Draft Budget for CMS Construction in the Year 2002

INTRODUCTION

This document summarizes the funding requirements for the payments that the CMS Collaboration plans to make in the year 2002 in order to follow the detector construction schedule.

The year 2002 will be the fifth year of Magnet construction, and construction will have 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 year 2002.

The present estimates for the payments which are expected to be made during the year 2002 by the CMS institutes and from the Common Funds add up to 90 MCHF, i.e. about 20 % of the total CMS construction cost. Adding this estimate to the payments that have already been made up to the end of 2000 (127 MCHF) and to the budget for the year 2001 (75 MCHF), then about 292 MCHF are expected to be paid by the end of the year 2002. This corresponds to some 64 % of the total orginally estimated detector construction cost.

The figures shown as "Payments expected in 2002" in the Summary Table (Annex 9) are to be considered as best estimates at the present stage. They will depend, case by case, on commercial tenders received, on contract negotiations or 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 CERN or other funding agencies underwrite formal guarantees for future payments).

As was the case for the Draft Budget documents for previous years, most figures given in this document are based on the CMS Cost Estimate, Version 9 at Level 3 (which is also the reference used for the MoU given at 1995 prices). Some of these items in that Cost Estimate had to be further broken down into sub-items (e.g. into specific procurement contracts). These entries are identified with the original Level 3 reference (e.g. 1.2.02) appended by a letter (e.g. 1.2.02.A, 1.2.02.B, etc).

For the Tracker, the new breakdown of the revised estimate, as shown in the Draft Amendment to the CMS MoU for the "All-Silicon Tracker" (CMS RRB-D 2000-89), is used for the preparation of this Draft Budget.

1. MAGNET

An overview of the 2002 budget requirements is shown in **Annex 1.** The total budget estimate for the Magnet Common Project is 17.45 MCHF.

Following the agreed policy of the CMS Collaboration concerning the ways of making contributions to the CMS Common Projects, the Draft Budget for 2002 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) contributions in kind.

1.1 Procurements from the CMS Magnet Common Fund

Items that are neither procured directly through CMS institutes, nor provided as contributions in kind 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 40 % of the total cost of the CMS Magnet.

The expected payments from the CMS Magnet Common Fund in the year 2002 will amount to some 10.45 MCHF. The breakdown of these expenditures is given in Annex 1.

The largest payments (> 0.40 MCHF each) from the CMS Magnet Common Fund will be for the:

- procurement contract of the helium refrigeration plant (2.18 MCHF),
- metallic structure around the magnet yoke (1.10 MCHF),
- power supplies and bus bars (0.82 MCHF),
- thermal shields (0.70 MCHF),
- transfer of the helium refrigeration plant, (0.63 MCHF),
- Coil transfer to underground cavern (0.45 MCHF),
- preparation of coil assembly and tooling (0.40 MCHF),
- CERN/CEA Cooperation Agreement (0.40 MCHF).

The expected payments for all these larger items add up to some 6.7 MCHF.

1.2 Payment to Contracts

1.2.1 Package A: Barrel Yoke and Vacuum Tank

The procurement of the barrel yoke and the vacuum tank from Deggendorfer Werft and Eisenbau, will be completed in the year 2002 with the welding of the vacuum tank. For this, a final payment of some 0.2 MCHF will have to be made.

1.2.2 Package B: End Caps

The contract for the six end-cap disks and ancillary parts, placed with Kawasaki Heavy Industries/Japan, is near completion. The final delivery of some remaining items as

required to complete the procurement, such as the follow-up and the final assembly on the CERN site, and a few other components will require payments of about 0.2 MCHF in the year 2002.

1.2.3 Package C: Superconducting Conductor

A number of important contracts were placed by ETH Zürich and by Fermilab for the procurement of materials and fabrication as required for the super-conducting conductor. For the co-extrusion, for the welding of the reinforcement and for the associated quality assurance about 1.97 MCHF will have to be paid by ETH Zürich, whilst Fermilab expects to spend some 0.35 MCHF for additional superconducting strands.

1.2.4 Package D: Coil Winding

INFN has placed the contract with Ansaldo (Italy) for the design, development, and procurement of the winding of the superconducting coil. The payments for this contract in 2002 will be about 3.66 MCHF, to be made by INFN as part of its contribution to the CMS Magnet Common Project.

