Report from CERN Council

Partikeldagarna 2026
Lund, September 17-18

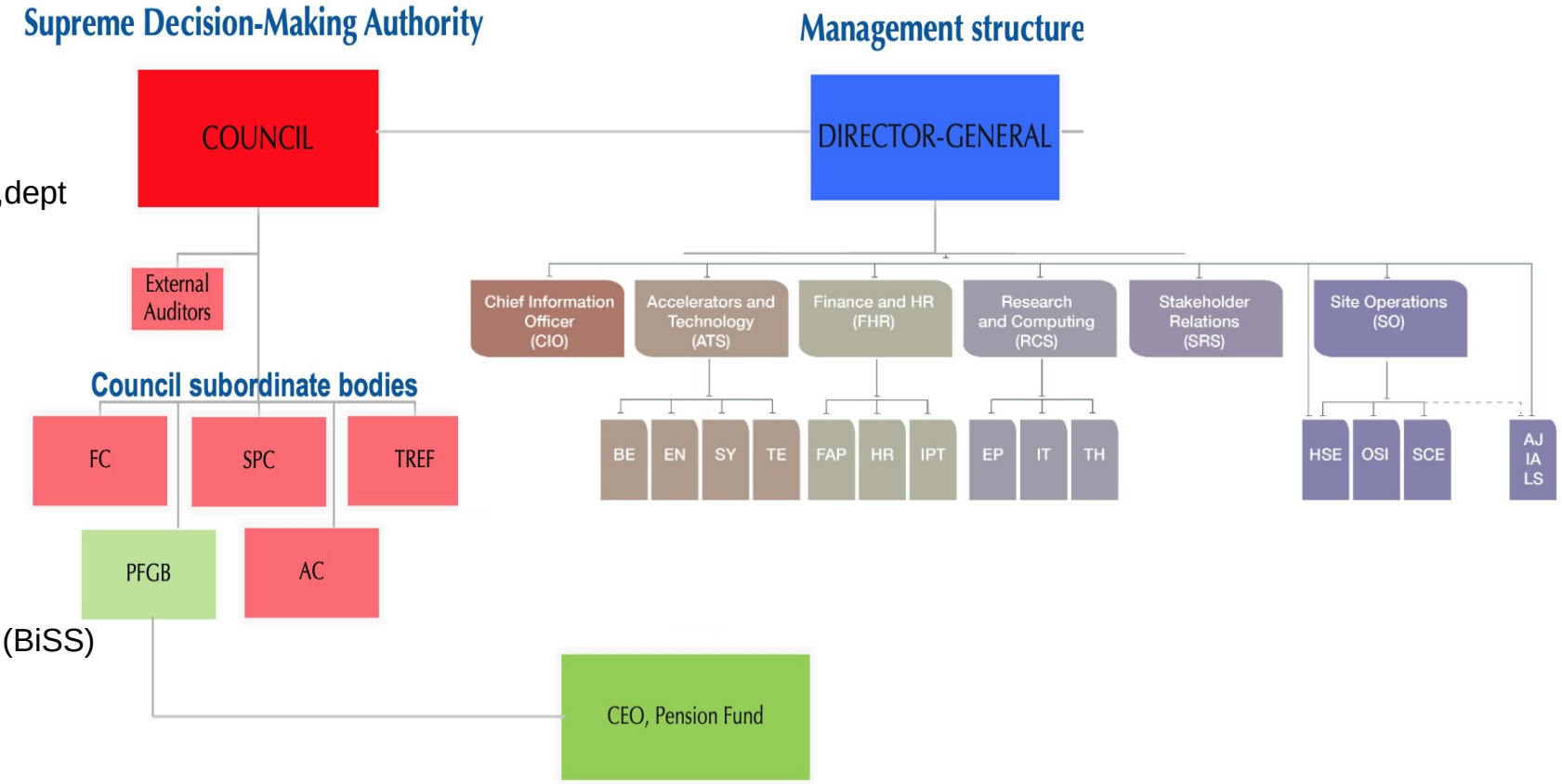
Richard Brenner, Uppsala University

Organigram2026 →

E.Sjöstedt (VR)
R. Brenner (UU)
S. Strandberg(SU),dept

FC:
A. Carlmark
Malkoch (VR)
B. Åsman (SU)

ILO:
Fredrik Engelmark (BiSS)



CERN management 2026-2030

Mark Thomson (DG)

<u>Directors</u>

- Director for Accelerators and Technology: Oliver Brüning
- Director for Research and Computing: Gautier Hamel de Monchenault
- Director for Stakeholder Relations: Ursula Bassler
- Director for Finance and Human Resources: Jan-Paul Brouwer
- Director for Site Operations: Mar Capeans
- Chief Information Officer (CIO): Enrica Porcari

