LS2 report: rejuvenation for the antiproton decelerator

March 13 2019, by Achintya Rao

The AD target area during LS2. Credit: Maximilien Brice/CERN

The Antiproton Decelerator (AD), sometimes known as the Antimatter Factory, is the world's largest source of antimatter and has been operational since 2000. Here, antiprotons are slowed down and sent into the experiments, where they are combined with antielectrons to produce

the most basic antiatom: that of antihydrogen. Over the course of the second long shutdown of CERN's accelerator complex (LS2), the AD will receive several enhancements as well as repairs and refurbishments.

The recently installed ELENA ring, which was commissioned over 2017 and 2018, is designed to slow down even further the antiprotons decelerated by AD to ensure that the experiments can trap up to 100 times more antiprotons than they could without it. At the moment, ELENA is only connected to one of the experiments within the AD hall, the new GBAR experiment. The main work being done on the AD during the next two years is to extend the beam line from ELENA to all of the existing experiments and get ELENA fully operational. The lines that took the particles from the AD to the experiments have now been fully dismantled to prepare for the new injection lines from ELENA.

Other planned and ongoing activities involve the AD's 84 magnets, which focus and steer the whizzing antiprotons along their racetrack. Most of these magnets were recycled from previous accelerator facilities and are much older than the AD itself. They are in need of repairs and refurbishment, which started during the previous long shutdown (LS1) and was pursued during subsequent year-end technical stops (YETS). So far, nine of the magnets have been treated, and 20 of them are scheduled for treatment during LS2. The remaining magnets will either be treated in situ or will undergo refurbishment during the next YETS and the third long shutdown (LS3).

Removing the magnets to take them to the treatment facility is no easy task. The AD ring is encased in a large shielding tunnel made of concrete blocks. Therefore, the blocks making up the ceiling near the magnet in question have to first be removed and stored, allowing a crane to descend though the opening and extract the magnet (which weighs up to 26 tonnes), sometimes with a margin of only 1 cm. Related work is being done to consolidate other elements of the AD, such as the kicker

magnets, the septa magnets and the radiofrequency cavities.

One of the main tasks of LS2 that has already been achieved was the installation of a new cooling pump for the AD. Previously, a single set of pumps were operated, connected to both the AD itself and to its experiments. This meant that the pumping system was operational year round next to the AD ring, producing a constant noise at over 100 decibels in some places. The new dedicated pump allows the main pumping group to be turned off without affecting the experiments' cooling systems, saving money and improving working conditions for those who need to be in close proximity to the AD over the shutdown period. It also provides much-needed redundancy to the cooling circuits.

By the end of LS2, the AD hall will look very different from what it does today, but the changes are not merely superficial. They will ensure that CERN's antimatter factory continues to operate with high efficiency and help explore the mysteries surrounding elusive antimatter.

Provided by CERN

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