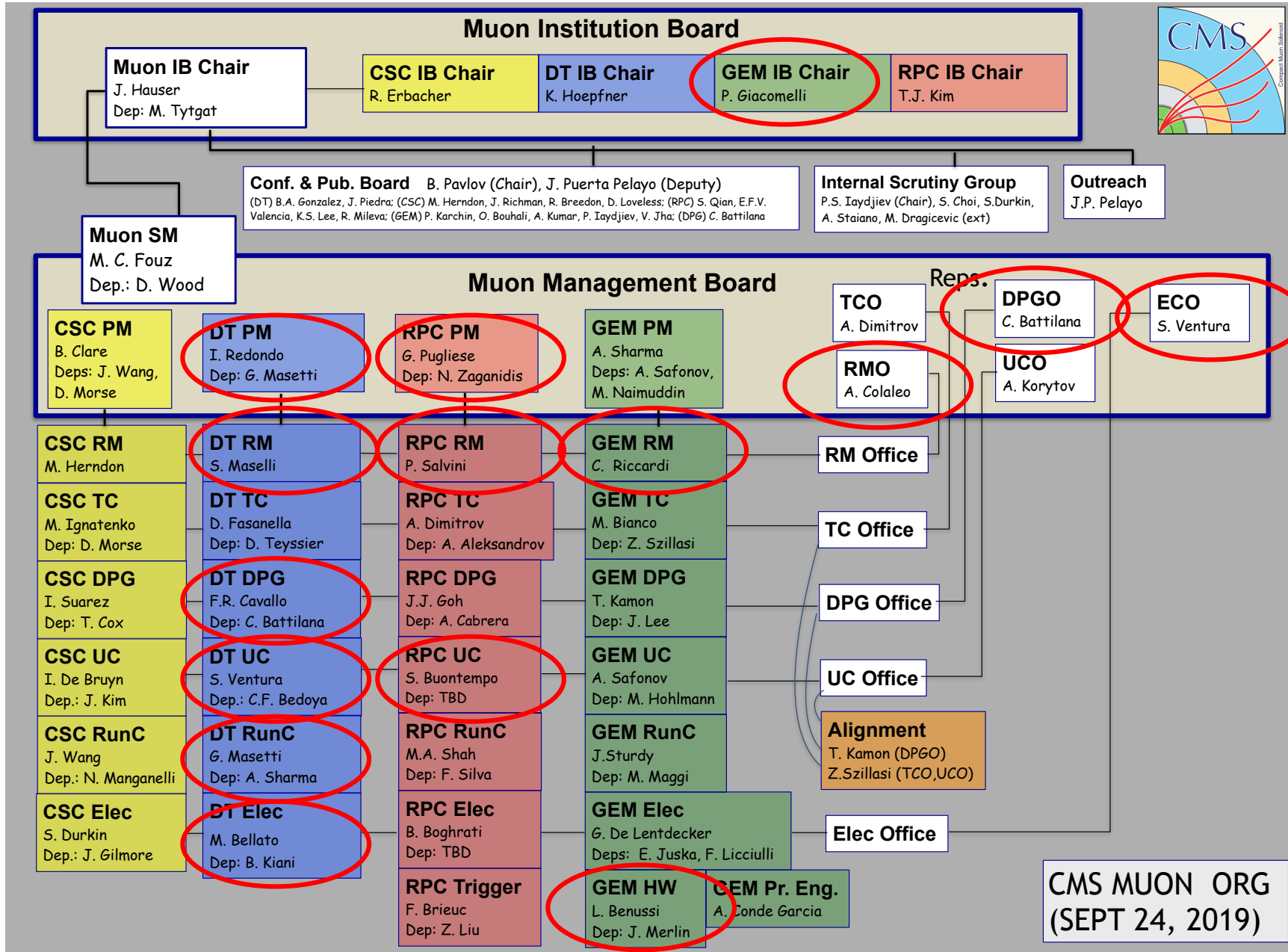


CMS Muon preventivi 2021

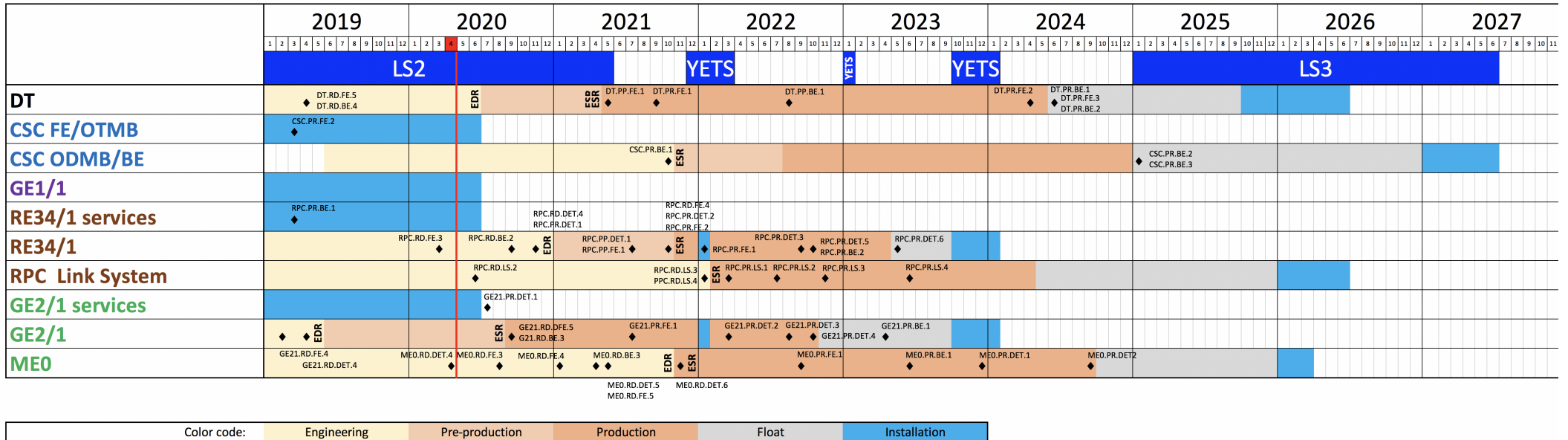
sandro ventura

CMS Muon Organigram 2020



Large number of INFN coordinators (L1/L2,L3) in all Muon activities

CMS Muon Phase-2 Upgrade Master Schedule



Unusual Phase-2 Upgrade schedule:

- Large part of upgrades (CSC, GE1/1, GE2/1, RE34/1) must be complete before LS3, in some case as early as during LS2
- This is driven by the limited excess to the endcaps during LS3

All schedules are updated to be in sync with the new Nov 2019 LHC schedule

GE2/1 and RE34/1 schedules are fully updated for the first time since TDR

- They were not put up for re-baselining in May 2019 in anticipation of major Run 3 schedule changes, more specifically, **Run 3 YETs**

DT Phase 2 : TDR Path updated

Table 3.6: High Level and External Milestones (HM and EM, respectively) for the DT upgrade.

	ID	Milestone title	Date		
2017	Design	DT.RD.FE.1	DT FPGA demonstrator: firmware implementation of multichannel TDC done (HM)	5.Dec.2016	✓
		DT.RD.BE.1	DT simulation: demonstration of L1 trigger pattern-recognition performance from DT TDC output done (HM)	11.Jan.2017	✓
		DT.RD.FE.2, DT.RD.BE.2	DT L1 and Readout System specification defined with demonstrator (HM)	7.Jun.2017	✓
2018	Prototyping	DT.RD.FE.3	OBDT demonstrator tested on DT chamber(s) (HM)	5.Mar.2018	✓
		DT.RD.FE.4, DT.RD.BE.3	DT prototype ready for slice test validation at PT5 (HM)	14.Nov.2018	✓
		DT.RD.FE.5, DT.RD.BE.4	DT prototype electronics (MiC2 and back-end) validated (HM)	4.Nov.2019	✓
2019/20	Production	DT EDR (EM)	Now	1.Jun.2020	✓
		DT.PP.FE.1	DT Final MiC2 pre-production validated (HM)	1.Jun.2020	Apr '21
Nel 2021:	Production	DT ESR apr '21			
		DT.PR.FE.1	OBDT PCB start of assembly phase (HM)	14.Jun.2021	Sept '21
		DT.PP.BE.1	DT Back-end pre-production system validated (HM)	6.Jul.2022	
		DT.PR.FE.2	DT: MiC2 production ready (HM)	22.May.2023	Apr '24
		DT.PR.BE.1	DT Back-end production completed (HM)	17.Apr.2024	
		DT.PR.FE.3, DT.PR.BE.2	DT ready for installation (HM)	17.Apr.2024	

R&D steps:

2017
- dimostrare il multichannel TDC su FPGA e la portabilità degli algoritmi di trigger in asincrono

2018
- qualificare la nuova architettura su di una camera intera

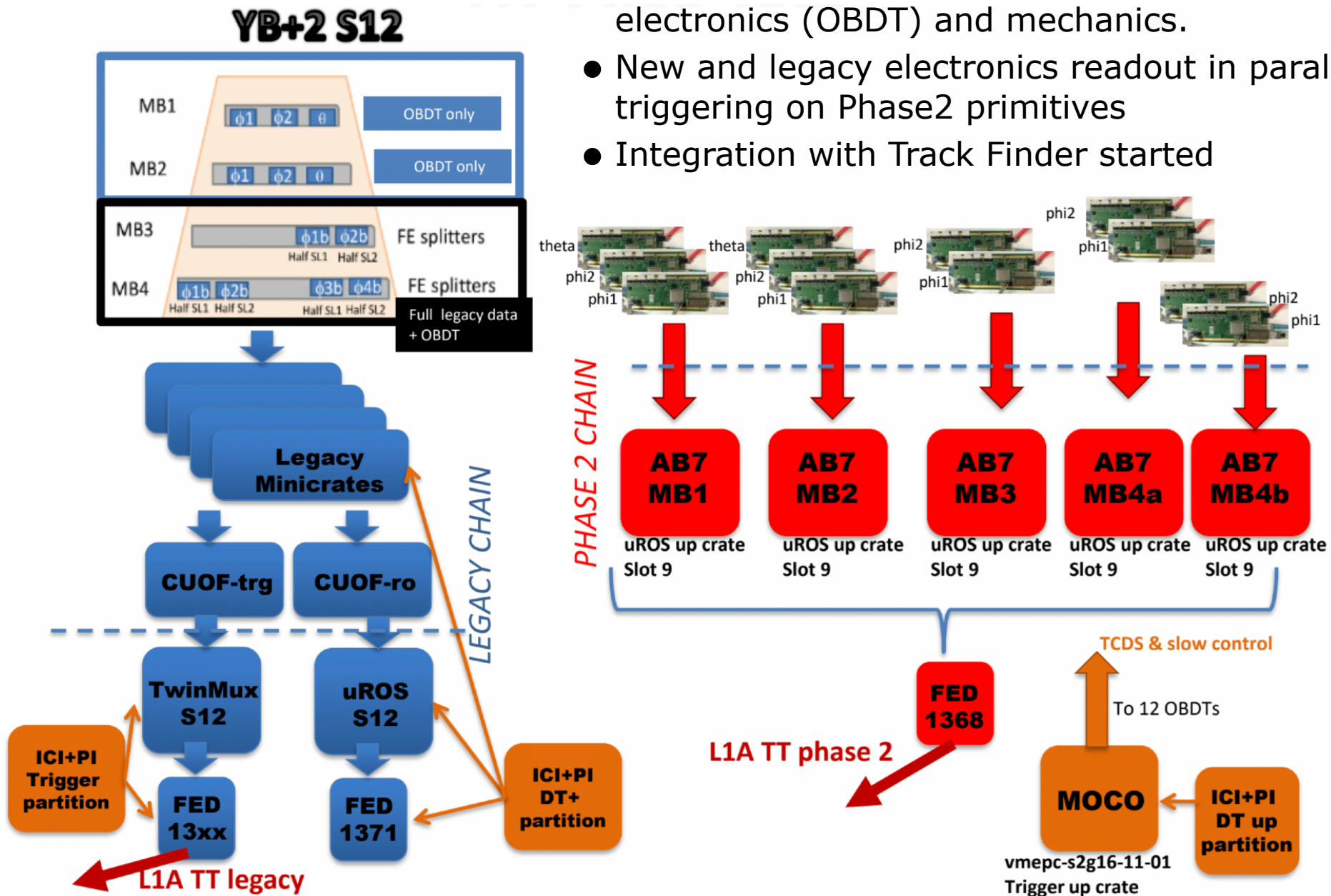
2019/20
- validare il track finding strumentando un intero settore (4 camere)

