



Contribution ID: 479

Type: Oral Presentation

Initial Results of an LYSO/SiPM PET Insert for Small Animal PET/MRI

Friday, 10 June 2011 17:30 (20 minutes)

To explore the biomedical applications, a positron emission tomography (PET) insert for small animal PET/magnetic resonance imaging (MRI) has been developed at Huazhong University of Science and Technology (HUST). The PET insert composes of the lutetiumyttrium oxyorthosilicate (LYSO) crystal array and the silicon photomultipliers (SiPMs) array, and it can be inserted in a 4.7 Tesla MRI scanner. The SiPM is a novel, solid-state photodetector, and it has many advantages for PET/MRI system, such as high photon detection efficiency (PDE), high gain, low operation voltage, and insensitive to magnetic field. We have measured the performance of the PET insert in the MRI by an all-digital data acquisition (DAQ) system, and evaluated the influence between the PET insert and the MRI scanner. The results show that the PET insert can work well in the magnetic field. The spatial resolution of the insert is 1.5 mm full-width-at-half-maximum (FWHM) and the average energy resolution is 33.1%@511KeV, which are the same as the result without the effect of the magnetic field. And the imaging of the MRI is also perfect, except when the DAQ of the PET is working, because of the interference of the electromagnetic wave caused by the strong current of the DAQ system. It implies that the PET insert based on the SiPM is appropriate for the PET/MRI system. In future work, we will optimize the readout of the PET insert for a higher energy resolution, evaluate the timing determination, eliminate the effects of DAQ for the MRI and get the imaging of PET and MRI at the same time.

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Session Classification: Instr. for Medical, Biological and Materials Res.

Track Classification: Instrumentation for Medical, Biological and Materials Research