Alarms and Limits at the Collider Detector at Fermilab

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I. What is CDF ALARMS?

The Collider Detector at Fermilab (CDF), is a large high energy physics experiment containing about 20 different detector systems with a total of some 100,000 High Voltage channels. These channels are monitored and can also be set remotely using a Windows interface system called the Alarms, Limits and Remote Monitoring System (ALARMS). The CDF ALARMS is a node on an accelerator-wide network known as the Accelerator Controls Network (ACNET) system.

The Windows interface consists of several loadable menus known as parameter pages that can be accessed via mouse on any of the consoles that are part of ACNET. One index page, the Experiment (E)-page, is devoted to CDF. Once accessed this page has all ALARMS operations on several similar sub-pages. Every operation (Primary Application) has a separate name such as PA1060 for the CDF High-Voltage Control program and PA1076 for the Alarms Monitor, and has an entry on this index page.

CDF ALARMS provides the interface between the on-shift personnel and control and monitoring of the detector. ALARMS is fully integrated into ACNET, and therefore allows the monitoring of the machine status at the beginning and during beam stores as well. ALARMS is not read out in the "fast" data stream.

II. Main Functions of CDF ALARMS

There are three primary functions of the CDF ALARMS system: high voltage control, online monitoring and data logging. A brief comment on each is given below:

• CDF ALARMS is the primary mode of High Voltage Control and online status display for detector systems. The appropriate sub-page is accessible through the E- index. The High Voltage Control function can be used to set individual detector channels, segments of a certain detector system or an entire detector system.
• CDF ALARMS provides online monitoring and display of the HV status (on, off, or standby), the status of low voltage power, temperatures and the detector systems. A summary of set alarms is provided as well.
Low voltage supplies are in general only monitored by ALARMS, although there are a few exceptions. Temperatures, pressures, flows etc. are continuously monitored by ALARMS.
• Data-logging and time plots for luminosity and various detector functions are also plotted on the CDF ALARMS consoles.

III. Hardware Components for the System

The CDF control room contains three ACNET Consoles (Fig 1) and two dedicated monitors for displaying detector status. The Consoles are presently VAX workstations running the VAX/VMS operating system. Any X-station can run the ALARMS program and display the various plots pertaining to detector status.

The heart of the monitoring system is two "i386" Front End processors that continuously monitor the detector from the first floor of the B0 assembly building. The ACNET consoles communicate with the Front End processors via ethernet, and the Front End processors communicate with the Central Database and Operations VAX via ethernet as well.

For the purpose of monitoring low voltages, temperatures, and pressures the Front End communicates with CAMAC-based modules directly using a Kinetic Systems 32- channel Scanning ADC. High Voltage control is either through direct communication to a CAMAC-based HV Controller (CAEN System) or via a series of PCs running a dedicated program monitoring several subsystems. One system (VTX) is controlled using a DAC. The Fastbus system of CDF has dedicated hardware to convert power supply currents, voltages, temperatures etc. to voltages which are connected to scanning ADCs located in CAMAC nearby.

IV. Database and Alarms Setting

Each device or channel that is monitored by ALARMS has a unique ACNET database entry that includes reading, setting and status properties. The database entry also contains a brief description of the device and information necessary for the front end to control it. The program DABBEL is used for database entries and is supported by the Accelerator Division. Only a few designated experts have access to this database.

Alarms are handled by an application known as AEOLUS running on the ALMOND cluster in the Accelerator Division. The Front End reads the hardware value for each channel and compares to its database of acceptable ranges. If the channel is out of tolerance, the Front End sends an alarm report to AEOLUS which forwards it to the Consoles. The appropriate primary application (PA1076) at CDF receives this information, organizes the results and displays them on the monitor.

V. Alarms Display Page

We display three types of Alarms: normal, ignored, and severe. Severe alarms require immediate action and are triggered if crucial channels are out of tolerance. Data taking is stopped and cannot resume until the problem is fixed; severe alarms are announced by DECTALK as they appear.

Normal alarms indicate a channel that may have drifted out of tolerance, but data taking can continue. However if a large number of normal alarms appear, then a severe alarm is set, and data taking is inhibited.

Ignored alarms allow the shift personnel to be reminded that a number of problems do exist but that these can be fixed later. Normal alarms can be ignored by clicking on the alarm. Severe alarms cannot be ignored.

The Alarms display page also indicates the status of various subsystems, the time, and the number of events being processed from AEOLUS. A window at the bottom communicates directly with the user; warnings, errors and informational messages appear here as well.

VI. Summary

The CDF ALARMS system has been running successfully for several years and no major upgrades are planned for it. The collaboration will continue to use the system through Run-II, or roughly the year 2002.

VII. Acknowledgments

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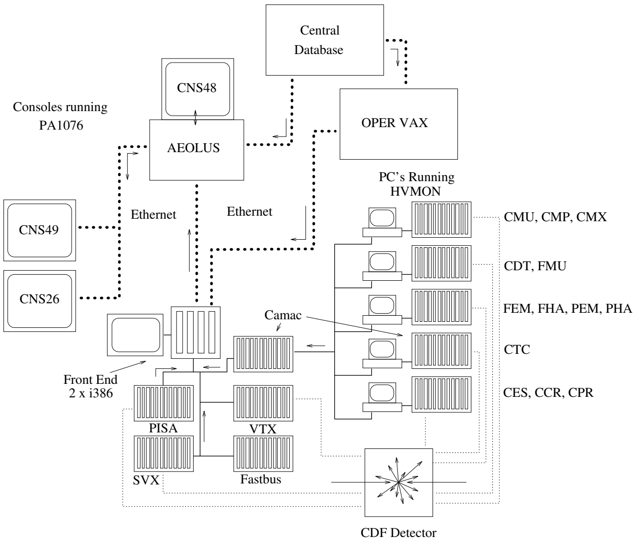

Figure. 1. A schematic of the CDF ALARMS system showing the consoles, Front End, and control of the detector systems.