Welcome and Introduction

Joint CERN-Korea Committee (CKC)

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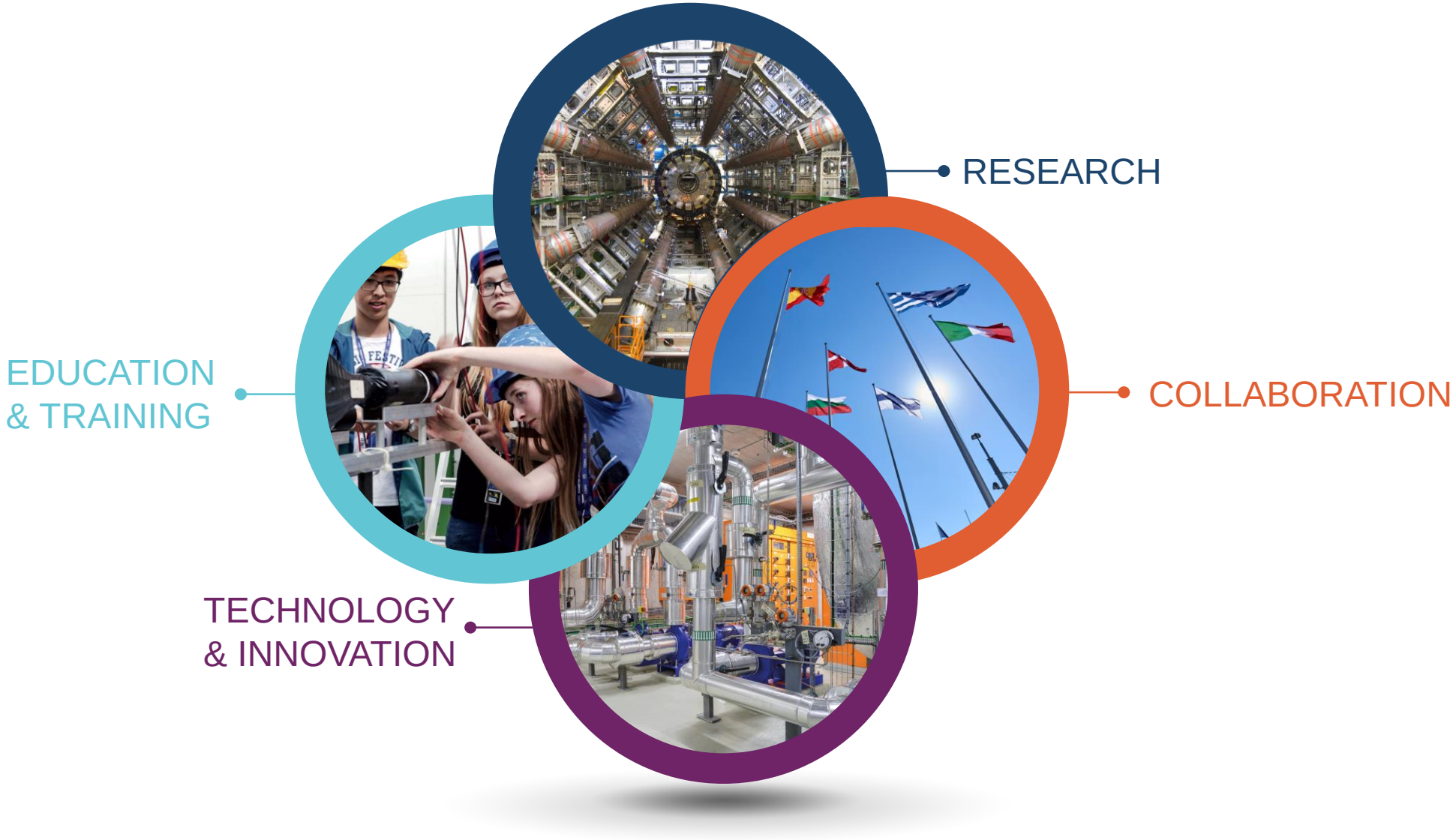
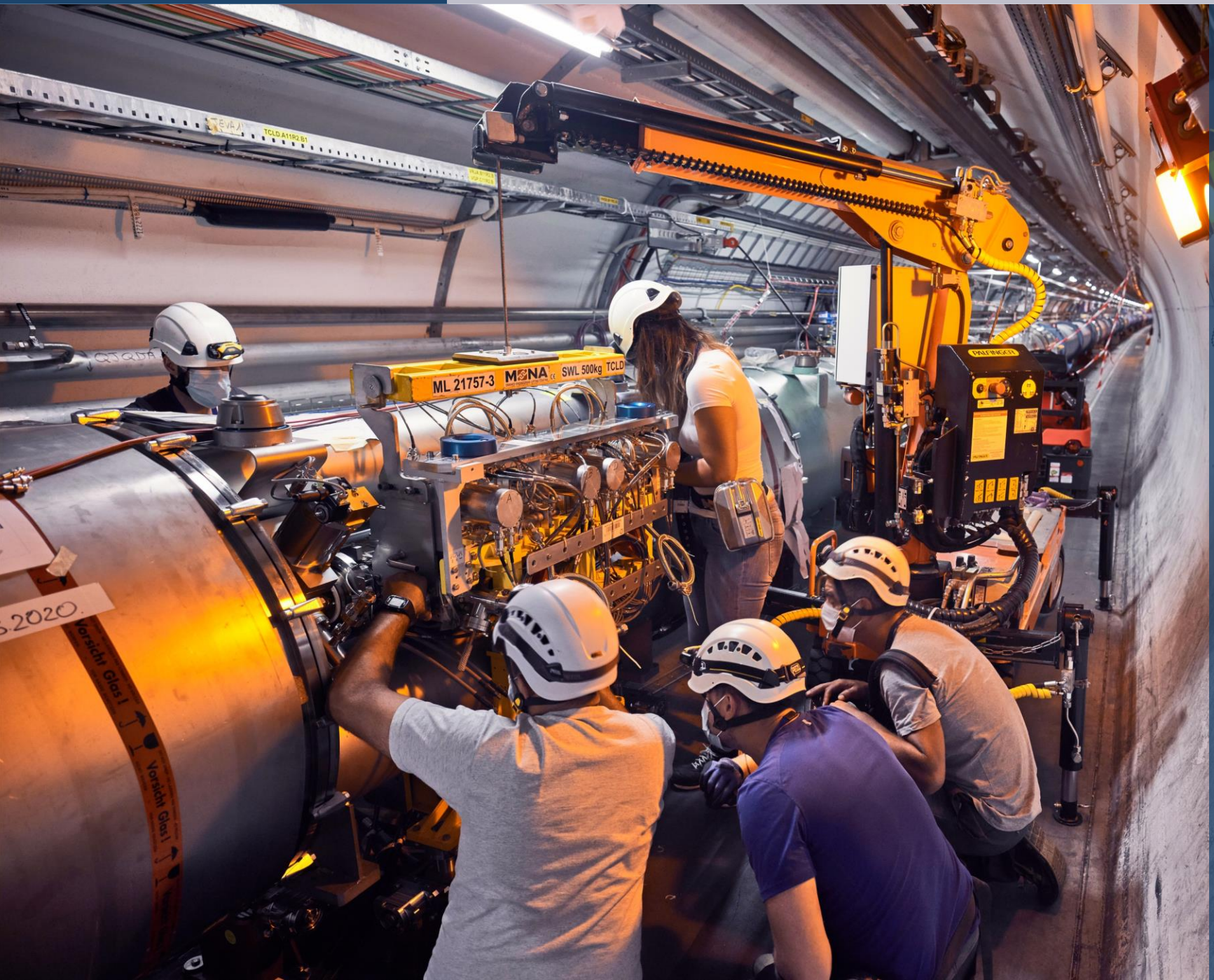
Head of Associate Member State and Non-Member State Relations
CERN
22 April 2024

