Fifteen Years of SA-CERN Collaboration
A Journey of Shared Success

NRF National Research Foundation 25 | iThemba LABS Laboratory for Accelerator Based Sciences

WITS UNIVERSITY

UNIVERSITY OF JOHANNESBURG

UNIVERSITY OF CAPE TOWN

Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

Cape Peninsula University of Technology

UNIVERSITY of the WESTERN CAPE

UNIVERSITY OF KWAZULU-NATAL INYUVESI YAKWAZULU-NATALI

DUT DURBAN UNIVERSITY OF TECHNOLOGY INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE CREATIVE. DISTINCTIVE. IMPACTFUL.

NELSON MANDELA UNIVERSITY

UNIVERSITY OF ZULULAND

Tshwane University of Technology We empower people

NWU

CERN

CERN

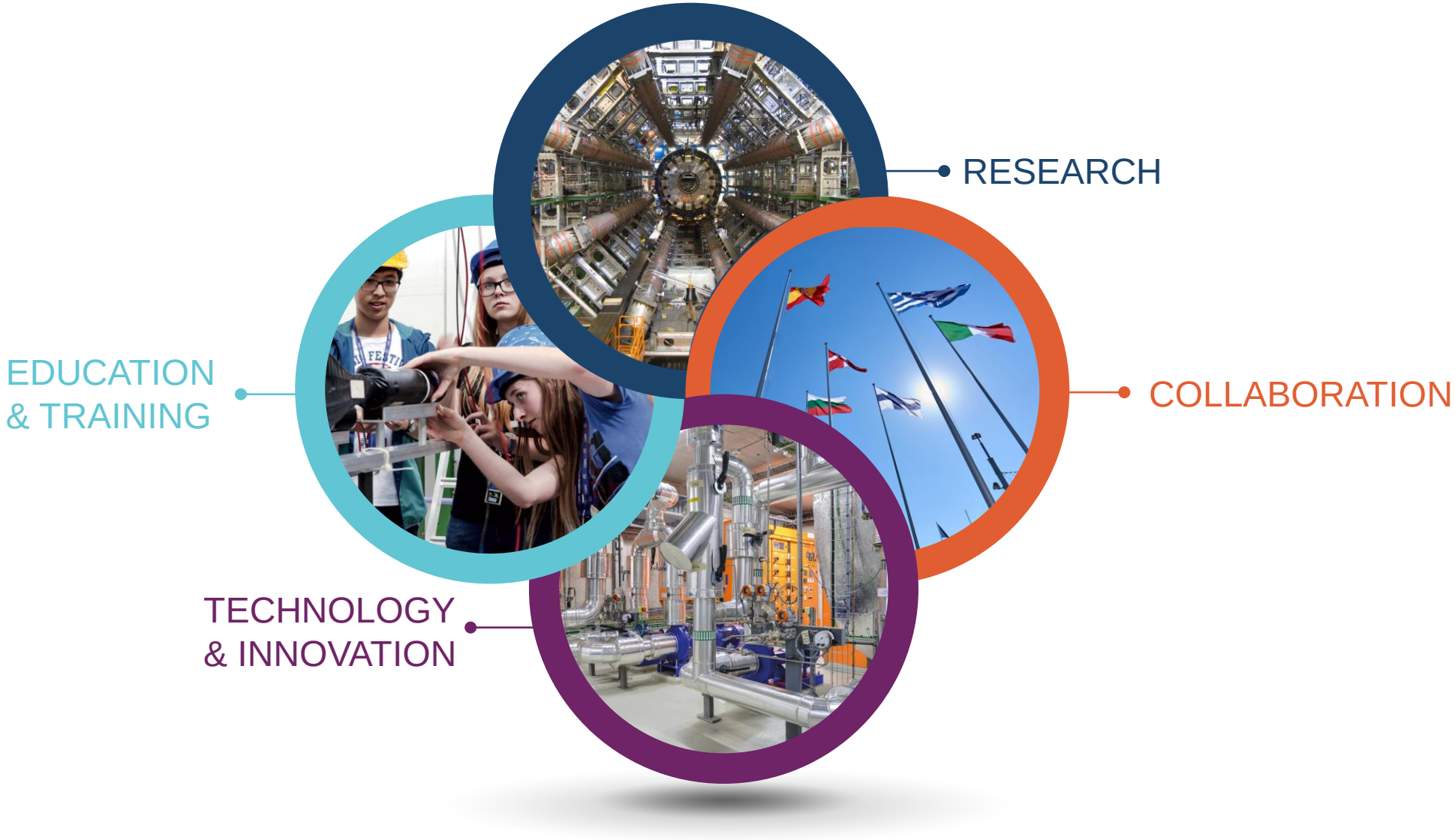
ALICE

ATLAS EXPERIMENT

ISOLDE


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

Four pillars underpin CERN's mission



COLLABORATION

Science for peace

CERN was founded in 1954 with 12 European Member States

As of 31 December 2023
Employees:
2666 staff, **1002** graduates
Associates:
12 370 users, **1513** others

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

10 Associate Member States

Brazil – Croatia – Cyprus*– India – Latvia – Lithuania
Pakistan – Slovenia* – Türkiye – Ukraine

4 Observers

Japan – USA – European Union – UNESCO

* Associate Member State in the pre-stage to Membership

~ 50 Cooperation Agreements

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bangladesh – Bolivia – Bosnia and Herzegovina
Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia – Honduras – Iceland – Iran – JINR – 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**
23.7 % 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 (581)

Brazil 135 – **Croatia** 37 – **Cyprus** 14* – **India** 145 – **Latvia** 21
Lithuania 17 – **Pakistan** 30 – **Slovenia** 26* – **Türkiye** 129 –
Ukraine 27

Observers (2226)

Japan 219 – **United States of America** 2007

* Associate Member State in the pre-stage to Membership

Cooperation Agreements (1596)

Algeria 2 – **Argentina** 16 – **Armenia** 16 – **Australia** 26 – **Azerbaijan** 3 – **Bahrain** 3 – **Canada** 206 – **Chile** 45
Colombia 24 – **Costa Rica** 3 – **Cuba** 3 – **Ecuador** 4 – **Egypt** 24 – **Georgia** 34 – **Hong Kong** 15 – **Iceland** 3 –
Indonesia 7 **Iran** 14 – **Ireland** 4 – **JINR** 293 – **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 **People's Republic of China** 414 – **Peru** 3 – **Philippines** 1 – **Republic of Korea** 168 – **Saudi Arabia**
South Africa 61 – **Sri Lanka** 10 – **Taiwan** 52 – **Thailand** 17 – **Tunisia** 4 – **United Arab Emirates** 10 – **Vietnam** 1


CERN
Dr Marcos Cesar Pontes
Minister of Science, Technology, Innovation and Communication, Brazil

The Power of Collaboration

Shared Vision: Advancing science for humanity.

