



## 1. Introduction

This report has been prepared for the first C-RRB meeting during Phase 2 of the LCG Project. The final sums for the personnel and material resources provided as voluntary contributions to LCG Phase 1 at CERN were practically identical to the figures presented at the last C-RRB in October 2005 and are not repeated here. The materials budget for the final year of LCG Phase 1 at CERN turned out differently from the planning figures of last October and is shown below.

Otherwise this report will concentrate on LCG Phase 2: The latest status for the signing of the WLCG MoU, updates to the WLCG capacity planning and the resource planning for LCG Phase 2 at CERN.

## 2. Prototype and CC Preparation Expenditure 2001 – 2005

Table 1 lists the amounts spent by LCG at CERN for materials during 2001 to 2005. This table shows the totals per year for the LCG prototype at CERN and the costs per year for preparing CERN's computer centre for Phase 2.

**Table 1: LCG Materials Expenditure at CERN 2001 - 2005 (kCHF)**

	2001	2002	2003	2004	2005	TOTAL	C-RRB8
<b>PROTOTYPE</b>	2472	3434	1074	2098	3421	12499	13868
<b>PREPARING CC for PHASE 2</b>	150	1665	2083	3371	971	8240	8649
<b>TOTAL PROTOTYPE OPERATION</b>	<b>2622</b>	<b>5099</b>	<b>3157</b>	<b>5469</b>	<b>4392</b>	<b>20739</b>	<b>22517</b>

There are two different kinds of changes in this table compared to the figures of last October. The first concerns a sum of 1410 kCHF for network equipment which was included under the Phase 1 Prototype cost in 2005. This amount was spent in 2005, but is now shown in the year 2005 of the Phase 2 budget table where it more logically belongs. The other change concerns a shift of 400 kCHF of payments for air conditioning work in the computer centre into the year 2006.

### 3. Materials Budget Evolution for LCG Phase 1 and Base Physics Computing

Table 2 shows the balance between the costs and the committed funding of materials for physics computing at CERN during Phase 1 of LCG.

**Table 2: Costs and Funding for Physics Computing Materials at CERN in MCHF**

	2001	2002	2003	2004	2005	Totals	Totals C-RRB8
<b>Costs</b>							
Sum Physics Comp.	8.4	9.9	9.9	9.6	8.5	46.3	48.5
Base Physics	5.8	4.8	6.7	4.2	4.1	25.6	26.0
LCG Phase 1 at CERN	2.6	5.1	3.2	5.5	4.4	20.7	22.5
<b>Funding</b>							
Income per Year	8.5	9.9	10.9	9.4	8.2	46.9	48.5
Base Physics	5.8	4.8	6.9	5.4	4.1	27.0	27.9
Addn. CERN Funding	2.6	1.4	0.7	2.1	2.0	8.8	9.3
Special Income	0.0	0.0	0.0	0.8	0.3	1.1	1.1
External Income	0.0	3.7	3.3	1.1	1.8	10.0	10.3
<b>Annual Balance</b>	0.0	0.0	1.1	-0.2	-0.3		
<b>Cumulative Balance</b>	0.0	0.0	1.1	0.9	0.5		0.0

The overall effect of the reduced spending and the shift of the network equipment to the Phase 2 budget produce now a positive cumulative balance of 0.5 MCHF at the end of LCG Phase 2 at CERN. This balance will still grow as 0.3 MCHF more of external income is only delayed and will arrive, bringing the amount available as carry-over to LCG Phase 2 at CERN to 0.8 MCHF.

Yet, as most of this positive carry-over is only the result of delaying payments, the funding situation of LCG Phase 2 at CERN will not be changed by this.

