FCC Collaboration Status

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http://cern.ch/fcc

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European Commission | Horizon 2020 European Union funding for Research & Innovation

photo: J. Wenninger

Science for Peace

CERN was founded in 1954 with 12 European Member States

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

Employees:
2704 staff,
1181 graduates and fellows
Associates:
12 406 users, **1401** others

24 Member States

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

10 Associate Member States

Brazil – Croatia – Cyprus* – India – Latvia – Lithuania – Pakistan – **Slovenia*** – Türkiye – Ukraine

4 Observers

Japan – USA – European Union – UNESCO

~ 50 Cooperation Agreements

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bahrain – Bangladesh – Bolivia – Bosnia and Herzegovina
Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia – Honduras – Iceland – Iran – JINR – 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 – South Africa – Sri Lanka – Thailand – Tunisia – United Arab Emirates – **Uruguay** – Vietnam

* Associate Member State in the pre-stage to Membership

Data as of 31 December 2024

Chile and Ireland are to become CERN Associate Member States.

A laboratory for people around the world

Distribution of all CERN Users by the location of their home institute

Geographical & cultural diversity
Users of **110 nationalities**
23.7 % women

Member States (7675)

Austria 88 – **Belgium** 142 – **Bulgaria** 49 – **Czech Republic** 250
Denmark 50 – **Estonia** 27 – **Finland** 88 – **France** 856 – **Germany** 1260
Greece 101 – **Hungary** 84 – **Israel** 75 – **Italy** 1657 – **Netherlands** 174
Norway 88 – **Poland** 363 – **Portugal** 110 – **Romania** 110 – **Serbia** 42
Slovakia 72 – **Spain** 448 – **Sweden** 103 – **Switzerland** 409
United Kingdom 1029

Associate Member States (631)

Brazil 141 – **Croatia** 35 – **Cyprus*** 12 – **India** 158 – **Latvia** 22
Lithuania 21 – **Pakistan** 35 – **Slovenia*** 29 – **Türkiye** 151 – **Ukraine** 27

Observers (2330)

Japan 229 – **United States of America** 2101

* Associate Member State in the pre-stage to Membership

Data as of 31 December 2024

Cooperation Agreements (1770)

Albania 7 – **Algeria** 1 – **Argentina** 17 – **Armenia** 28 – **Australia** 31 – **Azerbaijan** 2 – **Bahrain** 10 – **Canada** 203 – **Chile** 58
Colombia 25 – **Costa Rica** 8 – **Cuba** 3 – **Ecuador** 4 – **Egypt** 22 – **Georgia** 36 – **Hong Kong** 17 – **Iceland** 3 **Indonesia** 8 – **Iran** 18 – **Ireland** 11 – **JINR 305** – **Jordan** 2 – **Kazakhstan** 8 – **Kuwait** 2 – **Lebanon** 12 – **Madagascar** 1 **Malaysia** 1 **Malta** 3
Mexico 66 – **Montenegro** 4 – **Morocco** 22 – **New Zealand** 1 – **Nigeria** 1 – **Oman** 1 – **Palestine** 1
People's Republic of China 472 – **Peru** 3 - **Philippines** 1 – **Republic of Korea** 184 - **Saudi Arabia 4** – **South Africa** 73
Sri Lanka 7 - **Taiwan** 49 – **Thailand** 17 - **Tunisia** 3 – **United Arab Emirates** 14 – **Vietnam** 1

FCC Feasibility Study

Bottom-up approach in the community

EU Projects
NN

Collaboration Building
Gregorio Bernardi, Tadeusz Lesiak, Emmanuel Tsesmelis,

Communications
Panagiotis Charitos, Arnaud Marsollier

Study Support and Coordination
Study Leader: Michael Benedikt
Deputy Study Leader: Frank Zimmermann

Study Support Unit
IT: Sylvain Girod
Procurement: Adam Horridge
Quality management: Beatriz Arias
Resources: Sylvie Prodon
Secretariat: Julie Hadre, Jeanette Kotzian

Physics, Experiments and Detectors
Patrick Janot, Christophe Grojean, Guy Wilkinson

