



LS2 2015-2020
Coordination

LS2 Status of the accelerator



Picture taken on the occasion of the last Pressure Test in the LHC

- Long Shutdown 2 (LS2) scope
- Safety Coordination
- Back to “new normality”
- Schedules & Milestones



Handover between LS2
Coordination and PS Operation

LS2 in the PS – TE-MPE achievements and future

Achievements:

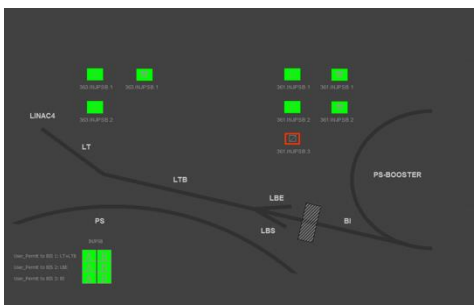
- Implementation of 5 new WIC systems
- Protecting
 - 320 magnets (TE-MSA)
 - 10 Septa and 2 bumpers (TE-ABT)
- Connected to
 - 320 power converters (TE-EPC)
- 735 interlock cables (EN-EL)



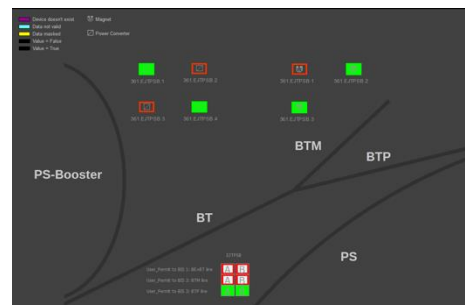
Future (next YETs or LS3)

- Deployment of a WIC system for the Main Units of the PS (+ PFWs and Figure 8)

WIC supervision in collaboration with BE-ICS



L4 to PSB TLs



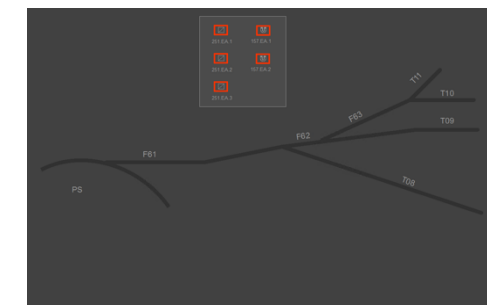
PSB to PS TLs



PS Aux



TT2 - nTOF TLs



East Area

-> End 2021

-> EYETS 22-23

Courtesy of: R. Mompou

LS2 in the PS – TE-MSC achievements and future



Achievements:

- 54 new magnets installed for L4 connection
- Removal and reinstallation of 48/100 Main Units and almost as many straight sections
- 43 Main Units were equipped with new PFWs
- Replacement of 31 F16 Quads
- Replacement of the F61 magnets
- Installation of 2 new F16 BHZs

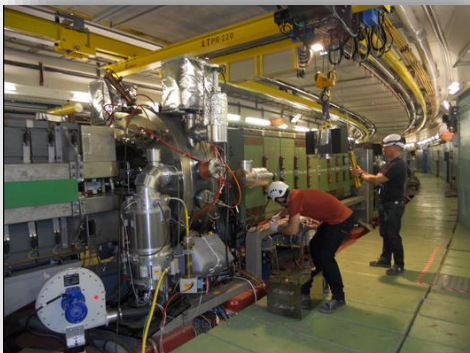
During HWC

- Reinstall the Main Units covers followed by a HV tests

Future (next YETs or LS3)

- Strategy of magnets covers consolidation under discussion

LS2 in the PS – TE-VSC achievements and future



Achievements:

- Vacuum consolidation (new ion pumps, fix pumping groups, etc.)
- Support to other groups: installation, alignment, magnet consolidation, etc. All vacuum sectors in PS and TLs open.
- Vacuum acceptance test before installation
- LIU layout modifications (LBE, BTP, LBS, new bumpers, etc.)
- Final commissioning pump down and leak detection

During HWC

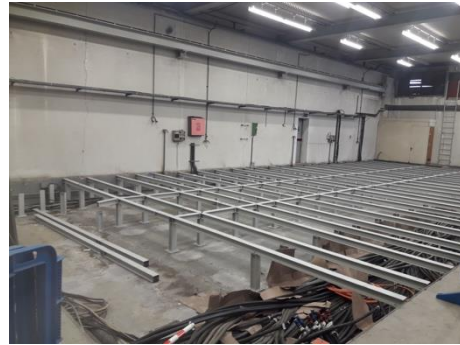
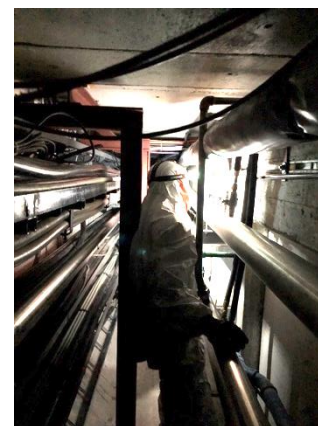
- Vacuum acceptance test and installation of new SEM48 BGI84

Future (next YETs or LS3)

- Vacuum consolidation including building 368 floor
- Support to other groups
- Regular maintenance (primary pumps of fix pumping groups)

Courtesy of: J. Ferreira Somoza

LS2 in the PS – SMB-SE achievements and future



Achievements:

- Civil engineering works for the connection of LINAC4 to the PS SWY
- Fully new false floor structure, roof renovation, wall replacement in B269
- Asbestos cleaning in the PS inner galleries
- Slabs consolidation
- Painting evacuation paths in the PS SWY
- Treated several water infiltrations in the PS and TT10 (TT2 side)

During HWC

- Install the slabs that could not be produced on-time

Future (next YETs or LS3)

- Consolidate the slabs on the outer side of the ring
- Marking all the slabs according to the tested and validated method used for the small slabs

Courtesy of: D. Pazem

Safety Coordination

ISTs Period - Injectors

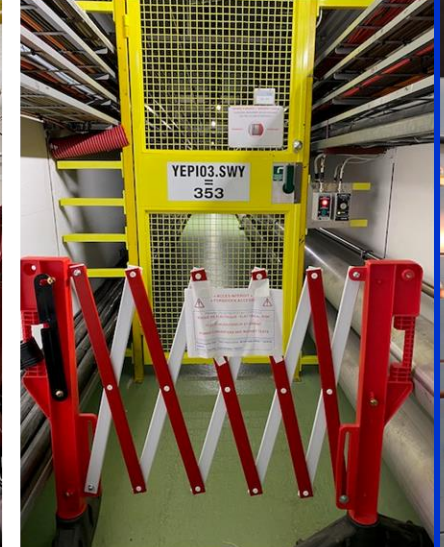
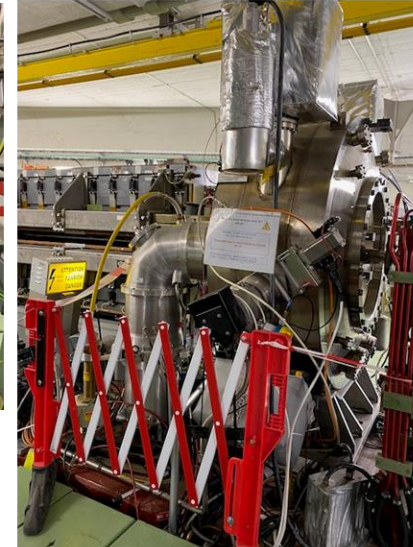
Network separation is lifted only for
needed for ISTs (Magnets, Kickers, Septa)



Very good collaboration with all groups
Special thanks to TE-EPC and EN-ACE

ISTs Period - Injectors

ISTs well identified on field by the groups
(Magnets, Kickers, Septa, RF cavities)



Pictures from PS SWY ISTperiod
Acknowledgements: A.Prost, M.Hourican
TE-ABT, A.Jibar BE-RF, F.Baltasar,
N.Mornand EN-ACE

Thank you very much to all groups!

