Contribution ID: **627** Type: **Parallel**

Characteristics of MCP-PMTs in magnetic field

Saturday, July 7, 2018 4:30 PM (12 minutes)

Performance of the microchannel plate photomultiplier (MCP-PMT) in magnetic field is an important aspect for its application in the proposed electron ion collider (EIC). The motivation of this paper is to explore the critical parameters that affect the performance of MCP-PMT in magnetic field, and to guide the design optimization of MCP-PMTs for high magnetic field tolerance. MCP-PMTs with two different designs were examined in magnetic field and the results were compared. The magnetic field tolerance of MCP-PMT with new independent biased voltage design shows significant improvement (up to 0.8 T) compared to that of the MCP-PMT with resistor chain design (up to 0.2 T), indicating that optimization of the individual MCP voltage is an important parameter for magnetic field tolerance improvement. The effects of other parameters such as the rotation angle relative to the magnetic field direction and the bias voltage between photocathode and entrance MCP were thoroughly studied with the independent biased voltage design. The gain of the MCP-PMT exhibits enhanced performance at ± 8 degree tilt angle due to the original MCP 8 degree bias angle. Maximum gain values are observed dependent on the optimal bias voltages in different magnetic field strength.

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Session Classification: Detector: R&D for Present and Future Facilities

Track Classification: Detector: R&D for Present and Future Facilities