

CMS: Financial Plan

for October 2002 RRB

At the last CMS RRB meeting (April 2002, RRB14) CMS presented a global shortfall of 62.75 MCHF (Table1) for the completion of an initial low luminosity detector consisting of the complete CMS detector minus the 4th endcap muon chambers (ME4/1 and ME4/2) and the 3rd forward pixel disks. This shortfall comprises a common part of 21.35 MCHF (14.65 C&I + 3.5 Magnet + 3.2 Infrastructure) and a Detector part of 41.4 MCHF.

Table 1: CMS Shortfall at RRB14

	Shortfall (kCHF)
Magnet	3,500
Infrastructure	3,200
C&I	14,650
Total CP	21,350
Tracker	6,900
ECAL	24,200
Muons	10,300
Total Detector	41,400
TOTAL	62,750

At RRB14 it was agreed that CMS should contact the Funding Agencies in order to obtain the levels and time profiles for firm commitments and less firm promises. CMS would then draw up a new overall financial plan (allowing for later money) for the October 2002 LHCC Comprehensive Review and the October 2002 RRB (RRB15). The plan proposed in this document takes account of the above which, after approval by the RRB, should be laid down in a bi-lateral exchange of letters between the Funding Agencies and CERN.

Based on the answers received from the various Funding Agencies, we propose the following financial plan:

1. The best estimate of the additional 'firm' contributions is 50. MCHF. An estimate of later funding is 1.7 MCHF, of which around 0.8 MCHF should be considered as likely to materialise (i-e the request has already been made or will be made shortly, with a reasonable chance of approval).
2. Our best estimate of the remaining shortfall is therefore $62.7 - (50. + 0.8) \approx 12$ MCHF.
3. To cover the remaining additional shortfall of 12 MCHF we propose to stage 50% of the DAQ 'slices' (L1 rate limited to 50 kHz) and the endcap RPC chambers at small radius, in addition to the already staged 4th endcap Muon station (ME4/1 and ME4/2) and the 3rd forward pixel disks.

1. Additional Contributions and Staging scenario

Following the recommendations of the last RRB, letters were sent to all funding agencies requesting possible additional contributions. With respect to these additional contributions we also requested information on what amounts can be taken to be as firm and what as less firm but possibly available later. Table 2 gives a summary of the received answers. Column 2 gives for each funding agency the guideline figures for additional

funds as shown in Table 4 of the RRB14 Financial Plan Document (CMS-RRB-2002-010). We are not requesting further investments from Switzerland, since it is providing an exceptional investment of 88.5 MCHF and in addition participates, together with CERN, in the Engineering Center. Columns 3 and 4 indicate the firm and the less-firm later additional contributions specified in the received answers.

Table 2: Additional funding in kCHF: guideline, firm and later commitments

		Guideline	Firm	Later
Austria		600	600	
Belgium		870	475	395
Brazil		500	500	
Bulgaria (as a CERN Member State)		106		
CERN		13,500	13,500	
China		700	700	
Croatia		49	49	
Cyprus		106	106	
Estonia		16	16	
Finland		870	870	
France	CEA	1,000	(660) *	340
	IN2P3	4,000	2,000	
Germany		2,703	2,703	
Greece		880		
Hungary		58	58	
India		774	100	200
Iran		500	500	
Italy		12,900	8,900	
Korea		458	500	
Pakistan		428	230	
Poland		528		
Portugal		352	300	
RDMS	Russia	2,250	2,200	
	Dubna Member States			
Serbia		400	400	
Spain		1,350	1,350	
Switzerland	Universities			
	ETHZ			
	PSI			
Taipei		410	200	210
Turkey		58		
United Kingdom		1,530	918	612
USA (2)	DOE	15,000	12,800	
	NSF			
Extra Contributions		62,896	49,975	1,757

(*) We gratefully acknowledge an increase of scope amounting to 660 kCHF in ECAL. However it is not included in the figure or 49.975 MCHF as the shortfall was determined later.

