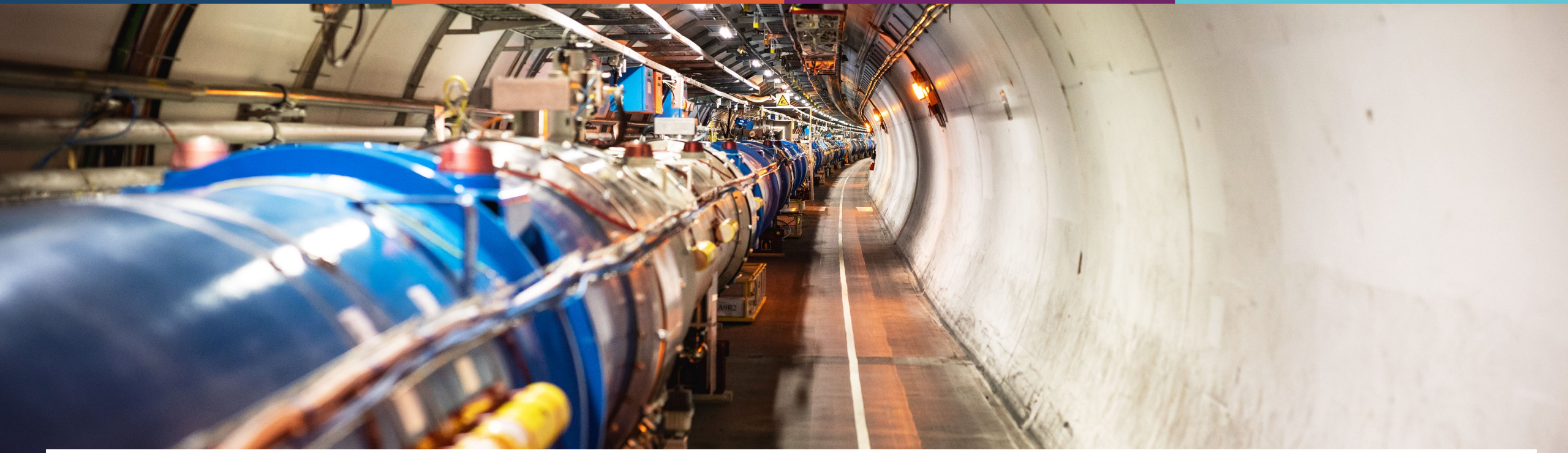


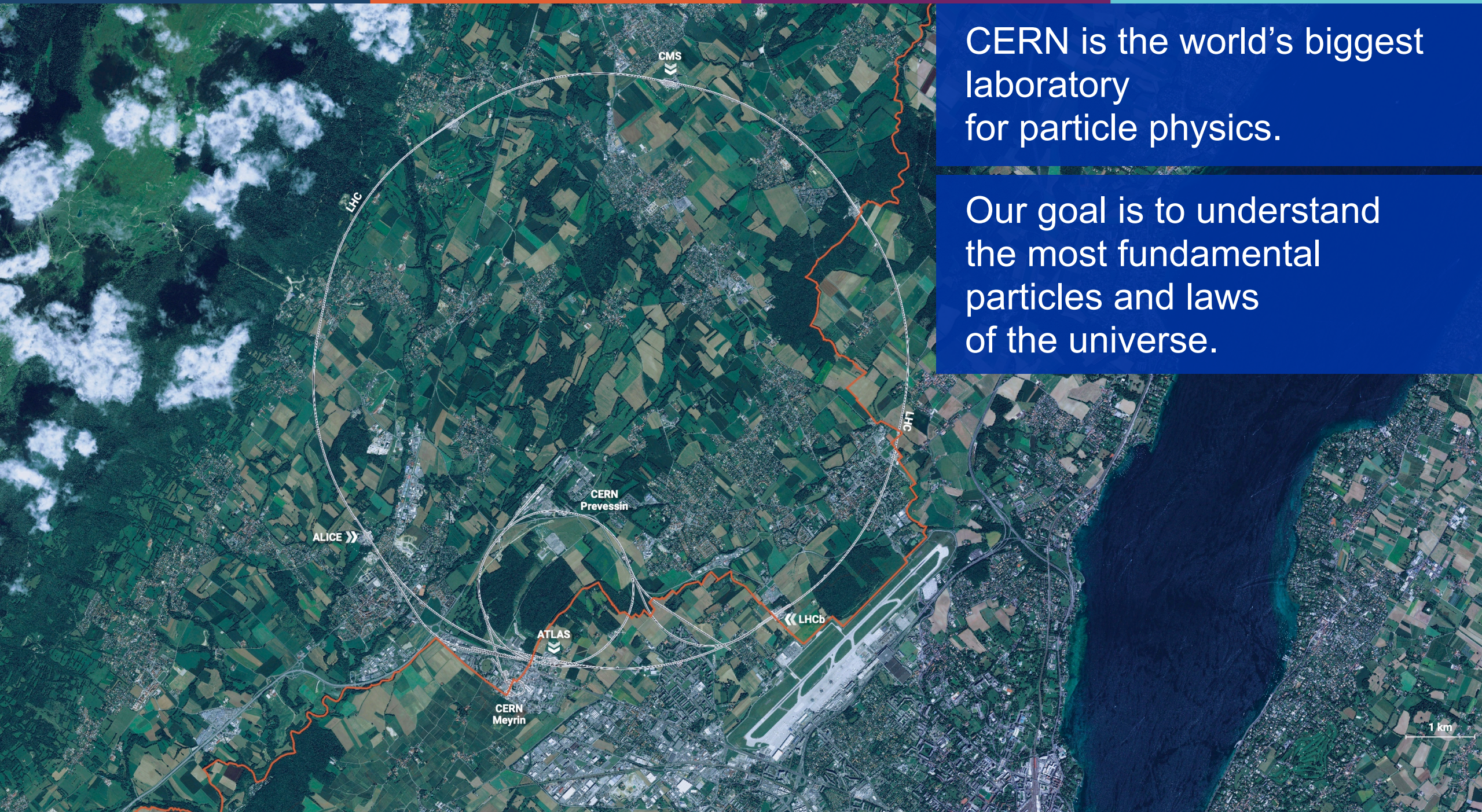
Organisation, Structure and Governance of CERN

Science for Peace School

Start from Slide 8, previous slides covered in earlier talk!

