

Overview

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 LHC. It currently includes over 1000 members from close to 100 institutions in some 30 countries.

ALICE consists of a central part, which measures hadrons, electrons and photons, and a forward spectrometer to measure muons. The central part, which covers polar angles from 45° to 135° over the full azimuth, is embedded in the large L3 solenoidal magnet. It consists of an inner tracking system (ITS) of high-resolution silicon tracking detectors, a cylindrical TPC, three particle identification arrays of Time-of-Flight (TOF), Cerenkov (HMPID) and Transition Radiation (TRD) counters and a single-arm electromagnetic calorimeter (PHOS). The forward muon arm (2° - 9°) consists of a complex arrangement of absorbers, a large dipole magnet, and 14 stations of tracking and triggering chambers. Several smaller specialized detectors (ZDC, PMD, FMD, T0, V0) are located at small angles. A calibration trigger on cosmic rays (ACORDE) will be installed on top of the L3 magnet.

A proposal to add a large single arm electromagnetic jet calorimeter (EMCAL) has been approved end 2007 by the respective funding agencies and production has started early 2008. Construction of most of the other detectors is complete and assembly, installation and commissioning are well under way.

Silicon Pixel Detectors .

Status: The cable, fiber and cooling connections on side A were completed and verified following the installation of the mini space-frame. In December 2007 the SPD was switched on for the first time and took part in the first ALICE global run. A fraction of the detector could not be commissioned due to the late delivery of the low-voltage power supplies, which was however completed in time for the February 2008 ALICE cosmics run. The whole SPD was then powered up and operated with the final DCS and DSS systems. The SPD collected cosmic data in the global DAQ and trigger partition. The first cosmic events in the SPD were evaluated with the online tools from raw data files. The offline reconstruction of the collected data is ongoing.

The silicon pixel trigger electronics system has been validated and installed in the lab. The pre-commissioning of the pixel trigger together with detector modules is ongoing.

Changes: No major changes.

Concerns: No major concerns.

Plans: SPD commissioning and optimization with cosmics will continue until the first proton beam. The pixel trigger will be installed in ALICE before the next cosmic run.

Silicon Drift Detectors

Status Since installation of the SDD in March 2007, extensive commissioning has taken place including cabling, services and detector tests. During the tests, a major upgrade of the control system for the liquid cooling has been decided, including the installation of a detailed flow control at the level of the individual ladder. The readout and the monitoring software for the new controls are currently being finalized. The SDD participated in data taking with cosmic rays end 2007 and early 2008. The two runs were very useful to commission and integrate the SDD with the general DCS, DAQ and ECS systems, and to test and commissioning the data quality assurance and online monitoring software. The second run has also included a prolonged data taking period together with the other IST subsystems, which will allow a test of the alignment programs.

Changes: No major changes

Concerns: No major concerns

Plans: Commissioning with cosmics.

Silicon Strip Detectors

Status: The SSD is completely installed with the exception of some power supplies still to be delivered. Both the Detector Control system and the Detector Safety System have been tested in real-life conditions and operate as required. An upgrade of the water cooling system (partly shared with SDD) is planned in order to increase the operational margins, improve diagnostics and hydraulic safety. One third of the C-side of the SSD (limited by power supply availability) participated in the December Cosmics Run whereas the full A-side participated in the February run. Operation of the detector was stable for days. Work is in progress on the implementation of common mode correction and zero suppression in the front-end firmware.

Changes: No major changes.

Concerns: Late delivery of power supplies.

Plans: Commission hardware and software for calibration and alignment.

Time Projection Chamber (TPC)

Status: The TPC was moved to the final position at the IP end September 07. Connection to the final services and commissioning started on the C-side. In December 07, the TPC participated with its C-side in the global commissioning of ALICE, with triggers from ACORDE and a smaller, dedicated scintillator setup below the TPC. On the A-side, after the installation of the miniframe in November 07, commissioning of services - much more complicated than on the C-side due to difficult access and the larger number of patch panels - was completed by March 08. First calibration data with radioactive Krypton were taken.

During commissioning, two voltage trips were observed in the TPC drift voltage system. Their origin was traced to small water residues in the (unused) cooling circuit of the resistor rods. This cooling system, tested before successfully above ground, is now being commissioned in the cavern; this should resolve the issue.

Changes: No major changes.

Concerns: No major concerns.

Plans: Final global commissioning, including laser/cosmics/Krypton calibration.

