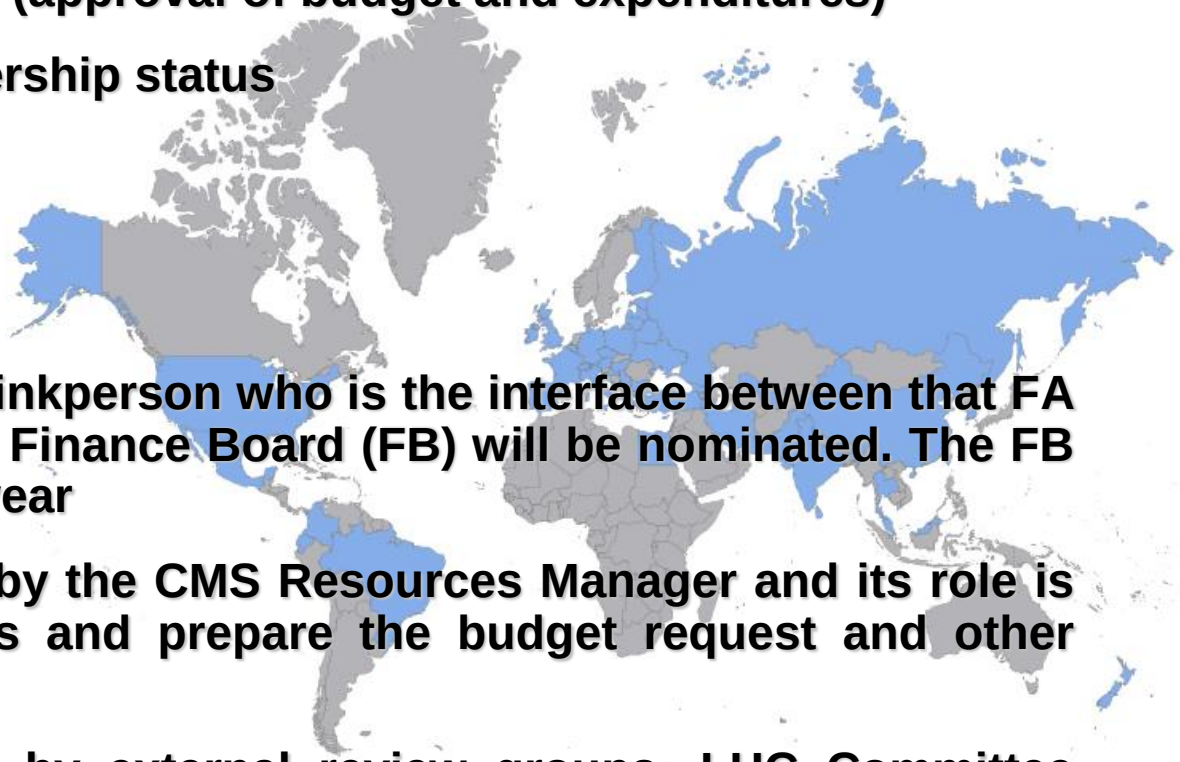
Finance Issues

A. Charkiewicz, Baltic Meeting, 29 May 2018

CMS is a global Collaboration

- CMS is composed of over 40 countries with each represented by one or more Funding Agency (FA) in the Resource Review Board (RRB)
- The RRB meets twice a year (April and October) and decides on all major financial issues related to CMS (approval of budget and expenditures)
- CMS has three types of membership status
  - Full member
  - Cooperating member
  - Associate member
- For new Funding Agencies a Linkperson who is the interface between that FA and CMS and a member of the Finance Board (FB) will be nominated. The FB meets on average ten times a year
- The Finance Board is chaired by the CMS Resources Manager and its role is to manage all financial issues and prepare the budget request and other documents for RRB approval
- The CMS budget is reviewed by external review groups: LHC Committee (LHCC), Upgrade Cost Group (UCG) and Scrutiny Group (SG)



