More than a spring-clean for LHC magnets

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Members of the LHC team working on its magnets. Credit: Maximilien Brice/CERN

In April, work began on one of the major projects scheduled for the second long shutdown (LS2) of the CERN accelerators: improving the electrical insulation of over 1200 magnets in the Large Hadron Collider

(LHC). To complete this mammoth task, more than 150 people are hard at work in the LHC tunnel... and they will be there for over a year.

The magnets in question are dipole magnets, which occupy 18 of the accelerator's 27 kilometers. These magnets bend the trajectory of the protons that are accelerated at a speed close to the speed of light. They are powered by a strong electrical current of 13 000 amps, which must be safely extracted in the event of a problem. For this purpose, each dipole magnet is fitted with a diode, a parallel circuit allowing the current to be diverted.

Since 2006, nine short circuits involving these diodes have occurred. "These short circuits were caused by residual metallic debris present in the machine since the magnets were manufactured," explains Jean-Philippe Tock, leader of the diode insulation (DISMAC) project. To avoid this happening again, two steps are being taken: removing as much metallic debris as possible and improving the electrical insulation of the diodes.

Those working on the DISMAC project are using a special vacuum cleaner, paired with an endoscopic camera, to eliminate the debris near to the diodes, i.e. at the junction between two magnets. They have also developed insulating caps for the diodes. A total of 1232 caps must be installed between now and summer 2020.

The to-do list for each diode is long: removing and refitting the beam monitoring equipment, mechanical cutting, opening the interconnection, cleaning, installing the insulation, electrical and quality assurance tests, welding, and more. Teams of experts from CERN, external firms and collaborating institutes must complete the work on ten interconnections per day in very restrictive spaces, all of which leaves no room for improvisation. "Since 2017, we have been working a lot on developing and optimizing our tools and installation procedures," emphasizes Jean-

Philippe Tock. The teams have been training on models over the past few months and are now working their way around the underground ring: the first of its eight sectors should be completed by December 2019.

Provided by CERN