Combined Strength: Tackling global challenges together.

Mutual Growth: Building capacity, knowledge, and opportunities.

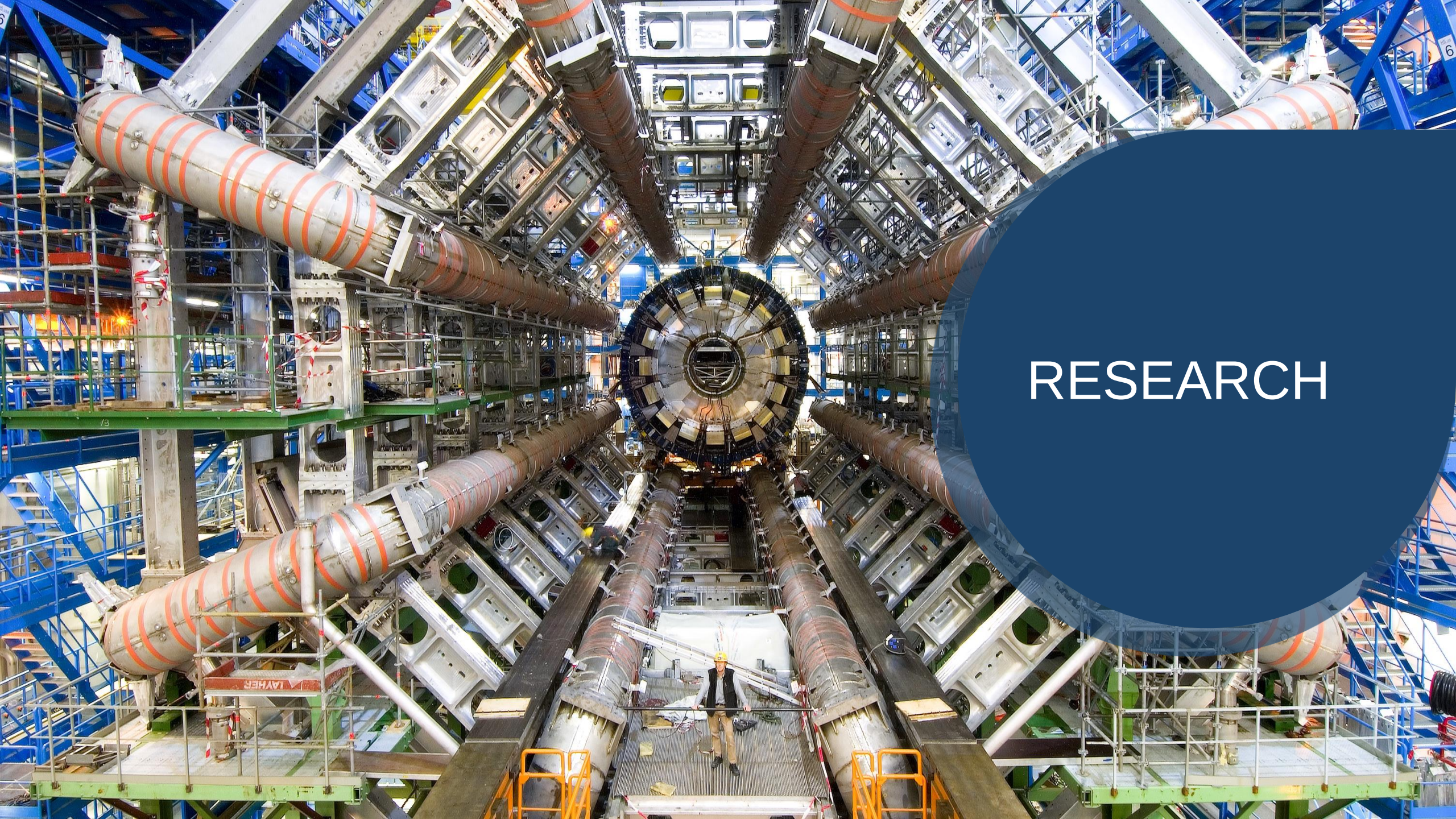
Science as a tool for bringing nations together

Herwig Schopper
Former Director General of CERN

> "We are trying to build, with the use of science, understanding in the region. The project is very special. Each of us brings its own history, its own wounds, its own scars. Each of us has its own interests, yet we have a common vision, which is to benefit the people of the region and the whole of humanity."
>
> **Eliezer Rabinovici**
> Chair of the Israeli Committee for SESAME

High-Level Benefits of SA-CERN Collaboration

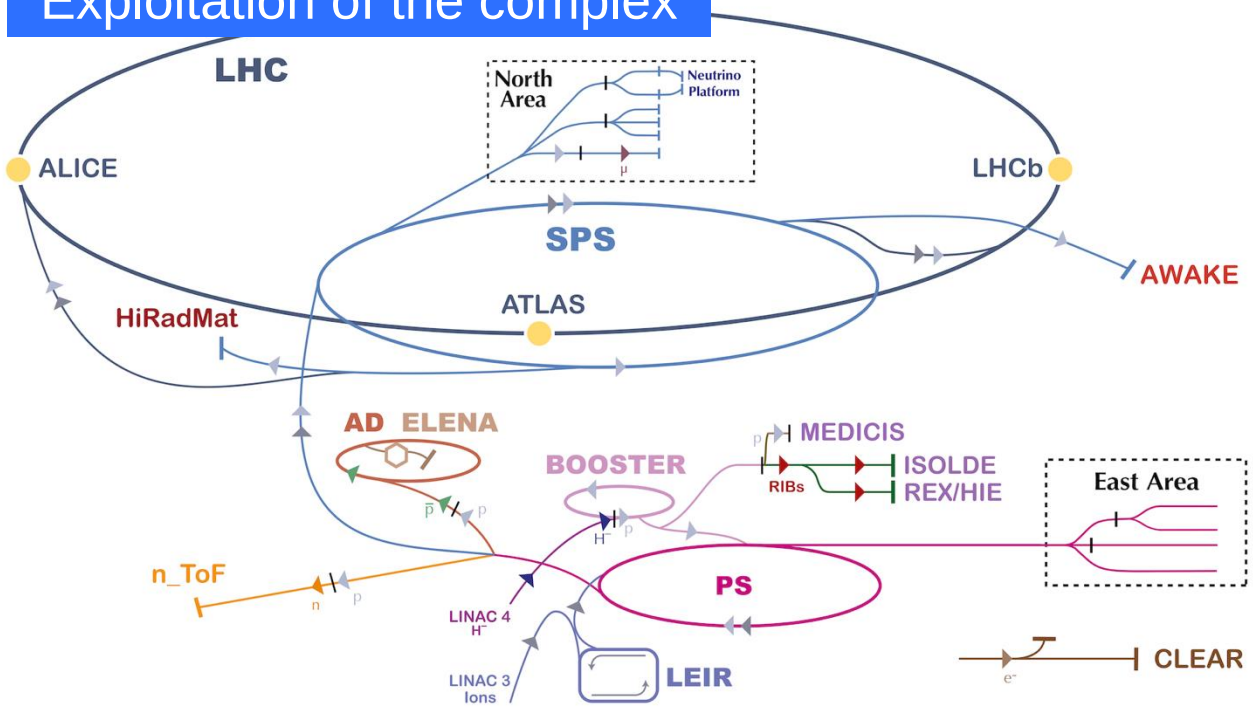
Scientific Advancement	• Unlocking the mysteries of the universe through shared expertise.
Global Community	• Strengthening bonds across nations through a shared commitment to discovery.
Capacity Building	• Educating and inspiring the next generation of scientists and engineers.
Technological Innovation	• Developing tools and technologies with broad societal impact.
Cultural Exchange	• Fostering respect, understanding, and collaboration across diverse perspectives.



