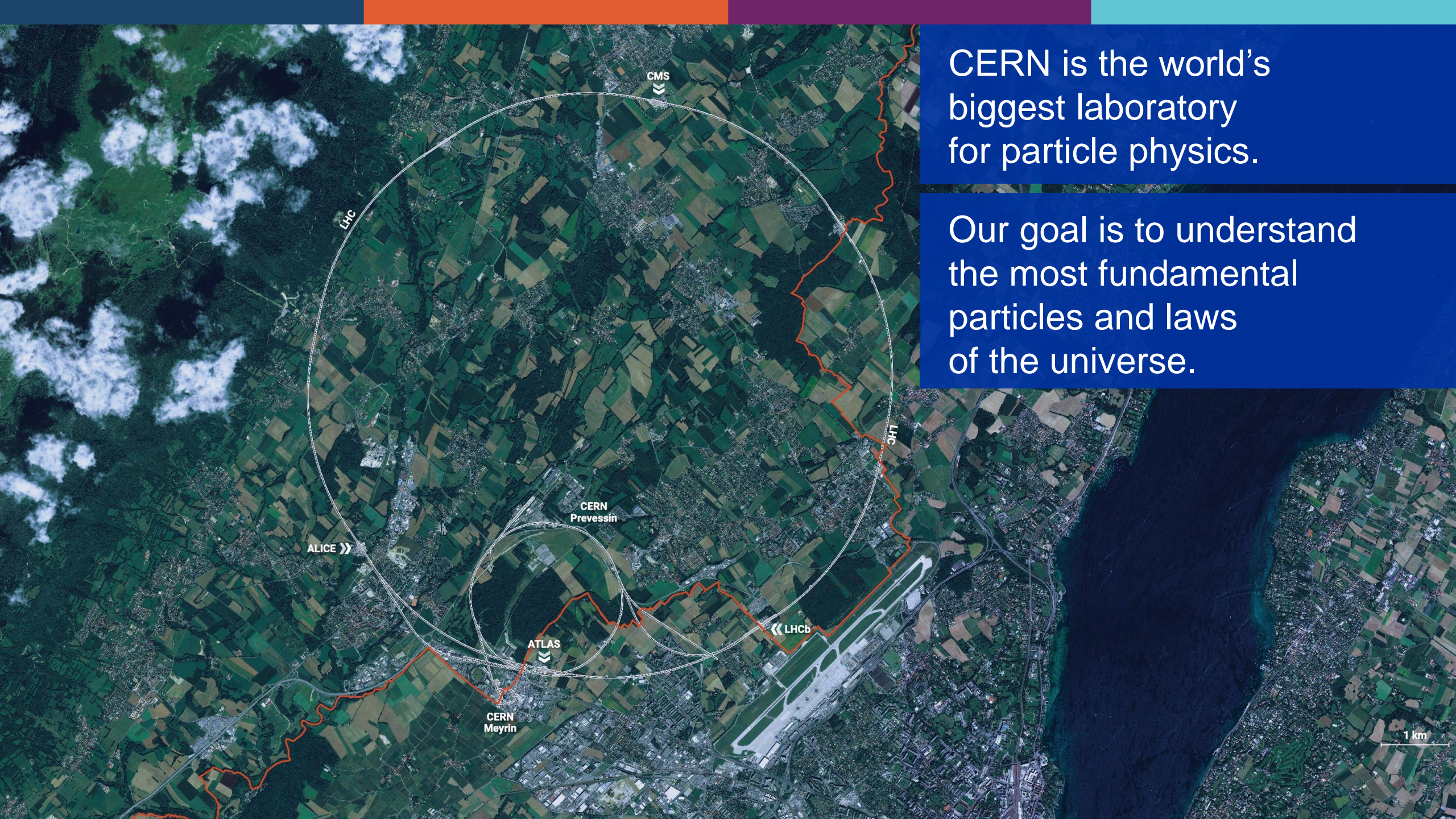




Organisation, Structure and Governance of CERN

Visit of Foundation Future Leaders Program

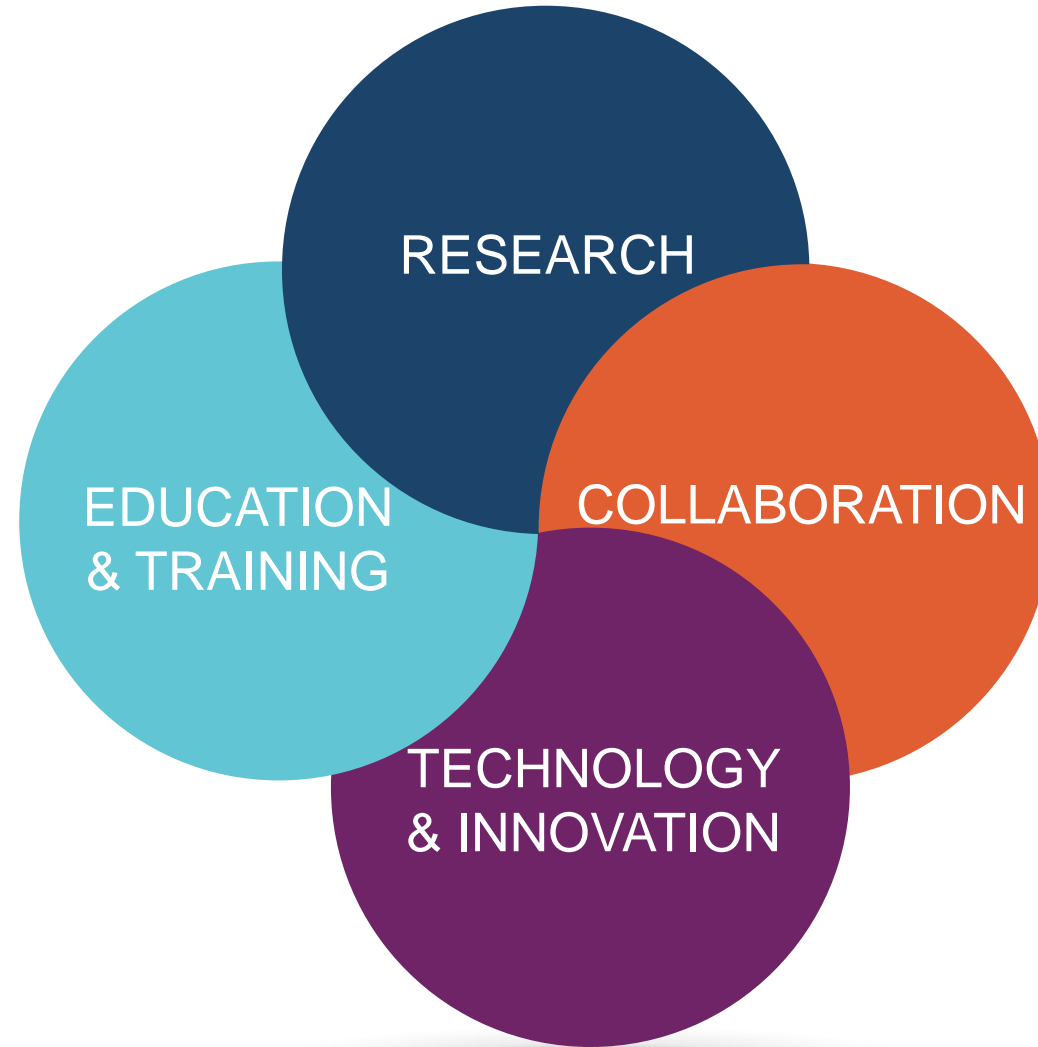
Emmanuel Tsesmelis
Head of Associate and Non-Member State Relations, CERN
Tuesday, 20 September 2022



