Contribution ID: **27**   Type: **ORAL**

Qualification Test of a MPPC-based PET Module for Future MRI-PET Scanners

Thursday 5 September 2013 14:40 (20 minutes)

We have developed a high-resolution, compact Positron Emission Tomography (PET) module for future use in MRI-PET scanners. The module consists of large-area, 4 x 4 ch MPPC arrays (Hamamatsu S11827-3344MG) optically coupled with Ce:LYSO scintillators fabricated into 12 x 12 matrices of 1 x 1 mm^2 pixels. At this stage, a pair of module and coincidence circuits was assembled into an experimental prototype gantry arranged in a ring 90 mm in diameter to form the MPPC-based PET system. The PET detector ring was then positioned around the RF coil of the 4.7 T MRI system. We took an image of a point 22Na source under fast spin echo (FSE) and gradient echo (GE), in order to measure interference between the MPPC-based PET and MRI. We only found a slight degradation in the spatial resolution of the PET image from 1.5 to 1.6 mm (FWHM; x-direction), or 1.6 to 1.8 mm (FHWM; y-direction) when operating with the MRI, while the signal-to-noise ratio (SNR) of the MRI image was only degraded by 5%. These results encouraged us to develop a more advanced version of the MRI-PET gantry with eight MPPC-based PET modules, whose detailed design and first qualification test are also presented in this paper.

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Session Classification: Session 7

Track Classification: Applications in Space, Medical, Biology, Material Sciences