OPEN SESSION:

1. ALICE Status Report: Juergen Schukraft
2. ATLAS Zero Degree Calorimeter Letter of Intent: Sebastian White
3. Prospects for Diffractive and Forward Physics at the LHC: Valentina Avati, Monika Grothe
4. RD42 Status Report: Harris Kagan

CLOSED SESSION:


* part-time

1. PROCEDURE

The minutes of the eighty-fifth LHCC meeting (LHCC 2006-035 / LHCC 85) and the report from the ATLAS Comprehensive Review (LHCC 2006-036 / LHCC-G-121) were approved.

2. REPORT FROM THE CHIEF SCIENTIFIC OFFICER

The Chief Scientific Officer (CSO) reported on the status of the LHC machine installation and commissioning. Installation of the LHC machine is proceeding well and the project is advancing towards meeting its milestone for closure at the end of August 2007, albeit on a tight schedule. Although the preparation of the cool-down of Sector 7-8 was slowed down due to various difficulties, the cool-down of this first sector is now progressing rapidly. During the pressure test of Sector 8-1 in late November 2006, the heat exchanger tube in the inner triplet failed. Subsequent investigations showed that the source of the problem is with the design of the extremities and all 24 inner triplet quadrupoles will need to be repaired. The repair plan is currently being put together.

3. REPORT FROM THE ALICE REFEREES

The LHCC heard a report from the ALICE referees, concentrating on the status of the sub-detectors, progress with the integration and installation of the experiment and on an update of the schedule and milestones.

The Committee heard a report on the Time Projection Chamber (TPC). Due to a broken wire, chamber OROC-00 has been replaced, but the cause of the break remains unclear. Studies to improve understanding of the effect are currently in preparation. The TPC has been successfully lowered to the UX25 underground cavern and after a test installation in the Space Frame inside the solenoid magnet of ALICE, is now
waiting for insertion of the Inner Tracking System (ITS) in front of the solenoid magnet.

Good progress was reported on the ITS. Integration of the Silicon Pixel Detector (SPD) is advancing well and installation in ALICE is scheduled to start imminently. Construction of the Silicon Drift Detector (SDD) is complete and is being delivered to CERN. Assembly of the Silicon Strip Detector (SSD) is also complete and is ready for installation in ALICE. Integration of the SDD and SSD is about to start. Installation of the ITS together with the central Be beam pipe is scheduled for prior to the end of March 2007. The major concern remains the delivery of the low voltage power supplies for the SPD and SSD.

The referees also reported on the forward detectors. The revised installation schedule of these detectors on the A-side has the entire installation sequence moved back by three weeks. Although this would allow completion of installation before the closure of the LHC ring in August 2007, no further contingency is available in the schedule.

The Committee took note of the ALICE installation schedule. The schedule to complete ALICE in time for the LHC engineering later in 2007 is tight but feasible. Several ALICE sub-detectors have been installed but not yet connected nor surveyed in their final locations. Installation of services to the sub-detectors remains a critical task.

The next ALICE Comprehensive Review will be held on 19-20 March 2007.

4. REPORT FROM THE ATLAS REFEREES

The LHCC heard a report from the ATLAS referees, concentrating on the status of installation, on the progress in the sub-detector production and assembly and on the review of the power supplies.

Installation of the ATLAS detector is proceeding well. The installation is being coordinated well and is based on a reasonable plan. The upcoming key critical milestones are related to the completion of the installation and commissioning of the Inner Detector (ID) and the lowering of both End-Cap Toroids (ECTs). Moreover, due to the restricted access in the underground cavern, completion of the installation and commissioning of the Muon Wheels is tight. The LHCC considers that the overall ATLAS installation schedule is tight but it nevertheless remains feasible to have the experimental beam pipe closed by the end of August 2007.

The referees reported on the status of the ECTs. Impressive progress was reported on the repair and system integration since the previous meeting of the Committee. Assembly of ECT-A is complete and is ready for transport to the ATLAS experimental area and to be installed in ATLAS in June 2007. Assembly of the ECT-C cold mass is complete and the scheduled installation in ATLAS in July 2007 is expected to be met. Although the test and installation schedules of the ECTs have tight schedules, no major problems are expected and the overall schedule is feasible.

The Committee heard a report on the Muon Wheels. Good progress was reported on the assembly and installation of the Muon Wheels. Installation and commissioning of Muon Wheels in ATLAS have started successfully but the Committee considers the overall schedule to complete the Muon Wheels to be very tight. Particular concerns relate to the timely completion of the positioning and alignment of the Wheels.