Nel 2021:

- OBDT Preprod validation

DT: the Phase2 Slice Test

- One full sector (YB+2/S12) with prototypes of new electronics (OBDT) and mechanics.
- New and legacy electronics readout in parallel, also triggering on Phase2 primitives
- Integration with Track Finder started

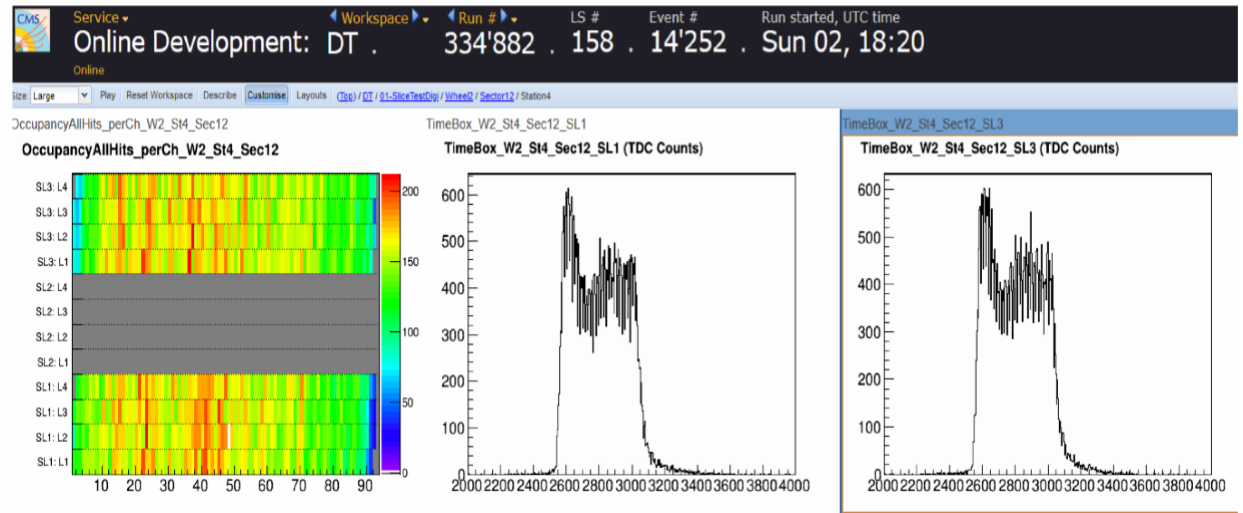


DT: the Phase2 Slice Test

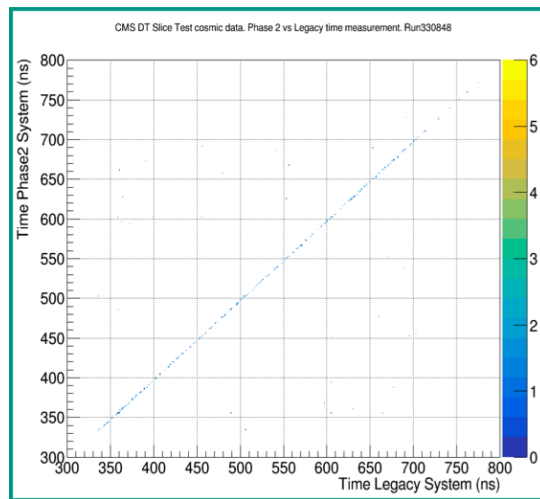
Event by event comparison shows full consistency

OBDT architecture and firmware validated

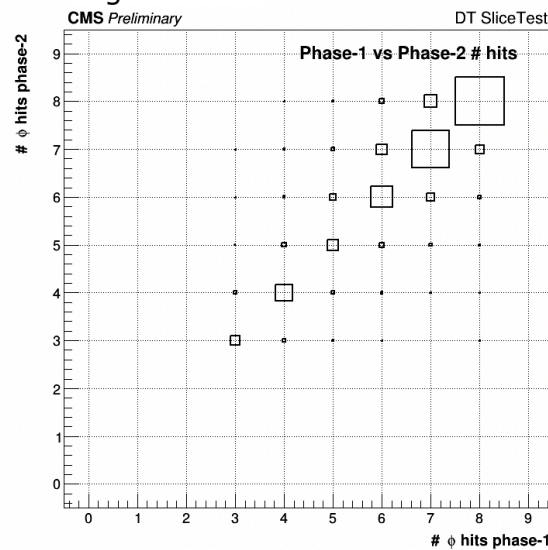
DQM metrics



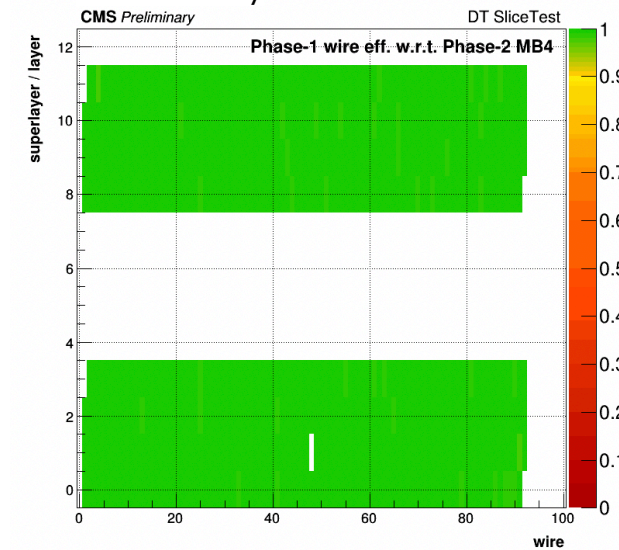
TDC measurements



Segment Hits



Hit efficiency



Parallel readout remains for the four YB+2/S12 stations in Run3: validation with beam conditions

DT LS2 restart at the pit

Back in September?

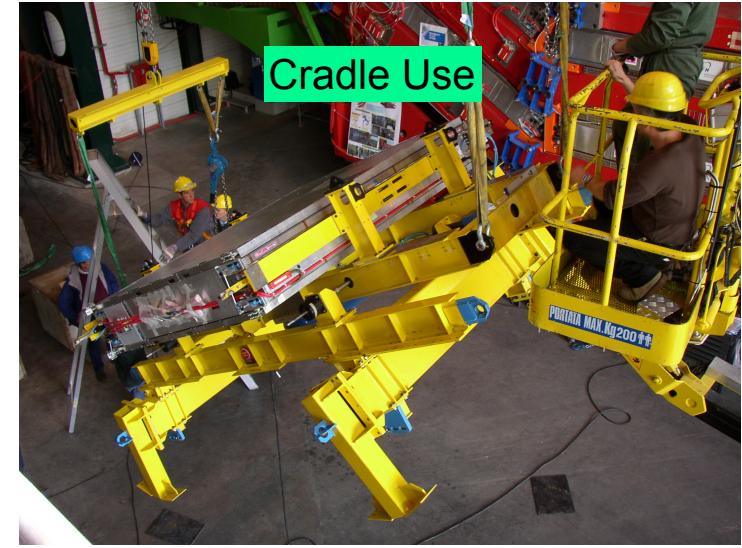
End Septemeber

Can start

October?

1st week of Septemeber

1. Alberto's MB4 shielding: **95 % done**; only YB+1 vertical sectors remains
 - Material is ready
2. Phase 2 Slice Test : **prepare for Run 3**
 - Reinstall minicrates in MB1/MB2
3. Minicrate repairs: **90 % done**
 - 7 interventions in YB+1
 - 3 in YB+2, 1 in YB-2
4. DT chamber extraction (YB+2 S7 MB2)
 - Lost full theta view in Run2
 - **Largest DT maintenance operation** in term of recoverable channels
 - Would allow to inspect a wire (aging)



	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020
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Non Critical Path 2	DT Mini Crate Phase-II Upgrade	DT Mic2 Slice Test				
	Endcap&Barrel	RE+3/1 cabling	GE+2/1 cabling	DT	DT MC	YB+
Non Critical Path 3	RPC repairs	"Prudent" strategy wrt uncertainty in travel restart			RPC gas/LV/HV	Commissioning
	MB4 Shielding					

DT Upgrade EDR Scope & Panel

25 June 2020

The Committee is asked to review:

- The readiness of the design of the Muon Drift Tubes electronics for HL-LHC.
- The feasibility of the installation plan in LS3, its impact and implications for CMS or other subdetectors.

Goal of the review

Endorse the design of the Muon Drift Tubes electronics for HL-LHC and thus authorize spending of CORE resources to start procurement of system components, subject to remarks and recommendations which the Committee may see fit to make.