Four pillars underpin CERN's mission

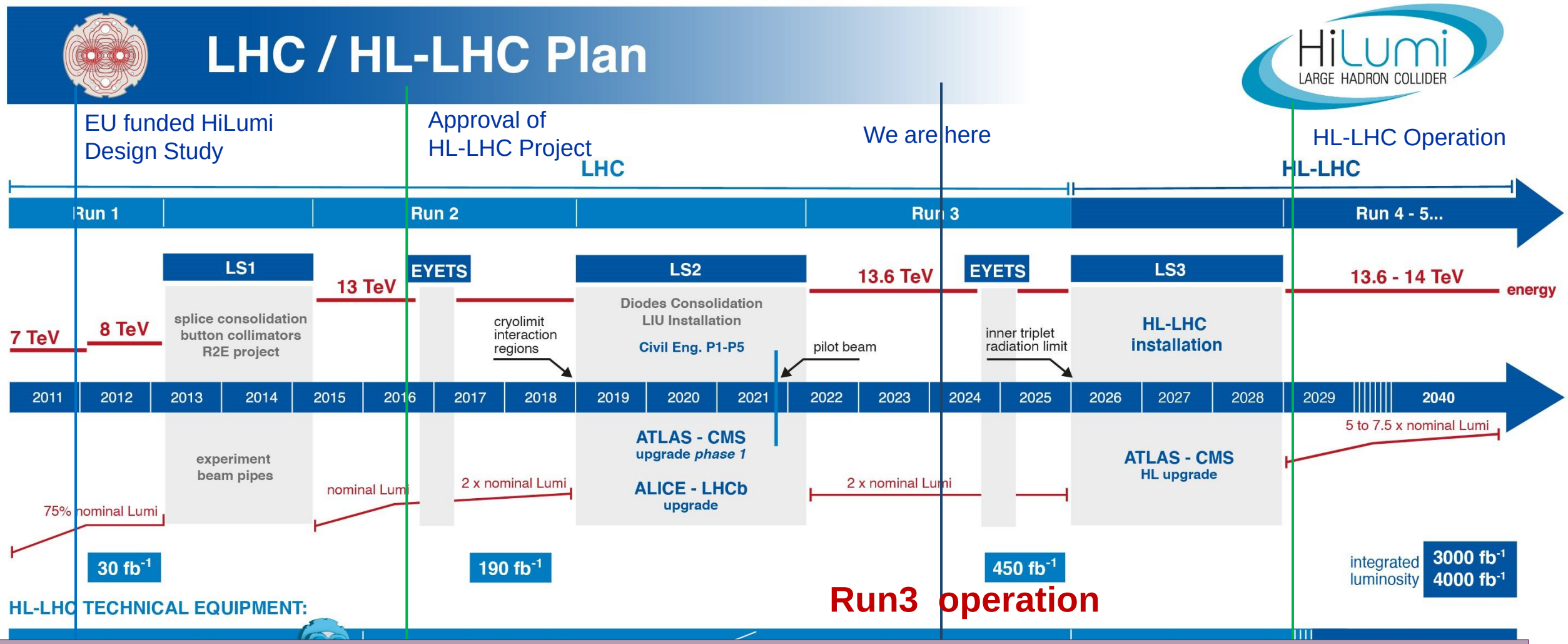




Upgrade to the High-Luminosity LHC is under way

- 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 2041.

