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With 23 Member States CERN is the world's leading laboratory for particle physics. Located astride the Franco-Swiss border near Geneva, its vocation is to understand the fundamental constituents of the Universe and the laws governing their behaviour.
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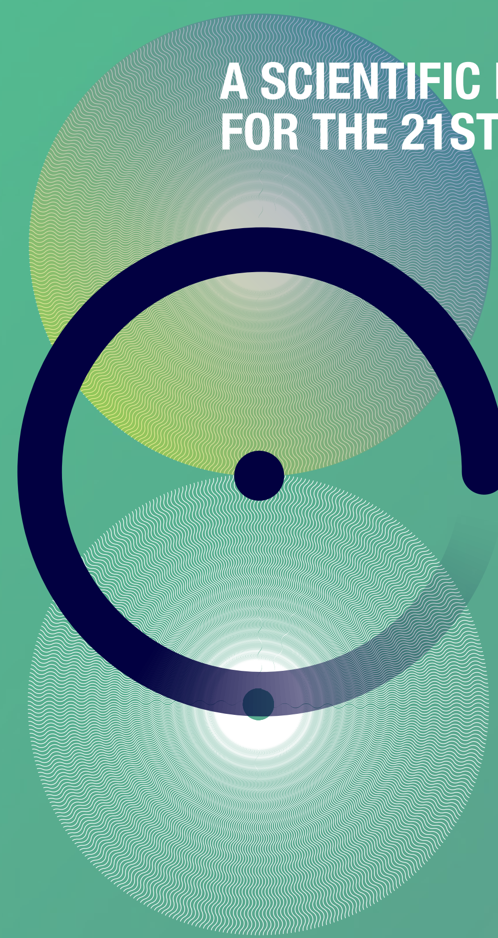
A SCIENTIFIC MISSION FOR THE 21ST CENTURY



MAKING HISTORY

At the end of the Second World War, a handful of visionary scientists and diplomats imagined using the neutral language of science to heal the wounds of war.
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As early as 1946, France proposed the creation of a European laboratory for fundamental physics and in 1949, Nobel Prize winner, Louis de Broglie, had a message delivered at Denis de Rougemont's European Cultural Conference in Lausanne. The initiative was gaining momentum, and in 1954, CERN was officially created under the auspices of UNESCO. A succession of increasingly powerful research facilities ensued, starting with Europe's most powerful particle accelerator, the Synchrocyclotron (SC), in 1957. Important discoveries were not far behind, along with technological advances that have transformed the world for the better. Three CERN scientists have received the Nobel Prize, the World Wide Web was invented at CERN in 1989, and CERN has made important contributions to technologies ranging from medical imaging and therapy to touchscreens.

On 17 May 1954, the first shovel of earth was dug on the Meyrin site under the eyes of Geneva State Councillor, Albert Picot (right), and Frenchman, Robert Valeur, retiring Chairman of the interim Council.

CERN | FUTURE CIRCULAR COLLIDER
Feasibility Study

TOWARDS THE FUTURE OF PHYSICS

Today, CERN is home to the Large Hadron Collider (LHC), the largest and most powerful accelerator in the world.
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Data gathered from collisions reveals information about the particles and their interactions, which can be used to address fundamental questions about the Universe. In 2012, the LHC was the cradle to one of the biggest scientific discoveries of the century so far: the Higgs Boson. The observation of this particle, first predicted in 1964, completed the so-called Standard Model of particle physics, the theory that describes the particles that make up all visible matter in the Universe and the forces acting between them. The Standard Model is a triumph of 20th century science, but there remains much to be discovered: the matter we know, which makes up all galaxies, stars and planets and everything on them, only accounts for 5% of the Universe, the rest is obscure, and remains to be explored. To do so, new, more powerful accelerators will be needed.