The additional 'firm' contributions amount to a total of 49.975 MCHF. The later funding is less well defined and we estimate it to be 1.7 MCHF, with the following comments:

- i) Belgium: Only the FNRS Funding Agency has so far taken a firm commitment for their full share. It is anticipated that FWO will provide matching funding.
- ii) France CEA: A request will be made for these funds next year.
- iii) India: These funds should be available for components provided an in-kind contribution can be identified.
- iv) Taipei: There are good chances of obtaining these funds
- v) UK: A request has been made for these funds. The request will undergo a peer-review.

We estimate that at least 0.8 MCHF of the later funding is likely to materialise. Our best estimate of the remaining shortfall is therefore $62.7 - (50. + 0.8) \approx 12$ MCHF.

To cover the likely shortfall of 12 MCHF we propose the following staging scenario (in order of priority and applied as necessary):

	Cumulative staged spending	
	(MCHF)	(MCHF)
1. Stage 4 slices of DAQ (50% DAQ slices, L1 rate limited to 50 kHz)	8.0	8.0
2. Stage Cooling and Ventilation system in surface control room	0.5	8.5
3. Stage ~1/3 of Endcap RPCs	1.5	10.0
4. Stage 5 th slice of DAQ (L1 rate limited to 37.5 kHz)	2.0	12.0

We note that since last RRB three new countries have applied to join CMS. Two institutes from New Zealand were approved to join CMS in September. It is likely that institutes in Brazil and Ireland will be approved to join CMS in December. All three countries are interested in contributing to the DAQ slices. Furthermore, discussions with the US Heavy Ion groups are well advanced. A request for 2 DAQ slices has been made.

It is therefore unlikely that more than 50% of the DAQ slices will need to be staged.

We also note that the decision to adopt a common Low Voltage system is likely to lead to a saving of at least 2 MCHF. However, this saving cannot yet be guaranteed and thus cannot form a part of the plan presented here.

Table 3 gives the expected funding profile for these additional contributions, as deduced from the answers. This expectation has not been discussed with the Funding Agencies.

**Table 3: Expected Funding Profile for additional contributions (kCHF).
These profiles have not yet been discussed with the funding agencies.**

		2002	2003	2004	2005	2006	2007	2008	2009	2010	Grand Total
FIRM FUNDING CP	Austria	16	16	16	16	16	16	16	16	12	140
	Belgium		19	58	36	36	36				185
	Brazil		500								500
	CERN	600	6800	2400	2100	1100	500				13500
	China	96	404								500
	Croatia		25	24							49
	Cyprus		11	11	11	10	10				53
	Estonia		4	4	4	4					16
	Finland				73	73	73	71			290
	France-IN2P3			300							300
	Germany	358	163	166	137	9					833
	Hungary			18	20	20					58
	India	20	20	20	20	20					100
	Iran		500								500
	Pakistan		50	50	50						150
	Portugal	20	20	20	20	20					100
	RDMS-Russia		29	118	119	634					900
Serbia	400									400	
Spain		117	117	116						350	
Taipei	100	36								136	
UK				207						207	
USA-DOE			1100								1100
Firm Total CP		1610	9814	3322	2929	1942	635	87	16	12	20367
FIRM FUNDING DETECTOR	Austria	52	51	51	51	51	51	51	51	51	460
	Belgium			73	73	73	71				290
	China			200							200
	Cyprus		11	11	11	10	10				53
	Finland				145	145	145	145			580
	France-IN2P3			200	500	500	500				1700
	Germany			468	468	468	466				1870
	Italy			2800	2800	3300					8900
	Korea					250	250				500
	Pakistan		30	30	20						80
	Portugal	40	40	40	40	40					200
	RDMS-Russia			270	148	882					1300
	Spain		340	330	330						1000
Taipei		64								64	
UK		361	350							711	
USA-DOE	2800	1400	2500	2500	2500					11700	
Firm Total Detector		2892	2297	7323	7086	8219	1493	196	51	51	29608
Firm Total		4502	12111	10645	10015	10161	2128	283	67	63	49975
LATER CP	Belgium			27	26	26	26				105
	France-CEA					330					330
	UK				323						323
Later Total CP	0	0	27	349	356	26	0	0	0	0	758
LATER DETECTOR	Belgium			73	73	73	71				290
	India			100	100						200
	Taipei			60	50	50	50				210
	UK					289					289
Later Total Detector	0	0	233	223	412	121	0	0	0	0	989
Later Total	0	0	260	572	768	147	0	0	0	0	1747
Grand Total		4502	12111	10905	10587	10929	2275	283	67	63	51722

2. Proposed Sharing

Table 4 shows a proposal for how to cover the shortfall by sub-detector (columns) and by funding agency (rows) using only the firm additional-contributions.