LHC / HL-LHC Plan



➔ 2 years until start of Long Shutdown 3

➔ <u>The project is ready for installation start in 2026! ➔ endorsed by 2023 C&SR</u>

Goal of HL-LHC Upgrade Project

The main objective of the HL-LHC is to determine and build a hardware configuration and a set of beam parameters that will allow the LHC to reach the following targets:

- Prepare machine for operation beyond 2025 and up to **2040**
- Devise beam parameters and operational scenarios for:
  - Enabling a total integrated luminosity of **3000 fb^{-1}**
    - Implies an integrated luminosity of **250 fb^{-1} per year**
  - Operation at **$\mu \leq 140$** (➔ peak luminosity **5 x 10^{34} cm^{-2} s^{-1}**)

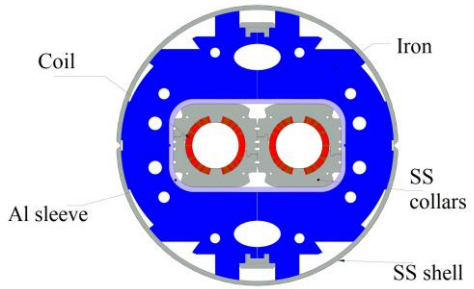
-> A challenge as well for the experiments!
Operation with levelled luminosity!

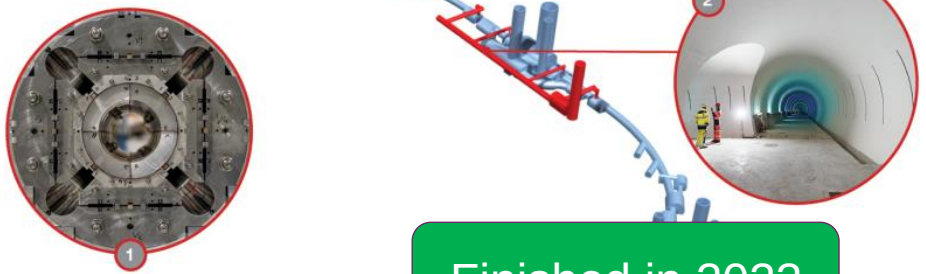
Technology Landmarks

Finished in 2023

Series production in Industry well underway

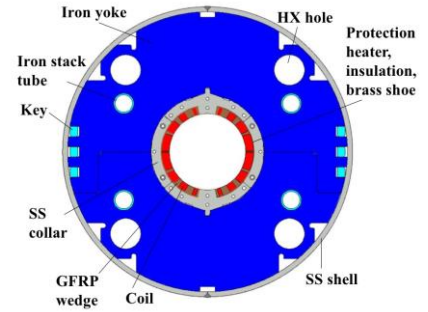
Prototype and first series delivered to CERN





