

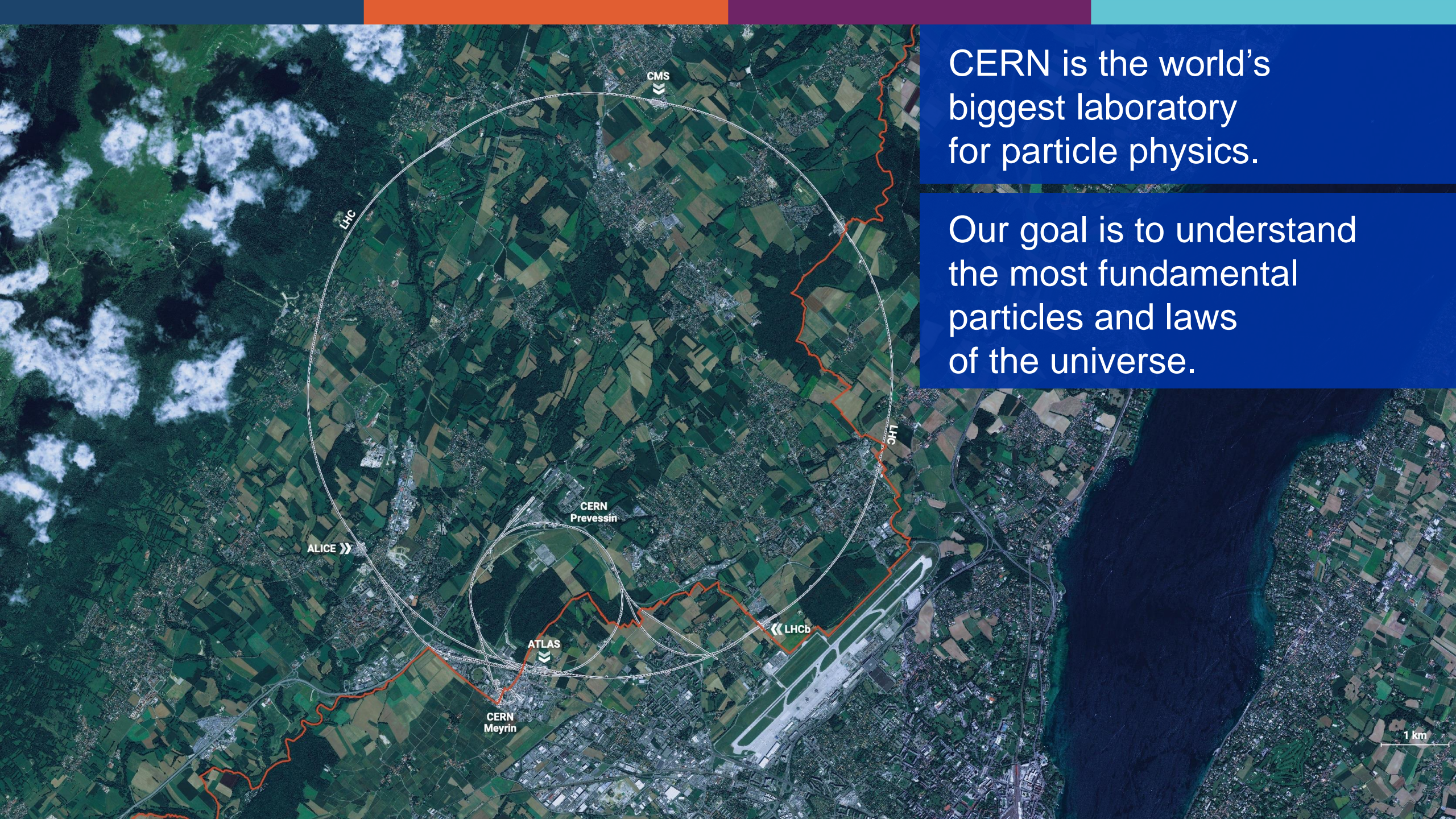




Introduction to CERN

On the occasion of the 30th anniversary of
CERN Membership of the Slovak Republic



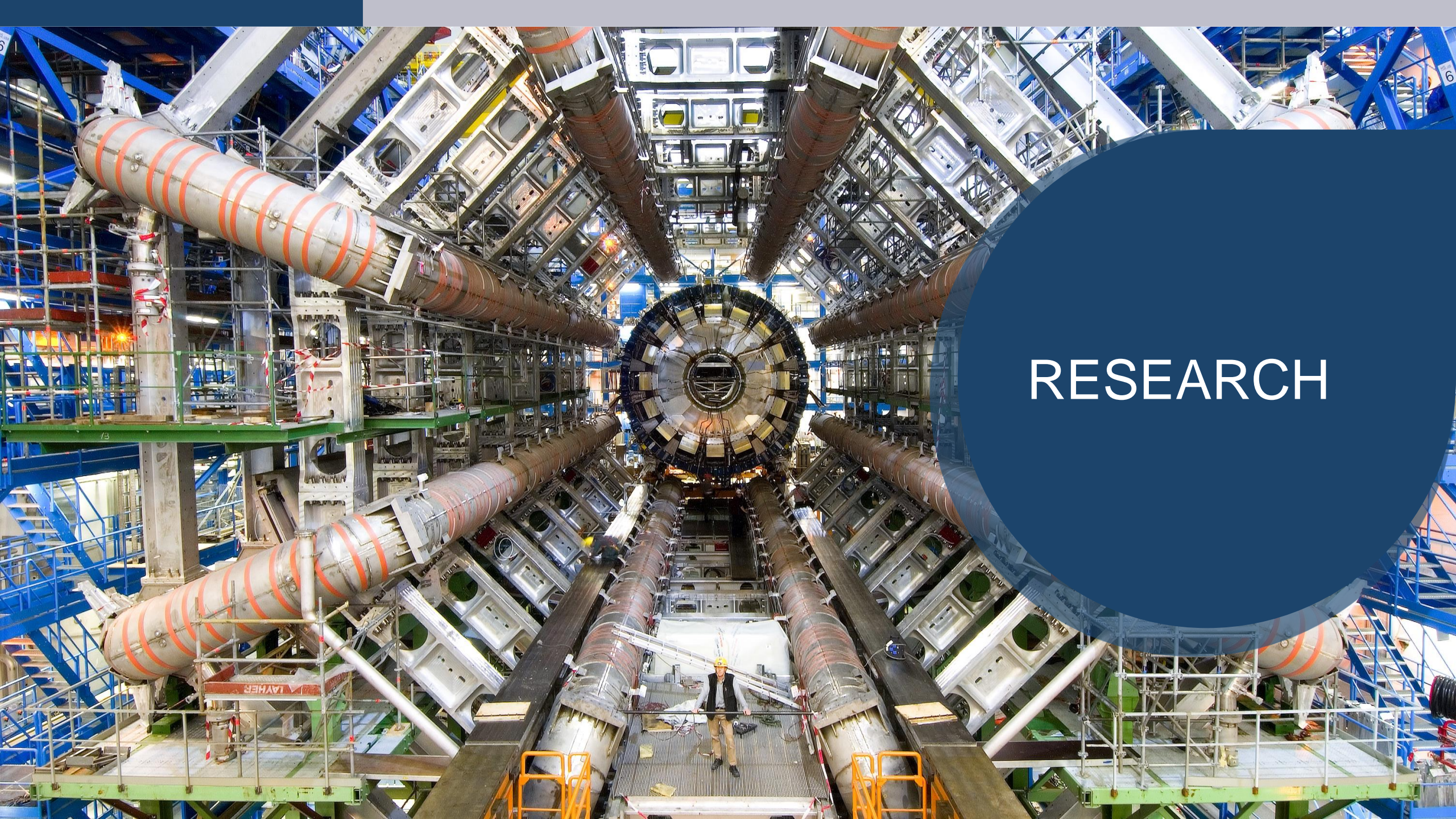


CERN is the world's biggest laboratory for particle physics.

