

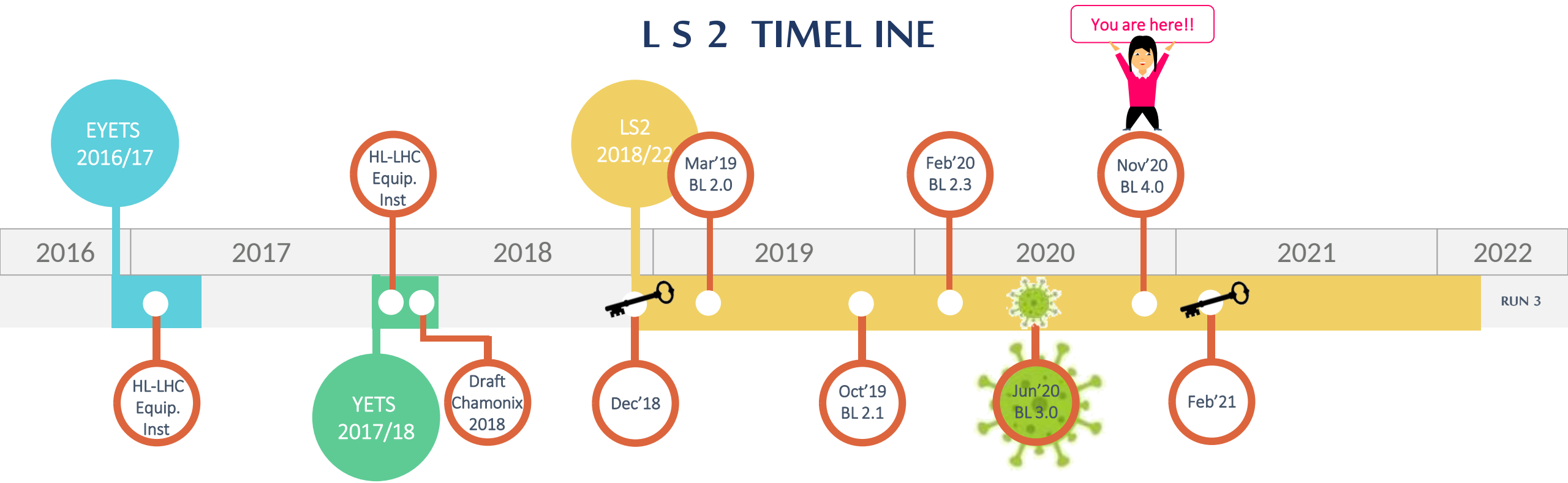
LS2-LHC pictures review

4th December 2020

Marzia Bernardini, María Barberán, Michela Pirozzi and Estrella Vergára

on behalf of CERN wide contributions

LS 2 TIMELINE



LS2 period: EYETS, YETS and LS2

Category	Days
LS 2	733 days
YETS/EYETS	226 days
Short TS	20 days

- ✓ More than 10000 IMPACTS managed
- ✓ 55 reports on the LMC (since June 2016)
- ✓ 64 reports on LS2C (since April 2015)
- ✓ 126 Coordination meetings
- ✓ ...and many more ad-hoc meetings

EYETS 2016/17

You are here!!

EYETS
2016/17

2016

2017

2018

2019

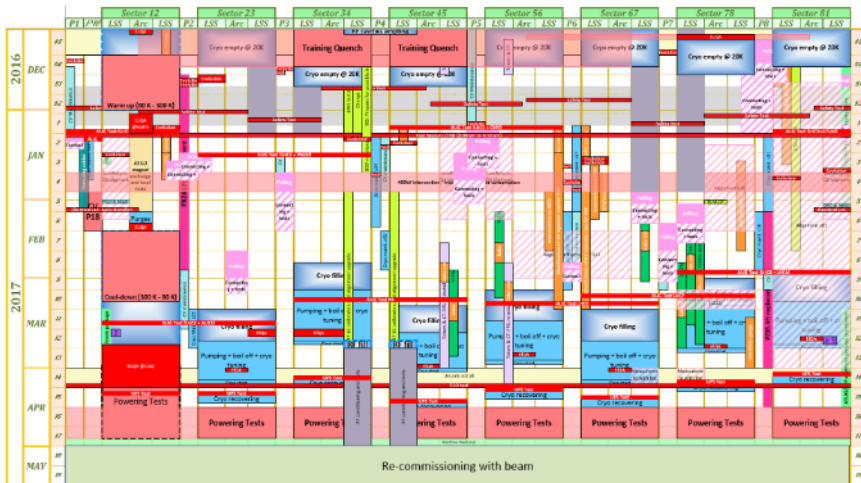
2020

2021

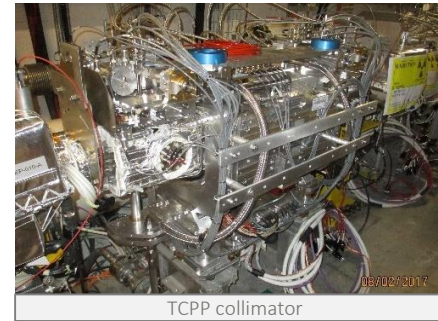
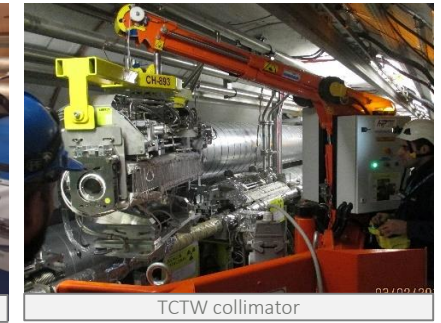
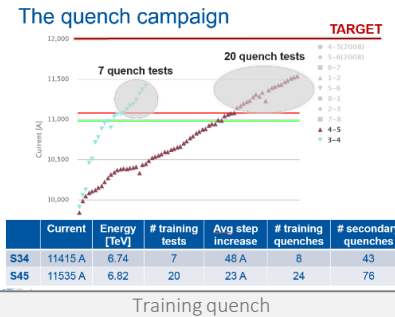
2022

RUN 3

5th December 2016 – 13th April 2017



- ✓ Training quench campaign
- ✓ A31L2 magnet exchange
- ✓ HL-LHC : 2 TCTW wire collimators P5, 1 TCSPM secondary proto collimator P7 and BWS P4
- ✓ 1 TCPPM primary collimator and 2 TCPC gonio crystal collimator P7
- ✓ BGV scintillator installation
- ✓ Replacement of the Existing turbo Pumping Groups on MKB Tanks
- ✓ Alfa shielding
- ✓ CT-PPS Horizontal Roman Pots installation



End-of-LS2 virtual ceremony on 4th December 2020

YETS 2017/18

You are here!!

2016

2017

2018

2019

2020

2021

2022

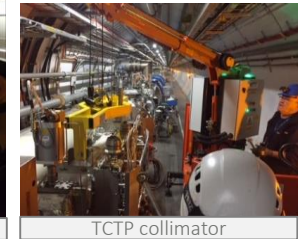
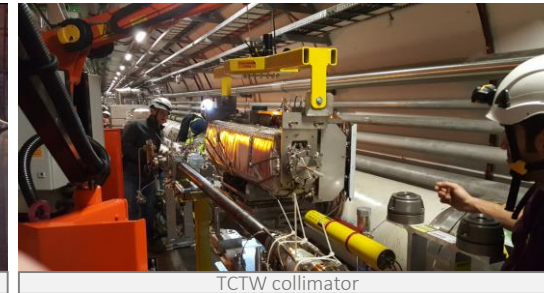
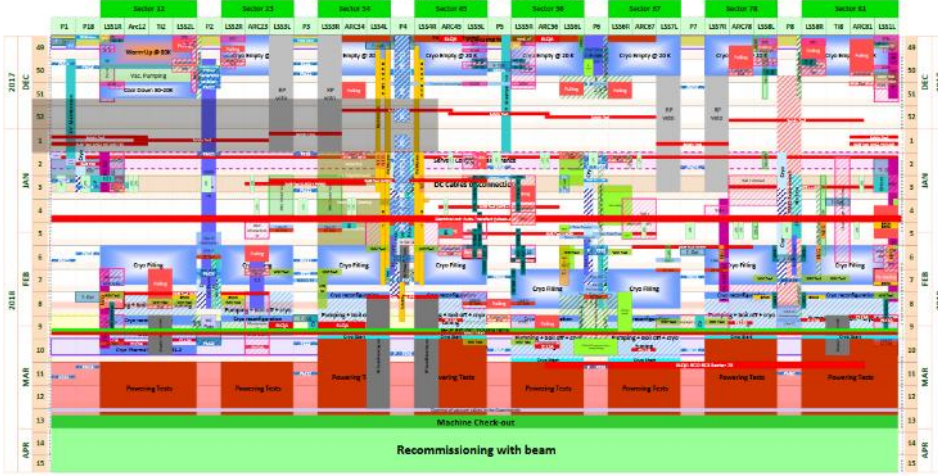
EYETS
2016/17

