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Installation and Test of the ATLAS Muon Endcap Trigger Chamber Electronics

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For the detector commissioning planned in 2007, a sector assembly of the ATLAS muon endcap trigger chambers
is progressed in CERN intensively. Final technical test for the electronics mounted on a sector must be accomplished at this stage. For systematic test of the electronics, we have developed a DAQ system on top of the
ATLAS online software framework. The system is not dedicated only for this test, but can be used also as the front-end detector part of the overall ATLAS DAQ system. We presume the extension to the ATLAS final one from the presently developed DAQ system must not be hard if it is built up in the common software framework.
In this presentation, we report installation of the electronics on the sector, development of the DAQ system and
its validity check performed through the electronics test at the chamber assembly stage.

Summary

For the detector commissioning at LHC planned in 2007, a sector assembly of the ATLAS muon-endcap chambers is progressed intensively in CERN. The thin gap chamber (TGC) is used for the muon-endcap trigger system. The muon endcap system covers the both endcaps of the detector (1.1<abs(eta)<2.4) to detect isolated muons and give the level-1 muon trigger signal with two ranges of the transverse momentum (pt) of low-pt > 6 GeV/c and high-pt > 20 GeV/c.
As at least three measurement points per track is necessary to identify a muon with even such coarse momentum estimation, there are three TGC discs per endcap (one has three layers with triplet chambers, and the other two discs have two layers each with doublet chambers). Every disc has commonly twelve sectors. This 1/12 sector is a construction unit for the trigger muon endcap system for both the chambers and electronics. The sector is also the unit for the trigger and readout system.
The electronics systems mounted on a sector are the front-end ASD (Amplifier-Shaper-Discriminator), readout chain (pipeline buffers, derandomizers and parallel/serial converter), trigger decision logic for the level-1 low-pt muon candidate signals, miscellaneous control and test circuits and Detector Control System (DCS). We also mount modules for high-pt decision logic as well as readout data concentrator nearby the sector, but these are not directly mounted on it.
Once the sector is installed in the whole ATLAS detector system in the cavern, one cannot access easily its electronics as well as cables. We have to test the electronics system after completion of the sector and fix or repair quickly if we find incomplete connection of cables or damage of electronics components. Furthermore since the system involves the level-1 trigger generation logic, timing adjustment of the electronics at this assembly stage is also the key issue from the signal synchronization point of view.
In order to check all the functionalities and adjust timing of the electronics system, it is necessary to do almost full DAQ operation to the sector. We have made a lot of DAQ systems so far for the standalone electronics consistency check or the integrated beam test with TGCs using the high energy muon beam. These DAQ systems constructed have been dedicated for specific purposes, but none of them can be used in the actual ATLAS online system, although various software codes in particular for individual module controls are re-usable with minor modification. For the present electronics test of the sector assembly, we have reformed the DAQ system once more. We made it with being fully complied with the ATLAS online software framework.
In this presentation we will describe the installation and mass-test procedure of electronics using this DAQ system in detail and some experience to fix problems encountered actually in the sector assembly. We would like to discuss the timing adjustment procedure in detail. If the adjustment in the sector level is done well, then the timing signals in larger parts (disc, side or overall muon endcap) will be smoothly synchronized. We discuss finally the front-end DAQ system itself and how we have evolved the system through the verification process of the electronics installation.

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