Fully validated in 2023 and first magnets ready for installation

Finished in 2023



Complete Prototype System installed in SM18 and under testing

½ system already installed for Run3

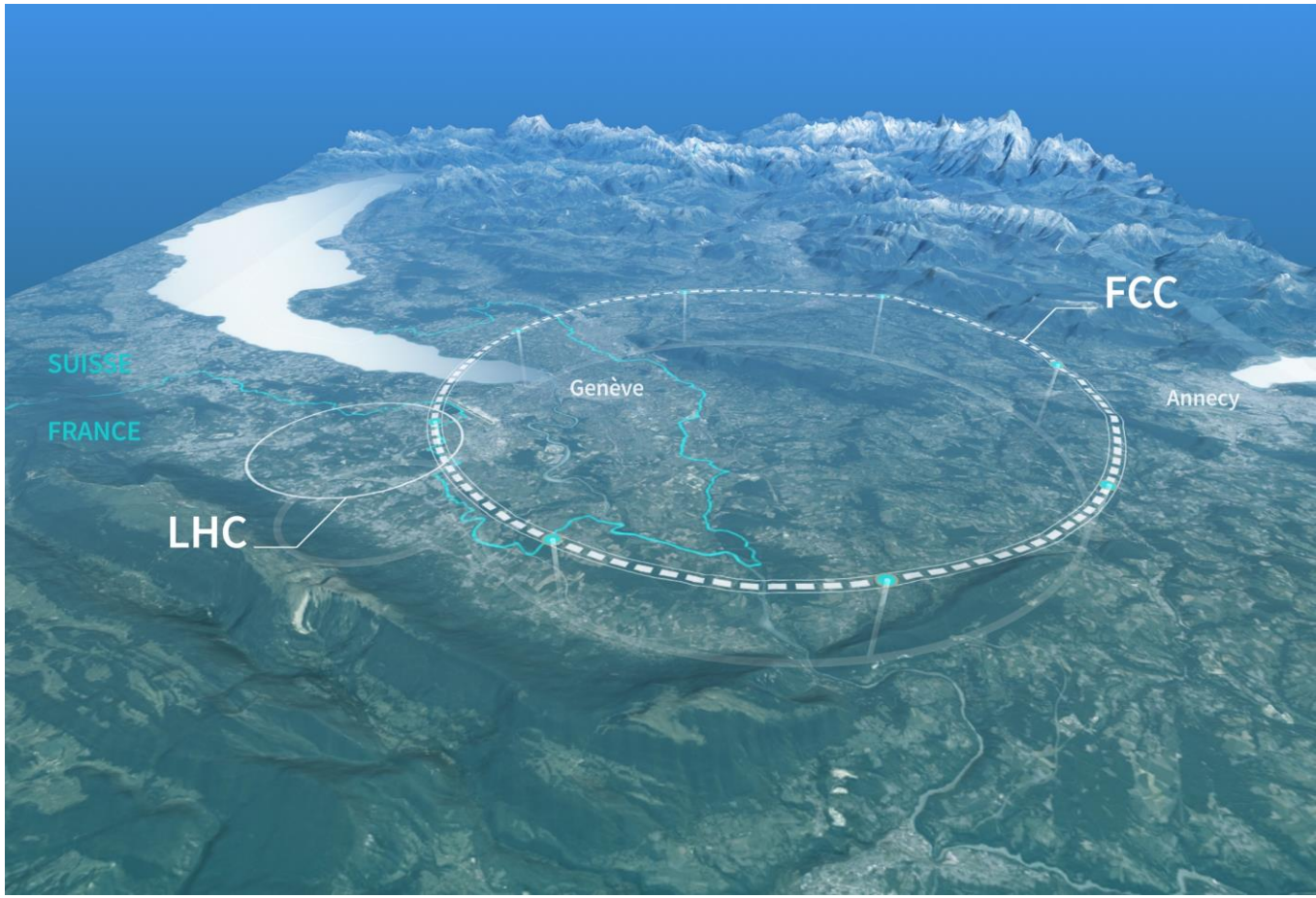
Successfully deployed in 2023 Pb-Pb run

Prototype cryostated @ CERN

Preparing CERN's future

Driven by the **2020 Update of the European Strategy for Particle Physics**

- Technical and financial feasibility study of a Future Circular Collider (report for end 2025)
- Accelerator R&D to develop technologies for FCC and for alternative options
- Detector and computing R&D
- Maintain and expand a compelling scientific diversity programme
- Continue to support other projects around the world

