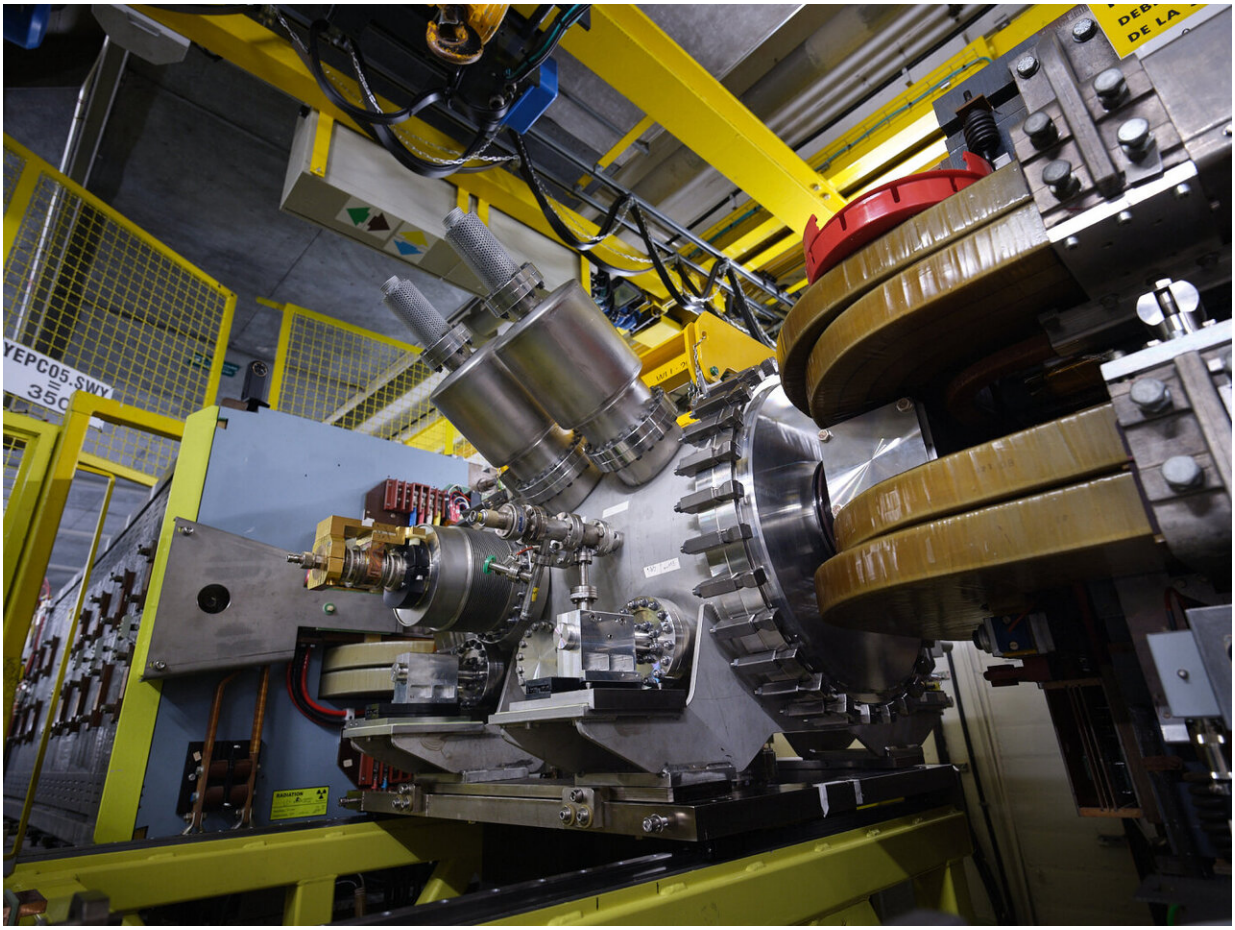
LS2 report: CERN's oldest accelerator awakens

March 10 2021, by Thomas Hortala



A new septum magnet after its installation in the Proton Synchrotron. Credit: CERN

"Synchrotron (PS) is the beating heart of CERN's accelerator system. Situated at the center of the complex, it feeds particle beams not only to the Large Hadron Collider (LHC), but to many of CERN's major facilities, including the Antimatter Factory and the East Area." Klaus Hanke, head of the Proton Synchrotron operations team, chooses his words carefully to describe CERN's oldest accelerator still in operation. On 4 March, the veteran accelerator received its first particle beam after a two-year shutdown, during which it underwent significant upgrades to prepare it for higher luminosity (an indicator of the number of collisions).

Within CERN's accelerator complex, protons extracted from a hydrogen gas source are accelerated in the brand new Linac4 and in the PS Booster before injection into the PS, which then feeds, either directly or indirectly, the vast majority of CERN's accelerators and experiments. The new Linac4 and the upgraded PS Booster now provide the PS with a beam accelerated to up to 2 GeV, a 0.6 GeV increase compared to past beam. To ensure that the 60-year-old PS can withstand these higher energies, the accelerator ring has been fitted out with cutting-edge equipment in recent years, including refurbished magnets, new beam-dump systems and beam instrumentation devices, and upgraded radiofrequency and cooling systems.

The injection of the first beam into the PS marks the end of more than ten years of research and development focused on this equipment as part of the LHC Injectors Upgrade project. Months of dry test runs (without beam) and system checks ensured the success of this important milestone on the road to the broader reactivation of CERN's accelerators. "The injection is not a rocket launch, we do not push a button and watch as the PS roars to full capacity. We inject protons gradually, tweaking settings and fixing things along the way until we reach a satisfactory energy level," explains Klaus Hanke.

The injection of the first beam will be followed by a commissioning period of a few months to fine-tune the accelerator's specs while the rest of CERN's accelerator system gradually emerges from its two-year slumber. These machines, and the many experiments they are connected to, will benefit from the higher energy levels during the next experimental run starting next year: with higher energies come more focused, denser particle beams, which translates into more precision in experiment results. But it isn't until the advent of the High-Luminosity LHC that the upgrades of the PS and the broader accelerator system will show their true potential: the sturdier and more efficient rings will be key in delivering a final luminosity in the LHC that is expected to be ten times higher than previously.

Provided by CERN

Citation: LS2 report: CERN's oldest accelerator awakens (2021, March 10) retrieved 25 April 2024 from https://phys.org/news/2021-03-ls2-cern-oldest-awakens.html