

1. Introduction

The following report summarises

- Current signature status of the Worldwide LHC Computing Grid (WLCG) Memorandum of Understanding (MoU)
- WLCG funding and expenditure estimates at CERN up to 2015
- Resource accounting for Tier-1 and Tier-2 sites
- Status of experiment requirements and resource pledges

Complementary information can be found on the WLCG website <http://lcg.web.cern.ch/LCG/>

2. WLCG Memorandum of Understanding Signature Status

Since the October 2009 C-RRB meeting, no further signatures have been obtained. Following some recent enquiries to have the original signed documents for each country available on-line, an electronic archive has been created. This is available via the WLCG website under the MoU page or by contact with lcg.office@cern.ch

Table 1 shows the current signature status including date of signature. The C-RRB will be kept informed of all future developments and any new MoU signatures.

Country	Agency/Institute – MoU	Date signed
Australia	AusHEP	24 April 2007
Austria	BMWf	10 November 2008
Belgium	FNRS	24 October 2006
	FWO	20 September 2006
Brazil	FAPESP (English version) (Portuguese version)	15 May 2009
Canada	CFI	17 October 2006
	ATLAS-Canada-West	1 April 2008

	ATLAS-Canada-East	2 April 2008
China	IHEP	6 February 2006
Czech Republic	FZU	14 April 2008
Denmark	NSRC	12 July 2006
Estonia	NICPB	24 October 2007
Finland	HIP	23 October 2007
France	CEA-DSM-DAPNIA (IRFU)	8 February 2006
	CNRS-IN2P3	2 March 2006
Germany	BUW	8 August 2007
	DESY	8 February 2006
	Freiburg	8 November 2007
	FZK	12 April 2006
	Goettingen	4 April 2009
	GSI	21 February 2006
	LMU-LRZ	3 December 2007
	MPG	13 February 2006
	RWTH Aachen	29 November 2006
Hungary	NKTH	3 December 2007
India	DAE	21 April 2006
Israel	ICHEP	30 April 2007
Italy	INFN	27 September 2006
Japan	ICEPP	31 March 2006
Korea (Republic of)	KICOS - ALICE (Daejeon)	26 October 2007
	KICOS - CMS (Daegu)	11 November 2008
Netherlands	NIKHEF	20 April 2006
	NIKHEF Addendum	20 April 2006
Norway	RCN	13 December 2007
Pakistan	PAEC/NCP	26 January 2006
Poland	Minister of Science & Higher Education	26 January 2007
Portugal	GRICES - LIP	25 July 2006
Romania	National Authority for Scientific Research	6 March 2006
Russia	FASI	3 July 2007
	JINR	4 September 2007
Slovenia	SiGNET	25 April 2007
Spain	MEC	6 July 2007
Sweden	SNIC	10 March 2008
Switzerland	SER/SNF/ETH/CSCS	11 April 2007
Taipei	Academia Sinica	9 December 2005
Turkey	TAEK	29 January 2008
Ukraine	National Academy of Sciences of Ukraine	5 July 2006
United Kingdom	PPARC	8 March 2006

United States	US-ATLAS	1 March 2006
	US-CMS	11 March 2006

Table 1: Signature Status of WLCG Memorandum of Understanding

3. Funding and Expenditure for WLCG at CERN

From the CERN budget the end of year book-closed situation for 2009 concerning WLCG, IT Department, resulted in the following final figures:

- Personnel budget 13.3 MCHF allocation, 13.8 MCHF spent
- Materials budget 18.7 MCHF allocation, 14.3 MCHF spent, 4.4 MCHF carried forward to 2010

Table 2 shows future funding and estimated expenditure for the years 2010-2015 based on long-term planning. For personnel costs, nominative details continue to be entered in CERN's planning tool APT including current personnel commitments, planned replacements and some new requests for key activity areas waiting management approval. It should be noted that EGEE-III and EGI/EMI commitments are not included in personnel cost calculations.

