CERN – Status and News

Eckhard Elsen

Director Research and Computing

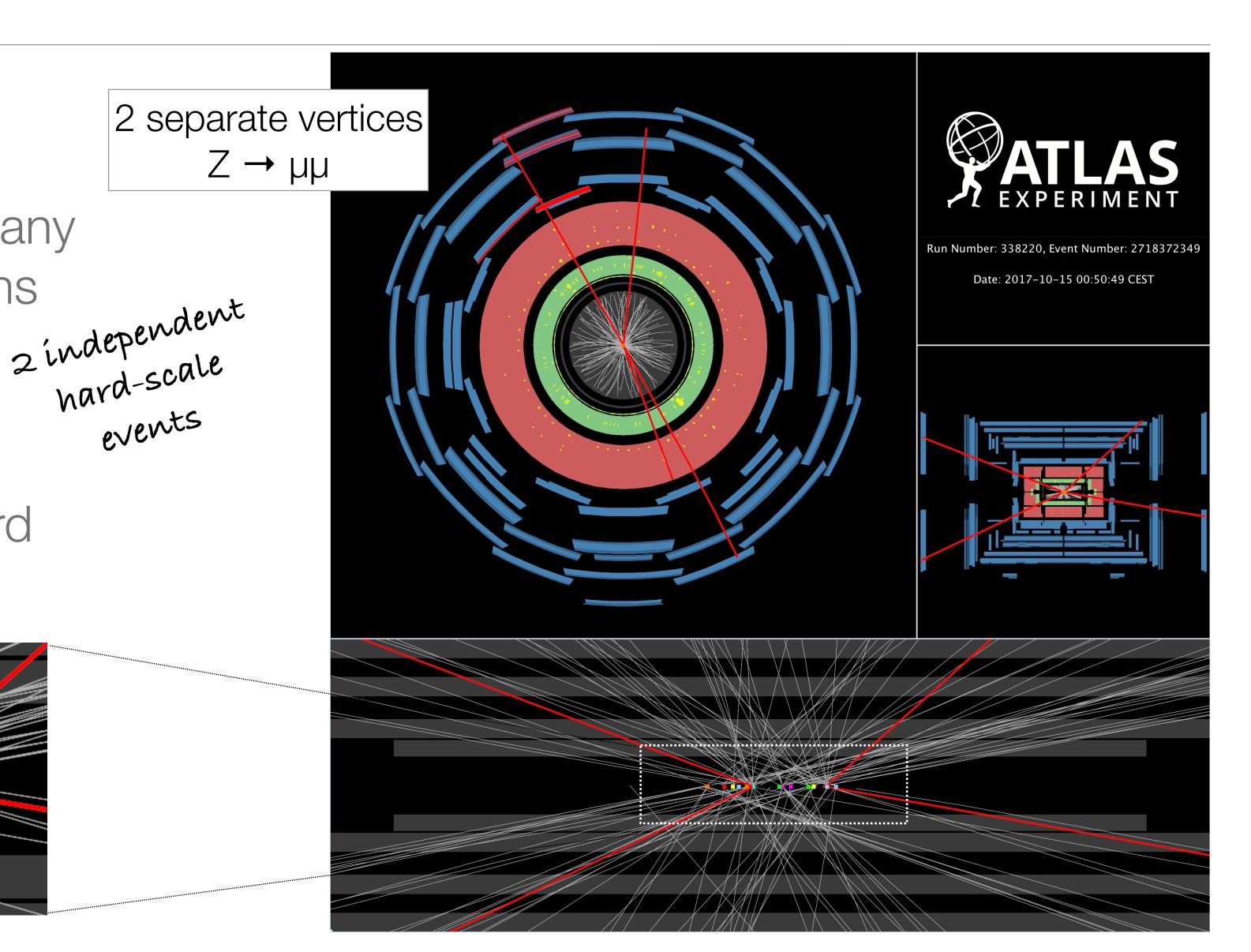




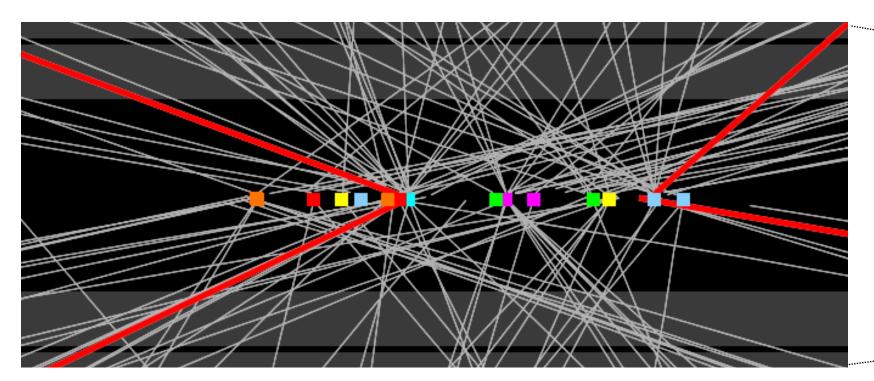
LHC RRB Meeting, April 23-25, 2018

Pile-up affects physics

• For low pile-up:



- 1 hard interaction and many minimum-bias interactions
- for high pile-up
 - possibly more than 1 hard interaction + min-bias

