

Draft Budget for CMS Maintenance & Operations in the Year 2006

INTRODUCTION

This document summarizes the funding requirements for the payments that the CMS Collaboration plans to make in the year 2006 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. The Annexes presented here are based on the scrutinized costs unless otherwise noted.

This M&O budget request includes the costs linked to the Addendum No. 1 to the Memorandum of Understanding for Maintenance and Operation of the CMS Detector, Core Computing (cf. CERN-RRB-2005-009). These costs can be found under categories A.9 and B.2.02, respectively in Annexes A.1 and B.1 and they had already been included in the M&O Preliminary Draft Budget 2006 (cf. CERN-RRB-2005-005).

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 figures shown as "Payments expected in 2006" in the Summary Table (**Annex 2**) have been reviewed by the RRB Scrutiny Group and are based on the updated PhD 2005 count.

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 Preliminary Draft Budget for the year 2006 presented at the previous RRB meeting (cf. CERN-RRB-2005-006), the present budget request has very slightly increased from 7'372 kCHF to 7'391 kCHF.

The estimated cost for the Addendum No. 1 to the M&O MoU in the year 2006 totals some 1'417 kCHF. Of this, a very large fraction (1'317 kCHF) is for manpower: the CMS

Collaboration strongly prefers to receive in-kind contributions for this particular category. Over 50% of the 2006 request is in fact already covered.

The CMS Collaboration has now a scheme to formalize in-kind contributions for both M&O-A and M&O-B for Computing. The goal is to advertise the opportunities for in-kind contributions and to ensure a fair chance is given to all Institutes to pledge such contributions.

Annex I.A gives the projected costs for M&O-A, including category A.9, until 2010.

This updated budget request has been discussed at the RRB Scrutiny Group.

In-kind pledged and agreed contributions to the M&O-A 2006 budget are as follows:

<u>Funding Agency</u>	<u>FTEs</u>
Belgium	0.7
Germany	0.9
Italy	1.2
Spain	0.1
RDMS-DMS	1.0
USA	1.4
<u>Total</u>	<u>5.3</u>

M&O CATEGORY B

With respect to the forecast for the year 2006 in the M&O Preliminary Draft Budget for the year 2006 (cf. CERN-RRB-2005-005), the present budget request has slightly increased from 5'915 kCHF to 6'073 kCHF.

The resources needed for the new B.2.02 category are human resources only. These total some 70 FTEs for the year 2006, to be available in the CMS Institutes directly. Some 55 FTEs are already pledged by many Institutes.

These contributions fall under the scheme mentioned above for in-kind contributions.

This updated budget request has been discussed at the RRB Scrutiny Group.

M&O CATEGORY B SHARING

Material Resources

The CMS Collaboration will share its M&O Cat. B costs for the year 2006 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 2006, which will not have been committed during 2006, will be reported to the April 2007 RRB and will be carried forward.

ANNEXES

Budget Requirements for M&O in 2006

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Annex I.B : Foreseen Cat. A Costs 2006-2010

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://cmsdoc.cern.ch/docofficial.shtml>
(Count closed on September 27, 2005)

Institute FA	PhD #	PhD %
Austria	11	1.1%
Belgium	28	2.7%
Brazil	4	0.4%
Bulgaria	5	0.5%
CERN	62	6.0%
China	14	1.3%
Croatia	6	0.6%
Cyprus	2	0.2%
Estonia	2	0.2%
Finland	12	1.2%
France-CEA	16	1.5%
France-IN2P3	36	3.5%
Germany	44	4.2%
Greece	19	1.8%
Hungary	6	0.6%
India	22	2.1%
Iran	3	0.3%
Ireland	1	0.1%
Italy	162	15.6%
Korea	15	1.4%
Mexico	5	0.5%
New Zealand	3	0.3%
Pakistan	3	0.3%
Poland	8	0.8%
Portugal	4	0.4%
RDMS-DMS	34	3.3%
RDMS-Russia	54	5.2%
Serbia	3	0.3%
Spain	30	2.9%
Switzerland-ETHZ	16	1.5%
Switzerland-PSI	11	1.1%
Switzerland-UNIV	5	0.5%
Taipei	11	1.1%
Turkey	15	1.4%
United Kingdom	41	3.9%
USA-DOE	258	24.8%
USA-NSF	69	6.6%
Grand Total	1040	100.0%

ANNEX 2

M&O Cat. A and B Costs by Funding Agency Payments expected in the Year 2006 (kCHF)

