Introduction générale du projet et des activités SU

Hélène Mainaud Durand

CERN, Mini revue sur les activités SU, 29/06/17

Outline

- Introduction to HL-LHC project (L. Rossi's slides)
- Introduction to HL-LHC survey activities

Goal of High Luminosity LHC (HL-LHC) as fixed in November 2010

From FP7 HiLumi LHC Design Study application

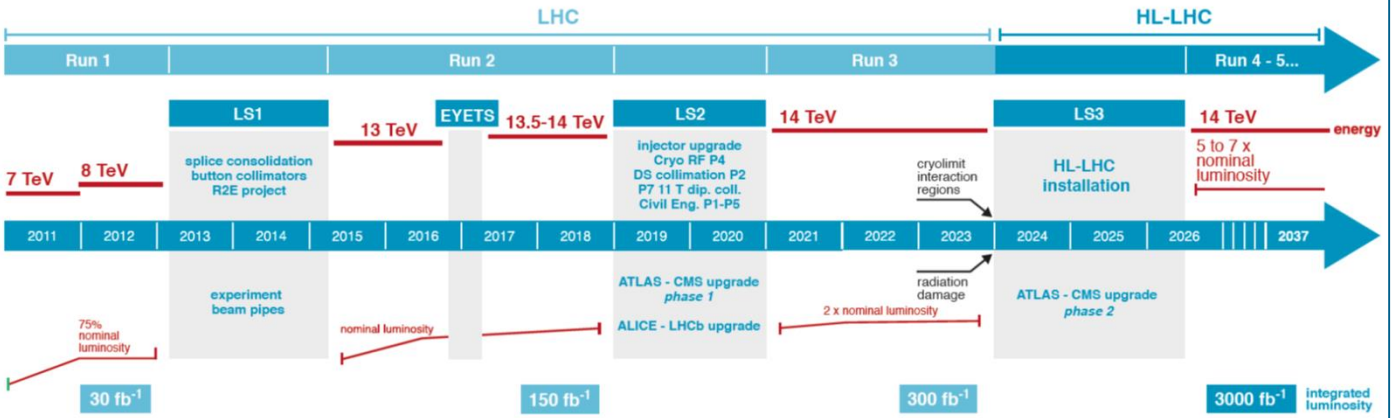
The main objective of HiLumi LHC Design Study is to determine a hardware configuration and a set of beam parameters that will allow the LHC to reach the following targets:

A peak luminosity of L_{peak} = **5×10^{34} $cm^{-2}s^{-1}$ with levelling**, allowing:

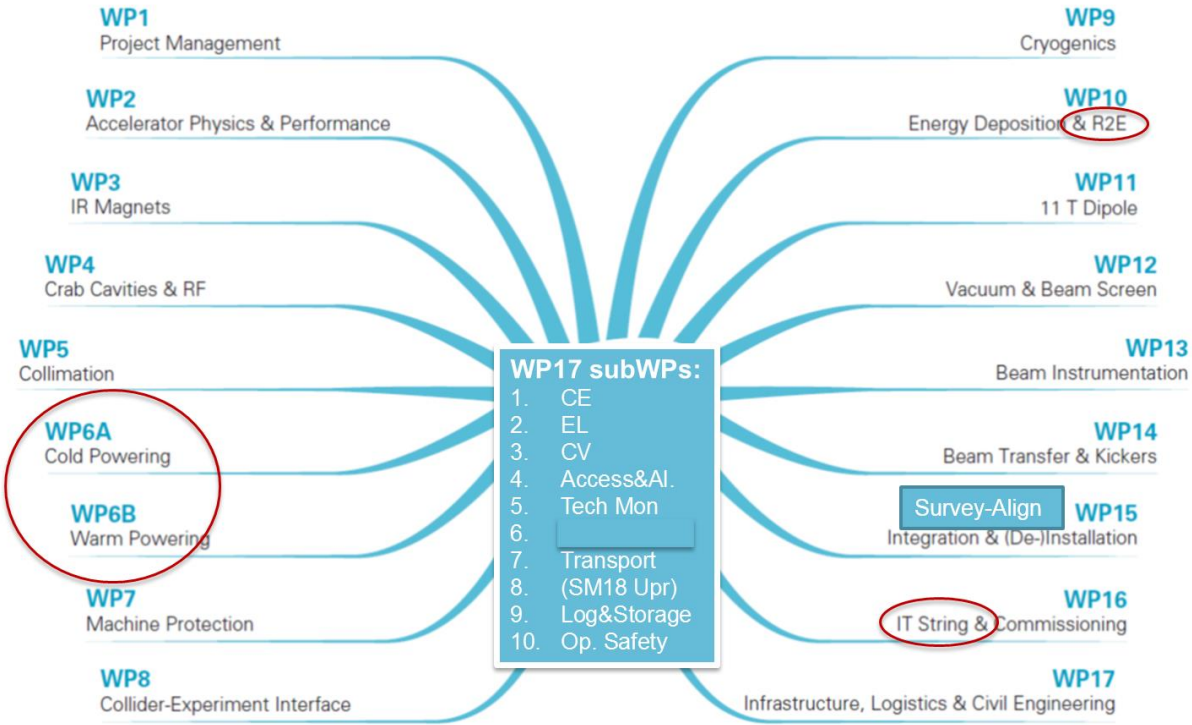
An integrated luminosity of **250 fb^{-1} per year**, enabling the goal of **L_{int} = 3000 fb^{-1}** twelve years after the upgrade.
This luminosity is more than ten times the luminosity reach of the first 10 years of the LHC lifetime.

