Coincidence time resolution of ultrafast photomultiplier tube coupled with LYSO crystal

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1. The Fast timing Photodetector

--SiPM has good single-photon time resolution, it has a small sensitive area and high noise. Thousands of SiPMs must be used for large-area detection, which is a big challenge for electronics, and the suppression of noise is also a big issue that needs to be considered.

--MCP-PMT, it has faster time resolution, low noise, and multi-anode MCP-PMT can achieve multi-channel readout. For large-area detection applications, MCP-PMT is a more suitable detector.

2. Fast time resolution MCP-PMT performance test

--The MCP-PMT with short rise time and small transit time spread (TTS) is called fast timing PMT (FPMT).

--Two FPMTs were used in this CTR experiment. Their waveforms and SPE spectrums were shown below.

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2. Fast time resolution MCP-PMT performance test

--The test device is shown on the left, and a high-sampling oscilloscope (bandwidth 4GHz, sampling rate 40Gs/s) is used for waveform acquisition.

3. Choice of Scintillator Crystal

--The performance data of several scintillator crystal were shown in the table.

--The luminosity and the decay time are key data for time resolution of the CTR experiment.

--Compared with various parameters, LYSO crystal is the most suitable crystal for CTR experiment.

--Considering the size of the light window of the FPMT and the flicker of LYSO itself, a 3*3*5mm LYSO crystal is selected for the CTR test.

Acknowledgement

This paper was supported by National Natural Science Foundation of China (No.11675205, No.11675196), Foundation of State Key Laboratory of Particle Detection and Electronics (SKLPDE-ZZ-201902), Program of Science &Technology Service Network of Chinese Academy of Science, Youth Innovation Promotion Association CAS. Thanks to the cooperation of: Wang Zhigang, Guo Hao, Wu Qi, Tan Min, Peng Shuo.

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