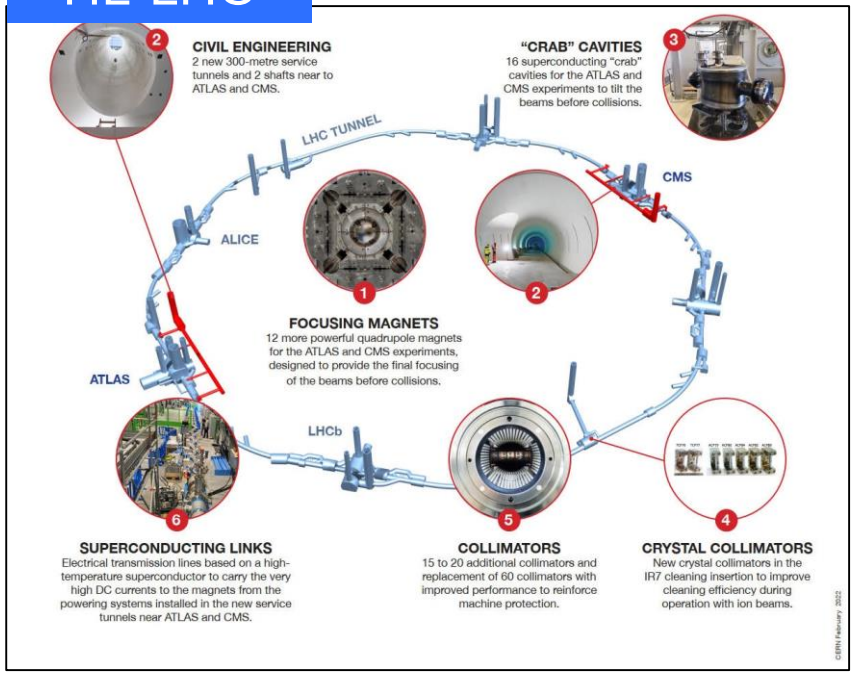
RESEARCH


WE FOUND A NEW PARTICLE
WE FOUND A NEW PARTICLE

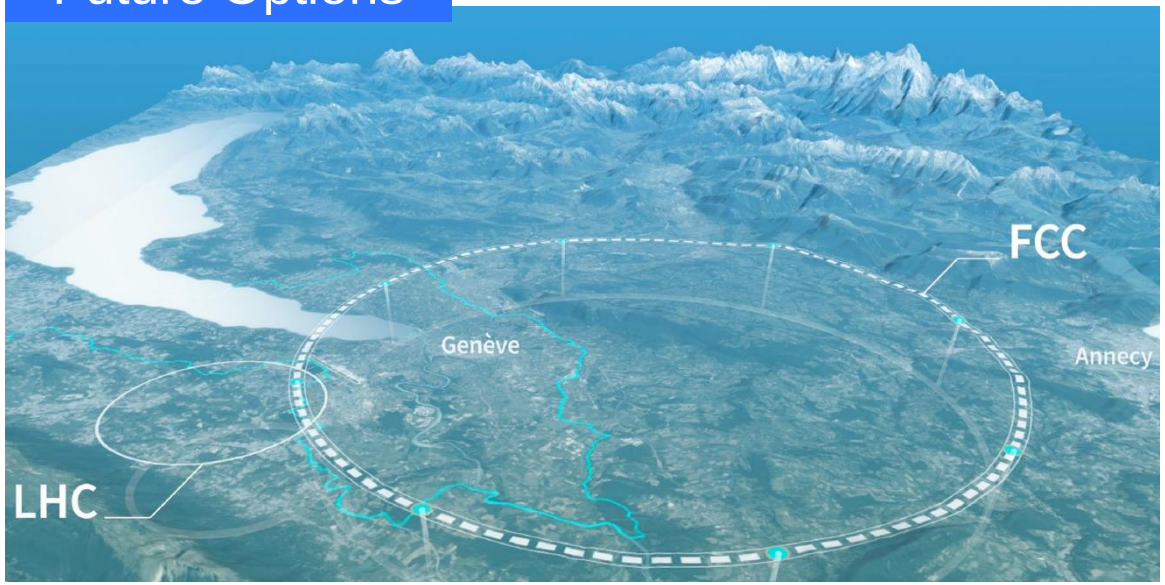
Exploitation of the complex



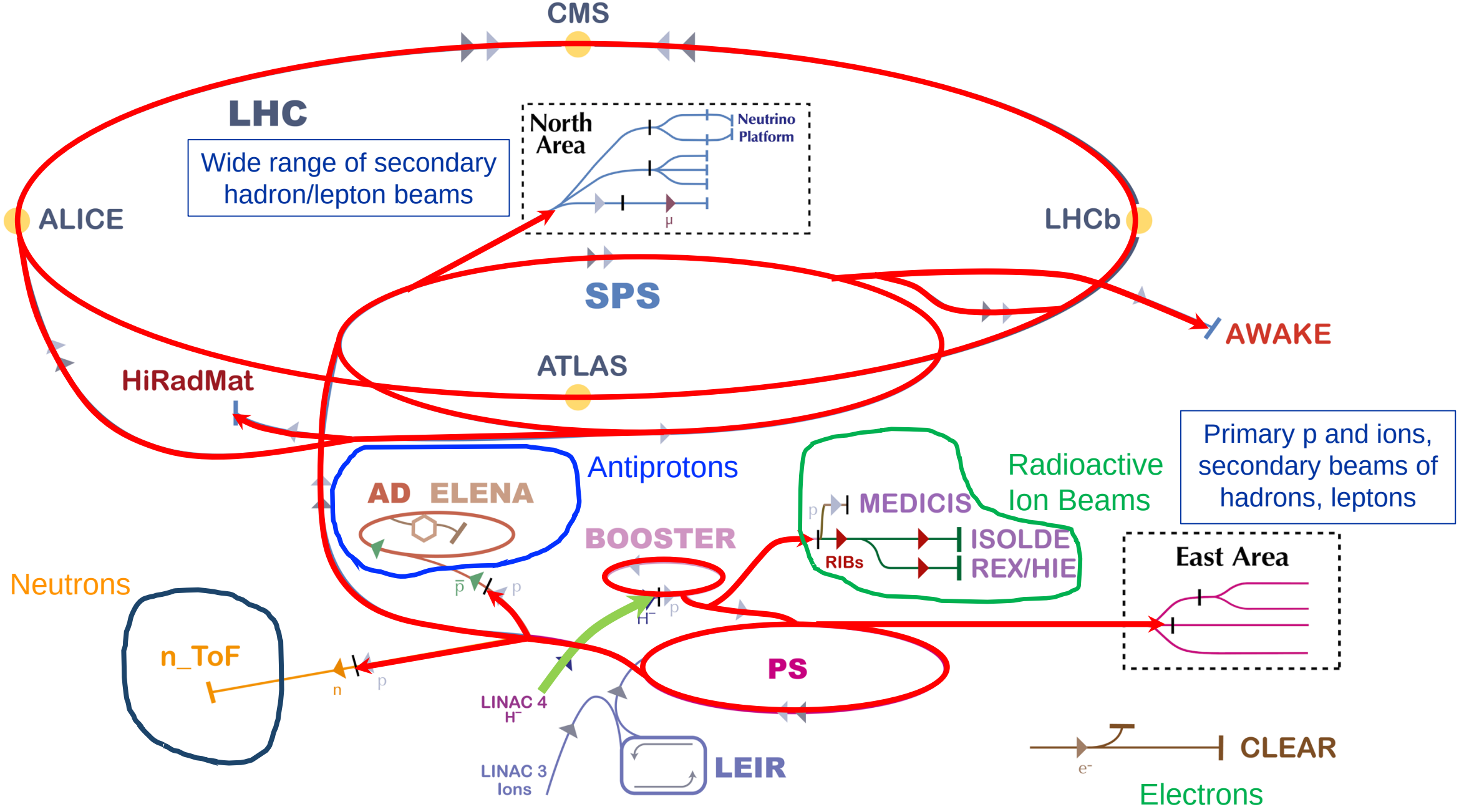
HL-LHC



