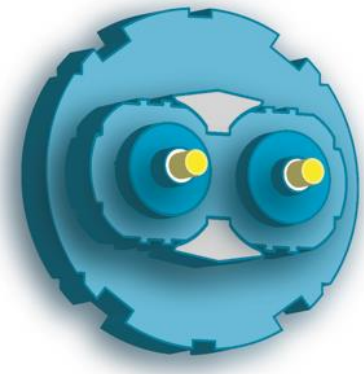


High Luminosity LHC

HL-LHC Cost and Schedule Review preparation

I. Bejar Alonso / B. Delille

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.

Background

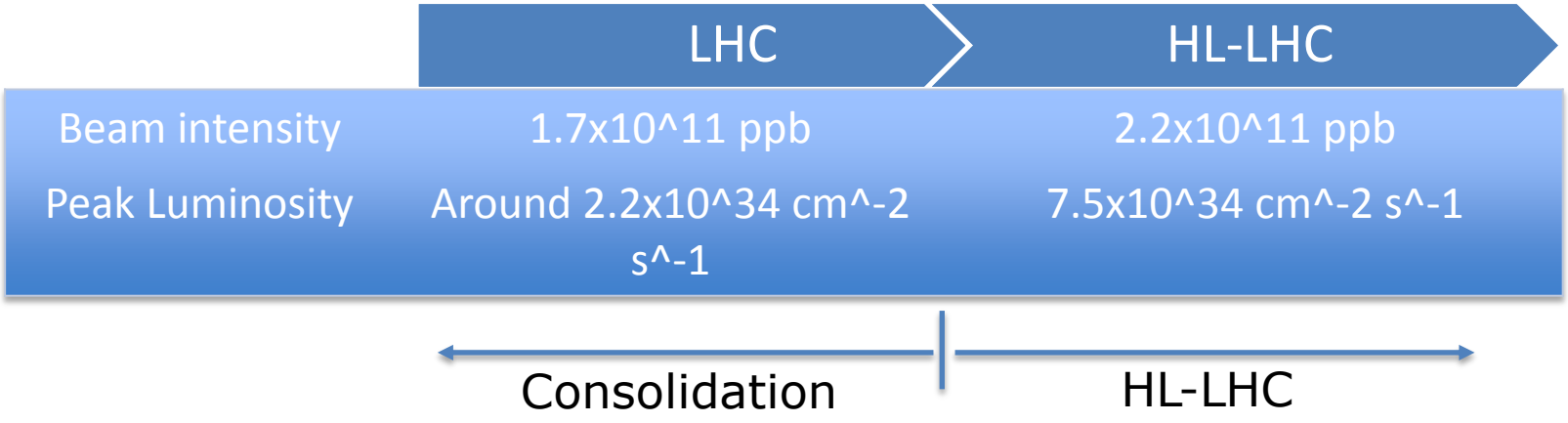
- MTP 2015-2019 incorporates long-term outlook up to 2025, in line with the updated European Strategy for Particle Physics
- Integration in the MTP of the construction and commissioning of the full HL-LHC programme and the completion of the detector upgrades by the end of Long Shutdown 3 (LS3), scheduled for the years 2023 to 2025
- Driving factor for the budget cumulative deficit for the period up to 2025

→Cost and Schedule Review – 9 to 11th of March 2015

Reviewers: CMAC and other experts

Cost & Schedule Review - Scope

- HL-LHC and LIU projects
- taking into consideration how these are linked to the consolidation project and the operation of the CERN accelerator complex



Cost & Schedule Review - Purpose

- Assess the status of the project development taking into account the technical developments that are still ongoing
- Assess the project baseline, i.e.
  - Project Scope
  - Schedule
  - Cost

