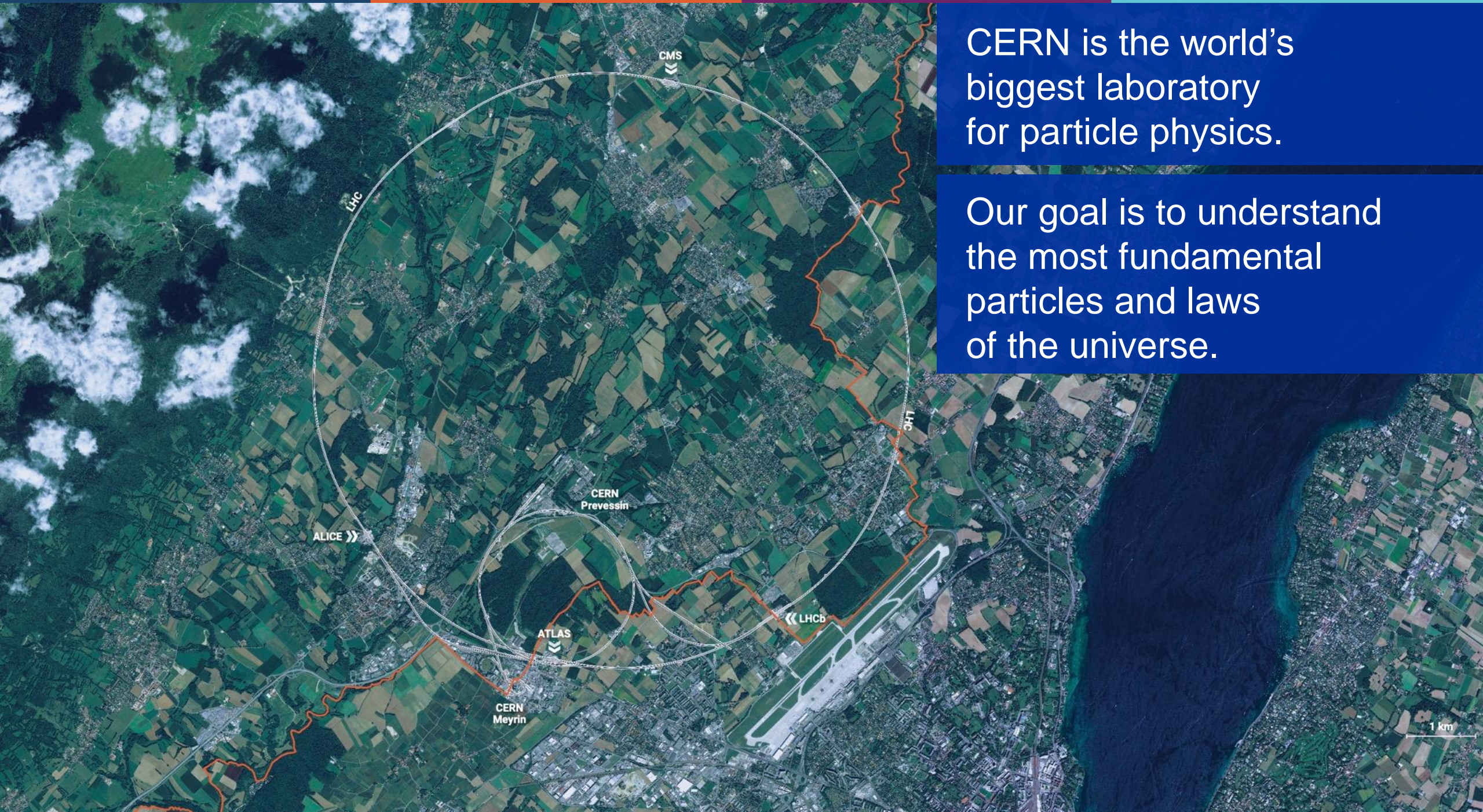


# WELCOME TO CERN



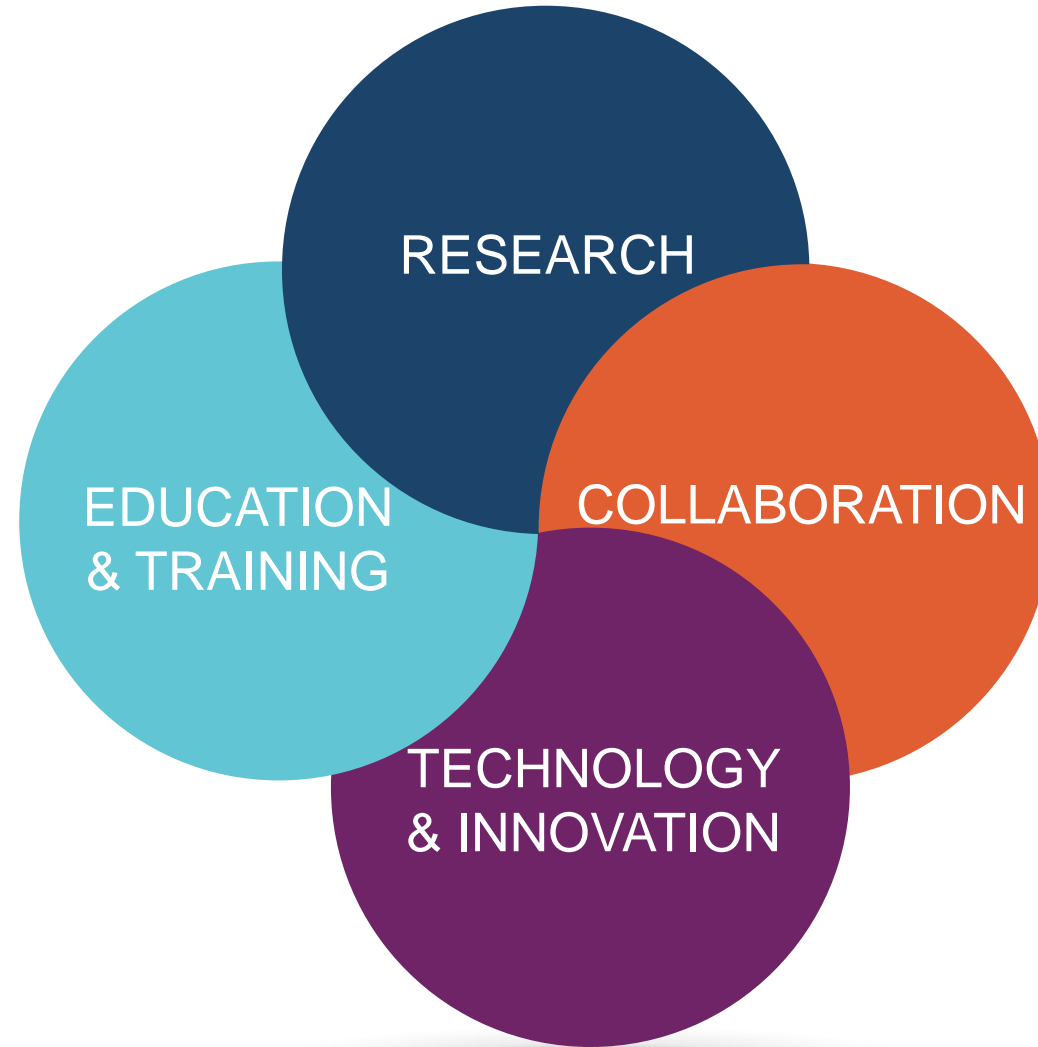
CERN is the world's biggest laboratory for particle physics.