Table 4: Sharing of firm additional contributions (kCHF)

Firm Extra Contributions	CP= C&I, Magnet, Infrastr.	Tracker	ECAL	HCAL	Muons	TriDAS	Tot. Det.	Total CMS
Austria (1)	140	460					460	600
Belgium	185	290					290	475
Brazil	500							500
Bulgaria (as a CERN Member State)								
CERN	13,500	800	4,700			-5,500		13,500
China	500				200		200	700
Croatia	49							49
Cyprus	53		53				53	106
Estonia	16							16
Finland	290	580					580	870
France	CEA IN2P3	300 700	660 1,000				660 1,700	660 2,000
Germany	833	870			1,000		1,870	2,703
Greece								
Hungary	58							58
India	100							100
Iran	500							500
Italy		3,800	1,300		3,800		8,900	8,900
Korea						500	500	500
Pakistan	150				80		80	230
Poland								
Portugal	100		200				200	300
RDMS	Russia Dubna Member States	900	1,300				1,300	2,200
Serbia	400							400
Spain	350				1,000		1,000	1,350
Switzerland	Universities ETHZ PSI		-1,900 5,400			-3,500		
Taipei	136		64				64	200
Turkey								
United Kingdom	207		711				711	918
USA (2)	DOE NSF	1,100	8,400	1,600	5,000	500	15,500	16,600
Contribution made before Cost to Complete Done			-660	-1,600	-2,200		-4,460	-4,460
Firm Additional Contributions (1)	20,367	5,600	23,128		8,880	-8,000	29,608	49,975
Completion Cost minus 8.5 MCHF DAQ staging(2)	20,850	6,900	24,200		10,300	-8,000	33,400	54,250
Balance (1) - (2)	-483	-1,300	-1,072		-1,420		-3,792	-4,275

A few comments can be made on the sharing of additional contributions proposed in Table 4. The 13.5 MCHF additional contribution from CERN is allocated only to the Common Part (C&I, magnet and infrastructure). Within the original CERN MoU funding 5.5 MCHF are shifted from the staged DAQ to the underfunded ECAL (4.7 MCHF) and Tracker (0.8 MCHF). Likewise, within the ETHZ funding, 3.5 MCHF from DAQ and 1.9 MCHF from Tracker are shifted to ECAL.

For the US_CMS team the total project money available for the construction period is fixed. Because of the past good cost-performance the US groups have been able to contribute towards items which were not part of their original MoU obligations. For the period 1998-2001 these additional contributions amounted to 9.4 MCHF including 3.8 MCHF of Cost Book deliverables. This contribution was made before the Cost-to-Complete shortfall was determined. For the remainder of the construction period it is projected that a similarly good cost-performance will lead to an additional contribution of 12.8 MCHF in Cost Book deliverables. Indeed 2.8 MCHF have already been committed in 2002 for ME1/1 electronics. US_CMS plans to contribute to the new ECAL electronics (~ 8 MCHF) and to the new LV system (~ 1 MCHF) which will be designed at Fermilab.

After staging of 50% of DAQ slices and cooling & ventilation plant the shortfall is reduced to 54.2 MCHF. With only 50.0 MCHF of firm money, there is still a shortfall of 4.2 MCHF.

The last row of Table 4 shows the distribution of this shortfall between the different sub-systems: Common Part: 0.5 MCHF, Tracker 1.3 MCHF, ECAL: 1 MCHF and Muons :1.4 MCHF.