Multigap Resistive Plate Chambers (MRPC) for TOF

Status: Modules: The delivery of mechanical components of the modules has been completed as well as the module's assembly with MRPC strips. The test in the Cosmic Ray Facility at CERN has been completed for 95% of the modules. Electronics: The mass production and delivery of the readout electronic boards is almost completed: 95% of the DRM (Data Readout Module), 89% of the TRM (TDC Readout Module), 95% of the LTM (Local Trigger Module), 100% of the CPDM (Clock and Pulser Distribution Module) cards have been delivered and tested. 92% of the custom crates with the LV DC-DC converters have been delivered and tested. The CTTM (Cosmic and Topology Trigger Module) board has been successfully used during the March cosmic run. Super Modules(SM): By mid March 2008, 14 SM were installed in the experiment, assembly of the last four is in progress. Integration and commissioning: The integration with the DAQ, TRIGGER, DCS and ECS systems has been successfully tested during the global commissioning and cosmic runs with some of the installed SM. The TOF detector has taken data both in the global DAQ partition with many other subdetectors and in a special partition with a few subdetectors giving a cosmic trigger with the CTTM. Several cosmic-muon tracks, hitting multiple MRPC strips inside the installed modules, have been observed since the December 2007 run.

Changes: No major changes

Concerns: No major concerns.

Plans: Complete SuperModule assembly and installation in spring 2008.

High Momentum Particle Identification Detector (HMPID)

Status: Installation of the services has been completed on schedule after moving the C₆F₁₄ circulation to its final location after lab tests. A procedure and tooling to access the electronics in

situ has been worked out and successfully applied in order to fix a problem with two readout control boards (RCB). The detector has been successfully operated during the December and February test runs with cosmic rays and the integration among DAQ, DCS and Trigger systems quite satisfying. The online and offline programs have been deployed, debugged and integrated in the general ALICE framework; fine tuning is under way.

During the test runs few HV trips have been observed and the causes are under investigation; however the rate and extent do not compromise the exploitation of the detector.

Changes: No major changes

Concerns: HV stability of some chambers.

Plans: Commissioning of the C₆F₁₄ to be completed by middle of April, in parallel with the investigation of the HV behavior. Continue development of online and offline programs.

Transition Radiation Detector (TRD)

Status: At the current production rate of readout chambers completion of production of all chambers is expected by fall of this year. During the calibration beam time in November 2007 with an entire super module from the production an excess leak rate in excess of the financially tolerable rate was discovered. This was not apparent during chamber production since the leaks were of viscous rather than diffusive nature. Meanwhile a repair procedure has been established and about 170 chambers have been successfully repaired. Currently, two super modules are being assembled for installation during week 18 and 19. In total, chambers for more than five super modules have been completely integrated with all readout electronics. Mass production of the readout electronics will soon be resumed after a yield problem had developed following internal rearrangements in the company responsible for the production.

During the first global cosmic run the entire Detector Control System (DCS) has been successfully commissioned. The final readout architecture including the Global Tracking Unit (GTU) has been further exercised following the first successful test during the calibration beam time.

All cables leading to the TRD have been checked prior to installation of further TRD super modules. Also, a special pre-trigger system necessary for the wake-up signal of the TRD has been installed and tested.

Changes: Correction of viscous leaks in readout chambers.

Concerns: Tight schedule for super module production.

Plans: Production of additional super modules for next installation slot.

Photon Spectrometer (PHOS)

Status: A long-term cosmic run of PHOS module #1 in the fall of 2007 revealed some damage caused by condensation inside the module during the warming up. An improved and airtight casing has been designed and will be produced by May 2008. The PHOS module #2 has been assembled in the existing casing, tested and commissioned. The cooling/thermo-stabilization plant of the PHOS spectrometer has been produced in Russia and delivered to CERN in November, 2007. The plant was assembled, tested and commissioned. The PHOS module #2, as well as the cooling/thermo-stabilization plant, will be installed in the experiment in April. In 2008, during the commissioning run, this module will be operated at a stabilized temperature of +18°C. Assembly is ongoing for the PHOS module #3, expected to be completed in the new air-tight casing by June. The PHOS module #1 will be re-assembled in the new air-tight casing by July. Two final modules (4&5) are partially funded (FEE cards by China, APD's and preamplifiers by Japan). The full PHOS with five modules can be completed by the end of 2010 provided that additional funds, requested from Russian in 2008 - 2010 for crystals and mechanics, are available.

Plans: Installation of one PHOS module in April, two more during the 2008/9 winter shutdown.

Changes: New airtight casing to avoid condensation.

