CERN/LHCC 2009-003
LHCC 97
19 February 2009

LARGE HADRON COLLIDER COMMITTEE

Minutes of the ninety-seventh meeting held on
Wednesday and Thursday, 18-19 February 2009

OPEN SESSION

1. Report from the LHC Performance Workshop – Chamonix 2009: Steve Myers
2. Report from the Topical Workshop on Electronics in Particle Physics 2008: François Vasey

CLOSED SESSION:

Present: F. Bedeschi, S. Bertolucci, G. Blazey, P. Bloch, H. Breuker, C. Cecchi, D. Espriu*, M. Ferro-Luzzi, M. Gonin, J.-F. Grivaz, C. Hawkes, J. Knobloch, M. Mangano, M. Martinez-Perez, P. Mato, A. Nomerotski, D. Pitzl, S. Smith, E. Tsesmelis (Secretary), T. Wyatt (Chairman), R. Yoshida

*part-time

Apologies: W. Kuehn

1. PROCEDURE

The Chairman welcomed Sergio Bertolucci, the new Director of Research and Scientific Computing, Philippe Bloch, the new PH Department Leader and Eckard Elsen, a new member of the Committee. In view of the fact that the experiments are, in general, making excellent progress towards being ready for first collisions, and that first collisions are now expected in October 2009, it has been agreed, in consultation with the Director of Research and Scientific Computing to cancel the LHCC meeting originally foreseen for May.

The minutes of the ninety-sixth LHCC meeting (LHCC 2008-021 / LHCC 96) were approved.

2. REPORT FROM THE DIRECTOR OF RESEARCH AND SCIENTIFIC COMPUTING

The Director of Research and Scientific Computing reported on issues related to the LHC. Repair of LHC Sector 3-4 is advancing well. Several precautionary measures are being taken. Firstly, an enhanced protection system measures the electrical resistance in the cable splices and is much more sensitive than the system existing on 19 September 2008. Moreover, a new pressure relief system has been designed. Installation of these valves on existing vacuum ports around the full LHC ring along with additional relief valves on dipole magnets in four LHC sectors will be completed in 2009, while the dipoles in the remaining four LHC sectors will be equipped in 2010. Such a system ensures that collateral damage to the LHC machine would be minor in all worst-case scenarios.

3. REPORT FROM THE LHC PROGRAMME CO-ORDINATOR

The LHCC heard a report from the LHC Programme Co-ordinator. He reported on the deliberations at the LHC Performance Workshop, which was held in Chamonix in

early February, presented the LHC schedule and summarised the organisation of the new CERN management structure.

The annual Chamonix yearly retreat is deemed to be crucial for establishing the accelerator plans for the year and for strengthening the links between the LHC machine and experiment groups. The deliberations at this year's workshop have resulted in a series of strong recommendations. Amongst them, the new LHC schedule foresees first beams in the LHC at the end of September this year, with collisions following in late October. An LHC proton run will continue through the 2009-2010 winter and a running period extending up to eleven months is feasible. A short technical stop has also been foreseen over the Christmas period. The LHC will run at an initial centre-of-mass energy of 10 TeV with the aim of collecting up to about 200 pb^{-1} of integrated luminosity in this first proton run. An ion run will follow the end of the proton run in 2010.

The LHC Programme Co-ordinator also presented the organisation of the new CERN management structure. He emphasised the organisation of the committees and working groups of the Accelerator Sector, including the role of the LHC Programme Co-ordinator and the LHC Programme Committee.

4. REPORT FROM THE ALICE REFEREES

The LHCC heard a report from the ALICE referees, concentrating on the status of the experiment.

The Committee heard a report on outstanding critical issues. Good progress was reported on the V0 detector, including the modification of the electronics, the evaluation of noise effects, the production of spares and the finalisation of the monitoring software. Evaluation of the cooling for the Silicon Pixel Detector (SPD) has advanced and several upgrades have been proposed and scheduled. Repair work due to problems with the high voltage and gas leaks on installed super-modules of the Transition Radiation Detector (TRD) is in progress. Issues related to the final production of the Multi-Chip Modules (MCM) read-out electronics have resulted in the need for additional funds, the request for which is presently ongoing. Good progress has been made in the realisation of the Photon Spectrometer (PHOS). Components for assembling three PHOS modules are available and the delivery of the air-tight cases is imminent. Modification of the Miniframe is in progress and is scheduled to be installed in early May 2009. Good progress was reported on identifying sources of common noise and on taking corrective actions.