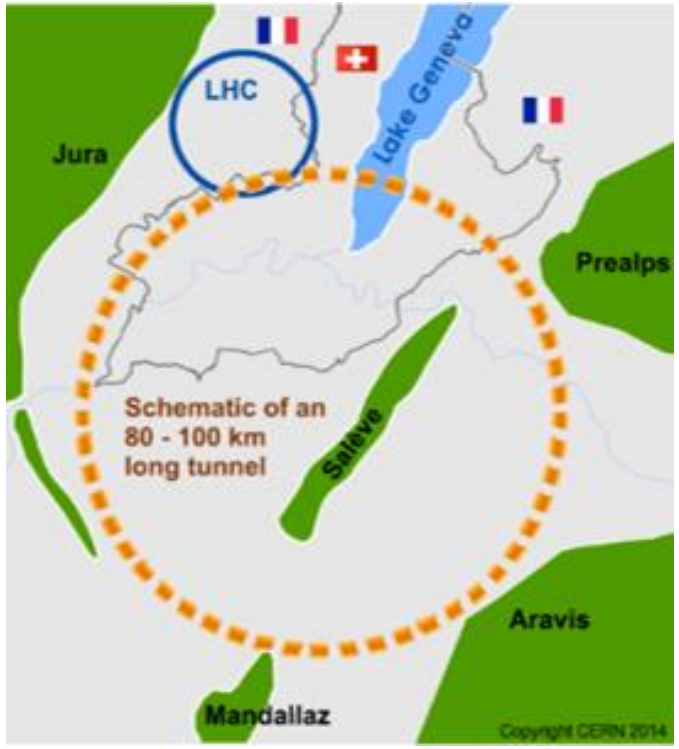


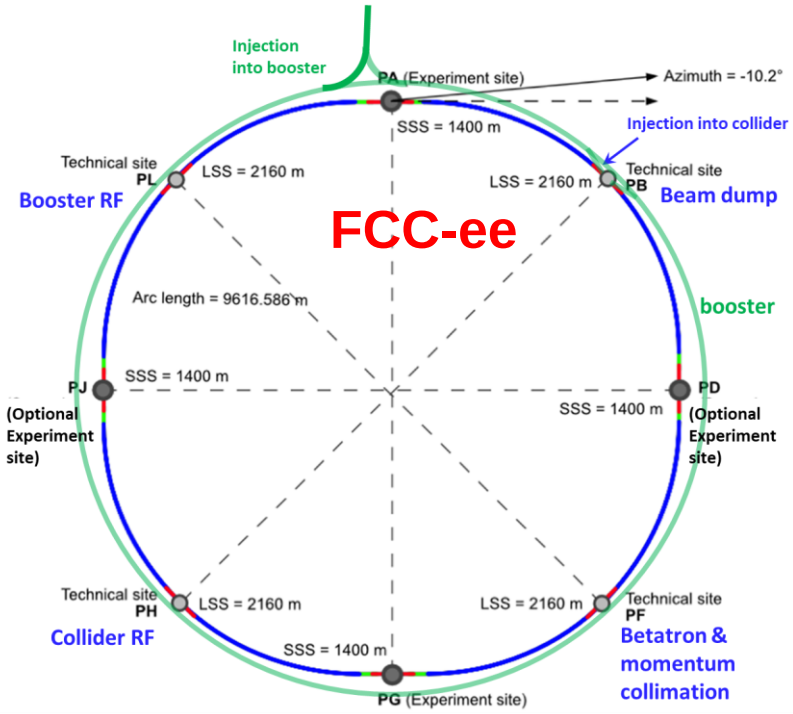
FUTURE CIRCULAR COLLIDER

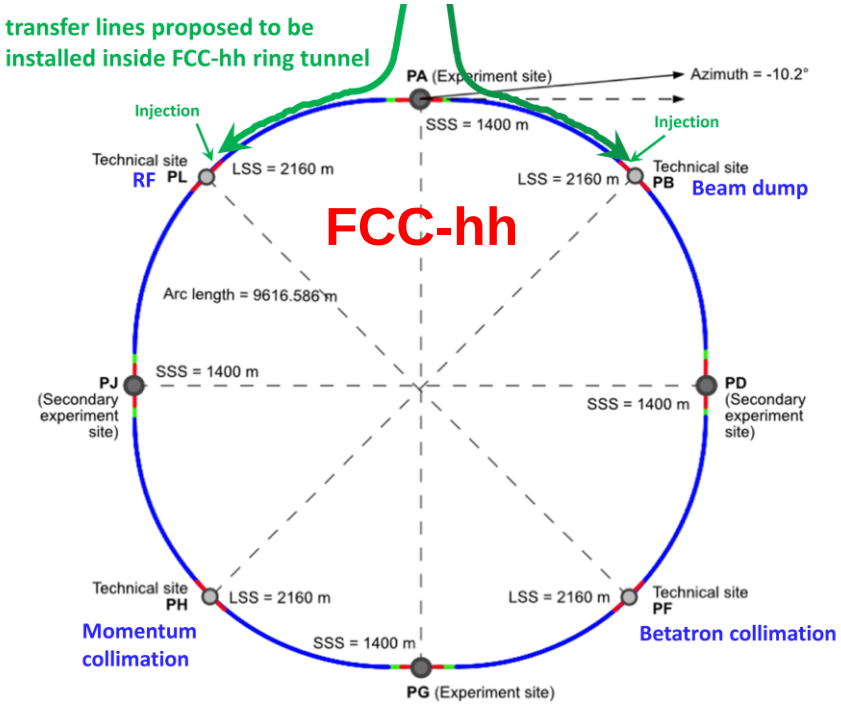
FCC Integrated Programme

Comprehensive long-term programme maximising physics opportunities

- **Stage 1: FCC-ee (Z, W, H, $t\bar{t}$) as Higgs factory, electroweak & top factory at highest luminosities**
- **Stage 2: FCC-hh (~100 TeV) as natural continuation at energy frontier, pp & AA collisions; e-h option**
- Highly synergetic and complementary programme boosting the physics reach of both colliders
- Common civil engineering and technical infrastructures, building on and reusing CERN's existing infrastructure
- FCC integrated project allows the start of a new, major facility at CERN within a few years of the end of HL-LHC



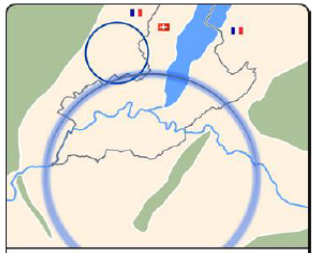


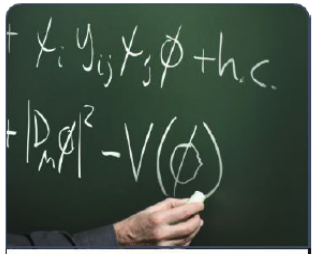


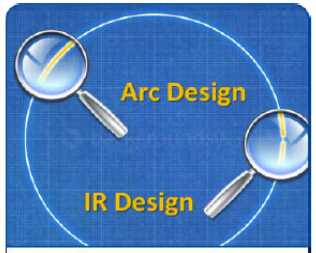
High-level Goals of Feasibility Study

High-level goals of Feasibility Study

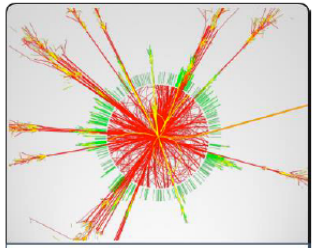
- optimisation of placement and layout of the ring and related infrastructure, and demonstration of the geological, technical, environmental and administrative feasibility of the tunnel and surface areas;
- pursuit, together with the Host States, of the preparatory administrative processes required for a potential project approval, with a focus on identifying and surmounting possible showstoppers;
- optimisation of the design of the colliders and their injector chains, supported by targeted R&D to develop the needed key technologies;
- development and documentation of the main components of the technical infrastructure;
- elaboration of a sustainable operational model for the colliders and experiments in terms of human and financial resource needs, environmental aspects and energy efficiency;
- identification of substantial resources from outside CERN's budget for the implementation of the first stage of a possible future project;
- consolidation of the physics case and detector concepts for both colliders.