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

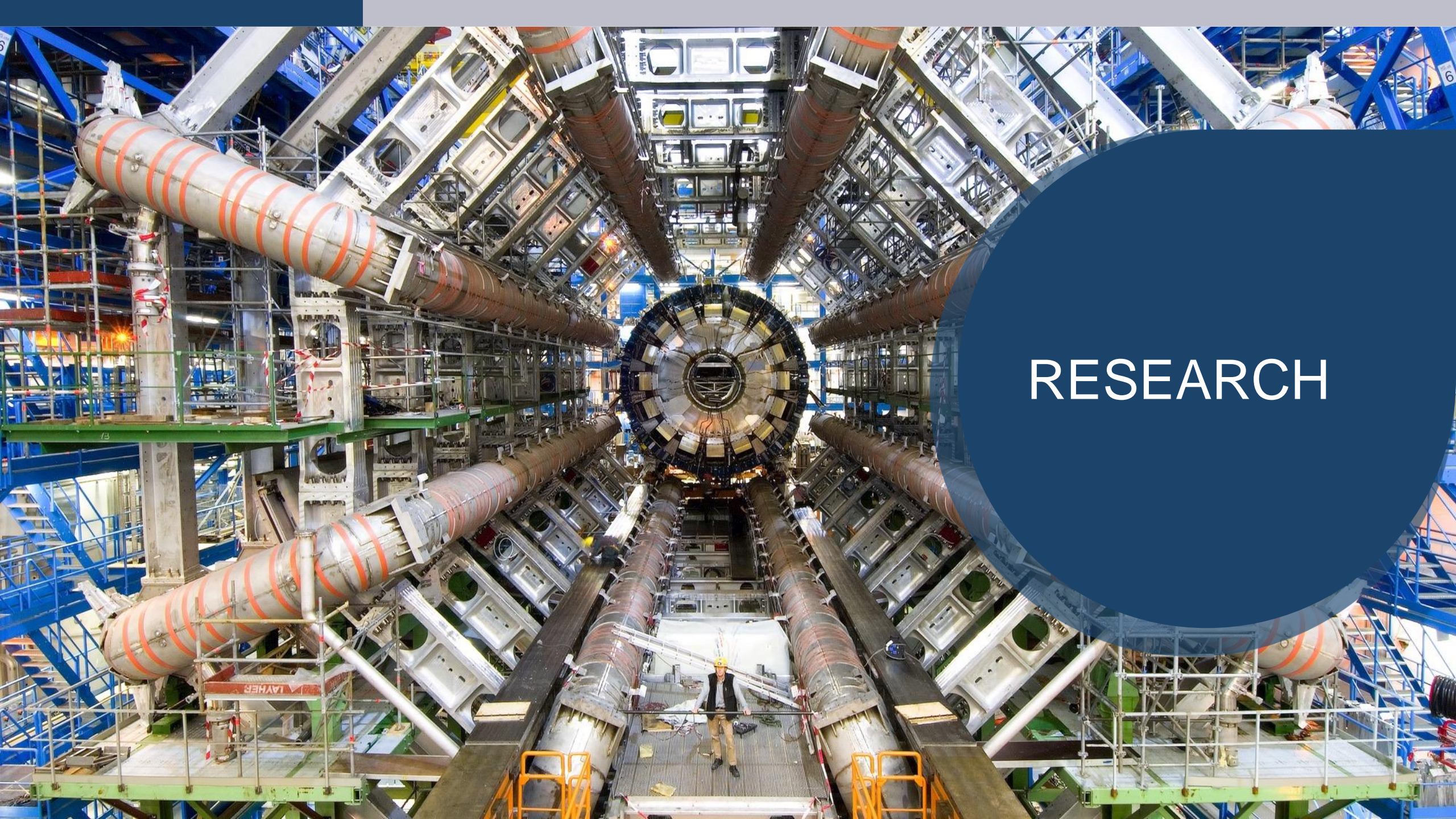




# Four pillars underpin CERN's mission





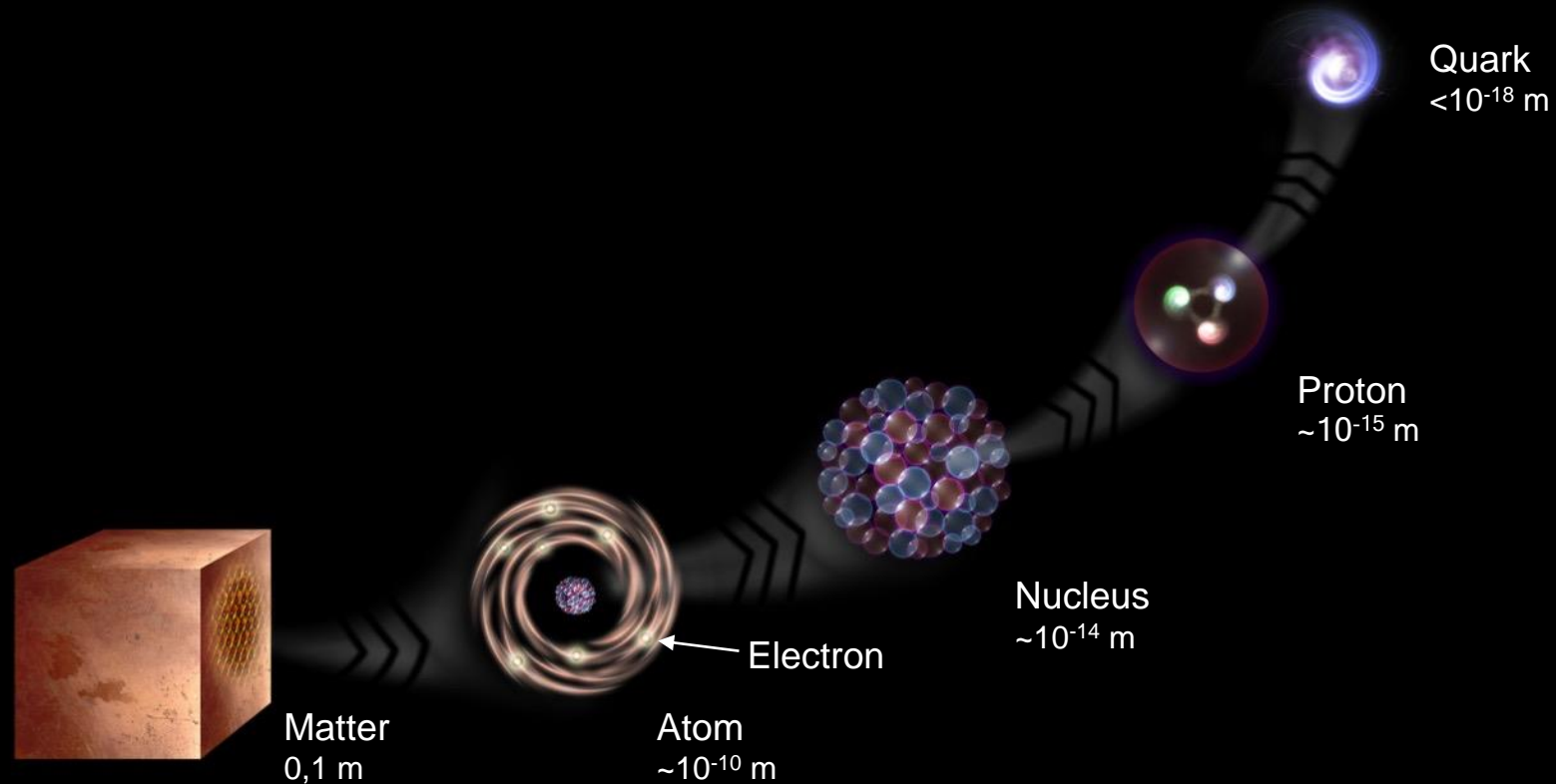


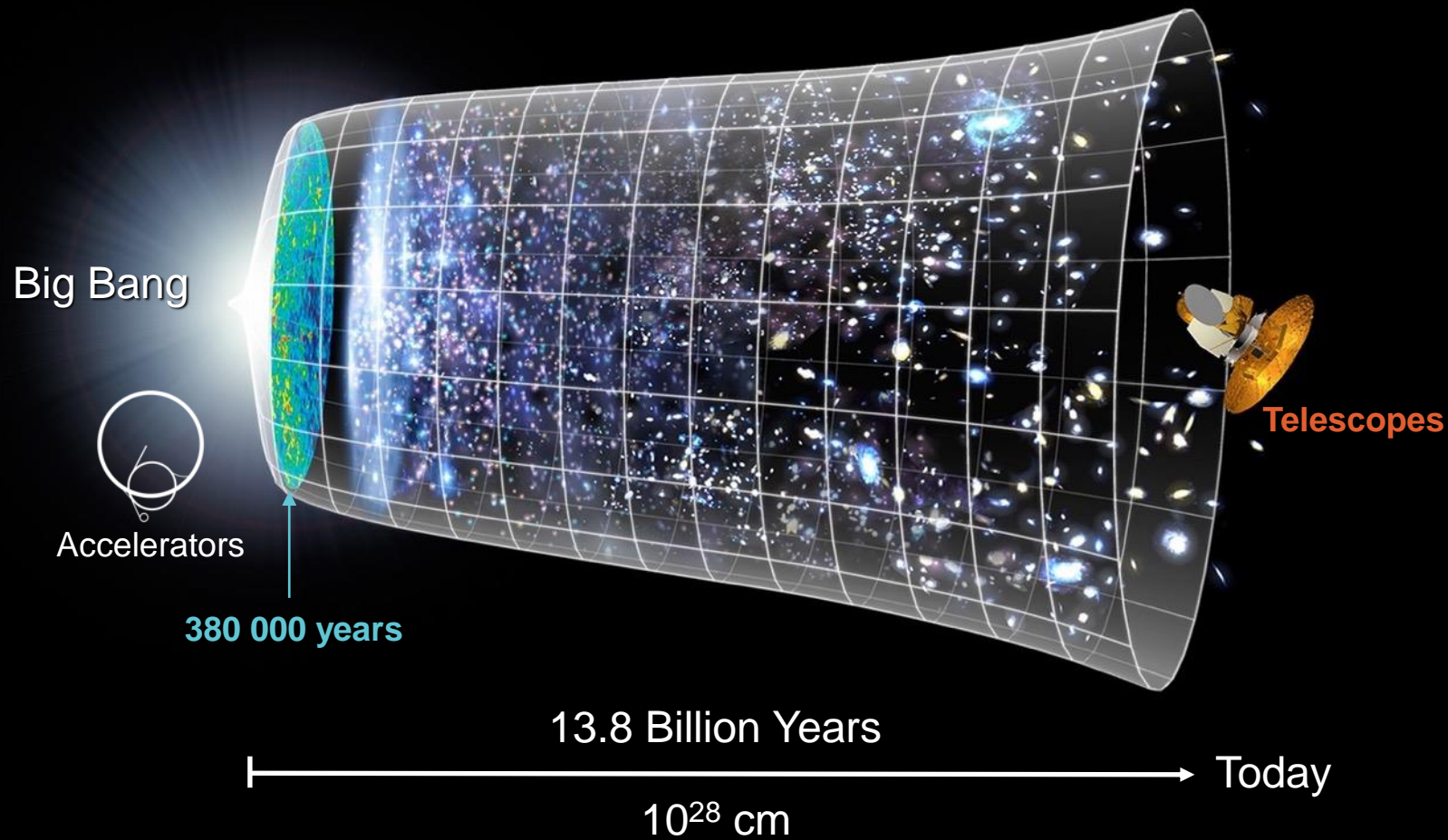
RESEARCH



# 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.



