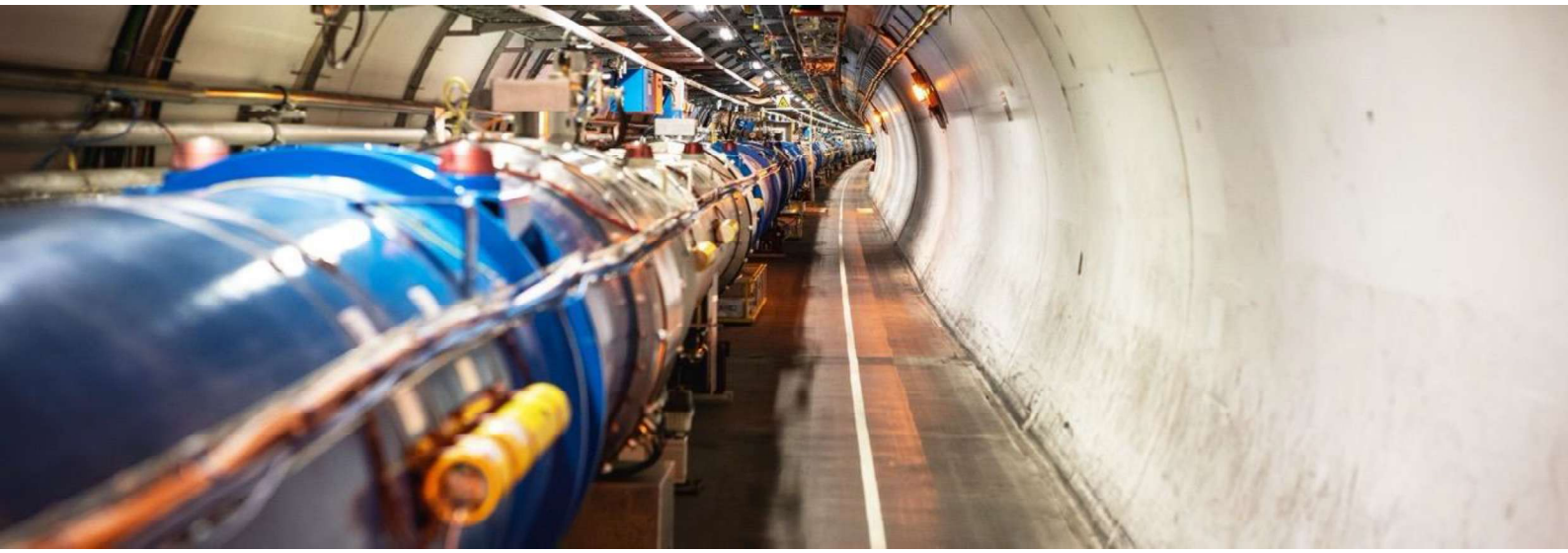
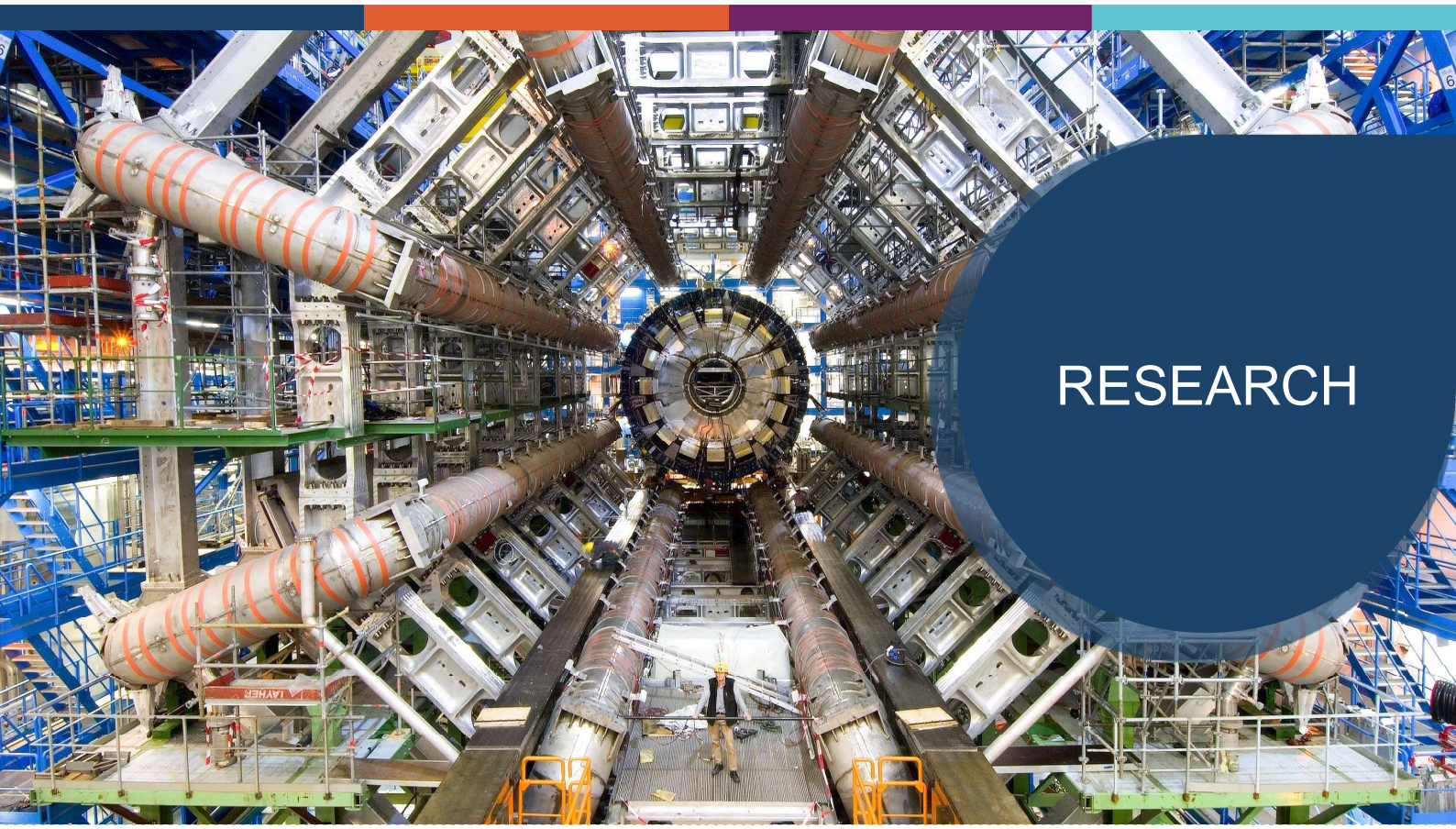


