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

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Content

The Tile Calorimeter (TileCal) is the hadronic calorimeter of ATLAS covering the central region of the ATLAS experiment. TileCal is a sampling calorimeter with steel as absorber and scintillators as active medium. The scintillators are read-out by wavelength shifting fibers coupled to photomultiplier tubes (PMT). The analogue signals from the PMTs are amplified, shaped and digitized by sampling the signal every 25 ns.

The High Luminosity Large Hadron Collider (HL-LHC) will have a peak luminosity of $5\mathrm{x}10^{34}\mathrm{cm}^{-2}\mathrm{s}^{-1}$, five times higher than the design luminosity of the LHC. TileCal will undergo a major replacement of its on- and off-detector electronics for the high luminosity programme of the LHC starting in 2026. All signals will be digitized and then transferred directly to the off-detector electronics, where the signals will be 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 reliability and redundancy of the system.

Three different frontend options are presently being investigated for the upgrade and a final solution will be chosen after extensive laboratory and test beam studies that are in progress. A hybrid demonstrator module was developed using the new electronics while conserving compatibility with the current system. The demonstrator undergoes extensive testing and will be installed during one of the next winter maintenance period.

Summary

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