Ultimate performance established 2015-2016: with same hardware and same beam parameters: use of **engineering margins:**
$L_{peak\ ult} \cong 7.5\ 10^{34}$ $cm^{-2}s^{-1}$ and **Ultimate Integrated $L_{int\ ult} \sim 4000$ fb^{-1}**
LHC should not be the limit, would Physics require more…

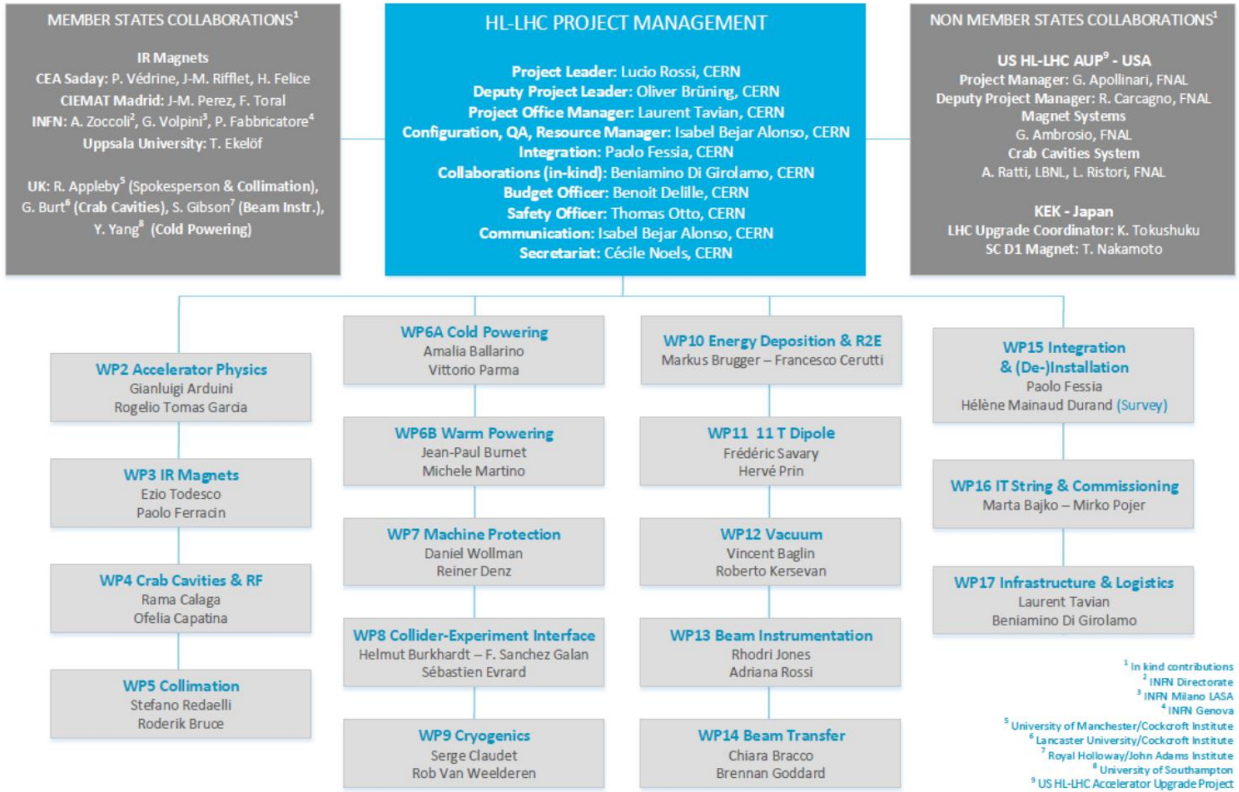
LHC / HL-LHC Plan



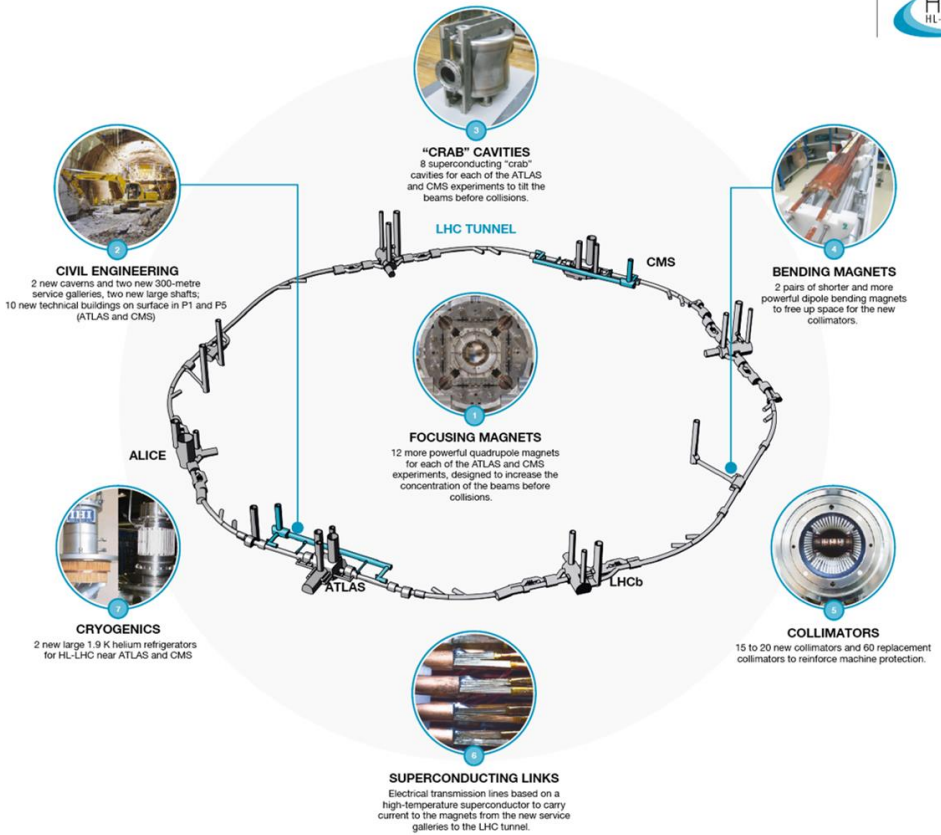
Project structure



High Luminosity LHC Project

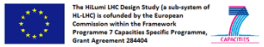


HiLumi LHC landmarks



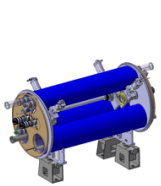
HL-LHC main milestones

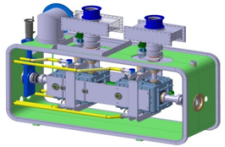
- 2010 : High Luminosity LHC Design Study established & application for EU funds
- 2011: approval and start of the EU co-funded FP7-HiLumi LHC Design Study with 20 Institutions
- 2013: Approval by EU HEP strategy of HiLumi as main project for the next decade; Kick off meeting in Daresbury of HL-LHC as construction project; P5 subpanel (USA) also put HL-LHC as next main project
- 2015: 1st C&S Review 1, end of the FP7-Design Study and insertion of the full funding profile in the CERN budget till 2026 (approved formally till 2020);
- 2015 Oct : end of FP7 design phase issue of first TDR-V0

