OPEN SESSION:

1. MOEDAL Status Report: James Pinfold / University of Alberta
4. ATLAS Status Report: Peter Jenni / CERN

CLOSED SESSION:


*) Part time

Apologies: W. Bartel, P. Lebrun, L. Maiani, D. Schlatter

1. INTRODUCTION

The minutes of the fifty-seventh LHCC meeting (LHCC 2002-013 / LHCC 57) were approved without modification.

The Research Director for Collider Programmes informed the Committee on various issues concerning the LHC programme.

He briefed the LHCC on the External Review Committee interim report to Committee of Council in March and on the status of the CERN medium and long term plans to be submitted to forthcoming sessions of Council.

He also reported on the very positive outcome from the April Resource Review Boards (RRBs) of the LHC experiments. The Memorandum of Understanding for each of the four experiments regarding the Maintenance and Operation (M&O) costs were approved. The M&O costs for 2002 were agreed and the funding agencies received the requests for 2003. Moreover, the Commissioning and Integration (C&I) costs were scrutinized and accepted by the RRBs. ATLAS and CMS will present to the October RRBs their spending profiles and plans on how to complete their experiments with the available funds. In view of this, the LHCC will review these plans in October prior to the RRBs.

He also informed the Committee that a technical review of the provision of heavy-ions at the LHC and its injectors will be held later in 2002. In view of this, the LHCC is calling for a workshop prior to this review to collect and consolidate the requirements from the ALICE, ATLAS and CMS experiments concerning their
desired luminosities, energies, and type of collisions, e.g. ion-ion (both Pb-Pb and lighter species), p-p and p-N, to successfully carry out the ion physics programme at the LHC.

In addition, the LHCC will be holding a review of the installation of the ATLAS and CMS experiments in the underground experimental caverns, including the projected schedules and milestones and the required resources to successfully carry out the installations.

Finally, the Director of Research reported on the possibility of not operating the PS Complex in 2005 in an effort to save money and to re-direct manpower to the LHC project. The LHCC requested that the LHC experiments study the consequences of such an action and submit their arguments on keeping the PS Complex running in 2005.

2. REPORT FROM THE ATLAS REFEREES

The Committee heard a report from the ATLAS referees, concentrating on the status of the Inner Detector and computing and reviewing the plan to complete ATLAS.

The referees reminded the Committee of the unstable operation of the SCT end-cap K4 hybrids. After a systematic study on various options, the SCT group is now pursuing a re-designed lay-out – K5. The group has planned a series of extensive system tests, with the aim of having results in mid-June 2002, which will serve as input to the design review scheduled for July 2002.

Moreover, the referees reported on the progress concerning the type of wire-joints for the barrel TRT. After a series of tests on various technologies, the group is now pursuing a solution based on a polyimide/epoxy joint. Further tests are planned on such joints, focusing on evaluating possible wire damage scenarios. The LHCC noted that the final choice of the gas for the TRT will be decoupled from the wire-joint decision as the timescale for a decision on the former is much longer. The LHCC also considers that although the impact of the wire-joint delay on the overall barrel TRT schedule is small, the schedule nonetheless remains tight. The LHCC will continue monitoring the progress in this area at its upcoming meetings.

The referees also presented the status of the computing, focusing on the Data Challenges (DCs) and the TDR for the Higher Level Triggers. The Committee noted that the delay in the schedule for the DCs is caused primarily by the extra time needed to update the detector geometry and read-out mechanism. The DCs were originally scheduled to be completed by the end of July 2002 but the date has now moved to the end of 2002. In view of this, ATLAS requests a 6-month delay in the submission of the Higher Level Trigger TDR, namely until June 2003, in order to allow sufficient time to analyse the DC data.

The LHCC expressed its concern on the uncertainties regarding production of RPCs given the changes in the bakelite and changes at the production site. In view of these uncertainties, ATLAS will be invited to the next Open Session of the LHCC to present the status and plans for the production of their RPCs.