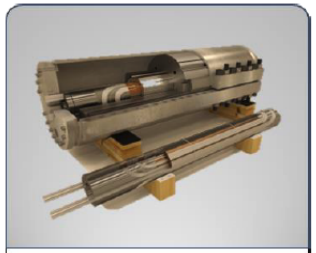

Infrastructures


Physics Cases



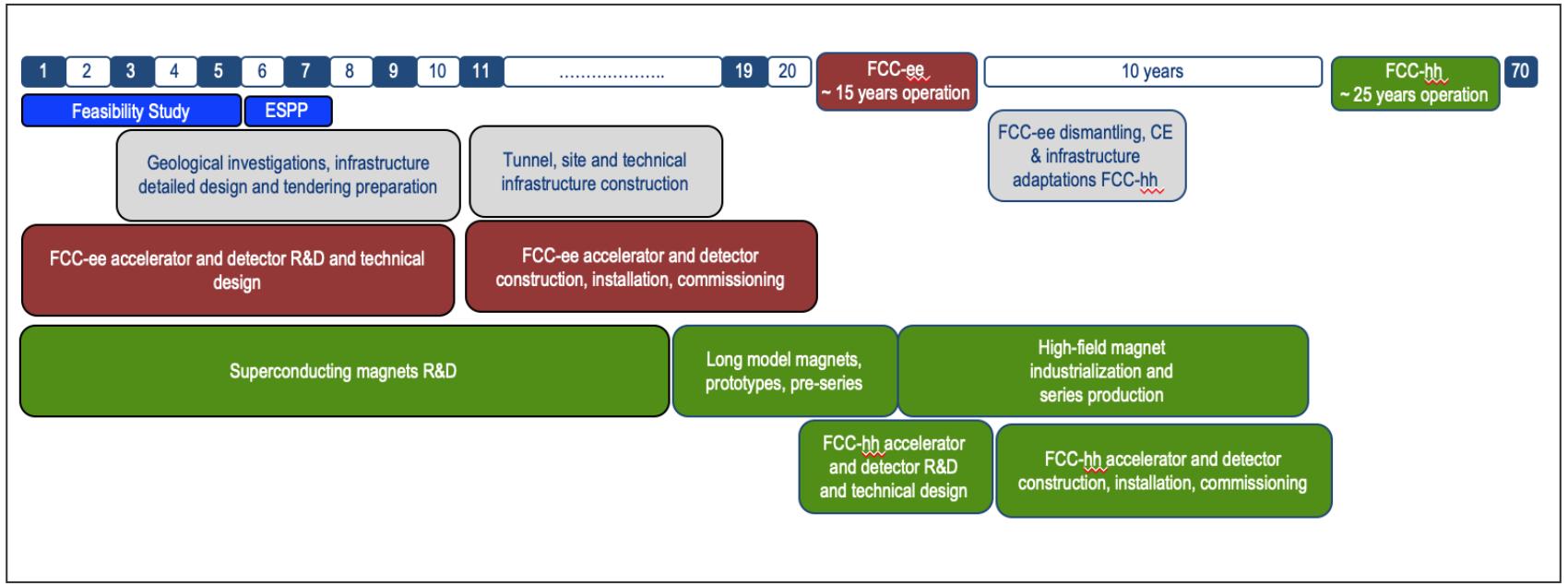
Collider Designs


Experiments

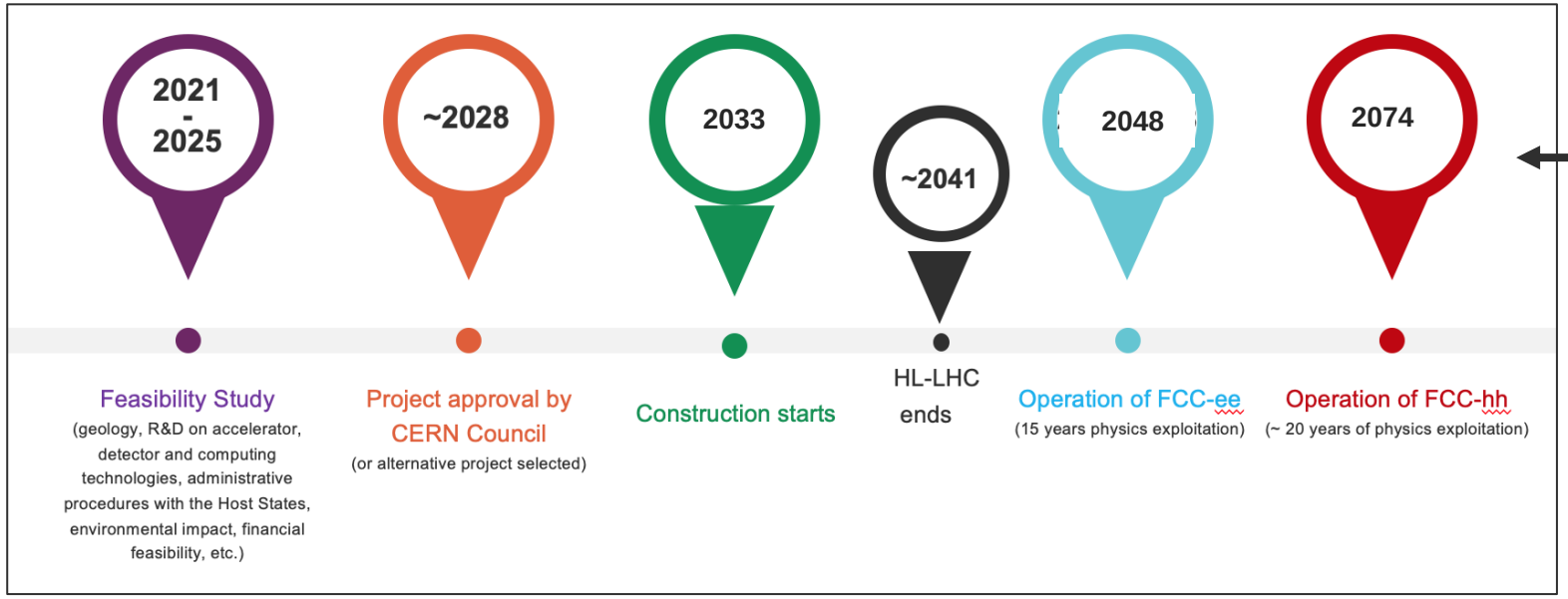

R&D Programs

Cost Estimates

FCC Integrated Programme - Timeline



Note: FCC Conceptual Design Study started in 2014 leading to CDR in 2018



"Realistic" schedule taking into account:

- ❑ past experience in building colliders at CERN
- ❑ approval timeline: ESPP, Council decision
- ❑ that HL-LHC will run until 2041

Can be accelerated if more resources available

FCC Feasibility Study – Mid-term Status Summary

The first part of the FCC Feasibility Study has been completed with the Mid-term Review

- 20 – 22 November 2023: SPC and FC review meetings on mid-term review
- 2 February 2024: CERN Council meeting on mid-term review

Focus 2021 - 2023:

- Identifying best placement & layout and adapting entire project to new placement.
- This provided the input for the mid-term review documentation and cost estimate update.

