High Luminosity LHC

Report from Parameter and Lay-out Committee

The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

PLC Mandate (part I)

- The PLC will establish and maintain a coherent and dynamic list of parameters and associated hardware lay-out for the HL-LHC. The list will include beam parameters, the new accelerator components including the ones interfacing with the experimental detectors, with their main characteristics and nominal performance. The PLC will maintain also a list of processes or operation cycles for the HL-LHC run.

PLC Mandate (part II)

- The PLC will monitor and recommend changes in parameters or machine layout based on interim reports from the work package (WP) leaders or any other relevant bodies. When applicable, it will also request dedicated studies to solve or mitigate any possible kind of inconsistencies and prepare the decision making process at the Steering Committee (SC).

HL-LHC Technical Committee

- The PLC works hand in hand with the HL-LHC Technical Committee for analyzing, studying and identifying or mitigating any possible kind of inconsistencies and conflicts with existing infrastructure and prepare a final technical proposal.
- Examples:
  - Long-Range Beam-Beam Wire compensators
  - Hollow electron lens

PLC Composition and Meeting Schedule

- Organization:

Chairman:	Oliver Brüning
Scientific secretary:	Markus Zerlauth
Administrative support:	Cecile Noels

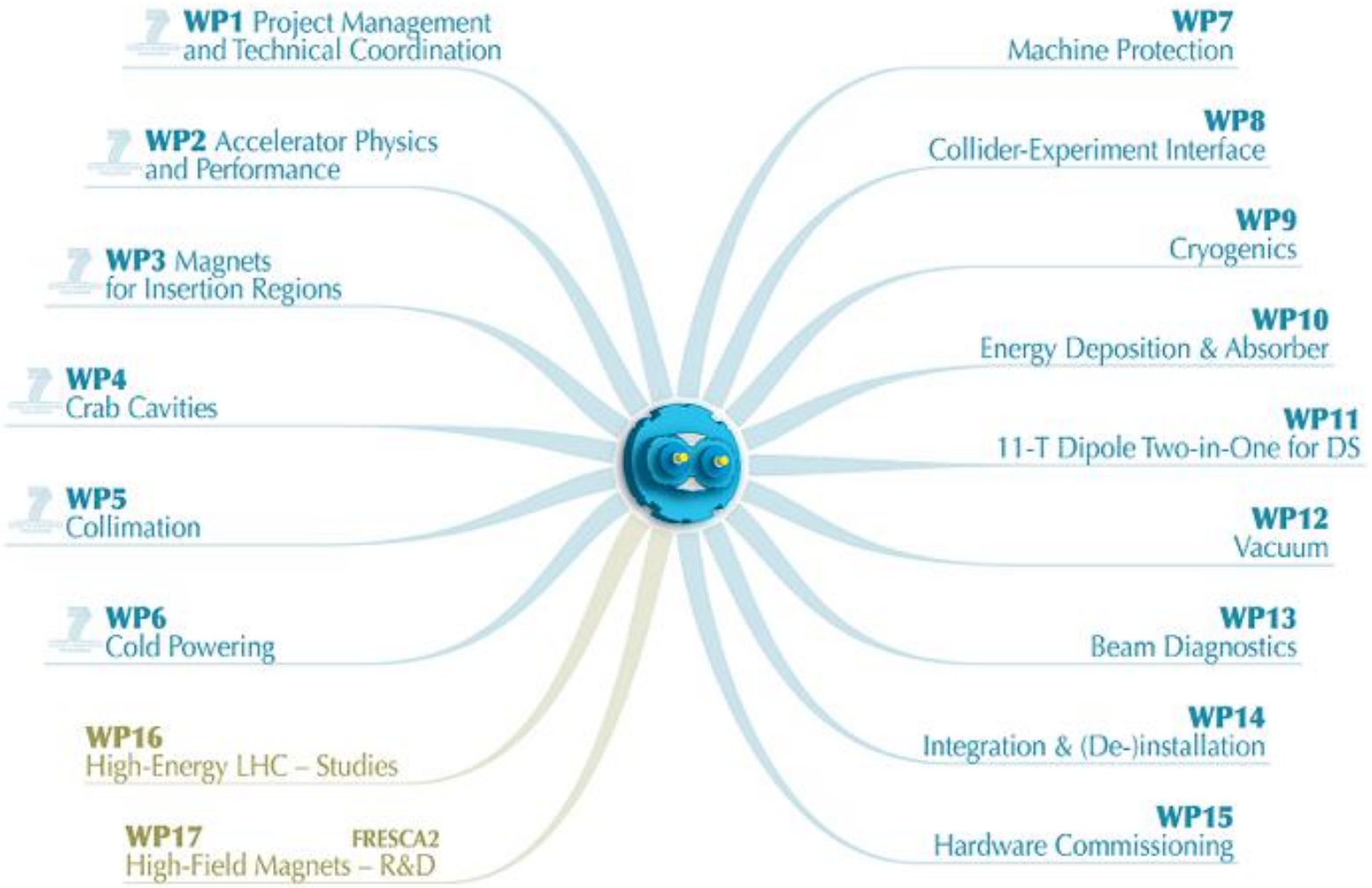
- Two meetings in 2012 so far and one planned for January 2013 ➔ 1 meeting every two months