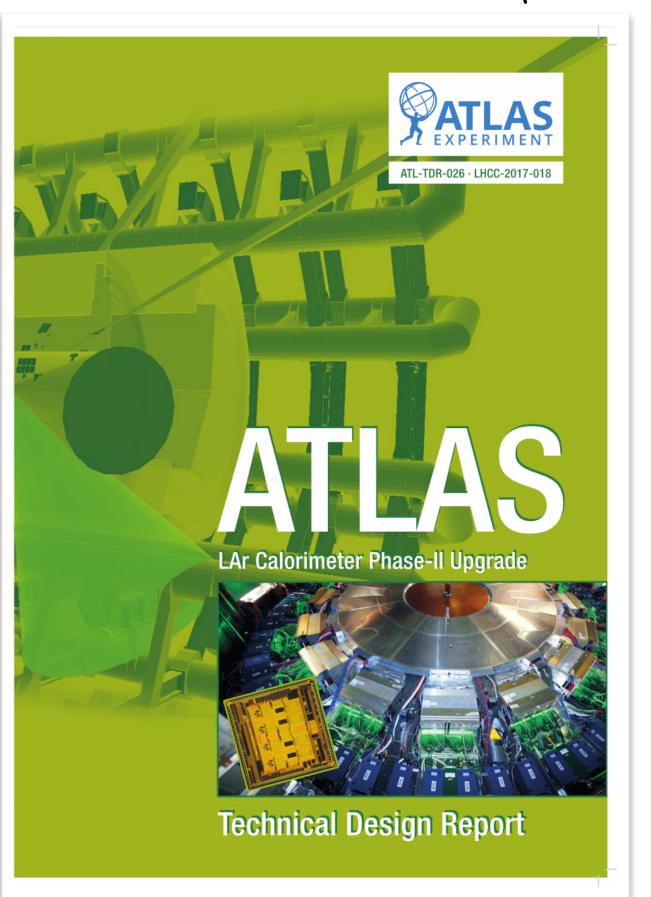


ATLAS and CMS Phase II Upgrades

- Original plans had been outlined in Lol and Technical Proposal
- Scoping Documents have been provided in addition end 2015
- All* TDRs have been received; good understanding of the technical needs and scope

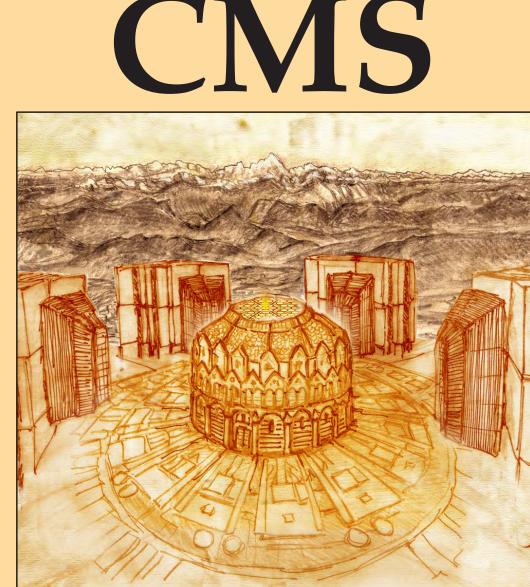
* CMS TDAQ scheduled to come later to profit from technology development

