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Prototype tests for a highly granular scintillator-based hadron calorimeter

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 allowing the prototype to be equipped with different types of scintillator tiles as well as SiPMs. Four of the currently available eight layers have been equipped with a novel design of scintillator tile wrapped in reflecting foil and directly coupled to a KETEK SiPM. The blue sensitive SiPM has 2304 pixels, an average gain of 600k electrons and an average dark count rate of 200kcps when operated at 2.5V above breakdown and 22°C. Furthermore the temperature dependence of the breakdown voltage for these SiPMs is only 17 mV/°C, which ensures a stable operation. The operation at fixed overvoltage ensures a homogeneous response and behaviour of the calorimeter. Results from recent beam test measurements of minimal ionizing particles will be compared to calibrations obtained in the lab and the analysis on electromagnetic showers will be presented. Plans for future hadron beam tests with a larger prototype will be discussed.

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