### 4. Regional Centre Resources for LHC Computing

Detailed capacity numbers for the different centres are contained in Annex 6 of the WLCG MoU. Table 3 shows a summary of the planned capacity for the first full year of LHC operation. This table contains numbers for “external” Tier-1 and Tier-2 centres and also the capacities for the Tier0 and the Analysis Facility at CERN. For each experiment the sum of the capacities planned to be pledged for the year 2008 is given together with required capacities as listed in the Computing Technical Design Reports (TDR) of the experiments. The Balance rows give the percentage still lacking to fulfil the TDR requirements completely. The SUM column gives the overall offers in the different categories (CPU, Disk, Tape) and their comparison with the total of the TDR requirements.

Table 3: Regional Centre Planning for 2008

Tier-1 Planning for 2008		ALICE	ATLAS	CMS	LHCb	SUM 2008
<b>CPU - MSI2K</b>	Offered	6.7	22.9	11.6	4.4	45.6
	TDR Requirements	12.3	24.0	15.2	4.4	55.9
	Balance	-46%	-5%	-24%	-0%	-18%
<b>Disk - PBytes</b>	Offered	2.7	12.5	5.5	2.2	22.9
	TDR Requirements	7.4	14.4	7.0	2.4	31.2
	Balance	-63%	-13%	-21%	-10%	-26%
<b>Tape - PBytes</b>	Offered	3.1	9.1	9.6	1.9	23.7
	TDR Requirements	6.9	9.0	16.7	2.1	34.7
	Balance	-55%	1%	-42%	-9%	-32%

Includes current planning for all Tier-1 centres

Tier-2 Planning for 2008		ALICE	ATLAS	CMS	LHCb	SUM 2008
<b>CPU - MSI2K</b>	Offered	5.6	20.1	18.3	4.4	48.4
	TDR Requirements	14.4	19.9	19.3	7.7	61.3
	Balance	-61%	1%	-5%	-42%	-21%
<b>Disk - PBytes</b>	Offered	1.5	6.3	4.8	0.8	13.4
	TDR Requirements	3.5	8.7	4.9	n/a	17.1
	Balance	-58%	-29%	-3%	n/a	-22%
# Tier-2 federations - included(expected)		15 (17)	24 (30)	25 (29)	11 (12)	40 (49)

Tier-0 Planning for 2008		ALICE	ATLAS	CMS	LHCb	SUM 2008
<b>CPU - MSI2K</b>	Offered	3.3	4.0	4.6	0.6	12.5
	TDR Requirements	3.3	4.0	4.6	0.6	12.5
	Balance	0%	0%	0%	0%	0%
<b>Disk - PBytes</b>	Offered	0.2	0.4	0.4	0.3	1.3
	TDR Requirements	0.2	0.4	0.4	0.3	1.3
	Balance	0%	0%	0%	0%	0%
<b>Tape - PBytes</b>	Offered	2.5	5.7	4.9	0.5	13.6
	TDR Requirements	2.5	5.7	4.9	0.5	13.6
	Balance	0%	0%	0%	0%	0%

CAF Planning for 2008		ALICE	ATLAS	CMS	LHCb	SUM 2008
<b>CPU - MSI2K</b>	Offered	3.9	2.1	3.8	0.3	10.0
	TDR Requirements	5.0	2.7	4.8	0.3	12.8
	Balance	-22%	-22%	-22%	-21%	-22%
<b>Disk - PBytes</b>	Offered	1.2	1.5	1.2	0.4	4.2
	TDR Requirements	1.5	1.9	1.5	0.5	5.3
	Balance	-20%	-20%	-20%	-20%	-20%
<b>Tape - PBytes</b>	Offered	0.9	0.4	1.5	0.7	3.4
	TDR Requirements	1.2	0.5	1.9	0.9	4.4
	Balance	-23%	-23%	-23%	-23%	-23%

The Tier-2 planning in Table 3 lists for each experiment the number of Tier2 centres or federations, which have their capacity plans already announced and in brackets the overall number of Tier2s, including centres which have stated that they plan to provide capacity and are listed in Table 4 below. By now 40 Tier2s have provided already data and this number is expected to grow to 49.

