

Fundamental Research in an International Perspective

CERN – European Organization for Nuclear Research
The Organization, current research, and education.

Dr. Sascha Marc Schmeling

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

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

CERN Council

President: E. Rabinovici
Secretary: CERN DG



- (Associate) Member States: 2 delegates each
- ex-officio
 - FC Chair
 - SPC Chair
- various observers by invitation, incl. ECFA Chair

Finance Committee

Chairperson: L. Salzarulo



- (Associate) Member States: 1-3 delegates each
- ex-officio
 - Council President
 - SPC Chair

Scientific Policy Committee

Chairperson: H. Montgomery



- 14 individual members
- ex-officio
 - ECFA Chair
 - Chair of CERN Committees (LHCC, MAC, SPSC, INTC)
- permanent invitations
 - CERN DG, Council President, FC Chair

Audit Committee

Chairperson: J. Schieck



Tripartite Employment Forum

Chairperson: B. Åsman



Pension Fund Governing Board

Chairperson: O. Malmberg





Council Secretariat
Legal Service

Director General
Fabiola Gianotti 

Internal Audit
Health, Safety, and Environment Unit

Finance and Human
Resources
Rafael Bello 


Research and Computing
Joachim Mnich 

Accelerators and
Technology
Mike Lamont 

International Relations
Charlotte Warakaulle 


Finance and
Administrative Procedures
Florian Sonnemann 

Experimental Physics
Manfred Krammer 

Beams
Rhodri Jones 

Education, Communication,
and Outreach

Human Resources
James Purvis 


Theoretical Physics
Gian Giudice 

Engineering
Katy Foraz 


Diplomatic and Stakeholder
Relations

Industry, Procurement, and
Technology Transfer
Christopher Hartley 

Information Technologies
Enrica Porcari 

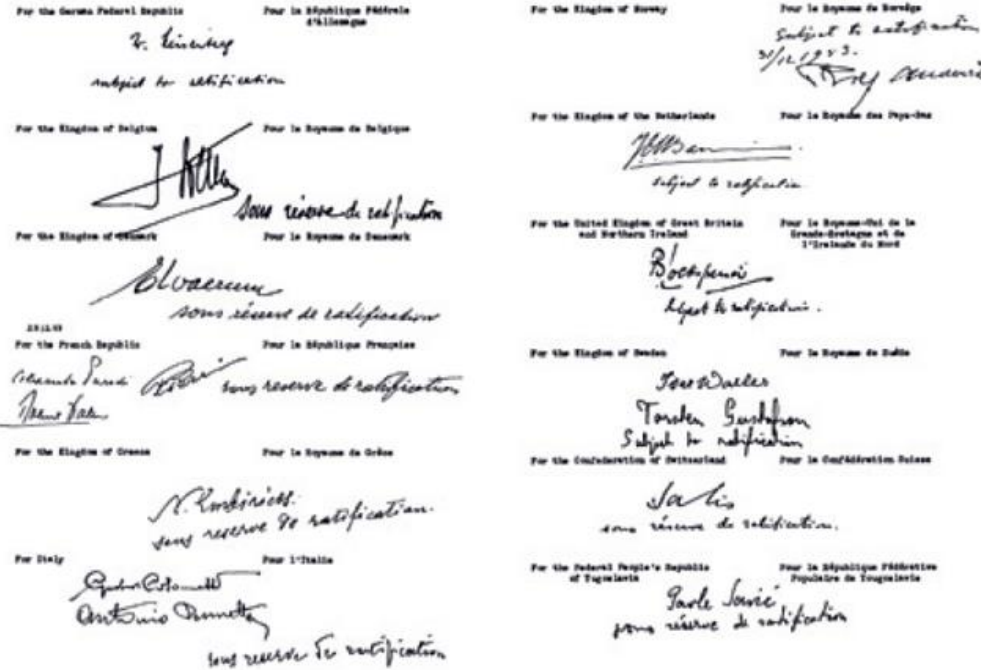
Systems
Brennan Goddard 

Site and Civil Engineering
Mar Capeans 

Technology
Jose Miguel Jimenez 



La sixième session du Conseil fut organisée à Paris du 29 juin au 1^{er} juillet 1953. C'est à cette occasion que la Convention établissant l'Organisation fut signée, sous réserve de ratification, par douze Etats membres.



The Sixth Session of the CERN Council took place in Paris on 29 June—1 July 1953. It was here that the Convention establishing the Organization was signed, subject to ratification, by twelve States.

