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Development of MCP-PMT for Nuclear Physics Programs[1]
JUNQI XIE, SYLVESTER JOOSTEN, ZEIN-EDDINE MEZIAN, CHAO PENG, DEAN WALTERS, LEI XIA, Argonne National Laboratory — Microchannel plate photomultipliers have compact electron amplification design, providing them with excellent magnetic field immunity and precision timing performance. These characteristics make them promising potential photosensors for Nuclear Physics programs. We report the improvement of MCP-PMTs with low-cost microchannel plates functionalized by the atomic layer deposition technique at Argonne National Laboratory. Multiple photomultipliers were fabricated with different microchannel plate pore sizes and gap lengths. Their magnetic field immunity and precision timing performance were characterized and compared. With smaller pore size microchannel plates and reduced gap lengths, the magnetic field immunity of these photomultipliers improves from 0.7 Tesla to over 1.5 Tesla, the precision timing characteristics are also improved with a rise time from 519 ps to 394 ps, time resolution in a single photoelectron mode from 68 ps to 35 ps, and a root-mean-square timing distribution from 132 ps to 83 ps. To expedite the application of MCP-PMT for various programs, a $10 \times 10 cm^2$ MCP-PMT fabrication facility is under construction at Argonne to produce larger size, high-performance MCP-PMTs.

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