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CALICE scintillator-SiPM calorimeter prototypes: R&D highlights and beamtest campaigns

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- Among various technical options of high granularity calorimetry being explored within the CALICE collaboration, two technological prototypes based on the scintillator option have been developed to address major challenges of system integration, including an electromagnetic calorimeter prototype (namely CALICE ScW-ECAL) and a hadron calorimeter prototype (namely CALICE CEPC-AHCAL). The ScW-ECAL prototype is finely segmented with 6700 readout channels in total and consists of 32 longitudinal layers, each with scintillator strips ($45 \times 5 \times 2\,\mathrm{mm}^3$) and a copper-tungsten plate in a transverse size of $22 \times 22\,\mathrm{cm}^2$. The AHCAL prototype has been developed with totally 12960 readout channels in 40 longitudinal layers. Each layer is instrumented with an array of 18×18 scintillator tiles ($40 \times 40 \times 3\,\mathrm{mm}^3$) and an iron plate of $72 \times 72\,\mathrm{cm}^2$. Both two prototypes are based on the silicon photomultiplier (SiPM) readout scheme and compact front-end electronics chips have been fully integrated onto the readout boards, where each scintillator strip/tile is directly coupled with a SiPM individually (i.e. the "SiPM-on-Tile" design developed within the CALICE collaboration).
- Successful beamtest campaigns were successfully finished for the both prototypes at CERN PS as well as SPS beamlines during 2022 and 2023. Decent statistics of data samples were collected with high-energy beam particles in the momentum range of 1-350 GeV and . This contribution will present prototype developments and results of key performance evaluated based on the beamtest data. Highlights of ongoing studies of electromagnetic and hadronic shower properties will also be included.

Collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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