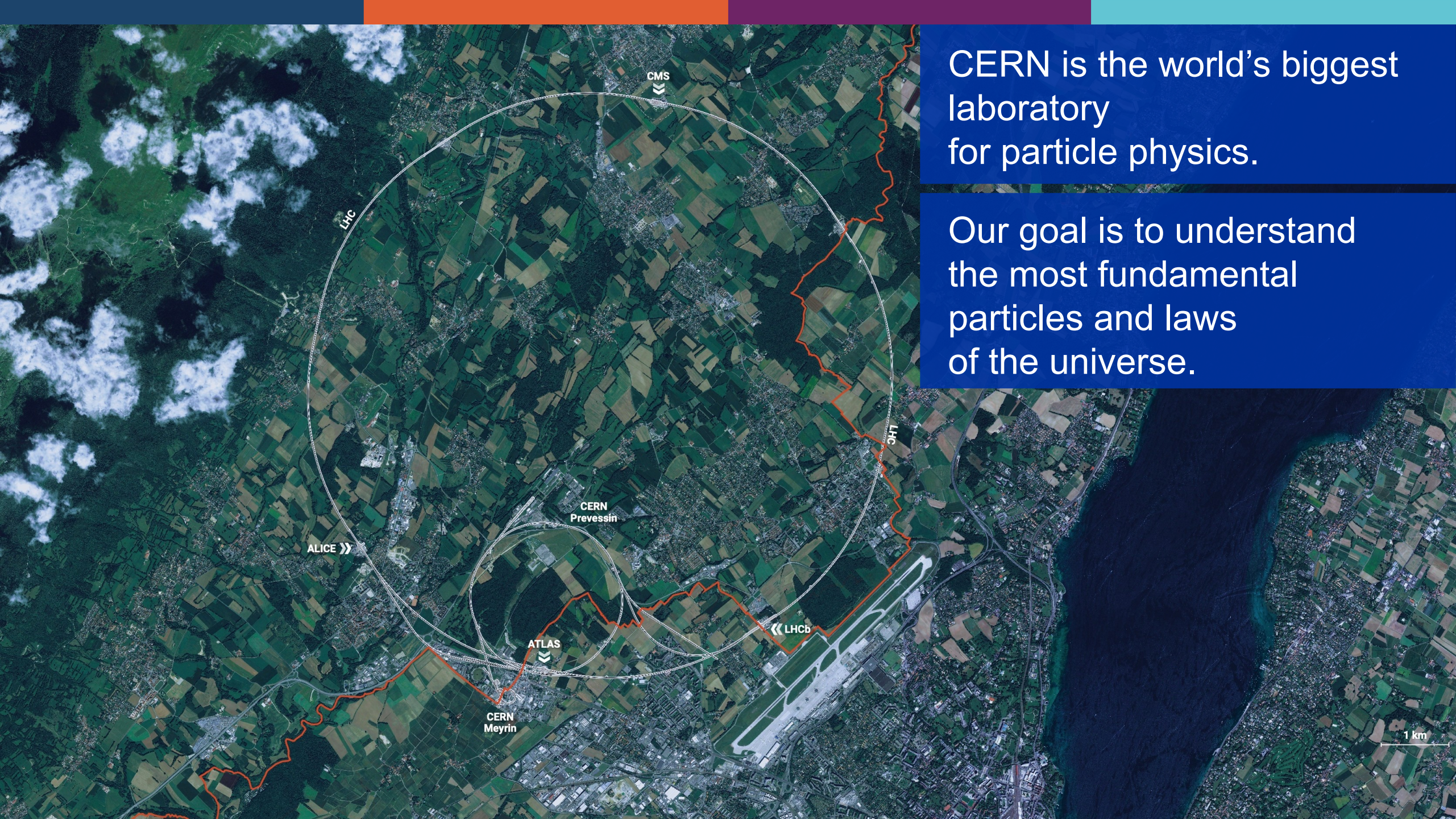




WELCOME TO CERN

Toshiba

24th January 2025

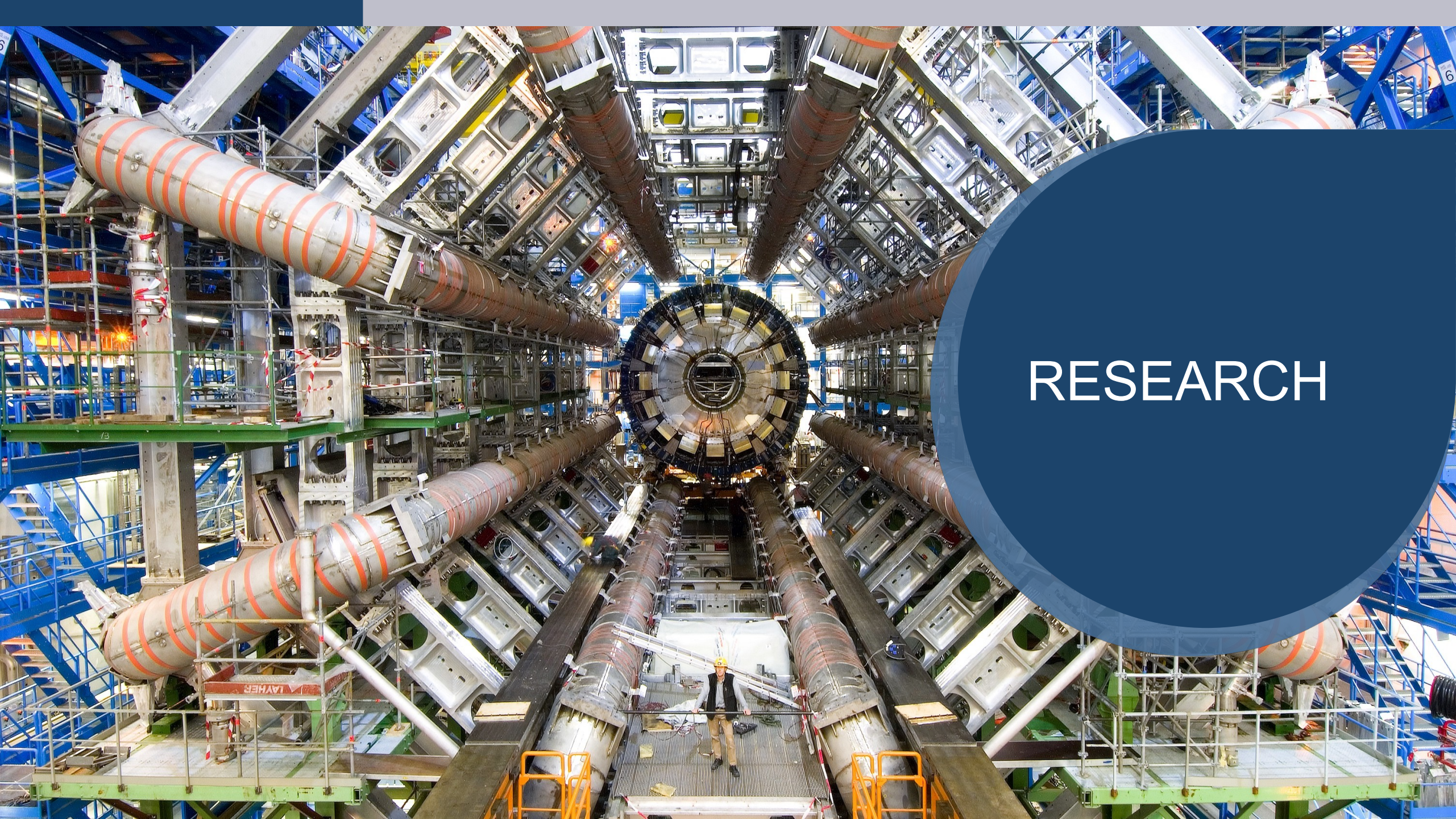


CERN is the world's biggest laboratory for particle physics.

