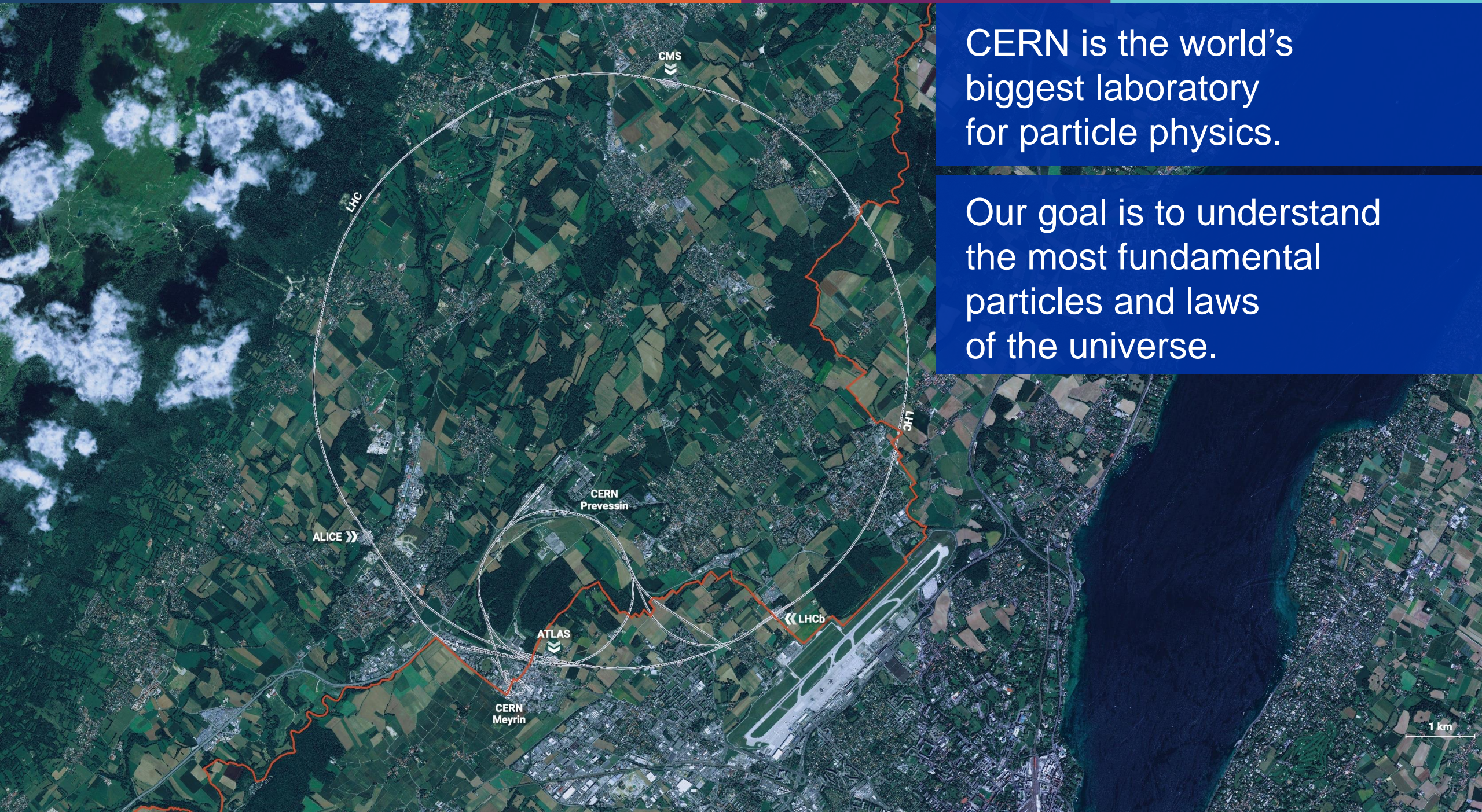


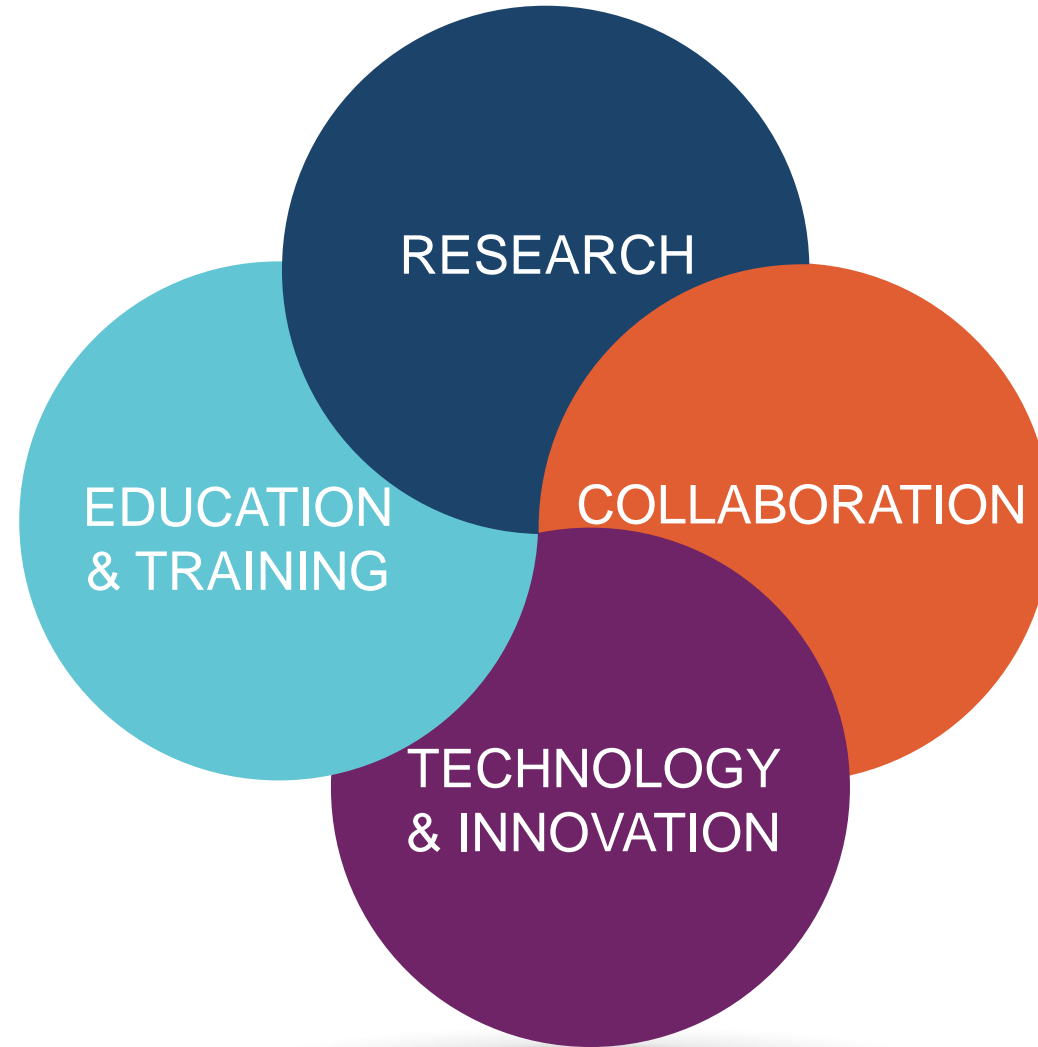
WELCOME TO CERN

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

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