The LHCC took note of the ALICE shutdown schedule. The doors of the solenoid magnet will be closed on 20 June 2009 and the A-side shielding, radiation plug and ventilation will be ready on 12 September 2009. Global commissioning of ALICE is scheduled to start in early August 2009 and continue until first beam injection.

5. ALICE TECHNICAL DESIGN REPORT ON THE ELECTROMAGNETIC CALORIMETER

The LHCC has completed its scientific and technical evaluation of the ALICE Technical Design Report (TDR) on the Electromagnetic Calorimeter (EMCal) (LHCC 2008-014 / ALICE TDR 14) submitted in September 2008. The Committee was impressed by the quality of the work presented in the TDR and congratulates the Collaboration. The concept of the EMCal, based on the Shashlik technology, is well suited to the challenge of enhancing the ALICE experiment's capabilities for jet quenching measurements. Moreover, the EMCal will enable the ALICE experiment to trigger on high-energy jets, to reduce the measurement bias for jet quenching studies, improve the jet energy resolution and augment existing ALICE capabilities to measure high-momentum photons and electrons.

The Committee has no major concerns. An ancillary document (LHCC 2009-004 / G-145) records the overall assessment by the LHCC of the project at this time, thereby emphasizing some points which should be monitored in the future as the project

progresses. The LHCC review of the TDR was not a detailed review of the engineering or procurement readiness.

Recommendation:

The LHCC recommends general approval of the ALICE TDR on the Electromagnetic Calorimeter. The LHCC considers the schedule given in the TDR to be reasonable. The schedule will be used by the Committee to measure and regulate the future progress of the project.

6. REPORT FROM THE ATLAS REFEREES

The LHCC heard a report from the ATLAS referees, concentrating on the status of the experiment, the reprocessing of cosmic-ray data and the status of the software and computing and requests for the initial LHC running period.

The referees reported on the status of the ATLAS detector. Good progress was reported on the Semiconductor and Pixel Detector optical link replacements, on the LAr Calorimeter optical links and on the LAr low-voltage power supplies. Issues which need further attention are the Pixel Detector loss of channels (0.5% to 1.5%) and leaking cooling coils; and the Cathode Strip Chamber (CSC) read-out, which is not yet established, but for which new firmware is expected in the late spring. The LHCC considers that ATLAS has a reasonable experiment commissioning plan with sufficient contingency.

The Committee also heard a report on the reprocessing of cosmic-ray data. The referees consider that the reprocessing has been a successful exercise and the feedback has been valuable. The ATLAS computing model is adequate and the optimisation of the performance with respect to staging, database and monitoring is underway. The software release strategy is serving the experiment well and there is a good agreement between cosmic-ray data and simulation.

7. REPORT FROM THE CMS REFEREES

The LHCC heard a report on the CMS experiment, concentrating on the status of the detector, the shutdown activities and the software and computing.

The referees reported on the status of the CMS detector. Installation of the Preshower (ES) is underway. All 4 Dees of the ES are ready for installation and installation of the ES+ is scheduled to start on 2 March 2009 while that for ES- starts on 13 March 2009. Installation of the ES completes the CMS low-luminosity detector. The Committee noted that solutions are in hand for all significant issues highlighted at the previous session of the LHCC. Good progress was reported on resolving the Resistive Plate Chamber (RPC) dark current problem; the field-sensitive Hybrid Photo Diodes (HPDs) for the Hadronic Barrel Calorimeter have been replaced; the renovation of the Tracker cooling plant is well underway; the fringe field problems have been largely mitigated and an extensive effort continues in order to understand the reasons for it being larger than the predictions; and procedures and tooling to reduce risks and time in opening and closing the CMS detector have been developed. CMS has also taken the provisional decision to re-install the CASTOR Calorimeter following improvements to the field-tolerant photomultipliers and to the support structures. A trial assembly and test with the magnet on is scheduled for June 2009. The design of the remote-handling device for the Zero Degree Calorimeters (ZDCs) in the LHC tunnel will be reviewed on 19 February 2009 at a combined CMS and LHC Engineering Design Review. CMS plans to close in June 2009 for a 4 T cosmic-ray run. The experiment will be ready for beam in mid-August 2009, i.e. with a four-week contingency.