(with special thanks to Pippa Wells, Emmanuel Tsesmelis and Paul Collier)

Thursday, 8 Dec 2022



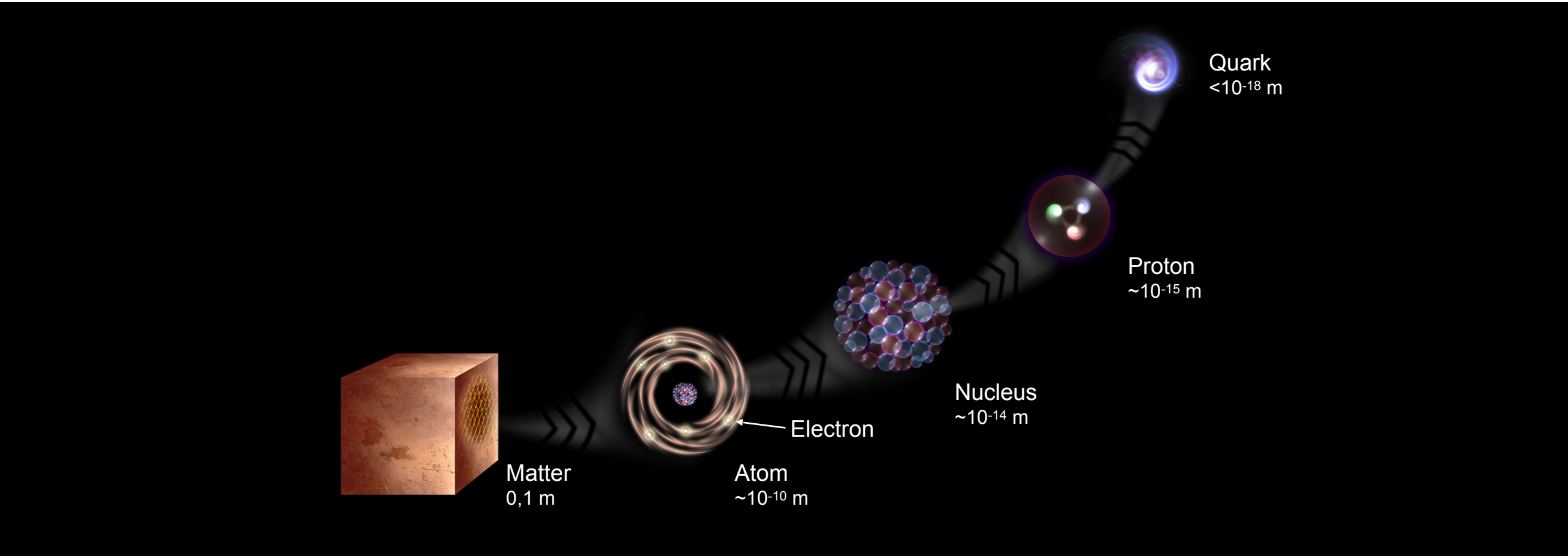
CERN is the world's biggest laboratory for particle physics.

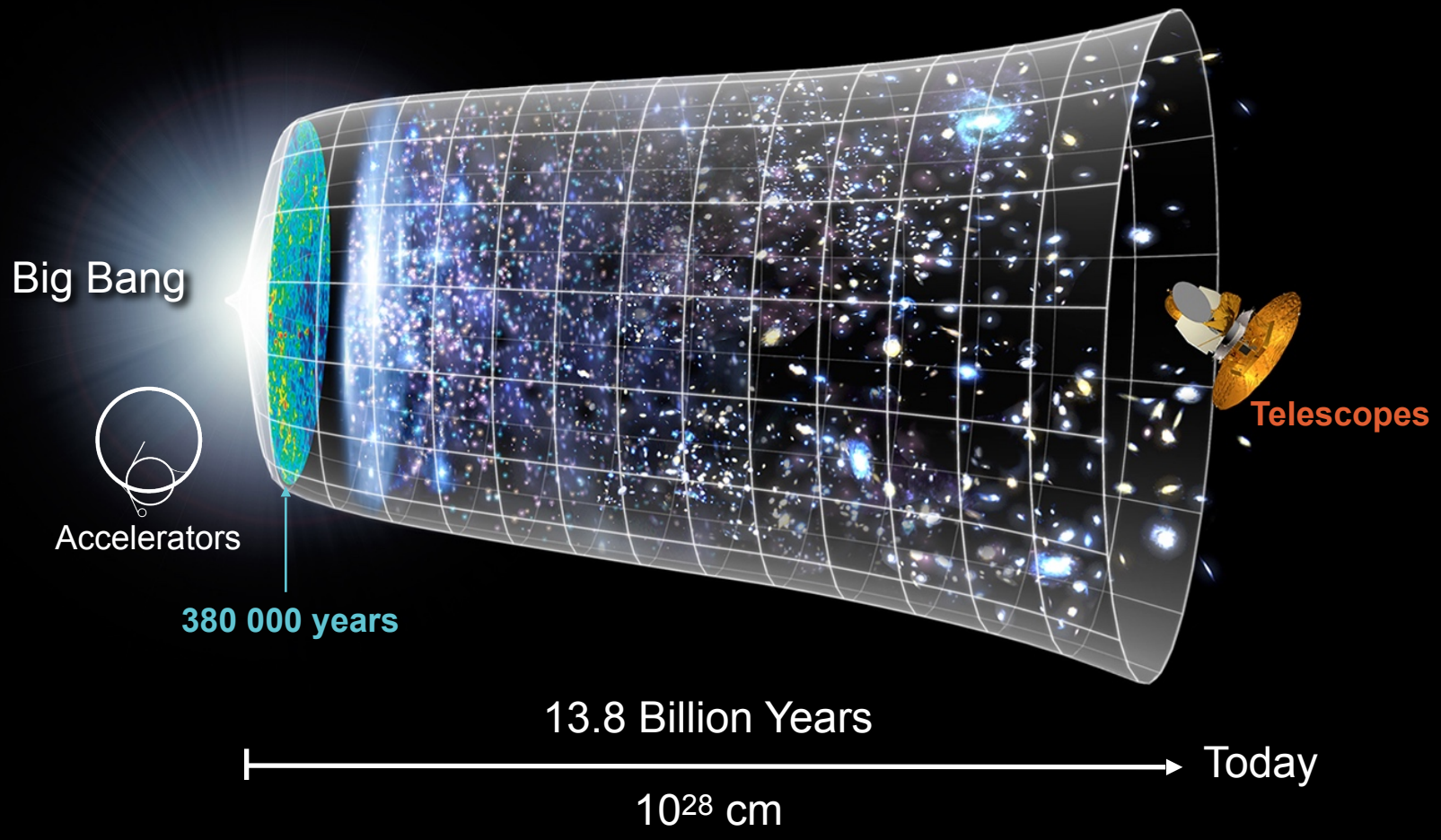
Our goal is to understand the most fundamental particles and laws of the universe.

Four pillars underpin CERN's mission

What is the universe made of?

