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Development of a MPPC-based Prototype Gantry for Future MRI-PET Scanners

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We have developed a high spatial resolution, compact Positron Emission Tomography (PET) module designed for small animals and intended for use in magnetic resonance imaging (MRI) systems. This module consists of large-area, 4×4 ch MPPC arrays (S11827-3344MF; Hamamatsu Photonics K.K.) optically coupled with Ce-doped $(Lu,Y)_2(SiO_4)O$ (Ce:LYSO) scintillators fabricated into 15×15 matrices of 0.5×0.5 mm^2 pixels. We set the temperature sensor (LM73CIMK-0; National Semiconductor Corp.) at the rear of the MPPC acceptance surface, and apply optimum voltage to maintain the gain. The eight MPPC-based PET modules and coincidence circuits were assembled into a gantry arranged in a ring 90 mm in diameter to form the MPPC-based PET system. We have developed two types PET gantry: one made of non-magnetic metal and the other made of acrylonitrile butadiene styrene (ABS) resins. The PET gantry was positioned around the RF coil of the 4.7 T MRI system. We took an image of a point ^{22}Na source under fast spin echo (FSE) and gradient echo (GE), in order to measure the interference between the MPPC-based PET and MRI. The spatial resolution of PET imaging in a transaxial plane of 1 mm or less (FWHM) was achieved in all cases. Operating with PET made of ABS has no effect on MR images, while operating with PET made of non-magnetic metal has a significant detrimental effect on MR images. This paper describes our quantitative evaluations of PET images and MR images, and presents a more advanced version of the gantry for future MRI/DOI-PET systems.

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