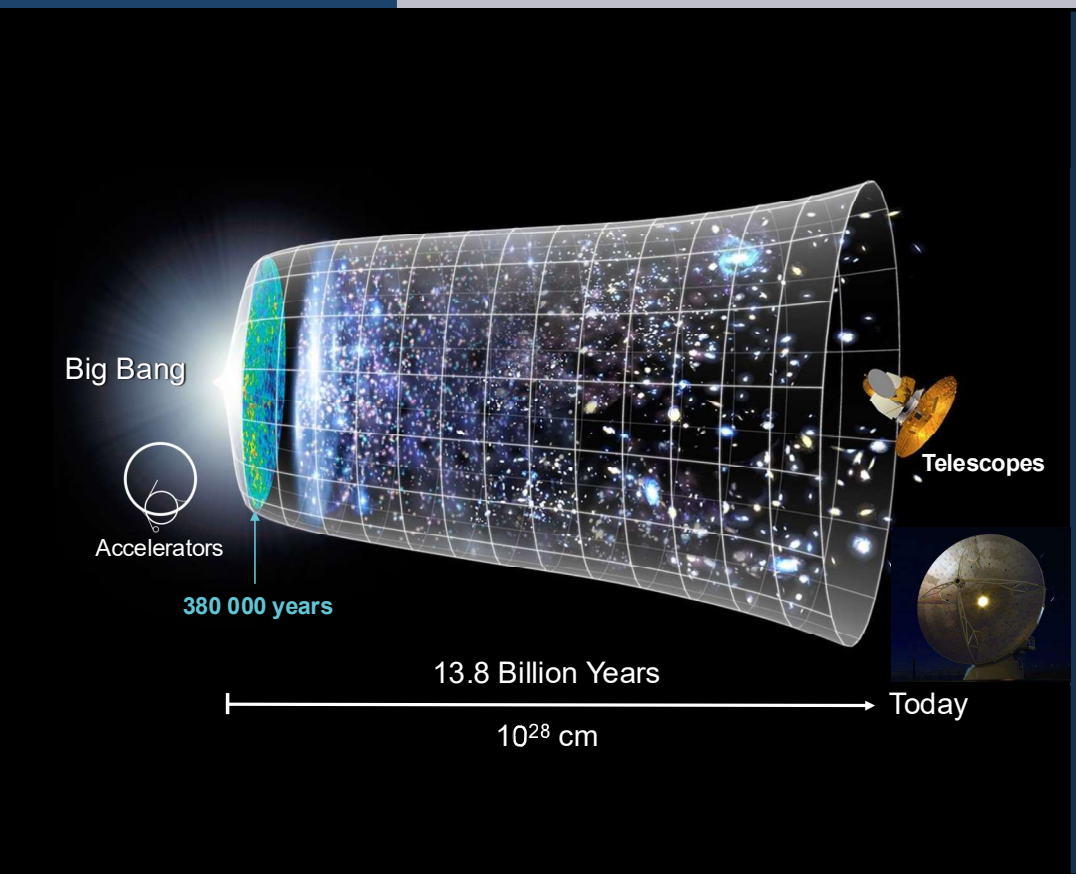
Latin-American Scientific Cooperation at CERN