The later contributions from Belgium, India and Taipei are likely to materialise for a total of 0.8 MCHF. We believe that this is probably enough to complete the Common Part (Magnet, Infrastructure and C&I), the Tracker and the ECAL within the contingency created by the choice of a common LV system and/or income from additional collaborators. Should this turn out not to be the case, we are prepared to stage a 5th slice of the DAQ system to save an additional 2 MCHF. The underfunding of the Muon system on the other hand cannot be covered by any of the later contributions expected from Belgium, India and Taipei. This underfunding comes entirely from the End-Cap RPC system, for which it is necessary to prepare a staging plan (see later).

3. Financial Plans for the underfunded Sub-Detectors

The information received on the funding profile for the additional-contribution allows us to present a preliminary financial plan for the various items affected by a shortfall.

3.1 The Common Part

Table 5 shows the financial plan for the Common Part (C&I, magnet and infrastructure).

Taking into account only the firm funding the overall position is close to being balanced. However a negative balance is apparent for the years 2002, 2004 and 2005 and a positive balance in 2003. So far in 2002 our income has consisted of displacement funding of about 637 kCHF (from manpower expenditure from Magnet and Infrastructure projects), and in-kind contributions amounting to about 500 kCHF. Furthermore we have postponed expenditure of about 500 kCHF on items that could be delayed technically. The displacement funding, used in 2002 to cover the urgent C&I expenses, will be returned in 2003. We are currently re-examining the exact profile of the funds needed and request the relevant agencies to consider the possibility of making funds available earlier than indicated in Table 5. We hope to arrive at a more balanced position, year-by-year, for the April 2003 RRB.

Table 5: Common Project Financial Plan

Common Projects		PAYMENTS versus FUNDING (KCHF)									TOTAL
No.	Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	
1	Magnet										3500
1.1	Heavy Lifting Operation	0	350	700	2450	0	0	0			3500
8	Infrastructure										2700
8.1	Beam Pipe	0	100	700	0	0	0	0			800
8.2	SCX Cooling and Ventilation Plant (500kCHF staged)	0	0	0	0	0	0	0			0
8.3	Neutron Shielding ME chambers	400	200	0	0	0	0	0			600
8.4	YE4 (Support of RE4 and Shielding of ME4)	0	500	0	0	0	0	0			500
8.5	YE4 Ancillaries	0	100	0	0	0	0	0			100
8.6	Forward Cylindrical Shielding (FCS)	0	250	250	0	0	0	0			500
8.7	FCS Ancillaries	0	200	0	0	0	0	0			200
	TOTALS	400	1700	1650	2450	0	0	0			6200
9	C&I	1755	5460	3746	2339	1350	0	0			14650
	GRAND TOTAL NEEDED CP (1)	2155	7160	5396	4789	1350	0	0			20850
	FIRM FUNDING										
	Austria	16	16	16	16	16	16	16	16	12	140
	Belgium		19	58	36	36	36				185
	Brazil		500								500
	CERN	600	6800	2400	2100	1100	500				13500
	China	96	404								500
	Croatia		25	24							49
	Cyprus		11	11	11	10	10				53
	Estonia		4	4	4	4					16
	Finland				73	73	73	71			290
	France IN2P3			300							300
	Germany	358	163	166	137	9					833
	Hungary			18	20	20					58
	India	20	20	20	20	20					100
	Iran		250	250							500
	Pakistan		50	50	50						150
	Portugal	20	20	20	20	20					100
	RDMS		29	118	119	634					900
	Serbia	400									400
	Spain		117	117	116						350
	Taipei	100	36	0							136
	United Kingdom				207						207
	USA DOE		1100								1100
	TOTAL FIRM FUNDING CP (2)	1610	9564	3572	2929	1942	635	87	16	12	20367
	DIFFERENCE (2)-(1)	-545	2404	-1824	-1860	592	635	87	16	12	-483
	LATER										
	Belgium		0	27	26	26	26				105
	France CEA					330					330
	United Kingdom				323						323
	TOTAL LATER FUNDING CP	0	0	27	349	356	26	0	0	0	758

3.2 The Tracker

Table 6 shows the Financial Plan for the Tracker. Taking into account only the firm funding there is a deficit of 1.3 MCHF. For the Tracker the adoption of a common low voltage system should lead to savings of this order but this saving cannot yet be guaranteed and hence will be kept in the project to overcome any presently unforeseen difficulties. In any case, as mentioned earlier, funds may have to be diverted to the Tracker by staging of items unless further funding is committed. The profile also shows a large negative balance in the years 2004 and 2005. We are currently re-examining the exact profile of the funds needed and request the relevant agencies to consider the possibility of making funds available earlier than indicated in Table 6. We hope to arrive at a more balanced profile for the April 2003 RRB.

