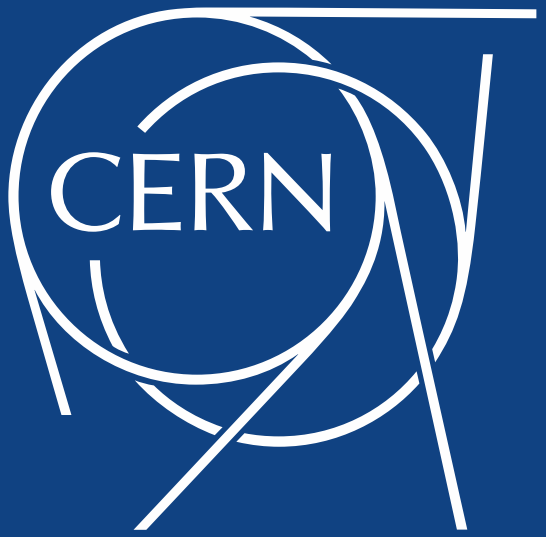

CERN

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*Chairman: José Miguel Jiménez / Scientific Secretary: J.Ph. Tock*

- Introduction
  *by José Miguel JIMENEZ*
- LIU Activities during LS2, highlight of changes with respect to last year
  *by Julie COUPARD*
- HL-LHC Activities during LS2, highlight of changes with respect to last year
  *by Laurent TAVIAN*
- LHC Experiments Activities during LS2
  *by Rolf LINDNER*
- Non-LHC Experiments Activities during LS2
  *by Markus BRUGGER*
- First Feedback from Plan
  *by Katy FORAZ*
- Framework schedule from EYETS 2016 to LS2
  *by Marzia BERNARDINI*
- General Safety
  *by Thomas OTTO*

# Long Shutdown 2 “Period” (LS2)

**LS2 Team**

| | |
|---|---|
| José Miguel JIMENEZ | Project Coordinator |
| Jean-Philippe TOCK | Project Office Manager |
| Katy FORAZ | Project Planning Coordinator |
| Mirko POJER | Project PLAN Data Quality Manager |
| Lisette Van Den BOOGAARD | Project Finance Officer |
| Thomas OTTO | Project Safety Coordinator for LHC |
| Ana-Paula BERNARDES | Project Safety Coordinator for Injectors |
| Stefanie SAPOUNTZI | LS2 Committee Administrative Support |
| Samy CHEMLI | LS2 Committee Scientific Secretary |

# Long Shutdown 2 (LS2) Project

*Project Scope & Mandate of LS2 coordinator (1/2)*

- The project scope **covers all activities** carried out and resources needed in the context of Long Shutdown 2 **over the whole CERN accelerator facilities**.

- The mandate of the project coordinator includes:
  - Prior to the start of the LS2, the **definition of main works to be achieved** over the LS2 and of potential options based on priorities given to activities. This study shall highlight in particular LS2 duration and resources needed for each option and be presented to the Directorate **by Q3-2016** for final decision;
  - The definition of a **CERN-wide "resource-loaded planning"**, ensuring the compatibility of resources and planning across the LHC Machine and LHC Experiments;

# Long Shutdown 2 (LS2) Project

*Project Scope & Mandate of LS2 coordinator (2/2)*

- The **preparation, coordination and follow-up till completion** of all LS2 activities in the frame of the LIU, HL-LHC Projects and other CERN approved projects. Work packages will define:
  - The work absolutely essential to achieve the LS2 objectives (activities which will bear a Priority 1-2), which execution will be closely followed up by the LS2 Coordinator;
  - The work which can be postponed to the LS3 (activities which will bear a Priority >2), which impact on LS3 will be assessed by the LS2 Coordinator.
- The **flexibility to use the end-of-year technical stops before and after the LS2** to decrease the load of the LS2 is left at the discretion of the LS2 coordinator and **is also part of the scope of the project**.

Julie Coupard, LIU Coordination
Katy Foraz, LS2 Project Planning Coordinator

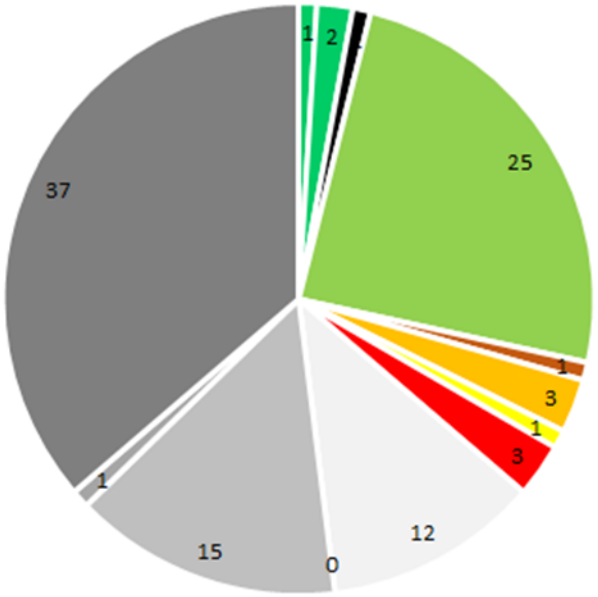
# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LIU Activities during LS2, highlight of changes with respect to last year*

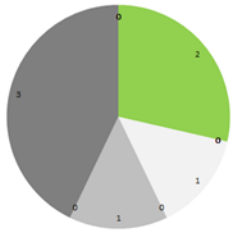
- **Integration studies // Space Reservation and Engineering Change Requests** (SRR and ECR)
  Roadmap for 2016-2017-2018 (objectives)