Material costs are based on the latest strategy to cope with the experiments requirements during the LHC data-taking years, and to move towards "green" computing. The increasing computing needs of the LHC experiments implies an increasing demand for power and cooling resources during the coming years. To fulfil these requests a strategy to achieve this without building a new large computer centre on the CERN site has now been adopted comprising:

- Investments into focused upgrades of the existing CERN Computer Centre to increase capacity and optimize the power and cooling efficiency
- Scalable increase of power and cooling capacity by using pre-fabricated containers at CERN
- Hosting of equipment in external sites either commercial hosting companies or sites provided by member states

The current planning is based on the latest experiment requirements up to 2012, extrapolated up to 2015. The power of CERN's Computer Centre (Building 513) will be upgraded by 400 kW and critical capacity will be improved foreseen from 2010 to 2012. Investment is needed for new tape drives in 2012 and 2013 and the 10 Gbit network will be expanded in 2011 to 2013. A container solution is envisaged to offer complementary capacity foreseen from 2012 to 2013, costs include extra networking and database equipment. Finally an external hosting solution is foreseen currently starting in 2013 however depending on final decisions it could start earlier reducing the need for containers in the latter years.

By the Autumn C-RRB more should be known about the final decisions impacting the computer centre strategy and the planning will be modified accordingly particularly once the external hosting solution is selected and final costs and timescales are known. This will be followed-up at future C-RRB meetings.

LHC Future Computing Funding and Expenditure Estimates (all figures in MCHF)							
	2010	2011	2012	2013	2014	2015	TOTAL
Funding							
From CERN Budget							
- Personnel	14.8	15.1	15.1	15.1	15.1	15.1	90.4
- Materials *	26.6	26.5	26.3	27.5	26.2	24.0	157.3
Contributions via Team Accounts**							
- Personnel	0.7	0.1					0.8
In-kind Contributions**							
- Personnel	1.0						1.0
Total							
- Personnel	16.6	15.1	15.1	15.1	15.1	15.1	92.2
- Materials	26.6	26.5	26.3	27.5	26.2	24.0	157.3
Total Funding	43.2	41.6	41.5	42.7	41.4	39.2	249.4
Expenditure							
- Personnel ***	16.5	15.0	14.5	14.8	15.1	14.8	90.6
- Materials	26.8	26.2	26.0	26.8	25.5	23.2	154.4
Total Planned Expenditure	43.3	41.2	40.5	41.6	40.6	38.0	245.1
Balance Personnel	0.1	0.1	0.6	0.4	0.0	0.3	1.6
Balance Materials	-0.1	0.3	0.3	0.8	0.7	0.8	2.8
Balance	-0.1	0.4	1.0	1.1	0.8	1.2	4.4
<small>* Includes re-profiling within the Medium Term Plan for the replacement Computer Centre pending SPC & FC approval ** As planned to be pledged in the WLCG MoU (Annex 6.6) *** Excluding EGEE-III/EGI/EMI funded personnel and Computer Centre Operators</small>							

Table 2: LHC Computing Budget Estimates for 2010-2015

4. Resource Accounting

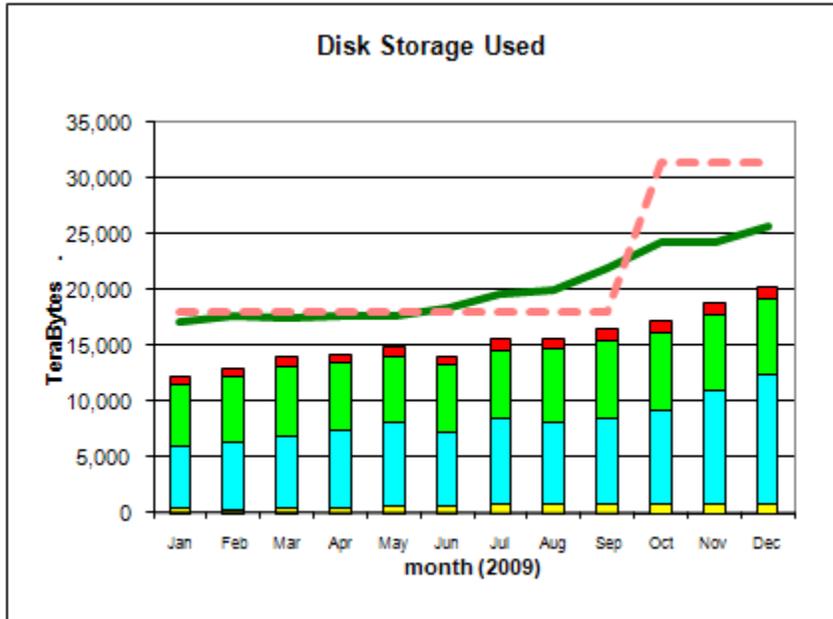
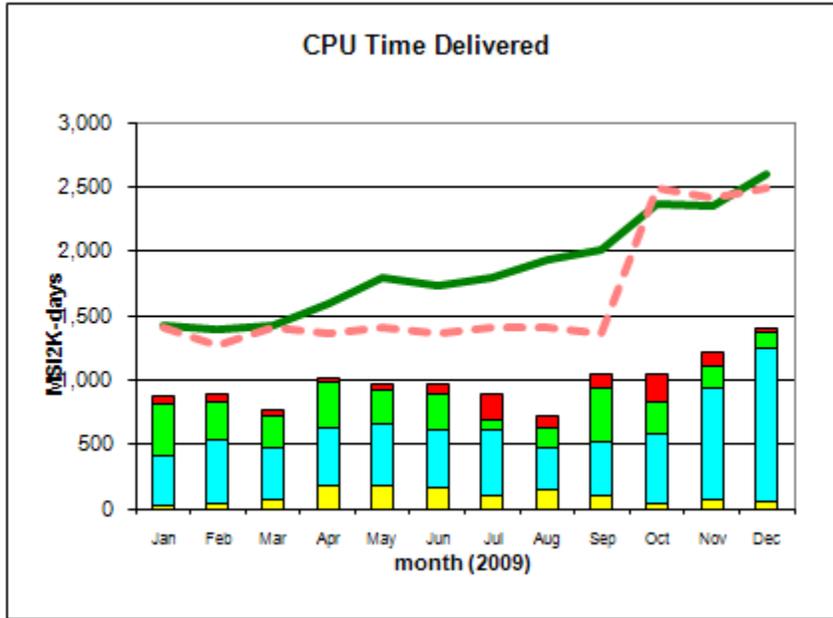
4.1 CERN and External Tier-1 Accounting

