

Upgrade of Tile Calorimeter of the ATLAS detector for the High Luminosity LHC

Wednesday 18 May 2016 08:50 (20 minutes)

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 $5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$, 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 in 2026.

The calorimeter signals will be digitized and sent directly to the off-detector electronics, where the signals are reconstructed and shipped to the first level

of trigger at a rate of 40 MHz. This will provide a better precision of the calorimeter signals used by the trigger system and will allow the development of more complex trigger algorithms.

Three different options are presently being investigated for the front-end electronic upgrade. Extensive test beam studies will determine which option will be selected. Field Programmable Gate Arrays (FPGAs) are extensively used for the logic functions of the off- and on-detector electronics. One hybrid demonstrator prototype module with the new calorimeter module electronics, but still compatible with the present system, is planned to be inserted in ATLAS by the end of 2016.

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Session Classification: High Luminosity LHC