

Status of the FCC cryogenics feasibility study (invited)

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Capitalising on the cryogenic operation experience of the LHC (Large Hadron Collider) at CERN and thanks to the promising results of the R&D efforts, the first phase of the Future Circular Collider (FCC) study presents in its Conceptual Design Report (CDR) published in January 2019 a clear route to a post-LHC machine, expected to be housed in a new 91km circumference underground tunnel. Regarding the cryogenic system, the CDR is describing the proposed architecture required by the implementation of the staged FCC programme, integrating in sequence a lepton (FCC-ee) then a hadron (FCC-hh) collider in the same tunnel with related cryogenic system upgrades respectively.

As from 2021, the FCC feasibility Study is capitalizing on the work of the Conceptual Design Report to refine its results regarding the architecture of the cryogenic systems of both FCC-ee and -hh machines, aiming at issuing an intermediate Feasibility Report by end of 2023 and a final report by 2025, which shall serve as input for the next European Strategy for Particle Physics (ESPP) update in 2026/2027.

The design of cryogenic systems is taking into consideration all the updates transmitted by stakeholders and impacting its general architecture, from the original ones on the general accelerator layout, to the more recent ongoing work on superconducting RF (SRF) cavities design for the FCC-ee machine.

This paper presents the status of the cryogenics study, emphasizing on the necessary update of the cryogenic processes and heat loads, helium inventory and energy consumption related to the recent modifications of the accelerator general layout, with a distinction made between the SRF systems, the detectors, and the machine-detector interface regions.

An operation mode targeting energy preservation is presented, while ongoing parametric studies on the design of specific components of the SRF cavities and the cryogenic distribution are introduced.

Finally, a preliminary installation strategy is described for surface and underground facilities, covering all operation phases of the machine, and recalling the next objectives to be met to complete the Feasibility Study in 2025.

Submitters Country

Switzerland

Author: DELPRAT, Laurent (CERN)

Co-authors: BRADU, Benjamin (CERN); NAYDENOV POPOV, Boyan-Kaloyanov (CERN); BRODZINSKI, Krzysztof (CERN)

Presenter: DELPRAT, Laurent (CERN)

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