Funding Agency	Category A	Category B	Total Category A+B	Total Invoiced
Austria	70.8	71.9	142.7	70.8
Belgium	180.1	123.3	303.5	180.1
Brazil	28.4		28.4	28.4
Bulgaria	32.2		32.2	32.2
CERN	398.9	383.6	782.5	398.9
China	99.5	36.2	135.7	99.5
Croatia	42.6	28.2	70.8	42.6
Cyprus	14.2	14.9	29.1	14.2
Estonia	14.2		14.2	14.2
Finland	77.2	54.8	132.0	77.2
France-CEA	102.9	112.6	215.5	102.9
France-IN2P3	231.6	239.0	470.6	231.6
Germany	283.1	272.6	555.6	283.1
Greece	122.2	114.1	236.3	122.2
Hungary	38.6		38.6	38.6
India	154.7	25.6	180.3	154.7
Iran	21.3		21.3	21.3
Ireland	7.1	7.0	14.1	7.1
Italy	1,042.3	1,144.9	2,187.2	1,042.3
Korea	106.6	53.7	160.3	106.6
Mexico	35.5		35.5	35.5
New Zealand	21.3		21.3	21.3
Pakistan	21.3	129.4	150.8	21.3
Poland	51.5	131.2	182.6	51.5
Portugal	25.7	39.0	64.7	25.7
RDMS-DMS	241.6	10.9	252.5	241.6
RDMS-Russia	360.1	143.8	503.9	360.1
Serbia	21.3	10.0	31.3	21.3
Spain	193.0	155.7	348.7	193.0
Switzerland-ETHZ	102.9	82.1	185.0	102.9
Switzerland-PSI	70.8	92.4	163.2	70.8
Switzerland-UNIV	32.2	50.0	82.2	32.2
Taipei	78.2	78.1	156.3	78.2
Turkey	106.6		106.6	106.6
United Kingdom	263.8	225.8	489.6	263.8
USA-DOE	1,822.0	1,613.2	3,435.2	1,822.0
USA-NSF	487.3	629.5	1,116.8	487.3
Grand Total	7,004	6,073	13,077	7,004

ANNEX A.1

M & O Cat. A

Budget Request for the Year 2006 (kCHF)

 Reviewed (Show All)

Maintenance & Operations (kCHF)				Year
Group	Description	Ref.	Details	2006
Maintenance & Operations	Detector related costs	A.1.01	Magnet	50
		A.1.02	Magnet controls	102
		A.1.03	Magnet power supply	20
		A.1.04	Gas systems	110
		A.1.05	Gas consumption	150
		A.1.06	Cooling systems	170
		A.1.07	Cooling fluids(above -50°C)	15
		A.1.08	External cryogenics	430
		A.1.09	Cryogenic fluids (below -50°C)	24
		A.1.10	Moving/hydraulic systems	70
		A.1.11	Detector safety systems	45
		A.1.12	Shutdown activities	130
		A.1.13	General Technical support	600
		A.1.14	UPS maintenance	50
		A.1.15	Electronics pool rentals	
		A.1.16	Beam pipe & vacuum	80
		A.1.17	Counting & control rooms	160
		Detector related costs Total		2,206
	Secretariat	A.2.01	Secretarial assistance	180
		A.2.02	Economat	15
		A.2.04	Printing and publication	50
		Secretariat Total		245
	Communications	A.3.01	GSM phones; on-call service	20
		A.3.02	Automatic call-back	0
		Communications Total		20
	On-line computing	A.4.01	System management	347
		A.4.02	Data storage, (temporary on disk)	25
		A.4.03	Detector controls	70
		A.4.04	Computers/processors/LANs	386
		A.4.05	Software licenses	60
		On-line computing Total		888
	Test beams, calibration facilities	A.5.01	General operation	100
		A.5.02	Common electronics	45
		A.5.03	Electronics pool rentals	30
		A.5.04	Gas systems	10
		A.5.05	Gas consumption	10
		A.5.06	External cryogenics	
		Test beams, calibration facilities Total		195
	Laboratory operations	A.6.01	Assembly areas, clean rooms	40
		A.6.02	Workshops	250
		A.6.03	Laboratory instruments	
		Laboratory operations Total		290
General services	A.7.01	Cooling & ventilation	240	
	A.7.03	Power distribution system	50	
	A.7.04	Heavy transport	550	
	A.7.05	Cranes	70	
	A.7.06	Cars	40	
	A.7.08	Survey	130	
	A.7.09	Storage space	100	
	A.7.10	Common desktop infrastructure	60	
	A.7.11	Academic Subsistence	130	
	A.7.12	Outreach	60	
		General services Total		1,430
Core Computing Infrastructure & Services	A.9.01	Central computing environment	519	
	A.9.02	Software process service	217	
	A.9.03	User support	273	
	A.9.04	Central production operations	308	
	A.9.05	Hardware	100	
	Core Computing Infrastructure & Services Total		1,417	
	Maintenance & Operations Total		6,691	
Power	Electricity	A.8.01	Power Consumption	700
			Electricity Total	700
	Power Total		700	
	Grand Total		7,391	

