Contribution ID: **16** Type: **Talk**

The SiPM readout plane for the ePIC-dRICH photodetector at the EIC: overview and beam test results

Wednesday, September 17, 2025 8:35 AM (20 minutes)

The dual-radiator Ring Imaging Cherenkov (dRICH) detector of the ePIC experiment at the future Electron-Ion Collider (EIC) will make use of SiPM sensors for the detection of the emitted Cherenkov light. The photodetector will cover ~ 3 m^2 with 3×3 mm^2 pixels, for a total of more than 300000 readout channels and will be the first application of SiPMs for single-photon detection in a collider experiment. SiPMs are chosen for their low cost and high photon detection efficiency, which remains unaffected even in the presence of a significant magnetic field (~ 1 T at the dRICH location). However, since they are not radiation-hard, careful attention is required to preserve their single-photon counting capabilities and to keep the dark count rate (DCR) under control throughout the years of operation of the ePIC experiment. DCR control can be achieved by operating SiPMs at low temperatures and by recovering radiation damage through high-temperature annealing cycles. The exploitation of the precise timing of SiPMs with fast TDC electronics further helps to reduce the impact of DCR as background noise and to improve the signal-to-noise ratio.

In this talk, we present an overview of the ePIC-dRICH photodetector system with highlights from the R&D performed for the operation of the SiPM optical readout in the ePIC experiment. Special focus will be given to development and beam test results of a large-area prototype SiPM readout plane consisting of a total of up to 2048 3×3 mm^2 sensors. The photodetector prototype is modular and based on a novel EIC-driven photodetection unit (PDU) developed by INFN, which integrates 256 SiPM pixel sensors, cooling and TDC electronics in a volume of $\sim 5\times5\times14$ cm^3. Several PDU modules have been built and successfully tested with particle beams at CERN-PS in October 2023 and in May 2024. The data have been collected with a complete chain of front-end and readout electronics based on the ALCOR chip, developed by INFN Torino.

Author: RUBINI, Nicola (INFN Bologna)

Co-author: PREGHENELLA, Roberto (INFN Sezione di Bologna)

Presenter: RUBINI, Nicola (INFN Bologna)

Session Classification: Photon sensor techniques for Cherenkov imaging counters

Track Classification: Photon sensor techniques for Cherenkov imaging counters