Future Circular Collider – Status & Plan

Frank Zimmermann, CERN
FCC Deputy Project Leader

many thanks to Michael Benedikt and Jean-Paul Burnet

Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Congrès de l'ACP 2026 CAP Congress
Ottawa, 24 June 2026

http://cern.ch/fcc

FUTURE CIRCULAR COLLIDER Innovation Study · EuroCirCol A key to New Physics · EASITrain · iFAST · EPITA · E-JADE · EAJADE · CHART Swiss Accelerator Research and Technology · CERN

*Work supported by the **European Commission** under the **HORIZON 2020 projects EuroCirCol**, grant agreement 654305; **EASITrain**, grant agreement no. 764879; **iFAST**, grant agreement 101004730, **FCCIS**, grant agreement 951754; **E-JADE**, contract no. 645479; **EAJADE**, contract number 101086276; **iRIS**, grant agreement no. 101275935, **EPITA**, grant agreement no. 101290927 and by the Swiss **CHART** program*

European Commission | Horizon 2020 European Union funding for Research & Innovation

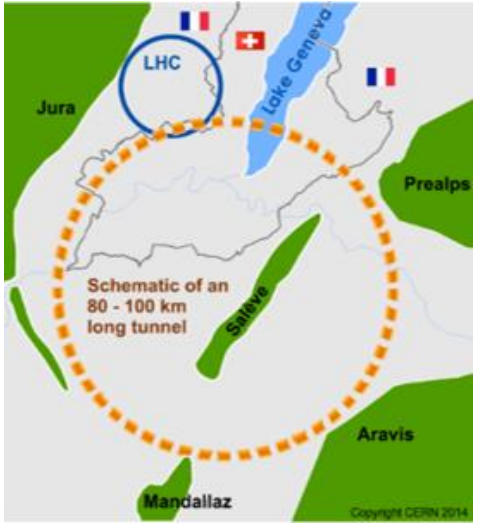
photo: J. Wenninger

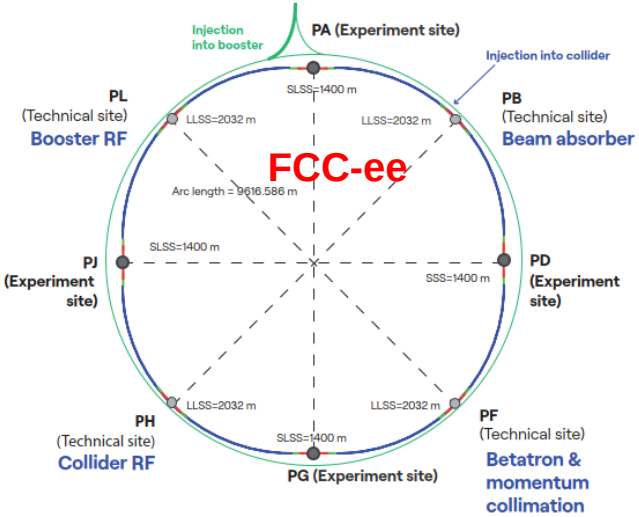
Future Circular Collider – scope

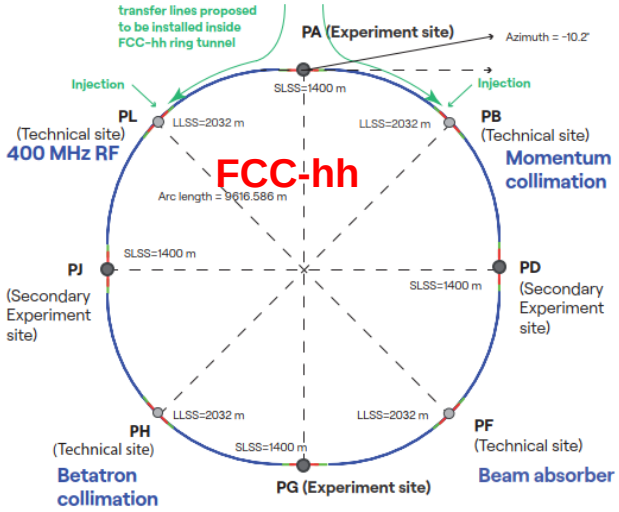
FCC-ee (Z, W, H, $t\bar{t}$): Higgs factory, electroweak & top factory at highest luminosities

FCC-hh (~100 TeV) as potential second step: energy frontier, pp & AA collisions; e-h option

- focus on implementation of FCC-ee as first step ; possible pathway to FCC-hh to be decided later
- common civil engineering and technical infrastructures, building on and reusing CERN's existing infrastructure
- highly synergetic and complementary physics programme maximising the physics opportunities
- FCC-ee project would allow the start of a new, major facility at CERN within a few years of the end of HL-LHC







2020 - 2045 | 2048 - 2062 | ~2075 ?

FCC-ee basic design choices and performance

- **Double ring** e^+e^- collider, allowing many bunches, high current, like LHC and B factories, different from LEP
- **Synchrotron radiation power 50 MW/beam** at all beam energies. Energy loss ΔE per turn:

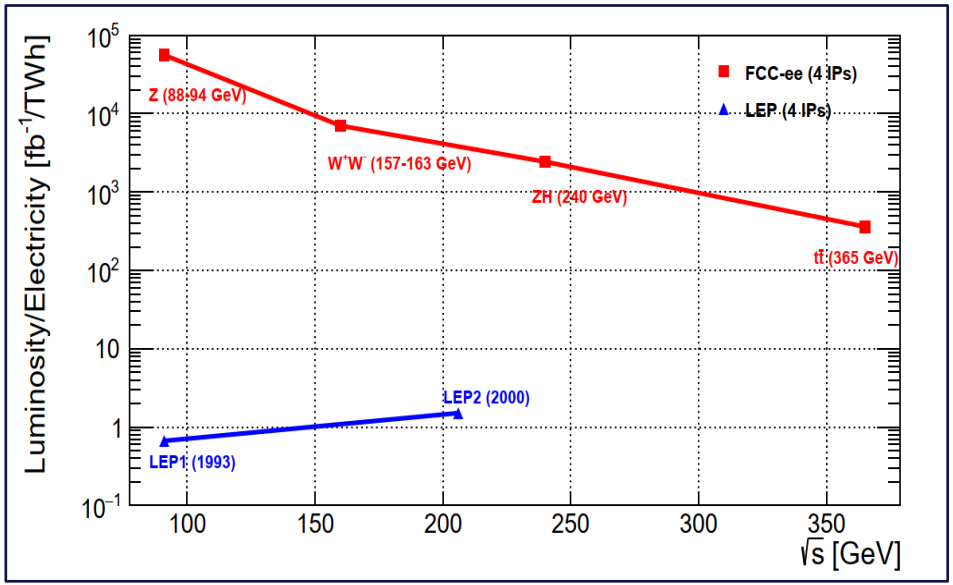
$$\Delta E \sim \gamma^4/\rho = (E/m_0)^4/\rho$$

- **Asymmetric IR layout** and optics to **limit synchrotron radiation towards the detector** and to provide **large** horizontal crossing angle **30 mrad for crab-waist collision optics,** demonstrated at DAFNE (Italy) and SuperKEKB (Japan)
- **Top-up injection** scheme as at modern light sources (APS, SLS,…) and as at recent e^+e^- colliders, PEP-II (USA), KEKB & SuperKEKB (Japan), BEPCII (China), requires **booster synchrotron in collider tunnel**

Combining concepts from past and present lepton colliders and using high-efficiency SRF system → a giant step in efficiency:

→10^4–10^5× luminosity/el.energy of LEP

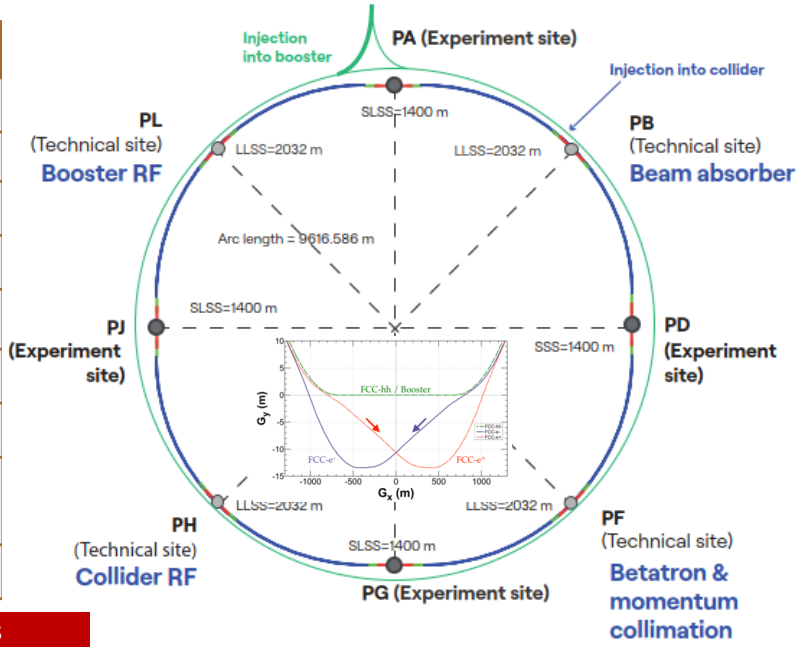
→ sustainable physics



Parameters from Feasibility Study

based on **GHC** lattice developed by K. Oide

parameter	Z	WW	H (ZH)	tt̄
beam energy [GeV]	45.6	80	120	182.5
synchrotron radiation/beam [MW]	50	50	50	50
beam current [mA]	1294	135	26.8	5.1
number bunches / beam	11200	1852	300	64
total RF voltage 400/800 MHz [GV]	0.08 / 0	1.0 / 0	2.09 / 0	2.1 / 9.2
# IPs	4	4	4	4
luminosity / IP [10^{34} cm^{-2}s^{-1}]	145	20	7.5	1.4
total integrated luminosity / IP / year [ab^{-1} / yr]	17	2.4	0.9	0.17
beam lifetime [min]	21	13	9	10