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



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

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'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

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



CERN – Founded for Science for Peace

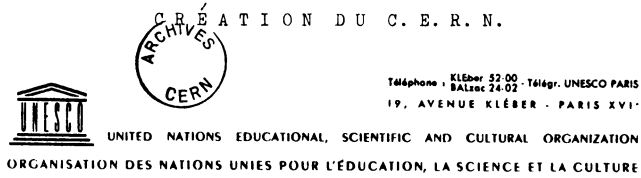
CERN founded in 1954 by 12 European States

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

Provisional Council 1952 Rome

Provisional Council 1953 Amsterdam



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.

Paris

Jakob Willes, R. Serin

Edouard *W. de Roo*

W. Kowarski

Annali *P. J. Butler*

W. K. King *Odd Dahl*

M. Masati *P. Preis*

Maria Jacobson *P. Lehmann*

Paulo Sanic *D. G. Perini*

Sten Sundjer *Torsten Gustafson*

Sven Waller

Hannes Alphen

Nils Riehn



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, 14th JULY, 1954

As amended

CONVENTION

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

PARIS, le 14th JUILLET 1954

Telle qu'elle a été modifiée

ÜBEREINKOMMEN

ZUR ERRICHTUNG EINER EUROPÄISCHEN ORGANISATION
FÜR KERNFORSCHUNG

PARIS, 1. JULI 1954

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

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 :

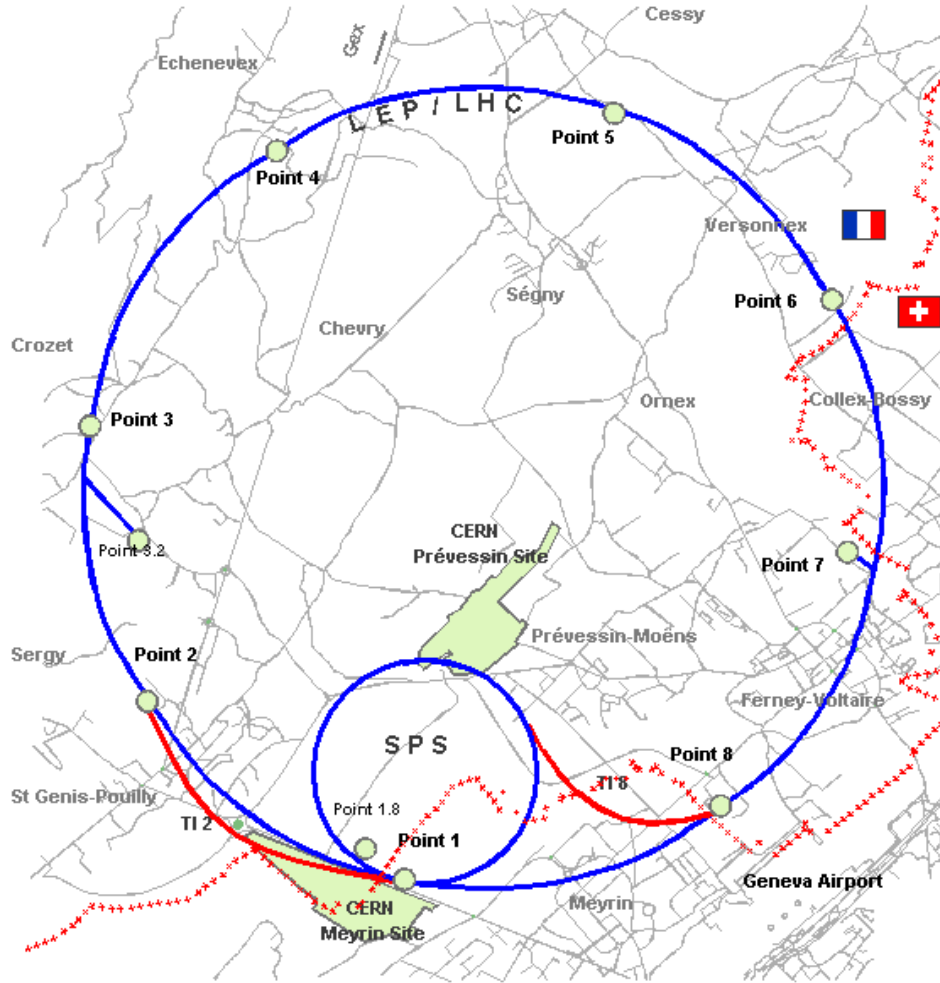
1965 : Meyrin Site extended on French territory for the construction of the Intersecting Storage Ring

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

≈ 500 ha in France





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:

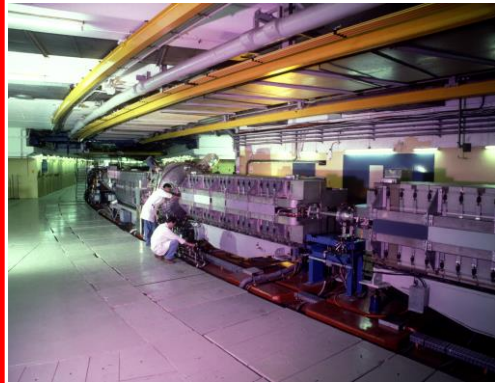
- hosting and support to the international scientific community in the fields of nuclear, particles and astroparticle physics;
- defining Europe's long-term strategy in particle physics (European Strategy for Particle Physics).



