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Prototype tests for a highly granular scintillator-based hadron calorimeter

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Within the CALICE collaboration, several concepts for the hadronic calorimeter of a future linear collider detector are studied. After having demonstrated the capabilities of the measurement methods in "physics prototypes", the focus now lies on improving their implementation in "engineering prototypes", that are scalable to the full linear collider detector. The Analog Hadron Calorimeter (AHCAL) concept is a sampling calorimeter of tungsten or steel absorber plates and plastic scintillator tiles read out by silicon photomultipliers (SiPMs) as active material. The front-end chips are integrated into the active layers of the calorimeter and are designed for minimal power consumption (power pulsing). The versatile electronics allows the prototype to be equipped with different types of scintillator tiles and SiPMs. A large prototype for beam tests with hadronic showers with ˜24000 channels, corresponding to ˜4.3 ⊠I, is under construction. As a first step, the absorber stack was partly equipped with several types of scintillator tiles and SiPMs and exposed to electron, muon and hadron beams. This also allowed to study system and integration aspects. The experience of these beam tests as well as the availability of new generation SiPMs with much reduced noise and better device-to-device uniformity resulted in an improved detector design with surface-mount SiPMs allowing for easier mass assembly. A small setup, based on the improved design, with ˜17 X0 (˜1.8 ⊠I) thickness has been built and tested with and without magnetic field in muon and electron beams. The presentation will discuss the testbeam measurements, the improved detector design and the ongoing construction of the large prototype.

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