Concerns: Delay of installation schedule caused by casing re-design.

Electromagnetic Calorimeter (EMCal)

Status: Full funding has been approved in the US. Final design, integration and safety reviews are completed. All major components are ordered and tooling is completed. Fabrication of all subsystems is about to commence. Goal is to complete two super modules for the 2009 run.

Changes: Full funding approved.

Concerns: Schedule for the completion of the first super modules in time for the 2009 run is very tight and relies heavily on suppliers meeting delivery schedules.

Plans: Move rapidly to mass production of detector and electronics.

Muon Tracking Chambers

Status: All the stations are installed, with the exception of one chamber inside the muon dipole, which will be installed in April. The commissioning is in progress: stand-alone DAQ read-out commissioning is done for station 1 and station 2 which have also entered along with chamber 5 the February global DAQ cosmic run. A number of problems with the readout of stations 3/4/5, mostly due to cables and connectors, have been identified and corrected, slowing down the progress of commissioning. Increased noise in some tracking stations has been found and attributed to the LV power supply. Contact with the supplier is established and tests in the factory are ongoing. The alignment and monitoring system for the muon spectrometer (GMS) is installed and commissioned in parallel with chamber commissioning.

Changes: No major changes.

Concerns: Delay due to read-out. Noise must be reduced but seems to be largely understood.

Plans: Commissioning phase will continue till the first injection. Stations commissioned in stand-alone mode enter progressively global running with cosmic.

Muon Trigger Detectors

Status: The complete set of RPCs including FE electronics, signal cables (1500 cables in total), service columns and ventilation system is installed. The detector, operated in streamer mode, was tested with cosmic rays in December 2007 and February 2008 together with the Local (242 units in total), Regional (16 units) and Global (1 unit) trigger boards. During these tests the detector was controlled by the Detector Control System and the readout was performed with one (out of two) final DARC card. During the second test period, the system was used to trigger on "horizontal" muon events. After the tests, activities to finalize the preparation of the system have been resumed. Detector alignment is at present under way as well as the installation of cables needed to operate the detector FEE with external (adjustable) thresholds.

Changes: No major changes.

Concerns: No major concerns.

Plans: Installation of the second DARC card, finalization and further commissioning of the system.

Forward and Trigger Detectors (ZDC, PMD, FMD, T0, V0, ACORDE)

Status: The four ZDC hadronic calorimeters have been installed in the tunnel. Trigger and readout commissioning is under way. The e.m. ZDC calorimeter (ZEM) will be installed in Spring 2008.

The ACORDE detector is fully installed, integrated with trigger and DAQ and is in regular use as cosmic trigger for ALICE commissioning.

The PMD detector (modules, support structure, electronics, services) has been assembled and tested. It was found necessary to improve the robustness of the electronics protection circuit by adding additional external components. Because of long delivery times, only six modules will be installed in April in preparation for the pp run later this year; the rest of the modules will be installed during the winter shutdown.

The FMD2 and FMD3 forward multiplicity detectors are now installed in ALICE (about 40.000 channels). FMD3 and FMD2 have been commissioned in situ using DAQ, DCS and the ALICE

trigger system. FMD1 (10000 channels) is at CERN awaiting assembly with V0-A and installation in ALICE in week 15. FMD3 has in test cosmic runs been read out with the TPC. Completion of the slow control system for the FMD is ongoing.

T0-A has been mounted in January 2008, completing the installation of the detector hardware. V0 production is complete. The V0-C detector has been installed and commissioned in situ using DAQ, DCS and the ALICE trigger system. The electronics will be completed and V0A will be installed in April.

Changes: Improved electronics protection of PMD, complete installation during WS 2008.

Concerns: No major concerns.

Plans: Complete installation, service connections and commissioning.

Trigger

Status: All five Central Trigger Processor (CTP) systems are now in operation, two in Birmingham and three at CERN, including one at Point 2. The two Birmingham systems are being used for training and system development respectively. One of the CERN systems is connected to test modules in the DAQ lab via 60m cables and fibers, allowing detailed tests and development work for the trigger, DAQ and ECS systems working together. The configuration and control software is ready, and development of monitoring and offline software is continuing. The CTP was successfully operated at Point 2 during the December and February-March cosmic runs, with up to nine detectors running in parallel (the maximum available at the time). At present the emphasis is on trigger commissioning, software development, and on training to increase the pool of ALICE members with experience of operating the trigger system.

Changes: No major changes

Concerns: No major technical concerns. However, wider funding issues in the U.K. threaten the trigger project.