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

Four pillars underpin CERN's mission

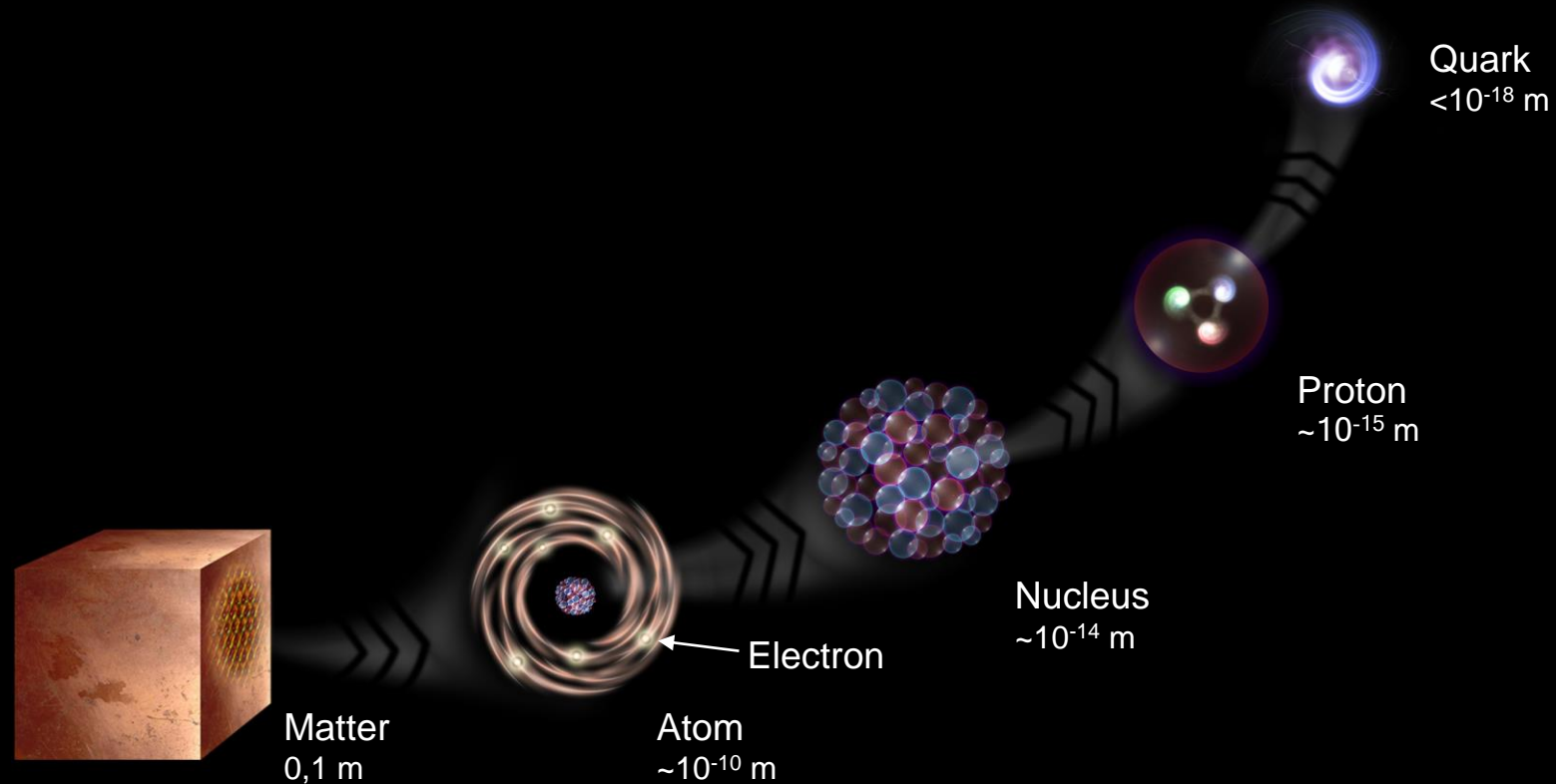


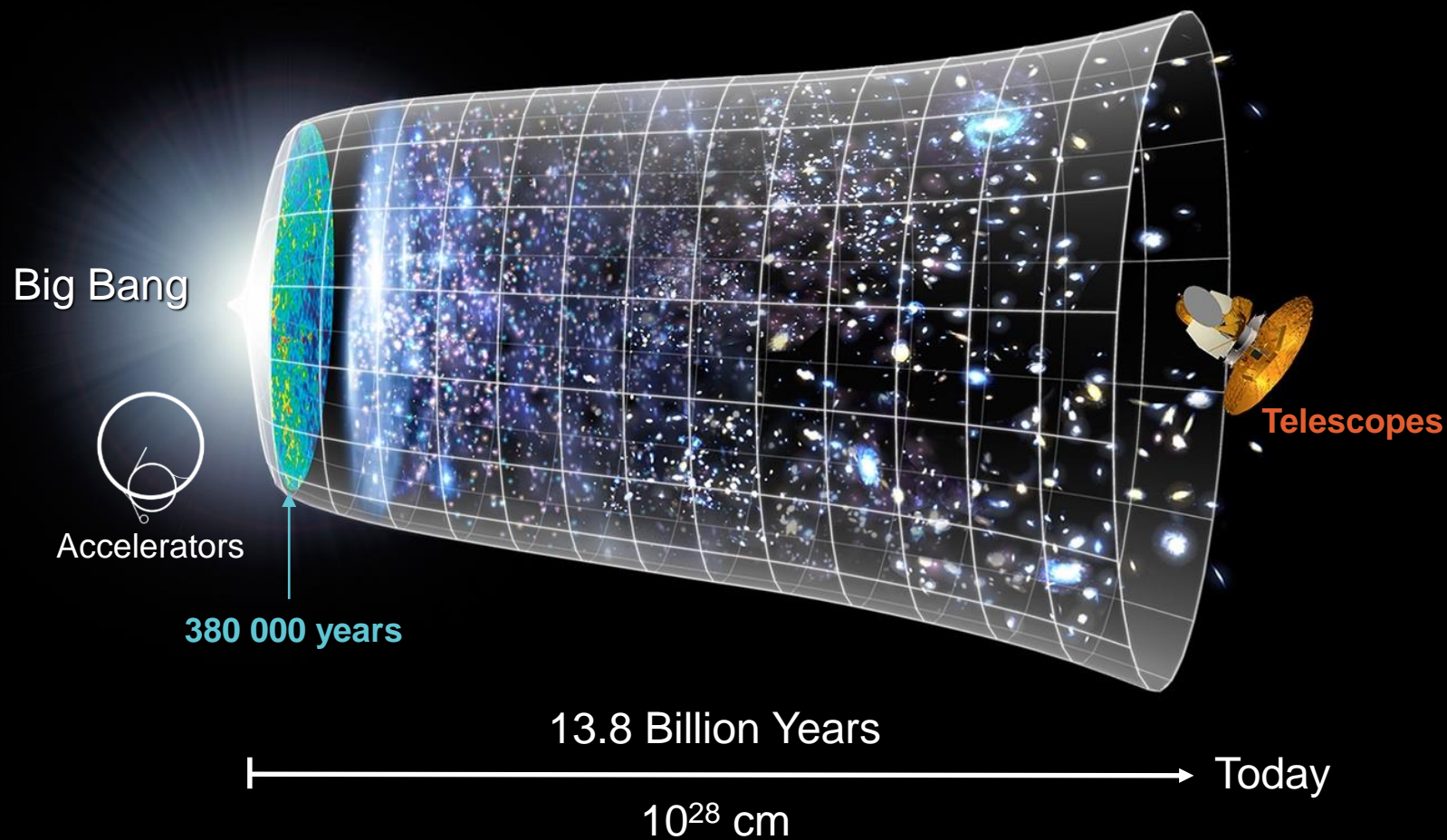


RESEARCH

What is the universe made of?

We study the elementary building blocks of matter and the forces that control their behaviour





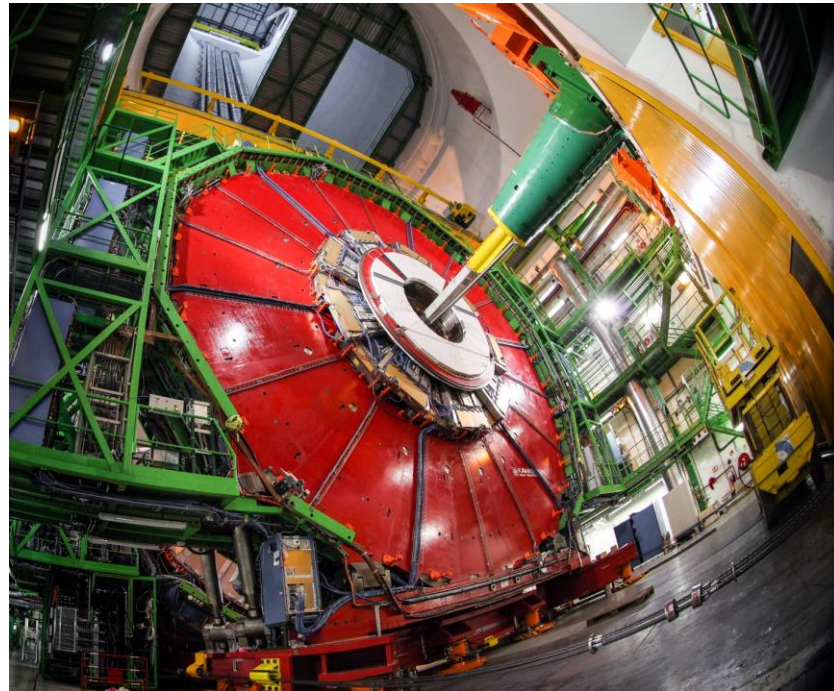
How did the universe begin?