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	70.8		70.8
Belgium	180.1		180.1
Brazil	25.7	2.7	28.4
Bulgaria	32.2		32.2
CERN	398.9		398.9
China	90.1	9.4	99.5
Croatia	38.6	4.0	42.6
Cyprus	12.9	1.3	14.2
Estonia	12.9	1.3	14.2
Finland	77.2		77.2
France-CEA	102.9		102.9
France-IN2P3	231.6		231.6
Germany	283.1		283.1
Greece	122.2		122.2
Hungary	38.6		38.6
India	141.5	13.2	154.7
Iran	19.3	2.0	21.3
Ireland	6.4	0.7	7.1
Italy	1042.3		1042.3
Korea	96.5	10.1	106.6
Mexico	32.2	3.4	35.5
New Zealand	19.3	2.0	21.3
Pakistan	19.3	2.0	21.3
Poland	51.5		51.5
Portugal	25.7		25.7
RDMS-DMS	218.7	22.9	241.6
RDMS-Russia	347.4	12.6	360.1
Serbia	19.3	2.0	21.3
Spain	193.0		193.0
Switzerland-ETHZ	102.9		102.9
Switzerland-PSI	70.8		70.8
Switzerland-UNIV	32.2		32.2
Taipei	70.8	7.4	78.2
Turkey	96.5	10.1	106.6
United Kingdom	263.8		263.8
USA-DOE	1659.9	162.1	1822.0
USA-NSF	443.9	43.4	487.3
Grand Total	6,691	313	7,004

ANNEX B.1

M & O Cat. B

Budget Request for the Year 2006 (kCHF or FTE)

Year	2006
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Description	Amount (kCHF/FTE)		Detector					Grand Total	
	Ref.	Details	Tracker	ECAL	HCAL	Muon	Trigger		Core Computing
Material Resources (kCHF)	B.1.01	Mechanics	10	55	29	28			121
	B.1.02	Gas-system	10	4	1	42			58
	B.1.04	Cooling system	50	66	1	21			139
	B.1.05	FE electronics	260	182		268			710
	B.1.06	Standard electronics, PS (LV, HV)	230	164	38	252			684
	B.1.07	Standard electronics, Crates	0	89	38	58			185
	B.1.08	Standard electronics, RO Modules	380	193	38	339	490		1,440
	B.1.09	Controls, (DCS, DSS)	82	195		276			553
	B.1.10	Sub-Detector Spares	5	145	3	184			337
	B.1.11	Areas	100	70	27	176			374
	B.1.12	Communications	15	22	122	37			196
	B.1.13	Store Items	40	70	126	58			294
	B.1.14	Hired Manpower @CERN	100	135	429	318			983
	Material Resources (kCHF) Total			1,282	1,390	855	2,057	490	
Human Resources (FTE)	B.2.01	Technical Manpower @CERN	4	8	9	12	8		41
	B.2.02	Core Computing Manpower @CMS						70	70
Human Resources (FTE) Total			4	8	9	12	8	70	111

ANNEX B.2

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

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger
Austria	1.6%				10.6%
Belgium	9.6%				
Brazil					
Bulgaria					
CERN	12.1%	11.1%		3.2%	1.7%
China				1.8%	
Croatia		2.0%			
Cyprus		1.1%			
Estonia					
Finland	4.3%				
France-CEA		8.1%			
France-IN2P3	7.3%	10.4%			
Germany	10.4%			6.7%	
Greece		6.1%			6.1%
Hungary					
India		1.6%	0.4%		
Iran					
Ireland		0.5%			
Italy	25.4%	14.3%		30.0%	0.9%
Korea				1.8%	3.5%
Mexico					
New Zealand					
Pakistan				6.3%	
Poland					26.8%
Portugal		2.0%			2.2%
RDMS-DMS		0.8%			
RDMS-Russia		5.7%	7.6%		
Serbia		0.7%			
Spain				7.6%	
Switzerland-ETHZ		5.9%			
Switzerland-PSI	5.5%	1.6%			
Switzerland-UNIV	3.9%				
Taipei		5.6%			
Turkey					
United Kingdom	5.5%	9.9%			3.5%
USA-DOE	10.3%	9.1%	66.2%	30.7%	32.2%
USA-NSF	4.0%	3.5%	25.8%	12.0%	12.6%
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%