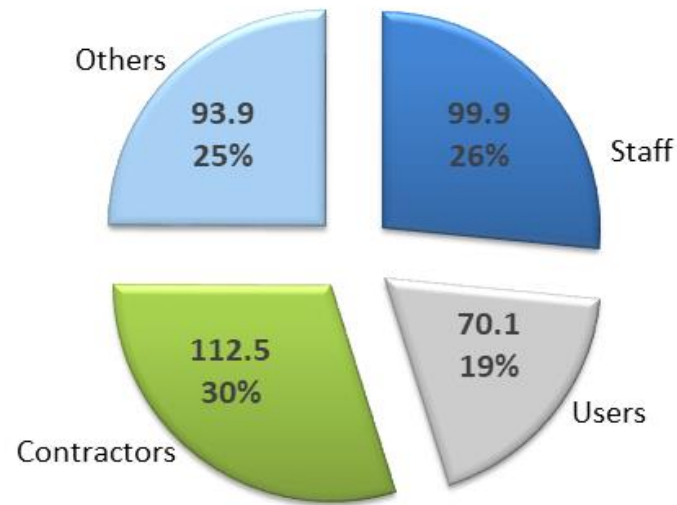
Personal Dosimetry

Collective personal dose
 (for LS2, 1st of January 2019 – 31st of August 2020)
376.4 person · mSv

Maximum individual dose
 (for the last 12 months, 1st of September 2019 – 31st of August 2020)
2 mSv

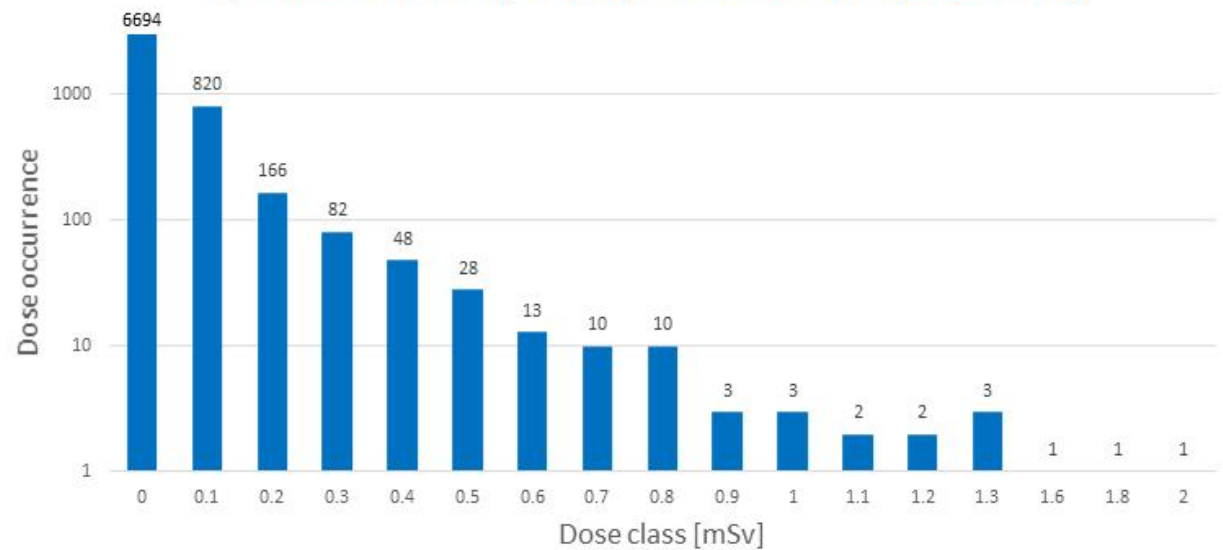


Dose distribution per category of personnel
 Values in person · mSv



Others: VISC,TRNE,TEMC,TECH,SASS, RETR, RETP, PJAS, PART, GPRO, FELL, EXTN, EXMP, DOCT, COS,CASS,APPR,ADMI

Individual dose occurrence per dose class
 (for the last 12 months, 1st of September 2019 – 31st of August 2020)



* = Preliminary results

Operational Dosimetry

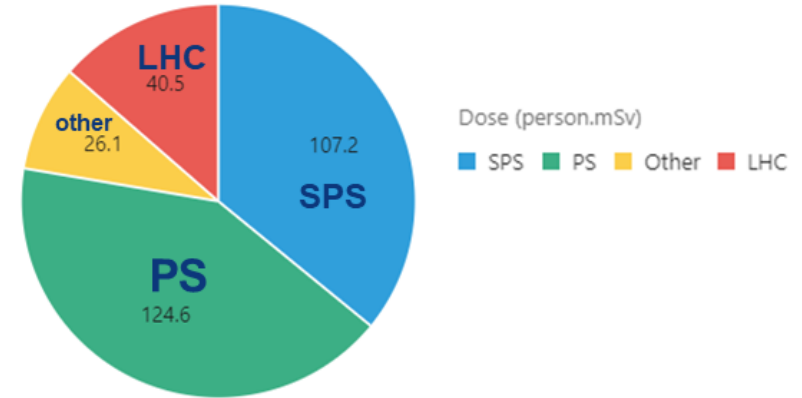
Operational Dosimetry

For work in Limited Stay and High Radiation Areas

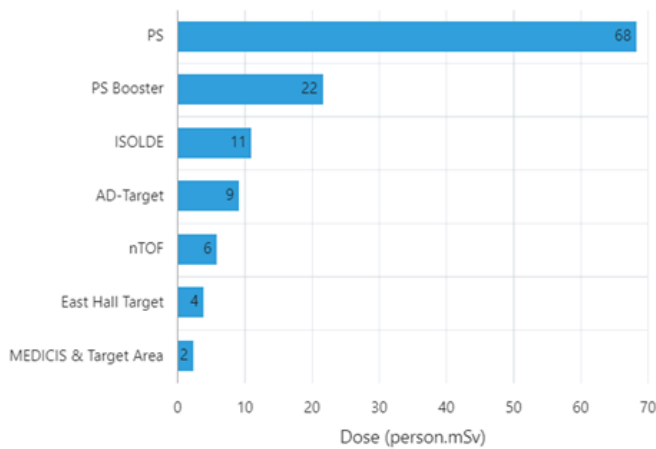


Collective operational dose
(for LS2, 1st of January 2019 – 25th of October 2020)
298.4 person · mSv

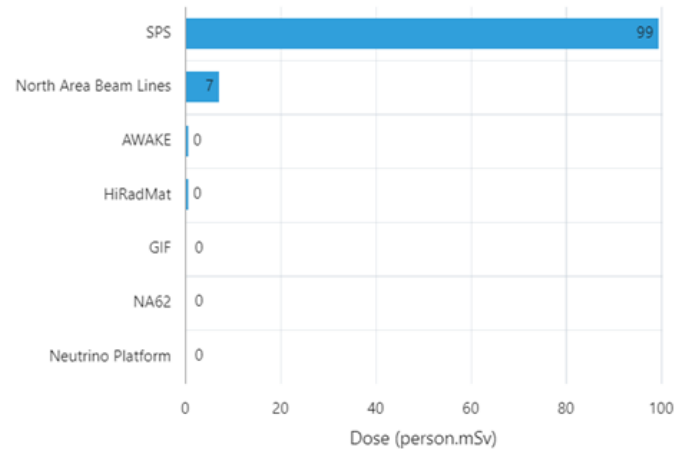
Dose by complex in person · mSv



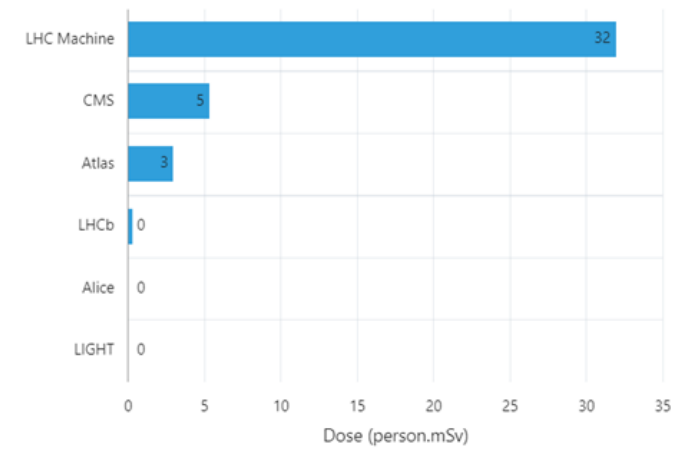
PS complex*



SPS complex*



LHC complex*



* Top 7 contributors

Safety: LS2 Accidents

1st September 2020

Facility	Total	Minor	With days of absence	Total days
PS	9	5	4	41
SPS	25	13	12	538
LHC inc. LEX	39	26	13	99
Surface	27	15	12	220
Total	100	59	41	898

