The ALICE Detector Control System, Ready for First Collisions

A Large Ion Collider Experiment

European Organisation for Nuclear Research

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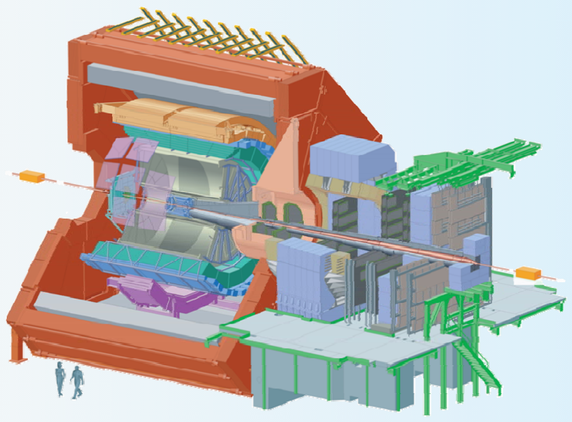
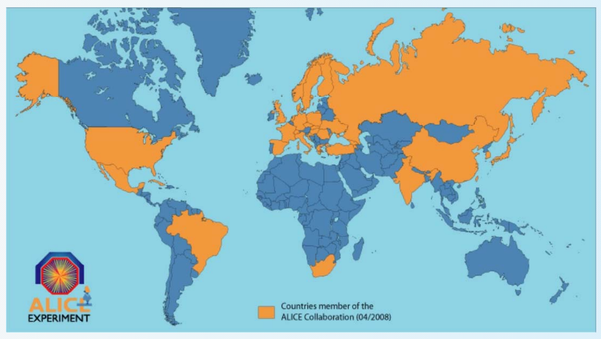
The ALICE Experiment at LHC



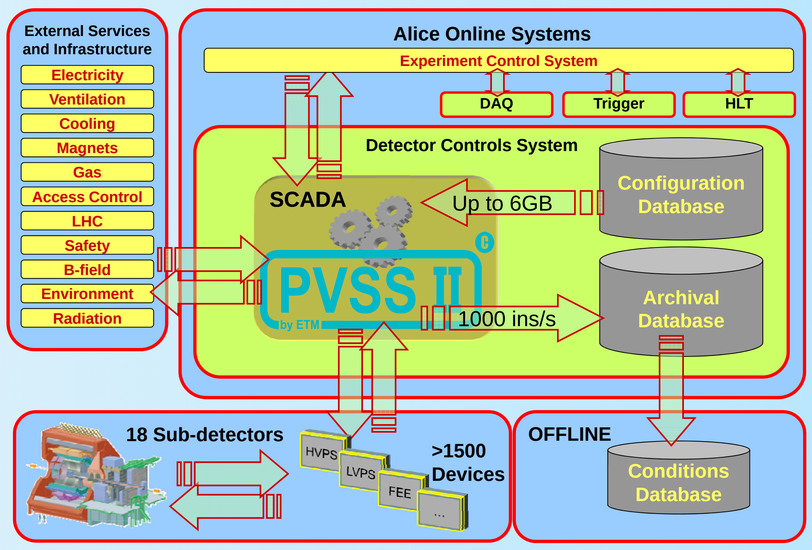
ALICE is a general purpose, heavy–ion detector designed to study the physics of strongly interacting matter and the quark–gluon plasma in nucleus–nucleus collisions at the CERN Large Hadron Collider (LHC). ALICE is one of the four large detectors installed on the 27 km accelerator and is composed of 18 sub-detectors.



More than 1000 physicists, engineers and technicians from 111 institutes in 31 countries contribute to the project.

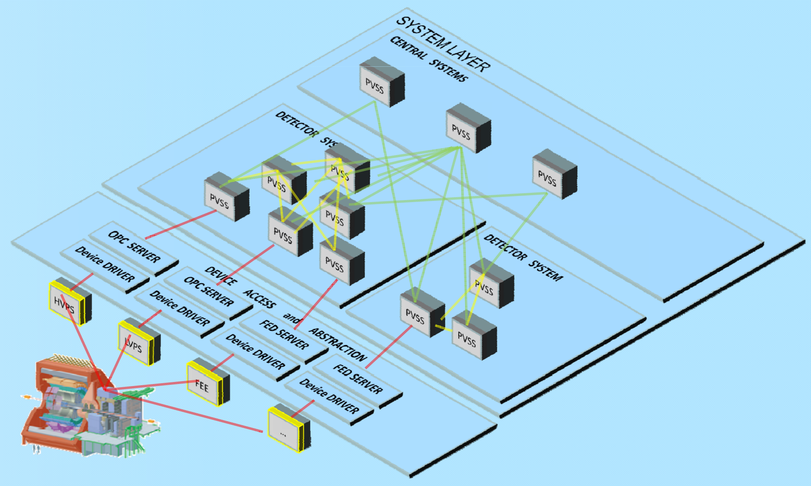
The Detector Control System in ALICE

The main task of the ALICE Detector Control System (DCS) is to ensure a safe operation of the whole experiment by a single operator as well as a high running efficiency by minimising the downtime.