The referees also reported on the status of the power supplies for the ATLAS experiment. No major concerns were expressed for the ID power supplies. Critical issues were raised for the Tile Calorimeter low voltage power supplies and relate to the reduced reliability, to the limited functionality and to the very tight procurement schedule for these systems. Retro-fitting and production of new modules of high voltage power supplies for the LAr Calorimeter are advancing well, and the critical path passes through the completion of production of such supplies for the End-Cap-C LAr Calorimeter. A new strategy is being implemented to solve the difficulties with the LAr Calorimeter low voltage supplies. This consists of awarding a contract
5. REPORT FROM THE CMS REFEREES

The LHCC heard a report from the CMS referees, concentrating on the review of the CMS status in December 2006, the status of the detector construction and installation and the overall schedule.

The referees reported on their review of the CMS status in December 2006. Good progress was reported on the Computing, Software and Analysis (CSA06) Challenge. Prompt reconstruction at the new Tier-0 facility went smoothly, transfer to Tier-1 centres exceeded targets and the transfer quality to Tier-2 centres was variable. For many analyses, the Challenge provided an important test for the validation of the analysis code under the CMSSW software framework. Future work will include improvements to the sustained high performance of the Tier-1 centres, increasing the role of the Tier-2 centres and the planning of a fully realistic Challenge with massively concurrent read/write accesses for the databases, full application of the Level-1 simulation, High-Level Trigger (HLT) and event pile-up. The HLT has been completely rebuilt during the move from ORCA to CMSSW. It is important for CMS to decide soon on the trigger algorithms and strategy in 2007 and 2008 and to provide a clear structure with connections to the sub-detector and physics groups. The draft CMS schedule that was presented to this review included several significant delays and had no contingency in the installation of the experiment. The LHCC referees recommended that CMS must develop a detailed, resource-loaded schedule consistent with the master LHC schedule and expand the Technical Co-ordination effort. CMS has since responded effectively to these recommendations.

The LHCC heard a report on the Tracker. Very good progress was reported on the Tracker. All Tracker sub-detectors have been integrated and tested in the Tracker Integration Facility (TIF). The quality of all sub-detectors is excellent. The challenge now lies with ensuring that the same quality is maintained throughout the integration of the Tracker sub-detectors into the Tracker Support Tube (TST). Prior to the integration into the TST, a Detector Performance and Quality Assurance Review is carried-out to ensure that all pre-integration issues have been thoroughly addressed.

The Committee heard a report on the Electromagnetic Calorimeter (ECAL). Production and delivery of crystals for the Barrel and End-Cap ECAL is advancing according to schedule and the crystals quality is good. Tests on refurbished ECAL motherboards, following repair to the kapton connections, show no particular problem. The first set of motherboards and cooling blocks have been inserted in Supermodule SM0 and the integration of the electronics for SM0 has started. Preparation of the Supermodules is on schedule. Installation of the ECAL into CMS must now be underground because of the delay due to the motherboard repairs.

The referees reported on the CMS schedule. Much progress was reported since December 2006 in developing the details of the CMS installation schedule. In particular, intense focus has been put on lowering and connecting YB0, cabling of the Tracker, and general pipework, all of which include credible plans to speed up the schedule. As a result, CMS was able to hold the schedule to the day during January 2007. The schedule to complete the initial CMS detector for the LHC run later in 2007 remains very tight and has no contingency.

6. REPORT FROM THE TOTEM REFEREE

The LHCC heard a report from the TOTEM referee. Pre-production of three Cathode Strip Chambers (CSCs) for the T1 Telescope, identical to the final detectors, have been delivered to TOTEM and mounted at the test beam. Mass production of the CSCs is scheduled to start in mid-February 2007. Production Gas Electron Multiplier (GEM) detectors for the T2 Telescope is advancing well and completion of manufacture is imminently and developing a back-plan based on two options. The schedule for the completion of the LAr Calorimeter low voltage supplies remains very critical. The delivery schedule for the Muon System power supplies does not at present satisfy the needs of the experiment and ATLAS is following-up production closely.
expected in June 2007 as planned. Ten such GEM detectors are presently mounted at the test beam. Excellent progress was reported on the Roman Pots. Components (mechanics) for all eight stations have been delivered and all Roman Pots have been mechanically assembled, except for all of the thin windows. A complete prototype of the sensor infrastructure, including the cooling, has been tested and it has been shown that the cooling system works satisfactorily. The LHCC took note of the document presenting the prospects for diffractive and forward physics at the LHC, which has been submitted jointly by the CMS and TOTEM Collaborations, and acknowledges the effort of the two Collaborations in developing the physics case. The Committee encourages the Collaborations to continue their studies in an effort to develop further the common physics programme and to go deeper in the analysis of the various physics channels of interest.

7. **REPORT FROM THE LCG REFEREES**

The LHCC heard a report on the LCG, concentrating on the service ramp-up, a status report on storage elements, job success monitoring and the gLite-3.0 deployment.

