Contribution ID: **93** Type: **Poster**

ELMB Microcontroller Firmware and SCADA Integration for the LHCb Muon Detector Readout Control System

Thursday, 6 September 2007 16:45 (0 minutes)

The LHCb Muon Detector System will be equipped with about 1400 high efficiency chambers (Multi-Wire Proportional Chambers and Triple-GEM detectors) which will host a total of 7500 front-end boards, each receiving 16 readout channels and having 93 registers for access. A distributed PC network runs the supervision program and allows download of start-up settings and procedures, and upload of data logs. This document presents an outline of the LHCb Muon Detector Readout Control System and recent improvements regarding mainly the ELMB (Embedded Local Monitor Board) microcontroller firmware and the Supervisory Control And Data Acquisition (SCADA) system in use, PVSS.

Summary

Hardware and software of the Chamber Readout Control System will be described. Control related data transfer is carried out utilizing CANopen between the host computer and control modules, and an I2C-like protocol based on LVDS for the connections with front-end boards. A distributed PC network runs the supervision program and allows download of start-up settings and procedures, and upload of data logs. A specific board (Service Board - SB) has been developed; it relies on Embedded Local Monitor Boards (based on a CAN controller and an ATMega128 microcontroller), allowing front-end circuitry monitoring and control by means of customized firmware development. In addition, the SB is provided with facilities as a flash-memory to data archiving and a radiation tolerant Actel FPGA, used mainly to generate test and synchronization pulses for front-end boards. The hardware control core is the ATMega128, a 8-bit RISC microcontroller. The microcontroller firmware is being implemented to fulfill the LHCb Muon requirements and many embedded procedures have been developed.

Each FEB contains 93 registers: as a consequence in total there will be more than 690000 byte wide registers in the LHCb Muon System which will be accessed by the SCADA system. For this reason, about 400 microcontrollers will be used and a server-client model communication system known as OPC (OLE for Process Control) is being used. It provides data-transfer between CAN devices and high-level software. The SCADA system in use has been chosen by CERN JCOP Group as a general solution for all LHC experiments. It is well adapted to large controlling systems, allowing manipulation of a high number of devices and registers by means of data acquisition, alarm handling, communication protocols, graphic user interfaces, etc.

A specific based SCADA system has been implemented for the LHCb Muon Detector with features which permit management of front-end by means of threshold calibration, auto-injection testing, chamber noise analysis, adjustment and initialization of front-end parameters, on-line monitoring, diagnostic procedures, data archiving and alarm handling. During data acquisition the system is capable of making decisions, correcting failures without human intervention, reporting changes and logging actions taken. In pre-acquisition state, users are allowed to alter parameters such as threshold, mask and signal width or check channels response and control noise rate. Such a control system has been modeled and implemented as Finite State Machine to be integrated to the LHC Experiment Control System. FSM hierarchical tree and states and actions for every control unit have been defined.

Primary author: Dr NOBREGA, Rafael (INFN Sez. Roma)

Co-authors: Dr PINCI, Davide (INFN Sez. Roma); MESSI, F. (Universita di Roma I "La Sapienza"); IACOANGELI, Francesco (Univ. + INFN Roma 1); Dr BOCCI, Valerio (INFN Sez. Roma); RINALDI, Walter (Universita di Roma I "La Sapienza")

Presenter: Dr NOBREGA, Rafael (INFN Sez. Roma)

Session Classification: Poster session