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

Four pillars underpin CERN's mission

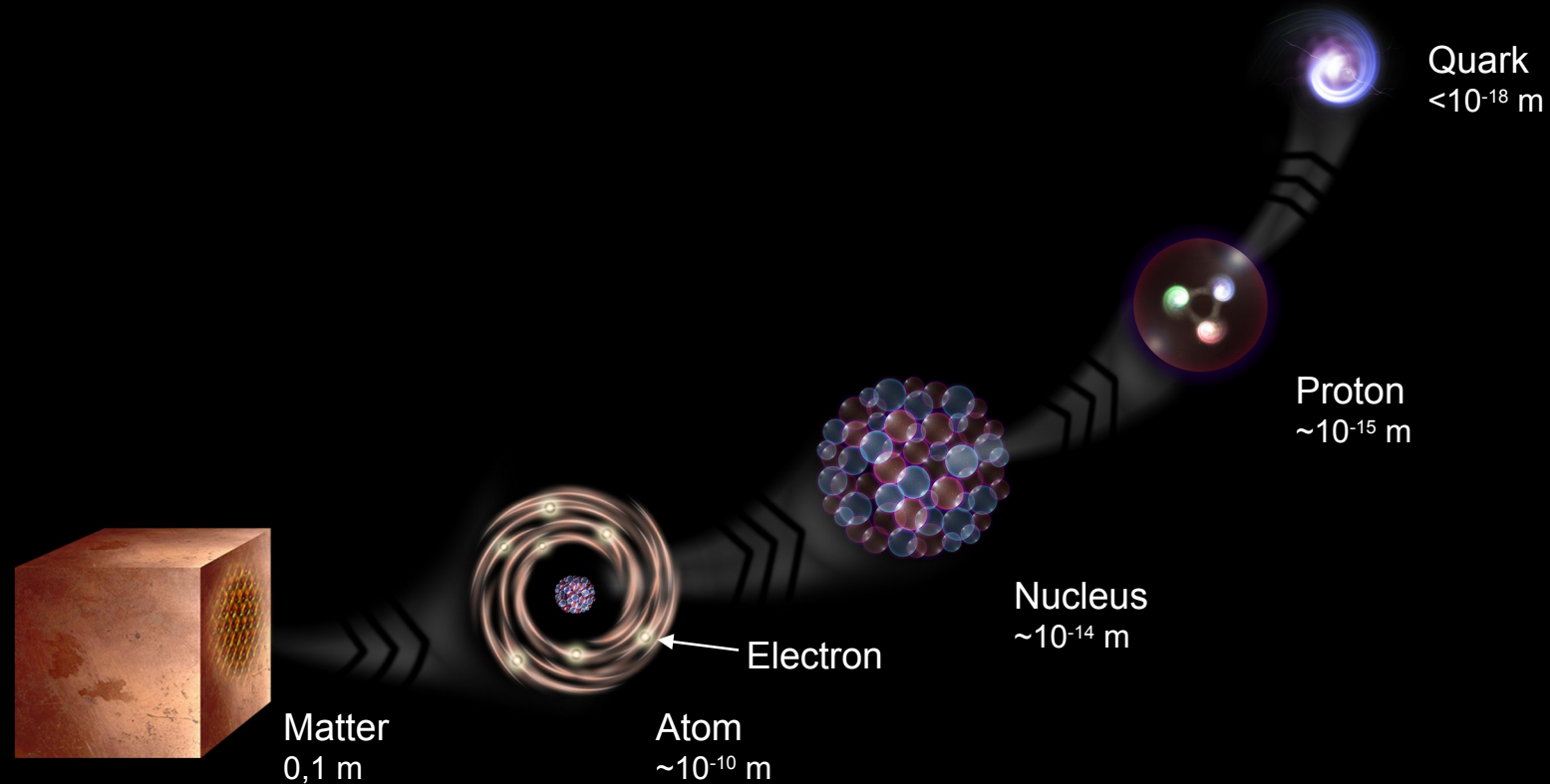


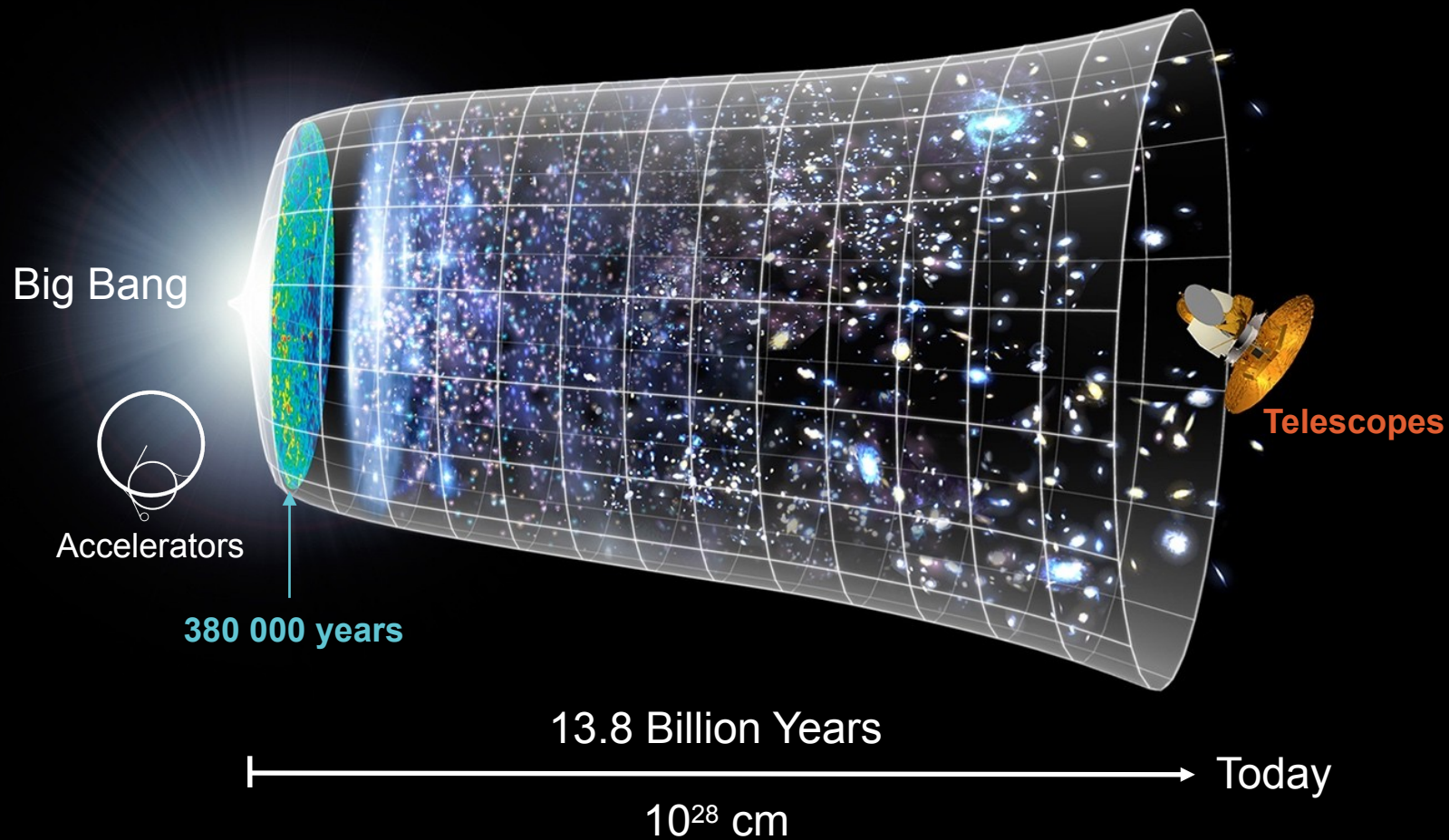


RESEARCH

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.

