

Draft Budget for CMS Construction in the Year 2003

INTRODUCTION

This document summarizes the budget required for the payments that the CMS Collaboration plans to make in the year 2003 in order to follow the detector construction schedule.

The year 2003 will be the sixth year of Magnet construction, and construction has started for all subdetectors, except for the Data Acquisition system. The construction of the latter will commence after the approval of its Technical Design Report (TDR) which will be submitted by the end of 2002.

The present estimates for the payments which are expected to be made during the year 2003 by the CMS institutes and from the Common Funds add up to over 86 MCHF. This is respectively about 20 % of the total originally estimated CMS construction cost and 17% of the CMS revised cost (cf. CMS Financial Plan, CERN-RRB-2002-010). Adding this to the payments which have already been made up to the end of 2001 (172.6 MCHF) and to the budget for the year 2002 (90 MCHF), about 350 MCHF will have been paid by the end of the year 2003. This is respectively about 77 % of the total originally estimated detector construction cost and 70% of the detector revised cost.

The figures shown as "Income and Payments expected in 2003" in the Summary Table (Annex 10) are to be considered as best estimates at the present stage. They will depend, case by case, on commercial tenders received, on contract negotiations and on currency exchange rates. It is, therefore, difficult to provide precise estimates except for due payments arising from existing contractual commitments.

The financial commitments on the Common Funds will be normally limited to the cash balance of these Funds (unless funding agencies underwrite formal guarantees for future payments).

This document presents in Annex 9 the budget request for Commissioning & Integration. In contrast to the Preliminary Draft Budget presented at the April RRB (cf. CERN-RRB-2002-008) we do not present the budget request for any other Cost to Completion item. These other items are treated in detail in the CMS Financial Plan (cf. CERN-RRB-2002-086).

1. MAGNET

An overview of the 2003 budget requirements is shown in **Annex 1**. The total preliminary budget estimate for the Magnet Common Project is about 7.5 MCHF.

Following the agreed policy of the CMS Collaboration concerning the ways of making contributions to the CMS Common Projects, the Draft Budget for 2003 for the CMS Magnet is broken down by the three following categories:

- (a) procurements from the CMS Magnet Common Fund,
- (b) payments to contracts (further broken down into Packages A to H), and
- (c) in-kind contributions.

1.1 Procurements from the CMS Magnet Common Fund

Items that are neither procured directly through CMS institutes, nor provided as in-kind contributions are procured through CERN and paid from the CMS Magnet Common Fund. The total amount of payments through the CMS Magnet Common Fund is presently estimated to be about one-third of the total cost of the CMS Magnet.

Many construction funds have been authorized up to and including the year 2002. Due to some delays in the construction a part of the authorized funds need to be carried forward to the year 2003 for payment. For the year 2003 the additional expected payments, beyond the funds already authorized, amount to some 4.3 MCHF. The breakdown of these expenditures is given in Annex 1.

The largest payments from the CMS Magnet Common Fund will be for the:

- helium system,
- coil surface tests,
- rigging equipment,
- magnet control system,
- the vacuum system, and the
- CERN/CEA Cooperation Agreement.

The expected payments for all these larger items add up to some 2.7 MCHF.

The initial payment for the rental of the 2'200 tons crane is reported in the accompanying document, the CMS Financial Plan, CERN-RRB-2002-086.

1.2 Payment to Contracts

Many large procurements for the CMS magnet were organized through institutes of the CMS Collaboration. Most of these procurements are scheduled to be completed by the end of 2002. It may happen that for some projects authorized funds need to be carried over into the year 2003 for payment.

The projects where payment to contract will also occur in the year 2003 are quality assurance of the superconducting cable and the coil winding. Quality assurance shall be covered by ETH Zurich and the estimated cost in the year 2003 is 100 kCHF. INFN had placed, within the framework of the CERN-INFN Co-operation Agreement, a major contract with Ansaldo (Italy) for the design, development, and procurement of the winding of the superconducting coil for the CMS Magnet. The payments for this contract in the year 2003 will be about 3.1 MCHF, to be made by INFN as part of its contribution to the CMS Magnet Common Project.

