

# Preliminary Draft Budget for CMS Maintenance & Operations in the Year 2009

## INTRODUCTION

This document summarizes the preliminary funding requirements for the payments that the CMS Collaboration plans to make in the year 2009 in order to maintain and operate the already constructed detectors and Collaboration-wide facilities (M&O Cat. A).

In addition we present also estimates for the subdetectors maintenance and operations expenses (M&O Cat. B).

Both M&O Cat. A and Cat. B costs have been last scrutinized by the RRB Scrutiny Group for M&O before the October 2007 RRB. The Annexes presented here are based on the latest available figures.

The Cat. A costs are invoiced by CERN on behalf of the CMS Collaboration.

The Cat. B costs will be invoiced only upon request of each sub-detector and only for a small fraction of the total presented here.

The sharing of the costs is preliminary and given for information only. The exact sharing will be available after the PhD list is updated in September 2008.

The figures shown as "Payments expected in the year 2009" in the Summary Table (**Annex 2**) have not yet been reviewed by the RRB Scrutiny Group. Furthermore, various sharing percentages are based on the 2007 PhD count, which will change in the M&O Draft 2009 Budget submitted to the October 2008 RRB.

Following the established procedure for the Preliminary Draft Budget for Construction, this document is meant to give timely information to the CMS Resources Review Board (RRB) and to provide input for further discussions with the CMS Funding Agencies to prepare the M&O Draft 2009 Budget, which will be submitted for approval to the RRB in October 2008 after scrutiny by the Scrutiny Group.

Timely and early payments for this budget are necessary due to the operational nature of the costs presented here.

## M&O CATEGORY A

With respect to the forecast for the year 2009 in the M&O Draft Budget for the year 2008 (cf. CERN-RRB-2007-083), the present budget request has changed in a few areas:

- A.1.16, Beam pipe & vacuum, has been increased for the year 2009. This has been done to allow the purchase of a spare beam pipe conical section. This is the only beam pipe section for which spares are not available.

The total estimated cost for M&O-A in 2009 is 12'937 kCHF, to be compared with the estimate presented to this board in October 2007 of 12'787 kCHF.

The estimated manpower cost for A.9, Core Computing, in the year 2009 totals some 1'575 kCHF. For this particular category and as for the current year, the CMS Collaboration strongly prefers to receive contributions directly from the Institutes/Funding Agencies rather than hiring personnel.

Annex I.A gives the projected costs for M&O-A until 2012.

Annex I.B gives the projected costs for M&O-B until 2012.

This updated budget request will be discussed with the RRB Scrutiny Group.

## M&O CATEGORY B

With respect to the forecast for the year 2009 in the M&O Draft Budget for the year 2007 (cf. CERN-RRB-2007-083), the present budget request has changed in the Tracker, ECAL, HCAL and Trigger areas.

The Tracker M&O-B budget request for 2009 now includes additional manpower under point B.1.14 to take into account our experience in operating the Tracker.

For ECAL, the 2009 total budget for the Material Resources should amount to 1'433 kCHF, as in 2008, but with a different sharing: the Hired Manpower at CERN B.1.14 will be compressed, and a sum of 210 kCHF will be devoted to parts of the Spare Supermodule (B.1.10), mainly Crystals. As for the former years, the sharing between Funding Agencies will be done by responsibility.

In 2010 the budget should be similar; in 2011, the payments related to the spare Supermodule should be finished. Then, the total of the budget should decrease, but only by 90 kCHF: we have to foresee the replacement of other parts, including the filtering unit of the Cooling Plant. This replacement should be stretched over two years.

HCAL has reviewed the yearly profile with a decrease of the order of 5% for the year 2009. While USA-DOE and USA-NSF contribute financially to the M&O-B, all Funding Agencies contribute technical manpower towards maintenance and operation of the detector.

Trigger has also reviewed its foreseen expenses, which now include provisions for manpower hired at CERN. The Institute manpower (B.2.01) required for detector service work will be included in the Memoranda of Agreement which are under discussion and is therefore not included here.