We reproduce the conditions a fraction of a second after the Big Bang, to gain insight into the structure and evolution of the universe.

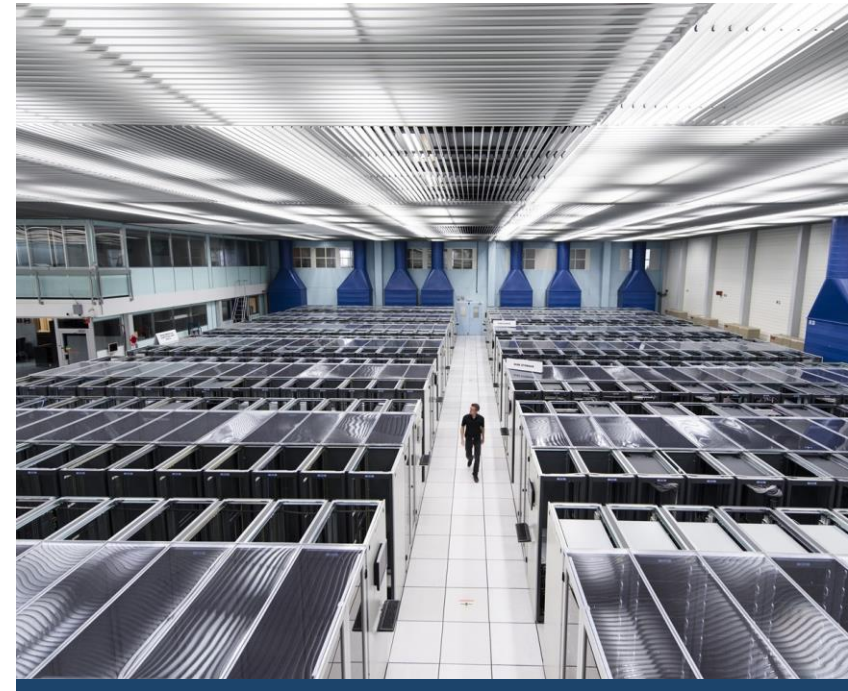
We develop technologies in three key areas