Integration studies → Validation of the ECR → Installation

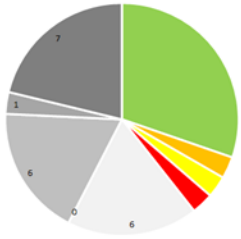
On schedule…




Global LIU Project

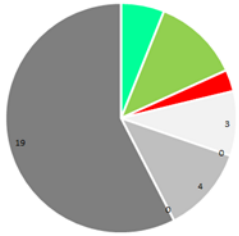


LIU-Linac3
Linac4 and LEIR



LIU-PS

LIU-PSB



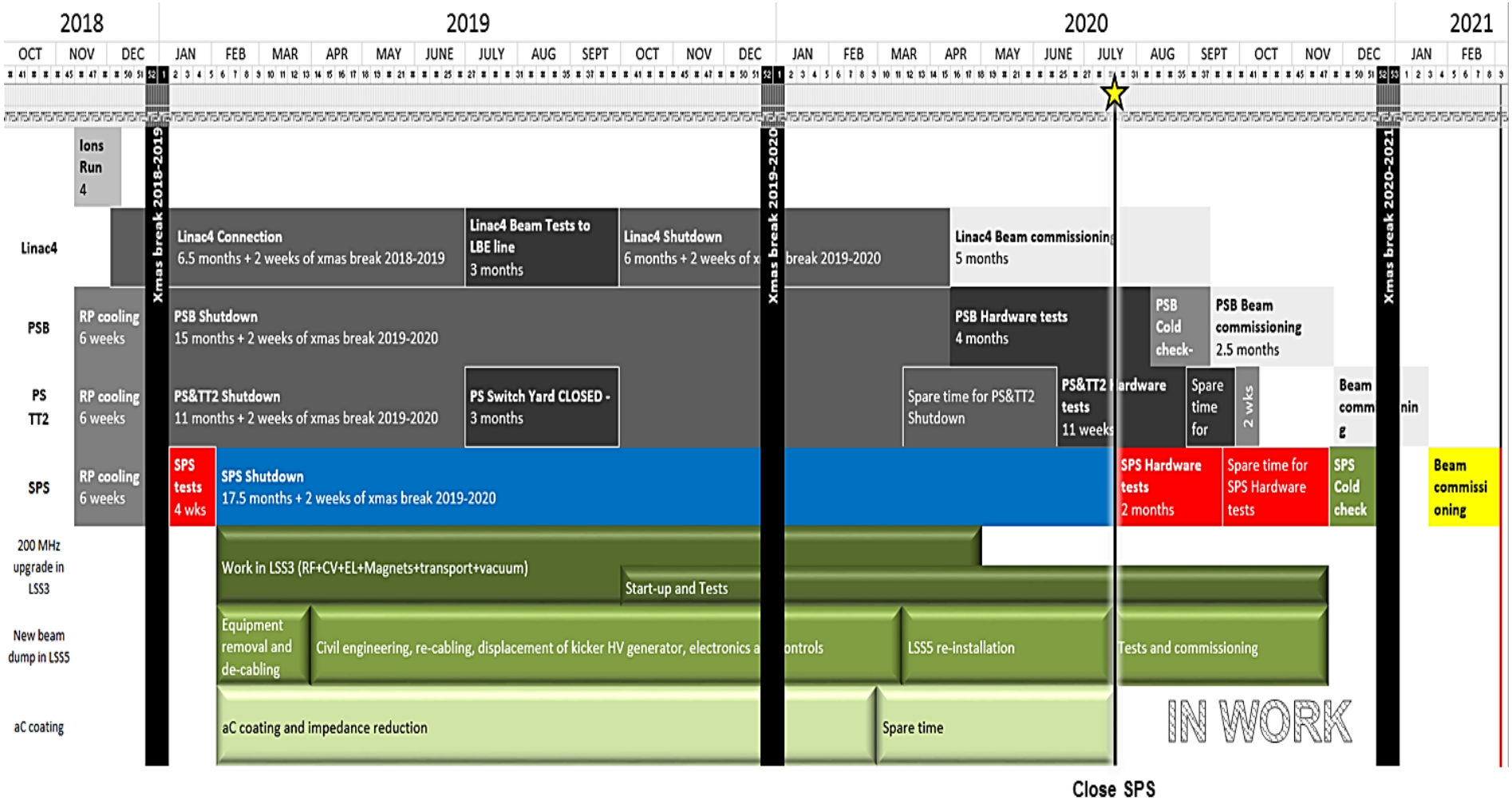
LIU-SPS

- IMPLEMENTED
- UNDER IMPLEMENTATION
- NOT IMPLEMENTED
- RELEASED
- APPROVAL CLOSED
- UNDER APPROVAL
- ENGINEERING CHECK CLOSED
- IN WORK
- SRR to provide
- ECR to provide for YETS 2015-2016
- ECR to provide for EYETS 2016-2017
- ECR to provide for YETS 2017-2018
- ECR to provide for LS2

Julie Coupard, LIU Coordination
Katy Foraz, LS2 Project Planning Coordinator

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LIU Activities during LS2, highlight of changes with respect to last year*



Julie Coupard, LIU Coordination
Katy Foraz, LS2 Project Planning Coordinator



# Conclusions

**Conclusions from LS2 Day** (sept-2015)

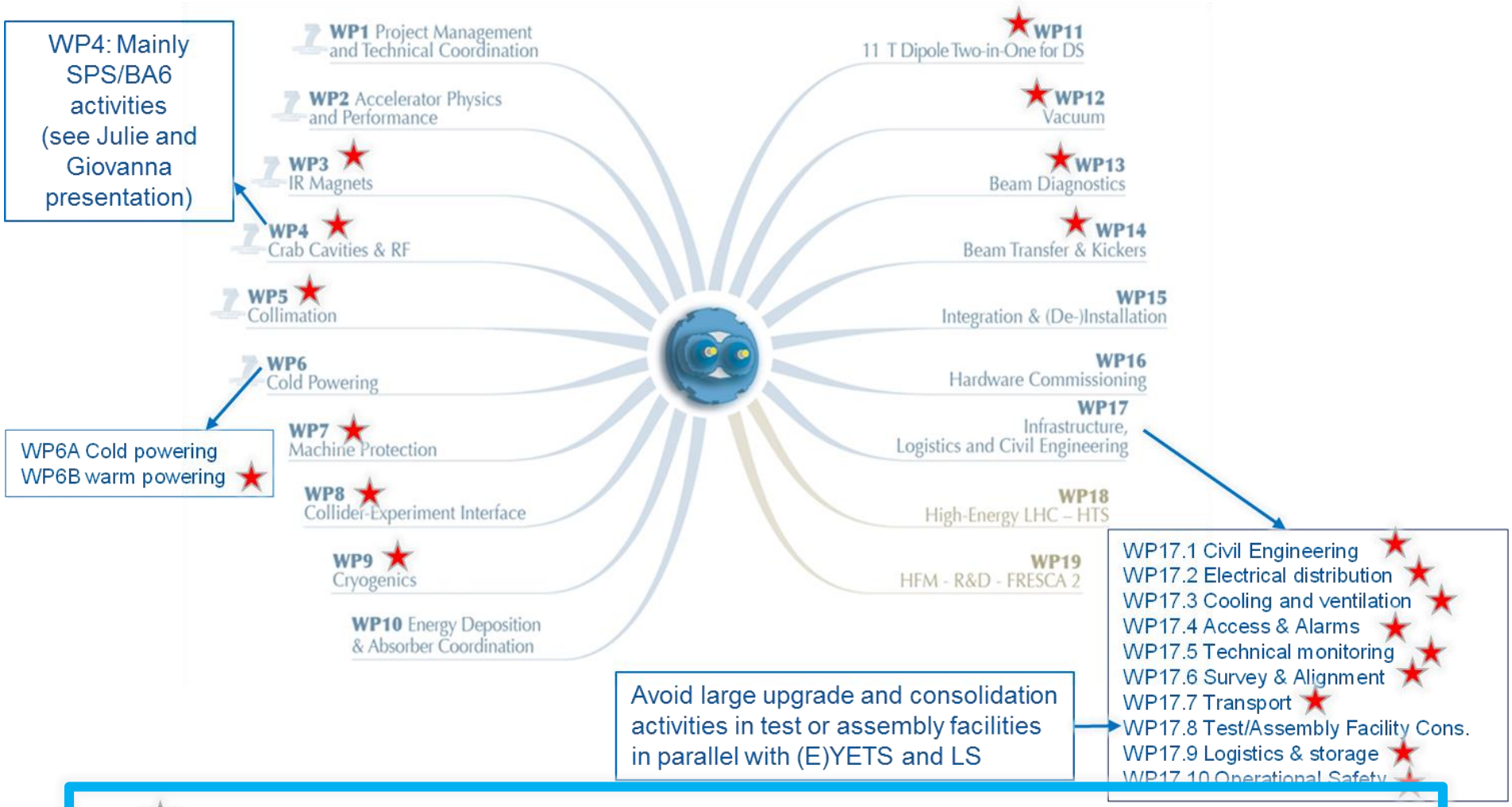
| | |
|---|---|
| • Some equipment installations have been anticipated to (E)YETS and will require the general services and infrastructure to be performed in the same timeline (EN-CV, EN-EL, EN-HE, EN-MEF, GS-SE, etc…).<br>  • The groups have to make the corresponding adequate requests, well ahead of time. | **Still valid** |
| • All equipment groups will be committed to the approved injectors master schedule.<br>  • The preparation phase need to fit with the installation forecast (studies, procurement, tests etc…) | **Still valid** |
| • The LIU schedule needs to integrate work from all projects, upgrade and maintenance activities and be presented as the Injectors schedule. | **In progress** |
| • All LIU activities need to be entered into PLAN and will be cross-checked with our LIU schedule. | **Almost complete** |

**In addition**

- Identification of the hazards in progress to take into account in the coordination and scheduling
- Need to know the definitive list of activities to add in the schedule (i.e. consolidations and safety requirements such as fire risks, asbestos)

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*HL-LHC Activities during LS2, highlight of changes with respect to last year*



# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*HL-LHC Activities during LS2, highlight of changes with respect to last year*

## 11 T dipoles, cryo-bypass & TCLD

| Chamonix 201 proposals |
|---|
| 2-unit installati |
| 2-unit installati |
| First unit to |
| Second unit |
| Long cryo-b |

| WP | 3 | 4 | 5 | 6A |
|---|---|---|---|---|

## Collimation (DS excepted)

| Chamonix 2014 : proposals |
|---|
| |
| |
| |

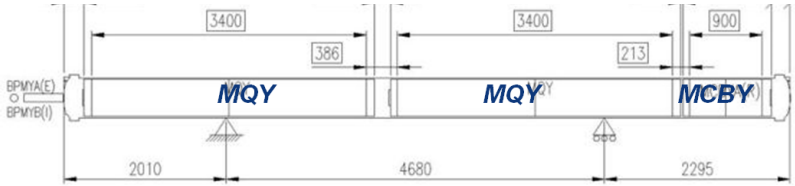
| WP | 3 | 4 | 5 | 6A.B |
|---|---|---|---|---|

## Cold and warm powering

| Chamonix proposals |
|---|
| Installation current feed |
| Installation TZ76 |

| WP | 3 | 4 | 5 |
|---|---|---|---|

## New Q5 quadrupoles at Point 6




HL-LHC proposal (Increase of longi-tudinal dimension by 3650 mm)

| Chamonix 2014 : LS2 activity proposals | Chamonix 2016: LS2 activity proposals |
|---|---|
| Replacement of Q5 quadrupoles in LSS6 by installation of longer Q5 quadrupoles | Maintained (LHC ECR to be done) |

