

Programmed stops in the LHC

10th LHC Operations "Evian" Workshop (22-25 November 2021)

23rd November 2021

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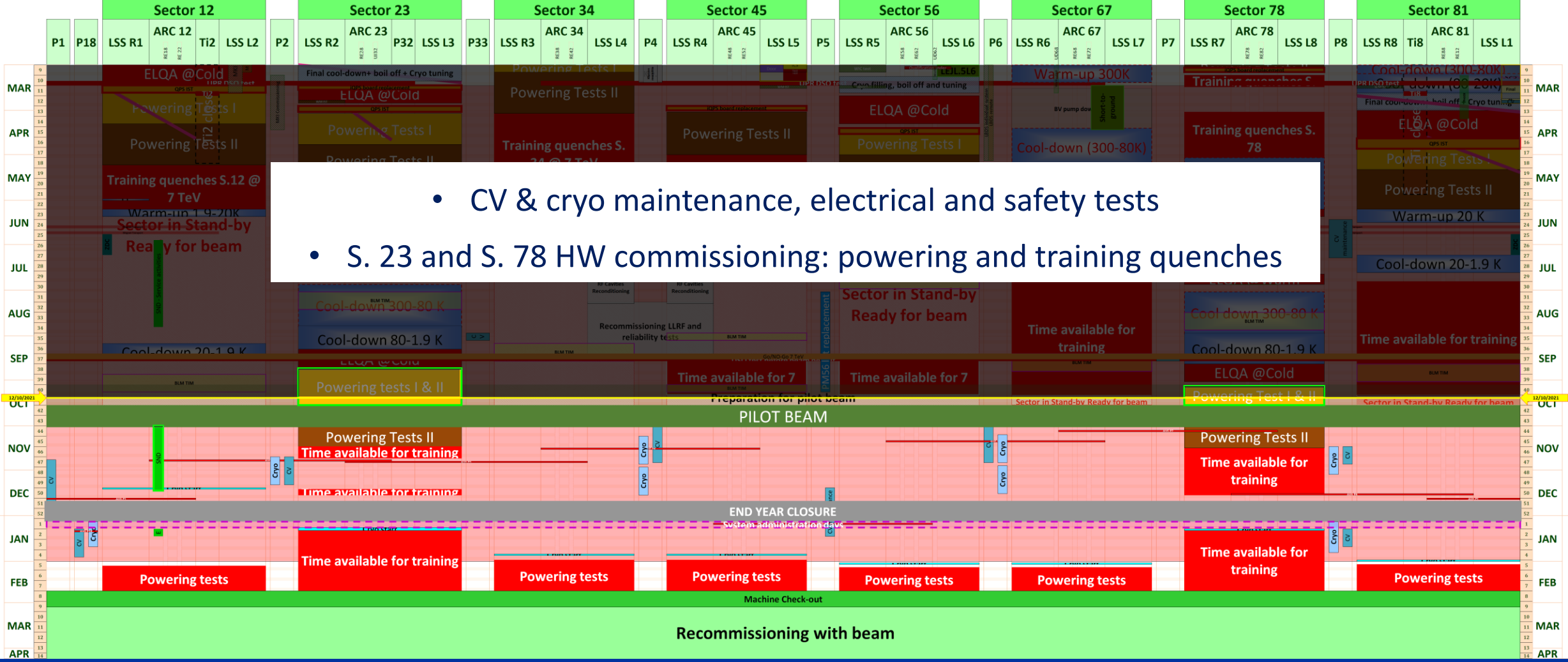
EN-ACE-OSS

Contents

- YETS motivation
- YETS 21-22 schedule evolutions
- LHC activities
- Overview on Run 2 programmed stops
- Run 3 programmed stops
- Conclusions

Once upon a time (October 2021)

... Main motivations for YETS 2021-22



- CV & cryo maintenance, electrical and safety tests
- S. 23 and S. 78 HW commissioning: powering and training quenches

YETS 21-22 baseline v 2.0 **OBSOLETE**

- The duration of the LHC YETS 2021-22 was of **16 wks**, including Year End Closure and Powering tests
 - From Monday 1st November 2021 to 21st February 2022 (start of Machine checkout)

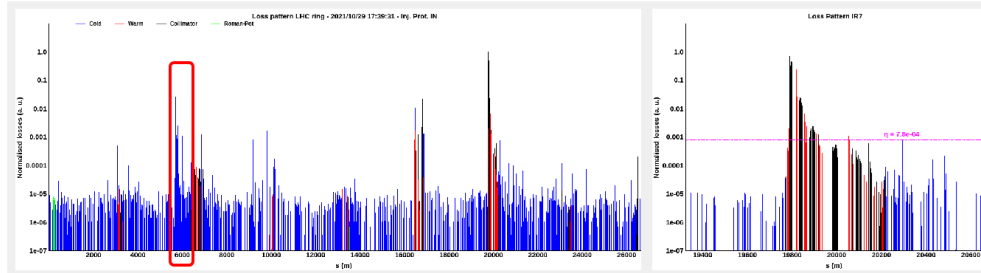
[ACC-PM-MS-0005 v.2.0](#) **OBSOLETE**



Sector 23 RF finger issue: what happened

Anomaly in 21L3

First signs of anomaly around 21L3 in loss maps of B1V, signature of a “thin target” at **location 21L3** (see dedicated presentation)



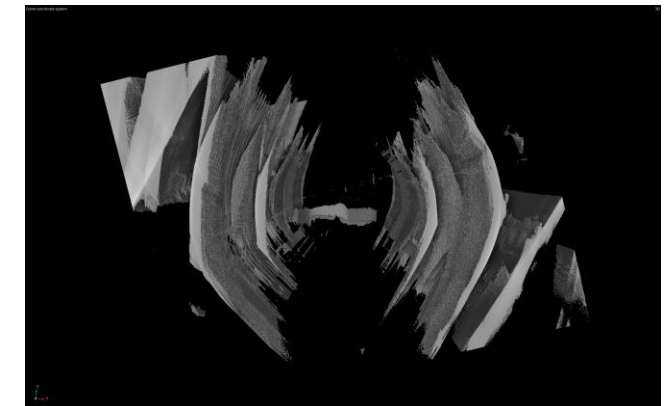
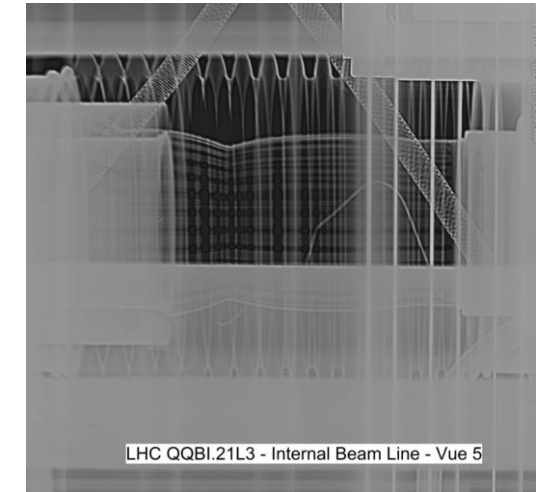
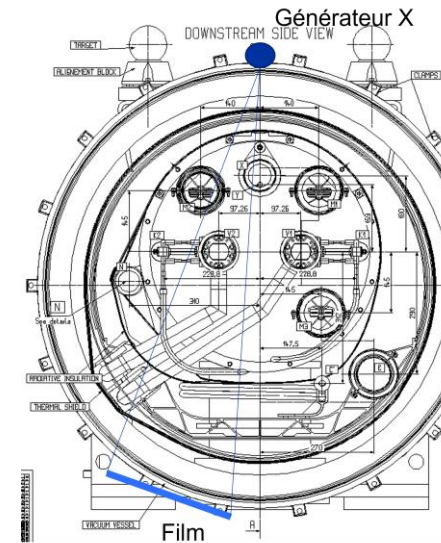
LHC Beam Test – LMC #427 - 03.11.2021 24

[LHC Machine Committee \(LMC #427\) \(3 November 2021\) · Indico \(cern.ch\)](#)

QQBI.21L3.V1: What did happen?

1. During the RF-ball test at room temperature (arc 2-3), the ball rolled from the point of entrance (Q11R2) up to a position around Q22L3 where it stopped.
2. An additional point of air ingress was moved from the extremity of the arc to the closest pumping port upstream the point of stop, Q24L3 in this specific case.
3. Once the venting point was approached, the RF ball continued its trip up to the collection point at Q7L3.
4. As the ball rolled along the whole arc, the procedure does not require further investigations.
5. During the pilot beam test anomalous high losses were detected at position Q21L3. The aperture map revealed an object lying on the bottom of the beam screen. X-ray were requested.
6. The X-ray unambiguously showed that the obstacle was a RF finger from the PIM of the internal beam pipe at the quadrupole-dipole transition. A tomography was requested.
7. The tomography showed the position of the finger. The contact with the copper sleeve is lost and the finger intrudes into the bottom of the beam screen leaving a physical aperture of 30 mm for the beam.

[LHC Machine Committee \(LMC #428\) \(17 November 2021\) · Indico \(cern.ch\)](#)



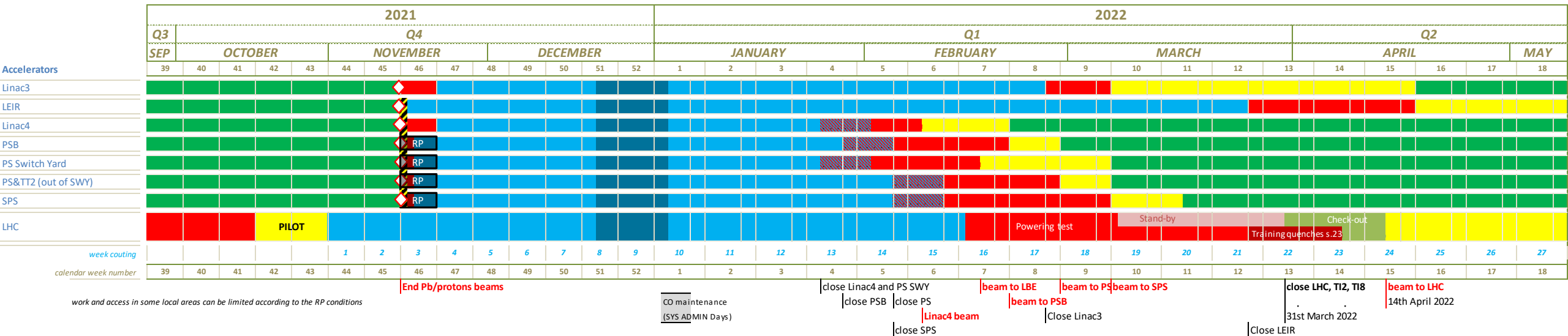
QQBI.21L3: X-Rays & Tomography Results

YETS 21-22: new handover OP & ACE

- The duration of the YETS 2021-22 is of **21 wks** (wrt 16 previous BL) including Year End Closure and Powering tests

➤ **From Monday 1st November 2021 to 31st March 2022 (start of Machine checkout)**

[ACC-PM-MS-0005 v.2.1 DRAFT](#)



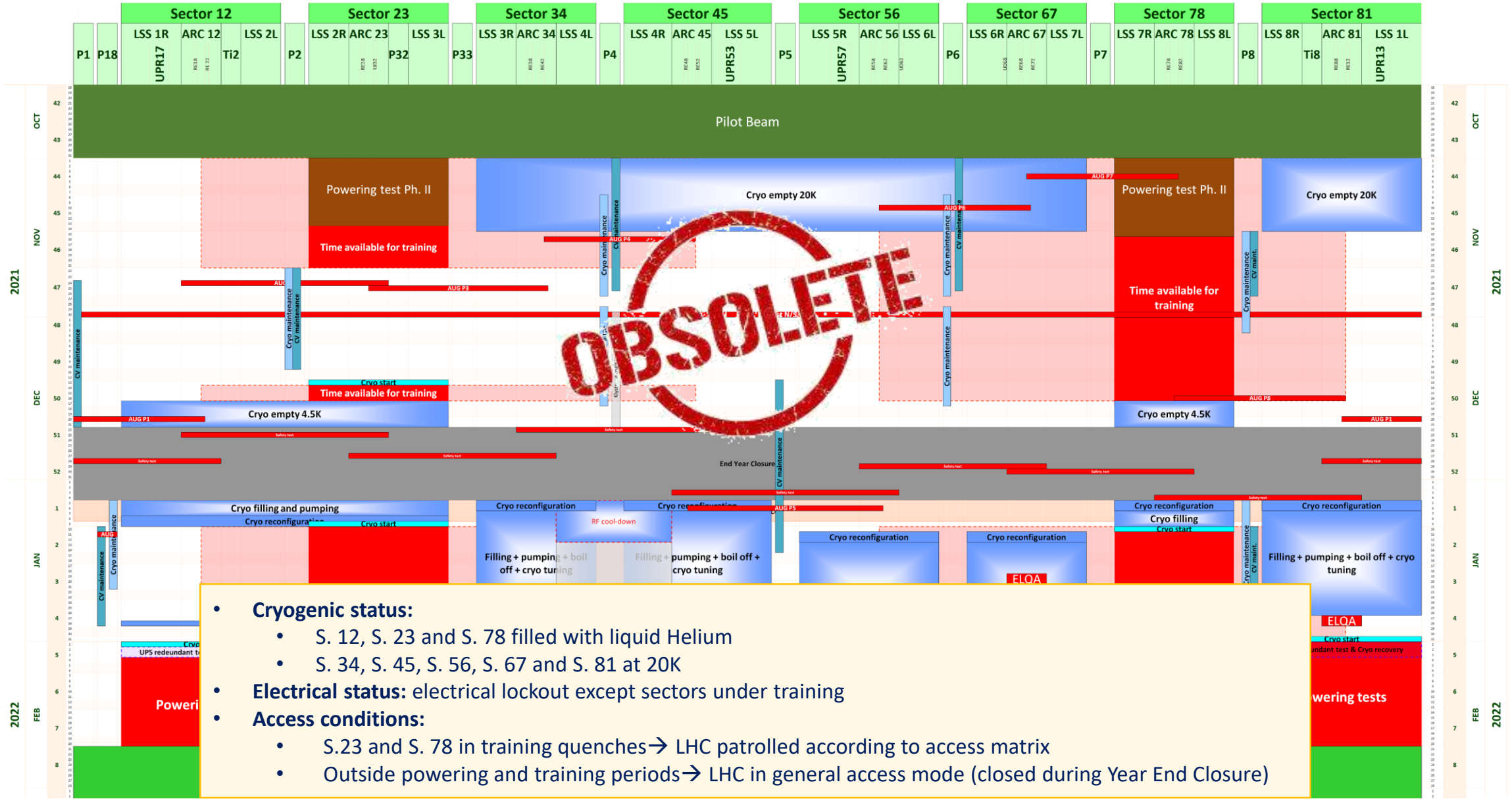
[297th IEFC meeting \(19 November 2021\) · Indico \(cern.ch\)](#)

- From the **1st November** the machine is back to EN-ACE
- Collaboration between EN-ACE and BE-OP to coordinate
- BE-OP in CCC until the end of training quenches and restart of powering phase II (as soon as patrols are required)
- The LHC will be **back to BE-OP on 15th February 2022**