The updated budget request will be discussed with the RRB Scrutiny Group.

## **M&O CATEGORY B SHARING**

### *Material Resources*

The CMS Collaboration will continue to share its M&O Cat. B costs for the year 2009 by responsibility for all subsystems.

### *Technical manpower*

The technical manpower required at CERN from the Institutes (item B.2.01 in Annex B.1) will be shared by responsibility for all subsystems.

## **SUMMARY**

The numbers given in this document are summarized in **Annex 2**. It should be noted that funds paid in 2009, which will not have been committed during 2009, will be reported to the April 2010 RRB and will be carried forward.

## **ANNEXES**

### **Preliminary Budget Requirements for M&O in 2009**

**Annex 1 :** PhD Scientists per Funding Agency

**Annex 2 :** M&O Cat. A and B Costs by Funding Agency

**Annex A.1 :** M&O Cat. A Budget Request 2009

**Annex A.2 :** M&O Cat. A by Funding Agency

**Annex B.1 :** M&O Cat. B Budget Request 2009

**Annex B.2 :** M&O Cat. B Budget Sharing 2009 by Funding Agency and Subsystem

**Annex B.3 :** M&O Cat. B Estimated Costs Incurred in 2009 by Funding Agency and Subsystem

**Annex I.A :** Foreseen Cat. A Costs 2008-2012

**Annex I.B :** Foreseen Cat. B Costs 2008-2012

# ANNEX 1

## PhD Scientists per Funding Agency Based on the Annually Revised Annex 13 of the M&O MoU

The List of Names is Available at  
[http://cms.cern.ch/iCMS/jsp/page.jsp?mode=cms&action=url&urlkey=CMS\\_DOCOFF](http://cms.cern.ch/iCMS/jsp/page.jsp?mode=cms&action=url&urlkey=CMS_DOCOFF)  
 (Count closed on October 2, 2007)

Institute FA	Data	
	PhD #	PhD %
Austria	11	0.9%
Belgium-FNRS	20	1.6%
Belgium-FWO	9	0.7%
Brazil	9	0.7%
Bulgaria	5	0.4%
CERN	68	5.6%
China	8	0.7%
Colombia	1	0.1%
Croatia	6	0.5%
Cyprus	3	0.2%
Estonia	1	0.1%
Finland	14	1.1%
France-CEA	17	1.4%
France-IN2P3	36	2.9%
Germany-BMBF	57	4.7%
Germany-DESY	16	1.3%
Greece	13	1.1%
Hungary	6	0.5%
India	26	2.1%
Iran	5	0.4%
Ireland	2	0.2%
Italy	188	15.4%
Korea	12	1.0%
Mexico	5	0.4%
New Zealand	5	0.4%
Pakistan	3	0.2%
Poland	8	0.7%
Portugal	6	0.5%
RDMS-DMS	24	2.0%
RDMS-Russia	59	4.8%
Serbia	3	0.2%
Spain	34	2.8%
Switzerland-ETHZ	12	1.0%
Switzerland-PSI	11	0.9%
Switzerland-UNIV	5	0.4%
Taipei	13	1.1%
Turkey	16	1.3%
United Kingdom	56	4.6%
USA-DOE	327	26.8%
USA-DOE-NP	16	1.3%
USA-NSF	84	6.9%
USA-NSF-NP	2	0.2%
Grand Total	1,222	100.0%