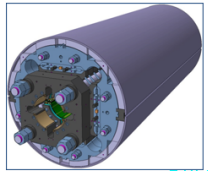


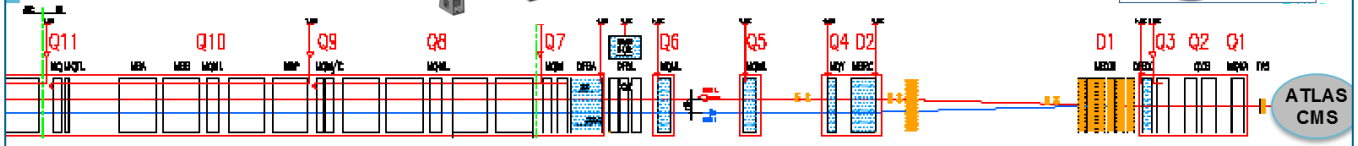
- 2016 (June Council): formal approval of the entire HL-LHC project; declared an ESFRI landmark
- 2016 June-August: re-baseline of the project
- 2016 2nd Cost & Schedule Review with full endorsement of new baseline cost

The largest HEP accelerator in construction









Dispersion Suppressor (DS) in P7

Modifications
1. In IP2: new DS collim. in C.Cryost.
2. In IP7 new DS collimation with 11 T

Cryogenics, Protection, Interface, Vacuum, Diagnostics, Inj/Extr, Controls, new UG and surface infrastr.

Matching Section (MS)

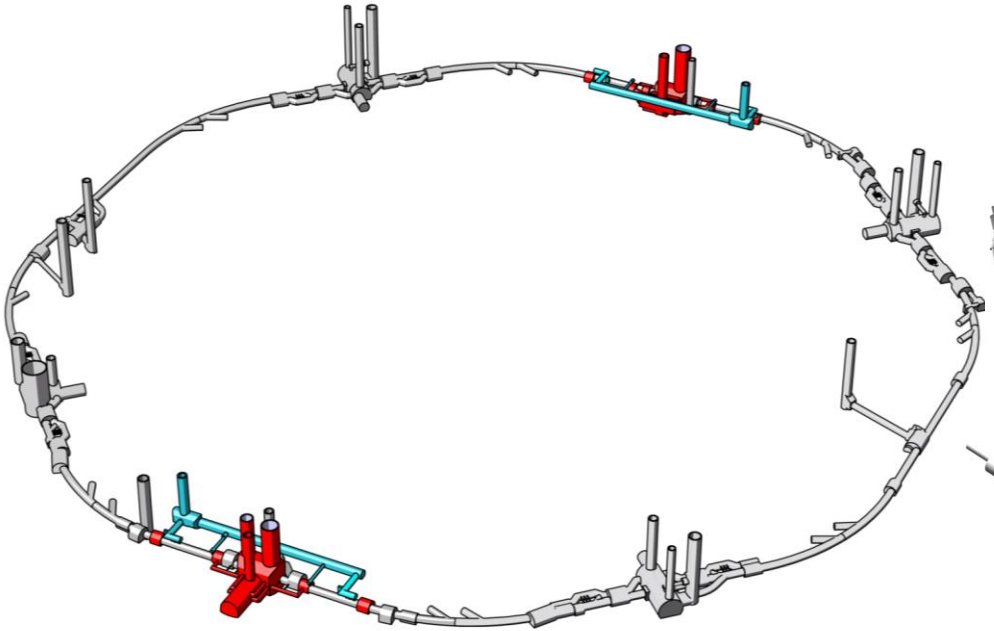
Change/new lay-out
1. TAXN
2. D2
3. CC
4. Q4
5. Correctors
6. Q5
7. Q5@1.9K in P6
8. New collimators

