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Development of planar microchannel plate photomultiplier with full range response and pixelated readout

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Planar microchannel plate photomultipliers (MCP-PMTs) with bialkali photocathodes are able to achieve single photon detection with excellent time (picosecond) and spatial (millimeter) resolution. They have recently drawn great interests in experiments requiring time of flight (TOF) measurement and/or Cherenkov imaging. Current MCP-PMTs have a response range of 300 nm –600 nm, limited by the window transmission and cathode materials. By replacing the glass window with fused silica, the detection range can be dramatically extended from 300 nm to 170 nm, providing much more efficient Cherenkov radiation detection.

The Argonne MCP-PMT detector group has recently designed and fabricated 6 cm x 6 cm MCP-PMTs with fused silica window. Initial characterization indicates that the fused silica window photomultipier exhibits a transit-time spread of 57 psec at single photoelectron detection mode and of 27 psec at multi photoelectron mode (100 photoelectrons). The MCP-PMTs was also tested at Fermilab test beam facility for its particle detection performance and rate capability, showing high rate capability up to 75 kHz/cm2, higher than the requirement for future electron-ion collider (EIC) experiment.

Currently, the group is exploring the new MCP-PMT with pixelated readout. With a pixelated readout, the new MCP-PMT will provide better position resolution for various applications in different experiments such as Belle II and EIC. The progress on pixelated readout MCP-PMT production and characterization will also be presented and discussed in the presentation.

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