

Framework Schedule from EYETS 2016 to LS2

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LHC Performance Workshop

Chamonix, 28th January 2016



ENGINEERING
DEPARTMENT

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General information

YETS and EYETS

- activities related to the regular maintenance
- length of the YETS and EYETS for the LHC and its Injectors

LS2

- Framework for the LHC
- Framework for its Injectors

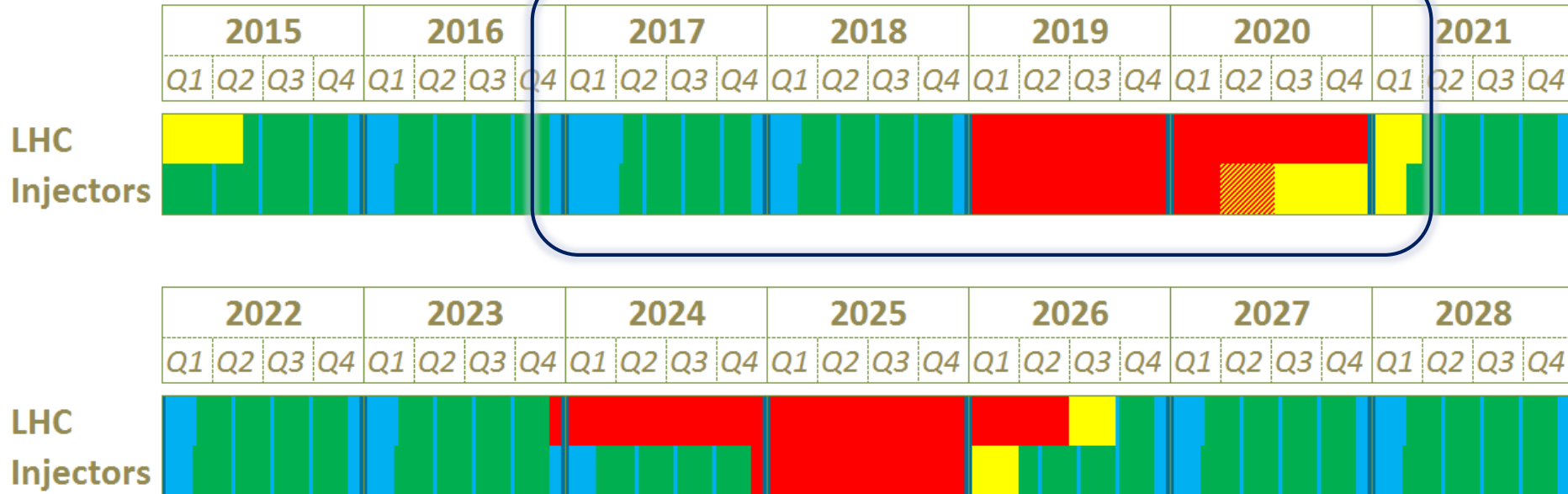
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LS2 PERIOD



The LS2 PERIOD includes:

- Extended Year End Technical Stop (EYETS) 2016-2017
- Year End Technical Stop (YETS) 2017-2018
- Long Shutdown 2 (LS2)

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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)

YETS duration: the frame

SPS

- Hardware tests (mainly magnet tests) before and after the shutdown
→ 2 wk
- CV maintenance for SPS (not including North Area) → 6 wk
- Activities related to Recommissioning by BE-OP → 3 wk can be considered as a baseline (this duration can evolve)
- The safety tests by BE-ICS and EN-EL

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 SPS is **13 wk*** (including the Christmas Break)

** The RP cool down period is not included*

YETS duration: the frame

PSB & PS

- Hardware tests (mainly magnet tests) before and after the shutdown → 1wk
- CV maintenance for PSB, PS, Linac2 and Linac4 (not including Isolde, AD, East Area, CTF3 and n-TOF) → 5wks
- Activities related to Recommissioning by BE-OP → 3wks can be considered as a baseline, but this duration can evolve
- The safety tests by BE-ICS and EN-EL

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 PS and the PSB is **11 wk*** (including the Christmas Break)

** The RP cool down period is not included*

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**.

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EDMS No.	REV.	VALIDITY
1470895	2.0	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.

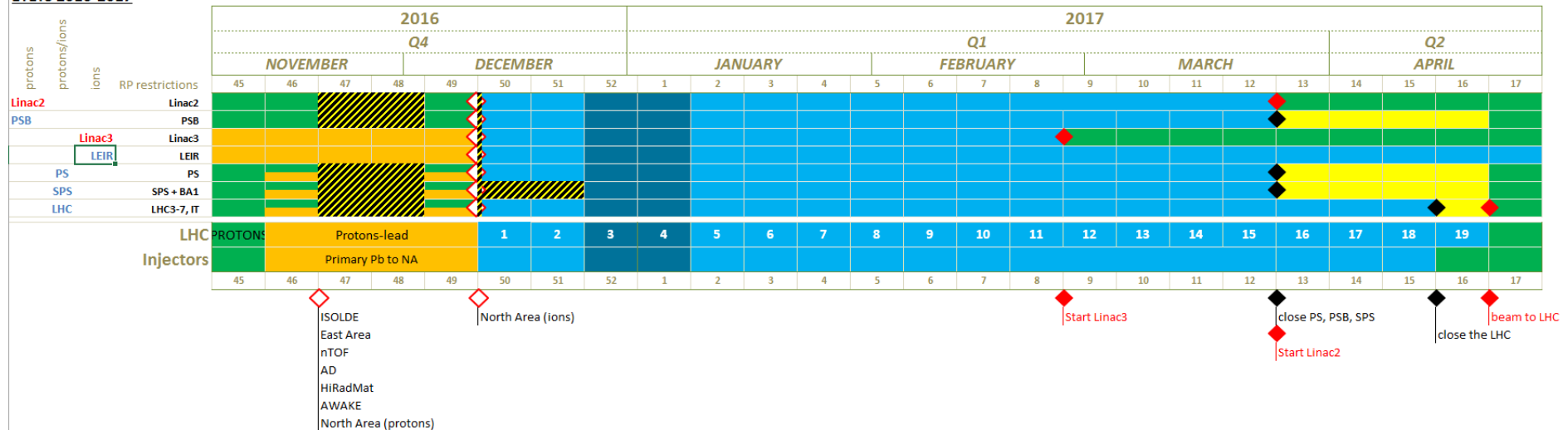
<https://edms.cern.ch/document/1470895/2.0>