Alternative under study to keep the existing Q5 quadrupoles and operate it at 1.9 K:
→ Additional impact on cryo (WP9) which has to supply and install 2 new QRL service modules
→ If validated probably to be postponed in LS3

| WP | 3 | 4 | 5 | 6A.B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17.1.2.3.4.5.6.7.8.9.10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*HL-LHC Activities during LS2, highlight of changes with respect to last year*

## Upgrade of cryogenics at P4

| Chamonix 201 proposals |
|---|
| Installation of a cold box in UX4 |
| Installation of a compressor sta |
| New Cryo-distr valve box) for R |

| WP | 3 | 4 | 5 | 6 |
|---|---|---|---|---|

## In-situ amorphous-carbon coating of beam screens

| Chamonix 2014 proposals |
|---|
| |

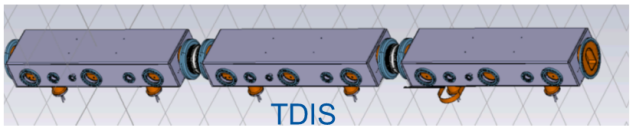
| WP | 3 | 4 | 5 | 6A. |
|---|---|---|---|---|

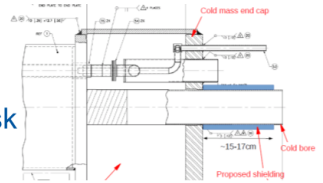
## Beam diagnostic

| Chamonix 2014 proposals |
|---|
| Installation of a p scanners (BWSF |
| Installation of be detector (BGV) 1 proto in LS2 |
| |
| |

| WP | 3 | 4 | 5 | 6A |
|---|---|---|---|---|

## Beam transfer and kickers




| Chamonix 2014 : LS2 activity proposals | Chamonix 2016: LS2 activity proposals |
|---|---|
| Installation of injection absorber (TDIS) in L2 and R8 | Maintained. (LHC-ECR to be done) |
| Installation of a MKI prototype in R8 during YETS 2017. | Maintained. (LHC-ECR to be done) |
| | Installation of absorber/mask in front of D1 in L2 and R8 instead of TCDD aperture change (HL-LHC ECR (if alternative validated) and LHC-ECR to be done) |
| | Beam Dumping System: Replacement of extraction kicker generators switch and upgrade of control system of MKD generators (LHC-ECR to be done) |

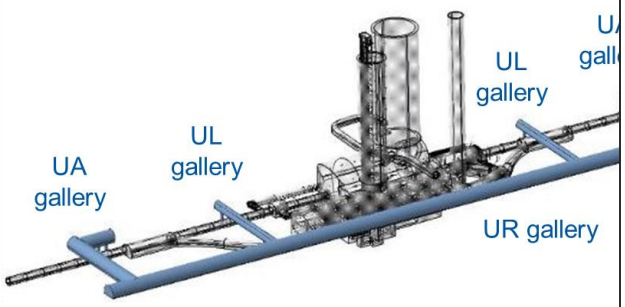
| WP | 3 | 4 | 5 | 6A.B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17.1.2.3.4.5.6.7.8.9.10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*HL-LHC Activities during LS2, highlight of changes with respect to last year*

## Civil engineering

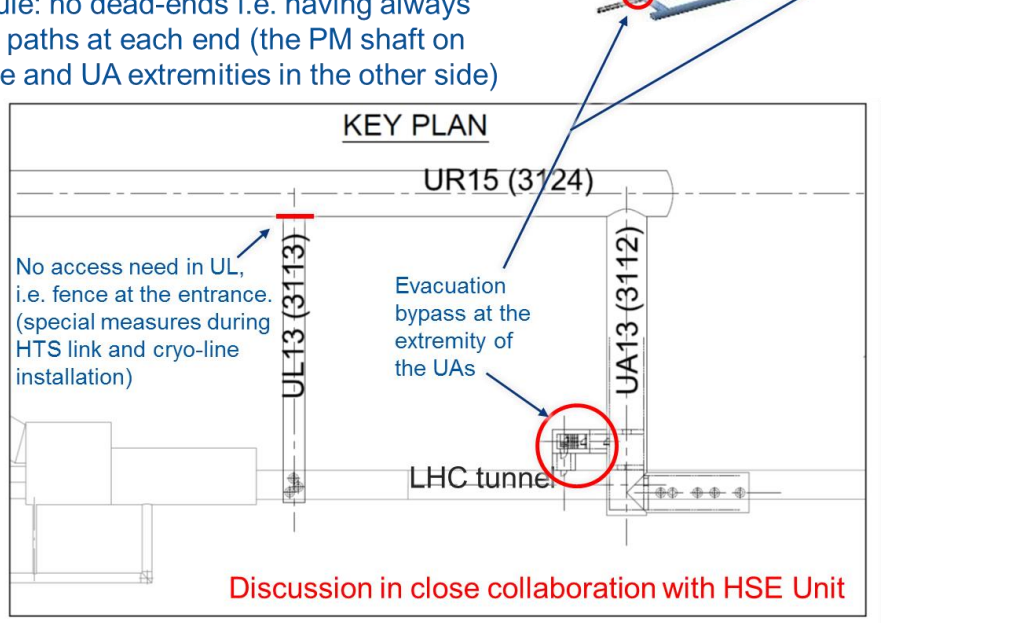
| Chamonix 2014 : LS2 activity proposals | Chamonix 2016: LS2 activity proposals |
|---|---|
| Identified as Run 3 activity | Excavation of underground structure at P1 and P5: 2018 (shaft), 2019-2020 (Cavern and galleries)<br>Construction start of surface building at P1 and P5 in 20 |




| WP | 3 | 4 | 5 | 6A.B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

## Safety of personnel

Basic rule: no dead-ends i.e. having always escape paths at each end (the PM shaft on one side and UA extremities in the other side)



# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*HL-LHC Activities during LS2, highlight of changes with respect to last year*

## Conclusions

- HL-LHC activities will be present during the LS2 and must be coordinated and included in the LS2 master schedule.

| WP | 3 | 4 | 5 | 6A.B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17.1.2.3.4.5.6.7.8.9.10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

- Some alternatives to the HL-LHC baseline are still under study. Decisions and/or HL-LHC ECR must be done in the coming months to allow sufficient procurement/fabrication time.
- For all (E)YETS & LS2 HL-LHC activities impacting the LHC configuration, LHC ECRs must be issued.
- Civil engineering for underground areas is now integrated in the LS2 and will be on the critical path.
- Post-LS2 personnel safety in HL-LHC underground areas has to be addressed. Decision has to be taken in collaboration with HSE. Option 3 seems more attractive but the impacts on LHC, on additional works and on LS2 schedule must be studied more in detail.
- Remarks: If all the addressed HL-LHC LS2 activities are accepted, the warm-up of 7/8 LHC sectors will be required.

| S12 | S23 | S34 | S45 | S56 | S67 | S78 | S81 |
|---|---|---|---|---|---|---|---|
| 11 T or alt. | 11 T or alt. | Cryo | Cryo | Q5 | 11 T Q5 | 11 T | |

