

Memorandum of Agreement

for the Maintenance and Operation of the CMS Detector

between the

CMS Collaboration (CMS)

and the

(Consortium of) Funding Agency(ies) (Provider)

(Consortium of) Institute(s) (Provider)

collectively named the Signatories

1. Introduction

This Memorandum of Agreement (MoA) between CMS and Provider is a collaborative agreement between scientists and does not constitute a legal contractual obligation on the part of the Signatories.

This MoA documents the terms of agreement between CMS and Provider for the provision of services towards the effective operation of the detector and all software and computing necessary for later physics analysis.

This MoA is done in accordance with the CMS Constitution (last revised December 15, 2006) and its Authorship rules. In case of conflicts, the CMS Constitution shall prevail.

Appendix 1 gives a set of guidelines to implement this MoA. The other Appendices document for each System Area the global needs of CMS.

The System Areas documented in the Appendices are in the order:

Tracker, ECAL, HCAL, Muon, Trigger, DAQ, Core Computing, Offline Software and Run & Technical Coordination.

The Annexes document the effort Provider will support in each System Area (this corresponds in first approximation to each subdetector built during the Construction phase).

This document covers specific agreements of operations responsibilities for a period of 24 months starting from the date of validity as indicated in the signatures-page. This document is tacitly renewable and its end date can be modified by each party with at least 6 months notice prior to the expiration date. The CMS Resources Manager shall be notified of all such changes.

In very exceptional and well documented cases, this document can be terminated with at least 6 months notice given to the CMS Resources Manager regardless of the expiration date.

Amendments to this document can be done at any time to adapt it to changing requirements by mutual agreement.

Each System Area shall name a System Area Manager who will be overall-in-charge of the corresponding annexes of the MoAs. The CMS Spokesperson, the Technical Coordinator and the Resources Manager shall receive from each System Area Manager a report every 6 months, in March and September, on the performance of the System Area MoAs.

The report will qualitatively point out successes, problems and proposed changes to address them.

The CMS management and/or the System Area Manager can request quantitative information if the qualitative report fails to address perceived issues.

2. It is agreed that

The Provider must contribute its agreed share of M&O resources in compliance with the Memorandum of Understanding for Maintenance and Operation of the CMS Detector (cf. CERN-RRB-2002-033) and its Addendum No. 1, Core Computing (cf. CERN-RRB-2005-009).

The Provider will carry out the tasks indicated in the Annexes for a duration of 24 months.

The Provider will have access to the M&O resources associated with its tasks during this period as indicated in the Annexes and will be responsible for the reporting and the proper usage of these funds.

The Provider will report to the System Area Manager on the execution of the tasks and of any problem that may arise.

Tasks eligible for service work fall in three categories:

- OPERATIONS: Shifts, Data taking, On-Call experts, Data Quality Monitoring, Offline monitoring processing jobs, Calibration, Alignment, DAQ.
- MAINTENANCE: Calibration, Repairs, Development of code for: HLT and Data Monitoring, Firmware, Frameworks, Database.
- SLHC: specific R&D activities focused on the CMS upgrade if approved by the CMS Collaboration.
- OTHERS: Test beams, Computing, a few selected management tasks.

The Provider will deliver an effort towards service work in the following ways:

- For each CMS publications signing member¹, the Provider will maintain signing rights by providing 6 months of 100% effort towards MoA's work every 2 calendar years.
This level of service work can be fulfilled by the Provider as an average across all its members.
- Each new member of the Provider joining CMS shall be allowed to sign CMS publications after providing 6 months of 100% effort towards service work during the first 24 months of participation in CMS. Any other relevant rule in the Authorship rules and CMS Constitution will also have to be satisfied.

¹ This includes graduate students.

The mandatory level of service for the two cases above will be reviewed at the end of the Commissioning period of the detector.

In the event that the tasks indicated in the Annexes are not carried out as agreed, the CMS Spokesperson will contact the Provider to agree on the measures to be taken to redress the situation. If the agreement fails to reestablish the proper level of performance within a reasonable time, the Spokesperson will bring the matter to the Collaboration Board who will decide on further action.

We agree on all the above and on the content of the Annexes as attached here. We have taken note of the Appendices to this document.

Validity dates: from _____ to _____

Done in Geneva, Switzerland

Done in _____

on _____

on _____

For CMS

For Provider

CMS Spokesperson

Title

CMS Resources Manager

Appendix 1

Guidelines for the Estimate of the Needs for Maintenance and Operation of the CMS Detector at CERN

1. Introduction

Using the information coming from other running experiments (CDF, D0, Babar) we have estimated for CMS a need of about 500-600 FTEs for the first two years of running (commissioning and first physics data). We expect these numbers will be reduced to about 250-300 FTEs in the future when stable machine and detector conditions will be achieved.