EYETS 2016-2017

- For the LHC the duration of the EYETS is 19 wks
- For the SPS, PS and the PSB, the duration is aligned to the LHC. This is due to the requests concerning:
 - the decabling project and its implementation strategy;
 - the anticipation of LIU activities during the EYETS

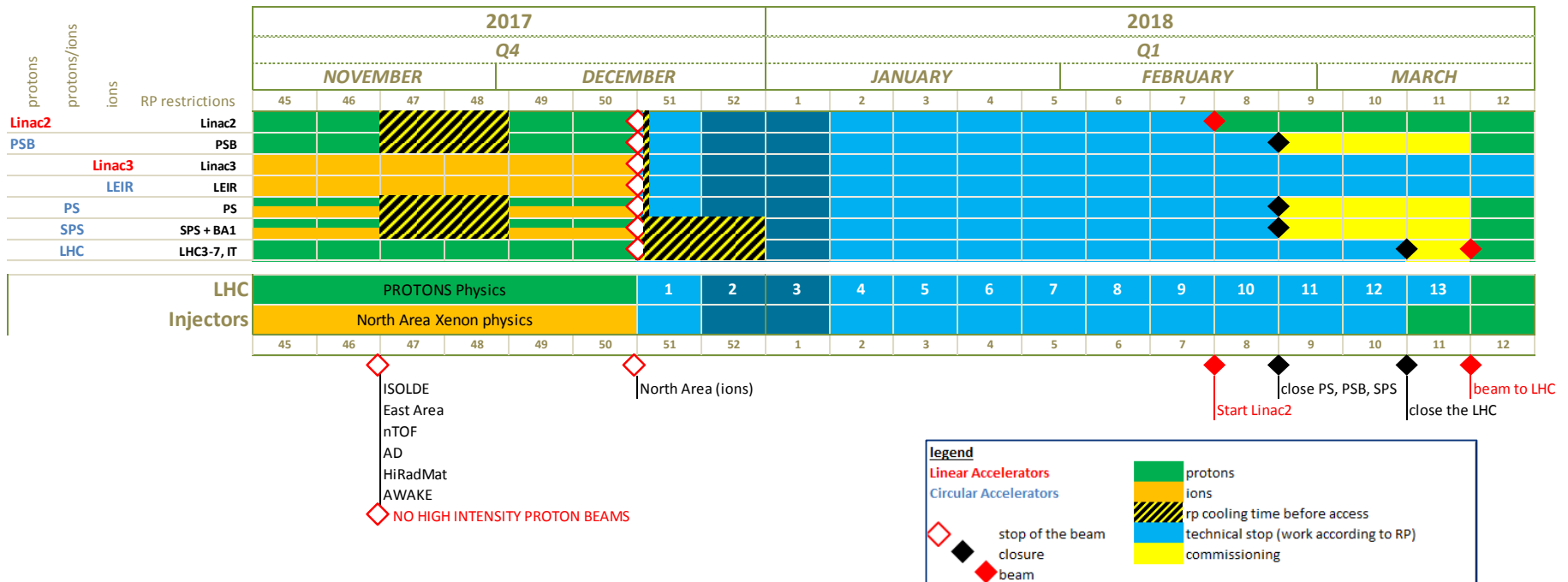
These durations includes the tests and HWC periods

EYETS 2016-2017



YETS 2017-2018

- For the LHC & the SPS: YETS kept to 13 wks
- For the PSB and the PS, the duration is aligned to the LHC and the SPS. This is due to the requests concerning:
 - the decabling project and its implementation strategy;
 - the anticipation of LIU activities during the YETS



Duration of YETS 2017-2018

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LS2 Framework for the LHC

During the LS2, three main categories of activities will be implemented

- Maintenance: *Cryogenics, Cooling and Ventilation, Vacuum, Electrical Systems, Collimation, Access System, Fire detection, ODH, ...*
- Projects: *HL-LHC*
- Consolidation & Other activities: *this could concern all equipment of the LHC machine*