4 years
6 x 10^{12} Z
LEP x 10^5

2 years
> 10^8 WW
LEP x 10^4

3 years
> 2x10^6 H

5 years
2 x 10^6 tt pairs

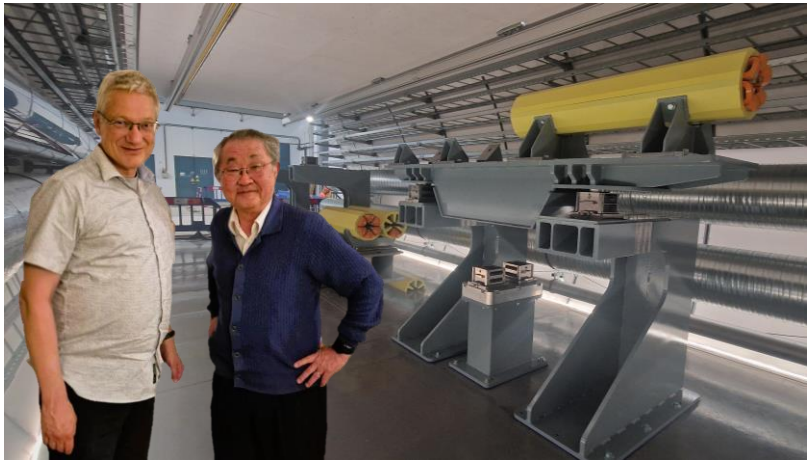
basis for nominal FCC-ee physics programme

Lattice change

Global Hybrid Chromaticity

From Katsunobu Oide

From 2015 to 2026



Backbone for FCC-ee studies
high-level of maturity, building on KEKB/SuperKEKB experience

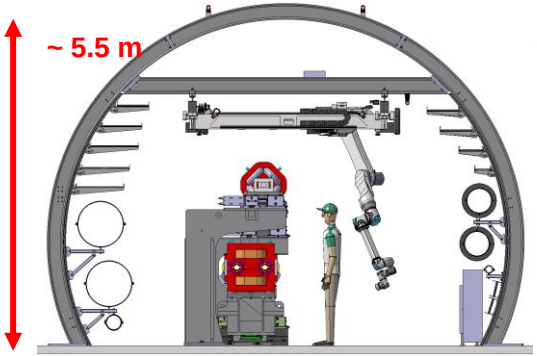
Local Chromatic Correction

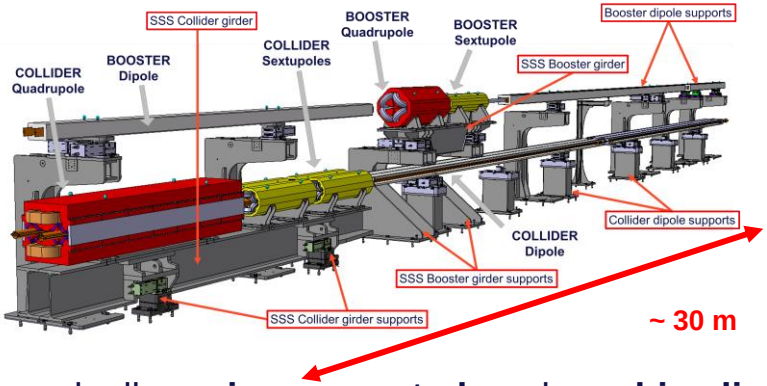
From Pantaleo Raimondi

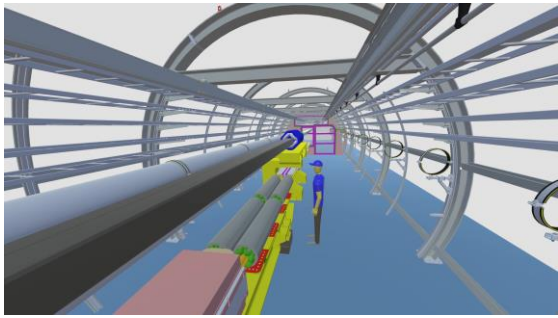
For the Reference Design Phase

Final focus design with both horizontal and vertical chromaticity correction, along with modular design of arcs and technical insertions (transparency conditions) inspired by ESRF-EBS work

Arc Half Cell Mock-up – from concept to reality

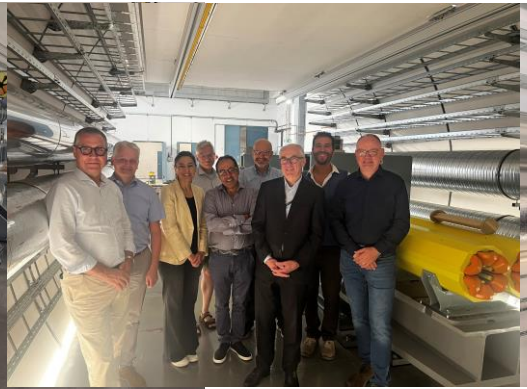






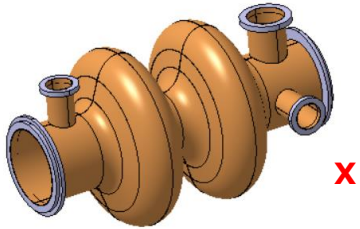
Mock-up installation well advanced, all **services mounted**, and **machine lines currently being installed !**

Key input for optimising 80 km FCC arc sections w.r.t. installation, integration, transport, robotics, etc.

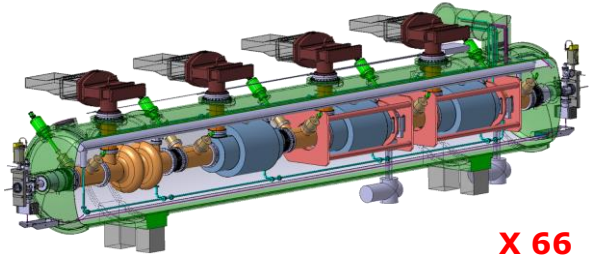


I. Syratchev

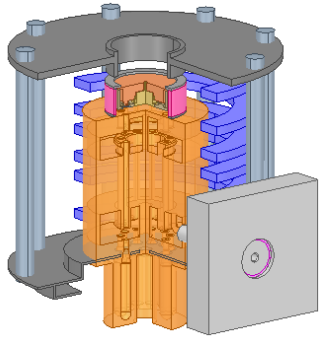
400 MHz RF system – collider Z, W, ZH



X 264



X 66



X 264

SC elliptical cavity
- 400 MHz, 2-cell,1.5 m. long
- Electropolished & seamless RF surface
- Niobium thin film with HiPIMS
- **Alternative 600 MHz** (bulk Nb)

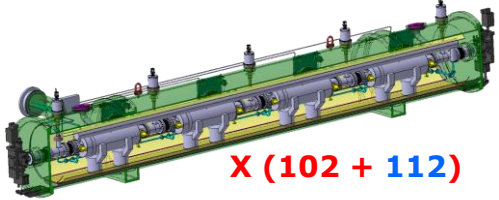
Cryomodule
- Segmented design, 4 cavities
- Vertical FPC, HOM damping & extr.
- Frequency tuning system
- Thermal and magnetic shielding

Multibeam Tristron
- **400 MHz** (or 600 MHz)
- 46 kV, 500 kW, CW
- ~ 90% efficiency

800 MHz RF system – for $t\bar{t}$ collider and booster

X (408 + 448)

R&D in collaboration with FNAL, IJCLAB, CEA, DESY, HZB, ESS



X (102 + 112)

Multibeam Tristron
- 800 MHz
- 250 kW, CW

X 408

X 448

SC elliptical cavity
- 800 MHz, 6-cell
- Nb_3Sn if R&D is successful

Cryomodule
- Segmented design, 4 cavities, 2 K
- Operation at 4.5 K if R&D successful

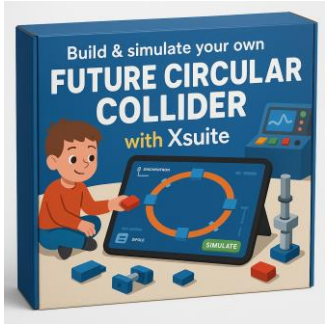
Solid State Amplifier (SSA)
- 800 MHz
- 10-15 kW pulsed

Objective: cryomodule demonstrator by 2031

A. Butterworth, J,-P. Burnet

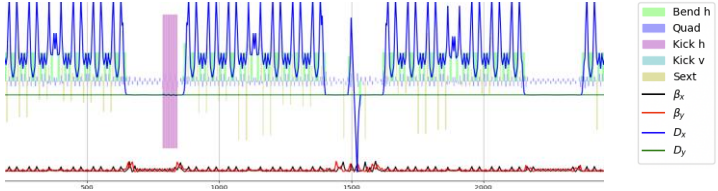
Xsuite code development & benchmarking

Xsuite has become the workhorse for FCC beam dynamics studies (optics, tuning, tracking, collimation, collective effects, …)



