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Coincidence and time determination in ToF PET model with TDC in continuous mode

Positron emission tomography (PET) is a technique emanating from nuclear physics methods and used in medicine and biomedical research for functional imaging. It is based on simultaneous detection of two gamma rays produced in annihilation of positrons from appropriate radioactive source in a body and subsequent reconstruction of source distribution, with gamma time-of-flight measurements as an important improvement in ToF PET, e.g. [1]. To obtain high-quality images and reduce irradiation of patients clinical PET systems comprise several thousands of detectors, complex electronics and software packages, and have corresponding high costs.

In order to investigate various possibilities for improvements and to provide as versatile as possible teaching tool for students, we have built a PET model inspired by the system at Royal Institute of Technology in Stockholm [2], but with additional features, such as TDC operating in continuous mode and registration of gamma ray energies. The system comprises 48 BaF2 detectors coupled to fast PMTs, CAMAC CFDs and data acquisition based on VME electronics, with image reconstruction in MATLAB and IDL. Detectors can be arranged in one ring of 48 detectors or two rings of 24 detectors. In this work we discuss implementation of TDC operating in continuous mode and corresponding off-line coincidence and time of flight determination.

[1] W. Moses, Nucl. Instr. and Meth. A580 (2007) 919

[2] T.Back, et al. Nucl. Instr. and Meth. A477 (2002) 8

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

http://www.phy.hr/~bosnar/vienna/abstract-ext-vienna10.pdf

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