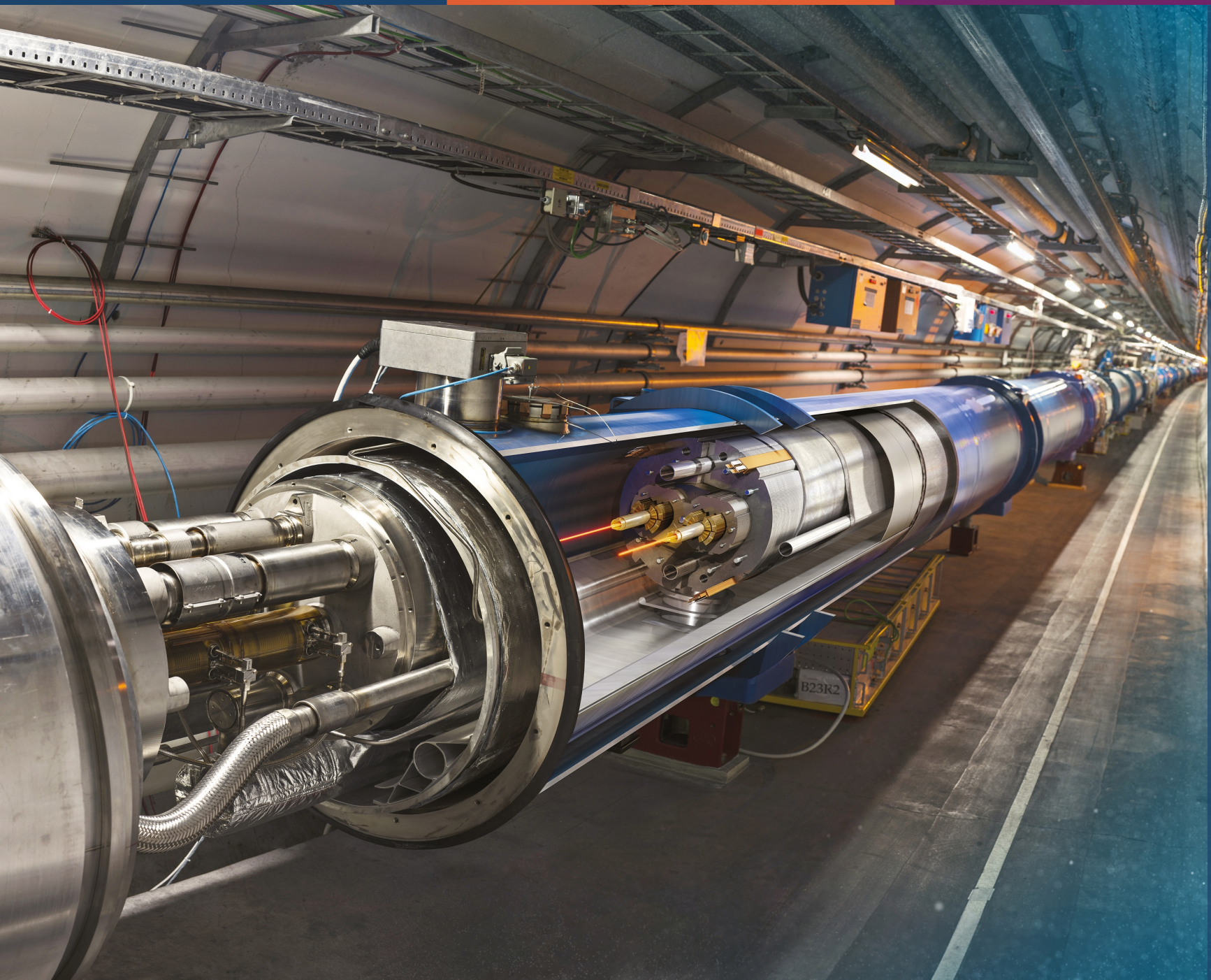
We study the elementary building blocks of matter
and the forces that control their behaviour





How did the universe begin?

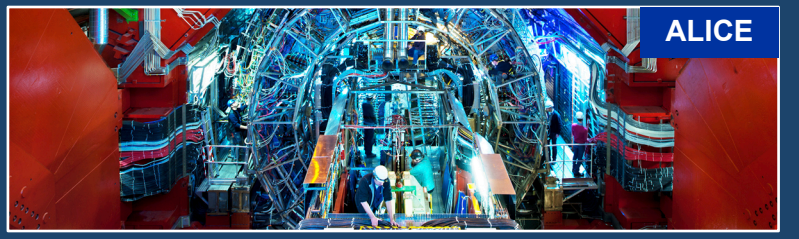
We reproduce the conditions a fraction of a second after the Big Bang, to gain insight into the structure and evolution of the universe.

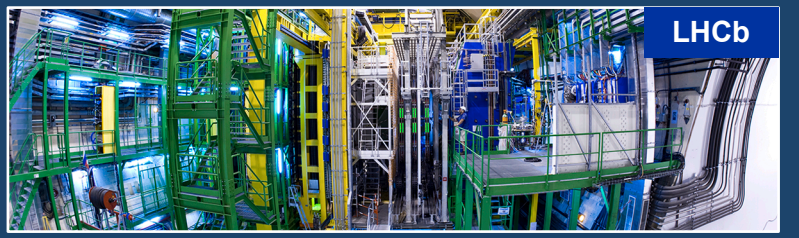


Large Hadron Collider (LHC)

- 27 km in circumference
- About 100 m underground
- Superconducting magnets steer the particles around the ring
- Particles are accelerated to close to the speed of light

Giant detectors record the particles produced at the four collision points





Upgrade to the High-Luminosity LHC is under way

- The HL-LHC will use new technologies to provide 10 times more collisions than the LHC.
- It will give access to rare phenomena, greater precision and discovery potential.
- It will start operating in 2029, and run until at least 2041.

CERN – Founded for Science for Peace

CRÉATION DU C. E. R. N.

ARCHIVES CERN

UNESCO

Téléphone : KLÉber 52-00 - Télégr. UNESCO PARIS
19, AVENUE KLÉBER - PARIS XVI·

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
ORGANISATION DES NATIONS UNIES POUR L'ÉDUCATION, LA SCIENCE ET LA CULTURE

In your reply, please refer to :
En répondant, veuillez rappeler :
N°

Genève, 15 février 1952

Professor I. Rabi,
Columbia University,
New York, N/Y.

We have just signed the Agreement which constitutes the official birth of the project you fathered at Florence. Mother and child are doing well, and the Doctors send you their greetings.

