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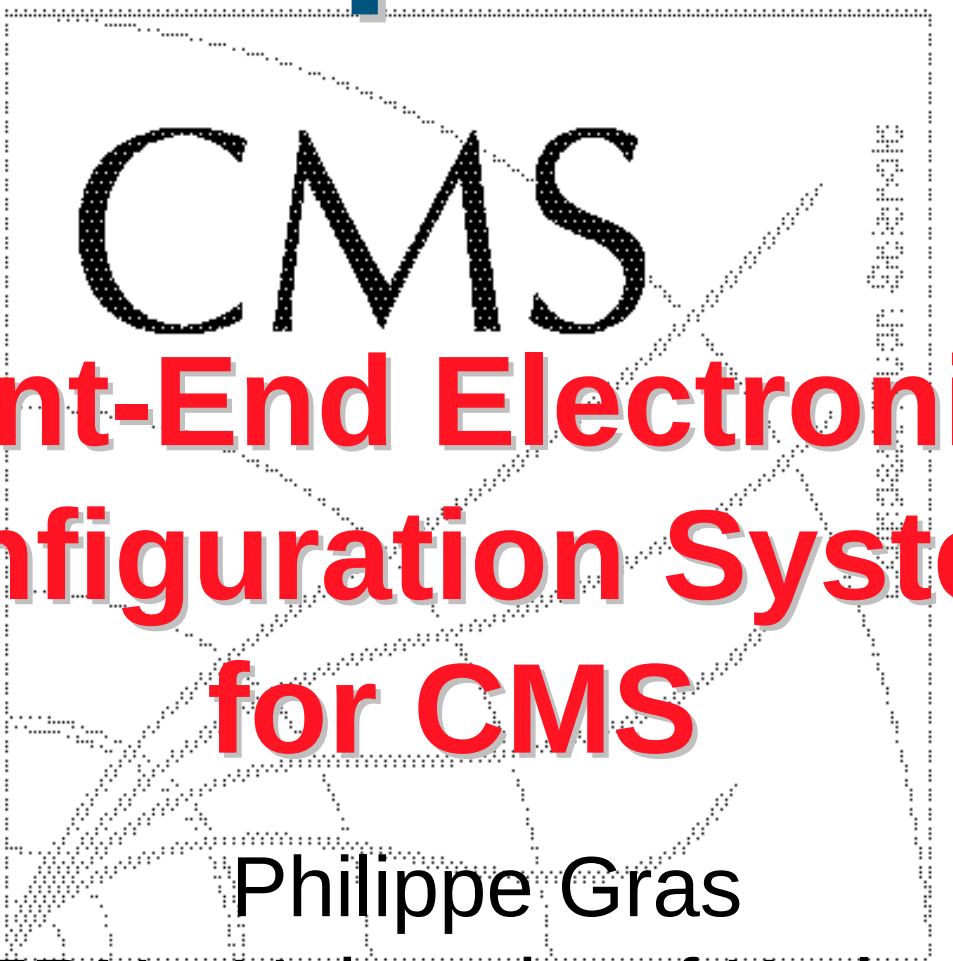


