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Multipurpose J-PET detector for tests of discrete symmetries and medical imaging

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The Jagiellonian Positron Emission Tomograph (J-PET) is a detector for: 1. medical imaging by combining metabolic information collected by standard PET with structural information obtained from Positronium lifetime in a concept of morphometric image, 2. tests of discrete symmetries, 3. and even test of quantum entanglement of photons originating from the decay of positronium atoms. The novelty of the system is based on usage of plastic scintillators for active detection material and trigger-less data acquisition system. The apparatus consists of 192 plastic scintillators read out from both ends with vacuum tube photomultipliers. Signals produced by photomultipliers are probed at four levels in the amplitude domain and digitized on 8 FPGA based readout boards in trigger-less mode. The recently presented concept of positronium imaging has the potential to increase the diagnostic efficiency of positron emission tomography (PET) based on the use of an additional indicator derived from the mean lifetime of one of the metastable positron and electron bound states - ortho-positronium (o-Ps). In this talk we will present the world's first in-vitro positronium images of human tissues from the J-PET detector, which allow to distinguish cardiac myxoma tissues from normal pericardial tissues based on the measurement of the mean o-Ps lifetime separately in each image voxel.

In-person participation

Yes

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