil, and [15O]-water applied. Comparing the PET data obtained with the BrainPET to those of the HR+ scanner demonstrated the high image quality and the superior resolution capability of the BrainPET. Furthermore, it is shown that various MR images of excellent quality could be acquired simultaneously with BrainPET scans without any relevant artefacts. It is demonstrated that the BrainPET/MRI is a promising basis for obtaining an image derived input function and correcting head motion in simultaneous PET/fMRI studies. Finally, a short reference to comparable MR-compatible BrainPET systems under development by others groups is given.

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