Facilities: Frequency Rate: 9.8
Severity Rate: 0.22

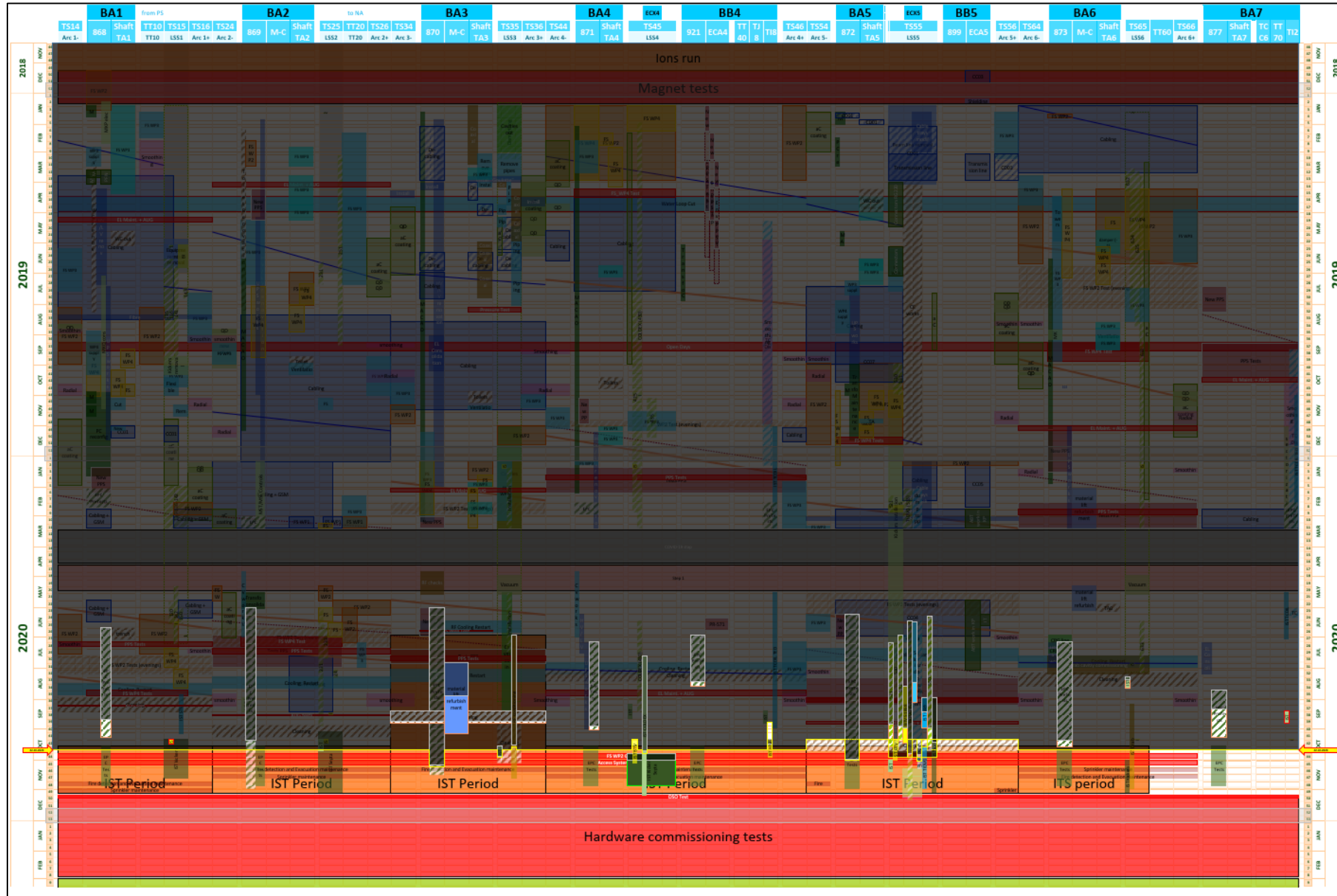
Description	All	Minor	With absence	Days of absence
Handling and Manipulation	26	11	15	345
Electricity	5	2	3	179
Collision, false movement	24	18	6	152
Fall	9	2	7	124
Hand tools and Power tools	17	13	4	54
Object in Movement	12	9	3	17
Machine tools	2	1	1	16
Vehicles (cycle, Pefra)	4	2	2	7
Divers (Insect bite)	1	0	1	4
Chemicals	1	1	0	0
Total	101	59	42	898



Frequency Rate:
 Accidents with absence per million hours worked
Severity Rate:
 Days of absence per thousand hours worked

LS1
Frequency rate : 8.4
Severity rate : 0.07

SPS Broken line



SPS status

- ECX5 Beam Dump project:
 - *Dump was installed in ECX5 this week. (Week 43)*
 - *Final connections, pump down & bake-out ongoing.*
- RF Cavity upgrade project.
 - *Installation is complete.*
 - *Conditioning of the cavities is ongoing.*
- Re-configuration of LSS1 is complete.
- PPS Project:
 - *All new access systems installed.*
 - *Final global tests during week 45. (Machine closed)*
- Fire Safety Project:
 - *Installation is complete.*
 - *Still: Final global tests during week 44. (Machine closed) & Final closing of gaps around new fire doors will be done during week 48.*
- IST Period started this week (Week 43)
- Hardware commissioning from wk. 50