- **Physics programme** — Matthew McCullough, Frank Simon
- **Detector concept** — Mogens Dam, Marc-André Pleier, Felix Sefkow
- **Physics performance** — Patrizia Azzi, Emmanuel Perez, Michele Selvaggi
- **Software and computing** — Gerardo Ganis, Brieuc François

Accelerators
Tor Raubenheimer
Frank Zimmermann

- **FCC-ee accelerator design** — Christian Carli, Frank Zimmermann
- **FCC-ee technical implementation** — Jean-Paul Burnet, Tor Raubenheimer
- **FCC-ee injector** — Paolo Craievich, Alexej Grudiev
- **FCC transfer lines** — Wolfgang Bartmann
- **FCC-hh design** — Massimo Giovannozzi
- **EPOL** — Jacqueline Keintzel, Guy Wilkinson
- **MDI** — Manuela Boscolo, Fabrizio Palla

Technical Infrastructures
Jean-Paul Burnet
Klaus Hanke

- **Integration** — Jean-Pierre Corso
- **Geodesy & survey** — Hélène Mainaud Durand
- **Electricity and energy management** — Jean-Paul Burnet
- **Cooling and ventilation** — Guillermo Peon
- **Cryogenics systems** — Laurent Delprat
- **Computing and controls infrastructure, communication and network** — Pablo Saiz
- **Safety** — Thomas Otto
- **Operation, maintenance, availability, reliability** — Jesper Nielsen
- **Transport, installation concepts** — Roberto Rinaldesi

Host State processes and civil engineering
Timothy Watson

- **Administrative processes** — Friedemann Eder
- **Placement studies** — Johannes Gutleber
- **Environmental evaluation** — Johannes Gutleber
- **Tunnel, subsurface design** — John Osborne
- **Surface sites layout, access and building design** — A. Mayoux

Organisation and financing models
Florian Sonnemann

- **Project organisation model** — NN
- **Financing model** — Florian Sonnemann
- **Procurement strategy and rules** — Anders Unnervik
- **In-kind contributions** — Anders Unnervik
- **Operation model** — Verena Kain

The FCC Approach to Global Collaboration

- FCC Collaboration being formed through a **global, two-way and integrative process**, while being **geographically balanced** and **topically complementary**.

- Open to **areas beyond conventional accelerator R&D** (environment & sustainability; education & training; knowledge transfer to society; & public engagement) and in areas that are **non-core activities** for CERN (e.g. geology, geodesy, logistics & materials science).

- Prepare foundations for contributions via **national laboratories, institutes and universities** and for **industrial R&D**.

- CERN engaged in **discussions with potential major partners** as part of the FCC Feasibility Study for such a global project being hosted at CERN.

FCC Global Collaboration Working Group (FGC)

- Engage with the participants - **national laboratories, institutes and universities** as well as **industry** in the MS, AMS and NMS - to carry out the following mandate:

  - Encourage an **expanded membership**.
  - Explore **opportunities** for future prospective participants.
  - Support new participants in **application process**.
  - Assist the new participants in defining **areas of collaboration**.
  - Conclude relevant **agreements**.
  - Facilitate the **integration** process.
  - Facilitate interest in **CERN non-core areas** - geology, geodesy, logistics, materials science.
  - Prepare the foundations for R&D and contributions by **industry.**
  - Liaise with **national contact persons** and **forums**.

Convened by Emmanuel Tsesmelis (CERN International Relations)

FCC Engagement Meetings

Overview

- Extended forums with interested countries to discuss collaboration with FCC.
- Topics:
  - Introduction to FCC.
  - Presentation of FCC physics, experiment, detector, accelerator and global collaboration.
  - Presentations from the country scientific community.

