

13th Plenary Meeting of the LHC Resource Review Boards, 22nd October 2001

All documents, files, etc. can be found at: <http://web.cern.ch/Committees/LHCRRB/RRB/>

1. Welcome and Introduction *R.J. Cashmore, Director for Collider Programmes*

The Chairman, R.J. Cashmore, welcomed the RRB delegates of ALICE, ATLAS, CMS and LHCb. He encouraged delegates to participate in the scheduled visits to ATLAS and CMS as there is much that is impressive to be seen.

He asked delegates who had not already done so to fill out a questionnaire on the use of e-mail and the Web, emphasising the advantages of rapid paper-less communications for LHC RRB business. He also asked that F. Baud-Lavigne be kept informed of any changes in responsibilities for RRBs so that mailing lists can be kept up-to-date.

2. Status of the LHC Machine *L. Evans, LHC Project Leader*

http://web.cern.ch/Committees/LHCRRB/RRB/P_2001_13_1.ppt

The LHC Project Leader, L. Evans, explained that his presentation had recently been given to ATLAS and so is maybe rather more technical than is normal for an RRB meeting.

Concerning civil engineering, Evans showed pictures of progress in the ATLAS hanging vaults and of the service cavern, finished and delivered to the collaboration. On the surface, the CMS assembly hall is complete and many other buildings are almost ready to be handed over to CERN. Underground, the two 2.6km transfer tunnels between the SPS and LHC are broken through, the two 700m beam abort tunnels are being excavated, and the CMS 'pillar' is complete and excavation of the experimental cavern has started.

He went on to explain work in progress along the injector chain, to keep the beam dimensions within the emittance 'budgets' needed to achieve the desired luminosities, a difficult job. The first step involving the PS has been successfully completed, thanks in part to a Canadian contribution for purchasing new hardware; the next element in the chain is the SPS.

The LHC super-conducting magnets, 6,000 of them, are critical components of the machine. In particular, the 1,232 main dipoles presented development challenges that have needed significant R&D; they are now in pre-series production and the two already tested behave most satisfactorily. The single remaining major technical hurdle to achieving the 2006 turn-on schedule is s-c cable production, which is still posing some problems.

On the cryogenics front, the first of the 4 18kW cryoplants and the first of the 8 'cold compressors' are presently being commissioned. The problem of the heat load on the beam vacuum chamber, observed at SLAC and KEK and predicted at LHC, appears to be surmountable. This is caused by synchrotron radiation photo-electrons hitting the chamber walls and producing secondary electrons that are accelerated to the other side, and so on. This amplification can deposit up to 2W/m along the chamber, a modest amount but exceedingly difficult to remove at 20 K. The surface emission co-efficient decreases with the bombardment, a process called electron scrubbing, and simulations show that for stable operation at the highest beam intensities and luminosities a manageably low co-efficient can be reached after 3 – 10 days running at 10^{33} luminosity.

On the magnet front, string #2, a real half-cell, is complete. The full cool-down reached <1.9 K, and the string was powered, comfortably reaching the 12kA needed for the nominal beam energy.

Among the contributions from Member States MSs and Non-Member States NMSs are: s-c main quadrupoles from Saclay, warm quadrupoles from Canada for the cleaning insertions, sextupoles from India for correcting higher harmonics, s-c quadrupoles from US and Japan for the insertion regions, classical dipoles (360) and quadrupoles (180) from Russia for the two transfer lines (equivalent to half of the SPS and all have arrived), abort septa also from Russia for safe operation of the beam dumps, and dipoles from BNL which will collide the beams by having the fields in the two tubes in the same direction.

Finishing with the installation schedule for the 8 LHC octants, Evans reported that LEP dismantling is almost finished, that cryoline installation will start in Q1 of 2002 in sector 7-8, and that the first dipole will go in during Q3 of 2003. Installation will continue sector by sector until the full machine is closed and cold at the end of 2005.