**Table 4: Planned Additional Tier2 Centres or Federations**

<i>Institution</i>	<i>Experiments served with priority</i>			
	<i>ALICE</i>	<i>ATLAS</i>	<i>CMS</i>	<i>LHCb</i>
Austria, UIBK, Innsbruck		X		
Belgium, Belgian Tier-2 Federation - UA - UCL - ULB - UMH - VUB			X	
Brazil, Brazilian Tier-2 Federation - CBPF - UERJ - UFRJ - UNESP		X	X	X
Canada, Canada East Tier-2 Federation		X		
Canada, Canada West Tier-2 Federation		X		
Hungary, Hungarian Tier-2 Federation - KFKI, Budapest - SZTAKI, Budapest - Eotvos Univ., Budapest - Debrecen Univ.	X		X	
Israel, HEP-IL Federation - Technion, Haifa - Weizmann, Rehovot - Tel Aviv Univ.		X		
Slovenia, SiNET Tier-2		X		
Ukraine, Ukrainian Tier-2 Federation - Kiev: BITP, IPS, IMBG, MAO, ICB, KNU - Kharkov: KhIPT, ISM, IRA, KhNU - Lvov: ICMP, LNU	X		X	

## 5. Progress in Signing the WLCG Memorandum of Understanding

Until the C-RRB of April 2006 it is expected that a majority of the funding agencies having declared pledges in Annex 6 of the WLCG MoU will have signed. Table 5 shows which signatures have been collected so far and which have still to arrive.

**Table 5: Signature Status of WLCG MoU**

### Member States

<b>Country</b>	<b>Funding Agency/Signatory</b>	<b>Already Signed (Y/N)</b>
Czech Rep.	MSMT CR	N
Denmark	National Science Research Council	N
Finland	HIP	N
France	CEA/DSM/DAPNIA	Y
France	CNRS/IN2P3	Y
Germany	FZK	Y
Germany	DESY	Y
Germany	GSI	Y
Germany	MPG	Y
Italy	INFN	N
The Netherlands	NIKHEF	Y
Norway	NRC	N
Poland	Ministry of Science & Education	N

Portugal	GRICES/LIP	Y
Spain	MEC	N
Sweden	Research Council	N
Switzerland	CHIPP	N
United Kingdom	PPARC	Y

**Non-Member States**

<b>Country</b>	<b>Funding Agency/Signatory</b>	<b>Already Signed (Y/N)</b>
Australia	AusHEP	N
Canada	NSERC	N
China	MoST/NSFC	Y
India	DAE	Y
Japan	Univ. Tokyo	Y
JINR, Dubna	JINR	N
Pakistan	PAEC/NCP	Y
Romania	Natl. Authority for Scientific Research	Y
Russia	Federal Agency for Sc. & Innovation	N
Taipei	Academia Sinica	Y
USA	US-ATLAS	Y
USA	US-CMS	Y

## 6. Resources for LCG Phase 2 at CERN

Table 6 shows the cost and funding estimates for LCG Phase 2 at CERN.

