OPEN SESSION:

1. CMS Status Report: Tejinder Virdee
2. CMS Physics Technical Design Report Addendum 1 –
   High Density QCD with Heavy Ions: David d’Enterria
3. LHCf Status Report: Oscar Adriani

CLOSED SESSION:

Present:   S. Bertolucci (Chairman), J.-J. Blaising, S. Dalla Torre, J. Engelen,
          M. Ferro-Luzzi, M. Gonin, V. Kekelidze, J. Knobloch, M. Mangano,
          R. Mankel, M. Martinez-Perez, P. Mato, C. Niebuhr, B. Peyaud, C. Rembser,
          S. Smith, E. Tsesmelis (Secretary), R. Yoshida

Apologies:   P. Dauncey, S. de Jong, F. Forti, J. Haba

1. PROCEDURE
   The minutes of the eighty-seventh LHCC meeting (LHCC 2007-015 / LHCC 87) and
   the report from the ALICE Comprehensive Review (LHCC 2007-016 / LHCC-G-132)
   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.

   The repair of the Inner Triplet heat exchangers has been completed successfully.
   However, on 27 March, the structural supports to one quadrupole magnet of the Inner
   Triplet in Sector 4-5 failed a high pressure test in the LHC tunnel. To fix the structural
   supports' design flaw, a team of scientists and engineers has proposed to add to each
   Q1 magnet and to each Q3 magnet a set of four cartridges that can absorb the
   longitudinal force generated during the pressure test. The solution was presented to a
   review held at CERN on April 24 and 25. Since then the design of the cartridge system
   has been refined and parts needed for the cartridge and their installation have been
   ordered. Detailed tests of the design are in progress. The final design reviews will take
   place at Fermilab and CERN over the next weeks.

   The delays caused by the Inner Triplets would not allow the LHC Engineering Run to
   go ahead later this year. Instead, the reduced objective of an Injection Test into the
   LHC should now be considered. The clear priority for the LHC Project remains to
   commission the machine to 7 TeV top energy in 2008. The revised LHC schedule
   along the lines described above will be presented to the LHC experiments and to the
   next session of Council.
Discussions on the White Paper are continuing and more information is expected in time for the next Council.

3. REPORT FROM THE ALICE REFEREES

The LHCC heard a report from the ALICE referees, concentrating on progress in the experiment since the Comprehensive Review in March 2007.

The referees reported on the failure of the Gigabit Optical Link (GOL) on the Multi-Chip Module (MCM) in several Half-Staves (HS) of the Silicon Pixel Detector (SPD) just prior to the termination of the half-barrel test in March 2007. Even after detailed diagnostic tests, the cause of the GOL malfunction has not yet been fully understood. Following an internal review, ALICE took the decision to replace the damaged HS, accepting in the process the associated risks and delays in the SPD installation schedule. However, installing the SPD with the failed HS would have resulted in an unacceptable loss of performance of the detector. The repair of the HS is now well-underway and the revised date for the start of installation of the SPD in ALICE is set for 18 June 2007, which is a delay of seven weeks.

The Committee heard a report on the general ALICE detector installation. The experimental beam pipe, the T0-C timing detector, the V0-C, and the Forward Multiplicity Detector FMD-3 have been installed according to plan. The 7-week delay to the SPD installation has resulted in the entire ALICE installation sequence up to the installation of the Miniframe, which carries the detector services without which commissioning of the ALICE sub-detectors cannot be completed, being also delayed. In order to recover some of the delay, the Time-of-Flight (TOF) and Transition Radiation Detector (TRD) installation procedures have been changed in order to allow installation of the TOF and TRD with the Miniframe in place. In conclusion, the overall result of the SPD incident is a delay of three weeks to the closure of the LHC vacuum through ALICE.

The Committee took note of the list of LHCC milestones due at the end of May 2007 and of the overall ALICE schedule. The LHCC considers that it is reasonable to expect ALICE to be ready with the initial working detector for the start of LHC operation assuming that the sub-detector production and delivery schedules are maintained and the commissioning of the experiment proceeds as planned.

4. REPORT FROM THE ATLAS REFEREES

The LHCC heard a report from the ATLAS referees, concentrating on the general status, installation of the Inner Detector, and update of the power supply status and a report on the combined running and commissioning.