3. LHC Computing Project

H.F. Hoffmann, Director for Scientific Computing

http://web.cern.ch/Committees/LHCRRB/RRB/P_2001_13_2.ppt

H.F. Hoffmann, Director for Scientific Computing, reported on progress since the LHC Computing Review was discussed at the RRBs in April. The paper CERN2379/Rev., a 'Proposal for Building the LHC Computing Environment at CERN', describing a 2-phase project, was presented to the CERN Council in September 2001 (and distributed at the meeting). A noteworthy feature of this Grid-based project is that it provides high level training and leading edge technology opportunities well beyond particle physics.

Phase 1, 2001 – 2004, covers technology development and increasingly demanding data challenges of the experiments. The aim is to have a production prototype ready at CERN and in participating MSs and NMSs in 2004. Council approved this phase on condition that the necessary resources can be identified. Successful completion of phase 2, 2005 – 2007, the first production system including CERN's Tier0 + Tier1 centres, will be of vital importance to the LHC experiments.

In addition to the present investment of some ~ 70% of CERN-IT Division resources into LHC computing, additional resources required, in MCHF, are:

	<i>Phase 1, 2001 - 2004</i>	<i>Phase 2, 2005 - 2007</i>
<i>Staff</i>	22.4	21.9
<i>Materials</i>	29.5	95.8
<i>Total</i>	51.9	117.7

The 22.4MCHF for staff in Phase 1 represents ~40 FTEs and the total of 117.7 MCHF for Phase 2 includes 10% contingency for the outcome of the experimental programme.

Hoffmann presented the structure of the LHC Computing Grid Project and the composition of its various bodies, showing the interactions between the Project Overview Board POB, the Software and Computing Committee SC2 and the Project Execution Board PEB. Synergetic links with external bodies included the EU DataGrid project, other HEP and non-HEP grid projects, e-Science in the UK, and the CERN openlab concept involving several industrial partners. Internal reporting lines will be to the LHCC and the Common Computing RRB which will be set up to have its first meeting next April.

The POB, PEB and SC2 will meet in November or December and a launching workshop will be held for all participants early in 2002, possibly recurring annually as a project workshop.

Hoffmann then presented the status of the EU DataGrid project, which started at the beginning of 2001 with 9.8M of EU funding, 21 partners (including PPARC, INFN, CNRS, NIKHEF and ESA). The emr/011113

project covers middleware, test beds and applications and its work is 90% focussed on HEP/LHC. The first test bed is ready for release and an EU review is foreseen for March 2002. To ensure interoperability of the various grid efforts there is intensive collaboration with similar projects in Europe and elsewhere, mainly the US.

As for resources, on the staffing side the 40 FTEs are already available and more are pledged, while of the 30MCHF needed for materials >10MCHF are pledged. Discussions continue to find the remaining funds within and beyond the MSs, with FAs and with industry, and in-kind contributions of suitably qualified people would be welcome. In addition, the EU may decide to give more money and industry may contribute more through the CERN openlab.

Discussion

S. Bhave (IN): will NMSs with Tier-2 centres be represented on the POB?

H-F.Hoffmann: this is being debated.

4. The LHC and the CERN programme *L. Maiani, Director General*

For more details see: <http://user.web.cern.ch/info/LHCCost/>

The Director General presented the preliminary results of the in-depth review of the costs to CERN of the LHC machine and its experiments, as reported, somewhat informally, to Finance Committee and Committee of Council in September. The numbers will be refined during the coming months but are unlikely to vary by any substantial amounts. The missing funds amount to 850 MCHF:

	1996 budget*	Increase	2001 (to 2006)
LHC machine & experimental areas**	2600	480	3080
CERN's share of detectors	210	50	260

* no contingency, apart from time, was allowed on 1996 costs

** main items: magnet assembly, civil engineering, infrastructure, industrial services for installation

Additional expenses:

Prototyping (s-c magnets, cryogenics, vacuum, etc.)***	150
CERN GRID computing infrastructure	120
Special contributions shortfall w.r.t. 1996 estimates & targets	50

*** to be found within CERN's budget 1996-2009

The first cost overruns were noted in 1999 and by 2000 CERN was prepared to launch a full cost review. To be realistic however, such a review had to await the decision to end the LEP programme. In addition, some major LHC tenders e.g. for magnet assembly and cryogenics were pending (and are still not finalised).