The LHCC heard a report on preparations the software, computing, calibrations and readiness for physics. The referees consider that these areas are in extraordinarily good shape. In particular, excellent progress was reported on the analysis from the CRAFT

cosmic-ray runs, in the development of physics objects, in preparing analyses for 10 TeV collisions, in the Tracker alignment and in the reconstruction.

8. REPORT FROM THE TOTEM REFEREES

The LHCC heard a report from the TOTEM referees, concentrating on the status of the detectors and a report from the joint CMS-TOTEM meeting.

The referees reported on the status of the TOTEM detectors. The last modules from a total of 70 Cathode Strip Chambers (CSCs) of the T1 Telescope are expected to be at CERN by mid-March 2009. The assembly of the T1 Telescope has slipped by about two months from the previous LHCC session and the production schedule for the readout is very tight. The schedule now has the assembled four half-arms ready by the end of May 2009, after which installation in CMS can proceed. Installation of the Gas Electron Multiplier (GEM) detectors for the T2 Telescope has also slipped by about one to two months and the installation of the negative side of the T2 Telescope is now in conflict with the CMS schedule. The availability of electronics for the Roman Pot detectors remains a concern and installation of all Roman Pots will be completed only in early summer 2009. The schedule for completion of the TOTEM detectors prior to LHC beam in 2009 is very aggressive. TOTEM is developing their local DAQ system in such a way that compatibility and integration with CMS will be an evolution of this system for the joint CMS and TOTEM physics programme during later LHC runs. The Committee asks for a dedicated discussion in this area as soon as possible. The Committee noted also that much work remains to be done in the areas of offline software, databases and simulations.

The Committee will monitor closely progress in the completion of the TOTEM experiment at its future sessions. The Committee requests TOTEM to provide a clear schedule with milestones for the installation phase, improved documentation detailing the experiment's readiness for physics and assurances for an early integration of the TOTEM DAQ with CMS.

9. REPORT FROM THE LHCb REFEREES

The Committee heard a report from the LHCb referees, concentrating on the status of the detectors, a summary of the shutdown activities and preparations for LHC run in 2009.

The LHCb experiment is essentially complete and operational. Coating of the UX85/3 experimental beam pipe has solved satisfactorily all vacuum issues and an aluminium spare is available. A replacement beryllium beampipe has been ordered and will be available in 2010/2011. Good progress was reported on the Vertex Locator (VELO), Silicon Tracker, Electromagnetic Calorimeter, the Ring Image Cherenkov detectors (RICH-1 and RICH-2), with no major issues having been reported.

The referees also reported on the LHCb shutdown work. Good progress was reported on the primary tasks during this period, which include the completion of the installation and commissioning of the M1 muon station, the modification of the Cockcroft-Walton bases for the Electromagnetic Calorimeter, installation of an upgraded Magnetic Distortion Measurement System (MDMS) in RICH-1, exchange the failing Hybrid Photo Diodes (HPDs) in RICH-2, exchange of the defective ladders of the Trigger Tracker (TT) station and an upgrade of the High-Level Trigger farm and network. Installation of the M1 Muon Station is expected to be completed only in late July 2009 as mounting of the M1 station is only starting now.

The Committee took note of the LHCb schedule. LHCb expects to complete the shutdown activities by the end of July 2009 and then to take TED-dump data resulting from the interaction of injected beam on the beam stop. Such data is very useful for testing the whole LHCb system and for aligning the Tracking detectors.

The LHCC also heard a report on the global check of the DAQ, Trigger and Offline processing. LHCb has run simulated data through the whole Online and Offline

System. The exercise has been a great success, showing that the complete chain functions well.

10. REPORT FROM THE LHC UPGRADE MINI-REVIEW

The Committee heard a report from the first LHC Upgrade Mini-review concerning both the machine and experiments.

Machine Upgrades

The Conceptual Design Report of the LHC Interaction Region Upgrade Phase I was released in November 2008. It is based on large-aperture quadrupole magnets using established NbTi cables for the final-focus triplets around ATLAS and CMS, with the goal of reducing the β-function at the interaction points from 0.55 m. to 0.25 m, thus increasing the peak luminosity towards $2\text{-}3\times10^{34}$ $cm^{-2}s^{-1}$. The interface to the experiments remains at ±19m. Space for the longer quadrupoles is gained by replacing the normal-conducting D1 separation dipoles by a large-aperture superconducting dipole similar to the one used at RHIC. The existing cryogenic infrastructure will be used up to its cooling limit of 500 W at 1.9 K per triplet. For the insulation of the superconducting cable a new technique is being developed with the aim of better thermal coupling. The work towards a prototype is delayed by at least half a year due to the repair work for the Sector 3-4. The original schedule (from autumn 2008) foresaw a string test in 2012 and installation in early 2013. An LHC beam optics for Phase I has been worked out, which should be used by the experiments to investigate machine-related backgrounds and the acceptance of forward detectors.