1.3 In-kind Contributions

All approved in-kind contributions have been delivered to CERN and have been reported to the RRB in previous years.

2. TRACKER

An overview of the 2003 budget requirements is shown in **Annex 2**. The total budget estimate for the CMS Tracker is 30.7 MCHF.

The year 2002 completes the transition from the development to construction phase of the CMS Silicon Strip Tracker. Contracts for the two largest procurements for the Tracker Project were placed during 2001, for the silicon sensors and optical links respectively. During the last quarter of 2002 and the first half of 2003, the contracts for the remaining silicon detector components will be placed, and module assembly will start. In the year 2003 the module assembly will ramp up to reach the full rate of about 50 modules/day. This is reflected in the total anticipated expenditures of about 29 MCHF for the year 2003 on the Silicon Strip Tracker.

For the Pixel Vertex detector, expenditures in the year 2003 will ramp up to about 20% of the overall Pixel estimated cost.

3. ELECTROMAGNETIC CALORIMETER

An overview of the 2003 budget requirements is shown in **Annex 3**. The total estimated cost for the Electromagnetic Calorimeter (ECAL) is 16.1 MCHF.

It is still hoped that before the end of the year 2002 the last purchase order for crystals could be negotiated subject to the availability of financial guarantees. This order is for about 16000 endcap crystals at about 6.8 MUSD to be paid between 2003 and 2005. This and other items which cannot be covered inside the allocated ECAL funding, are to be found in the CMS Financial Plan, CERN-RRB-2002-086.

Two contracts for barrel crystal production are already running in parallel. The total estimated payments for barrel crystal production in the year 2003 amounts to 5 MCHF.

Large procurement contracts for photodetectors – APDs for the barrel and VPTs for the endcaps – have already been placed and the estimated payments in the year 2003 are 1.8 MCHF.

The contract for the procurement of the high voltage system for the barrel was placed in 2002 and will require 1.0 MCHF during 2003.

During the year 2002 it was foreseen to conclude purchase orders for ADCs, front end electronics and optical links. Due to technical reasons the purchase orders have not yet been signed. Nevertheless, it is expected that these procurements will require 4.1 MCHF in the year 2003.

Other procurement expenditures are foreseen for

- mechanical structures for barrel and endcaps,
- investments for the assembly and installation of the barrel,
- parts for the monitor systems, and
- detectors for the preshower.

In order to adhere to the tight construction and installation schedule, a number of critical orders must still be committed by the end of 2002/beginning of 2003.

For several of the anticipated procurements authorization for commitment has not been given yet. Delays which already occurred in the authorization of funds have a direct impact on the construction schedule and the timely completion of the detector.

Some funds authorized for procurements in 2002 are carried forward to the year 2003.

4. HADRON CALORIMETER

An overview of the 2003 budget requirements is shown in **Annex 4**. The total budget estimate for the HCAL is almost 7 MCHF.

4.1 Barrel (HB)

In 2003, assembly of the barrel calorimeter (HB) in SX5 will have been completed. The readout boxes with front-end electronics and phototransducers (HPDs) will be installed on HB. A vertical slice test of the front-end, readout, and control electronics will commence in SX5. Testbeam calibration activity will continue in the H2 test beam.

4.2 Outer Barrel (HO)

Assembly of the outer HCAL (HO) tile trays will be completed and all trays will be at CERN in the beginning of 2003. The tile trays will be tested at CERN and installation of the trays will commence. Fabrication of the readout boxes will be in process during the year.

4.3 End Cap (HE)

Assembly of the endcap calorimeter (HE) in SX5 will also be completed in 2003. The readout boxes with front-end electronics and phototransducers (HPDs) will be installed on HE. Tests of HE will continue in SX5.