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

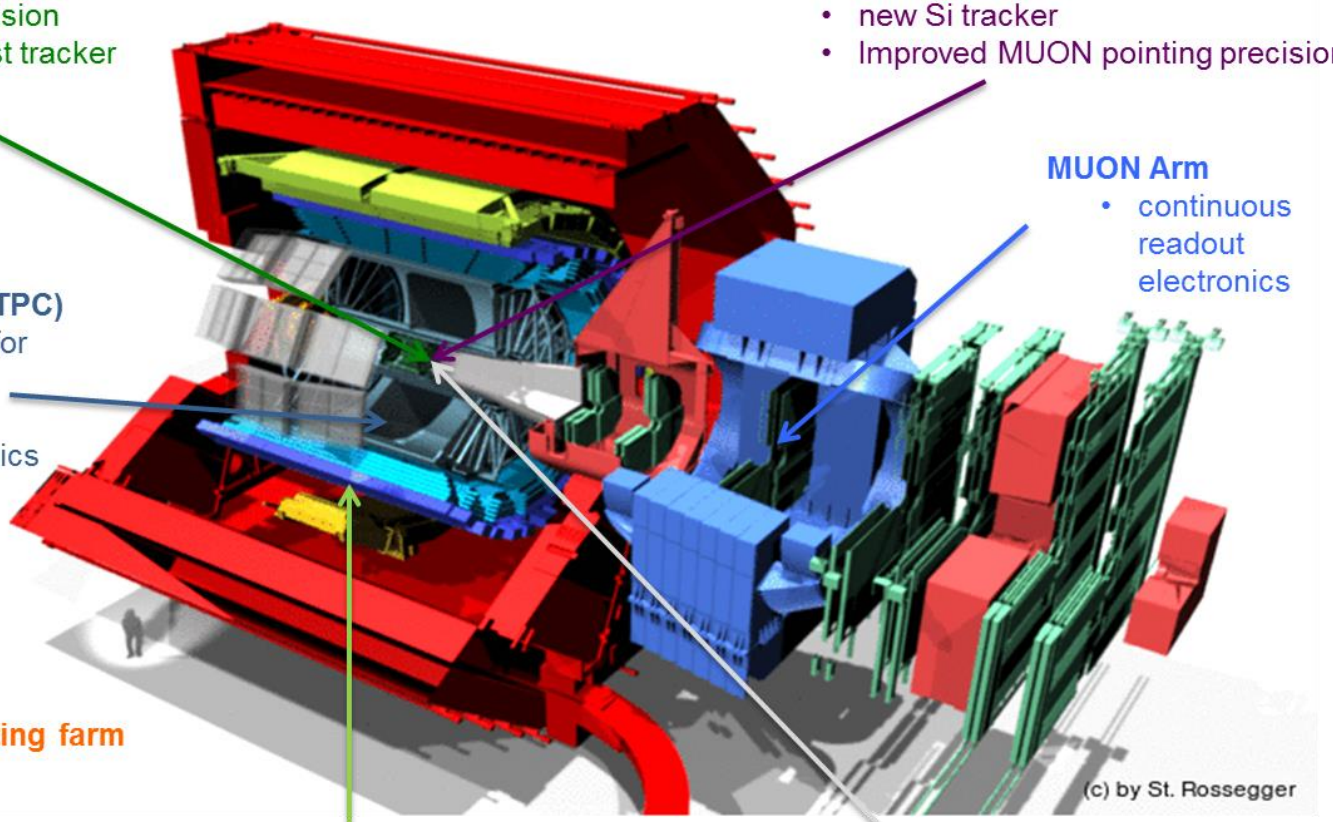
## *LHC Experiments Activities during LS2: ALICE*

**New Inner Tracking System (ITS)**
- improved pointing precision
- less material → thinnest tracker at the LHC

**Muon Forward Tracker (MFT)**
- new Si tracker
- Improved MUON pointing precision

**MUON Arm**
- continuous readout electronics

**Time Projection Chamber (TPC)**
- new GEM technology for readout chambers
- continuous readout
- faster readout electronics



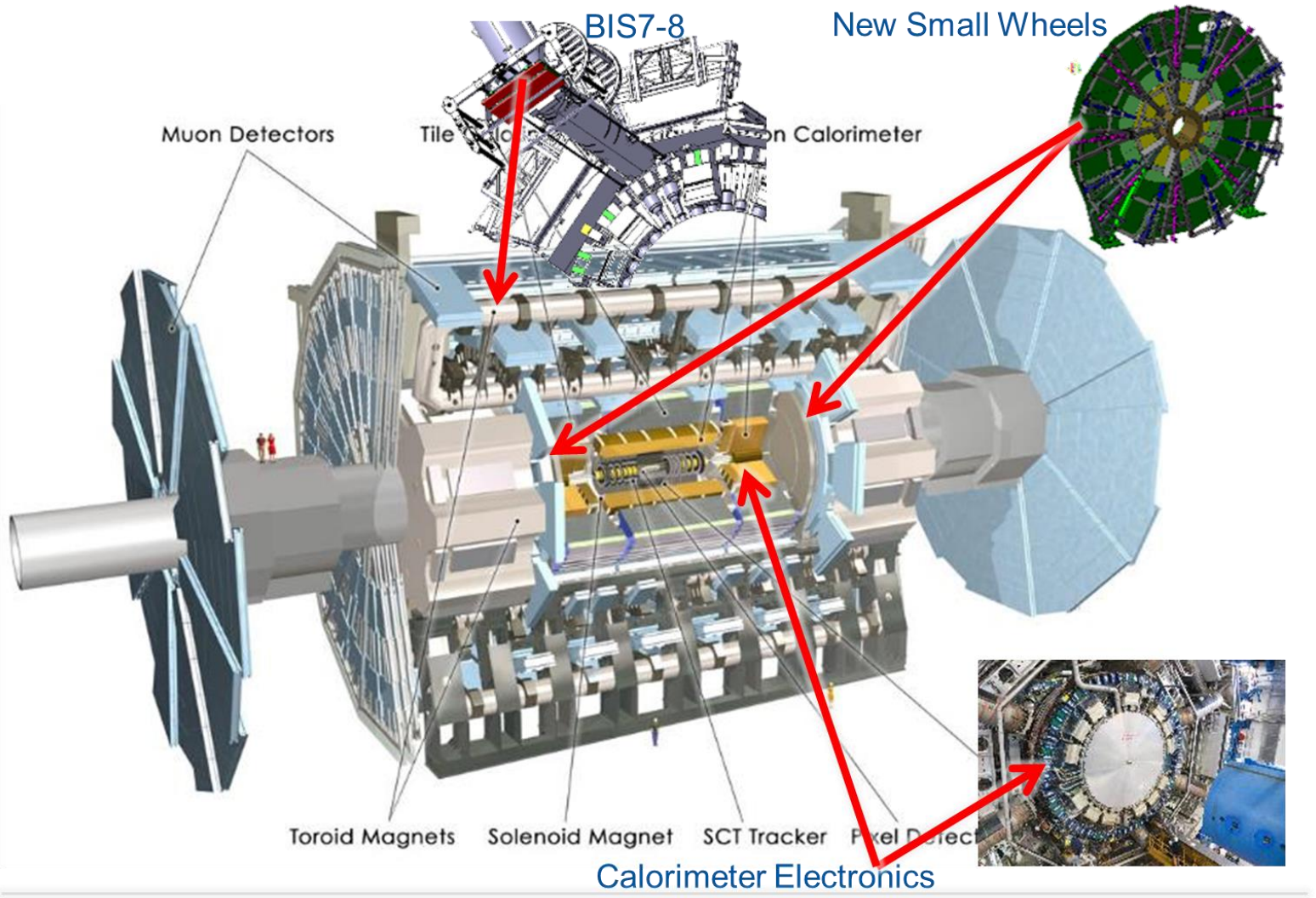

**New Online/Offline computing farm (O2)**
- new architecture
- on line tracking & data compression
- 50kHz PbPb event rate

**TOF, TRD**
- Faster readout

**New Trigger Detectors (FIT)**

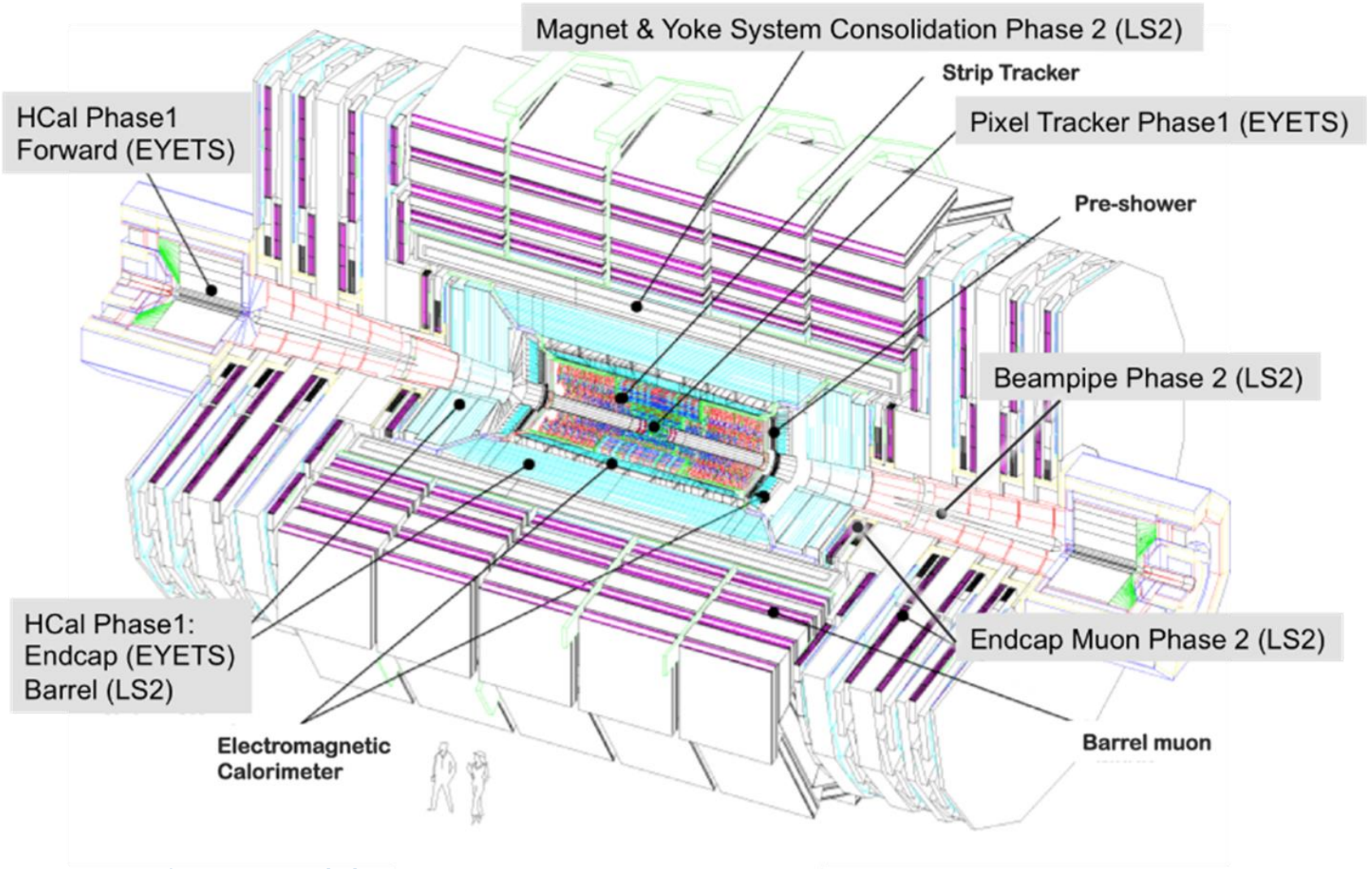
# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2: ATLAS*