Finally, the LHCC heard a report on the revised cost-to-completion and the proposed plan to proceed with the detector construction. Given the recent agreement at the April RRBs to cover the M&O costs, the remaining cost-to-completion for ATLAS is 68 MCHF, and consists of items concerning construction completion and C&I costs. Following many very constructive contacts with the Funding Agencies, ATLAS is developing a tentative sharing proposal between these agencies to cover the remaining cost-to-completion. The LHCC considers that the schedule to complete ATLAS by 1 April 2007 is realistic and that the planning has some flexibility and contingency.

The LHCC noted that further contingency in case the total funding is not available in time for the first physics run in 2007 would have to be provided by deferrals in either
the HLT/DAQ components or in other systems. Uncertainty remains on the actual loss to physics by deferring the former components and the resulting reduction to the input trigger rate to the HLT. The LHCC asks ATLAS to clarify the issue. The Committee also asks ATLAS to consider other systems where deferrals may be made. The LHCC will submit documentation to the next ATLAS RRB, providing the Committee’s considerations on the staging plans and their impact on the physics programme.

The next ATLAS Comprehensive Review will be held on 1-2 July 2002.

3. REPORT FROM THE CMS REFEREES

The Committee heard a report from the CMS referees, concentrating on the status of the ECAL, Muon Spectrometer, computing and the funding of the experiment.

Concerning the ECAL, good progress was reported on the crystals, the APD and VPT photosensors, the mechanics and the installation scheme. The LHCC also received documentation from CMS on the proposed changes to the ECAL electronics (LHCC 2002-18/M-11). Re-organisation of the read-out system, whereby the number of optical links and the number of off-detector boards will be reduced but with the inclusion of new Level-1 ASICs electronics, provides cost savings to the ECAL project. A feasibility study of the new electronics configuration is underway. However, the LHCC considers that the biggest uncertainty remains with the successful development of the FPPA component of the read-out electronics. A new management structure has been set up and the required manpower has been found within the Collaboration and integrated into the ECAL electronics group.

The LHCC considers that the plan presented by CMS on revamping the ECAL read-out is sound and the Collaboration is encouraged to proceed to the final design incorporating the modifications. The LHCC, however, asks CMS to submit an Addendum to the ECAL TDR as soon as possible for consideration by the Committee. Significant investments on the ECAL electronics should await the final recommendation of the LHCC on the Addendum to the ECAL TDR.

Moreover, the referees reported on the Muon Spectrometer. The LHCC considers that the CSC project is on schedule and is keeping within the budget. As for the DTs, assembly of the chambers is behind schedule, although the delays are considered to be recoverable. Also, the Committee noted the delay in the production of the read-out and trigger electronics and the tight schedule for their installation in the experiment. Progress was demonstrated in the preparations for the RPC chamber assembly. However, the LHCC expressed its concern on the uncertainties regarding production of RPCs given the changes in the bakelite and changes at the production site. In view of these uncertainties, CMS will be invited to the next Open Session of the LHCC to present the status and plans for the production of their RPCs.

Furthermore, good progress was reported on the computing. CMS is considered to be cooperating well with the LHC Computing Grid (LCG) project. However, the alignment of the CMS computing with the LCG project has temporarily slowed down developments in CMS. The LHCC will monitor the CMS computing to ensure that positive feedback emerges from the LCG project and progress resumes.

Finally, the referees reported on the funding situation and on the schedule and milestones. Given the recent agreement at the April RRBs to cover the M&O costs, the remaining cost-to-completion for CMS is 63 MCHF, and consists of items concerning construction completion and C&I costs. CMS is considering systems where deferrals may be made. The LHCC will submit documentation to the next CMS RRB, providing the Committee’s considerations on the staging plans and their impact on the physics programme. The LHCC considers that the schedule to complete CMS by 1 April 2007 is realistic and that the planning has some flexibility.
and contingency. The critical path still remains with the integration of the Trigger/DAQ.

4. DISCUSSION ON THE ATLAS AND CMS TRIGGER RATES AND ASSOCIATED PHYSICS PERFORMANCE

The LHCC heard a report from the joint meeting held on 14 May 2002 between the ATLAS and CMS referee teams and the respective ATLAS and CMS trigger teams regarding the projected higher-level trigger rates in the two experiments and the associated physics performance. The trigger rates and performance of the two experiments are found to be compatible when compared using the same trigger thresholds. Moreover, as the rates are very sensitive to the trigger thresholds, it is possible to optimise the trigger thresholds further in order to maximize the acceptance of the triggers. In view of this, the Committee requests the experiments to develop a plan for their physics programmes given the optimised trigger rates and the resulting computing resources required. The LHCC will assess the above plans in forthcoming meetings.