4.4 Forward (HF)

Delivery of the forward calorimeter (HF) absorber wedges and the associated installation tooling will be completed in 2003. A number of the wedges will be fully optically assembled and tested with radioactive sources. A substantial number of HF wedges will be tested in the test beam. The photo-multiplier tube (PMT) and base production will continue in 2003. The readout boxes will be finished and ready for installation onto the detector. Assembly of the HF table will be completed.

5. MUON DETECTOR

An overview of the 2003 budget requirements is shown in **Annex 5**. The total budget estimate for the Muon Detector is 11.8 MCHF. Some items are unfunded and reported in the CMS Financial Plan, CERN-RRB-2002-086.

5.1 Barrel Drift Tubes (DTs)

With electrode production continuing at JINR and IHEP-Protvino, mass production of chambers will be ongoing at RWTH Aachen, INFN Padova, INFN Torino and CIEMAT Madrid, where, by the end of 2003 a total of over a hundred chambers will be completed. Chamber installation on wheels YB-0 and YB-1 will take place at the end of 2003. A significant part of the foreseen budget will be spent on read out electronics and trigger procurements.

5.2 Forward ME1/1

The completed ME 1/1 Cathode Strip Chambers (CSCs) are scheduled for installation onto the first endcap yoke disk in mid-2003. For the second endcap yoke disk, YE1, 36 ME 1/1 CSCs are foreseen to be manufactured in JINR.

5.3 Endcap Cathode Strip Chambers (CSCs)

In 2003, the mechanical assembly of 144 CSCs at Fermilab will be finished. More than 50% of the CSCs will be assembled with on-chamber electronics and tested at the FAST sites at the University of Florida and UCLA and then shipped to CERN. The CSC factories at PNPI and JINR, Russia and IHEP, China will continue CSC assembly with electronics using US supplied electronics and parts. Installation of the CSCs at CERN on the YE2 iron yoke disc at SX5 will continue. The mass production of the off-chamber electronics will begin.

5.4 Barrel Resistive Plate Chambers (RPCs)

The largest part of the expected budget will be invested in the procurement of electronics, while the rest will be used for the payments for bakelite and single gaps, for tooling and for assembly and installation.

5.5 Forward Resistive Plate Chambers (RPCs)

Most of the estimated payments will be needed for the procurement of single gaps in Korea, for the procurement of the front-end electronics in Pakistan and for the construction of the mechanical structures for the chambers in China.

5.6 Alignment

The foreseen budget will be invested in the procurement of front-end electronics, board computers and Data Acquisition hardware for the Barrel alignment. Furthermore, link-MAB instrumentation, ME1/1 chamber optical sensors and mounts along with part of the laser system will be procured.

6. TRIGGER AND DATA ACQUISITION

An overview of the 2003 budget requirements is shown in **Annex 6**. The total budget estimate for the Trigger and Data Acquisition System is 3.2 MCHF, and the Trigger is in full construction phase.

6.1 Trigger

The Calorimeter Trigger preliminary budget (some 1.2 MCHF) will be dedicated to the assembly of backplanes, receiver cards, electron isolation and clock cards of the regional trigger.

The production of the muon port cards, sector receiver cards and sector processor cards of the Cathode Strip Chambers Trigger will be pursued in 2003. The budget for the CSC trigger is about 0.3 MCHF

Some 1.0 MCHF will have to be paid for the RPC Trigger construction in the year 2003. This amount will be used to purchase the link boards mechanics, the production of the pattern comparator ASIC and the preproduction of the trigger boards.

6.2 Data Acquisition

The construction of the Data Acquisition will begin after the approval of its Technical Design Report (TDR) to be submitted by the end of 2002. A small amount (0.5 MCHF) is foreseen for final prototypes of readout elements.

7. OFFLINE COMPUTING

An overview of the 2003 budget requirements is shown in **Annex 7**. The total budget estimate for the Offline Computing Common Project is 0.25 MCHF.

