ATLAS DAQ/HLT rack DCS

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Elsevier use only: Received date here; revised date here; accepted date here

Abstract

The ATLAS Detector Control System (DCS) group provides a set of standard tools, used by subsystems to implement their local control systems. The ATLAS Data Acquisition and High Level Trigger (DAQ/HLT) rack DCS provides monitoring of the environmental parameters (air temperatures, humidity, etc.). The DAQ/HLT racks are located in the underground counting room (20 racks) and in the surface building (100 racks). The rack DCS is based on standard ATLAS tools and integrated into overall operation of the experiment. The implementation is based on the commercial control package and additional components, developed by CERN Joint Controls Project Framework. The prototype implementation and measurements are presented.

Keywords: ATLAS; DCS; rack

1. Introduction

The control and monitoring of the ATLAS experiment infrastructure is provided by Detector Control System [1]. The independent DCS of detector subsystems, based on the hierarchy of the Local Control Stations (LCS) and the Subdetector Control Stations (SCS) are unified by the Global Control Stations (GCS). The central ATLAS DCS group also provides a set of standard tools, used by subsystems to implement their local control systems.

The DAQ/HLT equipment is housed in 120 racks with horizontal air flow and water air-cooling [2]. The DAQ/HLT rack DCS [3] is similar to the local DCS of detector subsystems – its scope is shown on Figure 1:

The main motivation of the rack monitoring is prevention of the equipment overheating and mist condensation in the rack cooler. The implementation of the rack infrastructure monitoring is a full responsibility of the DAQ/HLT. The rack DCS employ two LCS – one in the underground counting room (USA15) and one in the surface building (SDX1) – connected to the TDAQ SCS.

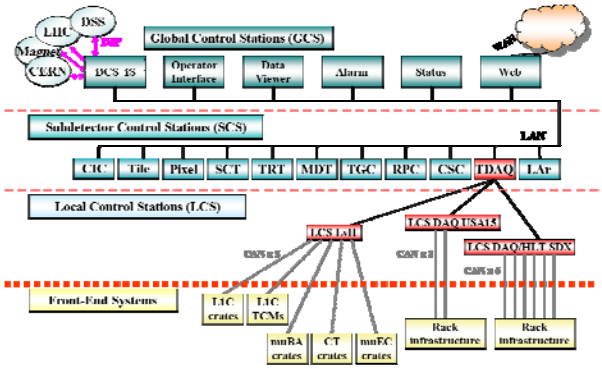

Figure 1. Scope of the DAQ/HLT rack DCS

2. Rack parameters for monitoring

The following parameters will be monitored by the rack DCS inside the racks in USA15 and SDX1 computing rooms:

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- air temperature – by 3 sensors at the top, middle and bottom inside the rack,
- temperature of the inlet and outlet cooling water pipes of the rack cooler,
- relative humidity (dew point) – by a relative humidity sensor located on the bottom of the rack cooler,
- cooler fans failure (while is not critical for the operation of the equipment in the rack) – provided that a fan status signals are available.

A status of the rear door (open/closed), water leak/condensation inside the cooler and smoke detection inside the rack will not be monitored by the DAQ/HLT rack DCS because they are considered as not critical or unpractical to implement.

In a few racks there is Single Board Computer (SBC) in VME crate which require a remote Reset. This control feature will be also implemented in the rack DCS.

3. Rack parameters for monitoring

The "standard" ATLAS DCS toolkit is based on the Embedded Local Monitor Board (ELMB) – a general-purpose CANbus node with the 64 channel ADC and input/output ports for monitoring and control of detector equipment – e.g. sensors, status and control elements. It is connected to the LCS with a CANbus interface. The commercial control package (PVSS II) and additional components, developed by CERN Joint Controls Project Framework are exploited on the LCS, SCS and GCS for the overall integration into ATLAS DCS. The ATLAS DCS sensors readout chain is shown on Figure 2:

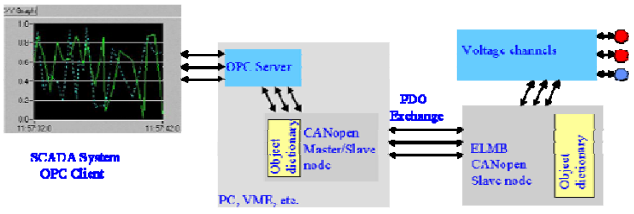

Figure 2. ATLAS DCS sensors readout chain

The ELMB is mounted on the motherboard which provides sockets for different sensor's adapters and four connectors to sensors. For the rack DCS the following adapters are used:

- 4-channel adaptor for the TF25 NTC temperature sensor from Quartz (sensor requires 1 ADC channel of ELMB and uses 2-wire measurement principle) and for the fans with rotation sensors, supplied with the cooler.
- 1 kOhm resistor network for the relative humidity sensor HS-2000V from Precon (sensor requires 1 ADC channel of ELMB and uses direct voltage measurement; in addition, it contains a temperature sensor which may be also used).

All rack sensors (5 temperature, 1 relative humidity and 3 fan rotation) will be located on the rear door of the rack, where the cooler is mounted. The signals from the sensors are routed to the wiring terminal and connected to one of four available ELMB connectors. One ELMB is used for 3 neighboring racks leaving one connector for a possible upgrade or test purposes.

4. Prototype implementation and tests

First prototype was assembled in the lab and contained complete measurement chain for temperature and humidity sensors. Initial measurements were done for the temperature and the relative humidity (shown on Figure 3).

Figure 3. Initial relative humidity measurements

The second prototype is under commissioning in the USA15 underground counting room. It exploits one LCS, full length CANbus cable and two ELMB nodes in DAQ racks. The ELMBs are located at the rear of the racks in custom boxes and the sensors – at the rear doors.

The LCS is running PVSS – the main DCS tool for ATLAS. The CERN Joint Controls Project Framework provides an integrated set of guidelines and software tools which is used to develop the control applications. The presentation of the rack parameters is being implemented on two levels – the individual rack panel gives access to sensor values and alarm limits and the summary panel to present the overall status of the DAQ/HLT racks in USA15 and SDX1.

References

[1] Design and Implementation of the ATLAS Detector Control System, H. Boterenbrood et al., ATL-DAQ-2003-043, 19 Nov 2003.
[2] ATLAS DAQ/HLT Infrastructure, Y.Ermoline et al., 11th Workshop on Electronics for LHC and future Experiments, Heidelberg, Sep 12-16 2005.
[3] DAQ/HLT Rack DCS, Y.Ermoline et al., ATLAS note in preparation.