YETS
2017/18

RUN 3

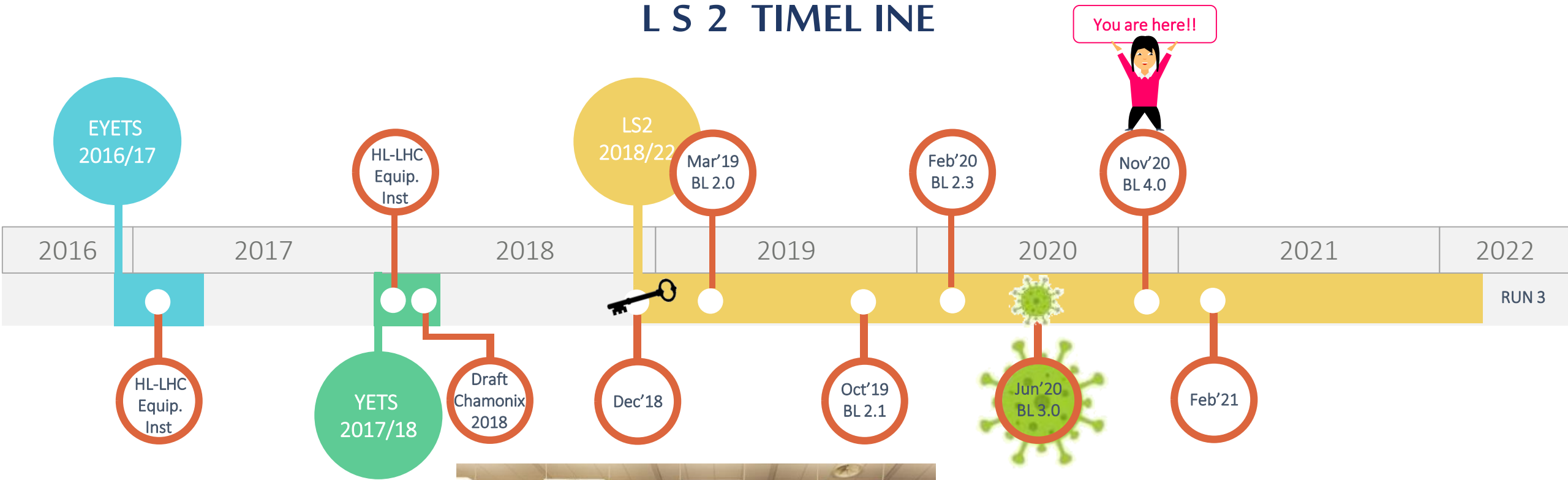
4th December 2017 – 9th March 2018

LHC YETS 2017-2018 Baseline V4



- ✓ 16L2 issue
- ✓ Solenoid installation at 31L2
- ✓ HL-LHC: 2 TCTW wire collimators P1, Fluorescence Measurement Test Chamber Installation (BGC) P4 and UPR cables rerouting P1/5
- ✓ Crane refurbishment (PR711) in UX45
- ✓ Preparation for UL55 platform UL55 at LS2

LS 2 TIMELINE



End-of-LS2 virtual ceremony on 4th December 2020

LS 2 - Maintenance

Cooling & Ventilation and Cryogenics



CV maintenance



CRG maintenance



CV maintenance



CRG maintenance



LS2 – Consolidation, Maintenance and Test

Cabling and Optical Fibers campaigns, EN-EL networks (400 kV, 66 kV, 18 kV), diesel power stations, UPS, 18 kV and transformers



18 kV switchgear maintenance



UPS battery maintenance



EHT4 400kV transformer



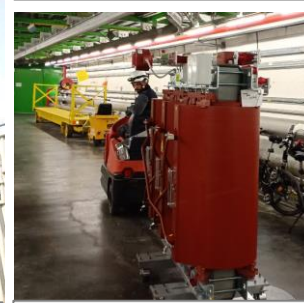
Primary 18kV substation -ME9/ consolidation & upgrade



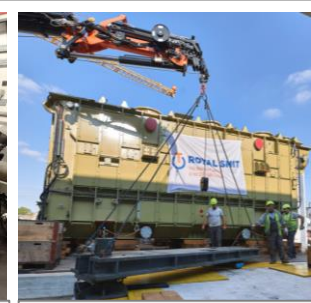
66kV Bus bars fixing



CERN wide AUG tests



LHC dry transformer



BE2 new 400kV substation



Meyrin diesel power station consolidation



Cable and Optical fibre campaigns

LS2 - Consolidation

6 LHC Lifts replacement, Access system upgrade and WCC hose replacement
R2E & Power Converters upgrade



PAD-MAD UL55 renovation



PAD-MAD PM25 upgrade works



WCC hose replacement



installation of new racks 600A



R2E: installation of new racks 600A



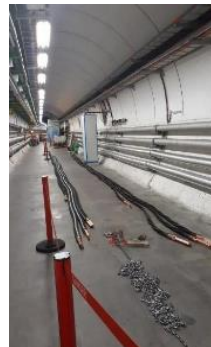
PM65 replacement



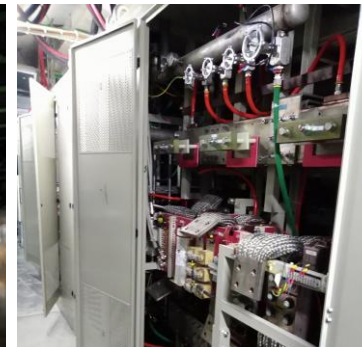
MAD Upgrade



PAD-MAD PZ65 upgrade



WCC hose replacement



Water Cooling plate exchanged



R2E: installation of new racks 600A

LS2 - Consolidation

Beam Vacuum activities, Beam instrumentation upgrade and Machine protection DYPQ upgrade



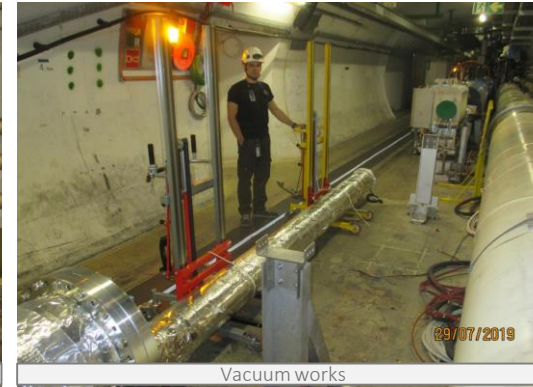
Vacuum works



Vacuum works



Vacuum works



Vacuum works



Vacuum works



BGC installation



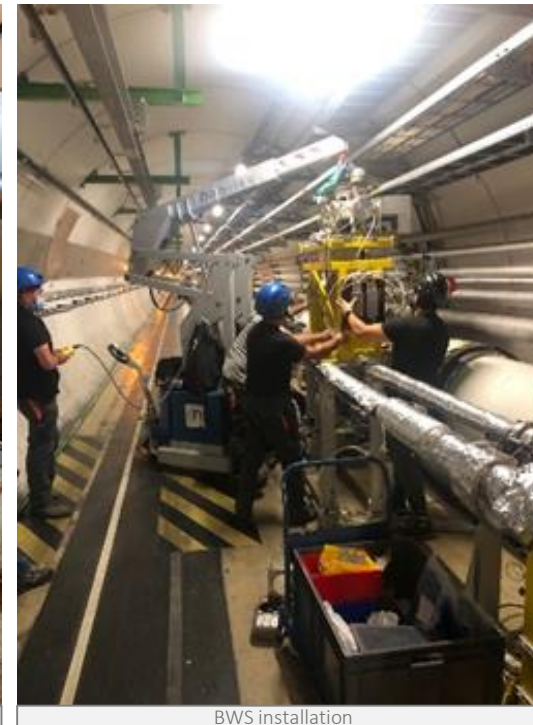
BGC works preparation



Interferometer installation



BPMWL A5L8 installation



BWS installation



DYPQ racks removed and re-installed

LS 2 – DUMP activities

Installing new dumps in their new frames, remove spare dump for upgrade, welding process, store ex-operational dumps at UX65 and UD68 dump autopsy