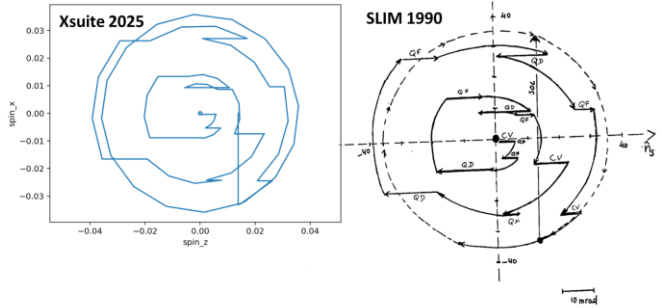
Xsuite

SuperKEKB optics in Xsuite

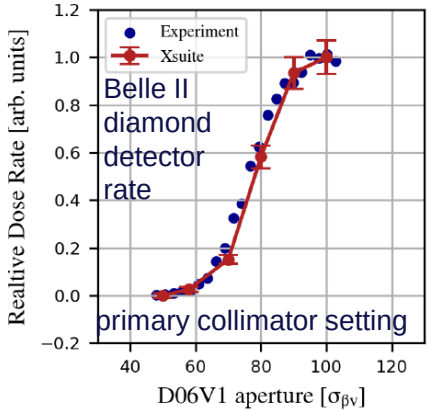


Xsuite **spin tracking**

Brookhaven National Laboratory



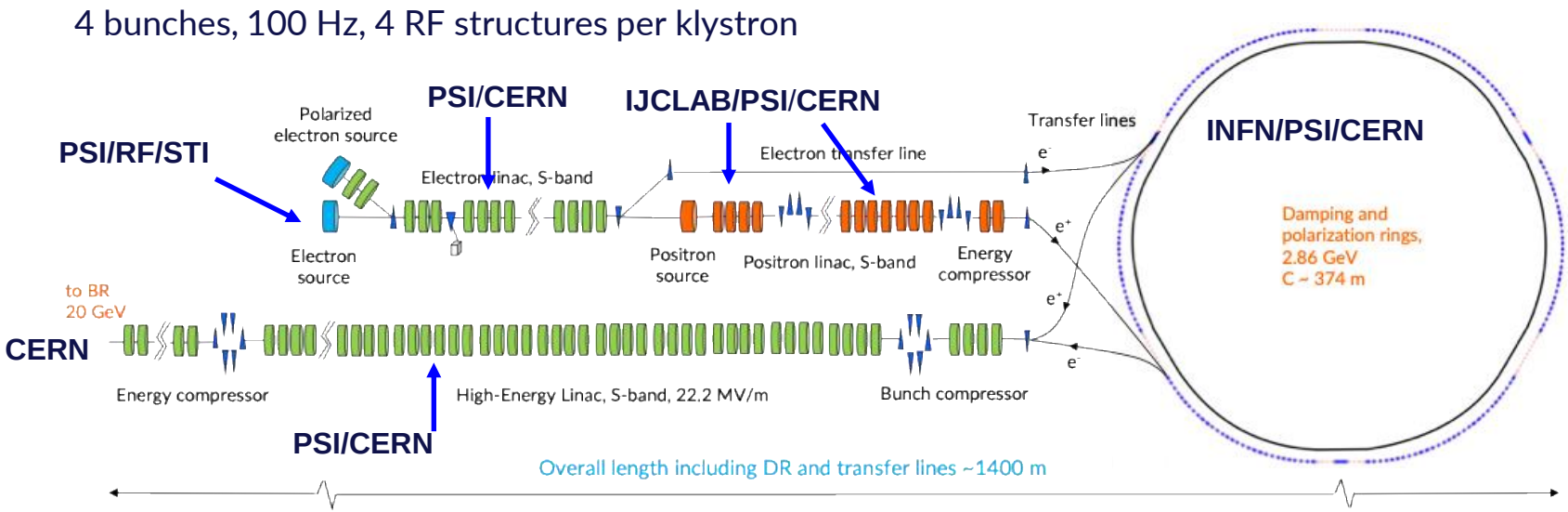
SuperKEKB beam loss simulations



Xsuite-simulated response of Belle-II diamond detector to change in collimator position

→ New Belle II MDI subgroup with focus on Xsuite simulations

The injector complex

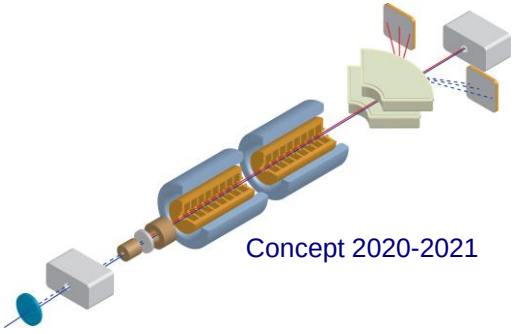


Goals for next two years (Reference Design Phase):

- Finalisation of injector complex design, including damping ring and polarisation schemes
- Definition of placement, civil engineering requirements, surface integration and technical infrastructure needs

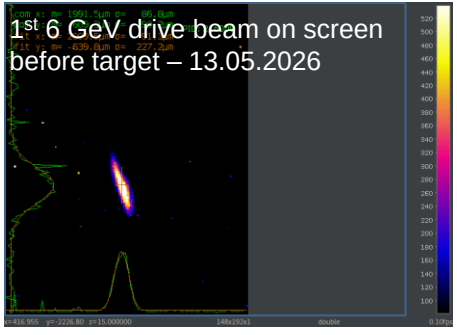
PSI Positron Production (P^3) Experiment

- **P^3 : Demonstrator experiment of a e^+ source and capture system for FCC-ee**
- Installed at SwissFEL @ PSI, electron beam with up to 6 GeV on target.
- Aims to demonstrate positron production and capture efficiency.



Concept 2020-2021

Installation 2025-2026

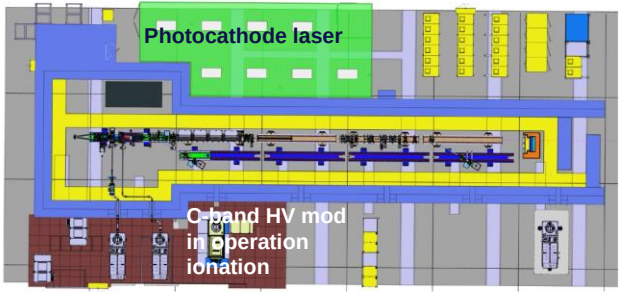


1st 6 GeV drive beam on screen before target – 13.05.2026

Beam studies in 2026:

- Beamline commissioning completed
- HTS solenoid for adiabatic capture
- RF conditioning started
- (first) **e^+ production in summer**

Electron Source Test Facility @PSI



- **Proof of principle of the electron source for top-up operations: charge modulation,** 1 or 2 bunches, 0–5 nC at 100 Hz
- Based on the SwissFEL photocathode RF gun
- **Procurement of components ongoing**
- **First electron beam: second half 2027**

other FCC-ee science opportunities

large circumference, high energy, abundant positron production, low-emittance beams, high-power beamstrahlung, injector complex

→ FCC-ee offers unique opportunities for various other fields of physics and science

Examples:

- production of **true muonium**
- creation of a **Bose-Einstein condensate of positronium**
- **high(est)-energy photons**, Compton imaging, nuclear research etc.
- **spatially coherent photon beams**, possibly **down to 0.1 Å wavelengths**
- **higher average and peak brightness** than any existing or planned light source
- **radioactive isotope production**
- **neutron source**

Eur. Phys. J. Plus (2026) 141:271
https://doi.org/10.1140/epjp/s13360-026-07399-w

THE EUROPEAN PHYSICAL JOURNAL PLUS

Regular Article

Other science opportunities at the FCC-ee

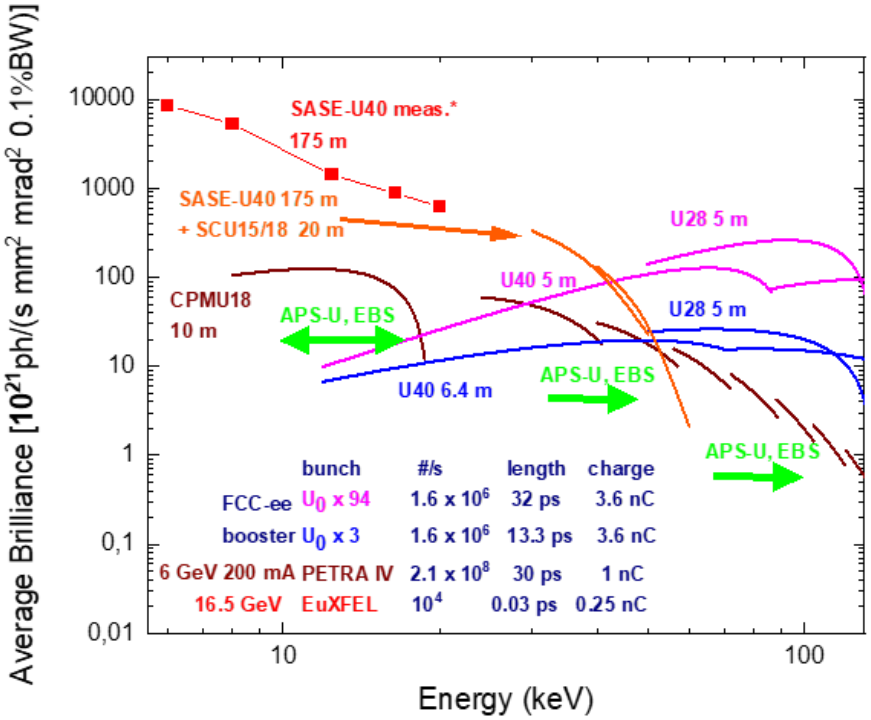
I. Agapov[1], E. E. Alp[2], K. Andre[3], S. Antipov[1], A. Apyan[4], G. Arduini[3], L. Bandiera[5], W. Bartmann[3], H. Bartosik[3], M. Benedikt[3], S. Bettoni[7], J. M. Byrd[2], M. Calviani[3], A. Camper[8], C. Carli[3], S. Casalbuoni[9], A. Chance[10], P. Craievich[7], P. Crivelli[11], B. Dalena[10], M. Dickmann[12], M. Doser[3], I. Drebot[13], C. Duchemin[3], K. Dupraz[14], A. Frasca[3,15], S. J. Freeman[3,16], F. Gunsing[10], J. Jäckel[17], B. King[18], M. W. Krasny[19], A. Lechner[3], C. C. Lindstrøm[8], A. Mazzolari[5,6], C. Milardi[20], E. Musa[1], R. Negrello[5,6], F. Nguyen[21], K. Oide[22], Y. Papaphilippou[3], G. Paternò[5], V. Petrillo[23], K. Piotrzkowski[24], B. Rienäcker[16], G. Schnell[25,26], C. Schroer[1], I. Schulthess[1], L. Serafini[13], V. Shiltsev[27], M. Stampanoni[7,11], A. Variola[28], T. Watson[3], H.-U. Wienands[2], M. Wing[29], F. Zimmermann[3,✉]

