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Operation and Performance of the ATLAS Tile Calorimeter

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TileCal, the central hadronic calorimeter of the ATLAS detector is a key system to measure and reconstruct hadrons, jets, hadronic decays from tau leptons and missing transverse energy, also participating in muon identification. TileCal is a sampling calorimeter composed of plastic scintillators interleaved by iron plates. Wavelength shifting optical fibres collect the scintillating light from the tiles and are read by photomultiplier tubes (PMTs). The calorimeter comprises 64 wedged modules across the azimuthal direction, segmented radially and in pseudorapidity to define the 5000 detector cells. Double cell readout, by approximately 10000 PMTs, provides redundancy in the cell energy measurement. The TileCal energy scale was determined a priori with test beam measurements and, during operation, dedicated calibration systems allow to monitor each step of the readout chain independently to address respective response fluctuations. A Cesium radioactive source assesses the response of the whole detector, a laser system provides controlled light pulses to monitor the photodetectors and the front-end electronics is calibrated through charge injection. Besides, the integrated current of the cells' response to minimum bias events provides auxiliary information on the whole detector response stability during proton collisions. The performance of the detector during Run 2 was studied with cosmic ray muons and the large sample of proton-proton collisions during data quality assessment activities. Furthermore, isolated hadrons and high momentum muons were used as probes to study the response of the calorimeter at the hadronic and electromagnetic energy scale, respectively. The influence of pile-up on the detector noise levels and the detector response uniformity were also analysed and compared to estimates from Monte Carlo simulation. Finally, the time resolution of TileCal was investigated with multijet events. In this presentation, the methods and results of the TileCal Calibration and Performance during Run 2 will be presented.

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