1.2.5 Package H: Swiveling Platform

Following a request of the CMS Collaboration, the University of Korea, Seoul, made a call for tender and subsequently signed a contract with Hanjung (Korea) for the manufacture and delivery of the swiveling platform as needed for the assembly of the coil. The value of the Korean contribution through this contract is about 0.73 MCHF, which is a little less than the total Korean contribution to the Magnet Common Project.

1.3 In-kind Contributions

1.3.1 Support Feet for Four Outer Barrel Rings

Pakistan has delivered the support feet for the four outer barrel rings of the magnet at an estimated value of 0.63 MCHF. It has been agreed that this contribution from Pakistan is to be accounted over 5 years, i.e. the value for the year 2002 is 0.13 MCHF.

2. TRACKER

An overview of the 2002 budget requirements is shown in **Annex 2.** The total budget estimate for the CMS Tracker is 21.6 MCHF.

The Tracker will have completed the transition from development to construction phase by the end of the year 2001. The spending profiles for the years 2001 and 2002 will thus be determined by how closely that transition follows the model assumed for the project planning.

The detailed figures presented here are, therefore, subject to further modification as the project continues to progress over the next several months.

2.1 Pixel Detector

For the Pixel Vertex detector, expenditures in the year 2002 will remain moderate (about 0.52 MCHF), at about 5 % of the overall Pixel budget, and will be mainly directed towards electronics pre-series and engineering runs.

2.2 Silicon Detector

By the end of 2001, most of the major contracts for the Silicon Detector will have been placed, and module assembly will have started. In the year 2002 the module production will ramp up to reach a rate of 50 modules/day. We also expect to procure some 40% - 50% of all silicon sensors, front-end hybrids and electronics, and other module components, as well as the necessary equipment for single and multi-module test-stations. A large fraction of the optical link elements will be procured in the year 2002, as well as most of the remaining mechanical support elements. Procurements of some elements of the read-out, control and power supply systems will also proceed.

It is estimated that about 10.40 MCHF will have to be paid for the procurement of the silicon sensors and their accessories, about 5.58 MCHF for their electronics and power supplies, some 4.70 MCHF for their mechanics and cooling, and 0.70 MCHF for analog optical links, monitoring and data acquisition.

3. ELECTROMAGNETIC CALORIMETER

An overview of the 2002 budget requirements is shown in **Annex 3.** The total budget estimate for the Electromagnetic Calorimeter (ECAL) is 21.33 MCHF.

The institutes in charge of the ECAL construction will continue, wherever possible, to prepare and conclude their procurement contracts in accordance with the requirements of the CMS construction schedule. However, the ECAL Project is now facing severe difficulties in obtaining on time the necessary resources for these contracts. In particular, the procurement contracts for endcap crystals, the ADCs and VPTs, all adding up to about 18 MCHF, must now be placed urgently to ensure a complete ECAL at LHC start. These commitments are now awaiting authorization.

The procurements contracts for all the barrel crystals have now been placed and will require payments of about 5.0 MCHF in the year 2002. However, it is now urgent to place the contract(s) for 16,000 endcap crystals. This implies making commitments of some 6 MUSD, of which only small fraction would have to be paid in the year 2002.

Other important procurement expenditures are foreseen for:
- photo-detectors (APDs and VPTs),
- low-voltage and high voltage systems,
- front-end electronics,
- mechanical structures for barrel and endcaps,
- initial investments for the assembly and installation of the barrel,
- parts for the monitor systems, and
- detectors for the Preshower.

Some funds authorized for procurements in 2001 are carried forward to the year 2002.

4. HADRON CALORIMETER

An overview of the 2002 budget requirements is shown in **Annex 4.** The total budget estimate for the HCAL is 7.99 MCHF.

4.1 Barrel (HB)

In the summer of 2002, there will be an extensive test beam activity to calibrate HCAL wedges. In August, HB+ wedges will be taken to the surface hall above the experimental vault (SX5) and assembled into a half-barrel.

In the summer or fall, the ASICs will be delivered to FNAL. These will then be tested and installed into cards. Readout Modules (RMs) will be assembled from these cards, from HPDs, and from mechanical components. There will be a five-person factory at FNAL to perform this assembly/testing work. Later in the year, RMs will start to be delivered to CERN. Moving wire radioactive source drivers for HB and HE will also be delivered to CERN. In the fall, the HCAL group will start to mount a system-test facility at SX5. This facility will be used to burn-in wedges during the winter/spring of the year 2003.