Dumps new frames



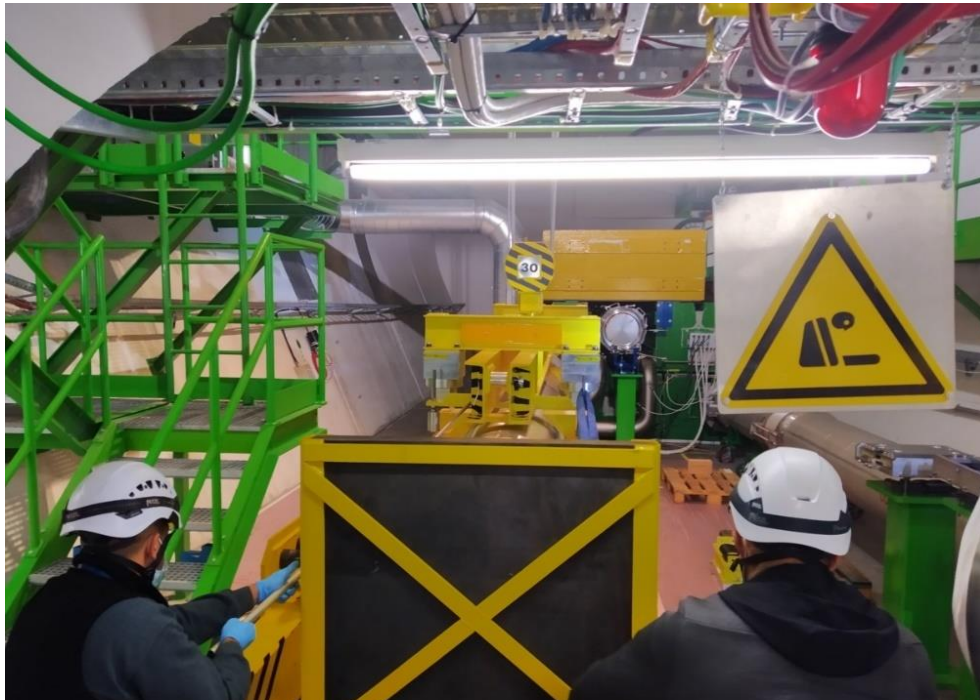
Dumps transport



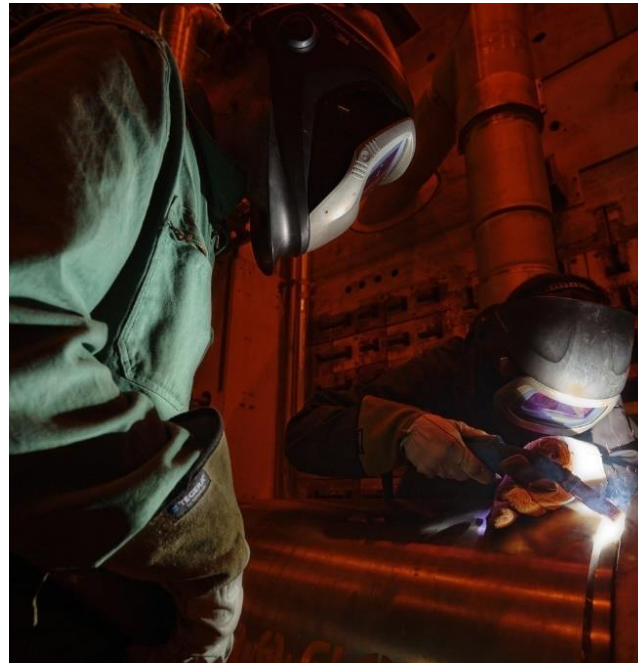
New dumps installation



New dumps transport



Remove spare dumps for updating



Welding process



Ex-operational dumps store at UX65

LS 2 – LIU collimators in T12 and T18

6 TCDIL installed in T12 & 6 TCDIL installed in T18



Collimators installation



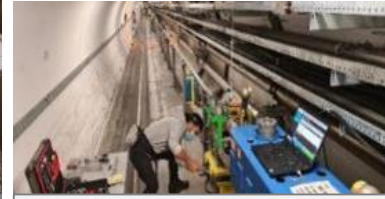
Collimators T12-T18 ready to be installed



Collimators installation



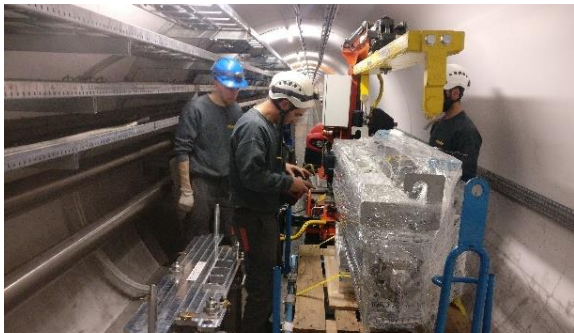
Collimators installation



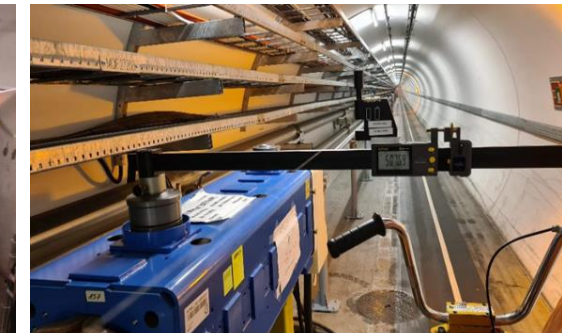
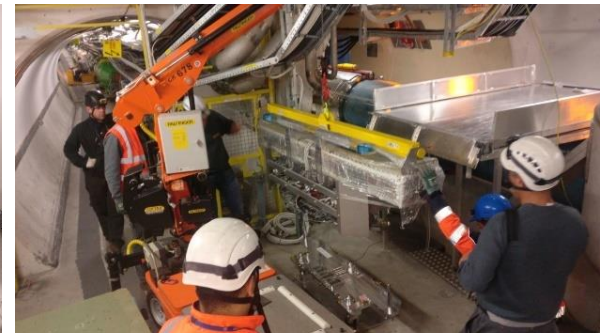
T12 alignment