1952 **UNESCO** 2014



The Mission

Fundamental Research
at the frontier of human knowledge

Innovative Technologies
for fundamental research



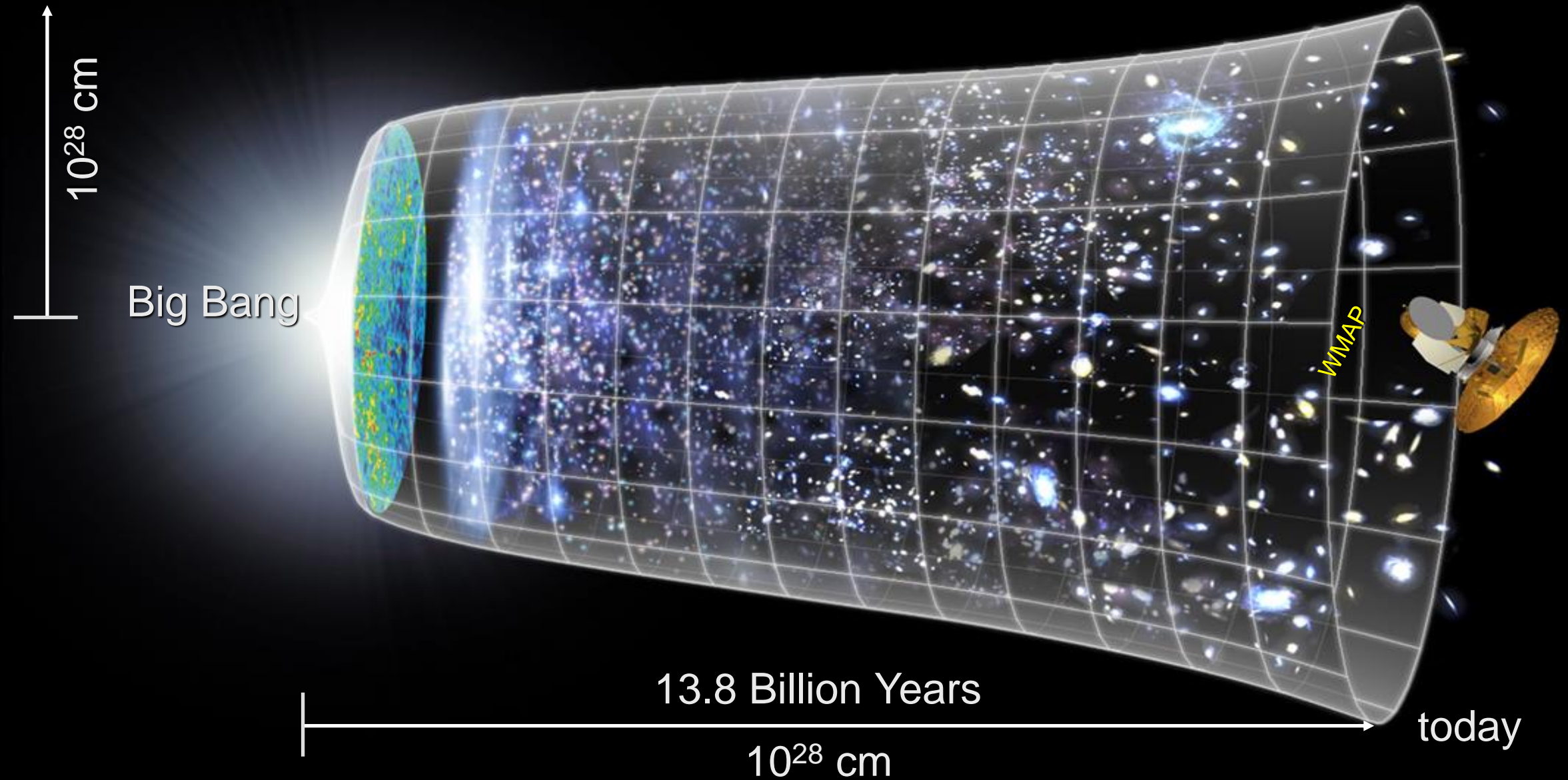
Collaboration
for the good of humanity

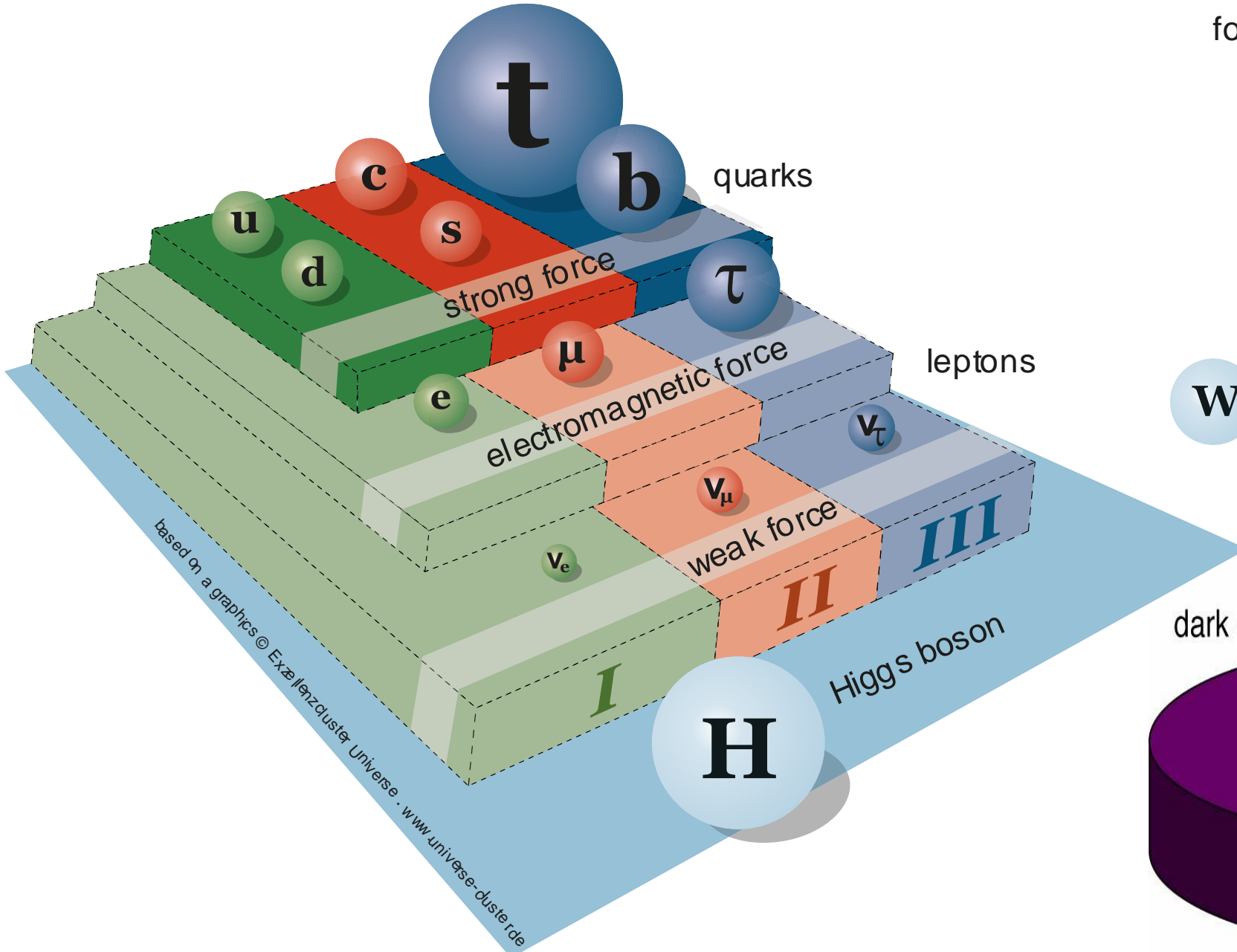
Education & Inspiration
training of future generations



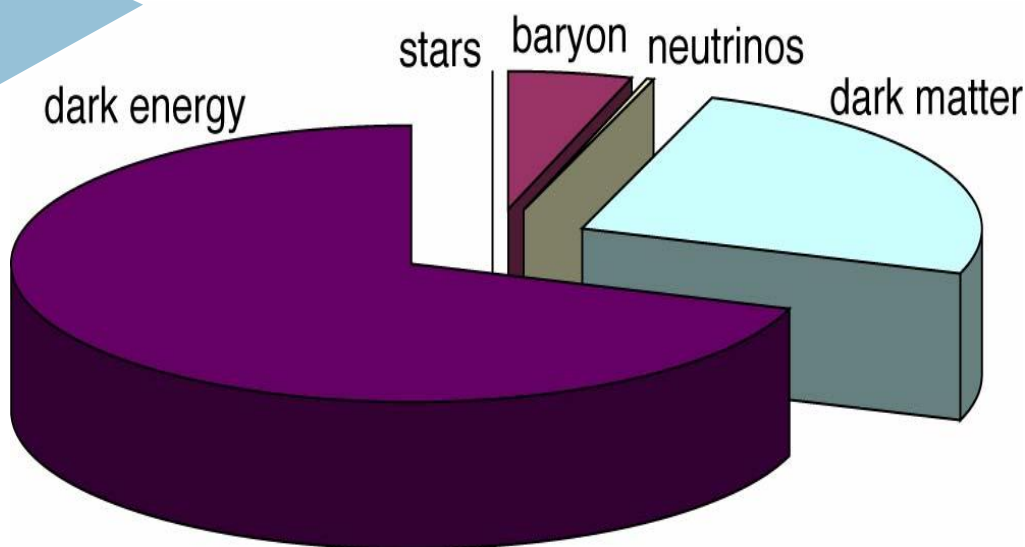
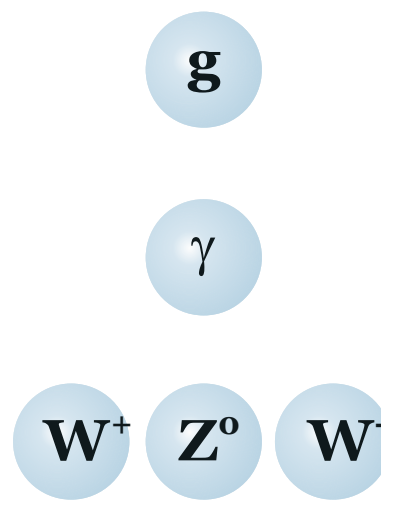
The Scientific Challenge

