



Planned capacity and estimated costs of the CERN Tier-0 Centre and the Analysis Facility (CAF) in Phase 2 of the LCG Project (2006-2008)

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Planned Installed Capacity at CERN

	<i>year</i>	2006	2007	2008
processing capacity (MSI2K)		3.4	9.1	22.6
	<i>Tier-0</i>	2.4	4.8	12.6
	<i>CAF</i>	1.0	4.3	10.0
disk capacity (PBytes)		0.77	2.01	5.46
	<i>Tier-0</i>	0.23	0.46	1.26
	<i>CAF</i>	0.54	1.55	4.20
Tape drives		80	200	200
Tape storage (PBytes)		1.55	4.87	16.98
	<i>Tier-0</i>	1.55	3.39	13.58
	<i>CAF</i>	0.00	1.48	3.40

Estimated costs

MCHF

	<i>year</i>	2006	2007	2008	<i>total</i>
processors		3.7	4.6	7	15.3
disk storage		1.8	2.6	4.8	9.2
tape storage (media only)		0.5	2.5	4.8	7.8

Costs include marginal costs of infrastructure (rack, power distribution, first layer of LAN switching, installation, warranty, etc.)



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Summary of Cost Estimates for the CERN LHC Computing Facility LCG Phase 2 : 2006-08

01-dec05 - Bernd Panzer, Chris Eck, Les Robertson adapted by CE to fit budget

The cost calculations are based on the requirements of the experiments as documented in the LCG TDR, with the CAF capacity reduced by 20% in 2008 to fit the budget (the reduced capacity numbers are as reported in the MoU). In 2007 it is assumed that there will be 50 days of data taking in the second half of the year.

All costs - MCHF

	year	2006	2007	2008	total	% of total cost
Basic Infrastructure		6.2	8.4	3.7	18.3	28%
Computer Centre UPS and Cooling		1.8	2.0	0.0	3.8	
Systems administration services		0.3	0.3	0.3	0.9	
Physics Database Services		1.0	1.0	1.0	3.0	
Grid certification, test and servers		0.6	0.3	0.3	1.2	
Wide Area Network - line costs, intergration with LAN		1.0	1.5	2.0	4.5	
LAN infrastructure		1.5	3.3	0.1	4.9	
Tier-0 Operation		11.1	6.5	13.3	30.9	47%
Processors		2.3	2.3	4.7	9.3	
Disk systems		0.5	0.5	1.3	2.3	
Tape storage infrastructure (including robots, maintenance)		2.2	1.3	1.7	5.2	
Tape drives		5.6	0.5	1.5	7.6	
Tape media		0.5	1.9	4.1	6.5	
CERN Analysis Facility (see note 1)		3.5	6.0	7.3	16.8	25%
Processors		1.4	2.3	2.3	6.0	
Disk systems		1.3	2.1	3.5	6.9	
Tape storage infrastructure (including robots)		0.4	0.0	0.3	0.7	
Tape media		0.0	0.6	0.7	1.3	
LAN - low level connectivity		0.4	1.0	0.5	1.9	
Total estimated cost		20.8	20.9	24.3	66.0	% of estimated cost
LCG Phase 2 Materials Budget (CERN-CC/2430 - Feb 2002 - see note 2)		22.0	22.0	21.9	65.9	100%
Funding - September 2005 (CERN/FC/4959/Draft - adjusted see note 3, 4)		20.8	11.5	17.7	50.0	76%

Notes

- 1 In 2006 the full capacity of the Tier-0 has been retained to enable preparations to proceed for data taking in 2007, but the capacity of the CERN Analysis Facility (CAF) has been reduced by 45% in 2007 to fit the available funding while still retaining the option of an analysis facility at CERN.
- 2 The materials budget of Phase 2 of the LCG project was agreed in February 2002 (CERN-CC/2430). This budget was funded and still covered the estimated materials costs at the time of the April 2005 Computing Resource Review Board (CERN-C-RRB-2005-005). The estimated costs have risen since then due to a reassessment of requirements discussed in an LHCC review (CERN-LHCC-2005-006 June 2005) and documented in the experiments' computing TDRs (summarised in the LCG TDR CERN-LHCC-2005-024). The capacity of the CAF has been reduced by 20% in 2008, with respect to the TDR requirements, in order to keep the total cost within the budget.
- 3 The personnel budget of the LCG project was also agreed in February 2002 (CERN-CC/2430) but CHF 20M was left unfunded with an expectation of receiving this level of funding from external sources. This has not been fully achieved and about CHF 15M remained outstanding at the April 2005 C-RRB meeting, at which the Director General announced that he would transfer this amount from the materials to the personnel budget in order to ensure continuity of staffing. This leads to the current funding level of CHF 50M, including CHF 0.5M from cuts in other (non-LHC) computing infrastructure. This retains the option for the CERN Analysis Facility in 2006, but will only be able to cover the Tier-0 in 2007-08 unless funding or requirements change.
- 4 External contributions to the personnel budget have been received from Italy, Germany Portugal and the European Union. Further contributions from Italy are under discussion.