CERN-RRB-2002-106
26.11.2002

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Minutes of the 9th RESOURCES REVIEW BOARD Meeting

(Held at CERN on 23rd October 2002)

Present:

Europe:

B. Jean-Marie (IN2P3, Paris);
J. Richter (BMBF, Bonn);
J. Engelen (NIKHEF, Amsterdam), A. J.Van Rijn;
F. Cervelli (INFN, Roma), C. Martellotti;
G. Polok (State Committee for Scientific Research, Warsaw);
D. Popescu (Institute of Atomic Physics, Bucharest), F. Buzatu;
F.E. Grishaev, V.I. Savrin (Ministry of Science, Moscow);
G. Chapuis (Université de Lausanne, Lausanne), A. Bay;
J. Seed (PPARC, Swindon), N. Harnew;
G. Zinoviev (Ministry for Science and Technology, Kiev).

Asia:

Yongtao Zhang (National Natural Science Foundation of China, Beijing), P. Ji.

CERN:

R.J. Cashmore (chairman), E.M. Rimmer (secretary),
K.H. Kissler, A.J. Naudi, C. Saitta, D. Schinzel, E. Tsesmelis.

LHCb:

T. Nakada, C. Matteuzzi, A. Smith, W. Witzeling .

Apologies:

CICYT, Madrid;
Universität Zürich, Zürich.

9th Meeting of the LHCb Resource Review Board RRB, 23rd October 2002

Documents **CERN-RRB-2002-nnn** can be found at **http://web.cern.ch/Committees/LHCRRB/LHCb/**

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1. & 2. Introduction & Approval of the minutes of the last meeting

R.J. Cashmore
Director for Collider Programmes

The Chairman, R.J. Cashmore, welcomed delegates to the meeting at which the main business will be approving the 2003 budgets. The Minutes of the last meeting were **approved** without changes. There were no matters arising.

3. Status of the experiment

Spokesperson T. Nakada
Paper CERN-RRB-2002-123 *Presentation CERN-RRB-2002-136*

- *General Issues*

LHCb milestones have been updated for first beam in April 2007.
New appointments since the last RRB are:

CALOrimeter (SPD, Preshower, Ecal, Hcal)	Project Leader	A. Schopper (CERN)
	Deputy	J. Lefrancois (LAL)
Outer Tracker	Project Leader	A. Pellegrino (NIKHEF)
RICH (RICH-1, RICH-2)	Project Leader	D. Websdale (ICL)
	Deputy	O. Ullaland (CERN)
VErtex LOcator	Project Leader	T. Ruf (CERN)

Technical Coordinator W. Witzeling (CERN)

LHCb was very pleased to announce that the Vice President of Tsinghua University, Beijing, has signed the Construction MoU for China's contribution to the common project and Outer Tracker. Signatures are still awaited from Brazil, Germany (discussion is in progress with the institutes that will sign) and Poland (where the situation is reported to be improving).

- *Status of LHCb-light*

Reoptimisation of the detector (to reduce the material budget) does not affect the design of the VELO, T1 to T3 (Outer Tracker and Inner Tracker), RICH-2, CALO and the muon system. These items, unchanged since the TDRs, are proceeding towards construction and are budgeted in the 2003 figures presented later.

New designs are needed for:

RICH-1	– modifications in mechanics and optics to shield photon detectors from the magnetic field
TT (behind RICH-1)	– change from straw / Si OT / IT combination to an all-Si detector – to be used in the L-1 trigger

However, the number of tracking stations has been reduced from 11 (Technical Proposal TP) to 9 (OT TDR) to 4 (LHCb-light) and so tracking with fewer stations must be validated. A first performance study has been made with more than 1 M events using new software (the first version of the final software). The codes had some 'running-in' problems e.g. the efficiency of some detectors was smaller than it should have been, track finding is not fully optimized, track fitting is not fully tuned and the vertex resolution is not well understood (this has nothing to do with the *light* set-up). Nonetheless, initial results were very encouraging: track finding efficiency was > 90% for p >5 GeV / c with a ghost rate ≤ 30 % dropping to ≈ 5% after some software bug fixes, and results from 600,000 b-bar inclusive events give an event yield close to that in the TP. Because of the design revisions of RICH-1 and TT, the need for physics performance studies with improved software and background studies with much higher b-bar statistics, the LHCb-light TDR submission, originally planned ~ end 2002, has been postponed to September 2003. This does not compromise the overall LHCb plan.

