Preliminary Draft Budget for CMS Construction in the Year 2003

INTRODUCTION

This document summarizes the preliminary funding requirements 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 this year.

The present preliminary 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 about 91 MCHF, i.e. about 20 % of the total CMS construction cost. 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 53.6 MCHF will have been paid by the end of the year 2003. This is about 77 % of the total estimated detector construction cost.

The figures shown as "Payments expected in 2003" in the Summary Table (Annex 10) are still very tentative at the present stage, and many of them are not yet agreed by the appropriate CMS funding agencies. According to the established procedure, this document is meant to give timely information to the CMS Resources Review Board (RRB) and to provide input for further discussions with the CMS funding agencies to prepare the Draft 2003 Budget, which will be submitted for approval to the RRB in October 2002.

The financial commitments arising from contracts that are expected to be placed in the year 2003 will depend, case by case, on contractual policy and the associated negotiations with the potential contractors. It is, therefore, too early to present reliable and precise estimates for all the commitments to be made by the end of the year 2003.

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).

1. MAGNET

An overview of the preliminary 2003 budget requirements is shown in **Annex 1.** The total preliminary budget estimate for the Magnet Common Project is 6.8 MCHF.

Following the agreed policy of the CMS Collaboration concerning the ways of making contributions to the CMS Common Projects, the Preliminary 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 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 3.9 MCHF. The breakdown of these expenditures is given in Annex 1.

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

- coil surface tests,
- initial payments for renting 2200 tons crane,
- 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 2.5 MCHF.

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 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 only project where payment to contract will also occur in the year 2003 is the coil winding. 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 2.8 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 preliminary 2003 budget requirements is shown in **Annex 2.** The total preliminary budget estimate for the CMS Tracker is 27.4 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, resulting in commitments of about 18.6 MCHF and of 9.4 MCHF for the silicon sensors and optical links respectively. During the year 2002, the contracts for the remaining silicon detector modules 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 25.6 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 preliminary 2003 budget requirements is shown in **Annex 3.** The total estimated cost for the Electromagnetic Calorimeter (ECAL) is 26.8 MCHF.

At present, details of the construction and of its budget for 2003 are still under study. It will depend on the technical progress made and on the conditions to be negotiated with potential vendors during the year 2002.

It is expected that during the year 2002 the last purchase order for crystals will be negotiated subject to the availability of financial guarantees. These are about 16000 endcap crystals for about 6.8 MUSD to be paid between 2003 and 2005.

There are already two additional contracts for barrel crystal production placed which run in parallel. The total estimated payments for crystal production in the year 2003 amounts to 13.5 MCHF.

Large procurement contracts for photodetectors – APDs for the barrel and VPTs for the endcaps – have 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 early 2002 and will require 1.0 MCHF during 2003.

During the year 2002 it is foreseen to conclude purchase orders for ADCs, front end electronics and optical links. 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 be COMMITTED in 2002, even though delivery and payment will start only in 2003.

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

4. HADRON CALORIMETER

An overview of the preliminary 2003 budget requirements is shown in **Annex 4.** The total preliminary budget estimate for the HCAL is 2.8 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. The photo-multiplier tubes (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 in process.

5. MUON DETECTOR

An overview of the preliminary 2003 budget requirements is shown in **Annex 5.** The total preliminary budget estimate for the Muon Detector is 13.2 MCHF.

5.1 Barrel Drift Tubes (DTs)

With part production continuing at JINR, IHEP and Protvino, mass production of chambers will be ongoing at RWTH Aachen, INFN Legnaro and Torino, Ciemat Madrid, followed by chamber installation at CERN. 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. For the second endcap yoke disk, YE1, 36 ME 1/1 CSCs are foreseen to be manufactured in JINR and will be delivered to CERN.

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.

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 preliminary 2003 budget requirements is shown in **Annex 6.** The total preliminary budget estimate for the Trigger and Data Acquisition System is 3.2 MCHF, ad 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 preliminary 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 this year. A small amount (0.5 MCHF) is foreseen for development of Readout Unit prototypes.