4.2 Outer Barrel (HO)

The assembly of the HO tile trays will be completed, and fabrication of the readout boxes will be in process in the year 2002.

4.3 End Cap (HE)

The assembly of the HE-1 mechanics and megatiles in SX5 will be completed. The fabrication of the HE+1 absorber structure and of the HE+1/YE+1 interface system will be completed at MZOR, Minsk, and they will be delivered to CERN, where assembly and installation of the HE+1 calorimeter will commence.

4.4 Forward (HF)

The major part of the HF absorber wedges will be delivered in 2002, and a significant part of the HF absorber (wedges 1-18) will be instrumented with optical fibers during this time. The fibers and the PMTs will be procured and the QA/QC efforts for both of these items will have been already established. The Wedges 19-27 will be delivered in September 2002.

5. MUON DETECTOR

An overview of the 2002 budget requirements is shown in **Annex 5.** The total budget estimate for the Muon Detector is 13.87 MCHF.

5.1 Barrel Drift Tubes (DTs)

The production of components and the mass production of chambers will continue in the four assembly sites (CIEMAT-Madrid, INFN-LNL, INFN-Torino and RWTH-

Aachen) while part production will be ongoing at IHEP-Beijing, IHEP-Protvino and JINR-Dubna.

The DT chamber assembly is planned to commence at CERN in the year 2002. A large part of the budget will be spent for the procurements of electronics and for the installation of gas and cooling pipes.

5.2 Forward ME1/1

The assembly of ME/1 Cathode-Strip Chambers (CSC's) will continue at JINR/Dubna. A first set of chambers will be delivered to CERN in the year 2002. The mass production of anode front-end boards will commence in Minsk, Belarus.

5.3 Endcap Cathode Strip Chambers (CSCs)

The production of the CSC chambers and on-chamber electronics will continue in the year 2002 in all the production sites (FNAL, Univ. of Florida, UC Los Angeles, PNPI St. Petersburg and IHEP Beijing). The CSC installation in the magnet end-cap disks is also planned to start in the course of the year 2002.

5.4 Barrel Resistive Plate Chambers (RPCs)

A substantial part of the estimated payments will be for the procurement of high- and low-voltage systems, in addition to payments for a large contract (1.12 MCHF) that was placed by INFN in the year 2001 for the procurement of front-end electronics.

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 production of the front-end boards in Pakistan and for the construction of the mechanical structures for the chambers.

The Resources Review Board, at its meeting held in April 2001, agreed to use, from the CMS Common Fund for Offline Computing, a total amount of up to 0.80 MCHF to alleviate the lack of funding for the Forward Resistive Plate Chambers. A total amount of 0.60 MCHF will be used for this purpose in the year 2002.

5.6 Alignment

The procurement and production of the light sources (LEDs), and associated electronics to be lodged on the Muon Barrel chambers has been completed in the course of the year 2001. A large part of the estimated payments in the year 2002 will be for the pre-production prototype of the Mechanical Barrel Alignment structures (MABs). The remaining funds will be committed on optics and optoelectronics for the MAB components and mechanics for sensor mounts and transfer plates (Endcaps and Link).

6. TRIGGER AND DATA ACQUISITION

An overview of the 2002 budget requirements is shown in **Annex 6.** The total budget estimate for the Trigger and Data Acquisition System is 3.40 MCHF.

6.1 Trigger

The Technical Design Report (TDR) for the Trigger as submitted in December 2000 was approved by the LHCC allowing the start of trigger construction. In the year 2002 most of the trigger sub-systems should have started production.

The estimated payments for the Calorimeter Trigger (some 1.25 MCHF) will be for the production of crate backplanes, receiver cards, electron isolation and clock cards of the regional trigger.

The production of the muon port cards and sector receiver cards of the Cathode Strip Chambers Trigger is expected to take place in 2002. Trigger crates, power supplies and crate controllers will be purchased, as well as parts for the clock and control boards. The estimated payments for the CSC trigger are about 0.80 MCHF.