CERN founded in 1954 by 12 European States

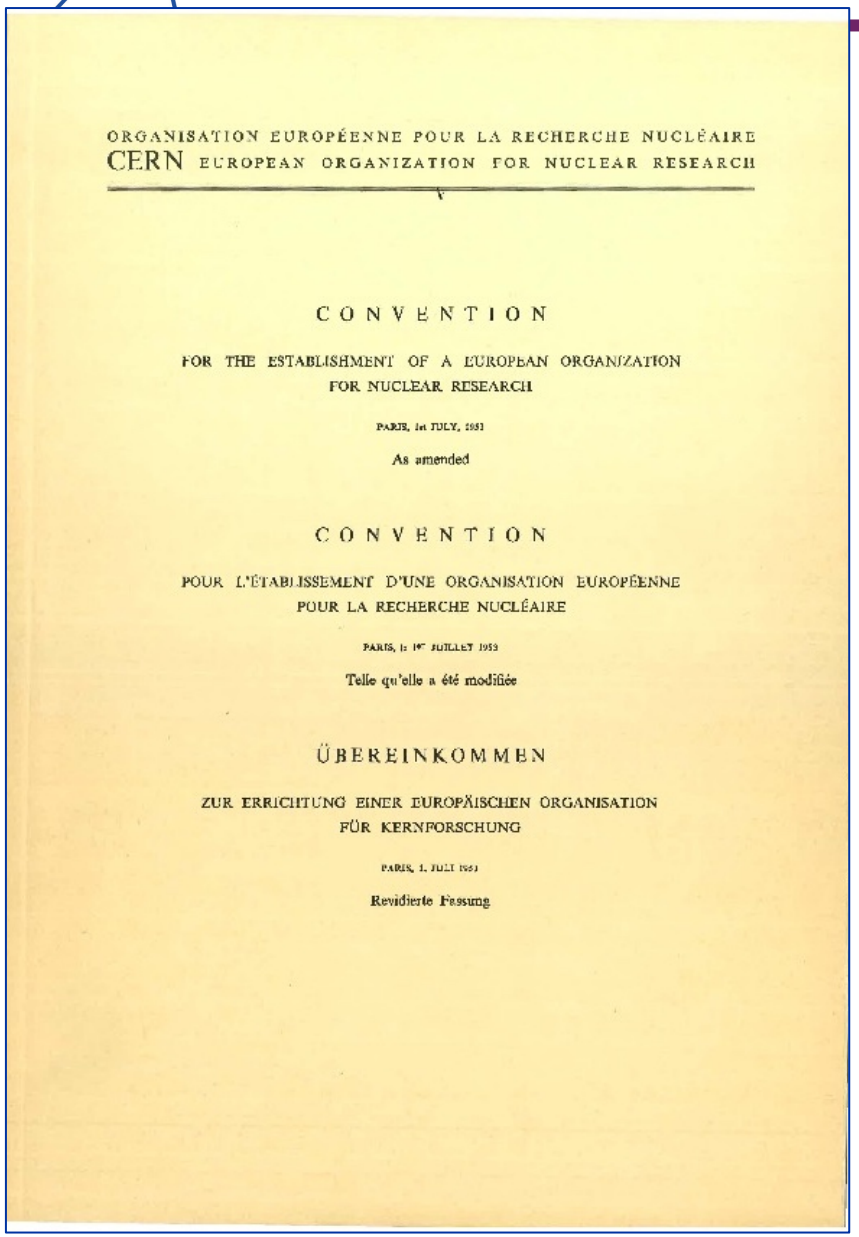
Historical background: creation of CERN after the WWII experience:

- Pool resources among European States to provide for world-class research infrastructures in nuclear/particle physics
- Avoid further brain drain of scientists from Europe
- Restore peaceful collaboration in Europe

1st provisional Council 1952 Rome

3rd provisional Council 1953 Amsterdam

CERN: An Intergovernmental Organisation



ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CONVENTION

FOR THE ESTABLISHMENT OF A EUROPEAN ORGANIZATION
FOR NUCLEAR RESEARCH

PARIS, 1st JULY, 1953

As amended

CONVENTION

POUR L'ÉTABLISSEMENT D'UNE ORGANISATION EUROPÉENNE
POUR LA RECHERCHE NUCLÉAIRE

PARIS, le 1er JUILLET 1953

Telle qu'elle a été modifiée

ÜBEREINKOMMEN

ZUR ERRICHTUNG EINER EUROPÄISCHEN ORGANISATION
FÜR KERNFORSCHUNG

PARIS, 1. JULI 1953

Revidierte Fassung

- CERN is based on an international treaty: the **Convention**
  - Signed and ratified by the original twelve CERN Member States
  - Deposited with UNESCO in 1954
  - Revised in 1971
    - → Purposes of CERN
    - → Research Programmes and Activities
    - → Organs and governance structure
    - → Financial contributions
    - → Voting rights

- CERN is granted **Privileges and Immunities** (Art IX)
  - Host State agreements
  - Protocol of 2004 signed by all Member States
  - Granted in the interests of the Organization
  - Status in the Member States of an **international legal personality**
    - → Particular fiscal and customs arrangements
    - → Inviolability of premises and its archives
    - → Immunity from jurisdiction
    - → Free access of officials
    - → Specific Privileges and Immunities for personnel to facilitate exercise of official functions

Science for peace

CERN was founded in 1954 with 12 European Member States

23 Member States

Austria – Belgium – Bulgaria – Czech Republic
Denmark – Finland – France – Germany – Greece
Hungary – **Israel** – Italy – Netherlands – Norway
Poland – Portugal – Romania – Serbia – Slovakia
Spain – Sweden – Switzerland – United Kingdom

3 Associate Member States in the pre-stage to membership

Cyprus – Estonia – Slovenia

7 Associate Member States

Croatia – India – Latvia – Lithuania – Pakistan
Türkiye – Ukraine

6 Observers

Japan – Russia (suspended) – USA
European Union – JINR (suspended) – UNESCO

CERN's annual budget is 1200 MCHF (equivalent to a medium-sized European university)

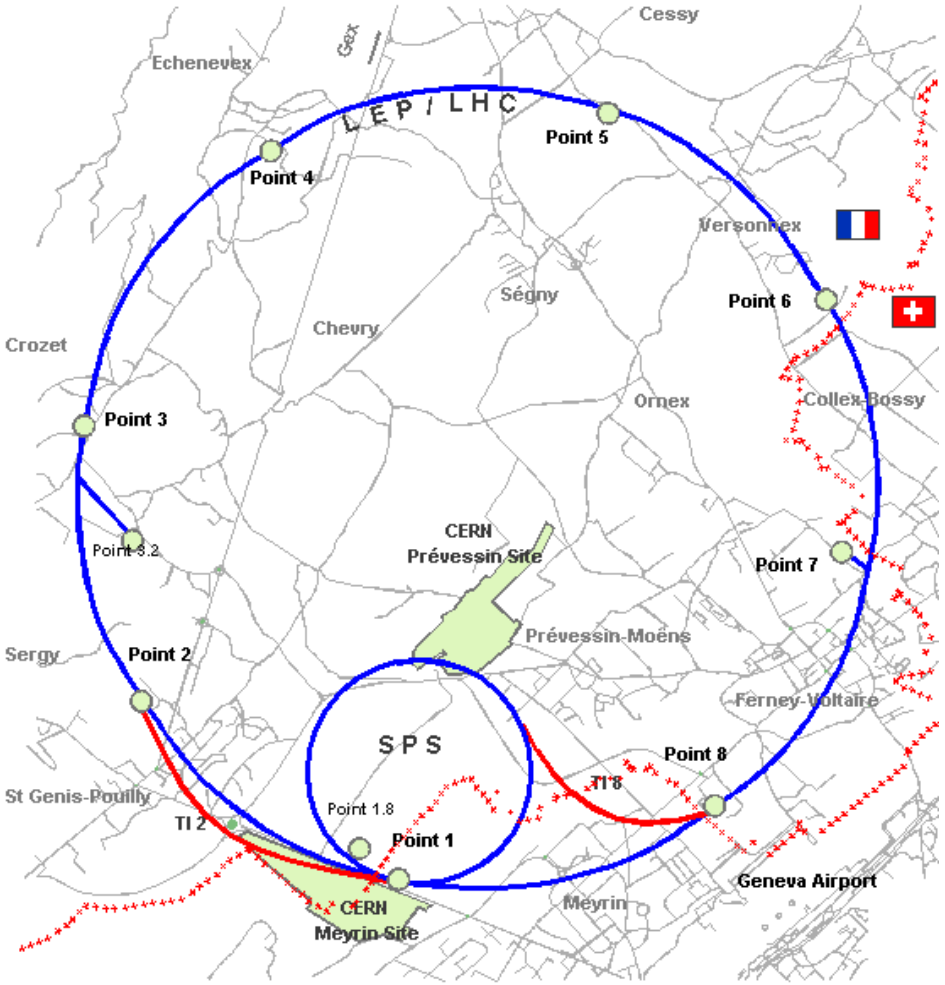
As of 31 December 2021
Employees:
2676 staff, **783** fellows