Review Committee:

Link Person:

- Ignacio Redondo, *DT Project Manager*

Technical Coordination:

- A.Ball, *Technical Coordinator*
- M.Capeans, *Upgrade Technical Coordinator*
- M.Hansen, *Electronics Coordinator*
- A.Gaddi (CERN) *Integration Office Lead*
- N.Dupont/R.Perruzza, *LEXGLIMOS*

Experts:

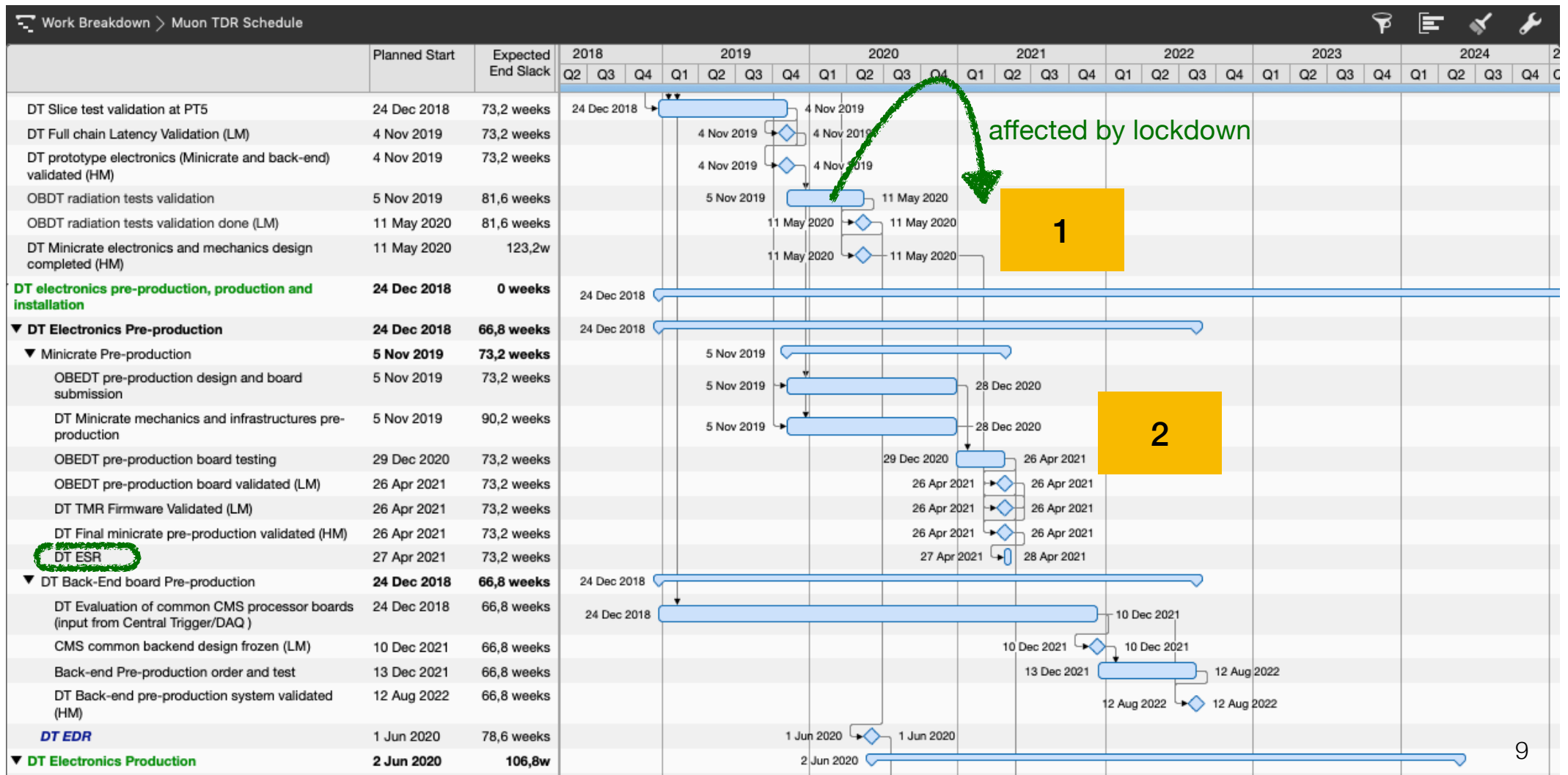
- A.Colaleo (Universita e INFN, Bari)
- T.Grassi (University of Maryland)
- G.Iles (Imperial College)

Ex-officio:

- F.Hartmann, *Upgrade Coordinator*
- A.Cardini, *P2UG member*
- M.Martinez, *P2UG member*

Through DT Merlin to LS3

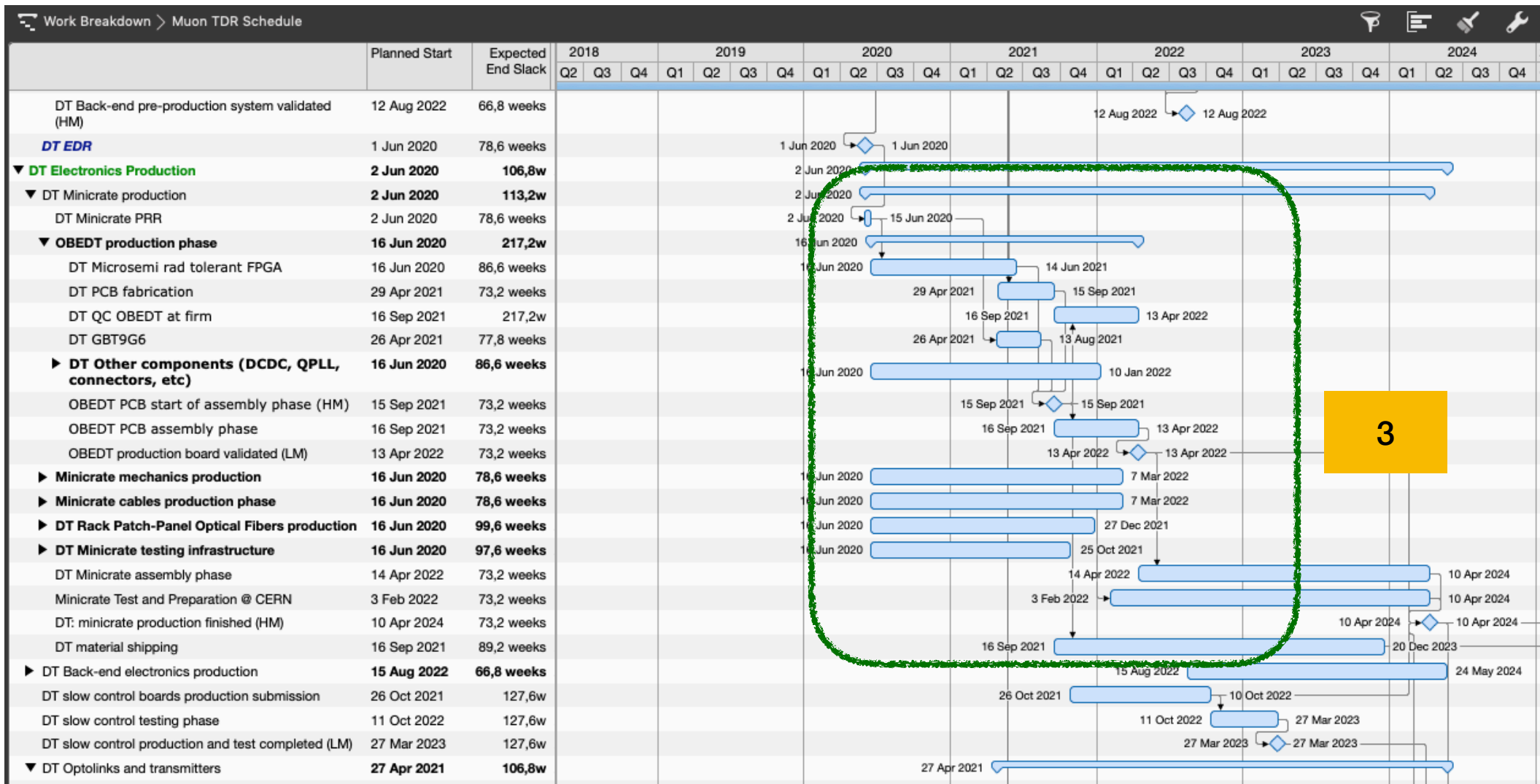
- 1 Reschedule Irradiation tests, after agreement with EC to fulfil ESR requirements
- 2 Stretched Pre-production design and testing to include improved solutions (e.g. coax cabling, larger FPGA, DC-DC vs LDO)



Through DT Merlin to LS3

3

Adjusted PCB production, assembly and testing tasks



Richieste DT 2021

CORE

BO

- 2.2.1 - Contributo INFN per MiC2 preproduction **64kE + 90 kE SJ**

TO

- 2.2.3 - Contributo INFN per ATCA Clock & Slow Control **46kE**

MOF-B

BO

- Contributo INFN MOF-B L1T **5.5kE**

TO

- Contributo INFN MOF-B DT **212kCHF**

ME

BO

TO

PD

- Maintenance Campaign LS2/Installazione Shielding MB4/GIF++ xx**5 mu**
- Slice test Integration/Re-Commissioning Run3 xx**13 mu**
- MiC2 preproduction tests and integration xx**10mu**

ManPower Phase2

PD

- Rinnovo contratto Firmware Engineer **76kE**

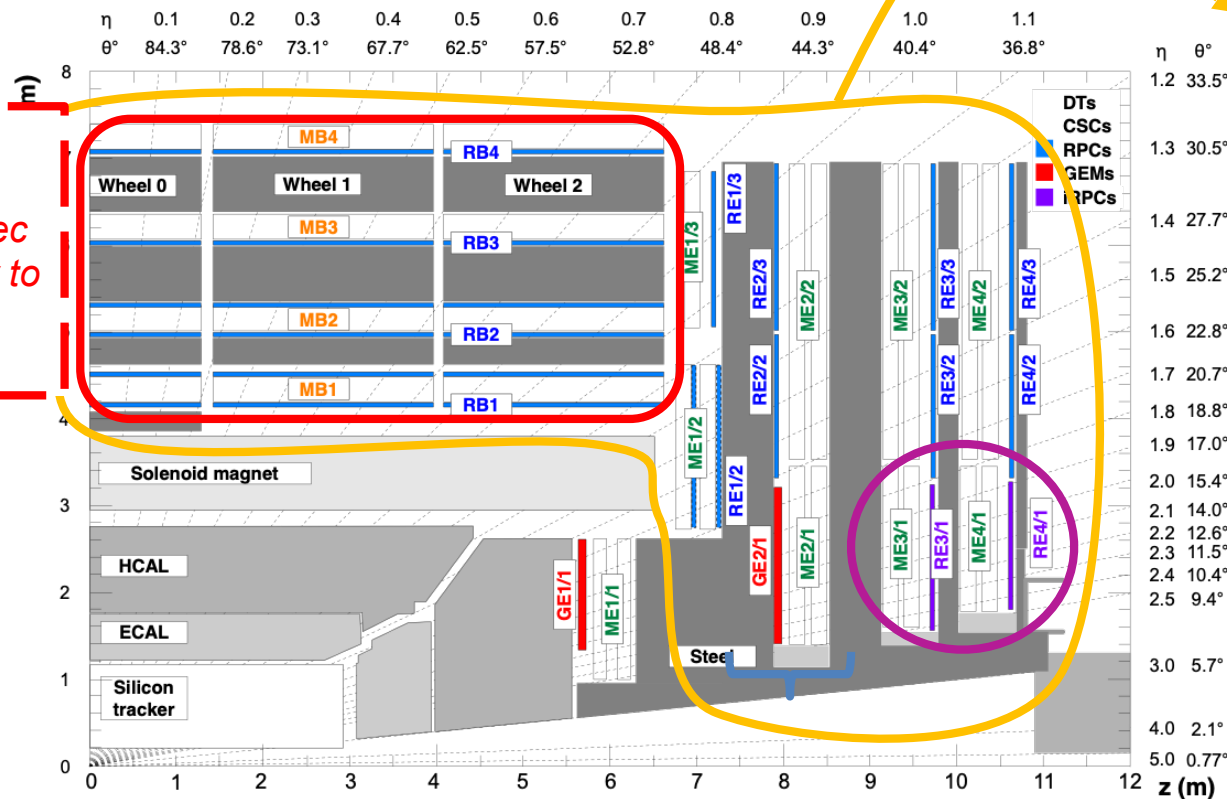
Short overview Activities RPC

Context: 2nd year of LS-2: HW activities going towards end; Commissioning will start
 Covid-19 has introduced 3 months delay on schedule, CERN has restarted
 Preparing for Phase-2 construction to start in 2021

