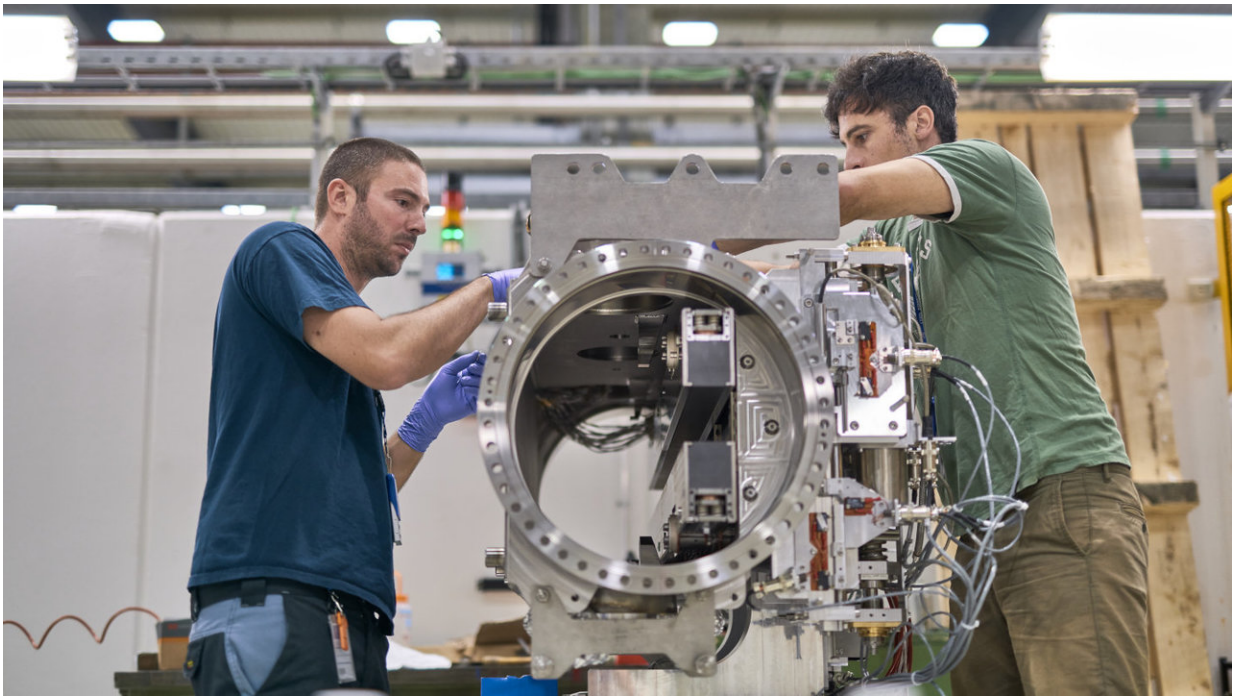
Halfway to high luminosity

October 24 2018, by Corinne Pralavorio



A new beam absorber for the zones where the beams are injected from the SPS was assembled and tested last summer. This is one of the developments presented at the High-Luminosity LHC annual meeting. Credit: Julien Ordan

The High-Luminosity LHC has reached its halfway point. The second-generation LHC project was launched eight years ago and is scheduled to start up in 2026, eight years from now. From 15 to 18 October, the institutes contributing to this future accelerator came together at CERN to assess the progress of the work as the project moves from prototyping

to the series production phase for much of the equipment.

The annual meeting is a chance to conduct a global review of the project – and global is the word, because, as project leader Lucio Rossi observes, "the High-Luminosity LHC is a worldwide project that has been worked on by an international collaboration since the very beginning". As well as CERN's Member States and Associate Member States, thirteen other countries are contributing to the project. New agreements have been signed recently with Japan and China and an agreement with Canada was announced in June. Representatives of the collaborating countries presented the status of their contributions during the plenary session. Some 1000 people are working on the project.

The civil engineering work has progressed considerably since it began in the spring: excavations have reached 30 metres at Point 1 and 25 metres at Point 5. The two 80-metre shafts should be fully excavated by the beginning of 2019.

As for the accelerator, one of the key tasks is the production of around one hundred magnets of eleven different types. Some of these, notably the main magnets, are made of a novel type of superconductor, niobium-tin, which is particularly difficult to work with. The short prototype phase is coming to an end for the quadrupole magnets that will replace the LHC's triplets and focus the beams very strongly before they collide. The long quadrupole magnets (7.15 metres in length) are being produced at CERN, while those measuring 4.2 metres in length are being developed in the United States in the framework of the US LHC-AUP (LHC Accelerator Upgrade Project) collaboration. Several short prototypes have reached the required intensities on both sides of the Atlantic. Two long prototypes (4.2 metres) have been produced in the United States and the second is currently being tested. At CERN, the assembly of the first 7.15-metre-long prototype has begun.

The dipole magnets at the interaction points, which divert the beams before and after the collision point, are being developed in Japan and Italy. One short model has been successfully tested at KEK in Japan and a second is in the process of being tested. INFN, in Italy, is also assembling a short model. Finally, progress is being made on the development of the corrector magnets at CERN and in Spain (CIEMAT), Italy (INFN) and China (IHEP), with several prototypes already tested. In 2022, a test line will be installed in hall SM18 in order to test a magnet chain at the interaction point.

One of the major successes of 2018 is the installation in the SPS of a test bench with an autonomous cryogenic unit. The test bench houses two DQW (double-quarter wave) crab cavities, one of the two architectures chosen for this ground-breaking equipment. The two cavities rotated the proton bunches as soon as the tests began in May, marking a world first. The construction of the DQW cavities will continue while the second architecture, RFD (radiofrequency dipole), is developed in the United States. The production of this novel equipment is the result of an international endeavour by Germany, the United Kingdom, the United States and Canada.

Many other developments were presented during the symposium: new collimators have been tested in the LHC; a beam absorber for the injection points from the SPS was tested over the summer and will be installed during the second long shutdown; a demonstrator for a magnesium diboride superconducting link is currently being validated; studies have been undertaken to test and adjust the remote alignment of all the equipment in the interaction region, etc.

Over the four days, some 180 presentations covered a wide range of technologies developed for the High-Luminosity LHC and beyond.

Provided by CERN