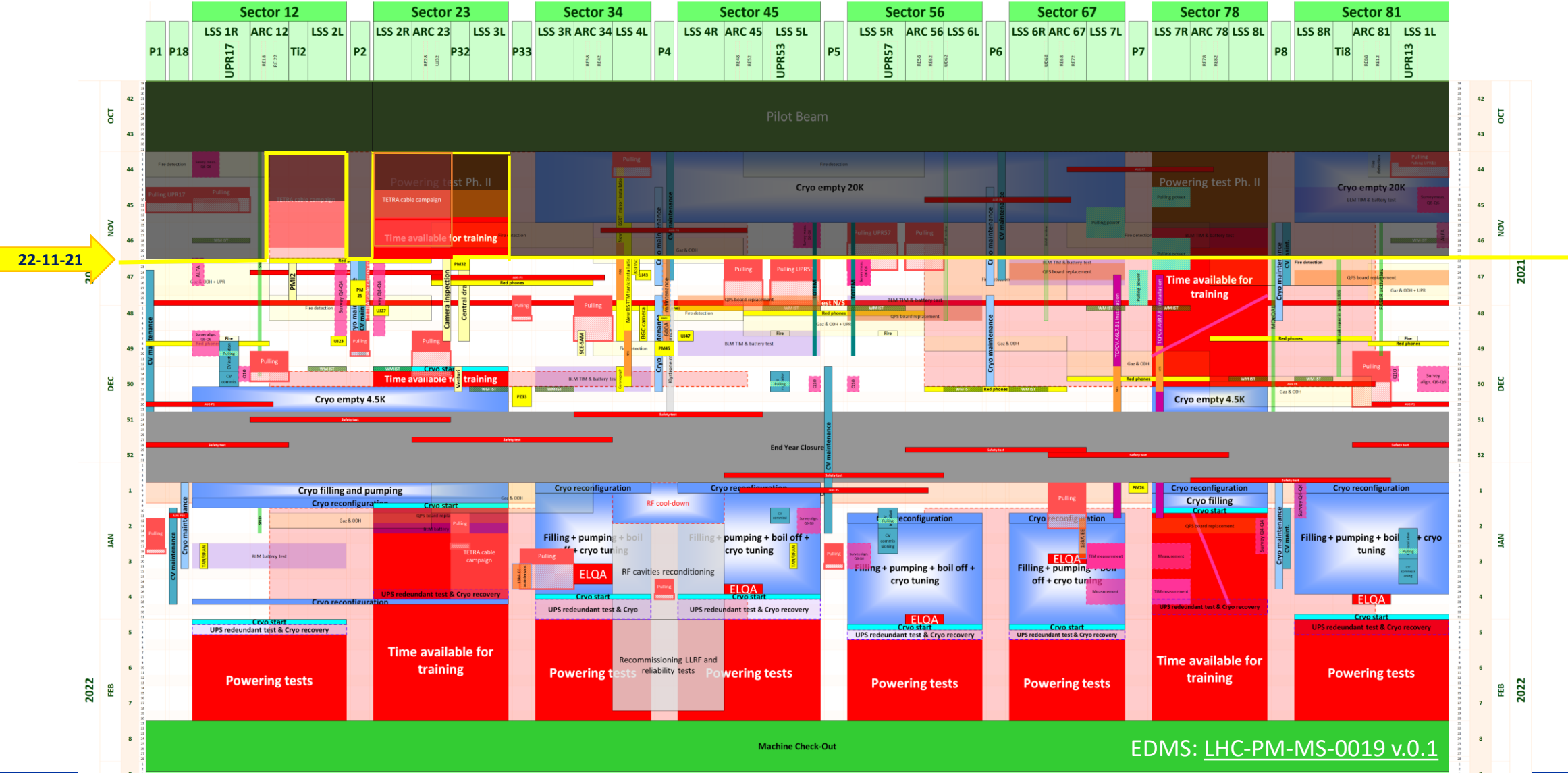


YETS 2021-22: Old frame

EDMS: LHC-PM-MS-0019 v.0.1

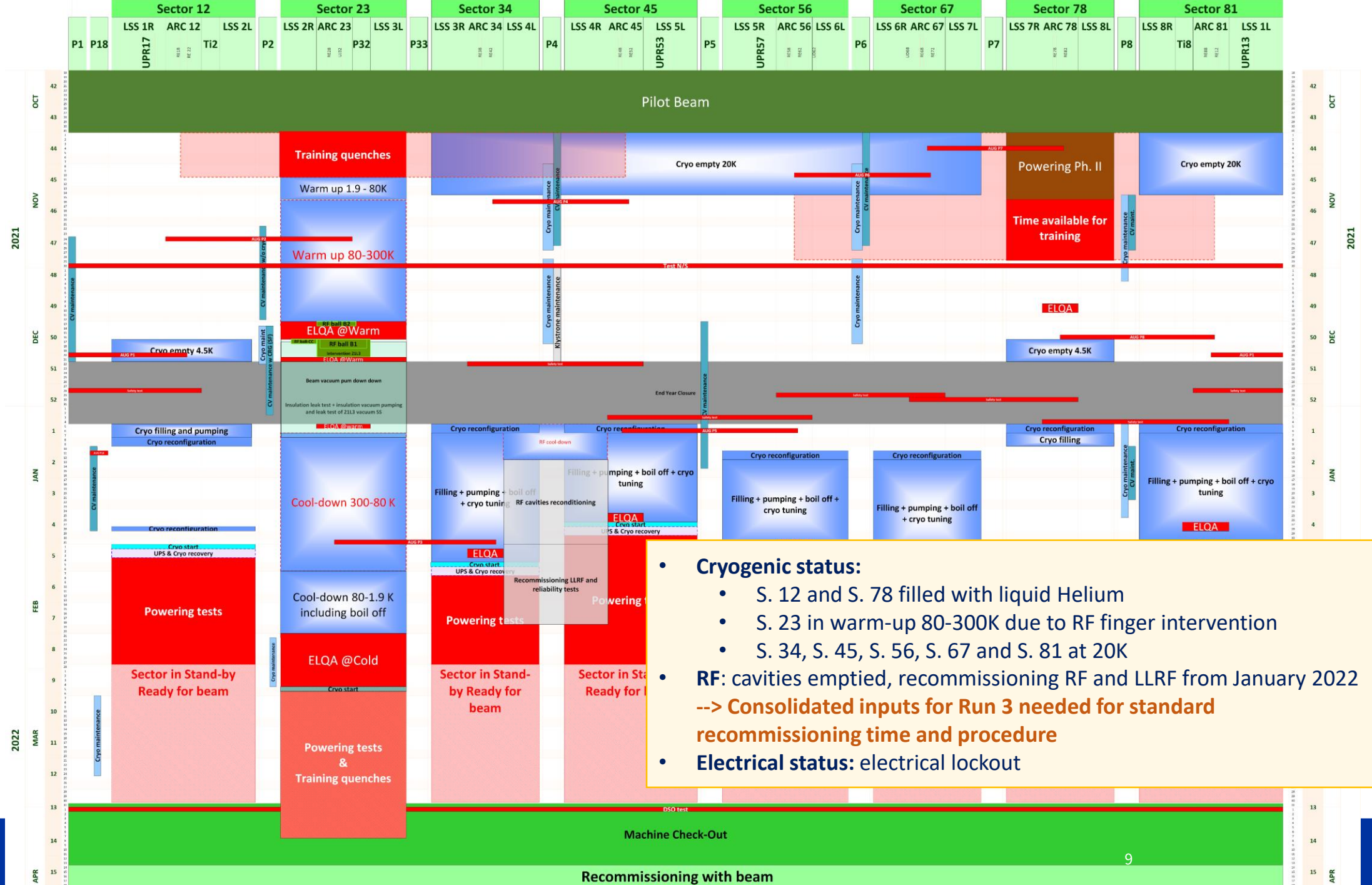


LHC-YETS: Broken line wrt LHC-PM-MS-0019 v.0.1



YETS 2021-22: Frame

LHC Machine Committee (LMC #428) (17 November 2021)

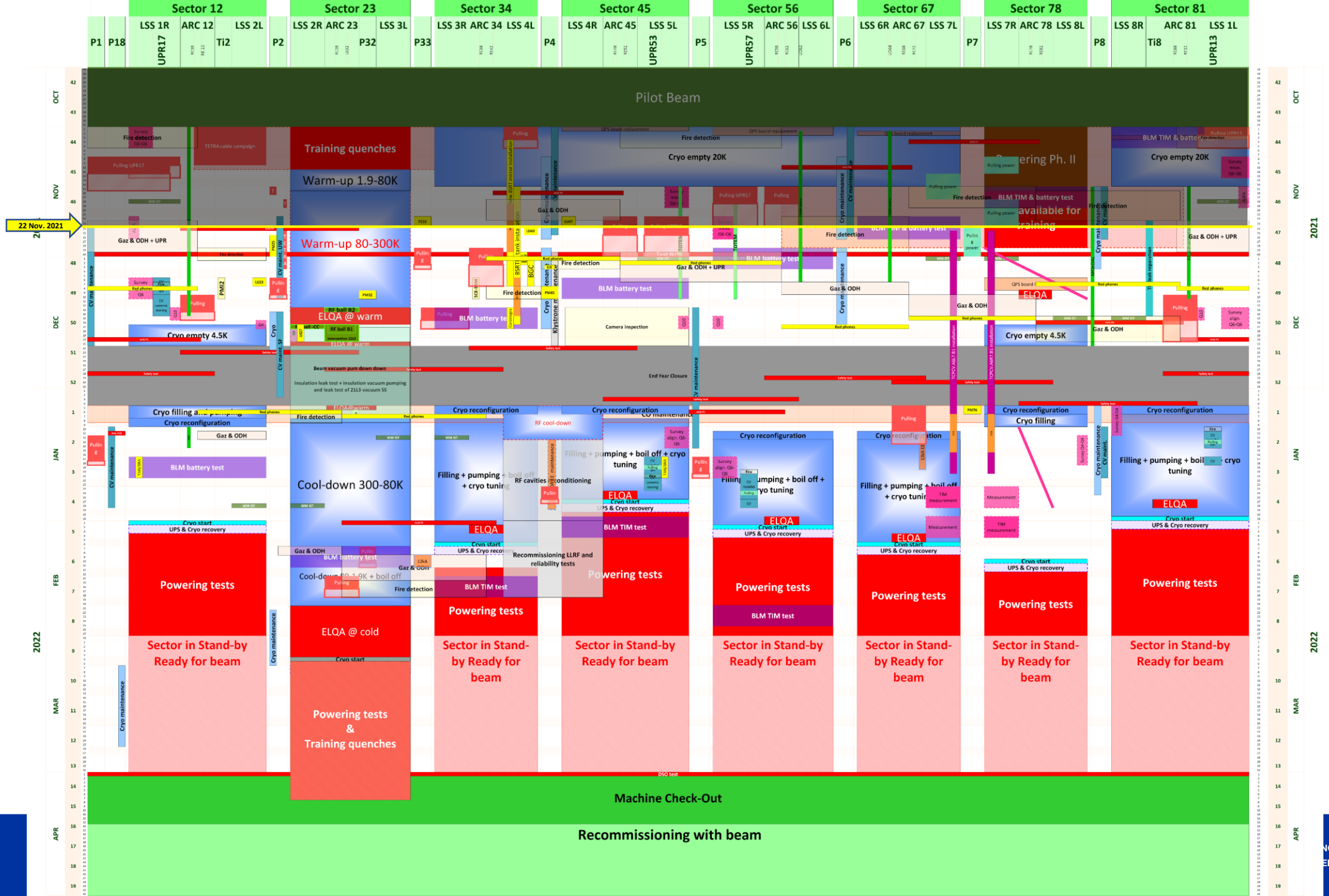


- **Cryogenic status:**
 - S. 12 and S. 78 filled with liquid Helium
 - S. 23 in warm-up 80-300K due to RF finger intervention
 - S. 34, S. 45, S. 56, S. 67 and S. 81 at 20K
- **RF:** cavities emptied, recommissioning RF and LLRF from January 2022
 --> **Consolidated inputs for Run 3 needed for standard recommissioning time and procedure**
- **Electrical status:** electrical lockout



YETS 2021-22: Global Schedule

LHC Machine Committee (LMC #428) (17 November 2021)



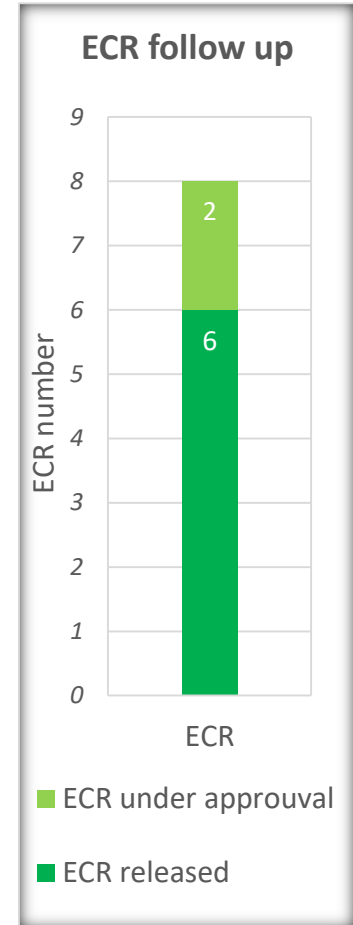
The Frame: CV & electrical maintenance

CV maintenance	Weeks
P1 & ATLAS	47, 48, 49, 50, 51 (2021)
P18	2, 3, 4 (2022)
P2 & ALICE	SU + UW: 47, 48, 49 (2021) SF + Cryo station: 50, 51, 52 (2021)
P4	44, 45, 46, 47 (2021)
P5 & CMS	50, 51 (2021) 1-2 (2022)
P6	44, 45, 46, 47 (2021)
P7	3, 4 (2022)
P8-LHC	SU8 + UA87: 46 → 47 (2021) SF + CRG station: 2 → 3 (2022)
P8-LHCb	46 → 47 (2021)

AUG TEST LHC		AUG TEST SPS	
Point	Day	Point	Day
LHC1 + ATLAS	20th December 21	BA1	15th December 21
LHC18 + SM18	11th January 22	BA2	13th December 21
LHC2 + ALICE	24th November 21	BA3	13th January 21
LHC3 + PM32	25th November 21 1st February 2022 (TBC)	BA4	9th December 21
LHC4	16th November 21	BA5	1st December 21
LHC5 + CMS	6th January 22	BA6	7th December 21
LHC6	10th November 21	BA7	3rd December 21
LHC7	4th November 21		
LHC8 + LHCb	16th December 21 (backup: 17th December 21)	PS + B	27-28 November 21
Preessin	29th January 21	BA80	18th January 22
Meyrin + Adm.	4th January 22	BA81	19th January 22
Meyrin W. + ISR	11th December 21	BA82 + 85	20th January 22
TEST N/S (10min)		AUTO TRANSFERT TEST	
All points on 30 th November 2021 (6am – 6:10am)		Not foreseen in YETS 2021-2022	

YETS 21-22 major changes

N°	Status	Scope	Location	Description	ECR	ECR Status	Group
1	Postponed	Consolidation	RE22	Modifications Ventilation of RE22	LHC-U-EC-0005 v.0.1	In Work	EN-CV
2	Postponed	Consolidation	-Between RE38 and RZ33	Construction of 2 access points to central drain between RE38 and RZ33		Needed	SCE-SAM
3	In Progress	Consolidation	SD1, SD2, SD4, SD6, SD8	MAD LHC Installation Safety barriers		Not needed	EN-AA
4	In Progress	Maintenance & Operation	TD62, TD68	New Beam Vacuum DUMP Windows in the TD62 and TD68 of the LHC	LHC-V-EC-0026 v.0.1	Released	TE-VSC
5	In Progress	Consolidation	RE42	Plexiglass protection in front of alveole CV		Not needed	EN-CV
6	In Progress	HL-LHC - WP5 - Collimation	IR7	* Upgrade Of The Crystal Collimation Test Stand in IR7	LHC-TC-EC-0015 v.1.0	Released	BE-ABP
7	In Progress	HL-LHC - WP13 - Beam diagnostics & instrumentation	LSSL4	* IR4L - Installation of BGC demonstrator	LHC-BGC-EC-0002 v.1.0	Released	SY-BI
8	In Progress	HL-LHC - WP17 - Technical infrastructures	UPR (13, 17, 53, 57)	* UPR (13, 17, 53, 57) Modification of ventilation WP17	LHC-U-EC-0009 v.0.1	Approved	ATS-DO
9	In Progress	HL-LHC - WP13 - Beam diagnostics & instrumentation	5L4	* Installation of a new BSRTM device	LHC-BSRTM-EC-0003 v.0.2	Released	SY-BI
10	In Progress	HL-LHC - WP13 - Beam diagnostics & instrumentation	LSS1 and LSS5	* Upgrade of the BRAN Luminosity Monitors in LSS1 and LSS5	LHC-BRAN-EC-0002 v.1.0	Released	SY-BI
11	In Progress	Consolidation	P2 (UL24, UJ23, UL26, UJ27)	Replacement GSM cable P2	ECR LHC-CC-EC-0004 v1.0	Under Approval	IT-CS
12	In Progress	Not defined	UA83	MoEDAL MAPP mQP detector in UA83	LHC-BSRTM-EC-0003 v.0.2	Released	BE-EA



■ Released ■ In progress ■ Postponed
■ Under Approval ■ Not needed * HL-LHC

In collaboration with A. Perrot & JP. Corso

HL-LHC during YETS 2021-22

WP13

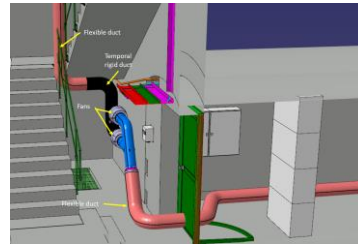
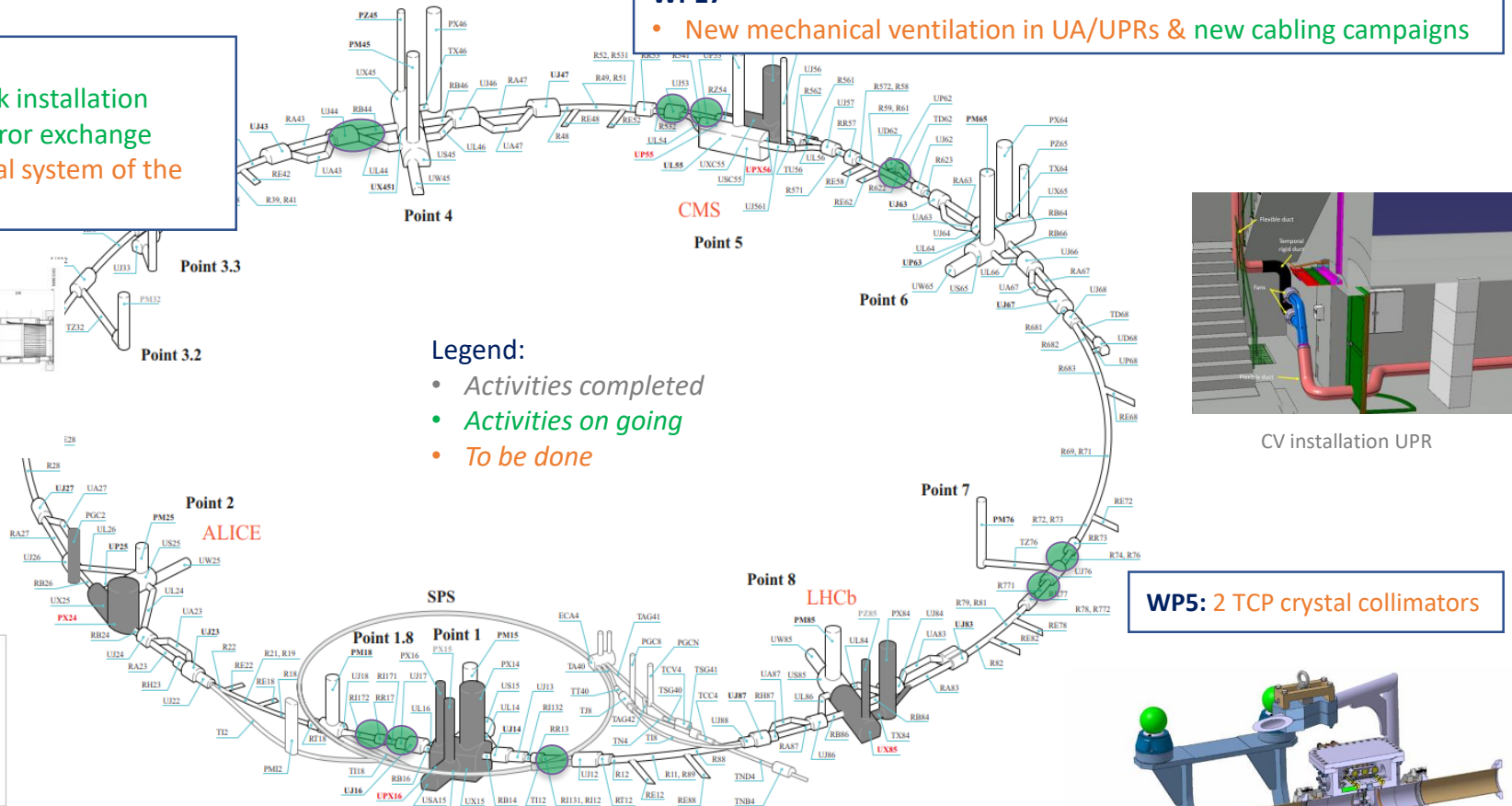
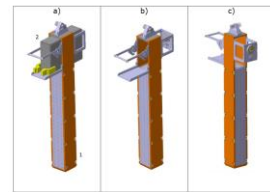
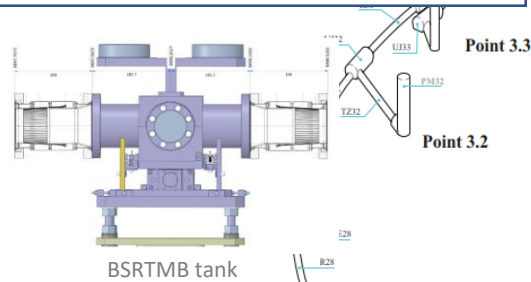
- Remove of BRANA & BRAND replacement (IP5 left)

WP17

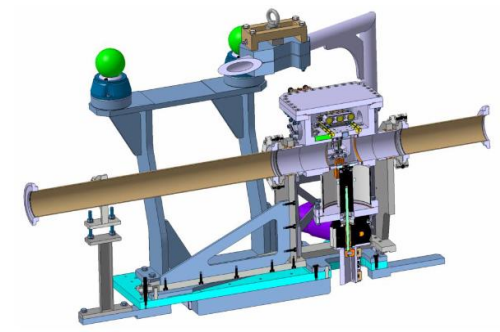
- New mechanical ventilation in UA/UPRs & new cabling campaigns

WP13

- BSRTMB.D5L4 tank installation
- BSRTMB.D5L4 mirror exchange
- BGC. C5L4.B optical system of the HEL prototype



WP5: 2 TCP crystal collimators



WP13

- Remove of BRANA & BRAND replacement (IP1 right)