1

RPC Leak Repair

- GWP CERN Priority
- Normally finished by Dec 2020, but remain ready to exploit further opportunities in 2021



2

RPC Ecogas Studies

- Poss. replacement R134 → HFO
- Studies under bkg radiation in GIF++

3

Improved RPC

- Prototype Tests
- Services installation

Phase-1 RPC Activities: P5



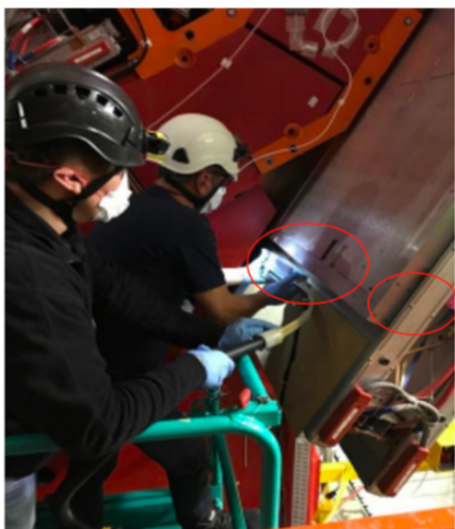
RPC Leak repair campaign

Extensive RPC leak repair campaign has been carried out during LS2

Barrel chambers:

REPAIRED	INSPECTED AND potentially REPAIRABLE	Leak not identified	NO reparation possible with partially extraction
53%	3.5%	23.5%	20%

Example of repair procedure



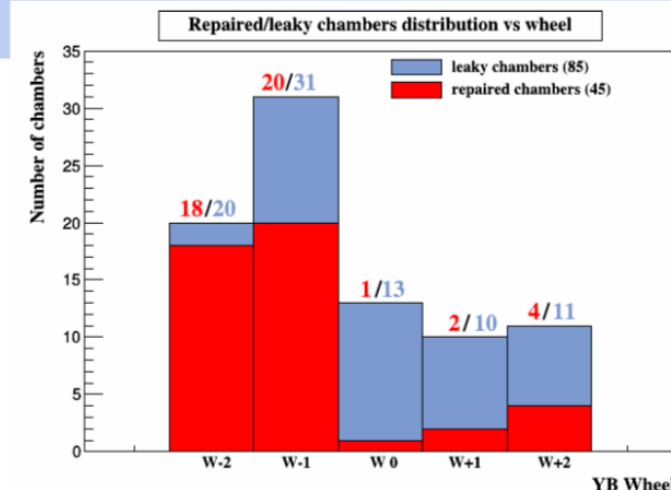
- Two new leaks developed since beginning of March located in W-1.

To be done:

- Repair of 2 more chambers is foreseen in September (+barrel wheels) in W+1/S04/RB4 where a modification of the extractor was required.
- Standard gas maintenance: perform leak inspection and connect the leaking (working) chambers to gas channels shared with another leaking (working) chamber to allow disconnection from the rack also when there is no access to the wheel. **Done in the negative barrel wheels.**
- Endoscope inspection of the positive and external barrel wheels.

Endcap chambers:

- Replaced 9 leaky chambers with spare chambers in RE-3, RE-2 and RE+3.
- One more leaking chamber to be replaced in RE-3.



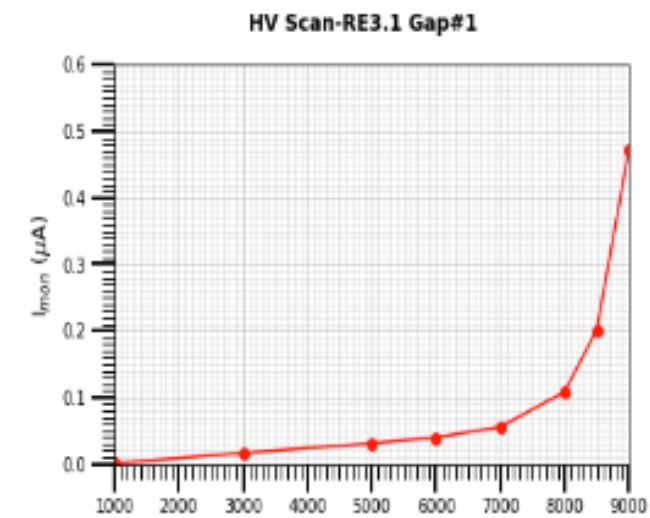
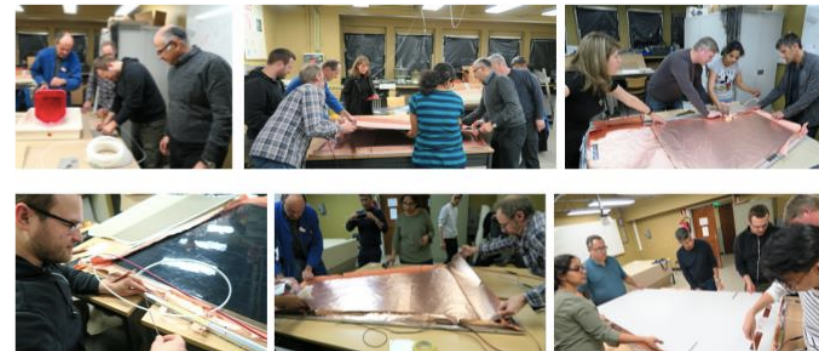
G. Pugliese, M. Franco
& N. Lacalamita

iRPC: first RE3/1 V0

In January 2020, the first two prototypes of the 3.1 station were assembled in UGent RPC Lab by a team of technicians and physicists from Gent Univ., all 3 Mexican Universities and Lyon group.

- All gaps received and QC tested (spacer, leak and darks currents tests)
- Assembly chamber procedure revised and manual prepared.
- One 3.1 prototype transported to Lyon for electronics integration

Plan to test the 3.1 prototypes at CERN in 904lab first and then in GIF++



iRPC: FE electronics validation



FEBv0: A board that contains:

- **1 PETIROC2A ASIC + FPGA (Cyclone 2)**
- Ethernet-based communication was conceived to read out the strips PCBV0 (44 strips)



FEBv1: This was intended to come closer to the final board to be compatible with CMS DAQ:

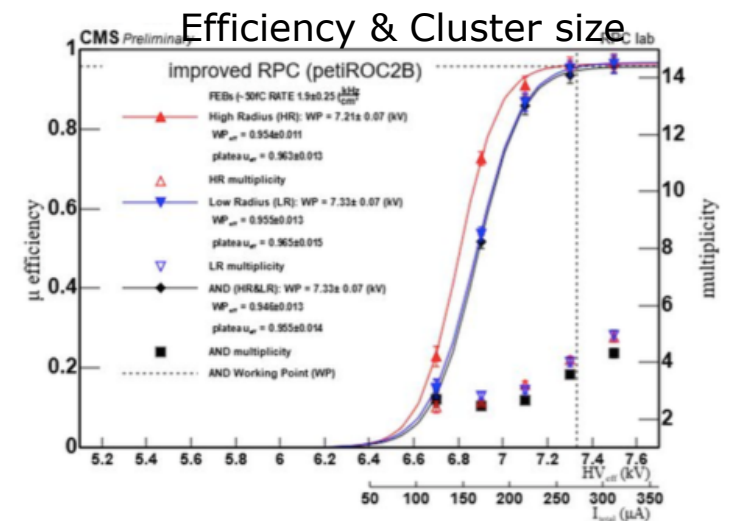
- **2 petiroc2A(B) + FPGA Cyclone V**
- Ethernet-based communication is used to read out the strips PCBV1 (48 strips)

Validation of FEB_V1

- An iRPC with **FEB_{V1}** was tested using a cosmic trigger made with shielded scintillators
- Efficiency plateau is $\approx 95\%$ with $\approx 2\text{kHz/cm}^2$ of background and a threshold of 50fc
- Upgraded teststand to work inside GIF++
- irradiation tests are planned for Sep 2020 and then again in 2021 with the final rad-hard version

FebV2 :

- All procurements shall arrive by July 2020 : ASICS, FPGA's, GBTx etc..
- September 2020 : production and cabling of 2 prototypes (if cabling compagny available in August)
- December 2020: 3 month of electronic tests + finalization of the test system. Work on chamber would start after.
- January 2021 : order for 20 FEB V2 if tests successful



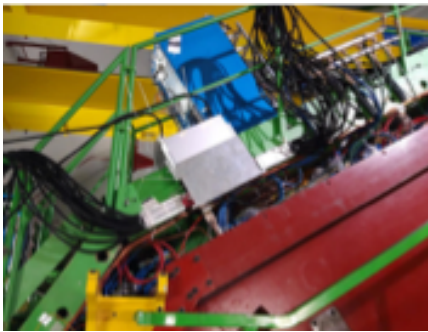
iRPC: RE3/1-4/1 services

Installation of RE-3/1 and RE+4/1 services: completed (in 2019)

Installation of RE+3/1 services started in Feb 2020

- Gas pipes and impedance boxes installed
- HV and LV cable installation planned for early summer 2020

Remaining 40% to be installed (HV/LV of RE+3/1 and RE-4/1) rescheduled awaiting confirmation of updated LS2 plans (summer/autumn 2020)

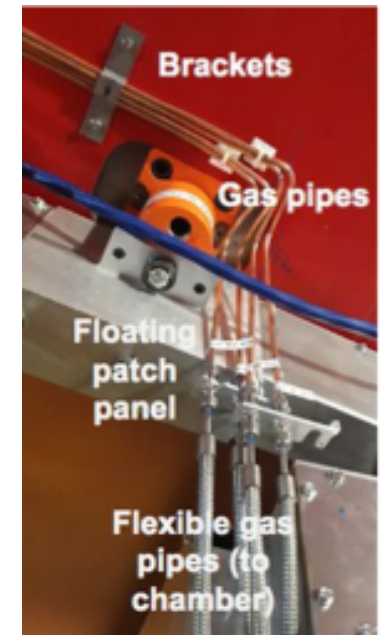


Fiber optics box installed
back of YE-3 and Y+3

Gas impedance boxes



RE4.1 cooling



RPC: attività' INFN in LS2

Completamento attività di manutenzione straordinaria

La previsione è di terminarle entro la prima parte del 2021, tenendo conto del rallentamento dovuto al covid-stop (RE-4 re-installation e re-commissioning, completamento manutenzione HV sull'endcap, completamento riparazione perdite di gas ecc. ..)