7. OFFLINE COMPUTING

An overview of the preliminary 2003 budget requirements is shown in **Annex 7.** The total preliminary 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 preliminary 2003 budget requirements is shown in **Annex 8.** The total preliminary budget estimate for Infrastructure is 6.0 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 4.5 MCHF and 0.5 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 still under discussion.

The major payments foreseen in 2003 are as follows:

- General installation will continue, and procurements of racks will start at a non negligible 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. If the discussions for the additional in-kind contributions are finalized, both the FCS and

the YE4 will be well advanced in their construction.

9. COMMISSIONING & INTEGRATION

An overview of the preliminary 2003 budget requirements is shown in **Annex 9.** The total preliminary budget amounts to almost 5 MCHF. This budget is being examined by the RRB Scrutiny Group for C&I and their findings will become part of the Draft Budget 2003.

The biggest material expenses foreseen are for the preparation of the surface hall for commissioning: 0.6 MCHF for pre-testing facilities and 0.56 MCHF for common electronics. The Magnet closing system is foreseen to almost 0.7 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.

It should be noted that the above requirements assume that the 2002 C&I budget is paid in full.

10. COST TO COMPLETION

The Annexes 1 to 9 of this document do not include funding requests, which are part of the shortfall. We have collected in Annex 10 additional requests from all subsystems which are part of the shortfall.

Annex 10 presents therefore the Cost to Completion for the year 2003 for all CMS subsystems and Annex 11 our total request, including Cost to Completion.

In order not to delay the construction of CMS, the shortfall for each sub-detector has been reallocated, whenever possible, to contracts that are not yet on the critical path. This is especially true for the ECAL where the shortfall due to the adverse CHF/USD exchange rate has been allocated to the endcap crystals.

11. SUMMARY

The numbers given in this document are summarized in **Annex 11** (Payments expected). It should be noted that:

(1) many numbers shown as "Payments expected" have not yet been agreed with the respective funding agencies. At this stage they are just indicative and for discussions in view of the preparation of the "CMS Draft Budget for 2003" which will be presented at the October 2002 RRB;

(2) some of the “Income expected” for the Tracker, the Electromagnetic Calorimeter and Commissioning & Integration is not yet defined, thus showing an apparent imbalance between “Income” and “Payments”. The institutes participating in these projects will determine their contributions, after agreement with their respective funding agencies, before the October 2003 RRB

(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).

11. ANNEXES

Preliminary Budget Requirements for 2003

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: Cost to Completion

Annex 11: Summary of payments expected in the year 2003

ANNEX 1

SUPERCONDUCTING MAGNET

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Procurements from Common Fund		
CF-01 Design and Follow-up	1.1.18	72
CF-02 Vacuum System	1.3.10	200
CF-03 Power Supply and Bus Bars	1.3.11	150
CF-04 Dump Resistor	1.3.12	150
CF-05 Magnet Safety System	1.3.13	50
CF-06 Magnet Control System	1.3.14	250
CF-07 Components Testing	1.3.16	100
CF-08 Coil Assembly - Tools and Operation	1.3.17.B	100
CF-09 Coil Surface Tests	1.3.18	360
CF-10 Studies and Supervision	1.3.19	1,096
CF-11 Consumables	1.3.20	113
CF-12 Coil Transfer into Underground Cavern	1.3.21	180
CF-13 Implantation and Integration	1.3.22	220
CF-14 2'200 t Crane Rental	1.4.01	350
CF-15 Rigging Equipment	1.4.02	285
CF-16 Field Mapping	1.4.05	250
Subtotal Procurements from Common Fund		**3,926**
Payments to Contracts		
Package A (Barrel Yoke and Vacuum Tank)		
A-01 Barrel Rings and Vacuum Tank	1.1.01	26
Subtotal		26
Package C (Superconducting Cable)		
C-01 Conductor - Quality Assurance	1.3.03	100
Subtotal		100
Package D (Coil Winding)		
D-01 Module Assembly, Swiveling Tooling	1.3.04	2,745
Subtotal		2,745
Subtotal Payments to Contracts		**2,871**
OVERALL TOTAL		**6,797**