Front-End Electronics Configuration System for CMS

Philippe Gras
CERN - University of Karlsruhe

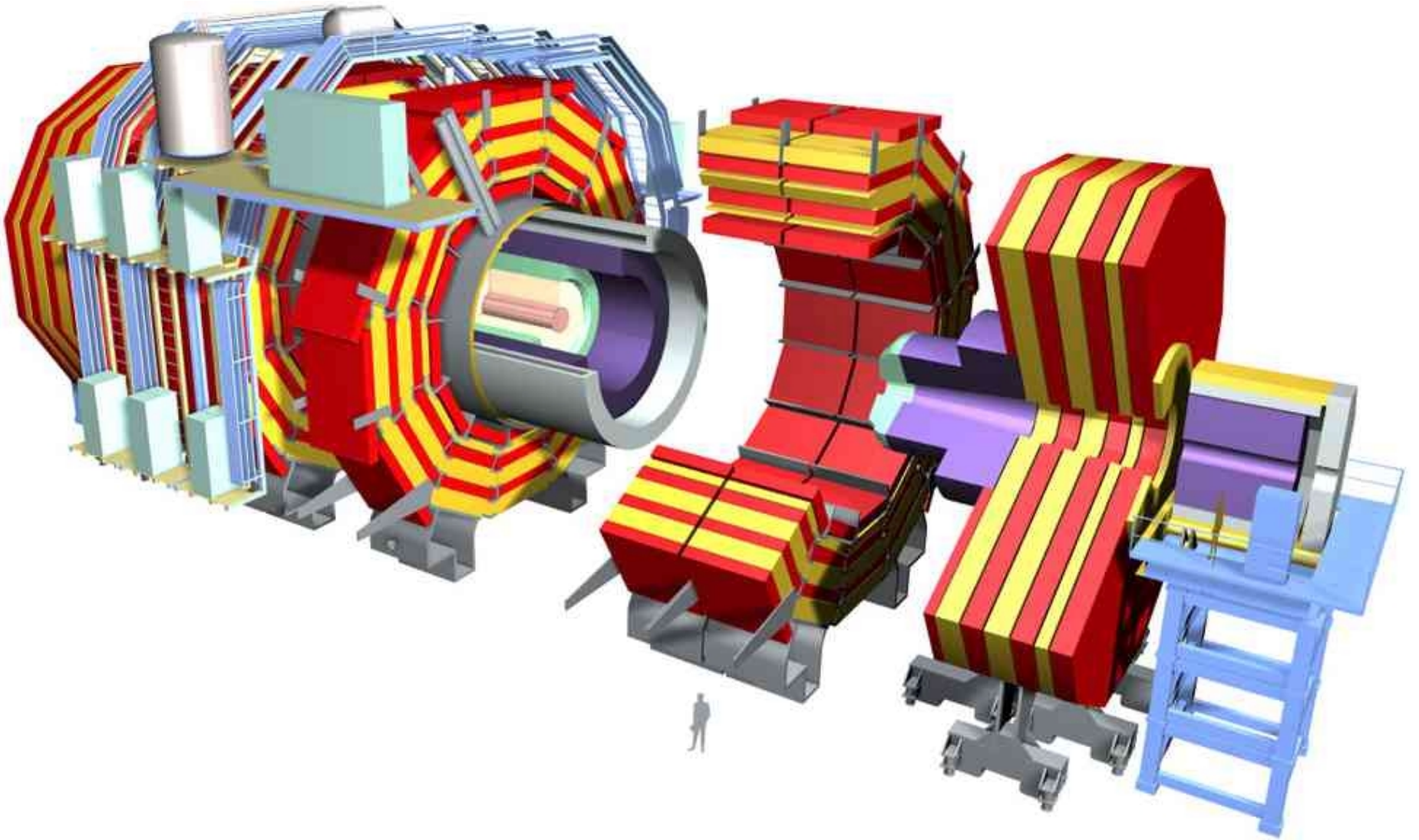
Outline

- Introduction
- Tracker electronics parameters
- Tracker beam test DCS overview
- Electronics configuration system
- Tools: A generic database navigator, Data control access, Alarm mechanism
- Additional development made for tracker test beam
- Conclusion