Accounting data for CERN and External Tier-1 sites has been reported at the last C-RRB meetings, and full accounting reports covering the years 2006-2009 are available on the LCG website Accounting page <http://lcg.web.cern.ch/LCG/accounts.htm>.

Due to problems with the site publishing structure on the accounting portal, at the time of writing this report confirmed data for all T1 sites is not available for 2010. Figure 1 shows the CPU delivered, Disk and Tape used at CERN and the external Tier-1s for the period January to December 2009 inclusive.

Normally the pledges should have changed in April to those of 2009, however following the LHC incident the WLCG Management Board agreed to a revised schedule for 2009 resource

purchasing and installation, and exceptionally the move to 2009 pledges took place in September instead of April.



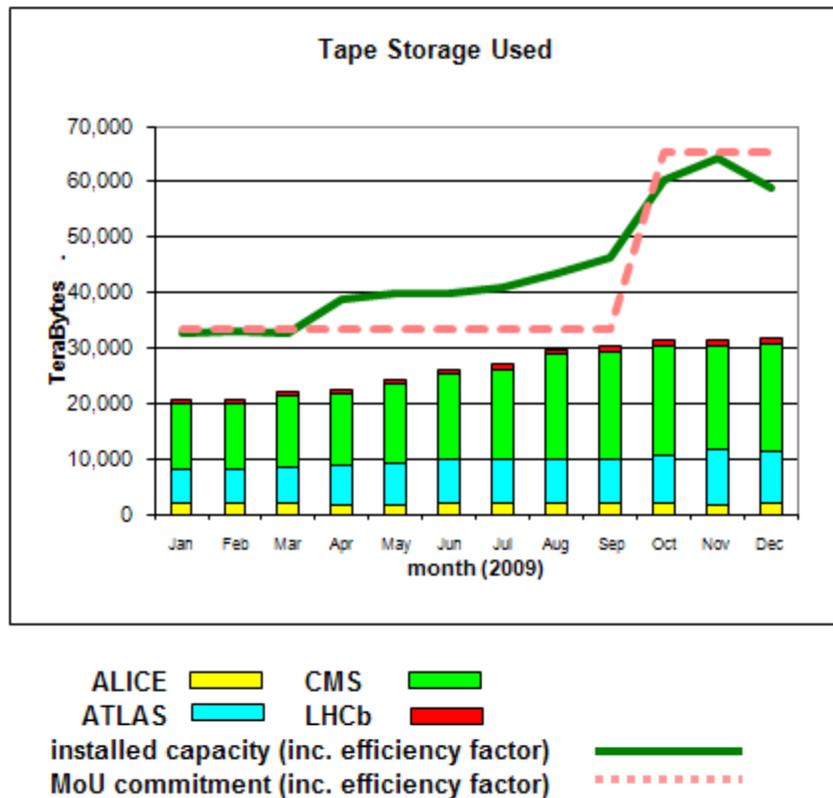


Figure 1: Accounting for CERN and External Tier-1s January - December 2009

The monthly graphs are distributed to the Overview Board Members and are available from the accounting page on the WLCG web as referenced above. If possible at the C-RRB meeting the data for the first months of 2010 will also be shown.