The 150 MCHF for prototyping will be absorbed into the normal CERN budget starting in 2002 at the rate of ~ 20MCHF per year. The next step will be to present a three-prong proposal for finding the missing 700 MCHF (~ 25% of original cost estimate) to the Finance Committee in November. The components will be:

1. Internal organisation and economies
 - austerity measures will be taken in all CERN sectors, slowing down or even stopping non-LHC activities
 - new methods of expenditure monitoring & control will be introduced to reduce reaction times

2. Extending loan repayment period

- from the outset, time was the LHC contingency
- 1996 plan foresaw loans to absorb peak expenditure up to 2008
- extra costs could be absorbed by extending the loans beyond 2008

3. Extra MS contributions

- CERN will ask MS to consider extra contributions, in particular for expenses not foreseen in 1996

Referring to recent criticism of the lack of transparency until now, Maiani accepted that there was some basis for this and said that lessons had been learned. In conclusion, the Director General stated that the LHC project is scientifically and technologically solid and that a solution for funding it will be found only with advice and input from CERN's institutional bodies. This must be acceptable by the whole community as a solution to the whole problem.

Discussion

- S. Ganguli (IN): does this situation effect the commissioning of the LHC machine?
LM: in principle not. The immediate problem is one of cash flow and it depends how this is addressed. Commissioning depends more on things like the production rate of s-c cables and the development of magnet assembly contracts.
- D.O. Riska (FI): what is the effect on intermediate activities like COMPASS and ISOLDE?
LM: this will be analysed. These activities need no new detector money, and the SPS and other beams are needed anyway for testing LHC detectors, but running time might be reduced.
- R. Wade (UK): are additional interest payments included in present figures?
LM: no, figures are in 2001 prices. Interest payments for different scenarios will be in the FC papers.
- S. Bethke (DE): in the LHC Computing Review Report the total cost was ~240 MCHF with ~1/3 needed at CERN. So where does the number 120 MCHF come from?
- H.F. Hoffmann: the latest estimates include infrastructure renewal in the CERN Computer Centre plus manpower. 240 MCHF was the materials budget estimate.
- K. Kleinknecht (DE): which non-LHC activities will be stopped?
LM: many are scheduled to stop in 2003, but COMPASS, ISOLDE, AD and NTOF will continue. R&D for future accelerators will be discussed, with the CLIC test facility #3 having top priority. The CERN Neutrinos to Gran Sasso facility is more than 3/4 funded externally but it will be reviewed and its installation schedule will be optimised to avoid penalising the LHC. Measures in these and other areas should streamline CERN behind the LHC and allow the laboratory to cover the 150 MCHF used for prototyping but hardly more.
- G. Wormser (FR): what is the contingency / uncertainty on the 480MCHF?
LM: there is some contingency in the civil engineering figures and we are looking for more aggressive budgeting which might produce ~ 70MCHF to be centrally managed. There is also some contingency in the 120MCHF for computing, maybe 10 - 20M, as computing depends on, for instance, the trigger level.

5. Memorandum of Understanding for Maintenance & Operation *D.A. Jacobs*

Draft MoU document: http://web.cern.ch/Committees/LHCRRB/RRB/BINGO_D_2001_5.pdf

Presentatione: http://web.cern.ch/Committees/LHCRRB/RRB/P_2001_13_3.ppt

The idea of an MoU for M&O was introduced to the RRBs in October 2000 and a generic draft, for a fictional detector called BINGO, has been in preparation since the spring of 2001. The draft has passed through several versions following discussions with the collaborations' managements, CERN financial and legal services and with a large number of RRB delegates at round-table meetings in September. Version 3.4, presently being discussed, takes account of all comments received and was put onto the Web in early October (paper copies were also available at the meeting).

The articles of version 3.4 were then presented by D. Jacobs, who is responsible for having put the text together. The aim was to receive a final round of comments and to thereafter revise the text to become the draft MoU document (or more correctly, four draft MoU documents, one for each of the real experiments) which will be presented to the RRBs next April for approval.

The following is a record of comments made by delegates related to possible changes or clarifications needed in the MoU text.

