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PRINCIPAL LHCC DELIBERATIONS

33RD MEETING OF THE ALICE RESOURCES REVIEW BOARD

31 OCTOBER 2012

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GENERAL

This document summarizes the principal LHCC deliberations concerning ALICE at the Committee's sessions in June and September 2012.

The LHCC considers that ALICE has made excellent progress, despite the recent operational issues, and the Committee congratulates the ALICE Collaboration on its achievements.

CONCERNS FROM THE PREVIOUS ALICE RESOURCES REVIEW BOARD

SUB-SYSTEM	CONCERN	STATUS
Muon System	Alignment is still worse than expected.	Alignment has improved considerably. The problems have to a large extent been understood and solved, and the mass resolution is near nominal.
V0 Detector	Gain loss traced to ageing of photomultipliers.	Consolidation programme for Long Shutdown 1 (LS1) under preparation.

STATUS OF THE EXPERIMENT

PHYSICS

The ongoing analysis of the first two heavy-ion runs has revealed many new results, including direct photon measurements, a study of collective effects and transport properties of the quark-gluon plasma (QGP), correlations and fluctuations. In the heavy flavour sector, the suppression and flow for D mesons and J/ψ has been observed. Since the previous LHCC session, 10 manuscripts have been submitted for publication by ALICE. During the recent Quark Matter Conference, ALICE presented 7 plenary talks, 30 parallel talks and 45 posters.

ALICE OPERATIONS

The LHCC discussed the status of ALICE running during the current period. The performance of the experiment was severely hampered by background from beam-gas interactions. Vacuum conditions in the long straight sections resulted in a background event rate exceeding the proton-proton collision rate by a factor of five. Recently, the situation has been improved by employing a new injection procedure.

Furthermore, the integrated luminosity was severely degraded by strong fluctuations in the satellite population occurring after the installation of a new PS cavity on 8 August 2012. As a consequence of the beam-related issues, only 30% of the planned proton-proton events could be collected so far.

The pPb pilot run was very successful, with ALICE recording 1.8 M events in stable beam conditions and with all sub-detectors operational. For the 2013 pPb run, ALICE has requested an integrated luminosity of 30 nb^{-1}.

ALICE has installed new high voltage supplies for the Time Projection Chamber (TPC) read-out chambers, resulting in a more stable operation and allowing to ramp up the high voltage to full gain at rates of up to 400 kHz.

Furthermore, the gain loss observed in the V0 detector has now been traced to ageing of the photomultipliers. A consolidation programme for the Long Shutdown 1 (LS1) is under preparation.

ALICE UPGRADES

The Committee discussed the upgrade plans currently under study by ALICE. The LHCC received the following documents: (a) "Upgrade of the ALICE Experiment Letter of Intent" and (b) "Conceptual Design Report for the Upgrade of the ALICE Inner Tracking System (updated version)".

The main physics topics at the LHC and uniquely accessible with the ALICE detector include (a) a measurement of heavy-flavour transport parameters (study of diffusion coefficients, azimuthal anisotropy and nuclear modification factors, in-medium thermalisation and hadronisation, and mass dependence of energy loss); (b) measurement of J/ψ, ψ', and other charmonium states down to zero P_T in a wide rapidity range with the potential to discriminate between statistical hadronisation and dissociation/recombination models and (c) a study of low mass / low P_T dileptons promising access to chiral symmetry restoration, QGP thermal radiation and the space-time evolution of the QGP.

The proposed upgrade will provide improved vertexing and tracking at low P_T, preserve the particle-identification capability and allow high-luminosity operation without dead-time. The upgraded system will include (a) a new, smaller radius beampipe and a new Inner Tracking System (ITS) detector with improved performance and high rate capability; (b) an upgrade of the TPC replacing the existing Multi-Wire Proportional Chamber (MWPC) read-out chambers with Gas Electrode Multiplier (GEM) detectors and (c) a high-rate upgrade for the read-out of the TPC, Transition Radiation Detector (TRD), Time-of-Flight (TOF) detector, calorimeters, DAQ and High Level Trigger (HLT), muon arm and trigger detectors.

The upgrade would allow ALICE to operate at 50 kHz minimum bias rate for PbPb collisions, inspecting all events and collecting more than 10 nb^{-1} of integrated luminosity. For the core physics programme, this would correspond to an improvement of statistics by a factor of 100. For triggered events, statistics would be improved by one order of magnitude.

The target milestone for installation and commissioning is Long Shutdown 2 (LS2) in 2018. To complete the physics programme after the upgrade, running with heavy ions for a few years following Long Shutdown 3 (LS3) in 2022 would be required. Furthermore, a proton-proton reference sample of about 0.5 fb^{-1} would be required, corresponding to a few months of proton-proton running at the equivalent PbPb centre-of-mass energy.

The LHCC **congratulates** ALICE in view of the impressive progress during the last year as reflected in the Letter of Intent for the ALICE upgrade and the updated ITS Conceptual Design Report. The detector studies are encouraging, both for the ITS project and for the TPC upgrade. The ITS Option A (monolithic pixels only) seems very attractive, both in terms of performance and cost. Including the option of an optimised pad plane, the GEM-TPC tracking performance and the resulting momentum resolution are comparable to the existing MWPC-based TPC.

The physics case has substantially improved compared to the first proposals submitted by ALICE to the LHCC one year ago and is now solid. Extensive simulations including estimates of systematic errors are available for the core physics programme. This increase in sensitivity for ALICE requires an upgrade of the rate capability of the TPC, a high resolution ITS, and a major upgrade of the online system and the read-out electronics. The combination of the new ITS with the high-luminosity upgrade enables a transition from the exploratory phase of LHC heavy-ion physics to the high-statistics / high-precision phase. Without such data, the field of study of ALICE will remain inconclusive.

The physics programmes of the two general-purpose detectors, ATLAS and CMS, and ALICE are complementary, for while the former may focus on selected hard probes, ALICE will be optimised for particle identification at low transverse momenta. The experiments are hence sensitive to different "messenger" signals and phases of the evolution of the QGP.

The LHCC **commends** this joint approach to heavy-ion physics and **endorses** the upgrade plans of the ALICE Collaboration. The Committee encourages further R&D towards the upgrade and is looking forward to the seeing the detailed technical solutions presented in the respective Technical Design Reports.