Fruitful collaboration between scientific & technical actors, in close cooperation with the CERN Host State services, at departmental/cantonal and local level. Direct exchange in place with communes concerned by surface sites. Environmental studies ongoing.

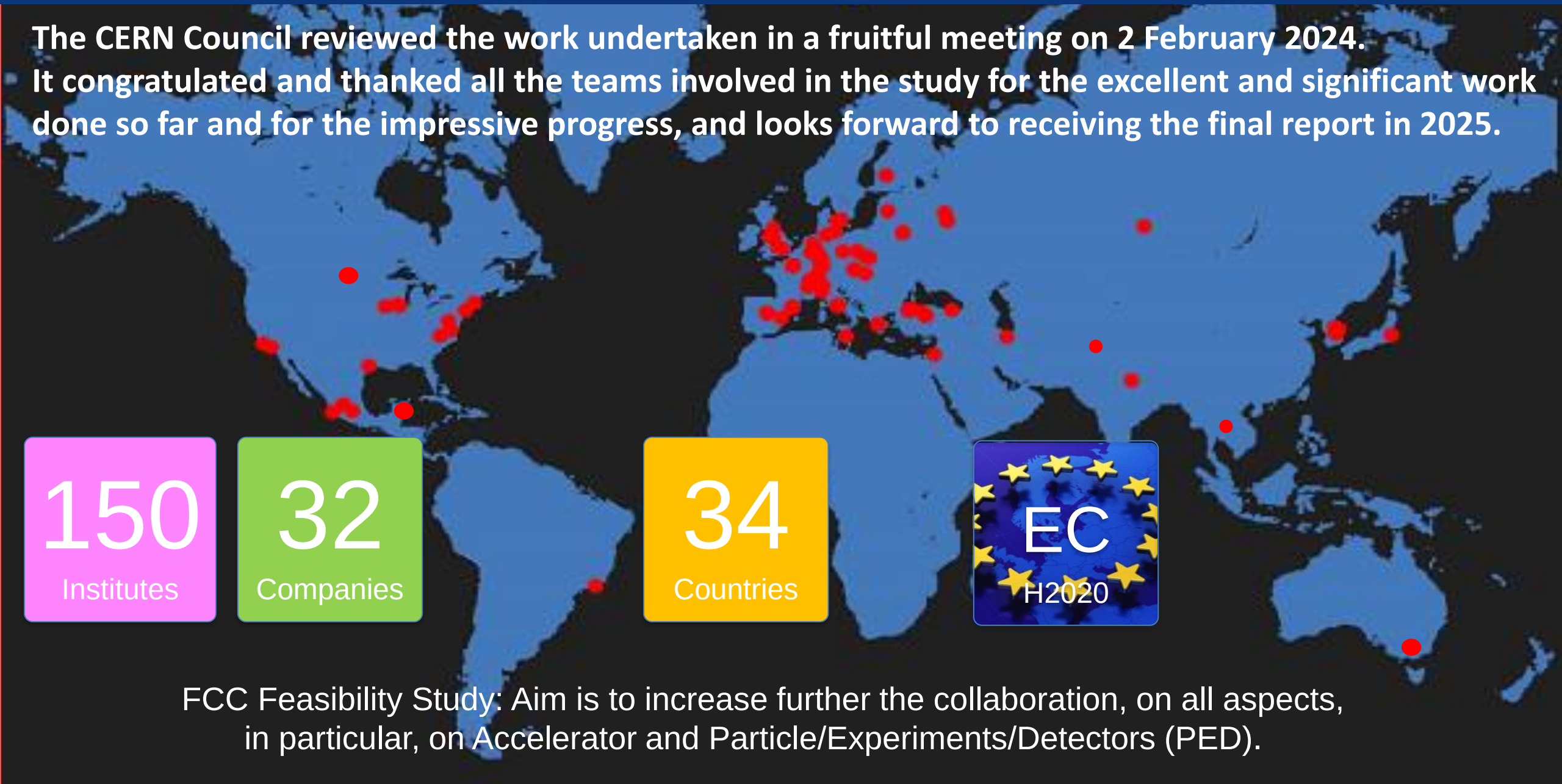
Focus 2024 - 2025:

- Subsurface investigations, further optimisation of implementation, surface sites, synergies, etc.
- Full design iteration in view of technical and cost optimisation of entire project.
- Cost containment and reduction of cost uncertainties, development of risk register.
- Further development of an affordable funding model and related governance implications (with Council).
- Environmental impact (civil engineering, excavated materials, sustainability); geological investigations
- Completion of the FCC Feasibility Study in 2025.