Two of the later TDRS



CERN European Organization for Nuclear Research Organisation européenne pour la recherche nucléaire

CERN-LHCC-2017-023 CMS-TDR-019



The Phase-2 Upgrade of the **CMS Endcap Calorimeter Technical Design Report**



Experiments

- Each major detector component provided its own TDR; 10 TDRs have been received in total
 - TDRs were scheduled not to arrive at the same time
 - soundness
 - Cost matrix and risks monitored by UCG
- Try to optimise and profit from synergies in technical development
- April RRB had been scheduled to close the loop for the first time

TDRs have been examined by LHCC for physics need and technical

Status April RRB

- an appetiser of what is to come at the HL-LHC
 - Experiments have to safeguard themselves (Timing detectors) •
- - •

• LHCC assumptions on LHC luminosity are realistic; pile-up of 60 in 2017 was just

• First time all TDRs have been scrutinised – thanks to tremendous LHCC/UCG effort

• A smaller version of the upgrade will not exploit the investments in HL-LHC in full

Cost has been optimised; a little more to be gained with additional R&D

Loop has been closed: Scoping Document \rightarrow 10+1 TDRs \rightarrow Cost Overview

Money Matrix

- - original cost frame maintained
 - LHCC and are now included in the phase II upgrade
 - encouraging involvement of funding agencies •
 - have reached good closure so far
- October 2018 RRB will settled the final sharing •

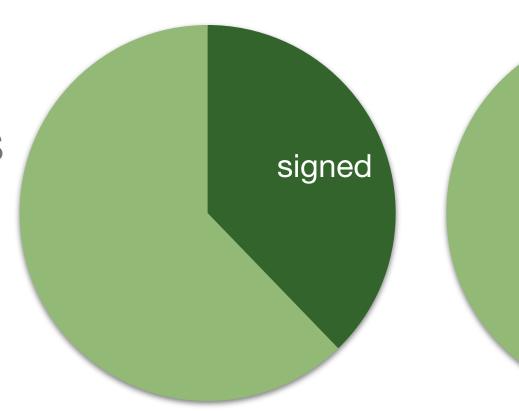
Continuously updated and maintained by experiments during the process

timing detectors have been examined for physics need in November

Common Fund for HL-LHC – Status of Signatures

- Single MoU to describe Common Fund capped at a fraction O(10%) ~ 25 MCHF
 - spread evenly over construction period •
- Sharing according to PhD or equivalent
- Separate budgeting from M&O but similar • accounting methods ATLAS
- Status of signatures:

Fraction of signatures



ATLAS COLLABORATION

CERN-RRB-2017-058

Addendum No. 17

to the Memorandum of Understanding for Collaboration in the Construction of the **ATLAS Detector**

Common Items for the Phase-II Upgrade of the ATLAS Detector

same principle applied for both experiments

CMS

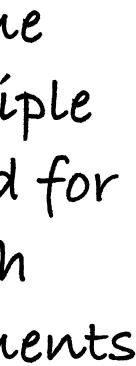
CMS COLLABORATION

CERN-RRB-2017-060

Addendum No. 10 to the Memorandum of Understanding for Collaboration in the Construction of the CMS Detector

Common Items for the Phase II Upgrade of the CMS Detector







CERN involvement in Phase II upgrade

- Host laboratory responsibilities
 - Have been well defined up and including LS2
 Considerable amount of Phase II Civil Engineering will take place in LS2
 - Remainder can now been settled on the basis of the installation work required for the detectors as described in the TDRs
- CERN is also actively contributing 55 MCHF (starting 2016) to the upgrade of ATLAS and CMS each
- Overall resource demands have to be sorted out by October 2018 RRB

ATLAS

ATLAS Phase-II Upgrades – envisaged CORE Contributions by Funding Agency [kCHF]

