DEVELOPMENT OF DETECTOR CONTROL SYSTEM SOFTWARE SIMULATOR FOR ELECTROMAGNETIC CALORIMETER PHOS

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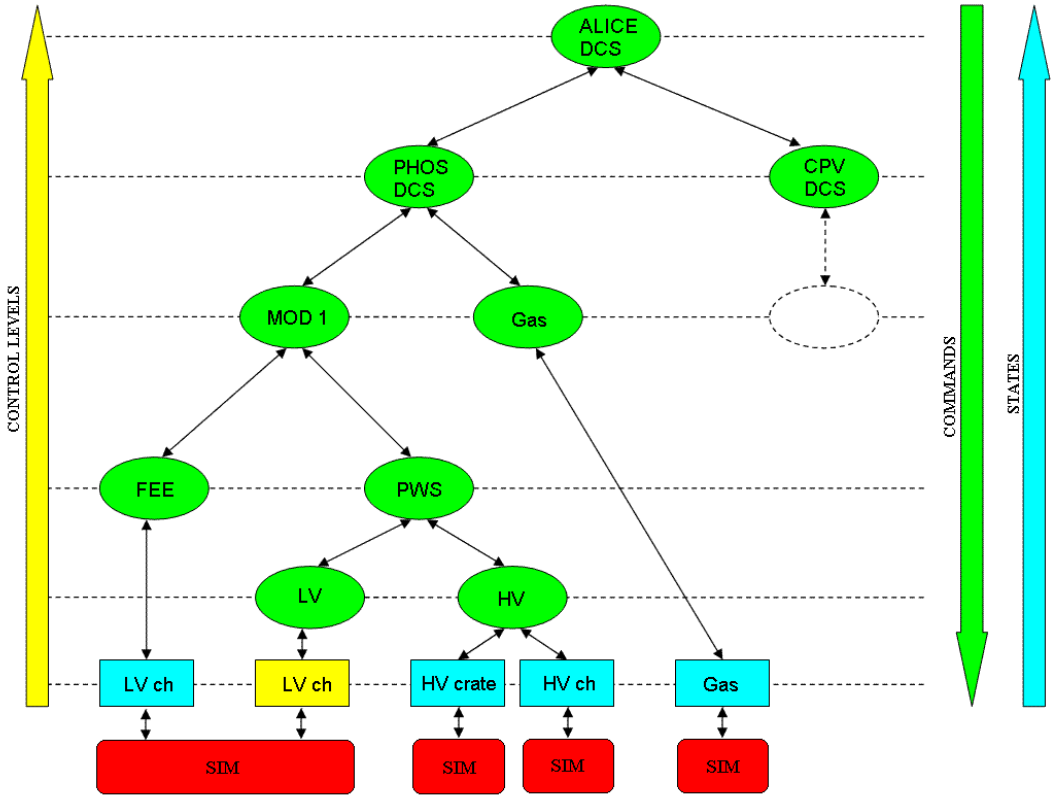
Devices and systems entering the PHOS calorimeter structure

Subsystems and devices as a part of three modules of PHOS detector:

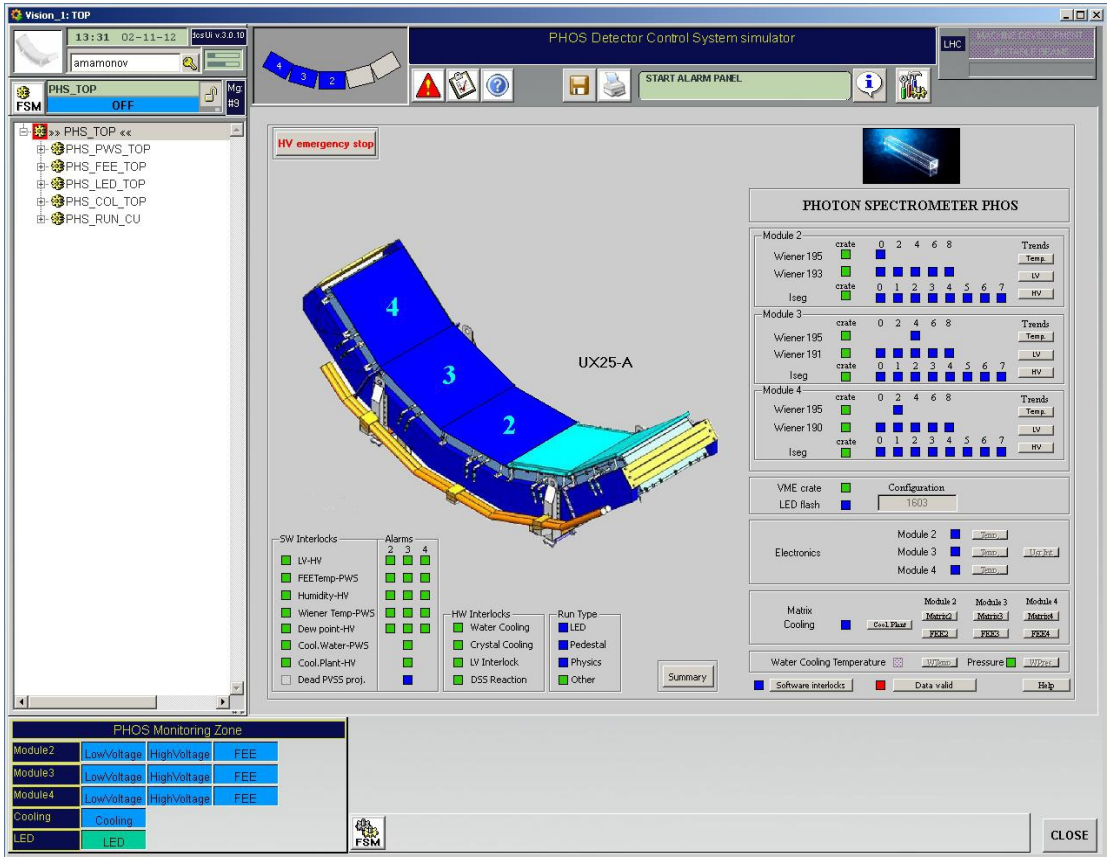
- ✓ Cooling and thermo stabilization system of crystals $PbWO_4$ matrix:
  - refrigerating machine;
  - 96 temperature sensors;
  - 15 humidity sensors;
- ✓ Monitor system based on Kingbright light diodes:
  - monitor system for each module;
  - WIENER VME power supply crate.
- ✓ Detector's electronics system:
  - 624 registering units FEC;
  - 12 control units RCU;
  - 24 trigger units TRU.
- ✓ Water cooling system for electronics:
  - common pumping station;
  - 3 locking valves.
- ✓ Gas supply system:
  - locking valve.
- ✓ Power supply system:
  - 5 power supply crates;
  - 18 low voltage channels;
  - 24 high voltage channels.
- ✓ ALICE control levels communication system.
- ✓ Alerting messages and detector's software protection interlock system.

Control structure of PHOS calorimeter



Detector control system of PHOS calorimeter is an hierarchy system which includes devices (blue color) and supervisory levels (green). Simulators (red) model the real devices' behavior and form an independent hardware abstract level.

Graphical user interface



The detector control system contains: users' interfaces, a system of rights and access, diagrams, a system of control over connection with devices, an alerting message system, a software and hardware detector protection system, a detector's automatic configuration system depending on the run type.

What is a simulator of detector control system for PHOS calorimeter?

Fundamentals for the simulator's development:

- ✔ More than 15.000 code lines.
- ✔ All the real devices are substituted by software analogs, based on statistics, acquired in the experiment ALICE from 2009 till 2012.
- ✔ A system of detector control does not know if it is operating with real devices or their software analogs.
- ✔ The following issues are simulated by the software:
  - ➢ Humidity measurements;
  - ➢ Temperature measurements;
  - ➢ Voltages and currents on installations;
  - ➢ Device states;
  - ➢ Device behavior in case of error appearance.
- ✔ A user can manually specify a fault probability of devices and systems.
- ✔ Independent operation of all devices – each in its own thread.

- ✔ Development environment:
  - ➢ Windows XP Professional / Windows Server 2003 operation system;
  - ➢ commercial system of control and data acquisition SCADA ETM PVSS II 3.8;
  - ➢ CERN Framework software;
  - ➢ built-in C-like scripting language CONTROL.

Simulator's advantages

Advantages of the simulator:

- ✓ Critical situations simulation
- ✓ Errors debugging
- ✓ Elaboration of user's graphic interfaces
- ✓ Elaboration of software protection interlocks and alarm messages
- ✓ Testing of installed software updates
- ✓ Preparation of documentation
- ✓ Training of ALICE DCS operators, PHOS experts
- ✓ Possibility of installation at any institute or university which are part of ALICE collaboration
- ✓ Possibility of integration of this simulator into ALICE detector control system
- ✓ Possibility of development of ALICE CPV detector control system without real devices with PHOS simulator libraries