WP17

- New mechanical ventilation in UA/UPRs & new cabling campaigns

List provided by the WPs Part I

WP	intervention	comment
2	None	
3	None	
4	None	
5	Installation 2 TPC (crystal collimators)	See EDMS 1973224
6A	None	
6B	None	
7	None	
8	None	
9	Inspection of existing installation to prepare LS3 in IP1, IP5, IP4	
10	None	
11	None	



List provided by the WPs Part II

WP	intervention	comment
12	Support to WP13: - Installation new BSRTMB tank LSS4 vac. Sec F5L4.B Support to WP5: - TPC Crystal collimator replacement in LSS7 in vacuum sector BSR7.R and BSL7.B	
13	- Installation new BSRTMB tank LSS4 L - Installation of the new Coronagraph prototype - Luminosity monitors: Removal of two BRANA (left of IP5 and right of IP1) replaced by the new BRAND prototypes. - Installation of the BGC optical system of the HEL prototype (on the left side of IP4) and connexion of Gas injection line	(already done during LS27)
14	None	



List provided by the WPs Part III

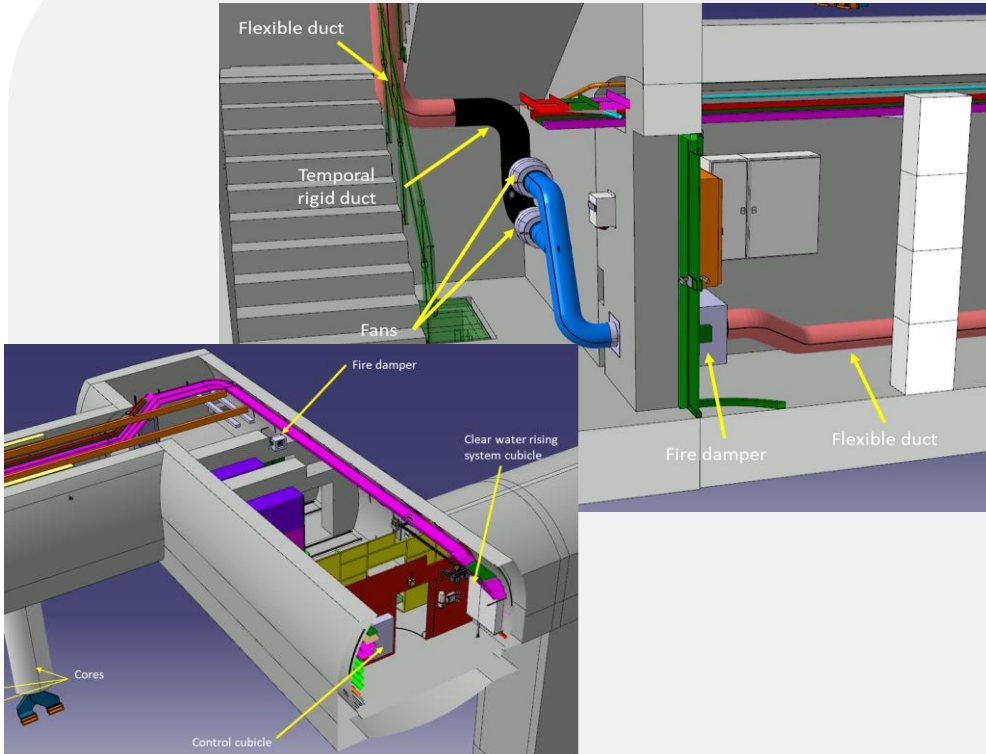
WP	intervention	comment
15	- Integration inspections - Inspection to check inventory of cable to disassembled (procedure to be defined yet)	
16	None	
17	- If the ECR is approved, the new temporary mechanical ventilation in the 4 UA/UPRs IP1 and IP5. Need for civil engineering new cores. - In the LHC tunnel itself the cabling related to same UPR intervention is planned. WP17 is working on the corresponding pre-DICs (already sent for the alarm system, to be done for the electrical distribution).	



Courtesy of P. Fessia, 140th HL-LHC TCC

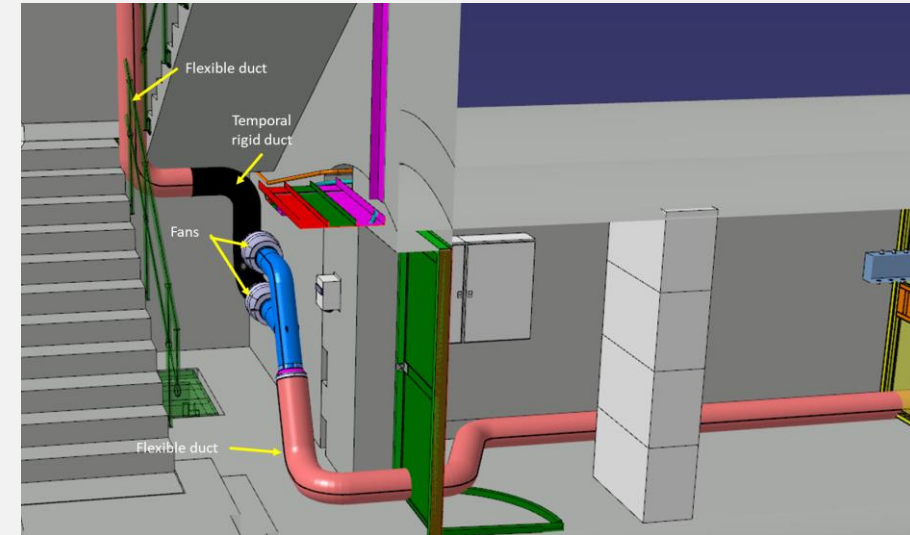
A focus on HL-LHC/WP17 & follow-up

What was planned



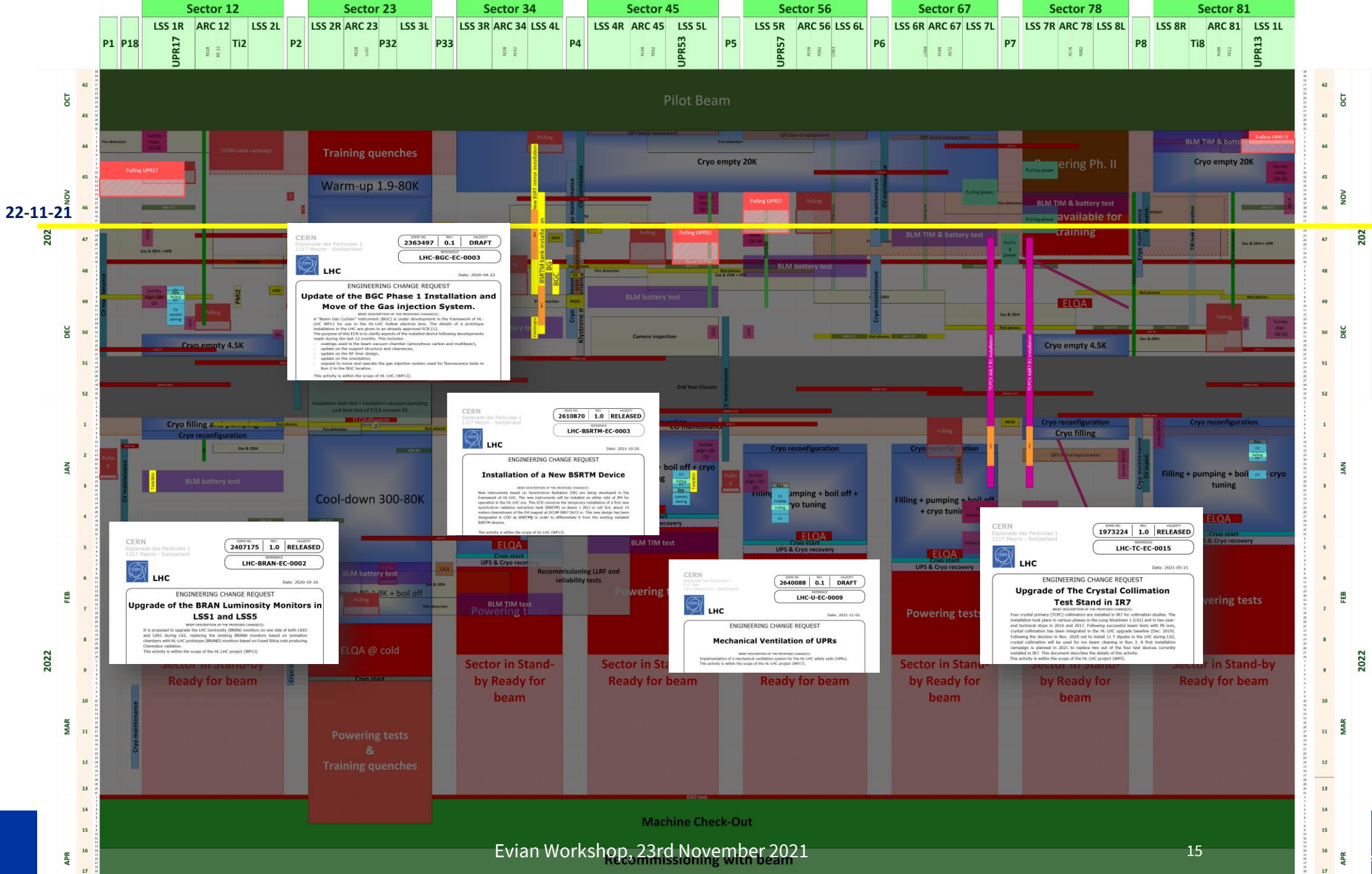
- ❑ Cores drilling
- ❑ Fire dampers installation
- ❑ CV installation (Fans + control cubicle)
- ❑ EN-AA works for ODH & Fire detection
- ❑ Powering and control cable pulling and connection

What we did & what we will do



- ❌ Cores drilling
- ❌ Fire dampers installation: due to Covid-19, fire dampers will not be provided by supplier in time for YETS 21-22.
- ❑ CV installation (Fans + control cubicle): after YETS 21-22, the flexible duct will not only have to be put through the screen door but also through the ventilation door.
- ❑ EN-AA works for ODH & Fire detection
- ❑ Powering and control cable pulling and connection →
- ✅ Control cables pulling completed for UP13/17 & UPR57

HL-LHC in YETS 21-22 schedule



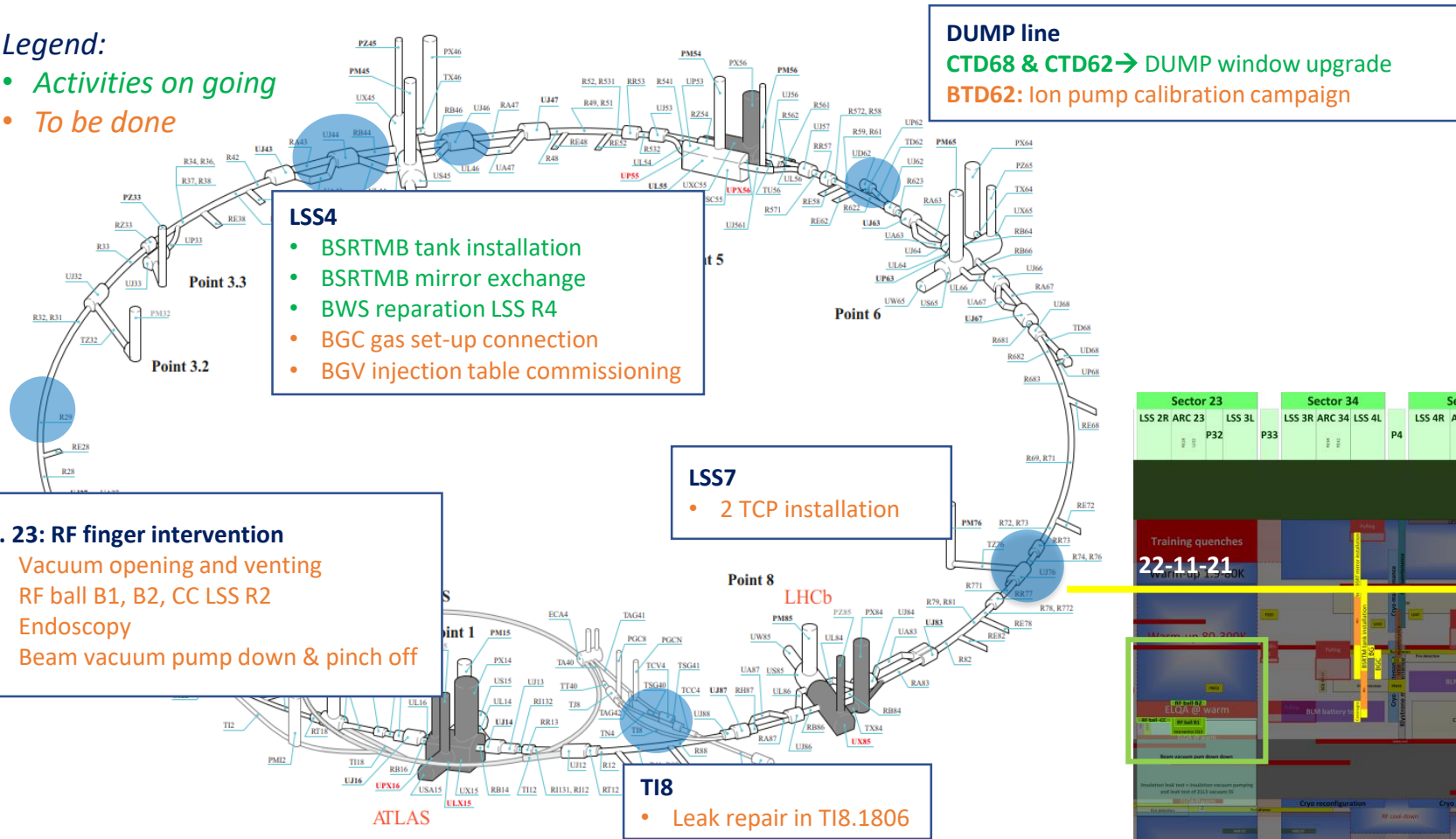
Evian Workshop, 23rd November 2021



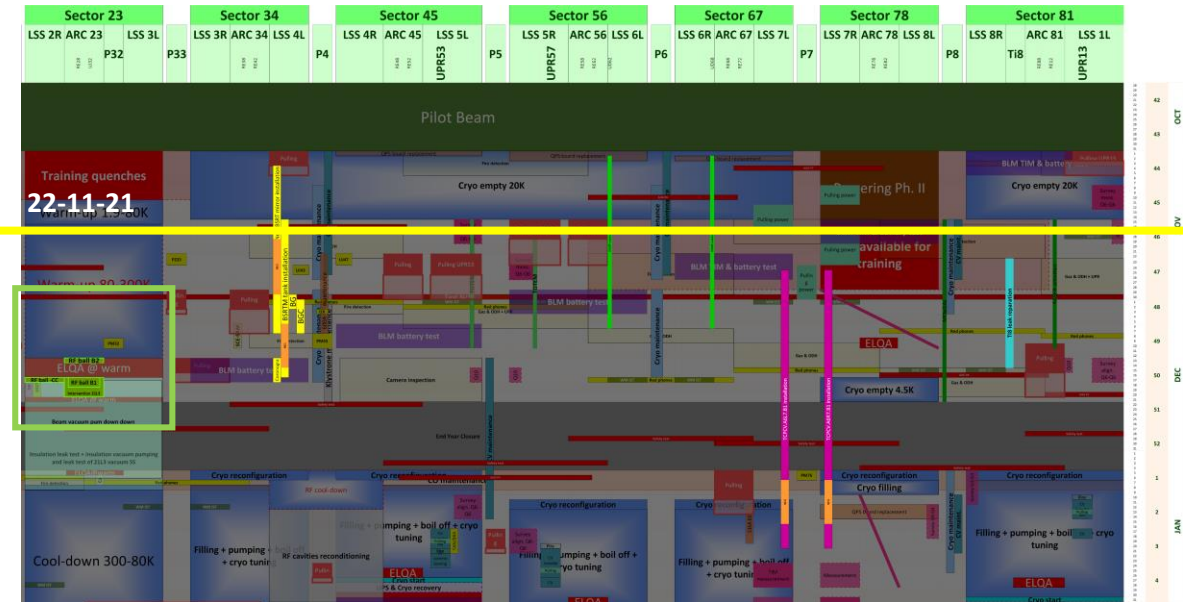
TE-VSC-BVO planning & follow-up

Legend:

- Activities on going
- To be done

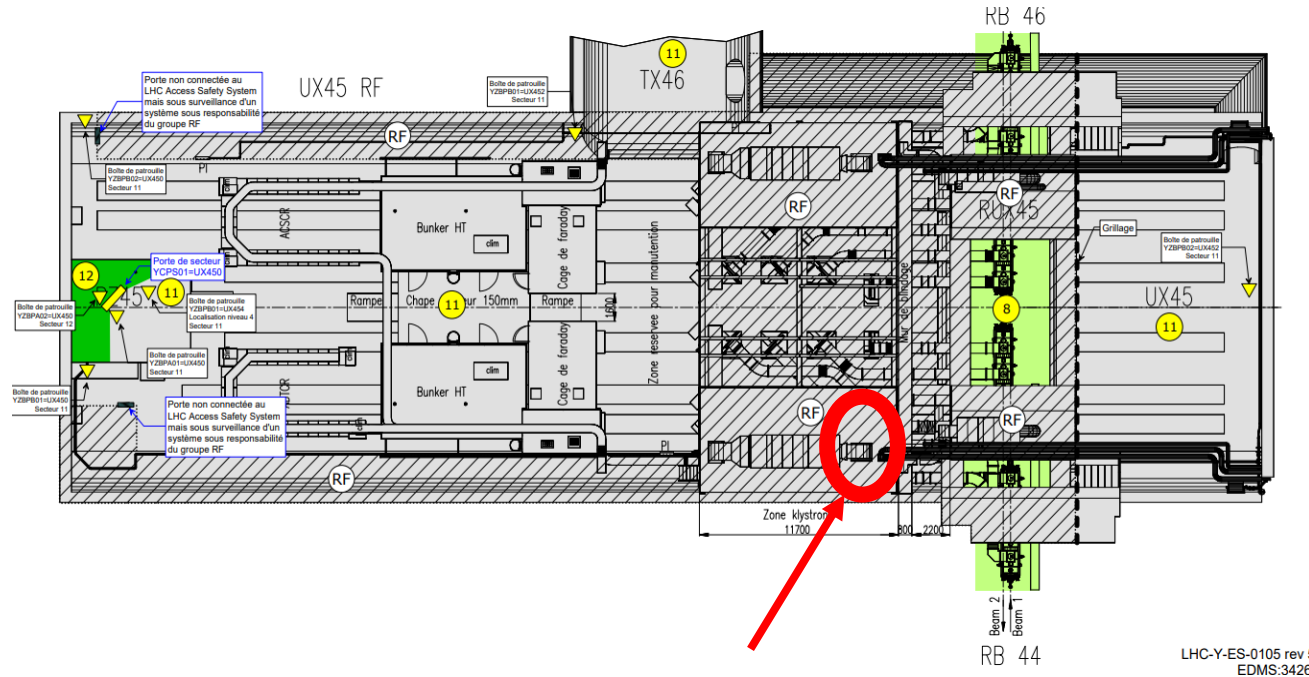


New BSRT to be installed



Bakeout for ATLAS (access to LHC needed) is planned for next year
 No activities in the tunnel for CMS, LHCb or ALICE are requested

