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## Performance and upgrade of the ATLAS Hadronic Tile Calorimeter

The Tile Calorimeter (TileCal) is a central hadronic calorimeter of the ATLAS experiment at the LHC. The TileCal plays an important role in the reconstruction of jets, hadronically decaying tau leptons, missing transverse energy, in the muon identification and provides information to the dedicated calorimeter trigger. This sampling calorimeter is composed by the plastic scintillating tiles and steel absorbers. The scintillating light is read-out by the wavelength shifting fibres coupled to the photomultiplier tubes.

The upcoming High-Luminosity phase of the LHC (HL-LHC), starting in 2030, will increase the nominal instantaneous luminosity by a factor of 5 to 7.5, alongside an upgraded ATLAS Trigger and Data Acquisition architecture. This upgrade necessitates a complete redesign of the readout electronics and power systems of TileCal. New electronics of the TileCal is needed to meet the requirements of a 1 MHz trigger, higher ambient radiation, and to ensure better performance under high pile-up conditions at the HL-LHC. Both the on- and off-detector TileCal electronics will be replaced during the shutdown of 2026-2030. PMT signals from every TileCal channel will be digitized and sent directly to the back-end electronics, where the signals are reconstructed, stored, and sent to the first level of trigger at a rate of 40 MHz. This will provide better precision of the calorimeter signals used by the trigger system and will allow the development of more complex trigger algorithms.

The TileCal upgrade program has included extensive research and development, including test beam studies and the construction of a Demonstrator module. This Demonstrator module with reverse compatibility with the existing system was inserted in ATLAS in July 2019 for operating in actual detector conditions.

A summary of first LHC Run 3 performance results including the calibration, stability, absolute energy scale, uniformity and time resolution will be presented. This talk will also include the ongoing developments for on- and off-detector systems, together with expected performance characteristics and results of test-beam campaigns with the electronics prototypes.

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