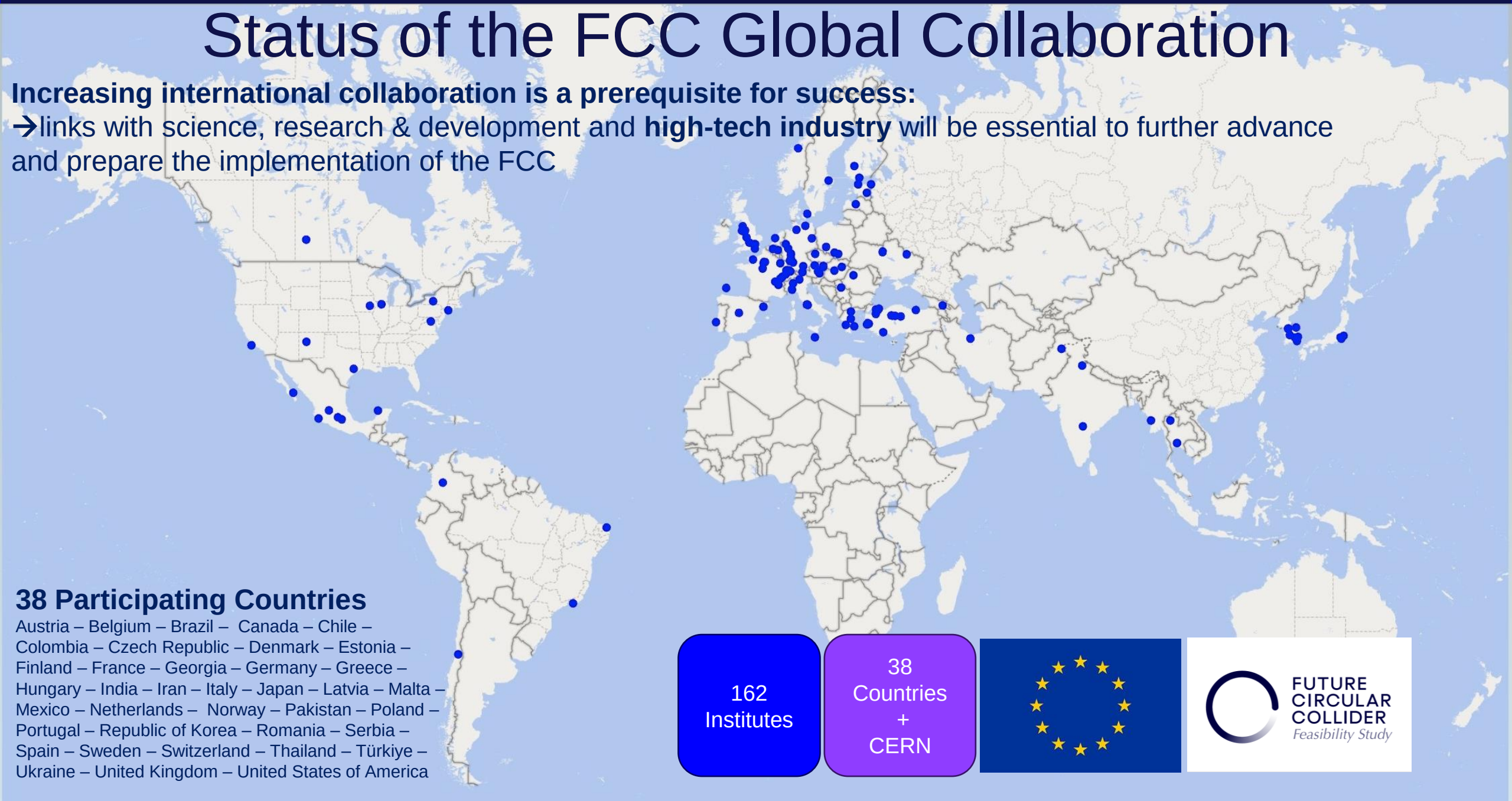
Meetings

- Mexico (mini meeting on accelerator)
  - June 2021
- Republic of Korea
  - September 2021
- Pakistan
  - September 2021
- Portugal
  - November 2021
- Estonia
  - March 2022
- Greece
  - January 2023, June 2023
- **India**
  - September 2024
- Engagement Meetings with **Canada, Lithuania and Thailand** to take place

Much interest continues to be expressed by participating countries and the FCC looks forward to stronger / deeper involvement in the follow-up.

