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A large-area prototype SiPM readout plane for the dRICH detector of ePIC at the EIC: test at the CERN-PS facility

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Silicon photomultipliers (SiPMs) have been selected as the photodetector technology for the dual-radiator RICH (dRICH) detector of the ePIC experiment at the future Electron-Ion Collider (EIC). A large-area prototype readout surface, consisting of a total of 1280 $3 \times 3 \text{ mm}^2$ SiPM sensors, was recently built and installed as part of the dRICH prototype during a beam test in October 2023 at CERN-PS. The SiPM prototype readout is based on a novel EIC-driven prototype photodetection unit (PDU) developed by INFN. This concept integrates 256 $3 \times 3 \text{ mm}^2$ Hamamatsu SiPM sensors and corresponding services (cooling and front-end electronics) into the prototype PDU volume of approximately $5 \times 5 \times 14 \text{ cm}^3$. The front-end and the readout electronics are based on the second version of the ALCOR chip developed by INFN Torino. Eight PDUs have been assembled and tested in the dRICH prototype and, in this presentation, the features of the PDUs and their performance within the prototype will be discussed. The results from the beam test at CERN-PS, with both positive and negative hadrons, will be presented to highlight the performance of the new SiPM detector readout surface. An alternative analysis approach based on machine learning for Cherenkov image reconstruction has been explored: results compared to classical ring reconstruction algorithms will be also reported.

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