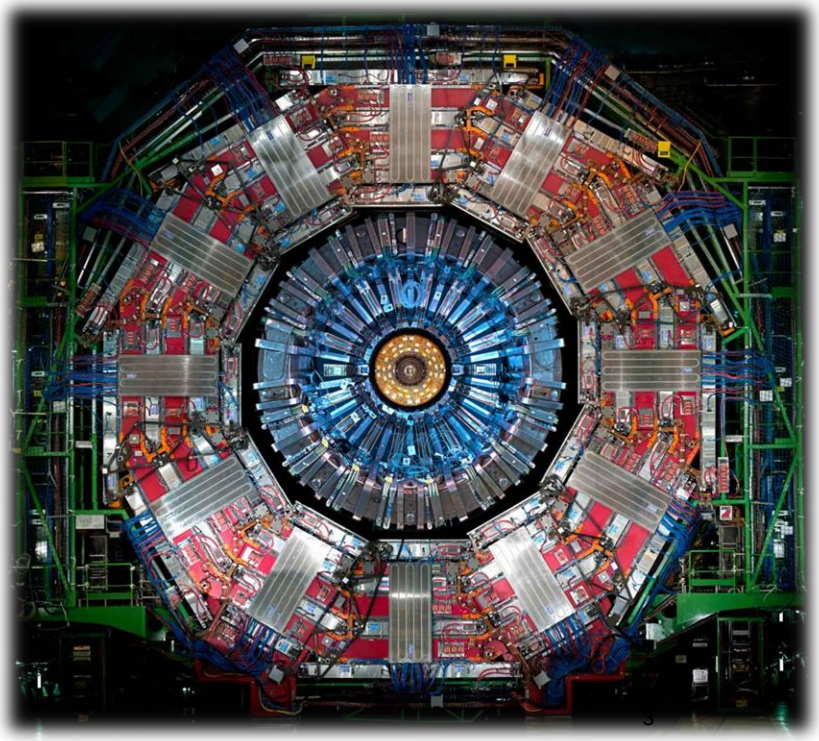
CMS Budgets

❑ Maintenance and Operation Category A (M&O-A)

- **Expenditures common to the whole detector**
- **Sharing based on the number of physicists signing CMS papers (PhD List)**

❑ Maintenance and Operation Category B (M&O-B)

- **Subsystem-specific expenditures**
- **Sharing based on institute responsibility PhD list as guideline**



❑ Upgrades

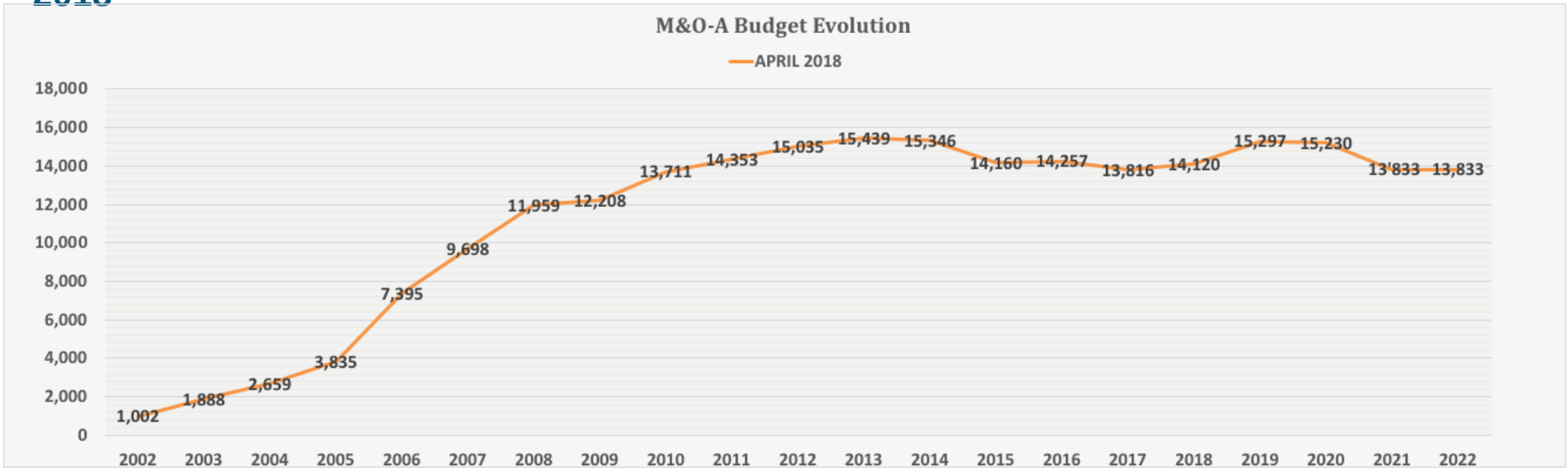
- **Phase I Upgrade (65 MCHF)**
  - ➢ **Including Common Fund of 6.5 MCHF**
- **Phase II Upgrade (280 MCHF)**
  - ➢ **Including Common Fund of 25 MCHF**