Collimators installation



Collimators installation



T12 alignment



Collimators installation

LS2 – DIS MAC & Magnets replacement

1232 dipoles

150 people

4 CERN departments

External firms

4 institutes worldwide

March 2019-October 2020



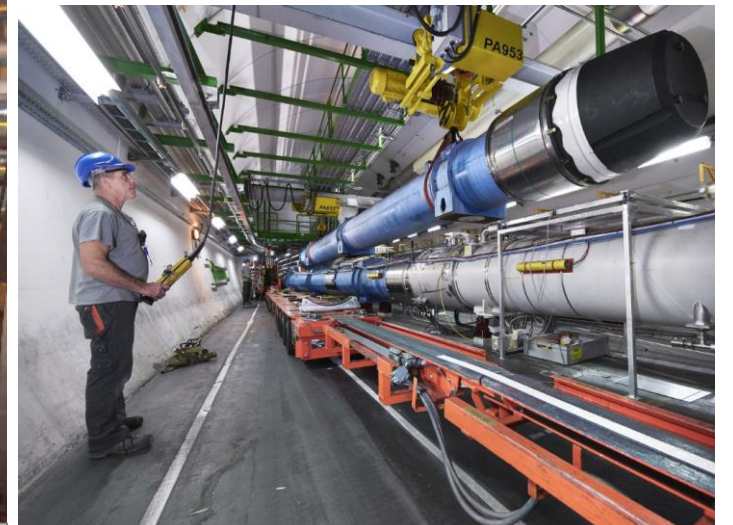
Diode box



Coriolis flowmeter



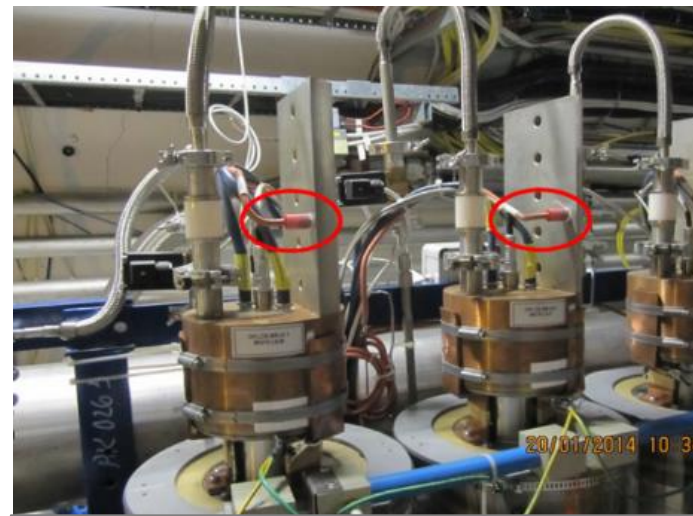
CC installation in P2



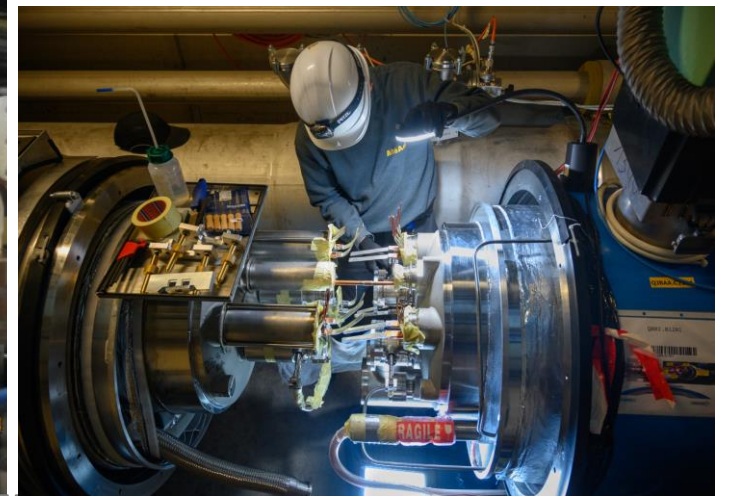
Magnet exchange campaign



Diode consolidation



Current lead maintenance

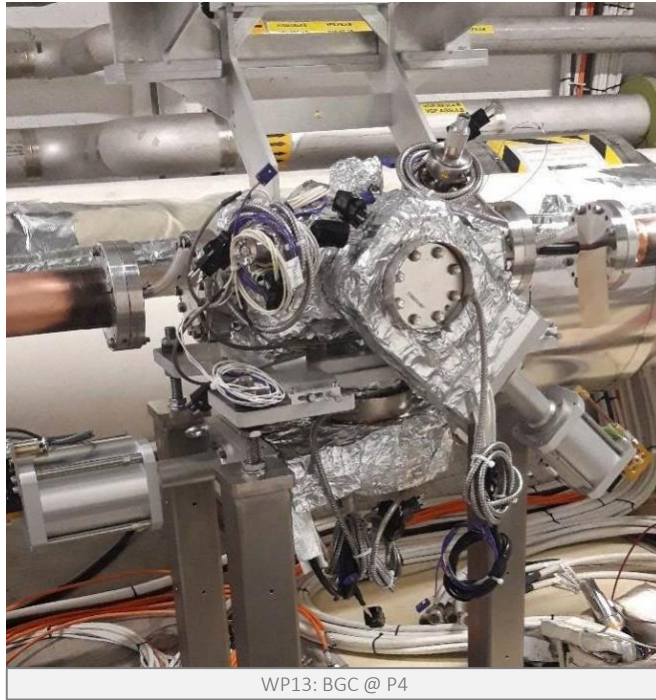


Interconnection works for diode consolidation



LS2 – HL-LHC activities

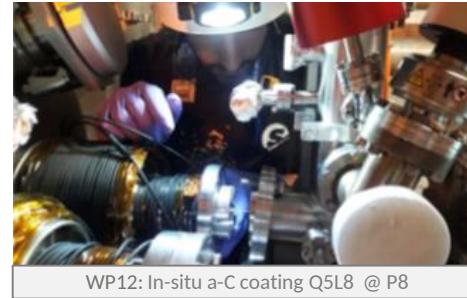
WP5: 2 TCLD @ P2 and 8 TCSPM @ P7; WP8: TANB @ P8; WP9: Cold box @ P4; WP11: Cryostat and by-pass connection @ P2;
WP12: In-situ a-C coating Q5L8 @ P8; WP13: BGC and BSRT halo monitoring @ P4; WP14: TCLIA @ P2 and TDIS @ P2/8



WP13: BGC @ P4



WP5: TCSPM @ P7



WP12: In-situ a-C coating Q5L8 @ P8



WP11: Cryostat connection @ P2



WP5: TCLD @ P2



WP9: Cold box @ P4



WP11: By-pass connection @ P2



WP14: TCLIA @ P2



WP13: BSRT halo monitoring @ P4



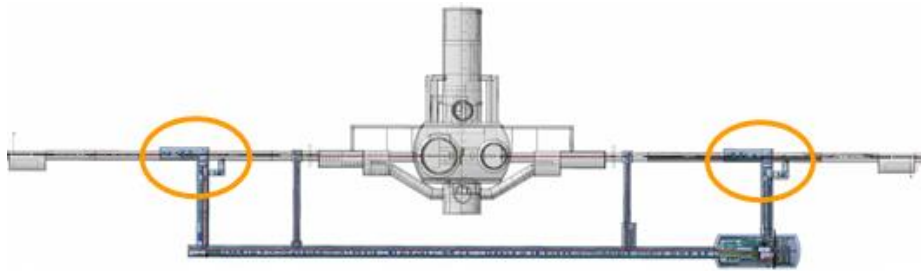
WP8: TANB @ P8



WP14: TDIS @ P2 and @ P8

LS 2: HL -LHC WP17 UPRs connections

LHC new galleries excavation, connections with LHC tunnel, services installation



Cable trays installation



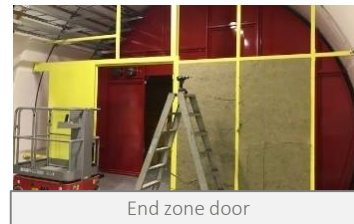
CV pump installation



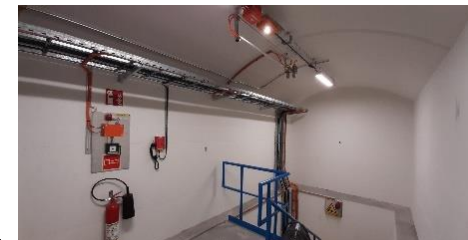
UPR17 opening



Sector door



End zone door



Safety equipment installation



UPR53 opening



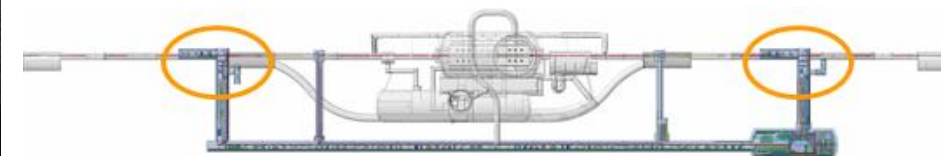
Fire resistant door



Civil Engineering works



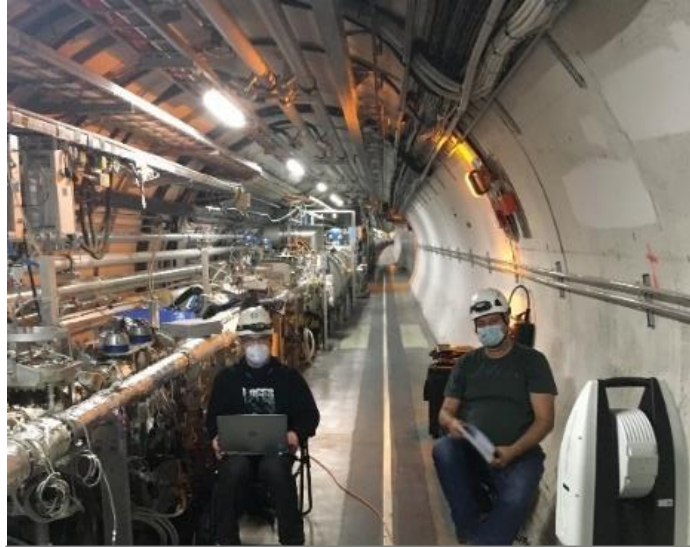
Ventilation fan



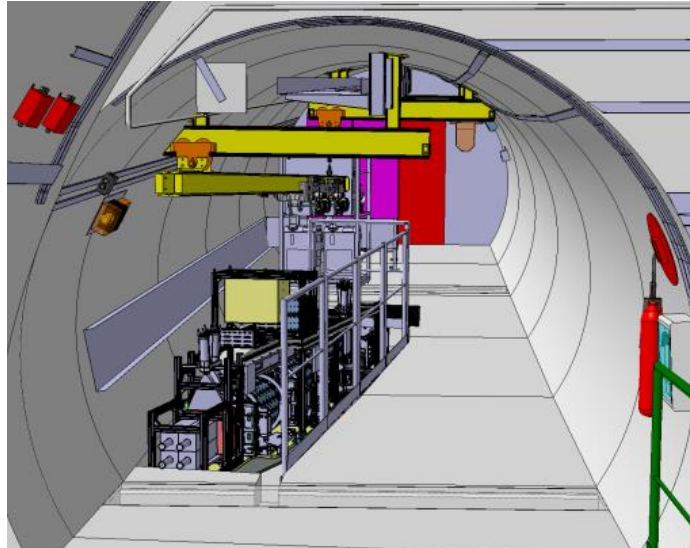
LS 2 – LHC Experiments : FAS ER, TOTEM, AFP



