Installation and Commissioning of the TileCal Read-Out Drivers

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Introduction

TileCal is the hadronic tile calorimeter of the ATLAS experiment at LHC/CERN. The main component of the TileCal back-end electronics is the Read-Out Driver (ROD). The ROD system is placed between the first and the second level trigger. The data produced in the detector is gathered and digitized in the front-end electronics and transmitted to the RODs through high-speed optical links. At the first level trigger rate the ROD system has to compute in real time information from 9856 front-end channels in less than 10 μs. Finally, the processed data are transmitted through optical links to the Read-Out System (ROS) located in the second level trigger.
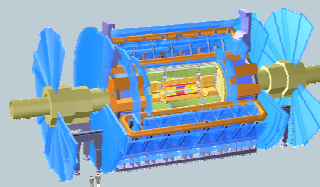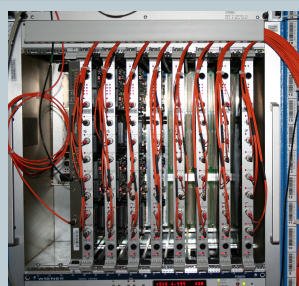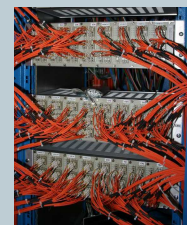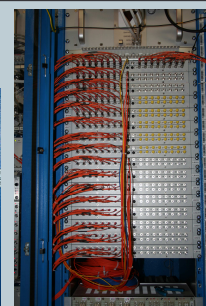
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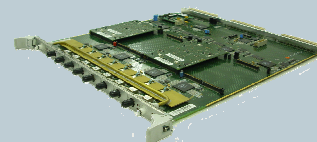
TileCal Read-Out Diver

Installation

The back-end hardware for the first level Trigger and Data Acquisition (TDAQ) of TileCal consists of four ROD crates and four trigger crates. Each ROD crate contains eight RODs with Transition Modules, a Trigger and Busy Module and a crate controller. The trigger crates are responsible for the Timing, Trigger and Control (TTC) information reception and distribution. The front-end data is received in the electronics cavern (USA15) in the patch panel rack through optical fiber. The TTC information is received from the Central Trigger Processor and distributed to front-end through the Optical Couplers (OC). The back-end electronics is completely installed in USA15.

ROD crate   USA15 patch panel   TTC OC rack

Commissioning

The TileCal commissioning is carried out in three overlapping phases. In the phase 1 the TileCal is commissioned in stand-alone mode. The phase 2 integrates TileCal with other ATLAS sub-detectors (LAr, TRT, SCT and muon spectrometer) and with central DAQ, DCS and TTC. In phase 3 ATLAS is commissioned with cosmic runs. The TileCal RODs are being used for data taking in all the three commissioning phases.

The Detector and Verification System (DVS) verifies the sub-detector performance in the phase 1. The Charge Injection System (CIS) test is used to measure the front-end electronics response to an injected charge and allows timing verification. The pedestal test identifies noisy channels. The data is acquired with ROD system and analyzed in-situ in the crate controller.

The ATLAS TDAQ software controls the data flow and acquisition for the TileCal commissioning. The TDAQ configuration for phase 1 is in stand-alone mode for calibration runs (CIS, pedestal, laser), and for phase 2, integrated with other sub-detectors for physic runs with cosmic trigger. The raw data is read-out and online processed with Optimal Filtering and Level 2 algorithms in the RODs. The byte-stream is off-line analyzed to certificate the detector.
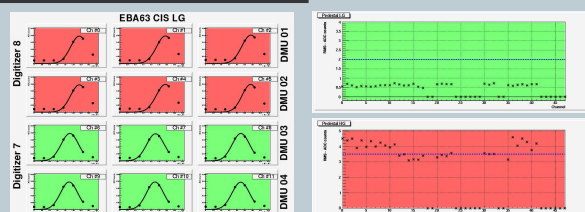
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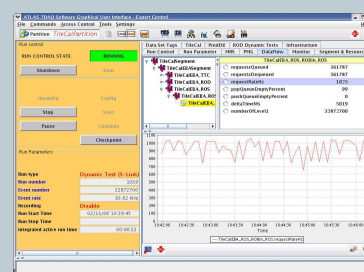
Trigger & DAQ software

Conclusions

The TileCal ROD system is completely installed in the ATLAS electronics cavern. The ROD system is being used for DVS tests and data acquisition for front-end modules certification within the TileCal commissioning phase 1. Furthermore, the RODs have been integrated within the rest of ATLAS sub-detectors and within the ATLAS central systems. In the commissioning phase 3 the RODs are participating in physics runs with cosmic rays using a setup of ATLAS close to operation.