A preliminary estimate of the needs for each subsystem (Magnet & Infrastructure, DAQ & Trigger, Computing, Muons, HCAL, ECAL, TRACKER) has been discussed in a few meetings. To have a better understanding of our real needs we have asked all project managers to prepare their plans following the same template.

2. Definitions

Provider: whoever signs a MoA. It can range from a single Institute to a consortium of Institutes, a Funding Agency or even a Consortium of Funding Agencies. It is strongly advised to sign an appropriate document to form a Consortium (e.g. MoU between all Institutes participating in a Consortium of Institutes, some formal letters of agreement between Funding Agencies in a Consortium).

System Area Manager: this is the subdetector Project Manager or the relevant coordinator for the Core Computing, Offline Software and Run & Technical Coordination.

3. Guidelines

The template contains the basic information we would need to collect. The assumptions are that we have each year a 6 months operation period followed by 6 months of maintenance/installation period. During operation, people on shift take care of the safe running of the experiment and of the quality of the collected data while another part of the community prepares replacements parts (both hardware and software), installs the most critical components during the short shut-down periods or whenever it is possible and services defective hardware or software components. During the shut-down periods a low-level operation of the detector is maintained while major installation/repair might occur.

For the operation: *managers* are people on shift in the control room, *operators* are people on shift not necessary in the control room (not enough space will be available). *Experts* on call

are people working at CERN and able to act within a maximum delay of 1/2h to solve the problems (by phone or by direct presence at the experiment). To calculate the total needs in FTE we advise the application of a factor 4 to the number of managers and operators needed per shift (a factor three for the three shifts/day+ contingency) and a factor 1/2 to the number of experts on call (a factor 3 for the three shifts a day but only 15% of the time really used in average; the expert on call might do other jobs while servicing the detectors). Consider 6 months per year as a normal operation period. Divide the people by a factor 3 for the operation of detectors during the shut-down periods.

Maintenance/installation. We do not envisage to work normally in shifts for maintenance during data-taking period while it might be needed for certain activities during the shut-down activities. Managers are people in charge for the various activities. Operators are people (e.g. physicists, engineers or technicians) working to maintain or repair defective components or preparing replacement parts. Large part of the work to prepare replacement parts can be done outside CERN. For commercial components some of these activities must be covered by contracts of maintenance and personnel belonging to companies working at CERN or in the company. To calculate the total needs in FTE we advise applying a factor of 1 to the number of people needed for these activities during the operation periods and a factor 2 for the shut-down/installation periods.

4. Frequently Asked Questions

• New Institutes

The MoA does not deal with the issue of new Institutes joining CMS, only with individuals who become new members of CMS. The new Institutes *entry fee/entry contribution* is outside the scope of the MoA.

• Interactions with M&O-B

Funds from M&O-B should be associated with the tasks that will need them. This is irrespective of the source of said M&O-B funds and of the Provider for the task. It would be simpler of course if the M&O-B funds were provided by the Provider itself, but this is not mandatory.

The M&O-B line *Technical manpower at CERN (FTE)* has to be reviewed to be mutually exclusive with the manpower requirements for the MoAs: we should avoid double counting. The limit cases are:

- to completely remove that line from M&O-B and base all manpower at CERN as part of the MoAs or
- to put all MoAs manpower as part of the M&O-B (technical manpower only!).

Any middle ground chosen should be documented as to be completely unambiguous.

The suggested way of handling the cut is to make jobs for non-signing members of CMS (e.g. technicians) part of the M&O-B *Technical manpower at CERN (FTE)* and all other jobs part of the MoAs, compatibly with the definition of service work as laid out in the MoA itself.

All Institutes should be contributing to M&O-B. Failure to do so will be handled following the procedure detailed in the M&O MoU, article 14.1.

- **Founding Members**

To recognize the work done by early CMS members, we could recognize a credit of 2 calendar years of service work for members having joined actively CMS before the year 2000 and a credit of 1 calendar year of service works for members having joined actively CMS before the year 2005.

No credit would be given for all other members.

Credits can only be used starting in 2010.

- **Handling of special cases**

No document can properly cover all possible cases. In this event, Provider can discuss with the System Area Manager to work out a solution for few special cases which may arise. These special cases should then be discussed into each System Area and with the CMS Spokesperson to ensure equal treatment for everybody across all System Areas.