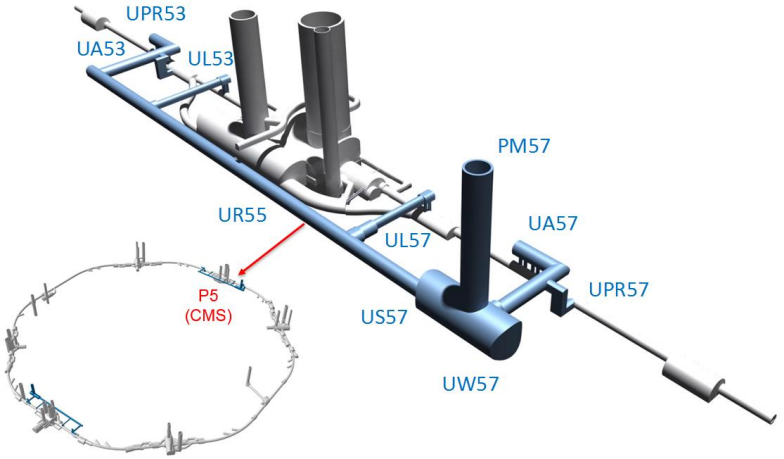
Interaction Region (ITR)

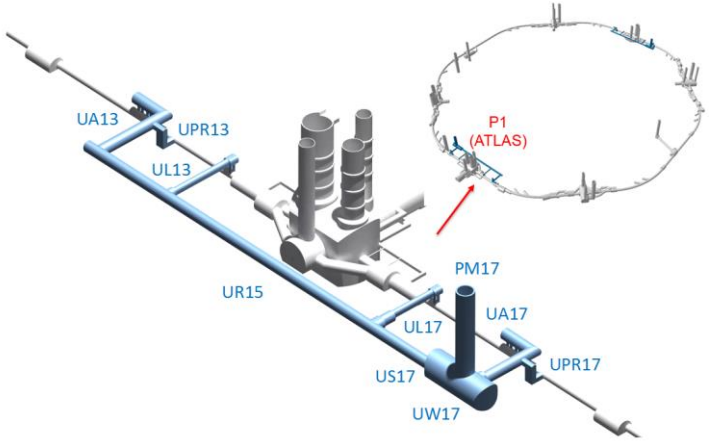
Complete change and new lay-out
1. TAXS
2. Q1-Q2a-Q2b-Q3
3. D1
4. All correctors
5. Heavy shielding (W)

> 1.2 km of LHC !!

