

# Data acquisition and processing in the ATLAS Tile Calorimeter Phase-II Upgrade Demonstrator

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The LHC has planned a series of upgrades culminating in the High Luminosity LHC (HL-LHC) which will have an average luminosity 5-7 times larger than the nominal Run-2 value. The ATLAS Tile Calorimeter (TileCal) will undergo an upgrade to accommodate to the HL-LHC parameters. The TileCal read-out electronics will be redesigned, introducing a new read-out strategy.

The photomultiplier signals will be digitized and transferred to the TileCal PreProcessors (TilePPr) located off-detector for every bunch crossing, requiring a data bandwidth of 80 Tbps. The TilePPr will provide pre-processed information to the first level of trigger and in parallel will store the samples in pipeline memories. The data for the events selected by the trigger system will be transferred to the ATLAS global Data Acquisition (DAQ) system for further processing.

A demonstrator drawer has been built to evaluate the new proposed readout architecture and prototypes of all the components. In the demonstrator, the detector data received in the TilePPr are stored in pipeline buffers and, upon the reception of an external trigger signal, the data events are processed, packed and read out in parallel through the legacy ROD system, the new Front-End Link eXchange (FELIX) system and an ethernet connection for monitoring purposes.

The data are processed in the Digital Signal Processors of the RODs and transmitted to the ATLAS DAQ system where the data are reconstructed using the ATLAS standard software framework. The data read out through FELIX and the monitoring ethernet connection use a new custom data-format and they are processed using special software packages.

This contribution will describe in detail the data processing and the hardware, firmware and software components of the TileCal demonstrator readout system. In addition, the system integration tests and results from the two test-beam periods planned for 2016 will be presented.

## **Tertiary Keyword (Optional)**

Data processing workflows and frameworks/pipelines

## **Secondary Keyword (Optional)**

Reconstruction

## **Primary Keyword (Mandatory)**

DAQ

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