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# Summary of Expenditure for CMS Maintenance & Operations for the Year 2007

## INTRODUCTION

This document summarizes the expenditure that the CMS Collaboration has made in 2007 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).

In line with the Expenditure Report for Construction, 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 sixth report that the CMS Collaboration presents on M&O Expenditures and the fifth year we report the M&O Cat. B. The budget request for M&O in 2007 was made in October 2006 (cf. CERN-RRB-2006-089).

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 2007 approved budget totalled to 8'098 kCHF plus 1'600 kCHF for the Energy consumption.

The actual invoiced amount was 8'847 kCHF.

We note that for 2007 some 115 kCHF, out of the invoiced contributions of 8'847 kCHF, are still outstanding to date (1.3%).

## 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**

In the area A.1.05, Gas consumption, we note a large overspending. On the other hand, the area A.1.08, External Cryogenics, has under spent due to the Magnet not being cooled down during 2007 as foreseen initially.

Overall the A.1 area, Detector related costs, is just over budget.

The higher than expected consumption of gas is largely due to the current lack of a recycling system and to leaks discovered while commissioning the various detectors. We expect to have a working recycling system during 2009. The current year is therefore expected to also show high gas consumption, but this was already foreseen in the 2008 budget.

The other areas show expenses close to the budgeted level leading to global underspending of some 1.5%.

For the Core Computing area, we received in-kind contributions from Germany, Italy, USA-DoE and USA-NSF.

- **Outstanding commitments**

The total amount of open commitments at the end of the year totalled some 135 kCHF.

Of these, some 110 kCHF are due to goods and/or services delivered before the end of the year. The remaining 25 kCHF are for goods to be delivered during 2008, mostly for cryogenics, fluids and transport operations.

## 2.2 M&O-B by sub-detector

- **Tracker**

The Silicon Strip Tracker (SST) budget for the year 2007 was 1'913 kCHF. The main expenses were related to the continuing integration of the Tracker Services in CMS, and the corresponding manpower requirements. Expenses related to the Tracker Integration Facility at CERN, accounted for approximately 25% of the total. While procurement of spares for many components has been completed in previous years, the procurement of spares for the Tracker Power Supply System is ongoing. This represented about 10% of the overall budget.

- **ECAL**

The total 2007 M&O B requests related to the Material Resources for the Electromagnetic Calorimeter of CMS amount to 1'398 kCHF. Contributions to these expenses were made either by placing orders directly or by additional cash contributions to the ECAL M&O B account. The total amount received has been 1'324 kCHF (95% of the Draft Budget).

The main expenses have been related to the Front End electronics, including the Motherboards (B.1.05), to the Hired Manpower at CERN (B.1.14) and to the Calibration Lasers (B.1.09).

For the Human Resources, the contributions provided have been of 15 Staff years, mainly used for the end of the construction and for the installation of the Barrel.

- **HCAL**

During 2007 HCAL continued integration activities both in the surface hall and underground. The on-detector front-end electronics are fully installed and cabling is nearly complete. HCAL is participating in the Global Runs, and detector commissioning is underway. Software development for the slow controls, detector safety system, for data monitoring, and for calibration is progressing.

In addition to detector commissioning, test beam activities provided a preliminary calibration of the combined endcap calorimeter (EE/ES/HE), and R&D was conducted on SiPMs as a possible replacement for HO HPDs.

All participating Funding Agencies contributed to these activities.

- **Muons**

For the Muon Barrel Drift Tubes, Barrel RPCs, Barrel Alignment and Link Alignment the requested budget was used in line with the original request, mainly on areas, store items and gas supply, and hired or technical manpower.

For the other Muon areas, expenses concentrated mostly on electronics, both standard and Front-End.

The M&O-B sharing between the Funding Agencies took into account the overall responsibilities and the different Funding Agencies contributed as expected.

- **Trigger**

Purchases of spares for the Trigger components have continued during 2007. This is expected to be completed during 2008. The Funding Agencies contributed to these purchases as expected.

## ANNEXES

**Annex 1:** M&O Cat. A Expenditures vs. Budget in 2007

# ANNEX 1

## M & O Cat. A Expenditure vs. Budget in 2007

Year	2007
System	A. M&O-A

Type	Subsystem	Item	kCHF	
			Budget	Payments
Expense	M&O-A w/o Power	A.1. Detector related costs		
		A.1.01 Magnet	40	48
		A.1.02 Magnet controls	142	142
		A.1.03 Magnet power supply	60	69
		A.1.04 Gas systems	210	170
		A.1.05 Gas consumption	200	494
		A.1.06 Cooling systems	180	206
		A.1.07 Cooling fluids(above -50°C)	200	200
		A.1.08 External cryogenics	465	233
		A.1.09 Cryogenic fluids (below -50°C)	40	25
		A.1.10 Moving/hydraulic systems	100	137
		A.1.11 Detector safety systems	65	67
		A.1.12 Shutdown activities	410	674
		A.1.13 General Technical support	610	590
		A.1.14 UPS maintenance	80	
		A.1.15 Electronics pool rentals		
		A.1.16 Beam pipe & vacuum	240	119
		A.1.17 Counting & control rooms	200	131
		<i>A.1. Detector related costs Total</i>	3,242	3,305
		A.2. Secretariat		
		A.2.01 Secretarial assistance	180	190
		A.2.02 Economat	15	6
		A.2.04 Printing and publication	50	69
		<i>A.2. Secretariat Total</i>	245	265
		A.3. Communications		
		A.3.01 GSM phones; on-call service	20	20
		A.3.02 Automatic call-back	50	64
		<i>A.3. Communications Total</i>	70	84
		A.4. On-line computing		
		A.4.01 System management	395	355
		A.4.02 Data storage, (temporary on disk)	16	21
		A.4.03 Detector controls	95	90
		A.4.04 Computers/processors/LANs	690	725
		A.4.05 Software licenses	60	3
		<i>A.4. On-line computing Total</i>	1,256	1,194
		A.5. Test beams, calibration facilities		
		A.5.01 General operation	80	64
		A.5.02 Common electronics	45	36
		A.5.03 Electronics pool rentals	20	17
		A.5.04 Gas systems	10	8
		A.5.05 Gas consumption	10	8
		A.5.06 External cryogenics		
		<i>A.5. Test beams, calibration facilities Total</i>	165	133
		A.6. Laboratory operations		
		A.6.01 Assembly areas, clean rooms	30	24
		A.6.02 Workshops	250	244
		A.6.03 Laboratory instruments		
		<i>A.6. Laboratory operations Total</i>	280	268
		A.7. General services		
		A.7.01 Cooling & ventilation	470	470
		A.7.03 Power distribution system	60	60
		A.7.04 Heavy transport	610	509
		A.7.05 Cranes	70	201
		A.7.06 Cars	40	6
		A.7.08 Survey	130	154
		A.7.09 Storage space	70	67
		A.7.10 Common desktop infrastructure	60	32
		A.7.11 Reviewing & Engineering	130	130
		A.7.12 Outreach	220	110
		<i>A.7. General services Total</i>	1,860	1,740
		A.9. Core Computing Infrastructure & Services		
		A.9.01 Central computing environment	141	230
		A.9.02 Software process service	141	92
		A.9.03 User support	141	110
		A.9.04 Central production operations	458	458
		A.9.05 Hardware	100	48
		<i>A.9. Core Computing Infrastructure &amp; Services Total</i>	980	937
		<i>M&amp;O-A w/o Power Total</i>	8,098	7,927
		<i>Power</i>	1,600	1,455
		<i>Expense Total</i>	9,698	9,382
		<i>Income</i>	9,698	9,548