Research on the Development of the Universe



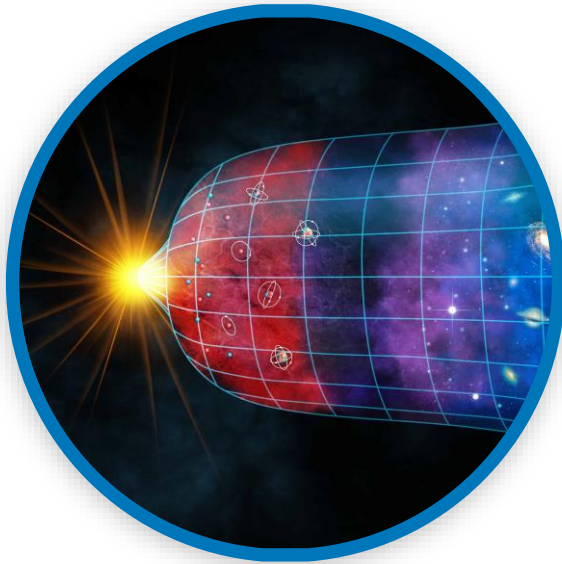


force carriers



R Research Questions

Early Universe



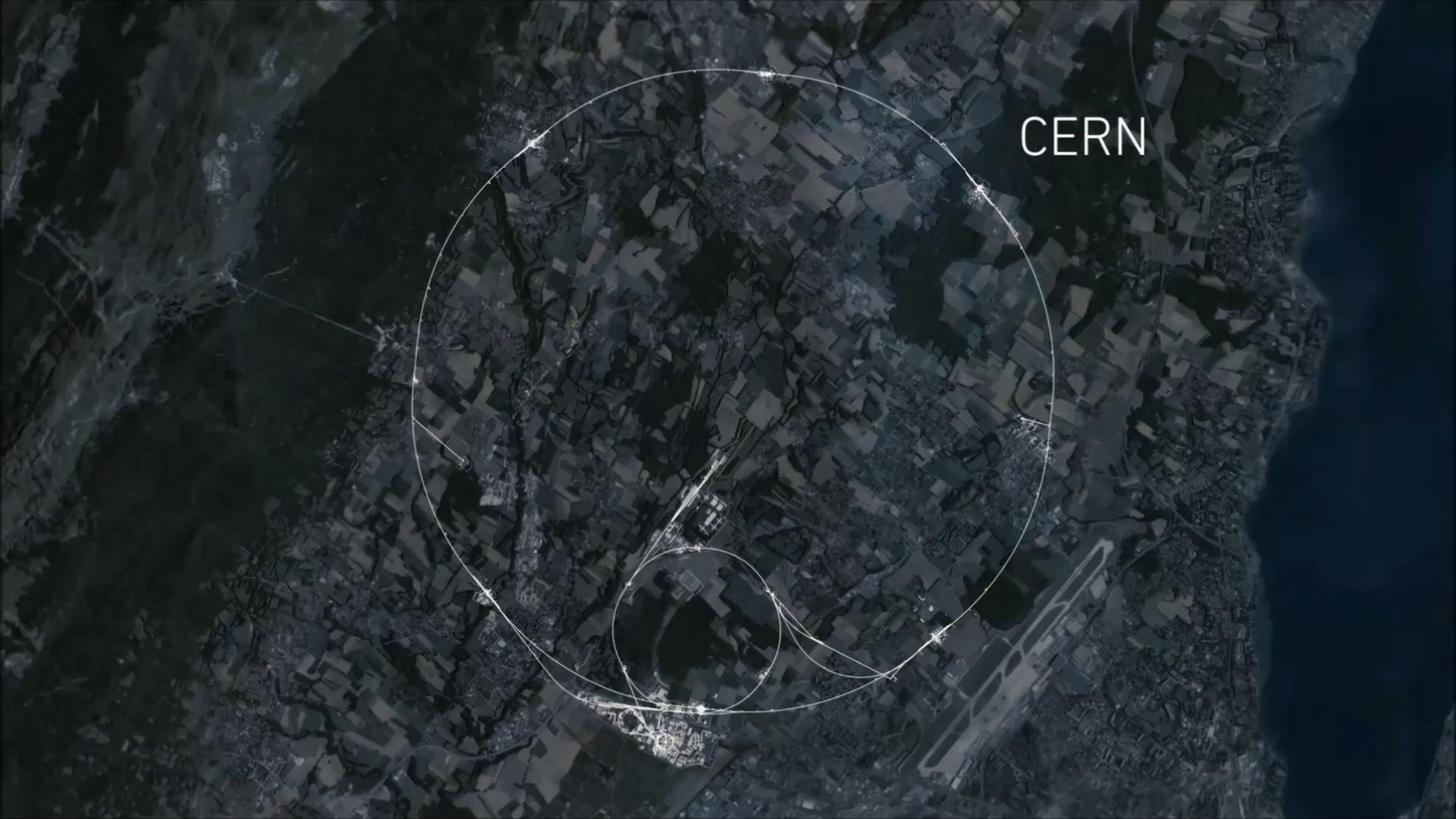
Anti-Matter



Dark Matter



CERN





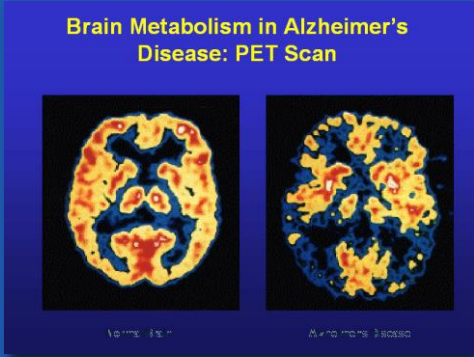
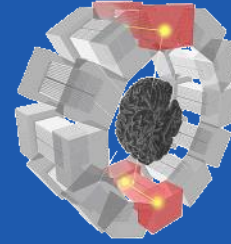
Particle Detection

Imaging

ClearPEM



PET Scanner

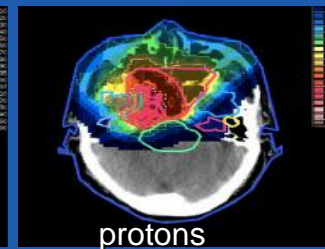
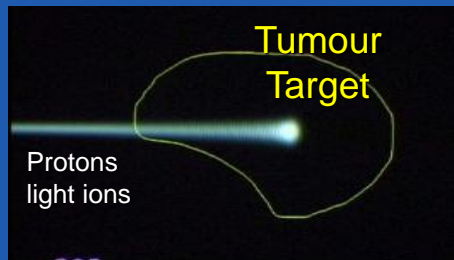


Hadron Therapy



Accelerated Particle Beams

~30'000 accelerators world-wide
~17'000 for medical applications



>70'000 patients/a world-wide (30 institutes)
>21'000 patients/a in Europe (9 institutes)



Medical Applications

World Wide Web

WWW



Sustainable Development Goals

Transforming our world



CERN Director-General Rolf Heuer addressing the Open Working Group on Sustainable Development Goals in December 2013.

*The CERN input may be found at
<https://sustainabledevelopment.un.org/content/documents/4628cern.pdf>*



THE GLOBAL GOALS
For Sustainable Development

Mapping CERN Contributions to the SDGs

SDG 3 - HEALTH

CERN helps to develop technologies that contribute to better healthcare for all, such as medical imaging and hadron therapy.



THErapy

Accelerators provide particle beams for more targeted cancer treatment.

SDG 4 - EDUCATION

Education is one of CERN's core missions. We offer high quality programmes that inspire thousands of students, teachers and young researchers each year.



BEAMLINE FOR SCHOOLS COMPETITION

Students from the two winning teams spend a week at CERN to carry out their experiment using a CERN accelerator.

SDG 5 - GENDER

Diversity is a core value for CERN. Our diversity policy aims at leveraging the added value that comes from bringing together people of different nationalities, genders, professions and ages.

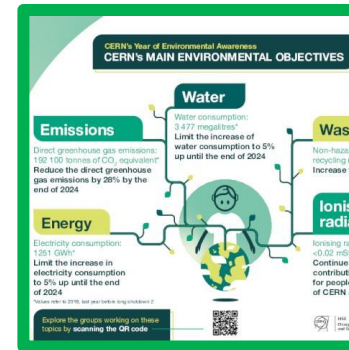


25 BY 25 DIVERSITY & INCLUSION INITIATIVE

First ever targets-based strategy to boost the nationality and gender diversity within the Staff and Fellows population.

SDG 7 - ENERGY

CERN develops strategies for minimise the increase of energy consumed by the installations, increase energy efficiency and implement energy recovery.



HEATING LOCAL HOUSING

Heat recovered from CERN's accelerator cooling systems to heat a new residential area in the town of Ferney-Voltaire, benefiting up to 8000 people.

SDG 9 - INNOVATION

CERN inventions are brought to industry through knowledge transfer, to have a positive impact on society and innovation.



A MAGNET IN THE LHC TUNNEL

Exploring the universe requires new technologies and ingenious engineering to build the machines that explore physics at a new frontier.

SDG 16 & 17 - INTERNATIONAL COOPERATION

CERN is a successful model for international collaboration. CERN gathers researchers from all over the world, contributing to human knowledge and peace, for the benefit of all.



SESAME

This new synchrotron light source in Jordan started operation in 2017. It is a unique collaboration between eight Middle East members, modelled on CERN's governance structure.

