

Comprehensive characterization of LAPPD and HRPPD photodetectors

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Abstract

Many experiments require the detection of single photons over a large, but finely segmented sensitive area with sub-nanosecond time resolution. To this end, Large Area Picosecond Photon Detectors (LAPPDs) and High Rate Picosecond Photon Detectors (HRPPDs) were recently developed by INFN in collaboration with academia. These detectors are based on Micro-Channel Plate-PMTs and have a size of 10-20 cm and a few mm segmentation. They feature a high time resolution and a low intrinsic noise rate. Their characteristics and relatively low cost per unit area make them ideal candidates for use as photodetectors in the pFRICH and hpDIRC of the electron-Proton/Ion Collider (ePIC) experiment at Electron Ion Collider (EIC).

In this contribution, we will present a comprehensive of LAPPD/HRPPD characterization campaign undertaken by the INFN sections of Trieste and Genova in collaboration with BNL and JLab. This campaign included measurements of the time resolution of single photons in a test beam at CERN, magnetic field measurements and ageing studies. Overall the expected performances of LAPPD/HRPPDs were confirmed. In particular we observed a single-photon time resolution of 87 ps RMS for the LAPPD. The LAPPD's gain drops in a magnetic field, but can be partially recovered by applying a higher bias voltage. Additionally, ageing measurements demonstrated photocathode stability of over a significant time interval.