CERN acts as central point for the storage of information concerning the Collaboration and its computing. There is an on-going improvement programme on file- and information-servers to provide the necessary computing facilities, project management, consultancy and support. In order to sustain the prototyping work, which is in accordance with the CMS Computing Model and its associated milestones, it is necessary to upgrade the existing equipment and purchase new systems.

The software development team makes use of commercial software products, which allow the team to take advantage of modern techniques. Software licenses are purchased for the CMS-wide use and evaluation of software products.

8. INFRASTRUCTURE

An overview of the 2003 budget requirements is shown in **Annex 8**. The total budget estimate for Infrastructure is 4.2 MCHF.

The detector assembly at SX5, the preparation for underground installation, which will begin in the second half of 2004, are the major components of the budget.

CERN will contribute for 4.0 MCHF, and 0.2 MCHF will be the value of in-kind contributions from Russia for the construction of the Rotating shielding. Additional in-kind contributions to build the YE4 shielding disks and the Forward Cylindrical Shielding (FCS) are being negotiated and are reported in the CMS Financial Plan, CERN-RRB-2002-086.

The major payments foreseen in 2003 are as follows:

- General installation will continue, and procurements of racks will start at level of 0.6 MCHF. The installation of cable trays and racks on the magnet yoke will continue for an estimated cost of 0.2 MCHF. The construction of the beam pipe will need 0.6 MCHF.
- The construction of the thermal shield against heat from cables will need 0.6 MCHF.
- The construction of the rotating shielding will continue at Protvino in the year 2003.

9. COMMISSIONING & INTEGRATION

An overview of the 2003 budget requirements is shown in **Annex 9**. The total budget amounts to almost 6 MCHF. The biggest material expenses foreseen are for the preparation of the surface hall for commissioning: 0.7 MCHF for pre-testing facilities and 0.6 MCHF for common electronics. The Magnet closing system is foreseen to almost 0.8 MCHF.

The support team needed to carry out the above activities is estimated to some 0.5 MCHF. Heavy transport operations will amount to over 0.4 MCHF.

As the 2002 C&I Budget has not been fully available, we have delayed some less critical activities as well as paid C&I items from the Magnet Common Fund. The latter item corresponds to 637 kCHF, which will have to be reimbursed in the year 2003 to the Magnet Common Fund. Both the delayed activities and the repayment have been added to the 2003 C&I Preliminary Draft Budget (cf. CERN-RRB-2002-015) to produce the present request.

10. SUMMARY

The numbers given in this document are summarized in **Annex 10** (Income and Payments expected). It should be noted that:

- (1) apart from the C&I budget which is on the critical path for the whole CMS detector, the other Cost to Completion items are not treated here. However, the CMS Financial Plan, CERN-RRB-2002-086, presents them in detail.
- (2) the numbers shown as "Payments Expected" are current best estimates.

- (3) the use of uncommitted funds, which may have been allocated by the funding agencies to their respective institutes in previous years for payments expected in 2003, is a matter of policy for the respective funding agencies and their associated institutes. Therefore they are not included in this document (except for the CMS Common Funds).
- (4) in addition, the open commitments to be expected for the end of the year 2003 will have to be covered either by additional cash income or by the corresponding financial guarantees to be provided by the Funding Agencies having not yet made their full contribution to the Common Funds.
- (5) the present budget request is balanced. In particular for the C&I the promised additional contributions cover the anticipated payments for the year 2003.