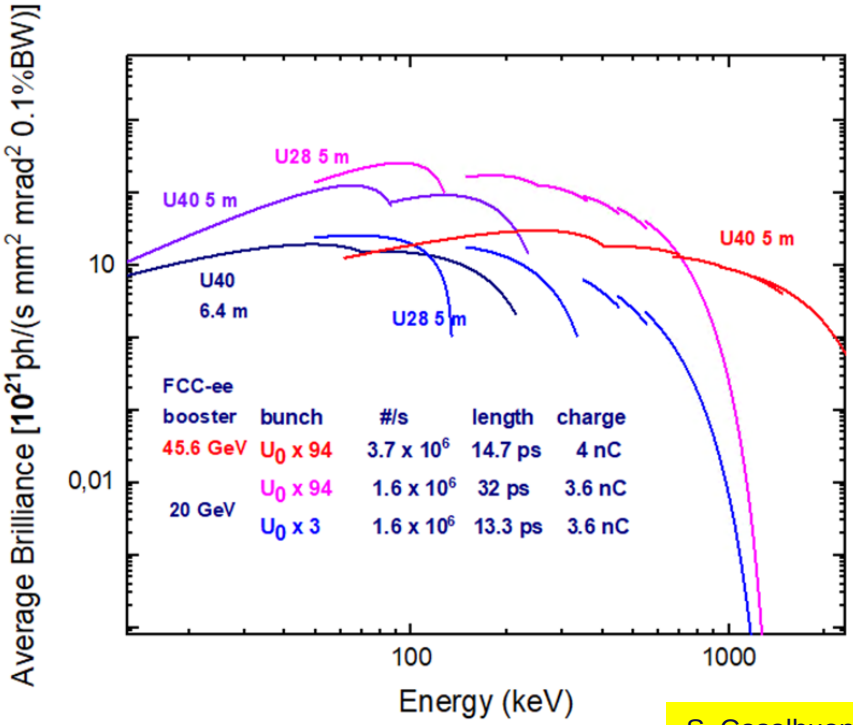
[1] Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
[2] Argonne National Laboratory, Lemont, IL, USA
[3] European Organization for Nuclear Research (CERN), Geneva, Switzerland
[4] A.I. Alikhanyan National Laboratory, Yerevan, Armenia
[5] INFN Ferrara, Ferrara, Italy
[6] University of Ferrara, Ferrara, Italy
[7] PSI, Villigen, Switzerland
[8] University of Oslo, Oslo, Norway
[9] European XFEL, Hamburg, Germany
[10] CEA Irfu, University Paris-Saclay, Gif-sur-Yvette, France
[11] ETH Zürich, Zurich, Switzerland
[12] University of the Bundeswehr Munich, Neubiberg, Germany
[13] INFN Milano, Milan, Italy
[14] IJCLab, Orsay, France
[15] University Liverpool, Liverpool, UK
[16] University of Manchester, Manchester, UK
[17] University of Heidelberg, Heidelberg, Germany
[18] University of Plymouth, Plymouth, UK
[19] LPNHE, Paris, France
[20] INFN LNF, Frascati, Italy
[21] ENEA, Frascati, Italy
[22] University of Geneva, Geneva, Switzerland
[23] University Milano, Milan, Italy
[24] AGH University, Cracow, Poland
[25] EHU Quantum Center and Department of Physics, University of the Basque Country UPV/EHU, Bilbao, Spain
[26] IKERBASQUE, Bilbao, Spain
[27] Northern Illinois University, DeKalb, USA
[28] INFN Roma1, Rome, Italy
[29] UCL, London, UK

Received: 19 August 2025 / Accepted: 2 February 2026

https://link.springer.com/article/10.1140/epjp/s13360-026-07399-w

FCC-ee booster as unique ultimate photon source





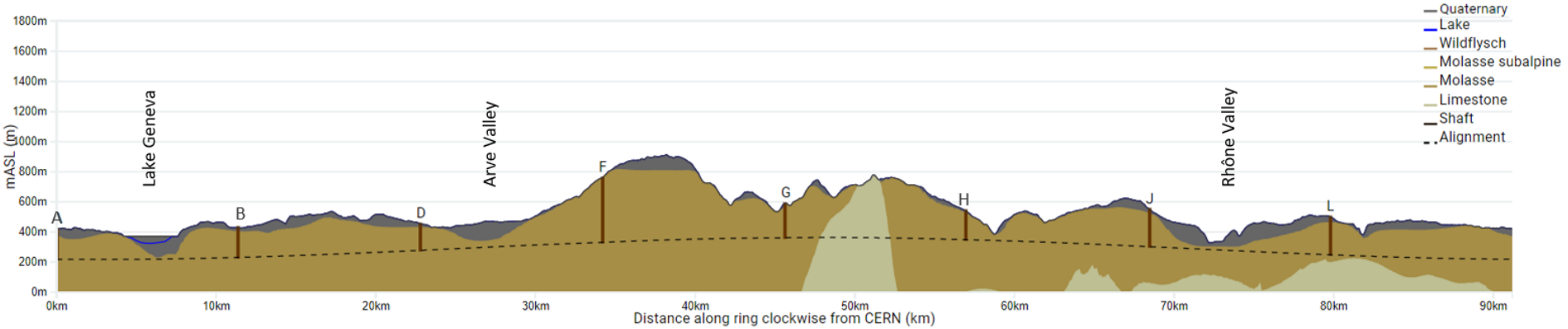
S. Casalbuoni

case for ≥20 GeV storage-ring light source: PRAB **28**, 024401 (2025); arXiv:2505.11022

"we argue that achieving further significant emittance reduction and increase in radiation brightness is only possible by increasing the beam energy"

I. Agapov
S. Antipov

Optimum placement of FCC tunnel and geology



Tunneling mainly in molasse layer (soft rock), well suited for fast, low-risk TBM construction.

6.25 million m³ excavated volume → ~8.5 million m³ excavation material on surface (expanded)

CE Designs of all underground structures developed

Average shaft depths ~240 m

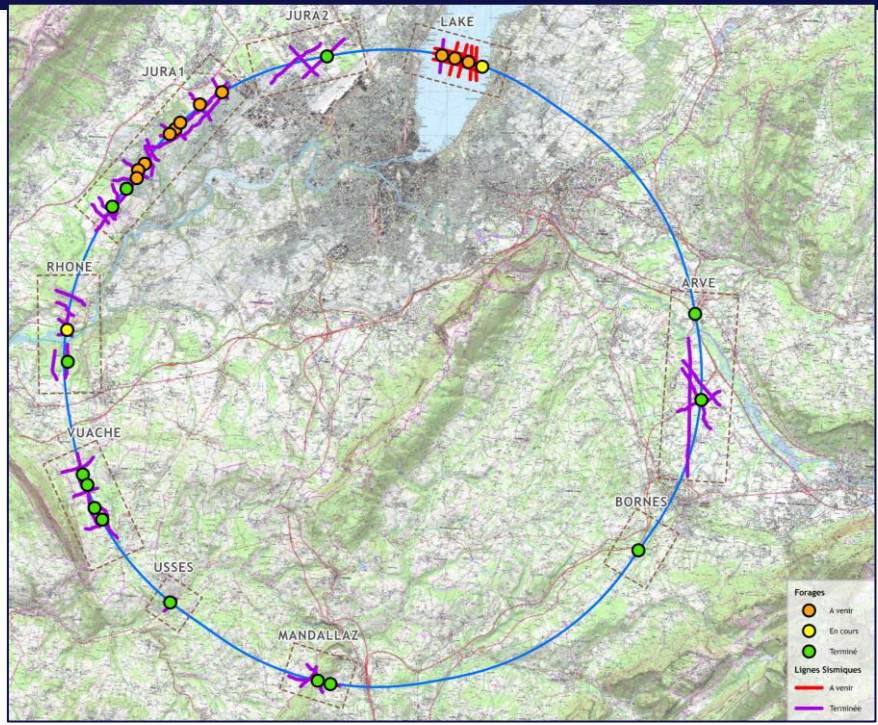
To fix the vertical position of the tunnel, interfaces between geological layers have to be known

Geological investigations

Focused on 8 zones to improve precision of geological model and identify the intercased moraine – molasse and molasse – limestone.

