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# The modular SiPM photodetector for the ePIC-dRICH detector at the EIC

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## **Overview of ePIC-dRICH detector of the EIC**



World's first collider for polarised electrons with protons and ions.

Major US Project in nuclear physics and going to be one of the important future facilities in the world, going to be constructed in **Brookhaven National Laboratory (USA)**.

#### will allow to explore the secrets of QCD

- Origin of mass & **spin** of the nucleons
- **3D images** of the nuclear structure

The collider is expected to start at the early 2030s.

One experiment foreseen till now **ePIC** 

A **dual-radiator (dRICH)** is in-charge for the forward **P**article **Id**entification **(PID)**.

It is a compact and cost-effective solution for a broad momentum coverage range **(3-50 GeV/c)**.

 $\label{eq:starsess} \begin{array}{l} p \sim 3\text{-}50 \ \text{GeV/c} \\ \eta \sim 1.5\text{-}3.5 \ \text{GeV/c} \\ e \sim up \ to \ 15 \ \text{GeV/c} \end{array}$ 



## **Detector integration and Electronics**

SiPM

sensors





4x matrices of 8x8 SiPMs

cold plate / heat exchanger

#### SiPM sensor matrices mounted on carrier PCB board

- 4x 64-channel SiPM array device (256 channels) for each unit
  - need modularity to realise curved readout surface
- 1248 photodetector units for full dRICH readout
  - 4992 SiPM matrix arrays (8x8)
  - 319488 readout channels



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#### dRICH Prototype 2k24 and experimental set up at CERN-PS



Full PDU



Prototype readout box

Schematic of the dRICH prototype



Fully equipped over 2k SiPM photo sensors





Experimental set-up

## **Beam Test Results**



- Clear Cherenkov rings were detected by the modular SiPM-based optical readout plane with more than 2000 channels. Unfortunately one ASIC chip (32 channels) has some front-end issue where photons were not detected.
- Reconstructed ring radii shows clear identification of protons, kaons and pions at 10 GeV/c momentum.
- A positive beam momentum from 2 to 11 Gev/c in 1 GeV/c momentum steps allowed us to identify the Cherenkov rings produced from proton, kaons, pions and positron.



**Conclusion:** The beam test validated the performance of the Photo Detection Unit. Successful beam test with **working over 2k SiPM photosensors**. The dRICH detector meets the performance requirements for the ePIC experiment at the EIC.

Thank you!