SY-RF klystron replacement during YETS 21-22



Where: in UX45, 1B1 klystron is at the very back of the cavern

Reason of change:

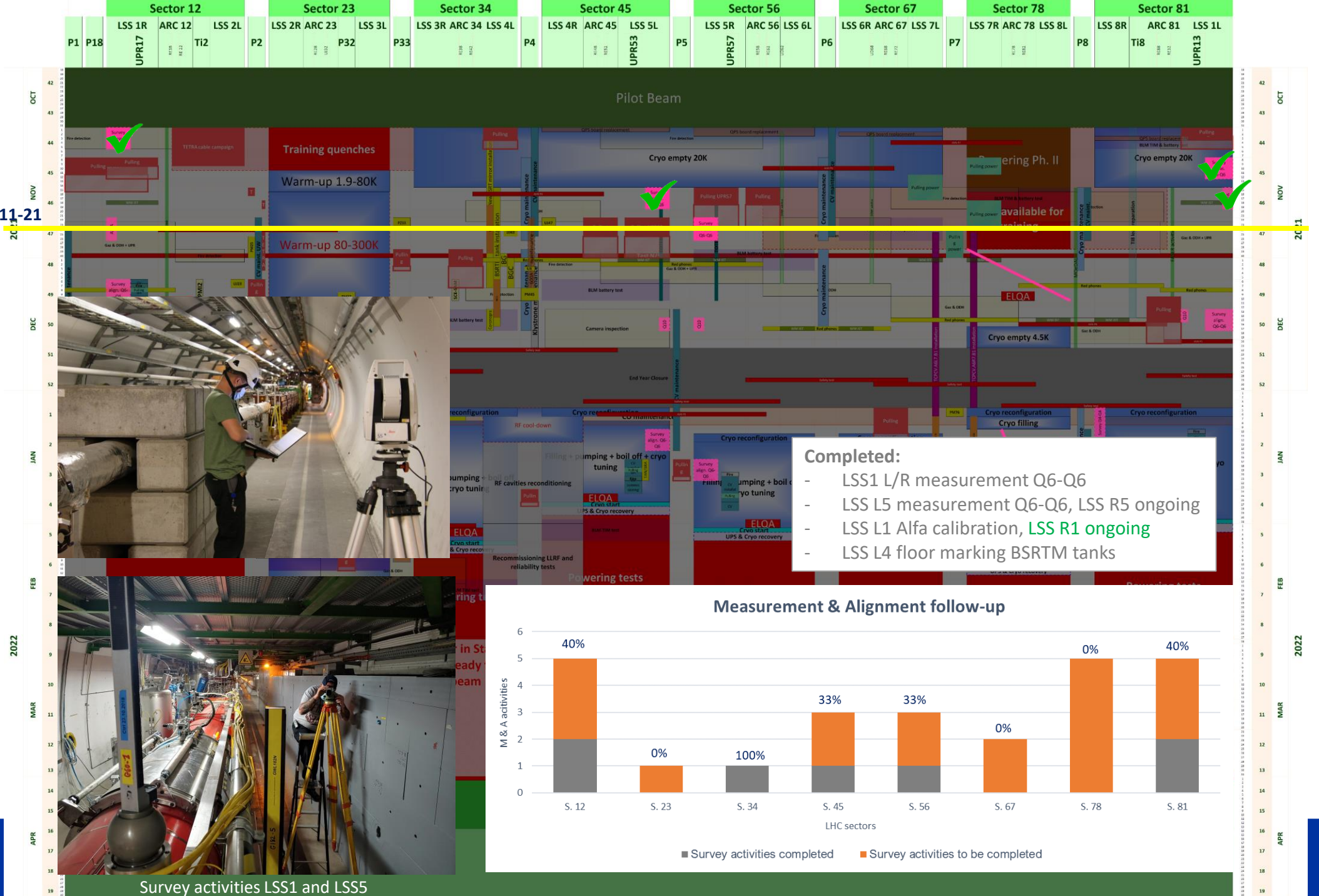
- Just before the pilot beam test, issue experienced on klystron 1B1.
- Tests have been performed to confirm the need of change.
- The replacement has been performed mid Nov 2021

General RF activities during YETS 21-22

- RF cool-down beginning 2022
- RF cavities reconditioning from wk. 2 to wk. 4 2022
- LLRF recommissioning from wk. 5 to wk. 7 2022

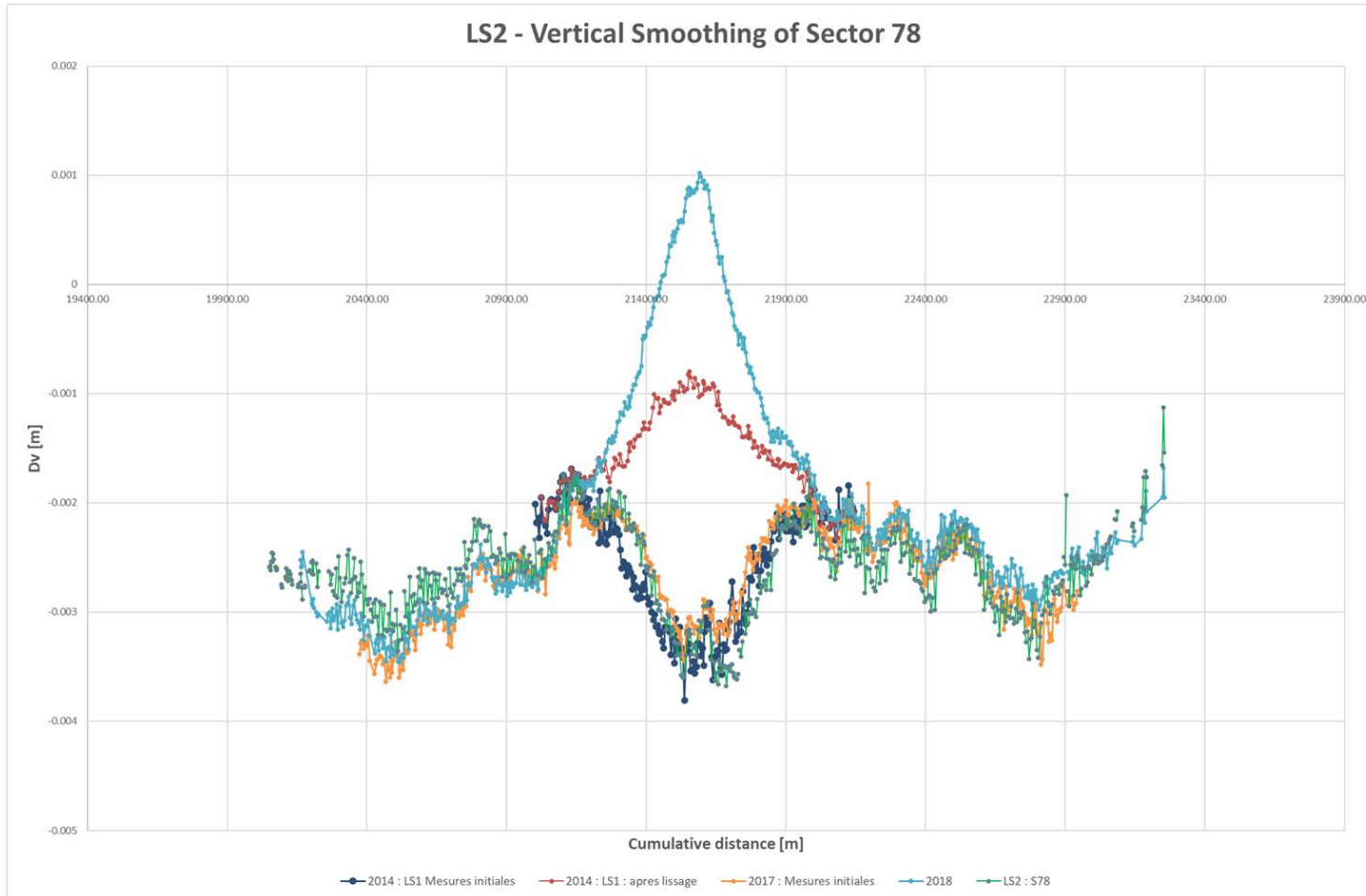
Survey: measurement & alignment

22-11-21

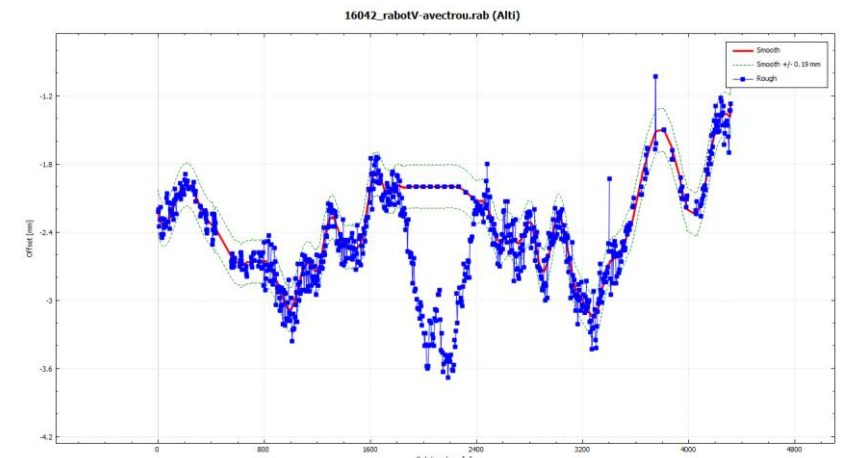


Survey activities LSS1 and LSS5

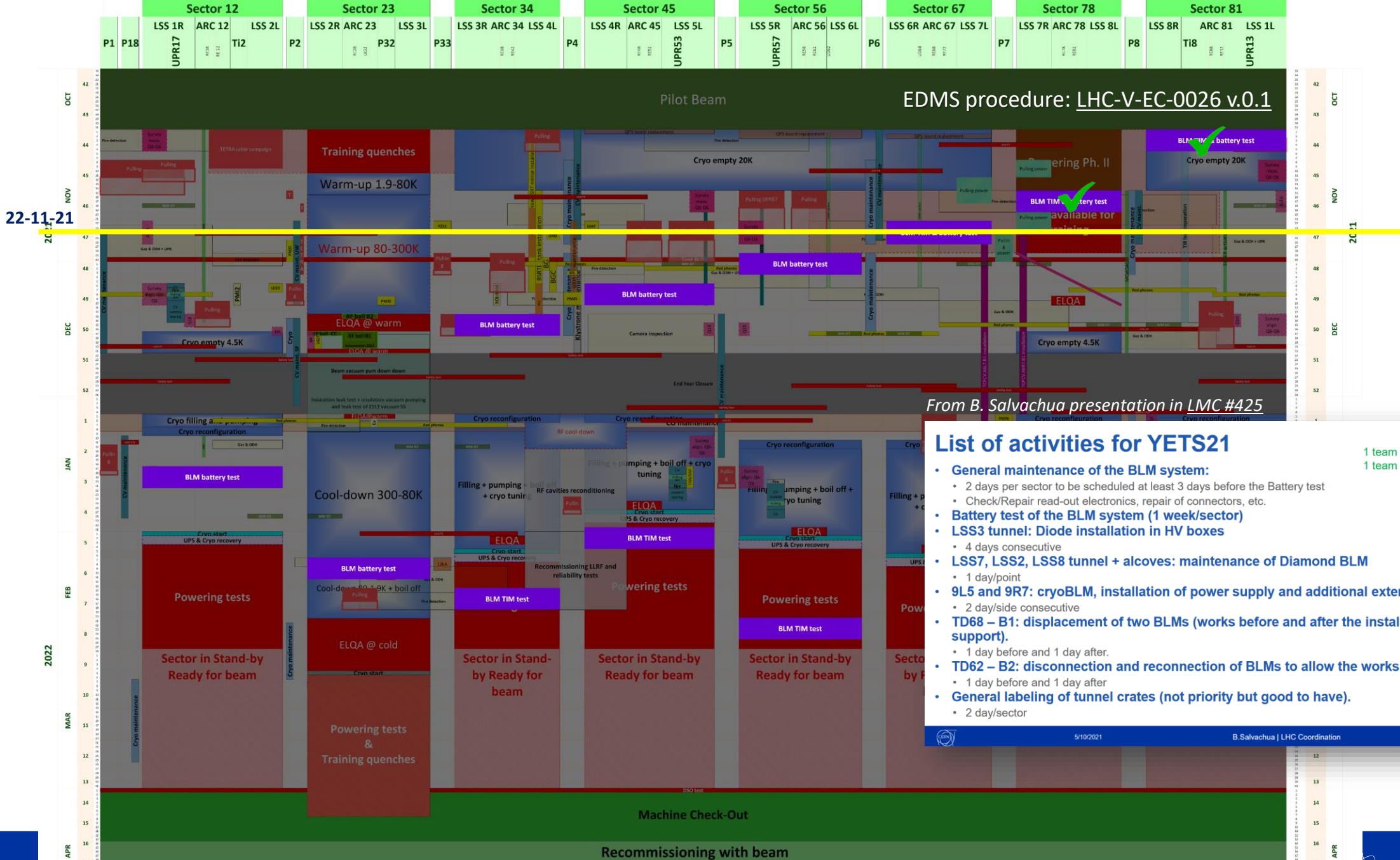
Needs in S.78 for re-measurement & re-alignment



- S. 78 has been critical in terms of movement since LEP tunnel:
→ 18 mm in 1992
- The sector has been already:
 - Measured & aligned in 2014 → LS1
 - Measured in 2016 → YETS
 - Measured & aligned in 2017 → EYETS
 - Measured in 2018 → YETS
 - Measured & aligned in 2020 → LS2



BLM TIM & Battery test



EDMS procedure: [LHC-V-EC-0026 v.0.1](#)

From B. Salvachua presentation in LMC #425

List of activities for YETS21

- General maintenance of the BLM system:
 - 2 days per sector to be scheduled at least 3 days before the Battery test
 - Check/Repair read-out electronics, repair of connectors, etc.
- Battery test of the BLM system (1 week/sector)
- LSS3 tunnel: Diode installation in HV boxes
 - 4 days consecutive
- LSS7, LSS2, LSS8 tunnel + alcoves: maintenance of Diamond BLM
 - 1 day/point
- 9L5 and 9R7: cryoBLM, installation of power supply and additional external detectors
 - 2 day/side consecutive
- TD68 – B1: displacement of two BLMs (works before and after the installation of new support).
 - 1 day before and 1 day after.
- TD62 – B2: disconnection and reconnection of BLMs to allow the works on the TD62.
 - 1 day before and 1 day after
- General labeling of tunnel crates (not priority but good to have).
 - 2 day/sector

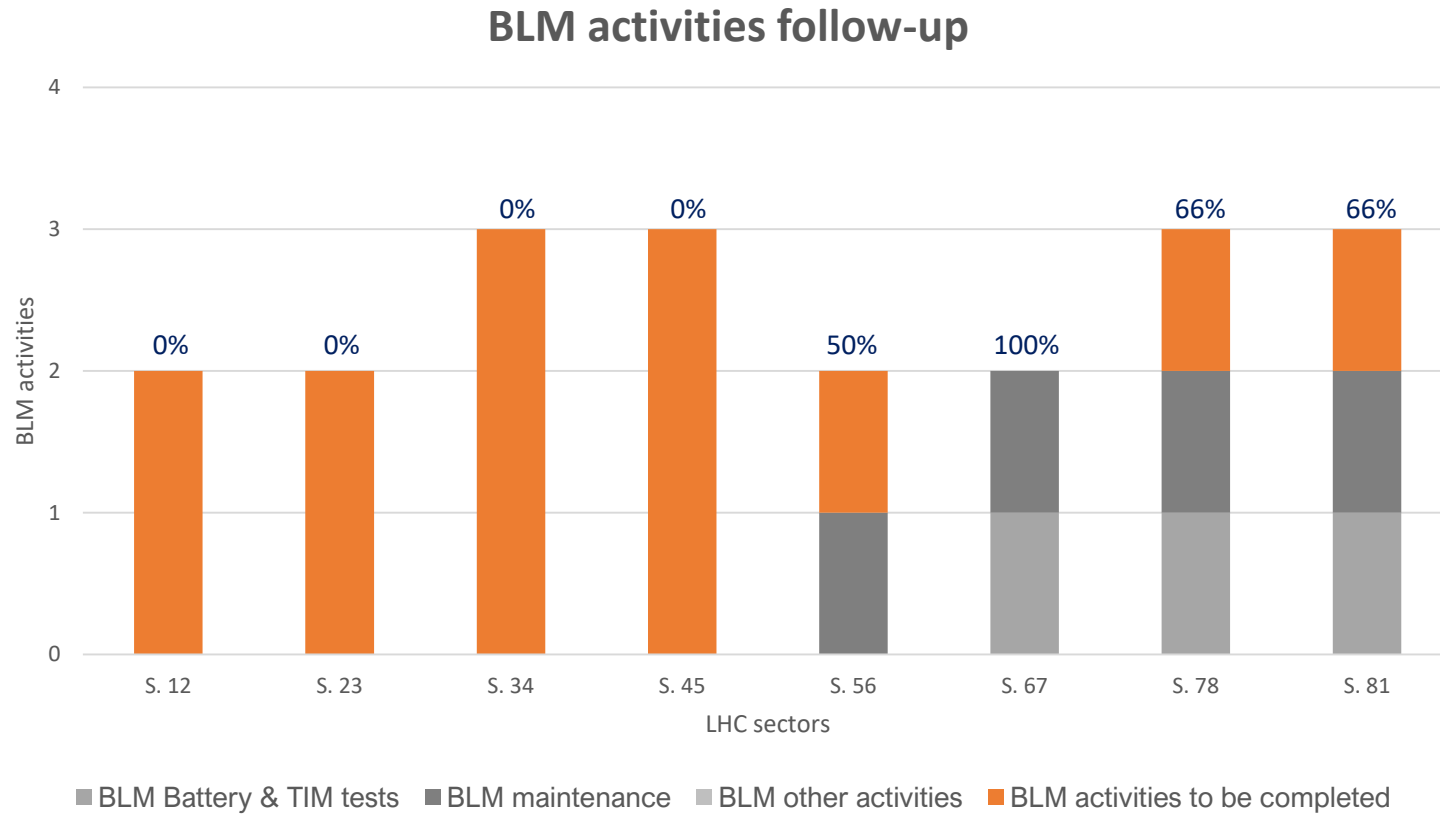
1 team for Battery test
1 team for the rest

5/10/2021 B.Salvachua | LHC Coordination

BLM TIM test will be performed outside normal working hours only when the sectors are patrolled



BLM tests & maintenance follow-up



New strategy for BLM TIM tests, under discussion



TIM3 preparation

TE-MPE activities & follow-up

Regular maintenance ongoing

Replacement of QPS boards circuits on RB circuits

- Sectors 45, 56, 67 and 81 completed.
- Sector 78 scheduled in Dec'21

Update of current lead heating system controllers

- RR13, RR53, RR57, RR73 and RR77 completed during LS2.
- RR17 scheduled in January'22

13kA EE system maintenance

- LSS3 and Sector 67 scheduled in 2022, the rest already done during the LS2

600A EE system maintenance

- Point 4 (UA43/47) scheduled from Jan. '22

Reduced ELQA campaign at cold

- Following S23 planning
- Scheduled from 17th January'22.