4.2 Tier-2 Accounting

Tier-2 accounting began in September 2007 and as for Tier-1 accounting past reports can be found on the LCG website Accounting page <http://lcg.web.cern.ch/LCG/accounts.htm>. The Tier2 accounting has also suffered from an unstable site publishing structure on the accounting portal and the data on the portal for Tier-2 sites in 2010 is not currently reliable.

Figure 2 shows the Federations with MoU pledge values above 1000 KSI2K. Figure 3 shows all those with pledge values equal to or below 1000 KSI2K, in both cases ordered by pledge. The data shows the status for December 2009. If possible at the C-RRB meeting more recent data will be shown.

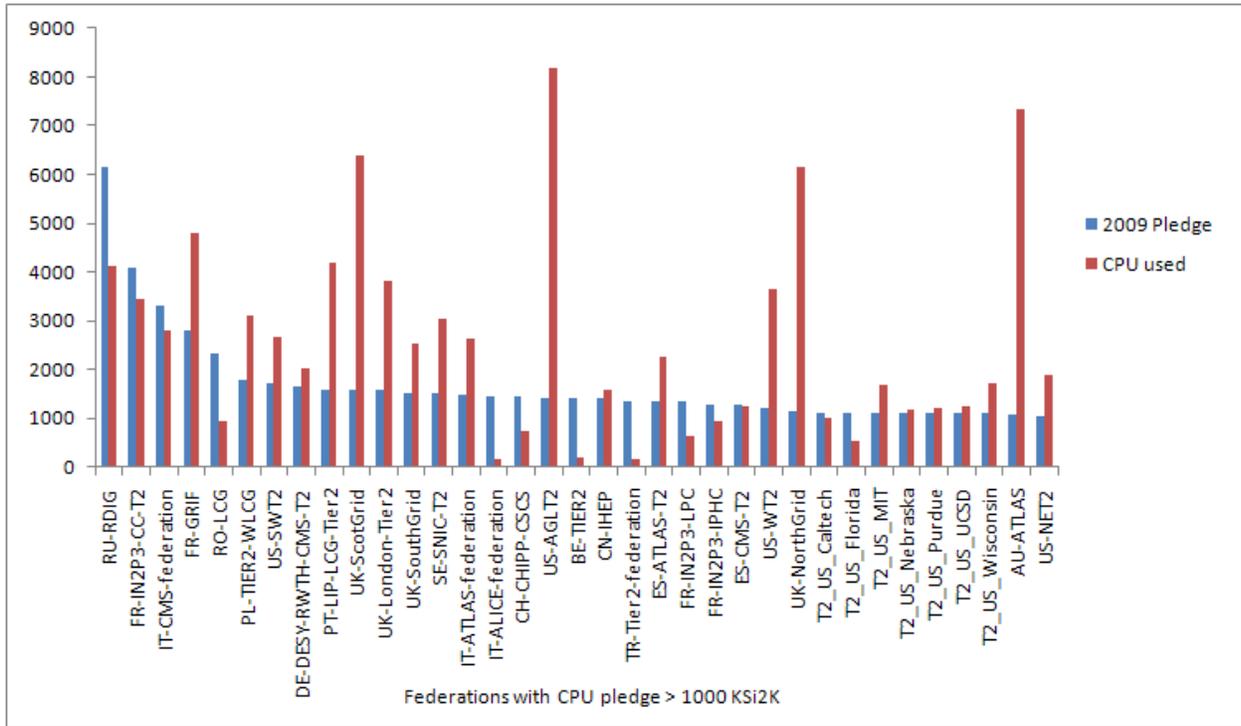


Figure 2: Accounting for Federations with CPU pledge > 1000 KSI2K in December 2009