New tunnels…




UPR53
UA53
UL53
PM57
UR55
UA57
UL57
P5
(CMS)
US57
UPR57
UW57

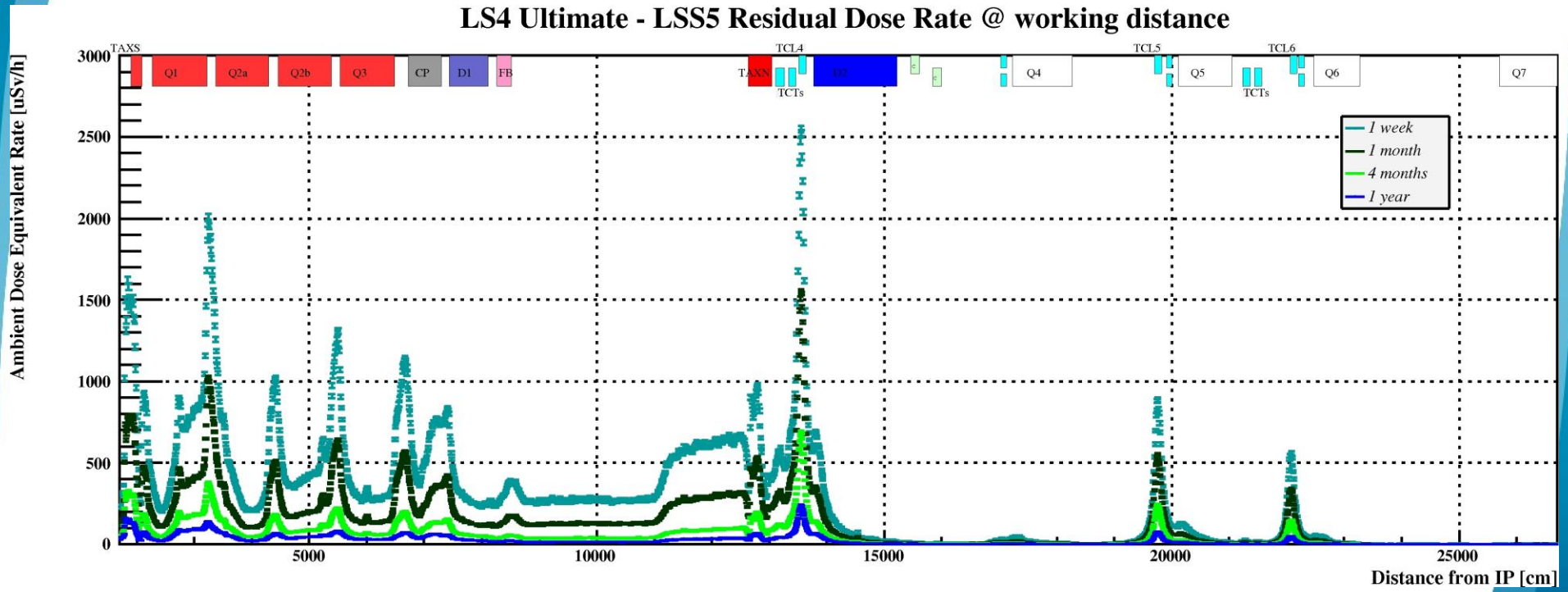

UA13
UPR13
UL13
P1
(ATLAS)
PM17
UR15
UA17
UL17
US17
UPR17
UW17

New components…

- Magnets (quadrupoles, dipoles, corrector package)
- Targets absorbers
- Beam instrumentation
- RF components (crab cavities, etc.)
- Masks
- Collimators
- Etc.