Appendix 2 Tracker System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	4.0	8.0	3.0	15.0	0.3	0.7	0.3	1.3		
		Electronics				0.0	0.0	0.0	0.0	0.0		
		Services		4.0	1.5	5.5	0.0	0.3	0.1	0.5		
	TOTAL DET. HARDWARE			4.0	12.0	4.5	20.5	0.3	1.0	0.4	1.7	0
	ELECTRONICS/DAQ	Power system	1.3	4.0	0.5	5.8	0.1	0.3	0.0	0.5		
		VME/DAQ	1.3	4.0	1.0	6.3	0.1	0.3	0.1	0.5		
		DCS/DSS	1.3	4.0	1.0	6.3	0.1	0.3	0.1	0.5		
	TOTAL ELECTRONICS/DAQ			4.0	12.0	2.5	18.5	0.3	1.0	0.2	1.5	0
	SOFTWARE/DQM	Raw data	1.3	4.0	1.0	6.3	0.1	0.3	0.1	0.5		
		Reconstructed data	1.3	4.0	1.0	6.3	0.1	0.3	0.1	0.5		
		Physics quality data	1.3	4.0	1.0	6.3	0.1	0.3	0.1	0.5		
	TOTAL SOFTWARE/DQM			4.0	12.0	3.0	19.0	0.3	1.0	0.3	1.6	0
TOTAL OPERATION			12.0	36.0	10.0	58.0	1.0	3.0	0.8	4.8	0	
MAINTENANCE	DET. HARDWARE	Detectors	0.3	3.0	8.0	11.3	0.7	6.0	16.0	22.7		
		Electronics	0.3		4.0	4.3	0.7	0.0	8.0	8.7		
		Services	2.3	9.0	10.0	21.3	4.7	18.0	20.0	42.7		
	TOTAL DET. HARDWARE			3.0	12.0	22.0	37.0	6.0	24.0	44.0	74.0	0
	ELECTRONICS/DAQ	Power	0.3	1.0	2.0	3.3	0.7	2.0	4.0	6.7		
		VME/DAQ	0.3	2.0	3.0	5.3	0.7	4.0	6.0	10.7		
		DCS/DSS	0.3	1.0	2.0	3.3	0.7	2.0	4.0	6.7		
	TOTAL ELECTRONICS/DAQ			1.0	4.0	7.0	12.0	2.0	8.0	14.0	24.0	0
	SOFTWARE/DQM	Raw data	0.3	1.0	3.0	4.3	0.7	2.0	6.0	8.7		
		Reconstructed data	0.3	1.0	3.0	4.3	0.7	2.0	6.0	8.7		
		Physics quality data	0.3	1.0	3.0	4.3	0.7	2.0	6.0	8.7		
	TOTAL SOFTWARE/DQM			1.0	3.0	9.0	13.0	2.0	6.0	18.0	26.0	0
TOTAL MAINTENANCE			5.0	19.0	38.0	62.0	10.0	38.0	76.0	124.0	0	
TOTAL SYSTEM AREA			17.0	55.0	48.0	120.0	11.0	41.0	76.8	128.8	0	

Appendix 3 ECAL System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	9.0			9.0	1.5			1.5		
		Electronics										
		Services			3.0	3.0			0.5	0.5		
	TOTAL DET. HARDWARE			9.0		3.0	12.0	1.5		0.5	2.0	
	ELECTRONICS/DAQ	Power system			3.0	3.0				0.5	0.5	
		VME/DAQ			4.5	4.5				0.8	0.8	
		DCS/DSS			3.0	3.0				0.5	0.5	
		TOTAL ELECTRONICS/DAQ					10.5	10.5			1.8	1.8
	SOFTWARE/DQM	Raw data		8.9		18.2	27.1	1.5		3.0	4.5	
		Reconstructed data		0.5		2.0	2.5	0.1		0.3	0.4	
Physics quality data												
TOTAL SOFTWARE/DQM			9.4		20.2	29.6	1.6		3.4	4.9		
TOTAL OPERATION			18.4		33.7	52.1	3.1		5.6	8.7		
MAINTENANCE	DET. HARDWARE	Detectors	0.5			0.5	1.0			1.0	322	
		Electronics										
		Services			0.7	0.7	1.4			1.4	406	
	TOTAL DET. HARDWARE			1.2			1.2	2.4		2.4	728	
	ELECTRONICS/DAQ	Power										
		VME/DAQ		0.5	1.0	1.5	1.0	2.0		3.0	625	
		DCS/DSS			0.7	0.7		1.4		1.4		
	TOTAL ELECTRONICS/DAQ			0.5	1.7		2.2	1.0	3.4	4.4	625	
	SOFTWARE/DQM	Raw data		0.2	2.0	2.2	0.4	4.0		4.4	80	
		Reconstructed data		0.2	2.0	2.2	0.4	4.0		4.4		
Physics quality data												
TOTAL SOFTWARE/DQM			0.4	4.0		4.4	0.8	8.0	8.8	80		
TOTAL MAINTENANCE			2.1	5.7		7.8	4.2	11.4	15.6	1,433		
TOTAL SYSTEM AREA			20.5	5.7	33.7	59.9	7.3	11.4	5.6	24.3	1433	