CLAF-MCTI High-Level Seminar
Perspectives for Scientific Cooperation in Physics in Latin America
Brasilia, December 5th, 2025
Salvatore Mele, CERN


RESEARCH
CAPACITY BUILDING
COLLABORATION
OUTLOOK FOR SCIENTIFIC COOPERATION



RESEARCH

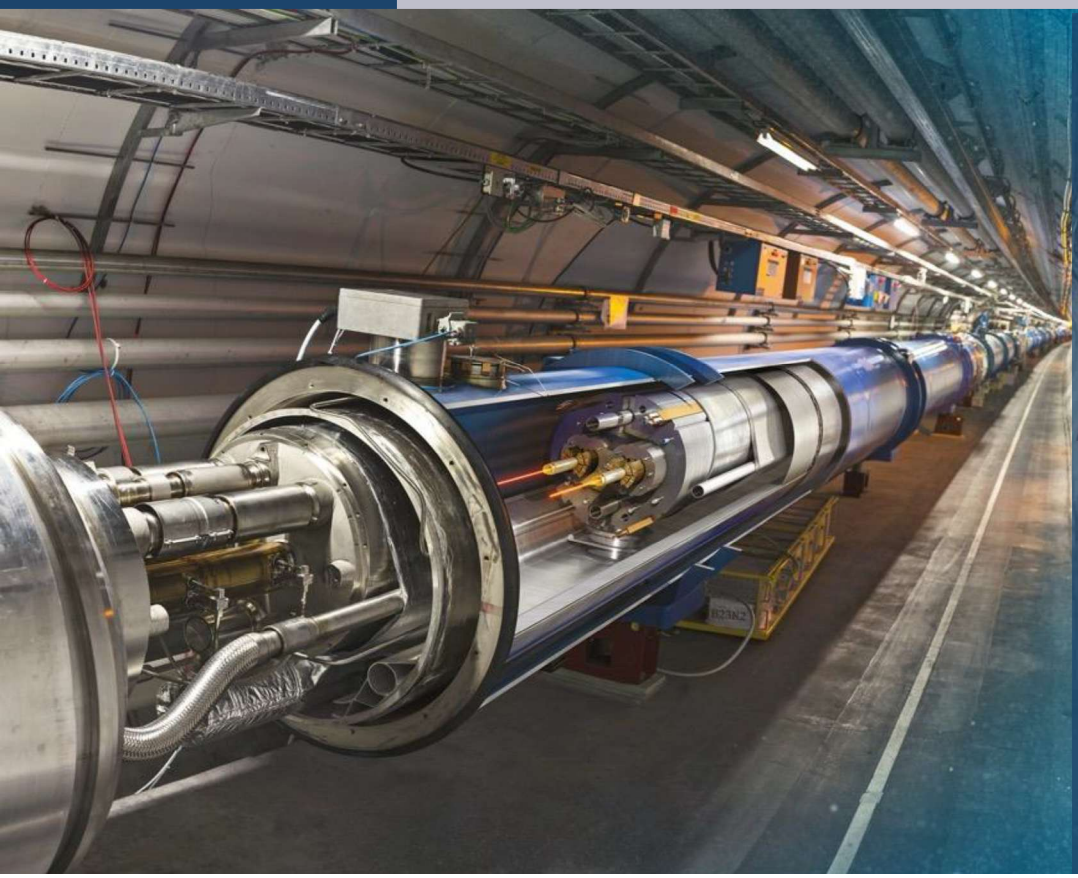


What is the Universe made of?