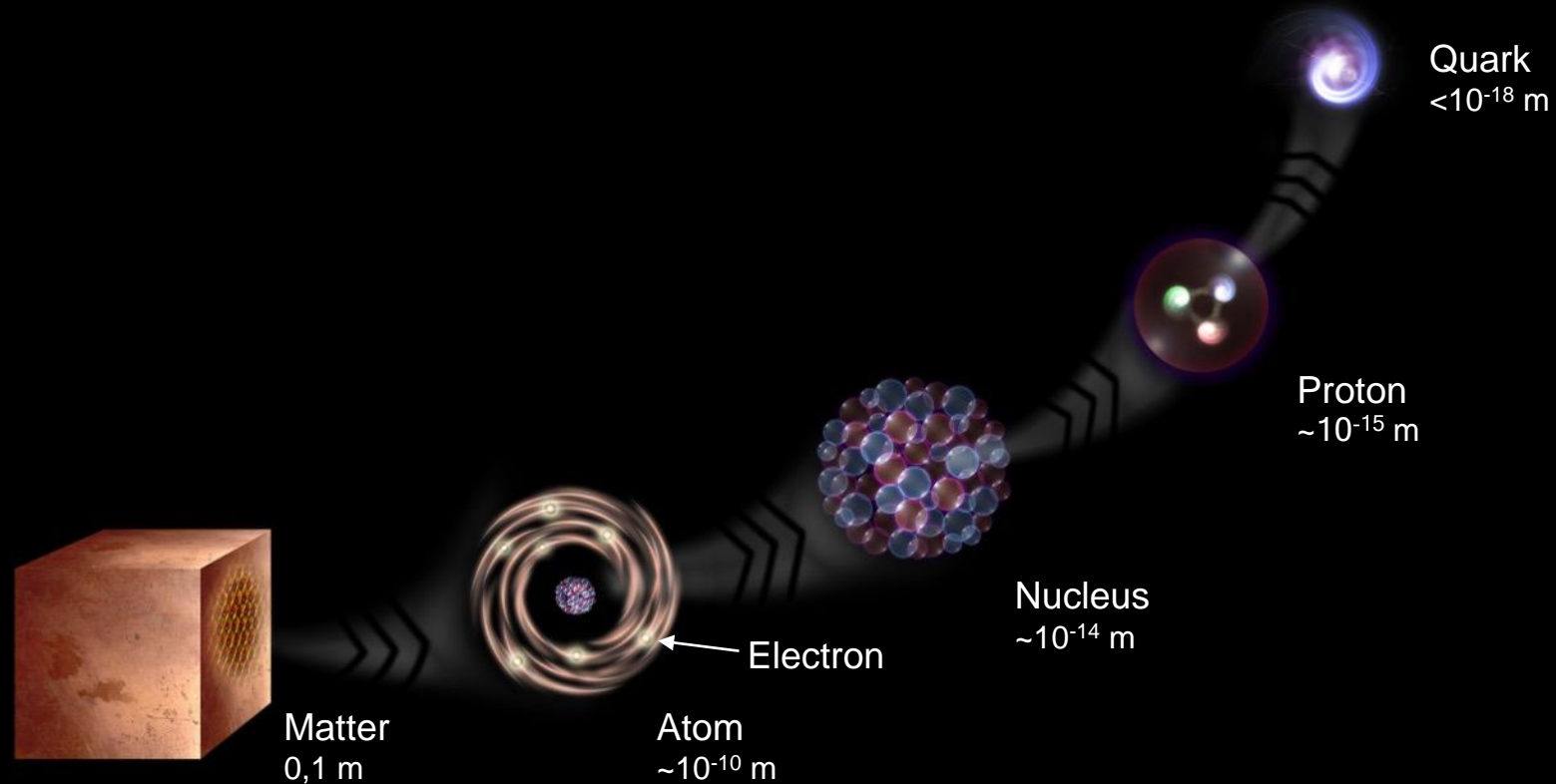


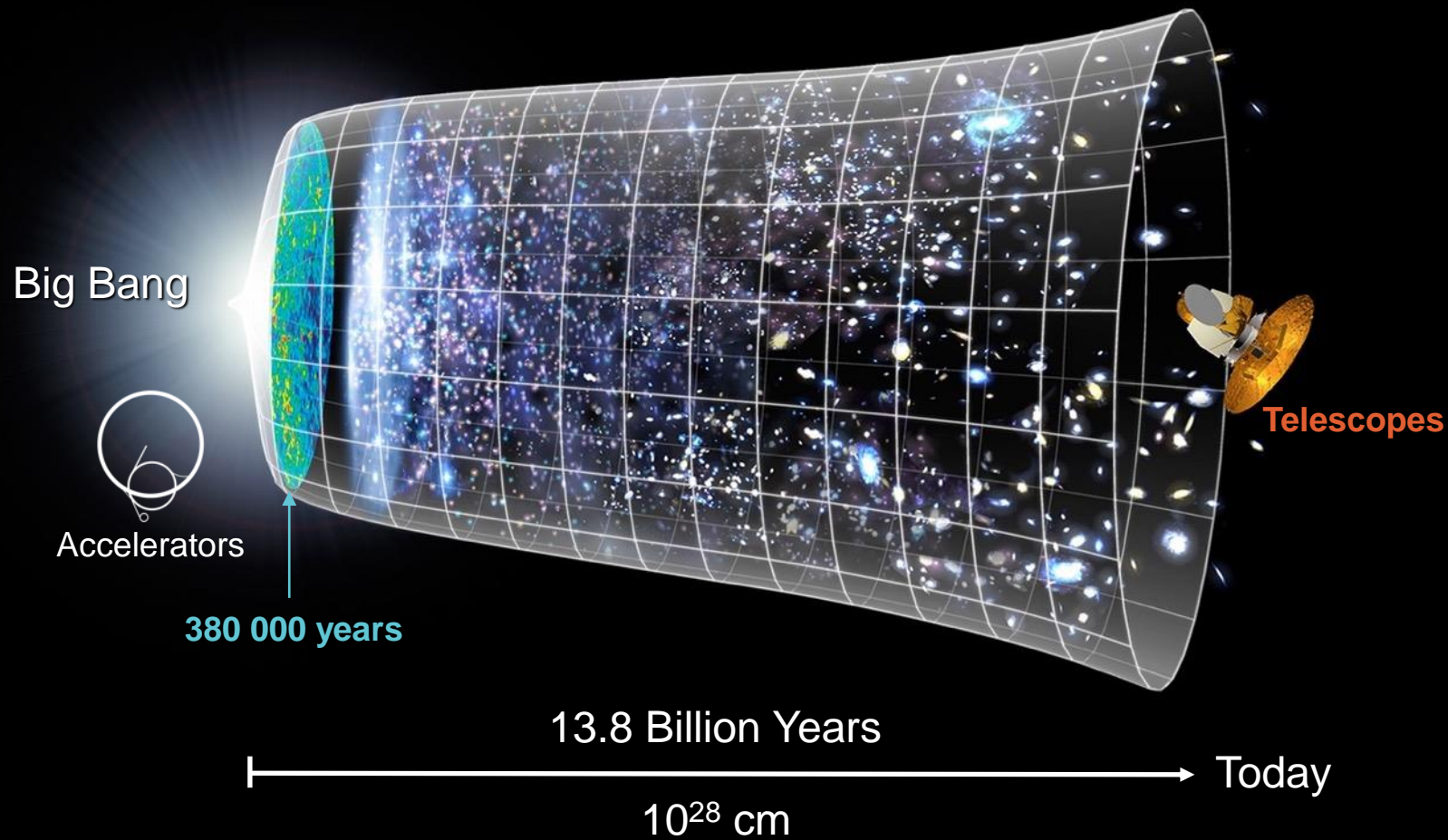
Four pillars underpin CERN's mission



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?