AFP activities



TOTEM calibration



FASER



LS 2 – Additional activities

RF cryo module replacement, Open Days & VIP visits, Alignment TI2 and 13kA SCT



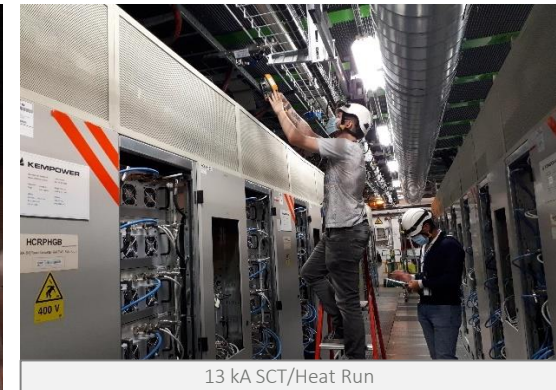
RF cryo module transport



RF cryo module replacement



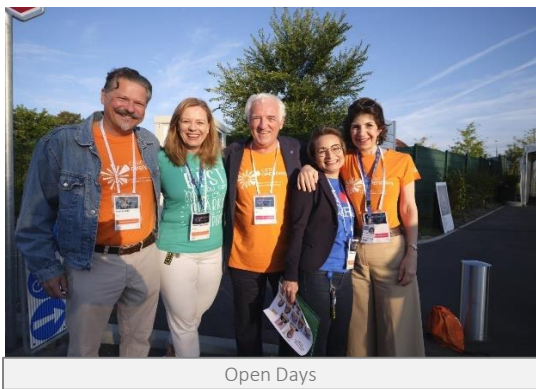
13 kA SCT/Heat Run



13 kA SCT/Heat Run



TI2 Alignment



Open Days



Open Days – Main entrance



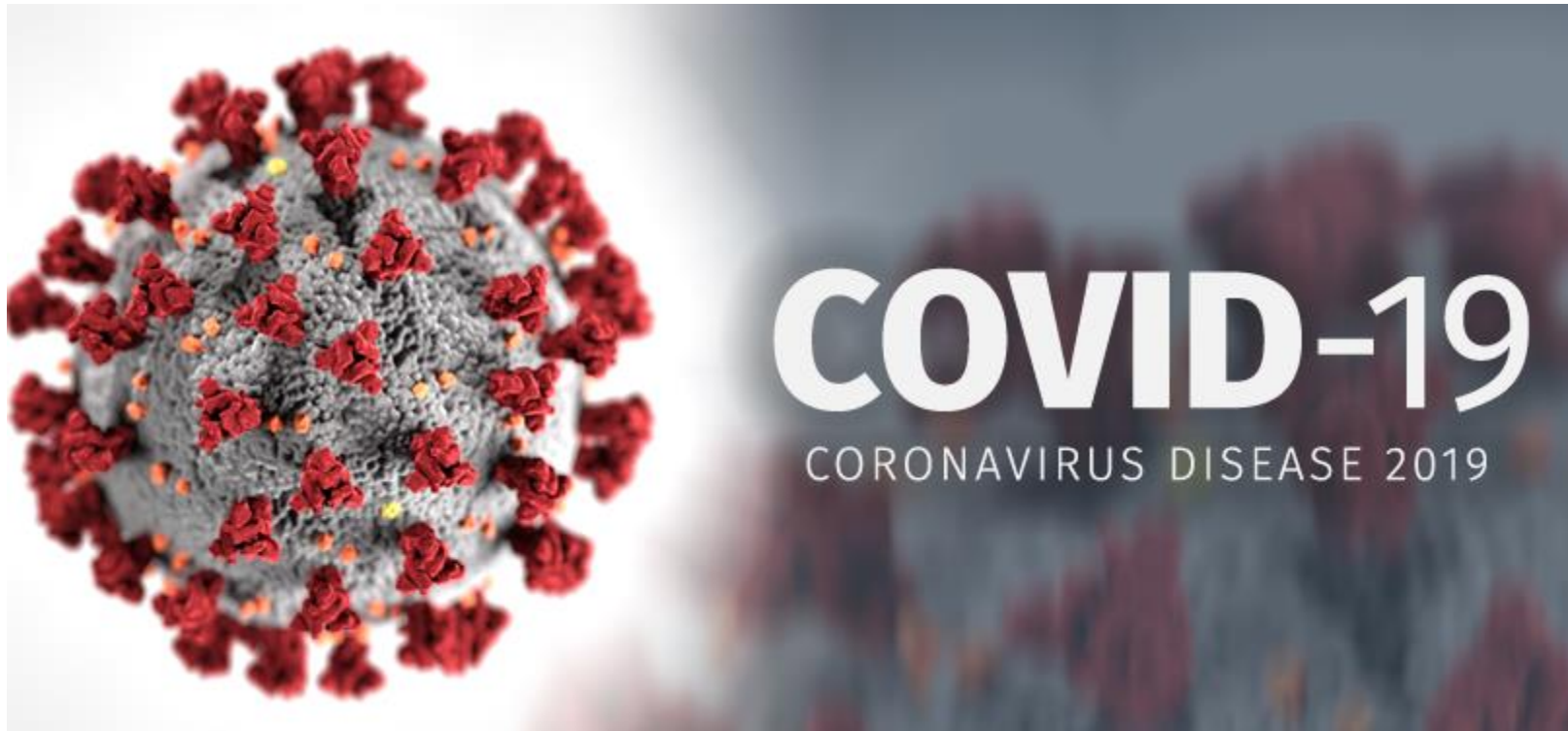
Open Days – Visit P6



13 kA SCT/Heat Run

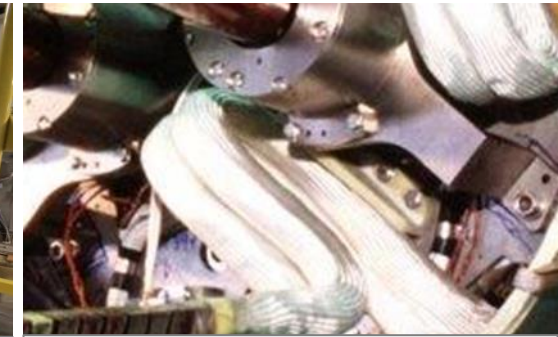
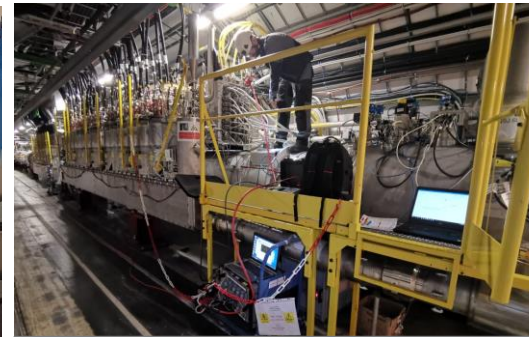
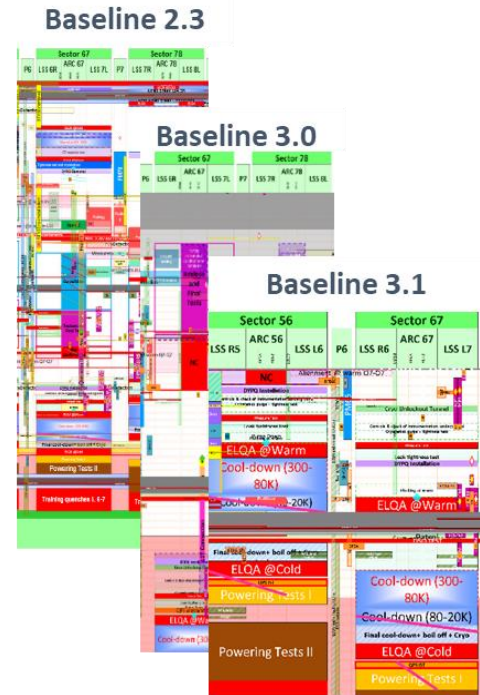


LS2 - Unexpected



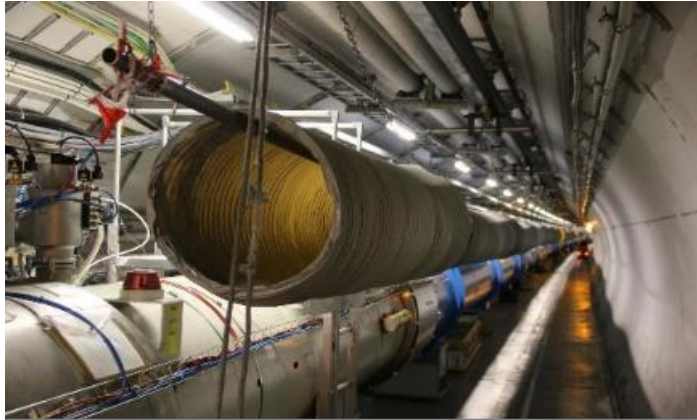
LS2 - Unexpected

Life during COVID, 11T Readiness, C16L2 beam screen consolidation, HV Cryo connectors, QRL leak in S81 and short circuit in S81