2019 M&O-A Preliminary Budget request

- The M&O-A cost estimates for 2019 were presented to the RRB at the meeting in April 2018

The total estimated budget for M&O-A is 15'297 kCHF

- The RRB is presented with a budget projection for the following 4 years
- Experience shows higher expenditures in the years of Long Shutdowns
- Final approval of the budget for 2019 is made by the RRB at its meeting in October 2018



2019 M&O-A Preliminary Budget Request

2019	Description	Budget in kCHF
M&O-A	A.1. Detector related	4'688
	A.2. Secretariat	312
	A.3. Communications	130
	A.4. On-line computing	3'525
	A.5. Test beams, calibration facilities	96
	A.6. Laboratory operations	610
	A.7. General services	2'272
	A.9. Core Computing Infrastructure & Services	1'964
Total without Power Cost		**13'597**
	A.8. Electricity	1'700
Total		**15'297**

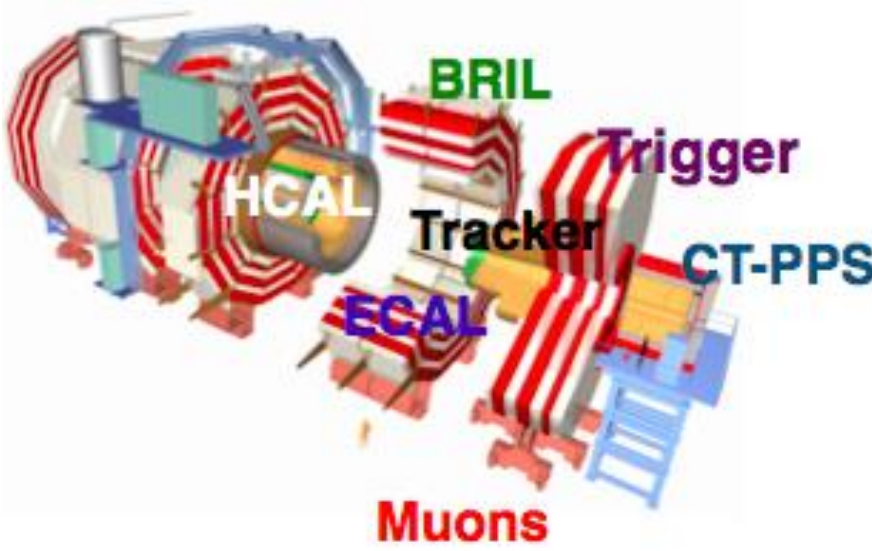
M&O-B Budget

- Each CMS Subdetector or Subsystem is an independent entity with its own management structure including a System Manager, System Resources Manager and an Institution Board which approves all major financial decisions and the annual budget

- Each CMS Funding Agency is expected to contribute to at least one Subsystem (where it is implicated on the technological and research level)

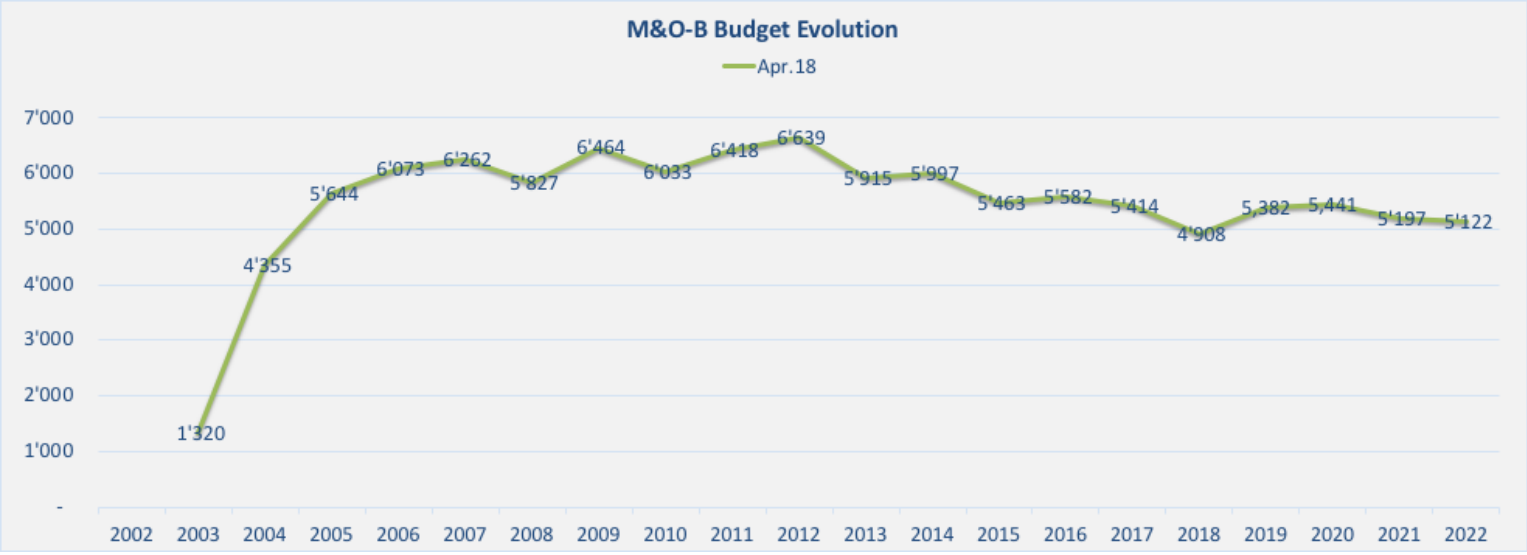
- The sharing mechanism among Funding Agencies and the consequent contributions are decided by the Institution Board