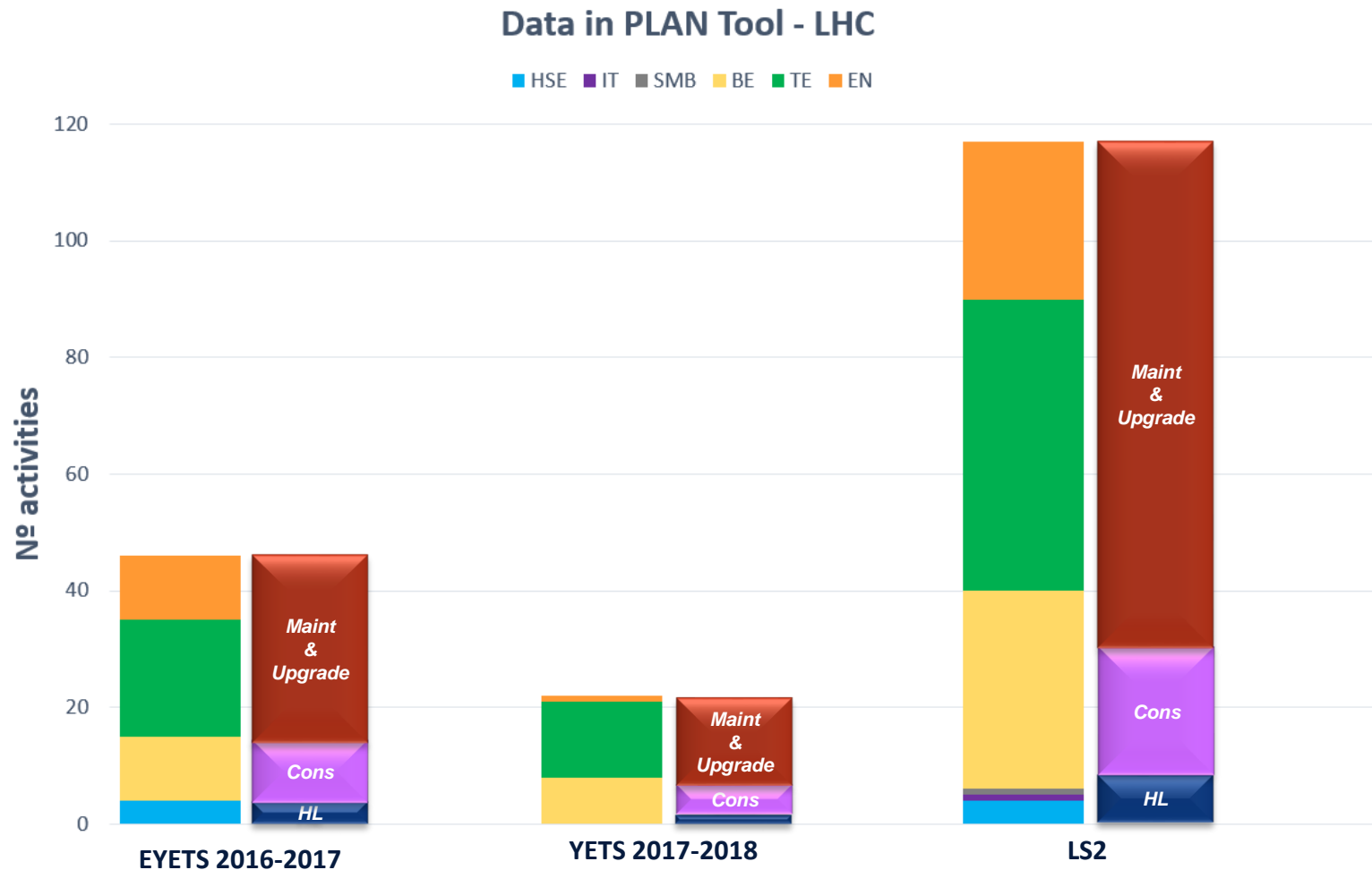
LS2 Days: <https://indico.cern.ch/e/436424>

The Baseline – as for Chamonix 2014 – foresaw a length of LS2 of 18 months, but following the requests of the HL-LHC project and the outcomes of the cost and schedule review, the Length of LS2 has been extended to 24 months.

PLAN tool is the database used to “build” the schedules concerning the LS2 period.

Inputs* in PLAN tool - LHC

** Only activities included, NO contribution*



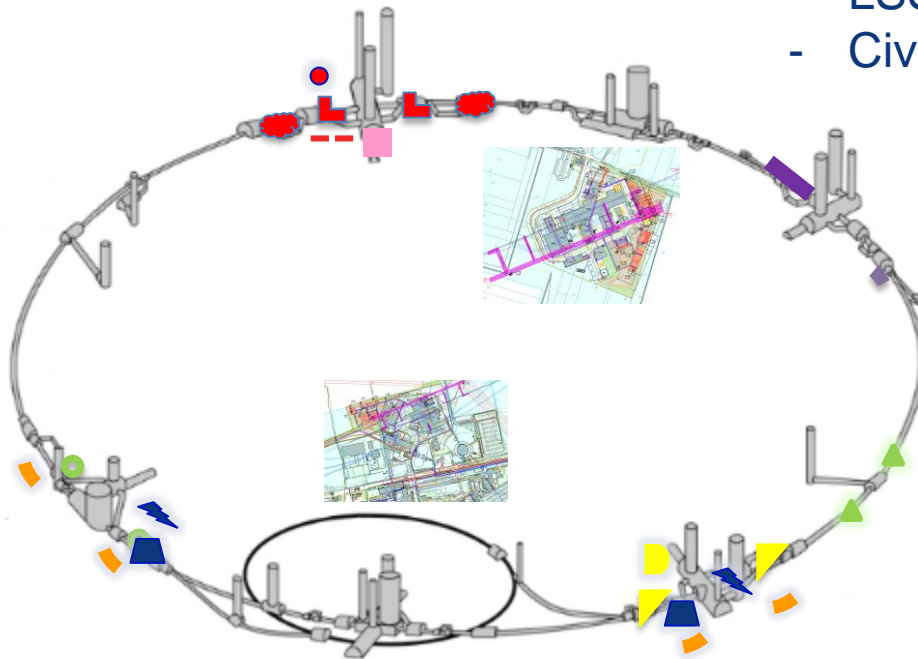
...not weighted data, but huge numbers related to maintenance & upgrade