Plans: Detector commissioning at Point 2. Implementation of new option to record trigger inputs directly at CTP. Continuation of improvements to trigger control and monitoring software.

Data Acquisition (DAQ)

Status: The DAQ has been intensively used during the cosmic runs of December '07 and February-March '08. The 14 detectors (partially) installed have taken data with the central DAQ and measurements of their readout performance have been performed. The detectors and the 4 online systems (Trigger, DAQ, HLT, and DCS) have been controlled by the ECS in standalone mode and in global partitions. The whole experiment has been operated from the ALICE Control Room and working rooms on the surface.

Changes: No major changes.

Concerns: No major concerns.

Plans: Prepare DAQ/ECS for data taking with beam.

High Level Trigger (HLT)

Status: The HLT infrastructure for the first year running is installed at Point-2 and operational, including the interfaces to other ALICE on-line systems (DAQ/DCS/ECS) and Off-line. During the global cosmic runs, online reconstruction was performed for the TPC, TRD and DiMuon detectors and online event visualization was provided for several detectors. PHOS is using the HLT successfully for calibration and first level data compression in cosmic tests.

During the time the HLT is not operated in on-line mode, off-line grid jobs are executed on the HLT cluster.

Changes: No major changes.

Concerns: No major concerns.

Plans: Continue commissioning, upgrade of the network infrastructure for heavy ion mode.

Offline

Status: Software: AliRoot has been continuously improved in particular with respect to memory management. The memory required for reconstruction is now below 2GB. The code is ready (raw-data decoding and subsequent reconstruction) to process the cosmic data acquired during the cosmic runs. The analysis framework is close to production status. Test trains including 3 packages from the physics working groups are regularly launched on the GRID and on CAF.

Full Dress Rehearsal: During the cosmic run raw data were continuously replicated from the CERN T0 to the major ALICE T1 and special data were selectively exported to some T2s. The target rate of 60MB/s was reached and sustained during the whole running period. The shuttle operated smoothly during the whole data-taking period. Synchronous reconstruction could not be achieved because of the code not being fully ready and because of the absence of an appropriate trigger signal. The size of raw data files needs still to be optimized for mass storage. The number of GRID users for analysis is steadily increasing although the access to data from the mass storage remains problematic.

Physics Data Challenge: After an interruption of MC production, to allow fixing the memory problems, the production has resumed and will run in parallel with the reconstruction of the data from the cosmic run.

Grid Services: The ALICE SE (LCG storage systems with xroot interface) has been deployed in all T1s but RAL and in several T2s. The objective is to have it deployed in all ALICE sites. All central services and site services run continuously and without long interruption in sites with a local ALICE contact person.

Changes: No major changes.

Concerns: Insufficient computing resources remain a concern.

Plans: Commissioning of the offline framework together with the detector commissioning, full dress rehearsal, user driven analysis challenge.

Installation & Assembly activities

Status: The EMCAL support structure has been successfully inserted in the experiment. The compensator platform, carrying the 20T compensator magnet, supporting the Miniframe and housing the laser hut was installed. The Miniframe, carrying all the A-side Services of TPC and ITS, was completed and equipped with services on the surface and was finally installed in the cavern. TPC and ITS services were partially connected and a first 2 week COSMIC run including fractions of all sub-detectors was conducted during December 2007. During this run the dipole magnet control system was fully commissioned. In January and February of 2008 the service connections on the Miniframe (A-side) were completed and another 2 week cosmic run was performed in March 2007, where the L3 magnet was fully commissioned and the dipole magnet and L3 magnet were both fully powered. Between the COSMIC runs, TOF installation was ongoing and to this date, 13/18 TOF modules are installed.

Changes: No major changes.

Concerns: No major concerns.

Plans: End of installation by May.

Global commissioning

Status: The initial commissioning has concentrated on the verification and testing of cables, gas and cooling connections and subsequent powering of electronics. During two weeks in December 2007 a first attempt was made to operate all installed detectors concurrently and globally, using cosmic and electronic triggers. Several problems were detected and corrected. In February 2008 a second five week cosmic run was started. During this run all installed detectors collected some calibration and alignment data. Up to 14 different detector systems were read out in parallel, with some runs lasting up to several hours. However, the full functionality of different trigger and DAQ configurations was not yet tested, and stability, error diagnosis and recover time need to be further improved.

Changes: No major changes

Concerns: No major concerns.

Plans: Continuous commissioning, calibration, and alignment with cosmic data from May until first beam.