

LHCb Technical Board 16 & 18 September 2002

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Agenda

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| 1. Approval of last TB summary | |
| 2. Report on the Photon Detector Review | D.Websdale |
| 3. Report on Electronics Reviews (Velo and L0) | J.Christiansen |
| 4. Electronics Matters (TTCrx, Electronics WG) | J.Christiansen |
| 5. Approval of the Milestone Document | W.Witzeling |
| 6. Plans for the Trigger TDR | H.Dijkstra |
| 7. Proposal for the updated Project Organization | T. Nakada |
| 8. Resistive Plate Chambers | G. Carboni |
| 9. LHCb-light, status of work and plans for the TDR | T. Nakada |
| 10. Inner Tracker TDR (postponed to 25th September) | O. Steinkamp |

Participants: P. Campana , G. Carboni, J. Christiansen, H. Dijkstra, J. Harvey, J. Lefrançois, R. Lindner, C. Matteuzzi, M. Merk, T. Nakada, T. Ruf, B. Schmidt, O. Schneider, A. Schopper, A. Smith, O. Steinkamp, D. Websdale, W. Witzeling

Invited: H.J. Hilke, A.Pellegrino

Excused: W. Flegel, D. Lacarrere, C. Padilla, U. Straumann

1. **Approval of last TB summary:** The summary of the last Technical Board was approved and will be accessible on the Web.
2. **Report on the Photon Detector Review:** D. Websdale reported on the RICH photon detectors status and planning. He summarized the developments since the last Technical Board and presented the outcome of the RICH PD review in June. Systematic measurements of the HPD prototype (10MHz chip) with pulsed LED show the expected photoelectron response, however, the fraction of good pixels is far below requirements due to detached bump bonds. Therefore, the milestone for June 2002 was not met and only because of the delay of the LHC start-up this milestone has been postponed to December 2002. If the bump bonding problem will be solved by end of this year, a small series of HPD with 10MHz chip will be produced until April 2003 and 40 MHz packaged anode assemblies will be tested (milestone). A complete 40 MHz HPD prototype is then expected in September 2003 (milestone). If a milestone is missed, the HPD will be replaced by the MaPMT. Pixel chip: the measurements show that the LHCb RICH requirements with a threshold of $< 2000e$ and noise $< 300e$ at 40 MHz are satisfied. Since the review in June more stringent tests of the 40 MHz chip have been executed; simultaneous read and write operation, operation at $90^{\circ}C$ and operation after 10 Mrad irradiation with 10 KeV x-rays have been successfully demonstrated. In the meantime, anode assemblies with 'relaxed' bump bonds have survived bake out after packaging onto the ceramic carrier. D. Websdale concluded that sufficient time remains to complete the project provided the milestones will be met. However, the MaPMT has to be kept as a viable backup solution. To this aim the development work on the FE electronics for the MaPMT has to resume now, the first step being the submission of a modified version of the Beetle as the front-end chip.

3. **Report on Electronics Reviews:** Three electronics reviews were held at CERN and Lausanne since the last TB in May. J. Christiansen summarized the outcome of the VELO general electronics and the L0 trigger review.

VELO electronics review: The architecture was considered to be sound and the responsibilities are well defined. Maintenance and upgrade scenario must be well defined as the lifetime for the detector is expected to be 3 years. Dead time due to heavily ionizing particles must be taken into account as well as effects of punch through failures in AC coupling capacitors. The interface from the ECS to the front-end was presented in 'write only' which is not allowed in LHCb.

L0 electronics review: The L0 trigger electronics architecture is sound and well organized, responsibilities are clear and the partitioning is well defined. The reviewers do not see any major difficulties in its implementation. The decision unit implementation based on partitions of FPGA processing units results in high flexibility. A clearly defined processing scheme with programmable options must be developed to allow trigger processing options and parameter changes via the ECS registers as design expertise and tools to reprogram FPGA's may not be available after a few years of LHCb running. The decision unit receives information from multiple systems and it has to be agreed upon the link technology. A clear interface document should be written. The complete presentation can be found at:

<http://doc.cern.ch/archive/electronic/other/agenda/a02354/a02354s1t3/transparencies/TB.pdf>

4. **Electronics Matters:** The TTCrx production will be launched this autumn and it will be the only one. J. Christiansen presented the summary of LHCb needs; the order will be part of a common order for all LHC experiments. The total number of 1760 TTCrx chips for LHCb includes 10% spares for each individual sub-detector and 10% for the entire experiment. 10- 20% spares will be added to the overall LHC request depending on the production yield. The expected price per chip is between 40-55 CHF.

J. Christiansen reported on the EP common project on low voltage power supplies for LHC experiments that can operate in an environment of radiation and magnetic field. So far, ATLAS and ALICE participated in the effort and LHCb only follows the development. It was discussed, whether LHCb should become more active in this area and it was proposed to collect the requirements for such power supplies within LHCb. R. Lindner will send information about the Wiener PL 500 power supply to the sub-detector groups and will gather the LHCb needs. If the LHC experiments do not give clear requirements to the working group, the common project may be closed down.