Discussion

J. Engelen (NL):	the LHCb-light TDR will be postponed till September 2003, but if its design is frozen why is a year needed to validate it?
TN:	because we want to demonstrate not just that the tracking system will work but that the physics performance is good enough, even better than the original TP, and so we want to study backgrounds, triggers, etc.
J. Engelen:	but you are doing this study with a reason; you must have a fall-back in mind.
TN:	at this point in the tracking study, we have no reason to believe that something will go wrong.
J. Engelen:	then I find 1 year for submitting a TDR is very long.
R.J. Cashmore:	so did the LHCC and we will come back to this later in their Report.
TN:	there is design work to be done for the RICH-1 and TT. The tracking alone could be validated by the Spring but the Collaboration wants the TDR to be more global and to contain all relevant information.
R.J. Cashmore:	the TT is part of the tracking and so there is an issue about the design; we should make some statements about this later as it is important.

- *Subsystem status*
  - *Experimental area*

Concrete reinforcement of the head-wall is completed and the ex-DELPHI concrete shield along the beamline has been cut. Installation of the magnet support will start beginning of 2003 and re-installation of the general services will be completed by Spring 2003.

  - *Beam Pipe*

Aluminium prototypes of the VELO tank exit window are under construction at CERN and a beryllium prototype of the first 10 mrad section (over 2 metres long) is being ordered from Komposit, Russia.

  - *Magnet*

The Al conductor has been delivered from Holton Machinery, UK to SigmaPhi, France, where 24 coil pancakes (out of 30) have been wound and 4 triplets (out of 10) have been potted. Magnet installation is planned for end of 2003.

  - *Calorimeters*

Ecal series production is advancing well at ITEP Moscow; 1,200 modules (out of 3,300) have been delivered to CERN; 50% delivery expected by July 2003. Hcal series production has started at IHEP Protvino; 2 modules (out of 52) have been delivered to CERN; 10% delivery expected by February 2003. A pre-production sample of SPD / Preshower modules was successfully manufactured in May-June 2002 at INR Moscow; 10% delivery expected by November 2003.

- *VELO*

Critical items for the vacuum tank, the Al RF shield and the rectangular bellows, are being prototyped. A decision on the front-end chip – SCTA-VELO (DMILL) vs BEETLE (0.25 µm) – will be taken beginning 2003. During 2003, 50% of Si sensors should be ordered and hybrid production should start.

- *Muon system*

After careful studies of aging, RPCs were abandoned in favour of MWPCs. This increases the number of MWPCs from 864 to 1344 and a production scheme must be worked out – to commission an extra site or increase the capacity of existing sites – and presented to the LHCC.

- *RICH*

RICH-2 has passed the EDR and construction will start soon. Orders for the mirrors and superstructure will be placed in 2003. The critical item is the photon detector; there has been good progress in resolving the HPD bump-bonding problem and a new prototype HPD should be ready by end 2002. The pixel read-out chip now works at 40 MHz and its analog characteristics satisfy LHCb RICH requirements. However, the MAPMT is kept as a backup solution and a BEETLE redesign is being prototyped as the front-end chip.

- *Outer Tracker*

Details of chamber design are being tidied up e. g. wire locator design. Clean rooms are being prepared at the three production sites, NIKHEF, Heidelberg and Warsaw (ready), and Krakow has produced a large prototype of the station support panel.

- *Inner Tracker*

Efficiency tests of large strip size (to reduce costs) Si sensors gave good results. The TDR for the mechanical design is completed. The optical link for data transmission out of the high-radiation environment of the experimental area has been successfully tested over 100 m and the TDR will be submitted in November 2002.