Status of the FCC Global Collaboration

Increasing international collaboration is a prerequisite for success:
→links with science, research & development and **high-tech industry** will be essential to further advance and prepare the implementation of the FCC



38 Participating Countries

Austria – Belgium – Brazil – Canada – Chile – Colombia – Czech Republic – Denmark – Estonia – Finland – France – Georgia – Germany – Greece – Hungary – India – Iran – Italy – Japan – Latvia – Malta – Mexico – Netherlands – Norway – Pakistan – Poland – Portugal – Republic of Korea – Romania – Serbia – Spain – Sweden – Switzerland – Thailand – Türkiye – Ukraine – United Kingdom – United States of America

162 Institutes

38 Countries + CERN

FUTURE CIRCULAR COLLIDER
Feasibility Study

INSTITUTION	COUNTRY
University of Liège	Belgium
PUC - Pontificia Universidad Católica de Chile	Chile
SAPHIR Millenium Institute	Chile
Universidad Nacional de Colombia (UNAL)	Colombia
Université Gustave Eiffel (Eiffel)	France
BRGM - Bureau de recherches géologiques et minières	France
Georgian Technical University (GTU)	Georgia
University of Miskolc	Hungary
UPES	India
INFN Sezione di Roma Tre	Italy
University of Malta (UM)	Malta
UAS, Universidad Autonoma de Sinaloa	Mexico
CINVESTAV	Mexico
Cracow University of Technology (PK)	Poland
Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH)	Romania
INCDTIM - National Institute for Research and Development of Isotopic and Molecular Technologies	Romania
Thailand Center of Excellence in Physics	Thailand
Topkapı Üniversitesi	Türkiye
Yozgat Bozok University	Türkiye
Akdeniz University	Türkiye
Institute for Scintillating Materials (ISMA)	Ukraine
Bogolyubov Institute for Theoretical Physics (BITP)	Ukraine
Kharkiv Institute of Physics and Technology (NSC KIPT)	Ukraine
V. N. Karazin Kharkiv National University	Ukraine
Taras Shevchenko National University of Kyiv (TSNUK)	Ukraine
Imperial College London (ICL)	United Kingdom
UoM, The University of Manchester	United Kingdom
Stony Brook University	United States

28 Memoranda of Understanding (MoUs) signed since previous Collaboration Board (June 2024)

Statement of Intent – CERN & USA

CERN and the US government have released a **joint statement** concerning future planning for large research infrastructures, advanced scientific computing and open science.

CERN and the US intend to **enhance collaboration** in planning activities for **large-scale, resource-intensive facilities** with the goal of providing a sustainable and responsible pathway for the peaceful use of future accelerator technologies.

“Should the CERN Member States determine the FCC-ee is likely to be CERN’s next world-leading research facility following the high-luminosity Large Hadron Collider, **the United States intends to collaborate on its construction and physics exploitation**, subject to appropriate domestic approvals.”

CERN Director-General, Fabiola Gianotti (right), and Principal Deputy US Chief Technology Officer, Deirdre Mulligan, of the White House Office of Science and Technology (left) at the signing ceremony. (Image:US Department of State, Bureau of Oceans & International Environmental & Scientific Affairs)

Washington, D.C., 26 April 2024

Statement of Intent – CERN & Canada

Signature of the Statement of Intent. CERN Director-General, Fabiola Gianotti, and His Excellency Mr Patrick Wittmann, Ambassador of Canada to Switzerland and Liechtenstein

