



# International Review of the Conceptual Design of the Cold Powering system for the HL-LHC Superconducting Magnets

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2017-02-02



# Practical details

- 3<sup>rd</sup> – 4<sup>th</sup> of July 2017
- At CERN
- <https://indico.cern.ch/event/643197/timetable/#20170703>
- Monday 3.07 : [30-7-18]
  - 8:30-9:00 : Closed session
  - 9:00-12:30 : Presentations (with coffee break)
  - 12:30-14:00 : Lunch
  - 14:00-~18:00 : Presentations (with coffee break)
  - ~ 19:00 Review dinner by invitation (all speakers are invited)
- Tuesday 4.07 : Morning : [30-7-18]
  - Visit to 927 and SM18
  - Answers to questions **(Make yourself available)**
- 12:00-14:00 : Lunch
- Tuesday 4.07 : Afternoon: [112-2-023]
  - 14:00-16:00 : Possible answers to questions **(Make yourself available)**
  - 16:00-17:00 : Closed session
  - **17:00 : Close out [30-7-18]**

## Members of the Review Panel:

- Akira Yamamoto (KEK-CERN, Chair)
- Maciej Chorowski (WUT)
- Chen-yu Gung (ITER)
- Joe Minervini (MIT)
- Davide Tommasini (CERN)
- Pierre Vedrine (CEA)

# Mandate and charges

- The High Luminosity LHC (HL-LHC) project has been approved by the CERN Council in the June 2016 session, with a financing profile covering till end of installation in 2026. For the first time the powering system is based on high current long ( $>100$  m) superconducting lines (called Superconducting Links) employing superconductor operating in He gas, well above the usual LHe or HEII temperatures.
- The HL-LHC cold powering (WP6A in the Project Breakdown) is a complex system that has to enable transferring about 100 kA into the superconducting magnets of the upgraded LHC insertion magnets. The system is now in an advanced phase of design; **SC links basic concept have been demonstrated about two years ago in a 20 kA - 20 m long demonstrators**, while a long prototype ( $>60$  m) of final size and current is under constructions. **Other features of the system, like joint box, cold distribution box, etc. are being designed or under validation**. However, due to various changes in the general powering scheme, some of them rather recent, **the design of the full system still requires some time**. **The system must be fully designed and validated within 2018 to allow launching production of components for the final production in 2019 and 2020**. The design must also live with the constraints given by the already defined technical infrastructure and integration, which at this stage cannot be substantially changed. **A test of a system in Inner triplet String is foreseen in 2021-23, and installation in LHC P1 and P5 is foreseen in 2024 and early 2025**.
- The present review has been called to examine **the preliminary design**, the main choices, to assess the presence of possible show-stoppers and to see if interfaces between WP3 (Magnets) and WP6B (warm powering), as well as Cryogenics and Circuit protection, are well defined. The review **will cover both technical aspects and general integration, as well as the global**

## Questions to be answered (1/2)

- Is the technical scope of the Cold Powering System well defined and **interfaces** with adjacent equipment well clarified, also regarding installation? And in particular is the design and validation of the components closely linked to the cold powering (for example: bus bars, quench detection and protection, warm powering, etc.) **sufficiently defined to allow finalization of the design of the CPS?**
- Is the general design correct and adequate to meet the scope? Is the design safe also with respect to the boundary conditions given by the magnets and circuit protection system?
- Is the basic design of each components or subsystem adequate to the scope with reasonable margins? **For the items still under definition, is the plan to finalize the design sound?**

## Questions to be answered (2/2)

- Is the **plan** to complete the design, to develop demonstrators for each critical item (for example splices among different materials, cabling of many large conductors, handling of the heavy and long SC links, e.m. coupling inter-circuit at acceptable level, etc.) **properly done and sound**? Are any critical design and technological developments that are still missing or in severe delay?
- Is the test plan including the IT String test adequate (without too many details at this early stage)?
- Are there issues that have been neglected or underestimated?

# Various

- While the cost and resources are not in the scope of the review (they have been reviewed by an international panel in HL-LHC C&S reviews on March 2015 and October 2016), the reviewers may **comment on the level of resources allocated to design, prototyping and validations, as well as on the schedule.**
- The review panel reports to the HL-LHC Project Leader and the panel chair is required to deliver a written report within one month after the review.
- **Design robustness, reliability and availability are critical domains to be demonstrated**