HL-LHC Installation Overview for the LS2

Courtesy Paula Alvarez Lopez – LS2 Days

Activities in:

- LSSs 2, 4, 6 and 8
- Civil Engineering in Points 1 and 5



■ New transp. refrigerator

■ New Q5

▲ TCSPM

● Cryo-bypass+TCLD

■ In-situ a-C coating

■ Mask for D2

■ TAXN

-- Prep. works halo
diagnostic systems

● High bandwidth pick-ups

■ Fast wire scanners

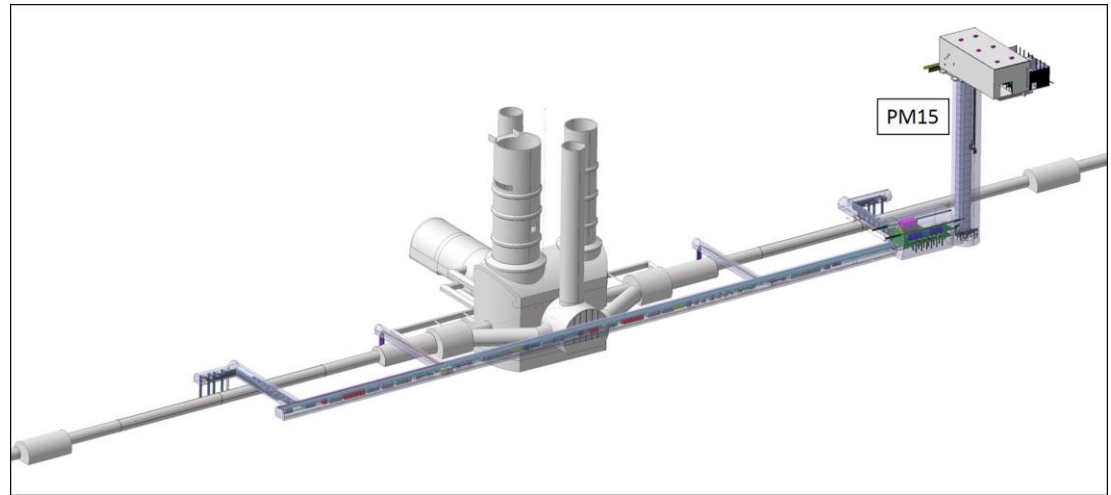
■ BGV

■ TDIS

■ Mask for D1

HL-LHC Civil Engineering @ P1 & P5

Courtesy Lucio Rossi – LS2 Days

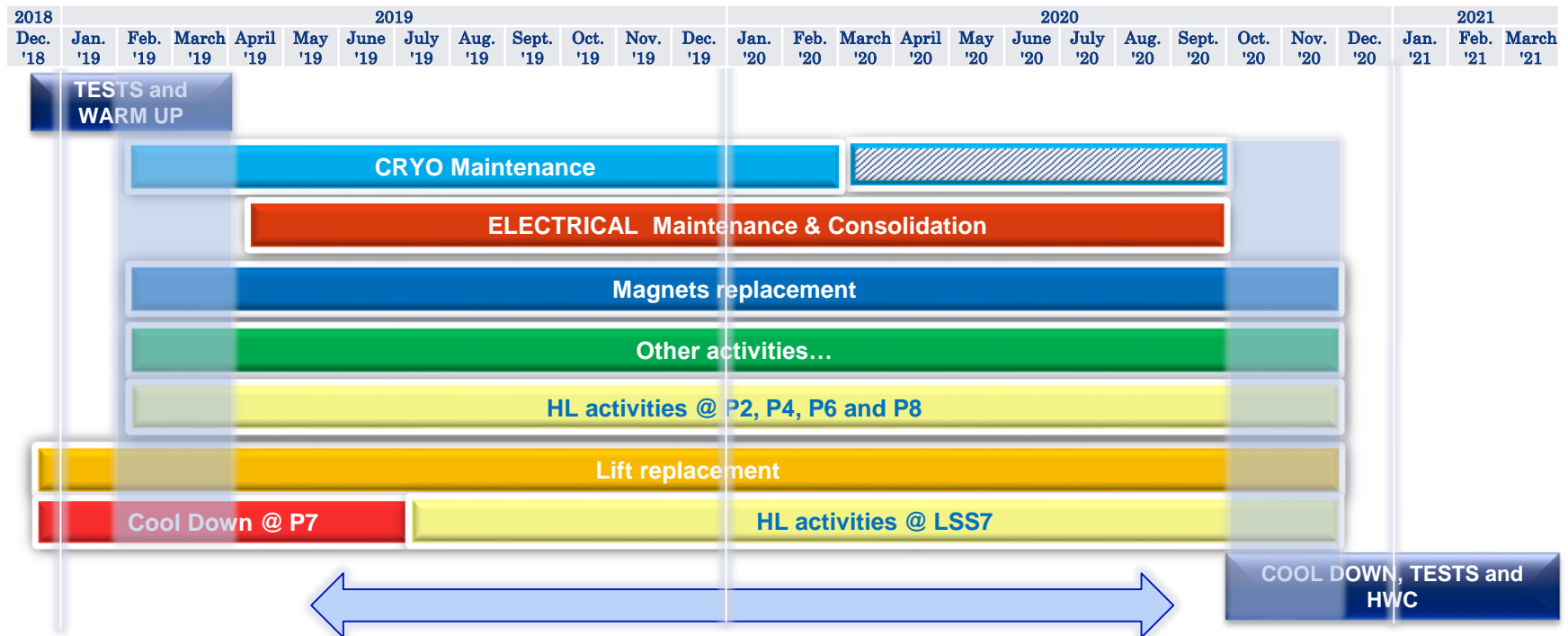


For HL-LHC, LS2 will be the period of D(TH)RILLING!

