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Readout Studies of 64-channel SiPM Arrays in Test Beams

We are studying a new readout system for the ATLAS TileCal. The idea is to replace the photomultiplier tubes by SiPM arrays. This allows us to record the signal of each individual tile, This information can be used for particle flow and would be useful for the ATLAS experiment since CMS is building this highly sophisticated endcap calorimeter. We have constructed a prototype reading out 32 3 mm thick TileCal scintillator tiles. Each tile is read out with two wavelength-shifting fibers that are coupled to a 64-channel SiPM array via an air gap or via optical grease. We first tested the prototype with electrons in a test beam at DESY where the beam was typically perpendicular to the tiles. We measured the relative gain and light yield of each channel. We studied the gain as a function of overvoltage and temperature and determined the breakdown voltage. The light yield for 3 mm tiles lies between two and three photoelectrons. To increase the light yield we also sent the beam through the longest side of the tile (about 22 cm). We further measured the uniformity by sending the beam at different x, y positions. We repeated some measurements with a second SiPM array. To study the response to hadrons we conducted another test beam at the PS at CERN.

Primary author: Prof. EIGEN, Gerald (Uni Goettingen)

Presenter: Prof. EIGEN, Gerald (Uni Goettingen)

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