# How do we do it?

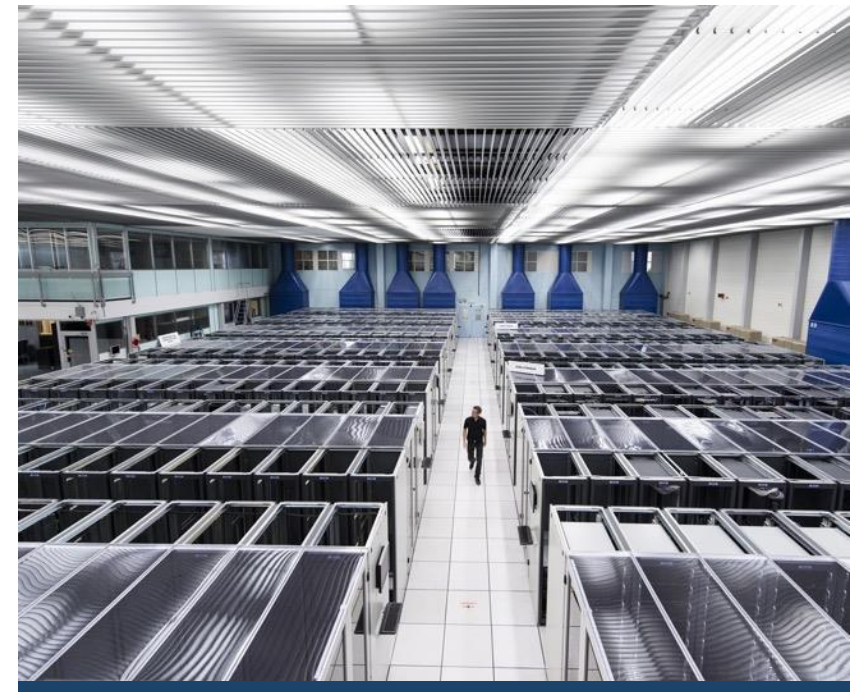
- We build the largest machines to study the smallest particles in the universe
- We develop technology to advance the limits of what is possible
- We perform world-class research in theoretical and experimental particle physics