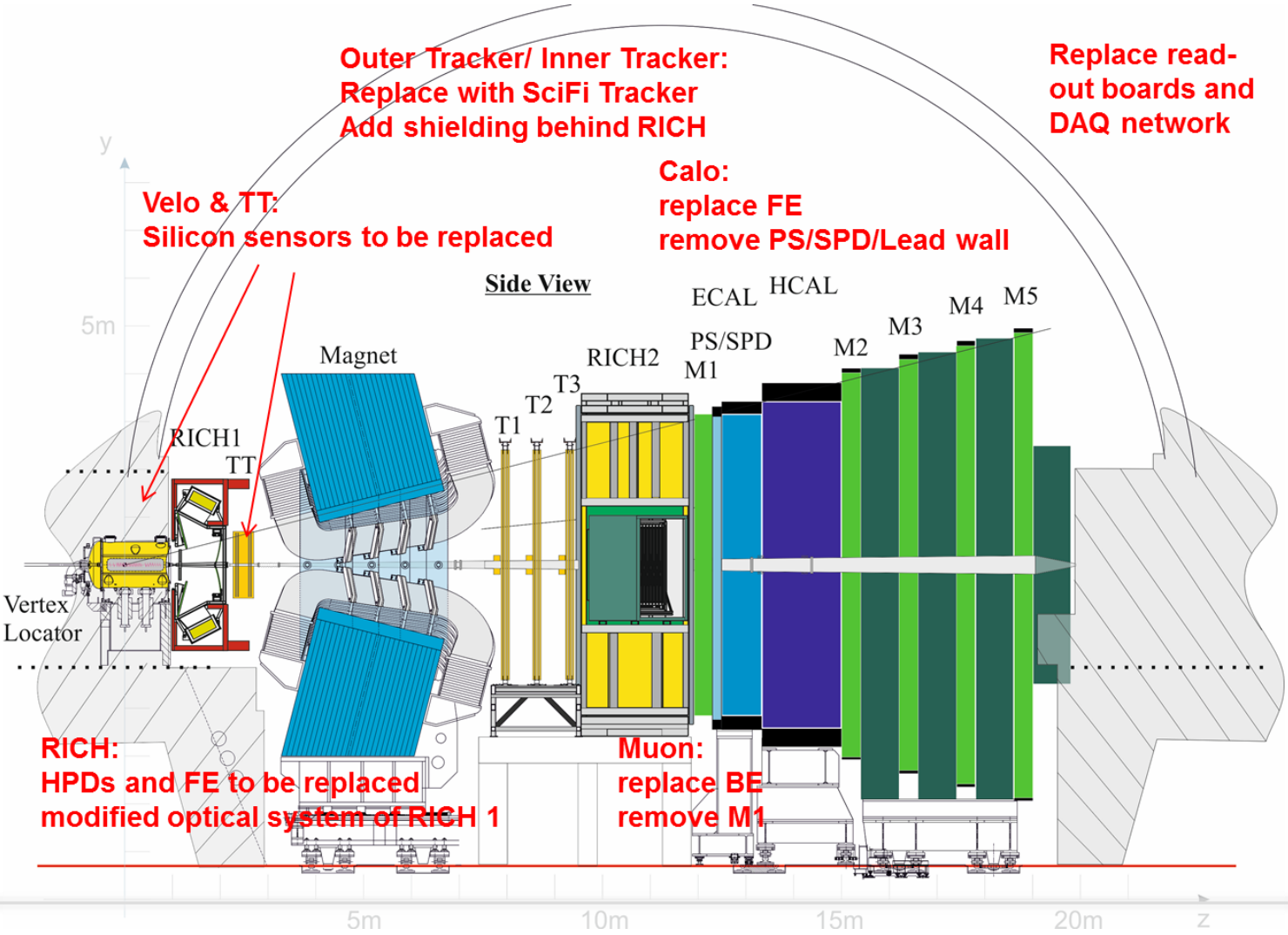
# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2: CMS*



# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2: LHCb*



# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2*

## Cooling and Ventilation

**ALICE**
- New water co
- Possibly upgr
- O2 computing
- TPC cleanroo
- Ventilation of

**ATLAS**
- Renewal vent
- Refurbishmen
- Study how to
- Upgrade of M

**CMS**
- Upgrade HVA
- Eliminate sudd
- Add 1.5 MW c
- Water product
- Compressed a

**LHCb:**
- New and upgr
- VELO,
- Cooling for the
- Pressure diffe

## Electrical distribution & cabling

**ALICE**
- 2 x 2.5MVA trans
- Large UPS insta
- 12k optical fibres
- Significant cablin cables etc. throu

**ATLAS**
- Upgrade and refu
- Upgrade of UPS
- Consolidation of
- Cabling for the n

**CMS**
- Upgrade UPS: C
- Electrical distr. fo

**LHCb**
- Power for 'Data
  - Primary sup
- ~17k optical fibre
  - All major su to be define
- Electrical distribu

## Survey

**ALICE**
- Significant surve re-installation of
- Close collaborati
- Metrology for tra

**ATLAS**
- Usual activities r
- Survey related t
  - During NSW
  - NJD measu
  - BIS 7/8 me

**CMS**
- Opening & closir
- Special focus on

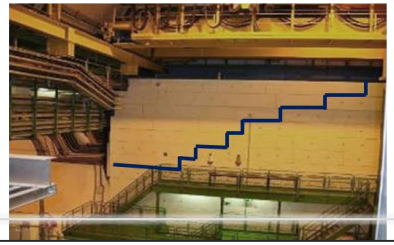
**LHCb**
- Survey already c systems and sur
- Metrology for Ve

## Handling

**ALICE**
- Opening of ALICE (shaft shielding, cavern shielding, mini-frame, TPC to surface) in 2 shifts at the beginning of LS2.
- Special transport of TPC from cavern to cleanroom.
- Installation of the entire ALICE upgrade during 2020.

**ATLAS**
- On top of usual activities, specific needs are identified for NSW integration
- Transport of NSW chambers (BB5, Bld 180) from 2016-2018
- JD shielding & NSW at B191 : 2 crane drivers (part time) from end-2016 to mid-2019
- Transport NSW from 191 to P1 and SW from P1 to 191 2019/20

**LHCb:**
- Dismantle ~33% of shielding wall
  - For passage of detector services
- Dismantling and installation of new detectors, support and access structures.
- Large object to be dismantled:
  - PS, SPD and lead wall, Outer Tracker, M1 station



# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2*

## Beam Pipe

**ALICE**
- New central beam pipe ordered Q3 2015, delivery Q2 2017.
- Bake-out equipment and installation chariot (2017)
- Removal of beam pipes
  LS2.

**ATLAS**
- No new beam pipes fore
- But full dismounting of b

**CMS**
- Full beam pipe dismoun
- Replacement of conical
- Preparation for replacen

**LHCb**
Entire beam pipe to be dis
- Venting, access, protec

## Safety & Radiation

**ALICE**
- Safety coordination for work

**ATLAS**
- Work package analysis for s
  and during LS2
- Study of storage of the Old S

**CMS**
- Work package analysis for s
- Storage of removed beam p

**LHCb**
- Due to heavy handling, man
  safety coordinator will be ma
  - Shall attend meetings,
- Radiation protection
  - LHCb provides personn
  - Additional support will

## Civil engineering

**ALICE**
- New visitor center (2016/2017)
- Baseline for O2 computing facility is a commercial container (choice end 2016). Infrastructure and noise protection needed.