  And
  - Project Management Methods
  - Risks: Evaluation and risk management

Cost & Schedule Review - 3 Days Programme

9 March 2015

- Plenary
- Breakout sessions

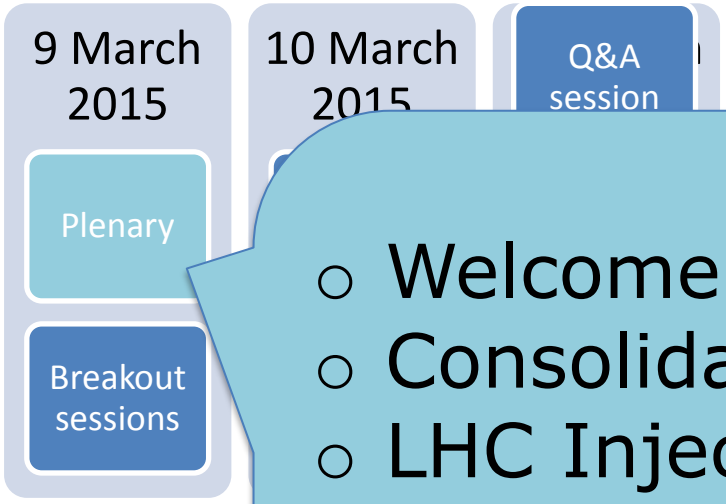
10 March 2015

- Breakout sessions
- Breakout sessions

11 March 2015

- Q&A session
- Recommendations and Close-out

Cost & Schedule Review - 3 Days Programme



- Welcome
- Consolidation Program
- LHC Injectors Upgrade Project – Plenary talk
- High Luminosity LHC Project – Plenary talk

Cost & Schedule Review - 3 Days Programme

9 March 2015	10 March 2015	11 March 2015
Plenary	Breakout sessions	Q&A session
Breakout sessions		

7 Parallel Sessions

LIU & HL-LHC	Accelerator Physics
LIU	Perspective of each Injector
HL-LHC	SC Magnets and Cryogenic Systems
HL-LHC	SC Cavities
HL-LHC	Other Accelerator Systems, Support and Interface Systems
LIU & HL-LHC	Infrastructure Upgrade and Integration
LIU & HL-LHC	Cost, Schedule, Management, Risks

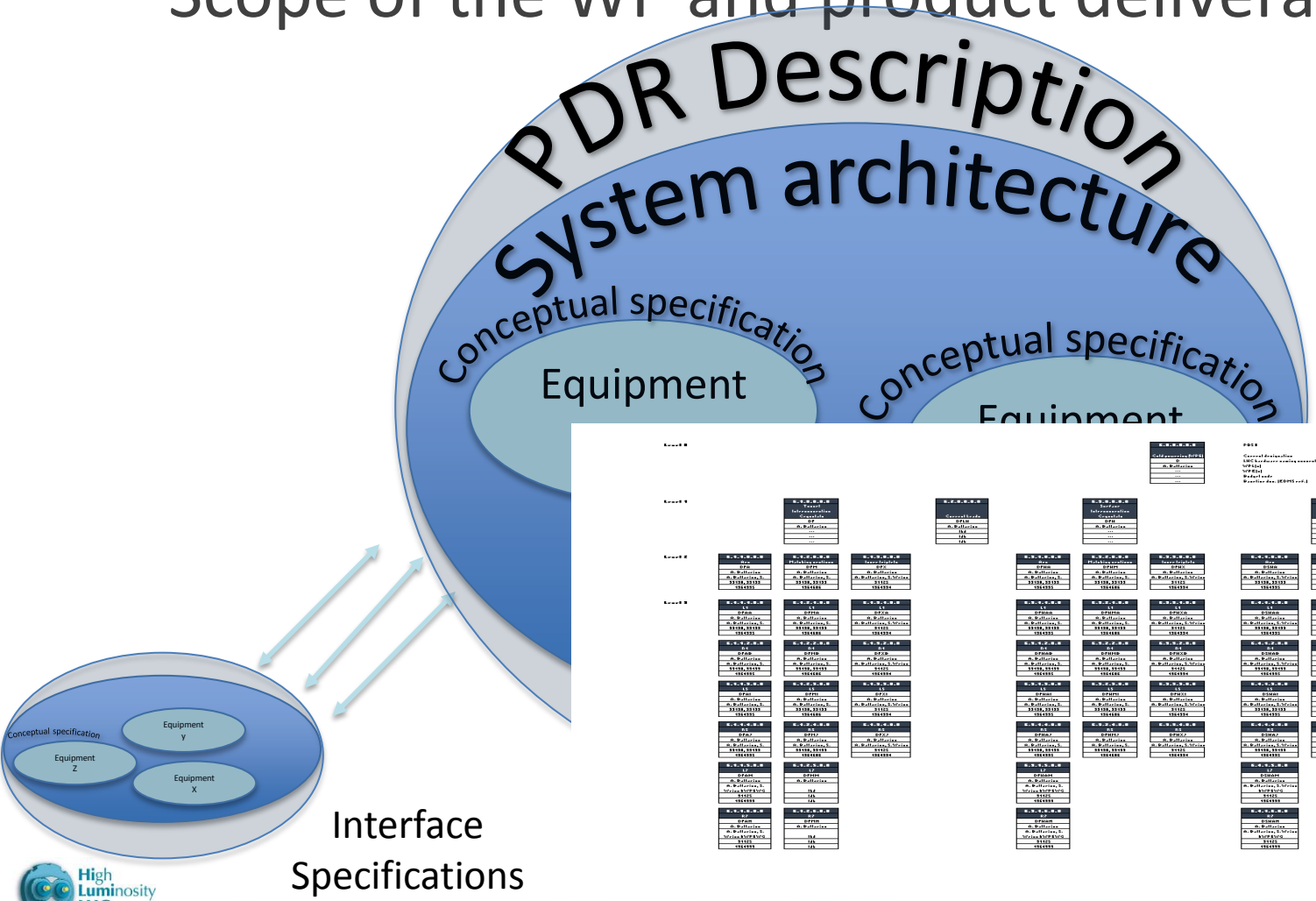
Breakout sessions: Typical information to be addressed