ACCELERATORS

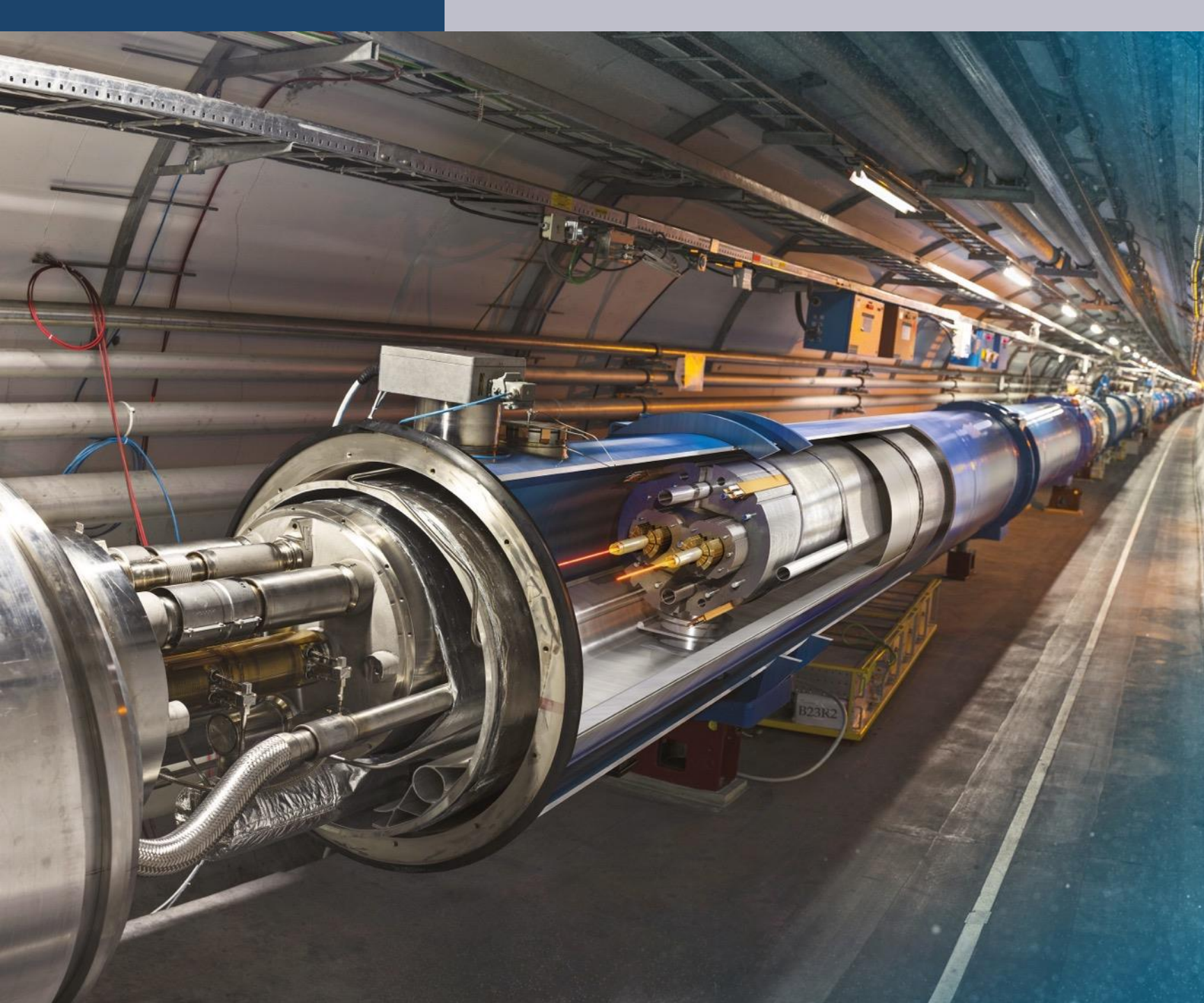


DETECTORS



COMPUTING



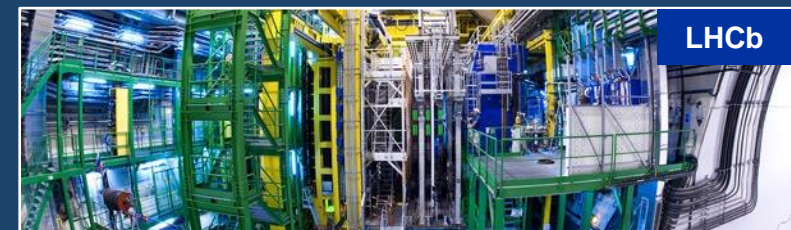
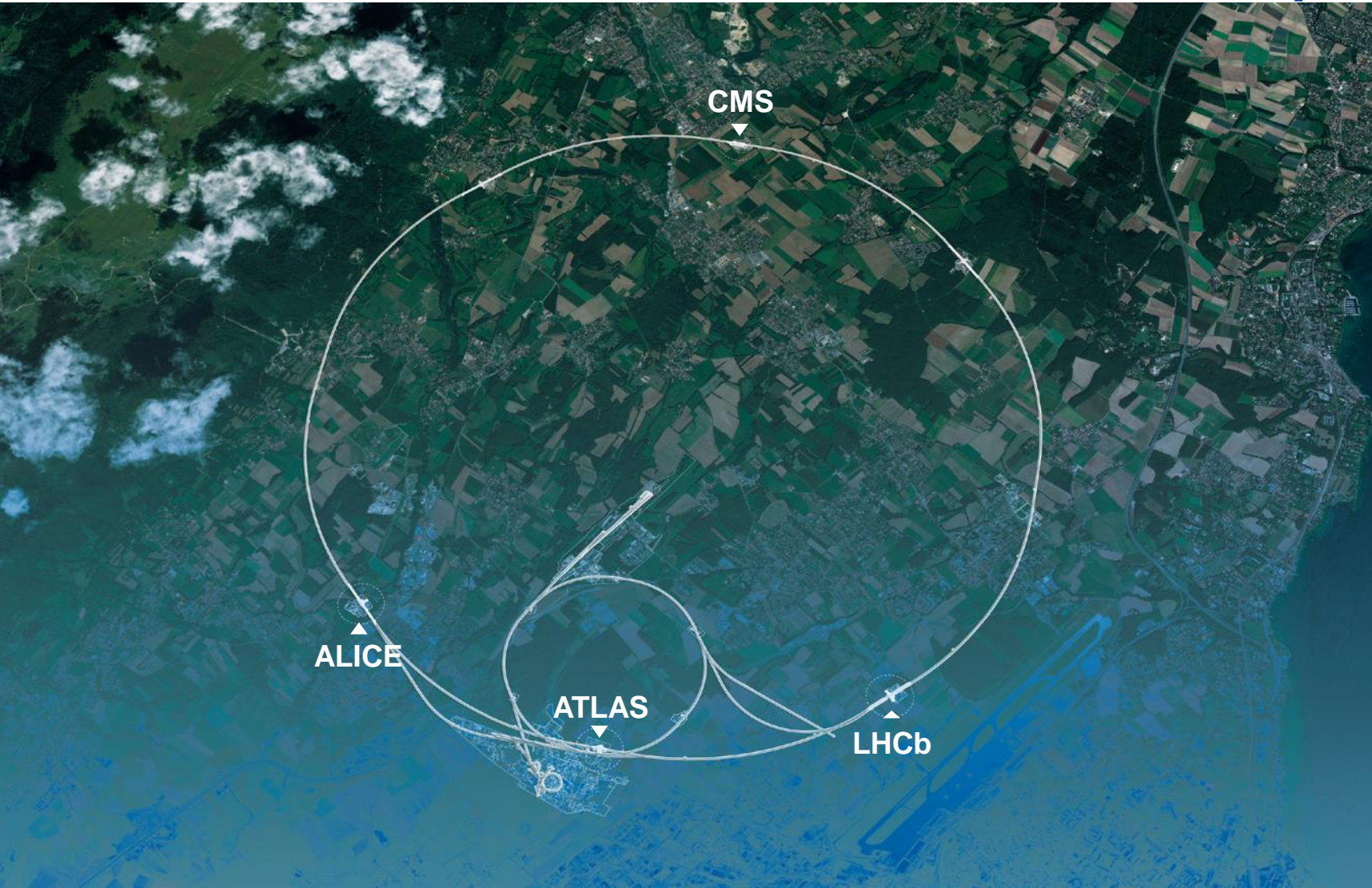


# Large Hadron Collider (LHC)

- 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

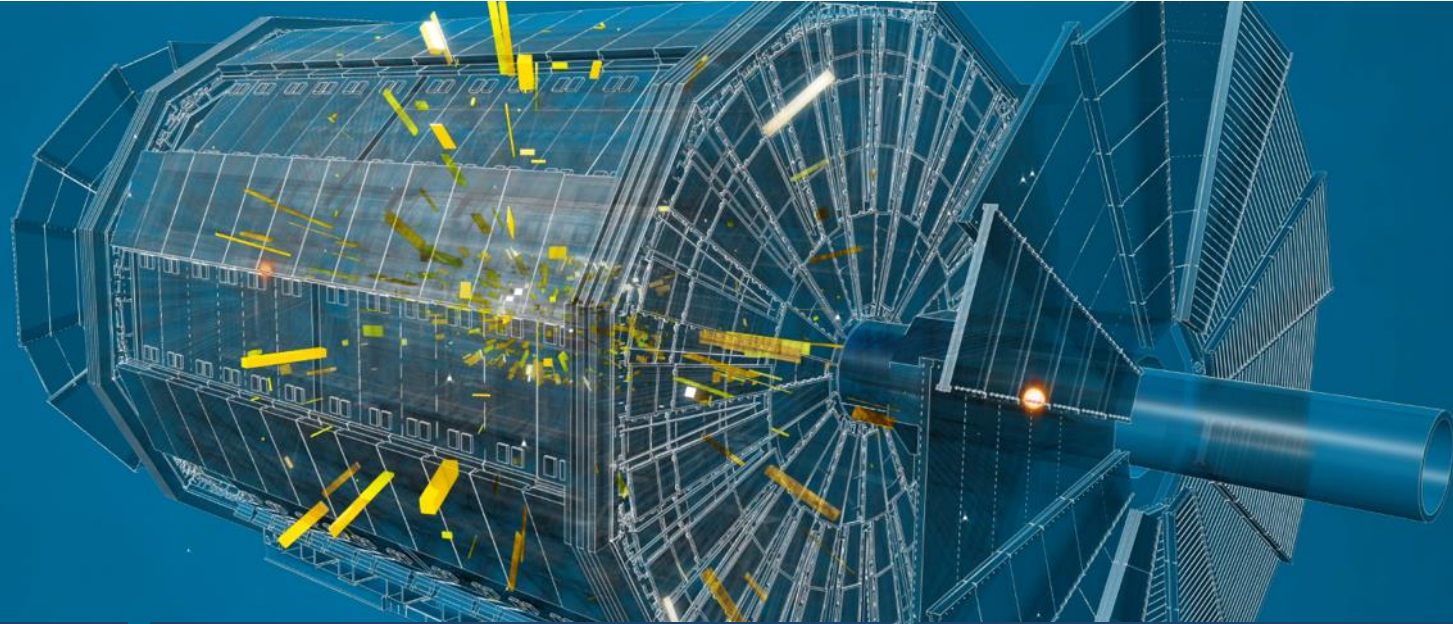


# Giant detectors record the particles formed at the four collision points





# The LHC detectors are analogous to 3D cameras



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



They take 40 million pictures a second. Only 1000 are recorded and stored.



The LHC detectors have been built by international collaborations covering all regions of the Globe.



# The Worldwide LHC Computing Grid (WLCG)



Used to store, distribute, process and analyse data.



1 million processing cores in about 170 data centres and 42 countries.

More than 1000 Petabytes of CERN data stored world-wide.