5. REPORT FROM THE ALICE REFEREES

The Committee heard a report from the ALICE referees, focusing on the general status, the review of the Addendum to the Time-of-Flight (TOF) TDR, and the follow-up of the software report at the March ALICE Comprehensive Review.

The referees reported on the general status of the experiment. The TDR for the Forward Detectors is currently being prepared with the aim of submitting it to the LHCC early in 2003 and a note on the holes in the TRD detector is also being written. Moreover, the funding for the PHOS is being evaluated. ALICE is continuing its studies to re-locate the HMPID. A new overall ALICE schedule is under preparation, given the revised LHC schedule.

The Committee heard a report on the referees’ preliminary reactions to the Addendum to the TOF TDR (LHCC 2002-16 TDR 8 Add. 1). The TOF detector was proposed in 1999 and presented in a TDR (LHCC-2000-12 / ALICE TDR 8) at the beginning of 2000. The TDR presented a detector based on Multigap RPCs with the aim of identifying charged particles over the full central region, in the intermediate momentum range above the ITS/TPC particle identification capability and partly overlapping with the HMPID higher momentum range. Several details of the final detector have since been studied and tested with a full size Multigap RPC: the type of glass both in terms of resistivity and of practical thickness, the definition of the edge of the active area, the optimal value of the gas gaps and the type of spacers to define them, the sharpness of the boundaries between adjacent pads.

The Committee is currently reviewing the Addendum to the TOF TDR. Following further questions and discussions, the referees will make a full report on the Addendum to the TOF TDR at the next meeting of the LHCC.

The GEANT4 group has submitted a note to the LHCC describing studies illustrating that GEANT4 is well-suited for the simulation of hadronic showers in the calorimeters of the LHC experiments, in response to certain claims to the contrary at the March ALICE Comprehensive Review. The current improvement in GEANT4 has resulted from correcting a bug in the previous version. The Committee noted that the data shown in the note are preliminary and work is continuing to develop and improve GEANT4.
6. REPORT FROM THE LHCb REFEREES

The LHCC heard a report from the LHCb referees, concentrating on a review of the general status of the experiment, progress with the re-optimisation of the detector and the status of the Hybrid Pixel Detectors (HPDs) for the RICH sub-detector.

Good progress was reported on the re-optimisation of the LHCb detector. The LHCC considers that the new lay-out yields an improved spectrometer, as illustrated by results from studies on the tracking and momentum resolution. The LHCC will continue monitoring the progress in the re-optimisation and will review the physics impact of the new configuration at its meeting in July 2002.

Moreover, the referees reviewed the status of the HPDs. Good progress was reported on the status of the 40 MHz read-out chip developed jointly with ALICE. It was shown to pass all the configuration and functionality tests. Threshold and noise specifications have been met at 10 MHz and tests are being prepared at 40 MHz.

Individual aspects of the HPDs have been tested and the device has behaved according to expectations, but with one important exception. Bump-bonding of the chips on to the pixel sensors has not yet been successfully demonstrated, resulting in a halt of the production of the new prototypes. Although many possible causes for the failure have been identified, demonstration of the feasibility of the process before late in the autumn 2002 appears now to be very unlikely.

On the other hand, the Multi-anode Photomultiplier (MAPMT) back-up option has not been sufficiently developed. In particular, the option of a binary read-out without compromising the performance has not been demonstrated, and the project suffers from a lack of manpower.

The LHCC considers the delay in the production of satisfactory HPD prototypes and the choice of the RICH photon detector to be a major concern. The Committee asks the LHCb Collaboration to develop clear plans for making the technical choice between the HPD and MAPMT options and for the R&D leading to a timely fabrication of working RICH photon detectors, and to provide a written report on these decisions to the July 2002 meeting of the LHCC.