About 0.96 MCHF will be needed for the RPC Trigger construction in the year 2002. It will cover the purchase of the link board mechanics, the production of the pattern comparator ASIC and the pre-production of the trigger boards.

The estimated payments for the development of prototypes for the DT Trigger (sector processor and timing card) and for the Global Trigger (fast decision logic and timing card prototypes, infrastructure and preparation for production) will be about 0.10 MCHF.

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 year 2002. A small amount (0.19 MCHF) is foreseen for development of Builder/Filter Units and Event Manager prototypes.

6.3 Detector Controls

The Detector Control System (DCS) is part of the DAQ project and as such will be described in the DAQ Technical Design Report. Whilst purchases of DCS hardware equipment are not yet forseen in 2002, about 0.11 MCHF will be required to pay for the software licenses of the adopted control system framework.

7. OFFLINE COMPUTING

An overview of the 2002 budget requirements is shown in **Annex 7.** The total budget estimate for the Offline Computing Common Project is 0.48 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 2002 budget requirements is shown in **Annex 8.** The total budget estimate for the Infrastructure is 3.94 MCHF.

CERN and Russia will fund these contributions for the CMS Infrastructure. The following major payments are foreseen:

- Procurements for personnel access systems, like scaffoldings, and the completion of the design of the structures around the yoke will cost some 0.40 MCHF. General survey using photogrammetry will continue for all large structures in SX5 for 0.22 MCHF.

- General installation will commence, whilst the studies and procurements of racks for use in magnetic fields will continue. The installation of cable trays and racks on the magnet yoke will begin at for estimated cost of 0.3 MCHF. The construction of the gas racks will start for 0.51 MCHF and a first cable chain will be procured for tests for 0.20 MCHF.

- The cooling plant and the ventilation of the SCX building will be procured (for about 0.1 MCHF). The design of the secondary water cooling system will be finalized for 0.2 MCHF.

- Specific safety systems, like sniffers and inertion system, will be procured for about 0.2 MCHF and hard-wired safety systems will be developed together with networks for the same amount.

- The construction of the rotating shielding will start at Protvino, to be accounted as a Russian contribution of 0.5 MCHF in the year 2002.

- In addition, it has become necessary to provide an additional shield against neutrons. This shield was not included in the original Infrastructure cost estimate but it will have to be provided in the year 2002 at an estimated cost of 0.6 MCHF.

9. SUMMARY

The numbers given in this document are summarized in **Annex 9** (Payments expected). Note that:

(1) the numbers shown as "Payments Expected" are current best estimates;

(2) the use, for payments in 2001, of uncommitted construction funds which have been allocated by the Funding Agencies to their institutes in previous years is a matter of policy for the respective Funding Agencies and their associated institutes to provide the deliverables as defined in the MoU. Therefore, any funds carried forward from 2001 to the year 2002 are not included in this document (except for the CMS Common Funds);

(3) **Annex 9** further shows that the planned level of payments from the Common Funds in the year 2002 can be just about covered by the total expected cash resources. This implies that the Magnet Project would be delayed, for the first time since the start of construction, if the cash income in the year 2002 is less than the planned payments. In addition, the open commitments to be expected for the end of the year 2002 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.

10. ANNEXES

Budget Requirements for 2002

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 : Summary of payments expected in the year 2002