The referees reported on the general status of the ATLAS experiment. Integration and installation of the Muon System (Barrel and Big Wheels) and of the Trigger and DAQ are progressing well. The End-cap Toroid magnets are being prepared for transport to Point 1 according to schedule. The LAr Calorimeters are fully connected and are being cooled. Good progress was reported on the computing and software with the plan for 2007, including the Full Dress Rehearsal in June-October, being reasonable. Installation of the Muon Small Wheels remains very critical.

The Committee heard a report on the Inner Detector. Significant progress has been made on the repair of the heaters of the evaporative cooling system. A well-prepared plan of testing and installation was reported with the aim to minimize the affect of the overall ATLAS schedule. However, at the time of the LHCC meeting, a repaired heater failed and this is currently being analysed by ATLAS. The LHCC considers that the most critical item on the ATLAS schedule is the installation of the Inner Detector and the Committee will keep monitoring progress in this area.

The referees reported on the power supplies. The repair of the low voltage power supplies for the Tile Calorimeter is advancing smoothly and according to schedule. Some concerns remain with the failure of the bulk 200 V power supply and is currently being re-worked. The programme of retro-fitting the low voltage supplies of the LAr
Calorimeters has started successfully and the rate of repair is being increased. Back-up solutions, needed in case of further difficulties with the baseline ALGEN solution, are being analysed. The total quantity of CAEN power supplies for the Muon System is satisfactory, although exact allocation between sub-detector types is not as expected. This is being rectified. The overall delay of the power supplies still creates problems for the commissioning of the detectors concerned.

The referees reported on the Letter of Intent for Zero Degree Calorimeters (ZDCs) for ATLAS. ATLAS proposes to build compact calorimeters that are to be located at approximately zero degrees to the incident LHC beams on either side of the ATLAS interaction point (IP), 140 m. from the IP. The aim is to observe forward-going neutral particles that are produced in heavy-ion, proton-nucleus and proton-proton collisions. The LHCC took note of the Letter of Intent and encourages the ATLAS Collaboration to continue the development of the ZDCs.

The LHCC took note of the on-going work regarding the ATLAS commissioning and preparations for LHC running. The Committee considers that the aims are well-defined and are proceeding in time for the first LHC physics run. The overall objectives include the integration of detectors and central systems as they become available, followed by the testing of various operational modes. This is followed by cosmic runs allowing for detector studies with particles and the transfer of data to the Tier-0 centre. The cosmic runs also provide an important element in the training of the collaboration members in the operation aspects of the ATLAS experiment.

The Committee also took note of the ATLAS Maintenance and Operation scheme and the planning for the operation task sharing. The operation of the ATLAS experiment, spanning from the detector operation to computing and data preparation, requires a significant effort across the full Collaboration.

The referees also reported on the ATLAS activities concerning the upgrade of the experiment in view of a possible upgrade to the LHC luminosity (SLHC). A number of ATLAS R&D proposals regarding the upgrade were presented and are being organized through an organizational structure put in place to oversee the ATLAS upgrade.

5. REPORT FROM THE CMS REFEREES

The LHCC heard a report from the CMS referees, concentrating on the status of the experiment and the general schedule.

The referees reported on the status of sub-detectors. Good progress was reported on the commissioning of the Tracker at the Tracker Integration Facility (TIF). Most of the goals for the warm operation at the TIF have been met while the aims for the cold operation have been developed and are reasonable. Good progress was also reported on the beam and radiation monitoring systems and the status and plans of the CMS luminosity group are reasonable.

The LHCC heard a report on the installation of the CMS experiment. Installation of the experiment is progressing smoothly and the enhanced CMS Technical Co-ordination and YB0 Task Force are contributing to the success. Installation of Barrel Electromagnetic Calorimeter (EB) Supermodule is well underway, and the installation of the YB0 services has started. The work is proceeding with a strong emphasis on safety and quality control and assurance.

The referees reported on the status of the Trigger, DAQ and software. Production of components for the Trigger is nearly complete and their installation and commissioning is proceeding with the aim of keeping pace with the detector commissioning schedule. The DAQ activities are advancing well and are on schedule for a global CMS cosmic run in November 2007. Excellent progress was reported on the High-Level Trigger (HLT). Significant improvements in speed were reported and preparations for the deployment in the DAQ chain at the CMS experimental area are in progress. The development of the offline software and preparations for the Computing, Software and Analysis 2007 (CSA07) Challenge are well-organised and are making excellent progress. The physics performance of the CMS detector, as described in the
Physics Technical Design Report Vol. II, has been validated with the CMS offline software CMSSW. Clear priorities have been set for the first-year physics at the LHC, and include the search for the Higgs boson in the WW channel, low-mass inclusive SUSY searches and a very powerful programme of Standard Model physics studies.