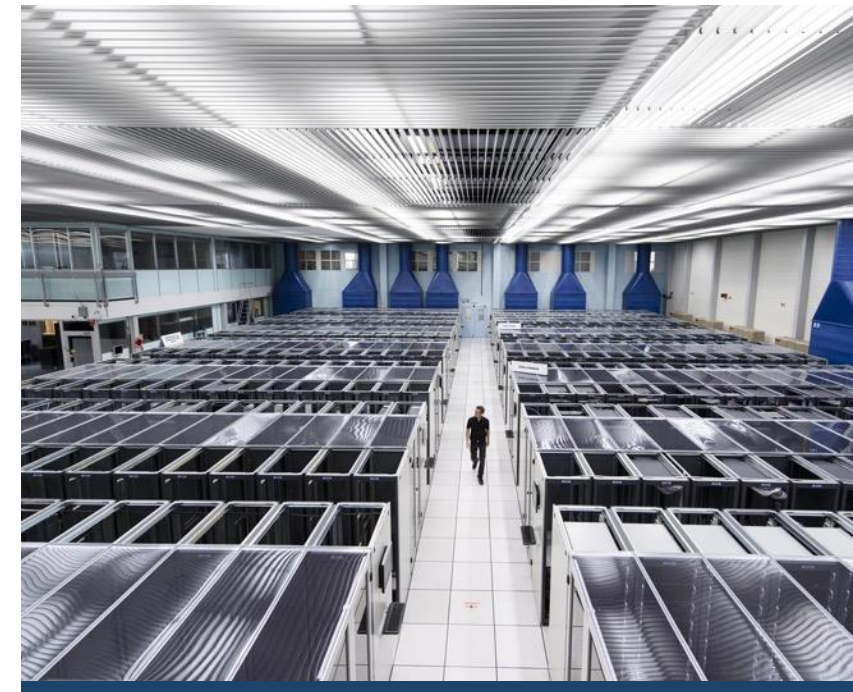
- We build the **largest machines** to study the smallest particles in the universe
- We **develop technology** to advance the limits of what is possible
- We perform world-class **research** in theoretical and experimental particle physics



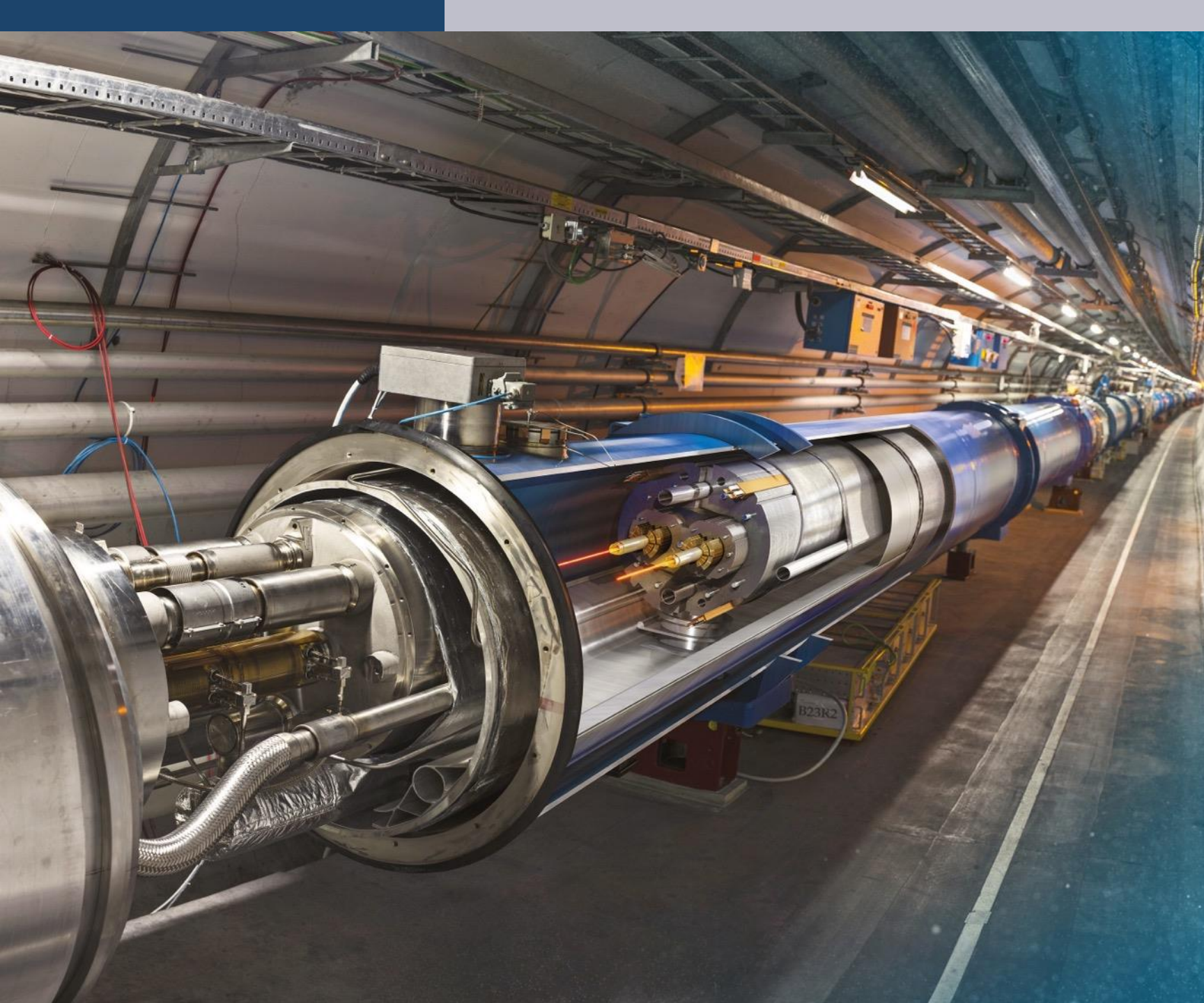
ACCELERATORS



DETECTORS



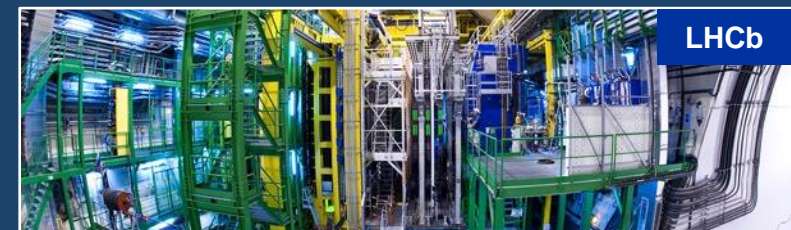
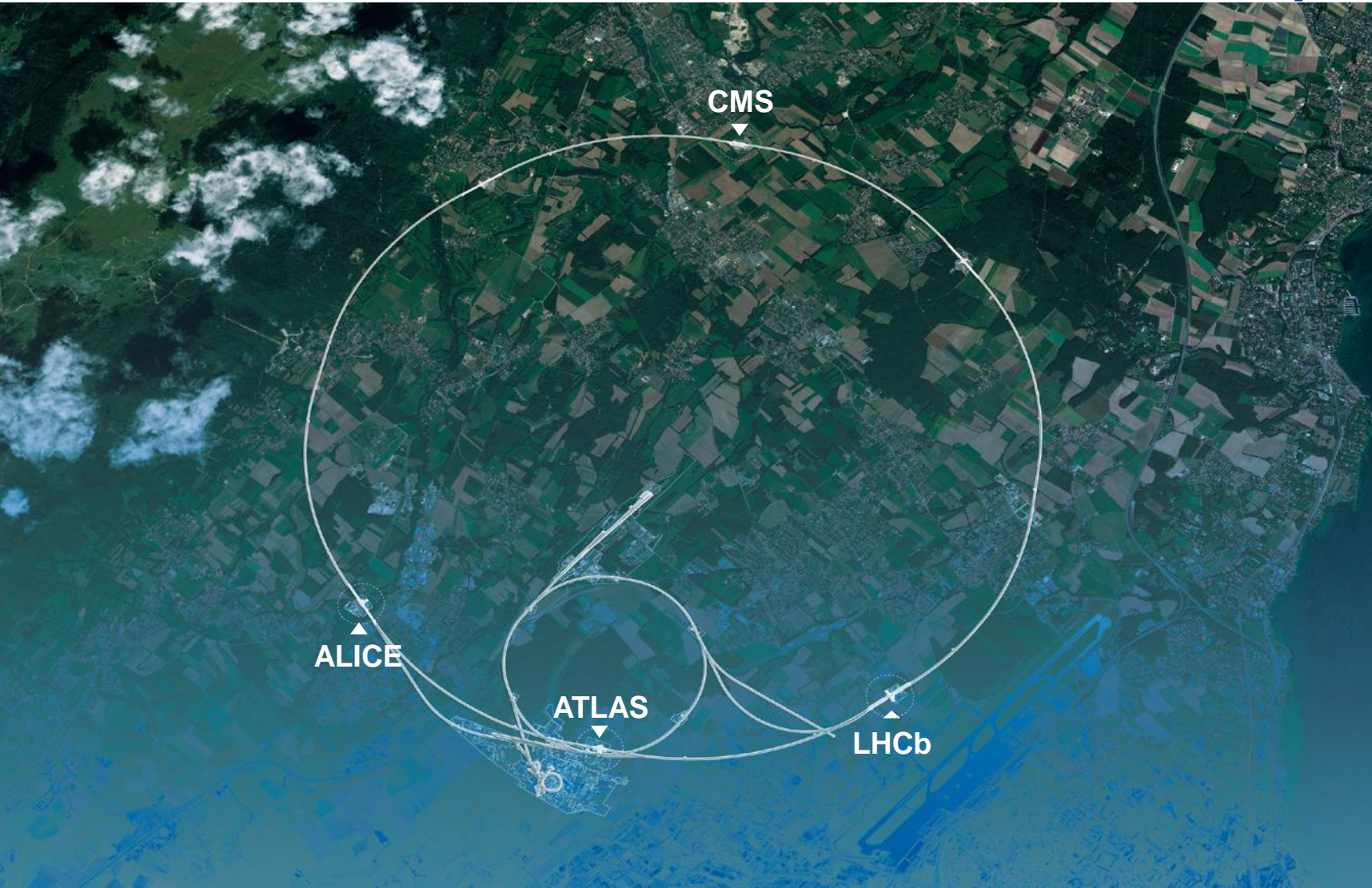
COMPUTING