UPS redundant test

- Scheduled from 28th January'22.

General Status



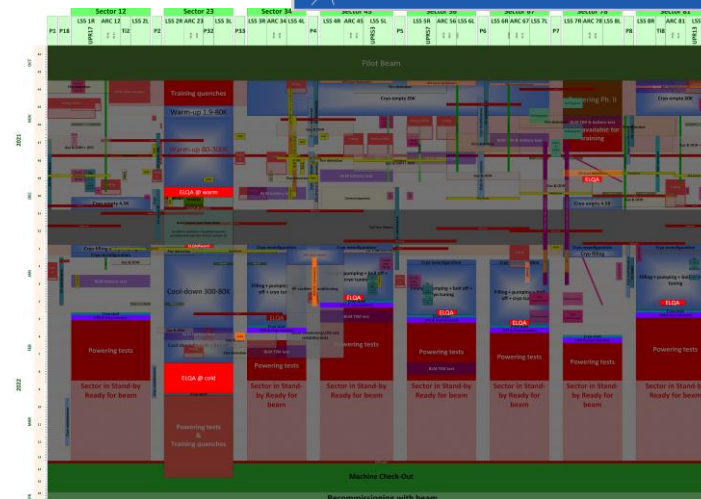
Status of the sectors

- **S12: fully commissioned at 7 TeV**
 - PGC with RB at 6.8 TeV, 100mV QPS boards reinstalled
- **S23: warm-up ongoing**
- **S34: fully commissioned at 7 TeV**
 - 100mV QPS boards reinstalled
- **S45: fully commissioned at 6.8 TeV (RB circuit reached 7 TeV)**
 - 100mV QPS boards reinstalled, EIQA tests to be carried out
- **S56: fully commissioned at 6.8 TeV**
 - 100mV QPS boards reinstalled, EIQA tests to be carried out
- **S67: fully commissioned at 6.8 TeV**
 - 100mV QPS boards reinstalled, EIQA tests to be carried out
- **S78: training completed**
- **S81: fully commissioned at 6.8 TeV**
 - 100mV QPS boards reinstalled, EIQA tests to be carried out



13 kA EE system maintenance

LHC powering tests @LMC - 17.11.2021



ELQA schedule during YETS



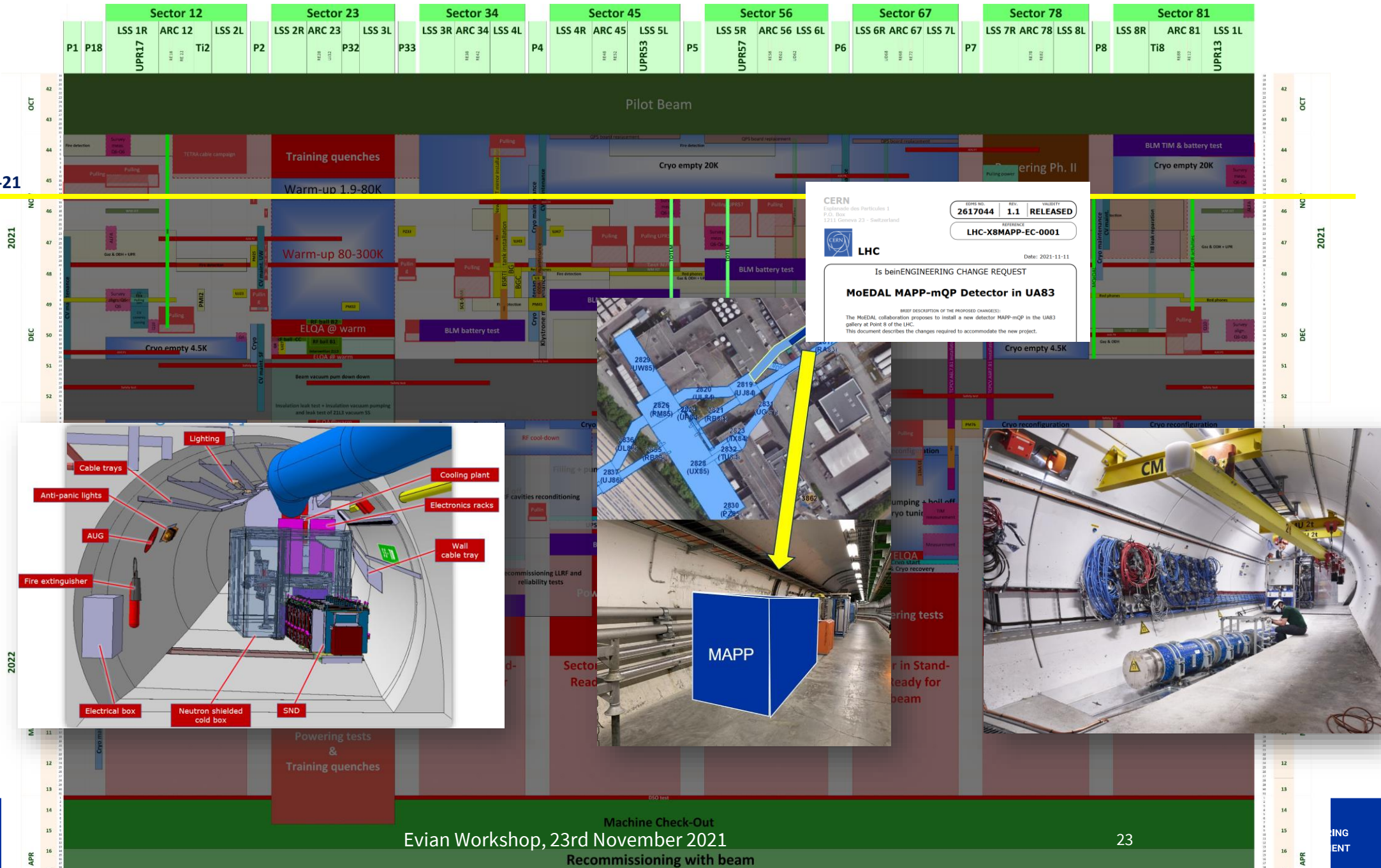
EIQA tests



600A EE system maintenance

YETS 21-22 Experiments

22-11-21



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Esplanade des Particules 1
P.O. Box
1211 Geneva 23 - Switzerland

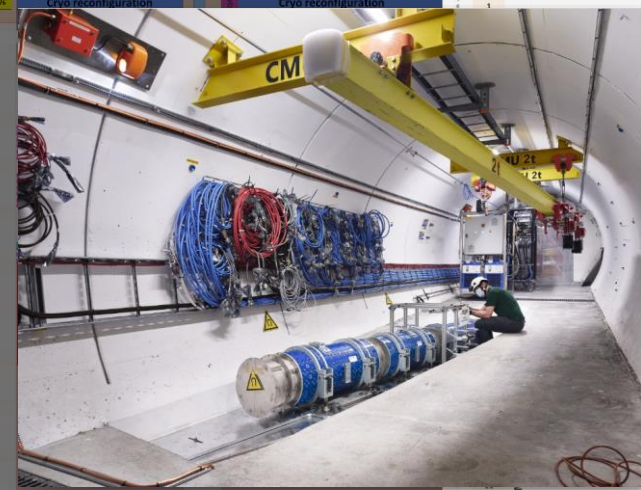
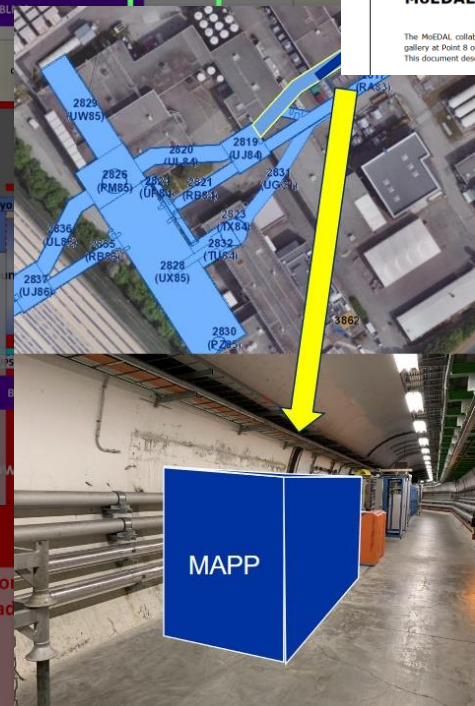
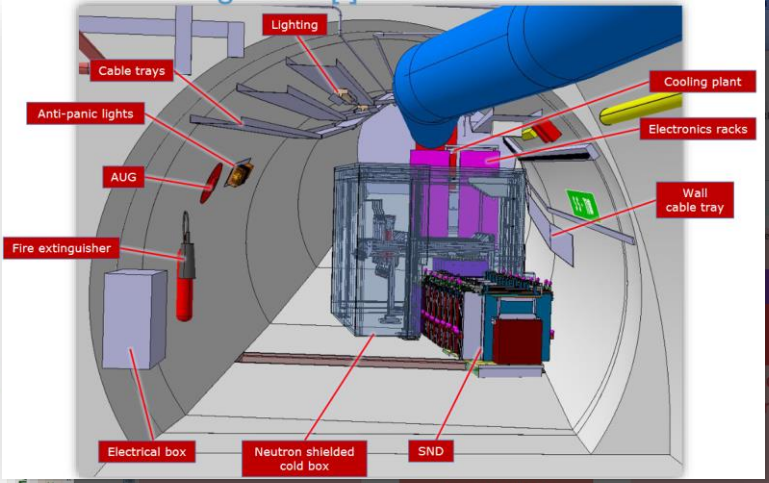
EDRS NO. 2617044 REV. 1.1 VALIDITY RELEASED
REFERENCE LHC-X8MAPP-EC-0001
Date: 2021-11-11

LHC

Is being ENGINEERING CHANGE REQUEST

MoEDAL MAPP-mQP Detector in UA83

BRIEF DESCRIPTION OF THE PROPOSED CHANGES:
The MoEDAL collaboration proposes to install a new detector MAPP-mQP in the UA83 gallery at Point 8 of the LHC.
This document describes the changes required to accommodate the new project.



YETS 21-22 experiments follow-up

SND

1. Barriers and obsolete LEP structure



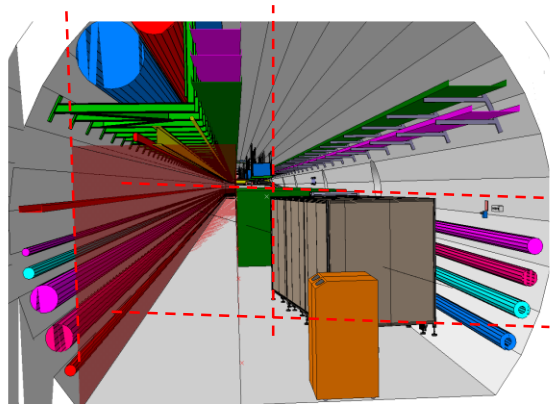
2. Iron blocks installation, cooling plant and target structure transport



Photos: courtesy of P. Diaz

MoEDAL

Activities just started



3. Floor marking and target structure alignment

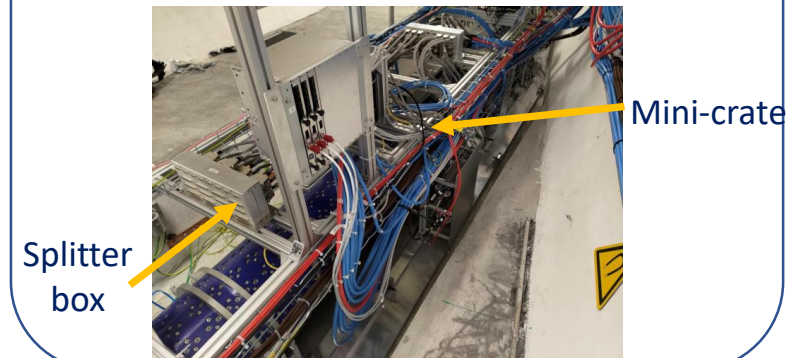


4. Target structure assembly and empty wall tests



FASER

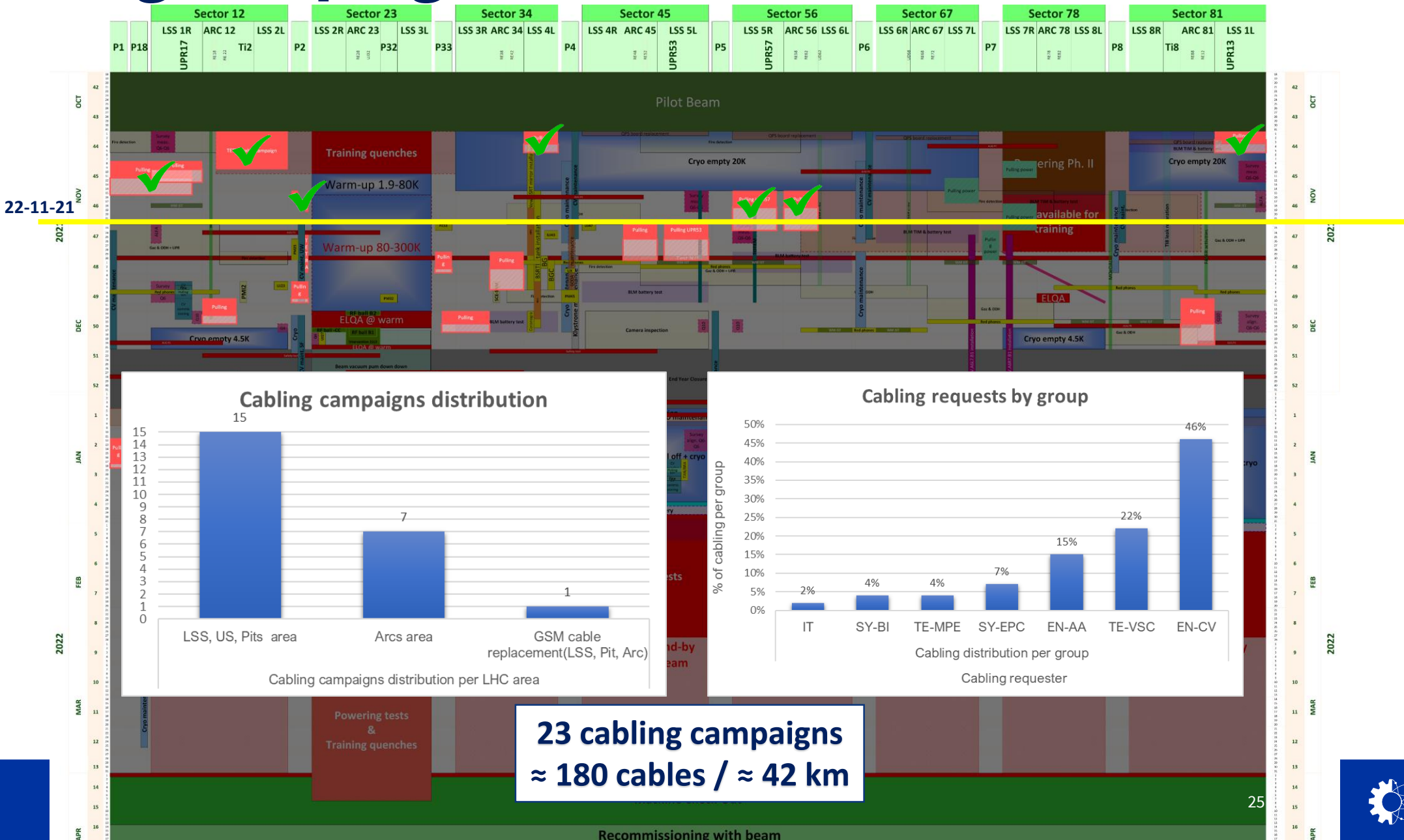
Installation, cabling and commissioning of power supplies and on-detector electronics



5. End wks. 44/45

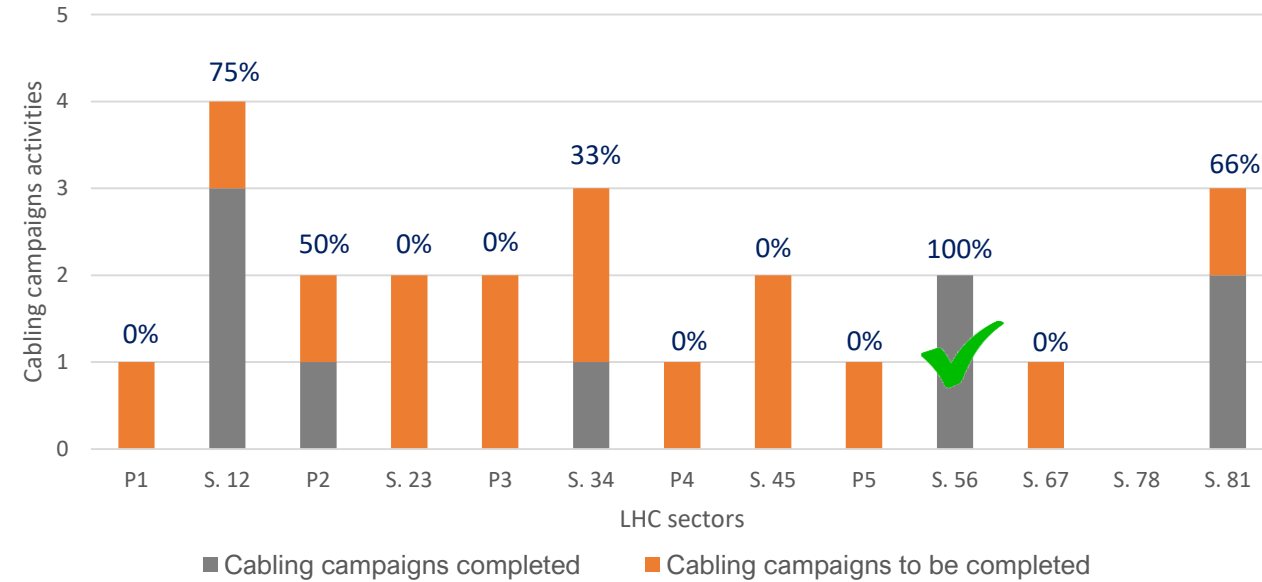


Cabling campaigns



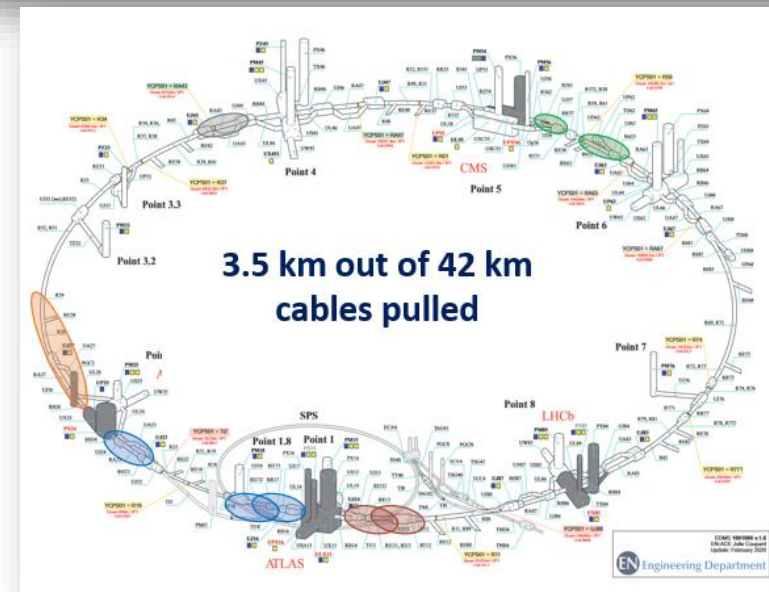
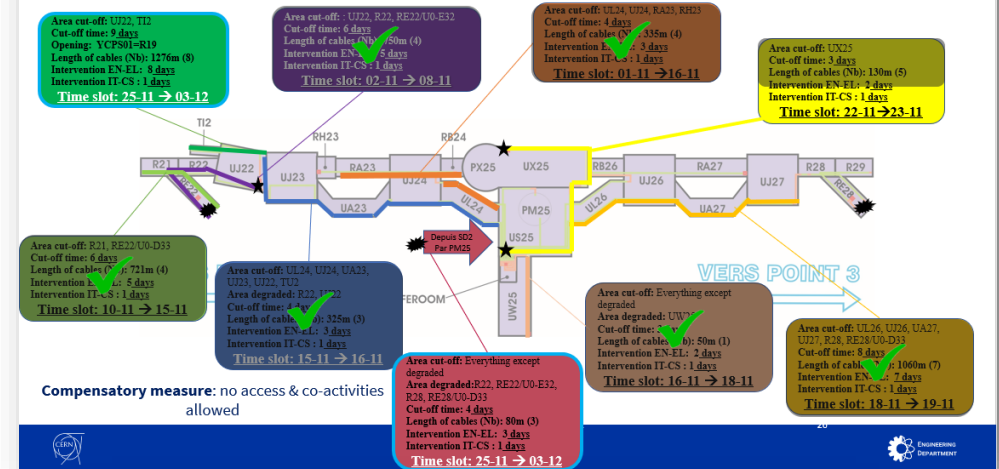
Cabling campaigns follow-up

