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Test beam results and future R&D of the fibre-sampling Dual-Readout Calorimeter

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The dual-readout calorimetric technique reconstructs the event-by-event electromagnetic fraction of hadronic shower through the simultaneous measurement of scintillating (S) and Cherenkov (C) light produced by the shower development. The new generation of prototypes, based on Silicon Photomultipliers (SiPMs) readout, is adding an unprecedented granularity to the well-known energy resolution.
A highly granular prototype (10x10x100mm3), designed to fully contain electromagnetic showers, has been recently built and qualified on beam. It consists of 9 modules, each made of 320 brass capillaries (OD = 2mm) equipped, alternatively, with scintillating and clear fibers. All the fibers of the central module are instrumented with SiPMs (one per capillary) while the PMTs are used for the others. The SiPM readout is based on the new FERS-System designed by Caen to fully exploit the CITIROC1A performances (i.e. wide dynamic range, linearity and multi-photon quality) even with SiPMs of small pitch size (15 μm) and small gain (1-3×105).

The recent test beam allowed to qualify the readout system and to define a procedure to calibrate the SiPM response from ADC to ph-e in a wide dynamic range: from 1 to 4000 ph-e (almost 60% of the cells available in the SiPM in use). In addition, this calibration provides the possibility to compensate for the intrinsic non-linear response of the sensor, when needed. The number of ph-e per GeV has been measured both for scintillating and Cherenkov light together with the calorimetric performances in the energy range of 10 −100 GeV.

In this talk, I'll review the system qualification, the test beam results, and the on-going R&D required to build a demonstrator capable to fully contain hadronic showers, required to assess the hadronic energy resolution.

Collaboration

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