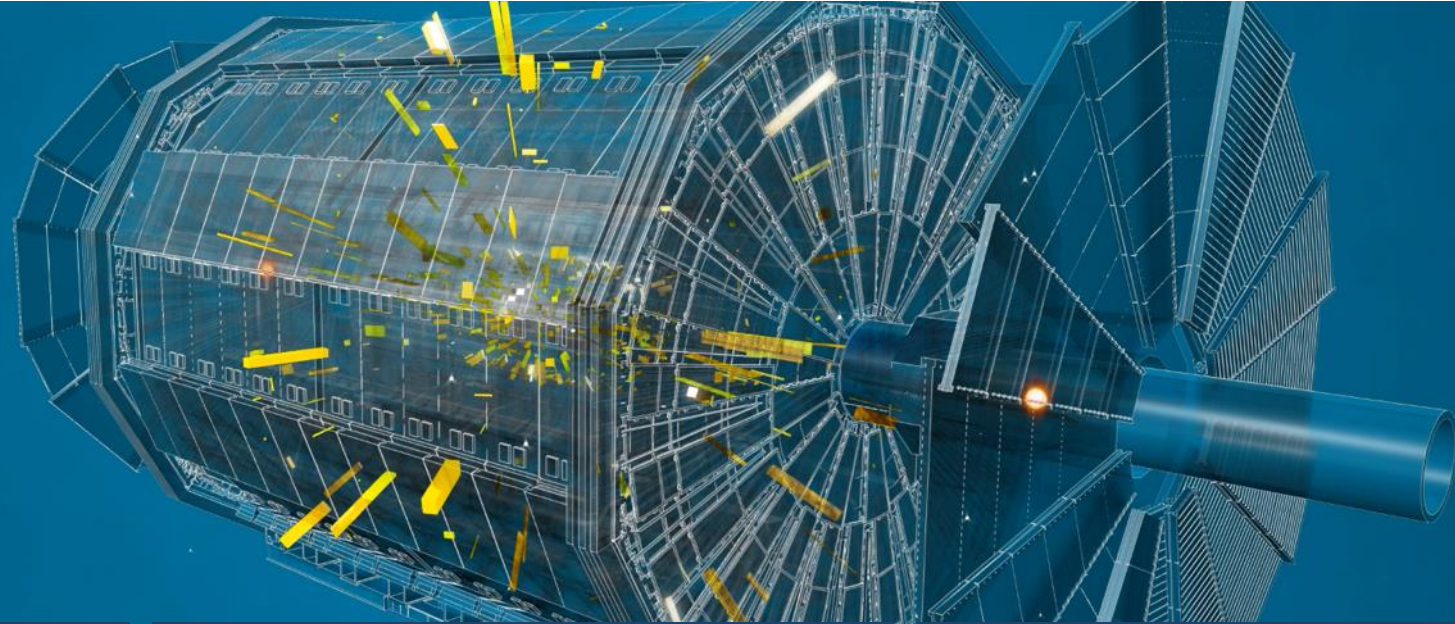
Large Hadron Collider (LHC)

- 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 produces more than 1 billion particle collisions per second



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.

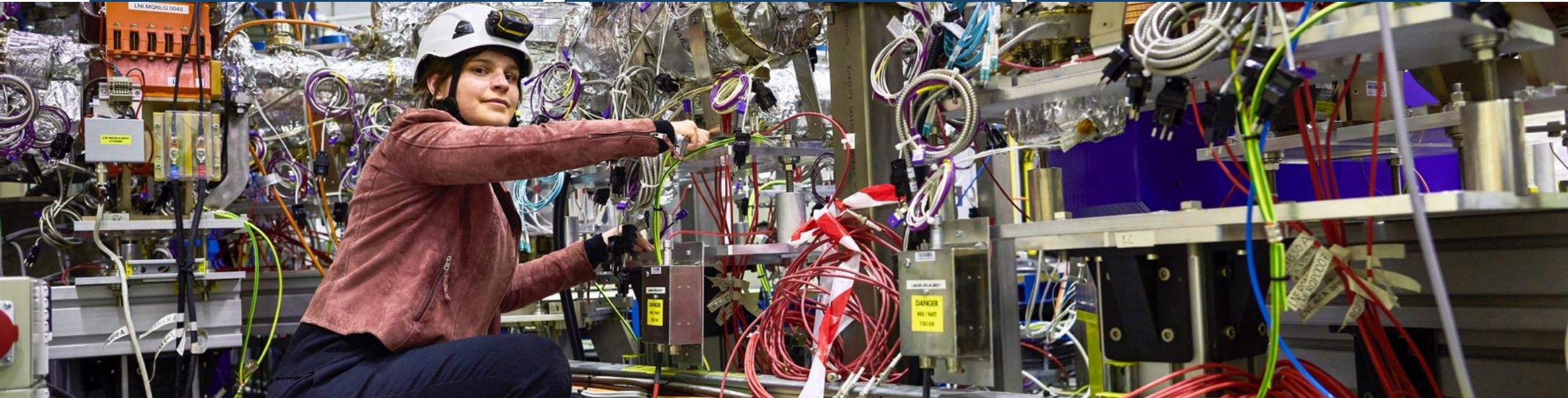
More than 1000 Petabytes of CERN data stored world-wide.

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?