The new RF cavities in LSS3

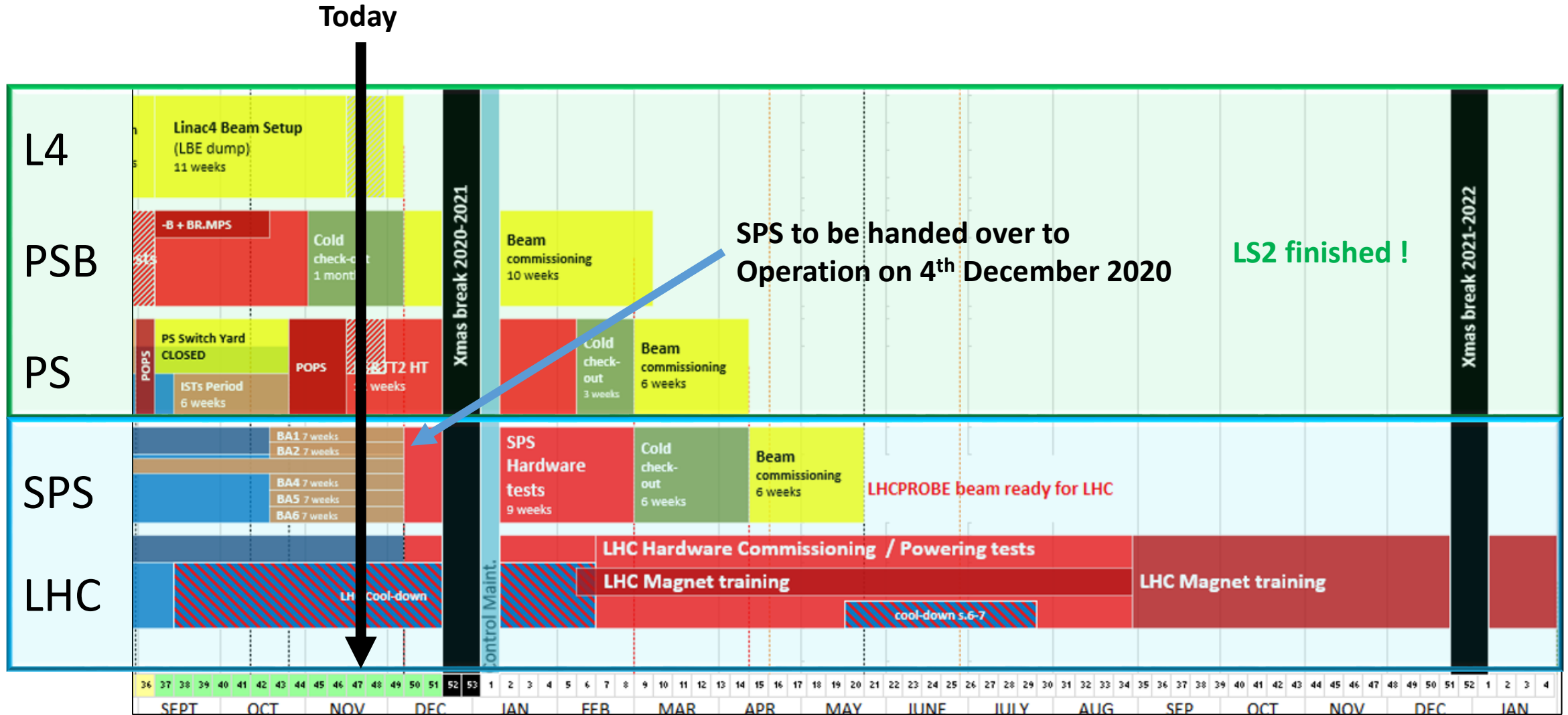


WP1: Final fire door installed in LSS5

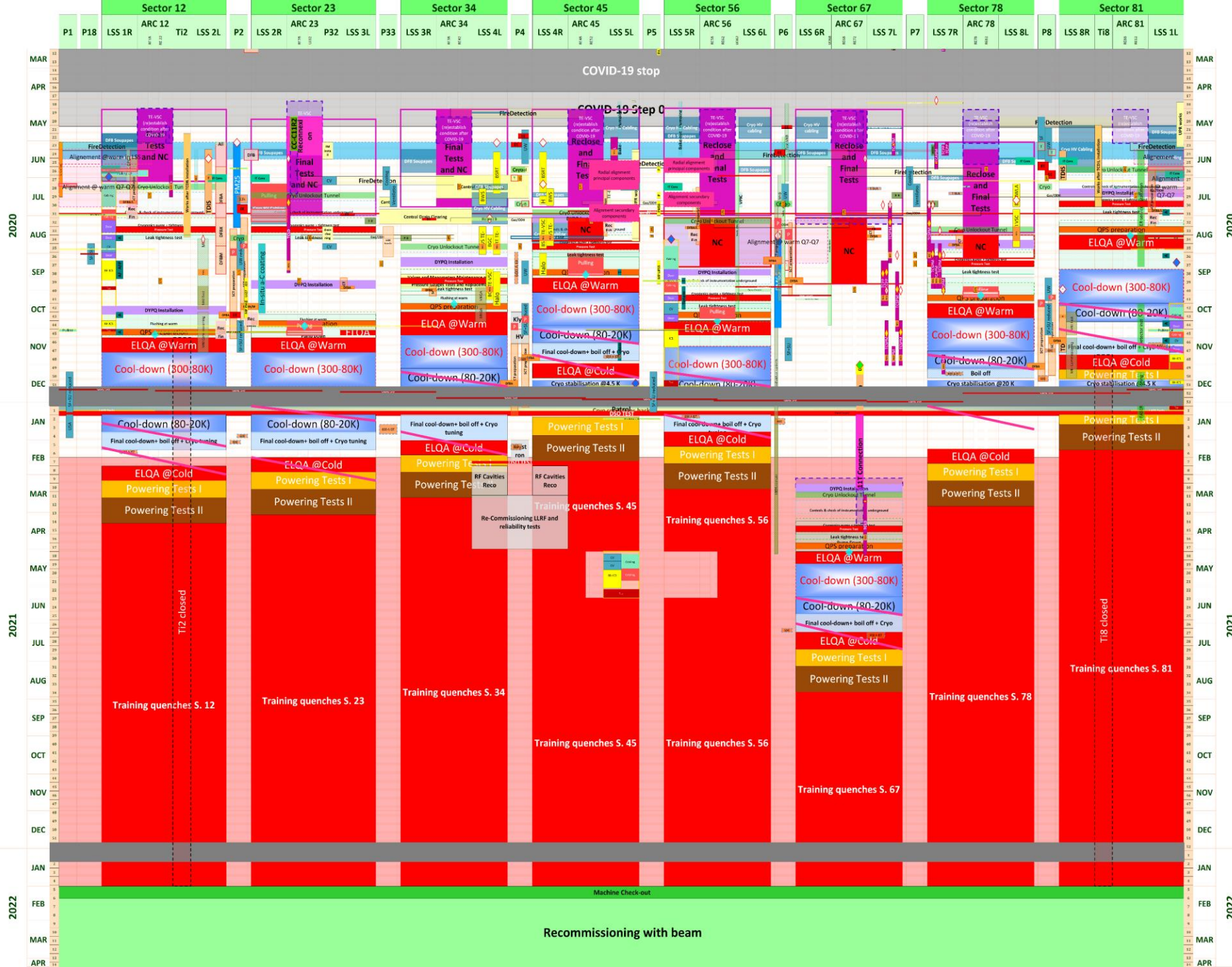
of LSS1 is complete

Master Schedule LS2 V3.0

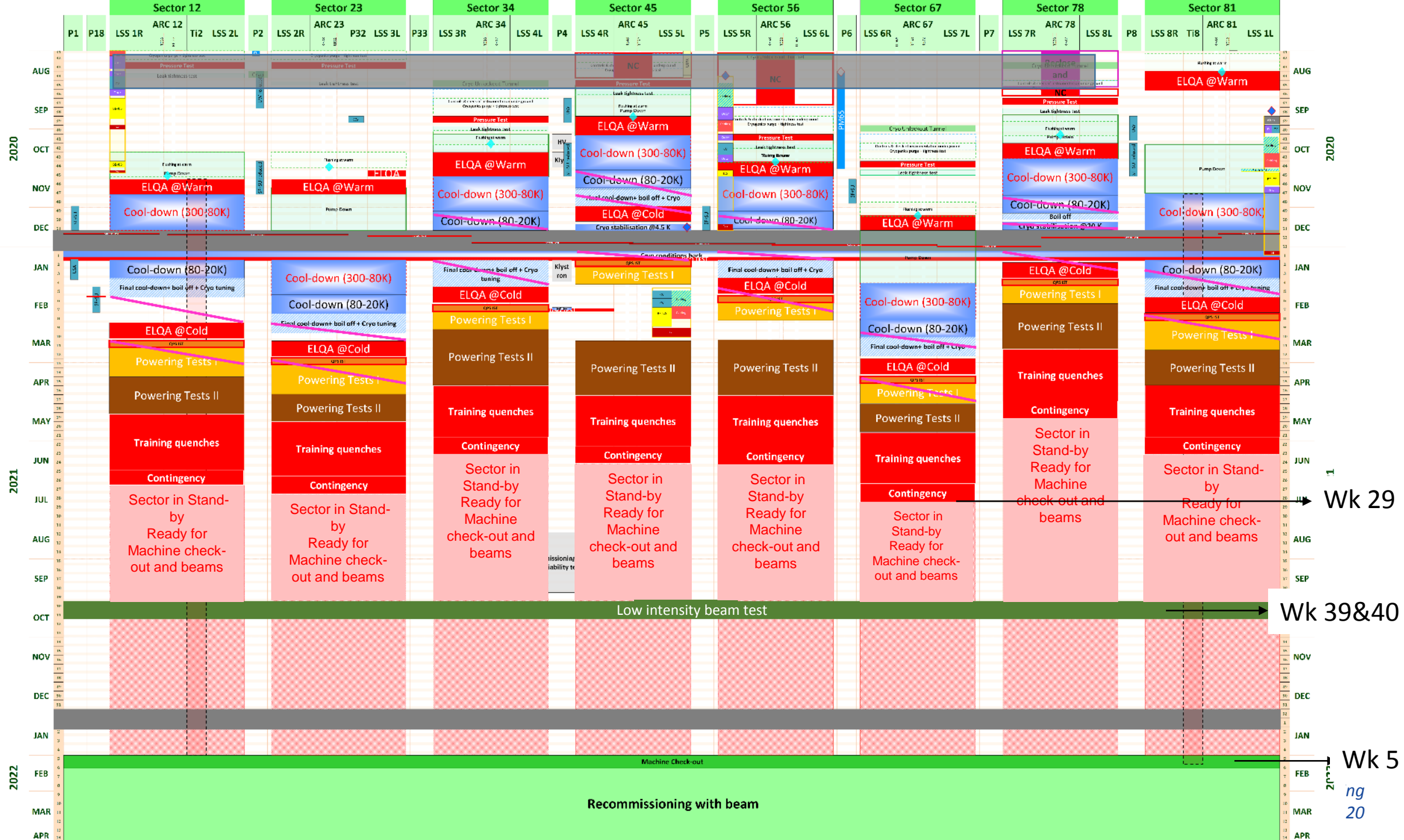
EDMS ACC-PM-MS-0002 v.3.0



LHC-LS2 Baseline 3.0



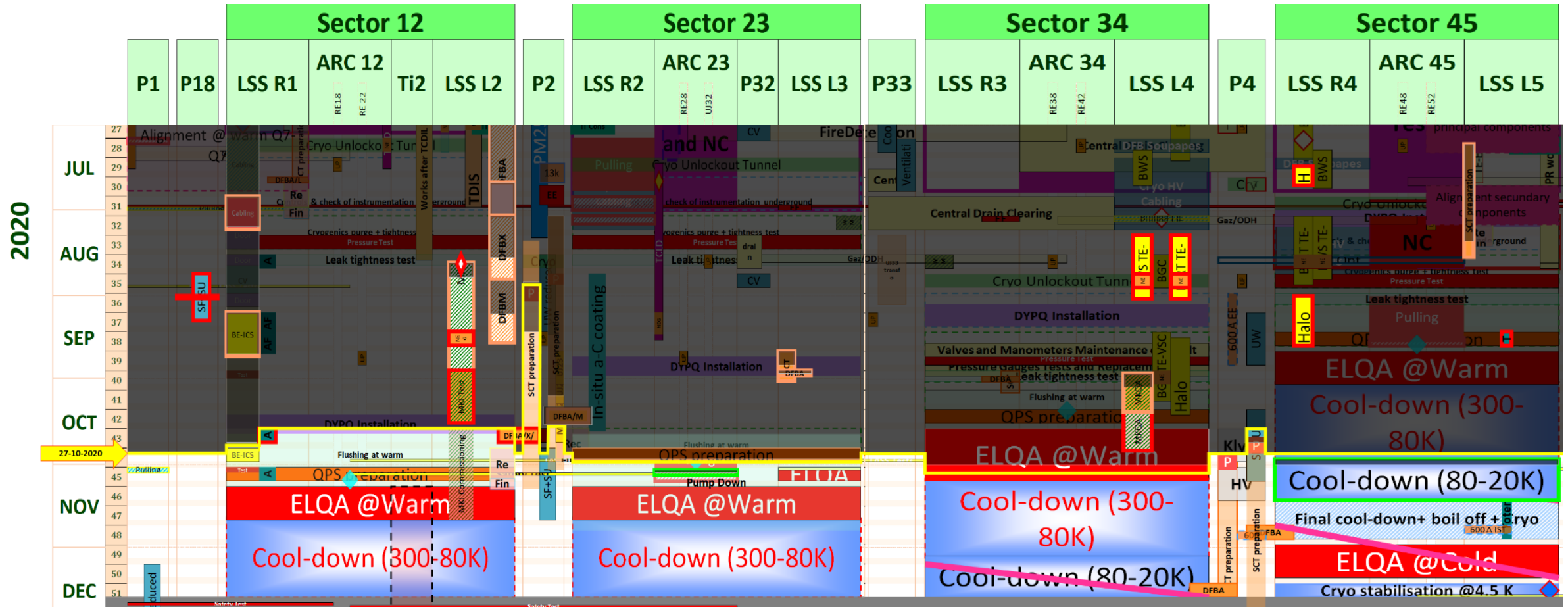
LHC-LS2 Baseline 3.1 *in work*



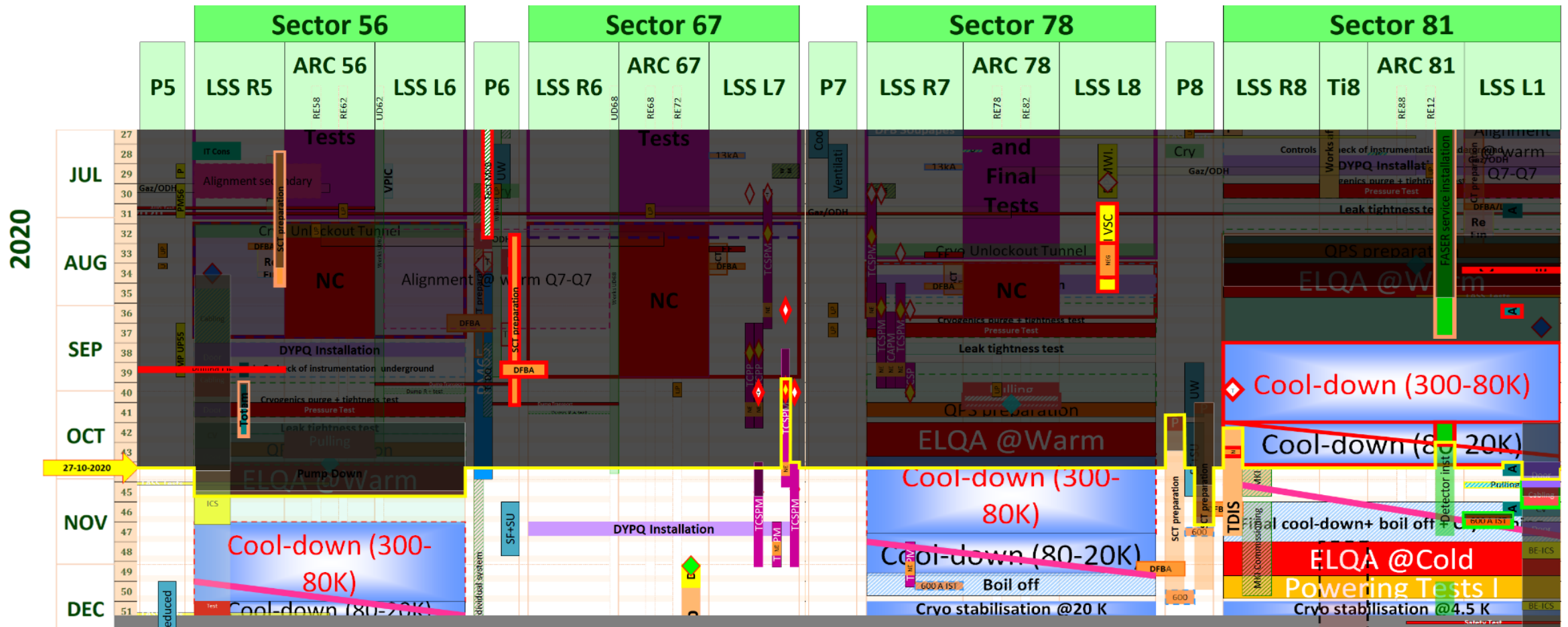
Summary table: main activities progress *(present wk 44)*

Activity	12	23	34	45	56	67	78	81
Cryo unlockout surface	W8	W34	W26	W30	W30	W30	W28	W2
Cryo unlockout underground	W27	W29	W35	W31	W32	W40	W33	W26
Pressure test	W33	W33	W39	W35	W41	W44	W37	W30
Flushing at warm	W44+W45	W43+W44	W40→W42	W36→W38	W43+W44	W48→W50	W39→W41	W32→W34
EIQA @Warm	W46+W47	W45→W47	W43→W45	W39+W40	W44+W45	W50+W51	W42+W43	W34→W36
Cool-down (300-80 K)	W48→W51	W2→W5/21	W46→W49	W41→W44	W46→W49	W5→W8/21	W44→W47	W48→W51
Cool-down (80-20 K) + filling	W2+W3/21	W6+W7/21	W50→W51	W44+W46	W50+51	W8+W9/21	W8+W49	W2+W3
Final cool-down+ boil off + Cryo tuning	W4+W5/21	W8→W9/21	W2→W4/21	W47+W48	W2→W4/21	W11+W12/21	W50	W4+W5
EIQA @Cold	W7+W8/21	W10+W11/21	W5+W6/21	W49+W50	W4+W5/21	W13+W14/21	W2+W3/21	W6+W7