J. Christiansen proposed to set up an LHCb electronics working group as plenary meetings are not very suitable to reach final decisions. This group should consist of max 20 members, one representative from each major subsystem. *The Technical Board agreed to the proposal to form such a working group.*

<http://doc.cern.ch/archive/electronic/other/agenda/a02354/a02354s1t3/transparencies/TB.pdf>

5. **Approval of the Milestone Document:** W. Witzeling presented the LHC milestone list document that has been revised taking into account the new schedule for the LHC project with first beam in the machine in April 2007. Missing milestones have been added for the Muon System, SPD/PS and RICH1 detector during the collaboration week. The Outer Tracker milestones will be once more updated within the next days. The milestones document will be sent to the LHCC referees on Wednesday 25-09-02.
6. **Plans for the Trigger TDR:** The Trigger Group discussed the plans for the submission of the Trigger TDR and agreed that it should be synchronized with the submission of the 'LHCb-light'

TDR. Splitting of the TDR in Low and a High –Level document was not favored by the Trigger Group.

The Technical Board requested a detailed planning towards the Trigger TDR and agreed on the submission date close to that of the ‘LHCb-light’ TDR.

7. Proposal for the updated project organization:

The Outer Tracker is now entering production phase and the LHCb management feels that it should become a project now. As the present Project Coordinator, Cristobal Padilla, will leave the LHCb Collaboration due to his new appointment, the LHCb management proposes to nominate Antonio Pellegrino (NIKHEF) as the OT Project Leader as of 15th October. Cristobal has kindly agreed to remain available until the end of this year so that a smooth transition can be ensured.

Although the RICH photon detector decision has not been made yet, construction of RICH-2 mechanics will start soon and the LHCb management feels that it should become a project now. The LHCb management proposes to nominate Dave Websdale (Imperial Collage) as Project Leader and Olav Ullaland (CERN) as his deputy as of 1st October.

The work on the series production of the Calorimeter modules now advances and first modules arrived at CERN. Meanwhile, the development of the associated electronics is in progress in France and Spain. From now on, the major part of the project will be the construction and installation of the detector at CERN, and Jacques Lefrançois expressed his strong desire that this should reflect on the project organization. Therefore, the LHCb management proposes a swap of the functions, Andreas Schopper takes over as Project Leader and Jacques becomes deputy with particular responsibility for electronics as from 1st of October.

The VELO programme is rapidly approaching the production phase and therefore should also become a project. The LHCb management proposes to nominate Thomas Ruf (CERN) as Project Leader as from 1st of October.

The Technical board supports the proposals by the LHCb management and those will be presented to the Collaboration Board.

8. Resistive Plate Chambers: G. Carboni gave the final report on the Resistive Plate Chambers. He summarized the LHCb muon RPC program starting with first tests in 1999. RPCs were tested in the Gamma Irradiation Facility at CERN. The rate capability (2 kHz) and prospects for cheap industrial production led to the proposal to use this technology described in the Muon TDR. In 2001 aging effects on RPCs were studied and an increase of the total detector resistance of up to a factor of 20 was observed, while the rate capability was still acceptable. Long-term aging tests in 2002 indicate the doubling of resistivity roughly every year and the rate capability has drastically dropped for both, the irradiated and non-irradiated RPC. The described behavior and as well as serious difficulties in the production – technical problems, large number of customers, only one producer and long delays – led the LHCb Muon Group to conclude that the safest solution is to rule out RPCs in LHCb and replace them by MWPCs.

The redistribution of the increased number of MWPC (864 -> 1344) among the existing production centers is difficult. At present the Muon Group studies a possible scenario to produce 240 chambers in a new production center in Florence and the remaining 240 chambers in an expanded production line at PNPI. The replacement of RPCs by the MWPCs has to be reported to the LHC committee as an addendum to the Muon TDR beginning of 2003. This also requires a final decision on the first Muon station as this influences the distribution of resources among the institutes participating in the production of chambers. The decision has to be taken by the end of November at the latest.

The Technical Board supports the decision to replace the RPCs by the MWPCs.

9. **LHCb-light, status of work and plans for the TDR:** T. Nakada presented the planning towards the submission of the 'LHCb Light' TDR which foresees the final MC production in February March of next year and submission of the TDR in September 2003. Extensive discussions followed, it was felt that the schedule is very tight for the design of TT and RICH1, but it is also clear that the 'LHCb Light' TDR cannot be delayed any further.

10. **Inner Tracker TDR:** O. Steinkamp presented the TDR contents briefly, but the discussion on the Inner Tracker TDR had been postponed to the 25th September, a further discussion is scheduled for the 11th of October. The 2nd draft will be sent to the Technical Board members at latest on the 8th of October.