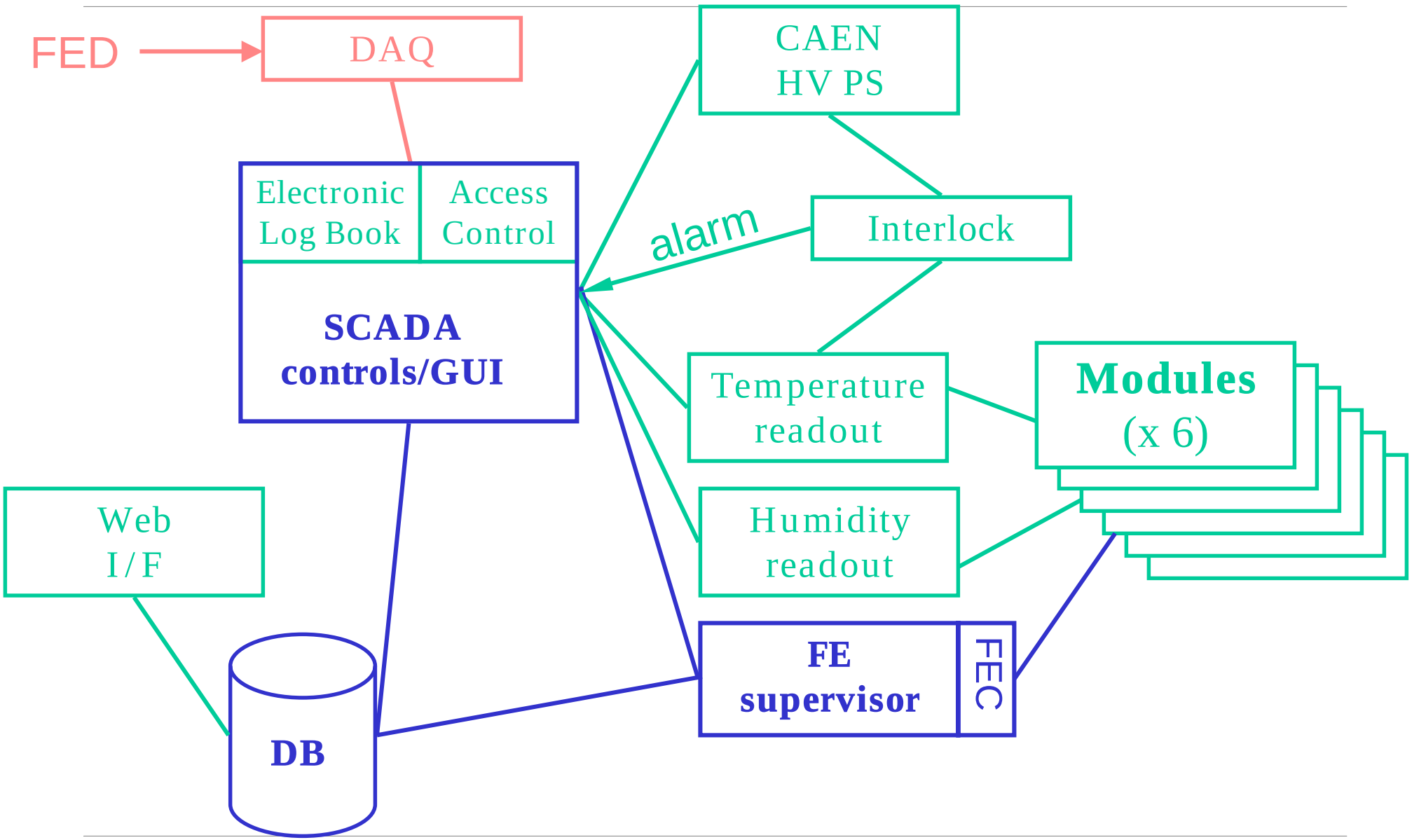
Introduction(1)

- 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 .

Introduction (2): CMS detector



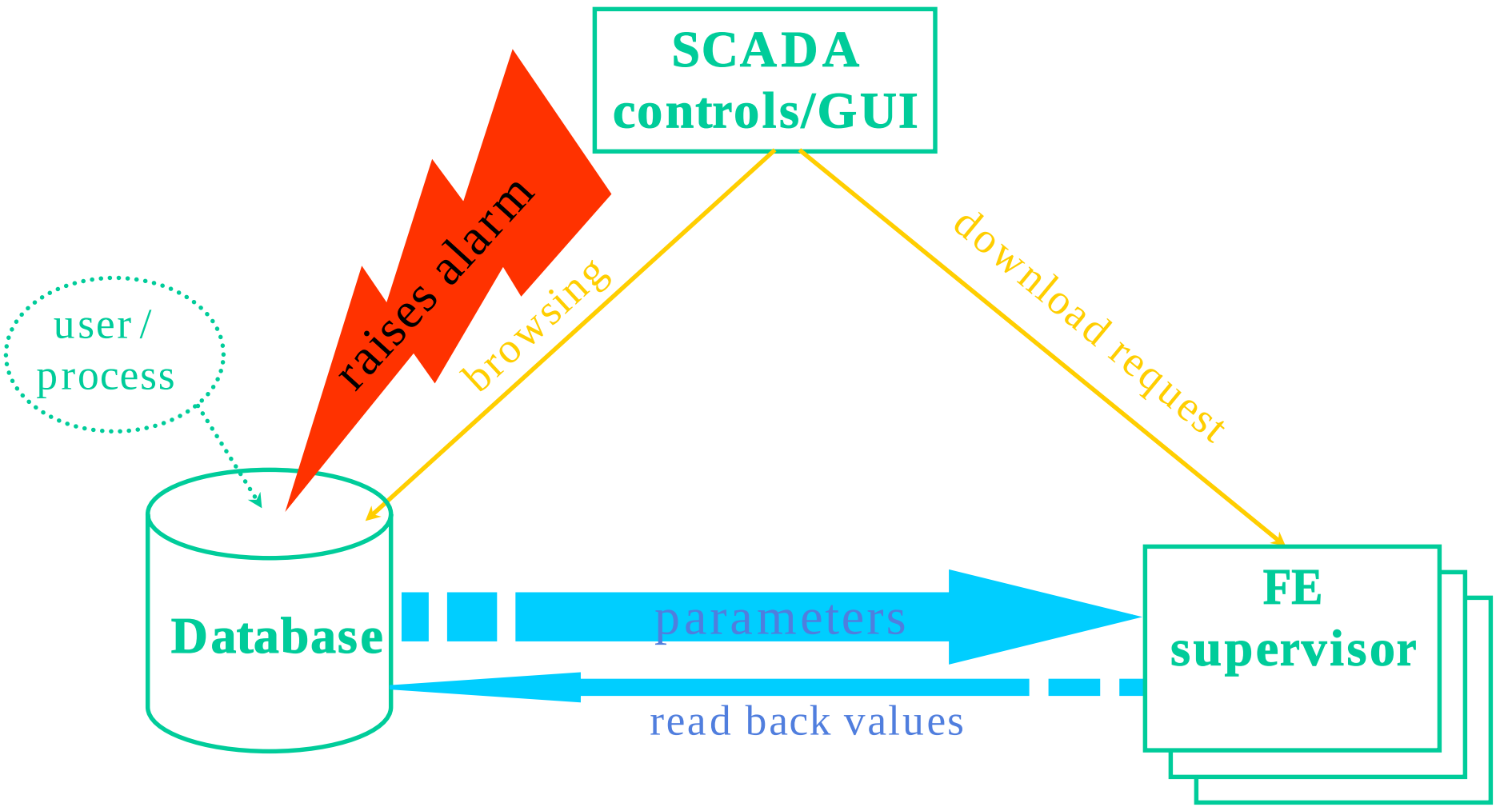
Tracker DCS overview (used in test beam)