	TDAQ	ITk	LAr	Tile	Muons
CORE Costs ¹⁾ [kCHF]	44'880	121'966	27'882	11'129	28'17
Funding Agency				С	ORE Commitmen
Argentina					
Armenia					
Australia					
Austria					
Azerbaijan					
Belarus					
Brazil					
Canada					
Chile					
China NSFC+MSTC					
Colombia					
Czech Republic					
Denmark					
France IN2P3					
France CEA					
Georgia					
Germany BMBF					
Germany DESY					
Germany MPI					
Greece					
Hong Kong					
Israel					
Italy Japan					
-					
Morocco Netherlands					
Norway Poland					
Portugal					
Romania					
Russia					
JINR					
Serbia					
Slovak Republic					
Slovenia					
South Africa					
Spain					
Sweden					
Switzerland					
Taipei					
Turkey					
United Kingdom					
USA DOE					
USANSF					
CERN					
TOTAL (kCHF)					
Uncertainty Low					
Medium					
High					
% of CORE Costs		1		-	
	1	I	<u> </u>	<u> </u>	L

Notes

1) CORE costs as defined in the TDRs and reviewed in detail by the Upgrade Cost Group (UCG) for TDAQ, ITk, LAr, Tile, Muons. For HGTD, FWD, µ-Tagger see notes 3-6).

2) Bars are normalised to the maximum in each column.

3) The High Granularity Timing Detector (HGTD) has not yet been reviewed, the TDR will follow in 2019.

4) A new LUCID detector was originally proposed in the Scoping Document under "Forward Detectors". It is now planned as a "Small Project" with details to be worked out in the coming months. 5) The remaining Forward Detector projects (ALFA,AFP,ZDC) are not being formally proposed at this stage.

6) The μ-Tagger project is not included in the present Phase-II scope, but remains an option as a further upgrade project for installation at a later stage (>2025)

- passed LHC/UCG -

	HGTD ³⁾	Total	Common Fund	TOTAL (incl. CF)	LUCID ⁴⁾	FWD ⁵⁾	µ-Tagger ⁶⁾
72	8'533	242'561	24'420	266'981	500	800	3'500
ents	2)						
						1	
		1					