Difficult environmental conditions…

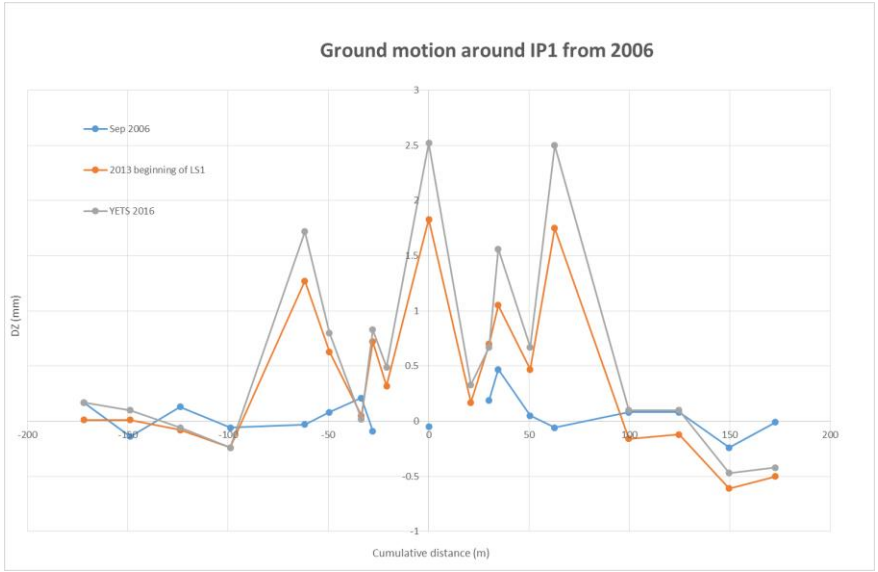
Residual dose rates

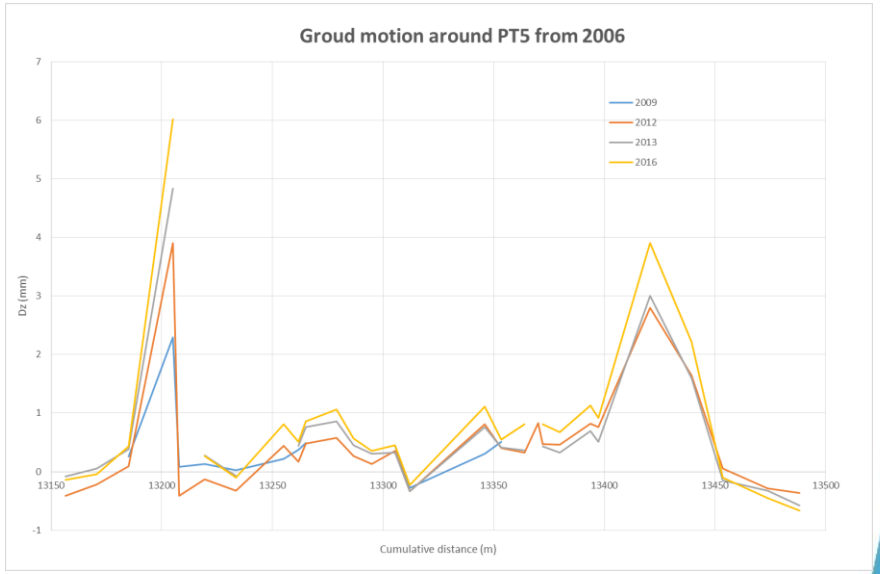


Ground motion

- Vertical ground motion

Edms n°1233554





Point 1 (vertical): + 0.25 mm/year

- Near the center of the cavern floor
- Between cavern and tunnel

Stable area after 100 m on each side of IP1

Point 5 (vertical): ground motion observed at the level of the new UJ caverns:

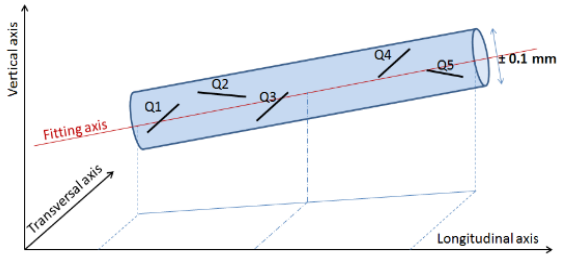
80m-130 m on each side of IP5

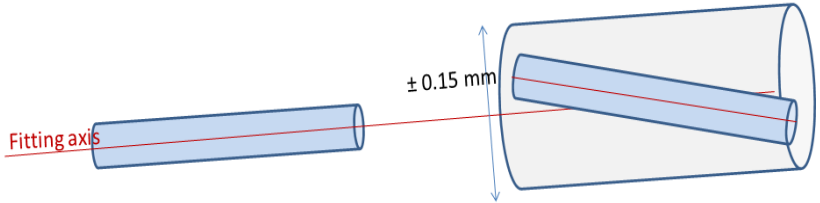
Beam requirements

CERN-ACC-2015-0014

