CMS HCAL
Detector Controls
Overview

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CMS HCAL control Tasks

1. Monitor readout box temperatures
(132 boxes)

2. Monitor rack mounted electronics
(26 crates)

3. Control and monitor high voltage supplies
(1800 PMT's, 500 HPD's)

4. Control and monitor front end electronics supplies
(132 supplies)

5. Control and monitorlaser calibration operations

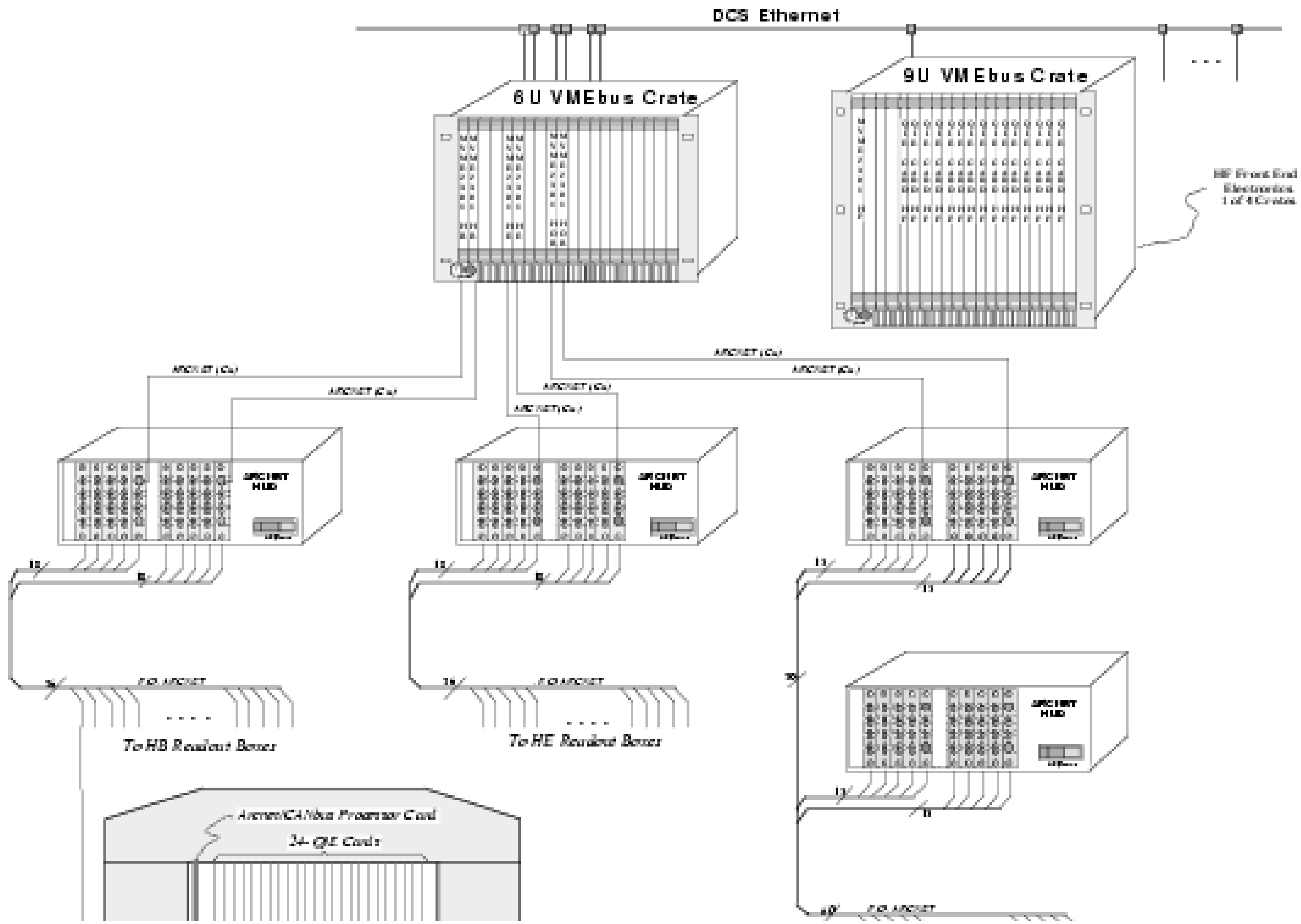
6. Control and monitor source calibration operations
including data acquisition and processing

7. Download and readout of electronics
(15000 channels)

8. Control and monitor test beam
equipment and devices

HCAL Detector Control System

M. Shea & John Elias 7 May 1998



I. HCAL Control Systems

A. Laser Calibration

1. Operate the neutral density filter mechanics for intensity control

2. Operate the output commutator to select destination

3. Operate and monitor the laser itself, e.g. on/off, temp, ...

4. Interface the laser trigger to an external pulse

5. Digitize the PIN diode intensity monitors

6. Provide readout of the PIN responses, filter and commutator - positions

7. Provide status and error information

This system is a non-intelligent local control interface for laser functions which also provides for high accuracy digitization of the intensity monitors. Some CSR space is needed for communicating status information, storing input information and reporting error conditions such as receiving trigger pulses too close together in time. Loading and retrieving information is via a VME32 interface.

