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Development of fast-timing MCP-PMT/LAPPD for particle identification

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Particle IDentification (PID) is fundamental to nuclear and particle physics experiments. Fast-timing MCP-PMTs are ideal candidate for PID sensors if the price is affordable. We report detailed design, fabrication and characterization of Argonne 6 × 6 cm^2 fast timing photodetectors based on next-generation microchannel plates (MCP). The whole assembly is made of low-cost borosilicate glass materials and hermetically sealed with a bialkali photocathode in a vacuum. The flexible photodetector design provides the potential of modifying individual components as well as the entire configuration to fit for different applications.

Recently, low-cost, large area pico-second photodetector (LAPPD^{TM}), which shares the similar design as Argonne MCP-PMT was successfully commercialized by our collaborator Incom, Inc. Efforts were devoted to modify the standard configuration of the LAPPD^{TM}, and to validate the performance on Argonne 6 × 6 cm^2 MCP-PMTs. Experiment results show great improvement of the detector's timing resolution and magnetic field tolerance, providing strong potential for PID applications. Results on high voltage, magnetic field strength and angle dependence will be presented in detail.

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