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



Configuration mechanism

- 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.

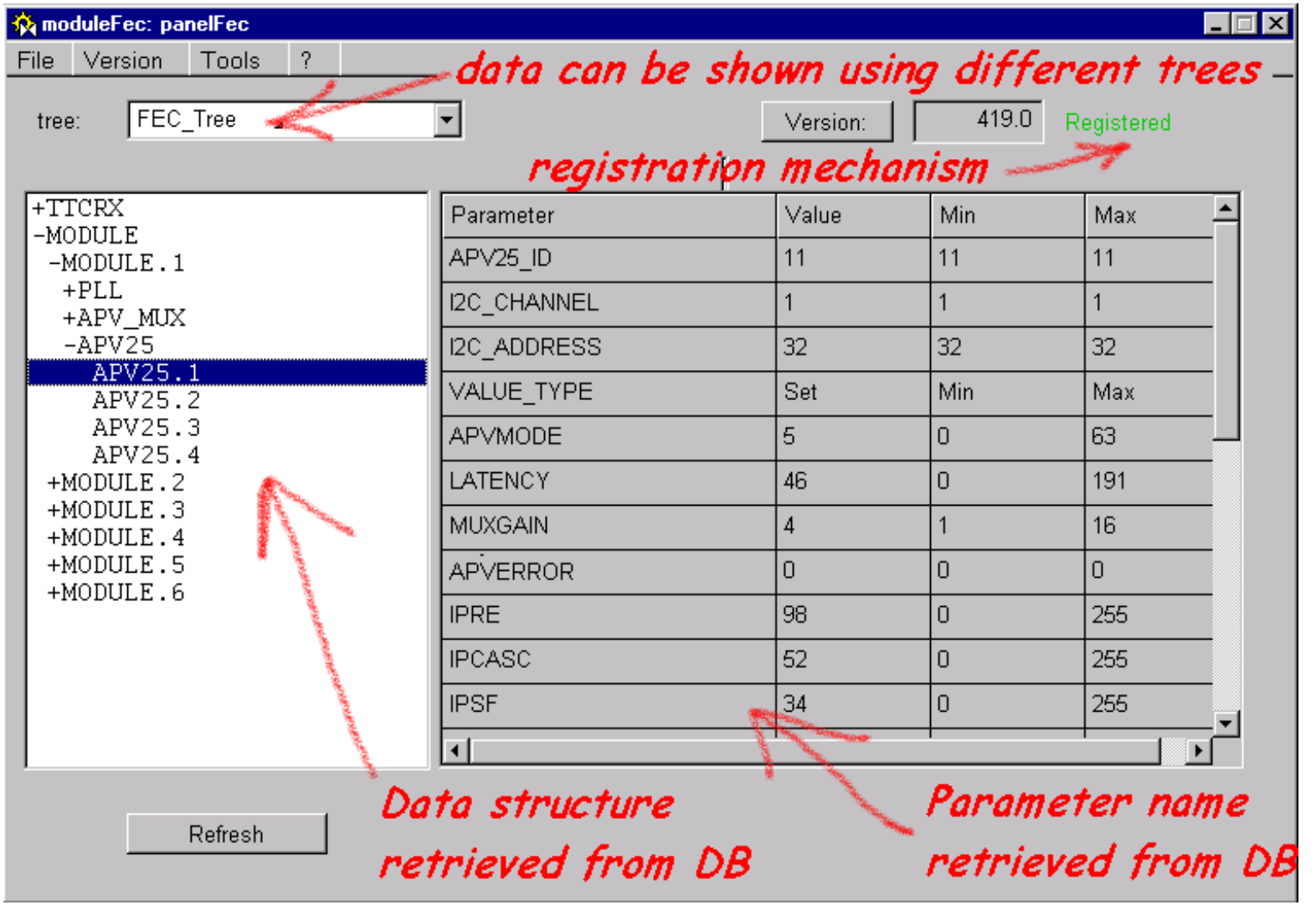
PVSS II SCADA