11. ANNEXES

- Annex 1:** Superconducting Magnet
- Annex 2:** Tracker
- Annex 3:** Electromagnetic Calorimeter
- Annex 4:** Hadron Calorimeter
- Annex 5:** Muon Detector
- Annex 6:** Trigger and Data Acquisition
- Annex 7:** Offline Computing
- Annex 8:** Infrastructure
- Annex 9:** Commissioning & Integration
- Annex 10:** Summary of income and payments expected in the year 2003

ANNEX 1

SUPERCONDUCTING MAGNET

Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
<u>Procurements from Common Fund</u>		
CF-01 Barrel Yoke and Vacuum Tank-Design and Follow-up	1.1.18	72
CF-02 Endcap Yokes-Design and Follow-up	1.2.04	120
CF-03 He Circuits	1.3.08	500
CF-04 Vacuum System	1.3.10	200
CF-05 Power Supply and Bus Bars	1.3.11	150
CF-06 Dump Resistor	1.3.12	150
CF-07 Magnet Safety System	1.3.13	50
CF-08 Magnet Control System	1.3.14	250
CF-09 He Refrigeration External Plant (Main contract)	1.3.15.A	200
CF-10 Components Testing	1.3.16	100
CF-11 Coil Assembly - Tools and Operation	1.3.17.B	100
CF-12 Coil Surface Tests	1.3.18	360
CF-13 Studies and Supervision	1.3.19	1,096
CF-14 Consumables	1.3.20	113
CF-15 Coil Transfer into Underground Cavern	1.3.21	180
CF-16 Implantation and Integration	1.3.22	220
CF-17 2'200 t Crane Rental	1.4.01	
CF-18 Rigging Equipment	1.4.02	285
CF-19 Field Mapping	1.4.05	130
<u>Subtotal Procurements from Common Fund</u>		4,276
<u>Payments to Contracts</u>		
<u>Package A (Barrel Yoke and Vacuum Tank)</u>		
A-01 Barrel Rings and Vacuum Tank	1.1.01	26
Subtotal		26
<u>Package C (Superconducting Cable)</u>		
C-01 Conductor - Quality Assurance	1.3.03	100
Subtotal		100
<u>Package D (Coil Winding)</u>		
D-01 Module Assembly, Swiveling Tooling	1.3.04	3,125
Subtotal		3,125
<u>Subtotal Payments to Contracts</u>		3,251
<u>OVERALL TOTAL</u>		7,527

ANNEX 2**TRACKER**

Payments expected in the Year 2003 (kCHF)

	<u>CE-Ref</u>	<u>Payments expected in 2003</u>
<u>Pixel Detectors</u>		
	2.1	
Detectors (incl. Pre-series)	2.1.01	110
Electronics (include. Engineering)	2.1.02	946
Module Mechanics	2.1.03	351
Support Structures & Assembly	2.1.04	209
	Subtotal	1,616
<u>Silicon Detectors</u>		
	2.2	
Procurement of Sensors	2.2.01	9,921
Kapton	2.2.02	385
Frames	2.2.03	1,312
Pitch Adapters	2.2.04	407
FE Hybrid	2.2.05	1,382
Interconnect Board	2.2.08	471
	Subtotal	13,878
<u>Electronics for Si Detectors</u>		
	2.3	
Module Electronics	2.3.01	1,663
Analogue Link	2.3.02	5,755
Digital Link	2.3.03	514
Analogue Optohybrid	2.3.04	493
Digital Optohybrid	2.3.05	107
FED	2.3.06	403
CCU Module	2.3.07	224
FEC	2.3.08	72
	Subtotal	9,231
<u>Power Supplies for Si Detectors</u>		
	2.4	
Power Supplies	2.4.01	723
Cables (installed)	2.4.02	474
Slow Control	2.4.03	73
	Subtotal	1,270
<u>Mech. Struct. & Cooling for Si Detectors</u>		
	2.5	
Inner Barrel	2.5.01	660
Inner Endcap	2.5.02	264
Outer Barrel	2.5.03	480
Outer Barrel Rods	2.5.04	270
Endcaps	2.5.05	146
Endcaps Petals	2.5.06	171
General Cooling	2.5.07	87
Integration (st, ts,...)	2.5.08	1,980
	Subtotal	4,058
<u>Monitoring for Si Detectors</u>		
	2.6	
Position Monitoring Systems	2.6.01	130
Temperature Control	2.6.03	110
	Subtotal	240
<u>Data Acquisition for Si Detectors</u>		
	2.7	
Test Stands	2.7.01	372
	Subtotal	372
OVERALL TOTAL		30,666

