

STRUCTURE OF CONTROL OVER ELECTROMAGNETIC CALORIMETER PHOS IN ALICE EXPERIMENT

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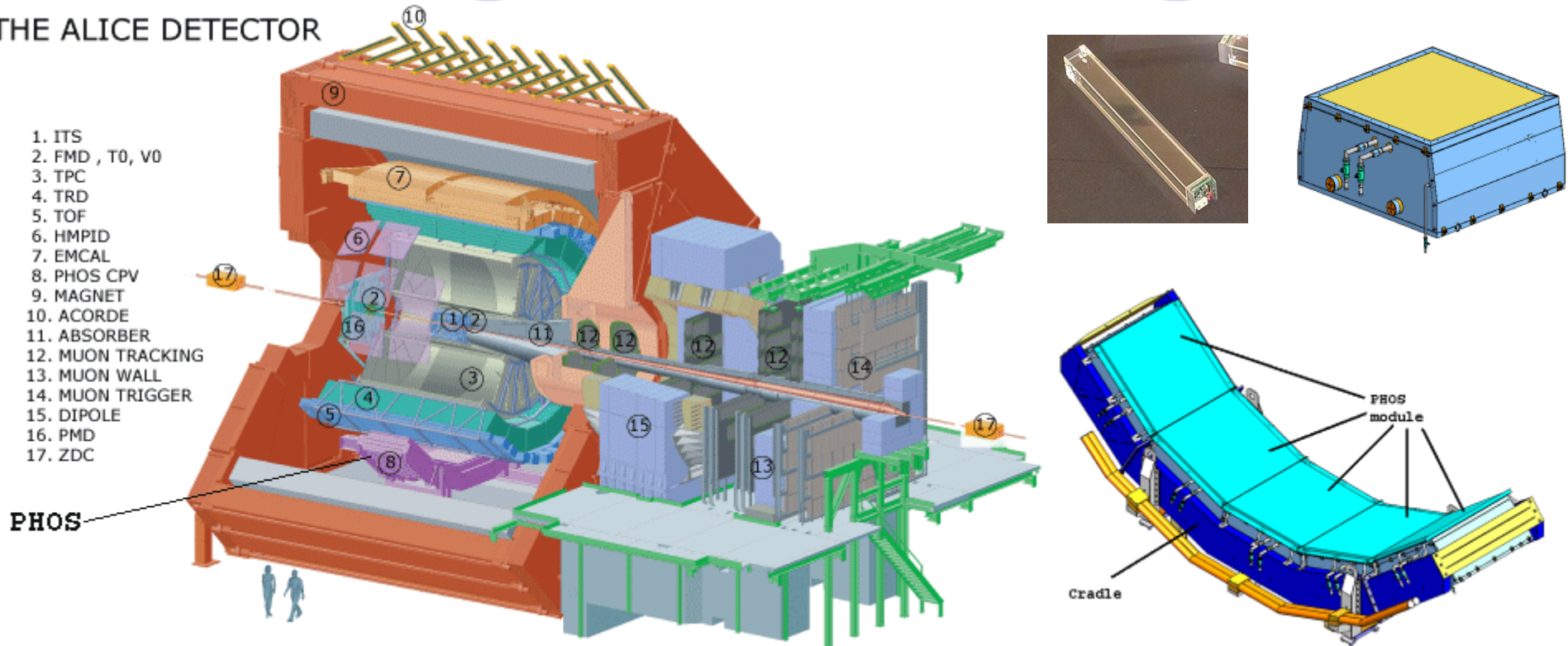
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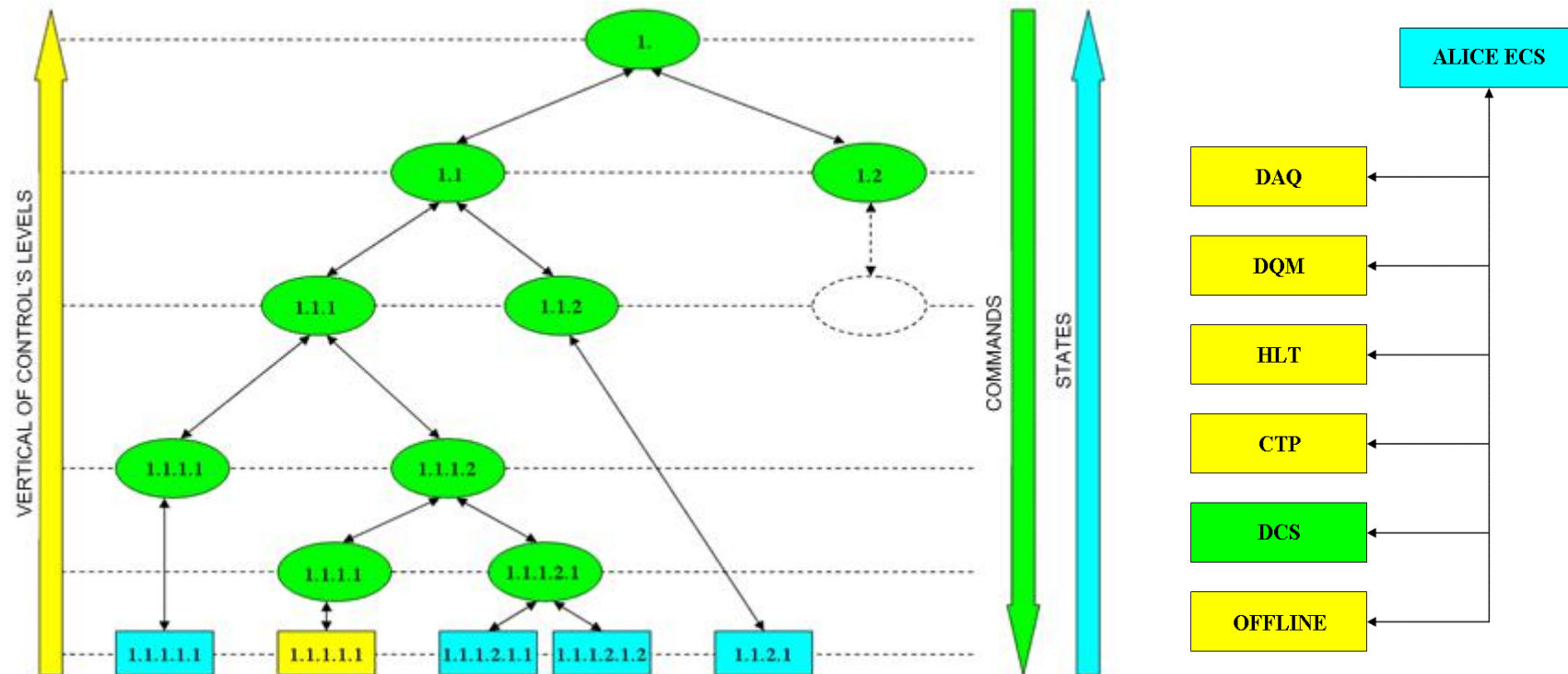
ALICE experiment and electromagnetic PHOS calorimeter

