Contribution ID: **19** Type: **Poster**

C2Po1B-01: LHC cryogenic system adaptation and recovery after a major insulation vacuum breakage in a final focusing superconducting magnet in 2023

Tuesday 20 May 2025 09:15 (1h 45m)

On July 17, 2023, during the LHC (Large Hadron Collider) beam operation for Physics Run 3, one of the low-beta superconducting quadrupoles located on the left side of LHC Point 8 (ITL8) experienced a quench following an electrical network disturbance. This quench unfortunately caused a crack in one of the magnet interconnection bellows, resulting in a significant leak between the cryogenic helium vessel, maintained at 1.9 K, and its insulation vacuum. As a result, the magnet rapidly warmed up, necessitating immediate repairs to resume LHC operations.

To avoid a full warm-up and cooldown of the entire 3 km LHC sector, which would have significantly impacted the physics schedule, it was decided—after a thorough risk analysis prioritizing personnel safety—to repair the magnet interconnection bellow in situ. This approach involved locally warming the affected area to room temperature while allowing the rest of the LHC sector to drift in temperature, with an upper limit of 80 K. This limitation restricted the available repair time to 10 days.

This scenario, originally not foreseen in the cryogenic operation procedures, was swiftly studied and validated using cryogenic dynamic simulations. A repair plan for the damaged bellow was rapidly developed and executed thanks to an impressive collaborative effort from various CERN teams, minimizing LHC downtime.

This paper describes the exceptional procedure of partial, localized warm-up, the requalification of the helium circuits following the repair, and the subsequent recooling of the machine to its nominal operating temperature, enabling the LHC to resume physics operations.

Author: BRADU, Benjamin (CERN)

Co-authors: HERBLIN, Lionel (CERN); Mr COMBE, Michel (CERN); PIROTTE, Olivier (CERN); GAHIER, Vanessa (CERN)

Presenter: BRADU, Benjamin (CERN)

Session Classification: C2Po1B - Large Scale Cryogenic Systems III: Operation & Design III