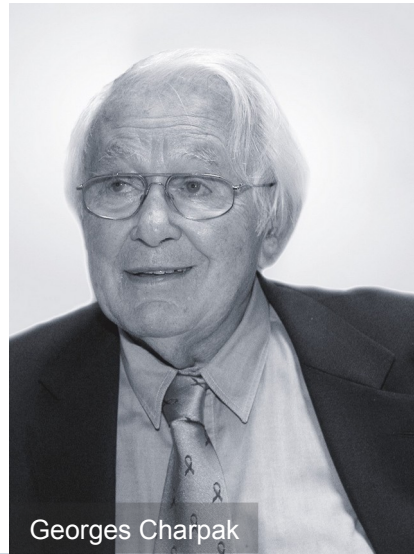
At CERN we help to answer these questions



Carlo Rubbia



Simon Van der Meer



Georges Charpak

Several CERN scientists have received Nobel Prizes for key discoveries in particle physics.

The Higgs boson was discovered in 2012; without it fundamental particles would be massless and atoms could not form.

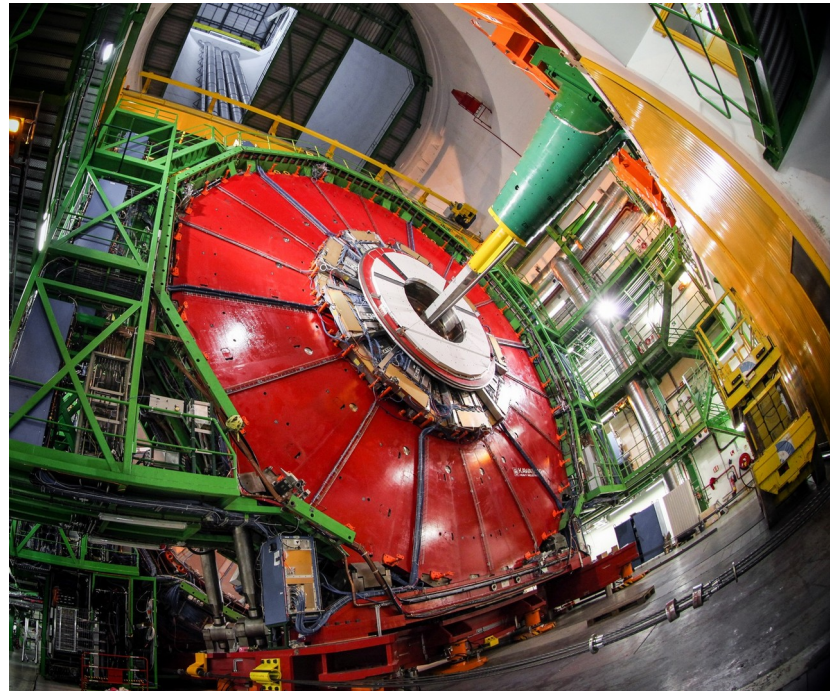


François Englert and Peter Higgs. With Robert Brout, they proposed the mechanism in 1964.

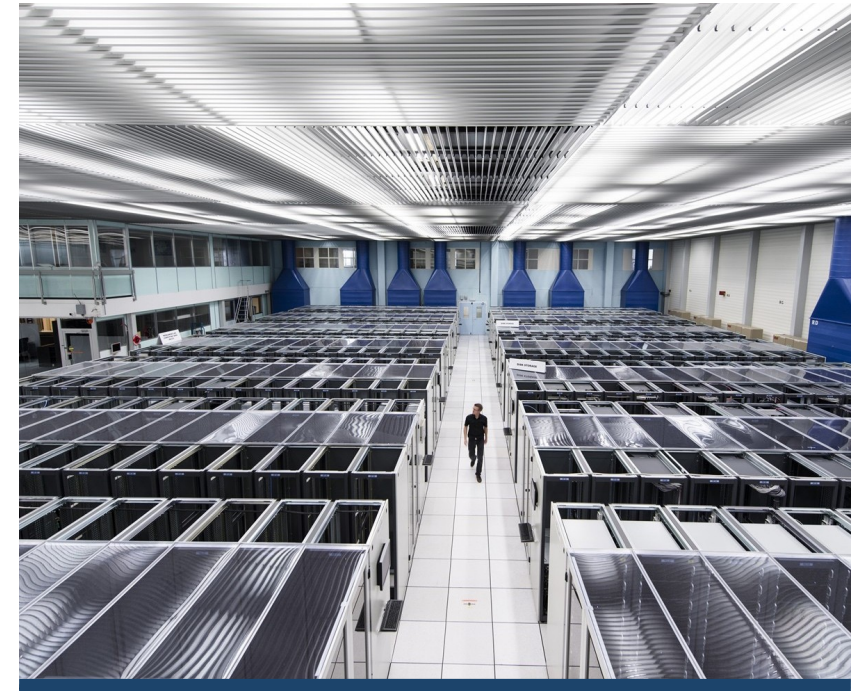
We develop technologies in three key areas