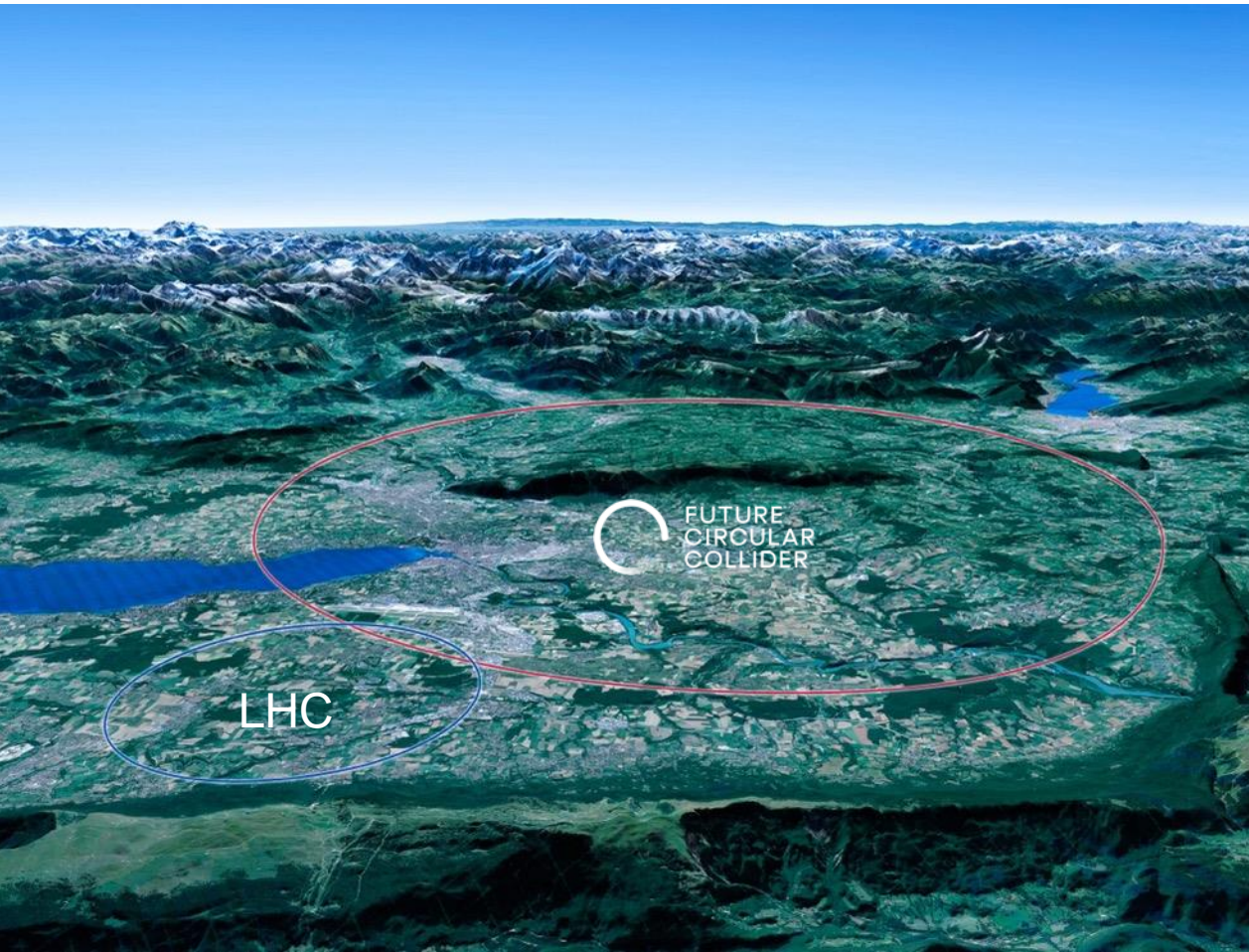
Why is the universe
made only of matter,
with hardly any
antimatter?

Why is gravity so weak
compared to the other
forces?

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 (2030-2041)
- 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





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

4 Observers

Japan – USA – European Union – UNESCO

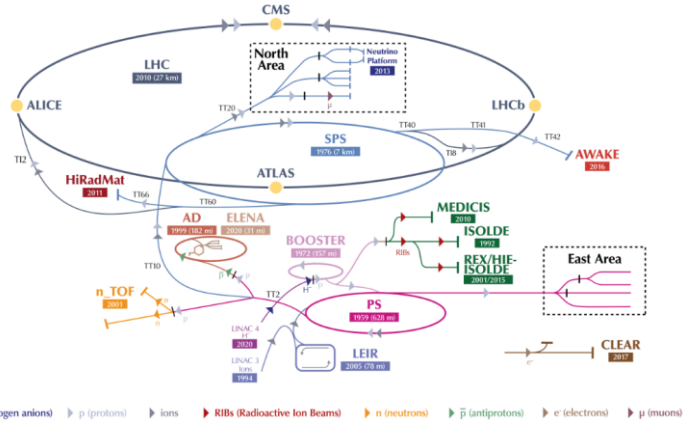
Around 50 Cooperation Agreements with non-Member States and Territories

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

The CERN accelerator complex
Complexe des accélérateurs du CERN



19 MEDICIS
 Medical Isotopes Collected from ISOLDE
 158 ISOLDE
 Isotope mass Separator On-Line facility
 PSB
 Proton Synchrotron Booster
 8 50

7 BASE
 Baryon Antibaryon Symmetry Experiment
 11 ASACUSA
 Atomic Spectroscopy and Collisions Using Slow Antiprotons
 16 ALPHA
 Antihydrogen Laser Physics Apparatus
 11 GBAR
 Gravitational Behaviour of Antihydrogen at Rest
 17 AEGIS
 Antihydrogen Experiment:
 Gravity, Interferometry, Spectroscopy
 ELENA
 Extra Low-Energy Antiproton
 AD
 Antiproton Decelerator

19 CLOUD
 Cosmics Leaving Outdoor Droplets
 PS
 Proton Synchrotron
 41 n_TOF
 Neutron Time-of-Flight Facility
 IRRAD
 Proton Irradiation Facility
 CHARM
 Mixed-Field Irradiation Facility
 5 29

10 56

1 2

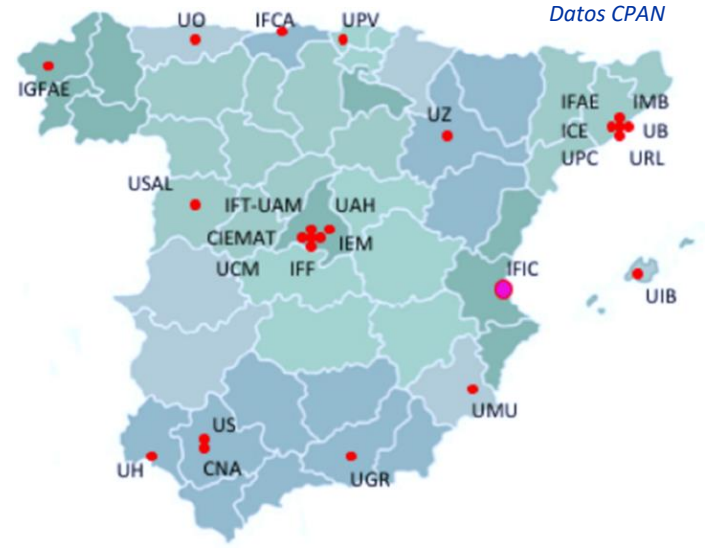
11 AWAKE
 Advanced Wakefield Experiment
 144 NEUTRINO PLATFORM
 UA9 6
 Crystal
 GIF
 Gamma Irradiation Facility
 SPS
 Super Proton Synchrotron
 HiRadMat
 High-Radiation to Materials
 AMS Control Centre 37
 Alpha Magnetic Spectrometer
 Payload Operations Control Centre

19 FASER
 Forward Search Experiment
 33 SND@LHC
 Scattering and Neutrino Detector at the LHC
 LHC
 Large Hadron Collider
 99 LHCb
 Large Hadron Collider beauty
 10 MoEDAL
 Monopole and Exotics Detector at the LHC
 LHCf 6
 Large Hadron Collider forward
 ATLAS 266
 A Toroidal LHC Apparatus
 ALICE 168
 A Large Ion Collider Experiment
 CMS 241
 Compact Muon Solenoid
 TOTEM 11
 Total Cross Section, Elastic Scattering
 and Diffraction Dissociation Measurement at the LHC
 5 150