Preamble explains why M&O MoUs are needed and how they will be handled

Art.1 describes the context of the Annexes and their relationship with those in the Construction MoU

Art.2 names the parties to the MoU and refers to the collaborating institutes and Funding Agencies

Art.3 describes the purpose of the MoU and sets precedence of Co-operation Agreements and Protocols

G. Mikenberg (IL): in case of conflict, 3.5 left the door open for the previous MoU to take precedent with respect to deliverables, etc., now it does not.

RJC: 3.5 states the precedence of any relevant Co-operation Agreements and Protocols (not the Construction MoU) over the M&O MoU.

D. Horn (IL): does the Construction MoU have precedence over the M&O MoU?

DAJ: yes; this is made clear in the Preamble.

J. Feltesse (FR): are Co-operation Agreements and Protocols public?

RJC: yes in the sense that they are known to the CERN Council and are listed.

Art.4 defines the duration of the MoU, withdrawals of FAs and institutes, and joining by new institutes

N. Lloyd (CA): 4.6 states that a new institute/country joining should make an extra contribution to M&O costs but says nothing about construction costs. This could discourage new collaborators from joining before construction is complete.

RJC: the intention is to allow newcomers to be asked for extra M&O costs to compensate for not having contributed to construction. Could just drop 'M&O' to allow any kind of extra contributions.

P. Jenni (ATLAS): yes, leave open the possibility of other additional contributions e.g. upgrades.

RJC: 'M&O' will be dropped.

Art.5 defines the detector, collaboration management and participating institutes

S. Bhave (IN): does the list of number of scientists with PhDs change each year? DAJ: Yes.

Is there scope for manipulation? Names could be changed year-by-year. Costs sharing by capital investment, at least during pre-exploitation, would be more transparent.

RJC: the collaborations will have to avoid manipulation; people have to behave reasonably.

G. Vesztergombi (HU): cost sharing by scientific personnel discriminates against smaller institutes.

RJC: this discussion is related to Art.9 rather than Art.5.

Art.6 defines the responsibilities of all parties to the MoU

K. Kleinknecht (DE): the separation into common items and sub-systems is not realistic; e.g. if someone provides super-conductor, maintenance of the coil cannot be their responsibility.

DAJ: the intention is that for M&O purposes the collaboration decides which items will be common items and which will be maintained by an institute or set of institutes.

J. Feltesse (FR): it is clear for items in the Common Fund, but there are 'local' common funds within sub-systems; 6.2 is ambiguous; it should refer to responsibilities as defined in the Construction MoU.

DAJ: the term 'common items' was used instead of 'common projects' was to allow collaboration to maintain items in common even if they had not been constructed in common.

RJC: will review wording. As for 'common projects' within a sub-system, that would fall into B-type expenses, dealt with later.

L. Gidefeldt (SE): CERN's 'General Conditions' GCs can change and create a problem with 6.6; the MoU might need to be renegotiated.

RJC: future changes to the GCs will have to be discussed with the RRBs. ATLAS & CMS were approved under old GCs, ALICE and LHCb under the new GCs.

G. Mikenberg (IL): the Construction MoUs (for ATLAS & CMS) were signed and budgeted under GCs that have since changed, making the Construction MoUs only half-valid. Maybe the new GCs should only come into force in the exploitation phase. New costs now will be at the expense of deliverables.

RJC: both old and new GCs have a clause indicating that CERN will provide resources according to what is available.

Art. 7 *defines the categories of M&O expenses*

J Yeck (USA): the GCs provide guidelines but it would be useful to have an explicit description of the procedure by which items are categorised; who decides, in particular for A versus C?

RJC: the Scientific Policy Committee SPC asked for all costs to be identified; CERN must provide a safe and secure working environment for the experiments; this determines the A/C decision and that decision has to be taken by CERN and accepted by Council.

S, Bhave (IN): a statement on responsibilities for B costs should be appended to the MoU of each collaboration.

DAJ: that question is addressed later; the collaboration must document and present its B costs arrangements annually to the RRBs.

Art. 8 *defines the roles of the RRB and its Scrutiny Group in the approval process*

Art. 9 *defines the rules for cost sharing and rebates*

G. Vesztergombi (HU): cost A sharing by scientists is not fair especially during pre-exploitation; it penalises small institutes; institutes will lose interest to increase staff; different types of publications may (should?) have different authors thus requiring a publication policy and several author lists.