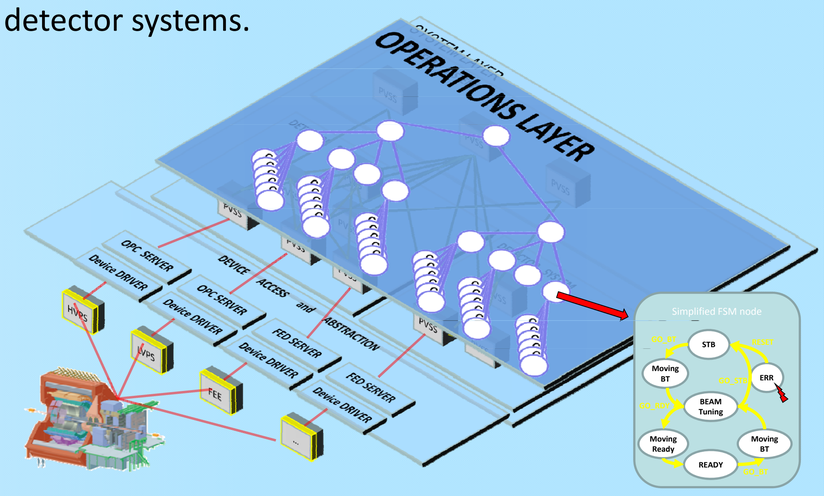


The DCS provides means of configuration and remote control and monitoring of all installed devices. It monitors the status of the experiments infrastructure and environment. The DCS plays a key role in the synchronization of the experiment with the status of the LHC. The DCS provides the offline with all parameters on the experiments operational conditions, relevant for the physics data analysis. The DCS is implemented using a commercial SCADA system: PVSSII.

The ALICE DCS Architecture



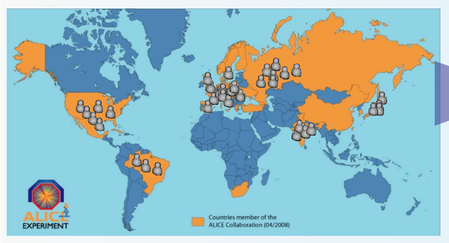
A device control framework hides the device complexity. The detector systems are built as distributed PVSS systems accessing devices through this framework. The topology is arbitrary, mainly defined by hardware resources. The central system is a distributed system of detector systems.



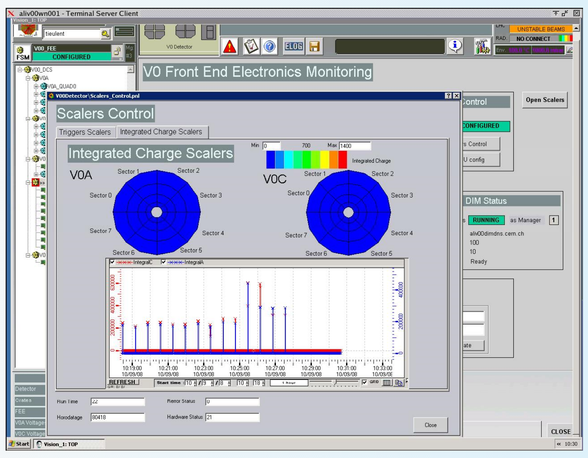
A hierarchical operations layer is built on top of the system layer. Finite State Machines (FSM) model the behaviour of devices and sub-systems. State changes can be triggered by commands or by state changes of one of the children.

Preparation for the 2008 LHC start

All detector control systems are implemented by the detector groups, in total more than 100 developers all over the world contribute to the control systems. A small central team coordinates all efforts. The whole DCS consists of well over 100 applications, running on a cluster of ~100 rack mounted PCs.



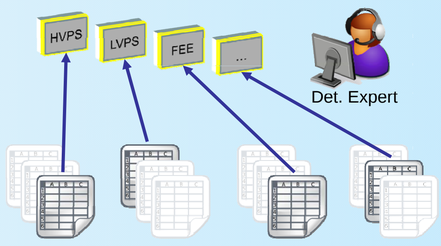
First installation started early 2007, and detector systems were commissioned during 2008. In individual integration sessions with each detector all systems were validated and integrated in the ALICE DCS. In common sessions groups of detectors were operated by a single central operator. Thanks to careful coordination and extensive commissioning the ALICE DCS was fully operational before the LHC startup in September 2008 and allowed for a successful and safe operation of the experiment with first beams.



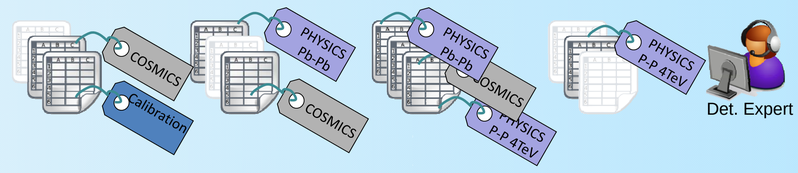
Scalars read by the V0 DCS system were the first experiment signal to confirm the first circulating beam in LHC on 10.09.2008. The lower peaks show bursts of particles going through ALICE, but stopped before completing a full turn. Removing the last beamstop made the protons pass twice through ALICE, doubling the number of detected particles.