All subsystems sharing by responsibility

ANNEX B.3

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

Estimated Costs Incurred in 2006 (kCHF)

Funding Agency	Tracker	ECAL	HCAL	Muon	Trigger	Total
Austria	19.9				52.0	71.9
Belgium	123.3					123.3
Brazil						
Bulgaria						
CERN	155.7	153.7		65.7	8.5	383.6
China				36.2		36.2
Croatia		28.2				28.2
Cyprus		14.9				14.9
Estonia						
Finland	54.8					54.8
France-CEA		112.6				112.6
France-IN2P3	94.1	144.9				239.0
Germany	133.9			138.7		272.6
Greece		84.2			29.8	114.1
Hungary						
India		22.2	3.4			25.6
Iran						
Ireland		7.0				7.0
Italy	325.1	198.8		616.7	4.3	1,144.9
Korea				36.7	17.0	53.7
Mexico						
New Zealand						
Pakistan				129.4		129.4
Poland					131.2	131.2
Portugal		28.2			10.9	39.0
RDMS-DMS		10.9				10.9
RDMS-Russia		78.8	65.0			143.8
Serbia		10.0				10.0
Spain				155.7		155.7
Switzerland-ETHZ		82.1				82.1
Switzerland-PSI	70.0	22.4				92.4
Switzerland-UNIV	50.0					50.0
Taipei		78.1				78.1
Turkey						
United Kingdom	71.0	137.7			17.0	225.8
USA-DOE	132.4	125.8	565.5	631.6	157.8	1,613.2
USA-NSF	51.7	49.1	220.7	246.5	61.6	629.5
Grand Total	1,282	1,390	855	2,057	490	6,073

ANNEX I.A

M & O Cat. A Costs 2006-2010

(All Figures in kCHF)

Reviewed (Show All)

All Amounts in kCHF					Year					Grand Total
Group	Description	Ref.	Details	Type (1)	2006	2007	2008	2009	2010	
Maintenance & Operations	Detector related costs	A.1.01	Magnet	C	50	40	40	30	30	190
		A.1.02	Magnet controls	O	70	110	110	110	110	510
				C	32	32	32	32	32	160
		A.1.03	Magnet power supply	O	10	30	30	20	20	110
				C	10	30	20	20	20	100
		A.1.04	Gas systems	O	80	160	160	160	160	720
				C	30	50	50	50	50	230
		A.1.05	Gas consumption	C	150	200	300	300	300	1,250
		A.1.06	Cooling systems	O	120	150	190	190	190	840
				C	50	30	30	30	30	170
		A.1.07	Cooling fluids(above -50°C)	C	15	20	20	20	20	95
		A.1.08	External cryogenics	O	180	345	345	345	345	1,560
				C	250	120	30	30	30	460
		A.1.09	Cryogenic fluids (below -50°C)	C	24	40	40	40	40	184
		A.1.10	Moving/hydraulic systems	O	50	50	50	50	50	250
				C	20	50	30	30	30	160
		A.1.11	Detector safety systems	O	25	25	25	25	25	125
			C	20	40	40	40	40	180	
	A.1.12	Shutdown activities	O	110	390	390	390	390	1,670	
			C	20	20	20	20	20	100	
	A.1.13	General Technical support	O	550	550	550	550	550	2,750	
			C	50	60	60	60	50	280	
	A.1.14	UPS maintenance	C	50	80	80	80	80	370	
	A.1.15	Electronics pool rentals	C							
	A.1.16	Beam pipe & vacuum	O	40	120	120	120	120	520	
			C	40	120	120	120	120	520	
	A.1.17	Counting & control rooms	O	120	120	120	120	120	600	
		C	40	80	120	120	100	460		
Detector related costs Total					2,206	3,062	3,122	3,102	3,072	14,564
Secretariat	A.2.01	Secretarial assistance	O	180	180	225	225	225	1,035	
	A.2.02	Economat	C	15	15	15	15	15	75	
	A.2.04	Printing and publication	C	50	50	100	100	100	400	
Secretariat Total					245	245	340	340	340	1,510
Communications	A.3.01	GSM phones; on-call service	C	20	20	20	20	20	100	
	A.3.02	Automatic call-back	C	0	0	0	0	0	0	
Communications Total					20	20	20	20	20	100
On-line computing	A.4.01	System management	O	347	667	987	987	987	3,975	
	A.4.02	Data storage, (temporary on disk)	C	25	75	150	250	250	750	
	A.4.03	Detector controls	C	70	90	110	130	130	530	
	A.4.04	Computers/processors/LANs	C	386	858	1,670	2,637	2,770	8,321	
	A.4.05	Software licenses	C	60	120	180	240	240	840	
On-line computing Total					888	1,810	3,097	4,244	4,377	14,416
Test beams, calibration facilities	A.5.01	General operation	O	80	60	40	40	30	250	
			C	20	20	20	20	10	90	
	A.5.02	Common electronics	C	45	45	15	15	15	135	
	A.5.03	Electronics pool rentals	C	30	20	20	20	20	110	
	A.5.04	Gas systems	C	10	10	10	10	10	50	
	A.5.05	Gas consumption	C	10	10	10	10	10	50	
		C								
Test beams, calibration facilities Total					195	165	115	115	95	685
Laboratory operations	A.6.01	Assembly areas, clean rooms	C	40	30	20	20	20	130	
	A.6.02	Workshops	O	220	220	220	220	220	1,100	
	A.6.03	Laboratory instruments	C	30	30	30	30	30	150	
Laboratory operations Total					290	280	270	270	270	1,380

