

CERN-RRB-2007-041

4 APRIL 2007

PRINCIPAL LHCC DELIBERATIONS

18TH MEETING OF THE LHCb RESOURCES REVIEW BOARD

25 APRIL 2007

EMMANUEL TSESMELIS

SCIENTIFIC SECRETARY, LHCC

GENERAL

This document summarises the principal LHCC deliberations concerning LHCb at the Committee's sessions in November 2006 and in February and March 2007.

STATUS OF THE LHCb TECHNICAL DESIGN REPORTS

	<i>Submission to LHCC</i>	<i>Research Board Approval</i>
Magnet TDR	December 1999	April 2000
Vertex Locator TDR	May 2001	November 2001
Inner Tracker TDR	November 2002	February 2003
Outer Tracker TDR	September 2001	February 2002
RICH Detector TDR	September 2000	February 2001
Muon Detector TDR	May 2001	November 2001
First Addendum Muon Detector TDR	January 2003	February 2003
Second Addendum Muon Detector TDR	April 2005	September 2005
Calorimeter TDR	September 2000	February 2001
Trigger (L0/L1) TDR	September 2003	February 2004
Online System TDR	December 2001	April 2002
Addendum to Online System TDR	November 2005	December 2005
Computing TDR	June 2005	March 2006
Re-optimized Detector TDR	September 2003	February 2004

CONCERNS FROM THE PREVIOUS LHCb RESOURCES REVIEW BOARD

SUB-SYSTEM	CONCERN	STATUS
Outer Tracker	Gain loss observed in the straw chambers.	Studies on understanding and mitigating the ageing effects and resulting gain loss observed in the Outer Tracker modules from the series production are continuing, but the source of the problem to ensure its long-term solution remains outstanding.

LHCC COMPREHENSIVE REVIEW

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 and installation of final components are well advanced and commissioning of systems has 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 at 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.

- 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. *Since the Comprehensive Review, production of the VELO modules has been completed.*
- The Inner Tracker (IT) and Trigger Tracker (TT) 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 Hybrid Pixel Detectors (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 problems encountered with 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. *Since the Comprehensive Review, production of the HPDs has been completed.*

- 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. *Since the Comprehensive Review, production of muon chambers has been completed.*
- 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 were 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 (HLT) 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.

INSTALLATION AND COMMISSIONING

The installation of the detector infrastructure and services is essentially complete and the installation of the VELO, RICH-1 and chambers for the Muon System is proceeding well, the mechanical C-frame supports for the Outer Tracker are nearly all in place and the installation of the experimental beam pipe is well-advanced. The commissioning of the LHCb experiment is also underway.