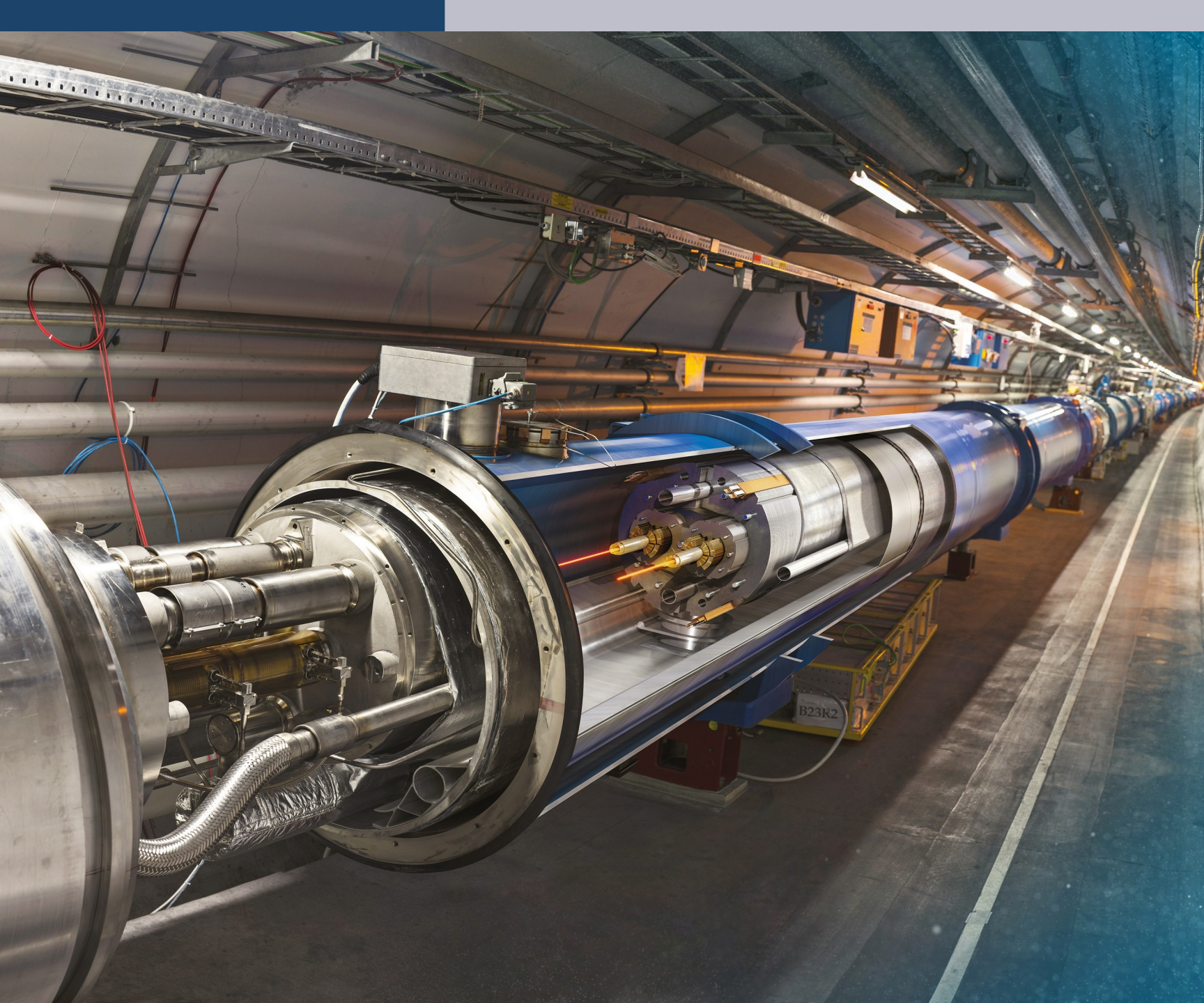
ACCELERATORS



DETECTORS



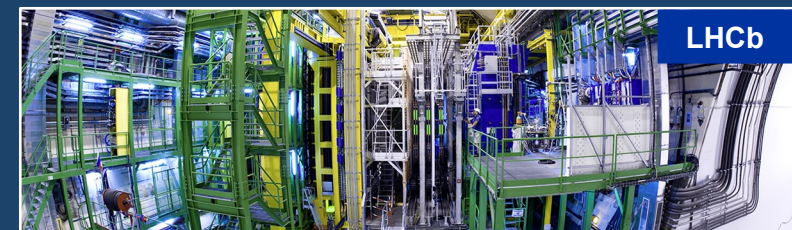
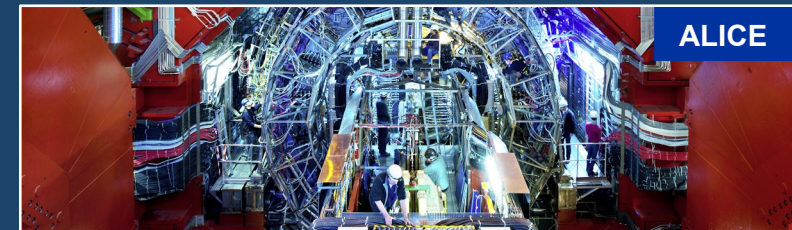
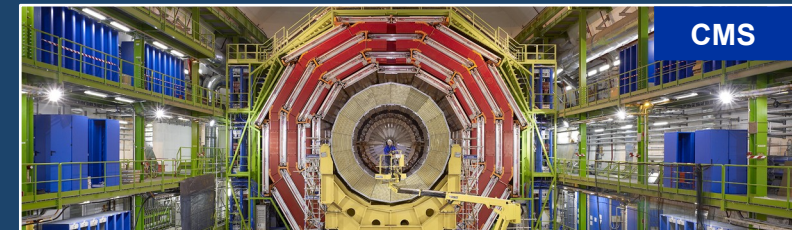
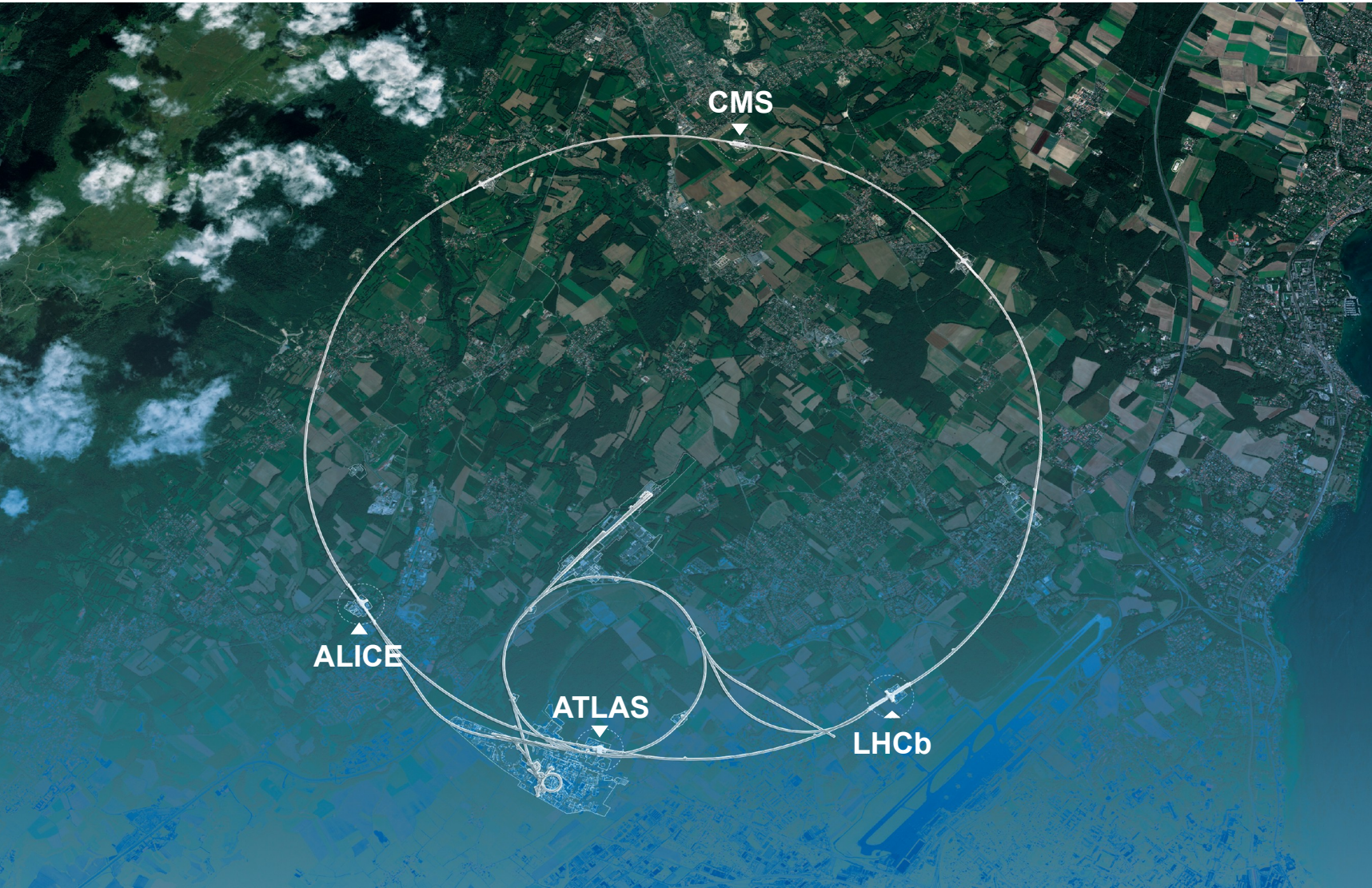
COMPUTING



