

Fast-timing microchannel plate photodetectors: design, fabrication and characterization

Thursday, 29 November 2018 10:15 (20 minutes)

We report detailed design, fabrication and characterization of $6 \times 6 \text{ cm}^2$ 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. A series of prototype MCP-photodetectors were fabricated following a step-by-step process including functionalization of glass capillary array through atomic layer deposition, MCP baking and scrubbing, photocathode deposition and hermetic thermo-compression sealing. The prototype MCP-photodetectors exhibit electron gains well beyond 10^7 level with excellent relative uniformity. The photodetectors present fast rise time of ~ 500 ps level and fall time of ~ 1.5 ns. Excellent timing resolution at single photoelectron mode of 20 ps and magnetic field tolerance up to 1.3 Tesla were achieved for photodetector with $10 \mu\text{m}$ pore size MCPs, comparing to that of 63 ps and 0.7 Tesla for the one with $20 \mu\text{m}$ pore size MCPs.

Primary author: XIE, Junqi (Argonne National Laboratory (US))

Co-authors: Dr DEMARTEAU, Marcel (Argonne National Laboratory); Dr MAY, Edward (Argonne National Laboratory); Dr WAGNER, Robert (Argonne National Laboratory); Dr XIA, Lei (Argonne National Laboratory)

Presenter: XIE, Junqi (Argonne National Laboratory (US))

Session Classification: Thursday morning