267 MCHF

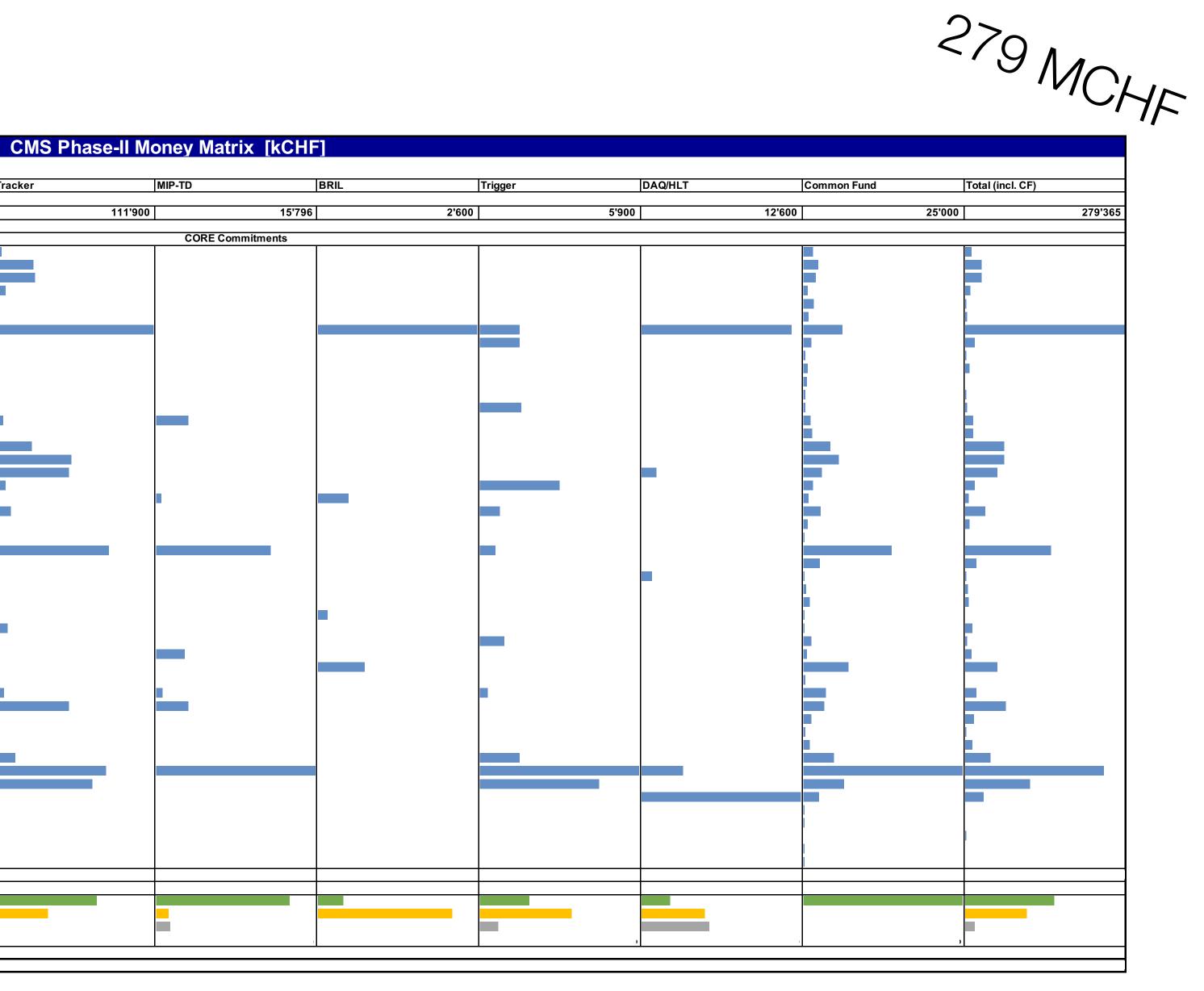
Bars normalised to maximum in column



CMS

	EC-CALO	ECAL Barrel	HCAL Barrel	Muons	Tracker
CORE Costs (kCHF)	67'127	12'675	580	25'187	
unding Agonov	1				
unding Agency ustria					
Belgium FNRS					
Belgium FWO					
Brasil/FAPESP					
Brasil/UERJ					
Bulgaria					
CERN					
China					
Colombia					
Croatia					
Cyprus					
Egypt					
Estonia					
Finland					
France-CEA				-	
France-IN2P3					
Germany BMBF		-			
Germany Helmholtz					
Greece					
lungary ndia					
ran					
reland					
taly Korea					
Lithuania					
Malaysia Mexico	-				
New Zealand					
Pakistan					
Poland					
Portugal RDMS-DMS-Russia					
Serbia					
Spain Switzerland					
Taipei Thailand					
Furkey					
Jnited Kingdom JSA-DOE					
JSA-DOE JSA-NSF			· · · · · · · · · · · · · · · · · · ·		
JSA-NSF JSA-DOE-NP					
Ecuador					
Aontenegro Qatar					
Jatar Sri Lanka					
atvia					
OTAL (kCHF)	+			ļ	
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Incortainty Low					
Incertainty Low /Iedium					
ligh	-				
% of CORE Costs					-
				1	

- passed LHC/UCG -



Bars normalised to maximum in column

ATLAS

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Azerbaijan					
Belarus					
Brazil					
Canada					
Chile					
China NSFC+MSTC					
Colombia					
Czech Republic					
Denmark					
France IN2P3					
France CEA					
Georgia					_
Germany BMBF					
Germany DESY					
Germany MPI					
Greece			-		
Hong Kong					
Israel					
Italy					
Japan					
Morocco					
Netherlands					
Norway					
Poland					
Portugal					
Romania					
Russia					
JINR					
Serbia					
Slovak Republic					
Slovenia					
South Africa					
Spain					
Sweden					
Switzerland					
Taipei					
Turkey					
United Kingdom					
USA DOE					
USA NSF					
CERN					
TOTAL (kCHF)					
Lineartainty Law					
Uncertainty Low					