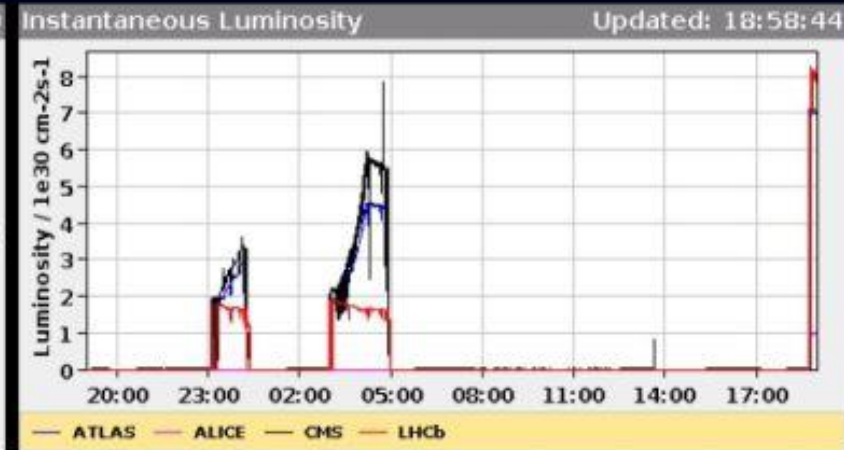
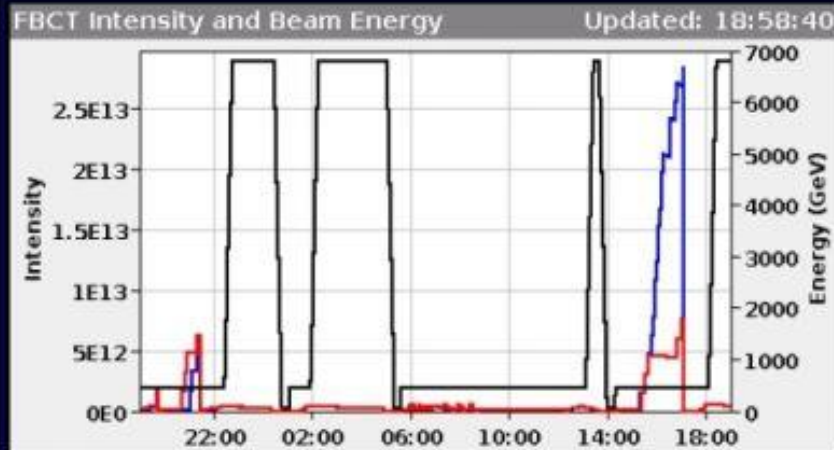
What happens now?

PROTON PHYSICS: STABLE BEAMS

Energy: 6800 GeV I B1: 4.00e+11 I B2: 4.03e+11

Beta* IP1: 1.20 m Beta* IP2: 10.00 m Beta* IP5: 1.20 m Beta* IP8: 2.00 m

Inst. Lumi [(ub.s)⁻¹] IP1: 6.98 IP2: 0.97 IP5: 7.90 IP8: 7.86



Comments (21-Apr-2023 18:58:40)

First STABLE BEAM at 6.8 TeV
of 2023!

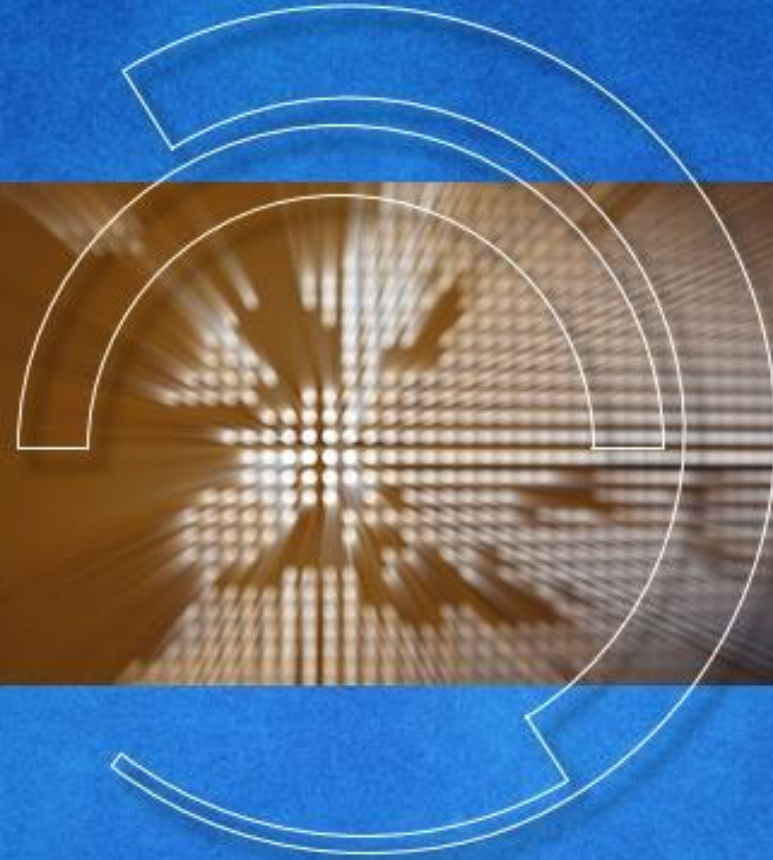
AFS: Single_3b_2_2_2

BIS status and SMP flags

	B1	B2
Link Status of Beam Permits	true	true
Global Beam Permit	true	true
Setup Beam	false	false
Beam Presence	true	true
Moveable Devices Allowed In	true	true
Stable Beams	true	true

PM Status B1 **ENABLED** PM Status B2 **ENABLED**

And then?



