Design principles and key features

Cryogenic distribution system
- 2 valve boxes – VB1 as interface to the cold box, VB2 to the Service Box
- Sub-cooler in VB1 phase separator to recondition supercritical helium supply stream
- 80 m long distribution line (TL): supercritical He for the supply and thermal shielding to minimize the losses
- Liquid helium produced at VB2 then sent to the Service Box

Service Box
- Main function: provide adapted interfaces between 4.5 K distribution, client cryostat and helium pumping system
- Integrated subcooling heat exchanger for supply helium stream precooling

Helium pumping system
- Water bath heater, installed power 10 kW
- 2 Roots pumping units, total 2.3 g/s at 20 mbar abs

Crab cavities cryomodule
- 4.5 K LHe sat and 2 K – 30 mbar abs operation
- 18 W (static) and expected 13 W (dynamic) @ 2 K
- Integration in SPS (same proton beams as in LHC)
- Mobile platform to bypass it when SPS serves as LHC injector

Movable helium cryoplant @ 4.5 K
- 4 major constraints: timeframe of the supply, guarantee of the required performances, accessibility of installation location, movability requirement
- Liquefaction mode: 7 g/s of LHe @ 4.5 K + 750 W shielding @ 50 – 80 K
- Refrigeration mode: 700 W @ 4.5 K + 300 W shielding @ 50 – 80 K
- LN$_2$ precooling in both modes
- LR280 from Linde Kryotechnik AG® with liquefaction and refrigeration turbines

Procurement timeline

Commissioning and operation

Design, procurement, installation and commissioning of the cryogenic infrastructure for a new superconducting RF test facility with beam at CERN

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Introduction. The High-Luminosity LHC project – HL-LHC aiming at peak luminosity above 5.0.10$^{34}$ cm$^{-2}$.s$^{-1}$ consists in replacing the matching sections on both sides of the ATLAS and CMS experiments. To complement new focusing quadrupoles, this upgrade considers using crab cavities, never operated with protons. New cryogenic infrastructure was thus initiated and recently installed at CERN SPS accelerator in 2018. This poster describes the main cryogenic requirements of this infrastructure, its design challenges, procurement, installation, and commissioning up to stable operation of the crab cavities module in superfluid helium at 2 K.