THE ALICE DETECTOR



The goal of ALICE experiment, conducted on the Large Hadronic Collider LHC — study of quark-gluon plasma, arising at collision of super-high energy ion beams. Electromagnetic calorimeter PHOS is a part of ALICE facility, consists of three modules and has 10752 measuring channels on the basis of crystals PbWO_4 , photodiodes Avalanche and microchips ALTRO.

Hierarchy structure of experiment control



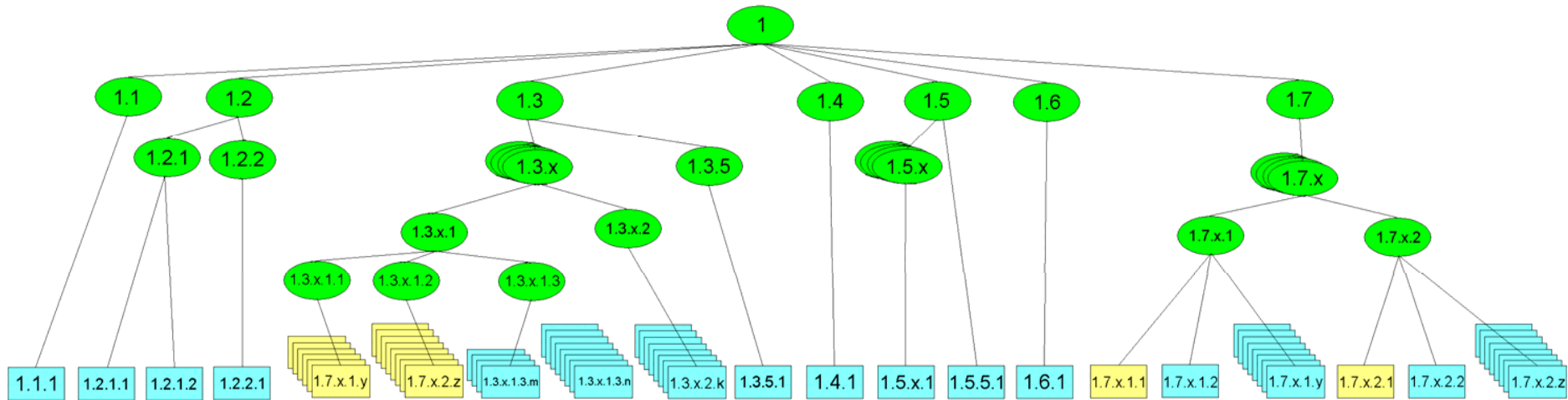
Arrangement of ALICE experiment represents a hierarchy structure of subsystems, one of which is a Detector Control System. Each detector control is built as a tree, consisting of finite devices, levels-supervisors and logical levels.