Table 6: Tracker Financial Plan

TRACKER COST-TO-COMPLETION		PAYMENTS versus FUNDING (KCHF)									
No.	Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
2.1	Silicon Sensor Procurement	0	0	500	0	0	0	0			500
2.2	Front-End Drivers (FED)	0	0	0	1900	0	0	0			1900
2.3	Front-End Controllers (FEC)	0	0	0	300	0	0	0			300
2.4	Cables Installation	0	0	1500	0	0	0	0			1500
2.4	Cooling Plant	0	0	800	0	0	0	0			800
2.5	Power Supplies	0	0	1900	0	0	0	0			1900
2.6	ETHZ (Shift of MoU funds)			800	1100						1900
	TOTAL NEEDED TRACKER (1)	0	0	5500	3300	0	0	0	0	0	8800
FIRM FUNDING	Austria	52	51	51	51	51	51	51	51	51	460
	Belgium			73	73	73	71				290
	CERN			300	500						800
	Finland				145	145	145	145			580
	France IN2P3			100	200	200	200				700
	Germany			220	220	220	210				870
	Italy			1200	1200	1400					3800
	TOTAL FIRM FUNDING TRACKER (2)	52	51	1944	2389	2089	677	196	51	51	7500
	DIFFERENCE (2)-(1)	52	51	-3556	-911	2089	677	196	51	51	-1300
LATER	Belgium			73	73	73	71				290
	TOTAL LATER FUNDING TRACKER	0	0	73	73	73	71	0	0	0	290

3.3 The Electromagnetic Calorimeter

Table 7 shows the Financial Plan for the ECAL. Taking into account only the firm funding there is a deficit of about 1 MCHF, which we hope could be covered by later funding. The profile shows large negative balance in the year 2004. We are currently re-examining the exact profile of the funds needed and request the relevant agencies to consider the possibility of making funds available earlier than indicated in Table 7. We hope to arrive at a more balanced profile for the April 2003 RRB. Although the payment is small for endcap crystals in 2003 an order has to be placed by mid-2003 so as not to delay construction of the endcaps. Hence a commitment for the full funds (about 6 MUSD) is urgently needed.

Table 7: ECAL Financial Plan

ECAL COST-TO-COMPLETION		PAYMENTS versus FUNDING (KCHF)									
No.	Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
3.1	Crystals	0	800	3600	3800	3100	0	0			11300
3.2	Electronics		300	5920	3680						9900
3.3	EB Mechanics	0	200	1000	100	0	0	0			1300
3.4	EE Mechanics	0	0	600	800	300	0	0			1700
	TOTAL NEEDED ECAL (1)	0	1300	11120	8380	3400	0	0	0	0	24200
FIRM FUNDING	CERN		800	1150	1650	1100					4700
	Cyprus		11	11	11	10	10				53
	France IN2P3			200	300	300	200				1000
	Italy			400	400	500					1300
	Portugal	40	40	40	40	40					200
	RDMS-Russia			270	148	882					1300
	ETHZ (Shift of MoU funds)		900	1900	1500	1100					5400
	Taipei		64								64
	UK		361	350							711
	US DOE			4200	4200						8400
	TOTAL FIRM FUNDING ECAL (2)	40	2176	8521	8249	3932	210	0	0	0	23128
	DIFFERENCE (2)-(1)	40	876	-2599	-131	532	210	0	0	0	-1072
LATER	India			100	100						200
	Taipei			60	50	50	50				210
	UK					289					289
	TOTAL LATER FUNDING ECAL	0	0	160	150	339	50	0	0	0	699

3.4. The Barrel Muon System

Table 8 shows the Financial Plan for the Barrel Muons. Germany, Spain and Italy are committed to deliver the full barrel system. There is no overall deficit for the Barrel Muons system. However the profile shows a negative balance in the year 2004. We are currently re-examining the exact profile of the funds needed and request the relevant agencies to consider the possibility of making funds available earlier than indicated in Table 8. We hope to arrive at a more balanced profile for the April 2003 RRB.

