LHCB RRB-D 2001-38
2 October 2001

Status of the LHCb Experiment

The LHCb Collaboration

1) Collaboration Matters

Laboratoire d'Annecy-le-vieux de Physique des Particules (LAPP) France joined LHCb in September. Bernard d'Almagne (LAL Orsay) became Deputy Spokesperson on 1st of October succeeding Ioana Videau who is now EP Deputy Division Leader. Cristobal Padilla from CERN succeeded Bert Koene from NIKHEF as Outer Tracker Subsystem Coordinator on 4th of October.

2) Experimental Area

Dismantling of the DELPHI experiment completed. The civil engineering work for the headwall and the fixed part of the radiation shield started. The layout of the cryogenic installation for the LHC machine in the UX85 cavern has been redefined, where the accessibility to the LHCb detector has been improved, in particular to the muon system.

3) The LHCb detector

3-1) Magnet

The orders for the Al-conductor, the coil construction and the steel plates for the yoke were made. The orders for the power supply are in progress.

3-2) Beam Pipe

After many simulation studies of the detector occupancy, an Al-Be alloy beam pipe with aluminium bellows was taken as the baseline choice and R&D work by the LHC beam pipe group started.

3-3) VELO

The Technical Design Report (TDR) of the LHCb Vertex Locator (VELO) was submitted in May 2001 and the baseline design of the detector was specified. For the radiation hard readout chips, development of both DMILL and 0.25 μm CMOS technologies are being continued. A regular contact with the machine group was established to ensure the compatibility of the design of the vacuum tank housing the Si detector and the LHC machine.

3-4) RICH

The most crucial issue is the development of the pixel Hybrid Photodiode (HPD). A solution to increase the readout speed of the pixel readout chip to the required 40MHz was found and is being implemented in the new chip design, which will be submitted in October for production. Eight pixel detectors were bump-bonded to the current readout chips showing promising results. The best one will be sent to DEP for encapsulation. We are late by three months compared to the original plan and the situation is being reviewed.

3-5) Inner Tracker

It was decided that the Inner Tracker will be made from silicon sensors only. In order to complete the R&D programme and to rearrange the institute responsibilities, the submission of the TDR has been delayed to the end of 2002. A study of the construction plan based on the experience from the other experiments shows that the delay of the submission should not introduce any problem with the commissioning date of the LHCb experiment.

3-6) Outer Tracker

The TDR of the Outer Tracker was submitted in September 2001. Self-supporting drift chambers based on straw tubes with conductive Kapton foils will be used. The completed prototype work demonstrates the viability of the choice. A new TDC chip with 0.25 μm CMOS technology is being developed to fulfil the LHCb requirements. A possibility to suppress the tracking stations from inside the spectrometer dipole magnet is being studied, which could reduce the material of the detector and simplify the construction effort.

3-7) Calorimeter System

Engineering Design Reviews of the electromagnetic and hadron calorimeter modules were made by external reviewers. The modules with the final design specification were successfully constructed validating the designs and the procedures for the construction and quality control. The most of the raw material was ordered. After the Production Readiness Reviews, series production of the modules has started. The Production Readiness Reviews for the frontend ASIC chips will be made soon.

3-8) Muon System

The TDR for the Muon System was submitted in May 2001. Single-gap RPC's with a BiCMOS readout chip developed for CMS will be used for the regions with a rate below 1 kHz/cm^2 and MWPC's with CARIOCA chips based on 0.25 μm CMOS technology being developed by LHCb, for the regions up to 100 kHz/cm^2. For the very small regions where the expected rate exceeds 100 kHz/cm^2, triple-GEM chambers or MWPC's could be adopted and development work is in progress. The tooling for the MWPC production is being developed and the various production sites are in preparation.

3-9) Trigger

Detailed electronics specifications for the first level calorimeter and muon triggers were completed. The architecture for the CPU-based second level vertex trigger was made and prototype studies are in progress. The trigger algorithm can be rather easily extended in order to improve the performance. In order to allow more prototype work and improvement, the Trigger TDR is delayed till the end of 2002. Since the scale of the trigger electronics is small, no schedule problem is foreseen for the production.

3-10) Computing

The Online TDR describing the data acquisition and the experiment control system will be submitted by the end of this year. Architecture and technology choices were reviewed by a panel, which included external reviewers. Commercially available Network Processors were taken as the baseline solution for the Readout Unit and G-bit Ethernet for the Readout Network. OO-based software framework is now used in production. Many FORTRAN routines are being wrapped and still in use. However, they are steadily replaced by C++ versions. In order to find lacking manpower, informal agreements between the LHCb collaboration and participating institutes, Computing Agreements, are being prepared.