Appendix 4 HCAL System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	0.5	1.0	0.5	2.0	0.2	0.3	0.2	0.7		
		Electronics	1.0	2.0	1.0	4.0	0.3	0.7	0.3	1.3		
		Services	0.5	1.0	0.5	2.0	0.2	0.3	0.2	0.7		
	TOTAL DET. HARDWARE			2.0	4.0	2.0	8.0	0.7	1.3	0.7	2.7	0
	ELECTRONICS/DAQ	Power system	1.0	1.0	0.5	2.5	0.3	0.3	0.2	0.8		
		VME/DAQ	2.0	2.0	1.0	5.0	0.7	0.7	0.3	1.7		
		DCS/DSS	2.0	2.0	1.0	5.0	0.7	0.7	0.3	1.7		
	TOTAL ELECTRONICS/DAQ			5.0	5.0	2.5	12.5	1.7	1.7	0.8	4.2	0
	SOFTWARE/DQM	Raw data	1.0	1.0	0.5	2.5	0.3	0.3	0.2	0.8		
		Reconstructed data	2.0	4.0	2.0	8.0	0.7	1.3	0.7	2.7		
		Physics quality data	2.0	4.0	2.0	8.0	0.7	1.3	0.7	2.7		
	TOTAL SOFTWARE/DQM			5.0	9.0	4.5	18.5	1.7	3.0	1.5	6.2	0
	TOTAL OPERATION			12.0	18.0	9.0	39.0	4.0	6.0	3.0	13.0	0
MAINTENANCE	DET. HARDWARE	Detectors	0.5	0.5	0.3	1.3	1.0	2.0	2.0	5.0		
		Electronics	0.5	1.0	0.5	2.0	1.0	2.0	2.0	5.0		
		Services	0.5	0.5	0.3	1.3	0.5	1.0	1.0	2.5		
	TOTAL DET. HARDWARE			1.5	2.0	1.0	4.5	2.5	5.0	5.0	12.5	0
	ELECTRONICS/DAQ	Power	0.5	0.5	0.3	1.3	0.5	0.5	0.5	1.5		
		VME/DAQ	1.0	2.0	1.0	4.0	1.0	2.0	2.0	5.0		
		DCS/DSS	1.0	1.0	0.5	2.5	1.0	1.0	1.0	3.0		
	TOTAL ELECTRONICS/DAQ			2.5	3.5	1.8	7.8	2.5	3.5	3.5	9.5	0
	SOFTWARE/DQM	Raw data	1.0	1.0	0.5	2.5	1.0	1.0	1.0	3.0		
		Reconstructed data	1.0	2.0	1.0	4.0	1.0	2.0	2.0	5.0		
Physics quality data		1.0	2.0	1.0	4.0	1.0	2.0	2.0	5.0			
TOTAL SOFTWARE/DQM			3.0	5.0	2.5	10.5	3.0	5.0	5.0	13.0	0	
TOTAL MAINTENANCE			7.0	10.5	5.3	22.8	8.0	13.5	13.5	35.0	0	
TOTAL SYSTEM AREA			19.0	28.5	14.3	61.8	12.0	19.5	16.5	48.0	0	