LHC LS2 Broken line 28th October 2020



LHC LS2 Broken line 28th October 2020

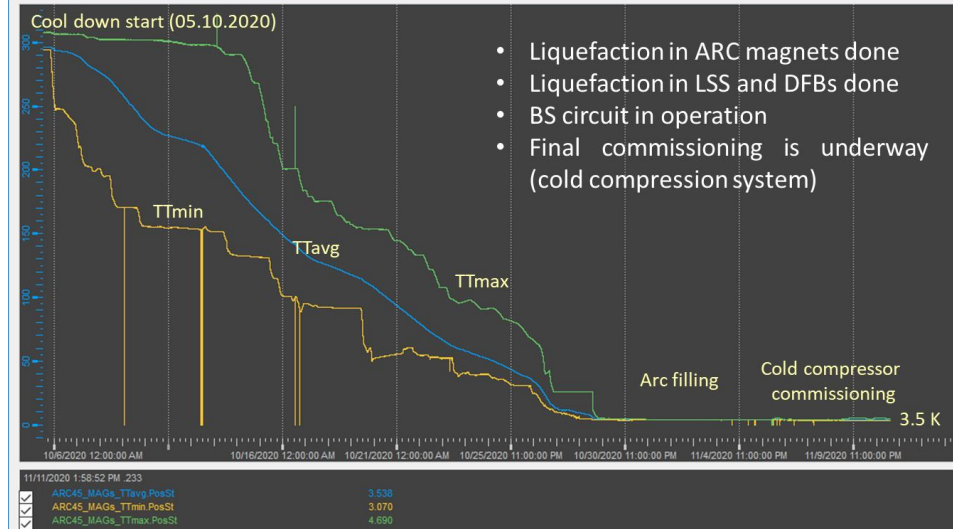


LHC Cool down 28th October 2020

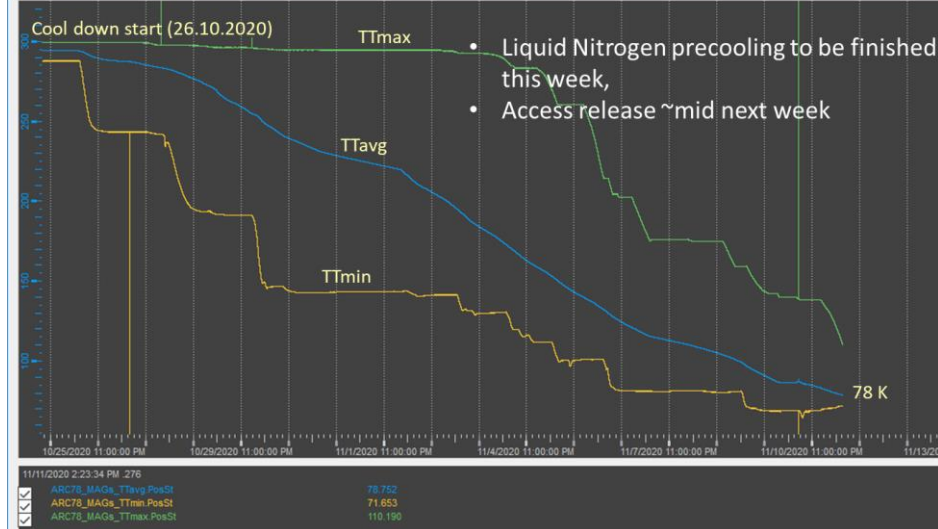
K. Brodzinski									
11/11/2020									
v.10.3		s1-2	s2-3	s3-4	s4-5	s5-6	s6-7	s7-8	s8-1
20	11/05/2020	unlock surface - done							
21	18/05/2020								
22	25/05/2020								
23	01/06/2020								
24	08/06/2020								
25	15/06/2020								
26	22/06/2020			unlock surface work					unlock tunnel work
27	29/06/2020								
28	06/07/2020	unlock tunnel work						unlock surface work	
29	13/07/2020		unlock tunnel work		unlock surface work				
30	20/07/2020					unlock surface work	unlock surface work		pressure test
31	27/07/2020				unlock tunnel work				
32	03/08/2020					unlock tunnel work			
33	10/08/2020	pressure test	pressure test					unlock tunnel work	
34	17/08/2020		unlock surface work						
35	24/08/2020			unlock tunnel work	pressure test				
36	31/08/2020								
37	07/09/2020							pressure test	
38	14/09/2020								
39	21/09/2020			pressure test					
40	28/09/2020						unlock tunnel work		
41	05/10/2020				cool down	pressure test			
42	12/10/2020								
43	19/10/2020								
44	26/10/2020						pressure test	cool down	
45	02/11/2020								
46	09/11/2020			cool down		cool down			
47	16/11/2020								
48	23/11/2020	cool down							cool down
49	30/11/2020								
50	07/12/2020								
51	14/12/2020								
52	21/12/2020								
53	28/12/2020								
1	04/01/2021								
2	11/01/2021		cool down						
3	18/01/2021								
4	25/01/2021								
5	01/02/2021						cool down		
6	08/02/2021								

LHC Cool down 28th October 2020

Sector 4-5 cool down



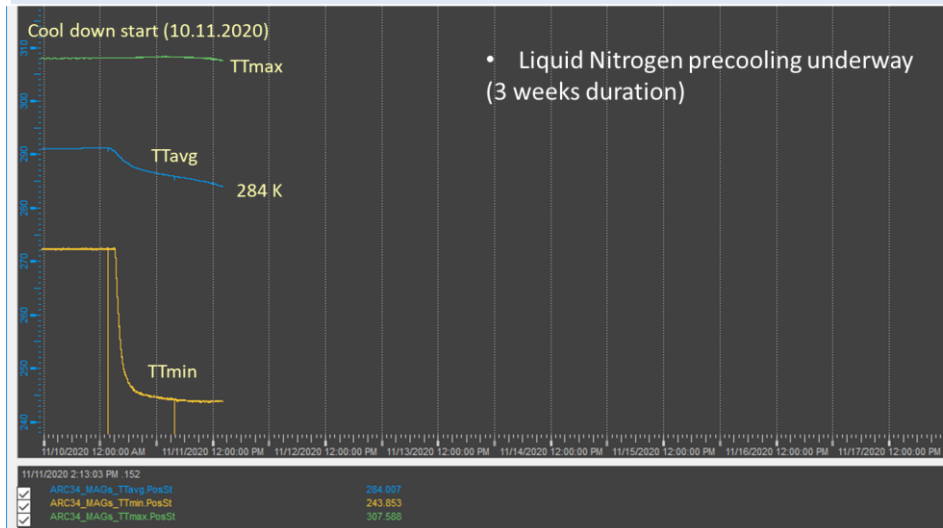
Sector 7-8 cool down



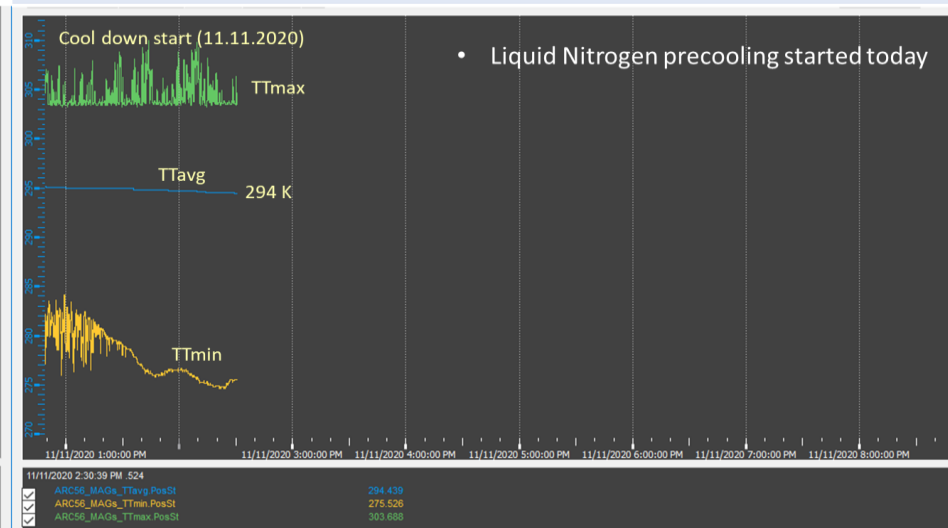
Helium recovery achieved at 95 %

Only 3 trucks to be recovered next weeks!

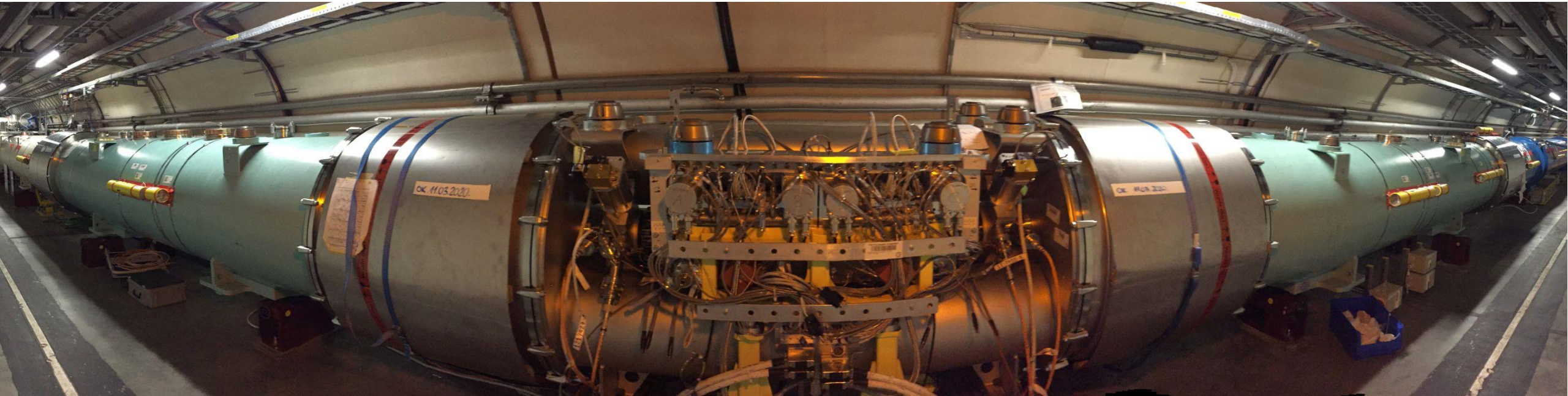
Sector 3-4 cool down



Sector 5-6 cool down



WP11 : Cryoassemblies @ P2 : Connection and bypass cryostats

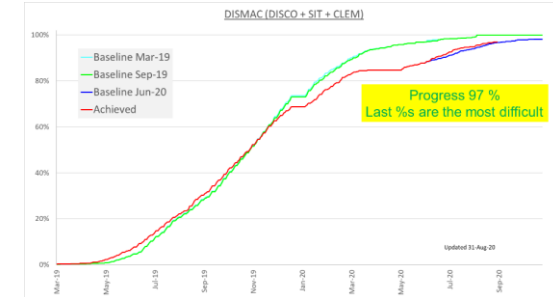


The 8 ICs of the 4 assemblies have been successfully leak tested.

Sectors 12 & 23 have been successfully pressure tested, validating the design and the execution of the IC between the WP11 assemblies at P2.