ANNEX 3

ELECTROMAGNETIC CALORIMETER

Payments expected in the Year 2003 (kCHF)

	<u>CE-Ref</u>	<u>Payments expected in 2003</u>
<u>Barrel</u>	<u>3.1</u>	
Crystals	3.1.1	4,908
Electronics	3.1.2	5,123
Mechanics	3.1.3	1,353
Assembly and Installation	3.1.4	1,000
Monitoring	3.1.5	307
	<u>Subtotal</u>	12,691
<u>Endcaps</u>	<u>3.2</u>	
Electronics	3.2.2	235
Mechanics	3.2.3	1,356
Monitoring	3.2.5	241
Preshower	3.2.6	1,609
	<u>Subtotal</u>	3,441
<u>OVERALL TOTAL</u>		16,132

ANNEX 4**HADRON CALORIMETER**

Payments expected in the Year 2003 (kCHF)

	<u>CE-Ref</u>	<u>Payments expected in 2003</u>
<u>Barrel</u>	4.1	
Mechanics	4.1.01	15
Read-out Boxes	4.1.03	5
Front-end Electronics	4.1.05	503
Calibration Systems	4.1.06	17
Trigger/DAQ Electronics	4.1.07	664
Voltage Supply Systems	4.1.08	237
Detector Control Systems	4.1.09	140
Pre-production Prototypes	4.1.10	26
	Subtotal	1,607
<u>Outer Barrel</u>	4.2	
Mechanics	4.2.01	
Optics	4.2.02	265
Read-out Boxes	4.2.03	180
Photodetectors	4.2.04	73
Front-end Electronics	4.2.05	412
Trigger/DAQ Electronics	4.2.07	457
Voltage Supply Systems	4.2.08	89
Detector Control Systems	4.2.09	73
	Subtotal	1,549
<u>Endcap</u>	4.3	
Mechanics	4.3.01	799
Read-out Boxes	4.3.03	5
Photodetectors	4.3.04	1
Front-end Electronics	4.3.05	286
Trigger/DAQ Electronics	4.3.07	544
Voltage Supply Systems	4.3.08	149
Detector Control Systems	4.3.09	54
	Subtotal	1,838
<u>Forward</u>	4.5	
Mechanics	4.5.01	824
Optics	4.5.02	273
Read-out Boxes	4.5.03	56
Front-end Electronics	4.5.05	373
Calibration Systems	4.5.06	43
Trigger/DAQ Electronics	4.5.07	337
Detector Control Systems	4.5.09	81
	Subtotal	1,987
<u>OVERALL TOTAL</u>		6,981

ANNEX 5

MUON DETECTOR

Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
<u>Barrel Drifttubes</u>	5.1	
Detectors and Components	5.1.1	590
Electronics	5.1.2	2,084
Mechanical Structure and Supports	5.1.3	84
Assembly and Installation	5.1.4	231
Service Systems	5.1.6	210
	Subtotal	3,199
<u>Forward ME 1/1</u>	5.2	
Detectors and Components	5.2.1	574
Electronics	5.2.2	100
Mechanical Structure, Supports	5.2.3	100
Assembly and Installation	5.2.4	28
	Subtotal	802
<u>Endcap CSC</u>	5.3	
Detectors and Components	5.3.1	1,719
Electronics	5.3.2	1,339
Assembly and Installation	5.3.4	39
Monitoring	5.3.5	
	Subtotal	3,097
<u>Barrel RPC</u>	5.4	
Detectors and Components	5.4.1	490
Electronics	5.4.2	1,200
Mechanical Structure and Supports	5.4.3	110
Assembly and Installation	5.4.4	150
Monitoring	5.4.5	60
	Subtotal	2,010
<u>Forward RPC</u>	5.5	
Detectors and Components	5.5.1	420
Electronics	5.5.2	400
Mechanical Structure and Supports	5.5.3	355
	Subtotal	1,175
<u>Alignment</u>	5.6	
Barrel	5.6.1	806
Forward	5.6.2	336
Link	5.6.3	383
	Subtotal	1,525
<u>OVERALL TOTAL</u>		11,807