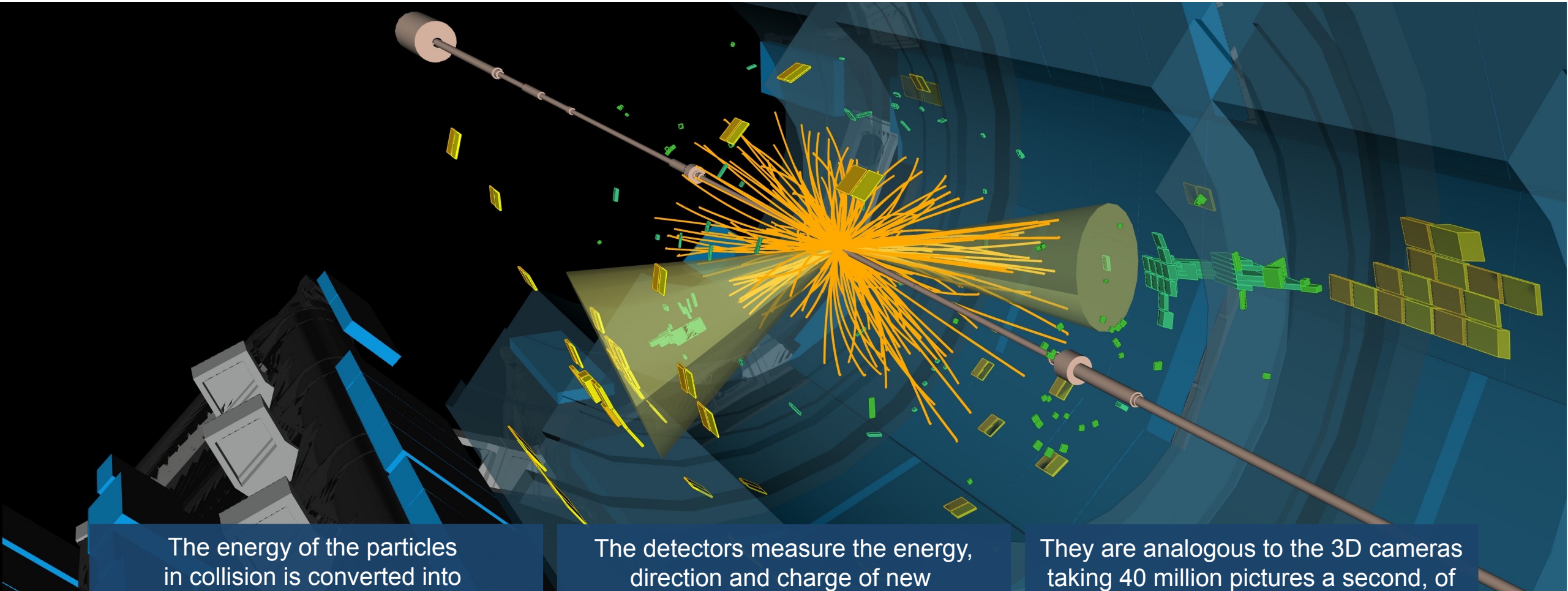
Large Hadron Collider (LHC)

- 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 formed at the four collision points



The LHC produces more than 1 billion particle collisions per second



The energy of the particles in collision is converted into new particles.

The detectors measure the energy, direction and charge of new particles formed.

They are analogous to the 3D cameras taking 40 million pictures a second, of which 1000 are selected and recorded.

The Worldwide LHC Computing Grid (WLCG)



WLCG

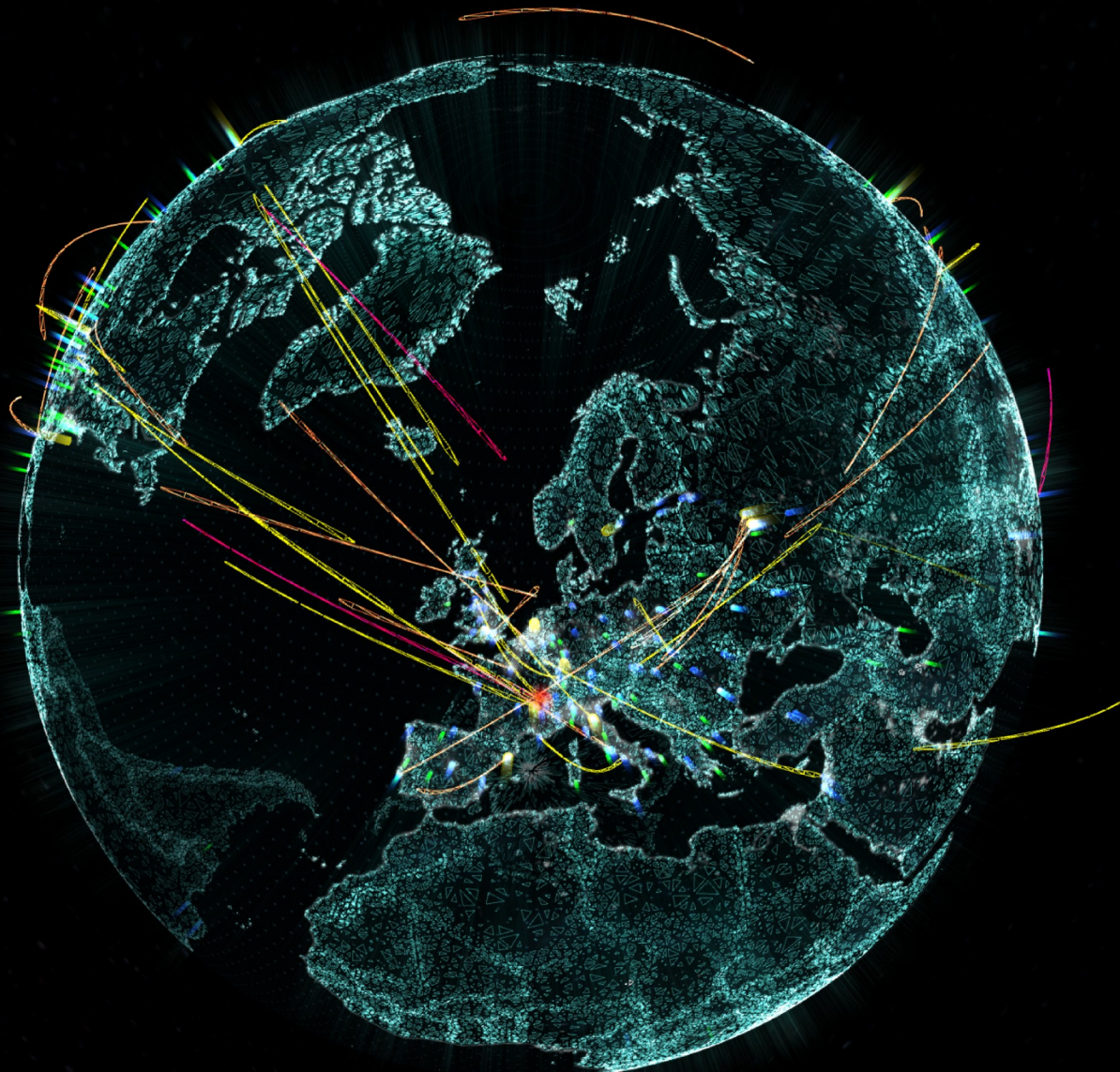
- Stores, distributes, processes and analyses LHC experiments' data.
- 1.4 million processing cores in 170 data centres and more than 40 countries.
- 1500 Petabytes of CERN data stored world-wide.

EXPERIMENTS SELECTION

- ALICE
- CMS
- ATLAS
- LHCb

TIERS SELECTION

- TIER 0
- TIER 1
- TIER 2
- TIER 3

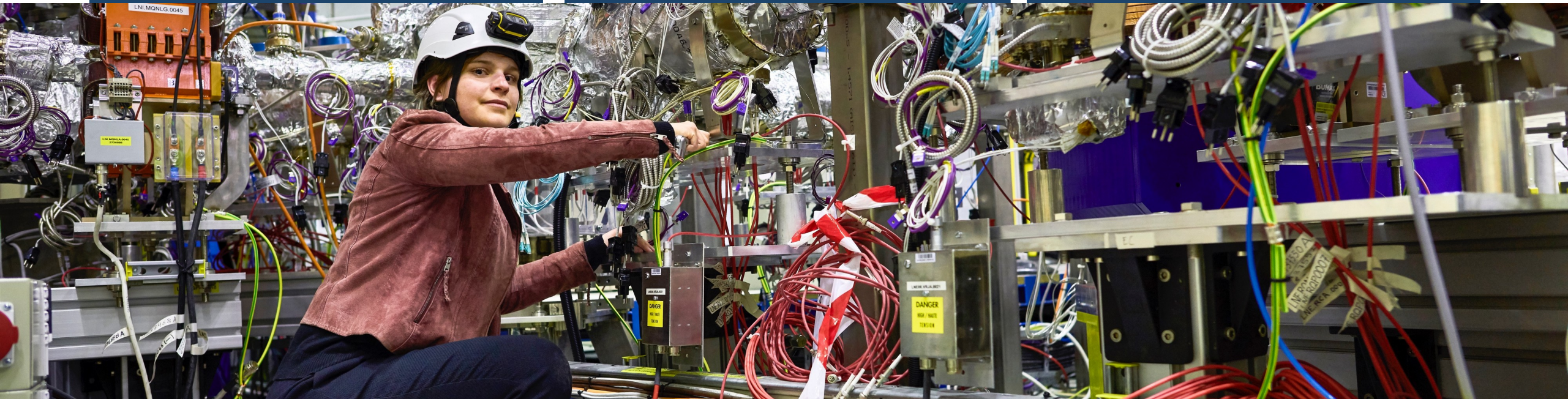


CERN has a diverse scientific programme

Nuclear Physics
(ISOLDE, n_TOF)