**ATLAS**
- Enlargement of SR1 building (+300 sqm) including the exisiting clean room

**CMS**
- Extension/Annexe to SX5 surface building (1000 m2)
- Re-equip SX5 heavy maintenance areas as lab space for Phase 2 build/maintenance
- Replacement of barracks & storage barns overwritten by HL-LHC buildings
- Probable construction of a UPS barn
- Modify SX5 and SDX roofs for endcap cal extraction/lowering by “crawler crane”

**LHCb**
- The new ‘Data Center’ will require preparation of new housing.
- Technical gallery from SCX to ‘Data Center’ and to transformer
- Storage for detector parts that will be recuperated, stored or become radioactive waste
  - Final disassembly can and will not take place in the underground
  - Requires storage space for large detector parts, with some components being radioactive.
  - Need protected area for storage of concrete blocks from the shielding.

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*LHC Experiments Activities during LS2*

## Where PLAN may help with parallelism…

**Major challenges ahead**

Similar activities at all LHC sites in parallel

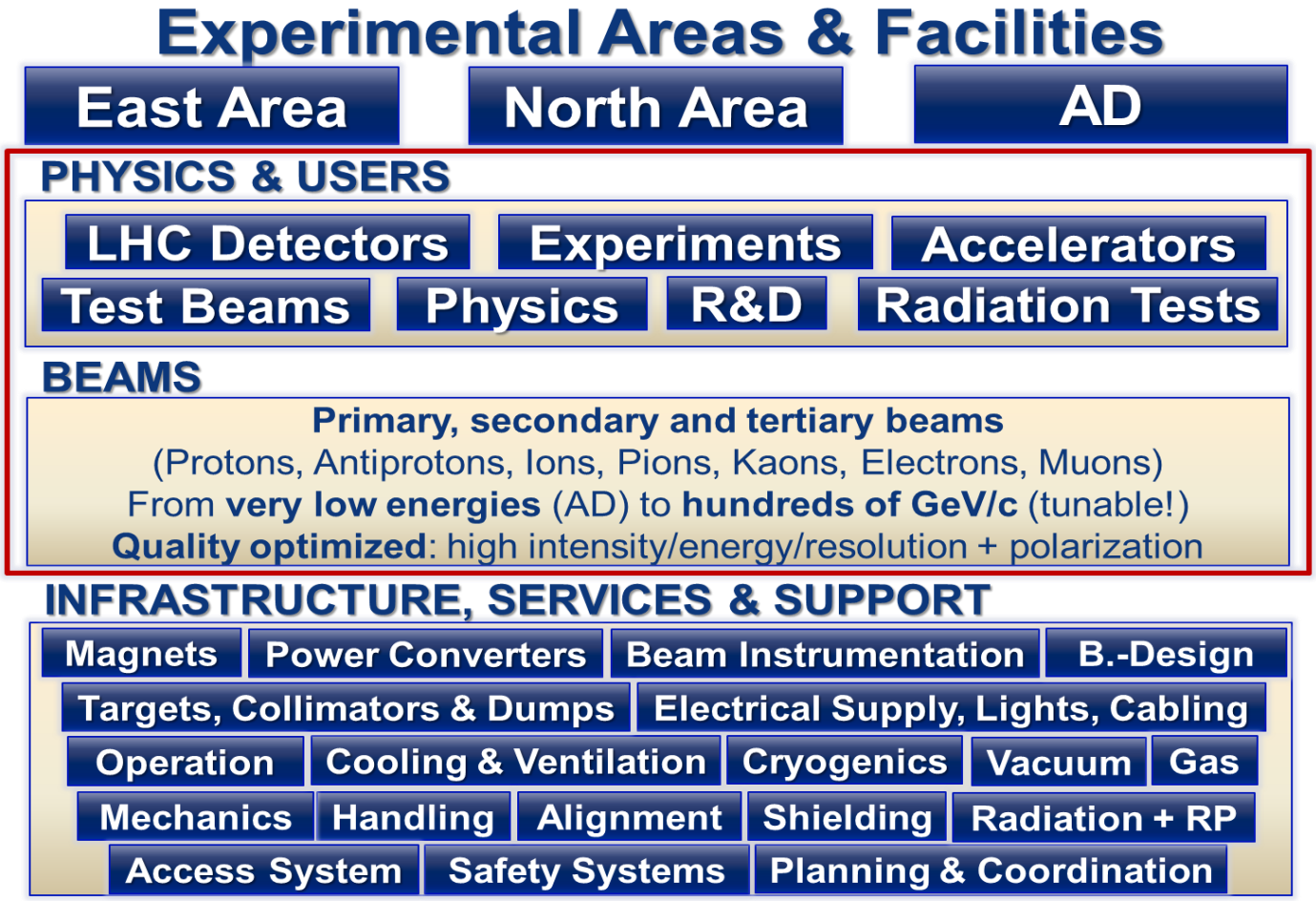
- Dismantling/re-installation of the beam pipe
- Removing/installing/re-installing detectors
- Cabling/fibre-installation
- Survey
- Handling
- Safety coordination

- For some projects, workload almost at the size of the initial experiment's installation, but:
  - Clearly less resources
  - Smaller time window
  - Considerably reduced preparation period

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*Non-LHC Experiments Activities during LS2*

A good summary of the challenges…



Katy Foraz, LS2 Project Planning Coordinator
Mirko Pojer, LS2 Plan Data Quality Manager

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*First Feedback from Plan*

## Goal of PLAN

**Agree** on **which activities will be performed** until the end of LS2, based on priorities and resources we have

- to **harmonize the method**
- to **give decision makers** a clear picture of the different requests, and their impacts

▼

**Unique repository with a simple approval process**

*Information: what, goal, impact if not done, support, resources availability & schedule*

All Groups from all Departments are on-board
…more efforts needed on PLAN data Quality…

- **Quality of information**: Definitively better than during the Plan Beta exercise, but one can always improve
- **Title**: very few mysterious names, but usually the goal is well described and no support is required..!
- **Goal**: it is always possible to insert links with edms documents and documents to the activities
  ► the better you define, the better contribution groups will be able to assess their contribution
- **WBS**: around 20% of wrong WBS
- Discrepancy of **granularity** between activities
- **Duplicates**: …there are…

►Standardization of resource **descriptions** ready for next stage

- **Cascade of contributions** ► this is now possible for a contribution group to enter another contribution group

Katy Foraz, LS2 Project Planning Coordinator
Mirko Pojer, LS2 Plan Data Quality Manager

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*First Feedback from Plan*

## Priorities

1. Safety
2. Activities needed to reach 300fb-1 during run 3
3. HL-LHC & LIU projects
4. Approved projects
5. Approved studies
6. Others

► Meetings with Department heads

LS2 Coordinator & A&T Sector Director
…DHs and Project Leaders consulted…

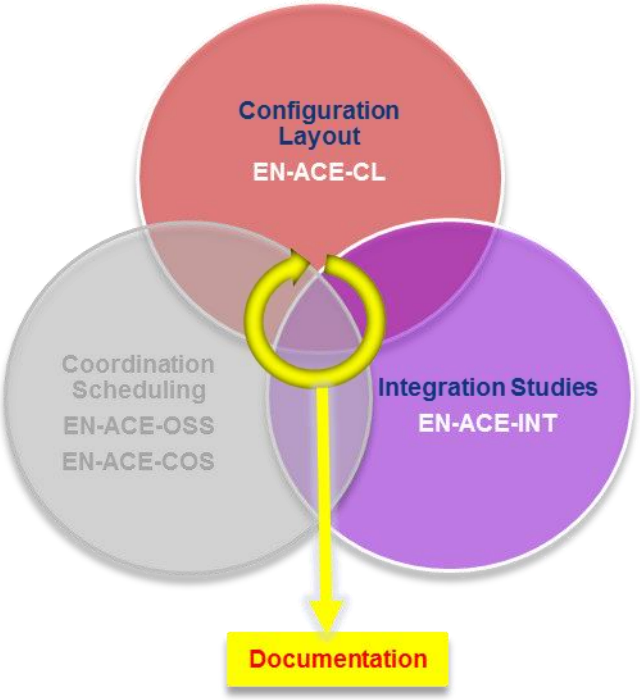
1. Safety
   - All activities needed to ensure safety of personnel and of our facilities
   - «Consolidation of AUG systems, Bas floor inspection, Maintenance of fire detection…»
2. Activities needed to reach 300fb-1 during run 3
   - Maintenance, upgrades, consolidation needed to run the accelerator complex & LHC experiments
   - "Replacement of damaged TBIU in SPS North Area, Maintenances park 18 kV et 3.3 KV , Electrostatic septum SEH31 replacement…"
3. HL-LHC & LIU projects
4. Approved projects
   - AD, Charm, nTof, Awake, ….
   - We found difficulties for some activities declared to assess if there were approved or not, especially with respect to budget & resources availability, as these fields were not completed ► creation of a new priority : «**4a. Approved projects if budgeted**" From 4a to 4 ► please complete the missing fields