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

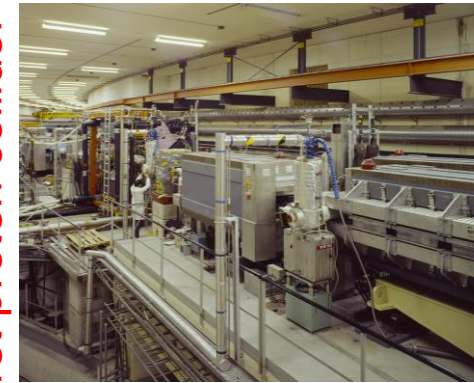
Explicitly mentioned in the Convention

W/Z discovery

Higgs discovery

EW-physics

1st proton collider



Intersecting Storage Ring (ISR)
1971-1984
62 GeV



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



Large Hadron Collider (LHC)
2009
14 TeV

Antihydrogen production

Nuclear Physics

Antiproton Decelerator (AD)
2000



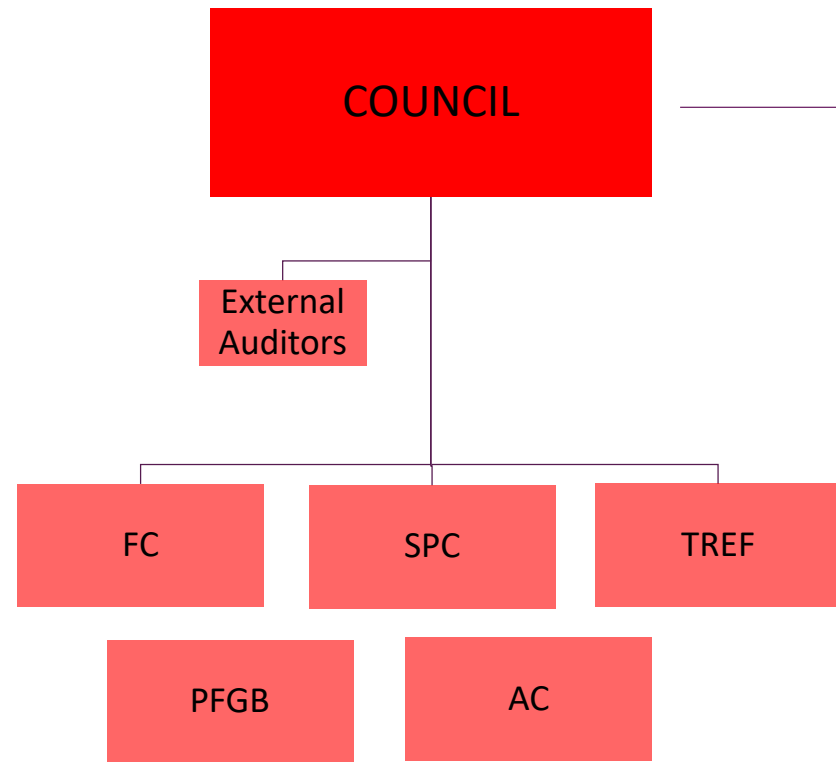
Isolde
1967



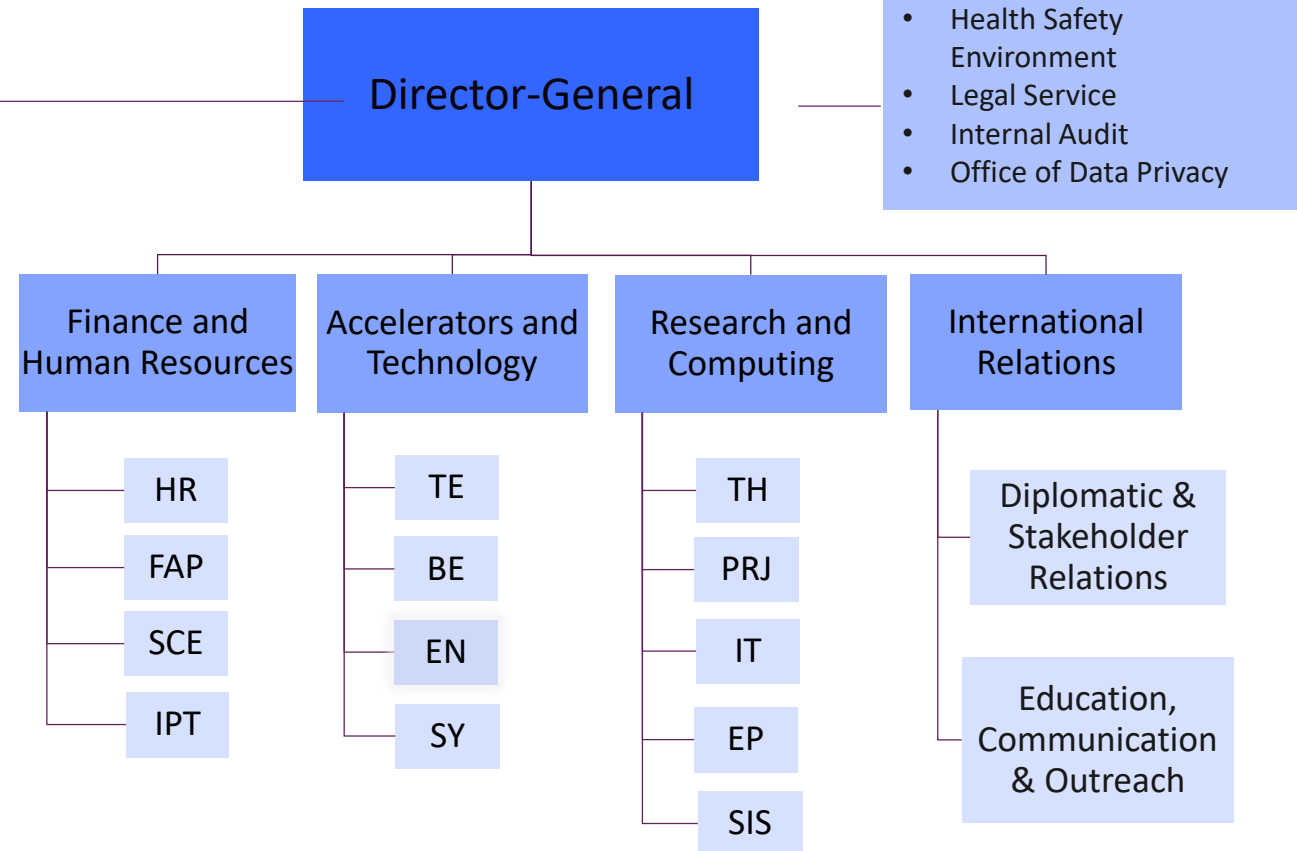


CERN's Governance

Supreme Decision-Making Authority



Management structure



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 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

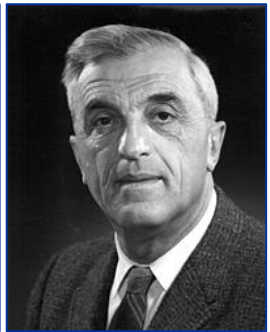
- laid down in the Council Rules of Procedure, adopted by the Council