LS 2 – Machine preparation beginning and end of LS 2

Warm-up, ELQA, Survey and Cool-down



EN-SMM measurement and alignment campaign



EN-SMM



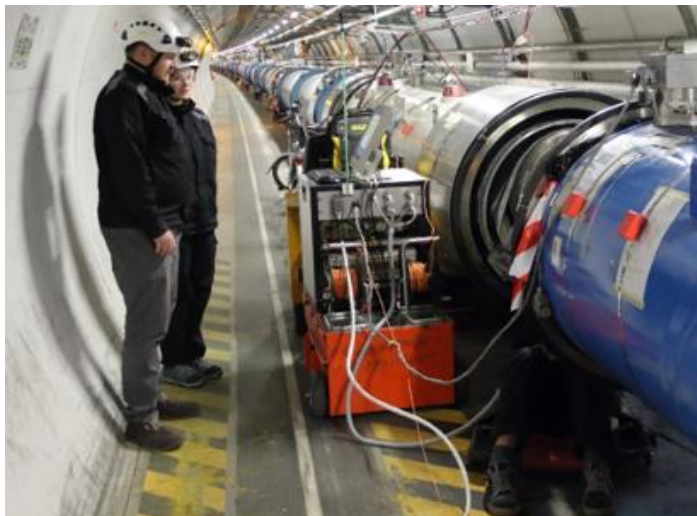
EN-SMM



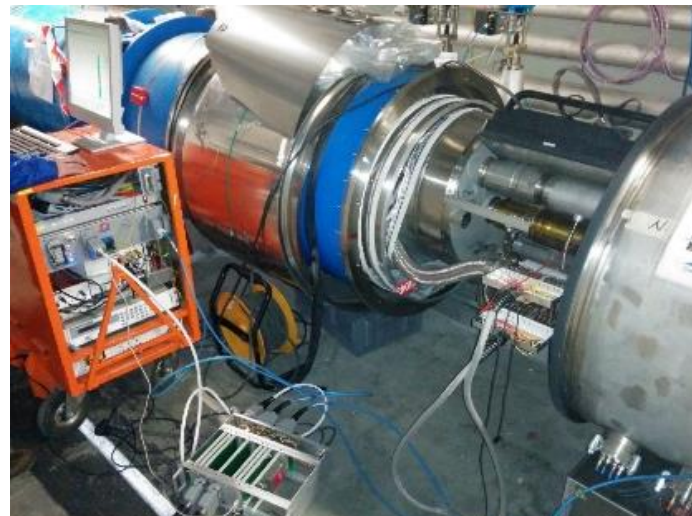
EN-SMM



Ghe for LHC pressure test



ELQA measurements



ELQA test after magnet exchange

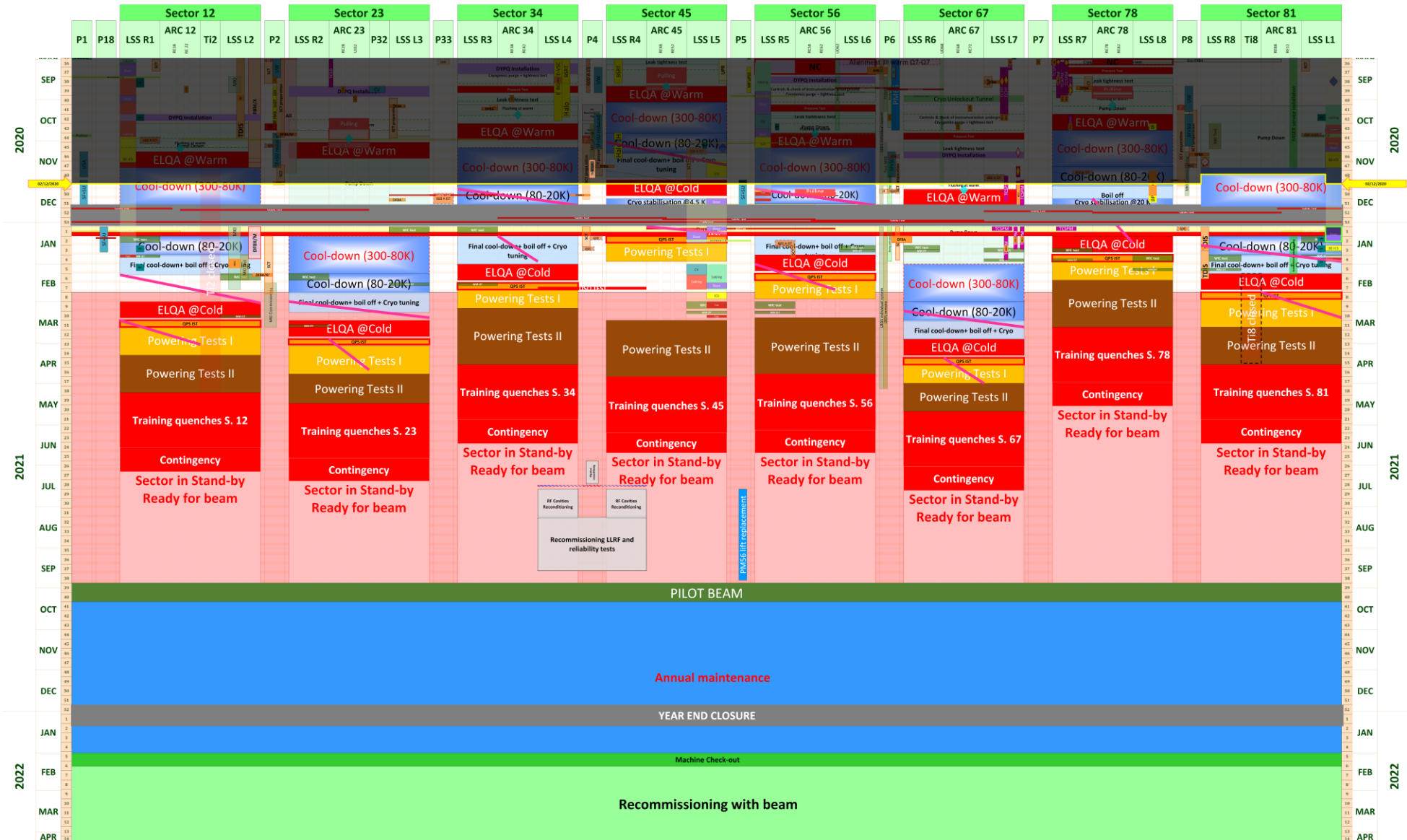


LN2 truck delivery



Last Pressure test in Sector 67

FUTURE LHC TIMELINE: Baseline 4.0 at 2nd Dec 2020



***THANK YOU !!!
MERCII !!!***



LS2

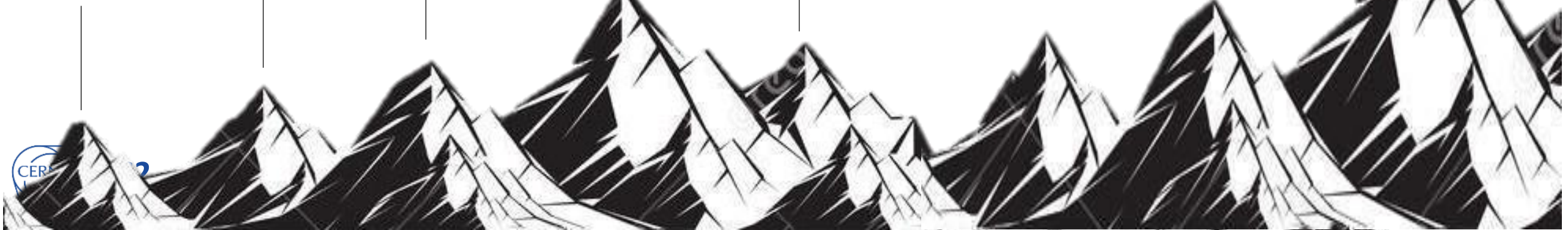
LS3

**YETS
2017/2018**

**EYETS
2016/2017**

**Annual
Maintenance 2021**

**YETS
2015/2016**





Attendees list of LHC LS2 coordination meeting

Name	Group
ANDREAZZA, William	BE-BI-ML
ARROYO GARCIA, Jonas	BE-ICS-SDS
BIBBI, James	BE-RF-PM
BJORK, Magnus	BE-CO-IN
BOOTH, William	BE-ICS-PCS
BRADU, Benjamin	BE-ICS-PCS
BRAVIN, Enrico	BE-BI-PM
BROCA, Nicolas	BE-ICS-AS
CALVO, Eva	BE-BI-BL
CIPOLLA, Gino	BE-RF-PM
COPY, Brice	BE-ICS-CIC
DEHAVAY, Claude	BE-CO-IN
DI LUCA, Serge	BE-ICS-AC
GAIGNANT, Christelle	BE-ASR-SU
GRAU, Silvia	BE-ICS-ACE
HAKULINEN, Timo	BE-ICS-CSE
HATZIANGELI, Eugenia	BE-BE-CO
JAKOBSEN, Sune	BE-BI-PM
KOZSAR, Ioan	BE-CO-SRC
LADZINSKI, Tomasz	BE-ICS-CSE
LANDRE, David	BE-RF-CS
MAGAGNIN, Paolo	BE-BI-ML
MARTINEZ YANEZ, Pablo	BE-RF-MK
MIARNAU, Ana	BE-BI-ML
NIELSEN, Jesper	BE-OP-TI
NINET, Benjamin	BE-CO-IN
NININ, Pierre	BE-ICS-CSE
POJER, Mirko	BE-OP-LHC
PRUNEAUX, Clement Daniel	BE-OP-TI
RAFFOURT, Denis	BE-ICS-AS
REDAELLI, Stefano	BE-ABP-HSS
ROSSI, Adriana	BE-ABP-HSS
SALVACHUA, Belen	BE-BI-BL
SCHMITT, Franck	BE-ICS-AC
SCHNEIDER, Gerhard	BE-BI-ML
SCHWERG, Nikolai	BE-RF-SFR
SOLFAROLI CAMILLOCCI, Matteo	BE-OP-LHC
SUYKERBUYK, Ronaldus	BE-OP-LHC
TRZEBINSKI, Maciej	BE-CO-APS
TURAJ, Katerina	BE-RF-SRF
VENESS, Raymond	BE-EBI-ML
VEYRUNES, Eric	BE-OP-SPS
WIGHAM, Morgan	BE-RF-PM
ZAMANTZAS, Christos	BE-BI-BL