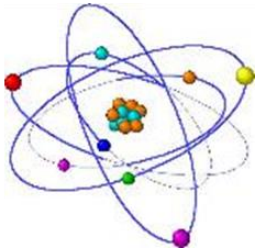
Katy Foraz, LS2 Project Planning Coordinator
Mirko Pojer, LS2 Plan Data Quality Manager

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*Framework schedule from EYETS 2016 to LS2*

## LS2 provides methodology for success…



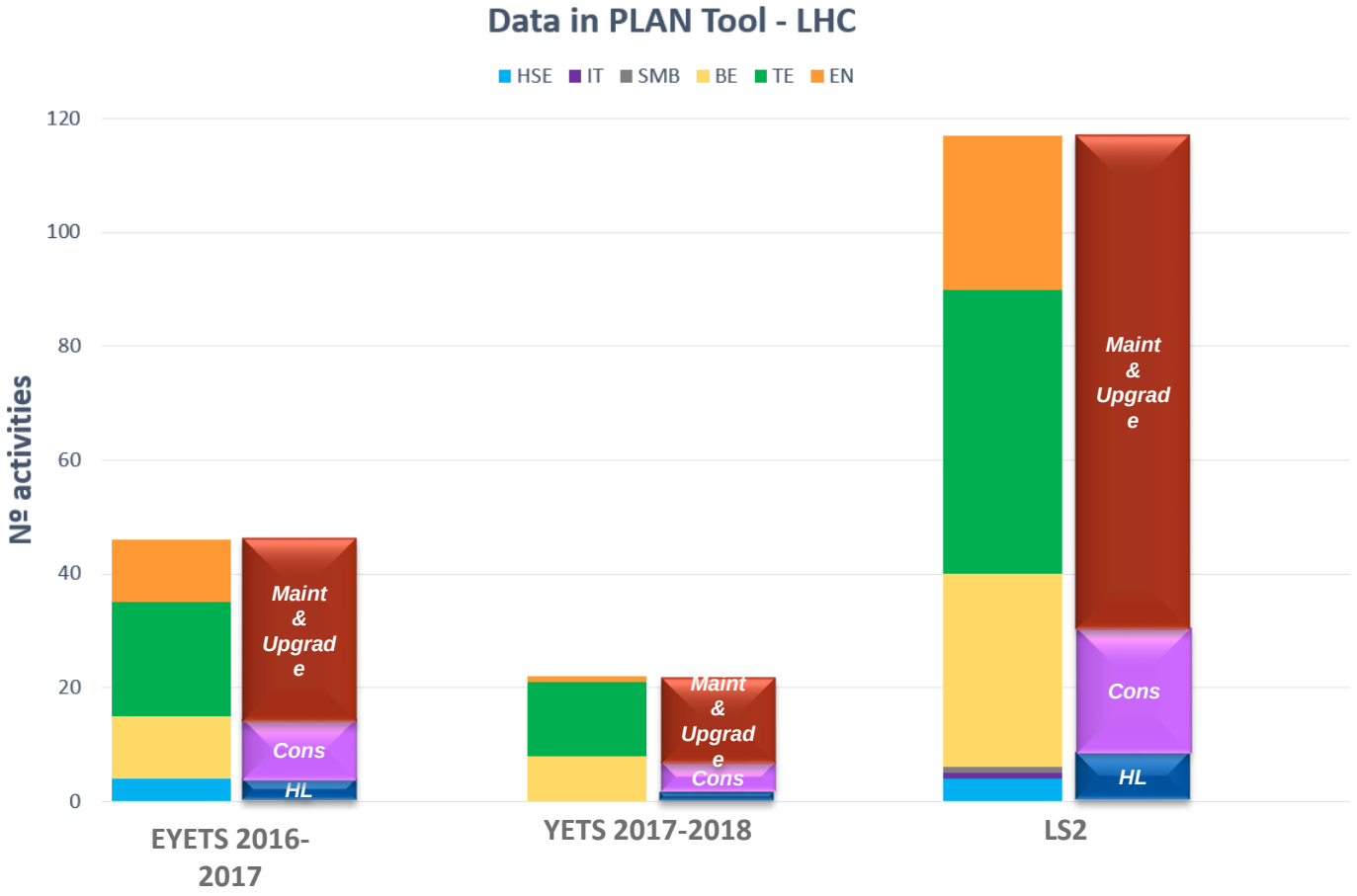


Katy Foraz, LS2 Project Planning Coordinator
Mirko Pojer, LS2 Plan Data Quality Manager

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*Framework schedule from EYETS 2016 to LS2*

## PLAN tool "mirrors" Requests & Affordability…



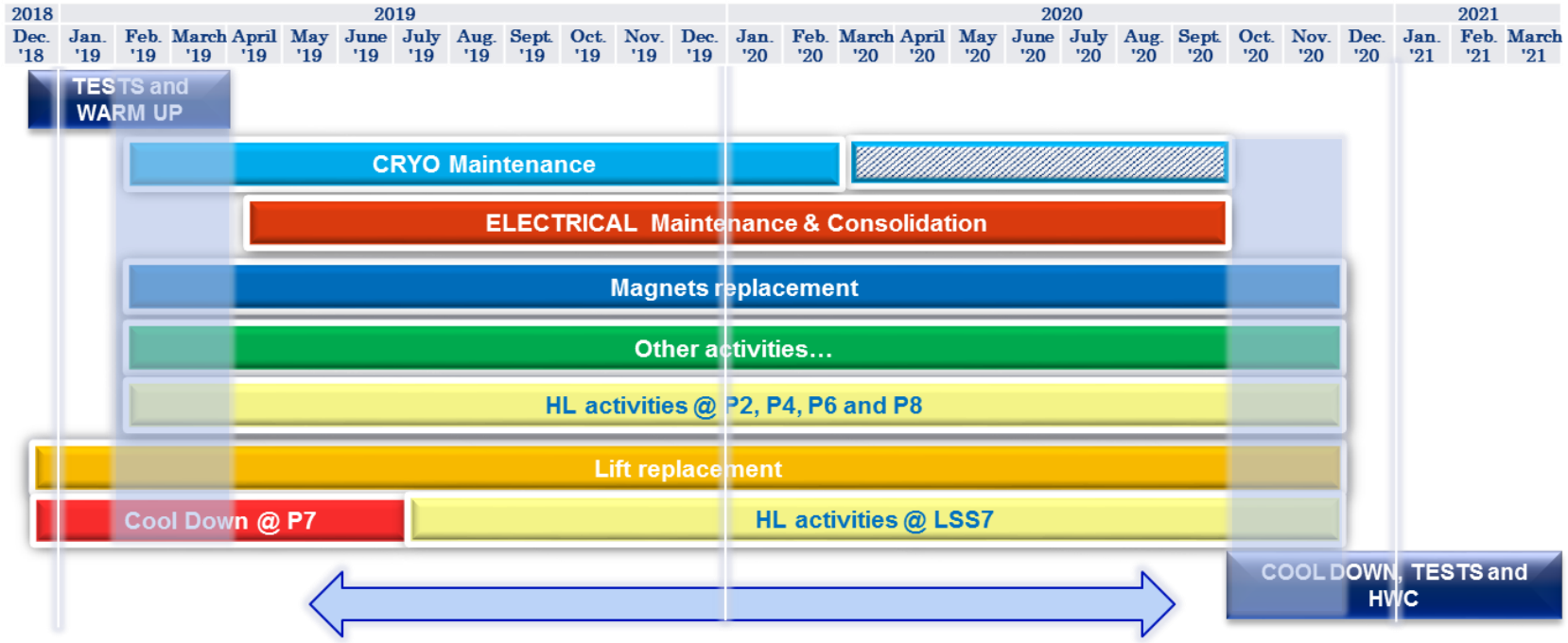

*…not weighted data, but huge numbers related to maintenance & upgrade*

Katy Foraz, LS2 Project Planning Coordinator
Mirko Pojer, LS2 Plan Data Quality Manager

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*Framework schedule from EYETS 2016 to LS2*