Completamento manutenzione straordinaria del gas system

riparazione o sostituzione delle flow cells malfunzionanti

Completamento installazione del sistema per la riduzione dei gradienti pressorii all'interno delle camere (valvole automatiche e camera dummy)

Re-commissioning RPC system (local & global)

Completamento installazione cavi & fibre ottiche su endcap negativo

causa covid-stop saranno terminate nella prima parte del 2021

Equipaggiamento del prototipo real-size con FEB_V2 e sua validazione alla GIF++

Costruzione del dimostratore (6 camere iRPCs) e test @ 904

installazione prevista durante EYETS 2021/2022 (* dipende da TC)

Test camere del dimostratore alla GIF++

Test con eco gas (sia per RPC che iRPC)

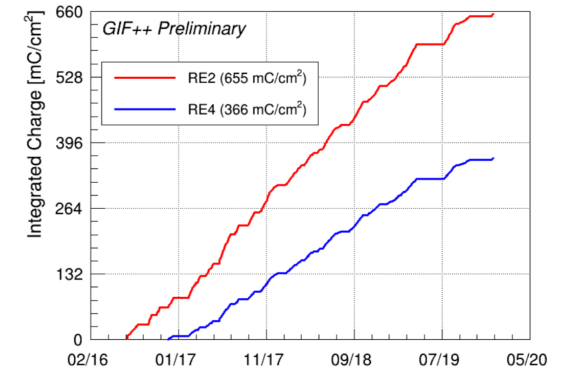
Phase-2 RPC Activities @ GIF++

• RPC & iRPC Longevity studies @ GIF++

- Ageing tests: $1C/cm^2$ + iRPC rate capability (2-3kHz/cm²)
 - 78% Complete for RE2; 44% Complete for RE4
 - Efficiency curves overlap after correction for bkg
- Study use of more ecofriendly gas (HFO1234ze)
- Production of HF in EcoGas & StandardGas

• iRPC tests (Phase-2)

- Readout iRPC decision towards Petiroc (March 2020) however not yet demonstrated full performance (only 2kHz/cm²)
- Therefore maintain Alternative option (Cardarelli – Tor Vergata) Prototype iRPCs tested in GIF++.

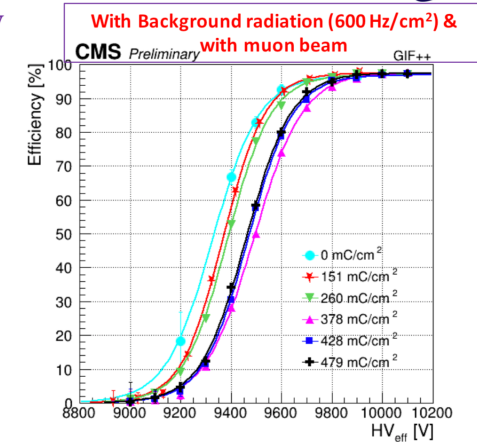


RE2	RE4
IRR. In 3 July 2016	IRR. In 25 Nov. 201
$Q_{int} : 655 \text{ mC/cm}^2$	$Q_{int} : 366 \text{ mC/cm}^2$
78 %	44 %

Reham Aly

RPC2020 – 10-1

ency



1.4 mm chamber with two 50 kΩ (*)

→ Study effect on cluster

Chamber equipped with P resistivity regions (5 mm

iRPC with Cardarelli FE

- Efficiency vs. HV_{eff} measured with background (600 Hz/cm²)
- WP shift of ~ 100 V after collecting > 300 mC/cm² of IC



ECOGAS STUDIES @ GIF++

R&D on a new ecological RPC gas mixture started in GIF++ in April 2019:

Five RPCs (2 CMS, ATLAS, ALICE, EP-DT) under test. One RPC equipped with CMS electronics.

Two eco-gas mixture based on HFO 1234ze (C₃H₂F₄) tested so far:

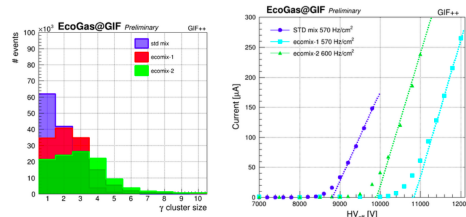
HFO - CO₂ - iC4H10 - SF₆ (45 - 50 - 4 - 1%)

HFO - CO₂ - iC4H10 - SF₆ (35 - 60 - 4 - 1%)



Preliminary considerations: an increase of current after some time observed with both gas mixture. Not clear results.

Plan is to take data at reduced humidity in order to understand if the current increase is related more to the HFO or to the humidity.



All results are here:

<https://twiki.cern.ch/twiki/bin/view/CMS/ECOGASRESULTS>

Richieste RPC 2021

CORE



- 2.4.3 - RE3/1-RE4/1 Power Systems **57kE** Restituiti nel 2020
- 2.4.2 - RE3/1-RE4/1 Front-End **18kE** S.J. -> Scelta opzione FE

MOF-B



- Contributo INFN MOF-B RPC **81.60kCHF**

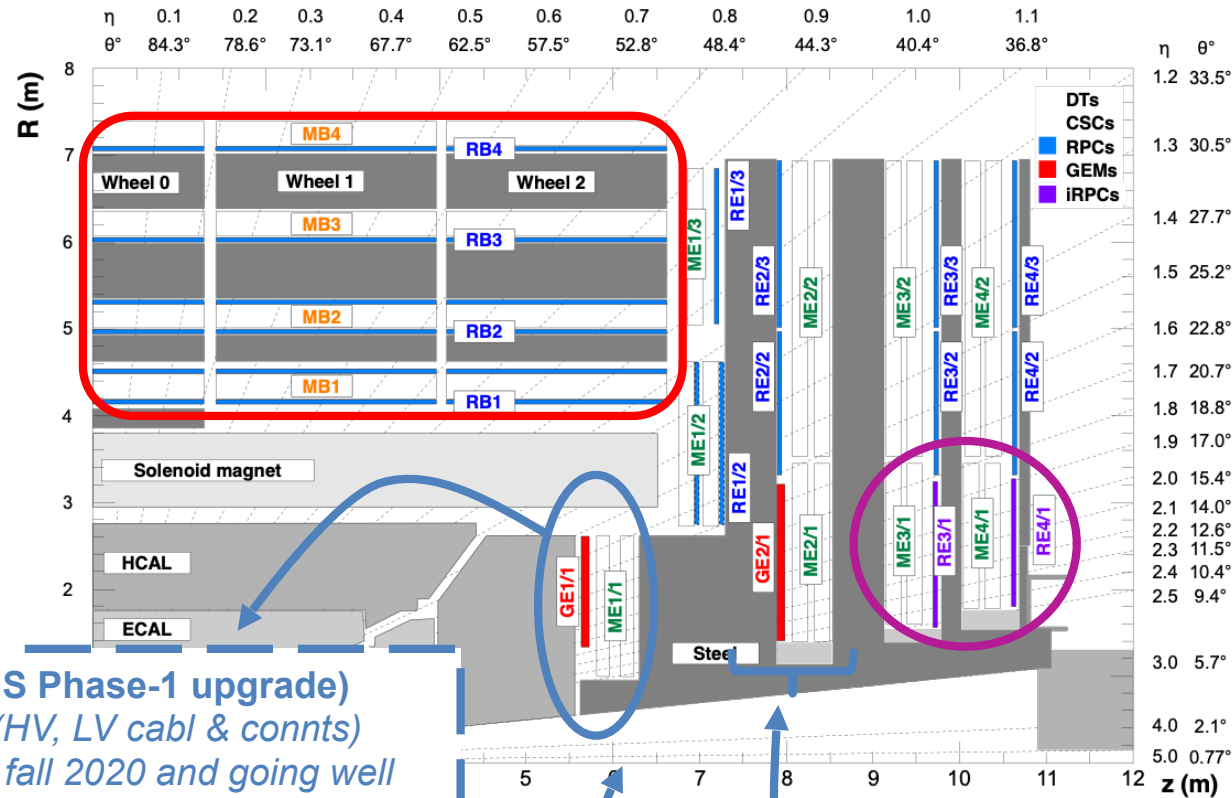
ME



- Maintenance @P5, GasGainMonitor **xxmu**
- Installazione Servizi RE3/1-RE4/1 **xxmu**
- GIF++ **xxmu**
- Ecogas **xmu**

Short overview Activities GEM

Context: 2nd year of LS-2: HW activities going towards end; Commissioning will start
 Covid-19 has introduced 3 months delay on schedule, CERN has restarted
 Preparing for Phase-2 construction to start in 2021



1

GEM GE1/1 Project (CMS Phase-1 upgrade)

- Installation of Services (HV, LV cabl & connts)
- Commissioning starting fall 2020 and going well into 2021

Priority of CMS
During LS-2 eyes are on us!