Name	Group
ALCAIDE LEON, Marta	EN-ACE-OSS
ANDRE, Louis-Frederic	EN-DHO
ARNAU IZQUIERDO, Gonzalo	EN-MME-MM
ARNAUD, Michel	EN-ACE-COS
BARBERAN MARIN, Maria	EN-ACE-OSS
BERNARDINI, Marzia	EN-ACE-OSS
BERTOLASI, Stefano	EN-EL-HT
BONNET, Michel	EN-ACE-COL
BOURREL, Thierry	EN-EL-BT
BOZZINI, Davide	EN-EL-DDO
BUSTAMANTE, Sebastien	EN-ACE-OSS
CALVIANI, Marco	EN-STI-TCD
CHAREYRE, Vincent	EN-EL-BT
CHARRONDIERE, Cedric	EN-STI-ECE
CHARVET, Thierry	EN-EL-BT
CHEMLI, Samy	EN-ACE-POP
CORSO, Jean-Pierre	EN-ACE-INT
COSTA MACHADO, Simao Pedro	EN-EL-CF
COUPARD, Julie	EN-ACE-OSS
CRESPO-LOPEZ, Olivier	EN-CV-LHC
CROMMELINCK, Carl	EN-EL-CO
CUMER, Gerard	EN-ACE-OSS
DE JONGHE, Jurgan	EN-ACE
DE MAN, Sven	EN-STI-TCD
DE MAYNARD, Henry	EN-EL-OP
DECREUSE-MICHAUD, Rachelle	EN-ARP-ADM
DELEVAL, Serge	EN-CV-OP
DEVINE, James Dilwyn	EN-EL-BT
DOS SANTOS, Nuno	EN-EL-BT
DRIDI, Ali	EN-CV-DOW
ETHERIDGE, John Robert	EN-ACE-OAS
FERAL, Bruno	EN-HE-HM
FOLCH, Ramon	EN-HDO
FUCHS, Jean-Frederic	EN-SMM-SU
FUMEY, Sylvain	EN-HE-HH
GIRARDOT, Gael	EN-EL-FC
GONZALEZ PUERTAS, Antonio	EN-EL-FC
GRILLOT, Serge	EN-ACE-COS
HAMY, Andy Jose Nicolas	EN-EL-OP
HERTY, Andreas	EN-SMM-SU
INFANTE, Sonia	EN-EL-CO
JEDREJ, Bertrand	EN-EL-BT
JOSA, Francisco	EN-CV-DOW

Name	Group
JUILLARD, Jean	EN-EL-OP
LAFARGE, Damien	EN-HE-HEM
LAMAS GARCIA, Inigo	EN-STI-TCD
LANGLOIS, Raphael	EN-CV-LHC
LEHTINEN, Jani	EN-CV-OP
LENDARO, Jerome	EN-STI-ECE
LOJON, Mickael Bertrand	EN-EL-OP
LUPKINS, Yann	EN-CV-DOW
LUQUE, Maria	EN-EA-EP
MARIN, Antonio	EN-ACE-SU
MEROLI, Stefano	EN-EL-CF
MOUCHE, Bruno	EN-EL-OP
MUTTONI, Yvon	EN-ACE-INT
NONIS, Mauro	EN-CV
PANIGONI, Jérôme	EN-ACE-COS
PAULAT, Emmanuel	EN-ACE-COS
PELLETIER, Serge	EN-HE-HH
PEREZ, Nicolas	EN-HE-HEM
PERILLO MARCONE, Antonio	EN-STI-TCD
PERROT, Anne-Laure	EN-ACE
PATROIX, Miriam	EN-DHO
PIGUIET, Aline-Marie	EN-MME-MM
PORRET, Alexandre	EN-MME
RIGOLLET, Mathieu	EN-EL-EIC
RODRIGUEZ FERNANDEZ, Jorge	EN-EL-CF
SAINT SULPICE, Bruno	EN-EL-OP
SERAPHIN, Yann	EN-HE-HH
VINCENT, Patrick	EN-ACE-COS
BAECHLER, Joachim	EP-EP-CMT
BALLY, Stephane	EP-CMX-SCI
BARDO, Laetitia	EP-CMX-SCI
DAVENPORT, Martyn	EP-DT-PT
DEILE, Mario	EP-EP-CMT
DUPONT, Niels	EP-CMX-SCI
FASSNACHT, Patrick	EP-EP-ADO
GASTAL, Martin	EP-CMX-SCI
HOPCHEV, Plamen Hristov	EP-EP-ULB
JAEKEL, Martin Richard	EP-EP-AGS
MILANOVIC, Marko	EP-UAT
RAVOTTI, Federico	EP-DT-DD
RAYMOND, Michel	EP-ADO-PO
REEVES, Kendall	EP-UAT
RIEGLER, Werner	EP-EP-AIO

226 people

Attendees list of LHC LS2 coordination meeting

Name	Group
ADORISIO, Cristina	HSE-RP-AS
ARREGUI REMENTERIA, Carlos	HSE-SEE-XP
BALLE, Christoph	HSE-SEE-ST
BALTASAR DOS SANTOS PEDR, Fernando	HSE-SEE-XP
CENNINI, Enrico	HSE-HSE-SEE
DELAMARE, Christophe	HSE-DI
HEHNEN, Tristan	HSE-SEE-XP
HERVE, Angelito	HSE-RP-AS
JUILLIEN, Jean-Paul	HSE-SEE-SI
PROTZ, Sebastian	HSE-SEE-XP
ROESLER, Stefan	HSE-RP-AS
SEGURA MILLAN, Gustavo	HSE-SEE-CO
TISON, Olivier	HSE-SEE-SI
TROMEL, Christophe	HSE-RP-AS
VINCKE, Heinz	HSE-RP-AS
BALAZS, Gyorgy	IT-CS-PO
CASENOVE, Stephane	IT-CS-DO
CHAPRON, Frederic	IT-CS-CE
HOSTALOT SANZ, Jordi	IT-EXT-NW
SIERRA MORAL, Rodrigo	IT-CS-TR
BIOT, Christophe	SMB-SE-CEB
CHAMEAUX, David Joseph Rene	SMB-SMB-SIS
MAGNIN, Frederic	SMB-SE-CEB
ATANASOV, Miroslav Georgiev	TE-ABT-SE
BAGLIN, Vincent	TE-VSC-VSM
BAJKO, Marta	TE-MSC-TF
BALLARINO, Amalia	TE-MSC-SCD
BAUCHE, Jeremie	TE-MSC-MNC
BECK, Richard	TE-CRG-ML
BOIVIN, Jean-Pierre	TE-VSC-ICM
BONETTI, Nicolas	TE-CRG-ML
BOTTURA, Luca	TE-TE-MSC
BOUCLY, Christophe	TE-ABT
BREGLIOZZI, Giuseppe	TE-VSC-BVO
BRESSON, Sebastien	TE-CRG-OA
BRODZINSKI, Krzysztof	TE-CRG-OA
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TOMMASINI, Davide	TE-MSC-MNC
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WEVERS, Ivo	TE-VSC-VSM
ZELKO, Nicolas	TE-VSC-BVO
ZYGARPOULOS, Lampros	TE-VSC-ICM

226 people

Ce que nous avons présenté c'est **VOTRE travail**.

Le travail de centaines de
Cernois, membres de Collaborations, Contractants, Fellows, FSU, PJAS

Chacun a contribué avec
passion, engagement et professionnalisme à la réussite de ce Long Shutdown 2!

C'était un défi magnifique que nous avons pu relever **ENSEMBLE !!!**

MERCI !!!

What we have presented is **YOUR** work.

