

Summary of Expenditure for CMS Maintenance & Operations for the Year 2009

INTRODUCTION

This document summarizes the expenditure that the CMS Collaboration has made in 2009 in order to maintain and operate the already constructed detectors and Collaboration-wide facilities (M&O Cat. A) as well as expenses made directly by the subdetectors communities to maintain their respective subdetectors (M&O Cat. B).

We present the income received in a manner similar to Common Funds and we report the payments classified following the Scrutiny Group's classification.

This is the eighth report that the CMS Collaboration presents on M&O Expenditures and the seventh year we report the M&O Cat. B. The budget request for M&O in 2009 was made in October 2008 (cf. CERN-RRB-2008-089).

Commitments are not detailed in this report owing to the very nature of M&O: long-term commitments should be rare and they will be commented upon in the text in the event they occur.

Most of the Funding Agencies have by now signed the M&O MoU.

1. INCOME

The M&O 2009 approved budget totalled to 10'408 kCHF plus 1'800 kCHF for the Energy consumption.

The actual invoiced amount was 11'216 kCHF.

We note that for 2009 some 178 kCHF, are still outstanding to date (1.9%).

2. PAYMENTS

2.1 M&O-A

An overview of expenditure versus budget is shown in the Annex 1.

The expenses classification presented here follows the categories established by the Scrutiny Group.

- **Expenses**

A significant overspending has been incurred in the M&O-A expenditure for 2009, due to the extended period of shutdown activities and the lack of budget for the maintenance of video-conference software. These facts had already been signalled to the RRB Scrutiny Group in the course of last year although the exact level could not be assessed at the time.

For the shutdown activities, overspending has been incurred in the categories A.1., Detector Related costs and A.7., General Services. The total amount of the expenditure is 8'295 kCHF versus a budget of 5'568 kCHF, an overspend of some 2'700 kCHF and it is due principally to the length of the 2009 shut-down which was twice the period foreseen at the time the budget was requested. In order to prepare for the very long run planned for 2010 and 2011, extensive work was carried out in the second part of the year in parallel with a more continuous operation of the open detector for commissioning. Most of the extra costs were related to manpower and the need to maintain work teams not foreseen in the initial planning, principally affecting budget items A.1.12, Shutdown Activities and A.1.13, General Technical Support. The additional activity required extensive use and maintenance of Moving and Hydraulic Systems and consequently the expenditures on budget line A.1.10 have been higher than budgeted as well as the related activities under A.7., General Services: Heavy Transport, Cranes and Survey.

Additional expenditures have been incurred to implement necessary safety measures in UX5 and SX5, resulting in overspending in the area A.1.11, Detector Safety Systems.

In the area A.1.05, Gas Consumption, there continues to be an overspend as in the previous year which is due to the gas recycling system not yet attaining its full capacity. The expenditure on this item was 624 kCHF as compared to a budget of 496 kCHF. It is expected that the recycling facility will allow for expenditure to be maintained at the allocated level as of 2010. Related work on the Gas Systems, preparation for circulation and purchase of necessary diagnostic equipment resulted in expenditures of 371 kCHF compared to a budget 260 kCHF.

Some additional costs were incurred in the area A.1.07, Cooling Fluids (above -50°C) with an expenditure of 336 kCHF vis-à-vis a budget allocation of 220 kCHF. This is due to the refurbishing of the C6F14 Plant and some leaks.

One specific item unrelated to shutdown activities, where an overrun was incurred, is in the category of Communications where, despite a request from CMS, no allocation was granted in 2009 for the budget item A.3.02, Collaborative Tools for the operation and maintenance of EVO, for which CMS was charged 323 kCHF.

In view of the anticipated budget over-run and to limit its impact, efforts were made to reduce the deficit by limiting and delaying expenditures on any other activity:

The overspending mentioned above totals some 3'050 kCHF. Thanks to efforts in other areas, globally the M&O-A material expenditure totals 12'796 kCHF compared to a budget of 10'408 kCHF, giving an overall overspending of 2'388 kCHF.

CMS will attempt to absorb the current budget deficit over the period 2010 – 2011 on the assumption that during this period the LHC will be in a constant running mode until November 2011 with only a short technical stop at the end of 2010 (in accordance with the LHC schedule agreed during the Chamonix Workshop).

- **Outstanding commitments**

The total amount of open commitments at the end of the year totalled some 801 kCHF, of which some 45% are related to industrial support contracts for 2009. The remainder are for consumables and goods to be delivered this year.

2.2 M&O-B by sub-detector

- **Tracker**

Contributions from Funding Agencies fully covered the Tracker budget request. Cash contributions paid directly to Tracker Team accounts amounted to 62% of the request and the rest was paid directly by collaborating Institutes for documented purchase of materials and/or services.

Overall, there was no funding problem in 2009. The arrangements with individual Funding Agencies and Institutes generally worked as expected. Furthermore, all Funding Agencies provided their expected shares of Human Resources as Technical Manpower at CERN.

During 2009, the Tracker undertook a major financial endeavor: the complete refurbishment of the Cooling system, which was defective, at a cost of 873 kCHF from the M&O-B budget. After cooling refurbishment, the major categories of M&O expenses were: Hired Manpower, the maintenance and procurement of spares for the Power Supply system, the ordinary Cooling system maintenance. A few individual items, namely Read-out electronics and Areas, required much less funding than requested. However, the funds saved on those items were all spent for the Cooling system. Without those savings, the Tracker would have needed extra contributions, and/or should have turned to CMS for help.

- **ECAL**

The total 2009 M&O B requests for the Material Resources for the Electromagnetic Calorimeter of CMS was 1'433 kCHF. Contributions to these expenses were made either by placing orders directly to, or by cash contributions to the ECAL M&O B account. The total amount received was 1'507 kCHF (105% of the Draft Budget). The main expenses were in the category of Hired Manpower at CERN (B.1.14) and to cover the second payment for the crystals used to equip the 37th Super Module (B.1.10).

