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**Summary of Principal LHCC Deliberations
(November 2001, January 2002 and March 2002 Sessions)**

**14th Meeting of the CMS Resource Review Board
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1. General

This document summarises the principal LHCC deliberations concerning CMS at the Committee's sessions in November 2001, January 2002 and March 2002.

A new version of the CMS schedule (Version V33) is under preparation, which has the initial CMS detector completed by 1 April 2007 and which is in line with the revised LHC schedule. The LHCC will review the new CMS schedule over the coming months. Good progress was shown in meeting the agreed milestones that expired over the last few months.

The LHCC noted that a financial plan to complete the detector is being developed by CMS and the Collaboration is making progress to ensure a viable funding strategy.

2. Magnet

The Magnet Advisory Group to the LHCC (MAG) submitted a written document providing an update on the status of the LHC spectrometer magnets. The review is not yet finalised and agreed to by the LHCC.

Good progress was reported for the conductor, assembly of the iron yoke and the auxiliary systems.

Qualification tests have been performed for the coil winding, and although the winding machine works as expected, delays of about 6 months have occurred in the production of the mandrel for the winding prototype. Production of the first coil module will now start by June. The first coil module should be delivered to CERN at the end of 2002, and all coil modules should be at CERN by the end of 2003. The MAG considers this to be challenging and will require considerable vigilance on the part of the CERN team.

The LHCC notes that even with the above delays, CMS is on schedule to perform the magnet tests on the surface and to have a working CMS detector ready in time for the start of LHC operation.

3. Tracking

The LHCC took note of the good progress on the development and procurement of the hybrids for the Tracker M200 tests planned for later this year. Moreover, the effects related to Highly Ionising Particles have been understood and have been quantified to occur at a rate less than 0.05%. Further understanding has also been demonstrated concerning the pin-hole effect and is now considered to be well under control.

4. Electromagnetic Calorimeter (ECAL)

The LHCC expressed its concern regarding the increase in the costs of the ECAL electronics and the consequent delays. Although CMS has instigated a programme to evaluate how to proceed with the ECAL electronics, the LHCC continues to consider the issue as being critical, since it could result in significant delays to the ECAL project.

To reduce the cost of the calorimeter, CMS proposes to rationalise the electronics components by decreasing the number of optical links and the number of off-detector boards, but introducing new on-detector ASICs for generating the Level-1 trigger primitive and storing the data until read-out upon a Level-1 trigger. The LHCC requests that CMS submits in May a written documentation in support of these changes, as they represent a significant change from what was approved in the ECAL Technical Design Report. This will enable the Committee to evaluate the technical and cost aspects and the impact on the schedule.

5. Muon Spectrometer

The LHCC reiterated its previous concerns on the RPCs. Some progress is, however, being made on developing a production plan and schedule and on implementing a management structure. Technical uncertainties remain regarding whether or not the end-cap RPCs will be coated with linseed oil.

Moreover, the LHCC also expressed its concern regarding the rate of production of the Drift Tube chambers and the schedule. The Committee will continue monitoring progress in this area.

6. Trigger/DAQ

The LHCC is reviewing the CMS trigger rates and the associated physics performance and is making a comparison with the corresponding studies in ATLAS. In particular, the Committee is currently concentrating on comparing the expected trigger rates in the two experiments and evaluating the number of events needed for calibration purposes and that associated with the physics processes as a function of the integrated luminosity.

Moreover, owing to the delay in the underground civil engineering, the critical path in the overall CMS schedule is the installation of the Trigger/DAQ system from the surface to the underground areas. The planning of the critical path items continue to be monitored by the LHCC.

7. LHC Computing Grid Project

The LHCC recommended that the LHC Computing Grid Project be treated by the Committee in a manner similar to that for the experiments. Therefore, the LHC Computing Grid Project will be made available to the LHCC for review,

documents and reports from the project, including its TDR. As a first step, and following the appointment of referees, the Committee will analyse the relation between the detector parameters and computing requirements, including the expected experiment trigger rates as a function of the machine luminosity. The procedure will be performed in consultation with the LHC experiments. The LHCC and the management of the LHC Computing Grid Project agreed to the above scheme of interaction between the Committee and the Project.

8. Test Beams

The requests from the LHC experiments to use test beams in the years 2003 to 2006 have been scrutinised by the LHCC at its January meeting and also in a dedicated meeting held on 14 February.

The LHCC believes that test beams are necessary in 2003 and 2004 for all LHC experiments to calibrate the final calorimeter modules, to perform the integration of the modules in the detectors, to validate the latest versions of the front-end read-out electronics and DAQ chain, to monitor the quality of the detector construction and to test the alignment procedures.

The Committee also believes that in the case of ALICE, ATLAS and LHCb, there are no compelling reasons to use test beams in the year 2005. The CMS test beam requirements in the years 2004-2006 are driven primarily by the calibration of the ECAL. The experiments have therefore been asked to proceed with their test beam programme assuming that beam will be available only in 2003, 2004 and 2006, where the operation of the SPS in the latter year is also required to commission the machine as an injector for the LHC.

The LHCC also recommends keeping the PS Complex operational in 2005 in order for the experiments to be able to perform final tests and calibrations that do not require the higher energy particles available at the SPS.