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The CMS logo is rendered in a dotted, pixelated font. It is positioned at the top of a large, faint dotted square frame that serves as a background for the central text.

CMS

Front-End Electronics Configuration System for CMS

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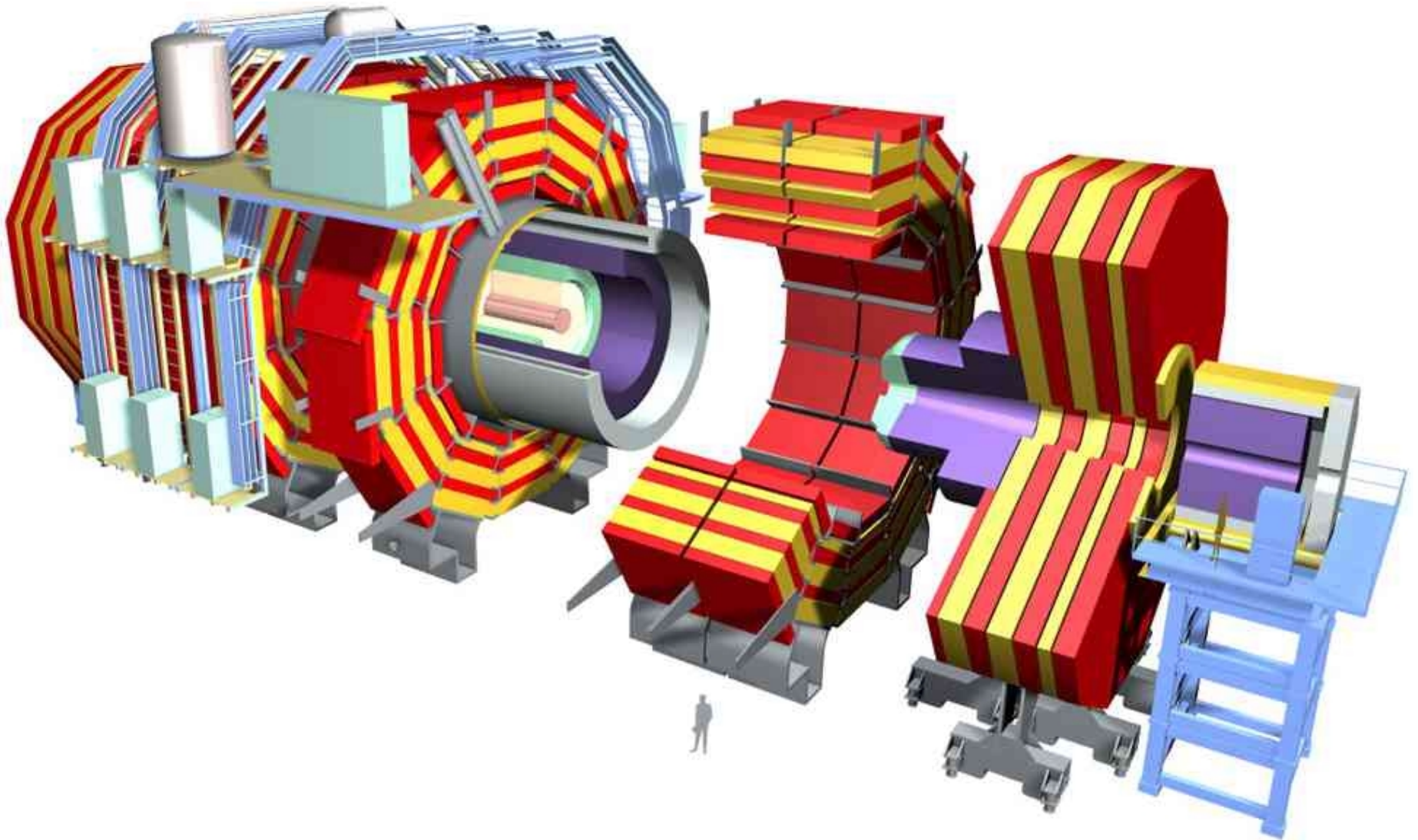


Introduction(1)

- CMS is one of the 4 experiments of the next CERN accelerator LHC. CMS detector: 12500 tons, $\varnothing 15\text{m} \times 21.5\text{m}$, 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 $\sim 250 \text{ m}^2 \text{ Si}$) and used in a beam test .