The referees reported on the outline of the 2007 service ramp-up. The aim for 2007 is for the computing to be ready for first data-taking ahead of the LHC machine start-up. Dress Rehearsals are scheduled for the second half on 2007. Much work has already been done on preparing the service and a great deal remains to be accomplished prior to the Dress Rehearsals, particularly in ensuring stability over a large number of sites. The LHC experiments are using the W-LCG service. Development of a production service dashboard is in progress and is needed to monitor progress of the provided service with aggregate summaries. Good progress was reported on the deployment of gLite-3.0. The gLite-3.0 has become the production middleware on Enabling Grids for E-sciencE (EGEE) and all services are in production use. Migration to Scientific Linux SLC4 is imminent. The CASTOR storage management service is still maturing while the software is stabilizing and more effort needs to be put in this area to complete the successful deployment. The deployment of the Storage Resource Manager SRMv2.2 is delayed further and its convergence plans are unclear. Back-up plans need to be discussed should SRMv2.2 not be available on time.

8. **ELECTRONICS FOR LHC AND FUTURE EXPERIMENTS**

The LHCC heard a report on the electronics for the LHC and future experiments. Following a massive development over the past decade, the LHC experiments have made tremendous progress in applying modern electronics and are now on the verge of final implementation. However, not all procurements are yet complete, commissioning of the final systems *in situ* will require time and the operation of all systems together will be a new experience. It is expected that these large and complex systems will need significant effort to be made to work together to the required standard. Critical areas have been identified for improving the systems for an LHC luminosity upgrade, including power delivery, optical links and ASICs in deeper sub-micron technologies. The schedule considered to upgrade the complex electronic systems is ambitious. There is plenty of scope for common efforts. Moving towards an upgraded LHC, certain pointers were raised to improve the electronics effort. The reliability and qualification at the LHC has been difficult. The LHC Electronics Coordinating Committee (LECC) workshops have contributed to addressing these issues and the workshops are now evolving into a wider electronics forum called Topical Workshop on Electronics for Particle Physics (TWEPP). While the LHC experiments are realising successfully their large electronic systems, it is probably unwise to take the current steady progress for granted. The new LHC upgrade phase would again require careful co-ordination and monitoring.
9. TEST BEAMS

The SPS and PS Coordinator reported on the status of the LHC injectors and on the LHC test beams.

He pointed out that the several major problems encountered in 2006 at the PS and SPS accelerators, including the breakdowns of the SPS main compensator, PS rotating main power system, PS injection septum failure, LINAC2 failures, and two major CERN power cuts would all have stopped and curtailed LHC operation. Consolidation of the LHC injection chain is presently underway with the aim of avoiding stop of these machines in the future.

Preparation of the User Schedule for the PS East Hall and SPS North Area is in progress, and it is expected that the requested beam time is available. The future of the Gamma Irradiation Facility (GIF) remains unclear and in order to make progress in the evaluation of future requirements, input is solicited from the LHC experiments for the need of such a facility to study detectors for an LHC upgrade.

The approved accelerator schedule for 2007 has the physics programme at the PS East Hall and at the SPS starting on 2 May and 25 May, respectively, and with both ending on 12 November. Operation of the PS Complex and the SPS as LHC injectors is scheduled as of 12 November. Commissioning of ion beams for the LHC in the SPS is scheduled to start on 4 September. The start of PS and SPS operation as LHC injectors is scheduled for 12 November.

10. LHCb COMPREHENSIVE REVIEW

The fifth of the LHCC Comprehensive Reviews of LHCb took place on 29-30 January 2007. The LHCC referees addressed the following areas: Vertex Locator, Silicon Tracker, Outer Tracker, RICH Detectors, Calorimeters, Muon System, Level-0 Trigger and Online Computing, Physics and Computing, Software and the High-Level Trigger, and the issues of Installation, Commissioning and Management.

Since the previous Comprehensive Review in February 2006, the LHCb Collaboration has made very significant progress towards the realisation of an experimental set-up ready to record proton-proton collisions at the LHC. The LHCC expects LHCb to have a working detector installed in time for the beginning of the LHC engineering run in 2007 provided the timely delivery of the sub-detectors and the current smooth advancement of the production and installation schedules is ensured.

Construction of final components is well advanced and installation and commissioning of systems have started in the UX85 underground cavern. The Electromagnetic Calorimeter (ECAL) and the Hadronic Calorimeter (HCAL) have been installed, aligned and cabled in the UX85 experimental cavern and the RICH-2 Ring Image Cherenkov Detector has also been installed in the UX85 cavern. Installation of the infrastructure and technical services in the experimental area is being completed. Issues concerning the interference due to the installation, commissioning and operation of LHC Machine components around the LHCb experimental hall are being successfully handled. The LHCC noted as a concern the delays and resulting tight schedules in the production of the Vertex Locator (VELO), the RICH-1 Detector and the installation of the first station of the Muon System (M1). Measures to mitigate ageing effects of the Outer Tracker are being implemented, although a full understanding of the cause of the resulting gain loss is still lacking.