- 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.

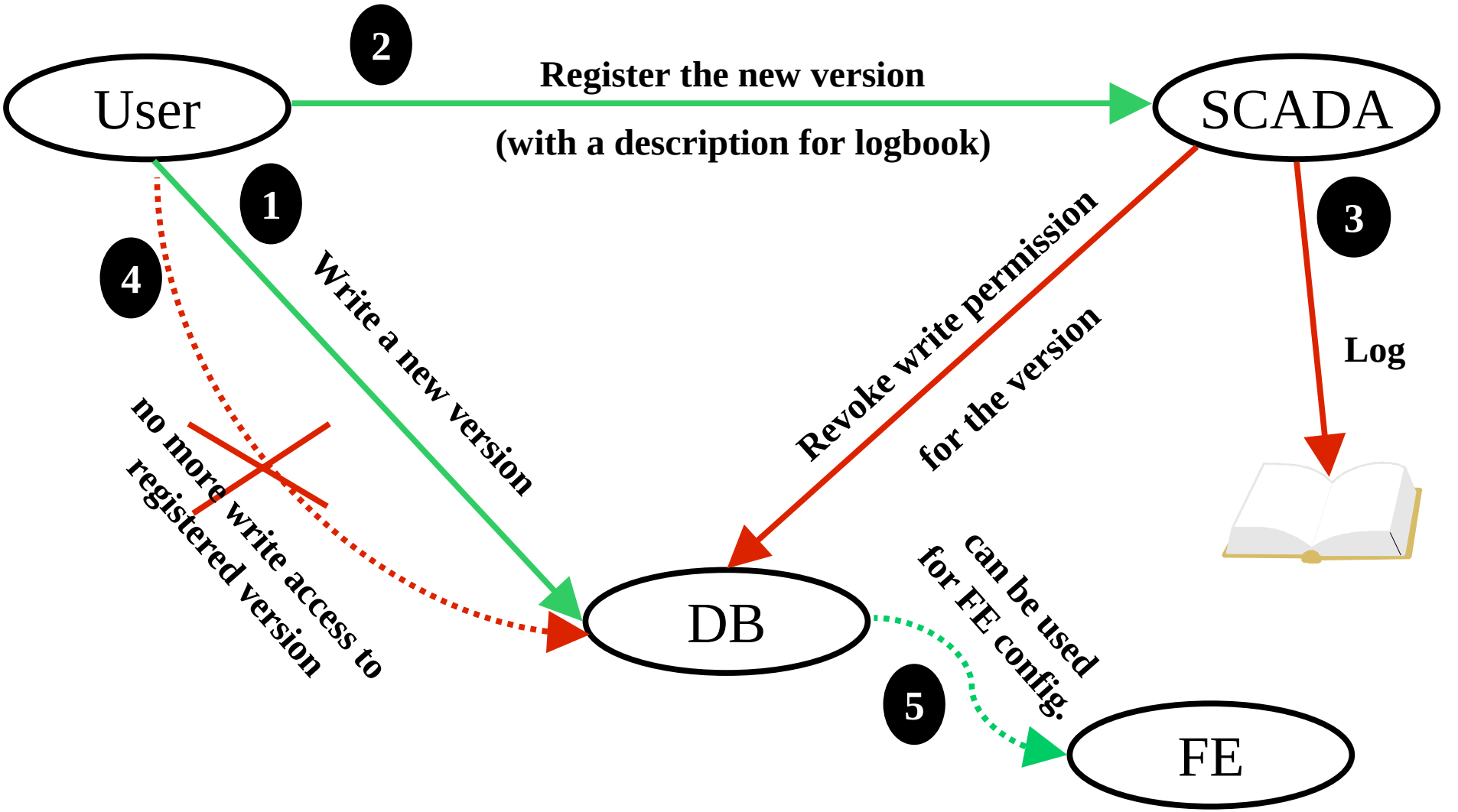
DBNav snapshot



Data access control mechanism

- 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).