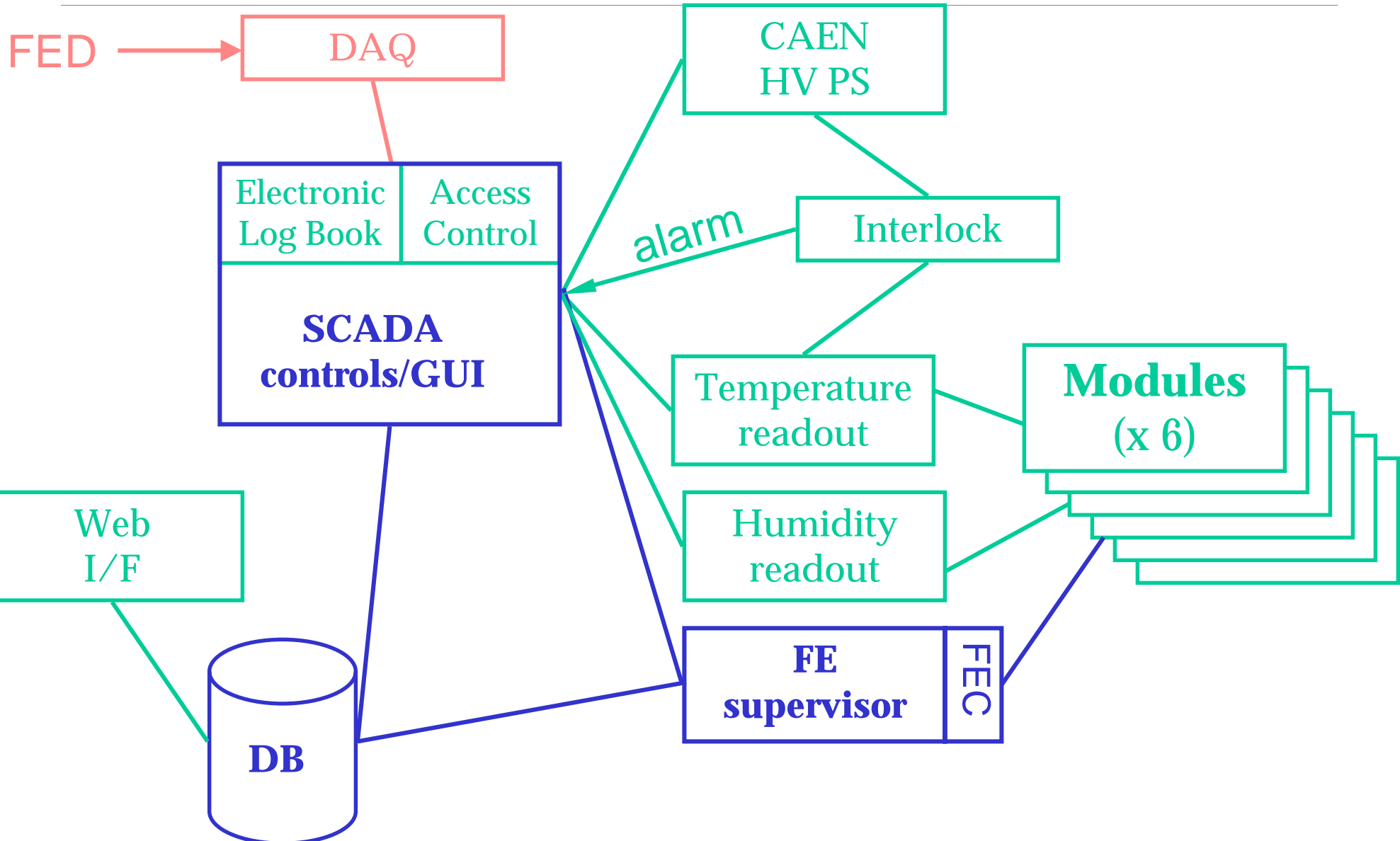


Introduction (2): CMS detector





Tracker DCS overview (used in test beam)