ACCELERATING SCIENCE SINCE 1954

1954	1957	1959	1971	1977	1981	1989	2008	2029	~2045
CERN	**SC**	**PS**	**ISR**	**SPS**	**SPS Collider**	**LEP**	**LHC**	**HL-LHC**	**FCC-ee?**
	15m	**628m**	**942m**	**7km**	**7km**	**27km**	**27km**	**27km**	**~ 91km**

1958 **Rare pion decay**
1965 **First observation of antinuclei**
1968 **MWPC electronic particle detection**
1976 **Touchscreen**
1977 **First PET image at CERN**
1983 **Discovery of W/Z bosons**
1984 **Nobel prize W/Z bosons**
1989 **Discovery three neutrinos**
1990 **World Wide Web**
1992 **Nobel prize MWPC**
2012 **Discovery of Higgs boson**
2013 **Nobel prize Higgs bosons**
2014 **FCC study**

NAME OF ACCELERATOR
Size of the accelerator ring
Scientific discoveries
Technological advances
Nobel prizes

MAINTAINING EUROPEAN LEADERSHIP

CERN's current flagship facility is the LHC, which will spearhead the Laboratory's research programme until around 2040.

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However, scientists are already thinking about a new facility to succeed it, reinforcing European leadership in particle physics. As recommended by the European Strategy for Particle Physics, CERN has established the Future Circular Collider (FCC) feasibility study to investigate the technical and financial viability of a new generation of particle colliders at CERN. Linked to CERN's present complex of accelerators this facility would take the baton of the LHC research programme and carry it to the end of the 21st century.

LOCAL IMPACT

The development of the FCC would have significant local impact, acting as a global hub of research and technical innovation.

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CERN's infrastructures already bring remarkable benefits for the region, ranging from economic to industrial, and taking in human capital development along the way. CERN Business Incubation Centres including one in the Pays de Gex, and the Swiss BIC of CERN Technologies are hives of technological creativity. Educational programmes reach thousands of students every year, and CERN is a major tourist destination, welcoming over 100 000 visitors in a typical year. The new research facility hosted at CERN would keep and expand local benefits across a broader area in both Host States through the 21st century. However, during the feasibility and, if the project is approved, construction phases, some disruption due to the civil engineering work is inevitable. As part of the feasibility study, extensive geological characterization will be carried out, including the drilling of boreholes around the proposed ring. If construction goes ahead, the civil engineering works would generate noise and traffic. The feasibility study integrates the avoid, reduce, compensate principle at every stages, striving to deliver a sustainable research infrastructure for the 21st century.

A RING BETWEEN LAKES AND MOUNTAINS

The future collider would be built in a ring-shaped underground tunnel located beneath the French departments of Haute-Savoie and Ain, and the Swiss canton of Geneva.

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If constructed, it would be one of the world's longest tunnels. Lessons learnt from the construction of the tunnel housing the LHC are being applied, some well-known constraints already restrict the final layout to a limited area: the tunnel must avoid geologically complex areas; it must maximize the efficiency of future colliders, be easily connectable to the LHC; and the location of the surface sites must respect social and environmental constraints. For this reason, diverse variants of the layout are being considered, following the principles avoid, reduce, compensate ensuring a sustainable design, enjoyed by the future generations.

FCC IN NUMBERS

~91 km circumference

150-400m depth

>35 countries participating

>150 universities and research institutes

8 shafts

TECHNOLOGICAL STEPS

The FCC tunnel would successively house two different colliders.