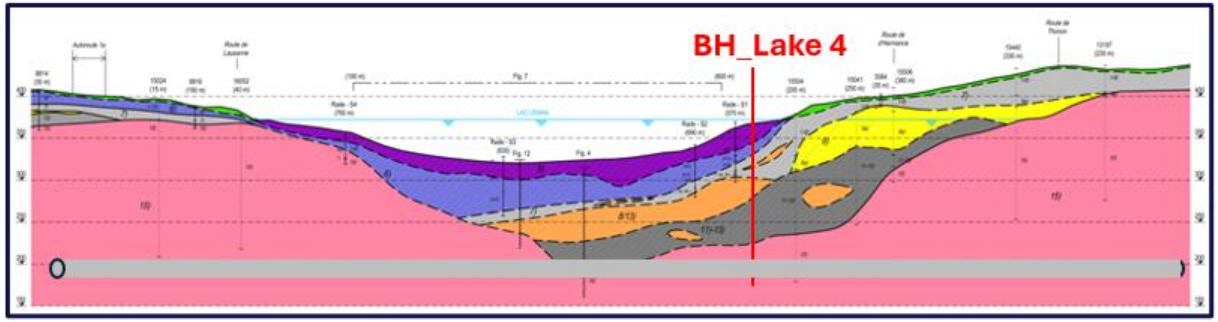
- **86 km of seismic investigations completed**
- **15 of 27 bore holes completed**
- **1st lake bore hole completed**
- **Completion of all bore holes ~June 2026**

Results so far confirm geological model

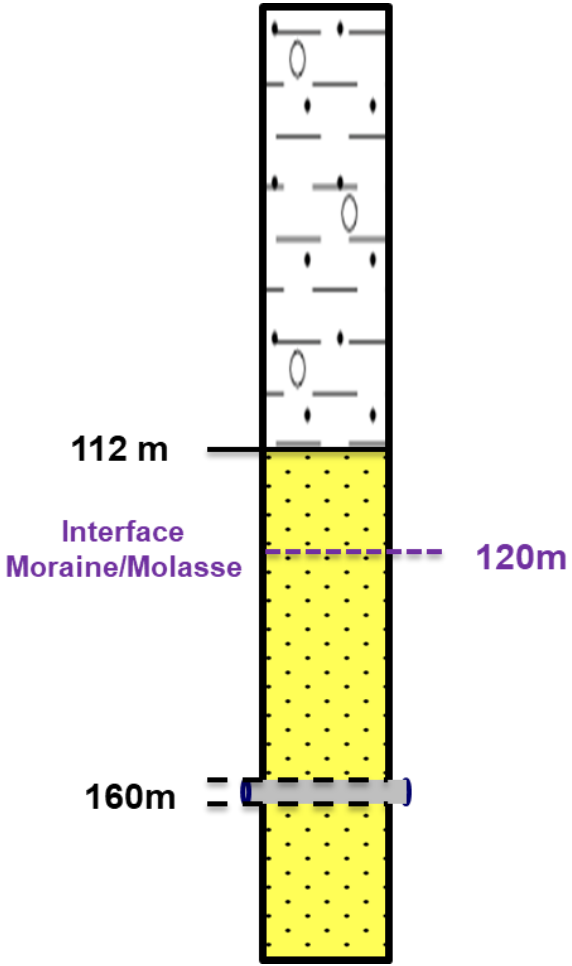



Lake Geneva – November 2025

Bore Hole Lake_04



- First lake borehole is positive with molasse commencing at a slightly shallower depth than assumed in baseline.
- If this is also the case for the other boreholes, it may be possible to make the tunnel shallower by several metres under the lake.
- It will also mean the Tunnel Boring Machine will remain in the molasse rock rather than going into the overlying moraine thus avoiding a more complex machine.



2025 CERN Council review of FCC Feasibility Study

- **June/July:** Reviews by FCC Feasibility Study **Scientific Advisory Committee (SAC),** chaired by A. Parker (Cambridge) & **FCC Cost Review Panel (CRP),** chaired by N. Holtkamp (Stanford)
- **September**: Reviews by CERN **Finance Committee (FC)** & **Scientific Policy Committee (SPC)**
- **6-7 November**: **CERN Council** dedicated session on FCC Feasibility Study,
- **Conclusions**:

The Council, being committed to maintaining CERN as a world leader in science and technology:

…. congratulates the CERN Management and all the personnel involved in the FCC Feasibility Study….

….. considers that the FCC would provide the platform for a visionary physics programme addressing many of the open questions in particle physics,... and **concludes that:**

a. the FCC Feasibility Study provides the basis for the FCC studies to continue and

b. the funding scenarios presented and the financial pledges obtained so far provide the basis for the continuation …towards securing the full financial commitments required for approval of the FCC project.

December 2025: **European Strategy Group** recommendations

- The **electron–positron Future Circular Collider** (**FCC-ee**) is recommended as the **preferred option for the next flagship collider at CERN.**
- A **descoped FCC-ee** is the **preferred alternative option** for the next flagship collider at CERN.

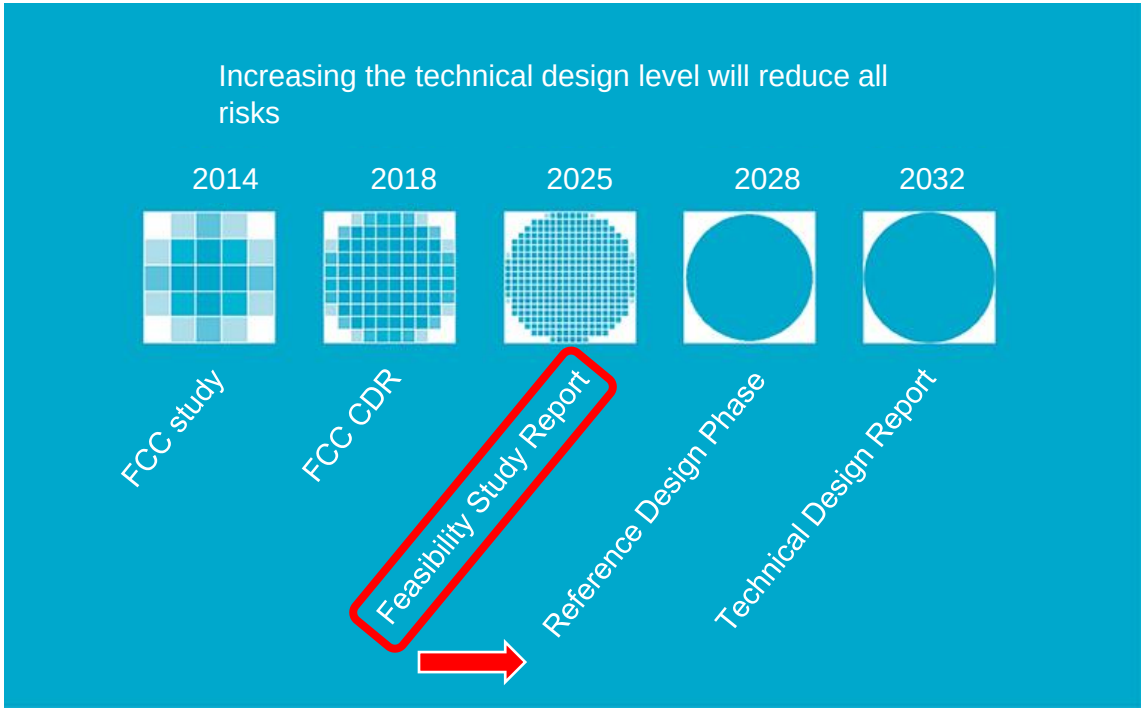
22 May 2026: **CERN Council updated European Strategy** for Particle Physics

- **The FCC-ee would offer the broadest exploratory programme in fundamental physics, with outstanding discovery potential**
- At the same time, **the FCC-ee would drive the development of new technologies and train thousands of early-career scientists, engineers and technicians.**

In addition to updating the Strategy, the **Council has invited the CERN Management to initiate discussions with the relevant authorities and entities in the Member and Associate Member States, as well as non-Member States and the European Union, with a view to developing a financially feasible funding plan for the possible FCC-ee project.**

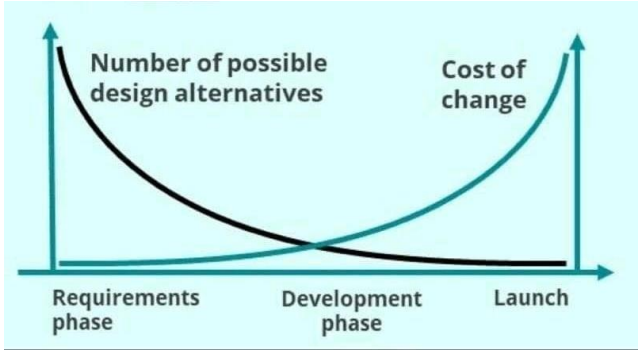
Reference Design Phase (RDP) 2026-2028

A critical phase for the project's success



The Rule 1-10-100

For every $1 to fix a problem during design, it would cost $10 to fix it during development, and it would cost $100 to fix it after the product's release.