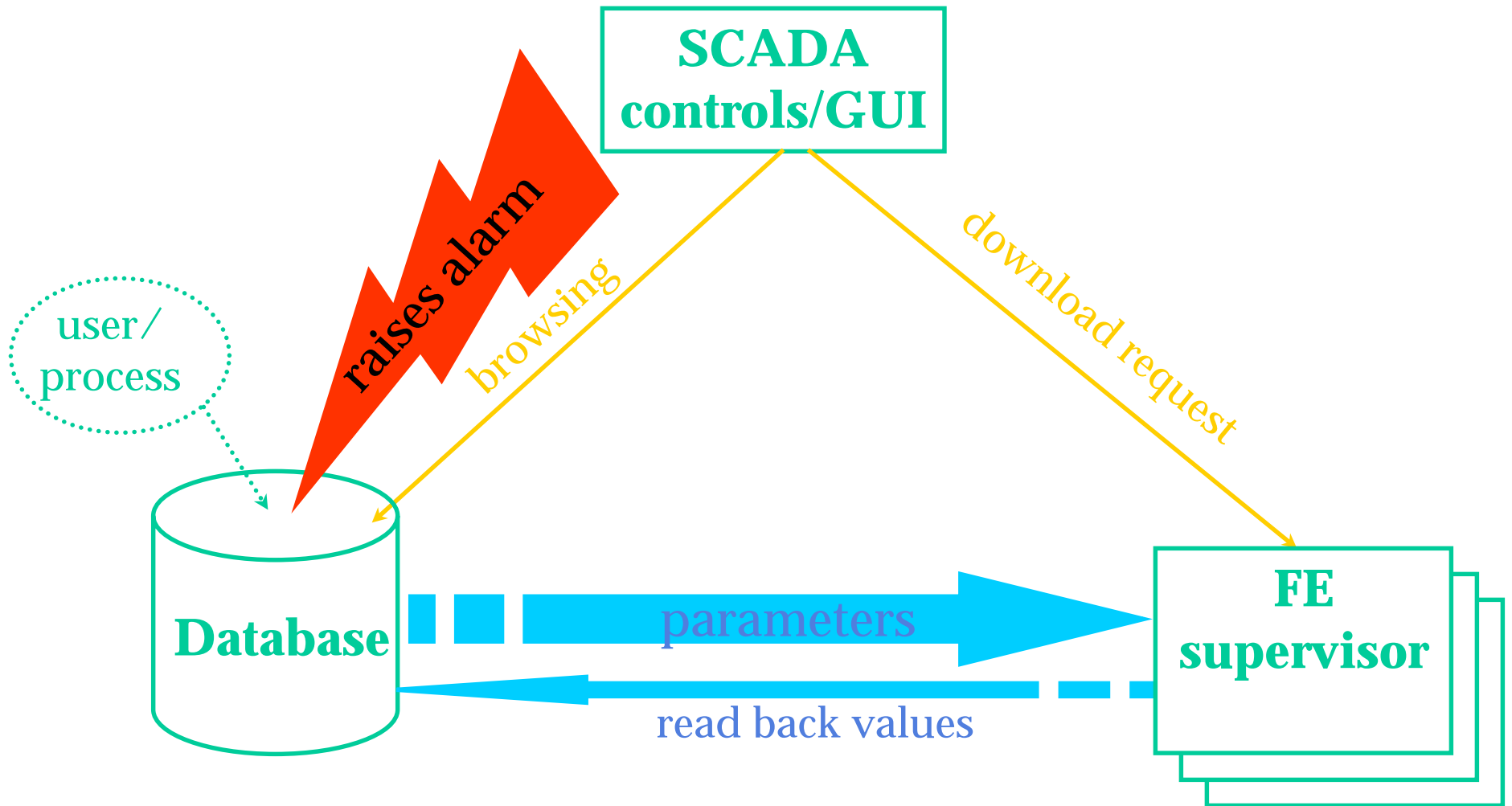


Tracker electronics parameters

- 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

moduleFec: panelFec

File Version Tools ?

tree: Version: Registered

data can be shown using different trees

registration mechanism

Parameter	Value	Min	Max
APV25_ID	11	11	11
I2C_CHANNEL	1	1	1
I2C_ADDRESS	32	32	32
VALUE_TYPE	Set	Min	Max
APVMODE	5	0	63
LATENCY	46	0	191
MUXGAIN	4	1	16
APVERROR	0	0	0
IPRE	98	0	255
IPCASC	52	0	255
IPSF	34	0	255

