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Performance of the ATLAS Hadronic Tile Calorimeter Demonstrator system for the Phase-II upgrade facing the High-Luminosity LHC era

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The High Luminosity Large Hadron Collider (HL-LHC) will have a peak luminosity of $5 - 10 \times 10^{34}\ cm^{-2}$ s^{-1}, five to ten times higher than the design luminosity of the LHC. The ATLAS Tile Calorimeter (TileCal) is a sampling calorimeter with steel as absorber and plastic scintillators as active medium. Major replacements of TileCal's electronics will take place during the Phase-II upgrade for the HL-LHC in 2026, so that the system can cope with the HL-LHC increased radiation levels and out of time pileup. The Phase-II upgrade system will digitize and send the calorimeter sampled signals to the off-detector systems, where the events will be reconstructed and shipped to the first level of trigger, all at 40 MHz rate. Consequently, development of more complex trigger algorithms will be possible with the more precise calorimeter signals provided to the trigger system. The new design comprises state of the art electronics with a redundant design and radiation hard electronics to avoid single points of failure, in addition to multi-Gbps optic links for the high volume of data retansmission and Field Programmable Gate Arrays (FPGAs) to drive the logic functions of the o and on-detector electronics. A hybrid demonstrator prototype module containing the new calorimeter module electronics, but still compatible with the present system was assembled and inserted in ATLAS during June 2019, so that the Phase-II system can be tested in real ATLAS conditions. We present current status and results for different the tests done with the demonstrator system running in ATLAS.

Minioral

Yes

IEEE Member

No

Are you a student?

Yes

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