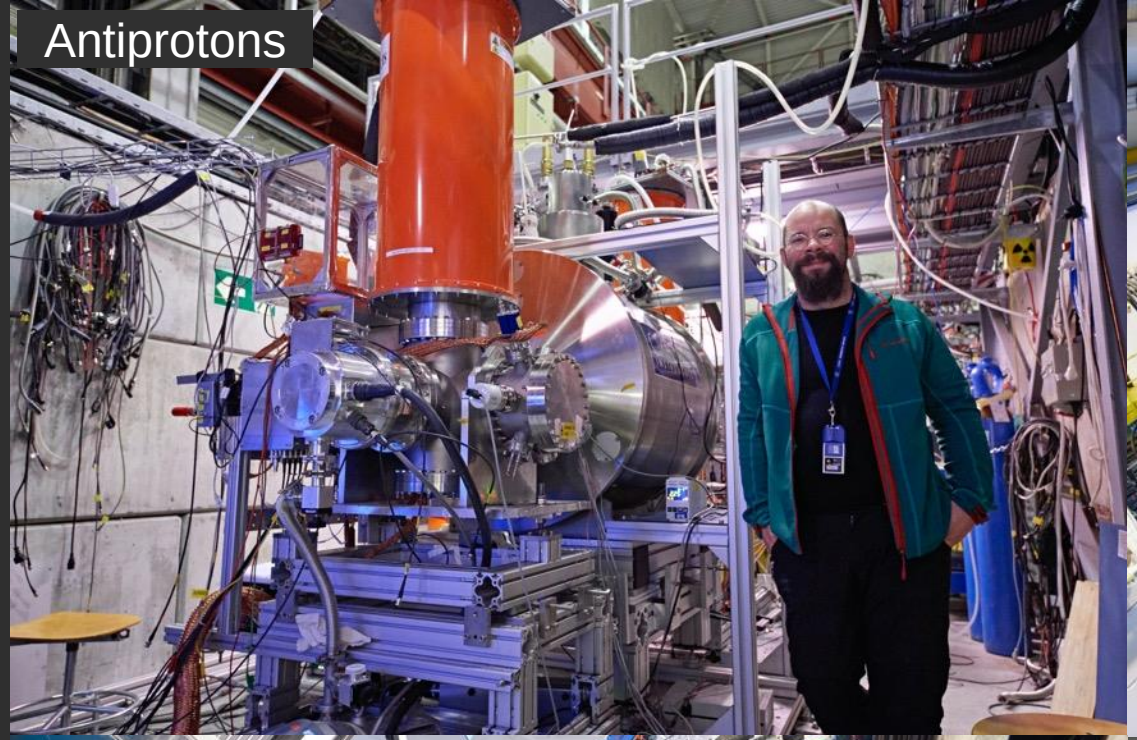
Future Options

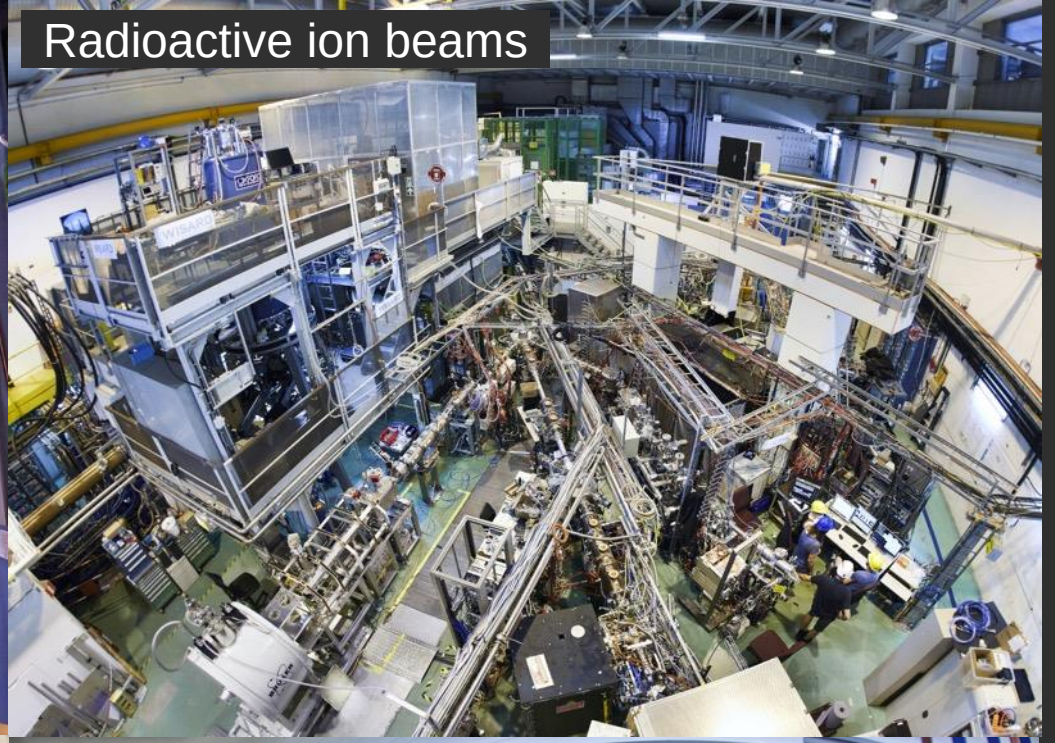


Technology/Engineering/R&D

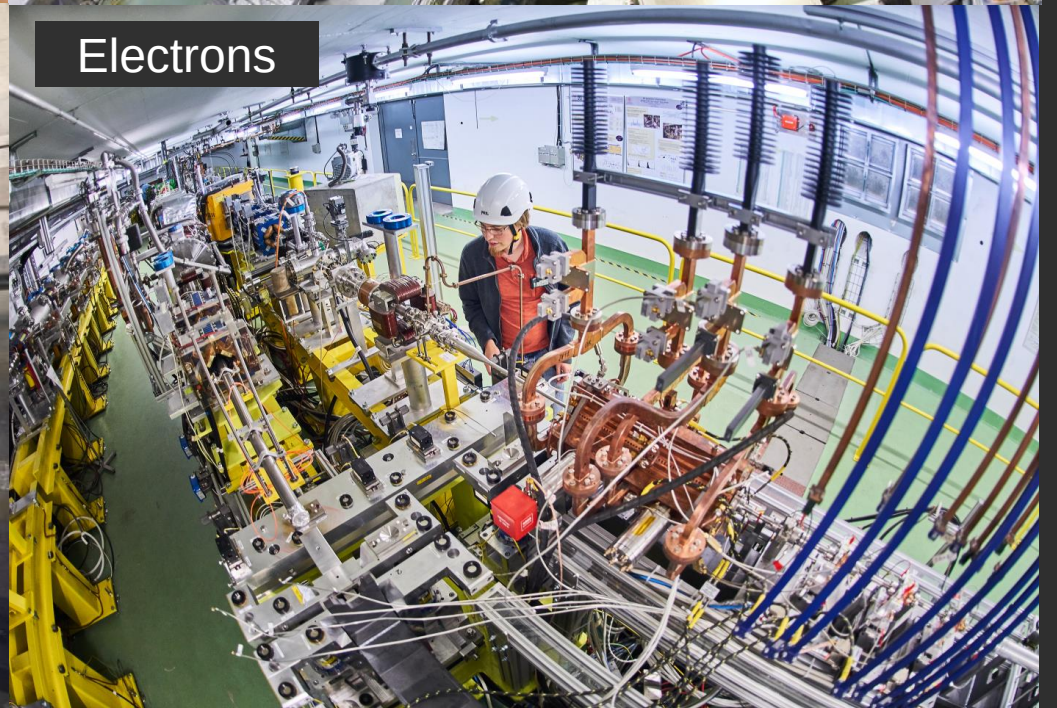


H⁻ (hydrogen anion) | p (protons) | ions | RIBs (Radioactive Ion Beams) | n (neutrons) | p̄ (antiprotons) | e⁻ (electrons)