Table 8: Barrel Muons Financial Plan

MUON-DT COST-TO-COMPLETION		PAYMENTS versus FUNDING (KCHF)									
No.	Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
4.1	Sector Collector+ Power Supplies	0	0	2200	0	0	0	0			2200
4.2	Power Supplies	0	0	0	1400	0	0	0			1400
4.3	Others (including Alignment)	0	340	0	0	260	0	0			600
	TOTAL NEEDED MUON-DT(1)	0	340	2200	1400	260	0	0	0	0	4200
FIRM	Germany	0	0	250	250	250	250	0	0	0	1000
	Italy			700	700	800	0	0			2200
	Spain		340	330	330						1000
	TOTAL FIRM FUNDING MUON-DT (2)	0	340	1280	1280	1050	250	0	0	0	4200
	DIFFERENCE (2)-(1)	0	0	-920	-120	790	250	0	0	0	0

MUON-RPC-Barrel COST-TO-COMPLETION		PAYMENTS versus FUNDING (KCHF)									
No.	Item	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
6.1	Cooling System	0	250	0	0	0	0	0			250
6.2	Gas Piping (needed in 2002, reimburse HV later)	0	500	0	0	0	0	0			500
6.3	HV System	0	600	0	0	0	0				600
6.4	Others	0	0	250	0	0	0	0			250
	TOTAL NEEDED MUON-RPC-Barrel(1)	0	1350	250	0	0	0	0	0	0	1600
FIRM	Germany	0	0	0	0	0	0	0	0	0	0
	Italy			500	500	600	0	0			1600
	Spain		0	0	0	0					0
	TOTAL FIRM FUNDING MUON-RPC-Barrel (2)	0	0	500	500	600	0	0	0	0	1600
	DIFFERENCE (2)-(1)	0	-1350	250	500	600	0	0	0	0	0

4. End-Cap RPCs

Finally, Table 9 shows the full Money matrix for the Endcap RPCs (REs). This subsystem is a common effort from China, Korea and Pakistan. Despite additional contributions from China (200 kCHF) and Pakistan (80 kCHF) it is underfunded by 1785 kCHF, of which 840 kCHF is temporarily covered by a loan from the Common Fund (800 kCHF) and from INFN (40 kCHF). The underfunding is manifest in electronics (HV and LV systems, skew-clear cables). The underfunding in gaps & strips will probably be covered by an in-kind contribution from Korea. An RPC gap factory has been installed in Korea and is ready to start production. Funding in Korea for producing all the gaps necessary for the End-Cap RPCs is under discussion at the moment. We are preparing a plan to manufacture the RE system that will be driven by the available resources and in the case of the inner chambers also by technical progress. Currently the manufacture is envisaged in three stages that are as follows:

- i) the outer chambers of the first muon station RE1 (RE1/2, RE1/3)
- ii) the outer chambers of the 2nd-4th muon station RE2-4 (RE2,3,4/2)
- iii) the inner chambers of all the stations RE1-4 (RE1,2,3,4/1)

A final plan will be presented to the LHCC first and then to the April 2003 RRB. It is expected that 1.5 MCHF of spending for items (ii) and (iii) can be staged. The later installation of the staged chambers in (ii) and (iii) is made somewhat easier by the independent mounting of CSCs and RPCs for stations 2 to 4. The physics impact of this staging consists of a lowered Level-1 trigger efficiency for forward muons and a reduced tolerance

to any problems in this high flux, and thus congested, region even at initial luminosities. Nevertheless, a full geometric coverage will be provided by the initial CSC system albeit at a cost of somewhat increased trigger rate.

