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Final Test at the Surface of the ATLAS Endcap Muon Trigger Chamber Electronics

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For the detector commissioning planned in 2007, a sector assembly of the ATLAS muon-endcap chamber and final test at the surface for the assembled electronics are progressed in CERN intensively. For the test, we built up the DAQ system using test pulse of two types and cosmic ray pulse. So far, 60% of all 320,000 channels have been already tested and most of them were installed into the ATLAS pit.
In this presentation, we will describe the DAQ systems and mass-test procedure in detail, and report the result of electronics test with some actual experiences.

Summary

For the detector commissioning planned in 2007, a sector assembly of the ATLAS muon-endcap chamber and final test at the surface for the assembled electronics are progressed in CERN intensively.
The thin gap chamber (TGC) is used for the muon-endcap trigger system. The muon-endcap system covers the both endcaps of the detector (1.05<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).
Each disc has the radius of about 10 meters, for example pivot doublet disc has the radius of 11m, and due to this huge detector size, the number of channels become about 320,000 in total. 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 (timing adjustment, bunch ID, coincidence) 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.
In order to check all the functionalities, it is necessary to do almost full DAQ operation to the sector. So DAQ systems of two types are built up with being fully compiled with the ATLAS online software framework. First one is using test pulse of two types which our electronics can provide intrinsically, and one can find out dead channels of electronics, incomplete connection between ASD and readout chain with this system. Second one is using cosmic ray pulse. To build up this system, a module called Commissioning Trigger Module (CTM) which can provide cosmic ray trigger with coincidence of trigger decision logic is developed. With this system, one can find out dead channels of a chamber, cable swapping of HV and readout line. We think this cosmic ray trigger will play a very important role at the detector commissioning stage. So far, 60% of all 320,000 channels have been already tested with only few tens remaining dead channels.

In this presentation, we will describe the DAQ systems and mass-test procedure in detail, and report the result of electronics test with some actual experiences.

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