Uncertainty Low			
Medium			
High			
% of CORE Costs			

Notes

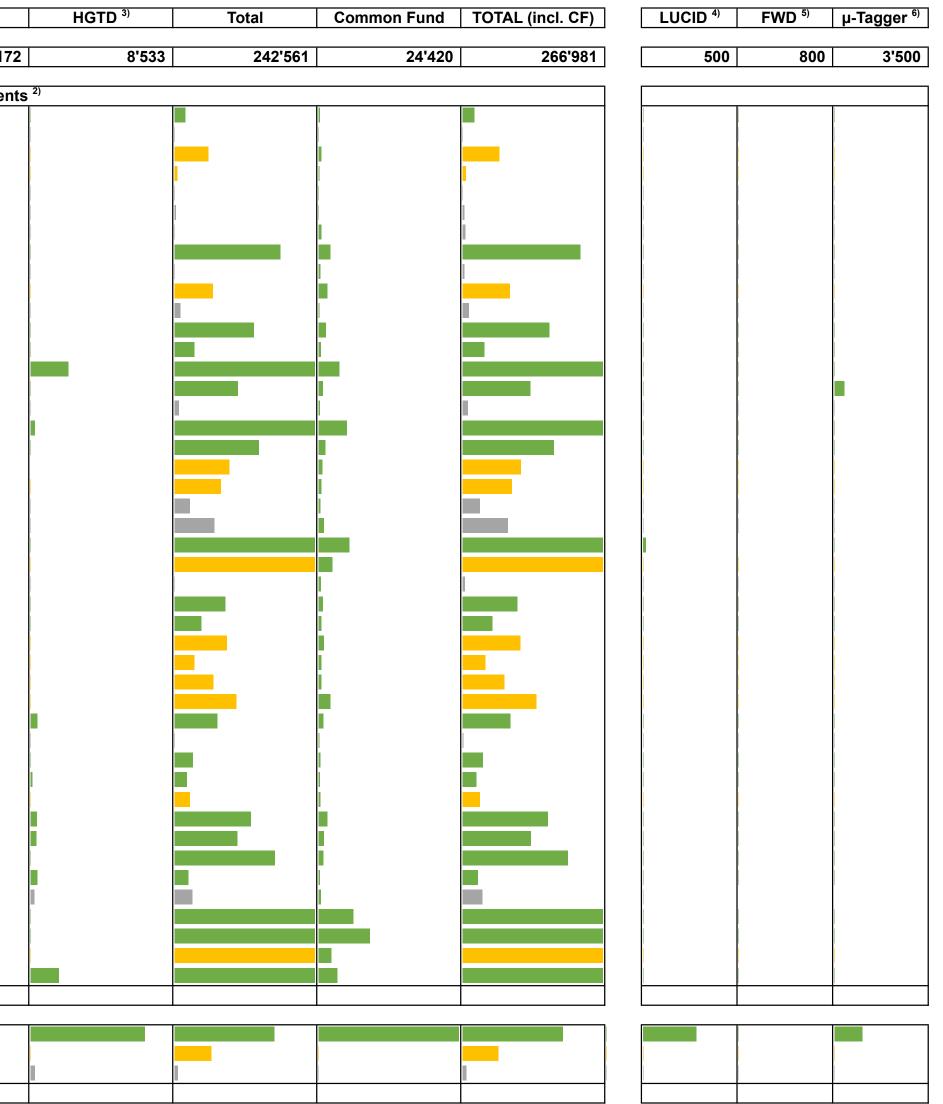
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2) Bar scale: 0 ... 10'000 kCHF; bars for larger CORE contributions are cut off at 10'000 kCHF.

3) The High Granularity Timing Detector (HGTD) has not yet been reviewed, the TDR will follow in 2019.

4) A new LUCID detector was originally proposed in the Scoping Document under "Forward Detectors". It is now planned as a "Small Project" with details to be worked out in the coming months. 5) The remaining Forward Detector projects (ALFA,AFP,ZDC) are not being formally proposed at this stage.

