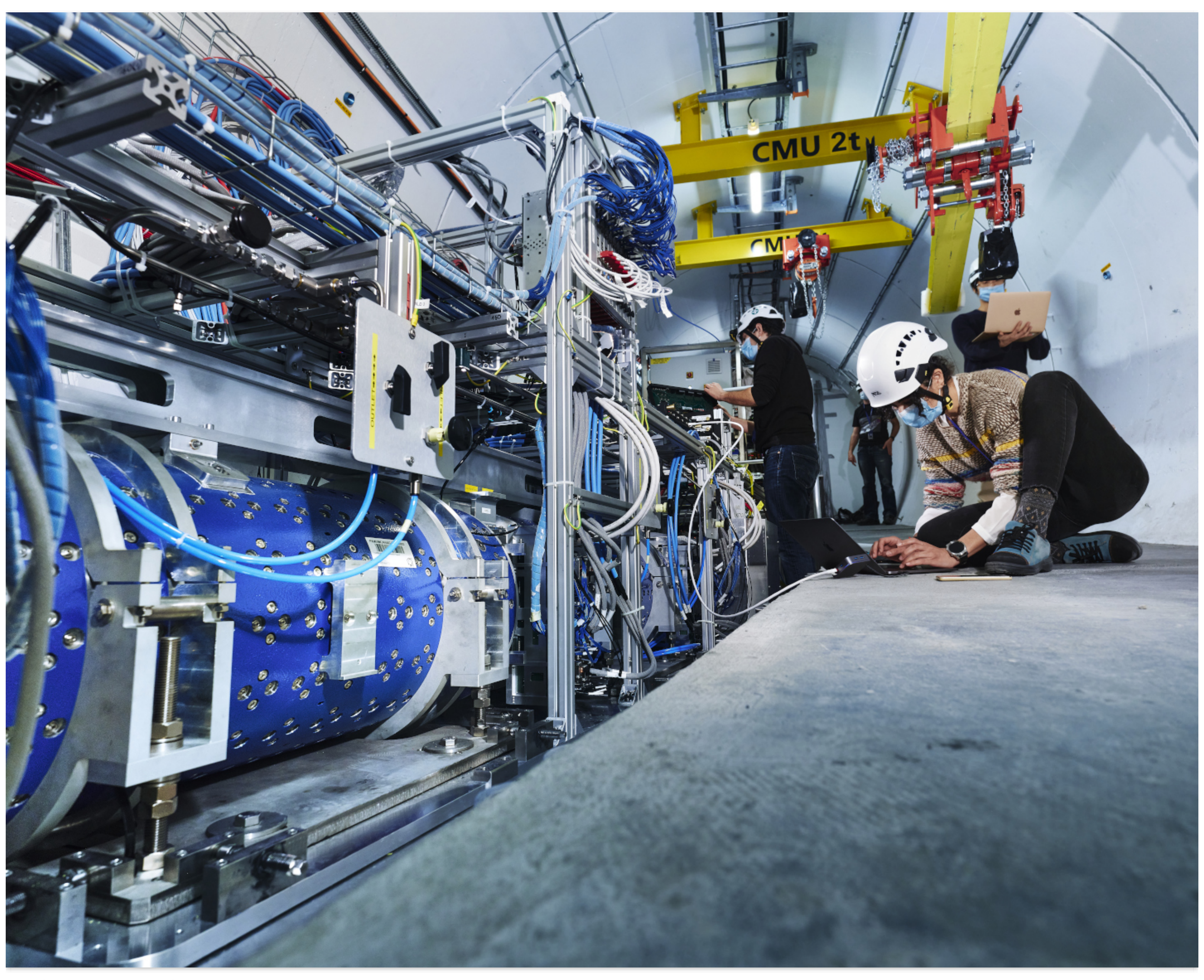
Voir en français

LS2 Report: FASER is born

FASER, the Forward Search Experiment, has been installed in the LHC tunnel during Long Shutdown 2. It is currently being tested and will start taking data next year

24 MARCH, 2021 | By Anaïs Schaeffer



The final elements of FASER were put into place this month. (Image: CERN)

FASER* (Forward Search Experiment), CERN's newest experiment, is now in place in the LHC tunnel, only two years after its approval by CERN's Research Board in March 2019. FASER is designed to study the interactions of high-energy neutrinos and search for new, as-yet-undiscovered light and weakly interacting particles. Such particles are dominantly produced along the beam collision axis and may be long-lived particles, travelling hundreds of metres before decaying. The existence of such new particles is predicted by many models beyond the Standard Model that attempt to solve some of the biggest puzzles in physics, such as the nature of dark matter and the origin of neutrino masses.

FASER is located along the beam collision axis, 480 m from the ATLAS interaction point, in an unused service tunnel that formerly connected the SPS to the LEP collider – an optimal position for detecting the particles into which light and weakly interacting particles will decay.

The first civil engineering works started in May 2020. "Because of the sloped geometry of the tunnel, the beam collision axis was actually passing under the ground," says Jamie Boyd, FASER co-spokesperson. "Measurements from the CERN survey team showed that, by excavating a 50-cm-deep trench, sufficient space would be created to house the 5-m-long FASER detector." In the summer, the first services and power systems were installed, and in November, FASER's three magnets were put in place in the trench.


The installation of FASER's three magnets took place in November, in the narrow trench excavated by CERN's SCE team. (Image: CERN)

A pretty simple experiment

At the entrance to the detector, two scintillator stations are used to veto charged particles coming through the cavern wall from the ATLAS interaction point; these are primarily high-energy muons. The veto stations are followed by a 1.5-m-long dipole magnet. This is the decay volume for long-lived particles decaying into a pair of oppositely charged particles. After the decay volume is a spectrometer consisting of two 1-m-long dipole magnets with three tracking stations, which are located at either end and in between the magnets. Each tracking station is composed of layers of precision silicon strip detectors. Scintillator stations for triggering and precision time measurements are located at the entrance and exit of the spectrometer.

The final component is the electromagnetic calorimeter. This will identify high-energy electrons and photons and measure the total electromagnetic energy. The whole detector is cooled down to 15 °C by an independent cooling station.

"FASER uses spare pieces from the ATLAS (for the tracker) and LHCb (for the calorimeter) experiments, which made possible its installation during Long Shutdown 2, so quickly after its approval," highlights Jamie Boyd.

FASER will also have a subdetector called FASERν, which is specifically designed to detect neutrinos. No neutrino produced at a particle collider has ever been detected, despite colliders producing them in huge numbers and at high energies. FASERν is made up of emulsion films and tungsten plates to act as both the target and the detector to see the neutrino interactions. FASERν should be ready for installation by the end of the year. The whole experiment will start taking data during Run 3 of the LHC, starting in 2022.

"We are extremely excited to see this project come to life so quickly and smoothly," says Jamie Boyd. "Of course, this would not have been possible without the expert help of the many CERN teams involved!"

———

**The FASER collaboration consists of 70 members from 19 institutions and 8 countries. FASER is supported by the Heising-Simons and Simons Foundations.*

FASER | dark matter | neutrino | LHC | Long Shutdown 2

Related Articles

FASER's new detector expected to catch first ...
Physics | News |
17 December, 2019

FASER: CERN approves new experiment to look f...
Experiments | News |
7 March, 2019

View all news ›

Also On Experiments

ALPHA cools antimatter using laser light for ...
Experiments | Press release | 31 March, 2021

Aligning the ATLAS muon spectrometer
Experiments | News | 23 March, 2021

ATLAS: Now under new management
Experiments | News | 2 March, 2021

View all news ›