2

GEM Phase-2 upgrades: GE2/1 & ME0

- Prototype Design & Construction
- Discharge tests @ CERN & Bari
- Test Packaged VFAT3 chip @ Bari
- Simulation of various HW design
- Simulation of HGCal & Neutron Bkg

Phase-1 GEM Activities: GE11

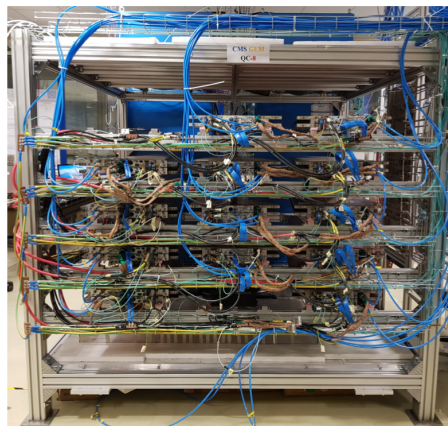
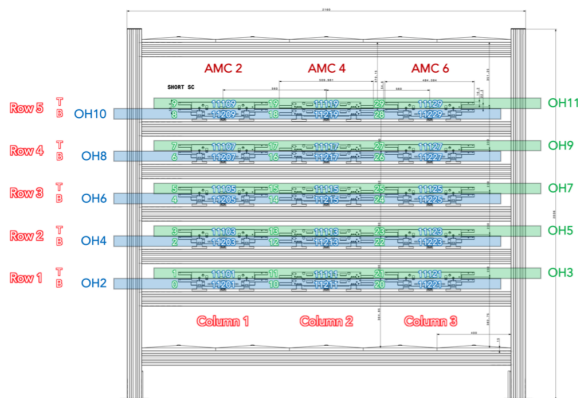
Installation of GE-1/1

- Summer – Fall Activities GE11(2020):
 - Refit spare chambers with electronics + valid QC6-7-8
 - Validation final positive endcap in cosmic stand
 - Installation positive endcap in p5
 - Installation services (LV, HV, cooling) in p5
 - Commissioning of pos & neg endcap in p5
- GE11 Activities in 2021:
 - Commissioning GE11 in MWGR and CRuZeT & CRAFT
 - Refurbishment ME11 Cooling Negative Endcap requires cabling & uncabling GE11



Ideal stand

Real stand



Cosmic Stand is Large Experiment:

- 92k readout channels!
- CMS-like DAQ based on uTCA be
- Frontend calibration procedures
- DCS (HV, LV, Gas, P,T) control & monitoring (data stored in DB)
- Offline DQM

Phase-2 GEM Activities: GE21

2

• Lessons learnt from GE1/1 implemented for Phase 2

- (1) Packaged VFAT3 chip to avoid bounding problems on small pads
- (2) Double Segmented foils reducing the discharge damage to FE

• GE21 Double-Segmented foils reduce detector capacitance

- But parasitic signal is picked up
- Careful balance between discharge protection & cross talk required
- Production of GE2/1 foils halted
- Investigations in Lab ongoing, solution identified but verification
- interrupted due to shutdown CERN

• Summer – Fall Activities GE21(2020):

- Verification identified solution GE21 for discharge & cross-talk
 - → will allow to (re-)launch GE21 Foil Production
- Testing of Packaged VFAT3 hybrid & GE21 Plugin Card
- Design & Prototype test of GE21 Construction Tools
- Preparation of Bari Construction Site

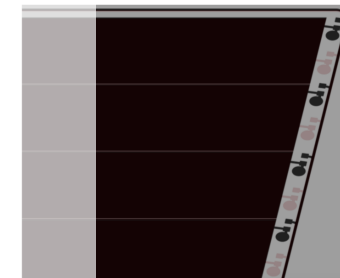
• GE21 Activities in 2021:

- Construction of 38 Modules GE21 M4 (Bari) + eventually also 10 M1
- Contribution to the QC/QA of Assembly components & preparation of various GE21 Assembly Kits to be sent to various construction labs (904)
- Refurbishment of Cosmic stand to host GE21 Chambers (904)
- Production of «Rolling Tables» to handle large GE21 Chambers (904)
- Installation of GE21 Demonstrator
 - Final QC/QA by Bari Physicists QC6-7-8 (904)
 - Installation & Cabling / Services (p5)

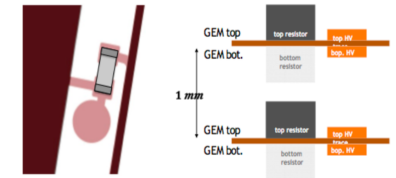


Double segmented foils for GE2/1

- GEM double segmentation would:
 - Reduce the propagation probability and the damage probability
 - Improve the high voltage stability of the GEM-foil in case of discharges
 - Allow efficient de-coupling of the bottom foil through protection resistor



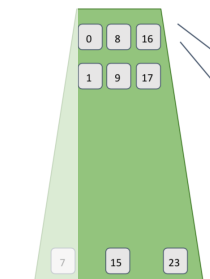
TOP side (in BLACK)
BOTTOM side (in RED)



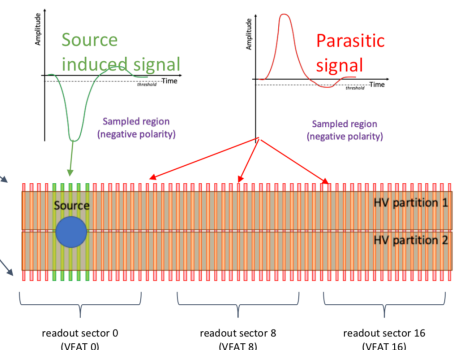
Bottom pad placed near the lower side of the same HV sector.

HV traces were moved away from the active area.

GMM CMS-Week GE2/1-ME0 Status Report CERN, Feb. 4, 2020 p. 1



GE1/1 Long chamber with double-segmented GEM foils



GEM VFAT3 packaging status

Deliverable/milestone	Relative timescale	Estimated/actual date
Placement of the order by CERN	T_0	Half July 2019
Design files and associated reports	T_1	October 2019
Approval by CERN of the substrate design	T_2	October 2019
Delivery of the prototypes	$T_2 + 8$ weeks	December 2019
Approval by CERN of the prototypes	T_3	June 2020
Approval by CERN to start work on the series production	T_4	June 2020
Delivery of the series production (first batch)	$T_4 + 4$ weeks	July 2020

200 pcs

- ❑ It took some time for ASE got the remain component (high precision resistor for current monitoring).
- ❑ The substrate mounting(just passive components). Some scratches on wafer, should be OK
- ❑ VFAT3 placement, bonding and encapsulation.
- ❑ VFAT3 should arrive at CERN around 26th May.
- ❑ **Latest update: the 200 packaged VFAT3 prototypes have been shipped out to IMEC. they will be shipped to CERN soon**
- ❑ the packaging test hardware ready, FPGA firmware OK, sw in development

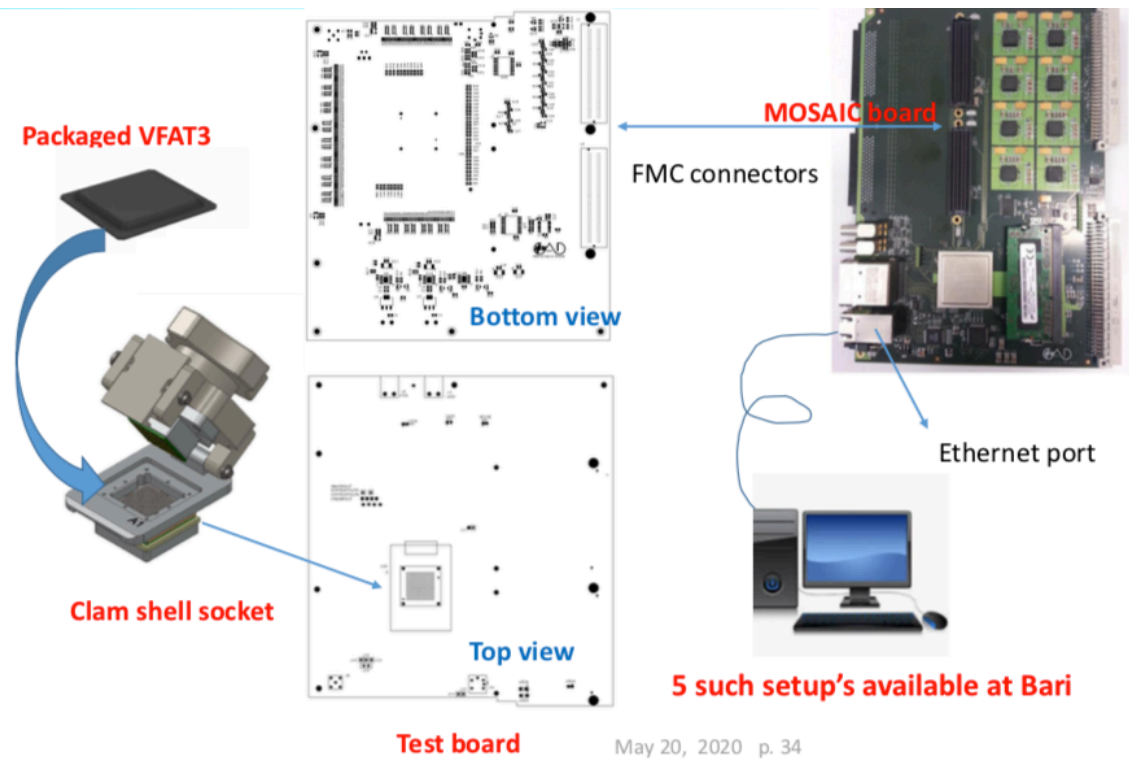
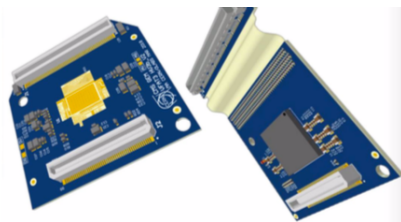
VFAT3 packaged testing setups

5 such setup's available in Bari

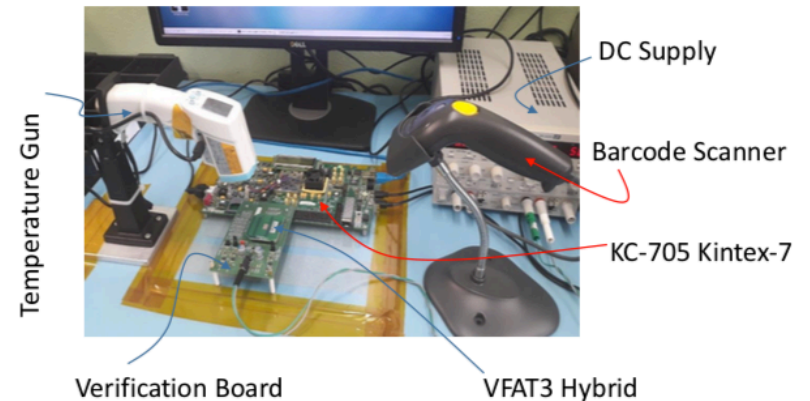
Plugin card testing

GE1/1 VFAT3 hybrid and GE2/1 Plug-In card are very similar Actually the digital connection to the GEB is the same:

- same panasonic connector
- same pin-out
- > can re-use the GE1/1 VFAT3 hybrid test bench



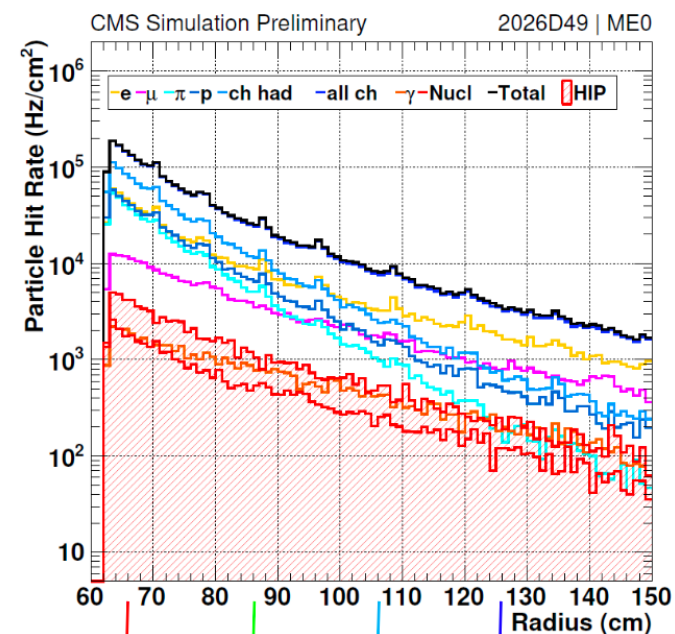
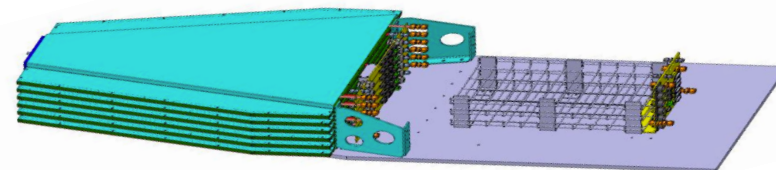
Hybrid test station