LS2 - DISMAC PROJECT OPCLIC team



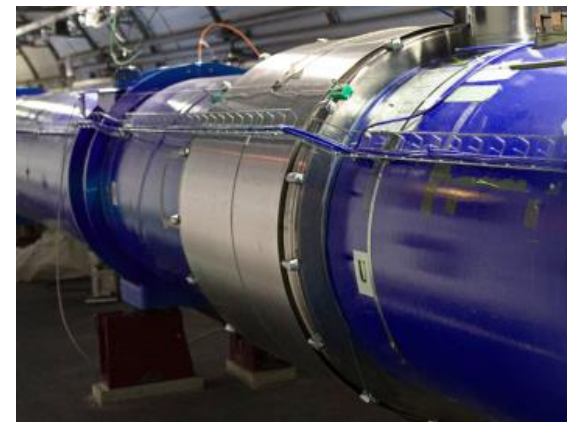
1st March 2019:
First Interconnection opening
QBBI.A30L8 sector 78



Participation of several teams (OPCLIC [TE-MS], BLM [BE-BI], CRIM [TE-CRG], PO [BE-OP]) including collaborators from NTUA (National Technical University of Athens) and WUST (Wroclaw University of Science and Technology)



3 August 2020:
Last Interconnection Closure
QBBI.8L8 sector 78



1360 closures FINISH!



Wroclaw University
of Science and Technology



Henryk Niedwiedzanski
Institute for Nuclear
Physics



LS2 2015-2020
Coordination



S1 successfully qualified

MBHA002 (S3) – cold mass in dis-assembly (orbital cut) for repair (Bdg.



S3 preparing for coil replacement

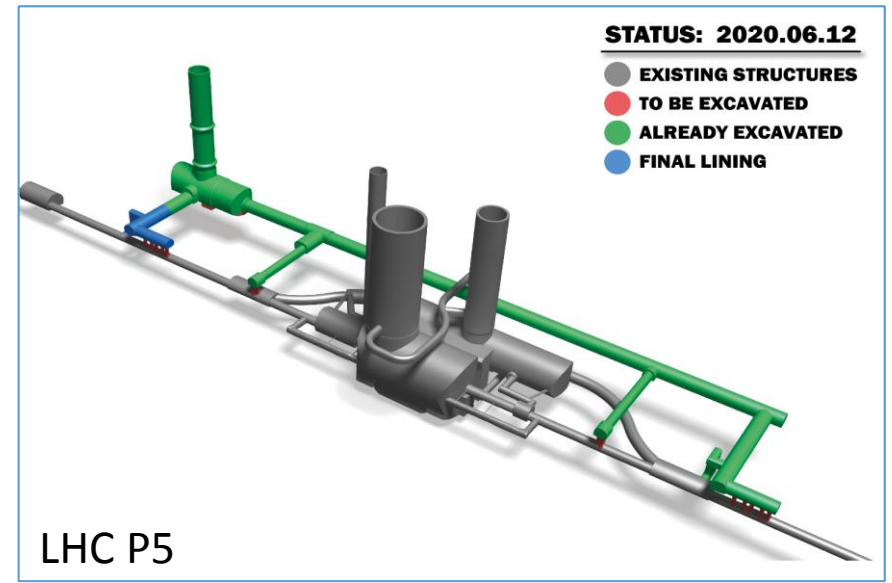
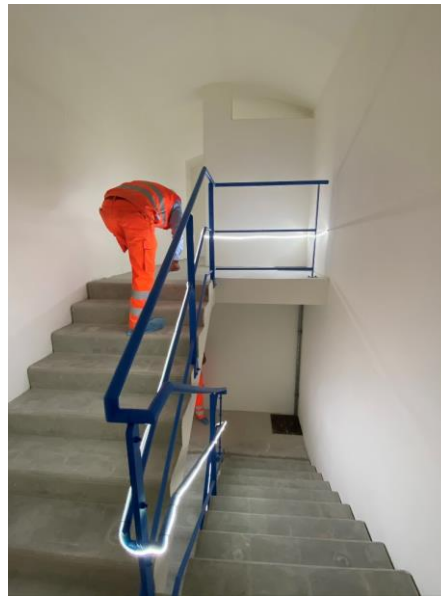
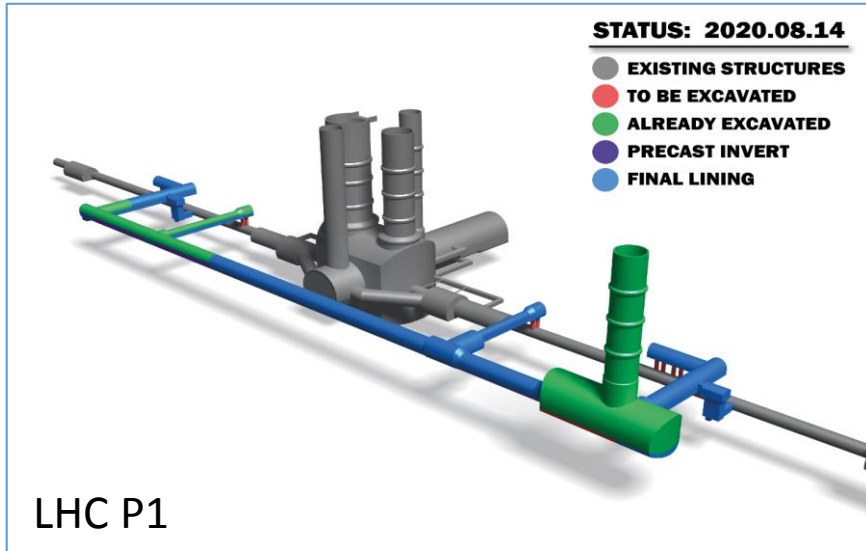


S2 & S4 @ SM18, cool down, being tested

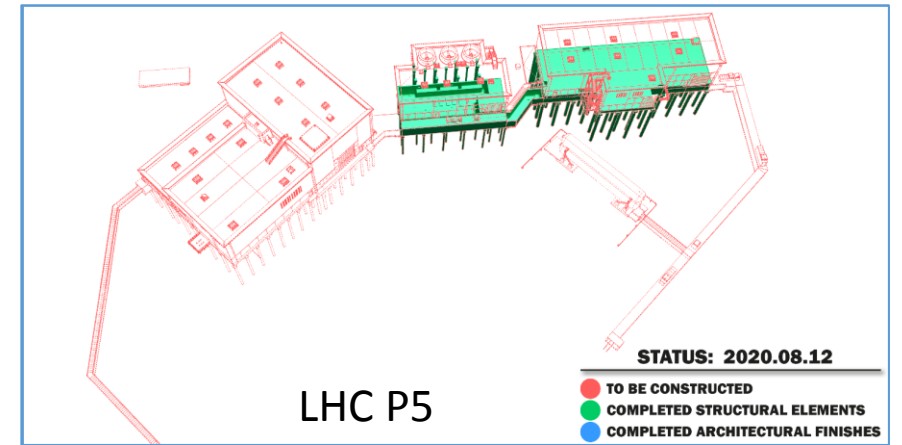
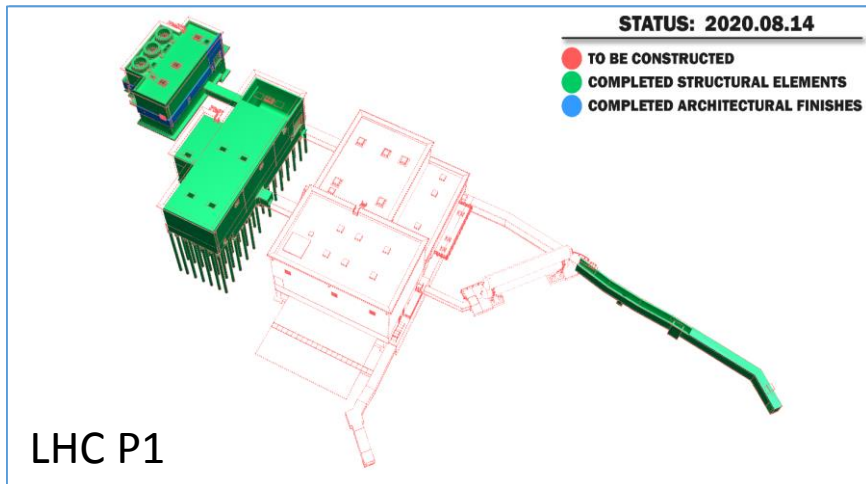