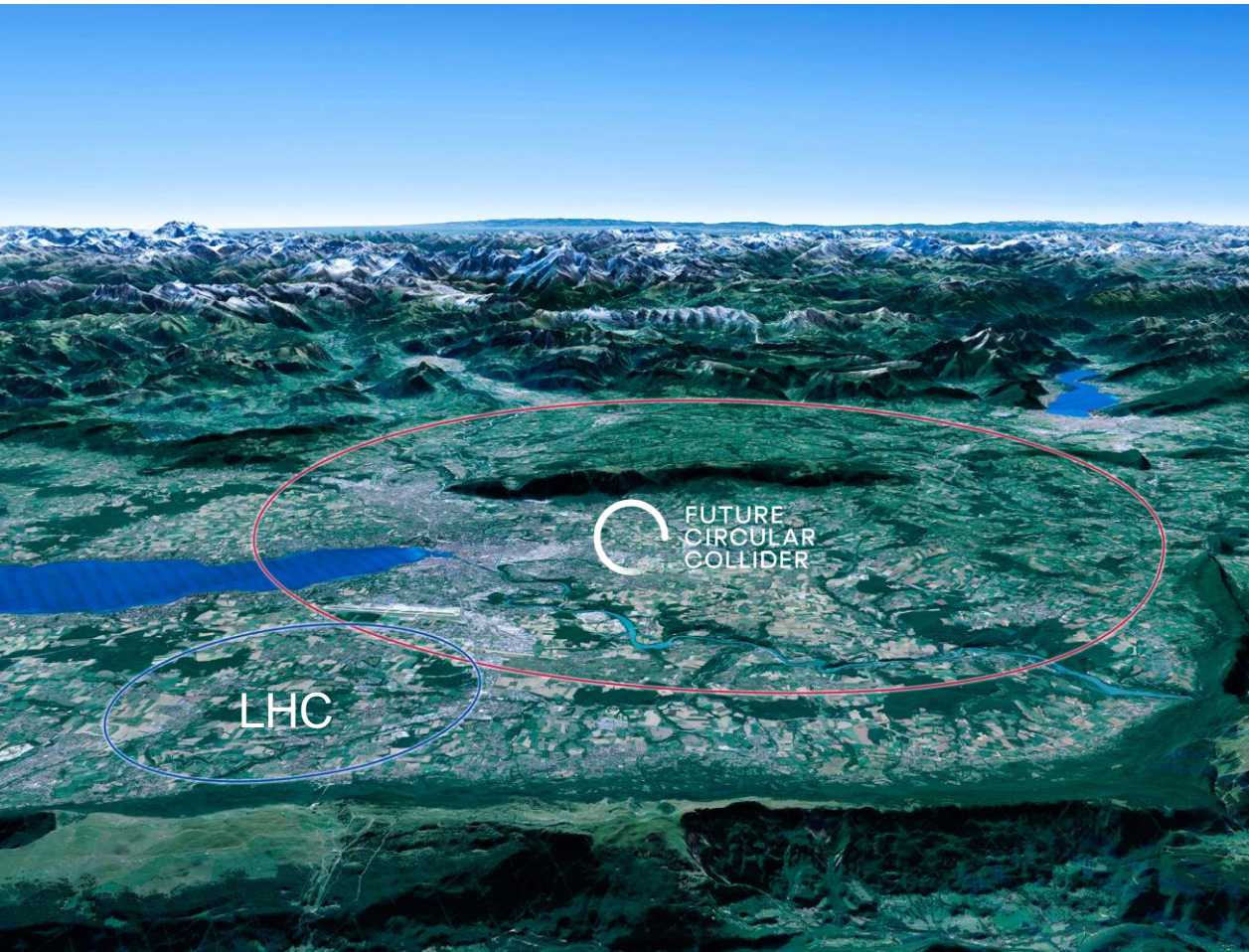
2020 UPDATE OF THE EUROPEAN STRATEGY
FOR PARTICLE PHYSICS

by the European Strategy Group

CERN Scientific Priorities for the Future

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

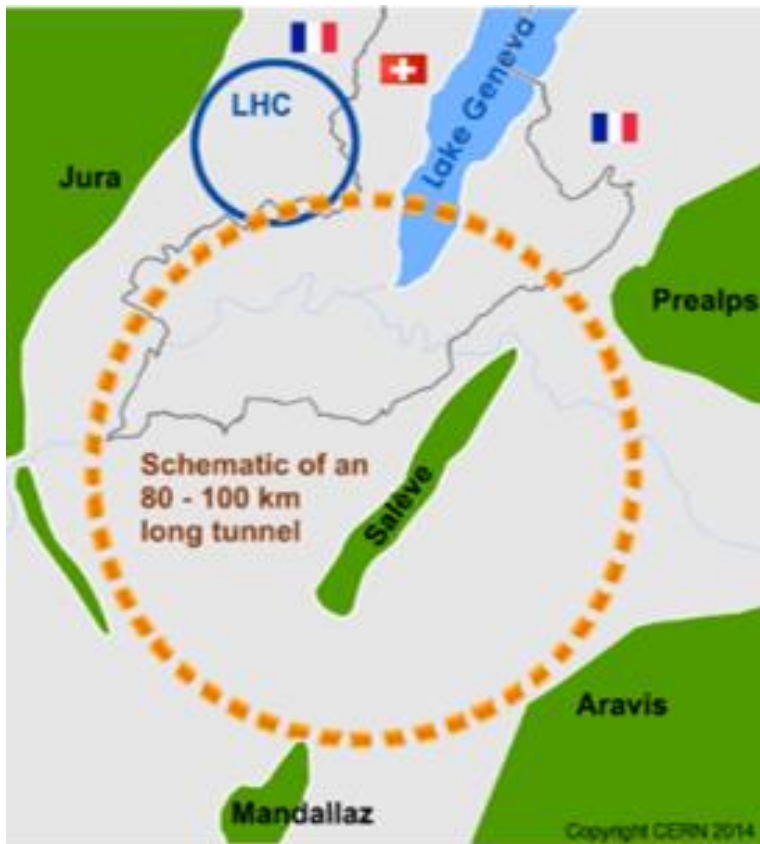
- Fully exploit the LHC & HL-LHC.
- Build a Higgs factory to further understand this unique particle.
- Investigate the technical and financial feasibility of a future energy-frontier 100 km collider at CERN.
- Ramp up relevant R&D.
- Continue supporting other projects around the world.



The FCC Integrated Programme

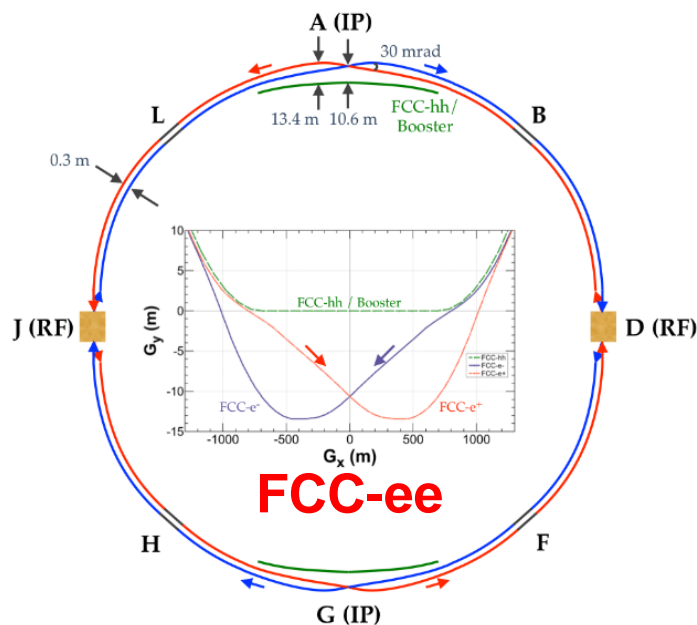
Inspired by successful LEP – LHC Programmes at CERN

Complementary physics, common civil engineering and technical infrastructures, building on and reusing CERN's existing infrastructure, FCC integrated project allows seamless continuation of HEP after HL-LHC



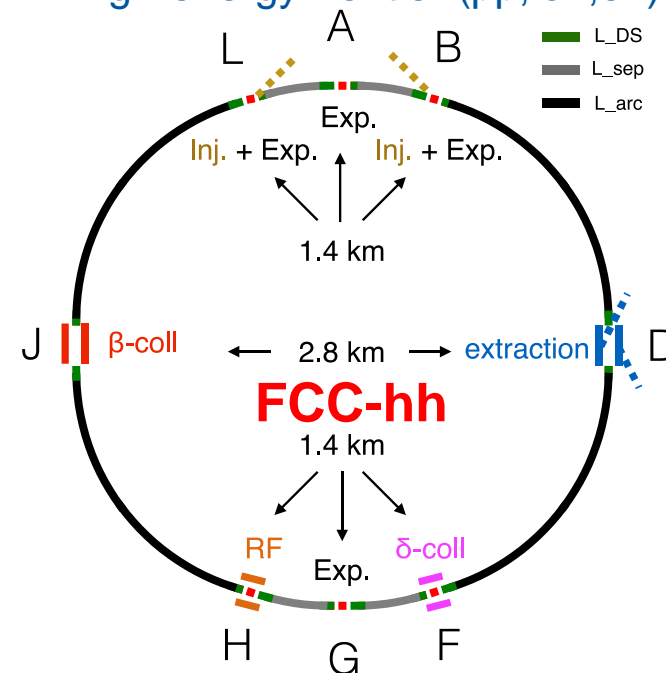
2020 - 2040

Phase 1 : FCC-ee
electron – positron Collider
Higgs, Z, W, ttbar Factory at highest lumi



2040 - 2055

Phase 2 : FCC-hh
proton – proton Collider
High-energy frontier (pp, ion, eh)

