

Summary of Expenditure for CMS Maintenance & Operations for the Year 2006

INTRODUCTION

This document summarizes the expenditure that the CMS Collaboration has made in 2006 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 fifth report that the CMS Collaboration presents on M&O Expenditures and the fourth year we report the M&O Cat. B. The budget request for M&O in 2006 was made in October 2005 (cf. CERN-RRB-2005-108).

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

An overview of income versus budget can be found in the Financial Report (cf. CERN-RRB-2007-009).

The M&O 2006 approved budget totaled to 6'691 kCHF plus 700 kCHF for the Energy consumption.

The actual budget invoiced was 6'252 kCHF plus Energy, a 439 kCHF reduction due to the slower ramp-up of the Core Computing manpower.

We note that for 2006 some 181 kCHF, out of the invoiced contributions of 6'252 kCHF, are still outstanding (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, Detector related costs, we note an overall overspending of slightly less than 6% of the budget. Gas and cryogenic fluids consumption are largely responsible for this situation.

The higher than expected consumption of gas is largely due to the current lack of a recycling system. It is expected to have a working recycling system during 2009. The current year and 2008 are therefore expected to also show higher than foreseen gas consumption.

The higher than expected cryogenic consumption arose from the Magnet test during which we lost important quantities of helium.

In the area A.4, On-line Computing, we note an underspend of some 300 kCHF. This is mostly due to delayed hiring of personnel.

The other areas show expenses at or below budget, leading to global underspending of some 4%.

For the Core Computing area, we received in-kind contributions from Belgium, Germany, Italy, USA-DoE and USA-NSF, for a total of 5.2 FTE.

- **Outstanding commitments**

The total amount of open commitments at the end of the year totaled some 216 kCHF.

Of these, some 116 kCHF are due to goods and/or services delivered before the end of the year. The remaining 100 kCHF are for goods to be delivered during 2007, mostly for cryogenics, fluids and transport operations.

2.2 M&O-B by sub-detector

- **Tracker**

The Silicon Strip Tracker (SST) budget for year 2006 was 2006 kCHF. All contributions were made available as expected. A substantial fraction of the budget (20%) was devoted to the procurement of spare components, mainly for additional silicon strip sensor modules, and for the Power System. The rest was used for the area allocated to the SST integration (electronics, cooling, cabling, network), and the corresponding manpower costs.

- **ECAL**

The total 2006 M&O B requests related to the Material Resources for the Electromagnetic Calorimeter of CMS amount to 1390 kCHF. Contributions to these expenses were made either by placing orders directly or by cash contributions through the ECAL M&O-B account. The total amount received has been of 1247 kCHF (90% of the draft budget).

The main expenses have been related to the hired manpower at CERN (B.1.14), to the calibration lasers (B.1.09), to Front End electronics (B.1.05) and to the H4 Test Area (B.1.11).

For the Human Resources, the contributions provided have been of 8.3 Staff years; this is very close to the expected value of 8.0 Staff years.

- **HCAL**

Major HCAL 2006 M&O-B activities included participation in the MTCC (Magnet Test and Cosmic Challenge) and vertical slice commissioning in SX5 and measurement of the combined calorimeter (EB/HB+HO,HE) response to hadrons using final readout electronics in the H2 test beam.

Other continued HCAL activities included HB/HE/HO RBX burn-in, installation and commissioning in SX5 and HF RoBox startup in bldg. 186, trigger/DAQ electronics installation and commissioning in bldg. 904, and development of the initial calibration paradigm for source and laser calibration of HB/HE/HF. Work continued on the DCS upgrade and on integration with all of CMS.

Other activities included work on HF trigger upgrade, upgrades to the source driver, and SiPM (Silicon photo-multiplier) R&D as a potential upgrade for the HO HPDs.

- **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 2006. This is expected to be completed during 2007 and 2008. The Funding Agencies contributed to these purchases as expected.

ANNEXES

Annex 1 : M&O Cat. A Expenditures vs. Budget in 2006

ANNEX 1

M & O Cat. A Expenditure vs. Budget in 2006

Year	2006
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	50	43
			A.1.02 Magnet controls	102	102
			A.1.03 Magnet power supply	20	16
			A.1.04 Gas systems	110	84
			A.1.05 Gas consumption	150	256
			A.1.06 Cooling systems	170	50
			A.1.07 Cooling fluids(above -50°C)	15	
			A.1.08 External cryogenics	430	416
			A.1.09 Cryogenic fluids (below -50°C)	24	119
			A.1.10 Moving/hydraulic systems	70	136
			A.1.11 Detector safety systems	45	41
			A.1.12 Shutdown activities	130	109
			A.1.13 General Technical support	600	690
			A.1.14 UPS maintenance	50	40
			A.1.15 Electronics pool rentals		
			A.1.16 Beam pipe & vacuum	80	123
			A.1.17 Counting & control rooms	160	112
		<i>A.1. Detector related costs Total</i>		2,206	2,336
		A.2. Secretariat	A.2.01 Secretarial assistance	180	180
			A.2.02 Economat	15	5
			A.2.04 Printing and publication	50	64
		<i>A.2. Secretariat Total</i>		245	250
		A.3. Communications	A.3.01 GSM phones; on-call service	20	16
			A.3.02 Automatic call-back		
		<i>A.3. Communications Total</i>		20	16
		A.4. On-line computing	A.4.01 System management	347	94
			A.4.02 Data storage, (temporary on disk)	25	25
			A.4.03 Detector controls	70	70
			A.4.04 Computers/processors/LANs	386	395
			A.4.05 Software licenses	60	2
		<i>A.4. On-line computing Total</i>		888	586
		A.5. Test beams, calibration facilities	A.5.01 General operation	100	123
			A.5.02 Common electronics	45	40
			A.5.03 Electronics pool rentals	30	32
			A.5.04 Gas systems	10	9
			A.5.05 Gas consumption	10	
			A.5.06 External cryogenics		
		<i>A.5. Test beams, calibration facilities Total</i>		195	203
		A.6. Laboratory operations	A.6.01 Assembly areas, clean rooms	40	32
			A.6.02 Workshops	250	221
			A.6.03 Laboratory instruments		
		<i>A.6. Laboratory operations Total</i>		290	253
		A.7. General services	A.7.01 Cooling & ventilation	240	240
			A.7.03 Power distribution system	50	50
			A.7.04 Heavy transport	550	520
			A.7.05 Cranes	70	39
			A.7.06 Cars	40	39
			A.7.08 Survey	130	130
			A.7.09 Storage space	100	59
			A.7.10 Common desktop infrastructure	60	64
			A.7.11 Reviewing & Engineering	130	130
			A.7.12 Outreach	60	77
		<i>A.7. General services Total</i>		1,430	1,347
		A.9. Core Computing Infrastructure & Serv	A.9.01 Central computing environment	346	353
			A.9.02 Software process service	145	147
			A.9.03 User support	182	185
			A.9.04 Central production operations	205	209
			A.9.05 Hardware	100	88
		<i>A.9. Core Computing Infrastructure & Services Total</i>		978	983
		<i>M&O-A w/o Power Total</i>		6,252	5,973
		<i>Power</i>		700	700
		<i>Expense Total</i>		6,952	6,673
		<i>Income</i>		6,952	6,623