- Hybrid Labelling
- 1
 - 2
 - 3
 -
 -
- ~2 minutes Test Time per hybrid
 - Online database storage
 - 2 set-up's available at CERN

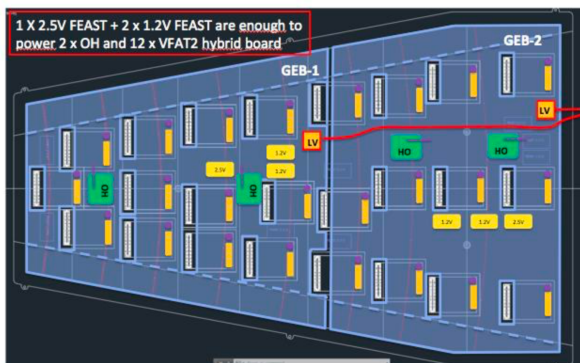
Phase-2 GEM Activities: ME0

- Design ME0 Readout Board & ME0 GEM Electronics Board (GEB) Inside GEM Electronics "Triad" group. Complex interplay between electronics & mechanical design
- Re-evaluation of ME0 background after HGCal Design improvements point towards much higher rates that ME0 need to maintain. Design of new ME0 Shielding using Fluka simulations.
Validation of Simulation results by performing Run-2 Data-MC comparisons for Fluka & GEANT for GE11 (Slice Test) and ME1/1
- Redesign ME0 GEM Foils & ME0 powering to deal with Rate-cap Simulation studies to design size of HV segments



ME0 GEB design

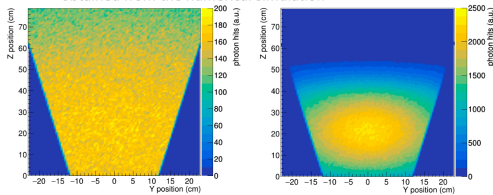
ME0 OH will be based on LpGBT allowing for power consumption reduction
ME0 GEB will be split in two separate domains powered by the same LV channel but now electronic components of mechanical parts will be shared between the two GEB domains which will act independently like the GEBs on the GE2/1 modules



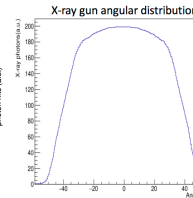
New approach to the rate capability study

Due to the *non-uniform irradiation*, each HV sector receives a *different photon flux*

- 1) a dedicated *numerical simulation* was developed to estimate the *HV sector weights* w_i :
 - w_i is the fraction of total current flowing through the protect. resistor of the *i-th* HV sector (in case of non-uniform irradiation!)
 - w_i is equal to fraction of total photons hitting the *i-th* HV sector obtained from the numerical simulation



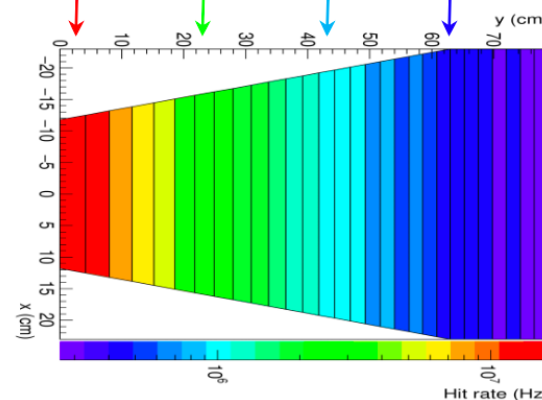
numerical simulation developed by Antonello Pellegrini (University of Bari and INFN)



- 2) the *HV sector weight* w_i is calculated as follows:

$$w_i = \frac{\text{current on the } i\text{-th HV sector}}{\text{total current on foil}} = \frac{\text{photon hits on } i\text{-th HV sector}}{\text{total photon hits}}$$

- the horizontal alignment precision of X-ray gun ~ 1 cm gives uncertainty on the HV sector weights
- the error propagation gives an uncertainty of ~ 0.2 on the gas gain drop



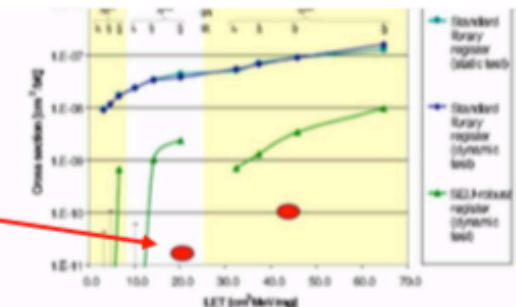
GEM VFAT3 irradiation

- In November 2019 VFAT3 was irradiated with Heavy Ion Beam to measure SEU x-sections:

- Slow Control Register
- SRAM memory

LET [MeV/(mg/cm ²)]	Ion	run dose [rad]	mean flux [i/cm ² s]	reached fluence [i/cm ²]	elapsed time[sec]	Cross section(cm ²)
20.4	Ni	979.2	9585	3000051	313	5.4 X 10 ⁻¹¹
46.1	Rh	7382.3	15028	10008557	666	1.6 X 10 ⁻¹⁰

Comparison with standard FF



- Good news:
 - SEU x-sections are very small
- Bad news:
 - Observed unexpected losses of synchronization
- Reminder:
 - All logic inside VFAT3 is implemented using TMR.
 - All FF outputs are voted using three independent voters and the three voters outputs are feed back to the three FF. The result is that every clock cycle FFs are updated with the corrected value.

⇒ Planning a new irradiation test at Louvain asap

Richieste GEM 2021

CORE

BA

- 2.5.2.1 - GE2/1 Fogli **10kE**
- 2.5.2.2 - GE2/1 Flex FE **15kE**
- 2.5.2.2 - GE2/1 FrontEnd **105kE** **S.J. -> Schedule LS2 affected by Covid**

MOF-B

LNF

- Contributo INFN MOF-B GEM **77.96 kCHF**

ME

LNF

BA

PV

NA

BO

- GE1/1 xxmu
- GE2/1- ME0 xxmu
- Servizi, Power, GIF++ xxmu

Simil-Fellow Detector

- Trigger GEM

ManPower Phase2

BA

- Rinnovo AR GEM **76 kE**

Camere Pulite

LNF

BA

- **8 kE**

CMS Muon milestones 2020

Completata installazione shielding MB4 per mitigare ageing camere esterne	Dicembre 2020	95%
Completamento maintenance straordinaria LS2 (Elettronica FE , Power Systems)	Dicembre 2020	60%
Finalizzazione disegno finale Minicrate Fase2 (elettronica + meccanica + integrazione)	Giugno 2020	fase2 100%
RPC Prosecuzione studi di ageing sulle camere irraggiate alla GIF++	Dicembre 2020	
Riparazione RPC gas leaks su più del 20% delle camere con perdite	Dicembre 2020	100%
Completata installazione dei servizi per RE3.1 / RE4.1	Dicembre 2020	fase2 60%
RE3/4-1 Inizio produzione detectors	Giugno 2020	fase2 0%
Validation of the chamber prototypes with the full electronics (back-end and front-end) prototype chain in cosmic data taking	Ottobre 2020	fase2
completion of GE2/1 services installation	Dicembre 2020	fase2

CMS Muon milestones 2021

DT Validazione produzione OBDT	Aprile 2021	fase2
RPC : riaccensione del sistema con prestazioni comparabili a quelle del RUN2 e con ripristino del flusso di gas esausto*	Dicembre 2021	
RPC : completati test @CERN di 6 camere iRPC (dimostratore) equipaggiate con FEB versione finale	Dicembre 2021	fase2
RPC : validazione power system su prototipi finali iRPC	Dicembre 2021	fase2

Sommario Anagrafica CMS Mu 2020

	Autori CMS	Tot CMS+Fase2	Fase2
	as June 2019	FTE	FTE
<i>Torino DT</i>	9	7,5	2,3
<i>Bologna DT</i>	15	13,2	1,8
<i>Padova DT</i>	14	16,25	4,1
Total DT	38	36,95	8,2
<i>Bari RPC</i>	8	5,3	3,7
<i>LNF RPC</i>	2	1,7	1,1
<i>Napoli RPC</i>	8	2,8	1,1
<i>Pavia RPC</i>	3	1,5	0,5
Total RPC	21	11,3	6,8
<i>Bari GEM</i>	8	9,7	7,5
<i>LNF GEM</i>	3	3,2	1
<i>Napoli GEM</i>	6		
<i>Pavia GEM</i>	5	6,5	4,5
<i>Bologna GEM</i>	2	1,9	0,4
Total GEM	24	21,3	13,4
Total Muoni	83	69,55	28,4