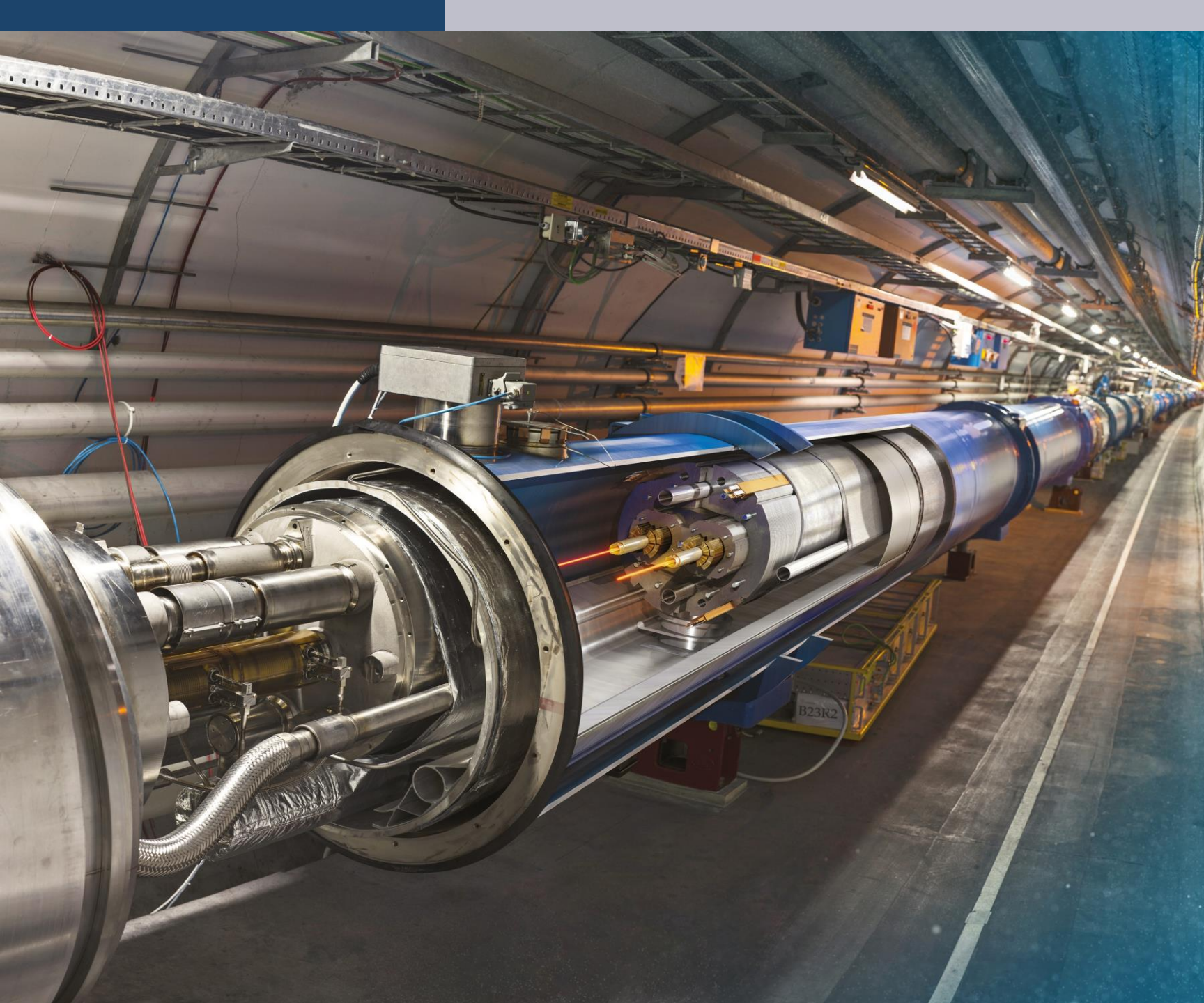
ACCELERATORS



DETECTORS



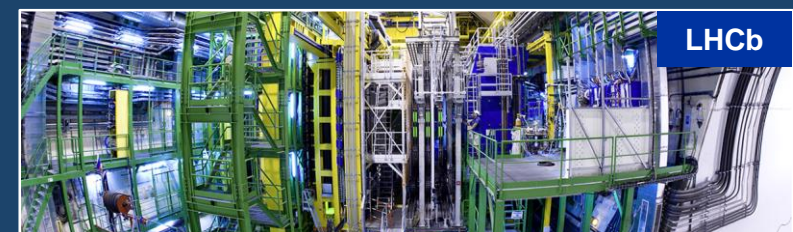
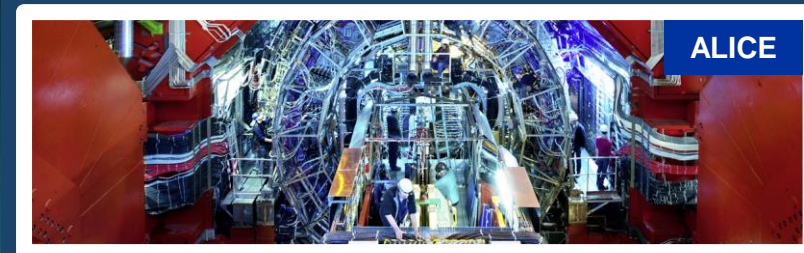
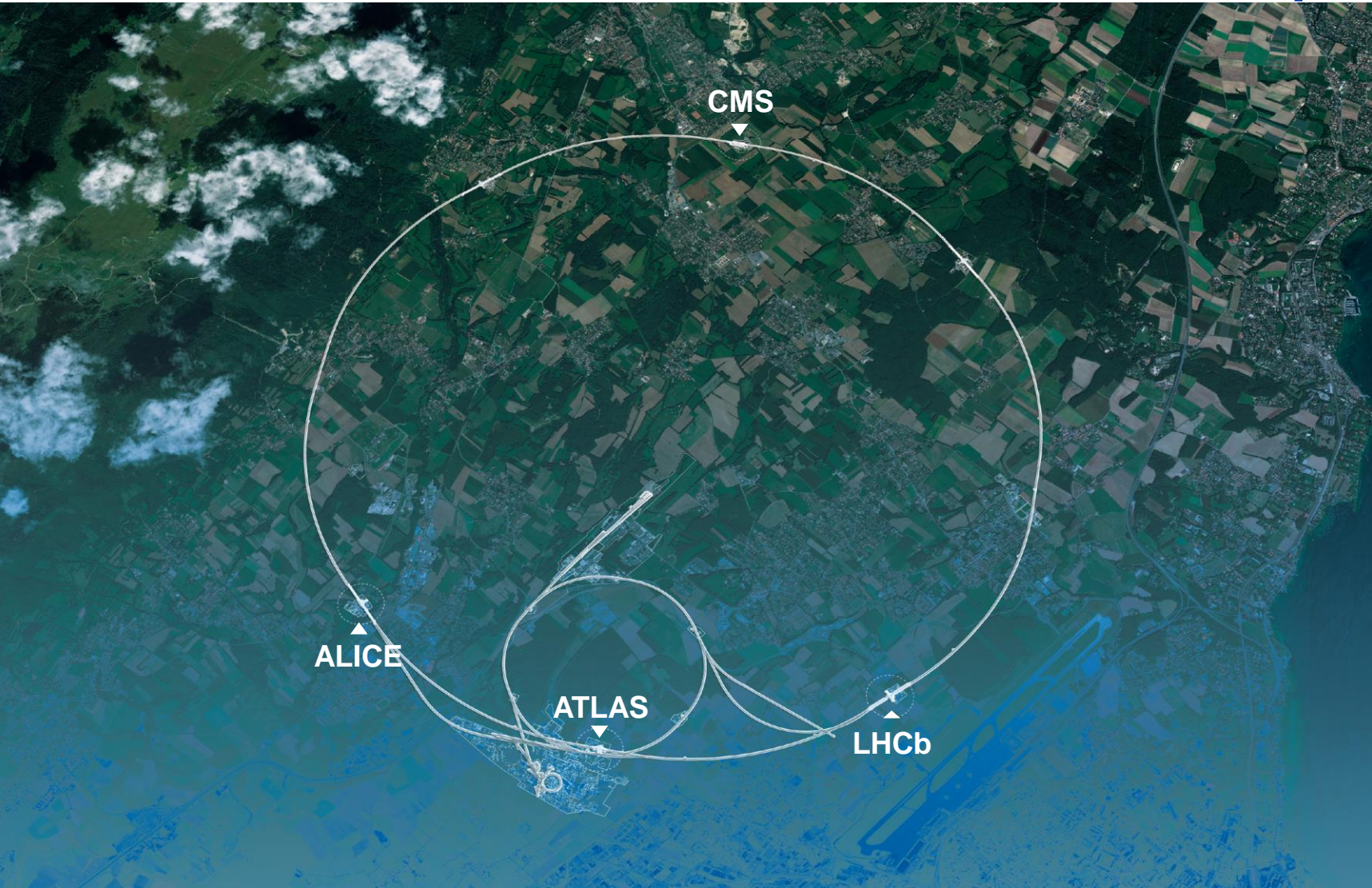
COMPUTING



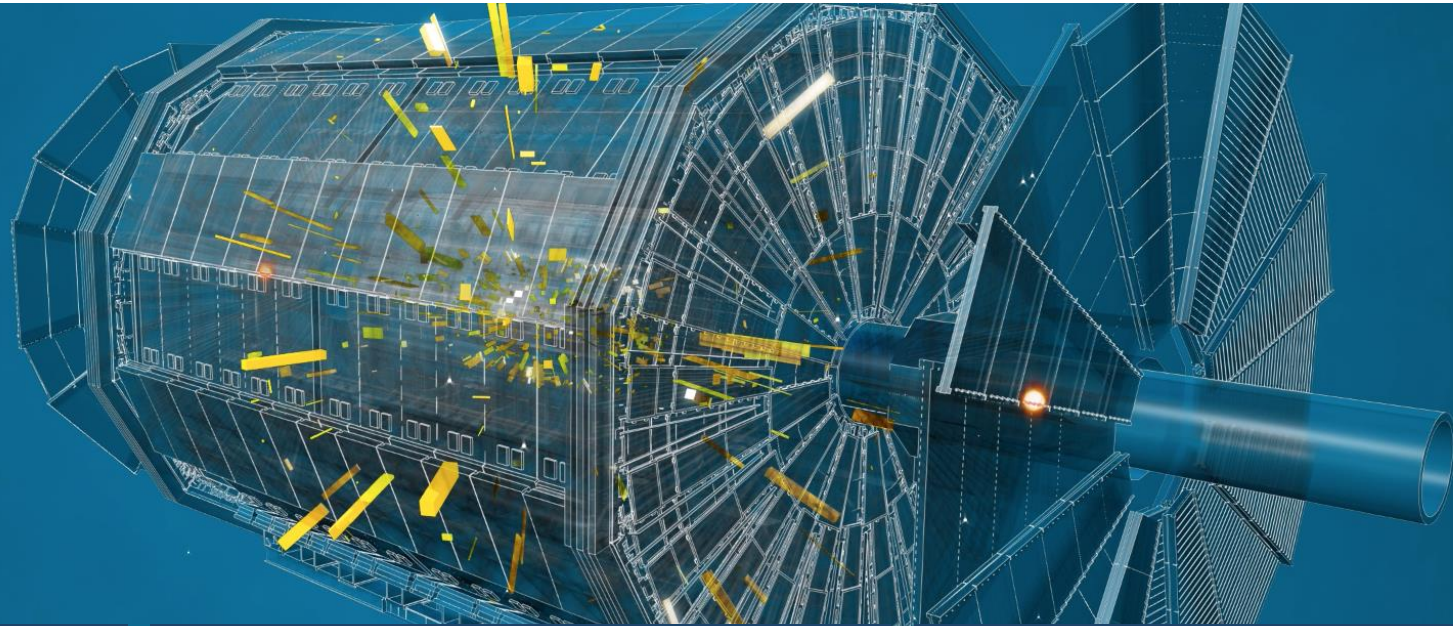
Large Hadron Collider (LHC)

- 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 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.

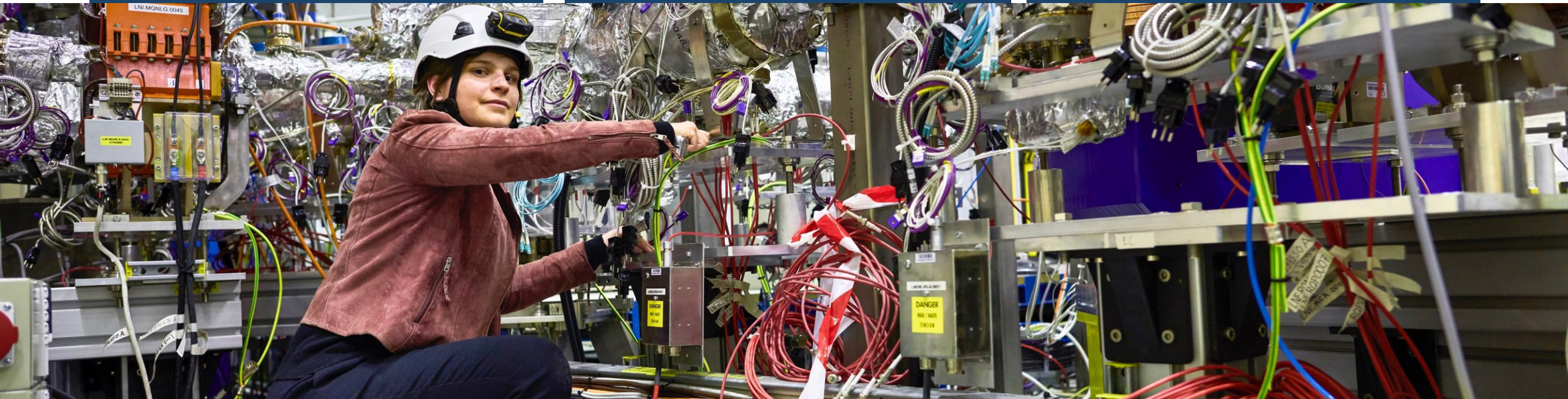
More than 1000 Petabytes of CERN data stored world-wide.

