

Detector Control System of BESIII

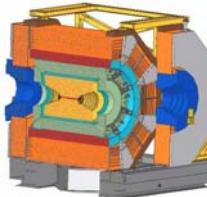
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INTRODUCTION

BESIII Experiment

The Beijing Spectrometer (BESIII) experiment at the upgrading Beijing Electron Positron Collider (BEPCII) with an energy range of 2–5GeV, a peak luminosity of 1033cm⁻²s⁻¹ at 3.78GeV is designed for high-precision measurements and new physics searches in the tau-charm energy region. The BESIII detector has a cylindrical symmetry with a total length of 5.6m and a radius of 2.6m and consists of four subdetectors for different tasks like particle identification and track reconstruction, energy measurement and muon spectrometry.



Scope of the DCS

The principal task of the DCS is to supervise and control the health status of the BESIII experiment and to guarantee a safe operation to the detector. The status of the BESIII experiment includes not only the status of the subdetectors but also the readout electronics, the PC farms, the experimental hall environment and other parameters from external systems.

The Challenges

- 1) About 9,000 data points covering dozens of physics parameters need monitoring or control.
- 2) Able to work continuously and stably for more than ten years in the harsh environment due to radiation and magnetic field.
- 3) The budget of the DCS is only 0.4% of the total cost of BESIII.

ARCHITECTURE

To provide a uniform and coherent interface to end user, the DCS is divided into three layers in its architecture:

➤ Front End Layer (FEL)

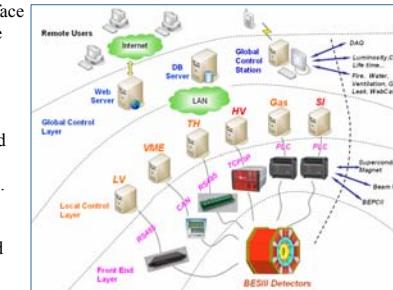
Simple sensors up to complex computer-based devices like embedded systems and PLC are utilized in the FEL to acquire parameters or execute control commands.

➤ Local Control Layer (LCL)

The LCL acquires data from the FEL and offers supervisory and control functions such as displaying, archiving and alert handling. Each Local Control Station (LCS) can work either in stand alone mode or integrated mode to satisfy the different stages of the BESIII experiment.

➤ Global Control Layer (GCL)

The overall supervisory and control of the BESIII detector will be performed from the Global Control Station (GCS). All the data of BESIII DCS will be stored in the DB Server and published to the Internet by the Web Server.



FRONT END LAYER

➤ Temperature and Humidity Monitoring

- ✓ Sensor: DS18B20, SHT75
- ✓ DAQ Board: custom-made boards
- ✓ RS485/USB Adapter: custom-made boards



➤ Low Voltage Power Supply Monitoring

- ✓ For the LV monitoring, the same technologies as in the TH monitoring system have been adopted except the TH sensors are replaced by amplifiers.



➤ High Voltage Power Supply monitoring and control

- ✓ CAEN SY1527LC HV power supply mainframe
- ✓ CAEN Library



➤ VME crates monitoring and control

- ✓ W-Ie-Ne-R VME crate.
- ✓ OPC Server developed by the IT-CO-FE group at CERN



➤ GAS monitoring and control & Safety Interlocking

- ✓ SIEMENS PLC
- ✓ OPC Server



LOCAL CONTROL LAYER

To acquire data from the FEL and offer supervisory and control functions, a software framework for LCL has been developed based on LabVIEW. The architecture of the framework is shown as the left figure.

The framework provided all the basic functions for the subsystems on LCS such as configuration, data storage, error and alert handling, logging, data storage and retrieve, system manage and GUI.

Each function is represented by a package of SubVIs, which make the framework highly flexible and scalable. It needs only little modifications on the configuration and driver package when apply the framework to a new specified subsystem.



GLOBAL CONTROL LAYER

➤ Global Control Station

In normal condition, the GCS will only display the summary information from the LCS and some key parameters such as run number, luminosity, current and lifetime. But when abnormal status occurs, the corresponding alarm or error messages will be popped up.

➤ Database Server & Web Server

Remote users can access all the real time and history data of BESIII DCS either in graph or text from the DCS webpage.
DB Server: MySQL
Web Server: Apache+PHP

