Low Voltage Control for the Liquid Argon Hadronic End-Cap Calorimeter of ATLAS

H.Brettel*, W.D.Cwienk, J.Habring, H.Oberlack, P.Schacht

MAX-PLANCK-INSTITUT FUER PHYSIK
Foehringer Ring 6, D-80805 Muenchen
brettel@mppmu.mpg.de

Abstract

At the ATLAS detector a SCADA system surveys and controls the sub-detectors. The link is realized by PVSS2 software and a CanBus hardware system.

The low voltages for the Hadronic Endcaps of the Liquid Argon Calorimeter are produced by DC/DC-converters in the power boxes and split into 320 channels corresponding to the pre-amplifier and summing boards in the cryostat.

Six units of a prototype distribution board are currently under test. Each of it contains 2 ELMBs as CanBus interface, a FPGA of type QL3012 for digital control and 30 low voltage regulators for the individual fine adjustments of the outputs.

I. Detector Control System Of Atlas

At CERN the slow control and survey of the accelerator, the detectors, sub-detectors and their components is realized by a SCADA system (Survey, Control And Data Acquisition). which is installed in a. The software, installed in a computer net, is “PVSS2” from the Austrian company “ETM”.

Links between net nodes and hardware are realized in different ways. Between the last node, typically a PC, and the detector electronics a CanBus is recommended by the collaboration for the transfer of control signals and the survey of temperatures, supply voltages and currents (figure 1).

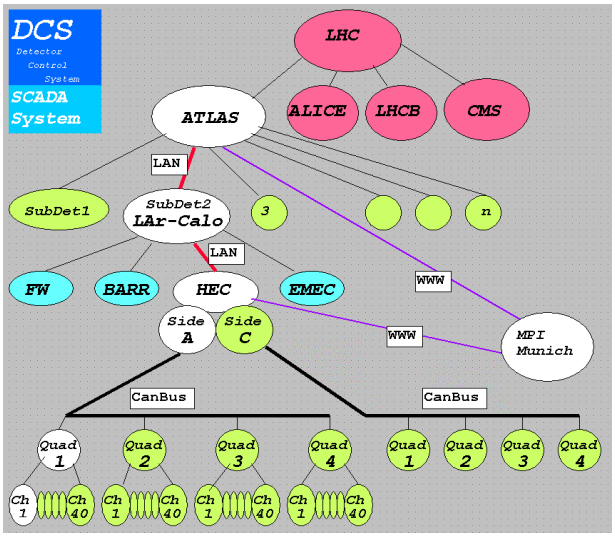

Figure 1: DCS, detector control system (principle structure)

At figure 1 possible data paths between the computers of the LHC, and the various detectors, sub-detectors and components are indicated. The example in white colour shows how information between the ATLAS main control desk and one low voltage channel can be transferred. A low voltage channel means in this context the entire supply and control of a cold pre-amplifier and summing board PSB inside the end-cap cryostat.

II. Low Voltage Control Of HEC

A. System Overview

The supply voltages for the cold front-end electronics of the two Hadronic End-cap wheels are generated in 8 power boxes PBs and distributed to 320 preamplifier and summing boards PSBs inside the cryostats. The boxes are mounted between the fingers of the Tile Calorimeter near the front-end crates FEC of the Liquid Argon Calorimeter end-caps (see figure 2).

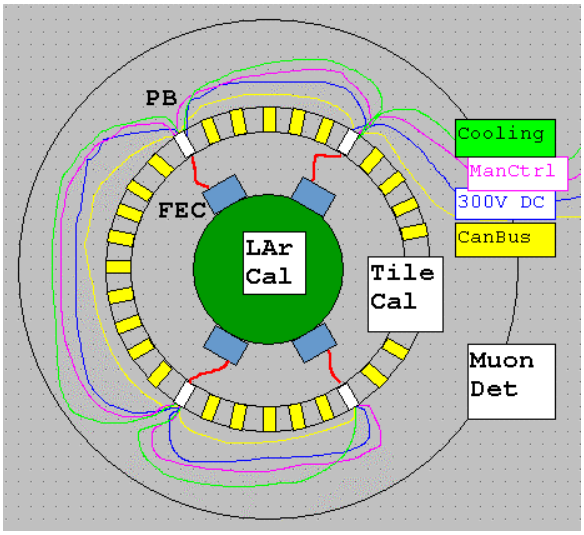

Figure 2: Positions of power boxes (white) and connection scheme

B. Hardware

The supply lines from UA15 arrive at the power box input connectors (cooling water, 300V DC, CanBus, manual control). Inside the power boxes the low voltages are generated by DC/DC converters and split into 40 channels,

each of them containing a +7.2V, +3.3V and –1.6V line. Linear regulators (STm) achieve the fine adjustments of the voltages and on/off control. The output cables of the PBs are connected to the top of the FECs. The connection to the base plane of the crate is made on 2 boards by shielded lines. From the base plane connectors the lines go to the feed-threw and arrive finally at the PSBs. As there are types of PSBs with 12 chips and others with 14 or 16, the supply currents are different. Therefore the lines had to be arranged in such a way that the thermal load is equally distributed over the cross section of the feed-threw. The 2 HECs have together 320 PSBs. That means we need 320 low voltage channels.