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

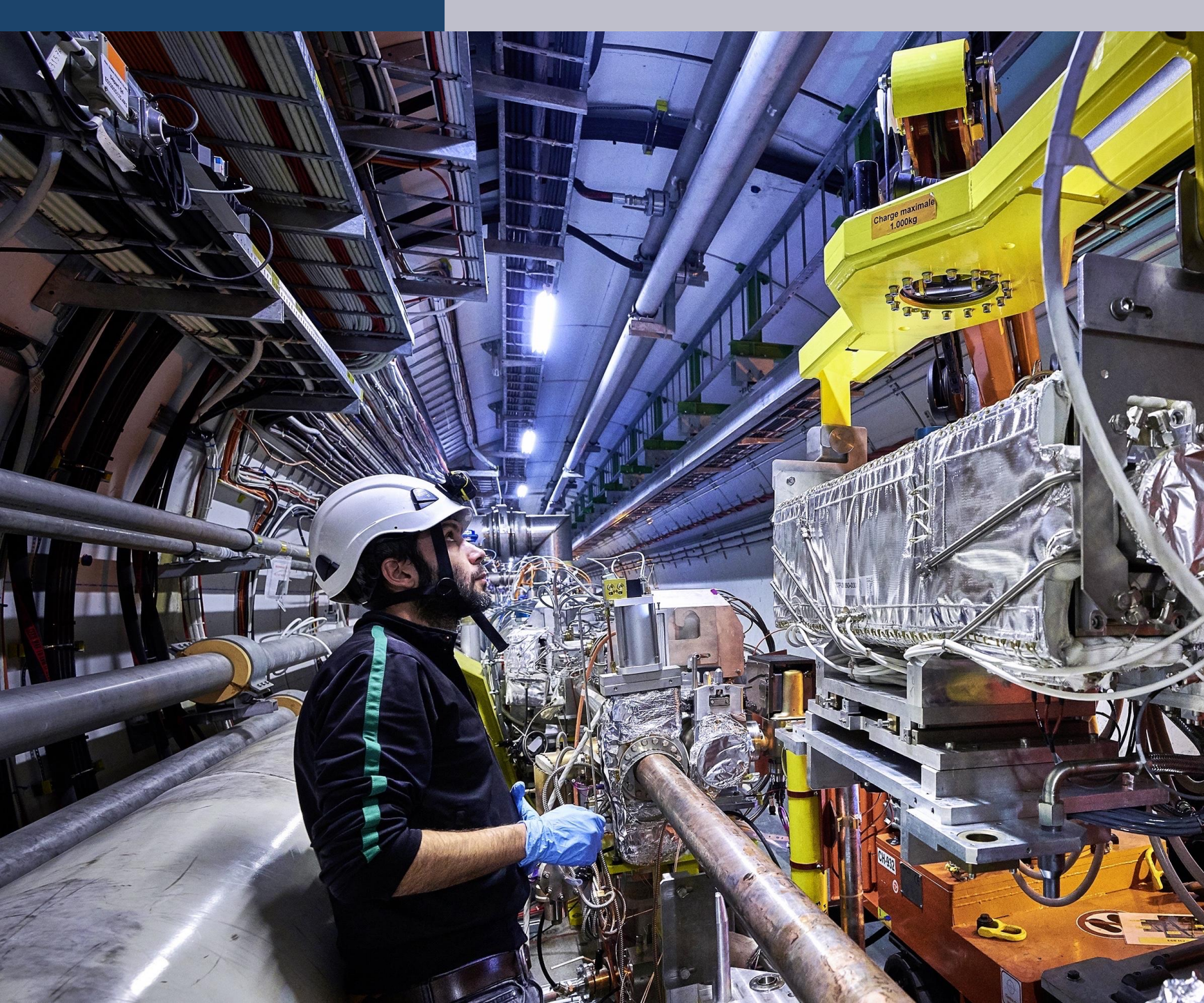
Including

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 approx. 2040.