The principal conclusions and concerns of the LHCC are summarised below. They will allow the Committee to follow up the outstanding issues and to monitor future progress of this project in forthcoming sessions of the LHCC prior to the next LHCb Comprehensive Review one year hence.

- Very good progress was reported on the VELO. Many technical problems, associated particularly with the silicon modules, RF boxes, and kapton cables, have been resolved. The overall schedule for the detector installation and commissioning
is tight but realistic. The major outstanding issue concerns a small leak detected in the RF boxes. The Committee has requested details on the procedures for the precise positioning of the modules with respect to the beam location at the start of the run.

- The TT and IT detectors are well advanced in their construction. The quality of the detectors is excellent. The TT and IT are likely to meet their schedule and be installed and tested in time for the LHC engineering run.

- There has been significant progress in the area of installation and commissioning of the Outer Tracker and related services. The front-end electronics is in production and will be ready in June 2007. In parallel to the detector installation, a remarkable amount of studies has been performed to understand and mitigate the ageing effects observed in the modules from the mass production. Several encouraging results in view of preventing and curing of the symptoms have been obtained, but the source of the problem has not yet been unambiguously identified. Continuation of the ageing investigations and further studies of the impact on the physics performance are still required.

- The Committee took note of the impressive general progress of the RICH detectors, the almost full completion of the RICH-2 assembly, and the success of the pre-commissioning during the September 2006 test beam exercise, during which the integration of several project elements, both in the hardware and software sectors, was performed successfully. The good quality and the regular delivery of the HPDs suggest that the challenging production will be successfully completed. The Committee appreciates the change of supplier and technology for the RICH-1 spherical mirrors following the failure of the beryllium mirror substrate supply. However, parts of the RICH-1 components are not yet available and the RICH-1 schedule to completion remains very tight. The commissioning of the RICH-2 in situ, scheduled to start in March 2007, is regarded as the next major milestone of the RICH project.

- Good progress was reported on the Calorimeters with no major concerns having been identified.

- Good progress was reported on the Muon System with no major concerns having been identified, except for the noticeable delay in the installation of the first station.

- Both the Level-0 and Online Systems are on target for the start of the LHC engineering run. While the progress should still be carefully monitored, there are no major concerns identified.

- The physics effort is well on track, and has made impressive progress in assessing the treatment of systematic effects in heavy flavor analyses, and in preparation for the physics topics of the early years of LHC data-taking. The physics studies need to be updated according to the increased realism in the detector geometry and material description. The computing project has progressed well demonstrating simulation and digitization of a large data sample in the Data Challenge DC06. The second part of the Challenge, including large-scale distributed reconstruction, analysis and alignment exercises, is only starting now, which results in a very busy schedule for 2007.

- The software and High Level Trigger infrastructure and algorithms are well advanced. The increased realism of the Data Challenge DC06 simulation has caused a performance deterioration whose impact on physics should be fully investigated. HLT testing on real data during the 2007 LHC engineering run is essential, as well as setting up dedicated data streams to verify the trigger efficiency and bias.

- Much progress was reported on the work in the UX85 experimental cavern. The LHCC considers that although the schedule is tight, it is realistic to expect LHCb to have a working detector installed in time for the beginning of LHC engineering run in 2007 and for the 7 TeV run in 2008.
11. REFEREES
Following changes to the LHCC membership, the new referee teams are as follows:
ALICE: P. Dauncey, M. Gonin, J. Haba (Co-ordinator)
ATLAS: F. Forti, V. Kekelidze (Co-ordinator), M. Martinez-Perez, P. Mato
CMS: S. de Jong, R. Mankel, S. Smith (Co-ordinator), R. Yoshida
LHCb: S. Dalla Torre, C. Niebuhr, B. Peyaud (Co-ordinator)
TOTEM: S. Dalla Torre
MOEDAL: B. Peyaud
LHCf: M. Mangano, C. Niebuhr
RD39: S. de Jong
RD42: V. Kekelidze
RD50: R. Yoshida
LCG: P. Dauncey, F. Forti (Co-ordinator), R. Mankel, M. Martinez-Perez

12. DATES FOR LHCC MEETINGS
Provisional Dates for 2007:
21 – 22 March
9 – 10 May
4 – 5 July
26 – 27 September
21 – 22 November

The LHCC received the following documents:
ATLAS Zero Degree Calorimeter Letter of Intent
LHCC-2007-001

Prospects for Diffractive and Forward Physics at the LHC
LHCC-2006-039/G-124

RD42 Status Report
LHCC-2007-002/RD42

ATLAS Comprehensive Review Report, 16 November 2006*
LHCC-2006-036/G-121

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