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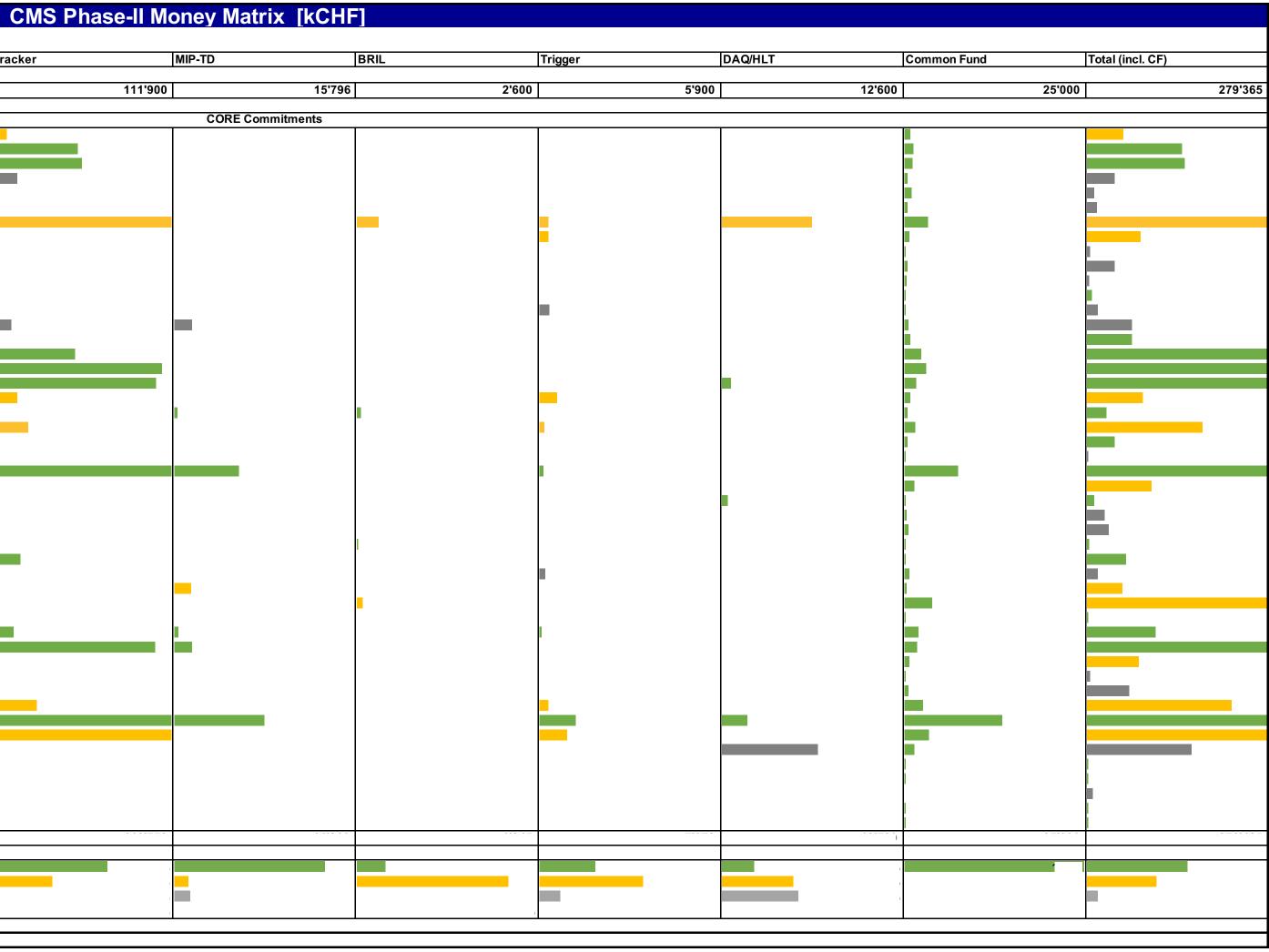


ails to be worked out in the coming months

Bars capped at 10 MCHF

CMS

EC-CALO ECAL Barrel HCAL Barrel Muons Tracker CORE Costs (kCHF) 67'127 12'675 580 25'187 Funding Agency Austria Belgium FNRS Belgium FWO Brasil/FAPESP Brasil/UERJ Bulgaria CERN China Colombia Croatia Cyprus Egypt Estonia Finland France-CEA France-IN2P3 Germany BMBF Germany Helmholtz Greece Hungary India Iran Ireland Italy Korea Lithuania Malaysia Mexico New Zealand Pakistan Poland Portugal RDMS-DMS-Russia Serbia Spain Switzerland Taipei Thailand Turkey United Kingdom USA-DOE USA-NSF USA-DOE-NP Ecuador Montenegro Qatar Sri Lanka Latvia TOTAL (kCHF) Uncertainty Low Medium High % of CORE Costs Δ (TOTAL-CORE Costs)