- *Trigger*

Basic designs of Level-0 components are complete and have been reviewed by a panel including external referees; prototyping is underway, e.g. for the pile-up veto and the decision unit. The Level-1 trigger is being re-evaluated, in view of LHCb-light, for robustness and increased efficiency.

- *Computing*

The off-line environment is now entirely in the C++ GAUDI framework (except for GEANT3 which is in FORTRAN). Large data samples were produced in August (a total of 3.3 M events from Amsterdam, Bologna, Cambridge, CERN, Lyon, Moscow, Oxford, RAL and Rio) to evaluate LHCb-light. Following approval of the TDR, on–line prototyping has started for the timing & fast control unit and the read-out supervisor. The so-called TTCrx chips for all sub-detectors have been ordered for delivery in 2003 (in DMILL technology with possibly limited availability in future) as part of a large CERN order.

Nakada concluded that LHCb is well on the way to be ready for physics in 2007. The magnet, Ecal and Hcal are into construction and several other sub-systems will start spending CORE money in 2003. The delay in submitting the LHCb-light TDR does not compromise the overall schedule, and preliminary results show that the physics performance is not damaged by the large reduction in the number of tracking stations.

4. Report from the LHCC *LHCC Scientific Secretary E. Tsesmelis*

Paper CERN-RRB-2002-117

Since the last RRB, the LHCC held LHCb sessions in May, July and October 2002. The Committee considers that LHCb is progressing well; a new list of milestones, compatible with LHC start-up in April 2007, is currently being reviewed. The first LHCC Comprehensive Review and Installation Review of LHCb are scheduled for January and March 2003 respectively.

The LHCC considered that the schedule for remaining TDRs is reasonable. However, it expressed concern that the Re-optimisation TDR has been postponed to September 2003 and has asked LHCb to make a status presentation at its Open Session in November 2002 for discussion in the Closed Session.

TDR	*Submission*
Inner Tracker	November 2002
Trigger (L0/L1)	January 2003*
Computing	End 2003
LHCb Detector Re-optimisation	September 2003

*actually September 2003; see later remarks

SUB-SYSTEMS
The LHCC:

- considers that progress on the dipole magnet and calorimeter is satisfactory.
- recommended approval of the Online System TDR; this was given by the RB in April 2002.
- concurs with the decision to replace RPCs with MWPCs in the muon spectrometer and will evaluate the MWPC construction plan at its next Session.
- supports the plans of the Outer Tracker group, noting that a possible change of baseline gas to Ar/CO_2 would not affect detector design and that the group will continue to study both options.
- notes the progress on the RICH HPD and MAPMT photodetectors and that the choice between them will be made end 2002. Nevertheless, the incurred delay in the photodetection system is a major concern.

COMPUTING
The LHCC is now reviewing the LHC Computing Grid Project LCG in the same way as it reviews the experiments. The Committee strongly supports the Project as a very important strategic step towards the success of the LHC Computing and regards the LCG Project team as well-organised and competent to undertake the task. The Committee considers that execution of the Project requires the immediate deployment of the organization structure and basic infrastructure. It finds that construction of an appropriately-sized and technologically-advanced computing centre is mandatory and also encourages construction of the CERN Tier-0 prototype.

Nakada remarked that the Trigger and LHCb-Detector Re-OptimisationTDR's will be aligned and that that did not seem to have been noted by the LHCC. Tsesmelis replied that he would look into it. [After the meeting,Tsesmelis confirmed that the LHCC had agreed that these 2 TDRs will be submitted in September 2003].

Cashmore noted that LHCb has made much good progress and is now entering the difficult stage of construction, when problems are inevitably encountered. The LHCC has expressed some concerns, the main one being the time needed to improve the software such that it can be used to fully understand LHCb-light. The Comprehensive Reviews of LHCb will be very important to show that the detector is coming together as a whole and the Installation Review will ensure that LHCb's needs are properly integrated into CERN's work programme.