Appendix 5

Muon-DT-BA-LA System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	1.3	0.7	0.8	2.8	0.4	0.2		0.6	49	
		Electronics	1.3	0.7	0.8	2.8	0.4	0.2	0.2	0.8		
		Services	1.3	0.7	0.8	2.8	0.4	0.2	0.2	0.8	9	
	TOTAL DET. HARDWARE			4.0	2.0	2.5	8.5	1.3	0.5	0.4	2.2	58
	ELECTRONICS/DAQ	Power system	1.3	0.7	0.7	2.7	0.4	0.2		0.6	49	
		VME/DAQ	1.3	0.7	0.7	2.7	0.4	0.2	0.2	0.8	20	
		DCS/DSS	1.3	0.7	0.7	2.7	0.4	0.2	0.2	0.8	6	
	TOTAL ELECTRONICS/DAQ			4.0	2.0	2.0	8.0	1.3	0.5	0.4	2.2	75
	SOFTWARE/DQM	Raw data	1.3	1.3	2.0	4.7	0.4	0.4	0.7	1.6	49	
		Reconstructed data	1.3	1.3	2.0	4.7	0.4	0.4	0.7	1.6		
		Physics quality data	1.3	1.3	1.0	3.7	0.4	0.4	0.7	1.6		
	TOTAL SOFTWARE/DQM			4.0	4.0	5.0	13.0	1.3	1.3	2.0	4.7	49
	TOTAL OPERATION			12.0	8.0	9.5	29.5	4.0	2.3	2.8	9.1	181
	MAINTENANCE	DET. HARDWARE	Detectors	1.0		0.5	1.5	1.0		0.5	1.5	29
			Electronics	0.5	1.0	3.0	4.5	0.5	1.0	3.0	4.5	100
Services			0.5		0.5	1.0	0.5		0.5	1.0	45	
TOTAL DET. HARDWARE			2.0	1.0	4.0	7.0	2.0	1.0	4.0	7.0	174	
ELECTRONICS/DAQ		Power	0.5	0.5		1.0	0.5	0.5		1.0	60	
		VME/DAQ	0.5	1.0	1.5	3.0	0.5	1.0	1.5	3.0	58	
		DCS/DSS	0.5	1.0	1.5	3.0	0.5	1.0	1.5	3.0		
TOTAL ELECTRONICS/DAQ			1.5	2.5	3.0	7.0	1.5	2.5	3.0	7.0	118	
SOFTWARE/DQM		Raw data		1.0	3.2	4.2		1.0	3.2	4.2		
		Reconstructed data		1.4	4.5	5.9		1.4	4.5	5.9	49	
	Physics quality data		1.0	2.5	3.5		1.0	2.5	3.5			
TOTAL SOFTWARE/DQM			0.0	3.4	10.2	13.6	0.0	3.4	10.2	13.6	49	
TOTAL MAINTENANCE			3.5	6.9	17.2	27.6	3.5	6.9	17.2	27.6	341	
TOTAL SYSTEM AREA			15.5	14.9	26.7	57.1	7.5	9.2	20.0	36.7	521	

Appendix 5 Muon-ME11 System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	0.5	0.1	0.2	0.8				0.0		
		Electronics		0.1		0.1				0.0		
		Services			0.1	0.1				0.0		
	TOTAL DET. HARDWARE			0.5	0.2	0.3	1.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power system			0.1	0.1				0.0		
		VME/DAQ				0.0				0.0		
		DCS/DSS			0.1	0.1				0.0		
	TOTAL ELECTRONICS/DAQ			0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data			0.4	0.4				0.0		
		Reconstructed data			0.1	0.1				0.0		
Physics quality data				0.1	0.1				0.0			
TOTAL SOFTWARE/DQM			0.0	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0	
TOTAL OPERATION			0.5	0.9	0.4	1.8	0.0	0.0	0.0	0.0	0	
MAINTENANCE	DET. HARDWARE	Detectors				0.0	0.2		0.5	0.7		
		Electronics				0.0			0.3	0.3		
		Services				0.0			0.1	0.1		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.2	0.0	0.9	1.1	0
	ELECTRONICS/DAQ	Power				0.0				0.1	0.1	
		VME/DAQ				0.0				0.0		
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data				0.0				0.2	0.2	
Physics quality data					0.0				0.2	0.2		
TOTAL SOFTWARE/DQM			0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0	
TOTAL MAINTENANCE			0.0	0.0	0.0	0.0	0.2	0.0	1.4	1.6	0	
TOTAL SYSTEM AREA			0.5	0.9	0.4	1.8	0.2	0.0	1.4	1.6	0	