Associates:
11 175 users, **1556** others

Around 50 Cooperation Agreements with non-Member States and Territories

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bangladesh – Belarus – Bolivia
Bosnia and Herzegovina – Brazil – Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia – Honduras
Iceland – Iran – Jordan – Kazakhstan – Lebanon – Malta – Mexico – Mongolia – Montenegro – Morocco – Nepal
New Zealand – North Macedonia – Palestine – Paraguay – People's Republic of China – Peru – Philippines – Qatar
Republic of Korea – Saudi Arabia – Sri Lanka – South Africa – Thailand – Tunisia – United Arab Emirates – Vietnam

CERN Headquarters and Host States



- Decision in 1953 to establish the laboratory in Geneva
- Organization hosted in Switzerland (Headquarters agreement)

- Extensions of CERN's territory into France :

  1965 : Meyrin Site extended on French territory for the construction of the Intersecting Storage Rings
  1972: Prévessin Site and SPS construction

Unique situation of IGO established on territory across border of two Host-States

Lease agreements today:

≈ 100 ha in Switzerland

CERN's Activities

Activities of CERN set out in the Convention:

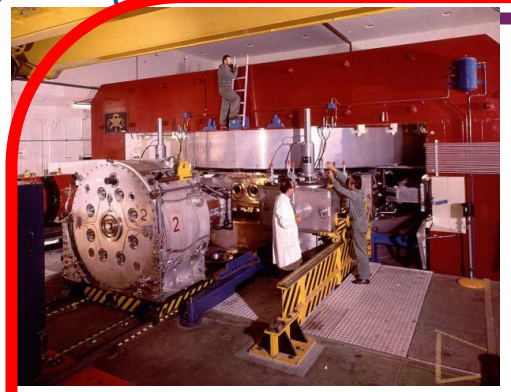
The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.

- Construction and operation of international research laboratory(ies), with
  - one or more particle accelerators
  - apparatus for use in the research programme executed on the accelerators
  - related scientific and administrative infrastructure
- Organization and sponsoring of international co-operation in particle physics inside and outside the lab(s), on
  - theoretical physics
  - work in the field of cosmic rays
  - promotion of contacts and exchange of scientists, dissemination of information, provision of advanced training
  - collaboration with and advising of other research institutions

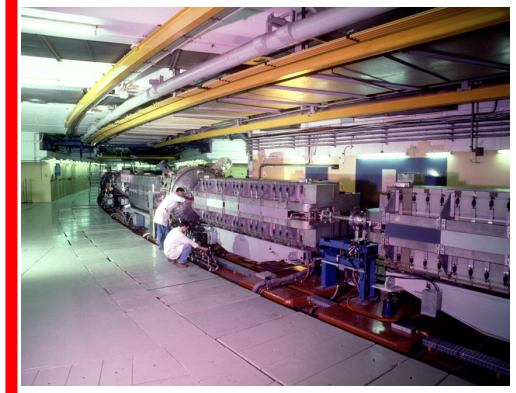
➔ **Includes today:**

- hosting and support to the international scientific community in the fields of nuclear, particle and astroparticle physics;
- defining Europe's long-term strategy in particle physics (European Strategy for Particle Physics).

Landmark Accelerators at CERN



Synchrocyclotron (SC) 1957-1990
600 MeV



Proton Synchrotron (PS)
1959
28 GeV

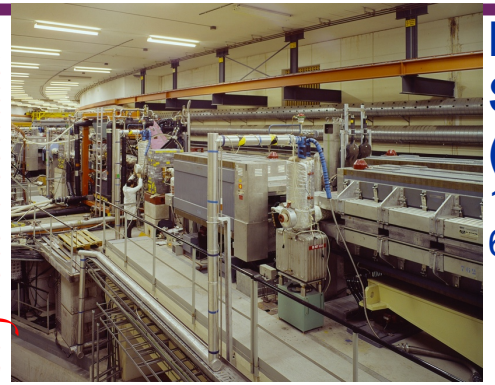
Super Proton Synchrotron (SPS)
1976
450 GeV

Super Proton-Antiproton Synchrotron (SppS)
1981-1991
590-630 GeV

W/Z discovery

Explicitly mentioned in the Convention

1st proton collider



Intersecting Storage Rings (ISR)
1971-1984
62 GeV

EW-physics

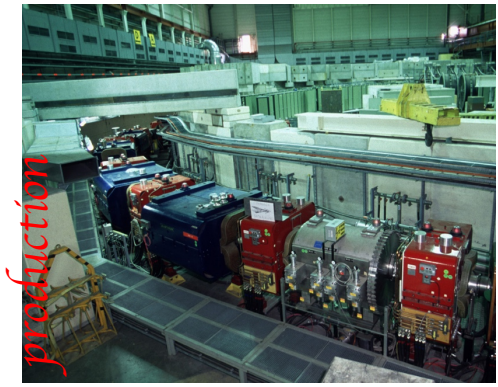
Large Electron Positron Collider (LEP)
1989-2000
90-209 GeV

