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Preliminary Performance of a Continuous Crystal PET Detector with TODT Readout Scheme

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Time over dynamic threshold (TODT) method has been theoretically proved with excellent linearity when compared to time of threshold (TOT) method and practically tested with good performance with its application in DAQ system for multi-anode PMT based PET detector. However, both the coincidence time resolution ($\text{FWHM} \approx 2\text{ns}$) and energy resolution were limited because of the relative low performance ($\text{FWHM} \approx 625\text{ps}$) of TDCs used in our previous work. In this report, we implemented 66-channel TDCs using tapped-delay line (TDL) method, with average resolution of around 90 ps in FWHM. The performance of CRT of the detector is improved to about 450 ps. Moreover, the signal-noise ratio of 64-channel readouts are observed much meliorated which is supposed to give rise to better intrinsic spatial resolution for the detector. In all, the time resolution of this continuous crystal based PET detector can be expected to be less than 370 ps for FWHM and the intrinsic spatial resolution can be expected to be less than 1.5 mm in average within the whole field of view.

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