Appendix 5

Muon-CSC System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	0.2	0.6	1.0	1.8	0.1	0.2	0.3	0.6		
		Electronics	1.0	2.0	3.0	6.0	0.3	0.7	1.0	2.0		
		Services	0.5	1.0	2.0	3.5	0.2	0.3	0.7	1.2		
	TOTAL DET. HARDWARE			1.7	3.6	6.0	11.3	0.6	1.2	2.0	3.8	0
	ELECTRONICS/DAQ	Power system	0.3	0.6	2.0	2.9	0.1	0.2	0.7	1.0		
		VME/DAQ	0.5	1.3	4.0	5.8	0.2	0.4	1.3	1.9		
		DCS/DSS	0.5	0.5	1.0	2.0	0.2	0.2	0.3	0.7		
	TOTAL ELECTRONICS/DAQ			1.3	2.4	7.0	10.7	0.4	0.8	2.3	3.6	0
	SOFTWARE/DQM	Raw data	1.0	2.0	3.0	6.0	0.3	0.7	1.0	2.0		
		Reconstructed data	0.5	1.0	1.0	2.5	0.2	0.3	0.3	0.8		
		Physics quality data	0.5	1.0	1.0	2.5	0.2	0.3	0.3	0.8		
	TOTAL SOFTWARE/DQM			2.0	4.0	5.0	11.0	0.7	1.3	1.7	3.7	0
	TOTAL OPERATION			5.0	10.0	18.0	33.0	1.7	3.3	6.0	11.0	0
	MAINTENANCE	DET. HARDWARE	Detectors			0.0	0.0	0.2		2.0	2.2	
Electronics					1.0	1.0	0.3		3.3	3.6		
Services					1.0	1.0	0.2		2.0	2.2		
TOTAL DET. HARDWARE			0.0	0.0	2.0	2.0	0.7	0.0	7.3	8.0	0	
ELECTRONICS/DAQ		Power			0.0	0.0	0.1		0.5	0.6		
		VME/DAQ			1.0	1.0	0.2		3.5	3.7		
		DCS/DSS			0.3	0.3	0.2		1.0	1.2		
TOTAL ELECTRONICS/DAQ			0.0	0.0	1.3	1.3	0.5	0.0	5.0	5.5	0	
SOFTWARE/DQM		Raw data			6.0	6.0	0.2		6.0	6.2		
		Reconstructed data			1.0	1.0	0.2		2.0	2.2		
	Physics quality data			1.0	1.0	0.2		2.0	2.2			
TOTAL SOFTWARE/DQM			0.0	0.0	8.0	8.0	0.6	0.0	10.0	10.6	0	
TOTAL MAINTENANCE			0.0	0.0	11.3	11.3	1.8	0.0	22.3	24.1	0	
TOTAL SYSTEM AREA			5.0	10.0	29.3	44.3	3.5	3.3	28.3	35.1	0	

Appendix 5 Muon-RPC System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	4.0		2.0	6.0	1.0		2.0	3.0	100	
		Electronics			1.0	1.0				0.0		
		Services			2.0	2.0			1.0	1.0		
	TOTAL DET. HARDWARE			4.0	0.0	5.0	9.0	1.0	0.0	3.0	4.0	100
	ELECTRONICS/DAQ	Power system			1.0	1.0				0.5	0.5	
		VME/DAQ		0.5	2.0	2.5				1.0	1.0	
		DCS/DSS		0.5	2.0	2.5				1.0	1.0	
	TOTAL ELECTRONICS/DAQ			0.0	1.0	5.0	6.0	0.0	0.0	2.5	2.5	0
	SOFTWARE/DQM	Raw data		1.0	2.0	3.0				1.0	1.0	50
		Reconstructed data			1.0	1.0				1.0	1.0	
Physics quality data				1.0	1.0				1.0	1.0		
TOTAL SOFTWARE/DQM			0.0	1.0	4.0	5.0	0.0	0.0	3.0	3.0	50	
TOTAL OPERATION			4.0	2.0	14.0	20.0	1.0	0.0	8.5	9.5	150	
MAINTENANCE	DET. HARDWARE	Detectors	1.0		2.0	3.0	1.0		2.0	3.0	100	
		Electronics				0.0				0.0		
		Services			1.0	1.0				1.0	1.0	
	TOTAL DET. HARDWARE			1.0	0.0	3.0	4.0	1.0	0.0	3.0	4.0	100
	ELECTRONICS/DAQ	Power			0.5	0.5				0.5	0.5	
		VME/DAQ			1.0	1.0				1.0	1.0	
		DCS/DSS			1.0	1.0				1.0	1.0	
	TOTAL ELECTRONICS/DAQ			0.0	0.0	2.5	2.5	0.0	0.0	2.5	2.5	0
	SOFTWARE/DQM	Raw data			1.0	1.0				1.0	1.0	50
		Reconstructed data			1.0	1.0				1.0	1.0	
Physics quality data				1.0	1.0				1.0	1.0		
TOTAL SOFTWARE/DQM			0.0	0.0	3.0	3.0	0.0	0.0	3.0	3.0	50	
TOTAL MAINTENANCE			1.0	0.0	8.5	9.5	1.0	0.0	8.5	9.5	150	
TOTAL SYSTEM AREA			5.0	2.0	22.5	29.5	2.0	0.0	17.0	19.0	300	