- In most Subsystems the relative percentage as defined by the PhD count is used. Only few use other schemes.



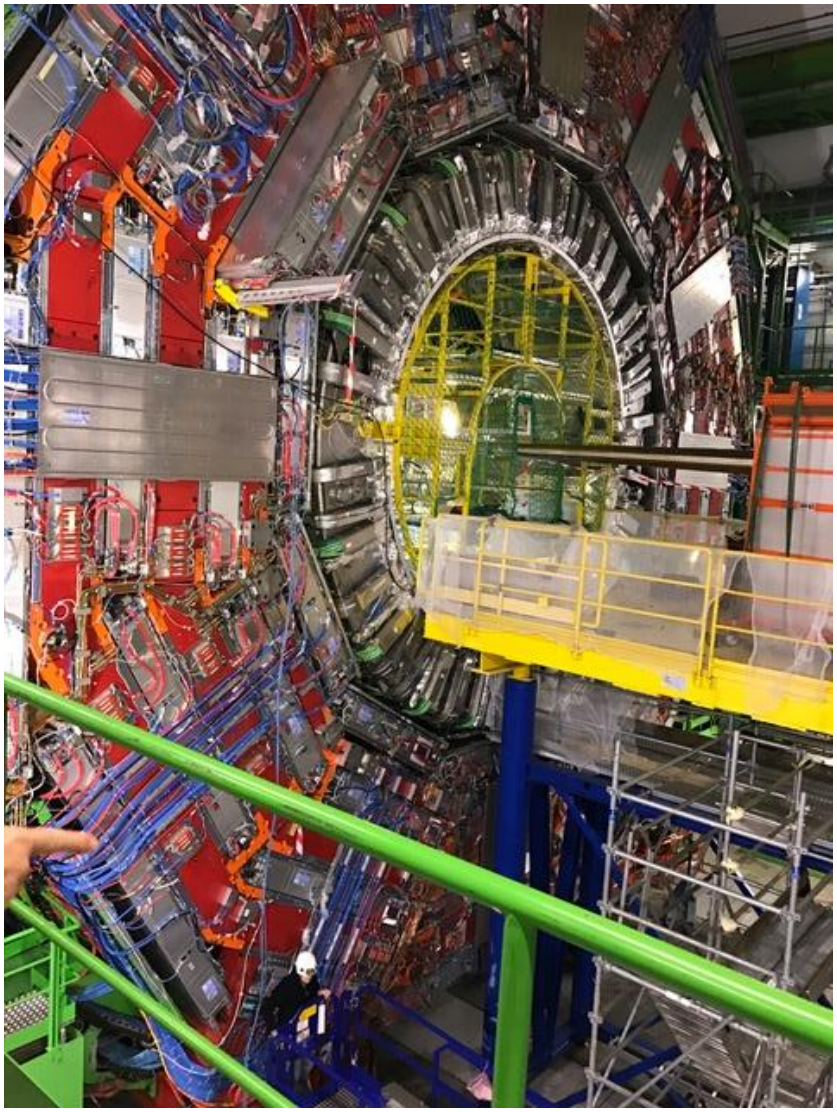
2019 M&O-B Preliminary Budget Request

- In the same way as the M&O-A budget the Subsystems' M&O-B budgets are submitted to the RRB for approval (preliminary request in April and final in October)
- The forecast of the M&O-B budget for 2019 amounts to 5'382 kCHF
- The M&O-B expenditures undergo formal scrutiny by the RRB Scrutiny Group **(following an internal CMS Scrutiny process)**
- The forecast for the next four years shows that the M&O-B budget remains at a flat level
- This is however likely to change in the future due to the addition of new Subsystems with the Phase II Upgrade **(Endcap Calorimeter, MIP Timing Detector)**



2019 M&O-B Preliminary Budget Request

Amount (kCHF/FTE)			Detector								
Description	**Ref.**	**Details**	**Tracker**	**ECAL**	**HCAL**	**Muon**	**Trigger**	**BRIL**	**CT-PPS**	**Core Computing**	**Grand Total**
Material Resources (kCHF)	B.1.01	Mechanics	10			5		5	3		23
	B.1.02	Gas-system	47		3	16					66
	B.1.03	Cryo-system									