Estimation of the deviation of the IT magnets from a laser straight line, with a quadratic sum of the following independent contributions: ± 0.27 mm

- Fiducialisation: mechanical axis vs external fiducials: ± 0.1 mm
- Smoothing :
  - Mechanical axis of quadrupoles included in a cylinder with a radius of 0.1mm
  - Left / right mechanical axis included in a cylinder with a radius of 0.15 mm.
- Misalignment between alignment campaigns: ± 0.17 mm (integrating ground motion, mechanical stress encountered during vacuum and cool-down phases)





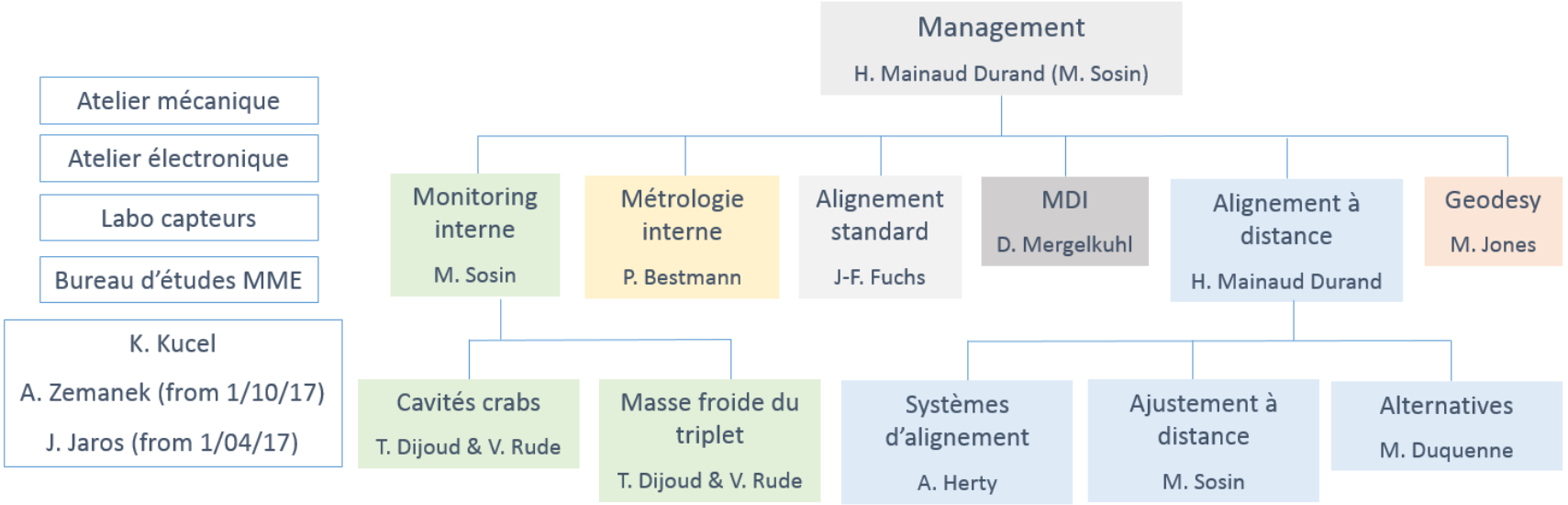
Remote adjustment of the position of the main components from Q1 to Q5 (5DOF)

