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PRINCIPAL LHCC DELIBERATIONS

32ND MEETING OF THE ATLAS RESOURCES REVIEW BOARD

12 APRIL 2011

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GENERAL

This document summarizes the principal LHCC deliberations concerning ATLAS at the Committee's sessions in November 2010 and March 2011.

The LHCC considers that ATLAS has made excellent progress in all aspects of the experiment and the Committee congratulates the ATLAS Collaboration on its achievements.

CONCERNS FROM THE PREVIOUS ATLAS RESOURCES REVIEW BOARD

SUB-SYSTEM	CONCERN	STATUS
Semiconductor Tracker (SCT) & Pixel Detector	Failure of optical links.	Much work has been done during the 2010-2011 Technical Stop on the optical links of the SCT and Pixel Detector to better understand the failures. ATLAS is planning to eventually modify in 2013 its Pixel Detector Service Quarter Panels and to provide a dry-air environment for those links in the read-out crates away from the detector.
LAr Electromagnetic Calorimeter	Failure of front-end optical transmitters of the LAr Electromagnetic Calorimeter.	All of the narrow spectrum optical links in the LAr Electromagnetic Calorimeter were replaced successfully during the 2010-2011 Technical Stop.
Inner Detector Cooling System	Reduced operational efficiency.	ATLAS plans to replace the evaporative cooling system in 2013 with a gravity-fed system.

STATUS OF THE EXPERIMENT

DETECTOR

During the 2010-2011 Technical Stop ATLAS completed its entire work-list of what it wanted to accomplish maintenance-wise on the ATLAS detector. Both sides of the detector were opened and all of the narrow spectrum optical links in the LAr Electromagnetic Calorimeter were replaced as well as all of the broken low-voltage power supplies in the Tile Calorimeter. These repairs went perfectly well and at the time ATLAS closed up its detector, essentially all channels of the LAr Electromagnetic Calorimeter and Tile Calorimeter were working. However, in the intervening

weeks, two Tile Calorimeter power supplies and one connector failed. In addition to these primary tasks, ATLAS installed its ALFA Roman Pot detectors on both sides of the central ATLAS detector and completed in excess of 100 other maintenance tasks on the detector as well as electrical and cooling systems servicing it.

Much work has been done on the optical links of the Semiconductor Tracker (SCT) and Pixel Detector to better understand the failures, thought to be related to number of flashes and the influence of humidity. ATLAS is planning to eventually modify its Pixel Detector Service Quarter Panels (SQPs) to facilitate repairs on the detector in a short access should it be necessary. It is also planning to provide a dry-air environment for those links in the read-out crates away from the detector. These measures are expected to reduce the number of failures. The plan remains unchanged other than the modifications now needed to be ready in 2013 rather than 2012, in line with the new LHC schedule.

TRIGGER AND COMPUTING

With the expected LHC operation at a bunch spacing of 75 ns, which compared to 25 ns bunch spacing and for the same overall luminosity translates into higher initial luminosities per bunch and results in increased pile-up, ATLAS believes that both its event size and its reconstruction time will increase by about 2.5 times that of 2010. ATLAS will not be able to accommodate these additions within its current computing model. Consequently, ATLAS has taken a number of steps to reduce both the event size and reprocessing time. Furthermore, it has revised its data distribution model in order to free up needed disk space to accommodate events of larger size (due to pile-up). Specifically, it will no longer support Event Summary Data (ESD), except for short-term performance applications and specialized samples, in order to reduce storage requirements.

Based on 2010 running, the experiment may want to maximize its physics output, particularly in 2012, by proposing to run its trigger at 400 Hz when the luminosity is high. This would allow the experiment to keep the present lepton thresholds (e.g. 20 GeV p_T on electrons) to maximize the sensitivity to a light Higgs boson. For the time being, however, the baseline trigger rate remains 200 Hz in order to stay within the available computing resources.

The Committee endorses the trigger plan outlined by ATLAS, which would maximize the physics benefit of the coming run. The LHCC also commends ATLAS for working hard to stay within its current computing budget. ATLAS is requesting a re-profiling of funds and shifting the computing funds in 2013 to 2012.

PHYSICS

Thus far, ATLAS has submitted (or published) 25 physics papers and has another 11 in the immediate pipeline. The analyses presented at the winter conferences much surpass the early analyses shown last year with a few pb^{-1} of data. These new analyses utilized sophisticated analysis techniques, demonstrated excellent detector modelling and derived backgrounds from data wherever possible. Two notable improvements out of a long list were the improved understanding of the luminosity measurement (resulting in an uncertainty of about 3%) as well as the improved understanding of the calorimeter jet energy scale. In short, the ATLAS Collaboration has in a single year measured the key features of the Standard Model, developed the sophisticated analysis tools and techniques required to search for new physics and already has an excellent understanding of their detector and its simulation. By all accounts, 2010 was a remarkably successful year for ATLAS.

The ATLAS experiment is focused on the physics. It produced 48 physics conference notes for this year's winter conferences. That is impressive especially when compared to the 102 conference notes for all of 2010. These conference notes covered a wide span of interesting physics and in many cases were on par with if not the best to date. A few examples include a 1 – 2% experimental error on the W and Z cross-sections, a Z cross-section measured to rapidity 4.9 (of one leg), a jet cross-section binned in E_T from 20 GeV to 1.5 TeV, a top quark cross-section with 10% uncertainty and a top mass measurement with 7 GeV uncertainty along with a wide range of Beyond Standard Model searches and an observed Standard Model Higgs sensitivity of 1.2 at a mass of 165 GeV when using power-constrained statistics.

2013 LHC SHUTDOWN

In terms of plans for the upcoming 2013/2014 Shutdown, ATLAS is expediting its Insertable B-Layer (IBL) upgrade so that it can be ready for installation in 2013. This gives the ATLAS Collaboration essentially two years to complete construction and checkout. While aggressive, the Committee has been convinced that it is achievable and the actual decision for installation can be deferred to just before the shutdown. ATLAS has not yet picked a sensor technology and continues to explore planar silicon and 3D silicon sensors. Both sensor groups will submit a final pre-production order and a decision will be based upon the quality, and yield from those orders. Both technologies meet the performance specifications put forth by the Collaboration. The current incarnation of the read-out chip could be made to work – though ATLAS would like to correct a few minor problems. Thus, ATLAS will submit another version of this chip for manufacturing this spring. This submission must work if ATLAS wants the benefit of those fixes – there is not sufficient time beyond this spring to do anything else and still be ready for 2013. Diamond detectors are not yet at a maturity level to be ready on this time scale. ATLAS is encouraged to continue to pursue this technology for the future as it is getting more mature with each passing year.

In addition, maintenance projects on the ATLAS list include the replacement of the Pixel Detector SQPs, the separation of the toroid and solenoid cryogenic delivery loops into two isolated systems, the improvement of the Tracker cooling system utilizing the siphon design and the replacement of all low-voltage power supplies of the LAr Calorimeter and Tile Calorimeter.