- **HCAL**

In 2009 HCAL reorganized to move from installation/commissioning to the operations phase of the experiment. The main activities focused on preparing the detector for collisions, including replacement of noisy HPDs and fabrication, installation, and commissioning of improved DCC boards (DCC2). HCAL participated fully in the cosmic runs throughout the year and in the colliding beam runs in November and December. CASTOR and ZDC are installed and both recorded data during the 900 GeV and 2.36 TeV runs. In addition, HO SiPM demonstrator boxes were installed and operated in the detector and SiPM radiation damage and aging studies were done, and beam tests of multi-anode and anti-Cherenkov PMTs for HF were conducted. All participating Funding Agencies contributed to these activities.

- **Muons**

For the Muon Barrel Drift Tubes and Barrel Alignment and Link Alignment the requested budget was used in line with the original request. During 2009 the largest fraction of the budget was spent, as foreseen, on hired manpower, in order to keep few positions of experts and coordinators available at CERN during maintenance and recommissioning of the apparatus, and finalization of the alignment system. The amount of repairs of the HV-LV system was completely in line with expectations. The M&O-B sharing between the Funding Agencies took into account the overall responsibilities (in the DT system it was agreed to share by investment until 2012) and all contributions from 2009 budget were received as agreed.

The CSC expenditures in 2009 were in line with the original budget, with the exception of the additional cost of cooling system repair. There were no major expenditures incurred which were not foreseen in the original budget. All Funding Agencies provided resources as requested and the M&O-B arrangements worked satisfactorily.

- **Trigger**

The total expenditure in 2009 was 134 kCHF against an income of 163 kCHF. The spending was therefore accommodated well within the total income.

The main cost to the budget was the upfront purchase of RPC link board spares. Other expenses included the cost of central software manpower and minor operational and stores costs. No major expenditures were incurred which were not foreseen in the original budget.

ANNEXES

Annex 1: M&O Cat. A Expenditures vs. Budget in 2009

ANNEX 1

M & O Cat. A Expenditure vs. Budget in 2009

Year	2009
System	A. M&O-A

Type	M&O-A w/o Power	Subsystem	Item	kCHF	
				Budget	Payments
Expense	M&O-A w/o Power	A.1. Detector related costs	A.1.01 Magnet	30	36
			A.1.02 Magnet controls	142	158
			A.1.03 Magnet power supply	40	43
			A.1.04 Gas systems	260	371
			A.1.05 Gas consumption	496	624
			A.1.06 Cooling systems	220	228
			A.1.07 Cooling fluids(above -50°C)	220	336
			A.1.08 External cryogenics	375	385
			A.1.09 Cryogenic fluids (below -50°C)	90	112
			A.1.10 Moving /hydraulic systems	130	572
			A.1.11 Detector safety systems	180	845
			A.1.12 Shutdown activities	410	820
			A.1.13 General Technical support	610	1,123
			A.1.14 UPS maintenance	80	91
			A.1.15 Electronics pool rentals		
			A.1.16 Beam pipe & vacuum	390	387
			A.1.17 Counting & control rooms	240	263
		<i>A.1. Detector related costs Total</i>		3,913	6,394
		A.2. Secretariat	A.2.01 Secretarial assistance	225	225
			A.2.02 Economat	15	15
			A.2.04 Printing and publication	50	43
		<i>A.2. Secretariat Total</i>		290	282
		A.3. Communications	A.3.01 GSM phones; on-call service	20	20
			A.3.02 Collaborative tools	100	366
		<i>A.3. Communications Total</i>		120	386
		A.4. On-line computing	A.4.01 System management	796	723
			A.4.02 Data storage, (temporary on disk)	52	45
			A.4.03 Detector controls	130	130
			A.4.04 Computers /processors /LANs	1,422	1,135
			A.4.05 Software licenses		
		<i>A.4. On-line computing Total</i>		2,400	2,033
		A.5. Test beams, calibration facilities	A.5.01 General operation	60	59
			A.5.02 Common electronics	15	15
			A.5.03 Electronics pool rentals	20	21
			A.5.04 Gas systems	10	10
			A.5.05 Gas consumption	10	9
			A.5.06 External cryogenics		
		<i>A.5. Test beams, calibration facilities Total</i>		115	114
		A.6. Laboratory operations	A.6.01 Assembly areas, clean rooms	20	20
			A.6.02 Workshops	250	257
			A.6.03 Laboratory instruments		
		<i>A.6. Laboratory operations Total</i>		270	277
		A.7. General services	A.7.01 Cooling & ventilation	595	563
			A.7.03 Power distribution system	60	124
			A.7.04 Heavy transport	340	441
			A.7.05 Cranes	35	169
			A.7.06 Cars	30	30
			A.7.08 Survey	130	215
			A.7.09 Storage space	50	36
			A.7.10 Common desktop infrastructure	45	46
			A.7.11 Reviewing & Engineering	150	156
			A.7.12 Outreach	220	121
		<i>A.7. General services Total</i>		1,655	1,901
		A.9. Core Computing Infrastructure & Services	A.9.01 Central computing environment	458	440
			A.9.02 Software process service	220	166
			A.9.03 User support	202	197
			A.9.04 Central production operations	695	585
			A.9.05 Hardware	70	20
		<i>A.9. Core Computing Infrastructure & Services Total</i>		1,645	1,408
		<i>M&O-A w/o Power Total</i>		10,408	12,796
		Power		1,800	436
		<i>Expense Total</i>		12,208	13,233
		<i>Income</i>		11,216	10,977