Higgs discovery

Large Hadron Collider (LHC)
2009
14 TeV

Antihydrogen production

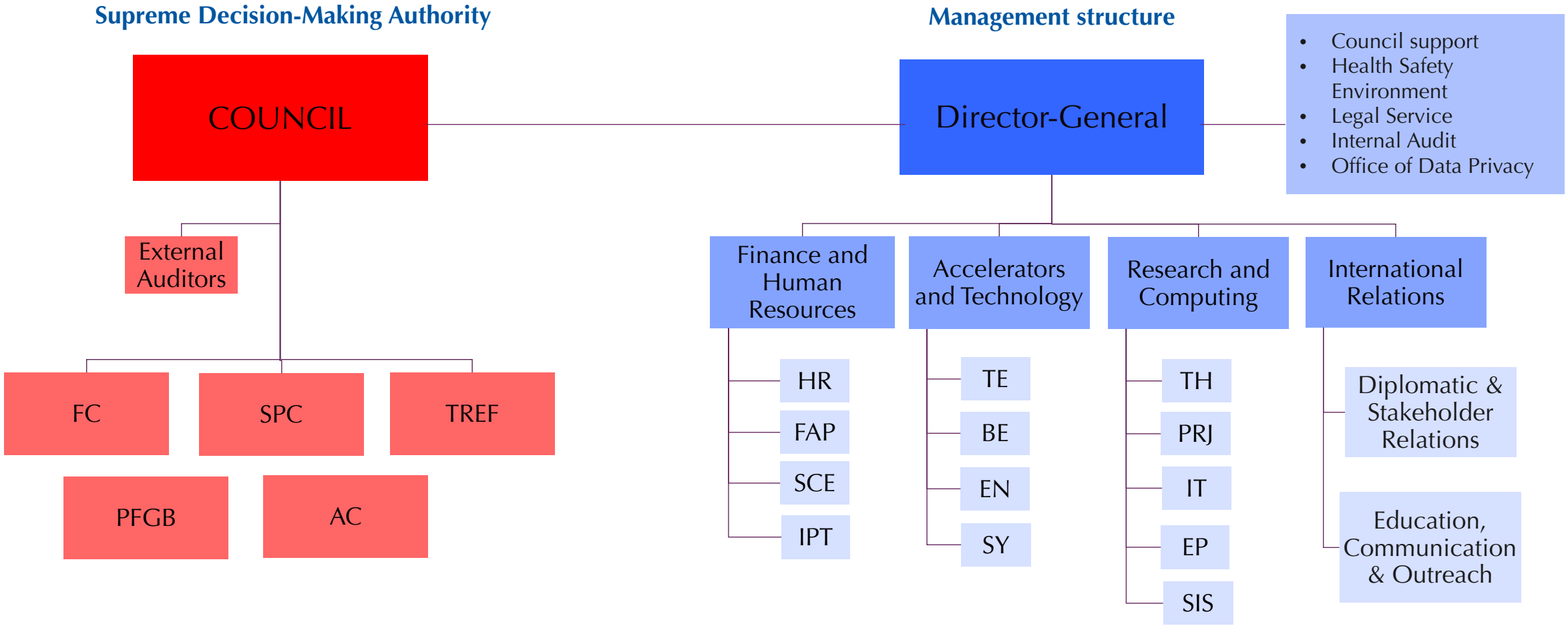
Antiproton Decelerator (AD)
2000



Isolde
1967

Nuclear Physics

CERN's Governance



CERN Council

Supreme decision-making authority

- Determine scientific, technical and administrative policy
- Admit new Member States and Associate Member States
- Approve programmes of activities
- Approve European Strategy for Particle Physics
- Approve the Medium Term (5y) Plan and Budget
- Approve financial statements and annual report
- Appoint Director-General and top-level personnel
- Responsible for the Pension Fund and appoint Pension Fund CEO

Composition

- 2 delegates per Member State appointed by government as well as possible advisors

Council President

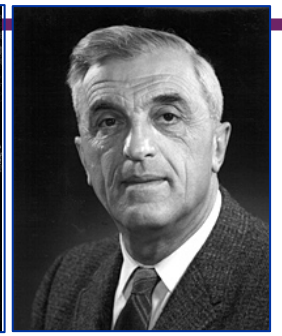
- appointed by the Council, normally from amongst the delegates, for maximum 3 years

Functioning

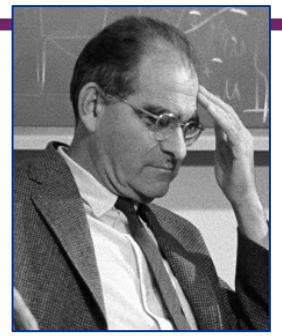
- laid down in the Council Rules of Procedure, adopted by the Council

Directors-General

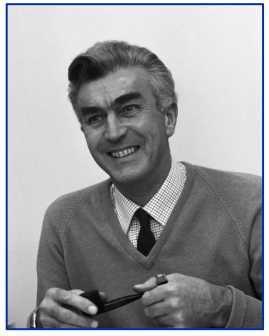

Edoardo Amaldi


Felix Bloch

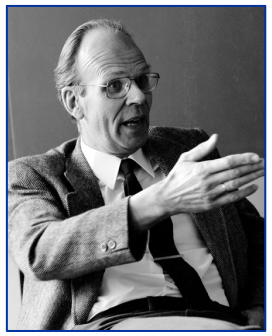

Cornelis Bakker


Victor Weisskopf


Bernard Gregory


John Adams

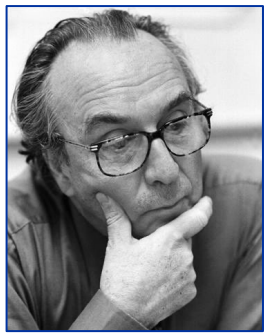

Willibald Jentschke


Léon van Hove

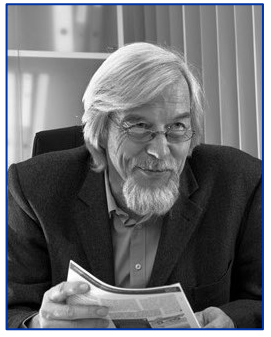

Herwig Schopper


Carlo Rubbia


Christopher Llewellyn-Smith


Luciano Maiani


Robert Aymar


Rolf Heuer


Fabiola Gianotti

- CERN executive organ
- Legal representative of CERN
- Management of CERN laboratory
- Preparation and submission of proposals for decision by Council
- Implementation of Council's decisions
- Reporting to Council
- Oversees implementation of European Strategy

A laboratory for people around the world

Distribution of all CERN Users by the country of their home institutes as of 31 December 2021

Geographical & cultural diversity
Users of **110 nationalities**
19.4% women

Member States 6642

Austria 74 – **Belgium** 122 – **Bulgaria** 39 – **Czech Republic** 227
Denmark 42 – **Finland** 71 – **France** 811 – **Germany** 1129
Greece 133 – **Hungary** 69 – Israel 67 – **Italy** 1423
Netherlands 157 – **Norway** 69 – **Poland** 278 – **Portugal** 89
Romania 105 – **Serbia** 36 – **Slovakia** 66 – **Spain** 328
Sweden 88 – **Switzerland** 372 – **United Kingdom** 847

Associate Member States in the pre-stage to membership **55**

Cyprus 10 – **Estonia** 24 – **Slovenia** 21

Associate Member States **367**

Croatia 36 – **India** 130 – **Latvia** 11 – **Lithuania** 12 – **Pakistan** 30
Türkiye 122 – **Ukraine** 26

