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# PRINCIPAL LHCC DELIBERATIONS

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35<sup>TH</sup> MEETING OF THE ATLAS RESOURCES REVIEW BOARD  
29 OCTOBER 2012

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SCIENTIFIC SECRETARY, LHCC

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**GENERAL**

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

**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. The highlight of the recent period has been the discovery of a new particle consistent with that of a Higgs boson.**

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**CONCERNS FROM THE PREVIOUS ATLAS RESOURCES REVIEW BOARD**

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SUB-SYSTEM	CONCERN	STATUS
Semiconductor Tracker (SCT) & Pixel Detector	Failure of optical links.	No failure of on-detector opto-boards have been observed so far. The mitigation plan being considered consists of removing the Pixel Detector in 2013 and replacing the existing Service Quarter Panels (SQPs) with new SQPs whose lay-out facilitates access to the optical links.

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**STATUS OF THE EXPERIMENT**

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**PHYSICS**

The physics programme is advancing well. ATLAS, along with CMS, announced on 4 July 2012 the discovery of a new particle, whose properties are consistent with that of a Higgs Boson. The ATLAS observation of the new particle was based primarily on the two-photon channel and the 4-lepton decay channel. By the time ATLAS published this result, the team had added in the WW decay and the significance grew to  $6\sigma$ . While such a success took a tremendous amount of effort from the Collaboration, it was by no means their only success. ATLAS continues to update and publish on a wide array of Standard Model measurements as well as searches for new physics. Thus far, no deviation from the Standard Model has been observed. ATLAS has submitted over 203 colliding beam papers to the journals and has written over 400 conference notes on the physics that they are performing.

In terms of this discovery, ATLAS has now (along with CMS) turned its attention to measuring the couplings to better understand the nature of the new particle. ATLAS will have a new update at the Hadron Collider Physics Symposium 2012 (HCP2012) this coming November. Besides updating all of the current channels, ATLAS will also show results in the  $b\text{-}b\bar{b}$  and  $\nu\nu$  channels. With the added data and improved analysis techniques, each channel should have an expected sensitivity at or higher than the Standard Model expectation. There is an agreement with CERN Management and CMS that

no new update will be carried out for the December CERN Council meeting. The next milestone for the Higgs studies following HCP2012 will be the 2013 winter conferences.

### OPERATIONS

Data taking operations are smooth. ATLAS has collected  $14 \text{ fb}^{-1}$  of data with about  $15 \text{ fb}^{-1}$  delivered. Data taking efficiency is steady at 94% and at the moment 88% of all data collected is being used for physics. ATLAS expects that number to get to 90% once the experiment reprocesses the current data and makes some corrections.

At the June 2012 LHCC session, ATLAS reported that the Transition Radiation Tracker (TRT) had developed several leaks. These leaks were modest, losing about 4 liters of Xenon per hour. The Collaboration was able to adjust flows and pressures such that the detector is able to operate well with no impact on the physics. Since then, the TRT has been stable. The leaks persist but no new ones have developed and the rate has not changed. A task force has been established but the findings to date have been inconclusive. ATLAS expects to be able to fix the leaks in the end-cap region during the Long Shutdown 1 (LS1), but will not be able to do anything about the barrel region since it will remain inaccessible.

The 40 new Tile Calorimeter power supplies installed during the year-end 2011-2012 Technical Stop continue to operate flawlessly, giving the Collaboration confidence to install the remainder during LS1. Meanwhile, the older models continue to trip.

The Collaboration continues to emphasise the importance of the 25 ns test runs in 2012 to ensure that the machine comes up in 2015 with the shorter bunch spacing compared to the current 50 ns bunch spacing.

The Level-1 trigger is operating a bit higher now than as reported at the LHCC session in June 2012 due to higher initial luminosities. It is now at 70-75 kHz with negligible dead-time. The Level-2 trigger is operating at about 5 kHz and Level-3 output is at 540 Hz, 400 Hz of which is for the three prompt streams and the remainder to be analysed at a later date. A few new triggers have been added to the delayed stream to increase the acceptance for Higgs in the  $\nu\nu b\bar{b}$  channel as well as the  $\tau\tau$  channel. The current trigger menu is good to an initial luminosity of  $8.5 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$  and ATLAS is developing a trigger menu good to  $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  just in case.

### COMPUTING

In terms of offline, the system design continues to be sufficiently flexible to respond to the changing demands of the experiment. The extension of the LHC running time does place significant demands on computing resources. For instance, the lifetime of the Event Summary Data (ESD) rolling buffer is being reduced from 6 to 4 weeks and the number of copies of data at both the T1 and T2 Tier centres has been reduced. The plan is to perform one full reprocessing of the 2010-2012 data and Monte Carlo to improve the quality of the reconstruction and to bring the entire data set to a uniform standard.

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### UPGRADES

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In terms of the planned Insertable B-Layer (IBL) upgrade, ATLAS continues to pursue both installation options; namely the one in which the entire detector is removed so that the Service Quarter Panels (SQPs) can be replaced and that in which the IBL and new beam pipe is installed in

the collision hall with the detector *in situ*. One major advancement since the June 2012 LHCC session is that the SQPs can be fully tested on the bench passively; it is not necessary to connect them to a detector for testing. That means that the SQPs will be fully and completely tested prior to when the December 2012 / January 2013 decision is made on which option to pursue. The LHCC was informed of a small leak that was found at the supplier in the new ATLAS beryllium beam pipe. Rather than try to fill it, ATLAS decided to cut the small section of pipe off the end that had the problem and weld a new section on. This will cause some delay in the delivery of the beam pipe but it is still expected to be at CERN well in advance of when it is needed.

During LS1, ATLAS will also install Uninterrupted Power Supply (UPS) systems with a 4-5 min. buffer on all read-out electronics in order to minimise the impact of the power glitches on the electronics. Also, the new cooling system construction is well underway. This passive, gravity-fed system should begin commissioning by year's end.

The LHCC noted two issues for LS2 preparations. The Muon Small Wheels are expected to be approved by the ATLAS Collaboration Board shortly. These Thin Gap Chambers (TGCs) and Micromegas detectors will have higher granularity and help in both triggering and physics tracking.

A review was held of the ATLAS forward physics detectors (AFP) proposed for installation at 210 m. from the ATLAS interaction point. The initial plan was to install them in LS1. That plan was disfavoured. Instead, ATLAS will consider installing them in a future intermediate year-end technical stop. Thus, some infrastructure will be installed during LS1 to allow this option. Meanwhile, the Collaboration asked the proponents for a full test-beam demonstration of readiness and asked for further physics studies.

Finally, ATLAS prepared two preliminary results that were submitted to the update of the European Strategy for Particle Physics, consisting of a document on the physics potential of the High-Luminosity LHC (HL-LHC) for proton-proton physics, including Higgs Boson coupling measurements, and a document on heavy-ions.