Directors-General



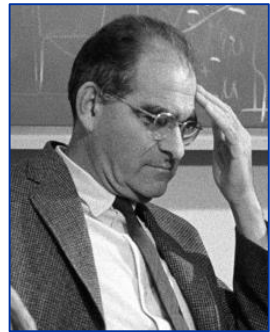
Edoardo Amaldi



Felix Bloch



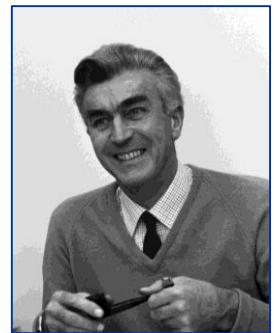
Cornelis Bakker



Victor Weisskopf



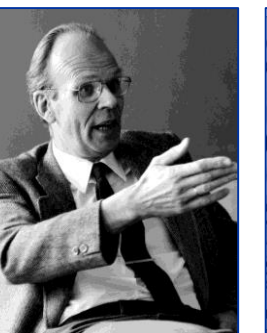
Bernard Gregory



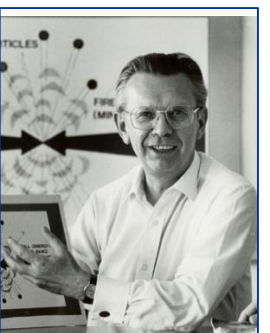
John Adams



Willibald
Lentzschke



Léon van
Hove



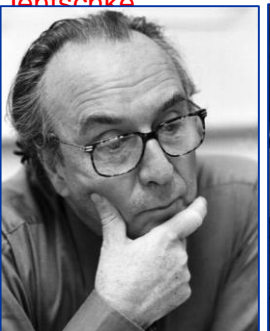
Herwig Schopper



Carlo Rubbia



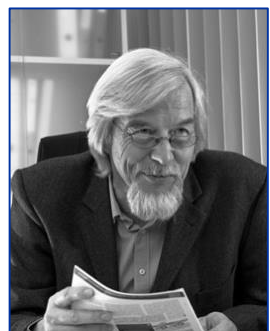
Christopher
Llewellyn-Smith



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

Funding for Accelerators & Experiments

CERN Convention stipulates “the operation of particle accelerators and the necessary ancillary apparatus for use in the research programmes”

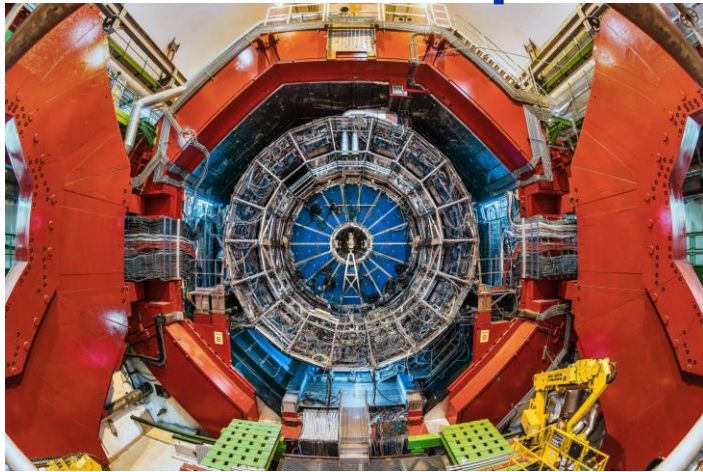
Since the days of LEP (1980s):

- **Accelerators** funded from the **CERN budget** (from Member States) and **project contributions** from non-member states (NMS).
- **Experiments** constructed by **(in-kind) contributions** from institutes in Members States and non-Member States; may be supplemented by a **cash contribution** to a Common Fund for the joint procurement of infrastructure.
- **Experiments** are **operated jointly by the collaborating institutes** and supported by a **Maintenance and Operations Budget** financed by all institutes (through their funding agencies), of which CERN is typically one.

LHC Experiments at CERN

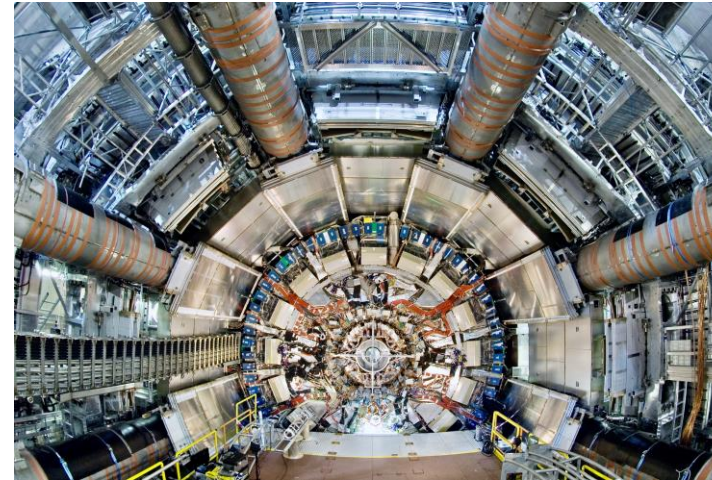
ALICE

~2000 members



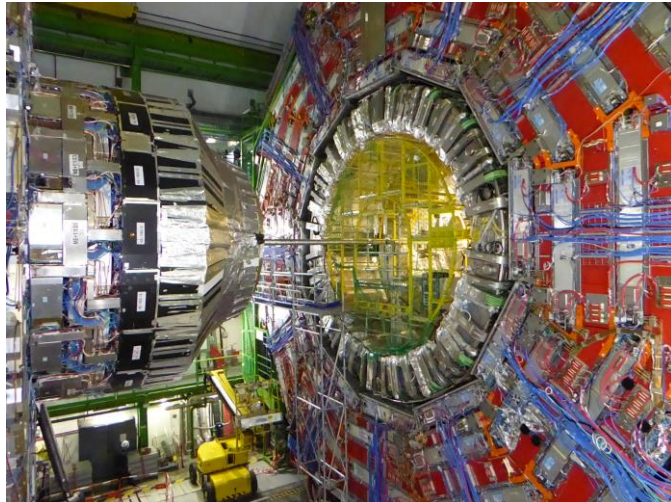
ATLAS

>3000 members



CMS

>3000 members



LHCb

>1400 members



Experimental Collaborations

- Interested physicists form a **proto-Collaboration** and propose an **experimental set-up** that is deemed capable of carrying out a measurement programme of interest using **infrastructure at CERN**.
- Once **approved** the physicists constitute a **formal Collaboration** with the aim to build and operate the apparatus and to analyse and publish the data recorded jointly
 - Their **home institute commits** to support their activity.
 - The **results are published** under the name of the Collaboration.
- **Collaborations are open** - new institutes may join following a well-defined procedure.

Approval and Review by Scientific Committee (LHCC)

- The competent **Scientific Committee** is called by the Director responsible for research. These committees are constituted by international and independent experts that **peer-review the proposals and progress reports**.
 - For the LHC, 4 proposals were received for general purpose detectors. Two merged (1992) to become ATLAS. Another was CMS.
 - **Expression of Interest** → **Letter of Intent** → **Technical Design Reports**
- **Progress is compared to milestones** set at the approval of the experiment
 - Now significant upgrades are in progress – similar procedure.
- Problems are flagged to the experiments, CERN management and funding agencies to allow for counter measures.
- **Research Board** receives the concise reports of the Committee.

