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A Linear Digital Timing Measure Method for In-Beam PET

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Abstract—Accurate timing is required in the annihilation event calibration and coincidence of the In-Beam positron emission tomography (In-Beam PET), which is the main way for the in-situ monitoring in the Heavy-Ion Cancer Therapy Device (HICTD). To achieve a high-resolution and low-cost time information, a linear digital timing measure method for In-Beam PET based on photomultiplier tube readout of LYSO crystals is presented. In this method, the field programmable gate arrays (FPGA) based data acquisition unit (DAQU) analyzes the event signals from detector, which are sampled by 14-bit analog to digital converters (ADCs) at the sampling rate of 50 MHz. Each event is examined by the energy and shape discrimination module in FPGA. Meanwhile, a stable digital trigger is synchronous generated with the valid event to launch the acquisition for the energy and time measure, which avoids the use of traditional analog timing circuit. The actual timing is calculated by linear interpolation between baseline and initial sample with the digital signal processing (DSP) unit in FPGA. Results show that the time resolution for this method is about 100 ps, which is useful and low cost for the development of readout electronics in the In-Beam PET.

Index Terms—Digital timing, Time stamp, In-Beam PET, FPGA, Linear interpolation

Minioral

Yes

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No

Are you a student?

Yes

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