Antiprotons


Radioactive ion beams


Protons


Electrons

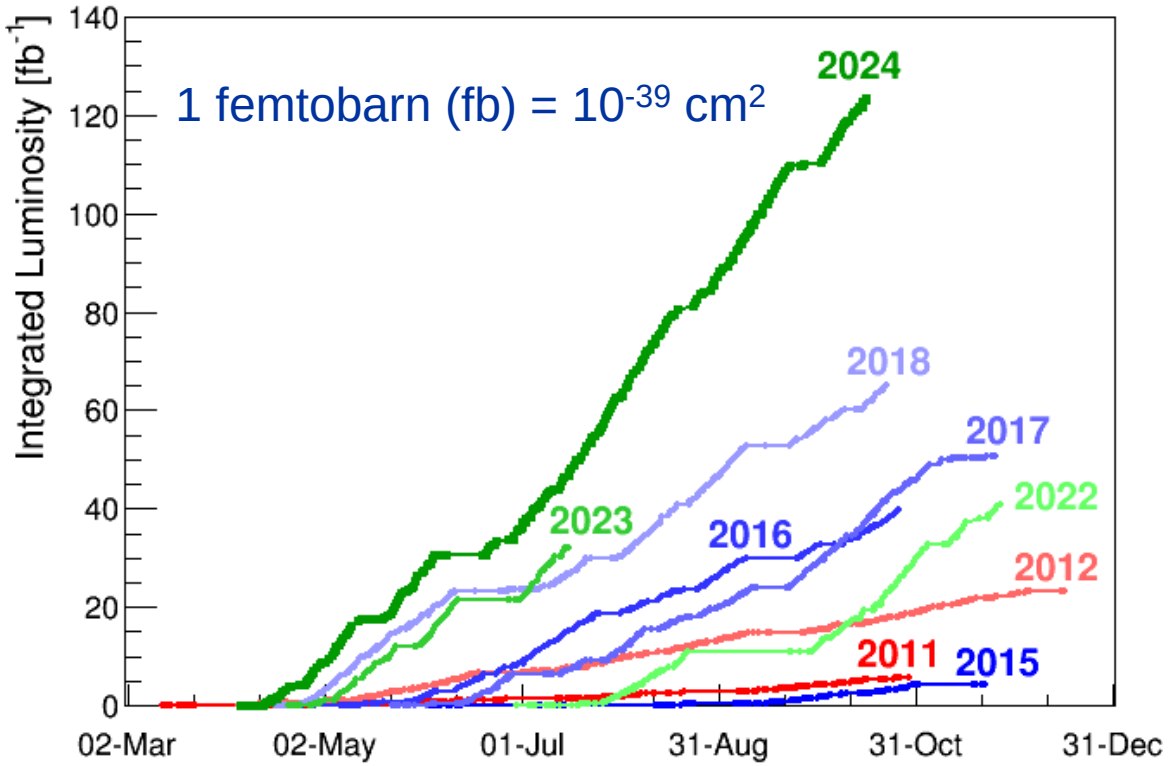
LHC

Wrap-up physics production

Impressive amount of integrated luminosity delivered to the experiments!