## Draft Master Schedule skeleton is defined…




Depending on the cool down and warm up sequence,

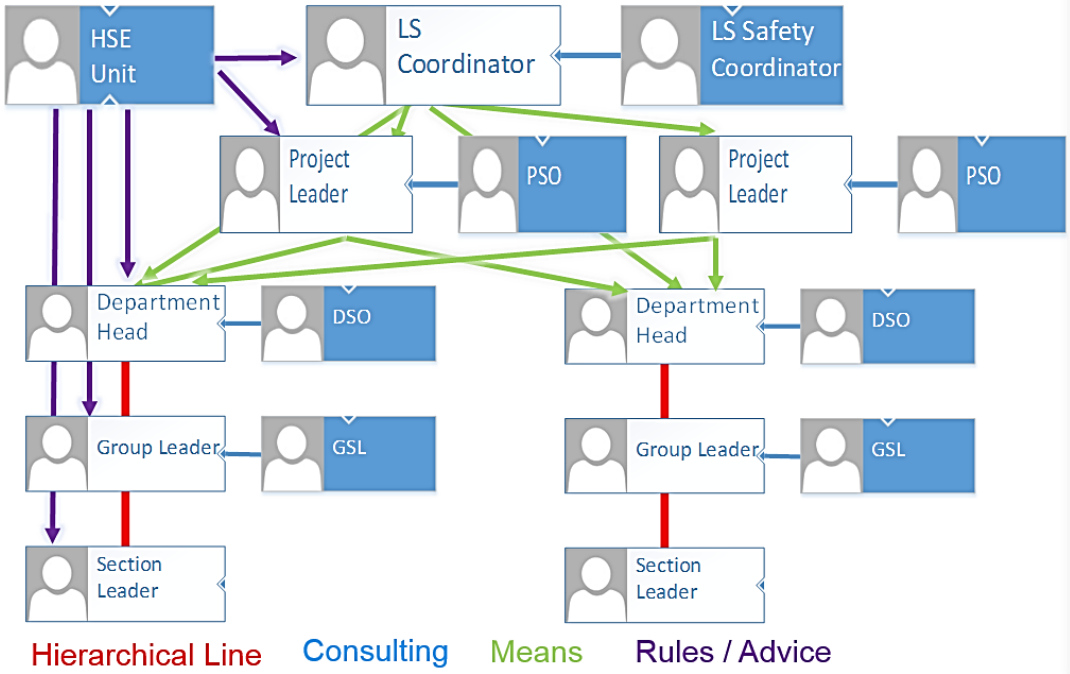
the available window for the activities is between **18** to **22 months**

Thomas Otto, LS2 Project Safety Coordinator for LHC
Ana-Paula Bernardes, LS2 Project Safety Coordinator for Injectors

# Session 8: (E)YETS and Long Shutdown 2 Strategy and Preparation

*General Safety*

## Who is in charge ?




## Targets: Safety first… everywhere!

- Continuity:
  - with LS1 for Accelerator infrastructures
  - Training & Readiness
- Reinforced:
  - Safety on Surface Buildings & Workshops
  - In-situ waste sorting
  - Grouping of radioactive transports

Thomas Otto, LS2 Project Safety Coordinator for LHC
Ana-Paula Bernardes, LS2 Project Safety Coordinator for Injectors

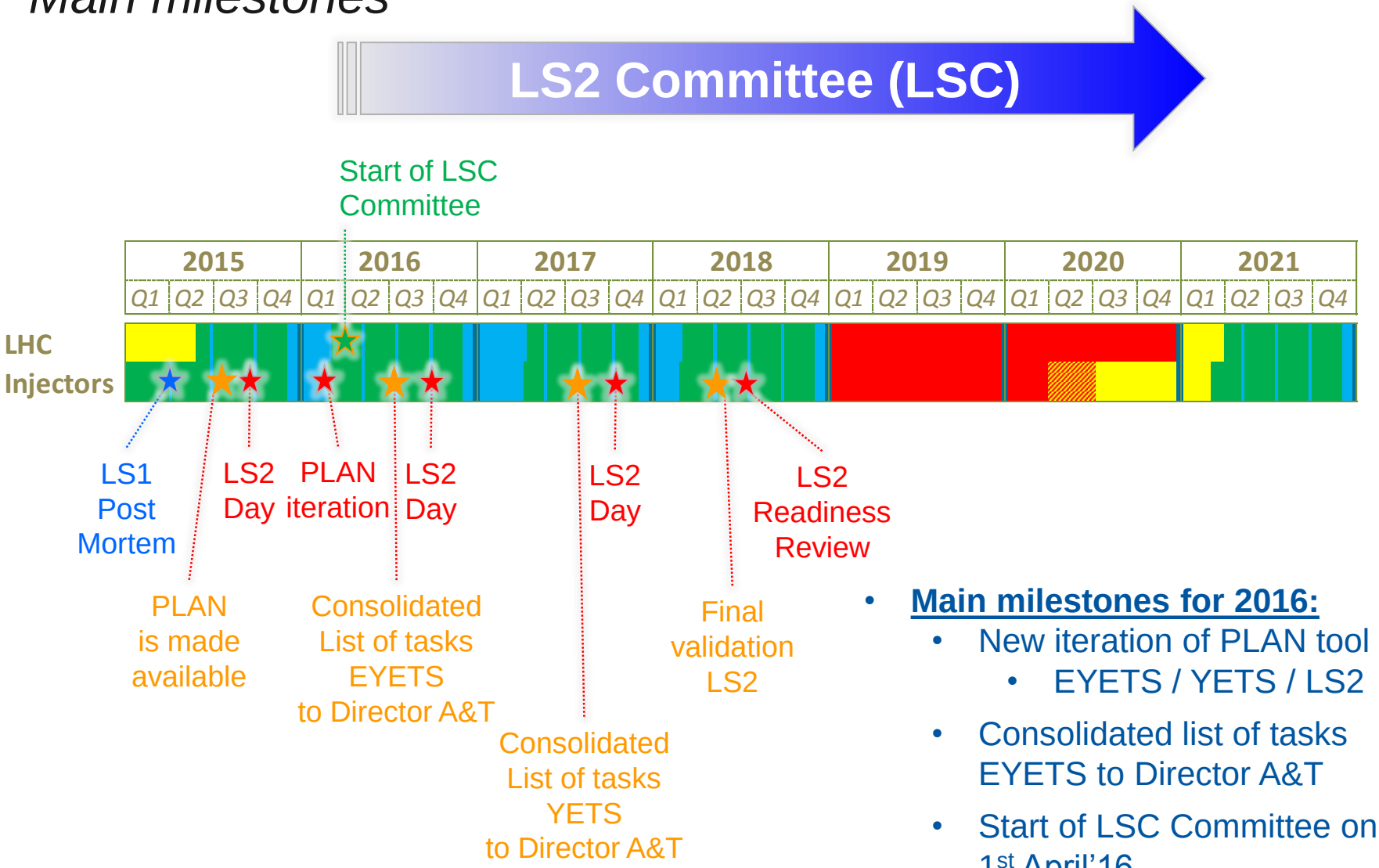


# Two aspects of Safety

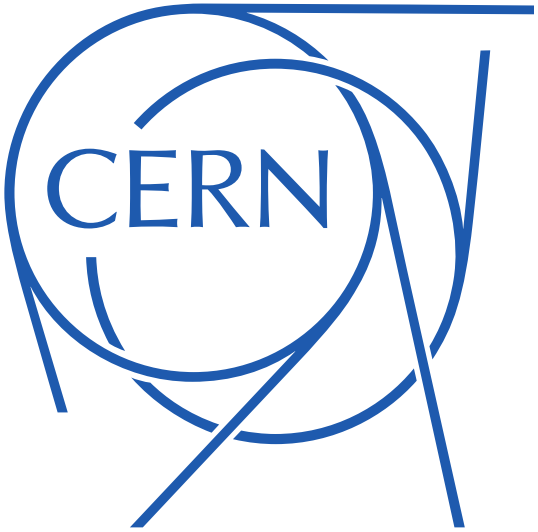
| Conformity | Preventive Workplace Safety |
|---|---|
| Equipment | Process |
| Standards (ISO, EN, Eur. Dir….) | Safety Rules, best practice |
| Inspection | Hazard identification, risk assessment |
| Report on non-conformities | Safety Report, action list |
| Make conform | Apply rules and best practice |
| Conformity marking | |
| User manual | Procedure manual |
| Training in use of equipment | Training the process |
| Safety Training | |
| Personal Protective Equipment | |

# Long Shutdown 2 (LS2) Project

*Main milestones*




- **Main milestones for 2016:**
  - New iteration of PLAN tool
    - EYETS / YETS / LS2
  - Consolidated list of tasks EYETS to Director A&T
  - Start of LSC Committee on 1st April'16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