ANNEX 6

TRIGGER/DATA ACQUISITION

Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
<u>Trigger</u>	6.1	
Calorimeter Trigger	6.1.1	1,150
CSC Trigger	6.1.2	300
DT Trigger	6.1.3	100
RPC Trigger	6.1.4	1,050
Global Trigger	6.1.5	150
	<u>Subtotal</u>	2,750
<u>Data Acquisition</u>	6.2	
Read-out Unit	6.2.1	500
	<u>Subtotal</u>	500
<u>OVERALL TOTAL</u>		3,250

ANNEX 7

OFFLINE COMPUTING

Payments expected in the Year 2003 (kCHF)

	<u>CE-Ref</u>	<u>Payments expected in 2003</u>
<u>Offline Computing</u>	<u>7.1</u>	
File Servers	7.1.1	60
Information Servers	7.1.2	30
Computing Power	7.1.3	45
Spares	7.1.4	20
System Assembly	7.1.5	10
Software Licenses	7.1.6	25
System Management	7.1.7	60
<u>OVERALL TOTAL</u>		250

ANNEX 8

INFRASTRUCTURE

Payments expected in the Year 2003 (kCHF)

	<u>CE-Ref</u>	Payments expected in 2003
<u>Access and Survey</u>	8.1	
Structures on Yoke	8.1.2	100
Personnel Access Equipment	8.1.3	300
General Survey	8.1.4	150
	Subtotal	550
<u>General Installation</u>	8.2	
Counting Room Structures	8.2.1	20
Racks with Cooling	8.2.2	500
Electrical Distribution from Outlets	8.2.3	100
Gas Systems and Primary Distribution Racks	8.2.4	350
Beam Pipe	8.2.5	600
Cable Trays to Counting Rooms	8.2.6	100
General Cabling	8.2.7.B	100
General Piping	8.2.8	100
	Subtotal	1,870
<u>Cooling & Ventilation</u>	8.3	
Detector Cooling Plant	8.3.1	300
Detector Specific Ventilation	8.3.2	50
Detector Primary Cooling System	8.3.3	400
	Subtotal	750
<u>Safety</u>	8.4	
Safety Installations	8.4.1	100
Safety Equipment Control	8.4.2	70
Hard-wired Safety System	8.4.3	50
Inertion System	8.4.4	60
	Subtotal	280
<u>Fixed Cranes</u>	8.5	
Lifting Tooling	8.5.4.B	50
	Subtotal	50
<u>Shielding Systems</u>	8.6	
Rotating Shielding	8.6.1	254
Neutron Shielding	8.6.3.B	400
	Subtotal	654
<u>OVERALL TOTAL</u>		4,154

ANNEX 9**Commissioning and Integration**

Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
<u>Additional facilities for commissioning on surface</u>		
	9.1	
Mixed water cooling	9.1.01	30
Gas distribution	9.1.02	100
Control Room (Barrack) Refurbishment	9.1.03	40
Smoke detection	9.1.04	75
LV system (1 generator)	9.1.05	120
Extra electrical and optical cabling in SX5	9.1.07	160
Common Electronics	9.1.08	640
Pre-cabling, Pre-testing facilities	9.1.09	700
Basic DSS for equipment protection	9.1.10	64
Semi Clean Room	9.1.11	60
	<u>Subtotal</u>	1,989
<u>Detector installation, opening and access facilities</u>		
	9.2	
Dummy end flanges (EB, EE, SE)	9.2.2	60
Magnet closing system	9.2.3	795
Control for magnet and power supplies	9.2.4	126
Floor Plates for UXC	9.2.6	336
Cherry Pickers and Access Platforms	9.2.7	300
	<u>Subtotal</u>	1,617
<u>General Services</u>		
	9.3	
Workshops	9.3.1	150
Heavy Transport Contract	9.3.2	501
Survey Contract	9.3.3	86
Infrastructure for Storage	9.3.4	210
Extra engineering design for integr. of magnet&det.	9.3.5	406
CMS Technical support team	9.3.6	500
	<u>Subtotal</u>	1,853
<u>OVERALL TOTAL</u>		5,459

