FUTURE CIRCULAR COLLIDER STUDY

The aim of the Future Circular Collider (FCC) study is to develop a conceptual design for a post-LHC particle accelerator infrastructure in a global context.

Expanding our understanding of the fundamental laws of nature requires the energy frontier to be pushed much further. Reaching this goal within the 21st century in an economic and energy efficient way calls for a large circular collider.

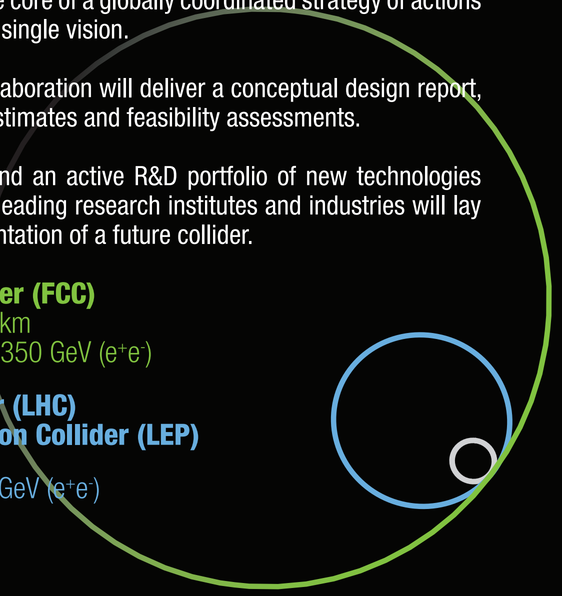
The study is a direct response to a high-priority request from the 2013 update of the European Strategy for Particle Physics which stipulated that:"CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines. These design studies should be coupled to a vigorous accelerator R&D programme, including high-field magnets and high-gradient accelerating structures, in collaboration with national institutes, laboratories and universities worldwide."

This is in line with the recommendations of the United States' Particle Physics Project Prioritization Panel (P5) and of the International Committee for Future Accelerators (ICFA).

The international FCC collaboration, hosted by CERN, brings together, as of March 2016, more than 70 institutes from around the globe. It is open to universities, laboratories and research centres of scientific excellence, as well as to high-tech companies. This set-up forms the core of a globally coordinated strategy of actions designed to converge towards a single vision.

By the end of 2018, the FCC collaboration will deliver a conceptual design report, together with preliminary cost estimates and feasibility assessments.

The conceptual design report and an active R&D portfolio of new technologies developed in collaboration with leading research institutes and industries will lay the foundations for the implementation of a future collider.



- **Future Circular Collider (FCC)**
  Circumference: 90 -100 km
  Energy: 100 TeV (pp) 90-350 GeV (e^+e^-)
- **Large Hadron Collider (LHC)**
  Large Electron-Positron Collider (LEP)
  Circumference: 27 km
  Energy: 14 TeV (pp) 209 GeV (e^+e^-)
- **Tevatron**
  Circumference: 6.2 km
  Energy: 2 TeV ($p\bar{p}$)

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Education, Communication and Outreach Group
April 2016
CERN-Brochure-2016-003-Eng

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant 654305. The information herein only reflects the views of its authors.

EXPANDING OUR HORIZONS

FUTURE CIRCULAR COLLIDER STUDY

WHAT

The **Future Circular Collider study** (FCC) is exploring the feasibility of several particle collider scenarios with the aim of significantly expanding the current energy and luminosity frontiers.

The Large Hadron Collider at CERN with its High Luminosity upgrade is the world's primary instrument for exploring the energy frontier until 2035. This defines the time window for **preparing a post-LHC high-energy physics research infrastructure.**

The FCC study will complement existing technical designs for linear electron positron colliders (ILC and CLIC).

A circular proton-proton collider offers the greatest potential leap in collision energy over the coming decades. A **100 TeV hadron collider** in a **100 km long tunnel** defines therefore the overall infrastructure for the FCC study.

The developments of baseline designs for an **energy-frontier** hadron collider and a **luminosity-frontier** electron-positron collider form the core of the study.

The realisation of such machines relies on leapfrog **advancements of key enabling technologies.**

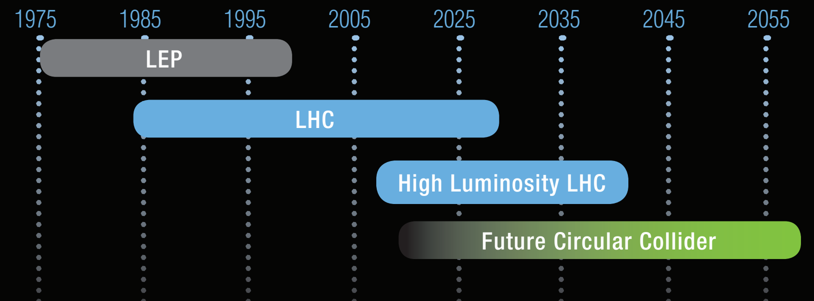
The foundations for these advancements are being laid in **focused R&D programmes:**

- a 16 Tesla high-field accelerator magnet and related superconductor research,
- an efficient 100 MW radiofrequency acceleration system and the associated power conversion systems,
- a highly efficient large-scale cryogenics infrastructure and the accompanying refrigeration systems.

Numerous other technologies are needed for reliable, sustainable and efficient operation.

The FCC study explores the physics cases for each collider scenario in a coordinated way that **embraces discovery and precision physics.**

The work programme includes **experiment and detector concept studies** to allow new physics to be explored. Detector technologies will be based on experiment concepts, the projected collider performances and the physics cases.



WHY

The discovery of the Higgs boson was a milestone in the long-standing effort to complete the Standard Model of Particle Physics. This theory describes the fundamental particles that make up the visible universe - including us - along with most of the interactions that govern their behaviour. Yet the Standard Model cannot explain several observations, such as:

- evidence for **dark matter**,
- **prevalence of matter** over antimatter,
- the **neutrino masses.**

The FCC, with its high precision and high energy reach, will extend, well beyond the LHC, the search for new particles and interactions, which could hold the key to understanding those unexplained phenomena.

Creativity and innovation are needed to develop the physics case, meet the required accelerator parameters and realise unprecedented experiments.

The **significant lead time of approximately twenty years** for the design and construction of a large-scale accelerator calls for a coordinated effort.

The goal is to ensure the **seamless continuation** of the world's particle physics programme after the LHC era.

HOW

The FCC study hosted by CERN is an international collaboration of more than 70 **institutes from all over the world.**

This prepares the ground for geographically well-balanced contributions, leveraging the competences of world experts in the numerous areas concerned. It also ensures that the entire **worldwide scientific community is involved from the very start** of the endeavour.

Bringing together physics, experiments, accelerator concepts and technology R&D within a single study will result in **a coherent and consistent design** for a future large-scale research infrastructure.

The experience from the operation of LEP and LHC together with the unique opportunity to test the novel technologies in the High Luminosity LHC provide a solid basis for assessing the feasibility of a post-LHC particle accelerator.

The EU's Horizon 2020 programme is funding the FCC study through the EuroCirCol project.