Central Configuration

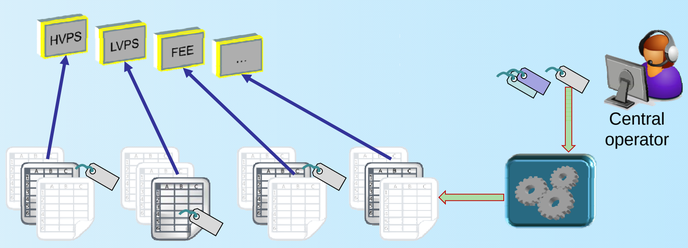
Before the start of each run, for each detector a configuration has to be applied to all sub-systems according to detector role and run type. Initially this will be done by detector experts. All configurations are stored in the configuration database.



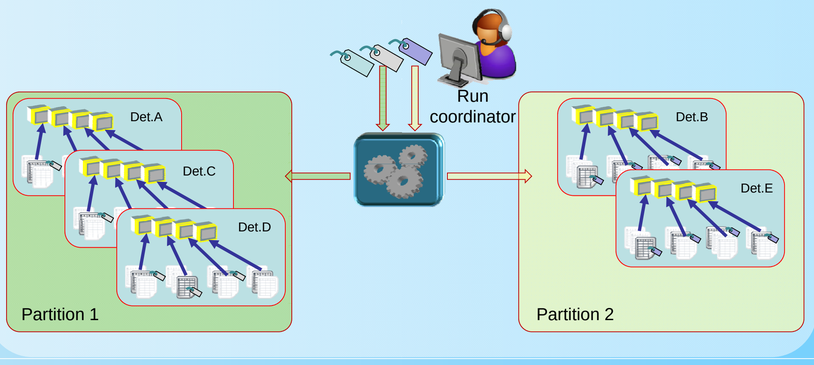
Detector experts can tag well tested configurations suitable for a given run type with self explaining tags, and make them visible for non expert operators.



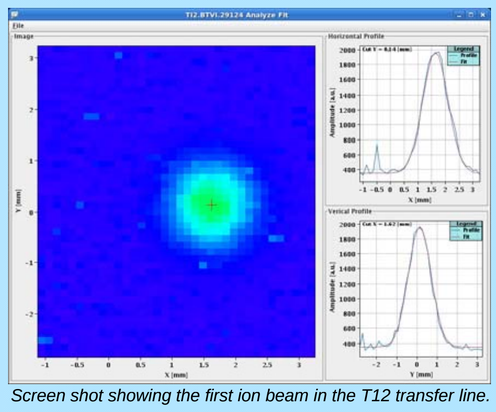
A central operator selects a configuration tag and the configuration tool will configure all sub-systems of a given detector according to the selected tag.



The run coordinator decides on the data taking program, composition of the running partitions and the configuration of each partition. By selecting the appropriate tag for each partition the configuration tool configures all detectors in the partition.



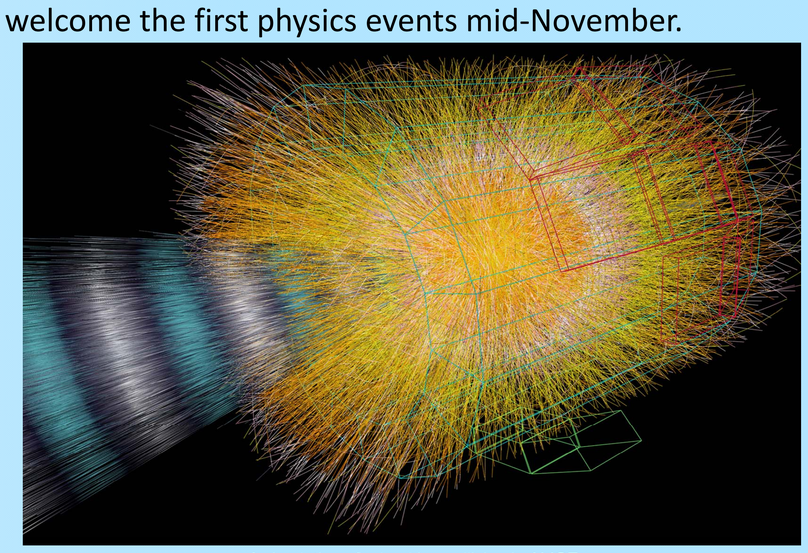
Looking forward to first collisions



Screen shot showing the first ion beam in the T12 transfer line.

On 28.09.2009 for the first time ever, lead ions have arrived at the doorstep of the LHC. Lead ions were extracted from SPS into the TI2 transfer line to LHC and dumped at the end of the transfer line. Located 200m downstream, ALICE observed the secondary muons: the first heavy-ion induced events in LHC.

LHC is now gearing up for first injections tests, with first beam through ALICE expected on 25.10.2009. The Detector Control System is ready to ensure the safe operation of the detector during these tests, and is well prepared to allow central operation of the experiment to welcome the first physics events mid-November.



A simulation of a lead ion collision in ALICE