Table 9: EndCap RPC Money Matrix

RPC_Endcaps Money Matrix		Contributions (kCHF)						Loans (kCHF)	
No.	Item	China	Korea	Pakistan	Tot. Contr.	Cost 2001	Balance	Italy	Com. Fund
7.01	Bakelite (1)				0	200	-200		200
7.02	Single Gaps and Strips (2)		585		585	720	-135		
7.03	Mechanics	75	100	240	415	350	65		
7.04	RE1 Panels (China, additional contribution)	200			200	200	0		
7.05	Chamber Assembly	75	100	240	415	350	65		
7.06	VLSI (3)				0	40	-40	40	
7.07	Front -End Boards			810	810	810	0		
7.08	Strips Connections to FE (4)				0	100	-100		100
7.09	Installation (5)			350	350	350	0		
7.10	Monitoring			60	60	60	0		
7.11	HV&LV Systems (6)		600		600	1500	-900		100
7.12	Cooling System (7)			120	120	100	20		
7.13	Gas System (8)				0	400	-400		400
7.14	Skew clear cables to link boards (9)			80	80	240	-160		
7.15	Splitter Boards (10)		400		400	400	0		
	TOTALS	350	1785	1900	4035	5820	-1785	40	800

(1) Loan from CF.

(2) Korea should cover the full cost (in kind contribution).

(3) VLSI have been already purchased by Italy. Loan from INFN.

(4) Kapton cables are abandoned. Cheaper solution under study for ~ 100 kCHF. Loan from CF.

(5) 5.4 man-years at CERN from Pakistan for installation + Tooling.

(6) LV System covered by central LV system. HV system same as Barrel. Final cost under study but expect < 1500 kCHF

(7) MoU contribution of 120 kCHF from Pakistan covered by in kind contribution to CP (collar system for HF).

(8) Already committed using loan from CF (part of a global contract).

(9) Cables from front-ends on chambers to link boards on the periphery. Will be assembled in Pakistan for Barrel&Endcaps (Additional Contribution)

(10) TRIDAS item. MoU Korean responsibility.

5. High Luminosity Upgrade

The list below shows the staged items, which we currently think are needed at high luminosity. The total list adds up to a cost of ~ 29 MCHF. The decision to build many of these items will only be taken after inspection of the first physics data.

Complete DAQ system and Cooling	8.5 MCHF
Complete Endcap RPCs	1.5 MCHF
ME4/2mechanics and electronics	9.2 MCHF
ME4/1 electronics	1.5 MCHF
ME4/1assembly in PNPI	0.5 MCHF
Restore ME1/1a electronics	1.5 MCHF
Extra neutronshielding	1.0 MCHF
3rd forward pixel layer	~2.5 MCHF
Double RPC RE2 station	~2.0 MCHF
Extra installation costs	~1.0 MCHF

CMS continues to attract new collaborators. New Zealand was approved to join CMS in September. They will contribute to the online computer farm and the pixels detector. Institutes from two new countries have presented their applications to join the CMS Collaboration in September. These are from Brazil and Ireland.

Brazil	Online Computer farm, YE4, forward detectors, electronics	YE4 in kind contribution Application received. Presentation in September 2002
Ireland	Online Computer farm, ECAL electronics	Application received. Presentation in September 2002

Discussions with other new collaborators are progressing:

Mexico	Silicon tracker in collaboration with US	In progress
Thailand	ME electronics boards	In progress
US (Heavy Ions)	2 DAQ slices, zero degree calorimeter	Proposal submitted to DoE

All in all contributions of the order of 10 MCHF could be expected.

6. Conclusions

CMS has drawn up a financial plan based on a request for additional funds. The best estimate for the additional 'firm' contributions is 50 MCHF. An estimate of later funding is 1.7 MCHF. Using only the firm indications the plan allows CMS to mount a detector for first beam requiring staging that is more aggressive than desired. Nevertheless this detector should be adequate for discovering new physics at the initial luminosities.

We request the relevant agencies to make firm the funding indicated as arriving later. We request all agencies to work with CMS to improve the funding profile so that it matches the technically driven profile so as not to delay the construction of CMS.