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Design and characterisation of a fully functional FoCal-E prototype in ALICE

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The FoCal-E detector is a part of the FoCal detector aiming to provide unique capabilities to measure small-x gluon distributions via prompt photon production. It represents an upgrade to the ALICE experiment, and will be installed during LS3 for data taking in 2027–2029 at the LHC.

This detector is composed of a Si+W sampling calorimeter hybrid design combining two different Si (Silicon) readout technologies: Pad layers and Pixel layers.

A first prototype is under development to demonstrate the performance of the proposed readout electronics. It is composed of 18 single E-pad boards and 2 MAPS layers. They are all connected via an interface board to an aggregator system. Each single E-pad contains 72 Si-pixel sensors and a front-end ASIC (HGCROC). This ASIC ensures that the response of each sensor is read out using an integrated charge sensitive amplifier-shaper and an analog to digital conversion system (few fC up to 10 pC) enabling the transmission of data on a standard digital connection. This board also contains probes to monitor the temperature, the power consumption and a local power converter to provide clean power supplies. The aggregator board is used to gather the data and trigger information from the detector (data rate of 1,28 Gb/s). It is based on an FPGA allowing the extraction of data via multiple supports.

This prototype is firstly used to validate the choice of the ASIC with the design of a testing board capable of emulating the response of the Si-sensors while developing the aggregator board and its associated firmware and software. It allows also measuring the performances of this system: measurements under beam and through a cosmic test for the measurements of the MIP. Results are used to optimize the design of the final E-pad modules and to finalize the aggregator system.

Collaboration

the ALICE Collaboration

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