1 6

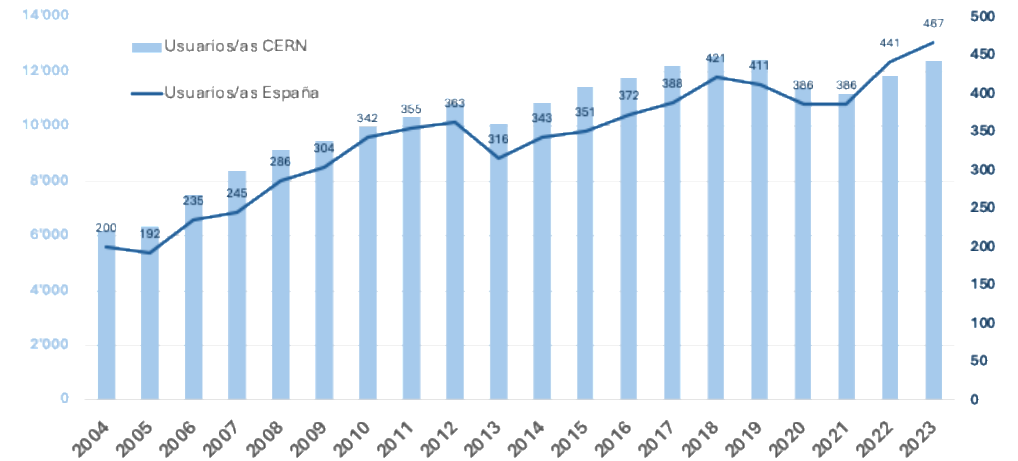
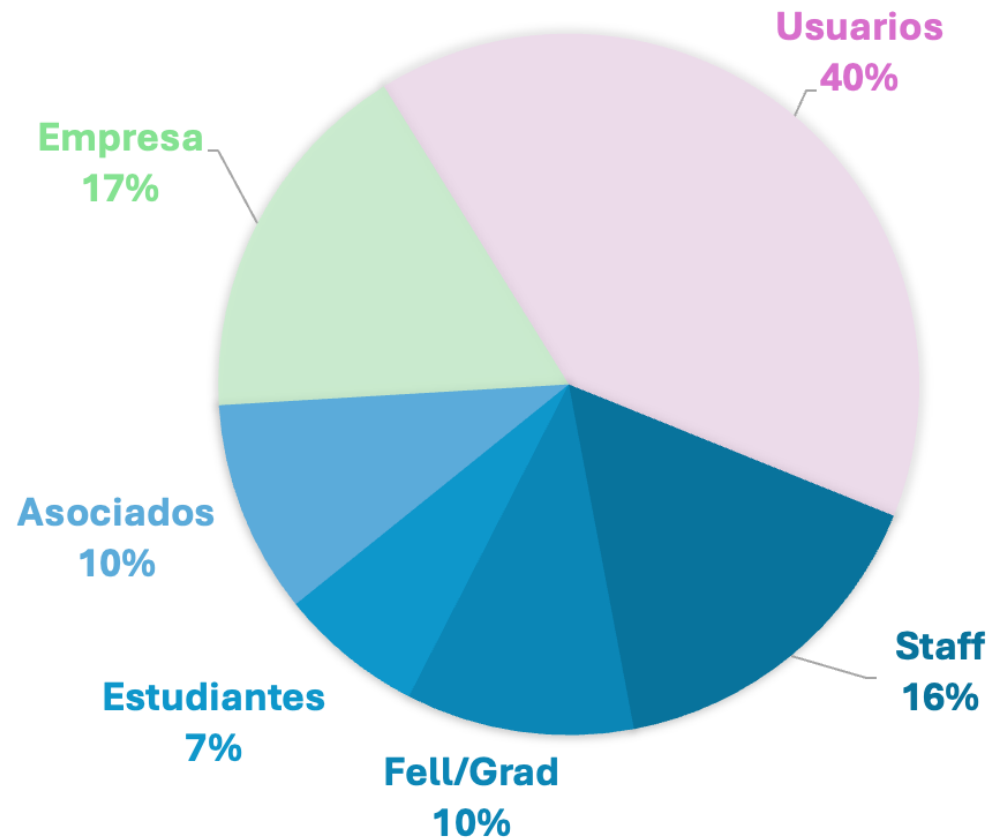
5 81

6 113

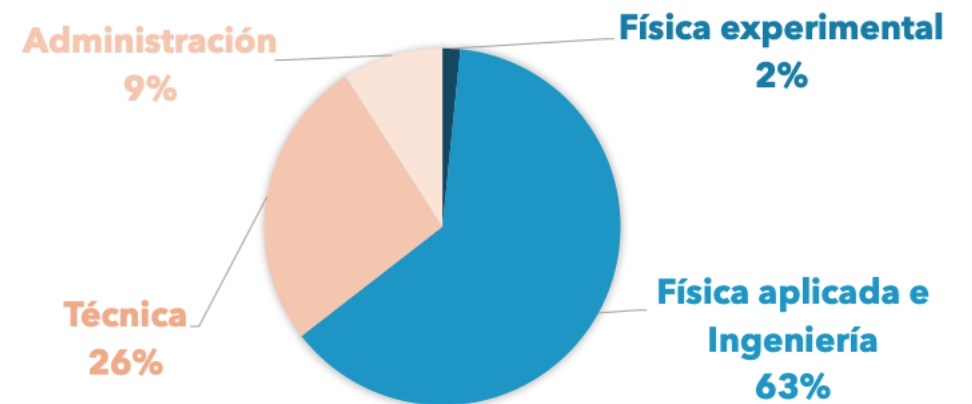


Spain @ CERN

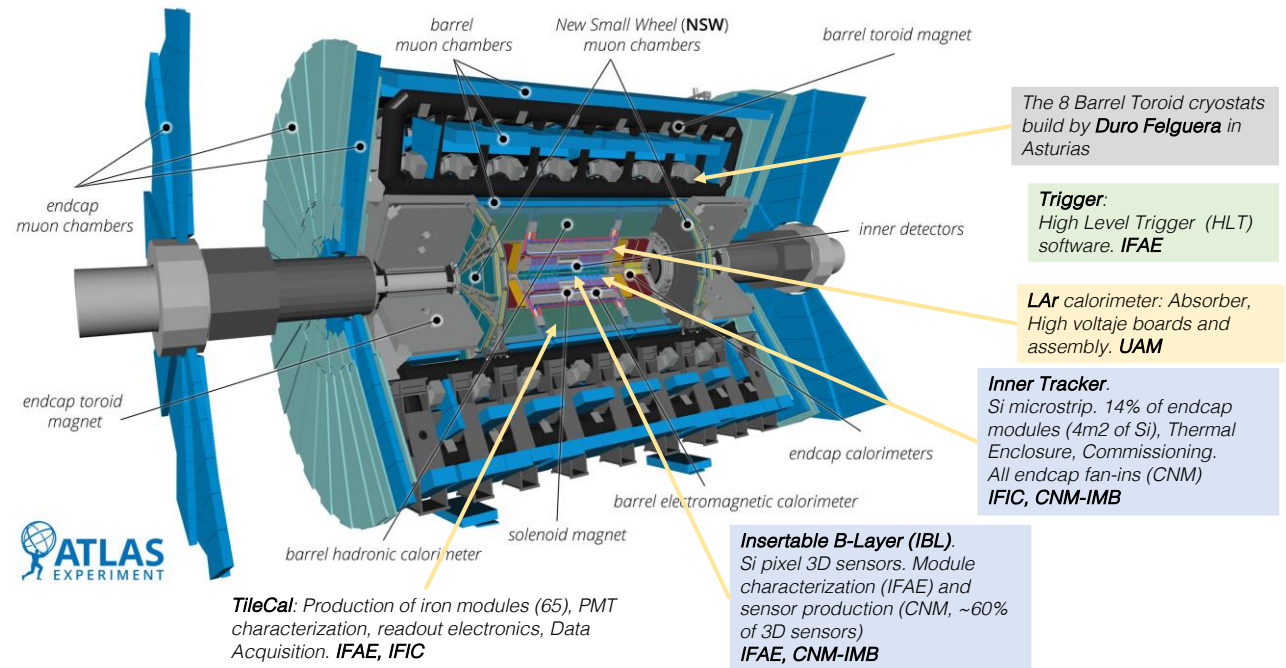
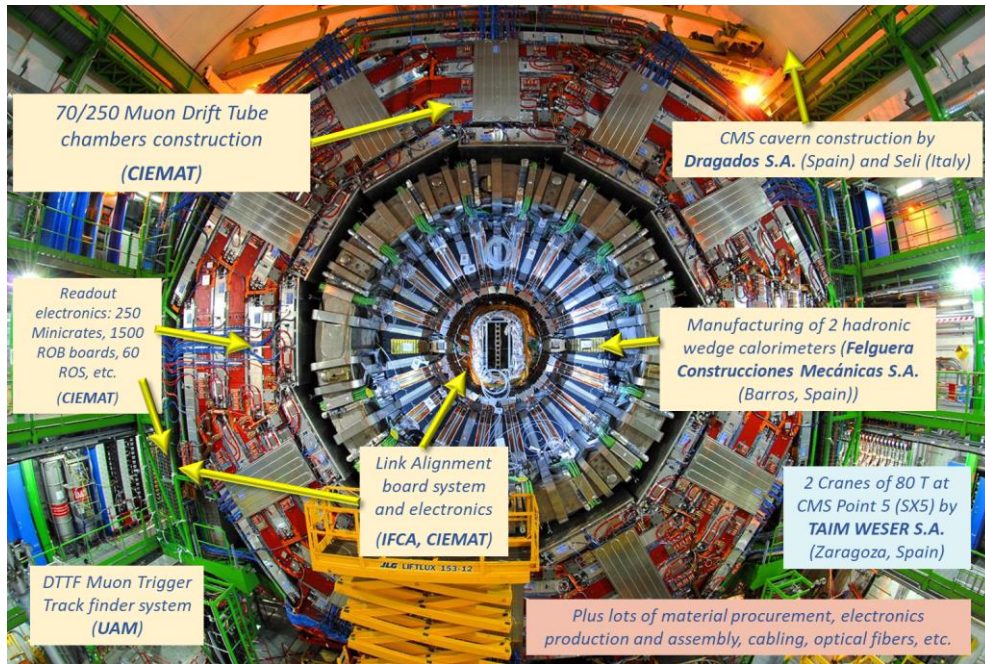
>1200 españoles/as relacionados con el CERN