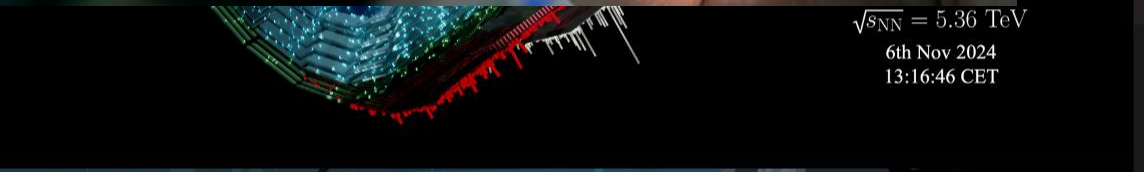
→ All targets and goals were reached and often surpassed!

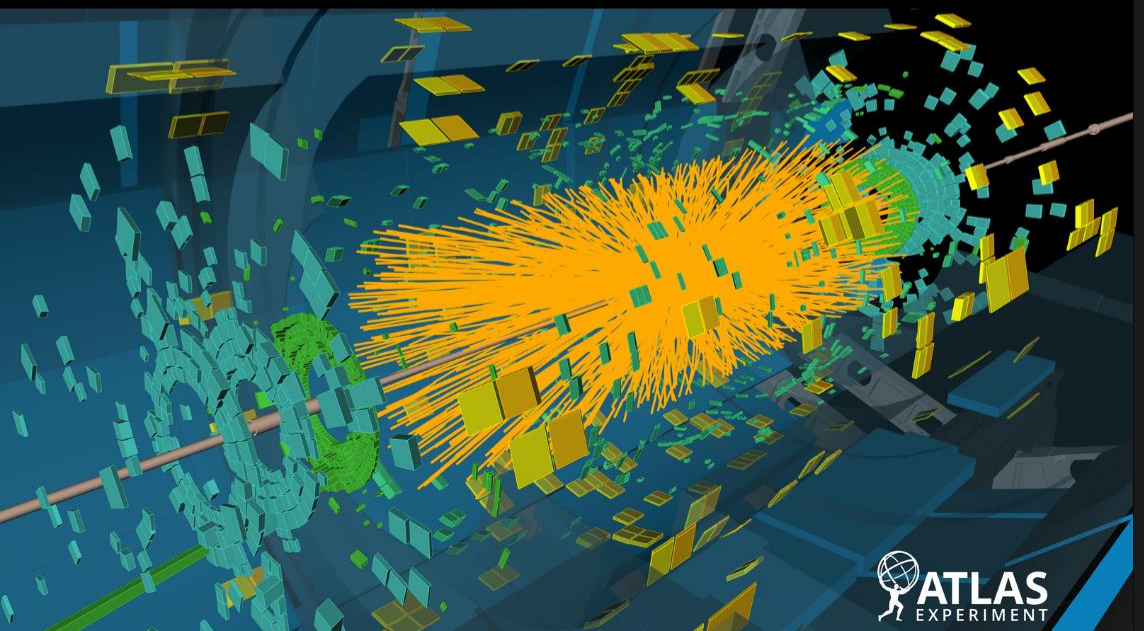
→ Amazing performance and incredible achievements!

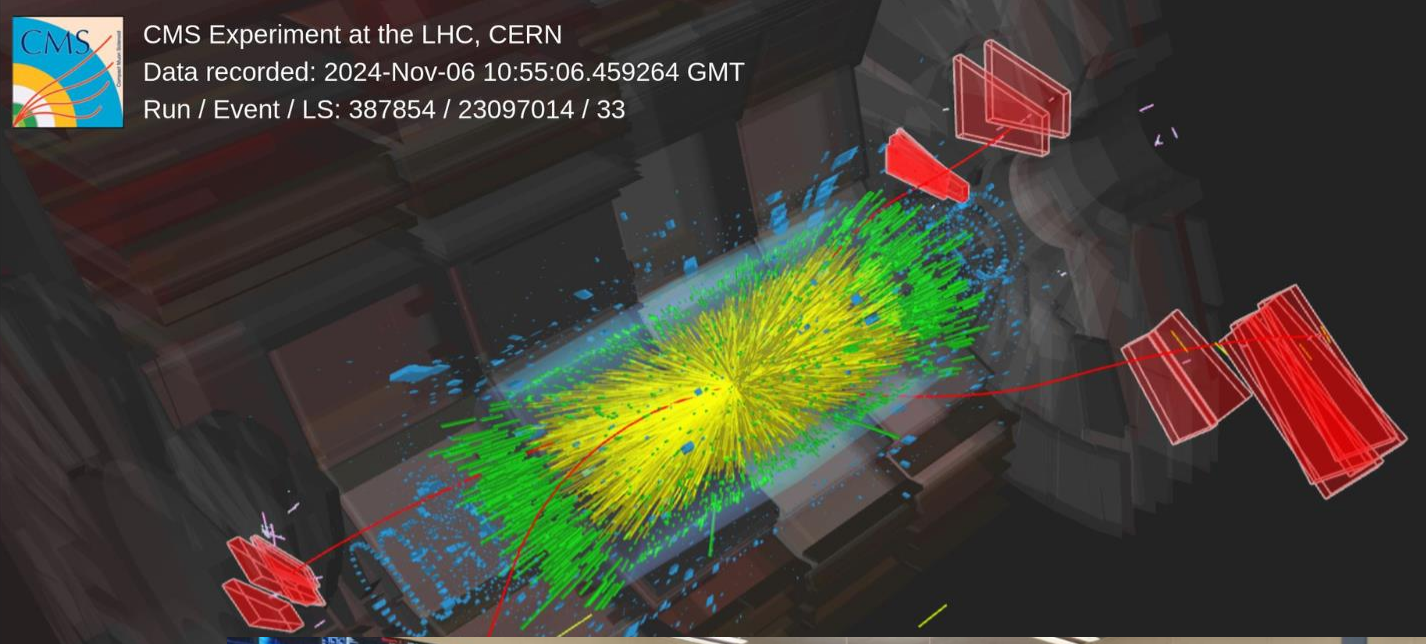


~125 fb^{-1} to both ATLAS and CMS

125 fb^{-1} x 80 mb = 10 quadrillion messy proton-proton collisions, ~7.5 million Higgs per experiment