Observers **2917**

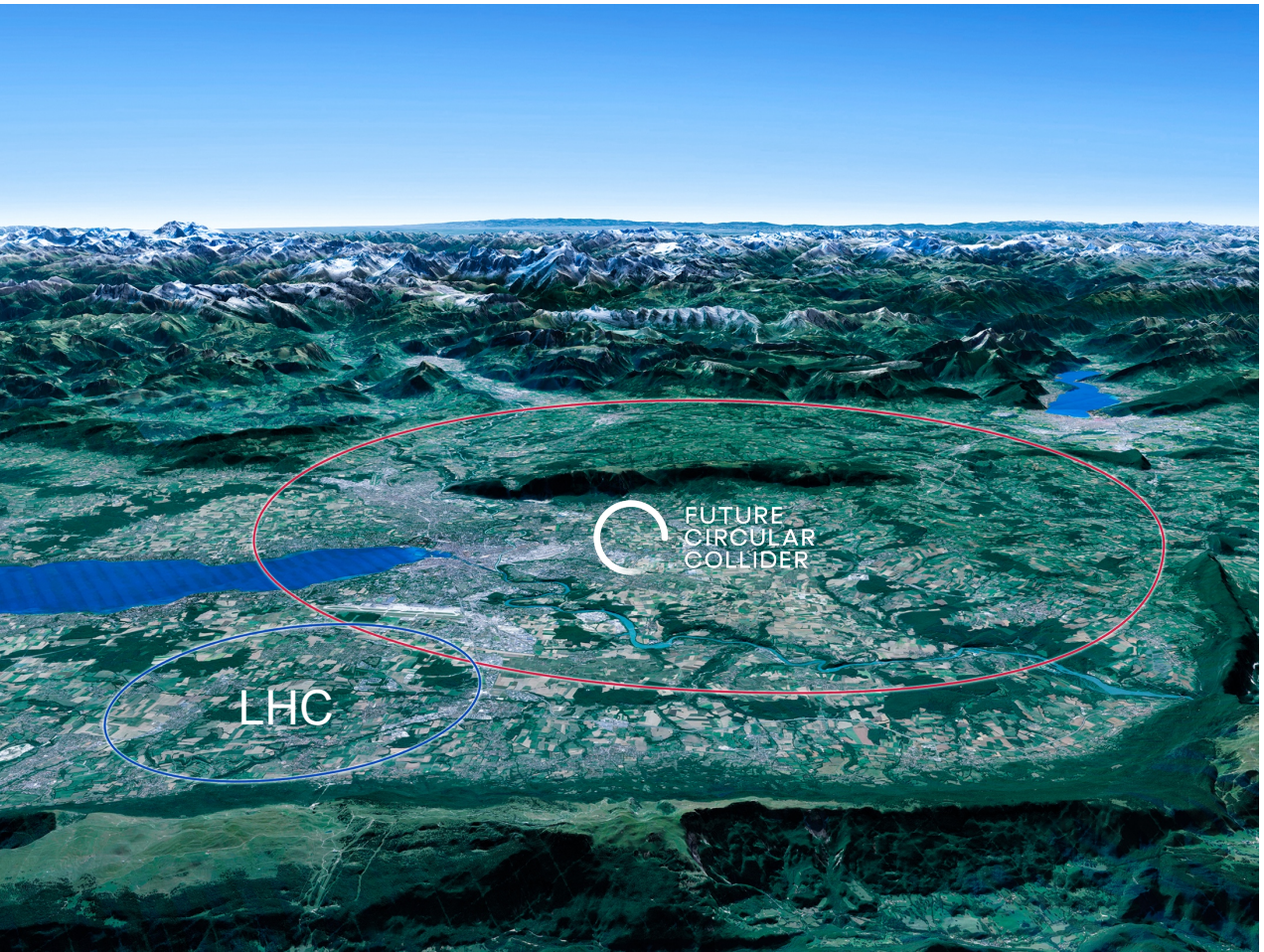
Japan 189 – **Russia** (suspended) 971 – **United States of America** 1757

Non-Member States and Territories **1194**

Algeria 3 – **Argentina** 16 – **Armenia** 10 – **Australia** 20 – **Azerbaijan** 3 – **Bahrain** 2 – **Belarus** 24 – **Brazil** 106
Canada 189 – **Chile** 23 – **Colombia** 18 – **Cuba** 3 – **Ecuador** 6 – **Egypt** 16 – **Georgia** 36 – **Hong Kong** 17
Iceland 3 – **Indonesia** 6 – **Iran** 11 – **Ireland** 6 – **Jordan** 5 – **Kuwait** 5 – **Lebanon** 15 – **Madagascar** 1
Malaysia 4 – **Malta** 2 – **Mexico** 48 – **Montenegro** 5 – **Morocco** 18 – **New Zealand** 8 – **Oman** 1 – **People's Republic of China** 314 – **Peru** 2 – **Philippines** 1 – **Republic of Korea** 113 – **Singapore** 3 – **South Africa** 52
Sri Lanka 10 – **Taiwan** 45 – **Thailand** 18 – **United Arab Emirates** 6

The search for the Higgs boson is the kind of adventure that draws many young people to science, even if they go on to work in more applied areas

European Strategy Update



Scientific Priorities for the Future

Implementation of the recommendations of the **2020 Update of the European Strategy for Particle Physics**:

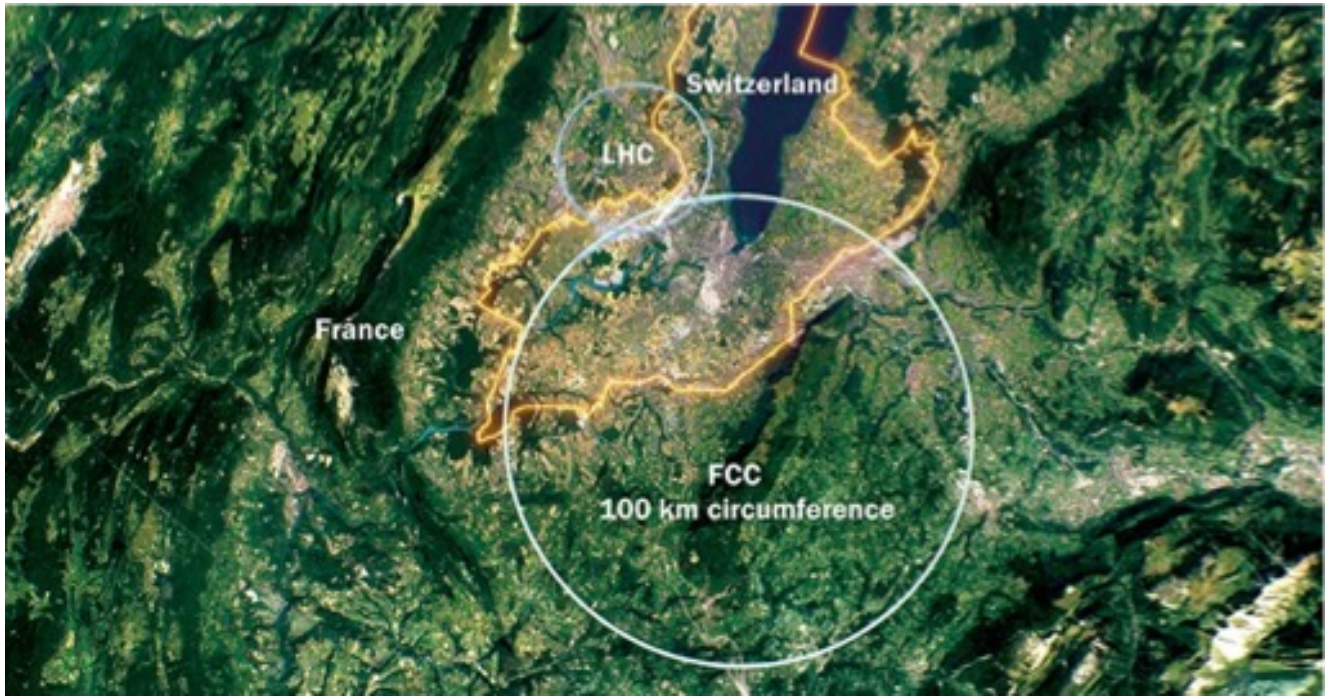
- Fully exploit the HL-LHC.
- Build a Higgs factory to further understand this unique particle.
- Investigate the technical and financial feasibility of a future energy-frontier 100 km collider at CERN.
- Ramp up relevant R&D.
- Continue supporting other projects around the world.