Devices and subsystems forming the calorimeter

Subsystems and devices being a part of PHOS detector:

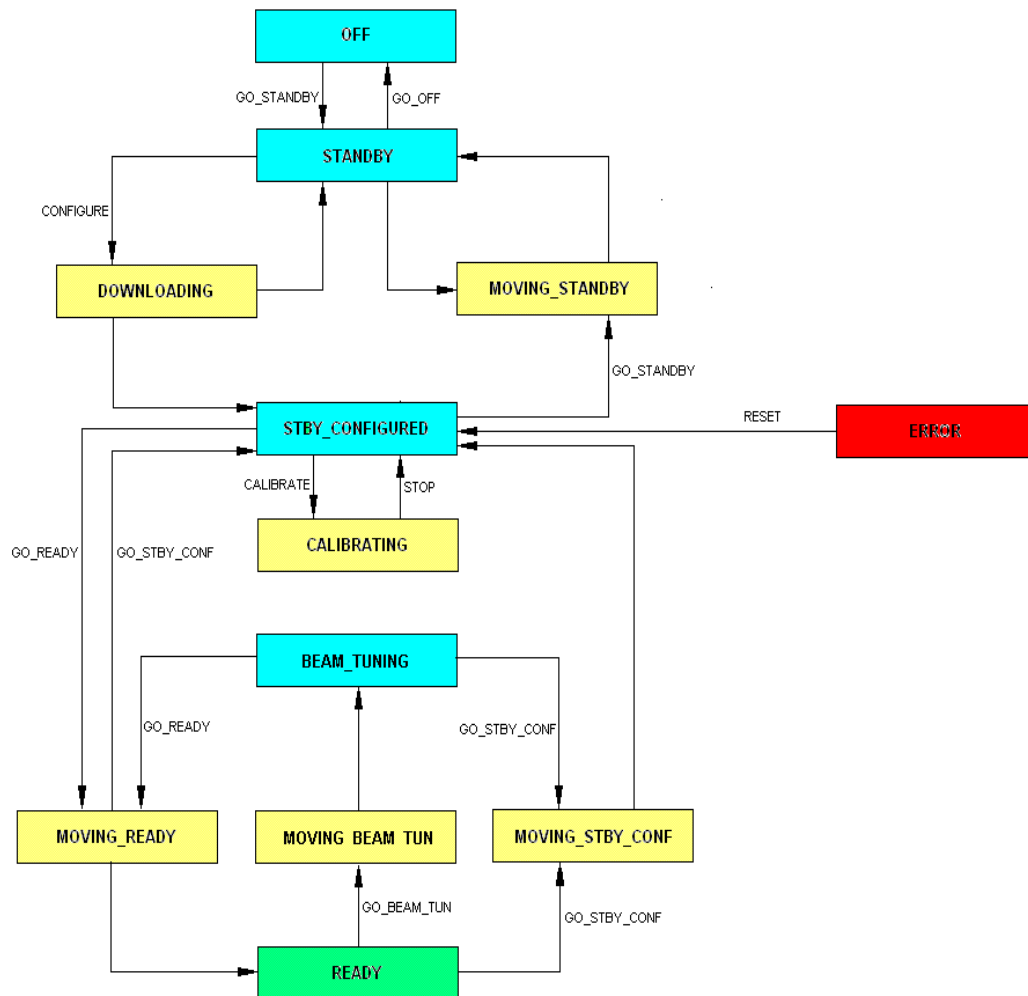
- ✓ System of cooling and heatset of array and crystals:
 - Refrigerating machine under control of SCADA CRW-DAQ.
- ✓ Monitor system on the basis of light diodes Kingbright:
 - Monitor system;
 - Supply frame WIENER VME.
- ✓ Detector electronics system:
 - 624 registering cards FEC;
 - 12 control cards RCU;
 - 24 trigger cards TRU.
- ✓ Electronics water cooling system:
 - Pumping station;
 - 3 locking valves.
- ✓ Detector supply system:
 - 5 supply frames;
 - 18 low-volt channels of constant voltage;
 - 24 high-volt direct voltage channels.
- ✓ Communication systems with top control levels.