>70% personal (staff) académico



Spain has made large contributions to LHC detector construction

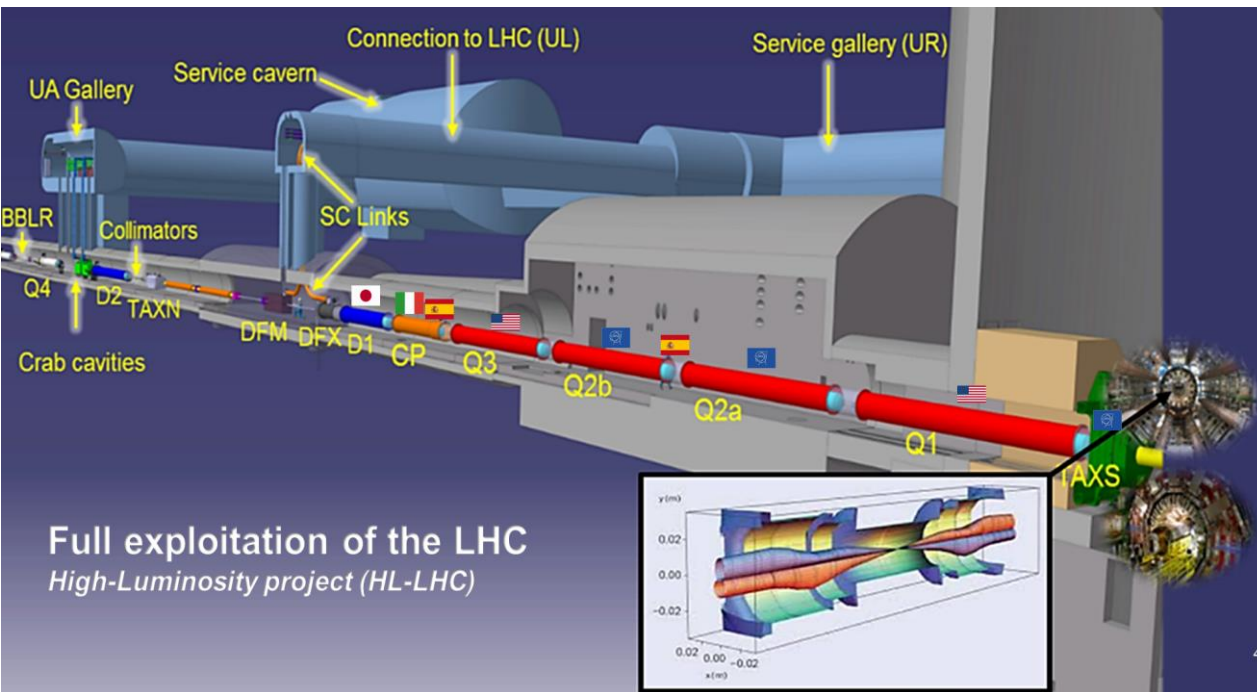
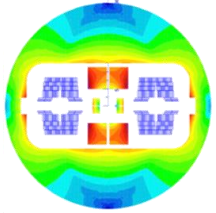


Spain historical contribution from Spanish companies and institutions, example of the CMS and ATLAS detectors

Spanish Institutes have been also very proactive on the Nuclear Physics domain, contributing to several initiatives in n-ToF and ISOLDE e.g. IDS, TAL, MINIBALL, T-REX, etc. and in THEORY



Spain is collaborating on forefront High Field Magnet technology involving Spanish Industry



- Spain also actively participates in European Grid activities
- Spain contributes in-kind to the HL-LHC project by supplying the Nested orbit correctors
- Spain is a strong partner of the High Field Magnet R&D program launched by CERN in a tripartite CERN-CIEMAT-CDTI (~30.4 MCHF)
- Spain is collaborating on Technologies for Ion Therapy centres

Spain flag pointing the in-kind contribution for HL-LHC Project (2.4% of the in-kind)



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

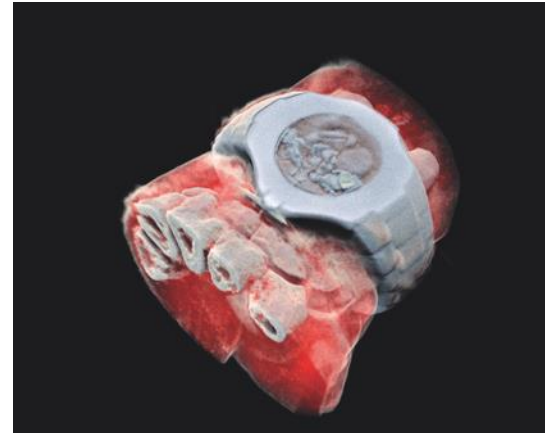
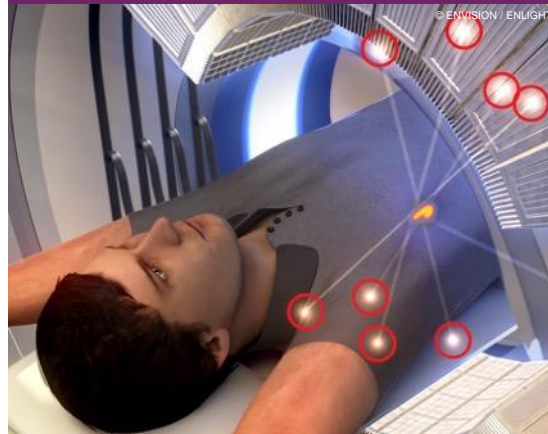
Medical imaging, cancer therapy, material science, cultural heritage, aerospace, automotive, environment, health & safety, industrial processes.

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



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

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



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

CERN produces innovative radioisotopes for nuclear medicine research.



A group of students, both male and female, are wearing hard hats (yellow and blue) and are focused on working with a large, complex piece of equipment. The equipment is mounted on a metal frame and has a large black cylindrical component. The students are looking intently at the equipment, with some reaching out to touch it. The background shows a laboratory or workshop environment with various cables and equipment. A green exit sign is visible on the wall. A teal circular graphic is overlaid on the left side of the image, containing the text 'EDUCATION & TRAINING'.