ANNEX 2

TRACKER

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Pixel Detectors	2.1	
Detectors (incl. Pre-series)	2.1.01	110
Electronics (include. Engineering)	2.1.02	950
Module Mechanics	2.1.03	350
Support Structures & Assembly	2.1.04	210
	Subtotal	**1,620**
Silicon Detectors	2.2	
Procurement of Sensors	2.2.01	6,661
Kapton	2.2.02	290
Frames	2.2.03	1,312
Pitch Adapters	2.2.04	359
FE Hybrid	2.2.05	1,382
Hybrid Support Plate	2.2.06	431
Interconnect Board	2.2.08	470
	Subtotal	**10,905**
Electronics for Si Detectors	2.3	
Module Electronics	2.3.01	1,181
Analogue Link	2.3.02	5,482
Digital Link	2.3.03	532
Analogue Optohybrid	2.3.04	472
Digital Optohybrid	2.3.05	68
FED	2.3.06	403
CCU Module	2.3.07	232
FEC	2.3.08	72
	Subtotal	**8,443**
Power Supplies for Si Detectors	2.4	
Power Supplies	2.4.01	561
Cables (installed)	2.4.02	474
Slow Control	2.4.03	66
	Subtotal	**1,101**
Mech. Struct. & Cooling for Si Detectors	2.5	
Inner Barrel	2.5.01	660
Inner Endcap	2.5.02	264
Outer Barrel	2.5.03	389
Outer Barrel Rods	2.5.04	749
Endcaps	2.5.05	146
Endcaps Petals	2.5.06	172
General Cooling	2.5.07	111
Integration (st, ts,…)	2.5.08	1,980
	Subtotal	**4,471**
Monitoring for Si Detectors	2.6	
Position Monitoring Systems	2.6.01	130
Temperature Control	2.6.03	110
	Subtotal	**241**
Data Acquisition for Si Detectors	2.7	
Test Stands	2.7.01	372
	Subtotal	**372**
OVERALL TOTAL		**27,153**

ANNEX 3

ELECTROMAGNETIC CALORIMETER

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Barrel	3.1	
Crystals	3.1.1	10,983
Electronics	3.1.2	5,591
Mechanics	3.1.3	1,333
Assembly and Installation	3.1.4	200
Monitoring	3.1.5	463
	Subtotal	**18,570**
Endcaps	3.2	
Crystals	3.2.1	60 (1)
Electronics	3.2.2	2,365
Mechanics	3.2.3	1,635
Monitoring	3.2.5	340
Preshower	3.2.6	1,385
	Subtotal	**5,785**
OVERALL TOTAL		**24,355**

(1) 2'470 kCHF are included in the Annex 10, Cost to Completion

ANNEX 4

HADRON CALORIMETER

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Barrel	4.1	
Mechanics	4.1.01	7
Read-out Boxes	4.1.03	4
Front-end Electronics	4.1.05	65
Calibration Systems	4.1.06	13
Trigger/DAQ Electronics	4.1.07	165
Voltage Supply Systems	4.1.08	120
Detector Control Systems	4.1.09	108
	Subtotal	**482**
Outer Barrel	4.2	
Mechanics	4.2.01	
Optics	4.2.02	265
Read-out Boxes	4.2.03	5
Photodetectors	4.2.04	40
Front-end Electronics	4.2.05	31
Trigger/DAQ Electronics	4.2.07	3
Voltage Supply Systems	4.2.08	51
Detector Control Systems	4.2.09	56
	Subtotal	**452**
Endcap	4.3	
Mechanics	4.3.01	799
Read-out Boxes	4.3.03	4
Photodetectors	4.3.04	1
Trigger/DAQ Electronics	4.3.07	16
Voltage Supply Systems	4.3.08	74
Detector Control Systems	4.3.09	41
	Subtotal	**935**
Forward	4.5	
Mechanics	4.5.01	484
Optics	4.5.02	273
Read-out Boxes	4.5.03	15
Front-end Electronics	4.5.05	30
Calibration Systems	4.5.06	33
Trigger/DAQ Electronics	4.5.07	4
Detector Control Systems	4.5.09	62
	Subtotal	**901**
OVERALL TOTAL		**2,770**