	B.1.04	Cooling system	58		4				3		65
	B.1.05	FE electronics			10	8		5	5		28
	B.1.06	Standard electronics, PS (LV, HV)	18	50	7	114		10	7		206
	B.1.07	Standard electronics, Crates			25	20		4	3		52
	B.1.08	Standard electronics, RO Modules	12		25	91	200	20	16		364
	B.1.09	Controls, (DCS, DSS)	130	10	15	22		2			179
	B.1.10	Sub-Detector Spares	100		46	1		20	6		173
	B.1.11	Areas	35	10		37		1	2		85
	B.1.12	Communications	35	10	25	33	5	9	5		122
	B.1.13	Store Items	25	20	23	50		8	4		130
	B.1.14	Hired Manpower @ CERN	730	350	918	1'290	174	170	259		3'891
Material Resources (kCHF) Total			**1'200**	**450**	**1'101**	**1'687**	**379**	**253**	**313**		**5'382**
Human Resources (FTE)	B.2.01	Technical Manpower @ CERN									
	B.2.02	Core Computing Manpower @ CMS								8	8
Human Resources (FTE) Total										8	8



CMS

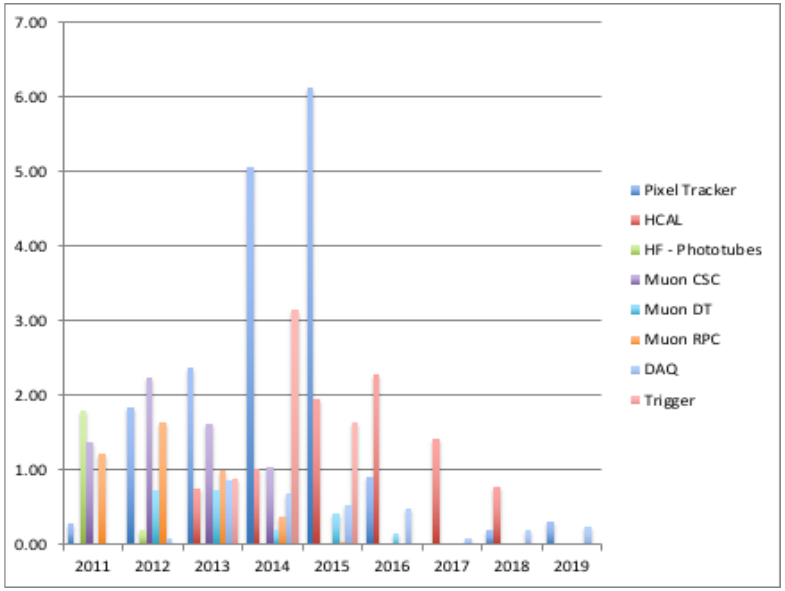
Compact Muon Solenoid

Upgrade Status

Status of Phase I Upgrade

- The CMS Phase I Upgrade has already been largely accomplished with few expenditures remaining for HCAL, Tracker and DAQ
- There is no change to the overall budget of the Phase I Upgrade
- There are no specific problems related to funding

