

Upgrade of the ATLAS hadronic Tile Calorimeter for the High luminosity LHC

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The Tile Calorimeter is the hadronic calorimeter covering the central region of the ATLAS detector at the Large Hadron Collider. It is a scintillator-steel sampling calorimeter read out via wavelength shifting fibers coupled to photomultiplier tubes (PMT). The PMT signals are digitized and stored on detector until a trigger is received. The High-Luminosity phase of LHC (HL-LHC) expected to begin in year 2026 requires new electronics to meet the requirements of a 1 MHz trigger, higher ambient radiation, and for better performance under higher pileup. All the TileCal on- and off-detector electronics will be replaced during the shutdown of 2024-2025. PMT signals from every TileCal cell 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. Changes to the electronics will also contribute to the data integrity and reliability of the system.

Three different front-end options are presently being investigated and will be chosen after studies of simulated physics performance and evaluation of prototype performance in test beams. A hybrid demonstrator compatible with the current ATLAS detector has been developed. The demonstrator is undergoing extensive testing and is planned for future insertion in ATLAS.

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