How do the forces that keep it together work?

Matter and antimatter originated together: where did all antimatter go?

We reproduce 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)

- Largest scientific instrument ever built (1998-2008) running since 2009
- 27 km circumference, -271.3ºC, colder than outer space
- About 100 m underground
- Superconducting Niobium-Titanium magnets steer the particles around the ring
- Particles are accelerated to 99.999999% of speed of light
- Upgrade to the High-Luminosity LHC is under way: 10x collision rate. Access to rare phenomena, greater precision, discovery potential (2030-2041)

CERN's technological innovations have applications in many fields

CERN is the birthplace of the World Wide Web

And there are many more examples
Medical imaging, cancer therapy, material science, cultural heritage, aerospace, automotive, environment, health & safety, industrial processes.

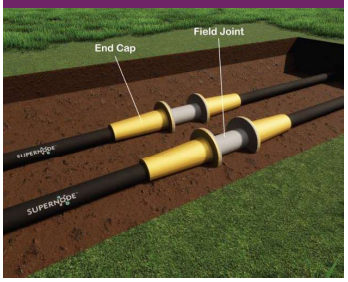
CERN Technologies: from fundamental research to everyday life. kt.cern

Accelerator technologies for cancer treatment with protons, ions and electrons.

Machine learning software for collision avoidance in autonomous driving.

Pixel detector technologies for high resolution 3D colour X-ray imaging.

Vacuum technologies for insulation of superconducting power cables



Anomaly detection AI algorithms for improved clinical management of stroke patients

Cryogenic technology for liquid hydrogen shipping

https://cds.cern.ch/record/2861714/files/CERN-Brochure-2023-004-Eng.pdf


COLLABORATION

Science for peace

CERN was founded in 1954 with 12 European Member States

(Belgium, Denmark, France, the Federal Republic of Germany, Greece, Italy, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and Yugoslavia)

25 Member States

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

10 Associate Member States

Brazil – Croatia – Cyprus – India – Ireland – Latvia – Lithuania – Pakistan – Türkiye – Ukraine

Chile signed AMS agreement in May '25
pending parliamentary ratification

4 Observers

Japan – United States of America
European Union – UNESCO

More than 50 Cooperation Agreements with non-Member States and Territories

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bangladesh – Bolivia
Bosnia and Herzegovina – Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia – Guatemala
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 – Uruguay - Vietnam

CERN's annual budget: ~1200 MCHF
(~ medium-sized European university),
fairly shared by Members and Associates
(90% discount) according to their economies.
Procurement and personnel opportunities

Employees (~56% of budget) Dec. '24:
2'704 staff (21% ♀), **1'181** fellows/graduates
Associates Sep. '24:
12'726 users, **1'513** other contributors

CERN Founding Convention (1953): The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character [and] 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. [It shall] organiz[e] and sponsor of international co-operation in nuclear research, including co-operation outside the Laboratories; this co-operation may include in particular […] the promotion of contacts between, and the interchange of, scientists, the dissemination of information, and the provision of advanced training for research workers

A laboratory for people around the world

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

Member States (7704)

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 – **Slovenia** 29 – **Spain** 448 – **Sweden** 103 – **Switzerland** 409
United Kingdom 1029

Associate Member States (613)

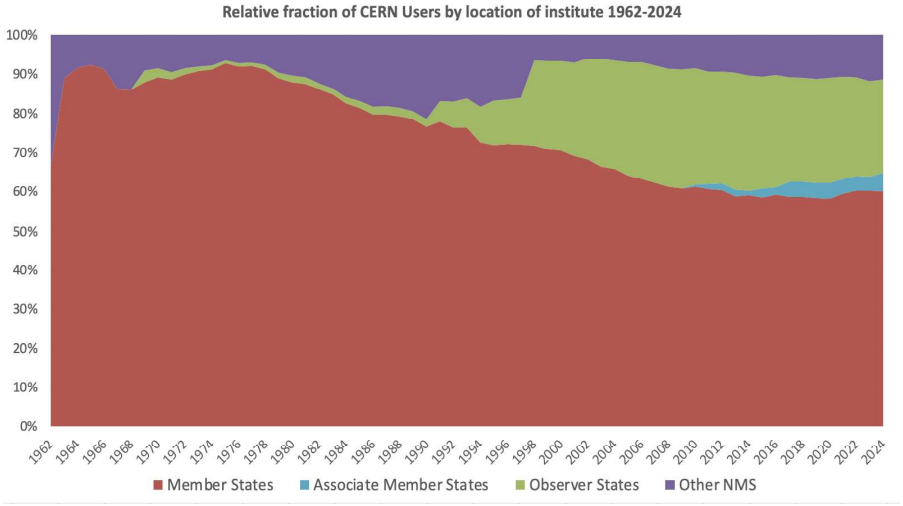
Brazil 141 – **Croatia** 35 – **Cyprus** 12 – **India** 158 – **Ireland** 11 – **Latvia** 22
Lithuania 21 – **Pakistan** 35 – **Türkiye** 151 – **Ukraine** 27