# ANNEX 2

## M&O Cat. A and B Costs by Funding Agency Payments expected in the Year 2009 (kCHF)

Funding Agency	Category A	Category B	Total Category A+B	Total Invoiced
Austria	100.3	109.3	209.5	100.3
Belgium-FNRS	182.3	124.7	307.0	182.3
Belgium-FWO	82.0	124.7	206.7	82.0
Brazil	95.3		95.3	95.3
Bulgaria	45.6		45.6	45.6
CERN	619.7	686.9	1,306.6	619.7
China	84.7		84.7	84.7
Colombia	10.6		10.6	10.6
Croatia	63.5	25.6	89.1	63.5
Cyprus	31.8	16.3	48.0	31.8
Estonia	10.6		10.6	10.6
Finland	127.6	110.8	238.4	127.6
France-CEA	154.9	92.2	247.2	154.9
France-IN2P3	328.1	298.7	626.8	328.1
Germany-BMBF	519.5	395.8	915.3	519.5
Germany-DESY	145.8		145.8	145.8
Greece	118.5	84.6	203.1	118.5
Hungary	54.7		54.7	54.7
India	271.0	45.1	316.1	271.0
Iran	52.9		52.9	52.9
Ireland	21.2		21.2	21.2
Italy	1,713.4	1,359.3	3,072.7	1,713.4
Korea	127.0	54.0	181.1	127.0
Mexico	52.9		52.9	52.9
New Zealand	52.9		52.9	52.9
Pakistan	31.8	78.5	110.3	31.8
Poland	72.9	174.1	247.0	72.9
Portugal	54.7	33.9	88.6	54.7
RDMS-DMS	254.1		254.1	254.1
RDMS-Russia	567.9	59.3	627.2	567.9
Serbia	31.8	12.0	43.8	31.8
Spain	309.9	104.6	414.4	309.9
Switzerland-ETHZ	109.4	146.2	255.6	109.4
Switzerland-PSI	100.3	83.7	183.9	100.3
Switzerland-UNIV	45.6	48.1	93.7	45.6
Taipei	137.6	70.5	208.2	137.6
Turkey	169.4		169.4	169.4
United Kingdom	510.4	278.1	788.5	510.4
USA-DOE	3,430.0	1,412.9	4,842.9	3,430.0
USA-DOE-NP	167.8		167.8	167.8
USA-NSF	881.1	455.2	1,336.3	881.1
USA-NSF-NP	21.0		21.0	21.0
<b>Grand Total</b>	<b>11,962</b>	<b>6,485</b>	<b>18,447</b>	<b>11,962</b>

# ANNEX A.1

## M & O Cat. A

### Budget Request for the Year 2009 (kCHF)

Maintenance & Operations (kCHF)				Year	
Group	Description	Ref.	Details	2009	
Maintenance & Operations	Detector related costs	A.1.01	Magnet	30	
		A.1.02	Magnet controls	142	
		A.1.03	Magnet power supply	40	
		A.1.04	Gas systems	210	
		A.1.05	Gas consumption	375	
		A.1.06	Cooling systems	220	
		A.1.07	Cooling fluids(above -50°C)	200	
		A.1.08	External cryogenics	375	
		A.1.09	Cryogenic fluids (below -50°C)	90	
		A.1.10	Moving/hydraulic systems	80	
		A.1.11	Detector safety systems, BCM/BRM	205	
		A.1.12	Shutdown activities	410	
		A.1.13	General Technical support	610	
		A.1.14	UPS maintenance	80	
		A.1.16	Beam pipe & vacuum	390	
		A.1.17	Counting & control rooms	240	
		Detector related costs Total			
	Secretariat	A.2.01	Secretarial assistance		225
		A.2.02	Economat		15
		A.2.04	Printing and publication		100
	Secretariat Total				340
	Communications	A.3.01	GSM phones; on-call service		20
		A.3.02	Collaborative tools		100
	Communications Total				120
	On-line computing	A.4.01	System management		796
		A.4.02	Data storage, (temporary on disk)		52
		A.4.03	Detector controls		130
		A.4.04	Computers/processors/LANs		2,422
		A.4.05	Software licenses		0
	On-line computing Total				3,400
	Test beams, calibration facilities	A.5.01	General operation		60
		A.5.02	Common electronics		15
		A.5.03	Electronics pool rentals		20
		A.5.04	Gas systems		10
		A.5.05	Gas consumption		10
	Test beams, calibration facilities Total				115
	Laboratory operations	A.6.01	Assembly areas, clean rooms		20
		A.6.02	Workshops		250
	Laboratory operations Total				270
	General services	A.7.01	Cooling & ventilation		590
		A.7.03	Power distribution system		60
		A.7.04	Heavy transport		340
		A.7.05	Cranes		35
		A.7.06	Cars		30
		A.7.08	Survey		130
A.7.09		Storage space		50	
A.7.10		Common desktop infrastructure		45	
A.7.11		Reviewing & engineering		50	
A.7.12		Outreach		220	
General services Total				1,550	
Core Computing Infrastructure & Services	A.9.01	Central computing environment		458	
	A.9.02	Software process service		220	
	A.9.03	User support		202	
	A.9.04	Central production operations		695	
	A.9.05	Hardware		70	
Core Computing Infrastructure & Services Total				1,645	
Maintenance & Operations Total				11,137	
Power	Electricity	A.8.01	Power Consumption	1,800	
	Electricity Total			1,800	
Power Total				1,800	
Grand Total				12,937	