Deliverables and Schedule for RDP

Reference Design Documentation by Q1 2028 to enable CERN Council decision on project realisation:

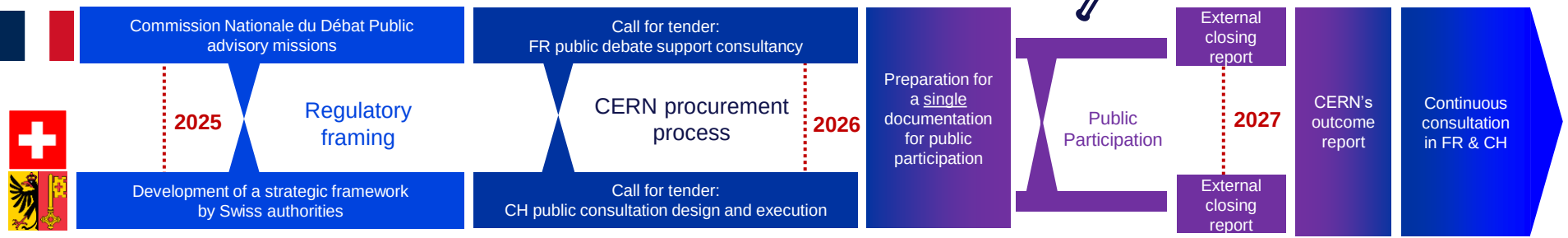
- Integrated technical baseline
- Resource-loaded project master schedule
- Updated cost estimate with uncertainty
- Project-wide risk register
- Procurement strategy (incl. in-kind contribution opportunities)

FCC Public Participation

- **In France:** independent body **Commission Nationale du Débat Public (CNDP)** is responsible for organising and overseeing the public debate (French Environment Code / Code de l'environnement).
- **In Switzerland: dedicated strategic framework** was created to allow the participation process to be tailored to the specific characteristics of the FCC project.
- **>20 events are organised in both Host States**: thematic public meetings (on FCC-related physics, environmental impacts, and socio-economic topics..), workshops with local residents, site visits and exploratory walks

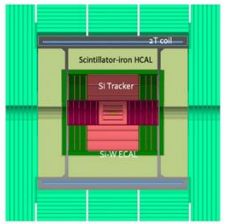
Key dates and websites (key year: 2026!) :

- France: from 2 June to 1 October 2026 - https://www.debatpublic.fr/projet-accelerateur-particules
- Switzerland: from 18 May to 2 October 2026 - http://www.concertation-fcc-cern.ch/

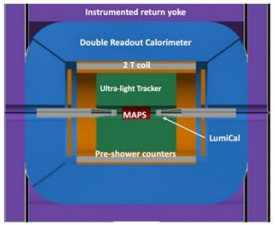


Physics, Experiments, Detectors - objectives

- Developing the **international high-energy physics community**
- Consolidating **interaction region layout, detector integration,** and **beam-background** mitigation
- Optimised **procedures for √s calibration** & possible **monochromatic operation at √s = 125 GeV**
- Finalising common **software/analysis framework** and developing **common computing architecture**
- Realistic studies of **experimental systematic uncertainties** for **EW precision** measurements and consolidation of the **pertaining requirements** on collider, detectors, and theory
- **Engagement of theory community** to address theory challenge and nurture the young generation
- Proposal for staging implementation and improvements of the **staged/descoped FCC-ee**
- **Prepare** to answer call for (at least 4) **documented EoI's for FCC-ee experiments end 2028**

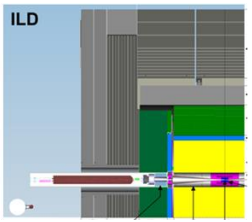


CLD



IDEA

ALLEGRO



ILD

ALFA

etc.

P. Janot et al.

FCC-ee Cost & Resources

Capital cost CAPEX (2024 CHF): construction new infrastructure and all equipment and experiments for operation at the Z, WW and ZH working points

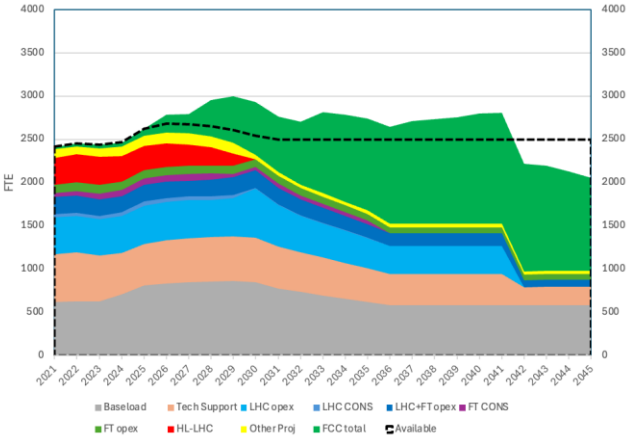
Domain	Cost [MCHF]
Civil engineering	6,160
Technical infrastructures	2,840
Injectors and transfer lines	590
Booster and collider	4,140
CERN contribution to four experiments	290
FCC-ee total	**14,020**
+ four experiments (non-CERN part)	1,300
FCC-ee total incl. four experiments	**15,320**

program-projects-activity breakdown

FCC Cost and PPA breakdown

Department	System	CAPEX2025
TE	Magnets	867
TE	Vacuum	947
TE	Protection and interlock systems	60
TE	Machine detector interface (Final Focus SC magnets)	55
TE	Cryogenics	337
SY	Power converters	710
SY	Beam transfer	104
SY	Beam intercepting devices	215
SY	Beam instrumentation	237
SY	Radiofrequency	666
SY	Transfer lines, from injector	126
SCE	Underground structures	4221
SCE	Surface structures	519
SCE	Other costs	747
SCE	Treatment of excavated material	600
EN	Element support and alignment	223
EN	Cooling and ventilation	835
EN	Electricity and energy management	684
EN	400 kV connection to RTE grid	30
EN	20 kV line connections	30
EN	Transport and logistics	168
EN	Configuration, coordination	0
BE	Accelerator control	33
BE	Polarisation and energy calibration	22
BE	Robotics	39
BE	Geodesy and survey	368
BE	AP+CCC shift crew	0
HSE	Safety management systems	197
IT	Comm, computing and data services	104
ADMIN	Land related cost	34
ADMIN	Transport related cost	51
ADMIN	Utilities (Water)	2
ADMIN	Admin services	39
INJECTOR	Injector Linacs	222
INJECTOR	Positron production	65
INJECTOR	Damping ring and beam lines	98
EN	Technical infrastructures	79
EN	Inj. and transfer line pre-injector/Booster Technical infrastructures	126
EXPERIMENTS	Exp. Detectors	144
EXPERIMENTS	Exp. Cryogenics	45
EXPERIMENTS	Exp. Technical infrastructures	99
Totals		14148
EXPERIMENTS	Collaborations	1295
		15443

CERN Workforce Projection:



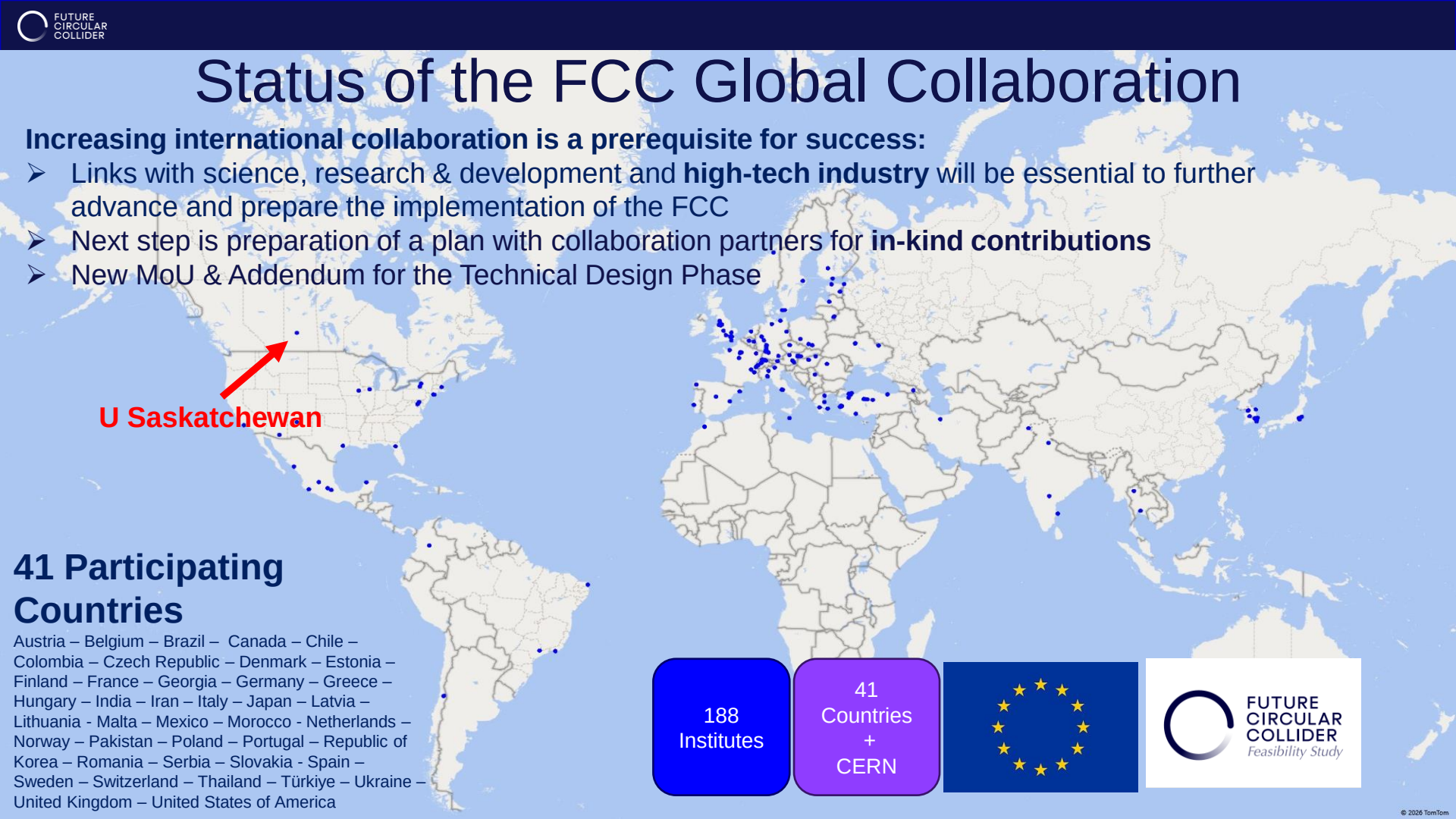
Missing 2,650 FTE.y **(530 MCHF)**
CERN workforce will peak at 3'000 in 2029
Workforce available at end HL-LHC