Observers (2330)

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

Cooperation Agreements (1759)

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 — **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

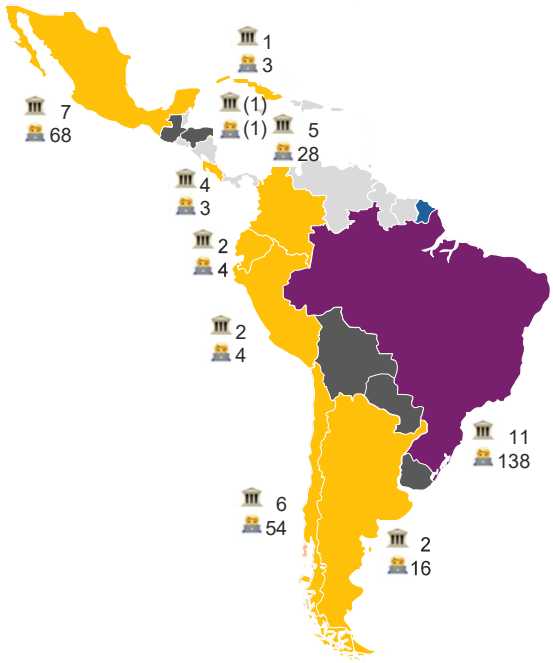


Geographical & cultural diversity
Users of **110 nationalities**
(30% affiliated abroad)
23.7% women

Over 900 research teams from 77 countries cooperate to build and operate detectors

'Users' are researchers & technologists visiting CERN for >5% of their working time in 5-year window. Local communities ~3-5 times larger (e.g. students/engineers participating remotely).

Latin America at CERN: institutional participation



'Users' are Researchers & technologists visiting CERN for >5% of their working time over a 5-year window. Local communities are in reality ~3-5 times larger (e.g. graduate students, engineers participating remotely)

Brazil became a CERN Associate Member State in March 2024. Chile's Association agreement signed in May 2025, under ratification.

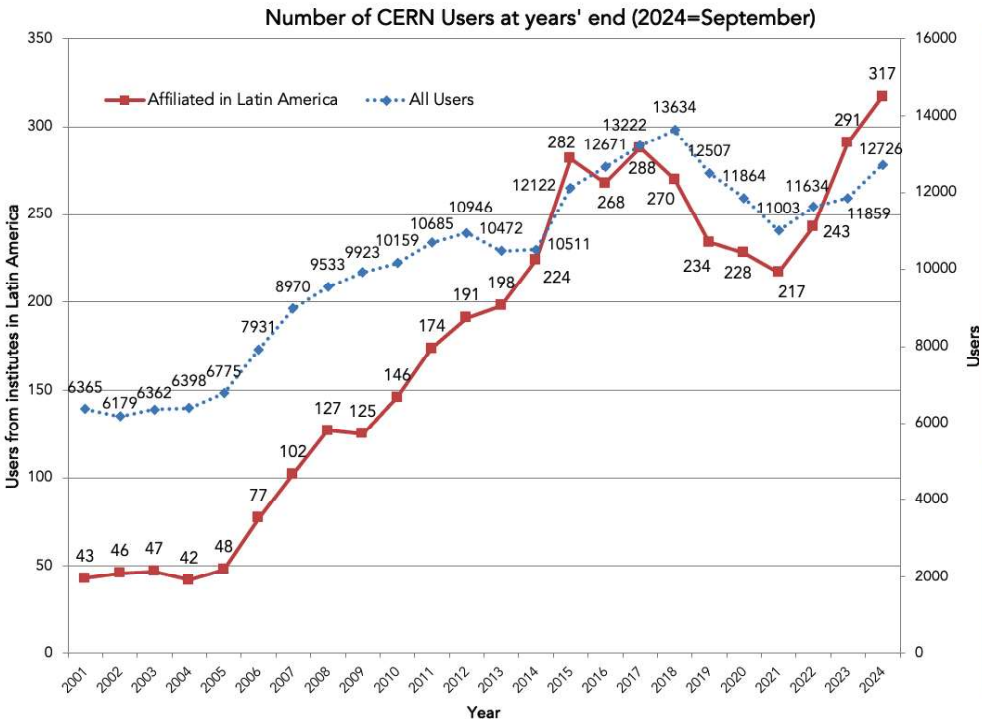
Since the 90's, CERN signed International Cooperation Agreements with 12 LA countries (including Brazil) and currently in force with: Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Honduras, Guatemala, Mexico, Paraguay, Peru, Uruguay.