The upgrade of the pre-accelerators has started with the construction of LINAC4, which will provide 160 MeV protons to the Booster by 2013. The design work for the 4 GeV Superconducting Proton Linac (SPL) to replace the Booster and the 50 GeV PS2 to replace the PS) Phase II in 2018 has started. Together, the new injectors will allow the beam brightness (protons per bunch / emittance) to increase by a factor of two.

Further options for a luminosity increase in Phase II are under study. All require even stronger final-focus quadrupoles, possibly using Nb_3Sn cables and a larger crossing angle. Crab cavities for bunch rotation to give head-on collisions are included in two options. A peak luminosity of 10^{35} cm^2s^{-1} in two interaction regions leads to a short initial beam lifetime (below 1 hour) and a pile-up of up to 400 inelastic collisions per bunch crossing. From the experiments' perspective it would be advantageous to start with lower pile-up and longer beam lifetime at smaller peak luminosity and then continuously increase the focussing during a fill, giving essentially the same integrated luminosity ('levelling'). The R&D effort towards crab cavities in the US and elsewhere needs more funding..

Experiment Upgrades

The ATLAS pixel readout chip develops inefficiencies at high rates, which are reached in the innermost layer at luminosities above 10^{34} cm^2s^{-1}. An internal task force group has reviewed the constraints and has recommended to insert a new smaller pixel layer inside the existing one, which requires a reduction of the beam pipe radius from 29 mm. to about 25 mm. Discussions with the machine group are ongoing (LEB group). The design of a new pixel readout chip is well advanced. For Phase II it is planned to replace the semiconductor and transition radiation trackers by an all-silicon tracker, possibly with trigger capability. A design task force is being set up. Trigger and DAQ upgrades are also under study. ATLAS is planning a TDR for the insertable B-layer and a Letter of Intent for Phase II in early 2010.

CMS considers replacing all three pixel layers with a low-mass 4-layer design while keeping the 29 mm. beam pipe radius for Phase I. A Technical Proposal is scheduled for submission in mid-2009 and a Technical Design Report for early 2010. For Phase II the silicon tracker, the trigger, and possibly parts of the muon detector and the

forward calorimeter need replacing. R&D projects are ongoing. Proposals are expected by mid-2010 and Technical Design Reports by 2012.

LHCb plans to increase its trigger capability by using a processor farm at Level-I, which requires an upgrade of all front-ends to 40 MHz readout. In addition, replacements for the silicon vertex Vertex Locator (VELO), silicon vertex detector, the straw-tube Outer Tracker, and the Ring Image Cherenkov (RICH) detector are being considered. This would allow data taking at several 10^{33} $cm^{2}s^{-1}$, a factor of 10 to 20 higher than at present. No machine upgrades are required around LHCb.

The ALICE physics programme in Phase I and II will be decided based on the results from the first years of LHC running. R&D projects are just starting within the Collaboration and include a new vertex detector around a smaller beam pipe, an improved particle identification, forward calorimetry, extended coverage of the barrel electromagnetic calorimeter, and a DAQ and trigger upgrade. Some channels and signatures would benefit from an increase of the heavy-ion luminosity by a factor four to five.

11. REPORT FROM THE WLCG MINI-REVIEW

The Committee heard a report from the second World-wide LHC Computing Grid (WLCG) Mini-review, concentrating on the general status, and the status of the experiments and that of the Tier centres.

General Status

The LHCC reviewed the status of the WLCG project. The experience on WLCG operations in 2008 is positive and more efforts are being put to increase the reliability of the services and reduce the number of incidents rate. However, some aspects of the model related to competition between experiments, such as reprocessing at the Tier-1 sites, and also chaotic user analysis are not totally explored and validated. Therefore, the Committee recommends carrying out a CCRC exercise involving all the experiments during 2009. According to WLCG estimation, the resources needed in 2009 and 2010 are not dramatically changed in view the new LHC schedule. The experiments are in the process of re-evaluating their needs and a clear statement from the machine in terms of LHC uptime and efficiency for 2009 and 2010 is required. Middleware projects around the world are providing stable service and link up with each other as needed. However, experiments still suffer from instabilities in services related to mass storage. The Committee looks forward to see the transition from the existing EGEE to future efforts to maintain Middleware core components relevant for WLCG operations. The Committee acknowledges the very good progress in the applications area and R&D related projects, and takes note of the lower-than-required manpower levels that are affecting primarily the simulation-related activities.