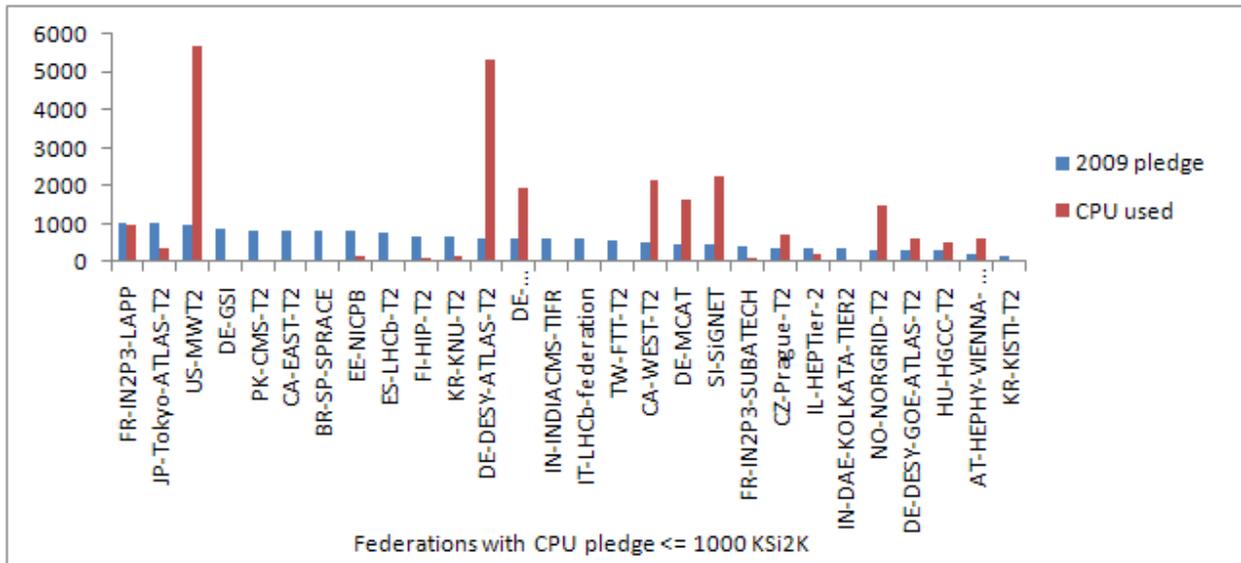


Figure 3: Accounting for Federations with CPU pledge <= 1000 KSI2K in December 2009

These figures show that many of the T2 sites are showing very encouraging results, however not all. Follow-up will continue with those sites not publishing once the publishing problems have been resolved.

5. Status of Experiment Requirements and Resource Pledges

It has been particularly difficult to give an accurate picture for 2010 illustrating the balance of resource pledges offered with respect to experiment requirements. Most data was collected in time for the last C-RRB meeting, Table 3 shows the incomplete status on 7th October 2009 shown at the meeting and subject to change:

Summary Ext. Tier1s	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	245800	413356	Offered	52604	212009	106815	41928	413356
			Required	57600	192000	100500	44000	394100
			Balance	-9%	10%	6%	-5%	5%
Disk (Tbytes)	34890	46742	Offered	6490	23544	12866	3842	46742
			Required	10800	21900	13400	3290	49390
			Balance	-40%	8%	-4%	17%	-5%
Tape (Tbytes)	40189	54450	Offered	9160	16803	24513	3974	54450
			Required	16300	14200	23300	2400	56200
			Balance	-44%	18%	5%	66%	-3%

Summary Tier2s with Split in 2010	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	308524	494221	Offered	50562	180106	186448	47105	494221
			Required	89600	240000	195000	38000	562600
			Balance	-44%	-25%	-4%	24%	-12%
Disk (Tbytes)	22647	36269	Offered	3484	17038	12646	301	36269
			Required	12600	24800	9200	20	46620
			Balance	-72%	-31%	37%	1404%	-22%

Table 3: 2010 experiment computing requirements and resources pledged for Tier-1 and Tier-2 sites status 07/10/09

On 24th February 2010 the final version of the pledge tables was released including information from Russia and the Nordic Data Grid Facility. This became the final version of the tables containing confirmed data from all sites. Table 4 shows the new summary.

Summary Ext. Tier1s	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	245800	412773	Offered	46388	216211	105506	44668	412773
			Required	57600	192000	100500	44000	394100
			Balance	-19%	13%	5%	2%	5%
Disk (Tbytes)	34890	44494	Offered	6278	22292	12510	3414	44494
			Required	10800	21900	13400	3290	49390
			Balance	-42%	2%	-7%	4%	-10%
Tape (Tbytes)	40189	51560	Offered	8720	15549	24138	3153	51560
			Required	16300	14200	23300	2400	56200
			Balance	-47%	10%	4%	31%	-8%