The impact and the final scope of the civil engineering works is not yet finalized

If the connections between the present LHC and the new galleries are realized during LS2, the impact on the other activities in Points 1 and 5 during LS2 needs to be assessed

LS2@LHC: Proposal of First Draft skeleton

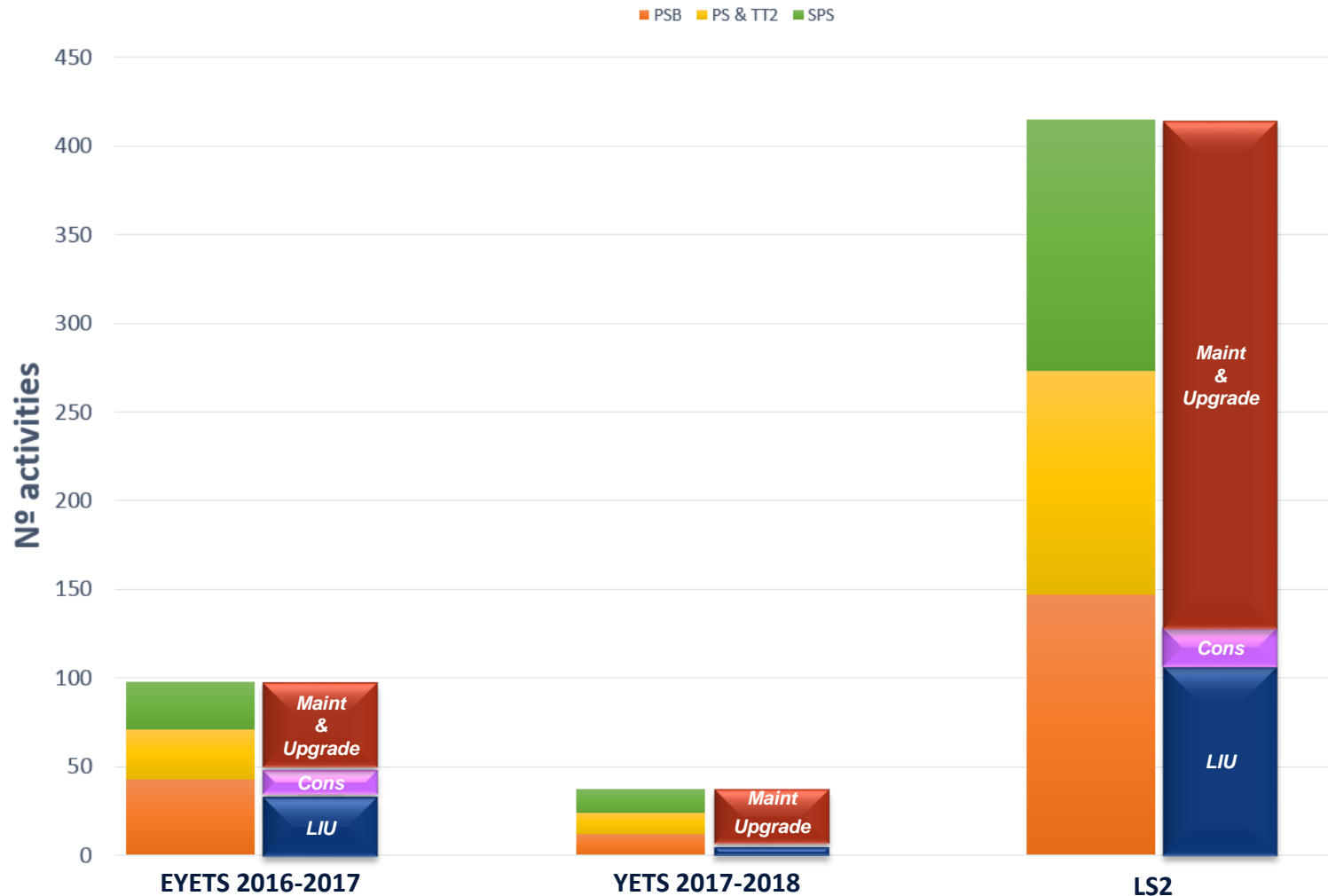


Depending on the cool down and warm up sequence,
the available window for the activities is between **18 to 22 months**