Cabling campaigns follow up



Cable & cable drums for GSM cabling campaign

GSM cabling campaign follow-up



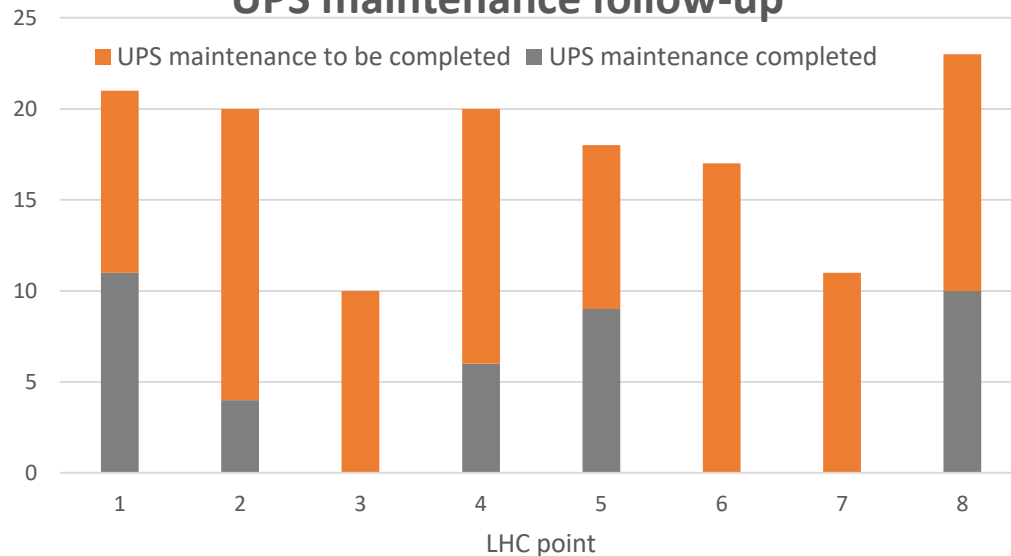
EN-EL consolidation & maintenances

- Transformers replacement: 2 at P2, 2 at P4
→ 1 done, 1 ongoing, 2 to come
- SCADA Maintenance
- 48 V Maintenance
- UPS Maintenances in US, UW and RE (CV, RF & CRYO systems)



TransformerS replacement

UPS maintenance follow-up



UPS

RE	LHC Point	44	45	46	47	48	49	50	1	2	3	4	5	6	7
52	5	SCADA	48V												
58	5	SCADA						48V							
42	4		SCADA			48V									
48	4		SCADA			48V									
12	1	48V		SCADA											
18	1	48V		SCADA											
62	6				SCADA		48V								
68	6				SCADA		48V								
72	7					SCADA	48V								
88	8					SCADA	48V								
22	2				48V		SCADA								
38	3							SCADA		48V					
78	7								48V	SCADA					
82	8										SCADA	48V			
28	2												SCADA	48V	
32	3												SCADA	48V	

EN-EL: UPS consolidation → Complete presentation @ LMC 15th Dec. 21

UPS incidents and Maintenance

- Incident: Fire outbreak on UPS (5 monoblocs batteries have a burned edge : RE18, UL55, RE58 ,UA87, UA23). Approximately 7700 monoblocs replaced out of a total of 9500 during LS2.
- Cause: Electrolyte leakage due to a crack on the edge of the container, which causes leakage current to the ground, leading to fire outbreaks.
- Risk: short circuit, UPS failure, fire outbreak even if the damage is contained by the use of fireproof materials. UPS are often redundant, therefore, the critical loads stay secured in case of battery failure.
- Situation: The visual inspection led to the identification of 8 defective materials.
- Main action foreseen to decrease the risk on the short term is to implement a residual current protection (test during W48), Installation on 82 UPS Batteries located underground during W03 to W07.



UPS battery fire outbreaks



UPS battery fire outbreaks



UPS

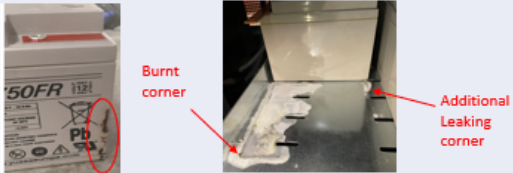

In collaboration with Julien Emonds-Alt, on behalf of EN-EL-MT

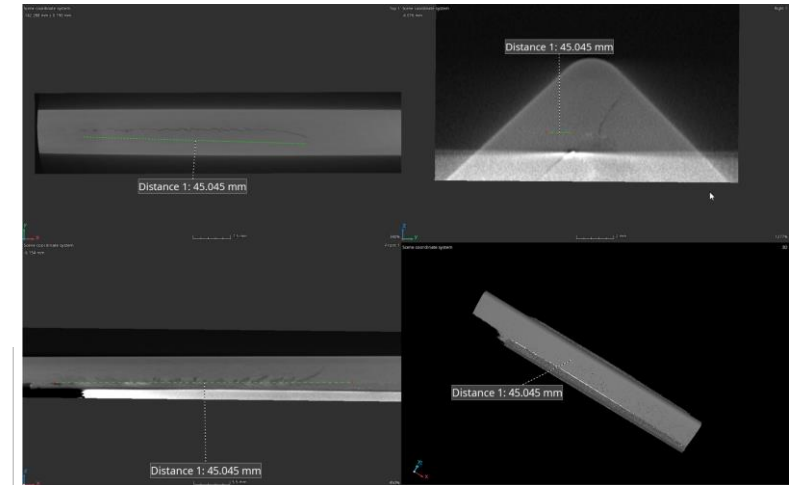
EN-EL: UPS consolidation → Complete presentation @ LMC 15th Dec. 21

Events

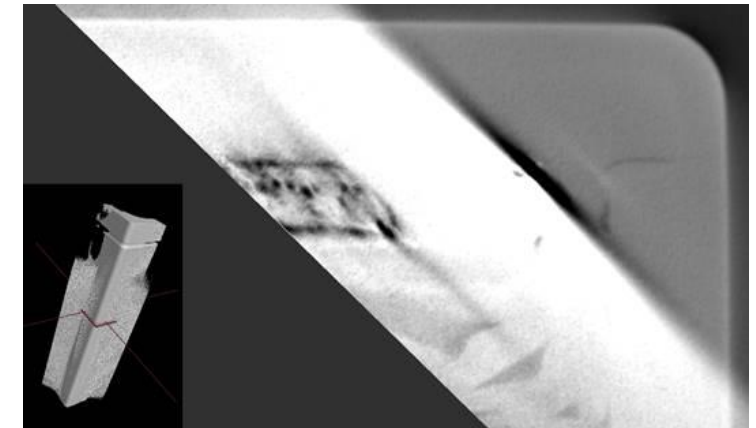
	EJG12/18	EJG13/A3	EJG11/56	EJG904*WH
Localization	LHC RE18	SPS BA3	LHC UL55	Mevrin Bld.180
Characteristics	1x 50 YUASA SWL750-FR	2x 50 YUASA SWL750-FR	2x 50 YUASA SWL750-FR	2x 50 YUASA SWL750-FR

Procurement	EJG12/18	EJG12/58
Battery replace c	Localization: LHC RE78	LHC RE58
Event detected a	Characteristics: 1x 50 YUASA SWL750-FR	1x 50 YUASA SWL750-FR
	Procurement: IT-4540	IT-4540

	EJG1/87	EJG11/23
Monobloc conce	Localization: LHC UA87	LHC UA23
Potential cause	Characteristics: 2x 50 YUASA SWL750-FR	2x 50 YUASA SWL750-FR
	Procurement: Borri (to be confirmed)	IT-4540
	Battery replace date: 01/02/2018 (by Borri)	16/09/2020 (LS2)
Picture	Event detected and date: Limited Burnt and Limited leak - Detected during visual inspection of the 10/11/2021	Burnt - Detected during visual inspection of the 12/11/2021
	Monobloc concerned: Monobloc B01 (17120428) Leak and burnt on diagonal corner of the same monobloc B01.	Monobloc B47 (20032328)
	Potential cause: CERN investigation ongoing (battery manufactured in 12-2017 !). <ul style="list-style-type: none"> No mechanical shock identified on container. Vertical burnt located on vertical edge. Limited leak on opposite corner of the burnt corner. → X-ray / microscope inspection to be done.	CERN investigation ongoing. <ul style="list-style-type: none"> Seems to be present since a long time. No mechanical shock identified on container.
	Picture: 	Picture: 

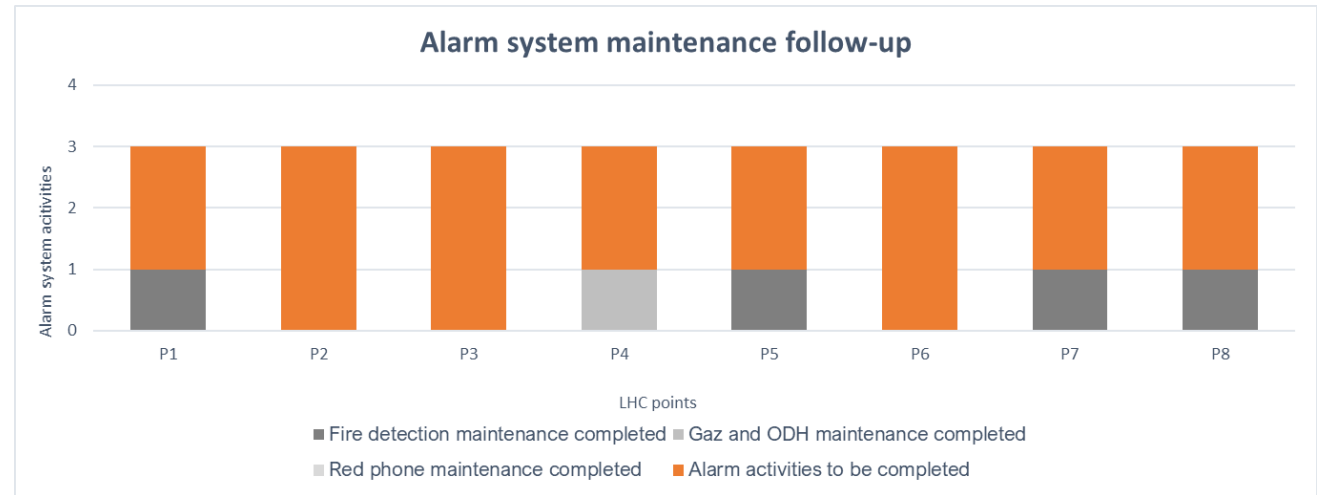
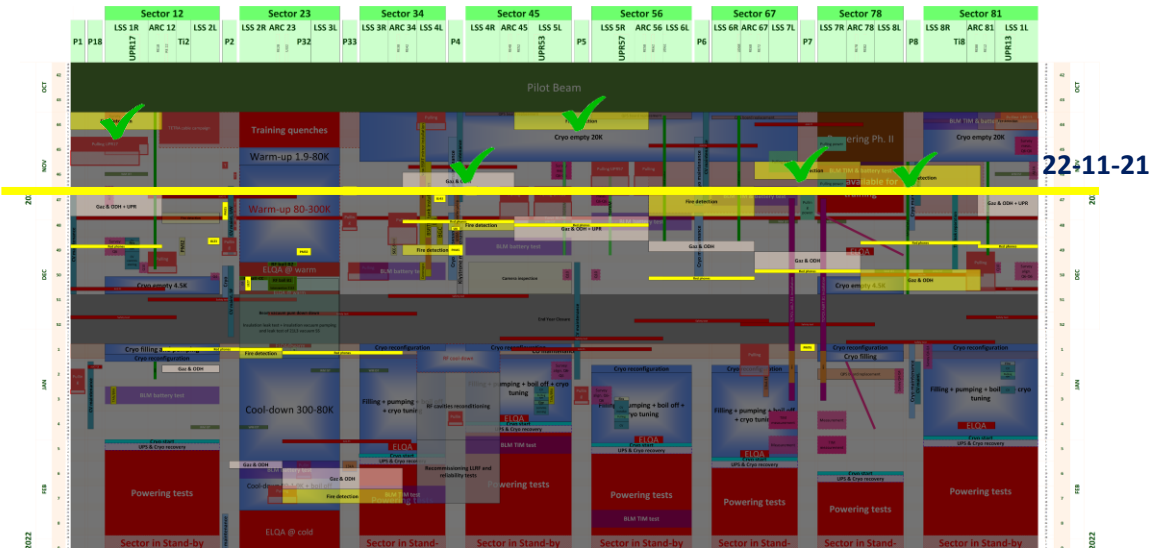


EJG12/78 : EN-MME X-Ray analysis



EJG12/58 : EN-MME X-Ray analysis

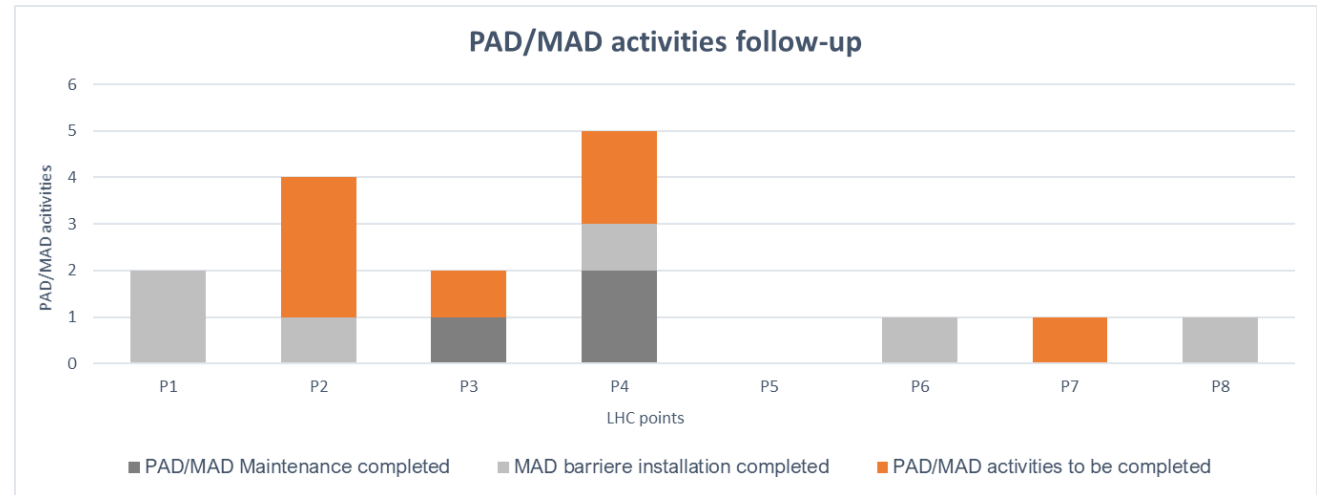
Access & alarm system maintenances



Anti-accident safety barriers installation

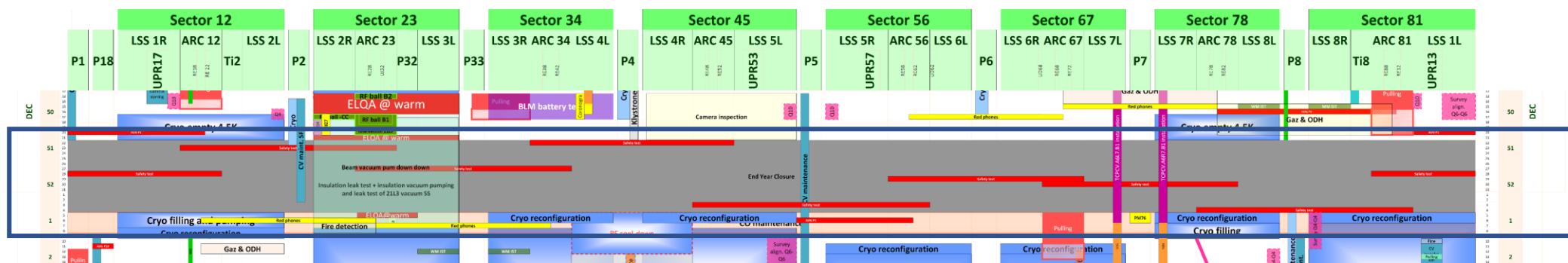


Temporary installation of control access system

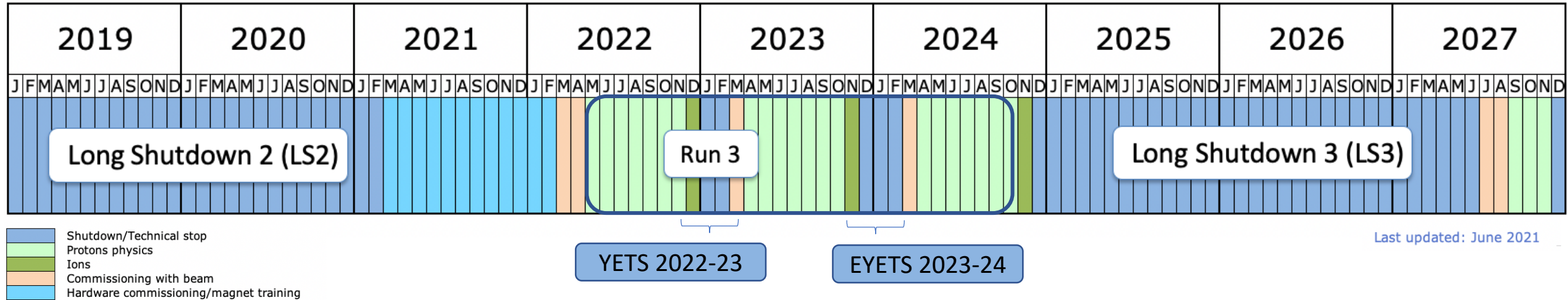


YETS 21-22: Year End Closure activities

Group	Activity	Location
EN-AA	Safety tests	All points - Underground
EN-CV	SF, SU, UW maintenance	Point 1 – Surface
EN-CV	SF maintenance	Point 2 – Surface
EN-CV	SF, SU, UW maintenance	Point 5 – Surface



Major challenges for Run 3



- Run 3 Installation Coordination → [Run3 Installation Coordination Kick-off Meeting \(26 November 2021\)](#)
- The programmed stops during the Run3 are: YETS 2022-23, EYETS 2023-24, Short Technical Stops
- LS3 is not part of Run 3 coordination but LS3 activities have to be analysed by the Run3 coordination team to assess if they can be anticipated during Run3
- LS3 baseline duration in the CERN Long Term Plans is 30 months. HL-LHC present installation schedule requires 34.5 months and it's under optimization.
- The 5th HL-LHC C&S review 2021 **recommended to shift the LS3 by one year** (starting date proposed at end 2025)
- The Extended Year End Technical Stop 2023-24 is requested by the Experiments. To be evaluated if the LS3 is shifted → Inputs in Chamonix workshop
- The EYETS could be beneficial for HL-LHC project to start the core drilling, but the feasibility is under study → Chamonix Workshop

Run 3 Year End technical stops: lessons learned from Run 2

YETS 2015-2016

Chamonix 2016

YETS duration: the frame

LHC

- CV maintenance in the LHC and its Experiments → 10 wk
- Safety tests (mainly during Christmas Break) by GS-ASE and EN-EL
- Minor regular maintenance on cryogenic equipment and rotating machines
- LHC Recommissioning → 1 wk can be considered as a baseline if no major intervention occurs during the YETS (the revision of the duration is under discussion)

Regular maintenance activities on other equipment are performed in the shadow of the activities listed above.