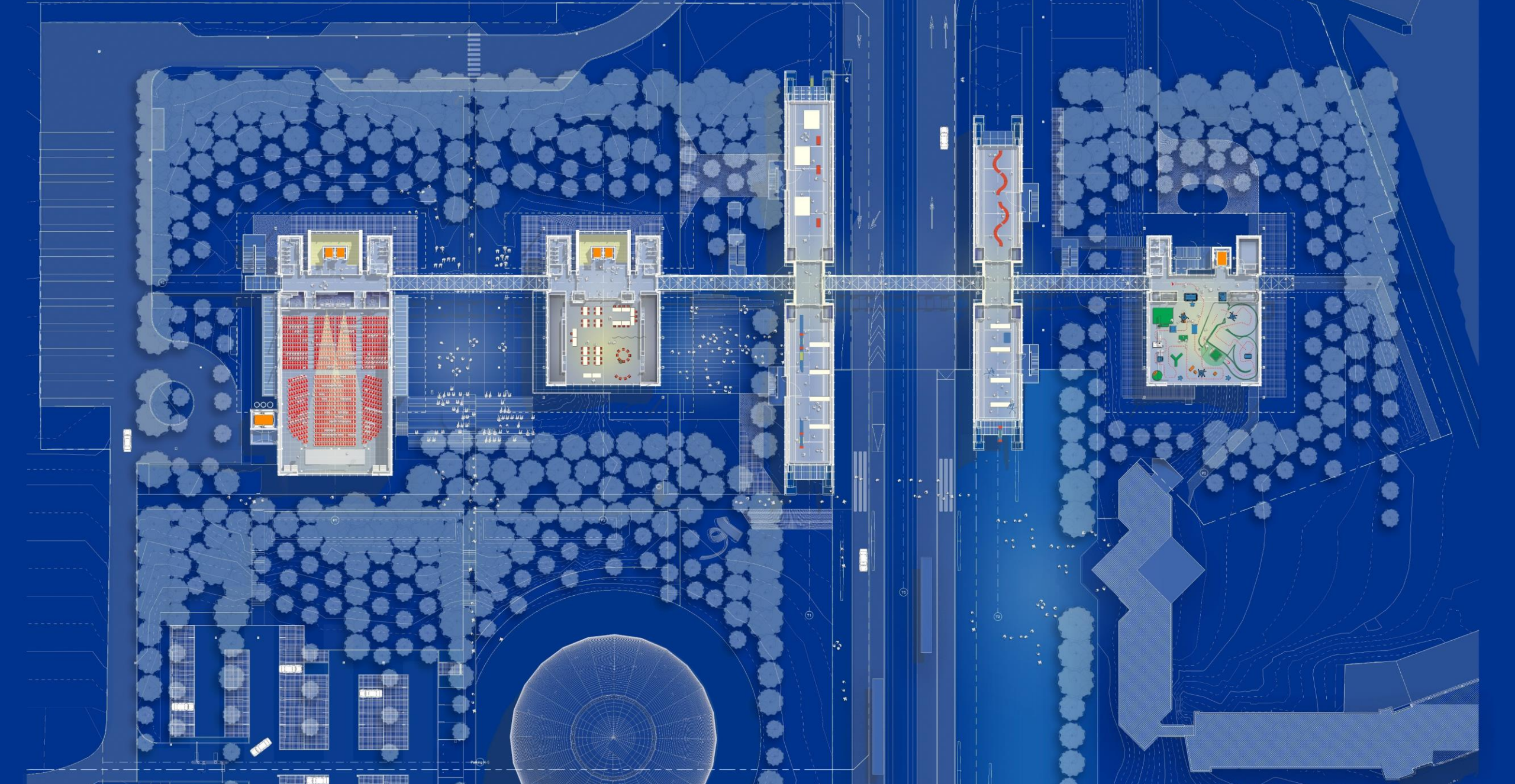


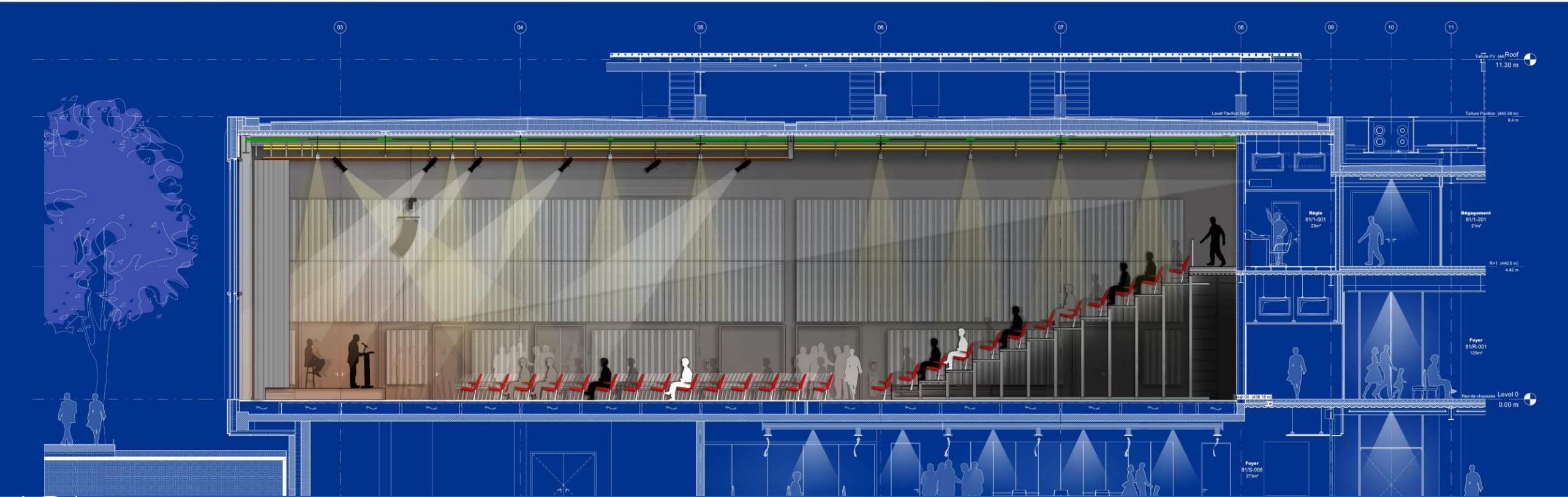
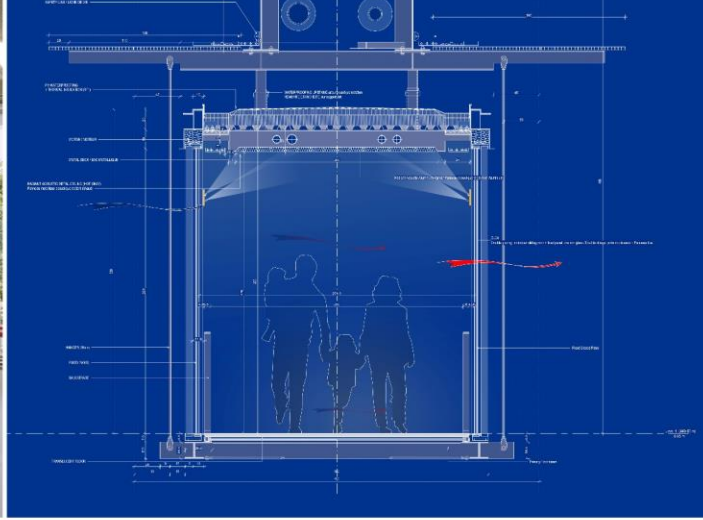
2060 - 2090



CERN Science Gateway







Opportunities



Administrative

Technical

Doctoral

Opportunities for Students



QUEST

ORIGIN

Research Fellowships



CERN

Summer Student Programme



Educational Opportunities – Tertiary and Beyond

The 2021/2022 European School of High-Energy Physics

April 18 - 31 May 2022

Standing Committee

Scientific Programme

Discussion Leaders

Sponsors

International Advisors

Local Committee

https://easpc.cern.ch/easpc2022/

AEPSHEP

Asia Europe Pacific School of High Energy Physics

05-18 OCTOBER 2022

Scientific Programme

Discussion Leaders

Local Committee

CERN School of Computing

4th - 17th September 2022
Kraków - Poland

Physics computing – Software engineering
Data Technologies ...and much more!

Two weeks of lectures and hands-on exercises on advanced and challenging computing topics. Rich social programme. For postgraduate engineers or scientists with experience in particle physics, in computing or in related fields.

Deadline for Application: 8 May 2022
https://indico.cern.ch/ecc-2022/

ISOTDAQ 9th EDITION 2018

INTERNATIONAL SCHOOL OF TRIGGER & DATA ACQUISITION

14-22 FEBRUARY 2018
VIENNA, AUSTRIA
HTTP://ISOTDAQ.HEPHY.AT

TOPICS

- TRIGGER**: ANALOG ELECTRONICS, PROGRAMMING ELECTRONICS, INTELLIGENT TRIGGERING, ASSOCIATIVE MEMORIES, FPGA PROGRAMMING
- DAQ**: ADC, DAC, DETECTOR READOUT, FIRMWARE CONTROLS, CHANNELS, FPGA, PCI, DATA NETWORKS, EVENT AND BUFFER MANAGEMENT, CSC++ PROGRAMMING FOR QCD
- APPLICATION EXAMPLES**: GENERAL CONCEPTS OF ISOTDAQ, PROJECT PHASES, DATA FROM LHC SYSTEMS

CERN ORGANIZING COMMITTEE

LOCAL ORGANIZING COMMITTEE

HOW TO APPLY

Introduction to Accelerator Physics

In collaboration with the Technical University of Kaunas (KTU) the CERN accelerator school is preparing its residential introductory course for September 2022.

Victoria Hotel Kaunas
18 September - 1 October 2022
Kaunas, Lithuania

The final decision on holding this course will be taken by July 2022. Hence previous inscriptions are only a firm expression of interest. Payments and travel organization will be done after the confirmation date.

The introductory CAS course represents the core teaching of all CAS courses and represents the ideal opportunity to be introduced into the field of particle accelerators. This course will be of interest to staff and students from laboratories and universities as well as from companies manufacturing accelerator equipment. The course will focus on various aspects of beam dynamics and it will provide an introduction to the underlying accelerator systems and technologies. Key topics will be consolidated through a series of discussion sessions and computer-based tutorials, while topical seminars will round up the program.