# ANNEX A.2

## M & O Cat. A by Funding Agency

All Figures in kCHF

Funding Agency	Category A without Power Bill	Power Billed	Category A
Austria	100.3		100.3
Belgium-FNRS	182.3		182.3
Belgium-FWO	82.0		82.0
Brazil	82.0	13.3	95.3
Bulgaria	45.6		45.6
CERN	619.7		619.7
China	72.9	11.8	84.7
Colombia	9.1	1.5	10.6
Croatia	54.7	8.8	63.5
Cyprus	27.3	4.4	31.8
Estonia	9.1	1.5	10.6
Finland	127.6		127.6
France-CEA	154.9		154.9
France-IN2P3	328.1		328.1
Germany-BMBF	519.5		519.5
Germany-DESY	145.8		145.8
Greece	118.5		118.5
Hungary	54.7		54.7
India	237.0	34.0	271.0
Iran	45.6	7.4	52.9
Ireland	18.2	2.9	21.2
Italy	1713.4		1713.4
Korea	109.4	17.7	127.0
Mexico	45.6	7.4	52.9
New Zealand	45.6	7.4	52.9
Pakistan	27.3	4.4	31.8
Poland	72.9		72.9
Portugal	54.7		54.7
RDMS-DMS	218.7	35.4	254.1
RDMS-Russia	537.7	30.2	567.9
Serbia	27.3	4.4	31.8
Spain	309.9		309.9
Switzerland-ETHZ	109.4		109.4
Switzerland-PSI	100.3		100.3
Switzerland-UNIV	45.6		45.6
Taipei	118.5	19.1	137.6
Turkey	145.8	23.6	169.4
United Kingdom	510.4		510.4
USA-DOE	2980.2	449.7	3430.0
USA-DOE-NP	145.8	22.0	167.8
USA-NSF	765.6	115.5	881.1
USA-NSF-NP	18.2	2.8	21.0
<b>Grand Total</b>	<b>11,137</b>	<b>825</b>	<b>11,962</b>

# ANNEX B.1

## M & O Cat. B

### Budget Request for the Year 2009 (kCHF or FTE)

Year	2009
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Amount (kCHF/FTE)			Detector					Core Computing	Grand Total
Description	Ref.	Details	Tracker	ECAL	HCAL	Muon	Trigger		
Material Resources (kCHF)	B.1.01	Mechanics	26	28	69	11			133
	B.1.02	Gas-system	14	5	2	44			65
	B.1.03	Cryo-system			0				0
	B.1.04	Cooling system	31	35	2	21			88
	B.1.05	FE electronics	0	0	0	172			172
	B.1.06	Standard electronics, PS (LV, HV)	548	215	0	185			948
	B.1.07	Standard electronics, Crates	0	48	0	68			116
	B.1.08	Standard electronics, RO Modules	748	167	0	245	490		1,650
	B.1.09	Controls, (DCS, DSS)	58	100	0	134			292
	B.1.10	Sub-Detector Spares	0	210	0	74			284
	B.1.11	Areas	233	80	23	82			418
	B.1.12	Communications	23	21	96	29			169
	B.1.13	Store Items	48	60	31	49			188
	B.1.14	Hired Manpower @CERN	660	465	346	290	200		1,961
Material Resources (kCHF) Total			2,389	1,433	568	1,405	690		6,485
Human Resources (FTE)	B.2.01	Technical Manpower @CERN	8	10	15	15	8		56
	B.2.02	Core Computing Manpower @CMS						96	96
Human Resources (FTE) Total			8	10	15	15	8	96	152