Appendix 6 Trigger System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
	ELECTRONICS/DAQ	Power system				0.0				0.0		
		VME/DAQ	2.5	7.9	2.1	12.5	2.5	7.9	2.1	12.5		
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			2.5	7.9	2.1	12.5	2.5	7.9	2.1	12.5	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data	1.3	5.6	0.0	6.9	1.3	5.6	0.0	6.9		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			1.3	5.6	0.0	6.9	1.3	5.6	0.0	6.9	0	
TOTAL OPERATION			3.8	13.5	2.1	19.4	3.8	13.5	2.1	19.4	0	
MAINTENANCE	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
	ELECTRONICS/DAQ	Power				0.0				0.0		
		VME/DAQ	1.1	3.4	4.9	9.4	1.1	3.4	4.9	9.4		
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			1.1	3.4	4.9	9.4	1.1	3.4	4.9	9.4	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data	0.6	2.4	0.0	3.0	0.6	2.4	0.0	3.0		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			0.6	2.4	0.0	3.0	0.6	2.4	0.0	3.0	0	
TOTAL MAINTENANCE			1.7	5.8	4.9	12.4	1.7	5.8	4.9	12.4	0	
TOTAL SYSTEM AREA			5.5	19.3	7.0	31.8	5.5	19.3	7.0	31.8	0	

Appendix 7 DAQ System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
	ELECTRONICS/DAQ	Power system				0.0				0.0		
		VME/DAQ		3.0	12.0	4.0	19.0	1.5	6.0	2.0	9.5	
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			3.0	12.0	4.0	19.0	1.5	6.0	2.0	9.5	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data				0.0				0.0		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		
TOTAL OPERATION			3.0	12.0	4.0	19.0	1.5	6.0	2.0	9.5	0	
MAINTENANCE	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
	ELECTRONICS/DAQ	Power				0.0				0.0		
		VME/DAQ		3.0	9.0	6.0	18.0	3.0	9.0	6.0	18.0	
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			3.0	9.0	6.0	18.0	3.0	9.0	6.0	18.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data				0.0				0.0		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		
TOTAL MAINTENANCE			3.0	9.0	6.0	18.0	3.0	9.0	6.0	18.0	0	
TOTAL SYSTEM AREA			6.0	21.0	10.0	37.0	4.5	15.0	8.0	27.5	0	

Appendix 8

Core Computing System Area Needs

WBS To Be Defined

			DATA TAKING				SHUT-DOWN				M&O
OPERATION	DET. HARDWARE	Electronics	MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF
		Services				0.0				0.0	
		Electronics				0.0				0.0	
		Services				0.0				0.0	
		TOTAL DET. HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power system				0.0				0.0	
		VME/DAQ				0.0				0.0	
		DCS/DSS				0.0				0.0	
		TOTAL ELECTRONICS/DAQ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0	
		Reconstructed data				0.0				0.0	
		Physics quality data				0.0				0.0	
		TOTAL SOFTWARE/DQM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
		TOTAL OPERATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
MAINTENANCE	DET. HARDWARE	Detectors				0.0				0.0	
		Electronics				0.0				0.0	
		Services				0.0				0.0	
		TOTAL DET. HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power				0.0				0.0	
		VME/DAQ				0.0				0.0	
		DCS/DSS				0.0				0.0	
		TOTAL ELECTRONICS/DAQ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0	
		Reconstructed data				0.0				0.0	
		Physics quality data				0.0				0.0	
		TOTAL SOFTWARE/DQM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
		TOTAL MAINTENANCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
		TOTAL SYSTEM AREA	0.0	0.0	0.0	55.0	0.0	0.0	0.0	55.0	0

Appendix 9 Offline Software System Area Needs

WBS To Be Defined

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power system				0.0				0.0		
		VME/DAQ				0.0				0.0		
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data				0.0				0.0		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
TOTAL OPERATION			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
MAINTENANCE	DET. HARDWARE	Detectors				0.0				0.0		
		Electronics				0.0				0.0		
		Services				0.0				0.0		
	TOTAL DET. HARDWARE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power				0.0				0.0		
		VME/DAQ				0.0				0.0		
		DCS/DSS				0.0				0.0		
	TOTAL ELECTRONICS/DAQ			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0		
		Reconstructed data				0.0				0.0		
Physics quality data					0.0				0.0			
TOTAL SOFTWARE/DQM			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
TOTAL MAINTENANCE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
TOTAL SYSTEM AREA			0.0	0.0	0.0	90.0	0.0	0.0	0.0	90.0	0	