The Committee took note of the general CMS schedule. The installation of the EB is scheduled to be complete in June 2007 and the Tracker in August 2007. CMS will be ready to close in October 2007 and the CMS systems, except for the End-cap Electromagnetic Calorimeter (EE) and the Pixel Detector, are expected to be in place for global data-taking in November 2007. A CMS cosmic run in November 2007 is maintained in order to perform a global commissioning and test of the experiment and to maintain momentum and focus. CMS is working on a revised schedule to take into account the revised LHC machine schedule.

The next Comprehensive Review for CMS is scheduled for 2-3 July 2007.

6. **CMS EXPRESSION OF INTEREST IN THE SLHC**

The LHCC heard a report describing the motivation and scope of the likely upgrades needed to the CMS experiment for the Super LHC (SLHC) – the upgrade to the LHC machine in order to increase the delivered luminosity by about an order of magnitude from its nominal design luminosity. The CMS upgrade plans are driven largely by the Tracker requirements, including the need for higher granularity, the potential need for a significantly larger Pixel Detector, the reduction of detector material, and the development of methods to form tracks with the Tracker at 40 MHz and 20 MHz as input into the Level-1 Trigger. Moreover, the CMS Trigger would need to be replaced. The level of R&D required is considered to be substantial and it is timely already now to begin focused development on the detectors required for the SLHC. Interaction with existing R&D projects needs to be strengthened. The LHCC took note of the CMS Expression of Interest in the SLHC and encourages the CMS Collaboration of developing avenues of R&D with a view of submitting a more detailed Letter of Intent. The LHCC will review developments in the proposed CMS R&D activities in the future.

7. **REPORT FROM THE LHCb REFEREES**

The Committee heard a report from the LHCb referees, concentrating on the status of the detector construction, installation and commissioning.

Good progress was reported on the detector construction. Production of the Muon Chambers, Trigger Tracker (TT) ladders, Vertex Locator (VELO) modules and Hybrid Pixel Detectors (HPDs) is complete, while production of the Inner Tracker (IT) modules is approaching completion.

The referees also reported on the status of the experiment installation. The installation of the infrastructure and general services, including the long-distance cabling, is essentially complete. The experimental beam pipe is in place and the clean gas injection system is being installed. Bake-out and commissioning of the beam pipe is in progress. Installation of detector components is advancing well. Installation and testing of Muon Stations M2-M5 is in progress while that for Station M1 will start in June 2007. Installation of the VELO and Ring Image Cherenkov (RICH-1) is scheduled for immediately after the bake-out of the experimental beam pipe in June 2007. All C-frames of the Outer Tracker have been installed and a prototype heating device for *in situ* heating of the Outer Tracker is undergoing tests at Heidelberg. Installation of the Online System is also advancing well.

Commissioning of various systems has started. A complete slice of the Hadronic Calorimeter (HCAL) and RICH-2 is controlled and commissioned from the LHCb experimental control room. Preparations for commissioning the Outer Tracker are in progress.
8. REPORT FROM THE TOTEM REFEREE

The LHCC heard a report from the TOTEM referee, concentrating on the general status of the experiment and on the proposal for early TOTEM running with the 90 m. optics.

Good progress was reported on the construction of the TOTEM detector. Mass production of the Cathode Strip Chamber (CSC) for the T1 Telescope has started and is expected to be completed by the end of 2007 and all the mechanical supports have been fabricated. Production of the T2 Telescope Gas Electron Multiplier (GEM) detectors is advancing well and are scheduled to be completed by June 2007. All eight Roman Pots have been assembled. Testing has started and the first Roman Pots have been delivered to the LHC vacuum group for installation. Good progress was also reported on the detectors, with all cables now in place and the first prototype detector being tested successfully with source using the VFAT front-end electronics. Extensive tests on the evaporative cooling system have been completed successfully. The LHCC took note of the TOTEM plans for beam tests at the SPS in 2007. The beam tests are considered essential in order to validate, improve and consolidate the electronics and DAQ. During 2007, TOTEM plans to install the T1 and T2 Telescopes once the CMS forward detectors are in place and also plan to have all eight Roman Pots together with their services installed but initially not with the complete set of sensors.