L. Foà (IT): in recent discussions there was a plea that exceptional cases should be handled flexibly with the agreement of the RRB; this is not in the text.

RJC: there is scientific and technical output during pre- exploitation. Bills will be paid by FAs with responsibility for several institutes; this reduces the % effect of changing the number of staff from a small institute. The RRBs will always have to accept exceptional cases on good grounds but must start with strict rules.

S. Tovey (AU): there is a problem if one person is active in more than one experiment.

RJC: there is no obvious solution.

P. Braun-Munzinger (DE): CERN Council should discuss the rebate formula not the DG.

RJC: will return to this later; must respect the way CERN operates.

A. Clark (CH): arrangements for category B costs should be consistent across experiments.

RJC: will have to see how this evolves.

G. Mikenberg (IL): experiments should decide their own arrangements for both B and A costs.

RJC: that is OK for B costs but SPC advises A costs by authors as practised elsewhere e.g. DESY.

G. Wormser (FR): amount of rebate not known when asked to sign MoU; need some indications.

RJC: RRBs are modelled on CERN's general procedures; budget figures are set each year, with forward looks, based on funds available. The rebate level will have to be fixed at the beginning of each year. Will see whether clarification is necessary in the MoU text.

K. Kleinknecht (DE): haven't understood whether the DG and Council approves the rebates.

RJC: CERN presents a Medium Term Plan MTP to Council every year and the rebate will be included.

K. K: I am discussing the rebate formula, which is controversial, not the amount.

P. Braun-Munzinger (DE): the GCs do not clearly define the A, B and C categories.

RJC: A/C split worked out from CERN responsibilities to provide a safe and secure laboratory and A/B split worked out with the experiments.

Art. 10 defines the procedures for M&O budget preparation and approval, invoicing and payments

F. Pauss (CH): need to know rebate level before can approve budget at the October RRBs.
RJC/DAJ: the rebate level will be approved in the MTP in June Council and so will be known at the October RRBs; should include this in the text.

Art. 11 defines the rights of members of the collaboration

Art. 12 states the standard legal rules covering the signatories

L. Gidefeldt (SE): 12.3 regarding excluding defaulting institutes from the collaboration is too hard. After 'in Article 14.1 below', delete the rest of the sentence.
RJC: will look whether the item is covered by 14.1; similar statements are in the Construction MoUs to protect the Collaborations.

Art. 13 specifies the frequency of updating certain Annexes

R. Wade (GB): MoUs are bi-lateral with each FA; will they all be identical?
RJC: that is the intention; the RRB would have to agree any (small) differences.

Art. 14 describes the handling of disputes

N. Lloyd (CA): 14.1 does not mention RRBs in the resolution of disputes.
RJC: they are mentioned earlier; 14.1 assumes the dispute has gone beyond the RRB; will check for consistency and include something to that effect.
G. Mikenberg (IL): 14.2 obliges signatories to the M&O MoU to respect their agreements in the Construction MoU but this may not be possible e.g. if paying M&O costs is only possible by reducing the supply of deliverables.
DAJ: 14.2 is intended to de-couple the 2 MoUs.
RJC: will look into this during the coming individual RRBs because may be source of conflicts.

Concerning approvals, the Director General commented that formalities must be separated from the substance. The rebate formula will have to be approved by the DG after discussion and agreement in the RRBs.

Cashmore thanked everyone for their remarks which will be taken into account preparing in the next and hopefully final draft(s) to be approved for circulation at the April RRBs. Delegates may, of course, send further comments by 'phone, mail or e-mail to D. Jacobs after the meeting.

6. Maintenance & Operation Cost Estimates and Rebates

R.J. Cashmore

Cashmore opened by commenting on the importance to the collaborations and to CERN of knowing the total costs of running the LHC experiments. He remarked that handling M&O costs requires a new system to be set up. The RRBs had agreed in April that 2002 would be a 'prototype' year and careful accounting will be needed to see how things evolve.