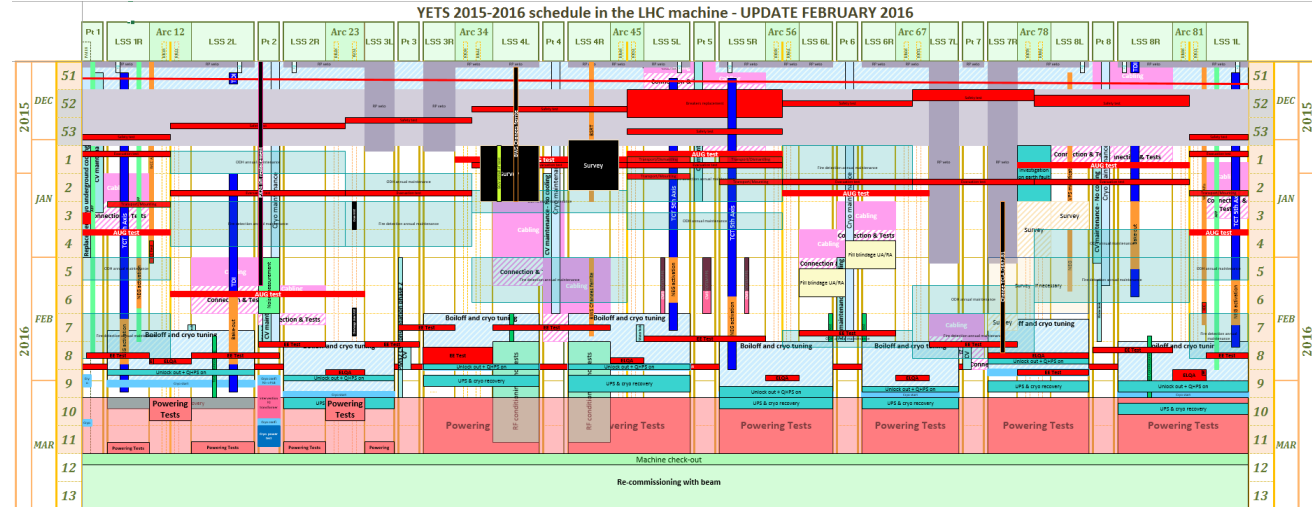
→ In conclusion, the minimum length (beam to beam) of the YETS for the LHC is 13 wk (including the Christmas Break)



Marzia Bernardini - LHC Performance Workshop 2016

2015				2016				2017				2018				2019				2020			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
LHC				YETS				EYETS				YETS				LS2							

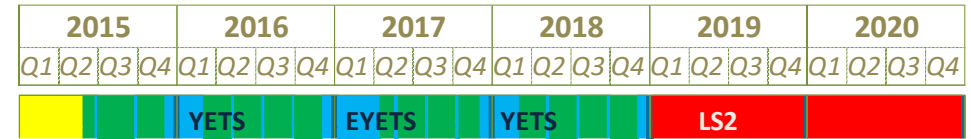
YETS 2015-16 final duration



	Standard duration (Chamonix 16)	Final duration	Δ	Reason
YETS 2015-16	13 weeks	14 weeks	+1 week	<ul style="list-style-type: none"> • 2 wks of powering test (instead of 1wk) • Transformer replacement at P2

Run 3 Year End technical stops: lessons learned from Run 2

EYETS 2016-2017



Chamonix 2016

EYETS 2016-2017: the frame

LHC

In addition to the baseline fixed for the YETS, there is a **request from CMS** to anticipate works of LS2, to prepare the Experiment to cope with the $2e34 \text{ cm}^{-2}\text{s}^{-1}$ luminosities. These works imply the full opening of the Endcaps and impact the duration of the YETS, which become an Extended YETS.

INJECTORS

The Injectors benefit from the Extended YETS of the LHC to maximize the activities related to the **decabling** project in the PSB and the SPS, and to anticipate activities related to **LIU project**.



EDMS No: 1470895
REV: 2.0
STATUS: RELEASED
REFERENCE: ATS-PM-MS-0001

Date: 20-Oct-2015

MASTER SCHEDULE

LENGTH OF YETS 2015-2016 / EYETS 2016-2017 / YETS 2017-2018

This is a proposal for the Year-End Technical Stops and the Extended Year-End Technical Stops before the Long Shutdown 2. It defines the length of the Technical Stops in the Linac2, Linac3, LEIR, PS, PSB, SPS and LHC accelerators. Start and end dates of the YETS and EYETS might evolve in time, but lengths need to remain unchanged.
For the already planned YETS 2015-2016, the dates must remain unchanged.

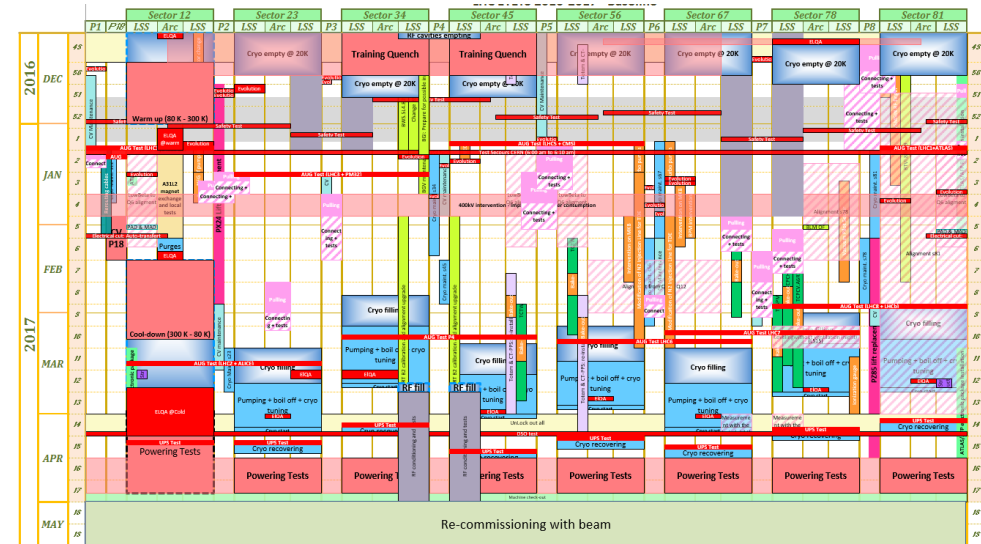
https://edms.cern.ch/document/1470895/2_0

Marzia Bernardini - LHC Performance Workshop 2016



The length (beam to beam) of the EYETS 2016-17 was **19 weeks**
(including End of the Year Closure)

EYETS 2016-17 final duration



	Standard duration (Chamonix 16)	Final duration	Δ	Reason
EYETS 2016-17	19 weeks	21 weeks	+2 wk	<ul style="list-style-type: none"> Cryo empty @ 20K during Year End closure Warm-up of s.12 for A31L2 magnet exchange (baseline duration for 1 magnet exchange) → Critical Path 2 weeks of Powering test

Run 3 Year End technical stops: lessons learned from Run 2

YETS 2017-2018

	2015				2016				2017				2018				2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
LHC	[Yellow]				YETS				EYETS				YETS				LS2				[Red]			

Chamonix 2016

YETS duration: the frame

LHC

- CV maintenance in the LHC and its Experiments → 10 wk
- Safety tests (mainly during Christmas Break) by GS-ASE and EN-EL
- Minor regular maintenance on cryogenic equipment and rotating machines
- LHC Recommissioning → 1 wk can be considered as a baseline if no major intervention occurs during the YETS (the revision of the duration is under discussion)

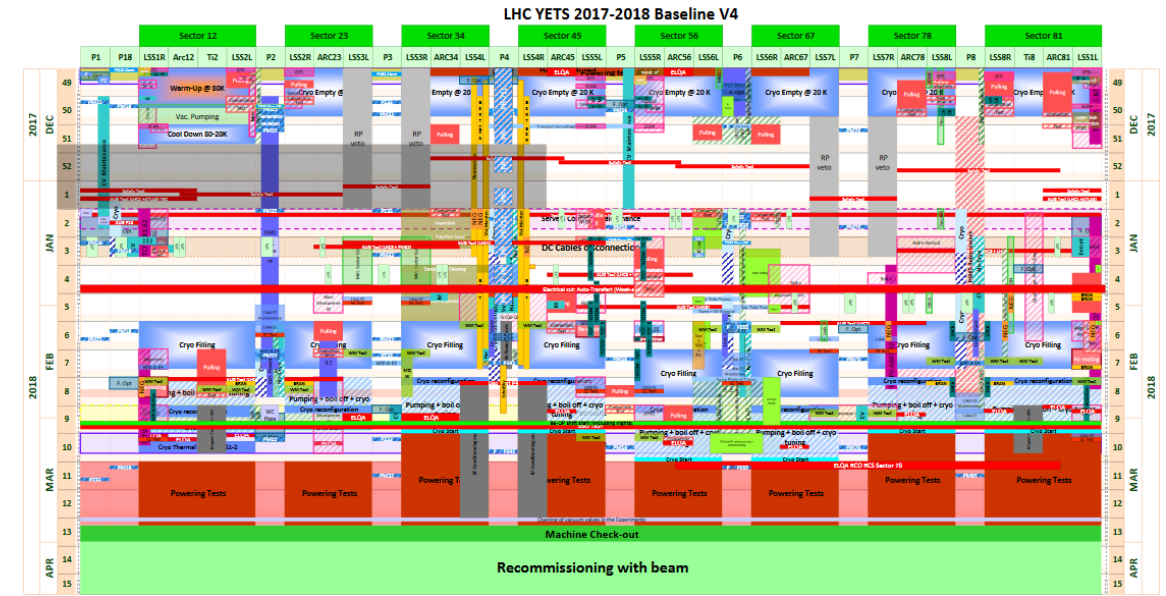
Regular maintenance activities on other equipment are performed in the shadow of the activities listed above.

→ In conclusion, the minimum length (beam to beam) of the YETS for the LHC is **13 wk** (including the Christmas Break)



Marzia Bernardini - LHC Performance Workshop 2016

YETS 2017-18 final duration

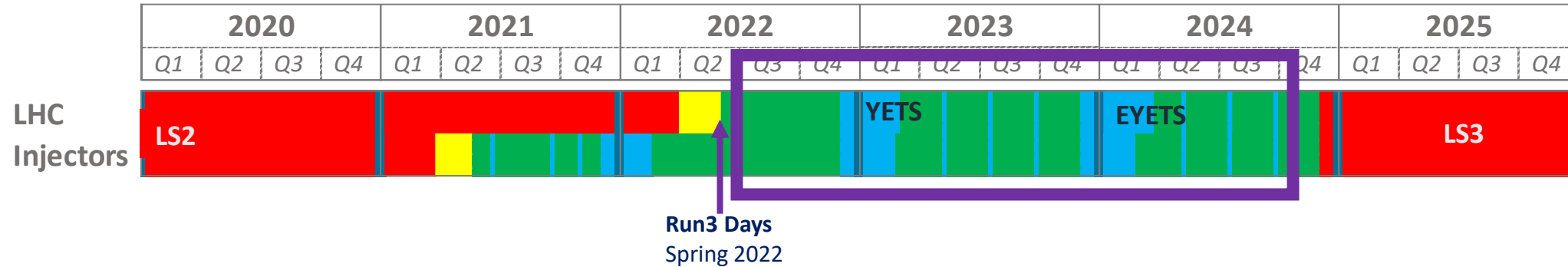


	Standard duration (Chamonix 16)	Final duration	Δ	Reason
YETS 2017-18	13 weeks	17 weeks	+4 week	<ul style="list-style-type: none"> • Cryo empty @ 20K during Year End closure • Warm-up @100K of s.12 for 16L2 issue • 2 weeks of Powering test

Run 3 Programmed stops

RUN 2	Standard duration (Chamonix 16)	Final duration
YETS 2015-16	13 weeks	14 weeks
EYETS 2016-17	19 weeks	21 weeks
YETS 2017-18	13 weeks	17 weeks

■ Long Shut-down
 ■ Beam Commissioning
 ■ Operation
 ■ Technical Stops



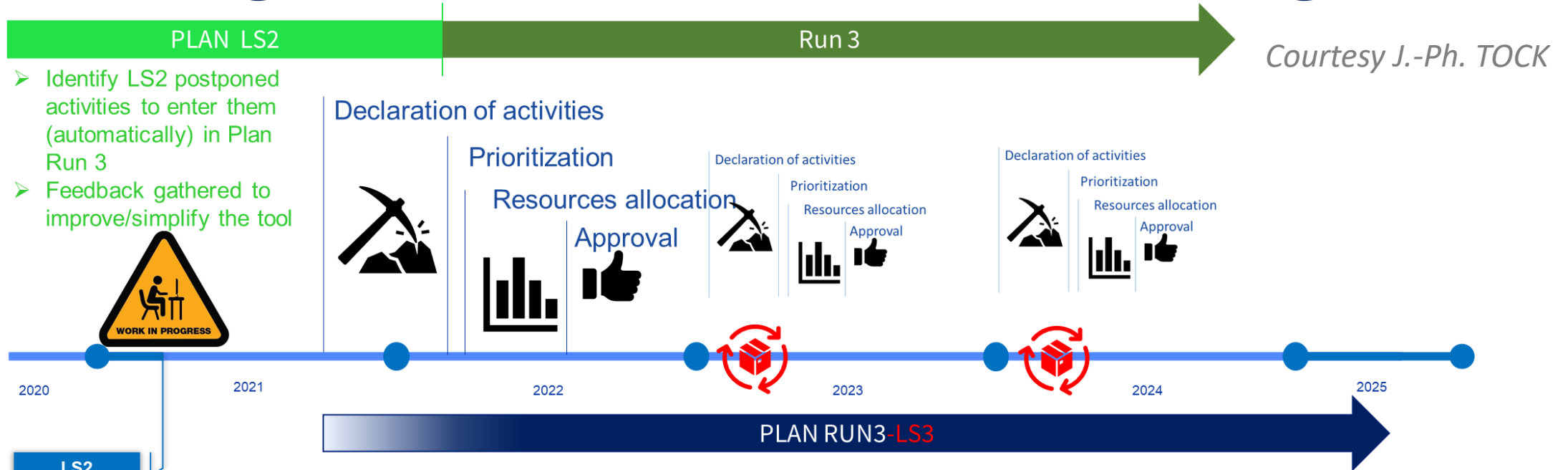
- **Programmed Stops in 2022**

→ No specific needs from Maintenance groups for a TS in June 2022.

Nevertheless, the need of a TS for Experiments must be defined, as well as its duration.