# ANNEX B.2

## M&O Cat. B Cost Sharing by Funding Agency and Subsystem

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger
Austria	1.7%				10.0%
Belgium-FNRS	5.2%				
Belgium-FWO	5.2%				
Brazil					
Bulgaria					
CERN	13.2%	17.4%		5.1%	7.4%
China					
Colombia					
Croatia		1.8%			
Cyprus		1.1%			
Estonia					
Finland	4.6%				
France-CEA		6.4%			
France-IN2P3	8.0%	7.6%			
Germany-BMBF	11.3%			8.9%	
Germany-DESY					
Greece		3.1%			5.7%
Hungary					
India		3.1%			
Iran					
Ireland					
Italy	27.5%	11.2%		38.1%	0.8%
Korea				2.2%	3.3%
Mexico					
New Zealand					
Pakistan				5.6%	
Poland					25.2%
Portugal		1.4%			2.1%
RDMS-DMS					
RDMS-Russia		4.1%			
Serbia		0.8%			
Spain				7.4%	
Switzerland-ETHZ	1.1%	8.4%			
Switzerland-PSI	2.8%	1.1%			
Switzerland-UNIV	2.0%				
Taipei		4.9%			
Turkey					
United Kingdom	6.0%	7.8%			3.3%
USA-DOE	8.6%	14.9%	74.1%	24.9%	32.2%
USA-DOE-NP					
USA-NSF	2.7%	4.6%	25.9%	7.7%	10.0%
USA-NSF-NP					
<b>Grand Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

# ANNEX B.3

## M&O Cat. B Costs by Funding Agency and Subsystem

Estimated Costs Incurred in 2009 (kCHF)

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger	Total
Austria	40.3				69.0	109.3
Belgium-FNRS	124.7					124.7
Belgium-FWO	124.7					124.7
Brazil						
Bulgaria						
CERN	314.9	250.0		71.1	50.9	686.9
China						
Colombia						
Croatia		25.6				25.6
Cyprus		16.3				16.3
Estonia						
Finland	110.8					110.8
France-CEA		92.2				92.2
France-IN2P3	190.2	108.5				298.7
Germany-BMBF	270.8			125.0		395.8
Germany-DESY						
Greece		45.0			39.6	84.6
Hungary						
India		45.1				45.1
Iran						
Ireland						
Italy	657.5	160.8		535.4	5.7	1,359.3
Korea				31.4	22.6	54.0
Mexico						
New Zealand						
Pakistan				78.5		78.5
Poland					174.1	174.1
Portugal		19.5			14.4	33.9
RDMS-DMS						
RDMS-Russia		59.3				59.3
Serbia		12.0				12.0
Spain				104.6		104.6
Switzerland-ETHZ	26.2	120.0				146.2
Switzerland-PSI	67.4	16.3				83.7
Switzerland-UNIV	48.1					48.1
Taipei		70.5				70.5
Turkey						
United Kingdom	143.6	111.9			22.6	278.1
USA-DOE	205.9	213.7	420.7	350.4	222.2	1,412.9
USA-DOE-NP						
USA-NSF	63.9	66.3	147.2	108.8	69.0	455.2
USA-NSF-NP						
<b>Grand Total</b>	<b>2,389</b>	<b>1,433</b>	<b>568</b>	<b>1,405</b>	<b>690</b>	<b>6,485</b>