B. LED Calibration

1. Load a DAC for intensity control

2. Load revolution and bunch counters for timing control

3. Control the on/off status bit for each of two LEDs

4. Provide readback of the DAC, counters, and status bits

This system is a non-intelligent control interface for LED functions distributed at about 150 HCAL locations. Loading and retrieving information is via a radiation tolerant fieldbus network.

C. Charge Injection

1. Load revolution and bunch counters for timing control

2. Control the on/off status bit

3. Provide readback of the counters and status bit

This system is a non-intelligent control interface for charge injection functions distributed at about 150 HCAL locations. Loading and retrieving information is via a radiation tolerant fieldbus network.

D. Front-end Electronics

1. Download CSR information to the front-end channel control ASICs

2. Readback CSR information from the front-end channel control ASICs

3. Download the embedded microprocessor in the control interface in each front-end electronics enclosure.

4. Provide limit and alarm functions for temperatures, voltages and currents readback from the front-end electronics enclosures

This system is a semi-intelligent control and monitor interface for the approximately 150 HCAL front-end electronics locations. Loading and retrieving information is via a radiation tolerant fieldbus network.

E. Photodetector High Voltage and Bias Voltage

1. Load parameter tables to a power supply module or crate

2. Communicate commands to a power supply module or crate

3. Parse and validate parameter values and commands before loading

4. Provide displays for status and voltage/current readings
5. Provide limit and alarm functions for voltages and currents

6. Annunciate tolerance alarms and trip alarms

7. Service external requests for status, voltage and current readings and commands_Provide a snapshot feature to record the immediate history of a trip

7. Provide a limited trending capability

This system is an intelligent local controller for a group of power supplies. It will conform to the JCOP model for HV control in that it will act as a master on the external communications path to send severe alarm messages and out of tolerance alerts. Also, the command repertoire will be a subset of the JCOP command set. Password protected internet access is foreseen. All commands and data values will be checked for validity before being transmitted to the supplies. Loading and retrieving information from the supplies is via a fieldbus network.

F. Radioactive Source Mover

1. Operate the commutator to select a destination

2. Operate the motor drive to position the source

3. Monitor status of operating parameters

4. Readout the source position transducer

5. Service external requests for commands, status and position readings

This system is a state machine coupled with a few IO peripherals and a network connection. Interconnections with the source mover are hard wired.

II. Development and Phases

A. Test beam and Building 186 Phase

Each control system prototype or demonstrator will be used in the test beam for development studies and control/monitor functions and in Building 186 for quality control and control/monitor functions. These systems are completely stand-alone, but will be required to save data in a standard format for future inclusion in a DCS database. Remote operation or view access may or may not be included. DAQ functions are implemented as CAMAC, VME, or PC modules.

The key point in this stand-alone phase is the systems should anticipate integration into a CMS wide detector control system at a later time. Basic capabilities such as acting as a real time data server and accepting commands and parameter changes from the network are to be built into the designs.

B. Electronics Burn-in at Point 5 Phase

As the electronics systems now operate at 40 MHz, some of the stand-alone systems (primarily calibration systems) will be integrated with a crate-based DAQ system. An overall control panel and display system is needed which communicates with all of the stand-alone control systems and the in-crate DAQ processors. Also included in this phase is a database facility. Remote operation and view access is necessary. Some degree of integration with the global detector control system is desirable particularly to facilitate data logging and remote access over a network. Display utilities, if ready at this time, would also be very useful.

With advice and assistance from the CMS DCS team, this level of integration and centralized operations can be constructed in a way which facilitates moving to the next level of integration needed for routine operations with the accelerator and the rest of the CMS detector. On the other hand, it is very important to preserve the capability for operating in this crate-based phase throughout the life of the experiment. CMS global systems are not likely to be available during maintenance periods and running with the global system is usually not efficient for trouble shooting and testing.

C. Accelerator Operations Phase

This final phase features full integration with CMS detector control and trigger and data acquisition systems. Control panel, alarm and limit, and display applications can be executed on any DCS processor, local or remote. The data acquisition system performs calibrations an order of magnitude faster than the crate-based system in the previous phase.