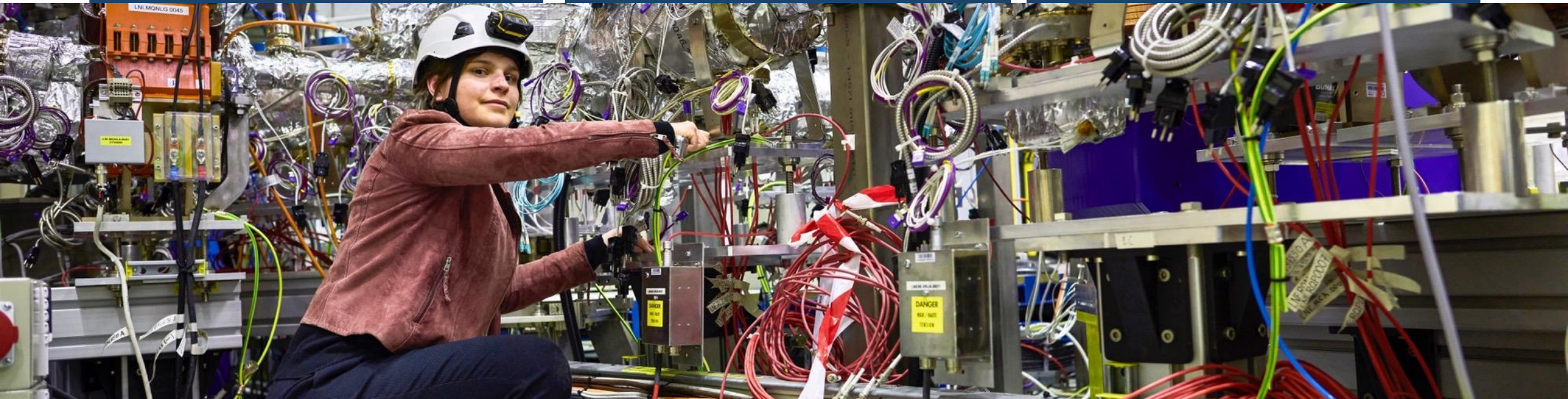


# CERN has a diverse scientific programme

Nuclear Physics  
(ISOLDE)

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

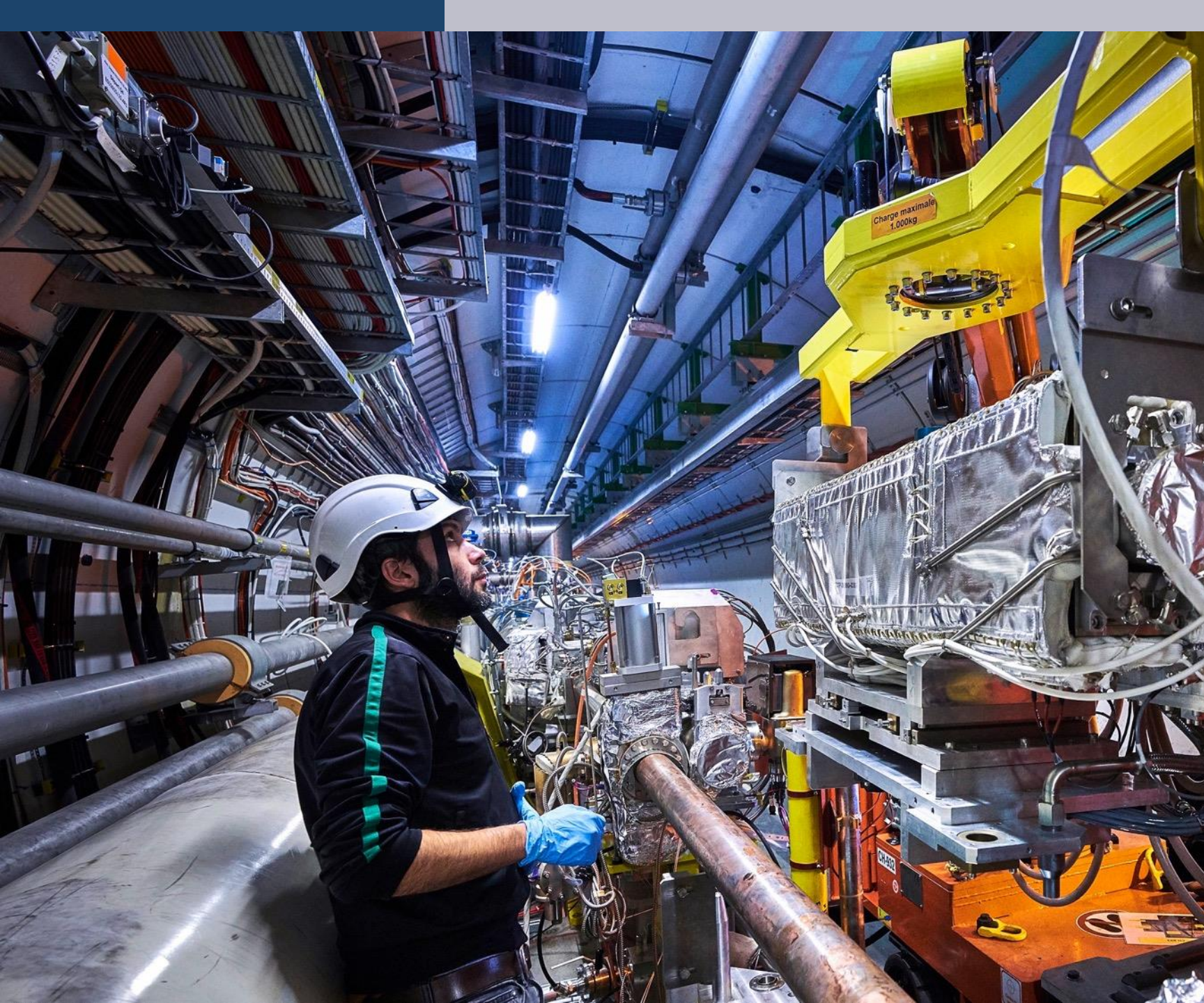
95% of the mass  
and energy  
of the universe is  
unknown.

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 2030 and run until 2041.