Contact: CERN Accelerator School
CH - 1211 Geneva 23
cas.web@cern.ch
Accelerator.school@cern.ch

14th CERN-FERMILAB HADRON COLLIDER PHYSICS SUMMER SCHOOL

CERN, 28 August - 6 September 2019

MAIN LECTURE TOPICS

International Advisory Committee

Local Organizing Committee

More information at: <http://cern.ch/hccps2019>

10th CERN LATIN-AMERICAN SCHOOL OF HIGH-ENERGY PHYSICS

15-30 March 2019

Scientific Programme

Field Theory and the EW

Special Lecture on Gravitational Waves

Practical Statistics

Neutrino Physics

Special Lectures

Facilities in Latin America

Highlights of LHC Run-2 and Future Prospects

Local Organizing Committee

International Advisory Committee

13th Inverted CERN School of Computing

From 28 September to 2 October 2020
ONLINE SCHOOL

Lectures:

- Programming Paradigms and Design Patterns
- Heterogeneous Programming with OpenCL
- Reconstruction and Imaging
- Computational Fluid Dynamics
- Modern C++ features
- Big Data processing with SQL

Registration and more information:
www.cern.ch/csc

Danube School on Instrumentation in Elementary Particle & Nuclear Physics

UNIVERSITY OF NOVI SAD, SERBIA
September 8-13, 2014

The school is an equal opportunity event intended for MSC, PhD and Postdoc students who want to acquire hands on experience in different detector technologies used in Particle Physics and Nuclear Physics. Researchers, who are actively involved in the field and are recognized experts in detector R&D, will give lectures and state-of-art laboratory sessions. Students are encouraged to attend, contribute and share their experience.

Review Talks

- Higgs Boson: from QED to LHC
- Future Challenges in Physics
- The Linear Colliders Challenges
- Neutrino Physics
- The Challenge of B-physics and rare decay events
- Astro-particle and dark matter searches
- Nuclear Physics

Accompanied by lectures and laboratory "hands-on" practice on detector techniques both in particle and nuclear physics.

More information and registration:
<http://cern-danube-school.uns.ac.rs>

Deadline for applications: June 15th 2014

The CERN Accelerator School is organizing the next general course on ADVANCED ACCELERATOR PHYSICS

06 - 18 November 2022
Neaclub, Sévrier, France

The course will be of interest to physicists and engineers who wish to extend their knowledge on accelerator physics and technologies and expand their professional network.

The course offers core lectures in the mornings combined with hands-on-tutorial in the afternoons. Participants will be able to select one afternoon course from the following three: RF-measurements, beam instrumentation, and beam optics design.

Contact: CERN Accelerator School
CH - 1211 Geneva 23
cas.web@cern.ch
Accelerator.school@cern.ch

CERN Education Programme for Teachers and Students

Teacher Programmes

1 staff
1 fellow
1 doct



Science Gateway

1 staff
5 fellows



2 doct

2 summies

1 technician

Competitions

1½ fellows



1 user



Internships

½ fellow



Publications

1 staff
1 adm
1 tech



Collaboration 1 user



Physics Education Research

1 doct



Education Team Summer 2023

Teacher Programme Participants 1998-2022 (Total: 13 871)



Member States 11 056

Austria 300 – Belgium 149 – Bulgaria 821
Czech Republic 171 – Denmark 348 – Finland 550
France 465 – Germany 1142 – Greece 952
Hungary 561 – Israel 56 – Italy 1139
Netherlands 227 – Norway 158 – Poland 588
Portugal 495 – Romania 20 – Serbia 84
Slovakia 307 – Spain 705 – Sweden 311
Switzerland 135 – United Kingdom 1372

Associate Member States

in the pre-stage to Membership 165

Cyprus 16 – Estonia 105 – Slovenia 44

Associate Member States 889

Croatia 114 – India 15 – Latvia 76 – Lithuania 64
Pakistan 9 – Türkiye 403 – Ukraine 208

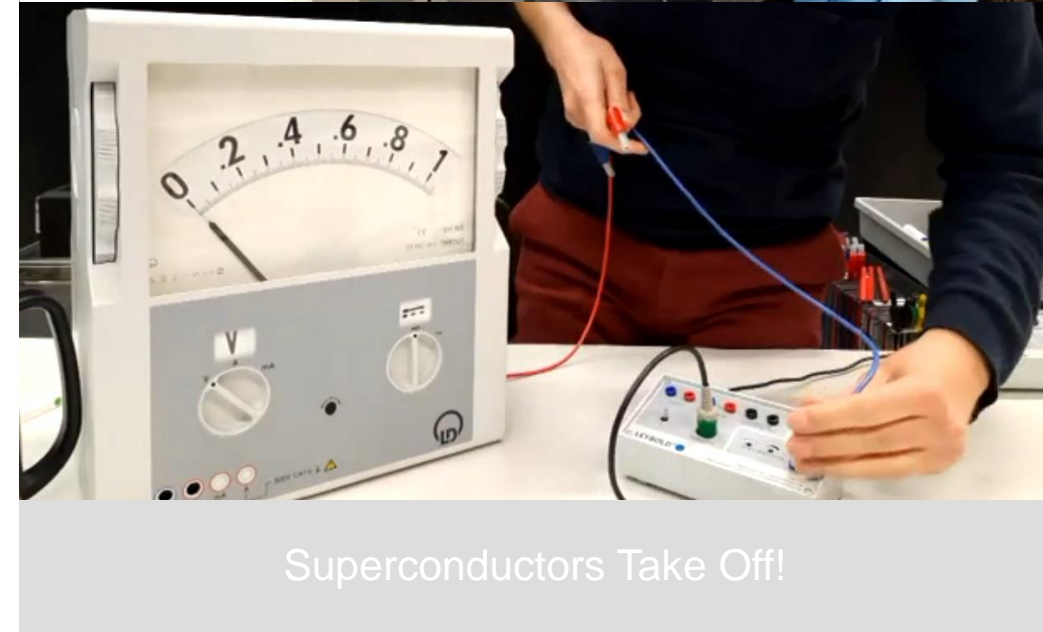
Observers 579

Japan 12 – Russia (suspended) 431
United States of America 136

Non-Member States and Territories 1182

Algeria 11 – Angola 11 – Argentina 3 – Armenia 3 – Australia 14 – Azerbaijan 2 – Bahrain 3 – Bangladesh 1 – Belarus 11
Bosnia & Herzegovina 36 – Brazil 273 – Burundi 2 – Cameroon 11 – Canada 20 – Cape Verde 5 – Chile 4 – Colombia 8
Costa Rica 4 – Dominican Republic 73 – Ecuador 2 – Egypt 3 – Eswatini 1 – Georgia 194 – Ghana 7 – Guinea Bissau 2
Indonesia 3 – Iran 15 – Ireland 10 – Jordan 13 – Kazakhstan 14 – Kenya 4 – Kuwait 1 – Kyrgyzstan 1 – Lebanon 21
Madagascar 2 – Malaysia 3 – Malta 51 – Mexico 113 – Moldova 4 – Mongolia 1 – Montenegro 17 – Morocco 2
Mozambique 24 – Nepal 6 – New Zealand 5 – Nigeria 2 – North Macedonia 13 – Palestinian Territories 5
People's Republic of China 3 – Philippines 2 – Qatar 1 – Republic of Korea 49 – Rwanda 20 – Sao Tome 8
Saudi Arabia 1 – Singapore 2 – South Africa 9 – Sri Lanka 3 – Taiwan 1 – Tajikistan 1 – Tanzania 1 – Thailand 23
Timor-Leste 10 – Uganda 3 – United Arab Emirates 1 – Uruguay 3 – Venezuela 1 – Vietnam 2 – Zimbabwe 1

It's Just a Phase!



Superconductors Take Off!

- Live interactive demonstrations of scientific phenomena
- Links to CERN research
- Questions and answers
- Various languages