ATLAS and CMS

ATLAS and CMS presented their 2008 status for software and computing and their plans for 2009. Both experiments fully supported the cosmic-ray commissioning (reconstructing ~300M cosmic-ray events) and distributed the data as specified by their models to the Tier-1 and Tier-2 centres for analysis. Reprocessing exercises were held and problems identified and fixed or are under further evaluation. For example, ATLAS is re-evaluating database access methods but the LHCC took note of the overall lack of manpower for the development of the ATLAS databases. Reliability of the Tier-1 centres is improving, although some reliability issues were seen during the cosmic-ray reprocessing exercises. There is steady Monte Carlo production at Tier-1 and Tier 2 centres, but it is labour intensive and thus there is on-going work to improve the production systems. CMS publishes site availability monitoring, with the monitoring using a wide range of inputs and will develop analysis tools and support based on the results of a task force. ATLAS has developed a test harness for testing Tier-2 performance and is working with the sites on optimisation. With matters generally in good shape, ATLAS and CMS have task lists for 2009 with targeted incremental changes to improve robustness, reliability and evaluating and adding

missing key functionality in order to be ready for detector commissioning in the summer and data in October. CMS is planning for end-to-end testing; ATLAS does not currently have such plans. While not currently planned for 2009, a Combined Computing Readiness Challenge would be beneficial for understanding resource competition issues at the Tier-1 centres. In the experiments' view the computing models themselves have changed little since the 2005 Technical Design Reports, although this is a topic of debate concerning the estimate of the ATLAS DPDs, as the resource request for the DPDs was not spelled out in the Technical Design Report. Requirements for resources are being updated after the revised accelerator schedule was announced following the Chamonix Workshop, including the best knowledge of event sizes and processing times are being reviewed now by both CMS and ATLAS and will be presented to the next Computing Resources Review Board. There will likely be evolution in the models after data arrives and tools are being put in place to understand the dataset usage.

LHCb

In the course of 2008, a number of Tier-1 sites were (re-)configured: LFC mirrors, DB replications, and SE migrations. Transfers from Pit 8 to Tier-0 and CASTOR were established at the nominal rate of 70 Mb/s, and to Tier-1 centres at rates in excess of 300 Mb/s. Cosmic events were used for internal time alignment of the sub-detectors, and for partial alignment between sub-detectors. All detectors were in the global runs as of the end of August 2008. Injection test data were used to observe tracks in the Vertex Locator (VELO), and for a rough global time alignment. The muon detectors and the calorimeters took data with the first beam on 10 September 2008. The DIRAC-3 system is now fully in operation for production activities since July 2008 and for analysis since December 2008. DIRAC-2 was de-commissioned on 12 January 2009. Computing and data quality shifts are run regularly, with a Grid expert on call. During the beginning of 2009, a complete emulation of the acquisition, the reconstruction, and the analysis will be performed, an exercise called FEST09. In 2009, LHCb anticipates collecting more than 3×10^6 collision data events at the nominal trigger rate of 2 kHz, and will simulate of the order of 2×10^9 events. No substantial deviation of the data model is foreseen, but more reprocessing is expected in the initial phase of collision data taking, and more analyses are expected to be performed at CERN. LHCb is pursuing efforts to reduce the event size and the CPU needs, and they consider using their High Level Trigger (HLT) farm in the future for reprocessing. Detailed requirements are being prepared for the WLCG workshop in March and the Computing Resource Review Board in April.