M&O Category A cost estimates were made by the experiments and examined as well as time permitted by the Scrutiny Group. SG members were:

Atul Gurtu, Tata Inst, Mumbai/CERN	Bernard D'Almagne, CRNS/IN2P3
Brigitte Bloch-Devaux, CEA/DAPNIA	Franco Cervelli, INFN Pisa
Guy Luijkcx, NIKHEF	Jim Yeck, DOE, US
Kay Koenigsmann, Uni-Freiburg	Paolo Giubellino, INFN Torino
Peter Chochula, Slovak Repub./CERN	Peter Von Handel, DESY
Steinar Stapnes, Uni-Oslo	Sven-Olof Holmgren, Uni-Stockholm
Tiziano Camporesi, David Plane, Peggie Rimmer (Scientific Secretary), Dieter Schinzel (Chair), Tom Taylor/CERN	

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Results from the 4 experiments were carefully compared and co-ordinated.
Items defined to be Category A and thus incurring costs to be paid in common are listed below.
Category A cost sharing is to be by the number of scientists supported by each FA.

CATEGORY A M&O Cost Items		
Detector related costs	Communications	Laboratory operations
Magnet	GSM phones	Assembly areas, clean rooms, active storage areas
Magnet controls	Automatic call-back	Workshops
Magnet power supply		Laboratory instruments
Gas systems		Electronics pool rentals
Gas consumption		
Cooling systems	On-line computing	General services
Cooling fluids(above -50°C)	System management	Cooling & ventilation
External cryogenics	Data storage, (temporary on disk)	Power
Proximity cryogenics	Detector controls	Power distribution system
Cryogenic fluids (below -50°C)	Computers/processors/LANs	Heavy transport
Moving/hydraulic systems	Software licenses	Cranes
Detector safety systems	Common desktop infrastructure	Cars
Detector-specific radiation protection		Cleaning
Shutdown activities	Test beams, calibration facilities	Survey
Detector (re-)integration & survey	General operation	Passive storage space
General Technical support	Common electronics	Common desktop infrastructure
UPS maintenance	Counting & control rooms	
Electronics pool rentals	Gas systems	Consultancy
Beam pipe & vacuum	Gas consumption	Reviewing
Counting & control rooms	External cryogenics	Engineering
	Proximity cryogenics	Training
Secretariat	Cryogenic fluids (below -50°C)	
Secretarial assistance	Cooling systems	Outreach
Economat	Cooling fluids(above -50°C)	
Photocopiers, fax, printers	Safety & radioprotection	
Printing and publication	Modifications	
	Electronics pool rentals	

Cashmore noted that, as recommended by the Scrutiny Group, some items previously Cat A have been assigned entirely or partially to Cat C, e.g. video-conferencing and cooling & ventilation, the safety aspects of the latter clearly being a host laboratory responsibility. He also noted that data recording media, removed from the list because of the difficulty of making accurate estimates at this stage, will come back either as M&O or as part of the LHC computing costs to run the CERN Tier 0 centre.

System-specific Category B costs, for which there is not yet a common approach, have not been scrutinised. ATLAS and CMS used the Cat A item template but this was not ideal and a Cat B item template is needed. Given that Cat B costs are comparatively low during next 2-3 years and that sharing will be proposed by collaborations, there is time to prepare this.

CATEGORY C M&O Cost Items
General services
Safety & radioprotection
INB compliance
Radioactive waste disposal
Access system
Elevators
Gerant de site
Flood control
Insurance (CERN standard)
Cleaning
Office space

Category C costs are paid by CERN and pertain to items necessary to provide a safe and secure working environment for the experiment and experimenters.

Rebate algorithms are given in the draft MoU. Each year CERN will have to decide on amount of the rebate. This amount will be split between MS and those NMS that have contributed to the LHC machine, in the ratio of the value of the contribution of these two groups. The rebate for a given FA will be a fraction of its A costs proportional to the contribution of the State to which it belongs normalised to the GDP of that State. CERN MS membership contributions are proportional to GDP.

Each experiment will have an M&O Common Fund for Category A costs. Rebated, non-itemised invoices will be issued, grouping all 4 experiments with the share by experiment indicated, an approach proved successful at LEP. Itemised costs will have been scrutinised and approved by the RRBs and itemised accounts will be presented annually to the RRBs. Rebates will lead to a known loss of income per experiment; and this will be made good by CERN.