Antimatter Research
(Antiproton Decelerator)

Cosmic rays and cloud formation
(CLOUD)



Fixed-target experiments,
which include searches for rare phenomena

Contribution to the Long Baseline
Neutrino Facility in the USA (LBNF)

There are many unanswered questions in fundamental physics

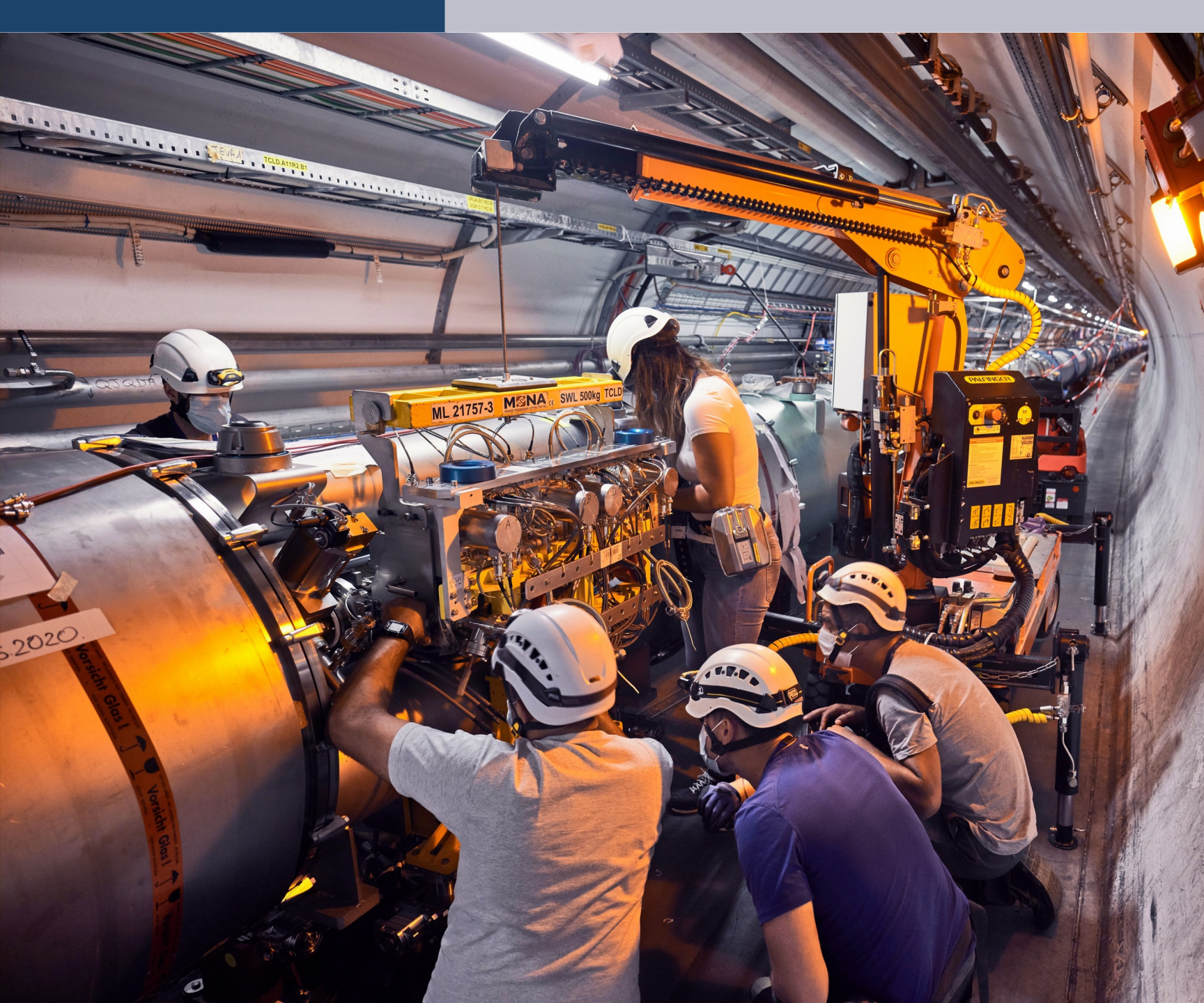
Including

What is the unknown
95% of the mass
and energy
of the universe?

Is there only one Higgs
boson, and does it
behave exactly as
expected?

Why is the universe
made only of matter,
with hardly any
antimatter?

Why is gravity so weak
compared to the other
forces?



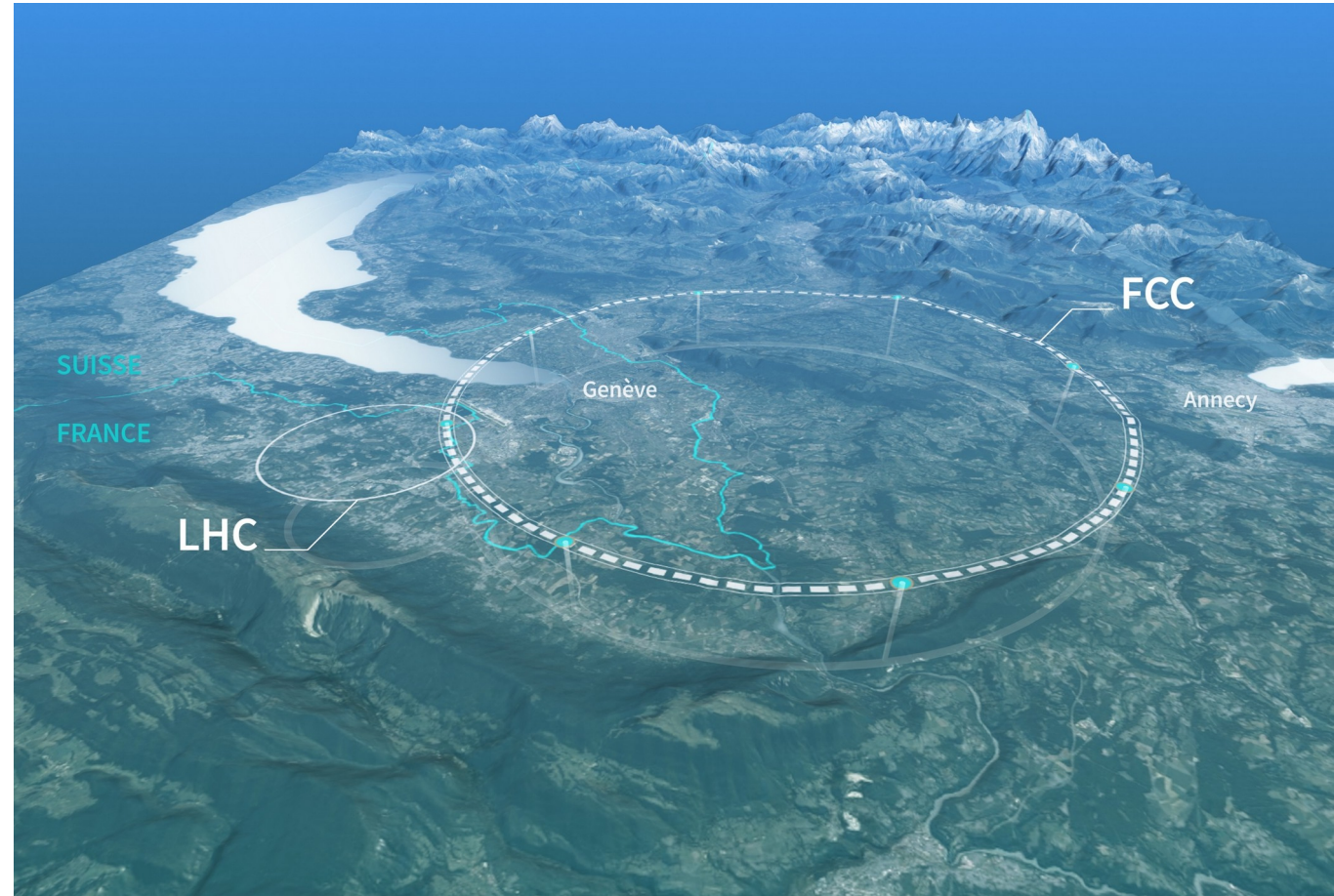
Upgrade to the High-Luminosity LHC is under way

- 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 2041.