Calorimeter control structure



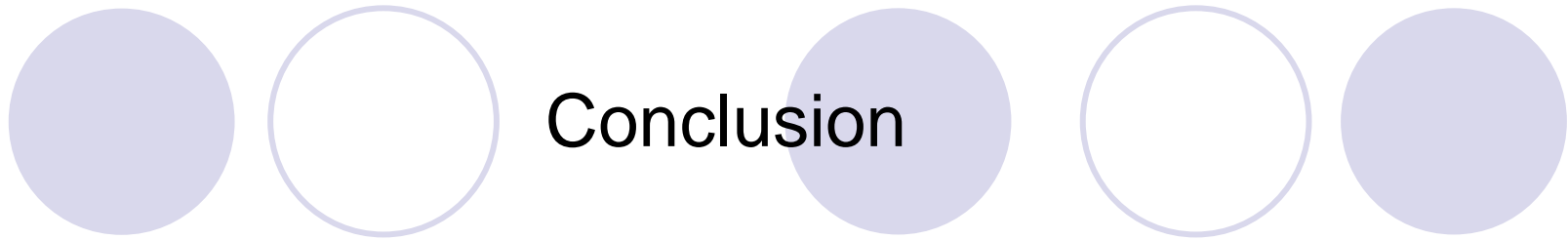
1 — the highest level of spectrometer control, 1.1 — upper level of cooling system control, 1.1.1 — cooling system and heatset of crystal array, 1.2 — upper level of monitoring system control, 1.2.1 — control level of supply frame WIENER VME, 1.2.1.1 — frame WIENER VME, 1.2.1.2 — CAN-interface, 1.2.2 — control level of monitor system, 1.2.2.1 — monitoring system, 1.3 — upper level of electronics control, 1.3.x — control level of spectrometer modules electronics (where x from 1 to 4), 1.3.x.1 — electronics control level, 1.3.x.1.1 — control level of low-volt supply channels, 1.3.x.1.2 — level of control over high-volt supply channels, 1.3.x.1.3 — electronics control level, 1.3.x.1.3.m — RCU-card (where m from 0 to 3), 1.3.x.1.3.n — FEC-card (where n from 0 to 27), 1.3.x.2 — control level of trigger devices, 1.3.x.2.k — TRU-cards (where k from 0 to 7), 1.3.5 - level of control over busybox, 1.3.5.1 — device busybox, 1.4 — level-supervisor over solenoid ALICE state, 1.4.1 — solenoid ALICE, 1.5 — upper level-supervisor over water cooling, 1.5.x — level-supervisor over water cooling, 1.5.x.1 — water cooling valves, 1.5.5.1 — water cooling system ALICE, 1.6 — control level responsible for communication with ECS, 1.6.1 — sub-control level, responsible for communication with ECS, 1.7 — upper level of supply system, 1.7.x — control level of spectrometer modules power, 1.7.x.1 — control level of low-volt supply, 1.7.x.1.1 — 13-volt supply frame WIENER PL512, 1.7.x.1.2 — 6-volt supply frame WIENER PL512, 1.7.x.1.y — low-volt supply channels (where y from 0 to 6), 1.7.x.2 — high-volt supply control level, 1.7.x.2.1 — supply frame ISEG, 1.7.x.2.2 — power module ISEG, 1.7.x.2.z — high-volt supply channels (where z from 0 to 7)

Top level of calorimeter control and its integration into experiment ALICE



The top level of calorimeter PHOS fulfils governing and control over all devices and systems of detector, synchronizes their work, belongs to the facility ALICE control system, as a dominated level, performs communication with other experiment systems.

All properties and control levels of calorimeter have its finite condition automation. Depending on the type of session selected by the coordinator of ALICE, PHOS detector is automatically adjusted and prepared for acquisition of required type data.



The results of the work performed:

1. There was developed a general hierarchy structure of control over all devices and systems forming PHOS calorimeter.
2. For each device and all control levels a finite automation, describing their behavior was created.
3. There were developed ways for integration of the top control level of PHOS calorimeter into experiment ALICE.
4. There was developed a detector's behavioral model depending on the type of session preset by ALICE coordinator.