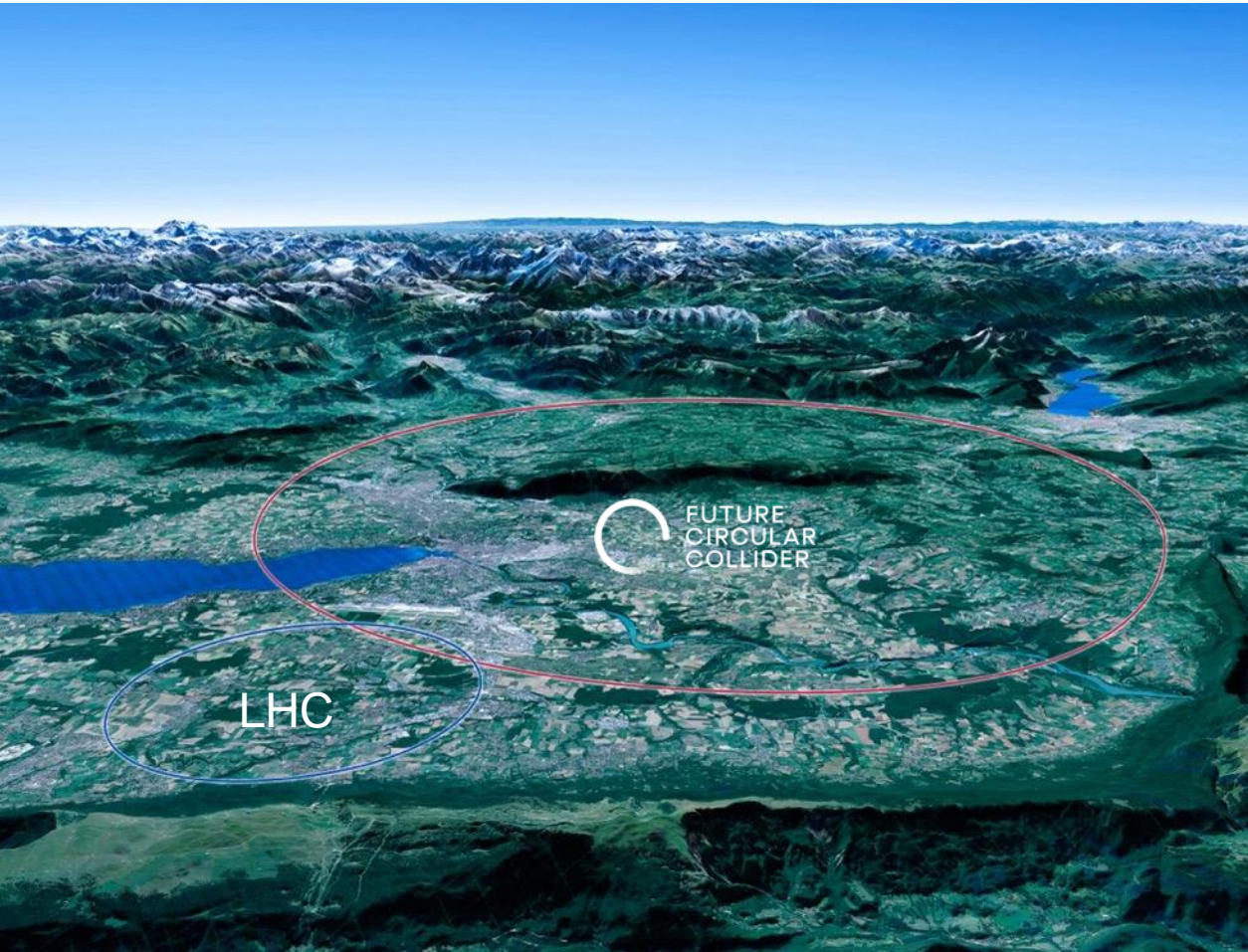




# Scientific priorities for the future

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 90 km collider at CERN
- Ramp up relevant R&D
- Continue supporting other projects around the world





A low-angle photograph of several flagpoles against a clear blue sky. The flagpoles are arranged in a diagonal line from the bottom left towards the top right. Various national flags are flying from the poles, including the Spanish flag, the Greek flag, the Italian flag, the German flag, the Danish flag, the Hungarian flag, the Finnish flag, and the flag of the United Nations. The sun is visible in the sky, creating a bright glow. On the left side, there is a large, semi-transparent orange circle containing the word "COLLABORATION" in white, uppercase letters.

COLLABORATION



# Science for peace

## CERN was founded in 1954 with 12 European Member States



### 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

### 2 Associate Member States in the pre-stage to membership

Cyprus – Slovenia

### 8 Associate Member States

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

### 6 Observers

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

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**

### 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



# 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**  
**24.5% women**

## Member States 7467

Austria 86 – Belgium 129 – Bulgaria 46 – Czech Republic 252  
Denmark 47 – Estonia 29 – 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 40

Cyprus 14 – 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



# United States and CERN



Fermilab scientists inspect precision timing components for the high luminosity upgrade to CMS, one of the LHC experiments at CERN.

*Credit: Fermilab / Dan Svoboda, Ryan Postel*

## *Today:*

- US has the largest collaborating community among all CERN users
- European Strategy for particle physics prioritized LBNF/DUNE in 2020
- HL-LHC upgrade and LBNF/DUNE labelled “highest priority” by US physics community in 2023 P5 report
- April 2024: US and CERN sign Joint Statement of Intent for large research infrastructures, advanced scientific computing and open science





# 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**

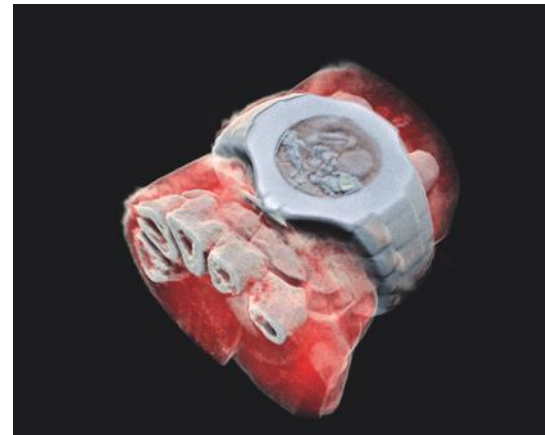
Medical imaging, cancer therapy, material science, cultural heritage, aerospace, automotive, environment, health & safety, industrial processes.



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

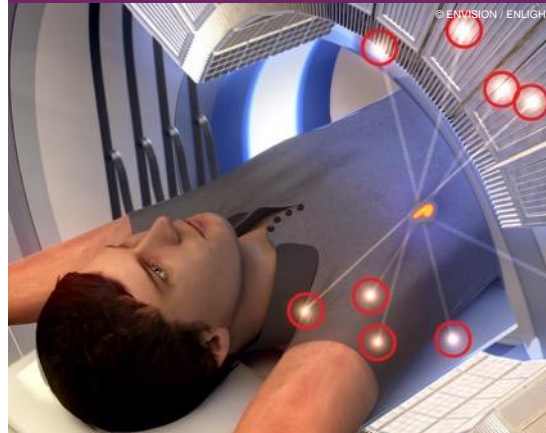


Technologies applied at CERN are also used in PET, for medical imaging and diagnostics.



CERN produces innovative radioisotopes for nuclear medicine research.

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.



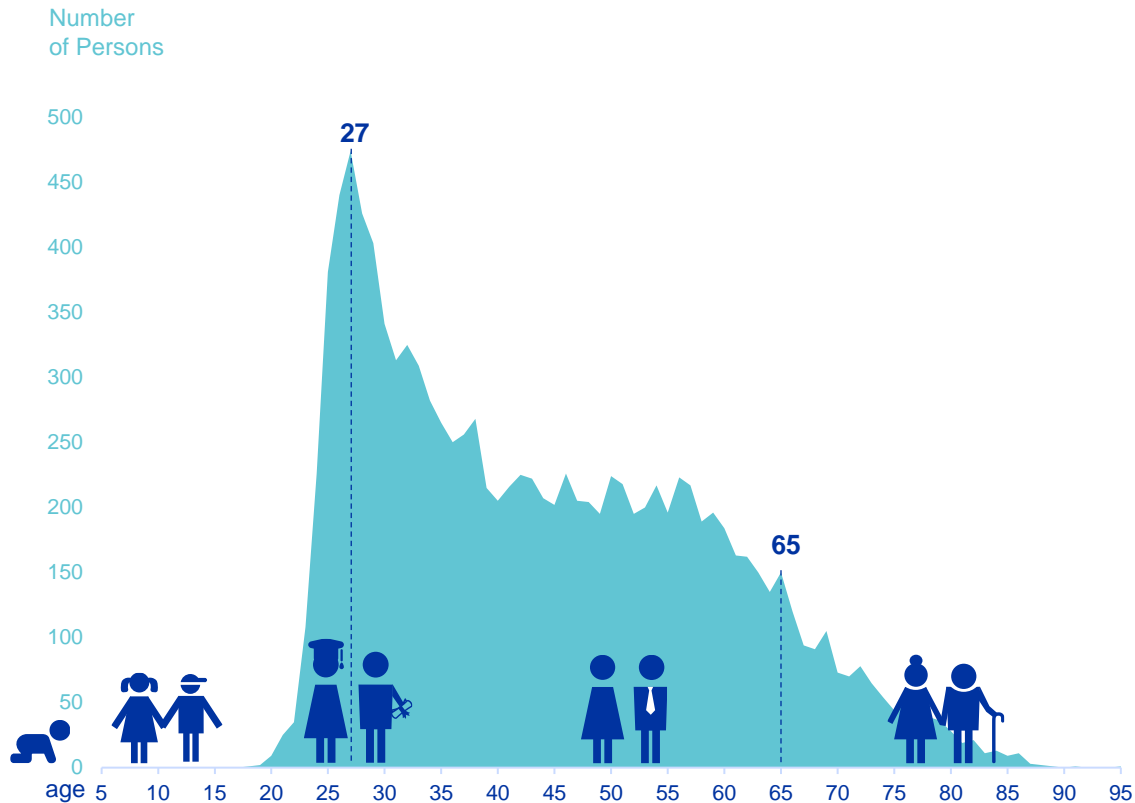


A group of students, both male and female, are wearing hard hats (yellow and blue) and are focused on a large, black, cylindrical piece of equipment mounted on a metal frame. They appear to be in a laboratory or workshop setting. One student in the foreground is adjusting the equipment. In the background, there are other students and a green exit sign with a white arrow pointing down. A teal circular graphic is overlaid on the left side of the image, containing the text 'EDUCATION & TRAINING'.