$\sqrt{s_{NN}} = 5.36$ TeV
6th Nov 2024
13:16:46 CET


ATLAS
EXPERIMENT

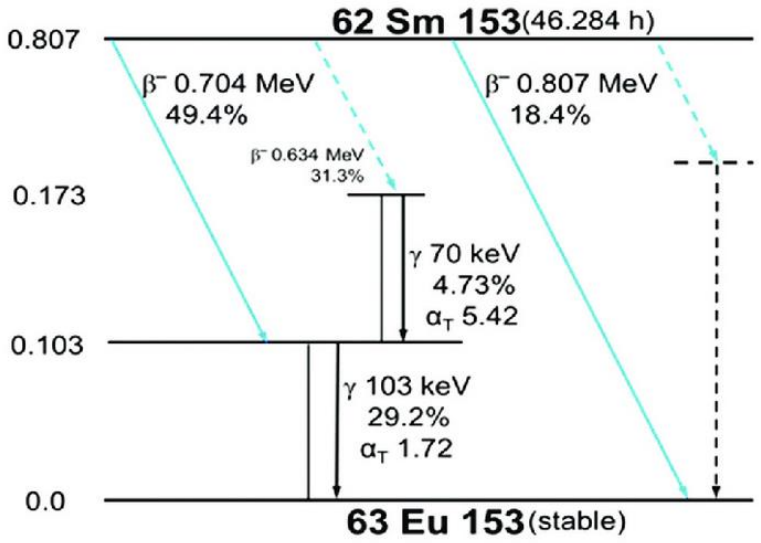

CMS
CMS Experiment at the LHC, CERN
Data recorded: 2024-Nov-06 10:55:06.459264 GMT
Run / Event / LS: 387854 / 23097014 / 33


LHCb


CERN

CERN-MEDICIS

Sm-153 production process for the University Hospital of Heidelberg (Germany)



Excellent theranostic agent

1 PRODUCTION

Production in reactor via Sm-152(n,g)Sm-153
Supplied from SCK CEN BR2 reactor so far

2 IMPORT AT CERN

Irradiated material shipping from production site to CERN-MEDICIS
Organised by the production site with importation approval from CERN HSE-RP-CS (radioactive shipping team)

3 MASS SEPARATION

Loading into the target container of a MEDICIS target.
Mass separation process to separate Sm-152 (stable) from Sm-153 (collected radionuclide of interest)

4 SAMPLE CHARACTERISATION

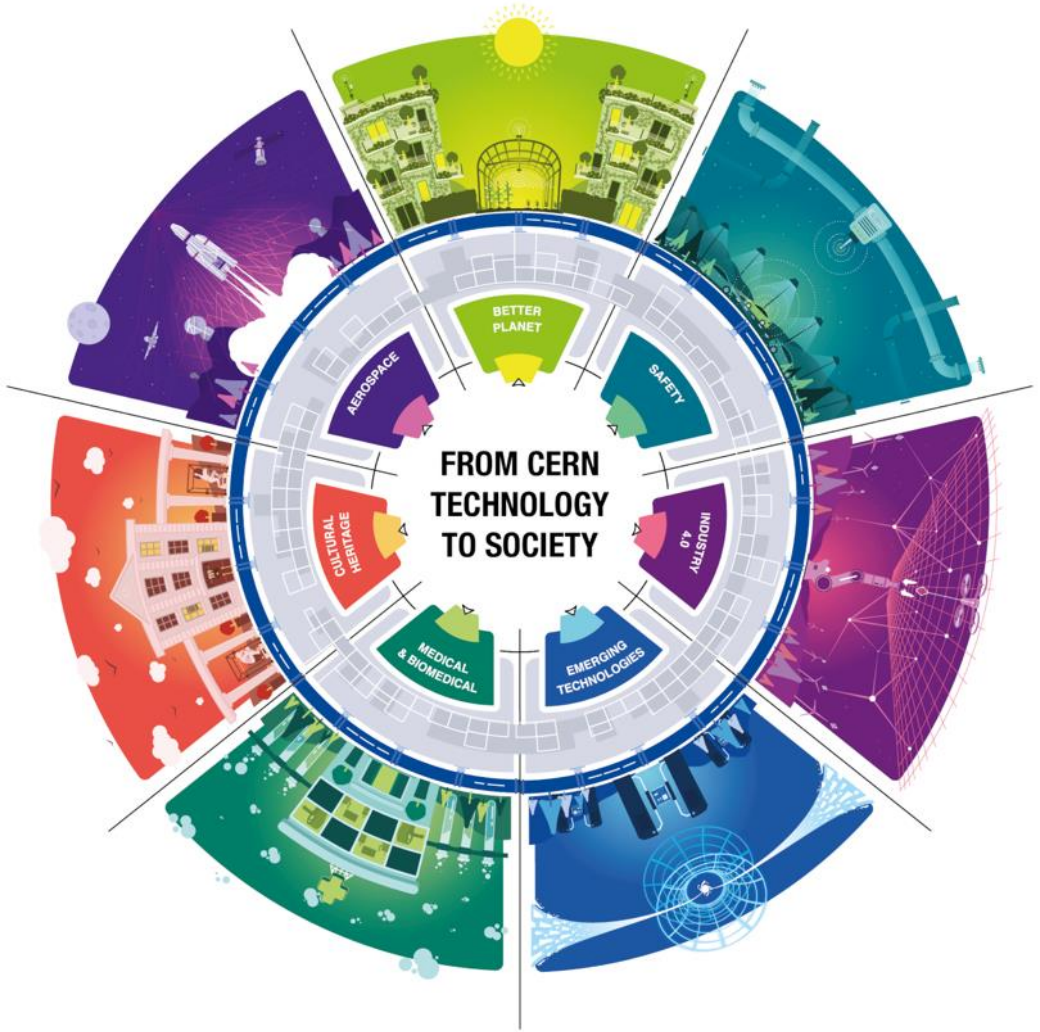
Sm-153 sample removal
Gamma-spectrometry of Sm-153 activity, used for shipping classification

5 EXPORT TO HEIDELBERG

Export to Heidelberg organised by HSE-RP-CS and MEDICIS Coordinator with use of dedicated transporter

TECHNOLOGY & INNOVATION

CERN as a Research Infrastructure



- Drive discovery and creation of knowledge
- Driver of innovation
- Integration of research communities
- Strong links to industry
- Collaborative ecosystem
- Societal impact
- Outreach and education

Places like CERN contribute to the kind of knowledge that not only enriches humanity, but also provides the wellspring of ideas that become the technologies of the future"

Fabiola Gianotti

Evaluation of the benefits that the UK has derived from CERN

Evidence Document

August 2020

CERN supports state-of-the-art research in fundamental physics, which advances understanding → UK scientists build on this enhanced understanding in their research → Supporting UK scientific achievement and progress (in PP and beyond)