Same structure of presentation for each WP – coordinated with LIU

- Scope of the WP and product deliverables
- Technical Baseline and Options
- Cost estimate - main drivers and uncertainty / alignment with schedule
- Schedule for each phase – Conceptual, Fabrication and Installation – and integration in the global schedule
- Risks: First level assessment and Risks register

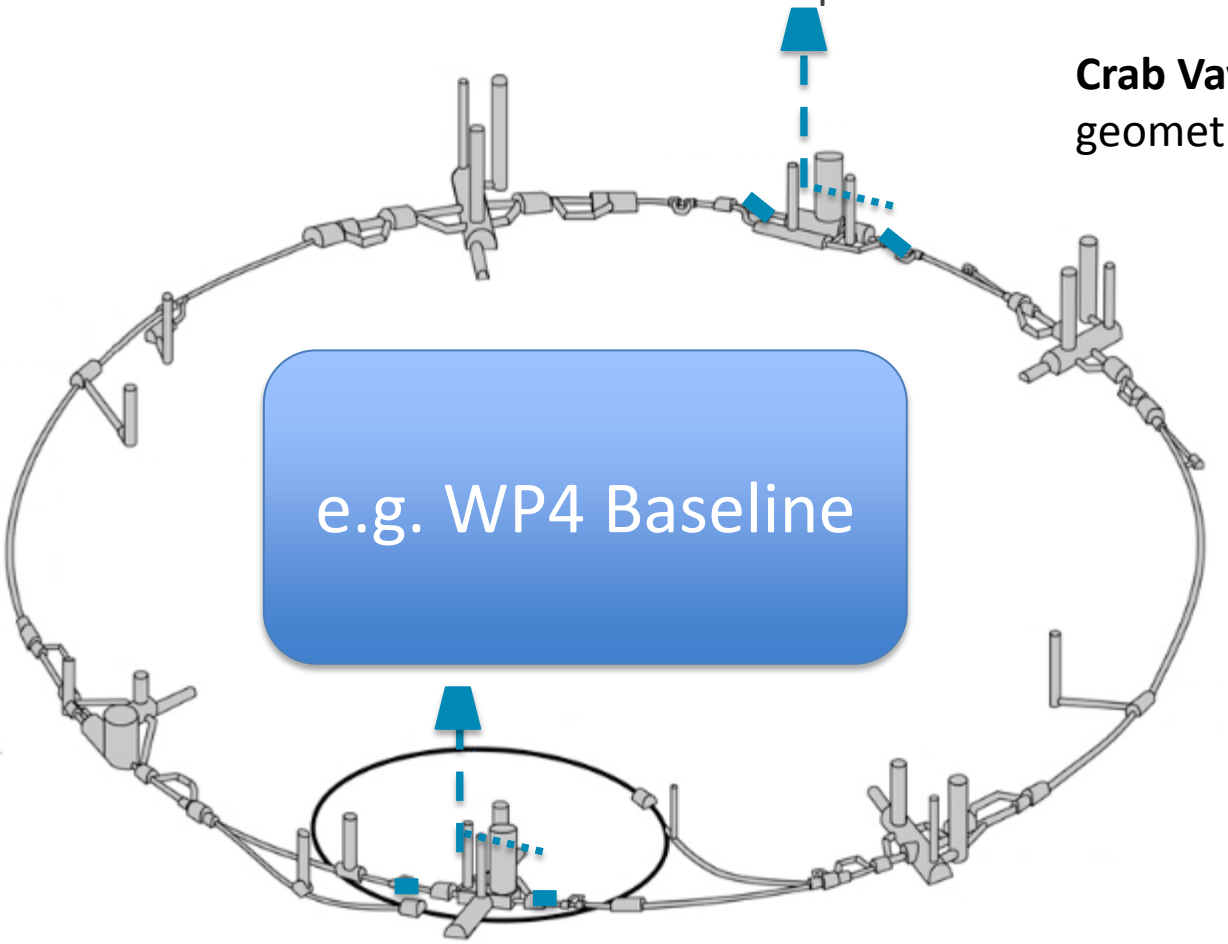
Breakout sessions: Typical information to be addressed