ANNEX 1

SUPERCONDUCTING MAGNET

Estimate of Payments expected in the Year 2002

		CE-Ref	Payments expected in 2002 [kCHF]
Procurements from Common Fund			
CF-01	Manufacture Follow-up	1.1.08.A	10
CF-02	Photogrammetry and Survey	1.1.08.B	10
CF-03	Grease Pad Systems	1.1.11.A	220
CF-04	Rails	1.1.14	150
CF-05	Design and Follow-up	1.1.18	70
CF-06	HE Supports	1.2.03	100
CF-07	Superconducting Strands - Replacements	1.3.01.G	180
CF-08	Thermal Shields	1.3.06	700
CF-09	Cold Supports	1.3.07	100
CF-10	He Circuits	1.3.08	200
CF-11	Cold Mass Instrumentation	1.3.09	100
CF-12	Vacuum System	1.3.10	300
CF-13	Power Supply and Bus Bars	1.3.11	820
CF-14	Dump Resistor	1.3.12	150
CF-15	Magnet Safety System	1.3.13	150
CF-16	Magnet Control System	1.3.14	350
CF-17	He Refrigeration External Plant (Main contract)	1.3.15.A	2,180
CF-18	He Refrigeration External Plant (Transfer)	1.3.15.B	630
CF-19	Components Testing	1.3.16	300
CF-20	Coil Assembly - Tools and Operation	1.3.17.B	400
CF-21	Coil Surface Tests	1.3.18	300
CF-22	Studies and Supervision	1.3.19	395
CF-23	Consumables	1.3.20	90
CF-24	Coil Transfer into Underground Cavern	1.3.21	450
CF-25	Implantation and Integration	1.3.22	220
CF-26	2'200 t Crane Rental	1.4.01	350
CF-27	Rigging Equipment	1.4.02	290
CF-28	Metallic Structure around Yoke	1.4.03.B	1,100
CF-29	Field Mapping	1.4.05	130
	Subtotal Procurements from Common Fund		**10,445**
Payments to Contracts			
Package A (Barrel Yoke and Vacuum Tank)			
A-01	Barrel Rings and Vacuum Tank	1.1.01	155
		Subtotal	155
Package B (Endcap Disks)			
B-01	HE Supports	1.2.03	100
B-02	Design and Follow-up	1.2.04	120
		Subtotal	220
Package C (Superconducting Cable)			
C-01	Co-extrusion of Insert	1.3.01.E	495
C-02	Superconducting Strands - Spares	1.3.01.B	350
C-03	EB Welding Reinforcement	1.3.02.B	1,375
C-04	Conductor - Quality Assurance	1.3.03	100
		Subtotal	2,320
Package D (Coil Winding)			
D-01	Module Assembly, Swiveling Tooling	1.3.04	3,660
		Subtotal	3,660
Package H (Swiveling Platform)			
H-01	Coil Assembly - Swiveling Platform	1.3.17.A	525
		Subtotal	525
	Subtotal Payments to Contracts		**6,880**
In-kind Contributions			
IK-01	Support Feet - Outer - Manufacture (In-kind from Pakistan)	1.1.06	125
	Subtotal In-kind Contributions		**125**
OVERALL TOTAL			**17,450**

ANNEX 2

TRACKER

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Pixel Detectors	2.1	
Detectors (incl. Pre-series)	2.1.01	55
Electronics (include. Engineering)	2.1.02	430
Module Mechanics	2.1.03	35
	Subtotal	**520**
Silicon Detectors	2.2	
Procurement of Sensors	2.2.01	7,425
Kapton	2.2.02	195
Frames	2.2.03	1,000
Pitch Adapters	2.2.04	240
FE Hybrid	2.2.05	700
Hybrid Support Plate	2.2.06	240
Interconnect Board	2.2.08	255
	Subtotal	**10,055**
Electronics for Si Detectors	2.3	
Module Electronics	2.3.01	1,110
Analogue Link	2.3.02	2,135
Digital Link	2.3.03	265
Analogue Optohybrid	2.3.04	255
Digital Optohybrid	2.3.05	45
FED	2.3.06	590
CCU Module	2.3.07	130
FEC	2.3.08	135
	Subtotal	**4,665**
Power Supplies for Si Detectors	2.4	
Power Supplies	2.4.01	420
Cables (installed)	2.4.02	425
Slow Control	2.4.03	65
	Subtotal	**910**
Mech. Struct. & Cooling for Si Detectors	2.5	
Inner Barrel	2.5.01	520
Inner Endcap	2.5.02	265
Outer Barrel	2.5.03	380
Outer Barrel Rods	2.5.04	620
Endcaps	2.5.05	180
Endcaps Petals	2.5.06	210
General Cooling	2.5.07	550
Integration (st, ts,…)	2.5.08	1,980
	Subtotal	**4,705**
Monitoring for Si Detectors	2.6	
Position Monitoring Systems	2.6.01	80
Temperature Control	2.6.02	80
	Subtotal	**160**
Data Acquisition for Si Detectors	2.7	
Test Stands	2.7.01	540
	Subtotal	**540**
OVERALL TOTAL		**21,555**