S5 in construction in LMF

HL-LHC civil engineering



HL-LHC civil engineering



HL-LHC – UA/UPRs Status

- **LHC connections completed (UPR13, UPR17, UPR53, UPR57)**

- **General Services installation inside UPRs:**

- **UPR17:**

- ✓ CE handover (including snagging list) on 29th June
- ✓ Worksite category change from Cat 1 to Cat “technical Stop”(Cat2) done
- ✓ Installation start from 1st July → **Staggered to implement security measures (Red tel., ventil.)**
- ✓ General services Installation restart from 27th July → **Completed**
- Commissioning **completed** w41, and Access Commissioning planned w45

- **UPR57:**

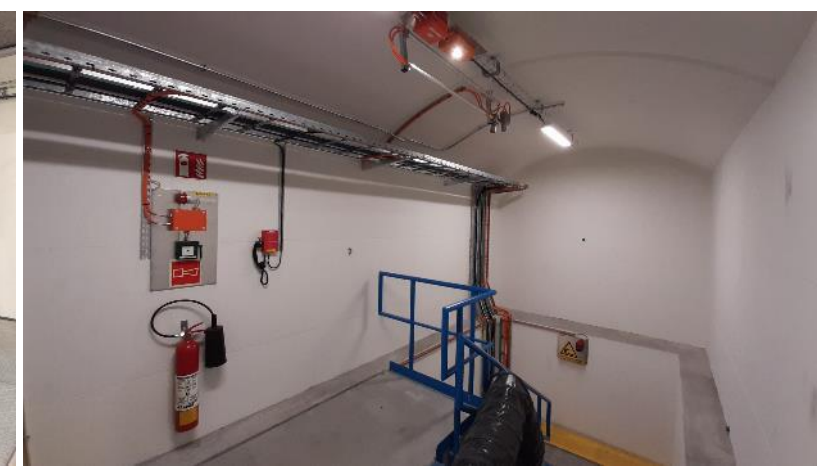
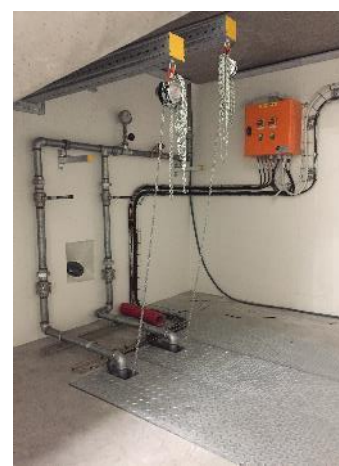
- ✓ CE handover (including snagging list) on 20th August
- ✓ Worksite category change from Cat 1 to Cat “technical Stop”(Cat2) done
- ✓ Installation start from 20th August → **Implementation of security measures completed on 28th August**
- General services Installation start form w36 → **Ongoing: Remains doors (Late due to Covid-19) & BE-ICS**
→ **Objective = Commissioning w50, and Access Commissioning w51**

- **UPR13:**

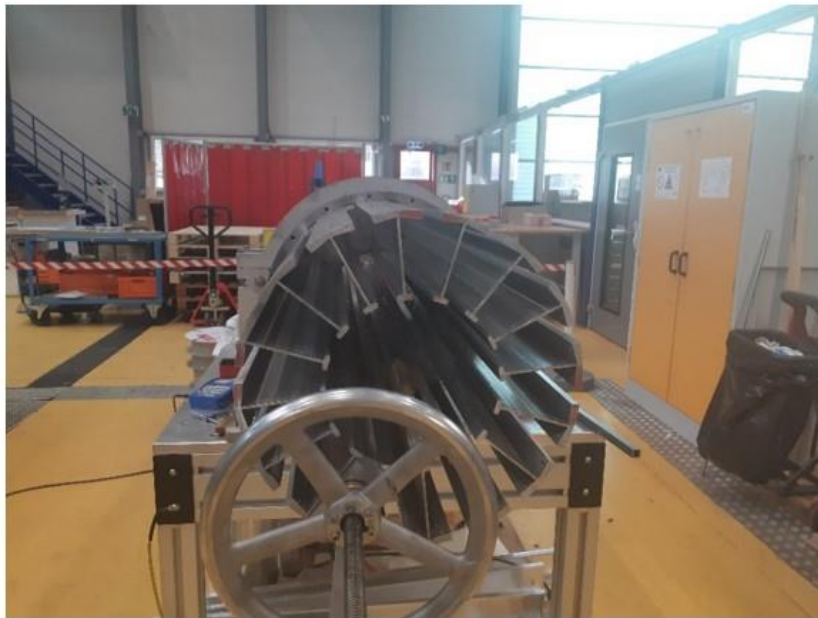
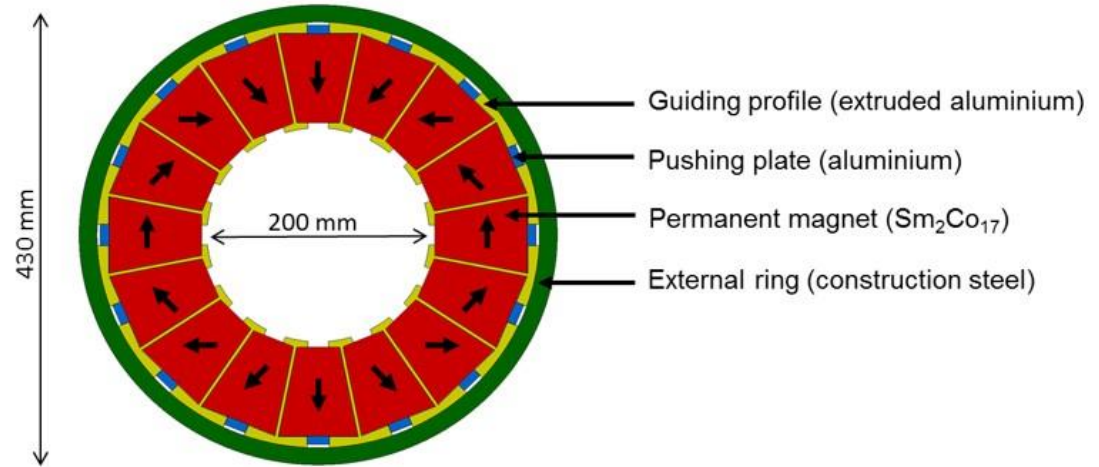
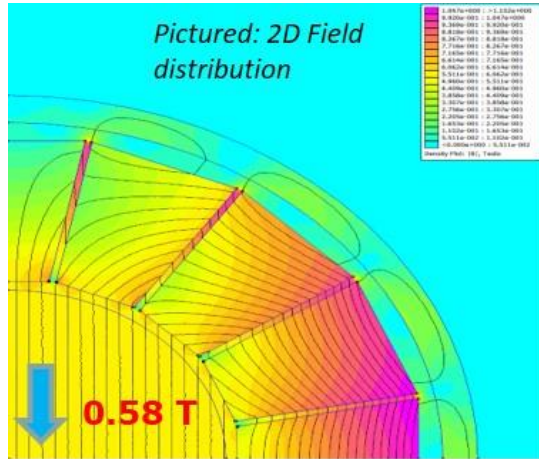
- ✓ CE handover (including snagging list) on 25th September
- ✓ Worksite category change from Cat 1 to Cat “technical Stop”(Cat2) done
- ✓ Installation start from 28th September → **Implementation of security measures completed on 2nd October**
- General services Installation start form w41 → **Ongoing: EN-EL activities completed. Remains EN-CV, doors, BE-ICS & IT**
- → **Objective = Commissioning w47, before Cool-down (300-80 K) in sector 81 (w48-w51)**

- **UPR53:**

- CE handover (including snagging list) on 6th November
- **Installation start date foreseen on 16th November, after security measures implementation**



FASER in TI12 (Sector 81)



Pictured: Innovative assembly of the Permanent Magnets blocks



Pictured: the three magnets installed in TI12 (LHC)

Closing remarks

Injectors & LHC follow post-COVID Master Schedule...

- ✓ L4, PSB and PS already in Hardware Commissioning
- ✓ SPS will be handed over to Operation on 4th December 2020.
- ✓ 4 Sectors of LHC are in cool down, two more next week. Last two in Jan-Feb'2022
- ✓ AI EIQA @ warm have been completed with only minor NCs.

New version 3.1 with linear schedules to be released on 27th November

Pilot beams up to nominal energy in the LHC on Wk 39-40 of 2021

Beams for Physics in Wk05 of 2022.



The LS2 is reaching its end
...was launched by previous DG in 2015
...Has been strongly supported by the present management
...Only few arbitrations done in 2016
All YETS and EYETS were used to optimise LS2 efficiency... and to learn and get prepared!
An amazing personal and team experience!
A wonderful Team driven by empathy and a common objective!
Safety and COVID-19 were giving us more challenges than expected... but we came out stronger!
A big thanks to the LS2 Team and to all the link persons in the groups contributing and supporting through the LS2 Committee. You all did a fantastic job.
Thanks to all contributors to the LS2 !!



LS2

Coordination