Research Board

- Research Board (RB) is chaired by the Director General of CERN and consists of the Directors, the CERN Department Heads and the chairs of the Scientific Committees.
- The **RB approval process** based on:
 - **Scientific recommendations** from Scientific Committee.
 - Assessment of the **financial situation** of the experiment.
 - **Resource implication at CERN** (support, services, technical installation, technology requirements). The Department Heads of the relevant technical groups at CERN assess the implications beforehand
- Final decision is taken by Council through the approval of the **Medium-Term Plan (MTP)**.

Participation in Experiments at CERN

- **General Conditions (GC)** are the **legally binding basis for participation** in a CERN hosted experiment
 - GC set out the rules for users and describe the host lab responsibilities
- Engagement in an experiment is concluded by a **Memorandum of Understanding (MoU)** between the collaborating institute (funding agency) and CERN, signed by the Director responsible for research.
 - **MoUs describe the responsibilities** for the construction of the experiments, the operation of the apparatus and its dismantling.
 - Funding Agencies have direct oversight of their funds via the **Resources Review Board**.

GC last update Dec 2020:

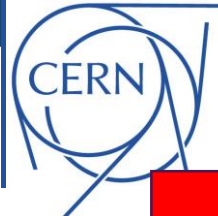
ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

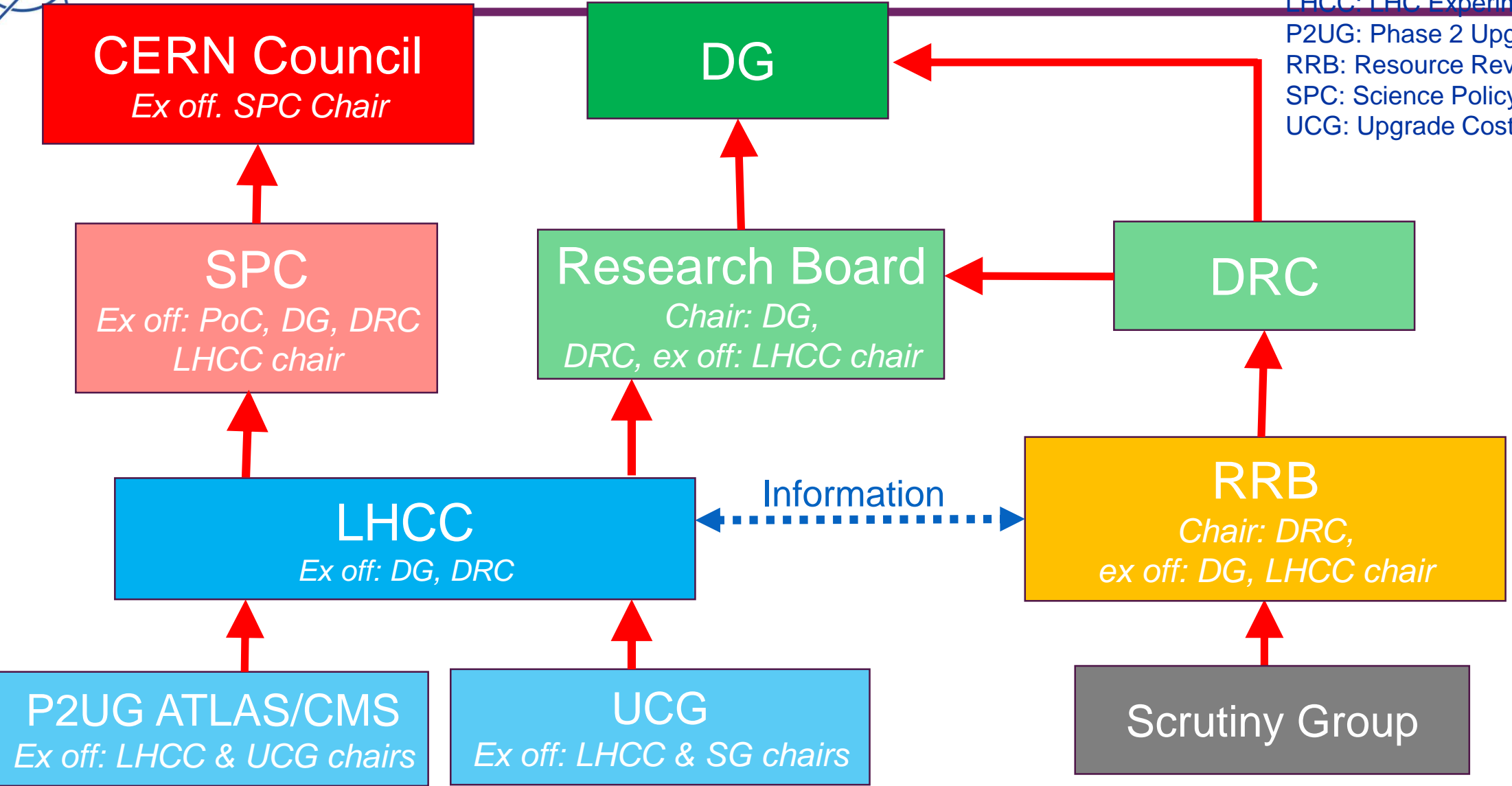
CERN GENERAL CONDITIONS

APPLICABLE TO THE EXECUTION OF
EXPERIMENTS



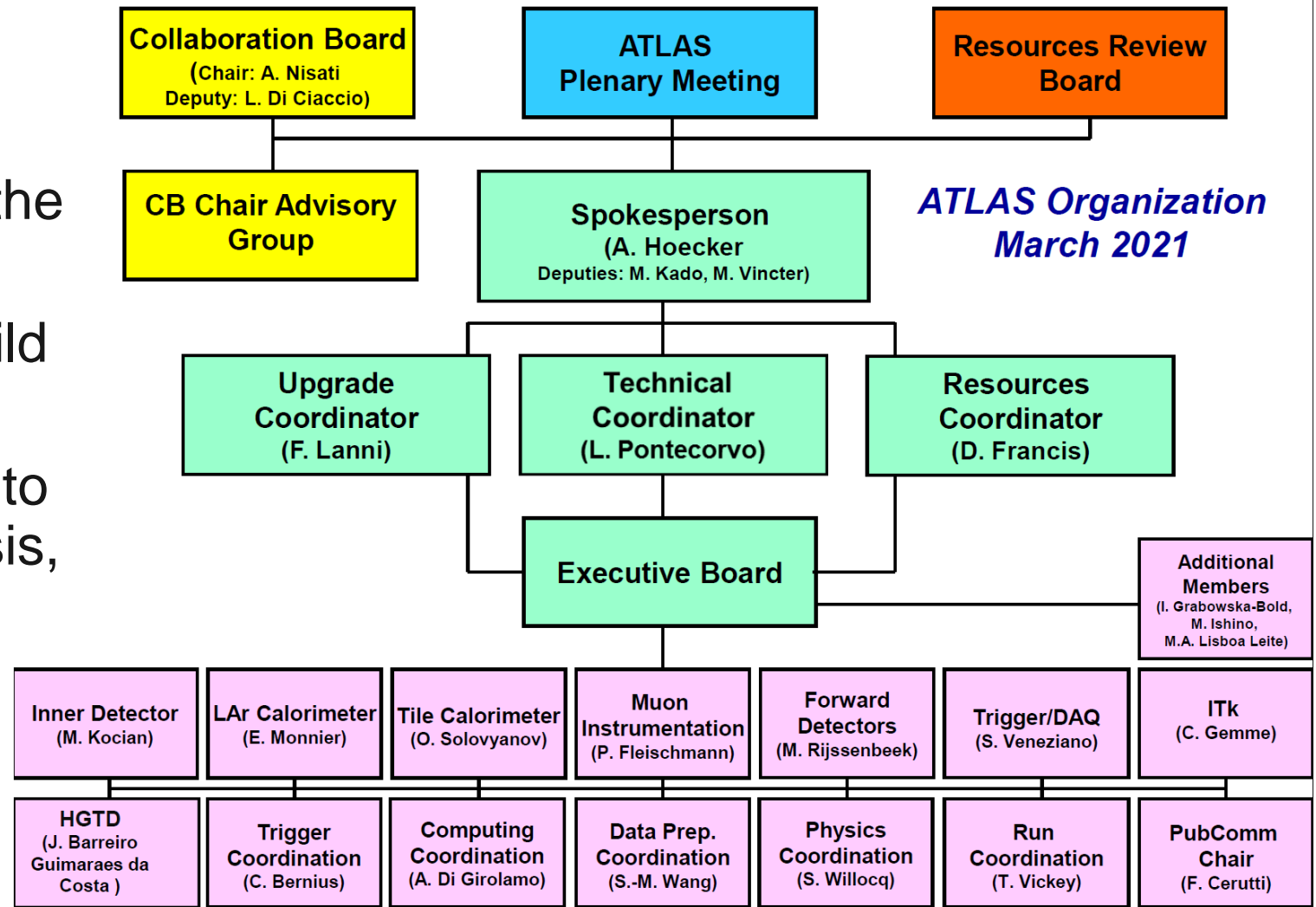
Sketch on Reporting on LHC experiments

LHCC: LHC Experiments Committee
P2UG: Phase 2 Upgrade Group
RRB: Resource Review Board
SPC: Science Policy Committee
UCG: Upgrade Cost Group



Example: ATLAS

- Broad engagement of the participating institutes
- Groups of institutes build parts of the apparatus
- The data are available to all physicists for analysis, organised in dedicated working groups



CERN is a model for open and inclusive collaboration



The LHC experiments are models of consensus building, competition and cooperation.

SESAME, a synchrotron light source in Jordan, is modelled on CERN's governance structure.

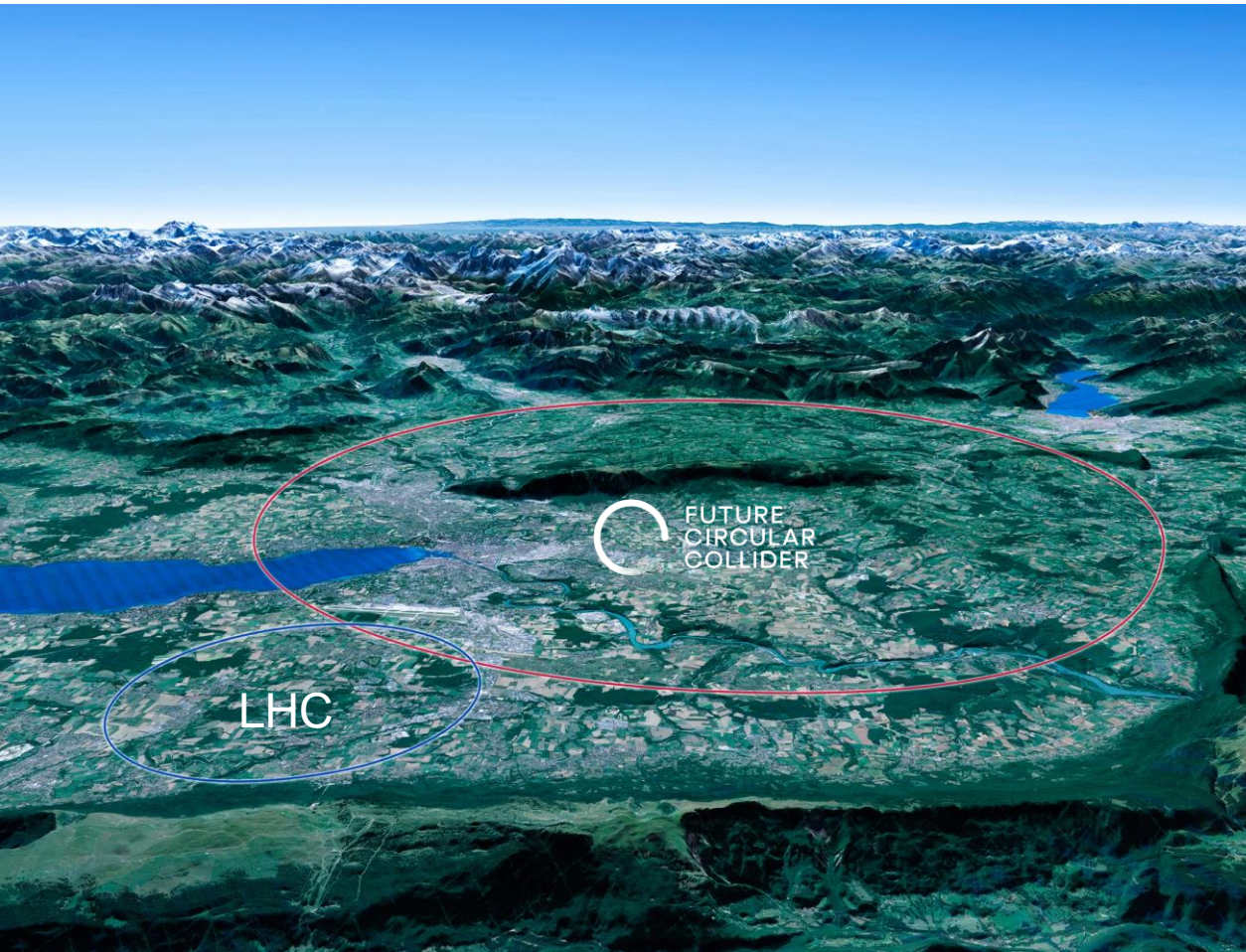


CERN provides the IT infrastructure for the satellite-analysis technology used for emergency response.