Inputs* in PLAN tool - Injectors

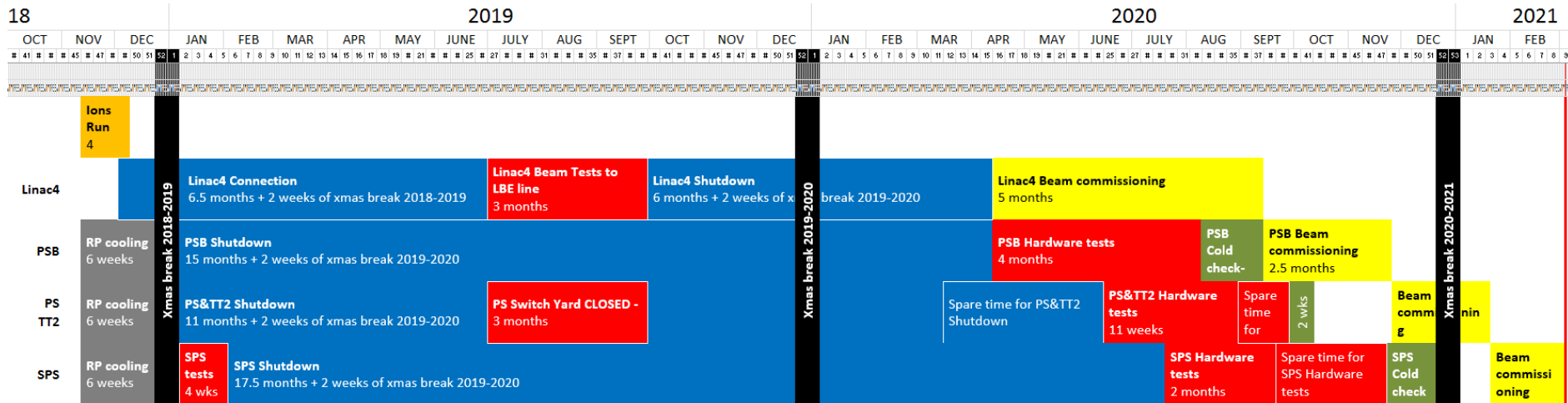
* Only activities included, NO contribution

Data in PLAN Tool - PSB, PS&TT2, SPS



LS2 Framework for Injectors

Defined by LIU project



Start of the LS2 for the Injectors:

- Surface activities for the Linac2, the Linac4 and the PSB machines will start in **November 2018 on surface**, during tunnel RP cooling.
- All other surface activities for the PS and the SPS will start at the end of the ion run, in **December 2018**.

Courtesy Julie Coupard

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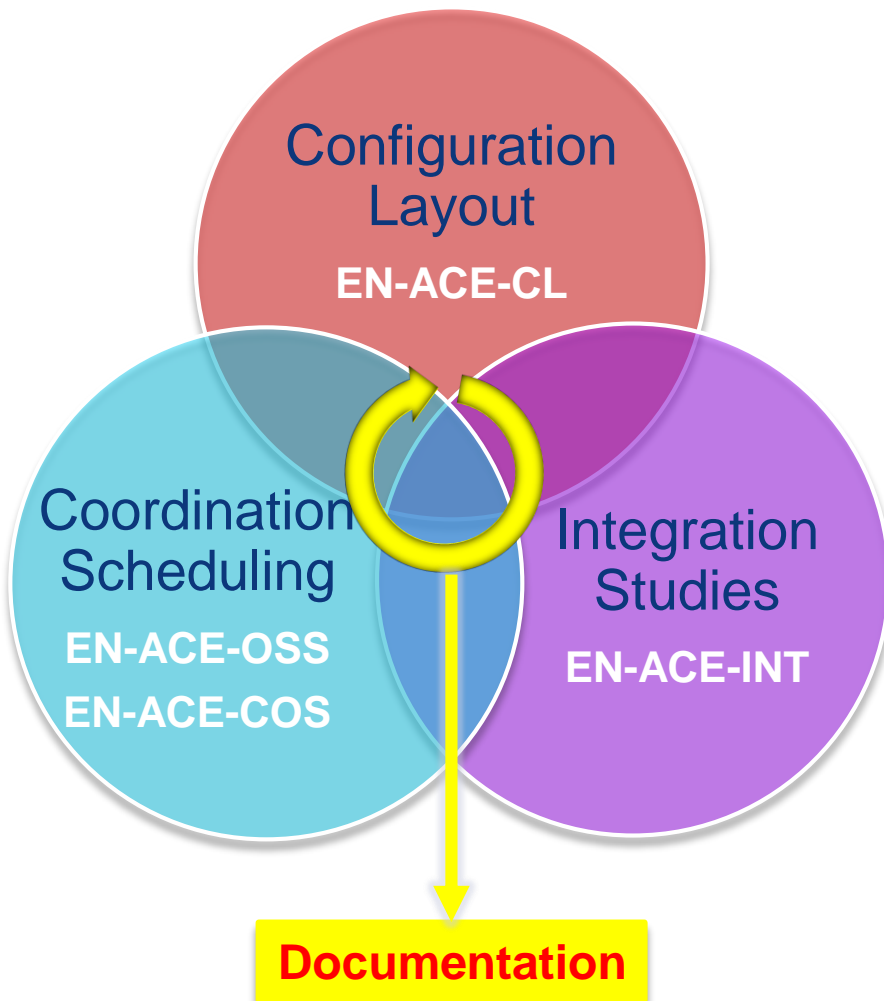
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Methodology and Interfaces with EN-ACE



Management of the configuration relative to the machines (*Space reservation, Engineering Change Request, Functional Specification, Engineering Specification, Installation Procedure, Tests Procedure etc...*)

Update of the layout databases

Central information of the 3D models between all design office (*services, mechanical etc...*)

Identification of the interferences
Non-conformities of installation

Central information of the activities to schedule taking into account the logistic and operational safety aspects

Follow-up of the documentation (*Space reservation, Engineering Change Request, Functional Specification, Engineering Specification, Installation Procedure, Tests Procedure etc...*)