The LHCC took note of the proposal for early TOTEM running with the $\beta^*=90$ m. optics. The Committee considers that TOTEM running during the early stages of LHC operation offers the opportunity to commission the TOTEM experiment and to provide first measurements of the $\sigma_{\text{tot}}$ and machine parameters, assuming good and stable conditions on both the TOTEM and LHC Machine sides and a good control of the instrumental uncertainties of the TOTEM detectors. The 'un-squeeze' from the standard injection and ramp optics of $\beta^*=11$ m. to the $\beta^*=90$ m. TOTEM optics appears feasible but needs to be verified during early LHC operation or during a machine development. The time needed to commission the $\beta^*=90$ m. optics is difficult to predict but is expected to be similar to that needed to commission the squeeze down to $\beta^*=2$ m. from $\beta^*=11$ m.

9. REPORT FROM THE LHCf REFEREES

The Committee heard a report from the LHCf referees. Since the previous review in 2006, the LHCf Collaboration has made very significant progress towards the realization of an experimental set-up ready for first collisions at the LHC. The LHCC considers it reasonable to expect LHCf to be ready for the start of LHC operation. All milestones have been successfully met, including the beam tests at the SPS, the installation of the infrastructure and general services, the completion of the construction of both calorimeters and the pre-installation tests in the LHC tunnel. The dates for the final installation of the calorimeters are being reviewed with the LHC machine groups.

10. REPORT FROM THE LCG REFEREES

The LHCC heard a report from the LCG referees, concentrating on the ramp-up and operation of the World-wide LCG (WLCG), the status of the services and the CMS Computing, Software and Analysis 2007 (CSA07) Challenge. Ramping-up of WLCG resources is in progress and the installed resources are now close to those pledged in the Memorandum of Understanding. Site reliability has improved and the plan is to further increase the target. Monitoring and accounting of job reliability are making good progress. The WLCG milestones are being met essentially as scheduled. A gradual transition from the Service Challenges to experiment LCG operations is being made and the services are being improved in order to address the needs of the experiments. The support of Storage Resource Manager 2.2 (SRM 2.2) by the mass storage systems is converging but the risk is that SRM 2.2 will come too late for the Dress Rehearsals in July 2007. The CMS CSA07 Challenge is a good example of an ambitious experiment challenge at the 50% of the expected data rates in 2008.
11. REPORT FROM THE RD42 REFEREE

The LHCC heard a report from the RD42 referee on the collaboration’s programme concerning the development of intrinsically radiation-hard Chemical Vapour Deposition (CVD) diamond devices.

Good progress was reported for the past year. New polycrystalline CVD (pCVD) material has become available in the form of wafers of large size and with good operation characteristics and good quality single-crystal (scCVD) has become available with sizes usable for detector construction. In collaboration with ATLAS and CMS, RD42 has constructed single-chip and multi-chip pixel modules based on CVD wafers using the final ATLAS 0.25 μm radiation-hard electronics. This pixel detector technology is developing with a view for application in future tracking detectors. Application of CVD-based detectors in BaBar and CDF has been successful and the CVD Beam Condition Monitor (BCM) has been installed in ATLAS. The Committee also took note of the continuing studies on radiation hardness of CVD.

The LHCC considers that the proposed research programme for 2007, concentrating on the radiation hardness of diamond trackers and pixel detectors, the construction of two additional pixel detector modules, beam tests with diamond trackers and pixel detectors and the continuing characterisation of diamond samples, to be reasonable.

In view of the above and given the modest request for resources for further work, the referee recommends that the R&D project be continued in 2007. A status report is expected to be submitted to the LHCC in one year’s time. The Committee agrees to the continuation of the project on this basis.

12. 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

13. The LHCC received the following documents:

CMS Expression of Interest in the SLHC - LHCC-2007-014/G-131
LHCC-2007-016/G-132
Minutes of the eighty-seventh LHCC meeting held on Wednesday and Thursday, 21–22 March 2007 - CERN/LHCC 2007-015/LHCC 87
14. DATES FOR LHCC MEETINGS

Provisional Dates for 2007:

4–5 July
26–27 September
21–22 November

*restricted circulation

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