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PRINCIPAL LHCC DELIBERATIONS

24TH MEETING OF THE ATLAS RESOURCES REVIEW BOARD

24 APRIL 2007

EMMANUEL TSESMELIS

SCIENTIFIC SECRETARY, LHCC

GENERAL

This document summarises the principal LHCC deliberations concerning ATLAS at the Committee's sessions in November 2006 and in February and March 2007.

CONCERNS FROM THE PREVIOUS ATLAS RESOURCES REVIEW BOARD

SUB-SYSTEM	CONCERN	STATUS
Power Supplies	The major outstanding problem area is related to the timely delivery of the low voltage and high voltage power supplies.	Repair of low voltage power supplies for the Tile Calorimeter is now well-defined and production of the retro-fitted units is now underway. The schedule to complete the low voltage power supplies for the LAr Calorimeter remains critical. The delivery schedule for the Muon System power supplies does not satisfy the requirements and at the current rate only a partial power supply configuration will be available for 2007.

LHCC COMPREHENSIVE REVIEW

The seventh of the LHCC Comprehensive Reviews of ATLAS took place on 13-14 November 2006. The LHCC referees addressed the following areas: Inner Detector, Calorimetry, Muon System, Installation & Commissioning, Trigger and DAQ, Physics, Software & Computing, Data Preparation, and the issues of Management, Technical Coordination, Costs, Magnet Systems and Electronics.

Since the previous ATLAS Comprehensive Review in October 2005, the ATLAS Collaboration has made very significant progress towards the realisation of an experimental set-up ready to record proton-proton collisions at the LHC in 2007. In particular, construction of the majority of the final components is either well-underway or completed, installation of the technical infrastructure in the underground caverns is essentially complete, installation of the sub-detector elements of the ATLAS experiment in the underground cavern is well-advanced, and commissioning of the ATLAS experiment is progressing well. The commissioning and field mapping of the Central Solenoid and Barrel Toroid (BT) magnet systems have been completed successfully and the magnets are ready for LHC operation. The procurement of the front-end electronics has in general been successfully

completed and that for the back-end electronics is advancing well. ATLAS is now developing an Operation Model in preparation for first LHC operations.

However, the LHCC noted certain issues of concern. The schedule for the installation and commissioning of the End-Cap Toroids (ECTs) and the Forward Muon Spectrometer is tight, as is that for the Pixel Detector. The procurement of power supplies for the calorimeters and Muon Spectrometer remains the major concern.

It is realistic to expect ATLAS to have an initial working detector for the start of LHC operation in 2007, although detector installation can be foreseen beyond this date. However, the LHCC considers that the ATLAS plan to have installed and commissioned an initial working detector by the first LHC run at the end of 2007 is challenging, as a number of systems no longer have any contingency in the schedule, originally included as a safety margin for their installation. The LHCC observes that additional resources, both in terms of money and manpower, would aid in completing the initial detector.

Detector elements not installed by the LHC start-up in 2007 will be staged. The staging plan consists of deferring installation of some components of the Inner Detector, the Calorimetry, the Muon Instrumentation, the Higher-level Trigger, DAQ and the radiation shielding. Their installation in a long shutdown, while requiring additional resources, would complete the ATLAS detector as described in the approved Technical Design Reports.

The conclusions and concerns of the LHCC are given below. They will allow the Committee to follow-up outstanding issues and to monitor future progress of this project in upcoming sessions of the LHCC prior to the next ATLAS Comprehensive Review.

- The LHCC congratulates the ATLAS Collaboration for the significant progress since the previous Comprehensive Review. All front-end electronics systems are produced and are being commissioned. Production of the back-end electronics is advancing well. The major concern is with the timely procurement of power supplies. Reasonable plans are being developed for the realization of the forward detector system in ATLAS and the LHCC encourages ATLAS to continue with the forward detector design effort. The plans for the ATLAS Operation Model are sound. Should the total Cost-to-Completion not be covered, detector elements not installed by the start-up of the LHC in 2007 will be staged.
- The Committee congratulates ATLAS for the impressive progress made on the Inner Detector (ID). Measurements of the sensor parameters, in particular the efficiency, noise level and channel yield, are as expected or better, all technical problems for the Pixel Detector has been resolved. The critical aspects of the future activities are related to the tight schedule, the delicate operations still to be performed and some manpower limitations for the Pixel Detector. The feebleness of the on-detector optoelectronic modules is regarded as a potential source of detector failure during future LHC operation.
- The hardware for the Liquid Argon (LAr) and Tile calorimeters is installed and is being commissioned. During the commissioning process, minor problems have been found and rectified. First data from cosmic-ray runs have been observed in the final configuration of the detectors, a milestone achievement for which the ATLAS Collaboration is congratulated. The offline reconstruction and simulation shows good progress and test beam data can be understood and described in detail. Further commissioning is limited by the availability of power

supplies. The timely resolution of the problems with the power supplies is a matter of concern and efforts to this end must be strengthened.