ANNEX 3

ELECTROMAGNETIC CALORIMETER

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Barrel	3.1	
Crystals	3.1.1	9,005
Electronics	3.1.2	5,575
Mechanics	3.1.3	2,740
Assembly and Installation	3.1.4	250
Monitoring	3.1.5	290
	Subtotal	**17,860**
Endcaps	3.2	
Electronics	3.2.2	430
Mechanics	3.2.3	115
Assembly and Installation	3.2.4	620
Monitoring	3.2.5	150
Preshower	3.2.6	2,150
	Subtotal	**3,465**
OVERALL TOTAL		**21,325**

ANNEX 4

HADRON CALORIMETER

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Barrel	4.1	
Mechanics	4.1.01	320
Optics	4.1.02	25
Front-end Electronics	4.1.05	725
Calibration Systems	4.1.06	140
Trigger/DAQ Electronics	4.1.07	1,080
Voltage Supply Systems	4.1.08	85
Detector Control Systems	4.1.09	95
	Subtotal	**2,470**
Outer Barrel	4.2	
Optics	4.2.02	600
Read-out Boxes	4.2.03	110
Photodetectors	4.2.04	30
Front-end Electronics	4.2.05	235
Trigger/DAQ Electronics	4.2.07	435
Voltage Supply Systems	4.2.08	30
Detector Control Systems	4.2.09	80
	Subtotal	**1,520**
Endcap	4.3	
Mechanics	4.3.01	950
Read-out Boxes	4.3.03	5
Front-end Electronics	4.3.05	340
Calibration Systems	4.3.06	180
Trigger/DAQ Electronics	4.3.07	650
Voltage Supply Systems	4.3.08	75
Detector Control Systems	4.3.09	55
	Subtotal	**2,255**
Forward	4.5	
Mechanics	4.5.01	195
Optics	4.5.02	390
Read-out Boxes	4.5.03	280
Front-end Electronics	4.5.05	265
Calibration Systems	4.5.06	120
Trigger/DAQ Electronics	4.5.07	455
Detector Control Systems	4.5.09	35
	Subtotal	**1,740**
OVERALL TOTAL		**7,985**

ANNEX 5

MUON DETECTOR

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Barrel Drifttubes	5.1	
Detectors and Components	5.1.1	840
Electronics	5.1.2	2,320
Mechanical Structure and Supports	5.1.3	70
Assembly and Installation	5.1.4	255
Service Systems	5.1.6	685
	Subtotal	**4,170**
Forward ME 1/1	5.2	
Detectors and Components	5.2.1	400
Electronics	5.2.2	150
	Subtotal	**550**
Endcap CSC	5.3	
Detectors and Components	5.3.1	615
Electronics	5.3.2	3,720
Mechanical Structure and Supports	5.3.3	130
Monitoring	5.3.5	150
	Subtotal	**4,615**
Barrel RPC	5.4	
Detectors and Components	5.4.1	460
Electronics	5.4.2	500
Service Systems	5.4.6	650
	Subtotal	**1,610**
Forward RPC	5.5	
Detectors and Components	5.5.1	420
Electronics	5.5.2	755
Mechanical Structure and Supports	5.5.3	455
Service Systems	5.5.6	600
	Subtotal	**2,230**
Alignment	5.6	
Barrel	5.6.1	175
Forward	5.6.2	370
Link	5.6.3	150
	Subtotal	**695**
OVERALL TOTAL		**13,870**

ANNEX 6

TRIGGER/DATA ACQUISITION

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Trigger	6.1	
Calorimeter Trigger	6.1.1	1,250
CSC Trigger	6.1.2	800
DT Trigger	6.1.3	65
RPC Trigger	6.1.4	960
Global Trigger	6.1.5	30
	Subtotal	**3,105**
Data Acquisition	6.2	
Filter Unit	6.2.2	165
Event Builder	6.2.3	25
	Subtotal	**190**
Detector Controls	6.3	
Detector Controls	6.3.1	110
	Subtotal	**110**
OVERALL TOTAL		**3,405**

ANNEX 7

OFFLINE COMPUTING

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Offline Computing	**7.1**	
File Servers	7.1.1	120
Information Servers	7.1.2	70
Computing Power	7.1.3	100
Spares	7.1.4	15
System Assembly	7.1.5	10
Software Licenses	7.1.6	60
System Management	7.1.7	100
Subtotal Offline Computing		**475**
OVERALL TOTAL		**475**