+TTCRX
-MODULE
-MODULE . 1
+PLL
+APV_MUX
-APV25
APV25 . 1
APV25 . 2
APV25 . 3
APV25 . 4
+MODULE . 2
+MODULE . 3
+MODULE . 4
+MODULE . 5
+MODULE . 6

Refresh

Data structure retrieved from DB

Parameter name retrieved from DB

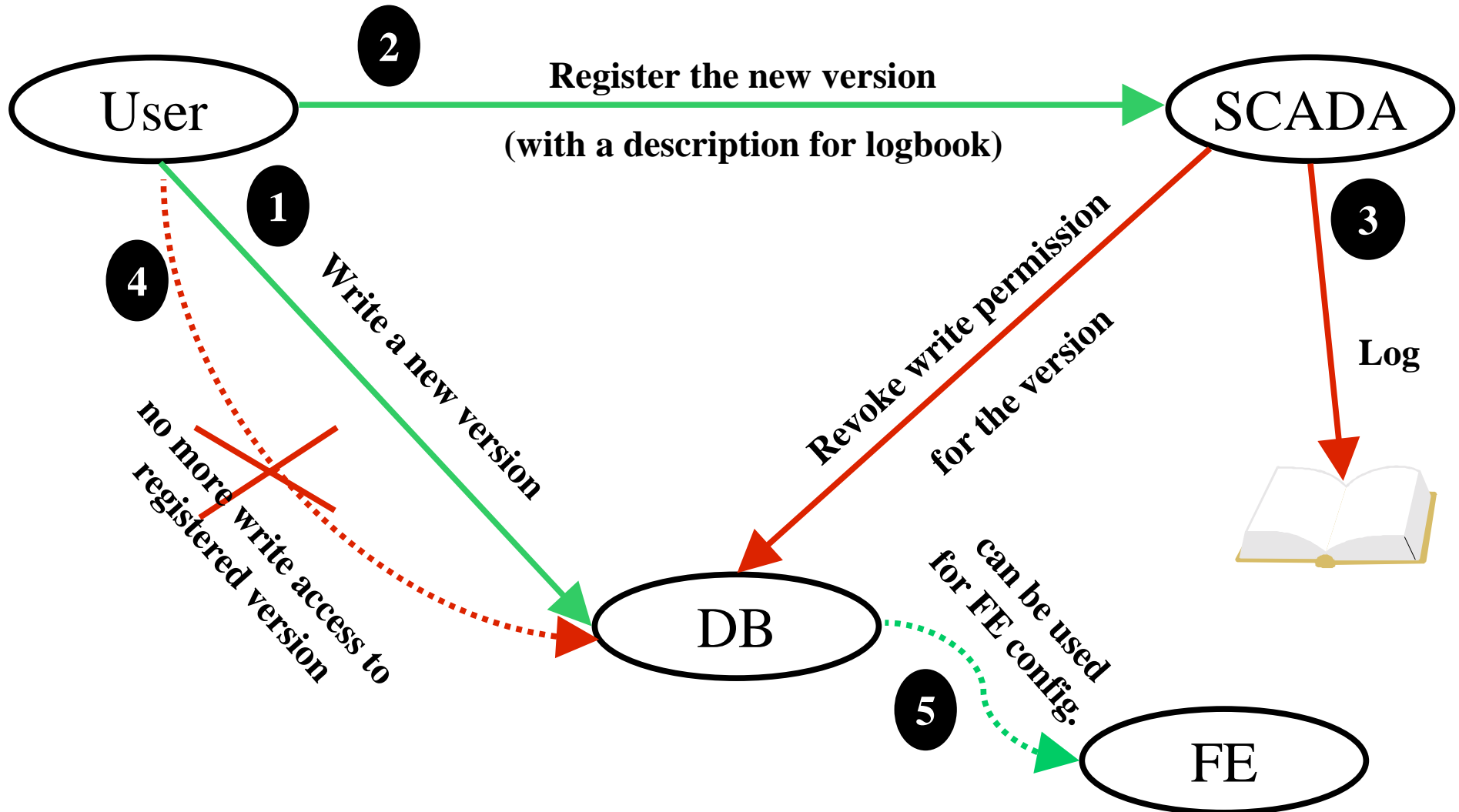


Data access control mechanism

- 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

moduleRC: panelRC

 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 Edit

Run stopped on user request

Event count per run: 3 Edit

save on disk

Batch mode

single Batch Setting...
 batch

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.