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CMS

Front-End Electronics Configuration System for CMS

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Outline

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● Tracker beam test DCS overview
● Electronics configuration system
● Tools: A generic database navigator, Data control access, Alarm mechanism
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- CMS is one of the 4 experiments of the next CERN accelerator LHC. CMS detector: 12500 tons, ∅15mx21.5m, 1Tbits/s (after LV1). See next slide.
- Supervision of CMS Detector Control System (DCS) has to control classical “slow control” (power supplies, gas system, ...) and FE electronics configuration.
- A system using an Oracle 8i database for storage and a SCADA for control has been designed for the FE configuration.
- This FE configuration system has been applied to the Tracker subdetector of CMS (a detector made out of ~250 m² Si) and used in a beam test.
Tracker DCS overview (used in test beam)

- FED
- DAQ
- SCADA controls/GUI
  - Electronic Log Book
  - Access Control
- CAEN HV PS
- Interlock
- Temperature readout
- Humidity readout
- Modules (x 6)
- FE supervisor
- FEC
- Web I/F
- DB
Tracker electronics parameters

- Tracker channels read out by chips called APV (Analog Pipeline Voltage mode).
  - pre-amplification
  - shaping
  - sampling
  - buffering (128x192 array of capacitor cells)

- Several parameters must be loaded into APVs:
  - shaper parameters
  - latency: at trigger delivery, the APV will output the value read latency x 25ns ago.

- Some other chips need parameters (PLL, APVMUX).

- In all, a few Mbytes of chip parameters.
  - Several versions (~100) of these parameters will be stored: need to keep trace of the parameters used for a given run.
Electronics configuration system overview

- **Database**
  - user/process
  - raises alarm
  - browsing
  - download request
  - parameters
  - read back values

- **FE supervisor**
  - SCADA controls/GUI

Diagram shows the interaction between the database and the FE supervisor through SCADA controls/GUI.
The configuration is controlled by the SCADA, which checks user permissions (access control).

The PVSS II (SCADA) control system sends a download request to a PVSS II API running in the FE supervisors.

On this request, each FE supervisor fetches the parameters of its FE from the DB and downloads them.

Each FE supervisor can then read back the values from its FE and write them into the DB.
PVSS II SCADA

- Industrial product from Austrian company ETM.
- Device oriented.
- Provides standard SCADA features: industrial hardware access, alarming, archiving, logging, scripting, GUI.
- Open to custom hardware (API).
- Runs on Windows and Linux.
- Scalable, distributed, hierarchy of systems.
- http://www.etm.at
A generic database navigator, DBNav

● A generic database browser has been developed using GUI capabilities of PVSS II.

● It’s been designed to show database content in tree view(s).
  ➢ The browser retrieves by itself data tree structure.
  ➢ User selects the tables containing the data.
  ➢ Not limited to one tree structure.

● It supports data versioning and a registration mechanism for DB write access control.
Data can be shown using different trees registration mechanism.

Data structure retrieved from DB Parameter name retrieved from DB
A registration mechanism has been developed using Oracle control access tools for data to be downloaded.

- SCADA system is the “administrator” of this access control.

DB access control based on user login is still available (e.g. for read access).
Data control access

1. User writes a new version.
2. Register the new version (with a description for logbook).
3. SCADA revokes write permission for the version.
4. No more write access to registered version.
5. FE can be used for FE config.

Note: FE config can be used for FE configuration.
FE electronics parameter alarm mechanism

- FE supervisors write in DB read back values.
- Then, the DB:
  - compares parameters with limits
  - computes the alarm message (one for the whole parameter set)
  - sends this message to PVSS II.
Parameter version selection

- Run number: 20991
- Run type: PHYSICS
- Parameter version: 359.0
- Latency set to 46,46,45,47,46,46
- State
  - Running
  - Pause
  - Stopped
  - Error
  - Running in batch mode
- Event #: 6241565
- DAQ options
  - Max Events per spill: 500
  - Run stopped on user request
  - Event count per run: 3
  - save on disk
- Batch mode
  - single
  - batch
  - Batch Setting...
  - Stop Run
  - Pause Run
Additional developments made for tracker test beam (see P. G. Verdini’s talk)

- High voltage control.
- Trending of humidity, temperature.
- Interlock of Power Supply based on PLC, SCADA is informed.
- DB-based electronic log book (parameter version, particle type, energy, description, start/stop time). Web interface for this logbook.
- Test beam control including communication with DAQ.
- Integration of DCS and test beam control in a single UI.
- Online help based in HTML accessible from the UI menu.
Conclusion

- System has been running uninterrupted in production conditions during the October’01 tracker test beam.
- Has been designed to be scalable to final system size.
- This system is very generic and can be easily used for other electronics configuration.
- The same environment is used to control FE configuration and standard slow control devices (e.g. power supplies).
- The logging of the parameters is essential for the test beam data analysis and for the final system.