FCC OPEX ~ 2-3% of CAPEX

Status of the FCC Global Collaboration

Increasing international collaboration is a prerequisite for success:

- Links with science, research & development and **high-tech industry** will be essential to further advance and prepare the implementation of the FCC
- Next step is preparation of a plan with collaboration partners for **in-kind contributions**
- New MoU & Addendum for the Technical Design Phase



41 Participating Countries

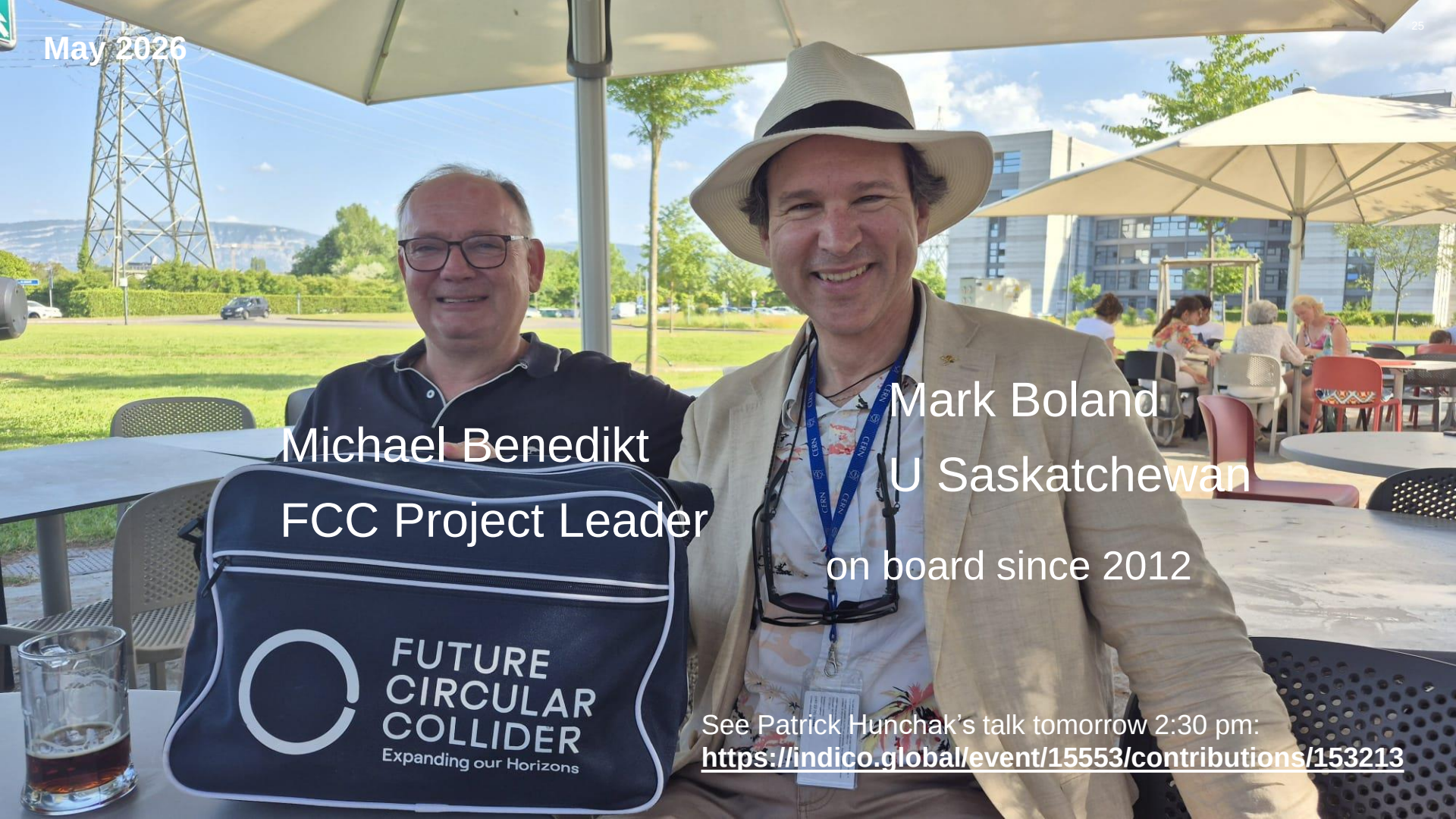
Austria – Belgium – Brazil – Canada – Chile – Colombia – Czech Republic – Denmark – Estonia – Finland – France – Georgia – Germany – Greece – Hungary – India – Iran – Italy – Japan – Latvia – Lithuania - Malta – Mexico – Morocco - Netherlands – Norway – Pakistan – Poland – Portugal – Republic of Korea – Romania – Serbia – Slovakia - Spain – Sweden – Switzerland – Thailand – Türkiye – Ukraine – United Kingdom – United States of America

188 Institutes

41 Countries + CERN

FUTURE CIRCULAR COLLIDER *Feasibility Study*


Nov 2021
FCC FS MoU signed at CERN
Patrick Hunchak
U Saskatchewan
Mark Boland
U Saskatchewan
Tamara Mawhinney, Minister-Counsellor, Permanent Mission of Canada
Rob Norris, Senior Government Relations, CLS/Usask
Nadja Schauer, Senior Trade Commissioner, Embassy of Canada



Michael Benedikt

FCC Project Leader

Mark Boland

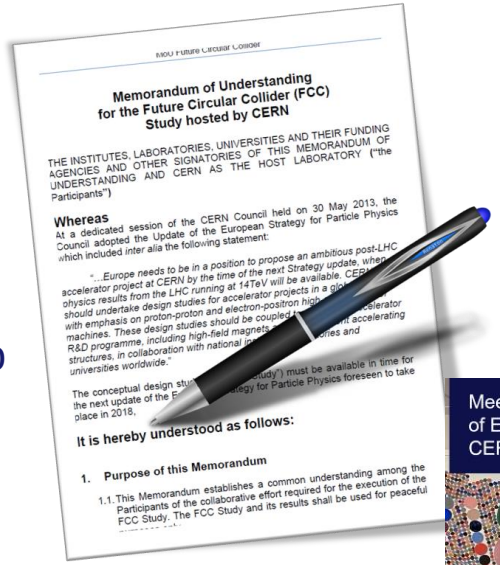
U Saskatchewan

on board since 2012

See Patrick Hunchak's talk tomorrow 2:30 pm:
https://indico.global/event/15553/contributions/153213

FCC collaboration framework

- A **consortium** of partners based on a Memorandum Of Understanding (MoU)
- Working together on a **best effort basis**
- **Incremental & open** to academia and industry
- Individual **projects** defined in **specific addenda**



MoU Future Circular Collider

Memorandum of Understanding for the Future Circular Collider (FCC) Study hosted by CERN

THE INSTITUTES, LABORATORIES, UNIVERSITIES AND THEIR FUNDING AGENCIES AND OTHER SIGNATORIES OF THIS MEMORANDUM OF UNDERSTANDING AND CERN AS THE HOST LABORATORY ("the Participants")

Whereas

At a dedicated session of the CERN Council held on 30 May 2013, the Council adopted the Update of the European Strategy for Particle Physics which included inter alia the following statement:

"...Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update, when physics results from the LHC running at 14TeV will be available. CERN should undertake design studies for accelerator projects in a global with emphasis on proton-proton and electron-positron high machines. These design studies should be coupled to R&D programme, including high-field magnets and accelerating structures, in collaboration with national laboratories and universities worldwide."

The conceptual design study ("the Study") must be available in time for the next update of the European Strategy for Particle Physics foreseen to take place in 2018,

It is hereby understood as follows:

1. **Purpose of this Memorandum**

1.1. This Memorandum establishes a common understanding among the Participants of the collaborative effort required for the execution of the FCC Study. The FCC Study and its results shall be used for peaceful

EU Commissioner Valdis Dombrovskis

Meeting of Finnish Minister of Economic Affairs with CERN's DG.

Last FCC collaboration meeting was the FCC Week 2026 in Helsinki, Finland: 66 public sessions, 265 oral presentations, 47 posters

! Save the date !

Next FCC collaboration meeting will be the FCC Week 2027 in Madrid, Spain, with integrated FCC Physics Workshop; Entire community invited and welcome

Progress and support towards funding

Statements of intent to collaborate with CERN on construction and exploitation of FCC-ee, signed with US and with Canada.

