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Data acquisition and Software the ATLAS Tile Calorimeter Phase-II Upgrade Demonstrator

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The LHC plans a series of upgrades culminating in the High Luminosity LHC (HL-LHC) which will have an average luminosity 5-7 times larger than the design LHC value. The electronics of the hadronic Tile Calorimeter (TileCal) will undergo a substantial upgrade to accommodate to the HL-LHC parameters. In particular, TileCal will undergo a major replacement of its on- and off-detector electronics.

The photomultiplier signals will be digitized and transferred off-detector to the TileCal PreProcessors (TilePPr) for every bunch crossing, requiring a data bandwidth of 40 Tbps. The TilePPr will reconstruct, store and send the calorimeter signals to 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.

In parallel, the data samples will be stored in pipeline memories and the data of the events selected by the ATLAS central trigger system and transferred to the ATLAS global Data Acquisition (DAQ) system for further processing.

Recently extensive tests have been performed recently with beam at the CERN accelerator facilities. External beam detectors have been used to measure the beam position and to generate a trigger signal when the particle beam impinges the calorimeter modules, while a Demonstrator system of the TileCal upgrade electronics has been successfully employed to read-out the calorimeter signals in parallel to the current TileCal electronics.

This contribution describes the results from the tests with beam performed at CERN, as well as the latest results on the development of the on- and the off-detector electronics, firmware, data processing and simulation components of the TileCal Demonstrator readout system.

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