All Amounts in kCHF					Year					Grand Total	
Group	Description	Ref.	Details	Type (1)	2006	2007	2008	2009	2010		
	General services	A.7.01	Cooling & ventilation	O	120	140	170	170	170	770	
		C		120	140	170	170	170	770		
		A.7.03	Power distribution system	O							
		C		50	50	40	30	20	190		
		A.7.04	Heavy transport	O	490	550	400	280	280	2,000	
		C		60	60	60	60	60	300		
		A.7.05	Cranes	C	70	70	50	50	50	290	
		A.7.06	Cars	C	40	40	30	30	30	170	
		A.7.08	Survey	O	120	120	120	60	60	480	
		C		10	10	5	5	5	35		
		A.7.09	Storage space	C	100	70	50	50	50	320	
		A.7.10	Common desktop infrastructure	C	60	60	50	45	40	255	
	A.7.11	Academic Subsistence	O	130	130	60	50	40	410		
	A.7.12	Outreach	C	60	60	60	60	60	300		
	General services Total					1,430	1,500	1,265	1,060	1,035	6,290
	Core Computing Infrastructure & Services	A.9.01	Central computing environment	O	519	623	675	675	675	3,167	
		A.9.02	Software process service	O	217	260	282	282	282	1,323	
		A.9.03	User support	O	273	327	355	355	355	1,665	
		A.9.04	Central production operations	O	308	370	400	400	400	1,878	
		A.9.05	Hardware	C	100	100	100	100	100	500	
Core Computing Infrastructure & Services Total					1,417	1,680	1,812	1,812	1,812	8,533	
Maintenance & Operations Total					6,691	8,762	10,041	10,963	11,021	47,478	
Power	Electricity				700	1,600	1,800	1,800	1,800	7,700	
	Power Total				700	1,600	1,800	1,800	1,800	7,700	
Grand Total					7,391	10,362	11,841	12,763	12,821	55,178	

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

ANNEX I.B

M& O Cat. B Costs 2006-2010 for all CMS Subdetectors

(Material Resources in kCHF, Human Resources in FTE)

Amount (kCHF/ FTE)			Year					Grand Total
Description	Detector	Subsystem	2006	2007	2008	2009	2010	
Material Resources	Tracker	Pixel	192	670	698	714	714	2,988
		SST	1,090	1,515	1,515	1,515	1,515	7,150
	Tracker Total		1,282	2,185	2,213	2,229	2,229	10,138
	ECAL		1,390	1,506	1,506	1,506	1,506	7,412
	HCAL		855	611	588	533	1,096	3,682
	Muon	Barrel Alignment	35	29	24	24	24	136
		Drift Tubes	614	639	607	607	607	3,074
		EMU	878	881	881	881	881	4,402
		Forward RPC	192	157	157	157	157	820
		LinkAlignment	60	31	16	16	16	139
		RPC Barrel	278	228	228	228	228	1,190
Muon Total		2,057	1,965	1,913	1,913	1,913	9,761	
Trigger		490	490	490	490	490	2,450	
Material Resources Total			6,073	6,756	6,709	6,670	7,234	33,443
Human Resources	Tracker	Pixel			2	2	2	6
		SST	4	6	6	6	6	28
	Tracker Total		4	6	8	8	8	34
	ECAL		8	10	10	10	10	48
	HCAL		9	9	9	9	9	44
	Muon	Barrel Alignment	2	2	1	1	1	7
		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		12	12	11	11	11	57	
Trigger		8	8	8	8	8	40	
Core Computing		70	75	81			226	
Human Resources Total			111	120	127	46	46	449