ANNEX 10

Income and Payments expected in the Year 2003 (kCHF)

(This table concerns only items which are listed in the CMS Cost Estimate)

Funding Agencies	COMMON PROJECTS					SUB-DETECTORS					Infrastructure	Commissioning & Integration	TOTALS		
	Common Fund	Payments to Contracts	In-kind Contributions	Subtotals for Magnet	Offline Computing	Totals Common Projects	Tracker	Electromagnetic Calorimeter	Hadron Calorimeter	Muon Detector				Trigger and Data Acquisition	Totals Sub-detectors
	MAGNET			OFFL	Σ						Σ			Σ	
Austria	80			80	20	100	513			30	250	793		11	904
Belgium	185			185	15	200	1,764 [C]					1,764		13	1,977
Bulgaria															
CERN							8,276	3,900		901	500	13,577	4,000	6,800	24,377
China										510		510		404	914
Croatia								25				25		18	43
Cyprus		26		26		26		50				50		8	84
Estonia	10			10		10								3	13
Finland	35			35	15	50	900				250	1,150			1,200
France - CEA								548				548			548
France - IN2P3	740			740		740	3,985	728				4,713			5,453
Germany	11			11		11	3,065			974		4,039		163	4,213
Greece	180			180	20	200		485				485			685
Hungary	30			30		30			273	75		348			378
India	150			150		150			265			265		14	429
Iran									510			510			510
Italy		3,125		3,125	60	3,185	9,506	1,764		3,470		14,740			17,925
Korea										575		575			575
Pakistan [A]										500		500		50	550
Poland	155			155		155					800	800			955
Portugal								250			50	300		14	314
RDMS - DMS									501	100		601			601
RDMS - Russia [B]								366	452	942		1,760	154	29	1,943
Serbia															
Spain					20	20				738		738		82	840
Switzerland - ETHZ	4,700	100		4,800		4,800		4,727				4,727			9,527
Switzerland - PSI					10	10	705					705			715
Switzerland - Univ.							389					389			389
Taipei	200			200		200		10				10		25	235
Turkey	30			30		30			160			160			190
United Kingdom							1,008	1,439			100	2,547			2,547
USA - DOE							332		3,056	2,657	1,300	7,345		1,100	8,445
USA - NSF							222	1,840	1,764	336		4,162			4,162
Funds expected to be carried forward from 2002	-453			-453	585	132								155	287
Reimbursement of C&I expenses to Magnet Common Fund	637			637		637								-637	
Income expected in 2003 plus funds from 2002	6,689	3,251		9,940	745	10,685	30,666	16,132	6,981	11,807	3,250	68,836	4,154	8,252	91,927
Planned payments	4,276	3,251		7,527	250	7,777	30,666	16,132	6,981	11,807	3,250	68,836	4,154	5,459	86,226
Funds expected to be carried forward to 2004	2,413			2,413	495	2,908								2,793	5,701

[A] = Estimated 'Net Western Value.'

[B] = Payment to Contracts plus Estimated 'Net Western Value.'

[C] = The exact commitment to be paid to the Tracker in 2003 depends on the exact amount spent in 2002. The accrued total should never exceed the Belgium commitment of 3,400 kCHF in the MoU

Shaded fields indicate that no contribution is expected in 2003 for this sub-detector from that Funding Agency