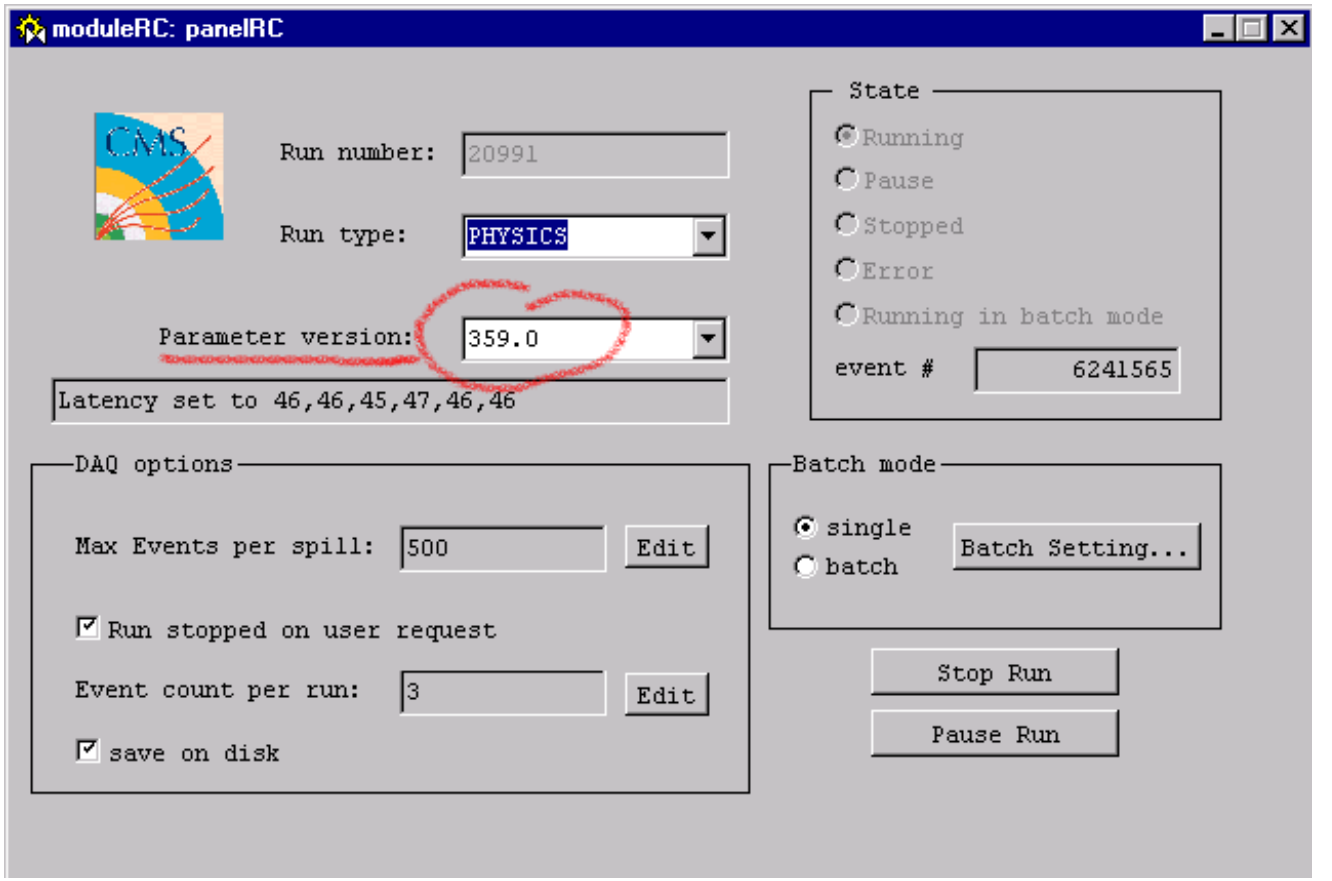
Data control access



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



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.