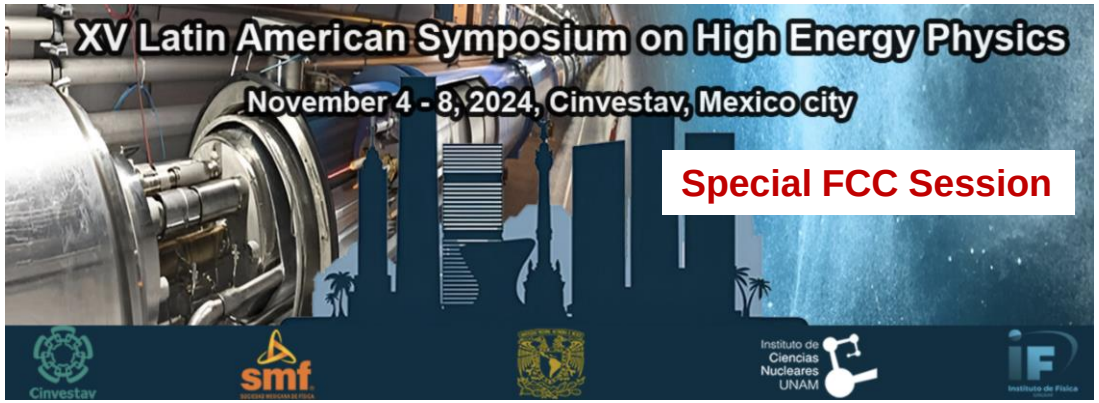
March 2025

CERN and the Canadian government have released a **joint statement** concerning **collaboration** on **future planning for large research infrastructure facilities**, and on **novel and advanced techniques and tools**.

CERN and Canada intend to **enhance collaboration** in planning of future projects, continue & expand cooperation on innovative detector, accelerator and computing technologies, **strengthen collaboration on FCC studies**, and promote joint efforts in developing advanced techniques and tools, such as artificial intelligence and quantum technologies.

*"Should the CERN Member States determine that the **FCC** is likely to be CERN's next world-leading research facility following the High-Luminosity Large Hadron Collider, **Canada intends to collaborate on its construction and physics exploitation**, subject to appropriate domestic approvals."*

Latin America



Institute	Country
CBPF, Brazilian Center for Physics Research	Brazil
UFRN, Federal University of Rio Grande do Norte	Brazil
PUC, Pontificia Universidad Católica de Chile	Chile
Millenium Institute SAPHIR	Chile
UNAL - Universidad Nacional de Colombia	Colombia
CINVESTAV, Centro de Investigación y de Estudios Avanzados del IPN	Mexico
UADY, Autonomous University of Yucatan	Mexico
UGTO, Universidad de Guanajuato	Mexico
BUAP, Benemérita Universidad Autónoma de Puebla	Mexico
UCOL, University of Colima	Mexico
UAS, Universidad Autonoma de Sinaloa	Mexico

Ukraine

Online Signing Ceremony with 5 Institutes from Ukraine (10 January 2025)

Participation in FCC through **MoU and Addenda**

STEP 01

Memorandum of Understanding

Identify institution

Download MoU below

Supply signatory name and function in MoU

Print twice and have MoU signed by legal representative

Mail 2 signed copies to: FCC Secretariat, CERN, ATS-DO, L00100, 1211 Geneva 23, Switzerland

MoU

STEP 02

Addendum

Identify area of work

Identify project contacts: one person at CERN and one person at participating institute

Download Addendum template

Elaborate Addendum

Provide Addendum for review and finalization to FCC Office

Addendum

STEP 03

Register Members

Register using FCC Collaboration member webform

Register

Current procedure at least until post FCC Feasibility Study structures are put in place.

International Forum of National Contacts (IFNC)

With an emphasis on **Physics, Experiments and Detectors (PED),** the IFNC engages with countries with **mature communities,** a **long-standing participation** in CERN's programmes and the **potential to contribute substantially** to the Organization's long-term scientific objectives to facilitate opportunities for national participation in the Feasibility Study and enlarge the HEP community of FCC.