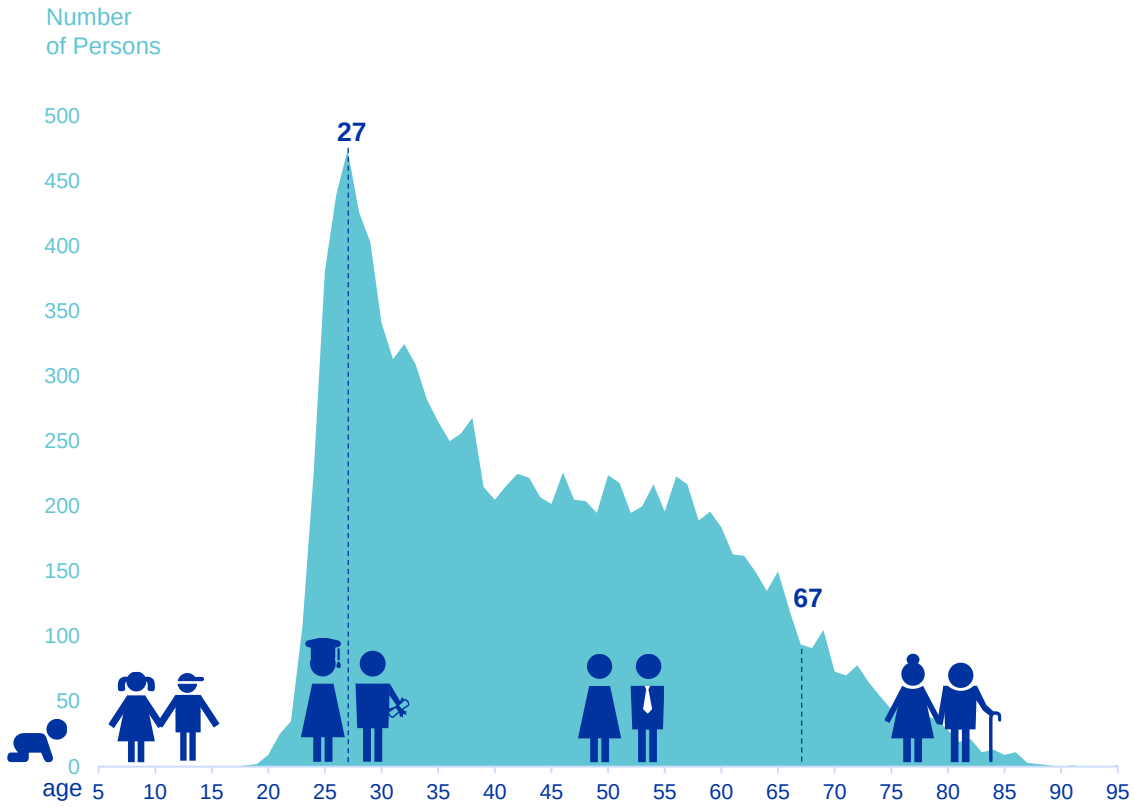
Pooled resources enable instruments, facilities and infrastructure that could not be developed alone → Investment enables UK access (national PP lab) and offers opportunities to participate in R&D → Supports strength of UK research community, helping sustain UK excellence and leadership

CERN's development and scientific goals drive technical advances in facilities and infrastructure → New innovations emerge, underpinned by technologies developed at / for CERN → Wider application brings benefits to UK researchers, consumers, patients, society

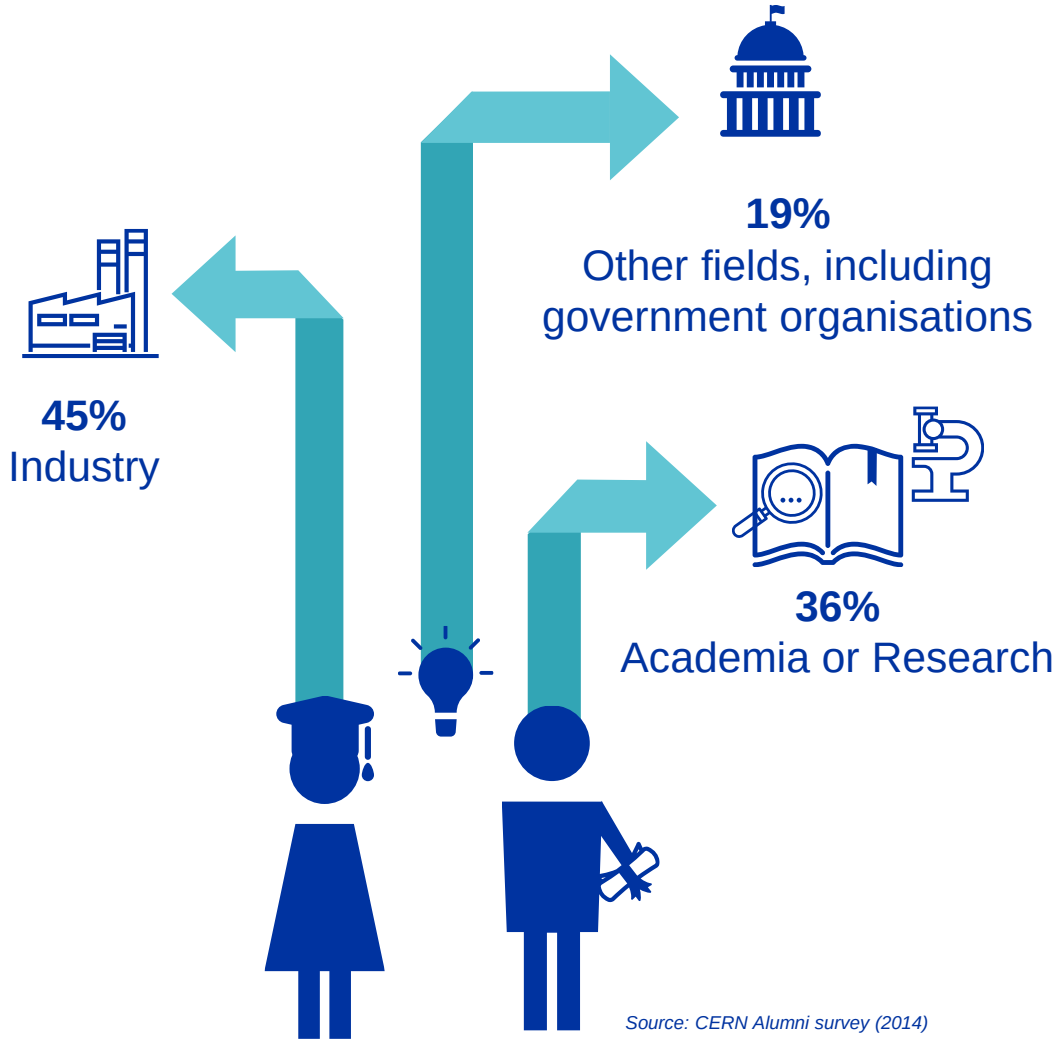
Details at technopolis's site

EDUCATION & TRAINING

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

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

4.7M followers on social media, from around the globe

Closing remarks

Science benefits from international collaboration in numerous ways

- Driver of excellence, diverse perspectives and expertise, combined resources to meet global challenges, economics and strategic benefits, cultural cross-links…
- **We are stronger together**

It's part of a process, a thread in the fabric of human development

Working together politically, intellectually, culturally, scientifically in the spirit of innovation, modernism and cosmopolitanism

Making progress on the back of the enlightenment values of reason, science, and humanism with technology and wealth generation playing their part – we've come a long way…

Our profound gratitude to South Africa for its support and commitment. We look forward with confidence in our partnership's future and the next 15 years!