**Table 6: LHC Computing Budget Estimates in MCHF**

	2005	2006	2007	2008	TOTAL
<b>Funding</b>					
<b>From CERN Budget</b>					
- Personnel	1.510	16.985	18.189	16.338	53.022
- Physics	0.000	11.925	12.924	13.084	37.933
- IT		8.410	9.393	9.921	27.724
- PH		3.515	3.531	3.163	10.209
- Additional	1.510	5.060	5.265	3.254	15.089
- IT	1.160	3.825	4.004	2.342	11.331
- PH	0.350	1.235	1.261	0.912	3.758
- Materials	1.410	24.980	16.544	24.464	67.398
- Physics Operations		4.880	4.774	4.878	14.532
- IT		4.460	4.344	4.468	13.272
- PH		0.420	0.430	0.410	1.260
- Tier 0 and CERN Analysis Facility	1.410	20.100	11.770	19.586	52.866
<b>Contributions via Team Accounts*</b>					
- Personnel		1.810	1.670	1.130	4.610
- Material		0.950	0.130		1.080
<b>In-kind Contributions*</b>					
- Personnel		0.910	0.950	0.120	1.980
<b>Total</b>					
- Personnel	1.510	19.705	20.809	17.588	59.612
- Materials	1.410	25.930	16.674	24.464	68.478
<b>Total Funding</b>	<b>2.920</b>	<b>45.635</b>	<b>37.483</b>	<b>42.052</b>	<b>128.090</b>
<b>Planned Expenditure</b>					
- Personnel **	1.510	19.705	20.809	17.588	59.612
- Materials	1.410	25.930	25.680	29.380	82.400
- Physics Operations		4.880	4.780	4.880	14.540
- Tier 0 and CERN Analysis Facility	1.410	21.050	20.900	24.500	67.860
<b>Total Planned Expenditure</b>	<b>2.920</b>	<b>45.635</b>	<b>46.489</b>	<b>46.968</b>	<b>142.012</b>
<b>Balance Personnel</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
<b>Balance Materials</b>	<b>0.000</b>	<b>0.000</b>	<b>-9.006</b>	<b>-4.916</b>	<b>-13.922</b>
<b>Balance</b>	<b>0.000</b>	<b>0.000</b>	<b>-9.006</b>	<b>-4.916</b>	<b>-13.922</b>

\* As pledged and planned to be pledged in the WLCG MoU (Annex 6.6)

\*\* - Personnel from EGEE and EGEE-II at a cost of 2.9 MCHF will participate in LCG at CERN during the years 2006 - 2008

- Operators Support from Computer Centre at a cost of 1.4 MCHF will participate in LCG at CERN during the years 2006 - 2008

These resources are not included in this Table.

The re-profiling of funds over the years has been done as announced already in the October C-RRB. Otherwise the main change compared with the last edition of this table is an improvement of the

negative materials balance by 780 kCHF. This is due to the combined effect of transferring 500 kCHF from cuts in the IT Department budget to LCG Phase 2 and paying for the additional LCG personnel in PH for the year 2005 out of the PH Department budget.

Table 7 contains the materials budget for LCG Phase 2 at CERN with more detail, splitting the cost of Tier-0 and CERN Analysis Facility into its major components.

**Table 7: Costs and Funding for Physics Computing Materials at CERN in MCHF**

<b>Funding</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>TOTAL</b>
From CERN Budget					
- <i>Materials</i>		24.98	16.54	24.46	<b>67.40</b>
- Physics Operations		4.88	4.77	4.88	<b>14.53</b>
- Tier0 and CERN Analysis Facility	1.41	20.10	11.77	19.59	<b>52.87</b>
Contributions via Team Accounts					
- Material		0.95	0.13		<b>1.08</b>
<b>Total Materials Funding</b>	<b>1.41</b>	<b>25.93</b>	<b>16.67</b>	<b>24.46</b>	<b>68.48</b>
<b>Planned Expenditure</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>TOTAL</b>
- Physics Operations		4.88	4.77	4.88	<b>14.53</b>
- <i>Tier0 and CERN Analysis Facility</i>	1.41	21.05	20.90	24.51	<b>67.87</b>
- Basic Infrastructure		6.45	8.40	3.74	<b>18.59</b>
- Tier0	1.41	11.10	6.50	13.45	<b>32.46</b>
- CERN Analysis Facility		3.50	6.00	7.32	<b>16.82</b>
<b>Total Materials Expenditure</b>	<b>1.41</b>	<b>25.93</b>	<b>25.67</b>	<b>29.39</b>	<b>82.40</b>
<b>Balance</b>	<b>0.00</b>	<b>0.00</b>	<b>-9.00</b>	<b>-4.92</b>	<b>-13.92</b>