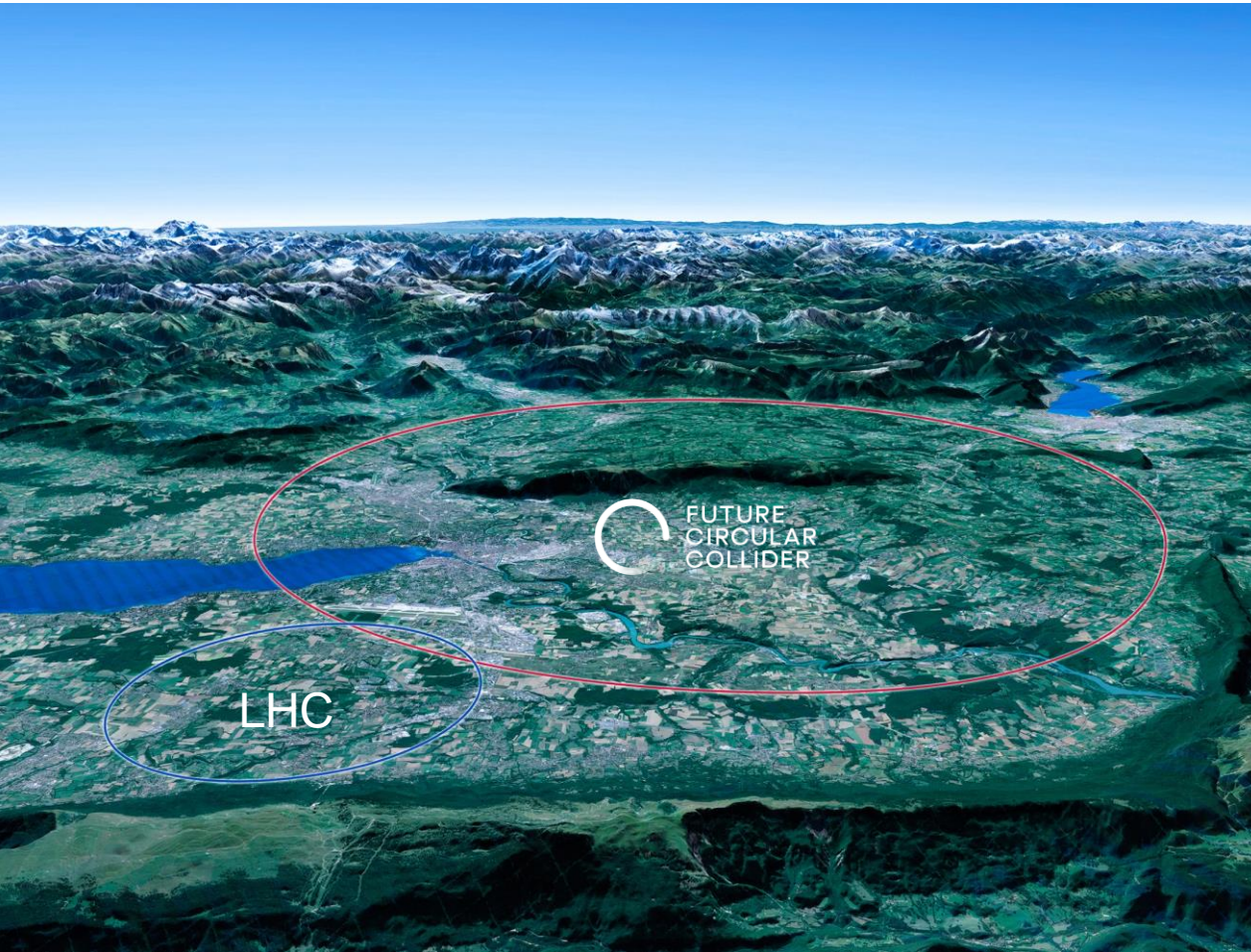


Scientific priorities for the future

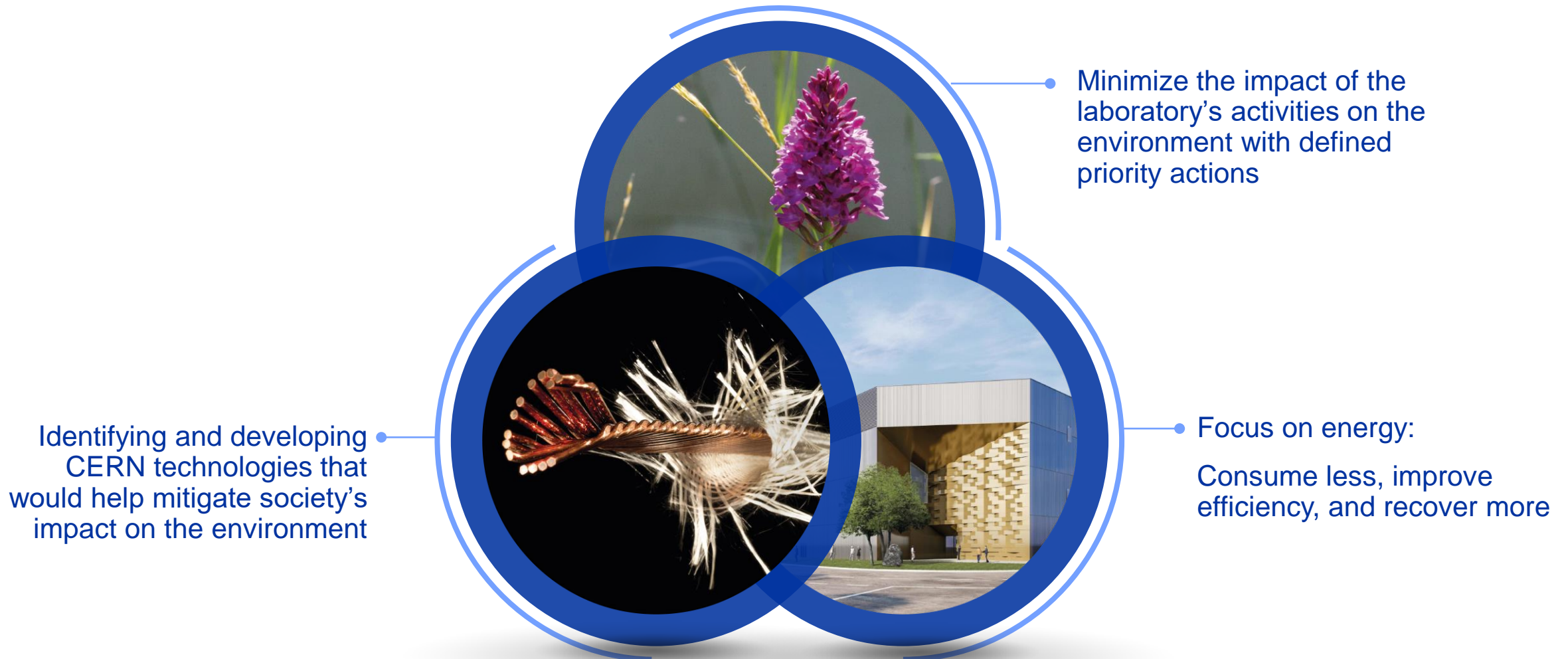
Implementation of the recommendations of the **2020 Update of the European Strategy for Particle Physics**:

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

We hope for the Slovak Republic to be an integral part of these efforts.



Committed to environmentally responsible 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

7 Associate Member States

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 – 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

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

As of 31 December 2022
Employees:
2658 staff, **900** fellows

Associates:
11 860 users, **1516** others

A laboratory for people around the world

Distribution of all CERN Users by the country of their home institutes as of 31 December 2022



Geographical & cultural diversity
Users of **110 nationalities**
19.4% women



Member States 7147

Austria 85 – Belgium 129 – Bulgaria 43 – Czech Republic 244
Denmark 49 – Finland 90 – France 844 – Germany 1225
Greece 119 – Hungary 73 – Israel 64 – Italy 1527
Netherlands 169 – Norway 79 – Poland 305 – Portugal 100
Romania 109 – Serbia 33 – **Slovakia 70** – Spain 383
Sweden 103 – Switzerland 406 – United Kingdom 898

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

Cyprus 15 – Estonia 30 – Slovenia 24

Associate Member States 382

Croatia 38 – India 132 – Latvia 16 – Lithuania 14 – Pakistan 35
Türkiye 122 – Ukraine 25

Observers 2991

Japan 216 – Russia (suspended) 873 – United States of America 1902

Numbers for Slovakia



- Personnel by nationality as of 31 December 2022
 - **117 users**
 - **14 staff**
 - **14 fellows**

Non-Member States and Territories 1271

Algeria 2 – Argentina 13 – Armenia 8 – Australia 21 – Azerbaijan 2 – Bahrain 4 – Belarus 18 – Brazil 122
Canada 199 – Chile 34 – Colombia 21 – Costa Rica 2 – Cuba 3 – Ecuador 4 – Egypt 20 – Georgia 32
Hong Kong 15 – Iceland 3 – Indonesia 5 – Iran 11 – Ireland 5 – Jordan 5 – Kuwait 4 – Lebanon 13 – Madagascar 1
Malaysia 4 – Malta 1 – Mexico 49 – Montenegro 4 – Morocco 19 – New Zealand 5 – Nigeria 1 – Oman 1
Palestine 1 – People's Republic of China 333 – Peru 2 – Philippines 1 – Republic of Korea 147 – Singapore 2
South Africa 52 – Sri Lanka 10 – Taiwan 45 – Thailand 17 – Tunisia 2 – United Arab Emirates 7 – Viet Nam 1



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.

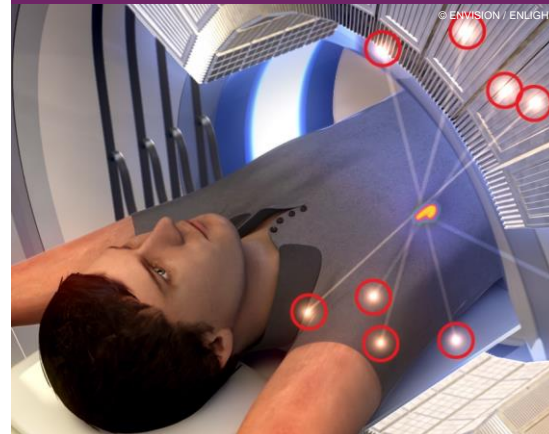
CERN's technological innovations have important applications in medicine and healthcare



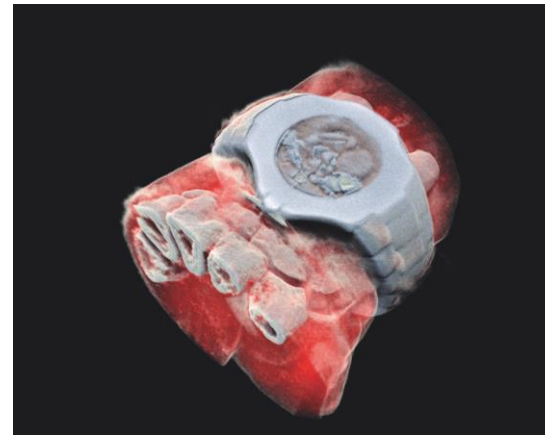
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Accelerator technologies are applied in cancer radiotherapy with protons, ions and electrons.

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

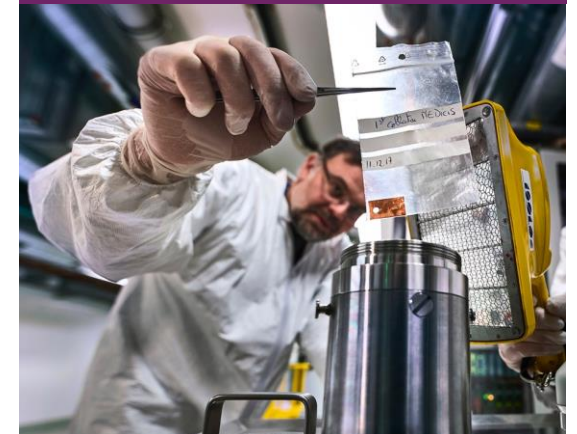


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Pixel detector technologies are used for high resolution 3D colour X-ray imaging.

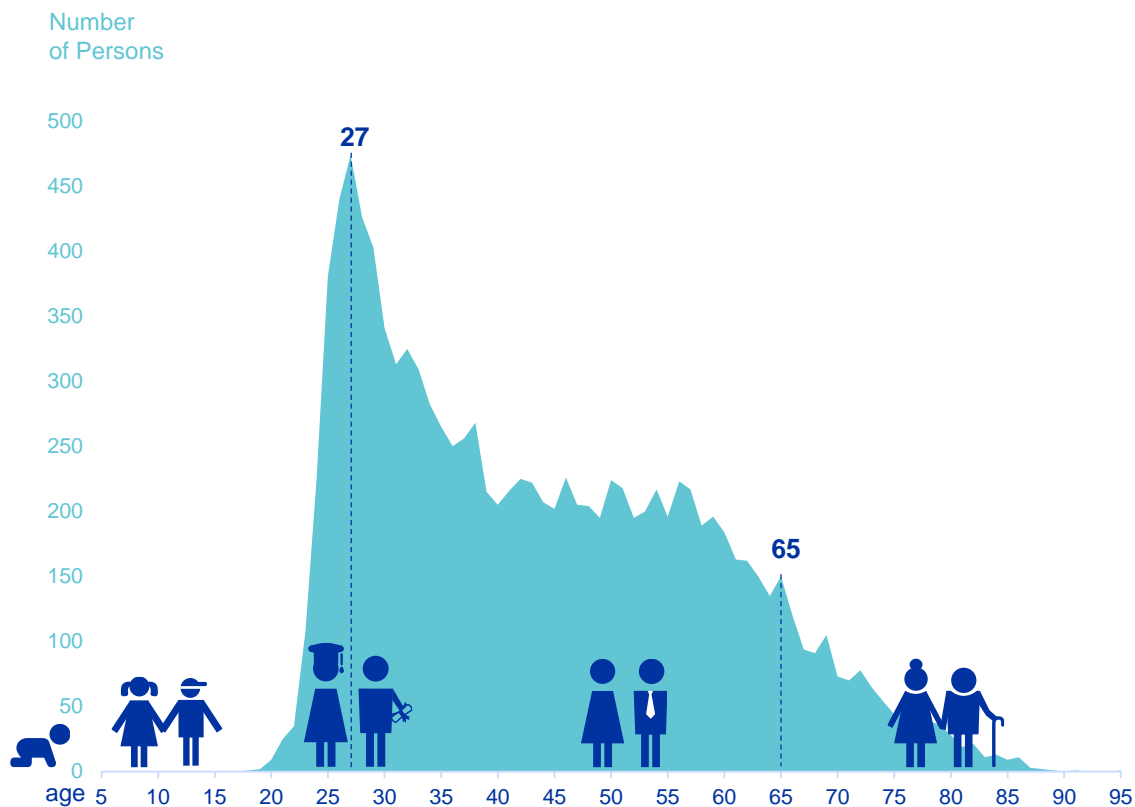
CERN produces innovative radioisotopes for nuclear medicine research.