Summary T2s with Split in 2010	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	308524	511828	Offered	54133	216969	197642	43084	511828
			Required	89600	240000	195000	38000	562600
			Balance	-40%	-10%	1%	13%	-9%
Disk (Tbytes)	22647	39714	Offered	4221	21345	13683	465	39714
			Required	12600	24800	9200	20	46620
			Balance	-66%	-14%	49%	2224%	-15%

Table 4: Final 2010 experiment computing requirements and resources pledged for Tier-1 and Tier-2 sites status 24/02/10

All C-RRB delegates were sent these new tables with an invitation to send input on “how to improve the pledge handling and publication process for discussion at the next RRB meeting. We have to find a good balance between the WLCG MoU which stipulates that the pledges for the next year are confirmed at the Autumn RRB meeting versus reality where we see requirements and preliminary or even confirmed pledges sometimes change”.

Following a budget cut in France communicated end February 2010, the confirmed pledges for the T1 and the T2 sites were reduced. The revised pledges were received on 12th April 2010. Table 5 shows the impact in summarised form.

Summary Ext. Tier1s	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	245800	402416	Offered	45559	210811	103516	42530	402416
			Required	57600	192000	100500	44000	394100
			Balance	-21%	10%	3%	-3%	2%
Disk (Tbytes)	34890	43577	Offered	6122	22018	12183	3254	43577
			Required	10800	21900	13400	3290	49390
			Balance	-43%	1%	-9%	-1%	-12%
Tape (Tbytes)	40189	50570	Offered	8485	15372	23677	3036	50570
			Required	16300	14200	23300	2400	56200
			Balance	-48%	8%	2%	27%	-10%

Summary Tier2s with Split in 20	2009	2010	Split 2010	ALICE	ATLAS	CMS	LHCb	SUM 2010
CPU (HEP-SPEC06)	308524	505807	Offered	52552	214976	196221	42058	505807
			Required	89600	240000	195000	38000	562600
			Balance	-41%	-10%	1%	11%	-10%
Disk (Tbytes)	22647	39625	Offered	4326	21238	13627	434	39625
			Required	12600	24800	9200	20	46620
			Balance	-66%	-14%	48%	2070%	-15%

Table 5: Final 2010 experiment computing requirements and resources pledged for Tier-1 and Tier-2 including change for France [status 12/04/10](#)

Comparing the summary shown at the last C-RRB meeting (Table 3) with the latest situation (Table 5) globally disk and tape at the Tier-1 sites has decreased whereas Tier-1 and Tier-2 CPU and Tier-2 disk has increased. The deficits for certain experiments, particularly ALICE, remain significant.

To conclude for the past it is clear that the revised LHC schedule and the resulting decision to tolerate a delay in the procurement and resource installation process has had an impact. The publication of the final experiment requirements for 2010 came late and unforeseen budget cuts impacted certain countries. Despite this, changes to confirmed pledge data in April of the given year does not conform to the spirit of the WLCG MoU.

Looking forward, revised experiment requirements for 2011 and 2012 are in the process of being reviewed by the Computing Resource Scrutiny Group (C-RSG). Once the final output of the Scrutiny Group is known these requirements will be the basis for resource pledges to be prepared and discussed at the next C-RRB meeting. Funding Agency representatives and delegates are therefore invited to take note that confirmed pledge data for 2011, including distribution between experiments for sites supporting more than one experiment, must be provided as well as planned pledges for 2012. To allow for compilation in time for the C-RRB meeting this input must be

provided by 30th September 2010 at the latest. Final experiment requirements agreed as a result of the scrutiny process will be distributed as soon as possible to enable this future pledge preparation work to begin.

6. Conclusion

No new MoU signatures have been added since the last report to the C-RRB. A complete electronic archive is now available for all WLCG MoU documents.

Following changes to the computing strategy, the future funding and expenditure estimates up to and including 2015 have been modified for materials. Once more is known about the cost and timescale of the hosting solution these estimates can be confirmed or modified accordingly. For personnel costs the future picture is relatively clear and does not give rise to particular financial concern.

Tier-1 and Tier-2 accounting will continue to be monitored on a monthly basis as soon as the site publication problems on the accounting portal are resolved.

The experiment requirements for 2011 and 2012 following confirmation with the C-RSG will be communicated as soon as possible to enable resource pledge preparation for the C-RRB Autumn meeting to begin. Sites should be prepared to confirm 2011 pledges and provide planned pledge data for 2012 by 30th September 2010 at the latest. Funding Agency representatives and delegates are requested to already take note to ensure the necessary internal discussions, meetings and decision-making bodies are forewarned to avoid the situation observed for 2010 confirmed pledges.