Cashmore announced that 300 kCHF is foreseen for rebates in 2002. This amount will rise in time, 2002 being a transition year to bring system into operation. He then presented some tables showing M&O Category costs and rebates. Some of these numbers, such as the number of scientists per FA, still need final revision before any invoices are issued.

Preliminary numbers, which may need revision, used to assess contributing NMS rebate fractions are:

Gross Domestic Product in billion USD (IMF - Sept. 2001)						
	1996	1997	1998	1999	2000	Average
Canada	611.6	631.2	607.9	656.4	711.1	626.78
India	384.4	417.4	426.2	454.5		420.61
Japan	4,695.7	4,313.3	3,940.4	4,499.4	4,749.3	4,362.20
Russian fed.	419.0	428.5	277.8	184.6	251.1	327.48
USA	7,813.2	8,300.8	8,790.2	9,268.6	9,872.9	8,543.20
Contributions to the LHC machine construction						
	Nominal	Effective MCHF				
Canada	30MCHF	22.8	Part of contribution is to PS			
India	25M\$	17.2	50% to India Fund			
Japan	13.85B¥	132	Part of contribution is to ATLAS			
Russian fed.	110MCHF	73	33% to Russia Fund			
USA	200M\$	215				
TOTAL		460				

M&O Category A costs to the FAs in kCHF are listed below. Rebates for 2007 are not indicated.

FUNDING AGENCY	Gross 2002	Rebate 2002	Net 2002	kCHF/ scientist 2002	Gross 2007	kCHF/ scientist 2007
Armenia	12.02		12.02	0.80	138	9.17
Australia	12.47		12.47	1.13	86	7.84
Austria	18.41	2.46	15.94	0.84	162	8.54
Azerbaijan	7.94		7.94	1.13	55	7.84
Belarus	15.87		15.87	1.13	110	7.84
Belgium	16.96	2.27	14.69	0.77	184	9.68
Brazil	18.27		18.27	0.87	190	9.04
Bulgaria	6.25	0.84	5.41	0.77	68	9.68
Canada	54.43	0.70	53.73	1.12	369	7.69
CERN	299.56		299.56	0.92	3,054	9.40
China	95.37		95.37	0.90	1,087	10.26
Croatia	9.65		9.65	0.80	136	11.31
Cyprus	0.89		0.89	0.89	12	12.49
Czech Republic	49.89	6.68	43.21	0.90	306	6.37
Denmark	9.07	1.21	7.86	0.79	68	6.78
Estonia	3.57		3.57	0.89	50	12.49
Finland	15.93	2.13	13.79	0.73	167	8.80
France CEA	80.54	10.79	69.76	0.91	526	6.83
France IN2P3	270.01	36.16	233.85	0.84	1,972	7.04
Georgia	21.54		21.54	1.13	149	7.84
Germany BMBF	178.05	23.84	154.20	0.84	1,326	7.21
Germany MPG/GSI	55.05	7.37	47.67	0.77	425	6.86
Greece	46.95	6.29	40.66	0.87	348	7.41
Hungary	30.90	4.14	26.76	0.72	336	9.09
India	48.63	0.72	47.91	0.75	670	10.47
Israel	28.35	0.61	27.74	1.11	189	7.56
Italy	446.71	59.82	386.89	0.77	3,890	7.73
Japan	55.56	0.60	54.96	1.12	378	7.71
Korea	33.11		33.11	0.85	465	11.91
Mexico	7.48		7.48	0.68	106	9.65
Morocco	5.67		5.67	1.13	39	7.84
Netherlands	63.39	8.49	54.90	0.84	430	6.61
Norway	25.63	3.43	22.19	0.82	180	6.65
Pakistan	10.71		10.71	0.89	150	12.49
Poland	67.98	9.10	58.88	0.77	547	7.20
Portugal	22.63	3.03	19.60	0.93	140	6.66
RDMS-JINR	205.61		205.61	0.93	2,172	9.79
Romania	26.60		26.60	0.95	241	8.62
Russia	420.19	35.69	384.49	0.83	3,967	8.61
Slovak Republic	44.22	5.92	38.30	0.78	333	6.79
Slovenia	6.80		6.80	1.13	47	7.84
Spain	87.04	11.66	75.39	0.87	647	7.43
Sweden	51.93	6.95	44.98	0.92	309	6.31
Switzerland	68.20	9.13	59.07	0.79	611	8.14
Taipei	18.48		18.48	1.03	178	9.91
Turkey	33.07		33.07	1.00	343	10.38