ANNEX 5

MUON DETECTOR

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Barrel Drifttubes	5.1	
Detectors and Components	5.1.1	590
Electronics	5.1.2	2,722
Mechanical Structure and Supports	5.1.3	84
Assembly and Installation	5.1.4	231
	Subtotal	**3,627**
Forward ME 1/1	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**
Endcap CSC	5.3	
Detectors and Components	5.3.1	1,719
Electronics	5.3.2	1,798
Assembly and Installation	5.3.4	105
Monitoring	5.3.5	39
	Subtotal	**3,661**
Barrel RPC	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**
Forward RPC	5.5	
Detectors and Components	5.5.1	420
Electronics	5.5.2	755
Mechanical Structure and Supports	5.5.3	455
	Subtotal	**1,630**
Alignment	5.6	
Barrel	5.6.1	806
Forward	5.6.2	102
Link	5.6.3	383
	Subtotal	**1,291**
OVERALL TOTAL		**13,021**

ANNEX 6

TRIGGER/DATA ACQUISITION

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Trigger	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
	Subtotal	**2,750**
Data Acquisition	6.2	
Read-out Unit	6.2.1	500
	Subtotal	**500**
OVERALL TOTAL		**3,250**

ANNEX 7

OFFLINE COMPUTING

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Offline Computing	7.1	
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
OVERALL TOTAL		**250**

ANNEX 8

INFRASTRUCTURE

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Access and Survey	8.1	
Gangways, Stairs	8.1.1	
Structures on Yoke	8.1.2	100
Personnel Access Equipment	8.1.3	200
General Survey	8.1.4	220
	Subtotal	**520**
General Installation	8.2	
Counting Room Structures	8.2.1	20
Racks with Cooling	8.2.2	600
Electrical Distribution from Outlets	8.2.3	150
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	**2,020**
Cooling & Ventilation	8.3	
Detector Cooling Plant	8.3.1	400
Detector Specific Ventilation	8.3.2	50
Detector Primary Cooling System	8.3.3	600
	Subtotal	**1,050**
Safety	8.4	
Safety Installations	8.4.1	150
Safety Equipment Control	8.4.2	100
Hard-wired Safety System	8.4.3	50
Inertion System	8.4.4	60
	Subtotal	**360**
Fixed Cranes	8.5	
80 ton /100 m	8.5.1	
80 ton /100 m Double Beam System	8.5.2	
20 ton Crane	8.5.3	
Lifting Tooling	8.5.4.B	50
	Subtotal	**50**
Shielding Systems	8.6	
Rotating Shielding	8.6.1	600
Neutron Shielding	8.6.3.B	1,400
Vertical 400 ton Lifting System	8.6.3	
	Subtotal	**2,000**
OVERALL TOTAL		**6,000**

ANNEX 9

Commissioning and Integration

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CE-Ref	Payments expected in 2003
Additional facilities for commissioning on surface	9.1	
Mixed water cooling	9.1.01	30
Gas distribution	9.1.02	10
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	560
Pre-cabling, Pre-testing facilities	9.1.09	600
Basic DSS for equipment protection	9.1.10	64
Semi Clean Room	9.1.11	60
	Subtotal	**1,719**
Detector installation, opening and access facilities	9.2	
Dummy end flanges (EB, EE, SE)	9.2.2	60
Magnet closing system	9.2.3	675
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
	Subtotal	**1,497**
General Services	9.3	
Workshops	9.3.1	150
Heavy Transport Contract	9.3.2	411
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
	Subtotal	**1,763**
OVERALL TOTAL		**4,979**