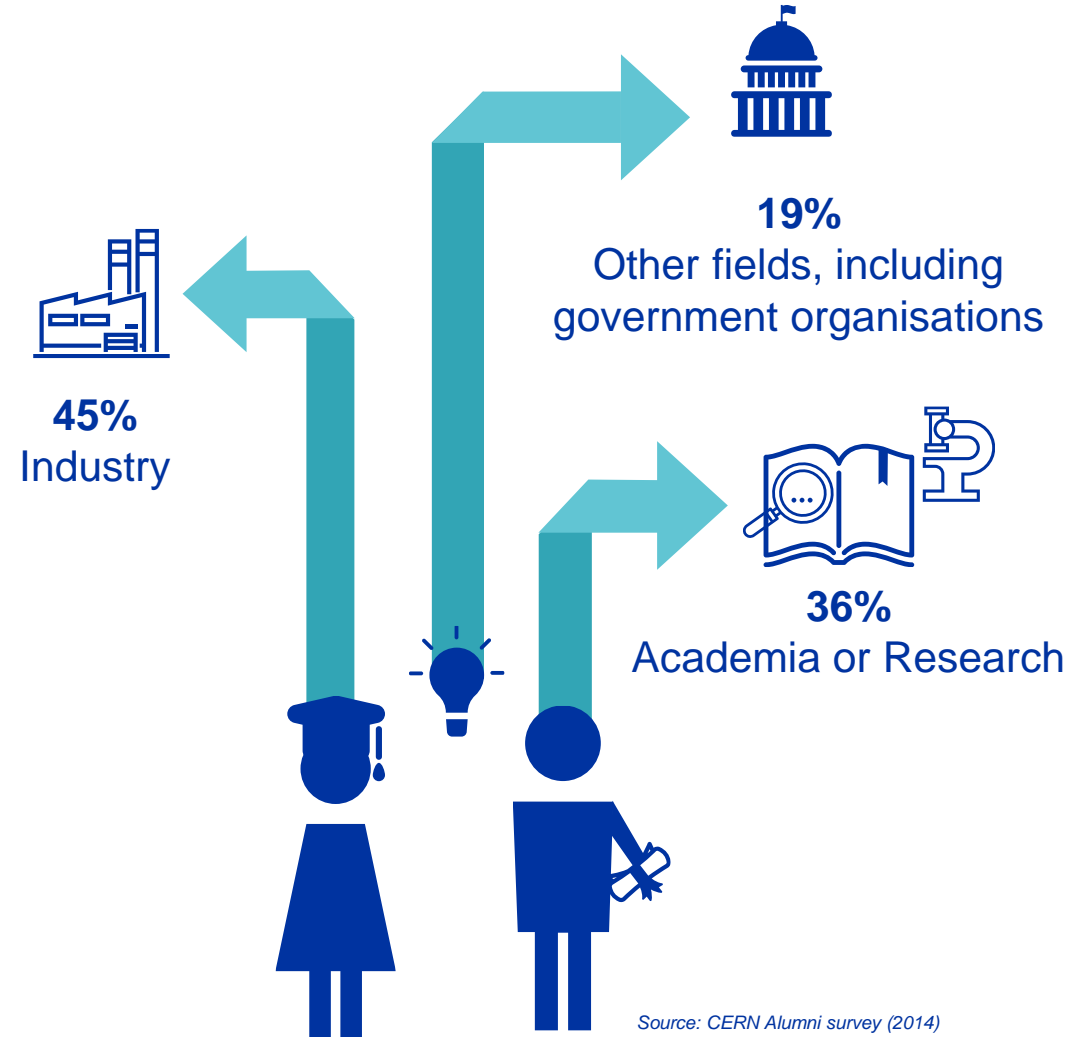
# EDUCATION & TRAINING



# 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



> 15 000 teachers participating in  
dedicated programmes, since 1998



# CERN Science Gateway



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

Nb of visitors 10/23 to 9/24  
361 379

Immersive exhibitions, education labs, events and shows.



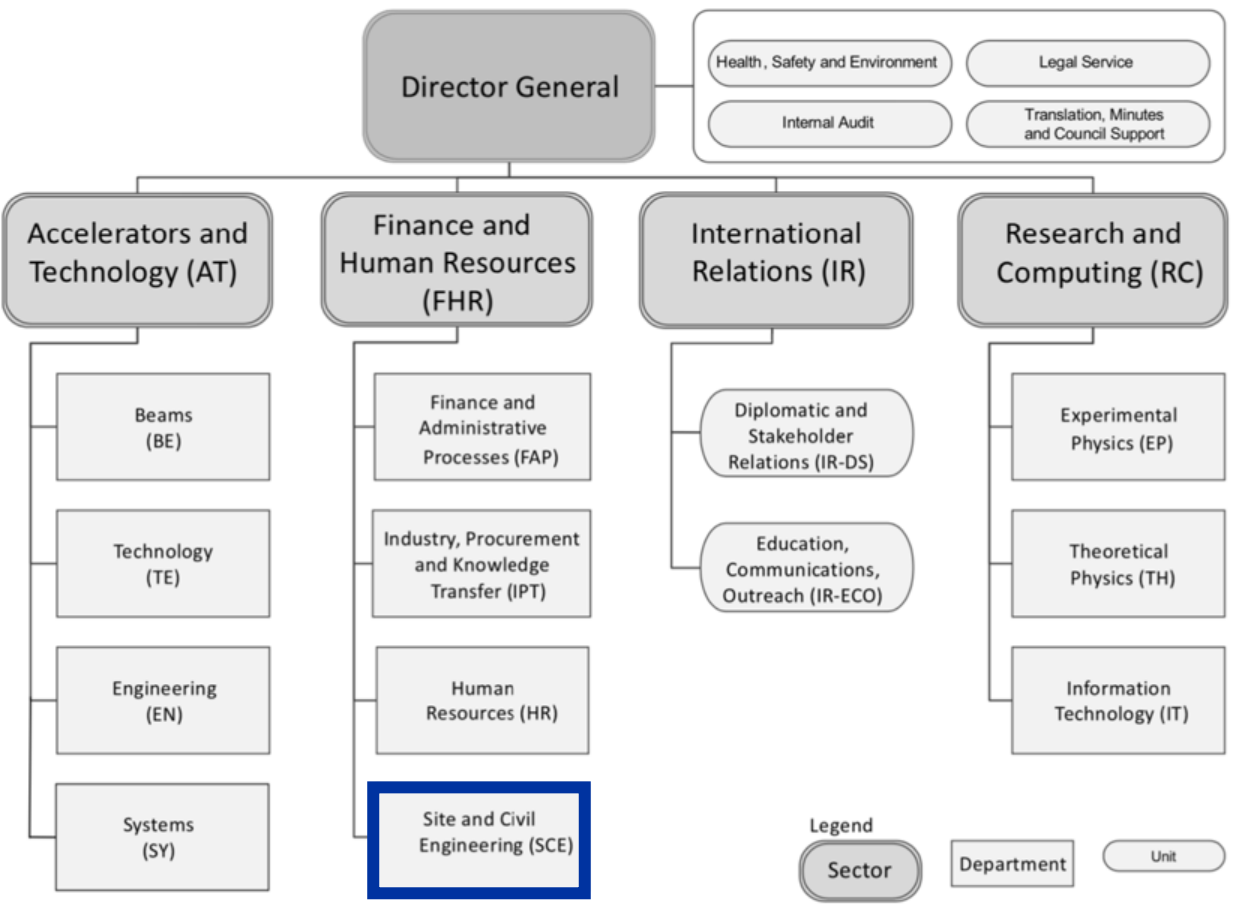
# Site Figures

- 620 ha of which 210 fenced with 110 ha green, 57 ha roads and P, 39 ha built
- 2 main sites (FR & CH) and 15 satellite sites
- 670 building from 10 m<sup>2</sup> to 20.000 m<sup>2</sup>
- 65% built before the 70s
- 70 km tunnels and 80 caverns
- 30 km roads
- 1000 km technical galleries and trenches
- 7000 to 9000 persons daily
- 490 hostel rooms
- 8500 working places
- 4300 parking places in Meyrin, 1400 in Preveessin
- 25000 daily movements to- and inter-sites