Scientific Priorities for the Future

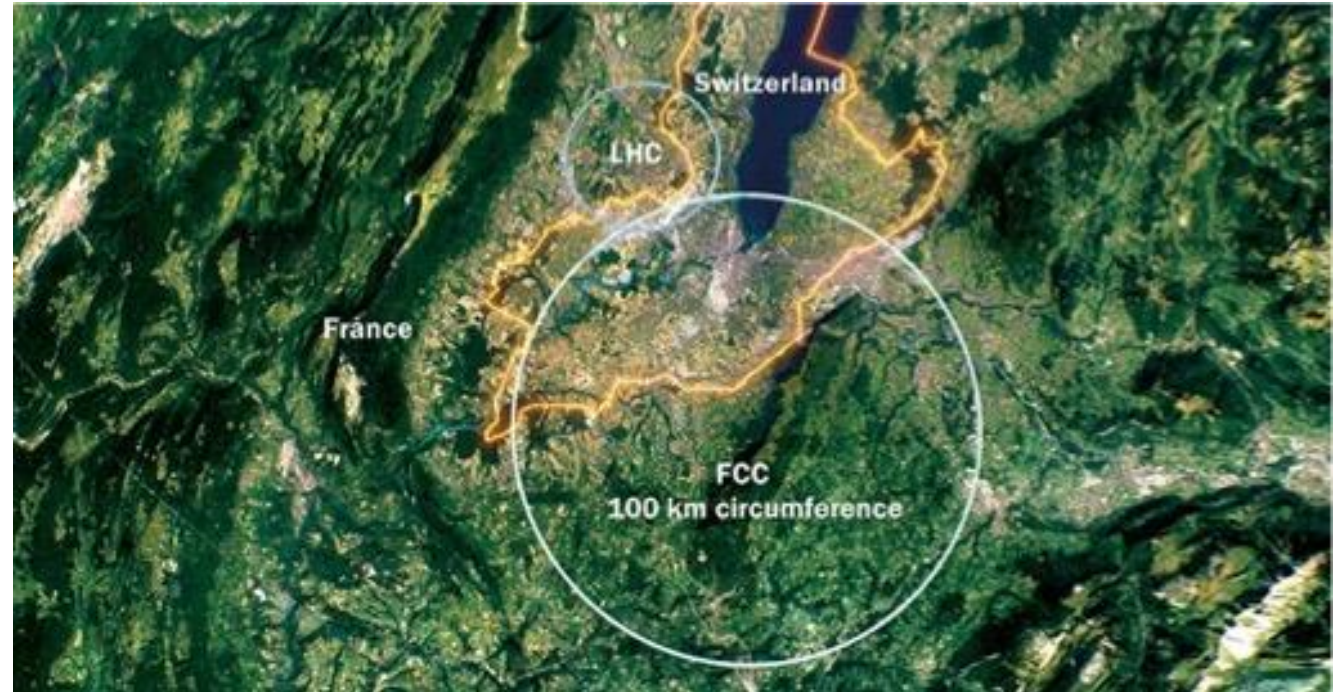
Implementation of the recommendations
of the **2020 Update of the European Strategy
for Particle Physics:**

- 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**.



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

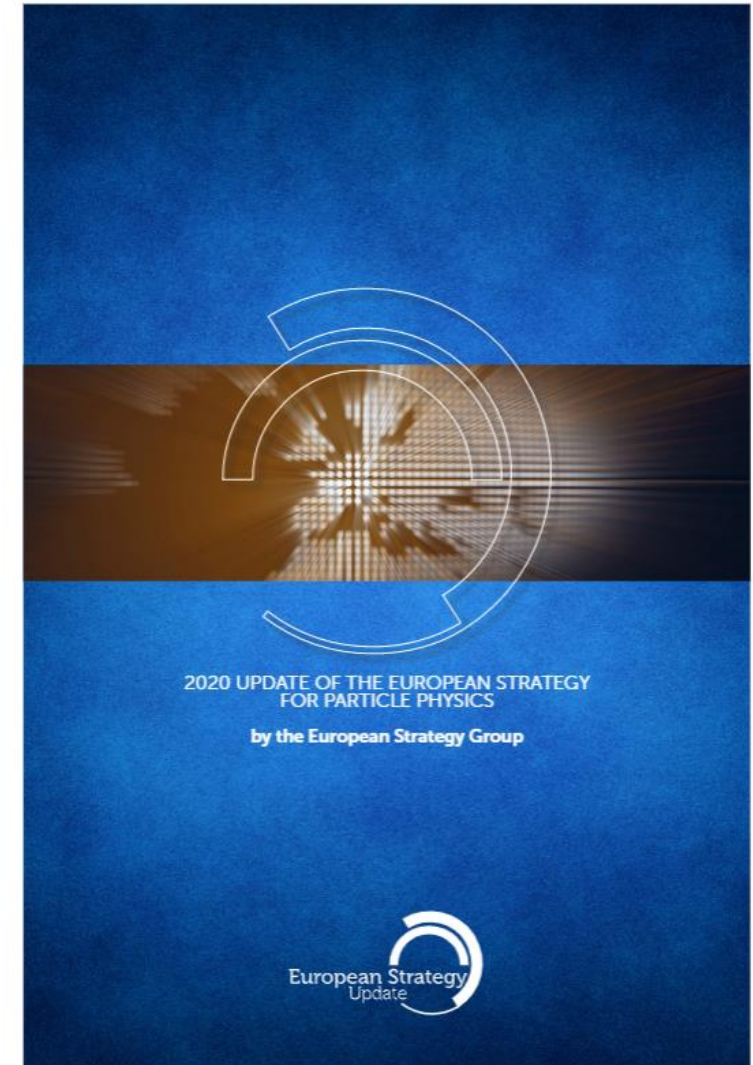
- **proton-proton collider (FCC-hh)**
 - defines infrastructure requirements
 - **80-100 km infrastructure** in Geneva area
 - ~16 T \Rightarrow 100 TeV pp in 100 km
- **electron-positron collider (FCC-ee)** as first step
- **proton-electron (FCC-he)** option