ALICE

The data volumes in 2008 represented 310 TB at CERN and 200 TB of copies at Tier-1 centres. ALICE is in the process of a large clean up of obsolete data: a large fraction of the 2006 data tapes is being removed; and a similar operation for simulated data is under consideration, but care has to be taken not to disrupt important preparatory work. The target is to remove 1.2 PB of master copies and duplicates. ALICE does not have any major issues in terms of middleware, and storage at the Tier-1 centres and Tier-2 centres is fully certified. All runs from 2008 cosmic-ray data have been processed, and selected runs have been reprocessed. A general second pass is foreseen once the alignment and calibration studies are finalized. ALICE is developing a framework for quasi-online processing, which was reviewed in January 2009; the middleware and fabric are fully tested for pass-1 at Tier-0, and partially at the Tier-1 centres. The shuttle, which collects all run-time conditions, stores them in a data base and publishes them on the Grid has been in production through 2008. Batch analysis is performed on the Grid, mostly on simulated data for now, but also for cosmic-ray data after pass-2 processing. Almost 2000 jobs were simultaneously running over 6 months, mostly for chaotic analysis. ALICE is now setting up analysis trains to group many analysis tasks on the same data set in order to optimise the data transfers. For prompt analysis, PROOF-enabled facilities are available at CERN and at GSI. In terms of middleware updates, ALICE has fully migrated to WMS submission, and have been running very stably CREAM CE in parallel with gLite at all sites. For storage, ALICE

is gradually increasing the number of sites with xrootd enabled SEs, and are in the process of increasing the file sizes for better efficiency. It is anticipated that cosmic-ray data taking will resume in July 2009. ALICE will collect proton-proton collision data at maximum bandwidth, with quasi-online processing, and AA collision data at the end of the 2009-2010 run, which will be processed within four months of data taking. ALICE considers 2009-2010 as standard years for simulations. Their requirements in terms of CPU needs and storage remain unchanged with respect to their Computing Technical Design Report, which means that ALICE will still be missing a large fraction of their request. ALICE should provide a detailed assessment as to how their physics reach will be impacted should this situation remain unchanged. ALICE also insist on their need to preserve the 1.5 FTEs they presently have at CERN for Grid support.

Status of the Tier Centres

The installation of resources and performance of Tier-0, Tier-1 and Tier-2 facilities has generally been good. Substantial improvements in reliability, availability, monitoring and usage have occurred during 2008. This can partly be attributed to the CCRC08 exercise. The challenge is now to maintain and continue these improvements through 2009, despite the delay in the LHC schedule.

For Tier-0, orders of new equipment were delayed from December 2008, due to the LHC schedule, with the hope of procuring better and less power-hungry units later. About 60% of 2009 pledged CPU and disk resources will be available by April, and the remainder by about October. Planning for 2010 procurement has started. About 20 PB of spare tape capacity will be available by October 2009, and a high-density 14 PB tape robot will be installed. Low CPU usage efficiency has been observed (60-70% ratio of CPU to wall-clock time), caused by long wait times for tape recalls. A method to "backfill" with short jobs, when a long wait is anticipated, improves the efficiency to ~97% in short tests. This will be refined and put into production. CASTOR performance monitoring metrics have been tested in preproduction, and will soon be released.

The CERN Computer Centre building operates close to its limit of electrical capacity. Even by upgrading capacity from 2.5 to 2.9 MW, and replacing equipment with new lower-power units, the limit will still be reached by late 2010. There are plans to build a new data centre on the Prevessin site, satisfying environmental standards. This may be ready by 2012, but the schedule is tight. Negotiations are ongoing to use an external site as a stop-gap solution during interim one-to-two year period.

Reliability of Tier-1 sites has generally been good, with fast responses to fix problems. This can be monitored for each site and each experiment using a set of SAM tests run at each Tier-1 at regular intervals. The results are being validated and the tests improved, so that they can be trusted. There have been periods of unscheduled down-time, due to a variety of problems. Such incidents are unavoidable and experiments must be prepared to cope with a Tier-1 being down. There are delays in installing some 2009 (and 2008) resources. All pledged resources will still be required for the extended 2009-2010 LHC run. Better planning is needed to communicate clearly to Tier-1s when experiment requirements change. The major concerns have been due to storage and databases. Tier-1 systems still need to be stress-tested with more than one experiment reprocessing data simultaneously. The LHCC strongly encourages such an exercise, involving at least ATLAS and CMS, before the restart of LHC in 2009. Chaotic user analysis has also not been fully tested.

Monitoring of Tier-2 sites has improved. Most achieve higher than 90% reliability, although a few have lower availability, due to scheduled down periods. The target should be 95% or higher for both. Communications between some Tier-1 and Tier-2 sites are good, while a few Tier-2 sites

remain more isolated. Steps are being taken to improve communication. Information on installed Tier-2 resources has improved, but some sites are still not reporting. Usage of Tier-2 resources has increased, with about 1500 unique users in January 2009, and 50-60% of the overall CPU usage at Tier-2 centres, mostly for simulation. Organised user support exists, but must improve to help beginners to start to use the Grid.