Alignment improvements

- Internal monitoring of the position of the cold mass inside the cryostat of the Inner Triplet quadrupoles
- Internal monitoring of the position of the crabs cavities inside their cryostat
- Remote determination and remote adjustment of intermediary components under discussion (collimators, warm BPM, masks in front of Q4 and Q5).
- Trace position of bellows, vacuum components, etc. through the life of the machine (train to perform such measurements during YETS and LS)
- Develop a standardized support for the adjustment of intermediary components (same configuration of adjustments, all adjustment knobs on the transport side)

Scope : “alignment & internal metrology”

- Mandate:
  - Cover all geodetic aspects of the project
  - Perform the alignment of the components of the beam lines & specific components in MDI area
    - Using standard means when possible
    - With specific alignment systems (sensors & actuators)
  - Cover the internal metrology aspects
  - Carry out the as-built measurements needed in all newly equipped area


Management
H. Mainaud Durand (M. Sosin)
Atelier mécanique
Atelier électronique
Labo capteurs
Bureau d'études MME
K. Kucel
A. Zemanek (from 1/10/17)
J. Jaros (from 1/04/17)
Monitoring interne
M. Sosin
Métrologie interne
P. Bestmann
Alignement standard
J-F. Fuchs
MDI
D. Mergelkuhl
Alignement à distance
H. Mainaud Durand
Geodesy
M. Jones
Cavités crabs
T. Dijoud & V. Rude
Masse froide du triplet
T. Dijoud & V. Rude
Systèmes d'alignement
A. Herty
Ajustement à distance
M. Sosin
Alternatives
M. Duquenne

HL-LHC: mini-revue sur les activités SU

Thursday 29 Jun 2017, 08:30 → 12:30 Europe/Zurich

864-1-D02 - BE Auditorium Prevessin (CERN)

08:40 → 09:00 **Introduction générale du projet et des activités SU**
Speaker: Helene Mainaud Durand (CERN)

09:00 → 09:20 **Alignement standard**
Speaker: Jean-Frederic Fuchs (CERN)

09:20 → 09:40 **Métrologie interne et fiducialisation**
Speaker: Patrick Bestmann (CERN)

09:40 → 10:00 **TAXS**
Speaker: Dirk Mergelkuhl (CERN)

10:00 → 10:20 **Géodésie**
Speaker: Mark Jones (CERN)

10:20 → 10:30 **Discussion**

10:30 → 10:45 **Pause café**

10:45 → 11:05 **Ajustement à distance**
Speaker: Mateusz Sosin (CERN)

11:05 → 11:25 **Systèmes d'alignement**
Speaker: Mr. Andreas Herty (CERN)

11:25 → 11:45 **Etudes spéciales**
Speaker: Mathieu Duquenne (Conservatoire National des Arts et Metiers - CNAM (FR))

11:45 → 12:05 **Monitoring des masses froides et cavités crabs**
Speaker: Mateusz Sosin (CERN)

12:05 → 12:25 **Organisation des activités et conclusion**
Speaker: Helene Mainaud Durand (CERN)

Thank you very much