FUTURE CIRCULAR COLLIDER

Status of FCC Global Collaboration

The CERN Council reviewed the work undertaken in a fruitful meeting on 2 February 2024.
It congratulated and thanked all the teams involved in the study for the excellent and significant work done so far and for the impressive progress, and looks forward to receiving the final report in 2025.



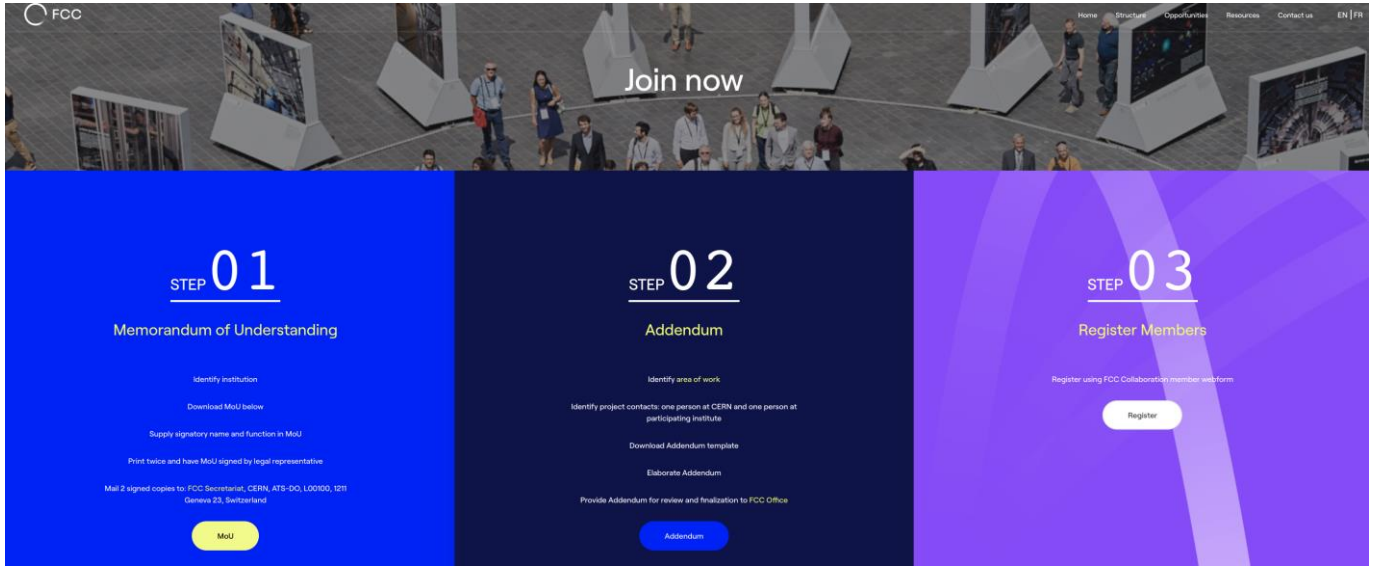
FCC Feasibility Study: Aim is to increase further the collaboration, on all aspects, in particular, on Accelerator and Particle/Experiments/Detectors (PED).

FCC Feasibility Study Collaboration Membership

Participation in FCC through **MoU and Addenda**.

The FCC MoU for the first phase of the study is being **updated to cover the Feasibility Study**.

The current participating institutes who wish to take part in the Feasibility Study can continue to participate on the basis of the previously signed MoU until the updated MoU is signed.



https://fccis.web.cern.ch/join-now

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

8 Associate Member States

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

6 Observers

Japan – Russia (suspended) – USA
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 – 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**
22.5 % women

Member States 7438

Austria 86 – **Belgium** 129 – **Bulgaria** 46 – **Czech Republic** 252
Denmark 47 – **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 **69**

Cyprus 14 – **Estonia** 29 – **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

CERN Science Gateway

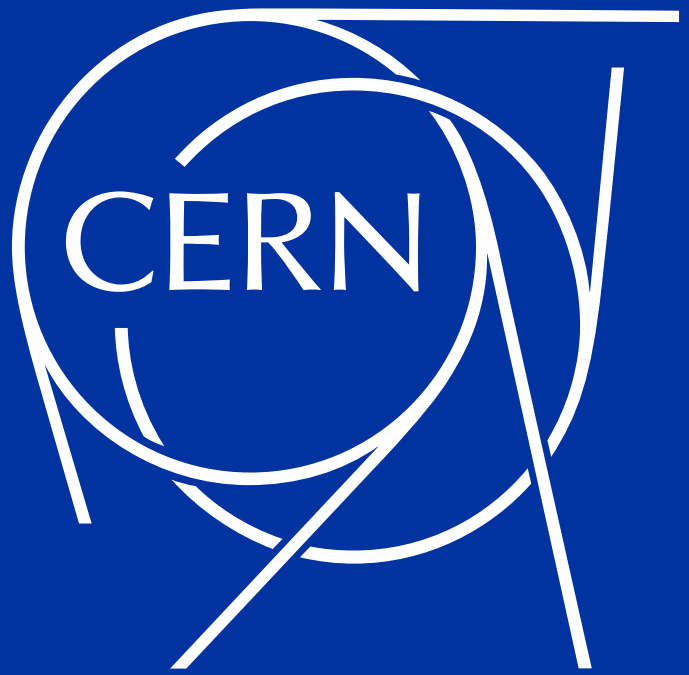
CERN's new education and outreach centre for all publics aged 5-plus.

Inaugurated
7 October 2023.

Number of visitors: **>150 000**

Immersive exhibitions, education labs, events and shows.

Centrepiece of CERN 70th Anniversary on 1 October 2024



Thank you