- Scope of the WP and product deliverables



Breakout sessions: Typical information to be addressed

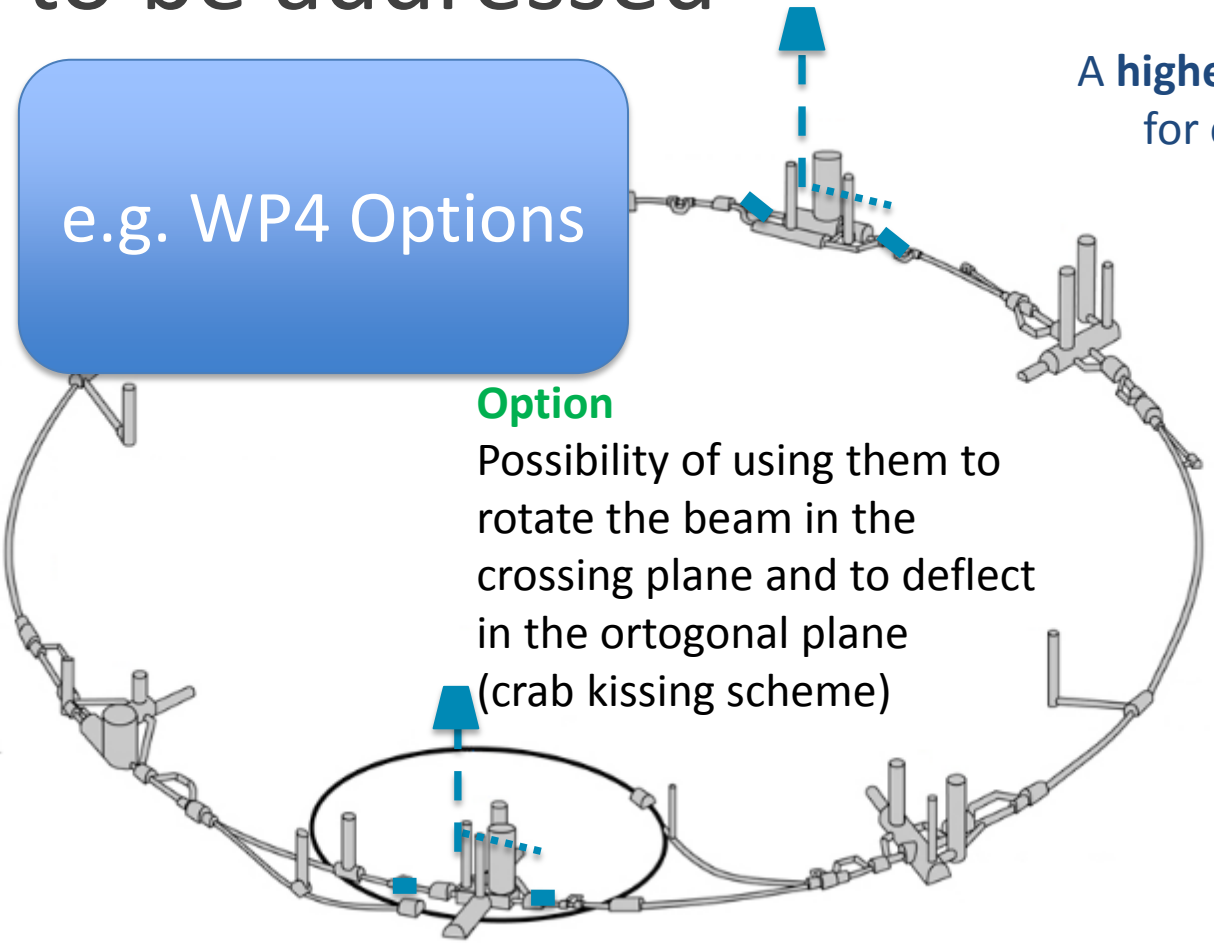
- Technical Baseline and Options



Crab Vavities to Compensate for the geometric reduction factor

Breakout sessions: Typical information to be addressed

e.g. WP4 Options



Option
Possibility of using them to rotate the beam in the crossing plane and to deflect in the ortogonal plane (crab kissing scheme)

A **higher harmonic (800 MHz)** either for changing the bunch profile or the synchrotron frequency distribution to improve beam stability

A **sub-harmonic (200 MHz)** system can either replace the existing main RF system or work with the 400 MHz RF system which in this case will act as the 2nd harmonic to increase bunch stability

When:
To reduce the beam induced heating, effect of intra-beam scattering, improve longitudinal beam stability and in some scenarios to increase or level luminosity

Breakout sessions: Typical information to be addressed

- Cost : Assess main cost drivers and uncertainty
  - Types of resources
    - M : Hardware (CHF)
    - P: staff and fellows (person.years)
    - M4P: fellows, MPAs, Ind. services (person.years)
- Cost : Populating Activity Planning Tool (CERN APT)
  - Bottom-up exercise with WP leaders:Dec14-Jan15
  - Synchronisation with resources coordinators (CERN DPOs)

Breakout sessions: Typical information to be addressed

- Schedule for each phase – Conceptual, Fabrication and Installation – and integration in the global schedule
- Life cycle for each one of the work package
- Milestones as connection points to global schedule

Risk Management

- Risks: First level assessment and Risks register