ANNEX 8

INFRASTRUCTURE

Estimate of Payments expected in the Year 2002

	CE-Ref	Payments expected in 2002 [kCHF]
Access and Survey	8.1	
Structures on Yoke	8.1.2	100
Personnel Access Equipment	8.1.3	300
General Survey	8.1.4	220
	Subtotal	**620**
General Installation	8.2	
Counting Room Structures	8.2.1	20
Racks with Cooling	8.2.2	250
Electrical Distribution from Outlets	8.2.3	135
Gas Systems and Primary Distribution Racks	8.2.4	510
Beam Pipe	8.2.5	150
Cable Trays to Counting Rooms	8.2.6	200
General Cabling	8.2.7.B	30
General Piping	8.2.8	30
	Subtotal	**1,325**
Cooling & Ventilation	8.3	
Detector Cooling Plant	8.3.1	250
Detector Specific Ventilation	8.3.2	100
Detector Primary Cooling System	8.3.3	210
	Subtotal	**560**
Safety	8.4	
Safety Installations	8.4.1	90
Safety Equipment Control	8.4.2	50
Hard-wired Safety System	8.4.3	90
Inertion System	8.4.4	60
	Subtotal	**290**
Fixed Cranes	8.5	
Lifting Tooling	8.5.4.B	**30**
	Subtotal	**30**
Shielding Systems	8.6	
Rotating Shielding	8.6.1	510
Neutron Shielding	8.6.3.B	600
	Subtotal	**1,110**
OVERALL TOTAL		**3,935**

ANNEX 9

Estimate of Funding and Payments expected in the Year 2002 (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	TOTALS
			MAGNET				OFFL.	Σ						Σ		Σ
Funding expected	Austria		85			85	15	100	235			15	95	345		445
	Belgium		185			185	15	200	1,485					1,485		1,685
	Bulgaria											120		120		120
	CERN								7,035	11,060		690	110	18,895	3,425	22,320
	China-NSFC/MST											450		450		450
	Croatia		6			6		6		25				25		31
	Cyprus			0		0		0		50				50		50
	Estonia		10			10		10						0		10
	Finland		285			285	15	300	1,000				200	1,200		1,500
	France	CEA								440			0	440		440
		IN2P3	740			740	20	760	2,400	1,395				3,795		4,555
	Germany		335			335	25	360	1,465			880		2,345		2,705
	Greece		185			185	15	200		340			0	340		540
	Hungary		30			30		30			240	20	0	260		290
	India		150			150		150		230	600			830		980
	Italy			3,660		3,660	70	3,730	6,550	1,605		3,565	0	11,720		15,450
	Korea		25	525		550		550				575	0	575		1,125
	Pakistan				125	125		125				955		955		1,080
	Poland		155			155		155					760	760		915
	Portugal									260			40	300		300
	Russia & Dubna Member States [B]	Russia	0	0		0		0		115	330	580		1,025	510	1,535
		Dubna M.S.								80	800	150		1,030		1,030
	Spain						15	15				665		665		680
	Switzerland	ETHZ	1,200	2,015		3,215	50	3,265	0	1,800			0	1,800		5,065
		PSI	0	110		110	10	120	0	1,000			0	1,000		1,120
		Universities							210					210		210
	Taipei-NSC		150			150		150		600				600		750
	Turkey		30			30		30			150			150		180
	United Kingdom		249			249	110	359	865	920			0	1,785		2,144
	USA	DOE		570		570		570	160	155	4,690	4,235	2,200	11,440		12,010
		NSF		0		0		0	150	1,250	1,175	370	0	2,945		2,945
	Funds expected to be carried forward from 2001		6,040			6,040	1,300	7,340								7,340
	Loan from Offline Common Project to Forward RPC's [*]						-600	-600				600		600		0
	Total income in 2002, including funds from 2001		9,860	6,880	125	16,865	1,060	17,925	21,555	21,325	7,985	13,870	3,405	68,140	3,935	90,000
	Payments expected in 2002		10,445	6,880	125	17,450	475	17,925	21,555	21,325	7,985	13,870	3,405	68,140	3,935	90,000
	Funds expected to be carried forward to 2003		-585	0	0	-585	585	0								

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

[*] In accordance with a decision taken by RRB-12