26 April 2024

White House Office of Science and Technology Policy Principal Deputy U.S. Chief Technology Officer Deirdre Mulligan signed for the United States while Director-General Fabiola Gianotti signed for CERN.

9 April 2025

CERN Director-General, Fabiola Gianotti, and His Excellency Mr Patrick Wittmann, Ambassador of Canada to Switzerland and Liechtenstein, exchanging signed copies of the **joint Statement of Intent between CERN and Canada.**

Strong support from European Union expressed in the recent EU Competitiveness Report stating inter alia that

"One of CERN's most promising current projects, with significant scientific potential, is the construction of the Future Circular Collider… …Refinancing CERN and ensuring its continued global leadership in frontier research should be regarded as a top EU priority"

"I am proud that we have financed the feasibility study for CERN's Future Circular Collider (FCC)..."
Ursula von der Leyen, President of the European Commission, during CERN 70 anniversary celebrations

For 2028-2034 budget plan, **a 3 BEuro budget line for FCC is proposed by the European Commission**, to be approved by European Parliament in 2027.

European Commission

Moonshots

Objective: ambitious technology driven projects that boost the EU's strategic autonomy through research, development and deployment.

Published fact sheet for Horizon 2028-34
[available at https://go.fzj.de/YHEMB]

Moonshots

Future Circular Collider

What: Sustain Europe's leadership in particle physics by investing in CERN's next-generation collider.

How: Co-invest with other CERN countries, leveraging Horizon Europe funding.

Clean Aviation

What: Lead the world in developing the next generation of CO_2-free aircraft.

How: Bring together industry and scientific capacities to achieve breakthroughs in clean aviation.

Quantum Computing

What: Make Europe the first continent with fully integrated quantum computing in daily life.

How: Develop applications from medicine to climate, solving previously impossible problems for 450 million citizens.

Next Generation AI

What: Model the new AI on the laws of nature and grounded in physics and biology.

How: AI developed by, with, and for European scientists and industry, drawing to Europe the world's best minds.

Data Sovereignty

What: Make Europe the global leader and safest hub for critical research data.

How: Provide access to critical data for researchers, universities and companies, offering competitive advantage in tackling global challenges.

Automated Transport and Mobility

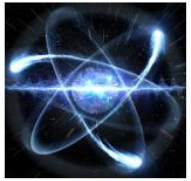
What: Advance safe, inclusive, and emission-reducing automated transport and mobility in Europe.

How: Invest in smart transport systems to improve traffic, reduce emissions, and enhance access.

Regenerative Therapies

What: Deliver breakthrough therapies to improve people's health and lives.

How: Harness Europe's scientific strengths to treat incurable diseases and personalise medicine.



Fusion Energy

What: The first commercial nuclear fusion power plant, generating safe, consistent, and reliable electricity.

How: Overcome the scientific and technological challenges necessary to put fusion on the grid in Europe by 2034.

Space Economy

What: Make Europe the leader in the space economy.

How: Develop the next generation launch vehicles such as reusable rockets, able to deploy massive cargo by 2040.

Zero Water Pollution

What: Move towards zero pollution of water in the EU.

How: Stimulate innovation to build a true water-smart economy which secures sufficient, clean and affordable water and sanitation to all at all times.

Ocean Observation

What: Achieving strategic autonomy in ocean observation infrastructure, data and information services.

How: Developing, connecting, governing and securing the next generation of European ocean observing technologies

CERN press releases end 2025

The European Strategy for Particle Physics reaches an important milestone

Geneva, 12 December 2025. At its 225th session, the CERN Council received the recommendations for the update of the European Strategy for Particle Physics, the aim of which is to develop a common vision for the future of the field. The recommendations will be reviewed by the Council in the coming months. A final decision is expected at a dedicated Council Session in Budapest in May 2026.

For the 2026 update of the ESPP, the CERN Council requested that the Strategy update should include the preferred option for the next collider at CERN and prioritised alternative options to be pursued if the chosen preferred plan turns out not to be feasible or competitive. ….

The electron–positron Future Circular Collider (FCC-ee) is recommended as the preferred option for the next flagship collider at CERN….

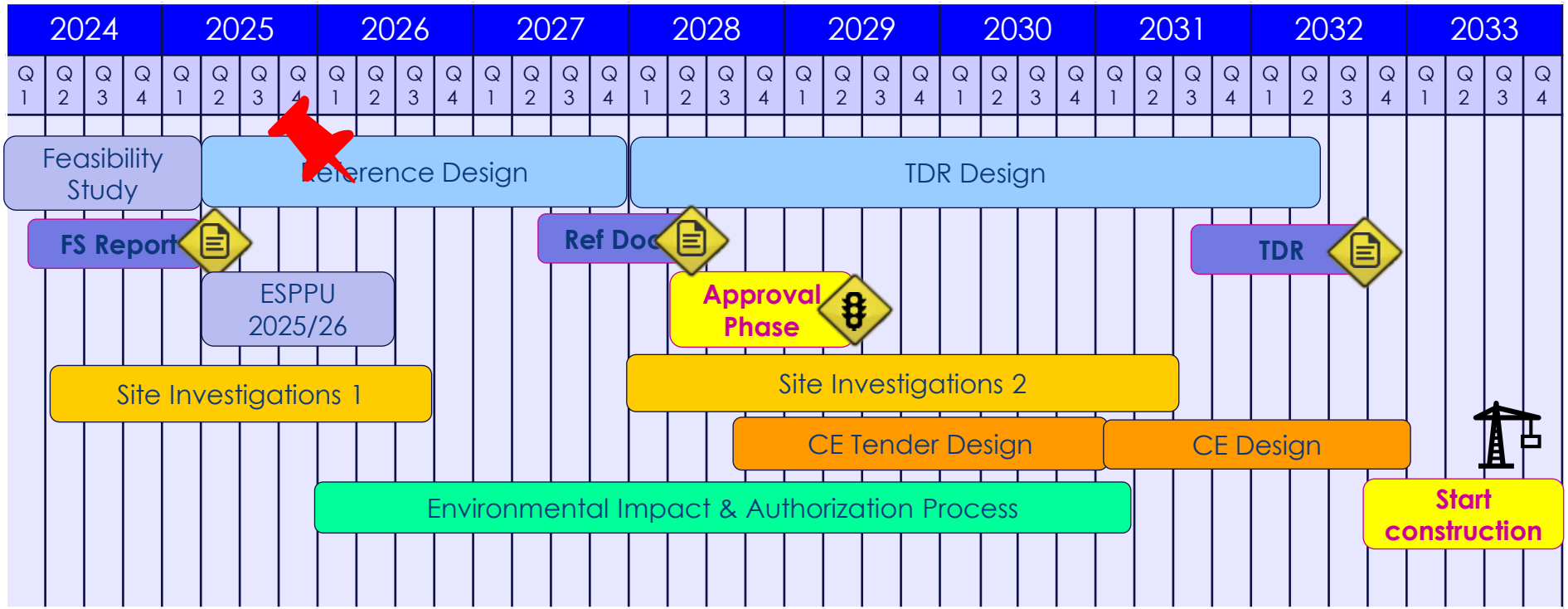
The ESG presents a descoped FCC-ee as the preferred alternative option for the next flagship collider at CERN.

A decision by the CERN Council on the possible construction of the FCC is expected around 2028.

Private donors pledge 860 million euros for CERN's Future Circular Collider

Geneva, 18 December 2025. For the first time in CERN's history, private donors (individuals and philanthropic foundations) have agreed to support a CERN flagship research project. Recently, a group of friends of CERN, including the Breakthrough Prize Foundation, The Eric and Wendy Schmidt Fund for Strategic Innovation, and the entrepreneurs John Elkann and Xavier Niel, have pledged significant funds towards the construction of the Future Circular Collider (FCC), the potential successor of the Large Hadron Collider (LHC). These potential contributions, totalling some 860 million euros and corresponding to 1 billion US dollars, would represent a major private sector investment in the advancement of research in fundamental physics.

Timeline till start of CE construction



possible in-kind contributions

Radiofrequency (RF) systems; warm RF structures, **superconducting RF cavities, cryomodules**, and RF power sources; **cryogenic systems**;
series production of magnets; vacuum chambers, vacuum pumps, interconnection modules; NEG coating;
kickers, septa, pulsed power systems; beam dumps, collimators;
beam instrumentation, esp. beam position monitors, polarimeters, emittance and bunch length monitors, beam current monitors, bunch current monitors;
laser systems for polarimeters and for the electron injector; **temperature/position sensors and alignment instrumentation**;
cooling plants and distribution systems;
electrical substations, power distribution systems; **large-scale control systems; particle source systems and associated diagnostics**;
tracking detectors, calorimeters, experimental magnets, DAQ systems; computing infrastructure and storage;
groundwater and spoil-management systems; tunnel boring machines and excavation support; environmental monitoring systems....

Summary

In December 2025, **FCC FS successfully passed CERN Council review**, and **ESG recommended FCC-ee** as preferred option for the next flagship collider at CERN.

On **22 May 2026** the **CERN Council approved the European Strategy Updated in its Budapest meeting.**

FCC-ee design level allows moving towards **technical design and prototyping phase**, well aligned with the **envisaged construction start by 2032/33**.

Many common issues with light sources., e.g., RF system, optics, optics corrections, top-up injection, emittance tuning, dynamic aperture momentum acceptance, beam lifetime, vacuum technology, beam diagnostics, alignment, etc.

Overarching goal for reference design phase: **enabling an informed Council decision on the FCC-ee in 2028.**