PLC Composition and Meeting Schedule

- Composition:

  All main hardware groups of the CERN accelerator sector will be represented as well as the main WPs in which the project is subdivided. The PLC Chairperson proposes the membership for approval to the Steering Committee (SC) of the HL-LHC. The PLC will meet as many times as needed at discretion of the Chairperson, with a minimum of four times per year.

HL-LHC Structure



HL-LHC PLC

- PLC page under High Lumi Project Intranet (Cecile):

https://espace.cern.ch/HiLumi/default.aspx

https://espace.cern.ch/HiLumi/PLC/default.aspx

HL-LHC PLC

Parameters agreed on at the 2nd HL-LHC Coordination Group Meeting:

-maximum of 140 events per crossing

- ➔ $L = 5\ 10^{34}\ cm^{-2}\ sec^{-1}$ for 25ns
- ➔ $L = 2.5\ 10^{34}\ cm^{-2}\ sec^{-1}$ for 50ns

Pile-up density leveling

- ➔ Leveling options?

-goal for integrated annual luminosity:

- ➔ 250 fb^{-1} per year

-Total luminosity for HL-LHC project

- ➔ 3000 fb^{-1} total

HL-LHC Performance Estimates

'Stretched' Baseline Parameters following 2nd HL-LHC-LIU:

Parameter	nominal	25ns	50ns
N	1.15E+11	**2.2E+11**	**3.5E+11**
n_b	2808	2808	1404
beam current [A]	0.58	**1.12**	**0.89**
x-ing angle [μrad]	300	590	590
beam separation [σ]	9.9	12.5	11.4
β^* [m]	0.55	**0.15**	**0.15**
ε_n [μm]	3.75	2.5	3.0
ε_L [eVs]	2.51	2.51	2.51
energy spread	1.20E-04	1.20E-04	1.20E-04
bunch length [m]	7.50E-02	7.50E-02	7.50E-02
IBS horizontal [h]	80 -> 106	**18.5**	**17.2**
IBS longitudinal [h]	61 -> 60	**20.4**	**16.1**
Piwinski parameter	0.68	**3.12**	**2.85**
geom. reduction	0.83	**0.305**	**0.331**
beam-beam / IP	3.10E-03	**3.3E-03**	**4.7E-03**
Peak Luminosity	1 10^{34}	**7.4 10^{34}**	**8.5 10^{34}**
Virtual Luminosity	1.2 10^{34}	**24 10^{34}**	**26 10^{34}**
Events / crossing (peak & leveled L)	19 -> 28	**207**	**476** **140** **140**

6.2 10^{14} and 4.9 10^{14} p/beam

➔ sufficient room for leveling (with Crab Cavities)

Virtual luminosity (25ns) of
$L = 7.4 / 0.305\ 10^{34}\ cm^{-2}\ s^{-1}$
$= 24\ 10^{34}\ cm^{-2}\ s^{-1}$ ('k' = 5)

Virtual luminosity (50ns) of
$L = 8.5 / 0.331\ 10^{34}\ cm^{-2}\ s^{-1}$
$= 26\ 10^{34}\ cm^{-2}\ s^{-1}$ ('k' = 10)

(Leveled to 5 $10^{34}\ cm^{-2}\ s^{-1}$ and 2.5 $10^{34}\ cm^{-2}\ s^{-1}$)

Main topics for first meetings:

- Mandate and composition ✔
- Baseline parameters ✔
- Approval of triplet coil diameter of 150mm ✔
- Layout and optics ✔
- Triplet beam screen and vacuum ✔
- Cryogenics (current limitations ➔ IR and arcs)
- Beam instrumentation (space reservations)
- Crab cavity (layout and parameters)
- EDMS Data base and documentation

HL-LHC PLC

Other future topics:

-Review of the HL-LHC Layout in the insertions

➔TAS & TAN space, space for additional components, Survey needs

-IR layout with CC

-Required corrector circuits➔ (e.g. triplet, additional octupoles etc)

-Generation of a common Glossary with the experiments ✔

-DS collimators

-Places for higher harmonic RF system and new BI

-Current limitations (e.g. MKI, dump, TDI etc)

-IR3 and IR7 warm magnet consolidation options

-Powering aspects and space requirements in the HL Irs

-Ion beam parameters during HL-LHC

-EDMS data base structure for HL-LHC

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