The work of hundreds of
Cernis, members of Collaborations, Contractors, Fellows, FSU, PJAS

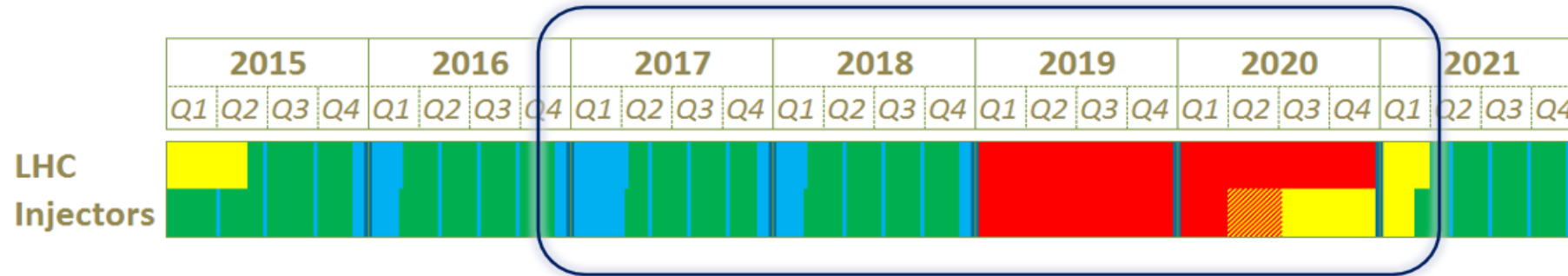
Everyone has contributed with passion, commitment and professionalism to the
success of this Long Shutdown 2!

It was a wonderful challenge that we were able to take on **TOGETHER!!!**

Thank you !!!

Overview

LS2 PERIOD



- Extended Year End Technical Stop 2016-2017
- Year End Technical Stop 2017-2018
- LS2



Marzia Bernardini - LHC Performance Workshop 2016

Photos and Films LS2

Courtesy Max. Brice and Paola Catapano

Installation of LHC's injection for the absorber TDIS at P8
<https://cds.cern.ch/record/2744978?ln=en>

Installation of LHC's injection for the absorber TDIS at P8
<https://cds.cern.ch/record/2744978?ln=en>
TDIS time-lapse mounting_16xFast · CDS Videos · CERN
<https://videos.cern.ch/record/2721012>

FASER : First phase of installation in the LHC tunnel
<https://cds.cern.ch/record/2744976?ln=en>

Storage for superconducting LHC magnets near SM18
<https://cds.cern.ch/record/2743293?ln=en>

TIM robot in the LHC tunnel
<https://cds.cern.ch/record/2743292?ln=en>

Final pressure test in the LHC in sector 6-7
<https://cds.cern.ch/record/2742898?ln=en>

HL-LHC P1 Group Photo
<https://cds.cern.ch/record/2735173?ln=en>

Upgraded LHC dump transport from UX65 to UD62 cavern
<https://cds.cern.ch/record/2734111?ln=en>

Installing the new upgraded dumps in their new frames
<https://cds.cern.ch/record/2729926?ln=en>

Installation in IR2 of Dispersion Suppressor Collimator (TCLD)
<https://cds.cern.ch/record/2725260?ln=en>

TDIS Installation Point 2
<https://cds.cern.ch/record/2723334?ln=en>

TDIS movement to P1
<https://cds.cern.ch/record/2723235?ln=en>

Handover between Lucio Rossi, HL-LHC Project Leader and his successor, Oliver Bruning – New connection between the HL-LHC UPR53 and the LHC tunnel at Point 5
<https://cds.cern.ch/record/2722346?ln=en>

Clean Room 867-R-P49 with TDIVG and people working
<https://cds.cern.ch/record/2722010?ln=en>

Installation of passive absorber mask TCAPM for warm magnet protection
<https://cds.cern.ch/record/2721185?ln=en>
<https://videos.cern.ch/record/2745909>

Welding process of the LHC beam dumps
<https://cds.cern.ch/record/2720481?ln=en>

Construction of surface buildings, underground cavern and galleries at LHC1 site for High-Luminosity LHC
<https://cds.cern.ch/record/2718818?ln=en>

Portrait of Marzia Bernadini in the LHC tunnel during LS2
<https://cds.cern.ch/record/2717880?ln=en>

Portrait of Marzia Bernadini in the LHC tunnel during the CERN restart COVID-19
<https://cds.cern.ch/record/2717879?ln=en>

Portrait of Amalia Ballarino and her team, Amalia is the project leader for superconducting electrical transmission line for the High-Luminosity LHC
<https://cds.cern.ch/record/2711436?ln=en>

Photos and Films LS2

Courtesy Max. Brice and Paola Catapano

HL LHC WP4 Cavity

<https://cds.cern.ch/record/2709094?ln=en>

Last diode installation in LHC 2020

<https://cds.cern.ch/record/2707761?ln=en>

Removal of spare LHC beam dumps for LS2 upgrades

<https://cds.cern.ch/record/2706998?ln=en>

Last bypass cryostat for IP2 collimators installation ready for transport to tunnel

<https://cds.cern.ch/record/2704594?ln=en>

HL LHC junction door with LHC - symbolic picture with CERN DG Fabiola Gianotti, Dr Frederic Bordry, Dr. Oliver Brüning, Dr Lucio Rossi

<https://cds.cern.ch/record/2704179?ln=en>

HL-HLC Opening the door

<https://cds.cern.ch/record/2704156?ln=en>

HL-LHC Cold box at Point 4

HL-LHC Boite froide au point 4

<https://cds.cern.ch/record/2703963?ln=en>

HL-LHC P1 Concrete coating

<https://cds.cern.ch/record/2702908?ln=en>

DISMAC : <https://videos.cern.ch/record/2742617>

DUMPS - Timelapse: <https://videos.cern.ch/record/2735174>

DUMPS Photos: <https://cds.cern.ch/record/2734111>, <https://cds.cern.ch/record/2729926>

LS2 Dismac project 1360 openings finished in LHC sector 1-2

<https://cds.cern.ch/record/2702384?ln=en>

Installation of two HL-LHC Connection Cryostats in 11L2 and 11R2

<https://cds.cern.ch/record/2700189?ln=en>

Installation of a New by pass near new cryostat intalled in 11L2

<https://cds.cern.ch/record/2699818?ln=en>

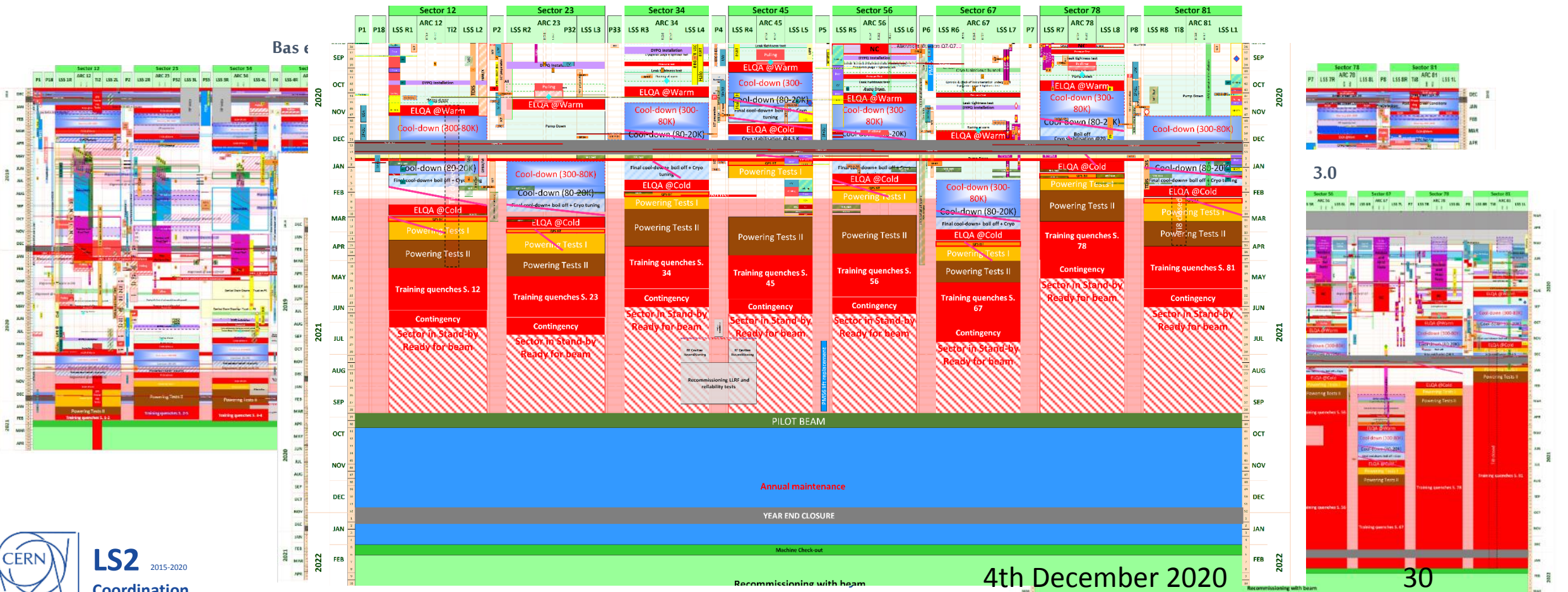
<https://cernbox.cern.ch/index.php/s/NDfOBmRZUNVLYsA>

LS2 TIMELINE - LS2 2018/22



3rd December 2018 – February 2022

Base line 3.1 Under approval



4th December 2020

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