Preparing CERN's future

Driven by the 2020 Update of the European Strategy for Particle Physics

- Technical and financial feasibility study of a Future Circular Collider (Spring 2025)
- Accelerator R&D to develop technologies for FCC and for alternative options
- Detector and computing R&D
- Maintain and expand a compelling scientific diversity programme
- Continue to support other projects around the world



Committed to environmentally responsible and sustainable research



COLLABORATION



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

8 Associate Member States

Brazil – 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 – 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 2023
Employees:
2666 staff, **1002** graduates
Associates:
12 370 users, **1513** others

A laboratory for people around the world

Distribution of all CERN Users by the country of their home institutes as of 31 December 2023



Geographical & cultural diversity
Users of **110 nationalities**
22.5 % women



Numbers for country

- Personnel by nationality as of 31 December 2023
 - x users
 - x staff
 - x fellows

Member States **7438**

Austria 86 – Belgium 129 – Bulgaria 46 – Czech Republic 252
Denmark 47 – Finland 88 – France 842 – Germany 1296
Greece 112 – Hungary 80 – Israel 74 – Italy 1609 – Netherlands 167
Norway 77 – Poland 322 – Portugal 105 – Romania 113
Serbia 38 – Slovakia 67 – Spain 413 – Sweden 106
Switzerland 419 – United Kingdom 950

Associate Member States in the pre-stage to membership **69**

Cyprus 14 – Estonia 29 – Slovenia 26

Associate Member States **541**

Brazil 135 – Croatia 37 – India 145 – Latvia 21 – Lithuania 17 –
Pakistan 30 Türkiye 129 – Ukraine 27

Observers **3005**

Japan 219 – Russia (suspended) 779 – United States of America
2007

Non-Member States and Territories **1317**

Algeria 2 – Argentina 16 – Armenia 16 – Australia 26 – Azerbaijan 3 – Bahrain 3 – Belarus 14 – Canada 206
Chile 45 – China 414 – Colombia 24 – Costa Rica 3 – Cuba 3 – Ecuador 4 – Egypt 24 – Georgia 34 – Hong Kong 15
Iceland 3 – Indonesia 7 – Iran 14 – Ireland 4 – Jordan 3 – Kazakhstan 3 – Kuwait 2 – Lebanon 7 – Madagascar 1
Malaysia 4 – Malta 1 – Mexico 56 – Montenegro 3 – Morocco 18 – New Zealand 2 – Nigeria 2 – Oman 1
Palestine 1 – Peru 3 – Philippines 1 – Republic of Korea 168 – Saudi Arabia 6 – South Africa 61 – Sri Lanka 10
Taiwan 52 – Thailand 17 – Tunisia 4 – United Arab Emirates 10 – Vietnam 1

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.



TECHNOLOGY & INNOVATION

CERN's technological innovations have applications in many fields

CERN is the birthplace of the World Wide Web

And there are many more examples

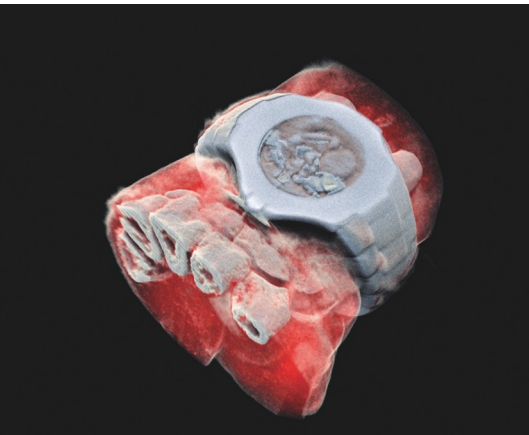
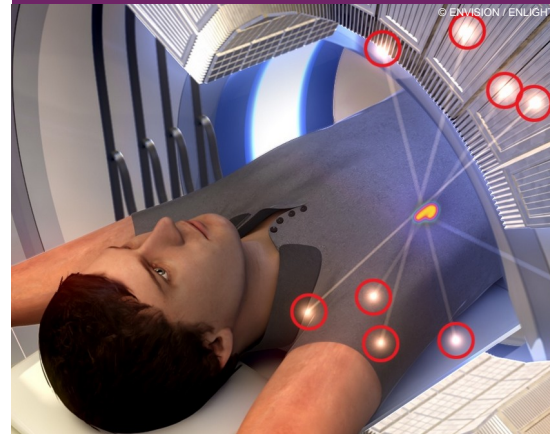
Medical imaging, cancer therapy, material science, cultural heritage, aerospace, automotive, environment, health & safety, industrial processes.

CERN's technological innovations have important applications in medicine and healthcare



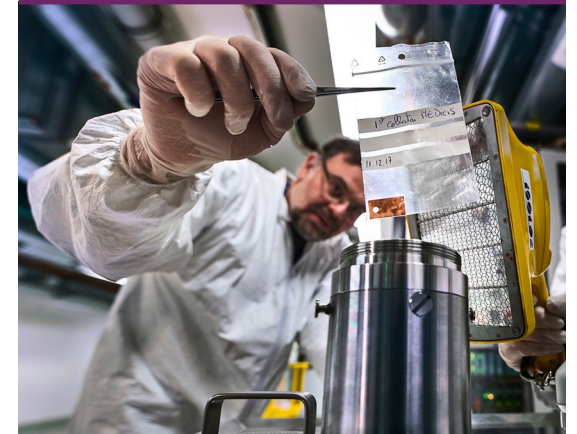
Technologies applied at CERN are also used in PET, for medical imaging and diagnostics.

Accelerator technologies are applied in cancer radiotherapy with protons, ions and electrons.



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

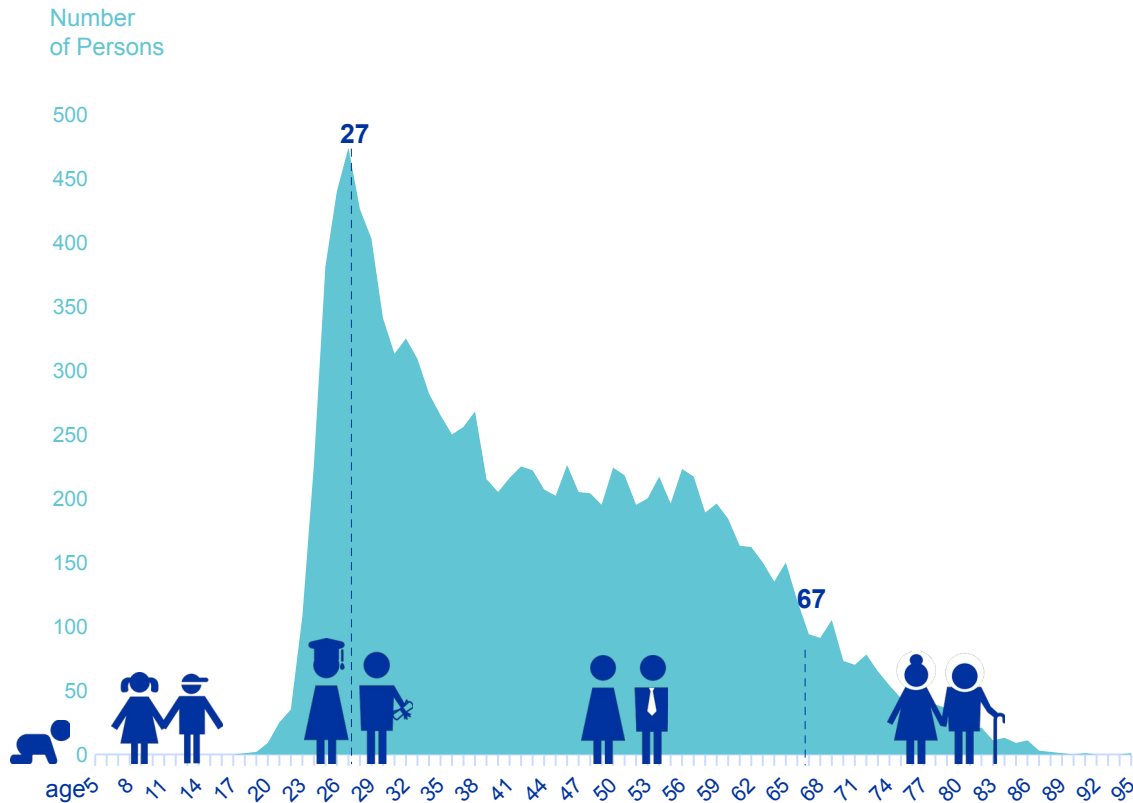
CERN produces innovative radioisotopes for nuclear medicine research.