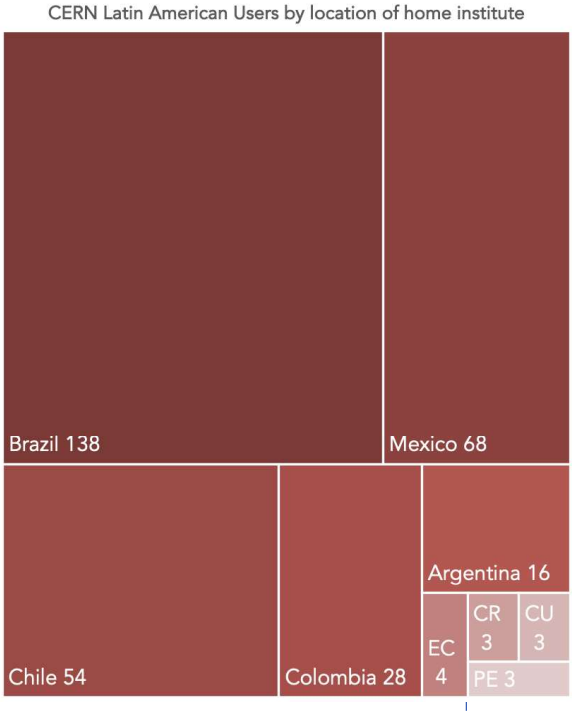
Over 300 'users' from 46 institutes in 11 Latin American countries participate in the CERN experimental programme (2.5% of total): Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Mexico, Peru. Opportunities for Guatemala and Uruguay.

Not including institutes participating in technical or R&D programmes
Argentina: *Universidad de Buenos Aires, Universidad Nacional de la Plata.*
Brazil: *Centro Brasileiro de Pesquisas Físicas, Universidade Federal do Rio de Janeiro, Universidade do Estado do Rio de Janeiro, Universidade Estadual de São Paulo, Universidade Estadual de Campinas, Universidade de São Paulo, Pontifícia Universidade Católica do Rio de Janeiro, Universidade Federal da Bahia, Universidade Federal do ABC, Universidade Federal de Juiz de Fora, Universidade Federal do Rio Grande do Sul*
Chile: Instituto Milenio SAPHIR, *Universidad Técnica Federico Santa María, Pontificia Universidad Católica de Chile, Universidad Andrés Bello, Universidad de La Serena, Universidad de Tarapacá, Comisión Chilena de Energía Nuclear, Universidad San Sebastian*
Colombia *Universidad de Antioquia, Universidad Nacional, Universidad Antonio Nariño, Universidad de los Andes, Universidad del Valle, Pontificia Universidad Javeriana*
Costa Rica: *Universidad de Costa Rica, Instituto Tecnológico de Costa Rica, Universidad Nacional, Universidad Estatal a Distancia, Universidad Técnica Nacional*
Cuba: *Centro de Aplicaciones Tecnológicas y Desarrollo Nuclear*
Ecuador: *Universidad San Francisco de Quito, Escuela Politécnica Nacional*
Honduras: *Unicersidad Nacioanal Autónoma de Honduras*
Mexico: *Benemérita Universidad Autónoma de Puebla, Centro de Investigación y de Estudios Avanzados, Universidad Nacional Autónoma, Universidad Iberoamericana, Universidad Autónoma de San Luis Potosí, Universidad Autónoma de Sinaloa, Universidad de Sonora*
Peru: *Pontificia Universidad Católica de Perú, University of Engineering and Technology*