- Good progress was reported on the Muon Spectrometer and all chambers, together with their front-end electronics, have been produced. The major concerns remain in the on-time delivery of the power supplies and in the timely installation and commissioning of the Forward Muon Spectrometer system in parallel with the installation of the ECT magnet system.
- There has been impressive progress in the area of installation and commissioning of the ATLAS detector reported since the 2005 Comprehensive Review and the ATLAS Collaboration is working coherently and efficiently towards the goal of having the detector fully operational in the summer 2007. The main concerns are the impact that the late completion of the ECTs has on the installation schedule of the Big Wheels on the Side-A and the effect of the delay in the delivery of the power supplies on the final commissioning of the calorimeters and muon system.
- Very good progress was reported on the Trigger, DAQ and Higher Level Trigger (HLT) activities. The Committee has no major concerns. The Committee encourages an early integration of the various sub-systems in the final DAQ/HLT architecture, and a well focused coordination of the various HLT software activities that should converge into a working DAQ / HLT system in 2007.
- The ATLAS Software and Computing efforts have made impressive progress since the previous Comprehensive Review. The ATLAS software has recently achieved a high level of realism to cope with the full complexity of real data. Computing is generally in good shape. Emphasis needs to be given to a timely completion and validation of the next software release, which will be the basis of the upcoming Calibration Data Challenge. Pending issues of the Distributed Data Management should be resolved. Full exercising and optimization of the distributed database infrastructure will occur in a relatively late phase of preparations, and hopefully not lead to unpleasant surprises.
- Good progress was reported on the Data Preparation effort. The plans of the effort are reasonable and the mandate of the Data Preparation group is focused on ensuring good quality data online and offline. Issues which should be addressed include making available the required manpower and resources and developing a detailed planning with a set of milestones in order to meet the tight schedule.
- The recent work in the area of physics studies has focused on ATLAS being ready to make optimal use of the early LHC data. These efforts include the preparation of the commissioning of the computing system, of the calibration data challenge and of the data-streaming test. The 900 GeV run has the potential to help in the commissioning of the experiments, but it is vital to plan for an extended period of physics validation also in 2008 before the physics analysis of the data at 14 TeV can be thoroughly pursued. The LHCC will review the activities of the combined physics performance working group at its next session. The Committee considers the progress made in physics studies to be reasonable and looks forward to results from the on-going tests and simulation challenges.

SPECTROMETER MAGNETS

Impressive progress was reported on the repair and system integration of the End-Cap Toroids (ECTs). Assembly of ECT-A is complete and has been transported from Hall 191 to the external test station in front of Building 180 where it is cold-tested. ECT-A is expected to be ready for transport to the ATLAS experimental area and to be installed in ATLAS in June 2007. The integration of the ECT-C is advancing well with the cold mass having been inserted into the vacuum vessel. The ECT-C is scheduled to be installed in ATLAS in July 2007. Although the test and installation plans of the ECTs have tight schedules, no major problems are expected and the overall schedule is feasible.

INNER DETECTOR

The critical issue regarding the Inner Detector is with the failure of the heaters of the evaporative cooling system of the Semiconductor Tracker (SCT). Ingress of moisture in the power unions and then in the MgO powder that insulates the heating wire from the inox sheath caused a short to ground destroying the power union. Analysis of the failure is in progress and repair plans, together with the impact on the ATLAS schedule, are being developed.

INSTALLATION AND COMMISSIONING

The Barrel Transition Radiation Tracker (TRT) and Semiconductor Tracker (SCT) have been installed in ATLAS while the End-Cap TRT is ready for installation after having been integrated and tested successfully. Considerable progress has also been made on the installation and commissioning of the Barrel and End-Cap Muon chambers.