Future Circular Collider (FCC) Study

International FCC collaboration (CERN as host lab) to study:

- ***proton-proton* collider (*FCC-hh*)**
  - defines infrastructure requirements
  - **80-100 km infrastructure** in Geneva area

    ~16 T ⇒ 100 TeV *pp* in 100 km
- ***electron-positron* collider (*FCC-ee*)** as first step
- ***proton-electron* (*FCC-he*)** option



FUTURE CIRCULAR COLLIDER
Innovation Study

FCC Feasibility Study

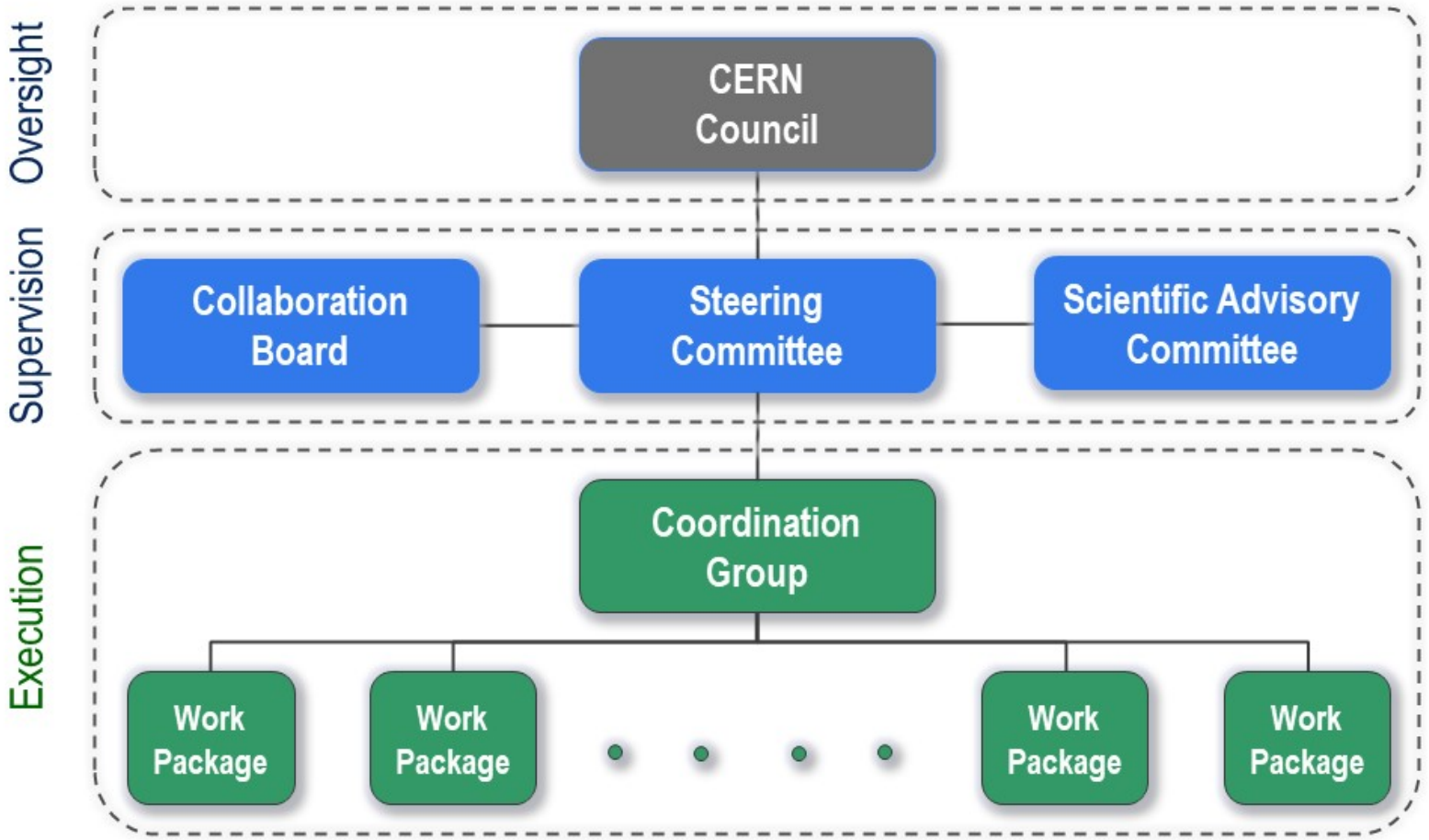
FCC Feasibility Study (FS) will address a recommendation of the 2020 update of the European Strategy for Particle Physics (ESPP):

- "Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage.
- Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update."

→ Complete Feasibility Study Report by end 2025

FCC Organisational Structure

- **Ownership** of the Feasibility Study by the Council.
- Effective and timely **supervision**.
- Integration of scientific and technical **advice**.
- **Participation of stakeholders** that can potentially make significant financial and technical contributions to a possible future project.
- **Execution** of Feasibility Study.



FUTURE CIRCULAR COLLIDER
Innovation Study

FCC Global Collaboration

increasing international collaboration as a prerequisite for success

34 Countries

EC H2020

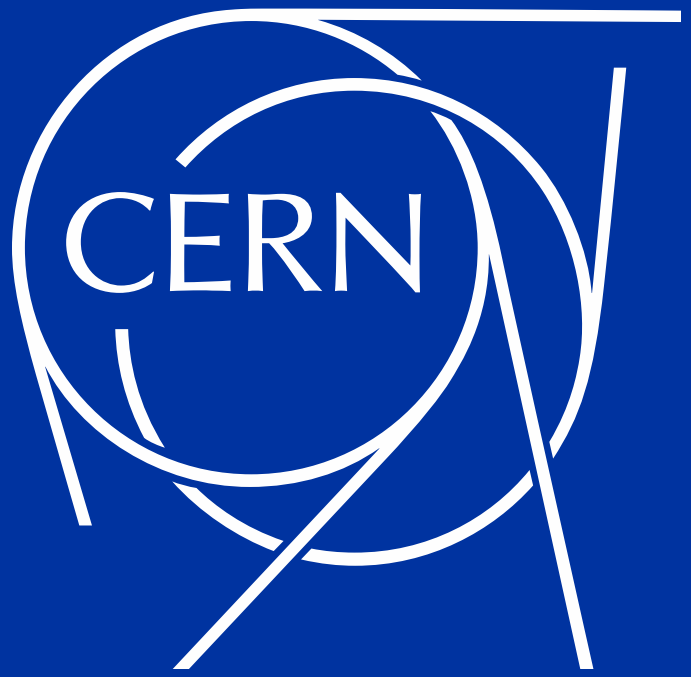
30 Companies

147 Institutes

93 member states
16 associate member states
21 non-member states with observer status
17 other non-member states

There are many unanswered questions in fundamental physics

CERN will continue to play a crucial role in the journey of exploration.
We must dare to work on bold projects, bridging us to the future.
Connecting projects with SDGs, as a community goal for “one earth”!


CERN