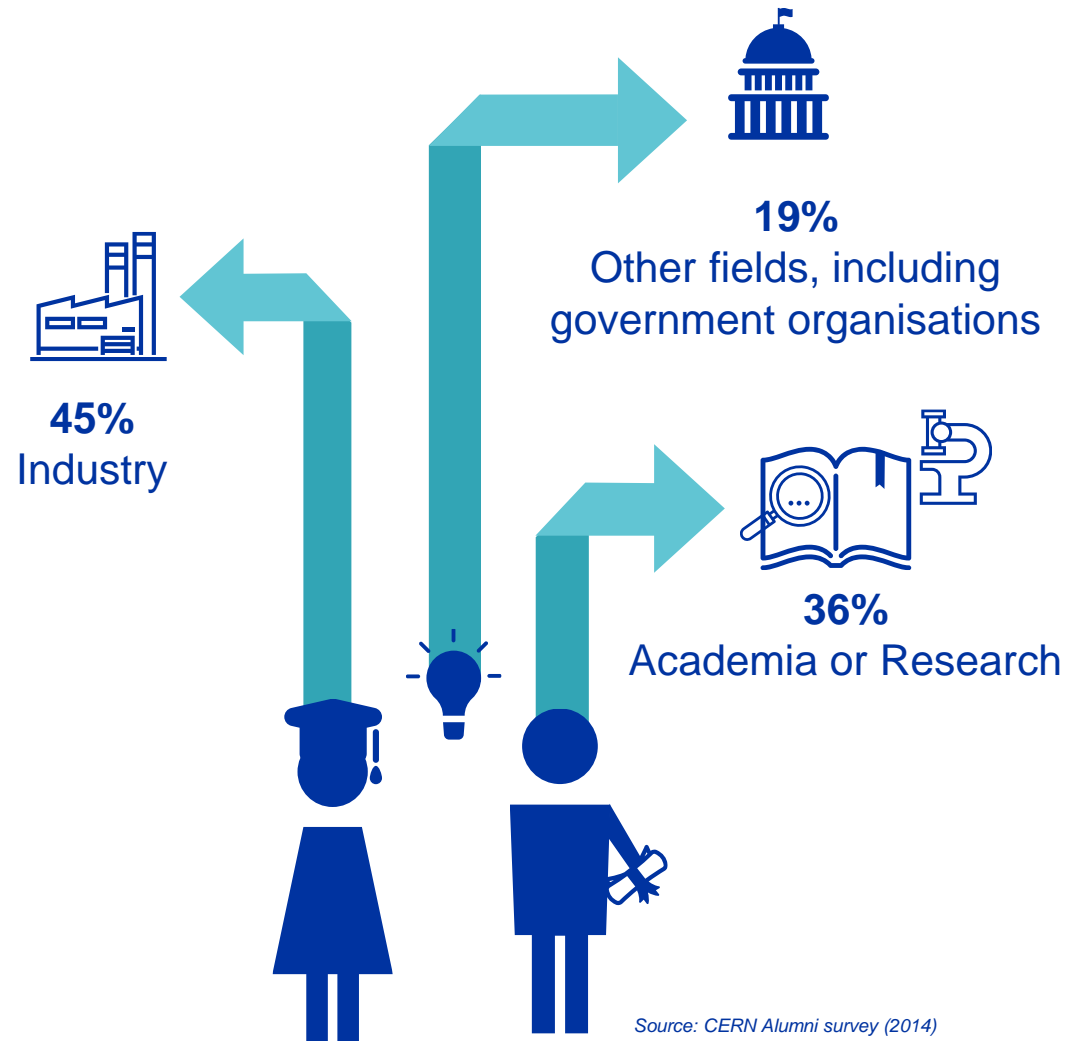
A group of students, both male and female, are wearing hard hats (yellow and blue) and are focused on a large, dark, cylindrical piece of equipment mounted on a metal frame. They appear to be in a laboratory or workshop setting. One student in the foreground is adjusting the equipment. In the background, 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

300 Undergraduate students in Summer programmes
>3000 registered PhD students.

>1000 Fellows, Technical and Doctoral Students in research and applied physics, engineering and computing.

>14 000 teachers since 1998 and >4000 participants in the webinar since 2020.



Some numbers for Slovakia

2 summer students during 2022

307 teachers in Teacher Programmes since 1998

7 teams in BL4S competition since 2014

534 students participating in S'Cool LAB since 2015

151 000 visitors on guided tours of CERN in 2019, from 95 countries.

CERN engages with citizens across the globe: on-site and travelling exhibitions in 15 countries, > 1 million visitors

Science Gateway will open in 2023, expanding CERN's outreach reach and impact, locally and globally.



Slovakia has a strong tradition in particle physics



CERN Member state in 1993

Today research in particle physics is carried out mainly at:

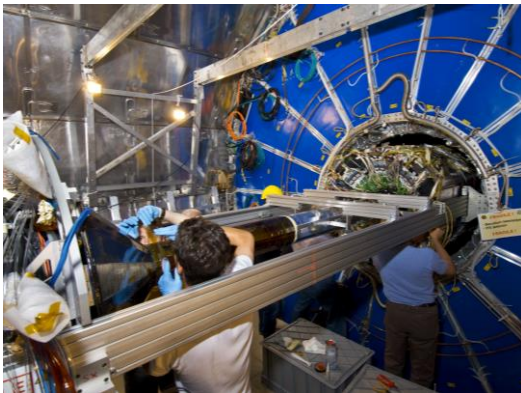
- Comenius University Bratislava
- Šafárik University Košice
- Technical University at Košice
- Matej Bel University at Banská Bystrica
- University od Žilina
- Slovak Academy of Sciences (Bratislava and Košice)

Visit by Her Excellency Ms Zuzana Čaputová, President of the Slovak Republic on Saturday, 21 May 2022.

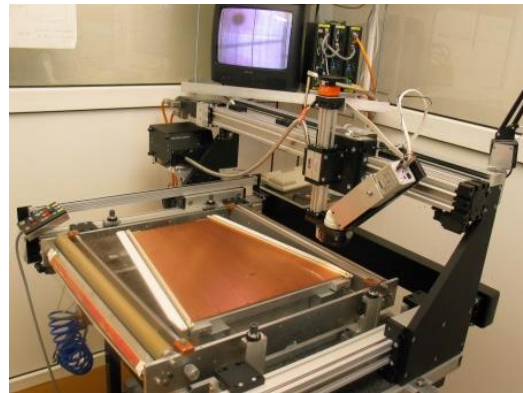


Slovakia has a wide-ranging involvement in the LHC programme

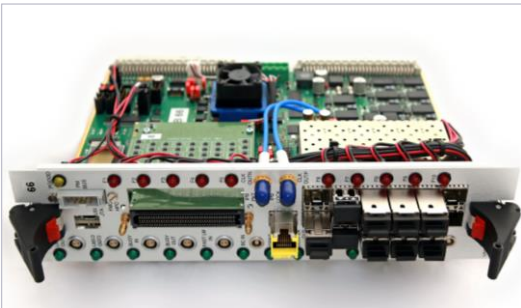
Contribution to ALICE experiment



ALICE pixel detector was developed, installed and operated with strong Slovak participation