Virtual Science Shows — the pandemic as great opportunity

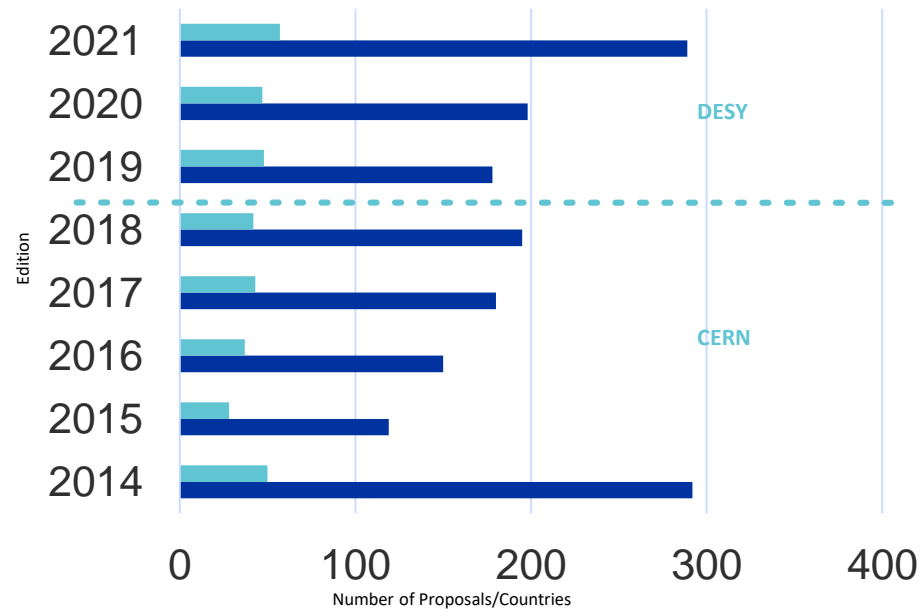
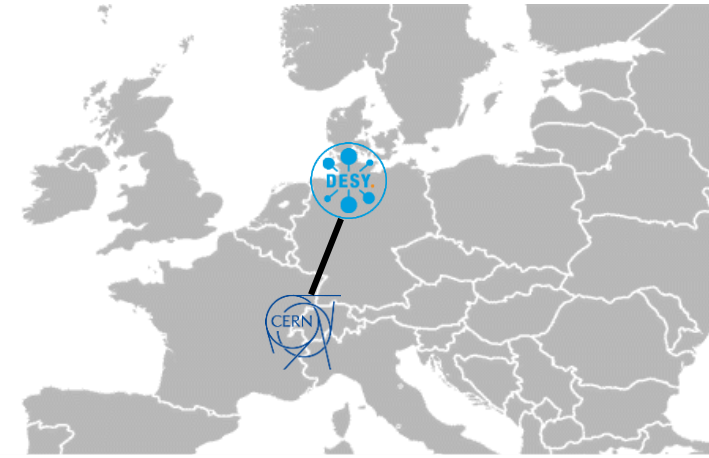
10/2/20
23

ESCO-ISP how we welcomed thousands of students and teachers in our living rooms



High-School Students Internship Programme

- Competition for High-School Student Teams
- Normally at CERN's PS, 2019-21 at DESY
- Participation 2021
 - 298 proposals
- 2022
 - back at CERN for the finals of the competition
 - with 1 additional winning team at DESY



Beamline for Schools Competition

Fostering i

Sarah Zöchling

Link to CERN

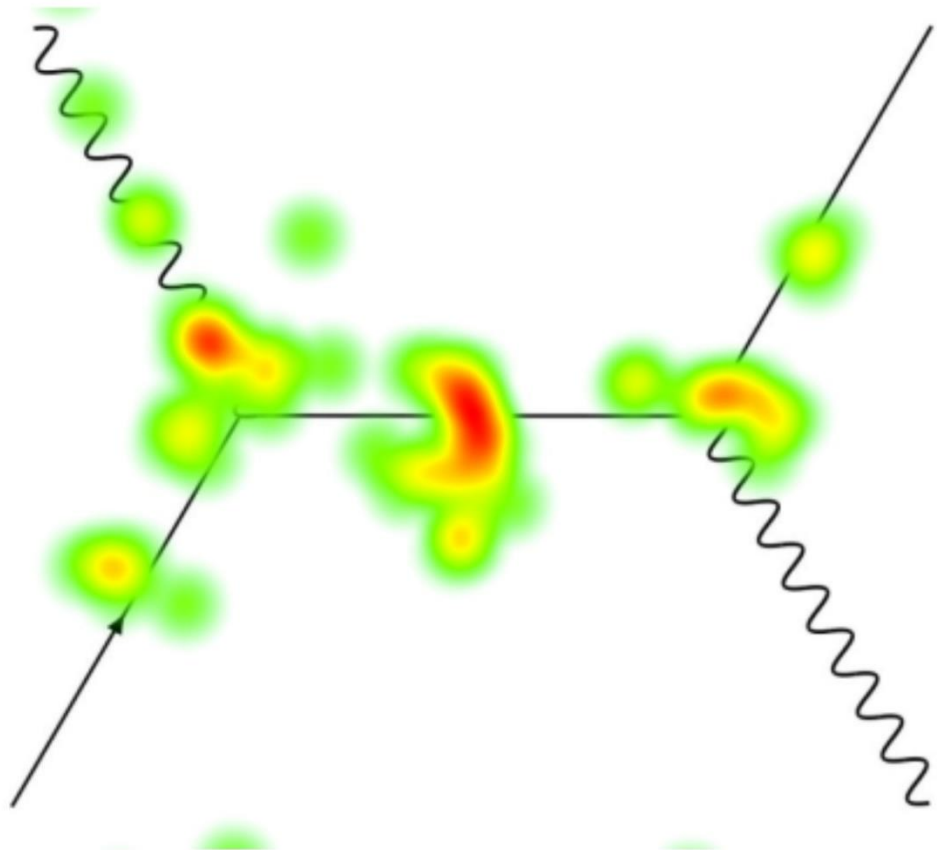
Development of
interest in partic
students' interes
contexts to ...

- define interest
- give recommen
material

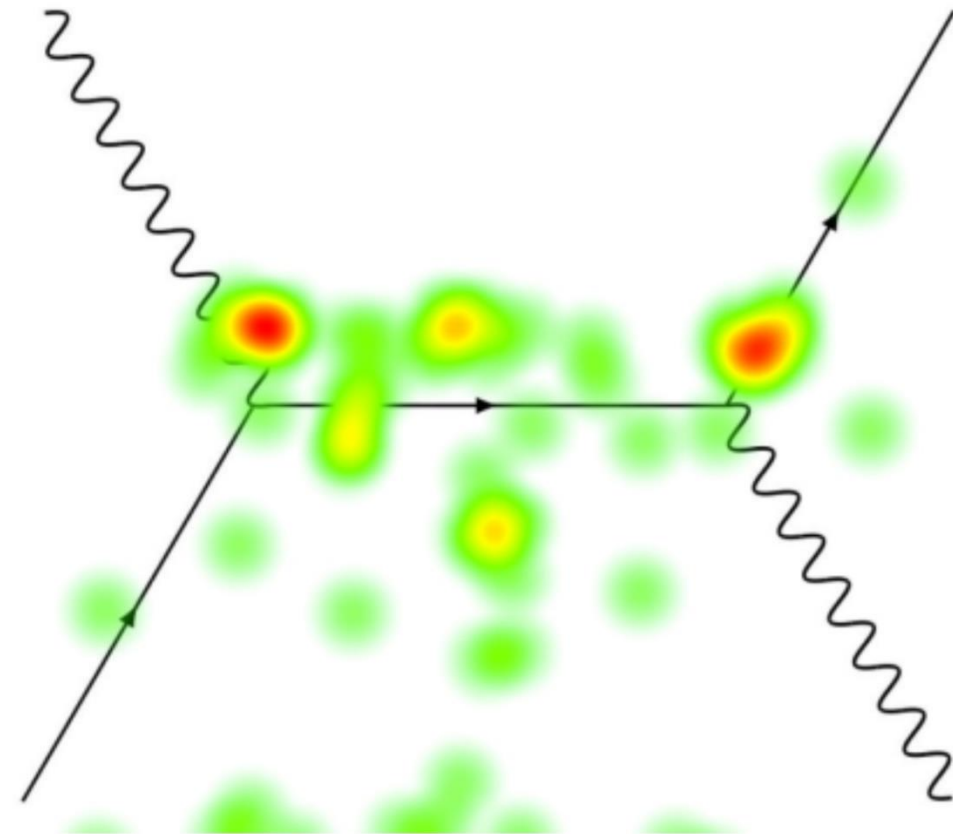


Eye Tracking in PER

Novices

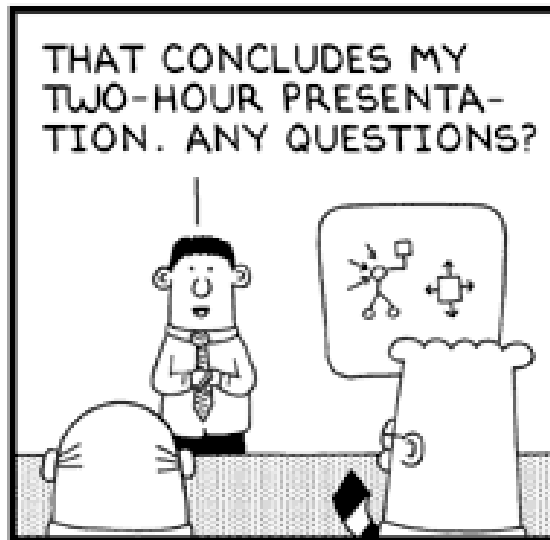


Experts



How many Vertices is the diagram composed of?

Your Questions



www.dilbert.com scottadams@aol.com



8/1/03 © 2003 United Feature Syndicate, Inc.