ANNEX 10

Cost to Completion

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

	CMS: Financial Plan, CERN-RRB-2002-010, Table 5, Reference	CE-Ref	Payments expected in 2003
ECAL		**3.**	
Endcaps		**3.2**	
Crystals	3.1 Endcap Crystals	3.2.1	2,470
Electronics	3.2 Electronics	3.2.2	500
		Subtotal	**2,970**
Muon Detector		**5.**	
Barrel RPC		**5.4.**	
Service Systems	6.1 Cooling System	5.4.6	250
Service Systems	6.2 Gas Piping (…	5.4.6	500
Service Systems	6.3 HV System	5.4.6	600
Forward RPC		**5.5.**	
Electronics	7.4 VLSI, Cables	5.5.2	300
Service Systems	7.1 Cooling System	5.5.6	300
Service Systems	7.3 HV System	5.5.6	700
		Subtotal	**2,650**
Infrastructure		**8.**	
General Installation		**8.2.**	
Beam Pipe	8.1 Beam Pipe	8.2.5	100
Shielding Systems		**8.6.**	
Neutron Shielding	8.3 Neutron Shielding ME …	8.6.3.B	200
Neutron Shielding	8.4 YE4 (Support of …	8.6.3.B	500
Neutron Shielding	8.5 YE4 Ancillaries	8.6.3.B	100
Mechanics and Shielding for HF	8.7 FCS Ancillaries	8.6.3.A	200
		Subtotal	**1,100**
OVERALL TOTAL			**6,720**

ANNEX 11

Preliminary Estimate of Payments expected in the Year 2003 (kCHF)

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

	COMMON PROJECTS						SUB-DETECTORS								
	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	Infrastructure	Commissioning & Integration	Cost to Completion [C]	TOTALS
Funding Agencies	MAGNET				OFFL	Σ						Σ				Σ
Austria	80			80	20	100	250			30	250	530				630
Belgium	185			185	15	200	1,712					1,712				1,912
Bulgaria																
CERN							6,765	9,975		901	500	18,142	4,500			22,642
China										510		510				510
Croatia								25				25				25
Cyprus		26		26		26		50				50				76
Estonia	10			10		10										10
Finland	35			35	15	50	801				250	1,051				1,101
France - CEA								803				803				803
France - IN2P3	740			740		740	2,401	728				3,129				3,869
Germany	0			0	30	30	1,441			974		2,415				2,445
Greece	180			180	20	200		485				485				685
Hungary	30			30		30			273	75		348				378
India	150			150		150			265			265				415
Iran									170			170				170
Italy		2,745		2,745	60	2,805	7,882	1,764		3,470		13,116				15,921
Korea										575		575				575
Pakistan [A]										955		955				955
Poland	155			155		155					800	800				955
Portugal								250			50	300				300
RDMS - Russia [B]								150	452	942		1,544	500			2,044
RDMS - DMS									501	100		601				601
Serbia																
Spain					20	20				1,166		1,166				1,186
Switzerland - ETHZ/Univ.	4,700	100		4,800	60	4,860	1,126	3,675				4,801				9,661
Switzerland - PSI					10	10	400	0				400				410
Taipei																0
Turkey	30			30		30			160			160				190
United Kingdom							715	1,870			100	2,685				2,685
USA - DOE							450		949	3,221	1,300	5,920				5,920
USA - NSF							300	1,840		102		2,242				2,242
Funds expected to be carried forward from 2002	-285			-285		-285										-285
Income expected in 2003 plus funds from 2002	6,010	2,871	0	8,881	250	9,131	24,243	21,615	2,770	13,021	3,250	64,899	5,000			79,030
Planned payments	3,926	2,871	0	6,797	250	7,047	27,153	24,355 [D]	2,770	13,021	3,250	70,549	6,000	4,979	6,720	95,295
Funds expected to be carried forward to 2004	2,084			2,084		2,084	-2,910	-2,740				-5,650	-1,000	-4,979	-6,720	-16,265

[A] = Estimated 'Net Western Value.'

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

[C] = See 'CMS: Financial Plan', CERN-RRB-2002-010, for details

[D] = The 2003 payment for endcap crystals (2'470 kCHF) has been included in the column Cost to Completion

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