  - First level assessment as done by LIU

    → 'What if ? method'
  - Risks register based on CERN-wide methodology, with existing risks catalog and risks impact and vulnerability matrices

→ to be further coordinated with LIU colleagues

In-kind contributions

- HL-LHC is a global project
  - with in-kind contributions
  - from different regions of the world
  - using different accounting systems
- « Value & explicit labor » methodology
  - independent of any particular accounting system
  - compatible with this diversity
  - adopted by other Organisations
- Value
  - lowest reasonable estimate of the price of goods and services procured from industry on the world market in adequate quality and quantity → the M
- Explicit labor
  - personnel provided by CERN and collaborating institutes → The P and M4P
  - expressed in person.years

Conclusions

- After the PDR, the C&S review is another challenging milestone
- The C&S review will provide us and the CERN management with answers
  - Is the estimated budget of the project adequate (within reasons)?
  - Are there any options to save some money?
  - What are the areas of high risk for scope, schedule or cost overrun?
  - Is the schedule well developed, credible and synchronized between the ongoing activities?
  - Are the foreseen resources correctly evaluated?
  - Will the expertise (management and technical) be available when needed?

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Breakout sessions: Typical information to be addressed

- Scope of the WP and product deliverables
  - General description from the PDR
  - Systems architecture
  - Interface specifications
  - Concept