

# Status of the LHC injectors, experimental areas and LHC insulation vacuum

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The injector chain of the Large Hadron Collider (LHC) underwent significant upgrades during the Long Shutdown 2, spanning from 2019 to 2021, aimed at achieving the beam quality necessary for the High-Luminosity LHC. This contribution serves as a continuation of the report presented in the preceding OLAV workshop [1]. It describes the upgrades and modifications implemented, alongside the encountered challenges during installation and commissioning. Additionally, it provides an overview of the operational experience gained thus far. This review extends beyond the LHC accelerator chain to incorporate various experimental areas such as HiRadMat, ISOLDE, nTOF, AWAKE, and more. Notably, ELENA has achieved full operational status following the installation of the new electron cooler and transfer lines, with the inaugural delivery of antiproton beams in 2018. Looking forward, this contribution also addresses the principal future challenges including the upcoming Long Shutdown 3 (spanning from 2026 to 2029) and beyond.

[1] J.A. Ferreira, Status of LHC injectors and experimental areas, 5th Workshop on the operation of large vacuum system OLAV, 2017, DESY Hamburg, Germany. <https://indico.desy.de/event/16256/>

## Summary

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