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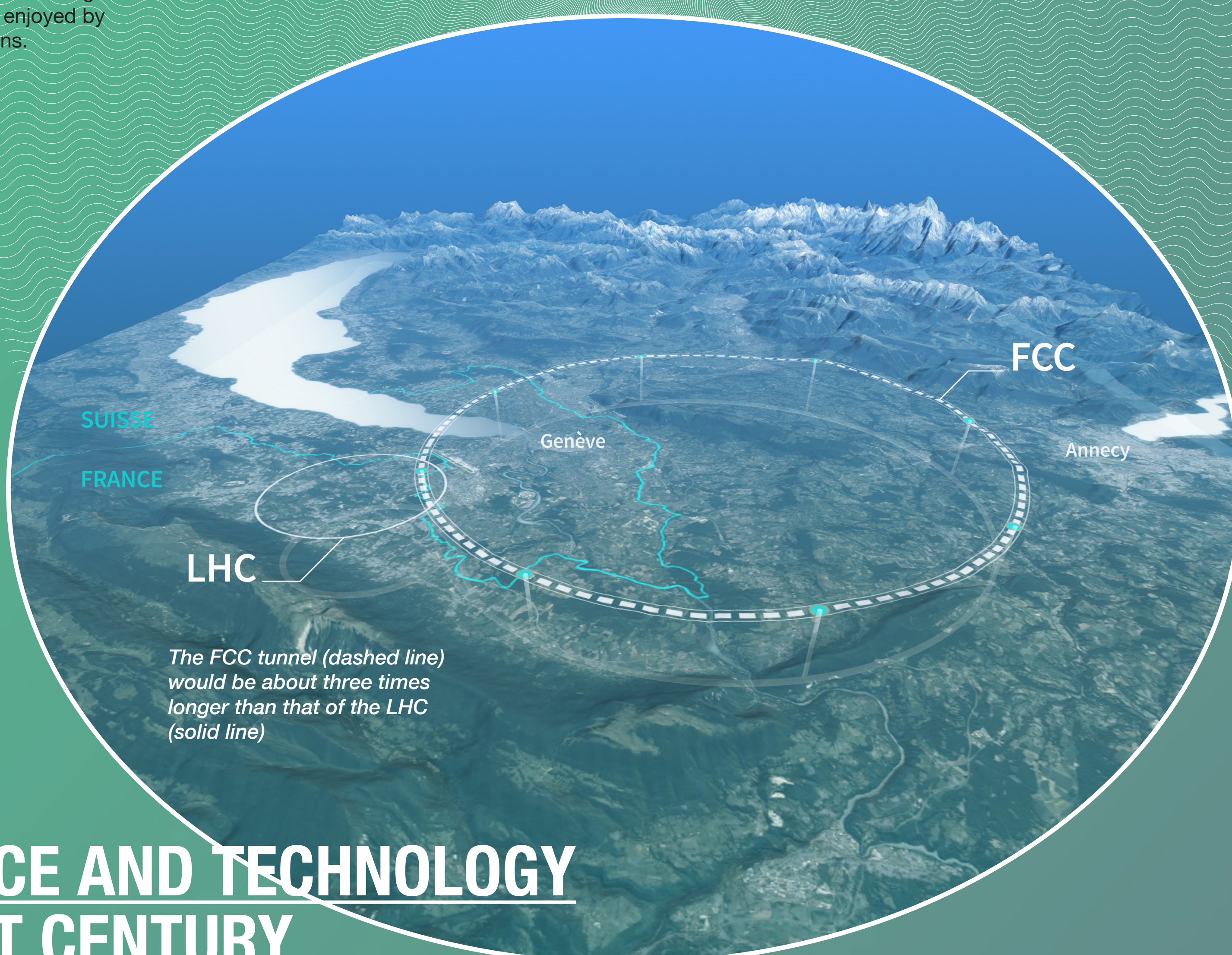
The first step is an electron-positron collider (FCC-ee) that would provide unprecedented precision measurements and potentially point the way to physics beyond the standard model. The second step would be a proton-proton collider (FCC-hh) reaching energies up to eight times those of the LHC and offering new discovery potential. The development of these colliders requires significant advances in many technologies. The effective interplay of different science and technology domains is the key to success, and the potential for innovation with application in society at large is considerable.



The FCC tunnel (dashed line) would be about three times longer than that of the LHC (solid line)

ADVANCING SCIENCE AND TECHNOLOGY THROUGH THE 21ST CENTURY

2014	2021-2025	2026-2027	~2028-2029	~2030-2040	~2045	2060-2070	~2070
FCC study	**FCC Feasibility Study**	**Update of the European Strategy for Particle Physics**	End of detailed studies. Presentation to CERN council for decision	Civil engineering works	Start Operation of the FCCee	Start operation of FCChh	Start operation of FCChh

FUTURE CIRCULAR COLLIDER
Feasibility Study