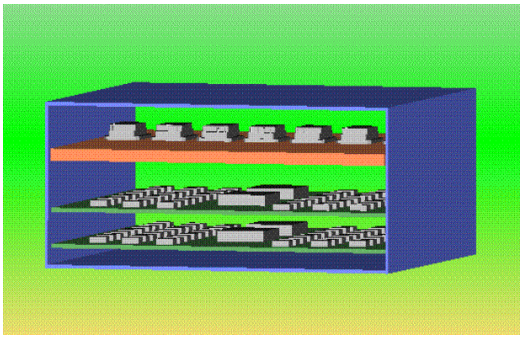

Figure 3: Interior of a power box PB, details not shown

The main components of a PB are a power board with the DC/DC converters and four control boards with CanBus interfaces (ELMB), digital control logic in a FPGA (QuickLogic QL3012) and linear low voltage regulators (STm L4913 and L7913). All boards are cooled by water.

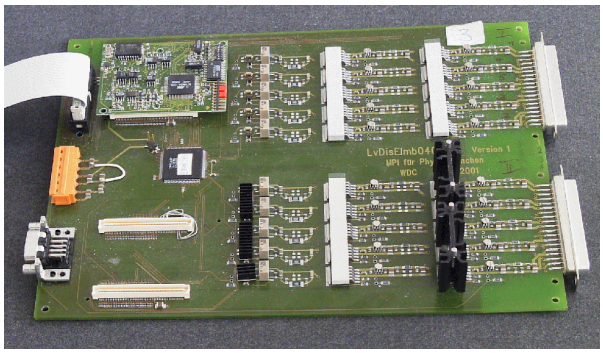

Figure 4: Control Board prototype, 1 ELMB removed

Six control board prototypes have been produced. Four of them are installed at CERN and control the low voltages at the module und wheel test. Because of delivery problems by STm, the low voltage regulators had to be replaced by standard types, which are not radiation tolerant. Final control boards will be designed end of this year.

C. Software

The SCADA software resides in a PC under WN2000 and is called a PVSS-project. The link to the CanBus interface board NICANII from National Instruments is done by OPC.

Graphical windows offer to the operator complete individual control und survey of the 320 supply channels.

The following pictures show some examples of control and display panels.

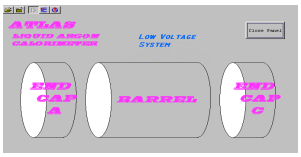

Figure 5: “Start-Up”, selection of end-cap A or C

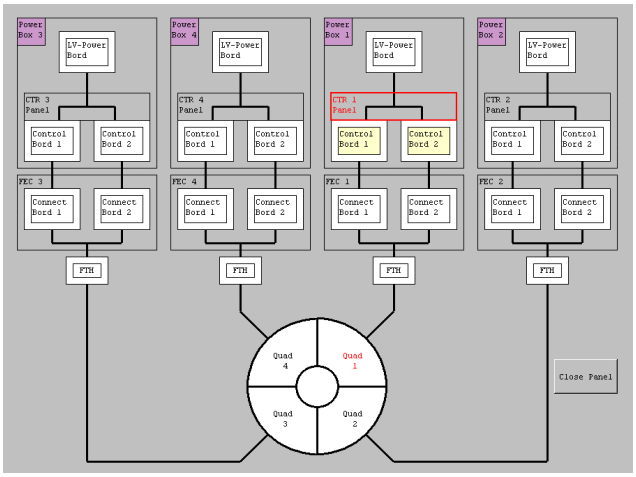

Figure 6: “Main Access”,

Channel controls, status displays or documentation, like schematics and construction drawings, may be accessed

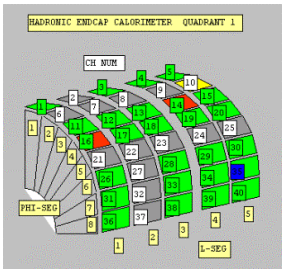

Figure 7: “Alarms”, Quadrant 3-D with blinking lights

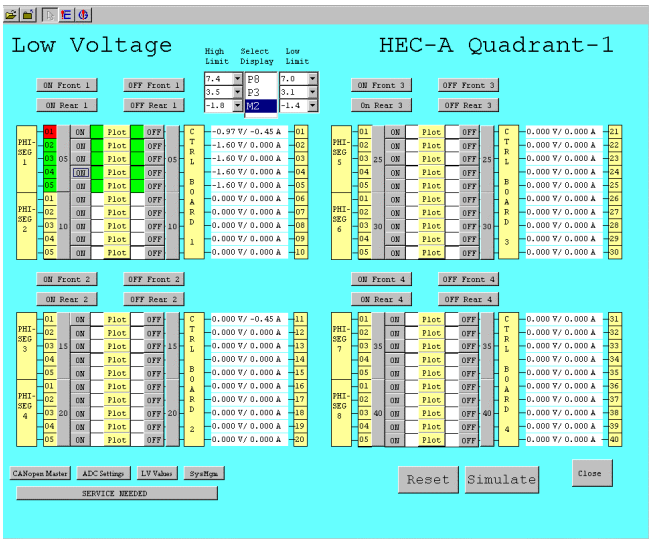

Figure 8: “Channel Control”, displays also voltages and currents