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

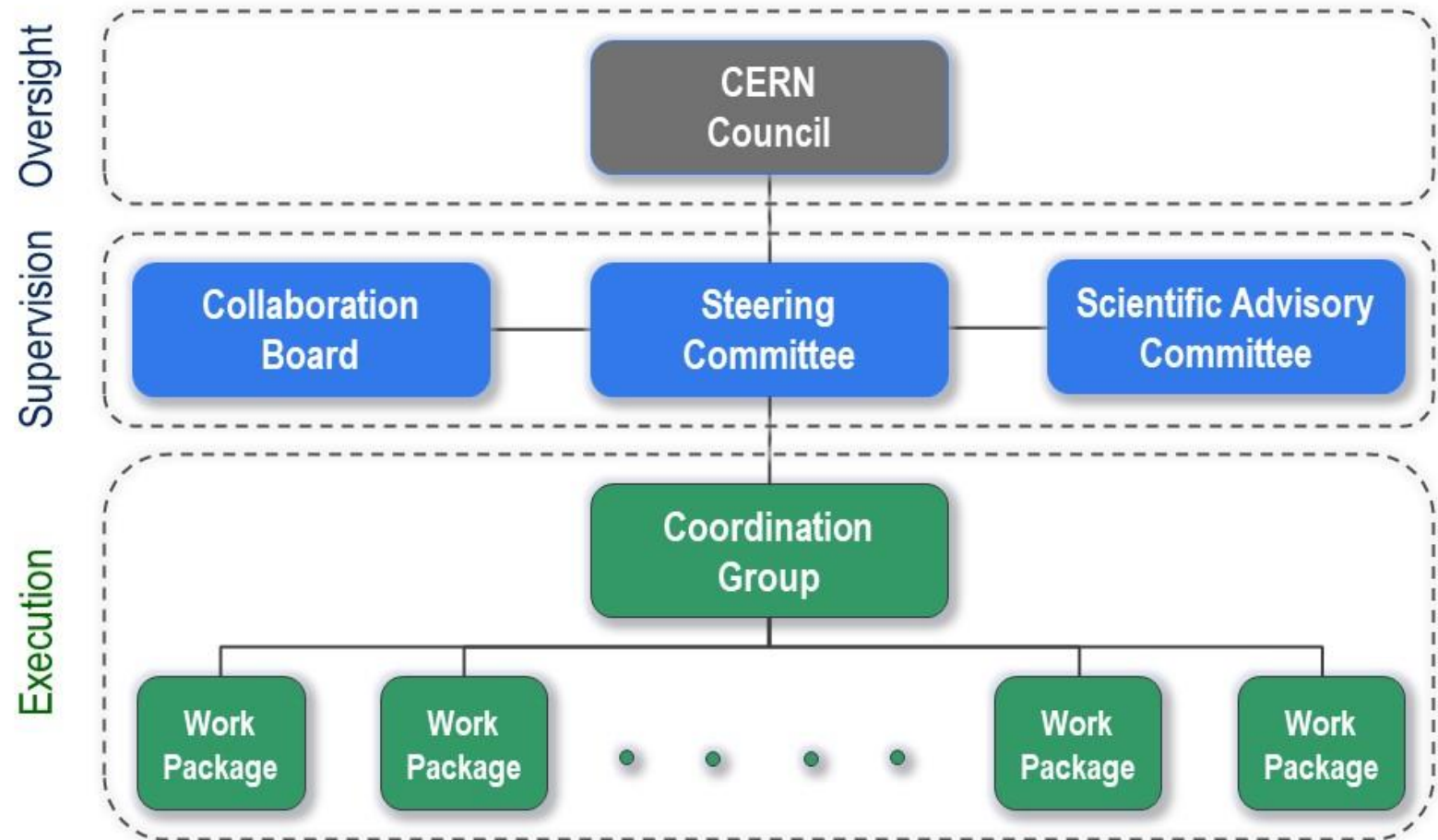
- “Europe, together with its international partners, should investigate the **technical and financial feasibility** of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage.
- Such a feasibility 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

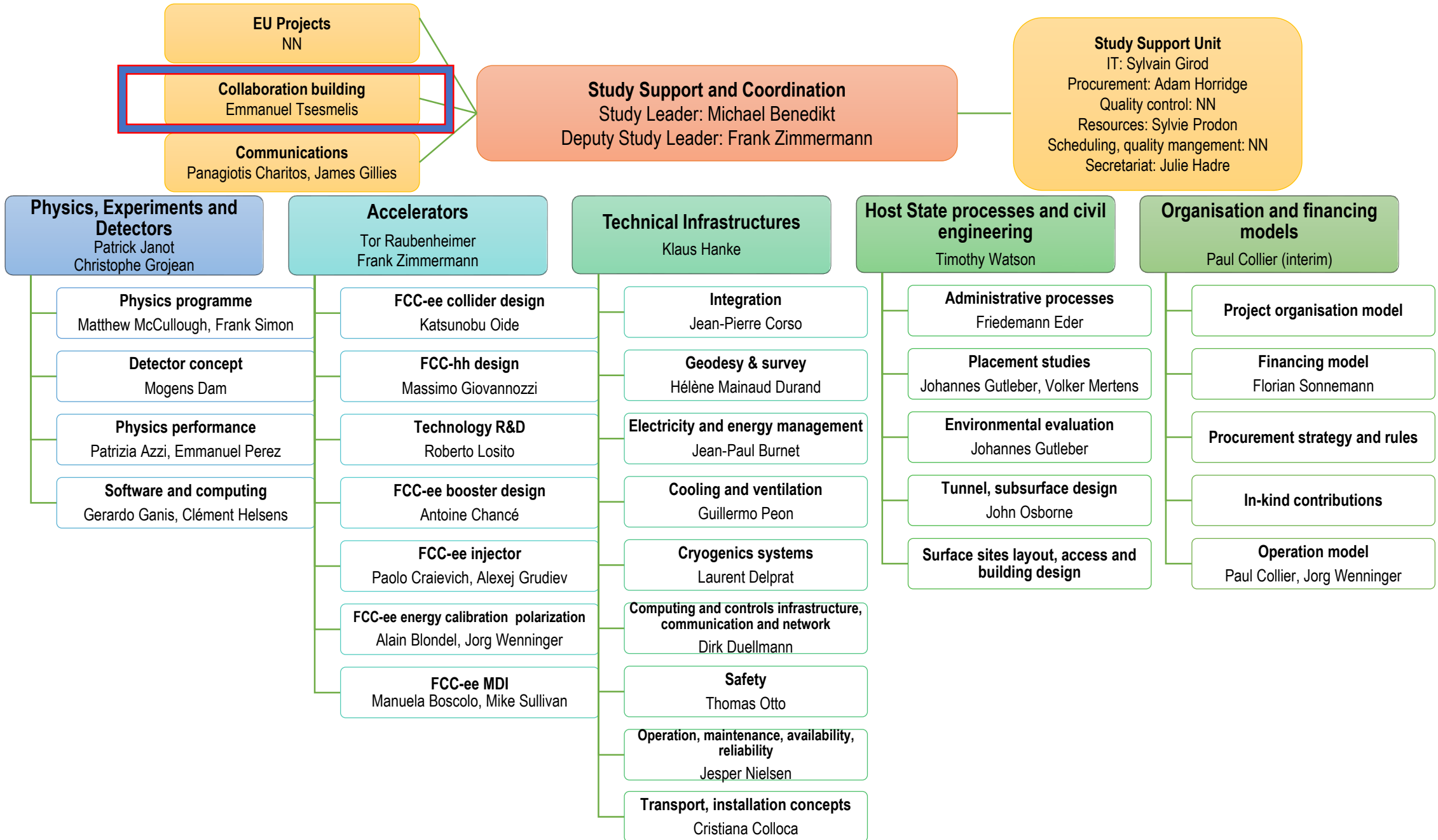


FCC Organisational Structure

- **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.



FCC Feasibility Study – Coordination Team and Contactpersons



Status of Global FCC Collaboration

Increasing international collaboration as a prerequisite for success:

links with science, research & development and **high-tech industry** will be essential to further advance and prepare the implementation of FCC

147
Institutes

30
Companies

34
Countries