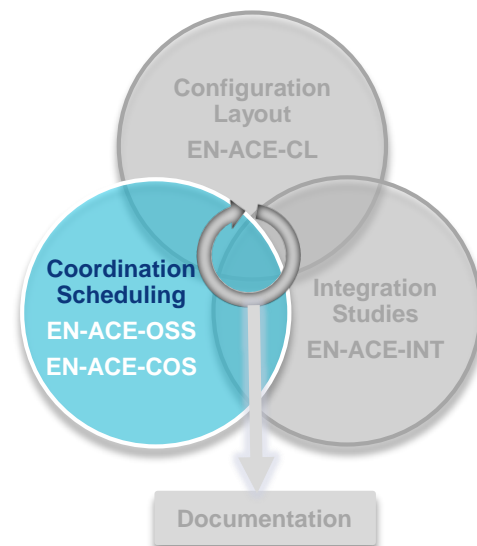
Follow-up of the Non-conformities of installation

Methodology and Interfaces with EN-ACE

COORDINATION & SCHEDULING

- Inside EN-ACE-OSS three working units
 - *the LHC*
 - *its Injectors (SPS, PS ring&TT2, PS Booster, Linac4)*
 - *the Projects (EHN1, SM18, De-cabling, ...)*
- Coordination meetings are held by the different **Facility Coordinators** to plan the activities during the YETS, the EYETS and the LS2
- Groups announce their activities (approved in PLAN tool) - technical, safety aspects and interfaces are discussed
- **Facility Coordinators** gradually refine the schedule and the organization
- VIC and Risk assessment: under the responsibility of the Works and Services Supervisor
GENERAL SAFETY INSTRUCTION GSI-WS-1
SAFETY COORDINATION FOR WORKS AND SERVICES
Implemented as from the 1st of June 2016

“Work and Services Supervisor: person under the responsibility of the Project Leader or the organic unit responsible for the contract who monitors a specific activity in an operation on behalf of CERN.”



GSI-WS-1 – Safety coordination for works and services
EDMS 1440245 ver. 1

Each operating entity participating in a Technical Stop shall:

- assess the risks connected with each of the activities it carries out and define the associated preventive and protective measures, documenting such provisions in writing and forwarding them to the organic unit responsible for the coordination of the Technical Stop;
- communicate with the organic unit responsible for the coordination of the technical stop to ensure that all the necessary provisions can be made in advance with regard to planning, managing and ensuring the safety of concurrent activities;
- take account of and implement any provision requested in the framework of coordination meetings and VICs;
- ensure that all of its own personnel are informed of Safety requirements and have all the necessary means to meet them.

Each one-off operation shall be the subject of a VIC when it is required by:

- the organic unit responsible for the coordination of the Technical Stop;
- any operating entity, particularly in the framework of work taking place adjacent to or above/below other work;
- any CERN Safety representative.

Each VIC shall be:

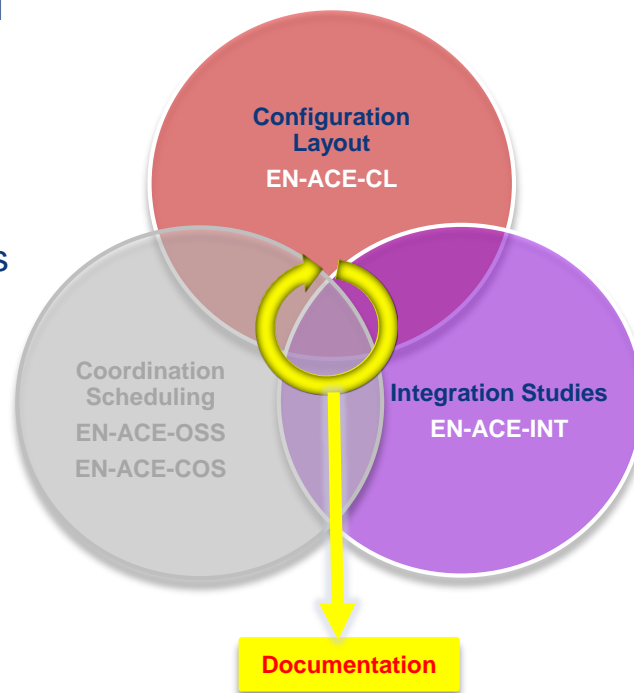
- organised and led by the Works and Services Supervisor, in the presence of a CERN Safety representative if the latter so requests;
- minuted using the announcement system for works and services and distributed via this system.

Methodology and Interfaces with EN-ACE

From Space Reservation (Project Phase) to ECR (Installation Phase)

Space reservation

- Existing situation and introduction
- Reason for change
- Detailed description
- Impact on other items
- References