5. Financial matters *CERN Finance Director A.J. Naudi*

- ***Common Fund accounts*** *CERN-RRB-2002-096*

Updating the distributed document, Naudi reported an additional contribution of 8 kCHF from Santiago, Spain. Additional expenditures have amounted to 585 kCHF. Outstanding membership fees exceed 200 kCHF. A. Smith reported that the outstanding membership fee of Barcelona, Spain, was due to mistake and should arrive soon.

- ***M&O 'A' accounts*** *CERN-RRB-2002-097*

Updating the distributed document, Naudi reported that INFN / Roma has paid 42 kCHF and further expenditure has been 75 kCHF. Payment of outstanding contributions would be welcome, if possible before the end of 2002. Cashmore emphasised that this money is needed to maintain and operate LHCb and that the Resource Coordinator will follow this up unless other arrangements have already been made. He expressed satisfaction that in this first year of M&O invoicing some 75% of contributions have already been received.

- ***Market Surveys & Invitations to Tender***

There was nothing to report on these items.

- ***External Audit***

The Spanish External Auditors of the Tribunal de Cuentas, Madrid, audited the Annual Accounts of the Organization for 2001 and concluded their report by stating: "As a result of the audit, we are of the opinion that the Annual Accounts 2001 properly reflect the recorded financial transactions of the year, which were in accordance with the budget provisions, the Financial Rules, the Internal Financial Regulations and other established financial procedures of CERN. The Annual Accounts with Financial Statements present fairly, in all material respects, the financial position of CERN as at 31 December 2001, subject to the observations in our report".

6. Budgets *Resource Coordinator A. Smith*

- **2002 - 2003 Common Fund and CORE budgets**

Paper *CERN-RRB-2002-124*

2002

COMMON FUND

Payments in 2002 for the CALO, 1.5 MCHF, and infrastructure, 0.2 MCHF, will be as expected. For the magnet, probably only ~ 1 MCHF will be paid out of the 2.9 MCHF foreseen due to delivery delays; the total of 4.6 MCHF should be spent by end 2003.

CORE

CALO is on schedule and of the 4.3 MCHF foreseen 400 kCHF funding will not be committed because LHCb used the revised LHC start-up schedule to delay ordering the electronics as prices should decrease with time The 1 MCHF foreseen for electronics in 2003 will also be spent later. The 0.7 KCHF foreseen for RICH spending will not be committed this year as the project is on hold because of the LHCb-light studies, however, RICH 2 is now launching procurement.

2003

Detector groups have revised their planning to be in line with the new LHC start-up schedule. Estimates for 2003 spending amount to some 10 MCHF, slightly less than the average for each of the next five years. There is sufficient money in Common Fund to cover the anticipated expenses.

COMMON FUND in MCHF

Calorimeters	1.8
DAH	0.06
Infrastructure	0.6
Magnet	1.6

DIRECT SUBSYSTEM FUNDING in MCHF

Subdetector		*Participating Institutes*
Calorimeters	2.2	France, Romania, Russia, Spain , Ukraine, CERN
Muon	0.60	Brazil, Italy, Russia, CERN
Outer Tracker	1.22	China, Heidelberg (BMBF), NIKHEF, Poland, CERN
RICH	0.94	Italy, UK, CERN
VELO	1.25	MPI Heidelberg (BMBF), NIKHEF, Switzerland (Lausanne), UK
DAH	0.17	Germany (BMBF + MPG), Italy,Spain, Switzerland, UK, CERN.

Discussion

F. Cervelli (IT): in future we need specification of the estimated FA contributions per sub-system.

RJC: that is an excellent suggestion. It has already been discussed inside CERN, and LHCb will move towards that manner of presentation.

The RRB **approved** the 2003 Construction Budget as presented.

- **2002 - 2003 M&O budgets**
  Paper *CERN-RRB-2002-125*

In October 2001, the RRB approved the 2002 Category A M&O budget at 371 kCHF. Spending is unlikely to exceed 250 kCHF, mainly because power and cooling costs will be less than expected.

