**The Future Circular Collider study (FCC) explores different designs of circular colliders for the post-LHC era.** The FCC collaboration will deliver a conceptual design report by the end of 2018, together with preliminary cost estimates and feasibility assessments that will lay the foundations for the construction of a future circular collider.

Reaching higher energies and unprecedented luminosities would allow us to explore the fundamental laws of nature and probe yet unexplained observations. A Future Circular Collider seems to be the obvious direction to go, given its ultimate access to energies and intensities far beyond anything that can be directly explored within the 21st century. Each of the suggested possibilities — proton-proton, electron-positron or electron-proton — has its own specific virtues and the future results from the next runs of the LHC will pin down the physics questions.

The development of baseline designs for an energy-frontier hadron collider and a luminosity frontier electron-positron collider forms the core of the study. The FCC-hh scenario focuses on a 100 TeV hadron collider in a 100 km tunnel, which would define the design of the overall infrastructure. The FCC-ee scenario involves a lepton-lepton collider, reaching energies of up to 350 GeV for electron-positron collisions. The hadron-lepton collider (FCC-he) option is also considered under the FCC study.

The construction of these machines relies on leapfrog advancements of key enabling technologies, while the lead time of approximately twenty years for the design and construction of an accelerator of this size calls for a coordinated effort.

The FCC study is an international collaboration of more than 70 countries that aims to ensure that the worldwide scientific community is involved in this endeavour from the beginning. It was launched as a response to the 2013 European Strategy Update for Particle Physics, which stated: “to propose an ambitious post-LHC accelerator project…CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines.” The study has received international support from the US Particle Physics Project Prioritization Panel (*P5*) and from the International Committee for Future Accelerators (ICFA). According to the US P5 recommendation of 2014: ”a very high-energy proton-proton collider is the most powerful tool for direct discovery of new particles and interactions under any scenario of physics results that can be acquired in the P5 time window.”

The study covers different aspects related to the design, commissioning and operation of this powerful machine in a reliable, efficient and sustainable way. A number of R&D programmes to push novel technologies have been launched, including high-field magnets (with almost double the magnetic field of the LHC magnets), new high-gradient accelerating structures, an efficient large-scale cryogenics infrastructure and refrigeration systems.

The FCC study coordinates the research and development work for accelerators and detectors around the world and prepares the ground for contributions from world experts. It places a strong focus on capacity building for young students in a number of different areas, as well as on cooperation with industrial partners with the aim of maintaining the current level of technological knowhow and fostering collaborations for technology developments beyond 2025.

The FCC study profits from the experience gained from the design and operation of LEP and LHC, while the scheduled upgrade of the High Luminosity LHC provides an excellent opportunity to test the new technologies and make the next step in advancing fundamental research towards a new territory.

A future circular collider, with its high precision and high energy reach, will extend the search of new particles and interactions well beyond the LHC, possibly proving our current theories or leading to exciting new developments. Creativity and innovation are needed to develop the physics case, meet the required accelerator parameters and realize unprecedented experiments. The FCC study sets the foundations for humanity’s next step towards the exploration of our Universe!

Visit the FCC study public pages to learn more about our work and find out how to get involved: <https://fcc.web.cern.ch/Pages/default.aspx>

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