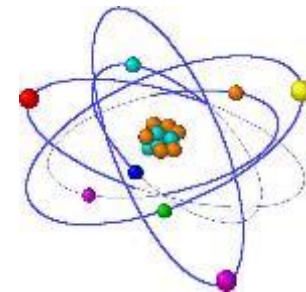
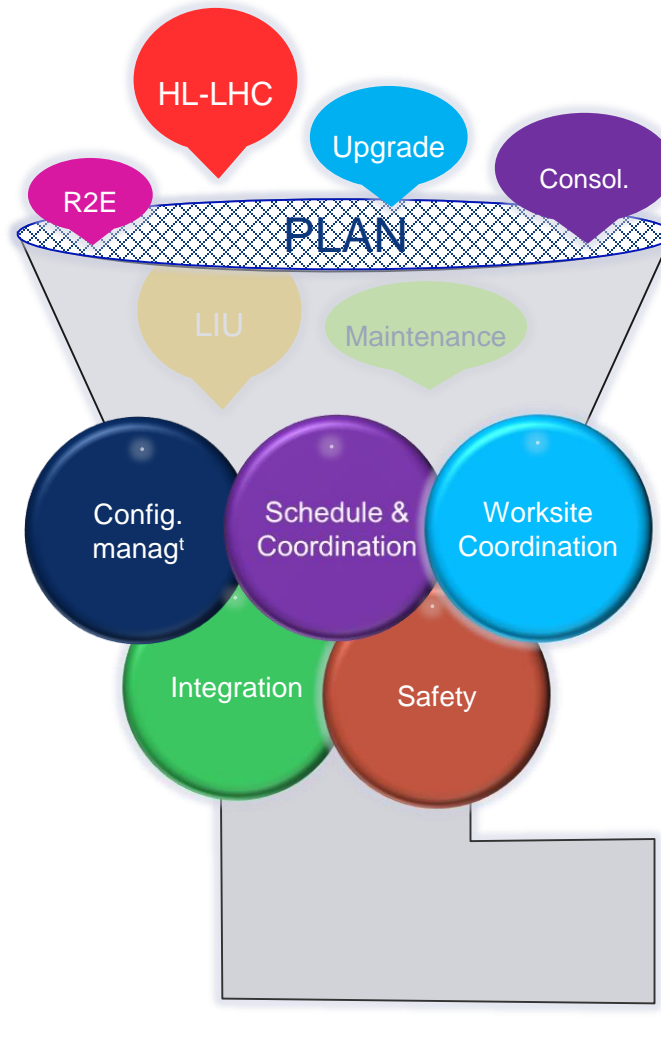


ECR

- Existing situation and introduction
- Reason for the change
- Detailed description
- Impact on other items
 - *Impact on items/systems*
 - *Impact on utilities and services*
- Impact on cost, schedule and performance
- Impact on operational safety
 - *Elément(s) important(s) de sécurité*
 - *Other operational safety aspects*
- Worksite safety
 - *Organization*
 - *Regulatory tests*
 - *Particular risks*
- References

Global picture

Courtesy K. Foraz – LS2 days



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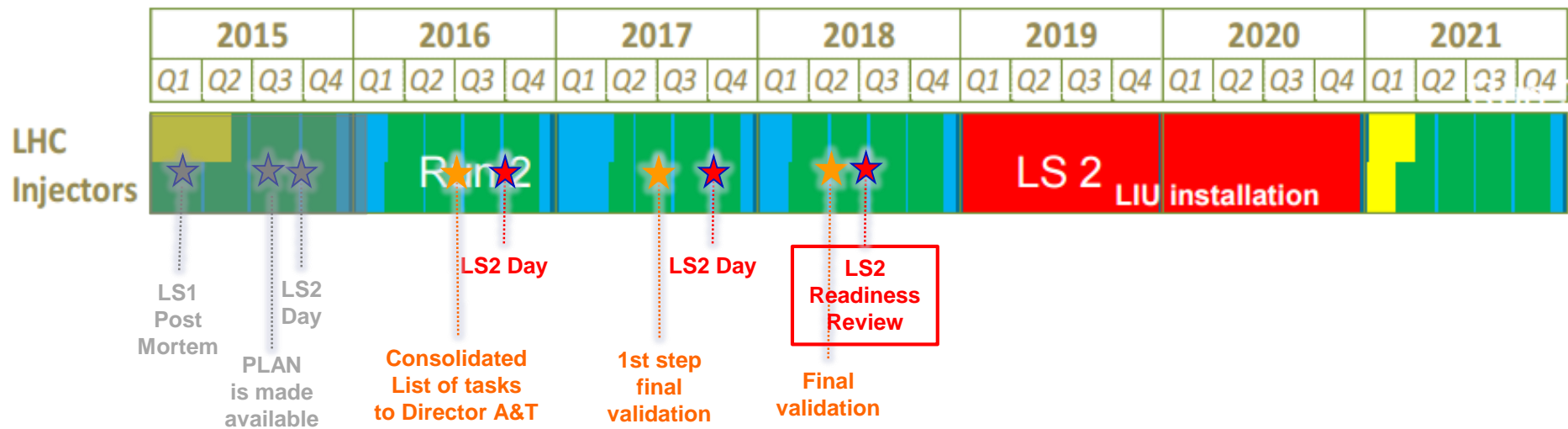
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LS2 Project: Main Dates and Milestones



- Yearly “LS2 day” as of 2015
- Activities declared in Plan by end’15 both for injectors and LHC;
- March’16, definition of activities for EYETS 2016;
- Mid’16, definition of activities for YETS 2017 and LS2;
- Preliminary “final” validation: mid 2017.
- LS2 readiness review – mid 2018

Courtesy J. Ph. Tock

Conclusions

- The YETS and EYETS are mainly dedicated to the annual maintenance in the LHC and its Injectors. Nevertheless major projects as the de-cabling project, LIU and HL-LHC will benefit from these periods of time to anticipate activities related to LS2
- The LS2 duration has been re-adjusted to allow the completion of major activities related to LIU and HL-LHC:
 - From 18 months to 24 (+4) months for LHC & its Injector chain
- The LS2 in the Injectors is mainly dedicated to the implementation of the LIU project
- The LS2 in the LHC is mainly dedicated to major maintenance, HL-LHC and civil engineering activities in preparation of LS3
- ...nevertheless a huge number of activities related to consolidation, maintenance and upgrade appears: resource allocation between all the activities should be assessed
- A consolidated list of tasks must be prepared to draft the first preliminary schedules



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