Phase I Spending Profile



Phase I Money Matrix

in kCHF	Subdetector-specific Upgrades								Detector-wide items							Total cost:		
31.03.2015							TDAQ		Common Items							65'089 kCHF		
Funding Agency	Pixel Tracker	HCAL	HF - Phototubes	Muon CSC	Muon DT	Muon RPC	DAQ	Trigger	Magnet power and Cryo	Beam Instrumentation	Infrastructure	Test Beam Facilities	Safety Systems	Electronics Integration	Engineering Integration	Total expected (without CF)	Common Fund (CF)	Original Total Upgrade FA Target (incl. CF)
Total Upgrade: 65'089	17'100	8'220	1'990	6'844	2'200	4'220	6'700	5'674	932	1'356	3'655	2	540	1'338	4'070			
Common Fund									800	6				000	2'950			
Austria	29							978.4								1'007	102	1'021
Belgium-FNRS	32					236										669	74	743
Belgium-FWO	140					496									60	696		743
Brazil		331														331		
Bulgaria						32											37	71
CERN	3'000					500	3'5			500	1'12		500		1'000	10'12	71	3'715
China				200		500		326										464
Colombia																	14	139
Croatia																	33	325
Cyprus								0								47	23	232
Egypt						150										150	14	139
Estonia					163											167	19	186
Finland	463					20						35				518	65	650
France-CEA																	70	696
France-IN2P3	904						30	38						0		1'750	246	2'461
Germany-BMBF	1'624				612						40					2'643	288	2'879
Germany-DESY	1'224	80								240						1'544	181	1'811
Greece								513								513	70	696
Hungary																	46	464
India		528				720				15						1'263	135	1'347
Iran																	28	279
Ireland															16	16		
Italy					1'000	588		10			300					2'960	803	8'033
Korea						545										545	98	975
Lithuania																0	19	
Malaysia					86											86	19	
Mexico																30	51	511
New Zealand																	9	93
Pakistan						38					800					1'185	9	93
Poland								329									70	696
Portugal								150								150	33	325
RDMS - DMS		468		20		30										998	98	975
RDMS - Russia		834		70				312								1'836	283	2'832
Serbia																	14	139
Spain					400											400	228	2'275
Switzerland (ETHZ,PSI,UNIV)*	3'638															3'638	176	1'764
Taipei	1'001															1'001	70	696
Thailand																	19	
Turkey		307														307	84	836
United Kingdom								760	126		126			250		1'262	260	2'600
USA (DOE-HEP, NSF)	4'074	5'672	2'000	5'454			700	1'858								19'758	2'046	20'459
USA (DOE-NP)																	102	1'023
Total committed	17'100	8'220	2'000	6'844	2'265	4'242	4'708	5'674	926	1'402	4'118	235	540	1'350	4'026	56'835	6'504	

Phase II Upgrade

- CMS is currently shifting full focus to intense preparations for the Phase II Upgrade with each Subsystem project having prepared a Technical Design Report (TDR) with accompanying cost, schedule and resource information
- All reviews by the LHCC and UCG (the Upgrade Cost Group) are complete for all projects except for the Trigger and DAQ systems, for which the final TDRs are planned in 2020-2021
- CMS Management continues iterations with Funding Agencies via the Linkpersons to the CMS Finance Board with the main objective of addressing cost and funding imbalances across different Subsystem projects
- One MoU Addendum defining GEM GE 1/1 Upgrade Project has been finalized the process of being signed by Funding Agencies participating in this project
- More MoU Addenda specific to every TDR project will follow after October 2018 RRB meeting in order to formalize the funding of the Phase II Upgrade
- New countries and institutes joining CMS are expected to contribute to the Phase II Upgrade (preferably in projects which remain underfunded)

Phase II Upgrade Common Fund

- A Phase II Common Fund has been established to cover infrastructure upgrades which benefit all Subsystems
- It will be financed by contributions expected from all CMS Funding Agencies as agreed at the October 2017 RRB with a total cost established at the level of 25 MCHF
- At the end of last year, CMS finalized the elaboration of an Addendum No. 10 to the Memorandum of Understanding for the Construction of the CMS Detector outlining the principles of this Common Fund
- Up to date, a significant number of Funding Agencies have already signed the document and some have made contributions, which is highly welcome since the Phase II Infrastructure work is already ongoing
- Sharing of costs is defined by the proportion of PhD physicist authors supported by each Funding Agency (list established for the 2015 M&O-A sharing)
- Newly joining countries will contribute in accordance with their foreseen number of PhDs (as defined in MoU Addendum No 10)

Questions