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Ukraine	18.87		18.87	0.73	248	9.55
United Kingdom	261.01	34.95	226.06	0.88	1,760	6.82
USA	564.72	5.01	559.71	0.99	5,723	10.15
TOTALS	3,952.20	300.00	3,652.20		35,089	

The following indication of trends is given on the understanding that error bars are larger for estimates of costs considerably in the future. C&I consists of items originally in the M&O lists but identified by the Scrutiny Group as being more correctly treated as Commissioning and Integration costs.

M&O and C&I COSTS 2002 - 2007 in kCHF						
	2002	2003	2004	2005	2006	2007
M&O Cat A	3,952	6,731	10,835	19,413	31,265	40,090
M&O Cat B	734	752	810	1,438	18,946	20,872
M&O Cat C	2,320	2,310	2,590	2,630	3,260	3,350
TOTALS	7,006	9,793	14,235	23,481	53,471	64,311
C&I (all Cats)	5,130	8,875	11,390	7,838	160	
GRAND TOTALS	12,136	18,668	25,625	31,319	53,631	64,311

Cashmore noted that at LEP, B costs had been larger than A costs, whereas at the LHC the situation is reversed. However, the (A+B) cost/scientist is not very different; it was ~ 13kCHF at the beginning of LEP operation and is estimated at ~ 15kCHF in 2007 for the LHC (number of scientists ~ 4,000).

Discussion

P. Braun-Munzinger (DE): rebate is not proportional to actual contributions to the machine so it is rather a cost reduction.

RJC: yes, in England, a rebated bill implies a cost reduction; here we are reflecting the use of the experimental program, that is how CERN works.

L. Maiani: the splitting of the rebated amount between the MS and NMS reflects exactly the actual contributions of these 2 groups, $\approx 6 : 1$.

K. Kleinknecht (DE): normalisation to GDP is not acceptable, rebates should be linearly proportional to contributions.

RJC: CERN contributions are all proportional to GDP.

S. Ganguli (IN): might expect some general services appearing as Cat A items to be Cat C, e.g. power.

RJC: there is no uniform rule; e.g. at DESY users pay for power.

J. Richter (DE): rebates should depend solely on contribution levels; this is very important for Germany and the BMBF delegation has difficulty with the rebate formula as it stands.

RJC: the formula reflects how CERN works: MS contributions are per GDP; thereafter all scientists are treated equally and charged according to the cost of their activities.

D. Horn (IL): remembers lower costs/scientist at LEP.

RJC: numbers are taken from the LEP Finance Review Committees (except OPAL, that did not report B costs).

7. Report from M&O Cost Estimates Scrutiny Group *D. Schinzel, Scrutiny Group Chair*

Document: http://web.cern.ch/Committees/LHCRRB/RRB/D_2001_8.pdf
 Presentation: http://web.cern.ch/Committees/LHCRRB/RRB/P_2001_13_4.ppt

This item was not presented due to a lack of time; it will be discussed by the individual RRBs.

8. Dates and formats for RRB meetings in 2002 *R. Cashmore*

Before closing the meeting, Cashmore showed the proposed format for the 2002 RRB meetings that will include a new LHC Computing RRB to be set up before April.

Monday		Tuesday		Wednesday	
<i>April 22 - 24</i>					
11.00 - 12.30	Plenary	09.00 - 12.30	LHC Computing	09.00 - 12.00	ALICE
13.30 - 17.30	CMS	13.30 - 17.30	ATLAS	13.00 - 16.00	LHCb
<i>October 21 - 23</i>					
11.00 - 12.30	Plenary	09.00 - 12.30	LHC Computing	09.00 - 12.00	LHCb
13.30 - 17.30	ATLAS	13.30 - 17.30	CMS	13.00 - 16.00	ALICE