EDUCATION & TRAINING

CERN's training, education and outreach programmes

1002 graduates
(including Research Fellows)

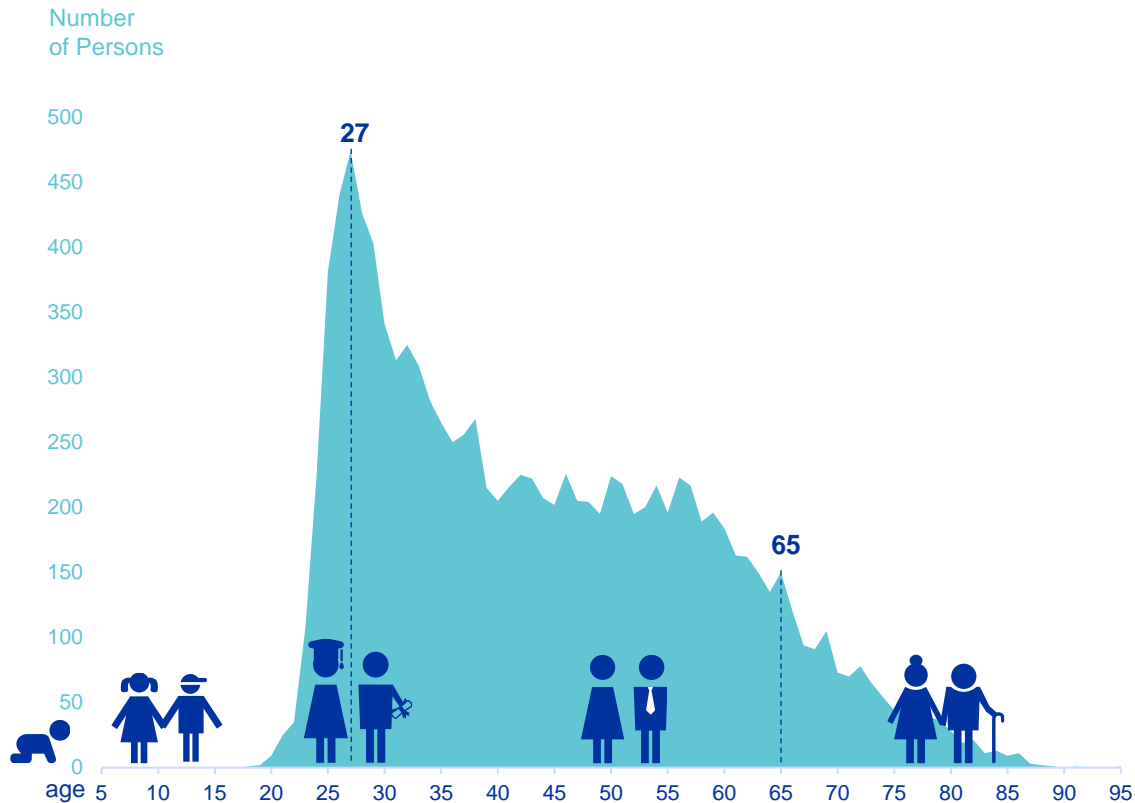
3 000 PhD students

300 Undergraduate students in
Summer programmes

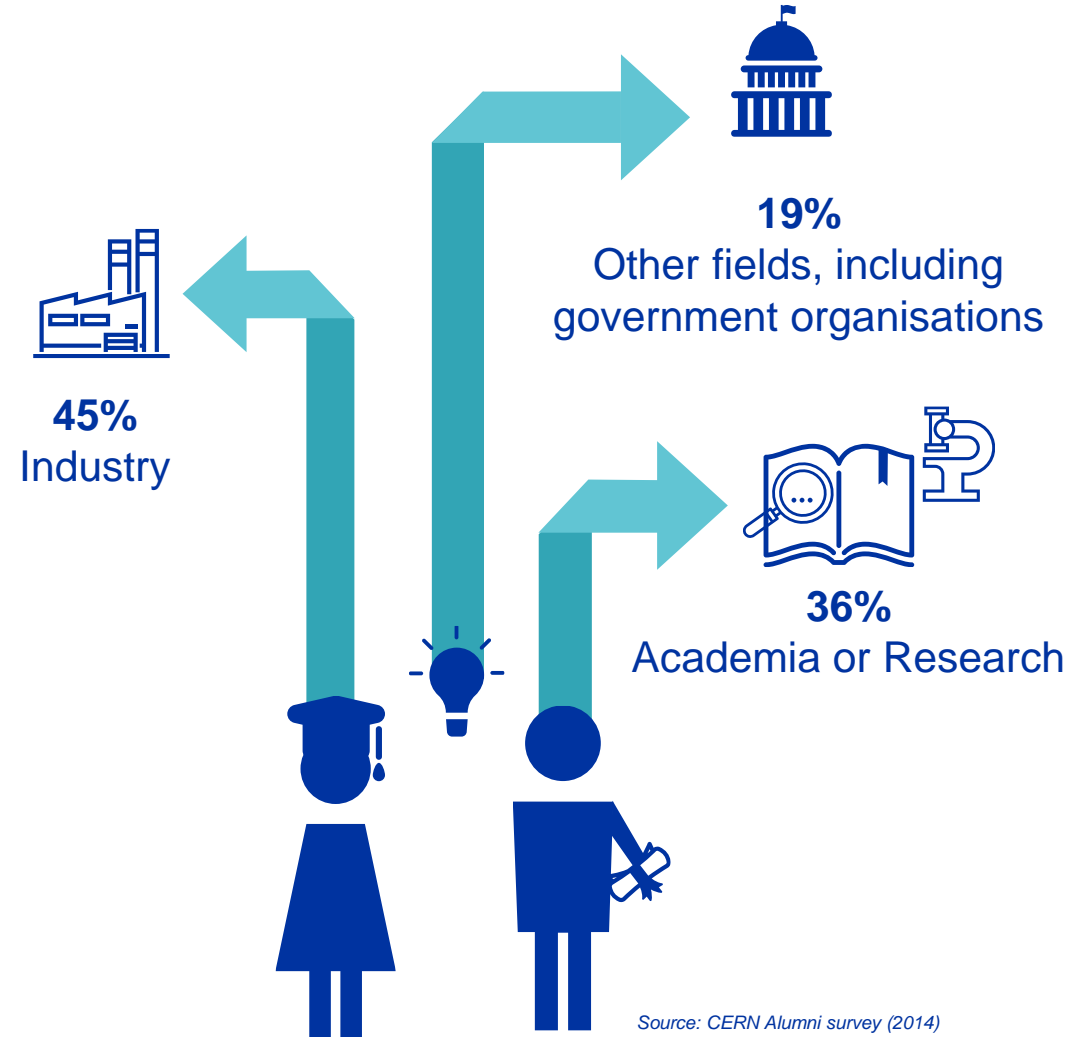


> 15 000 teachers participating in dedicated programmes since 1998

CERN opens a world of career opportunities



Age Distribution of Scientists working at CERN



PhD and Technical students leaving CERN

Source: CERN Alumni survey (2014)

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.

IdeaSquare



2021-2022-2023 in a nutshell

Although the physical doors to IdeaSquare were closed in 2021 due to COVID restrictions, we were open for virtual activities throughout that year and into early 2022. We finally reopened completely in March 2022, and astonishingly returned to (and even enhanced!) our pre-pandemic numbers.

+1,400
students and growing!

~x3 yearly increase in the number of students after COVID

207 students in 2021 (virtual students because of the pandemic)

651 students in 2022
551 students in 2023

In the last 3 years, the number of external institutions we collaborate with rose from **36 to more than 50**. Welcoming so many multidisciplinary students from these establishments gives I2 a unique intercultural approach that endows our ideas with amazing potential. Today, IdeaSquare's room capacity is about to reach its limit.

Since collaboration requests are growing, shouldn't we consider building an extension?

+40% increase in the number of collaborating institutions compared to the 2019-2020 period

+75% occupancy rate since I2 reopened after COVID

+40% occupancy rate at the weekends in 2023

40 CERN departments/groups using I2 prototyping facilities

Committed collaborators

140
university lecturers

366
authors published in CIJ

+2,300
students so far

+50
collaborating institutions

75 CERN personnel using I2 prototyping facilities

43 CERN staff involved in educational activities

Activities held

R&D&I projects

+15 collaboration projects with CERN

European projects

2 ongoing projects (ATTRACT + Crowd4SDG)

Events

+130 Total events

Prototype workshops

+100 participants on FPGA prototyping courses

20 CERN projects prototyped at IdeaSquare

Special events **39**

Education programmes

+200 student projects/prototypes developed

+200 societal challenges addressed

Fun facts

+42,700 cups of hot beverages consumed:

57% black coffee (including espresso)

22% hot water (tea)

11% hot milk (hot chocolate)

10% coffee with milk (including cappuccino)

+201,200 total cups of hot beverages since I2 opened

+2 types of wildflowers unexpectedly grew at our front door