12. REPORT FROM THE COMPUTING RESOURCES SCRUTINY COMMITTEE

The LHCC heard a report from the Computing Resources Scrutiny Group (CRSG) from its Chairman, D. Espriu. The mandate of the CRSG is to scrutinize a) the resource accounting figures for the preceding year, b) the use the experiments made of these resources, and c) the overall experiment requests for resources for the following year and for the subsequent two years. The CRSG will also examine the match between the refereed requests and the pledges from the institutes and will also make recommendations concerning apparent under-funding. The CRSG reports to the Computing Resources Review Board (C-RRB) of the LHC experiments.

The Committee took note of a series of recommendations from the CRSG. In particular, in the process of scrutinising the 2008 and 2009 requests of ALICE, ATLAS, CMS and LHCb, the CRSG has critically examined all possible aspects of the various computing models and their implementation. The CRSG concluded that the overall demand for resources in 2009 remains largely within expectations. A very limited amount of redistribution of resources may be advisable in 2009. The scrutiny of resources after the first LHC physics run will be very important in the process of reviewing and updating the computing models. Finally, the CRSG believes that the various computing models have to a large extent proven their validity and are robust enough to handle successfully the first LHC data in 2009.

13. EXPERIMENT INPUT TO THE CHAMONIX 2009 WORKSHOP

The Committee heard a report from the LHC Programme Co-ordinator on the input provided by the experiments to the LHC Performance Workshop. He reported on the usefulness of an LHC run at a centre-of–mass energy of 900 GeV; the interplay between integrated luminosity and time; the particle production cross-sections versus the centre-of-mass energy for ATLAS and CMS; the requests from ALICE, LHCb, LHCf and TOTEM; and the scheduling scenarios. ATLAS and CMS would like to run in 2009 with proton-proton collisions at the highest possible centre-of-mass energy at which operation is safe. With about 50 to 100 pb^{-1} of recorded good data at between 8 TeV and 10 TeV centre-of-mass energies, many new limits can be set on new particle searches, some being more stringent than those at the Tevatron, and major discoveries are also possible. With 200-300 pb^{-1} at such centre-of-mass energies, the LHC starts competing with the Tevatron for Higgs masses around 160 GeV, while for 1 fb^{-1} at 10 TeV centre-of-mass energy, the discovery of the Higgs at 160 GeV is possible. LHCb would require between 300 and 500 pb^{-1} at not less than 8 TeV centre-of-mass energy to surpass the Tevatron in B_s physics studies. As for LHCb, ALICE is not as interested as ATLAS and CMS in reaching the highest possible centre-of-mass energy for proton-proton collisions. A heavy-ion run in 2010 should be an option and the LHC and its injectors should be compatible with this. TOTEM could be operational under all running conditions and LHCf is interested in running at all centre-of-mass energies, with the goal of eventually making a measurement at 14 TeV centre-of-mass energy.

14. REFEREES

The LHCC referee teams are as follows:

ALICE: M. Gonin (Co-ordinator), W. Kuehn, J.-F. Grivaz

ATLAS: J. Blazey (Co-ordinator), C. Cecchi, P. Mato, D. Pitzl

CMS: E. Elsen, M. Martinez-Perez, S. Smith (Co-ordinator), R. Yoshida

LHCb: F. Bedeschi (Co-ordinator), C. Hawkes, A. Nomerotski

TOTEM, LHCf, MoEDAL: C. Cecchi, M. Mangano, P. Mato

LCG: J.-F. Grivaz, C. Hawkes, M. Martinez-Perez (Co-ordinator)

Experiment Upgrades:

Co-ordinator: D. Pitzl

RD39: D. Pitzl

RD42: A. Nomerotski

RD50: A. Nomerotski, R. Yoshida

RD51: W. Kuehn

15. The LHCC received the following documents:

- Minutes of the 96th Meeting of the LHCC, held on 19 and 20 November 2008 (LHCC-2008-021 LHCC 96)
- Review of the ALICE EMCAL TDR (LHCC-2009-004/G-145)

16. DATES FOR LHCC MEETINGS

Dates for **2009**:

6-7 May (CANCELLED)

8-9 July

23-24 September

18-19 November

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