# ANNEX I.A

## M & O Cat. A Costs 2008-2012 (All Figures in kCHF)

All Amounts in kCHF					Year					Grand Total	
Group	Description	Ref.	Details	Type (1)	2008	2009	2010	2011	2012		
Maintenance & Operations	Detector related costs	A.1.01	Magnet	C	40	30	30	30	30	160	
		A.1.02	Magnet controls	O	110	110	110	110	110	550	
				C	32	32	32	32	32	160	
		A.1.03	Magnet power supply	O	30	20	20	20	20	110	
				C	20	20	20	20	20	100	
		A.1.04	Gas systems	O	160	160	160	160	160	800	
				C	50	50	50	50	50	250	
		A.1.05	Gas consumption	C	450	375	300	300	300	1,725	
		A.1.06	Cooling systems	O	190	190	190	190	190	950	
				C	30	30	30	30	30	150	
		A.1.07	Cooling fluids(above -50°C)	C	200	200	145	145	145	835	
		A.1.08	External cryogenics	O	345	345	345	345	345	1,725	
				C	30	30	30	30	30	150	
		A.1.09	Cryogenic fluids (below -50°C)	C	140	90	40	40	40	350	
		A.1.10	Moving/hydraulic systems	O	50	50	50	50	50	250	
				C	30	30	30	30	30	150	
		A.1.11	Detector safety systems, BCM/BRM	O	75	75	75	50	50	325	
			C	130	130	130	90	90	570		
	A.1.12	Shutdown activities	O	390	390	390	390	390	1,950		
			C	20	20	20	20	20	100		
	A.1.13	General Technical support	O	550	550	550	550	550	2,750		
			C	60	60	50	50	50	270		
	A.1.14	UPS maintenance	C	80	80	80	80	80	400		
	A.1.16	Beam pipe & vacuum	O	120	120	120	120	120	600		
			C	120	270	120	120	120	750		
	A.1.17	Counting & control rooms	O	120	120	120	120	120	600		
			C	120	120	100	100	100	540		
	Detector related costs Total					3,692	3,697	3,337	3,272	3,272	17,270
	Secretariat	A.2.01	Secretarial assistance	O	225	225	225	225	225	1,125	
		A.2.02	Economat	C	15	15	15	15	15	75	
		A.2.04	Printing and publication	C	100	100	100	100	100	500	
	Secretariat Total					340	340	340	340	340	1,700
	Communications	A.3.01	GSM phones; on-call service	C	20	20	20	20	20	100	
A.3.02		Automatic call-back	C				100	100	200		
		Collaborative tools	C	100	100	100			300		
Communications Total					120	120	120	120	120	600	
On-line computing	A.4.01	System management	O	536	796	896	980	980	4,188		
	A.4.02	Data storage, (temporary on disk)	C	32	52	375	375	375	1,209		
	A.4.03	Detector controls	C	130	130	130	130	130	650		
	A.4.04	Computers/processors/LANs	C	1,843	2,422	2,281	2,467	2,770	11,783		
	A.4.05	Software licenses	C	0	0	0	0	0	0		
On-line computing Total					2,541	3,400	3,682	3,952	4,255	17,830	
Test beams, calibration facilities	A.5.01	General operation	O	40	40	30	30	30	170		
			C	20	20	10	10	10	70		
	A.5.02	Common electronics	C	15	15	15	15	15	75		
	A.5.03	Electronics pool rentals	C	20	20	20	20	20	100		
	A.5.04	Gas systems	C	10	10	10	10	10	50		
A.5.05	Gas consumption	C	10	10	10	10	10	50			
Test beams, calibration facilities Total					115	115	95	95	95	515	
Laboratory operations	A.6.01	Assembly areas, clean rooms	C	20	20	20	20	20	100		
	A.6.02	Workshops	O	220	220	220	220	220	1,100		
		C	30	30	30	30	30	150			
Laboratory operations Total					270	270	270	270	270	1,350	