- TS in September (1 wk)
- TS: before the Ion Run (3 days)
- **YETS 2022-23:** from 12th of December: Minimum length under study, will be presented in Chamonix 2022
- **EYETS 2023-24:** requested by the Experiments. To be evaluated if the LS3 is shifted

Run 3 Programmed stops - methodology



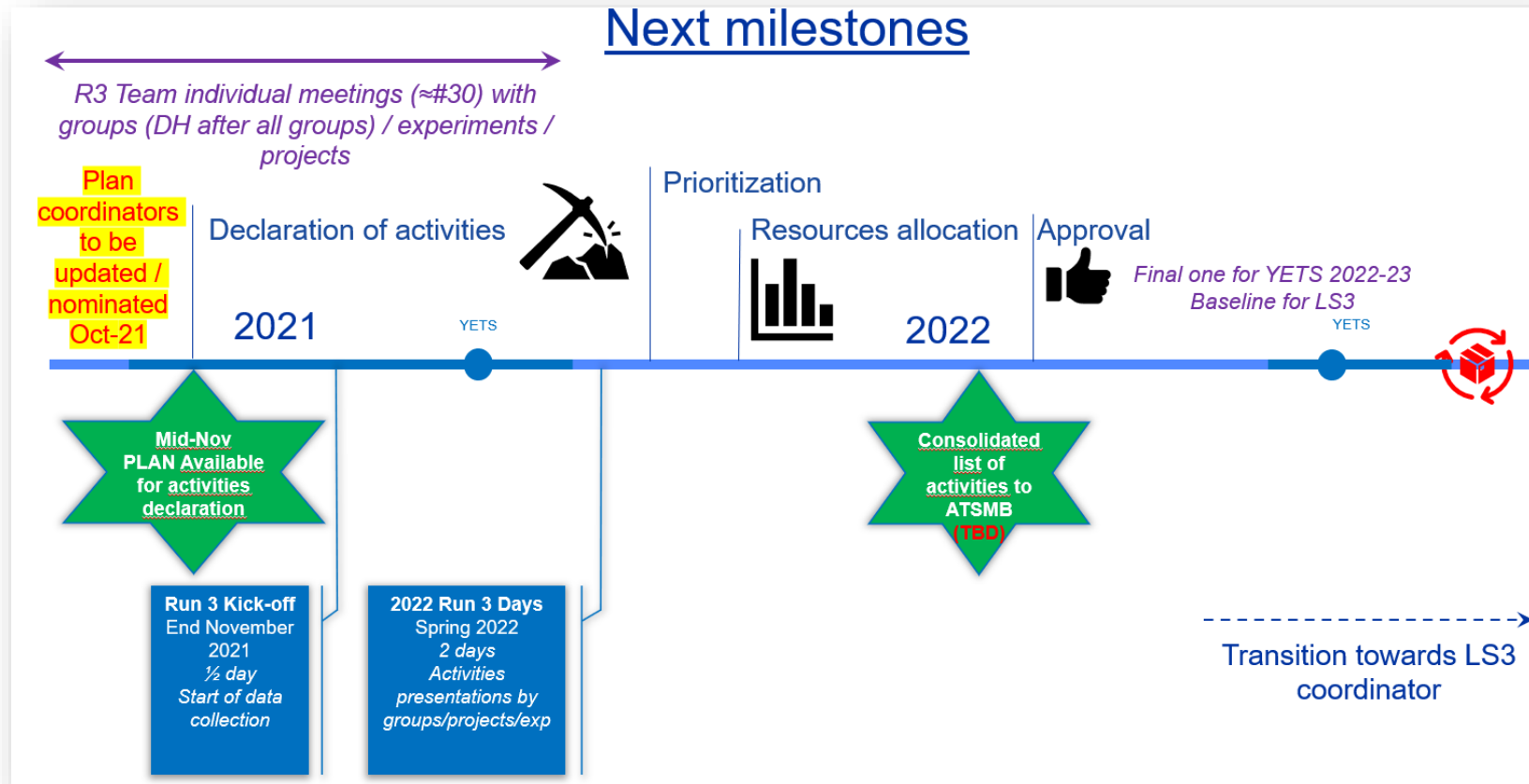
LS2
Debriefing
Day
June 2021
Ind. 1049103

- ❑ Approval is global, including LS3 – Approval by management
- ❑ Analyze with projects and support groups what could be anticipated from LS3
- ❑ Update frequency : once per year during run 3
- ❑ Exact deadlines to be defined considering CERN milestones, including transition towards LS3 coordination
- ❑ PLAN Run 3 + LS3 to be used *as of YETS 2022-2023 (Gap in 2022)*
Activities before YETS 2022-2023 can be entered

SAME METHODOLOGY as LS2 coordination (from EYETS 2017 to LS2-DEC. 2020)

Run 3 Programmed stops - methodology

Courtesy J.-Ph. TOCK



SAME METHODOLOGY as LS2 coordination (from EYETS 2017 to LS2-DEC. 2020)

Conclusions

Challenging years in front of us !



YETS
2015/2016

EYETS
2016/2017

YETS
2017/2018

YETS
2021/2022

YETS
2022/2023

EYETS
2023/2024

LS3

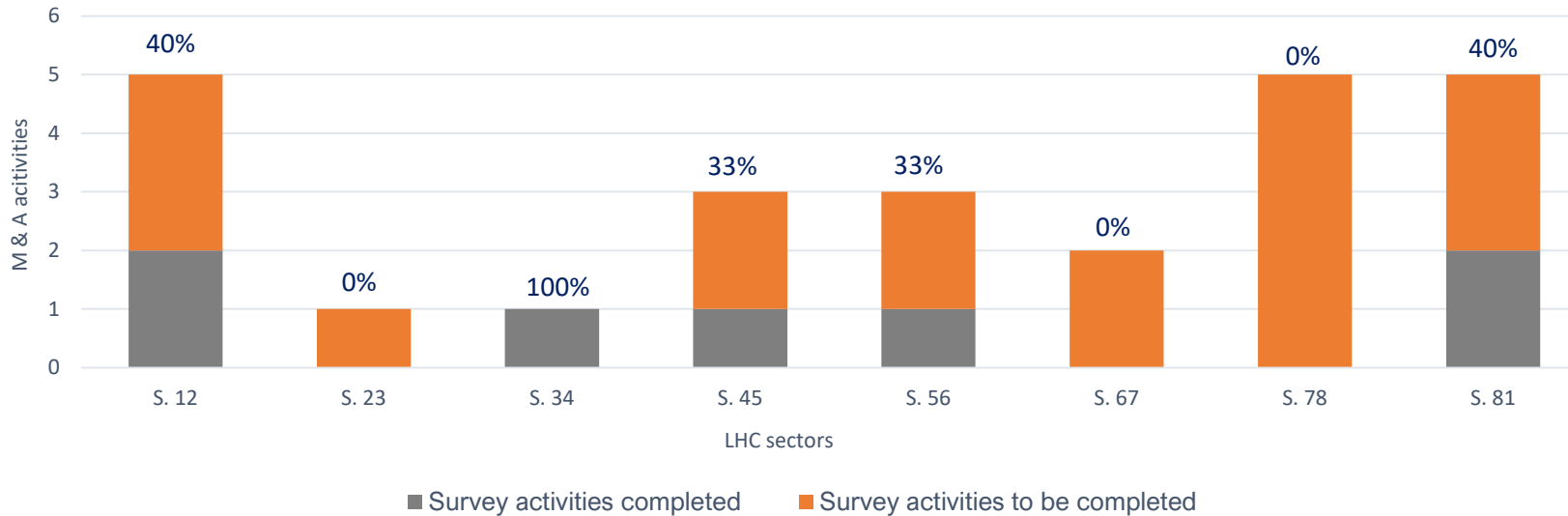


THANK YOU FOR YOUR ATTENTION!

Backup slides

Survey: Measurement & alignment follow-up

Measurement & Alignment follow-up



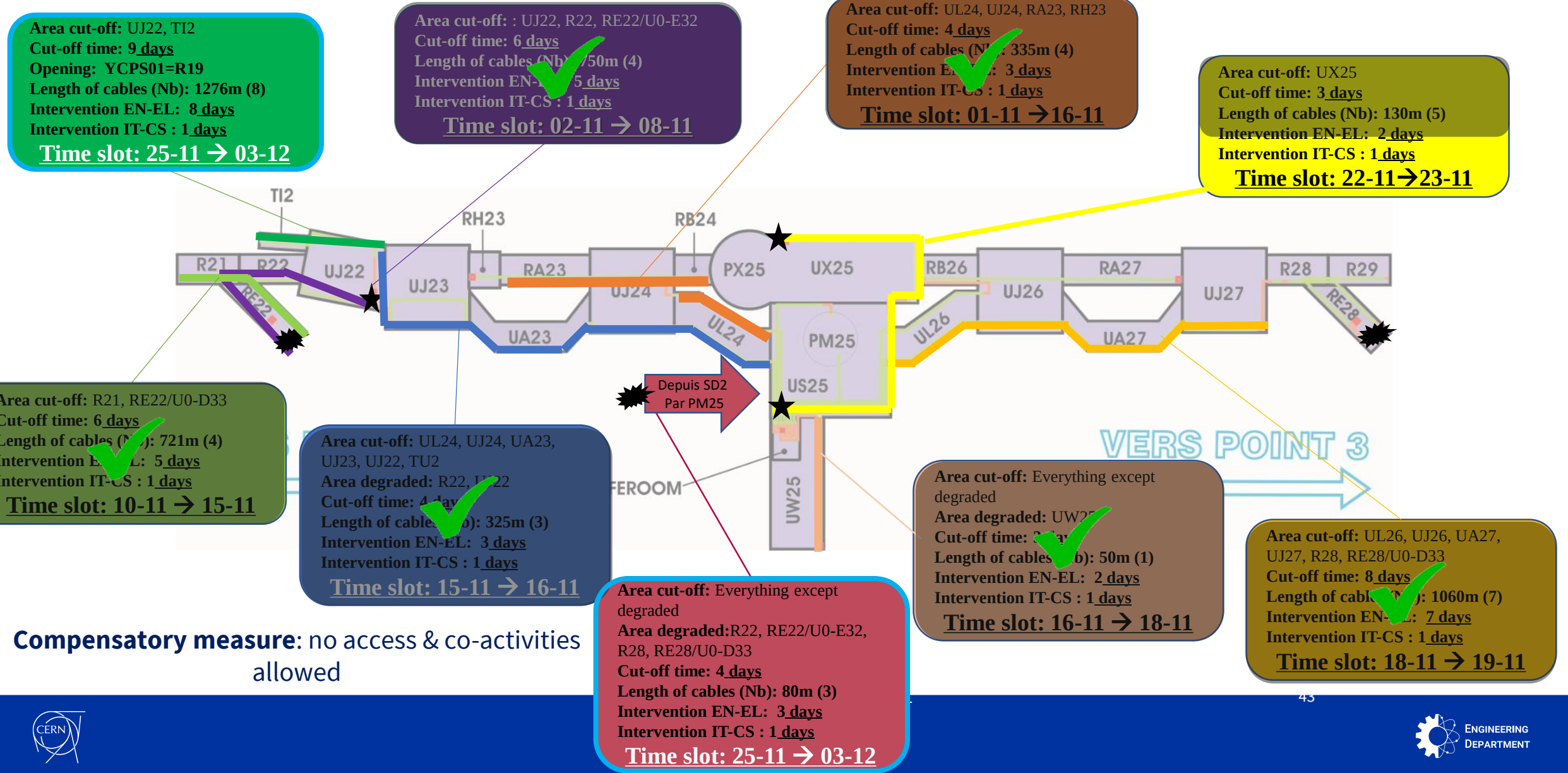
Activities completed/on going

- S. 12: Measurement LSS R1 with ITs measurement, ALFA calibration
- S. 23: Not started
- S. 34: Floor marking BSRTM marking and alignment
- S. 45: Measurement LSS L5
- S. 56: Measurement LSS R5
- S. 67: Not started
- S. 78: Not started
- S. 81: Measurement LSS L1 with ITs measurement, ALFA calibration

Activities to be done

- S. 12: Alignment LSS R1, Q10 GGPSO (LHC floor monitoring), LSS L2 (Q4/Q4) with ITs P2 measurement
- S. 23: LSS R2 (Q4/Q4) with ITs P2 measurement
- S. 34: Completed
- S. 45: Alignment LSS L5 with ITs measurement, Q10 GGPSO (LHC floor monitoring)
- S. 56: Alignment LSS R5 with ITs measurement, Q10 GGPSO (LHC floor monitoring)
- S. 67: TIM measurement, TCPCV.A6L7 alignment
- S. 78: TIM measurement, TCPCV.A6R7 alignment, Measurement & Alignment Arc 78, LSS L8 (Q4/Q4) with ITs P8 measurement
- S. 81: Alignment LSS L1, Q10 GGPSO GGPSO (LHC floor monitoring), LSS R8 (Q4/Q4) with ITs P8 measurement

GSM cabling campaign follow-up



Useful link for coordination

The screenshot shows the LHC YETS 2021-2022 website. At the top, there is a navigation bar with the LHC logo and links for 'LHC LONG SHUTDOWN 2 (2018-2021)', 'YETS 2021-2022', 'LHC ACCESS CONDITIONS', 'CONTACT AND USEFUL LINKS', and 'ARCHIVES'. Below the navigation bar, there are two tabs: 'YETS 2021-2022 Constraint Schedule' and 'YETS 2021-2022 Coordination Meetings'. Under the first tab, there is a link for 'Schedule GANTT Views Shortcuts'. The main content area features a large Gantt chart titled 'YETS 2021-2022' showing various activities across different sectors (Sector 12 to Sector 81) and time periods. To the right of the Gantt chart, there is a sidebar with the heading 'YETS 2021-22 Schedule Links'. This sidebar contains several links: 'LS2 Master Schedule', 'YETS 21-22 EDMS 2607784', 'GANTT Views (schedule viewer) (To be added)', and a list of activity categories: 'YETS LHC activities - short-term scaled', '(only activities finished in the past 2 weeks and starting in the next 6 weeks from Today)', 'YETS LHC activities - forecast', '(only activities finishing after Today)', and 'YETS LHC activities - all'. Below these are 'MS Project Files' and 'LHC Planning and Shared Documents', including 'Project Server' and 'Cross Facility View'.

<https://lhc-coordination.web.cern.ch/>

EDMS :

- YETS 21-22 Master schedule [ACC-PM-MS-0005 v.2.0 RELEASED](#)
- LHC YETS 21-22 [Schedule link](#)

HL-LHC installation equipment in the LHC tunnel

- 1 EYETS 2016
- 2 YETS 2017
- 3 LS2
- 4 YETS 2021

WP13: BWS

WP13: Fluorescence Measurement Test Chamber Installation (BGC)

WP9: Cryogenics upgrade of refrigerator & Cold Box

WP13: Wide-Band transverse pick-up BPW (postponed), Beam Gas Curtain BGC prototype & BSRT (adding halo cleaning)

WP13: Installation of a new BSRTMB tank, new Coronagraph prototype, BGC optical system of the HEL prototype (left IP)

WP5: 2 TCTW wire collimators

WP17: UPR cables rerouting

WP8: CMS forward shielding modification & VAX support installation

WP17: Completion of the underground installation, UPR connections and general services installation campaign services installation

WP13: Remove of BRANA and replace by the new BRAND prototype (left IP)

WP17: New mechanical ventilation in the UA/UPRs and in the tunnel area new cabling campaign

WP5: 2 Dispersion Suppression Collimators TCLD

WP11: CC in C11R2 & C11L2

WP12: In-situ α C-coating Q5-Q6 (postponed)

WP14: Injection Dump TDIS, Cooled MKI (postponed) & Displacement of TCLIA

WP5: 2 TCTW wire collimators

WP17: UPR cables rerouting

WP8: ATLAS forward shielding modification and JTT installation

WP17: Completion of the underground installation, UPR connections and general services installation campaign

WP13: Remove of BRANA and replace by the new BRAND prototype (right IP)

WP17: New mechanical ventilation in the UA/UPRs and in the tunnel area new cabling

WP5: 1 TCSPM secondary proto collimator

WP5: 8 Target Secondary Collimators TCSPM & 2 Dispersion Suppression Collimators TCLD (postponed)

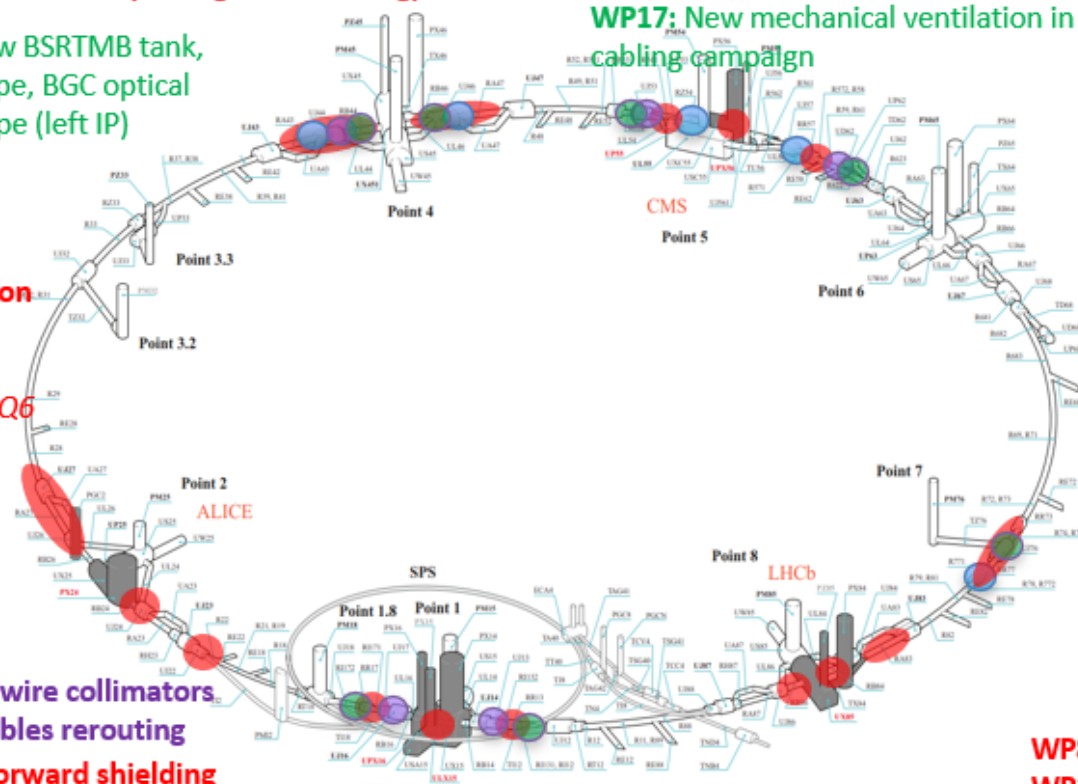
WP11: 11T in C9R7 & C9L7 (postponed)

WP5: 2 TCPC crystal collimators

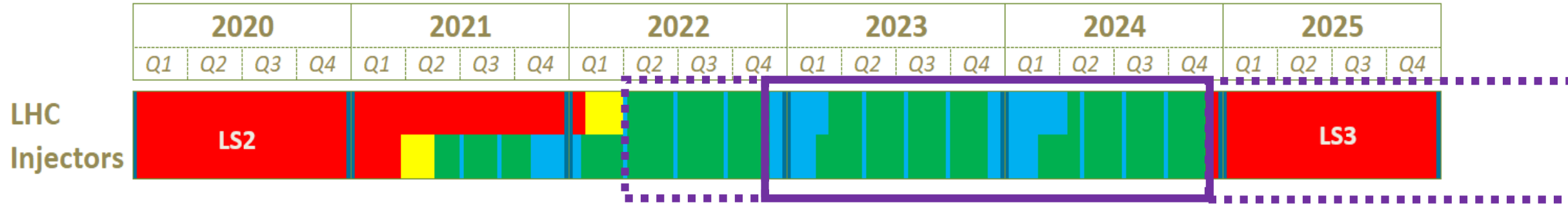
WP8: TANB both sides LSS8

WP12: In-situ α C-coating Q5-Q6 (postponed)

WP14: Injection Dump TDIS



Run 3 coordination covers a period :



LS3 activities have also to be analysed

Locations covered :

- Accelerator complex
- HL-LHC buildings
- Technical galleries
- Machine surface buildings (Consolidation and maintenance)

- Experimental areas, LHC- and non-LHC experiments
only in terms of resources needed from ATS (and HSE) during run 3 and LS3

There is no budget allocated to the Run 3 Installation Coordination

Courtesy of J.-Ph. TOCK

The Run 3 Installation Coordination Team

R3 Installation Coordinator	Jean-Philippe TOCK	EN-ACE
R3 Installation Coordinator Deputy	Rende STEERENBERG	BE-OP
R3 Installation Coordination Officer	Marzia BERNARDINI	EN-ACE
R3 PLAN Officer (including QA)	Fernando PEDROSA	EN-ACE
R3 PLAN Officer Assistant	Raoul MASTERSON	EN-ACE
R3 Administrative Support Officer	Anna LAMBERT	EN-ACE
HSE link person	Yves LOERTSCHER	HSE
	(Stefan ROESLER)	HSE
EROS link person	Cyrille BEDEL	EN-ACE
HL-LHC link person	Paolo FESSIA	ATS-DO
	(Michele MODENA)	ATS-DO

Courtesy of J.-Ph. TOCK