Appendix 10

Run-Technical Coordination System Area Needs

WBS To Be Reviewed

			DATA TAKING				SHUT-DOWN				M&O
OPERATION	DET. HARDWARE		MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF
		Detectors				0.0				0.0	
		Electronics				0.0				0.0	
		Services				0.0				0.0	
	TOTAL DET. HARDWARE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power system				0.0				0.0	
		VME/DAQ				0.0				0.0	
		DCS/DSS				0.0				0.0	
	TOTAL ELECTRONICS/DAQ		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0	
		Reconstructed data				0.0				0.0	
		Physics quality data				0.0				0.0	
	TOTAL SOFTWARE/DQM		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
TOTAL OPERATION			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
MAINTENANCE	DET. HARDWARE	Detectors				0.0				0.0	
		Electronics				0.0				0.0	
		Services				0.0				0.0	
	TOTAL DET. HARDWARE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	ELECTRONICS/DAQ	Power				0.0				0.0	
		VME/DAQ				0.0				0.0	
		DCS/DSS				0.0				0.0	
	TOTAL ELECTRONICS/DAQ		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	SOFTWARE/DQM	Raw data				0.0				0.0	
		Reconstructed data				0.0				0.0	
		Physics quality data				0.0				0.0	
	TOTAL SOFTWARE/DQM		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
TOTAL MAINTENANCE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
TOTAL SYSTEM AREA			0.0	0.0	0.0	40.0	0.0	0.0	0.0	40.0	0

Appendix 11 ALL System Area Needs

			DATA TAKING				SHUT-DOWN				M&O	
			MANAGERS	OPERATORS	EXPERTS	TOTAL	MANAGERS	OPERATORS	EXPERTS	TOTAL	kCHF	
OPERATION	DET. HARDWARE	Detectors	19.5	10.4	7.5	37.4	3.5	1.4	2.8	7.6	149	
		Electronics	3.3	4.8	5.8	13.9	1.1	1.5	1.5	4.1	0	
		Services	2.3	6.7	9.9	18.9	0.8	1.2	2.7	4.6	9	
	TOTAL DET. HARDWARE			25.2	21.8	23.3	70.3	5.4	4.0	6.9	16.4	158
	ELECTRONICS/DAQ	Power system	4.0	6.4	7.7	18.0	1.0	1.0	1.9	3.9	49	
		VME/DAQ	10.7	28.4	19.3	58.3	5.4	15.5	7.8	28.7	20	
		DCS/DSS	5.2	7.7	8.8	21.6	1.4	1.3	2.5	5.2	6	
	TOTAL ELECTRONICS/DAQ			19.8	42.4	35.7	97.9	7.8	17.9	12.1	37.8	75
	SOFTWARE/DQM	Raw data	13.6	9.7	26.7	50.0	2.7	1.8	5.9	10.4	99	
		Reconstructed data	7.0	16.0	9.0	32.0	2.8	8.0	3.1	13.9	0	
		Physics quality data	5.2	10.4	6.0	21.6	1.4	2.4	2.7	6.6	0	
	TOTAL SOFTWARE/DQM			25.7	36.2	41.7	103.6	6.9	12.3	11.8	30.9	99
	TOTAL OPERATION			70.7	100.4	100.7	271.8	20.0	34.2	30.8	85.0	331
MAINTENANCE	DET. HARDWARE	Detectors	3.3	3.5	10.8	17.6	5.1	8.0	23.0	36.1	451	
		Electronics	1.3	2.0	8.5	11.8	2.5	3.0	16.6	22.0	100	
		Services	4.0	9.5	12.8	26.3	7.3	19.0	24.6	50.9	451	
	TOTAL DET. HARDWARE			8.7	15.0	32.0	55.7	14.8	30.0	64.2	109.0	1,002
	ELECTRONICS/DAQ	Power	1.3	2.0	2.8	6.1	1.8	3.0	5.6	10.4	60	
		VME/DAQ	6.4	18.4	18.4	43.2	7.5	21.4	24.9	53.8	683	
		DCS/DSS	1.8	3.7	5.3	10.8	2.4	5.4	8.5	16.3	0	
	TOTAL ELECTRONICS/DAQ			9.6	24.1	26.5	60.2	11.6	29.8	39.0	80.4	743
	SOFTWARE/DQM	Raw data	1.5	5.0	13.7	20.2	2.3	8.0	17.2	27.5	130	
		Reconstructed data	2.1	8.8	10.5	21.4	2.9	11.8	15.7	30.4	49	
		Physics quality data	1.3	4.0	8.5	13.8	1.9	5.0	13.7	20.6	0	
	TOTAL SOFTWARE/DQM			5.0	17.8	32.7	55.5	7.0	24.8	46.6	78.4	179
	TOTAL MAINTENANCE			23.3	56.9	91.2	171.4	33.4	84.6	149.8	267.8	1,924
TOTAL SYSTEM AREA			94.0	157.3	191.8	628.1	53.4	118.8	180.6	537.8	2,254	