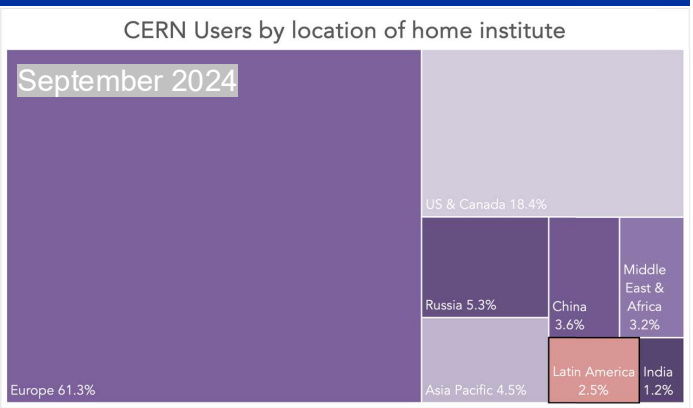
CERN Users (from Latin American institutes)

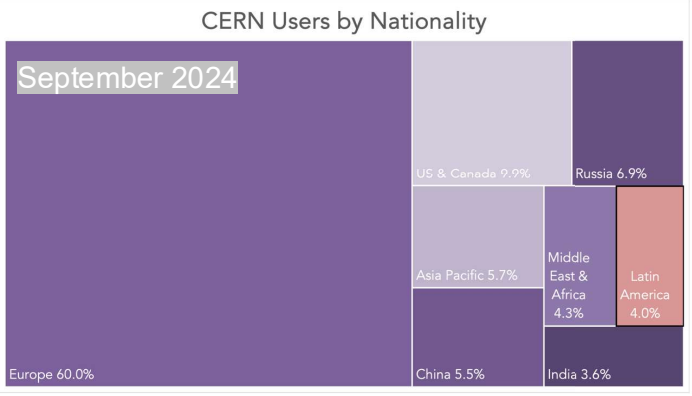
Students, Researchers & Technologists visiting for >5% of their working time over a 5-year window.
Local communities (Especially in Latin America) ~3-5 times larger: (under-)graduate students, engineers participating remotely/locally

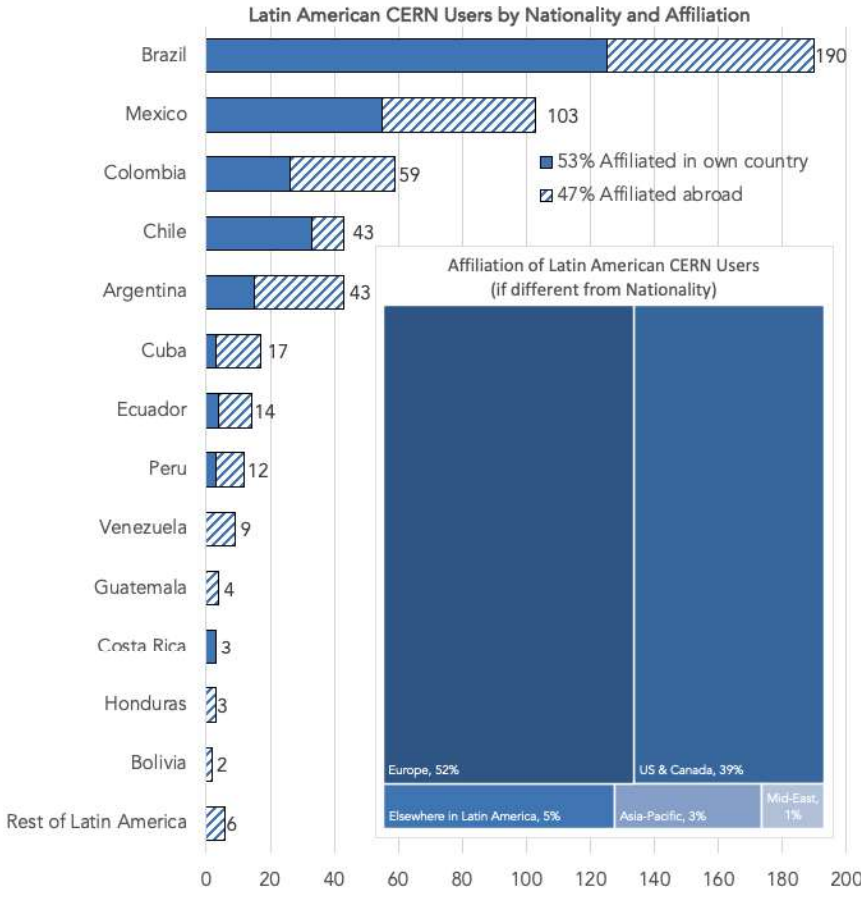




30% of 12'726 CERN Users are affiliated in a country other than their nationality.
47% of Latin American nationals are affiliated in a country other than their nationality
11% of Users in Latin American institutes are not Latin American nationals.