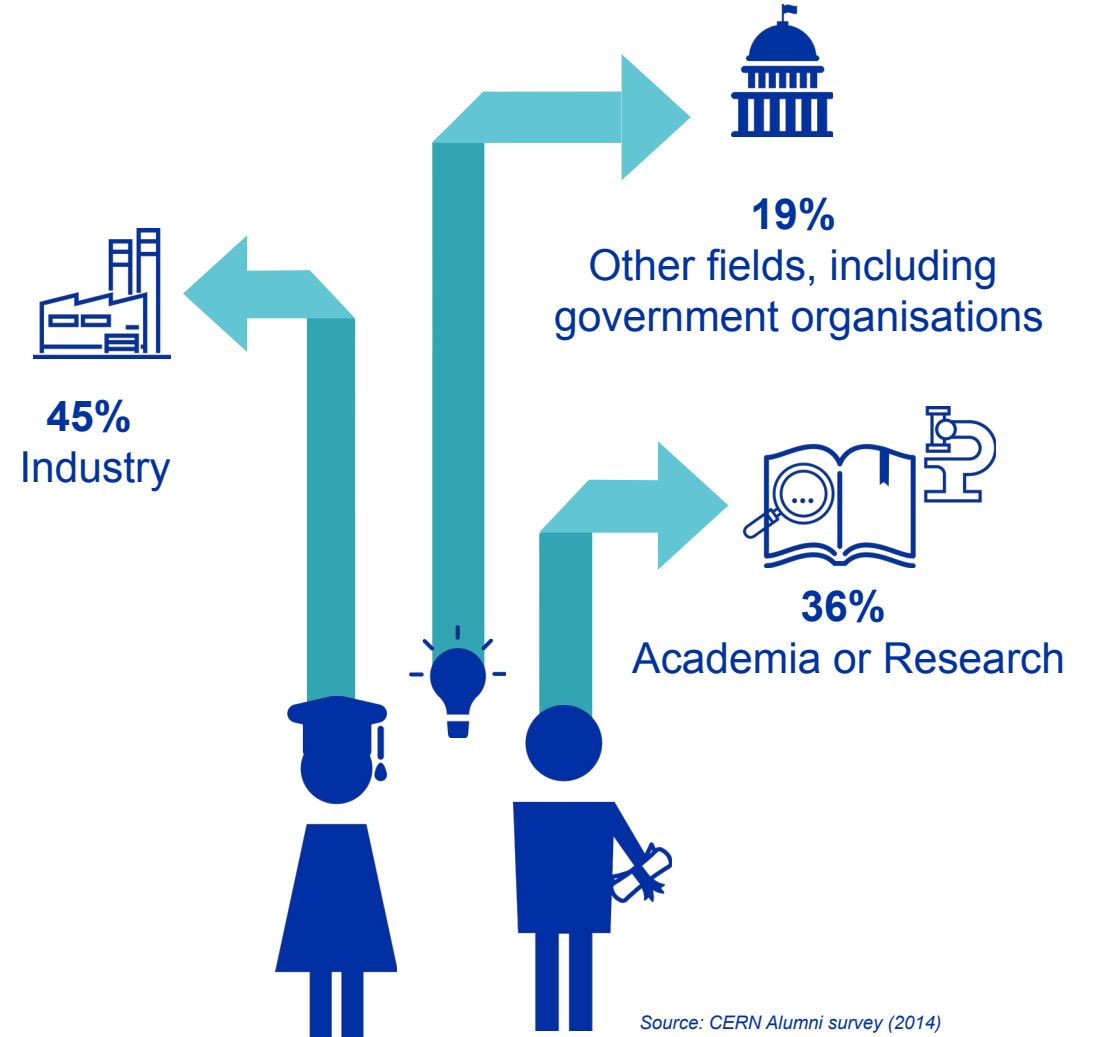


EDUCATION & TRAINING

CERN opens a world of career opportunities



Age Distribution of Scientists working at CERN



PhD and Technical students leaving CERN

CERN's training, education and outreach programmes

1002 graduates
(including Research Fellows)

3 000 PhD students

300 Undergraduate students in
Summer programmes



Numbers for country

- x summer students during 2023
- x teachers in Teacher Programmes since 1998
- x teams in BL4S competition since 2014

>14 500 teachers participating in
dedicated programmes, since 1998

Around 150 000 visitors per year on
guided tours of CERN,
from >50 countries

4.7M followers on social media,
from around the globe

CERN Science Gateway



CERN's new education and outreach centre for all publics aged 5-plus.

Inaugurated
October 2023.

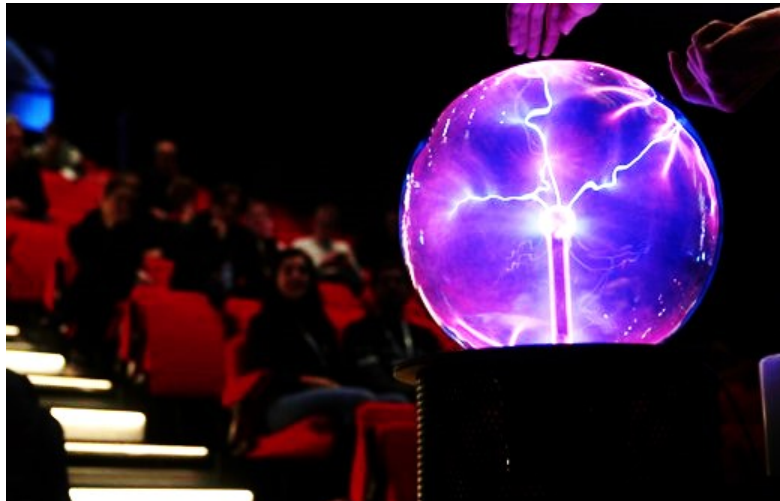
Number of visitors: **>245 000**

Immersive exhibitions,
education labs, events
and shows.

Science Gateway Education Activities 2023

Science Shows

- 5 different shows
- 36 shows at the Globe (Jan-Sept) with 1800+ visitors
- 40 shows at Science Gateway (Oct-Dec) with 2500+ visitors



Lab Workshops

- 10 different lab workshops
- 270 workshops with 5200+ participants (15% 5-15 y, 35% 16-19 y, 10% teachers or adults, 40% families & individual visitors)



CERN-Solvay programme

- 12 new education videos with 2.2 million views online
- 1000 certificates for online course
- 600+ applications from 60+ countries for camp (30 selected)





There are many unanswered questions
in fundamental physics

**CERN will continue to play a crucial role
in the journey of exploration**