Da aggiornare

Sommario Responsabilità CMS Mu 2020

Progetto	Sezione	Nome	livello	Ruolo	m.u. totale
DT	TO	Silvia Maselli	L2	DT Resource Manager	4
		Nicola Amapane	L3	DT Local Reco	2
		Silvia Maselli	L3	DT Link ottici Fase1 e Fase2	2
		Domenico Dattola	L3	Shielding MB4 chambers	2
		Bilal Kiani	L3	SX5 Phase2 Test Stand	2
		Mario Pelliccioni	L2	DT Run Coordination	4
	BO	Daniele Trocino	L3	L3 Standard Model PAG - MultiBoson (SMP-VV)	2
		Gianni Masetti	L2	DT Run Coordinatore	4
		Luigi Guiducci	L2	DT deputy upgrade coordinator	4
		Francesca Cavallo	L2	DT DPG Coordinator	4
		Carlo Battilana	L2	Muon DPG Office chair	4
		Carlo Battilana	L2	DT DPG deputy coordinator	4
		Luigi Guiducci	L3	DT trigger coordinator	2
		Stefano Marcellini	L3	DT trigger performance	2
		Marco Dalla Valle	L3	DT phase2 minicrate mechanics	2
		Roberto Carlin	L0	Spokesperson	9
	PD	Sandro Ventura	L2	Muon Electronics Office Representative	4
		Sandro Ventura	L2	DT Upgrade Coordinator	4
		Marco Bellato	L2	DT Electronics Coordinator	4
		Martino Margoni	L2	BPH Convener	4
		Marina Passaseo	L2	FOG coordinator	4
		Roberto Rossin	L3	DT trigger coordinator	2
		Anna Meneguzzo	L3	Ageing Studies Coordinator	2
		Paolo Roncheso	L3	BPH software coordinator	2
	Alessio B...	L3	...	2	
	DT				
RPC	BA	Gabriel Angliese	L1	RPC Project Manager	6
	LNF	Davide Piccolo	L3	Responsabile Studi LHCas	2
		Stefano Bianco	L3	Responsabile GGM	2
	NA	Salvatore Buontempo	L2	RPC Upgrade Coordinator	4
		Salvatore Buontempo	L3	Detector Consolidation Coordinator	2
	Sabino Meola	L3	DB Coordinator	2	
RPC					Tot. 18
GEM	BA	Maggi Marcello	L2	GEM Run Coordinator	4
		Venditti Rosamaria	L2	GEM Upgrade Physics Coordinator	4
		Merlin Jeremie	L2	GEM Production Manager	4
		Licciulli Francesco	L2	GEM Electronics Coordinator	4
		Verwilligen Piet	L3	GEM Detector Response Modeling Coordinator	2
		Verwilligen Piet	L3	GEM Phase-2 Simulation Coordinator	2
		Verwilligen Piet	L3	GEM Production Site Manager	2
	LNF	Merlin Jeremie	L3	GEM GE2/1 Production Manager	2
		Licciulli Francesco	L3	ASIC-DAQ Integration	2
		Benussi Luigi	L2	GEM Production Manager	4
	PV	Vai Ilaria	L3	GE1/1 Commissioning coordinator	2
		Ressegotti Martina	L3	GEM LV system responsibility	2
	BO	Riccardi Cristina	L2	GEM Resource Manager	4
		Cavallo Francesca	L2	GEM Upgrade Physics Coordinator	4
	NA	Giacomelli Paolo	L2	GEM IB Deputy Chair	4
		Paolucci Pierluigi	L2	Muon Resource Manager	4
		Paolucci Pierluigi	L3	GEM HV system responsibility	2
GEM					Tot. 52
MUON					Tot. 149

Da aggiornare

Sommario CMS Muoni Missioni

	Autori CMS	Tot CMS+Fase2	Fase2	MI	ME								Totale Missini
	as June 2019	FTE	FTE	1k€/FTE	1mu/FTE	Resp	EPR 1mu	Fase1/Manu/Longevity	Fase2	Tot mu	k€/mu	Tot ME	
<i>Torino DT</i>	9	7,5	2,3	7,5	7,5	16	9	6	5	43,5	3,7	161	169
<i>Bologna DT</i>	15	13,2	1,8	13,2	13,2	26	15	3,5	11	68,7	3,8	261	274
<i>Padova DT</i>	14	16,25	4,1	16,25	16,25	37	14	4	18	89,25	3,8	339	355
Total DT	38	36,95	8,2	36,95	36,95	79	38	13,5	34	201,45		761	798
<i>Bari RPC</i>	8	5,3	0,7	5,3	5,3	6	8	8,5	1,5	29,3	4,05	119	124
<i>LNF RPC</i>	2	1,7	1	1,7	1,7	4	3	6	2	11,7	3,7	58	60
<i>Napoli RPC</i>	5	2,8	1	2,8	2,8	8	5	1,5	7,5	17,3	3,5	68	71
<i>Pavia RPC</i>	3	1,5	0,6	1,5	1,5	0	3	3	1,5	7,5	3,7	28	30
Total RPC	18	11,3	6,8	11,3	11,3	18	18	19	3,5	69,8		273	285
<i>Bari GEM</i>	8	9,7	7,5	9,7	9,7	26	8	9,5	3	56,2	4,05	228	238
<i>LNF GEM</i>	3	3,2	1	3,2	3,2	4	3	8	4	22,2	3,7	82	85
<i>Napoli GEM</i>	6	8,8	3,2	8,8	8,8	6	6	1,5	7,5	29,8	3,95	118	127
<i>Pavia GEM</i>	5	6,5	4,5	6,5	6,5	8	5	9	8	36,5	3,7	135	142
<i>Bologna GEM</i>	2	1,9	0,4	1,9	1,9	8	2	3		14,9	3,8	57	59
Total GEM	24	30,1	16,6	30,1	30,1	52	24	31	22,5	159,6		620	651
Total Muoni	80	78,35	31,6	78,35	78,35	149	80	63,5	60	430,85		1654	1734

Da aggiornare

Sommario CMS Muoni Consumo 2020

	Consumo							Totale k€
	Metabolismo 1,5k€/FTE	Auto	Manu	Fase1	Fase2	PreProto	MOF-B k€ eur/chf 1.1	
<i>Torino DT</i>	7,5	4					192,7	204,2
<i>Bologna DT</i>	13,2	4					5,5	226,9
<i>Padova DT</i>	16,25	4						42,95
Total DT	36,95	12	0	0	0	0	198,2	474,05
<i>Bari RPC</i>	5,3	2						7,3
<i>LNF RPC</i>	3,7	2						5,7
<i>Napoli RPC</i>	4,3	2						4,8
<i>Pavia RPC</i>	1,2	6					8,5	84,5
Total RPC	11,3	8	2	0	0	0	81	102,3
<i>Bari GEM</i>	9,7	2				24		35,7
<i>LNF GEM</i>	3,2	2					74	79,2
<i>Napoli GEM</i>		2						2
<i>Pavia GEM</i>	6,5	2						8,5
<i>Bologna GEM</i>	1,9							1,9
Total GEM	21,3	8	0	0	0	24	74	127,3
Total Muoni	69,55	28	2	0	0	24	353,2	703,65

Da aggiornare

Grand Total CMS Mu 2020

CMS MU 2020	PreProto (kE)	MOF_B (kE)	ME mu Extra	Assegni Fase2 (kE)
DT		198,2	47,5	48
RPC		81	20	
GEM	24	74	53,5	48
Totale	24	353,2	121	96

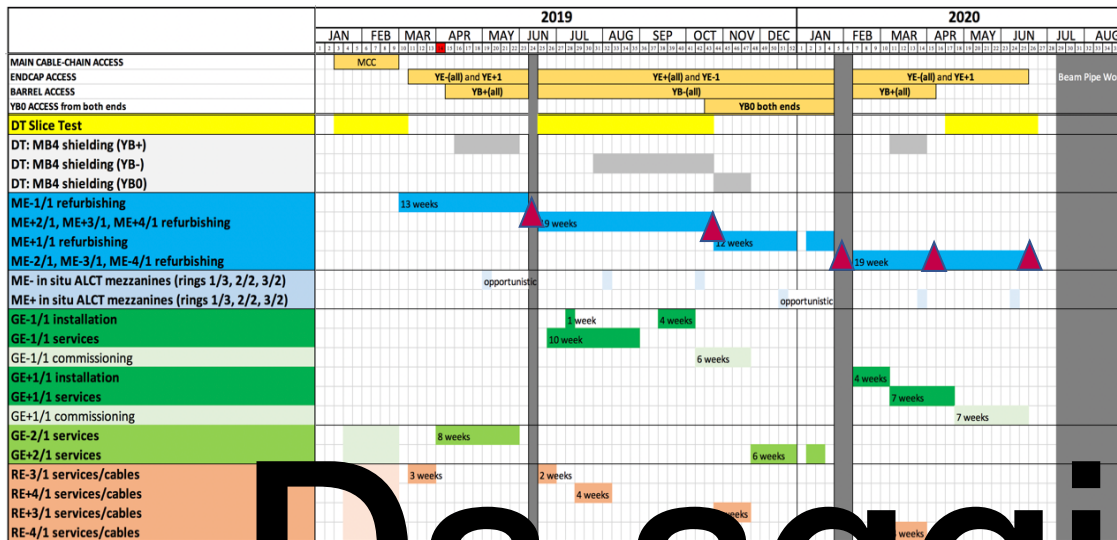
CMS MU Core Summary

CBS	Deliverables MoU	2018	2019	2020		2021	2022	2023	2024	Total Funded	Tot MoU KEuro	Tot MoU KCHF
				requests	funded							
2.2.1	DT Front-end electronics			174						174	1338	1472
2.2.2	DT Back-end electronics									0	495	545
2.2.3	Optolink									0	257	283
				174								
2.5.2.1	GE2/1 Detectors		224	136						358	368	405
2.5.2.2	GE2/1 FE Electronics	24	26	105						155	155	170
2.5.2.3	GE2/1 DAQ Backend									0	0	0
2.5.2.4	GE2/1 Power System	167								167	395	435
		191	250	239								
2.4.1	RE3/1 RE4/1 Chambers		50	39						89	91	100
2.4.2	RE3/1 RE4/1 FE electronics			18						18	45	50
2.4.3	RE3/1 4/1 Power System	20		57						77	136	150
		20	50	114						184		
2.5.3.1	ME0 Chambers										27	30
2.5.3.2	ME0 FE Electronics										210	231
2.5.3.5	ME0 Power System										435	479
		0	0	0								
Total Muon INFN Phase2		211	300	527	0	0	0	0	0	1038	3955	4350

Da aggiornare

backup

Upgrade and maintenance in LS2: Muons define critical path



Main Muon activities

- CSC inner ring electronics upgrade
- GE1/1 detector + services installation
- GE2/1, RE3/1, RE4/1 services pre-installation

Da aggiornare

LS2 muon maintenance activity in prep for Run 3

DT : shielding (reduce n background) + maintenance access to wheels (for -1, 0, 1, first since LS1)
 RPC: major leak suppression campaign as part of CERN greenhouse gas reduction strategy

Endcap mu phase 2 upgrade: stations GE2/1 and RE3/4-1

LS3 logistics (simultaneous Tracker, Calorimetry & barrel Muon upgrade)

- > severely limits station 2-4 access windows
- > thereafter make best use of opportunities for installation in Run 3 (E)YETS
- > completion of services installation in LS2 is a central priority → ON-GOING

Aim is to assure installation and commissioning completed for early in Run 4 at the latest.

New HL-LHC schedule will be agreed in fall 2019 between experiments and CERN

CMS Muon milestones 2019

DT prototype electronics (Minicrate and back-end) validated (HM) (TDR reference DT.RD.FE.5, DT.RD.BE.4)

Ottobre 2019 - In progress, installazione sul detector iniziata il 2 luglio come da schedule

fase2

DT Completamento analisi performance run2

100%

RPC Prosecuzione studi di ageing sulle camere irraggiate alla GIF++

Dic 19
in corso 70%

RPC Power system : validazione prototipi

Dic 19
Prototipo ordinato - In attesa di iniziare il test.

fase2

iRPC pre-produzione completata e validata

Dic19
Probabile slittamento per ritardo nella validazione della FEB

fase2

RPC Completamento analisi performance run2

100%

Completa caratterizzazione primo prototipo GE2/1 full size (M1+M2+M3+M4)

50%

fase2

GE1/1 Completamento dei servizi del sistema di potenza

100%