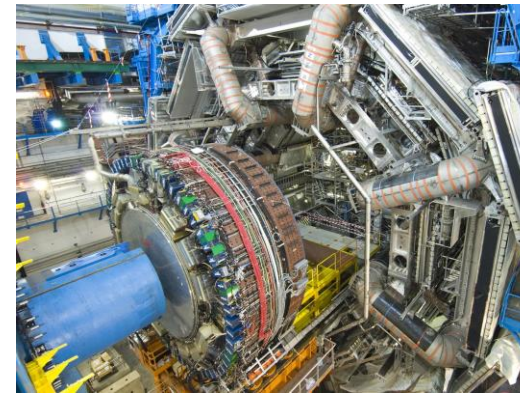


Inner modules of ALICE TPC were developed and produced in Slovakia

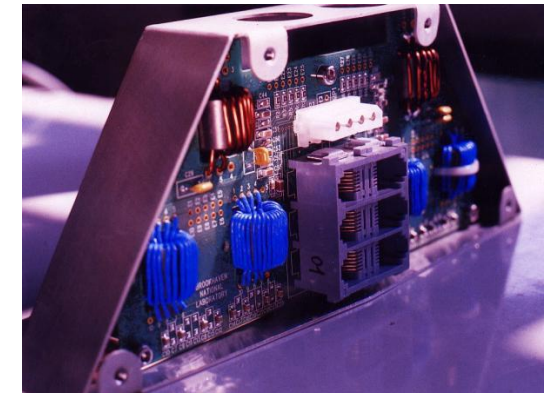


Slovak colleagues developed and operate core components of ALICE readout and Central Trigger System

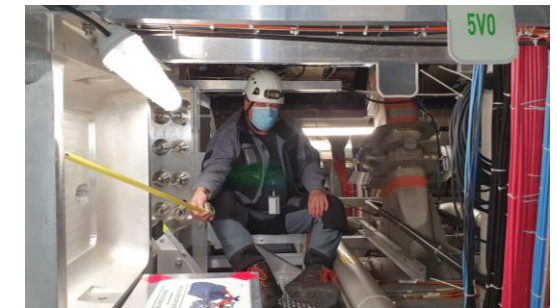
Contribution to ATLAS experiment



ATLAS Liquid Argon Calorimeter largely relies on electronics developed by Slovak engineers



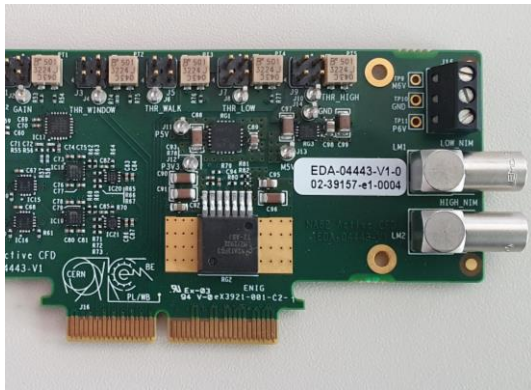
Several components, like filter boxes, were developed and produced in Slovakia



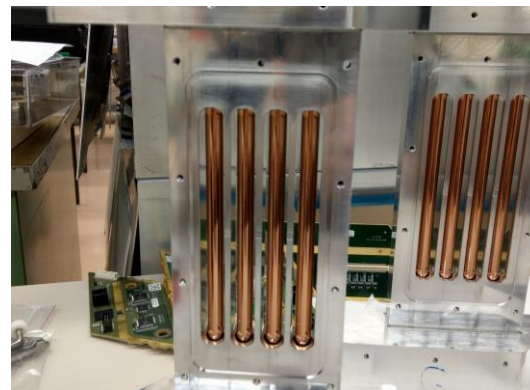
Not only Slovak hardware components can be found in the heart of the ATLAS experiment

Slovakia contributes actively to the fixed-target programme

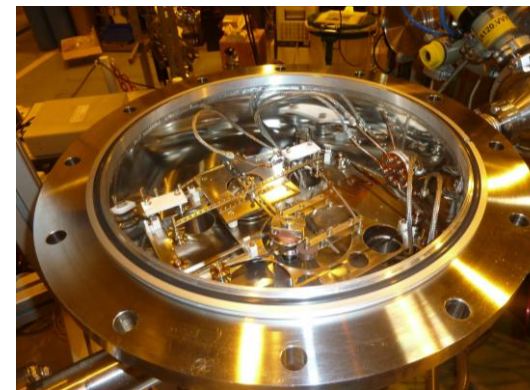
- Slovakia has a long tradition of participation in CERN fixed target programme (NA49, NA50, NA62, RE42, 7 ISOLDE experiments)
- Readout boards, gas monitors, detectors and software can be found in past and present experiments at CERN



High precision electronics developed for NA62 experiment. (28ps TDC, 5 ps Constant Fraction Discriminator)



The NA62 gas gain monitor used also in LHC



Core of the unique spectrometer TATRA developed in Slovakia, connected to beam line of the ISOLDE facility



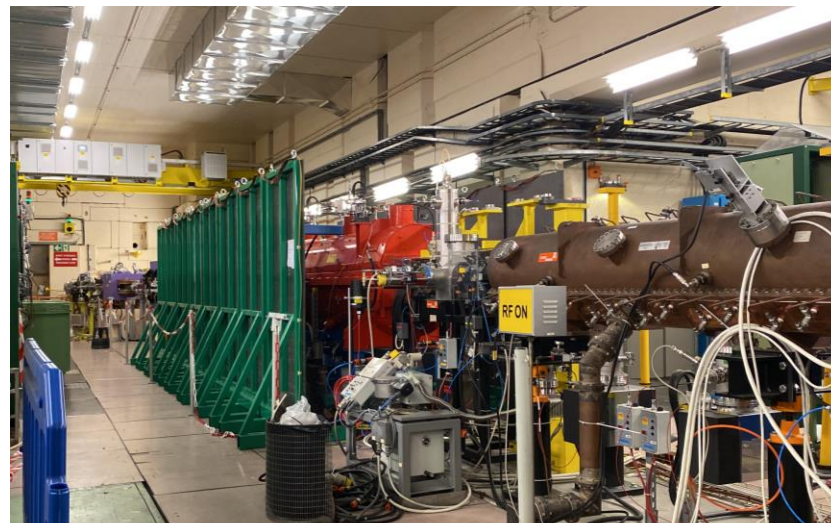
Straw detector of NA62 experiment

Slovakia has made important contributions to the construction of the LHC and the accelerator complex

- Strong Slovak presence in the design, development and operation of key components of the CERN accelerator chain
- Slovakia has strong potential for joining the activities linked to future accelerators and CERN is counting on it



Design, construction and operation of transverse feedback systems in LHC and the full accelerator chain.



Low-Level radio frequency system for Linac3, heavy ion accelerator at CERN.



Design, construction and operation of the accelerating radio-frequency system for the HIE-Isolde radioactive beam facility accelerator is also in Slovak hands. The beams are also used in SK experiments at ISOLDE.

Slovak support to CERN IT

- Slovak engineers and IT professionals develop sophisticated software for physics analysis or business applications
- LHC data is stored on storage systems designed and maintained by Slovak experts



Tape storage for LHC data with capacity of 600PB provided by 6 tape libraries with 50 000 tape cartridges



Slovak industry is a strong partner for CERN



Grey cryostat for LHC short straight section magnets produced at SES (Slovenské energetické strojárne) in Tlmače



Robots carry LHC magnets and align them with magnet support jacks made by ZTS (Závody ťažkého strojárstva) in Košice

ZTS won a prestigious LHC Industry award



CERN has received many high-level visitors from Slovakia



President of the Slovak Republic
Zuzana Čaputová



President of the Slovak Republic
Ivan Gašparovič



Speaker of the Slovak Parliament
Pavol Paška



Prime Minister of the Slovak Republic
Iveta Radičová

- CERN is delighted to host Slovak guests
- CERN has hosted more than 30 high-level visits of Slovak Presidents, government representatives, parliamentarians, diplomats, heads of the Slovak Academy of Sciences, universities and research institutes.
- CERN receives excellent support from the Slovak Mission to United Nations and International Organizations in Geneva.
- Slovak colleagues working at CERN guide hundreds of students and their teachers every year, providing inspiration to the next generation of scientists.



Slovak engagement in education and training



CERN hosts technical and doctoral students from Slovakia

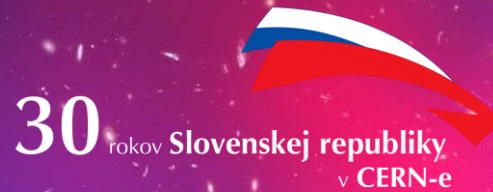
Some 600 high-school students from Slovakia visit CERN each year

So far 307 teachers attended high school teacher's programme at CERN

Slovak culture and gastronomy at CERN



Slovakia serves as honorary host for the traditional dinner of the CERN Council, June 2023



There are many unanswered questions
in fundamental physics

**We look forward to the Slovak Republic
continuing to play a central role in this journey
of exploration as a CERN Member State!**