- **Contact physics groups in a country,** typically from LHC or Future Colliders groups, requesting **to join as new institution.**
  - Discuss the physics case and the opportunities:
    - To study **R&D / Detector concepts** for FCC.
    - To expand the FCC Physics scope via the study of **physics case studies.**
    - To improve the **theoretical calculations** to exploit the FCC physics potential.
  - Help **form a national FCC group in each country**, with strong PED component, which can hold its national FCC meetings, including with the accelerator community (when possible).
  - Identify one or two **National Contacts** to exchange information between country and the FCC Management, across countries via IFNC meetings, and to strengthen/structure the national community.
  - Orient the new efforts towards the different FCC working groups.
  - Enlarge the list of **participating institutes and institute contacts (IFIC)** inside each country to create a sufficiently large community to ensure support and resources **for four experiments.**

Convened by Gregorio Bernardi and Tadeusz Lesziak (also National Contacts of France and Poland)

IFNC FCC PED Kick-off Meetings (*c.f.* FGC FCC Engagement Meetings)

Overview

- **Forums with interested countries** to discuss collaboration with FCC on PED topics:
  - Introduction to FCC Feasibility Study.
  - Detailed presentations of FCC physics, experiments & detectors.
  - General information on accelerator and global collaboration.

Recent Kick-off Meetings

– Nordic Countries (DK, NO, SE, FI)	March 2021
– India (Bangalore)	November 2022
– Brazil (Rio de Janeiro)	March 2023
– Mexico (Mexico City)	November 2024
– Chile (Santiago)	January 2025
– Taiwan (Taipei)	May 2025
– + informal meetings	

On-going discussions

- With not yet deeply involved European countries.
- Argentina and Canada (Japan and China have a special status).

Several other initiatives. Examples:

- 2nd Joint **FCC France-Italy Workshop** in Venice in November 2024 **Joint FCC-France & Italy Workshop in Venice**
- 3rd annual **US-FCC Workshop at FNAL/Argonne** April 2025 link (48 institutes participated)
- **German meeting** on Future Colliders@CERN In May 2024 (150 participants, >10 institutes participating in FCC)

FCC Experiment Collaborations

- **Expressions of Interest (EoIs) for subdetectors and detector concepts submitted to ESPPU (March 2025)**
- **Set up process after ESPPU in 2028-2029 for proto-collaboration formation**

The FCC Feasibility Study review committee recommends to work with the scientific community, institutes, laboratories and funding agencies to ensure support and resources for **four experiments**, facilitating the exploitation of the full scientific potential offered by the large investment in the FCC-ee facility:

- **Complete list of tasks** of the institutes in the **IFNC**.
- Iterate with National Contacts to gather latest information of possible **funding of the HEP teams**.
- Explore how the **countries/institutes position themselves** on the current and future potential **detector concepts**.

A **possible strategy** for building FCC experiment collaborations for the next five years **(for discussion)**:

- **Start from EoI** for sub-detector and detector concepts in 2025.

- Assuming positive recommendation to push forward by around 2028 by the CERN Council:
  - Start setting up **FCC Committee** (FCCC) and **proto-collaborations**, probably around proposed proto-detector concepts following call for Conceptual Design Reports (CDRs).
  - Benefit from the formation of the **Detector R&D** (**DRD) collaborations**.
  - Find a scheme to **reduce the number of proto-collaborations** (e.g. merging) if more than 4 proposals.
  - Process could **converge by 2030-2031**.

Concluding Remarks
Strengthening the FCC Collaboration

Starting from the support of the **CERN Host States**, build the support of the **Member States, Associate Member States and non-Member States (including the Observer States)**.

- The successful realisation of the **LHC (and HL-LHC)** is testament to the **strong and consistent support** CERN received from its **Member States and Associate Member States**.
- CERN Council required significant support from **Non-Member States, including the Observer States**, before giving final approval to the LHC.
- **High-level events** similar to that with the US and Canada should be organized with strong statements of intent.

Set up **governance structure** that will encourage participation / contribution / commitment to the FCC.

- FCC requires **long-term engagement and support of participants** from CERN's Member, Associate Member & Non-Member States. As the project evolves further, it is crucial to refine and adapt the collaboration model to ensure the efficient allocation of resources and sustained momentum.

Continue building interest in the FCC by engaging with communities world-wide through the **FCC Global Collaboration (FGC) Working Group** and the **International Forum of National Contacts** (IFNC).

Implement measures as proposed in the FCC-IS deliverable "**FCC Communication Plan**". https://zenodo.org/records/10567956

Thank you