Bars capped at 10 MCHF

Towards MoUs – Ownership of upgraded Detector components

- as we proceed to MoU for TDRs
 - will assume that ownership is transferred to CERN
 - this is relevant for decommissioning and disposal in particular after exposure to radiation
 - allows for coherent and consistent policy (environmental aspects, central planning and logistics)
- will try to incorporate this also in phase 1 components that will be extracted from the experiment

MoU between CMS and TOTEM – Full Integration of CT-PPS

- TOTEM and CMS have successfully negotiated a merging of the two collaborations
 - Starting in 2018 (most) TOTEM institutes will join CMS
 - TOTEM will continue to exist to carry out the 14 TeV high-cross section programme in Run 3
 - New head of PPS system will be Simone Giani
- More details in closed session

CERN-MoU	0-2018-003	
CMS-TOTEM Memorandum of Understanding		
between The European Organization for Nuclear Research (CERN), an Intergen Toganization having its seat at Geneva, Switzerland, as the host laboratory. Toganization having its seat at Geneva, Switzerland, as the host laboratory for the purpose of signature of this MCI releases person and the Chairperson of the Collaboration Beart. To TOTEM Collaboration ("TOTEM"), for the purpose of signature of this MCI releases person and the Chairperson of the Collaboration Beart. To TOTEM Collaboration ("TOTEM"), for the purpose of signature of this MCI releases person and the Chairperson of the Collaboration Beart. To ToteMCI To 2014. The TOTEM Collaboration and file CMS detector in combination Subtract To 2014. The TOTEM Collaboration and the CMS detector in combination Subtract Exclusive Production (CEP) using the CMS detector in combination Subtract Exclusive Production (CEP) using the CMS detector in combination Subtract Exclusive Production (CEP) using the select and point project cost and your erres selection for in the Subtract materian provide to study low erres selection for the Subtract materian provide to study low erres selection for the Subtract materian provide selection and the CMS-TOTEM Precision Proton Spectramere in 2016-2017. The MoU called for a review before Long Shutdware in the Subtract materian provide selection and studies of the difference of Long Shutdware in the Subtract materian sing in a point project cost and your erres selection and provide selection and studies of the difference of Long Shutdware in the Subtract of CEP. Mol Subtract Shutdware and your error selection parts and provide selection and studies of the difference of an selection and indeged worth purposes at each and provide selection	oU represented by 1 a Memorandum of V and QCD physics via on with forward proton ining during regular high CT-PPS 2015-2 2 (LS' 14 T tio c ptio the f Signed in Geneva, Switzerland on	d
expressed a sort 1 MoU from 2014, CMS-doc-13532 Page 1 of 7 19 April 2018 Page 1 of 7	Signed in Ga	lg lg
	Pril 2010	Signed in Geneva, Switzerland
	For CMS	on <u>20 April 2018</u> For TOTEM
	JoefButter JoefButter MS Spokesperson	Sim
	Matthias Kasemann Matthias Kasemann MS Collaboration Board Chair	Angelo Scribano TOTEM Collaboration Board Chair
19 April 20	18 Page 6 of 7	
		TOTEM-CMS CERN-RRB-2018-062



Composition of Scrutiny Group 2018

- SIMON, Frank (MPI Munich, DE) (Chair)
- HAHN, Ferdinand † (Scientific Secretary)

- GOLDSTEIN, Joel (Bristol, UK)
- CHRISTIE, William B. (BNL, US)
- PÖSCHL, Roman (Orsay, FR)
- CONVERY, Mary (Fermilab, US)
- LUBRANO, Pasquale (Perugia, IT)

- VASSEUR, Georges (CEA/IRFU, FR)
- SANDAKER, Heidi (University of Oslo)

- DANIELSSON, Hans (CERN, EP)
- MOLL, Michael (CERN EP)
- CAMPBELL, Michael (CERN EP)

• PRODON, Sylvie (CERN, FAP)

Conclusion

- TDRs have been received as scheduled •
 - Tremendous effort has been made by LHCC and UCG
 - LHCC / UCG work is very well supported (including cross-refereeing)
 - Upgrade Progress will be monitored by two standing sub-committees of the LHCC (see following presentations)
- Cost containment fulfilled • Optimisation/savings in some detector components; need of Timing detector