All Amounts in kCHF						Year					Grand Total
Group	Description	Ref.	Details	Type (1)	2008	2009	2010	2011	2012		
	General services	A.7.01	Cooling & ventilation	O	195	235	235	235	235	1,135	
				C	315	355	355	355	355	1,735	
		A.7.03	Power distribution system	C	60	60	60	60	60	300	
		A.7.04	Heavy transport	O	400	280	280	280	280	1,520	
				C	60	60	60	60	60	300	
		A.7.05	Cranes	C	35	35	35	35	35	175	
		A.7.06	Cars	C	30	30	30	30	30	150	
		A.7.08	Survey	O	180	120	60	60	60	480	
				C	15	10	5	5	5	40	
		A.7.09	Storage space	C	50	50	50	50	50	250	
		A.7.10	Common desktop infrastructure	C	50	45	40	40	40	215	
				O				40	40	80	
		A.7.11	Academic Subsistence	O	60	50	40			150	
			O	50	50	50	50	50	250		
	A.7.12	Outreach	C								
	General services Total					1,670	1,550	1,470	1,470	1,470	7,630
	Core Computing Infrastructure & Services	A.9.01	Central computing environment	O	378	458	458	458	458	2,208	
		A.9.02	Software process service	O	176	220	220	220	220	1,056	
		A.9.03	User support	O	150	202	202	202	202	960	
		A.9.04	Central production operations	O	607	695	695	695	695	3,388	
A.9.05		Hardware	C	100	70	70	70	70	380		
Core Computing Infrastructure & Services Total					1,411	1,645	1,645	1,645	1,645	7,992	
Maintenance & Operations Total					10,159	11,137	10,959	11,164	11,467	54,887	
Power	Electricity				1,800	1,800	1,800	1,800	1,800	9,000	
Power Total					1,800	1,800	1,800	1,800	1,800	9,000	
Grand Total					11,959	12,937	12,759	12,964	13,267	63,887	

(1) O=Operation, manpower intensive  
C=Consumables

# ANNEX I.B

## M& O Cat. B Costs 2008-2012 for all CMS Subdetectors

(Material Resources in kCHF, Human Resources in FTE)

Amount (kCHF/FTE)			Year					Grand Total
Description	Detector	Subsystem	2008	2009	2010	2011	2012	
Material Resources	Tracker	Pixel	148	164	164	164	164	804
		SST	1,765	2,225	2,125	1,900	1,900	9,915
	Tracker Total		1,913	2,389	2,289	2,064	2,064	10,719
	ECAL		1,433	1,433	1,433	1,343	1,343	6,985
	HCAL		517	568	510	523	535	2,653
	Muon	Barrel Alignment	24	24	24	59	39	170
		Drift Tubes	743	521	521	521	521	2,827
		EMU	574	459	459	459	459	2,411
		Forward RPC	157	157	157	157	157	785
		LinkAlignment	16	16	16	39	19	106
		RPC Barrel	228	228	228	228	228	1,140
	Muon Total		1,742	1,405	1,405	1,463	1,423	7,439
Trigger		222	690	690	690	690	2,982	
Material Resources Total			5,827	6,485	6,327	6,083	6,055	30,777
Human Resources	Tracker	Pixel	2	2	2			6
		SST	6	6	6	6	6	30
	Tracker Total		8	8	8	6	6	36
	ECAL		10	10	10	10	10	50
	HCAL		15	15	14	14	14	72
	Muon	Barrel Alignment	1	1	1	1	1	5
		Drift Tubes	4	4	4	4	4	20
		EMU	5	5	5	5	5	25
		Forward RPC	2	2	2	2	2	10
		LinkAlignment	1	1	1	1	1	5
RPC Barrel		2	2	2	2	2	10	
Muon Total		15	15	15	15	15	75	
Trigger		8	8	8	8	8	40	
Core Computing		96	96	96	96	96	480	
Human Resources Total			152	152	151	149	149	753