Finally, the referees reported on the progress LHCb is making toward meeting their overall milestones. Although a number have been successfully passed, several have been delayed. The latter, mostly related to the re-optimisation process, are considered not to be critical, with the exception of the one serious delay of the development of the HPD for the RICH sub-detector. The milestones are currently being revised to conform to the new LHC schedule and the new list will be submitted to the LHCC for review in the autumn.

7. REPORT FROM THE RD39 REFEREE

The RD39 referee reported on outstanding issues from the LHCC meeting in January 2002 concerning the provision by the Collaboration of a comprehensive short-term plan for their R&D, including schedules and assigned responsibilities. Documentation was submitted by the Collaboration (LHCC 2002-015), which informed the Committee on the RD39 plan, required resources and individual responsibilities.

The LHCC considers that the documentation fulfills the Committee’s request for additional information and encourages the Collaboration to continue work on a) understanding the phenomena of radiation damage in semiconductor devices, b) investigating parameters influencing the charge collection efficiency, and c) investigating larger size sensors together with the associated read-out. The LHCC considers that the technology developed by RD39 may be potentially a very interesting option for tracking detectors in high radiation environments and
recommends that the Collaboration carry out their further programme of work and submit a status report to the LHCC in one year.

8. REPORT ON THE R&D PROPOSAL ON THE DEVELOPMENT OF RADIATION HARD SEMICONDUCTOR DEVICES FOR VERY HIGH LUMINOSITY COLLIDERS

The Committee heard a report on the R&D proposal on the development of radiation hard semiconductor devices for very high luminosity colliders (LHCC 2002-003/P6). The proposal is to develop an R&D programme to provide a detector technology to operate at hadron collider luminosities of up to $10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ and a possible reduced bunch-crossing interval than the 25 ns of the LHC. The Committee considers that the proposed experimental programme is sound and that the results of the R&D would be important to future high luminosity colliders, including an upgraded LHC. However, the Committee asks the Collaboration to present a clearer and simpler organizational structure that will see through the main lines of R&D of the overall programme and that will include the assignment of individuals to particular tasks. The LHCC, therefore, recommends that the Collaboration carry out its programme of work on condition that the above concerns of the LHCC on the organizational structure are clarified. A status report should be submitted to the LHCC in one year.

9. REPORT FROM THE MOEDAL REFEREE

The LHCC heard a report from the MOEDAL referee. The MOEDAL Collaboration proposes to search for highly ionising particles, particularly monopoles, at the LHC. The search apparatus consists of a passive plastic track-etch detector to be deployed around the vertex region of LHCb at Point 8 of the LHC. The LHCC considers that the physics motivation for the search is sound and that the proposed experimental method and apparatus are reasonable. The Committee, however, asks the Collaboration to continue investigating the integration issues with LHCb, including the interfaces to the latter’s services, material, magnetic field and vertex detector and to study the background to the MOEDAL experimental search. The LHCC, therefore, encourages the MOEDAL Collaboration to continue developing their experimental design with the aim of submitting a Technical Proposal to the Committee in early 2003.

10. TEST BEAMS

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

The PS East Hall started on 6 May, but not before a short in a power supply transformer on the beam extraction line failed. As no spare is available and repair at CERN is not possible, the power supply has been sent back to the manufacturer and it may be up to a few months before it is brought back into use at the PS Complex. In the meantime, the PS East Hall is operating with a reduced primary proton beam energy of 20 GeV, rather than the 24 GeV, and with a reduced amount of beam intensity. ALICE and LHCb are not significantly affected by these conditions, but the LHC irradiation tests are experiencing difficulties to reach their integrated flux in their allocated beam-time.

Start of physics at the SPS is scheduled for 27 May. The SPS is already operational with beam scrubbing experiments for the LHC, which are studying methods to reduce the electron cloud effect.
11. DATES FOR LHCC MEETINGS

Dates for 2002:
3-5 July
2-4 October
27-28 November

The LHCC received the following documents

- Addendum to RD 39 Status Report (LHCC 2002-15/RD39 Add. 1)
- Addendum to ALICE Time of Flight TDR (LHCC 2002-16 TDR 8 Add. 1).
- Proposed changes to the CMS ECAL electronics (LHCC 2002-18/M-11)*.

* Restricted circulation

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