CAPACITY
BUILDING

CERN Non-Member State Summer Student Programme (running for >30 years)
8 weeks residential program for STEM undergraduates: lecture and sci/tech project
~1500 applications/year, ~130 internships/year, ~40% females
Externally funded (institutional/charity donors, specific partnerships): 7kCHF/student

Co-operation agreements and arrangements: Capacity building in the CERN Summer Student programme

Centro Latino Americano de Física

iila

MILLENNIUM INSTITUTE FOR SUBATOMIC PHYSICS AT HIGH-ENERGY FRONTIER SAPHIR

nic Costa Rica

”A PhD packed in two weeks” for ~80 students 2/3 from Latin America. Every other year, since 2001.

Proud to count the region’s scientific leaders in the field among our alumni

OUTLOOK FOR SCIENTIFIC COOPERATION

Scientific priorities for the future: High-Luminosity LHC (->2041) and beyond

Brazilian, Chilean, Costa Rican, Mexican teams designing the LHCb and ALICE detector upgrades: opportunity for regional cooperation, larger impact, and onboarding of new (applied science) communities

Beyond HL-LHC: Global community scientific prioritization effort under way, w/Latin American input
A strategy for CERN's next flagship project in early 2026 to be endorsed by CERN's Member States

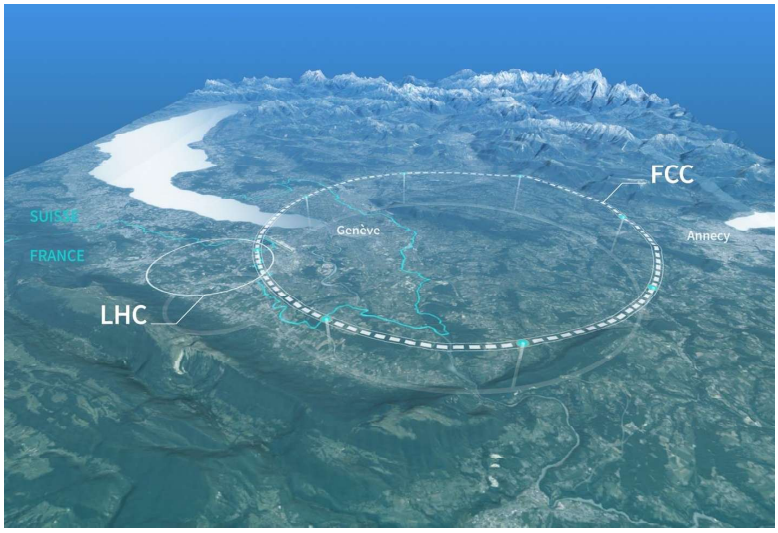
FCC: Future Circular Collider: ~90 km ring

Staged long-term programme
- One tunnel, two sequential colliders, shared infrastructure, as in 1985-2041 LEP-LHC

Technologically very ambitious:
- long-term innovation driver, global partners

Cost: ~11 BCHF for first stage, ~17BCHF second
- (LHC: ~5 BCHF in existing tunnel)

Tentative timescale:
- feasibility study: completed in **2025**
- community prioritization**: 2025**
- project approval **~2028**,
- construction **~2035-2045**
- first-stage operation **2045-2060**
- second-stage operation through **2090s**



Some personal concluding observations

- **Momentum for Latin America at CERN**
  Wider, larger, new, communities
  Enhances capacity-/community-building programs

- **Strong growth of Latin American institutional engagement:**
  Associate Membership, International Cooperation Agreements
  Increased intra-regional cooperation to onboard teams in new projects

- **One-in-a-generation opportunities ahead:**
  High-Luminosity LHC detector upgrades, physics programme
  Technology, physics opportunity for FCC R&D

Opportunity for regional cooperation on CERN's scientific programme
Regional cohesion can give Latin America a leading scientific role