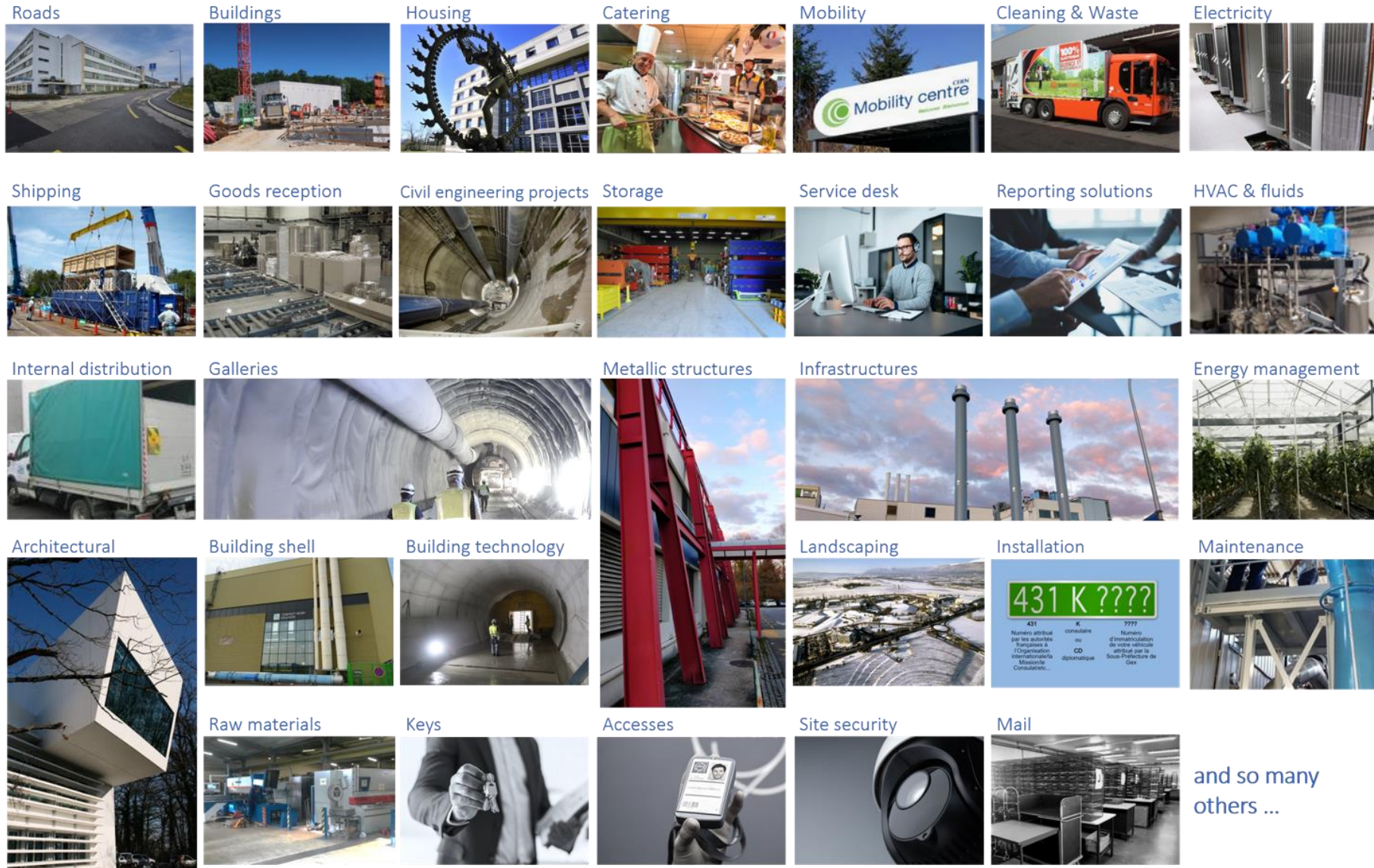
# Site and Civil Engineering (SCE) Department



The Site and Civil Engineering (SCE) Department manages and develops CERN's real estate assets and infrastructures in agreement with CERN's scientific strategy, as well as all the services related to the caretaking and operation of the CERN site.



# An extensive offer dedicated to CERN's Community







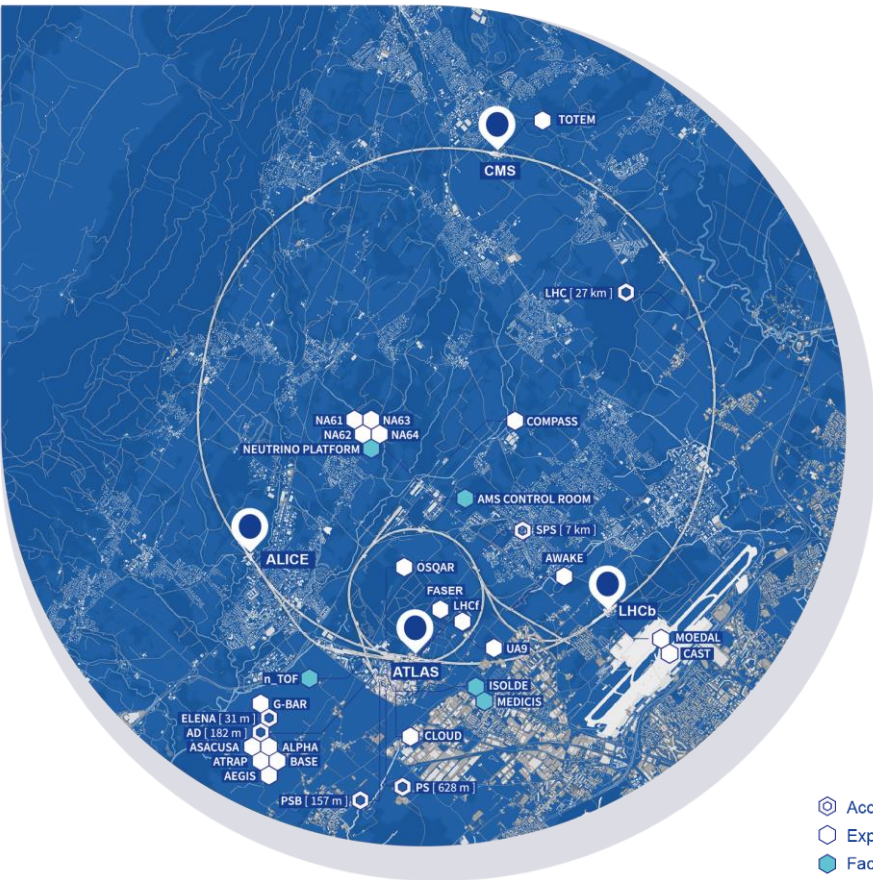
There are many unanswered questions  
in fundamental physics

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





# Very strong involvement in the LHC experimental programme CMS, ATLAS, ALICE, LHCb (NSF)



- Accelerator
- Experiment
- Facility



## LHC EXPERIMENTS:

- ALICE** 15 Institutes
- ATLAS** 50 Institutes
- CMS** 56 Institutes
- LHCb** 7 Institutes

## OTHER LHC EXPERIMENTS:

- TOTEM** 1 Institute
- MoEDAL** 2 institutes
- FASER** 3 institutes

## FIXED TARGET EXPERIMENTS

- AWAKE** 1 institute
- CLOUD** 3 institutes
- NA58 (COMPASS)** 2 institute
- NA61 (SHINE)** 4 institutes
- NA62** 2 institutes
- Neutrino Platform** 55 institutes

## ANTI-PROTON EXPERIMENTS

- ALPHA** 2 institutes

- ISOLDE**  
20 institutes

US has also contributed to the development of the Worldwide LHC Computing Grid and operates two Tier-1 centres (at BNL and FNAL) and several Tier-2 centres across US universities.



# CERN Neutrino Platform: current LBNF-related activities

- The CERN Neutrino Platform, which includes 2 massive DUNE detector prototypes, is an international hub for LBNF/DUNE R&D
- Final DUNE prototyping and testing at CERN between 2024-2025
- CERN delivery and installation of two cryostats in South Dakota 2025-2027 (total value ~\$200,000,000\*, plus additional contributions and expertise from CERN scientists and engineers)

*\*Estimate by US Department of Energy; only applies to final cryostats. Does not include costs of CERN Neutrino Platform.*