Category A 2003 budget estimates have been reviewed since the April RRB meeting and examined by the Scrutiny Group. The budget is 450 kCHF, unchanged since April, plus an estimated power cost of 120 kCHF, 50 kCHF lower than presented in April. Estimates in kCHF are:

UPS maintenance	5
Secretariat	85
Printing, Publications	35
On-Call communications	7
Test Beams	120
Laboratory Operations	55
Cooling & Ventilation	78
General services	55
Outreach	10
Total	**450**
Power	120
Grand Total	**570**

Smith showed the sharing of power costs between NMSs (Russia at a reduced rate in recognition of its contribution to the LHC machine), CERN as an LHCb collaborator (17.7 kCHF) and CERN on behalf of MSs (81.6 kCHF). At the April RRB, LHCb was asked to check its approach to Category A cost sharing vis-à-vis the other experiments. CMS use physicists-only PhD equivalents; ALICE and ATLAS use engineers+physicists PhD equivalents. LHCb use the latter approach; the difference between including and not including engineers is small on average. All institutes have been asked to revise their figures accordingly and very few replies are still missing (one institute in China, Brazil and Ukraine). The resulting sharing of the 2003 M&O costs amongst the collaborators is, in CHF:

FUNDING AGENCY	*No. PhD equivalents*	*% PhD equivalents*	*Cat A (no power)*	*Power*	*TOTAL*
Brazil	14	3.98%	17,898	4,773	22,671
CERN	52	14.77%	66,477	17,728	84,205
China	7	1.99%	8,949	2,386	11,335
France IN2P3	42	11.93%	53,693		
Germany BMBF	15	4.26%	19,176		
Germany MPG	8	2.27%	10,227		
ItalyINFN	63	17.90%	80,540		
Netherlands	17	4.83%	21,733		
Poland	13	3.69%	16,619		
Romania	4	1.14%	5,114	1,364	6,478
Russia	32	9.09%	40,909	9,098	50,007
Spain	15	4.26%	19,176		
Switzerland	16	4.55%	20,455		
UK	45	12.78%	57,528		
Ukraine	9	2.56%	11,506	3,068	14,574
TOTAL	352	100%	450,000		

LHCb will not have M&O Category B costs until ~ 2006, with the possible exception of the muon group which may start earlier.

D. Schinzel, Chair of the Scrutiny Group, reported that the SG was satisfied that the revised LHCb M&O Category A spending profile (Table 1C in *CERN-RRB-2002-108*) properly reflects the machine schedule change. It found that the numbers for 2003 are sound and can be approved.

Van Rijn asked how the reduced actual spending in 2002 will be handled. Cashmore explained that final 2002 figures will only be known after the April 2003 book closing. So 2003 invoices will be issued at the 100% level and any corrections will be made in 2004 invoices; this 2-year sequence will then be perpetuated.

The RRB then **approved** the 2003 M&O Category A cost estimates and sharing as presented.

7. Summary, future activities & A.O.B. *R.J. Cashmore*

A summary of the decisions taken at this meeting will be e-mailed to delegates as soon as possible.

LHCb is moving steadily ahead. Some sub-systems are making impressive progress and the LHCC is keeping careful watch that the collaboration is finding solutions to identified problems. The experiment, as it moves into construction, is beginning to be treated like ATLAS and CMS, with the first Comprehensive and Installation Reviews foreseen for Spring 2003.

For M&O, response to the 2002 costs is very positive and 2003 costs have been agreed. Signatures are steadily coming in for the M&O MoU and FAs that have not yet signed this document are encouraged to do so.

As defined in the M&O MoU, half of the **Scrutiny Group** members are due for replacement next April; Cashmore urged delegates to send names for external candidates to him by **NOVEMBER 30th 2002** (people with experience of large experiments and also, though not obligatory, of CERN, and preferably not involved with the LHC programme). The proposals will be discussed and considered with a view to forming a well-balanced new SG next April.

2003 meetings:	April 14 – 16	LHCb on the afternoon of Wednesday 16th
	October 20 – 22	LHCb on the morning of Wednesday 22nd