Department heads

- Accelerators and Technology sector
  - Said Atieh will lead the Engineering (EN) department
  - Rhodri Jones will lead the Technology (TE) department
  - Roberto Losito will lead the Accelerator Systems (SY) department
  - Malika Meddahi will lead the Beams (BE) department
- Finance and Human Resources sector
  - Giovanni Anelli will lead the Industry, Procurement and Knowledge Transfer (IPT) department
  - Kasia Pokorska will lead the Finance and Administrative Processes (FAP) department
  - Lisette Van Den Boogaard will lead the Human Resources (HR) department
- Research and Computing sector
  - Simone Campana will lead the Information Technology (IT) department
  - Giovanna Lehmann will lead the Experimental Physics (EP) department
  - Urs Wiedemann will lead the Theoretical Physics (TH) department
- Site Operations sector
  - Benoît Delille will lead the Occupational Health & Safety and Environmental Protection (HSE) department, formerly a unit, and will continue to report directly to the Director-General
  - Cedric Garino will lead the Site and Civil Engineering (SCE) department
  - Alex Kohls will lead the new Organisational Support and Improvement (OSI) department

CERN ”family”

- Member states (25):

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovak Republic, Slovenia (21 June 2025), Spain, Sweden, Switzerland and United Kingdom.

- Associate Member States (11):

Brazil, Chile, Croatia, Cyprus, India, Ireland (22 October 2025), Latvia, Lithuania, Pakistan, Türkiye and Ukraine

Chile has submitted applications for Associate Membership

- Observer status LHC (2):

Japan and the United States of America

- Observer status CERN (2+2):

EU and UNESCO + Russian Federation and JINR suspended from 2022

CERN ”family”

- Non-member states with international co-operation agreements with CERN:

Albania, Algeria, Argentina, Armenia, Australia, Azerbaijan, Bahrain, Bangladesh, Bolivia, Bosnia & Herzegovina, Canada, China, Colombia, Costa Rica, Ecuador, Egypt, Georgia, Iceland, Iran, Japan, Jordan, Kazakhstan, Lebanon, Malta, Mexico, Mongolia, Montenegro, Morocco, Nepal, New Zealand, North Macedonia, Palestine, Paraguay, Peru, Philippines, Qatar, Republic of Korea, Saudi Arabia, South Africa, Sri Lanka, Thailand, Tunisia, United Arab Emirates, United States and Vietnam.

- Scientific contacts:

Bahrain, Costa Rica, Cuba, Ghana, Honduras, Hong Kong, Indonesia, Kuwait, Luxembourg, Oman, Madagascar, Malaysia, Mauritius, Mozambique, Rwanda, Singapore, Sudan, Taiwan, Tanzania, Uzbekistan and Zambia

European Particle Physics Strategy Update

https://europeanstrategyupdate.web.cern.ch/welcome

- In June 2024, the CERN Council established and approved the remit of the European Strategy Group

”The aim of the Strategy update should be to develop a visionary and concrete plan that greatly advances human knowledge in fundamental physics through the realisation of the next flagship project at CERN. This plan should attract and value international collaboration and should allow Europe to continue to play a leading role in the field.”

- The ESG (European Strategy Group) should take into consideration:

- The input of the particle physics community;
- The status of implementation of the 2020 Strategy update;
- The accomplishments over recent years, including the results from the LHC and other experiments and facilities worldwide, the progress in the construction of the High-Luminosity LHC, the outcome of the Future Circular Collider Feasibility Study, and recent technological developments in accelerator, detector and computing;
- The international landscape of the field

- 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 Strategy update should also indicate areas of priority for exploration complementary to colliders and for other experiments to be considered at CERN and at other laboratories in Europe, as well as for participation in projects outside Europe.
- The ESG should review and update the Strategy and add other items identified as relevant to the field, including accelerator, detector and computing R&D, the theory frontier, actions to minimise the environmental impact and to improve the sustainability of accelerator-based particle physics, the strategy and initiatives to attract, train and retain the young generations, public engagement and outreach.

Timeline for the update of the European Strategy for Particle Physics

EPSS 2026 documents

- Future Circular Collider Feasibility Study Report Volume 1: Physics and Experiments
- Future Circular Collider Feasibility Study Report Volume 2: Accelerators, technical infrastructure and safety
- Future Circular Collider Feasibility Study Report Volume 3: Civil Engineering, Implementation and Sustainability
- Physics Briefing Book
- Preliminary report of the ESG WG2a on Project Assessment:
- Full assessment of large-scale accelerator projects at CERN - Report of ESG WG2a:

European Strategy for Particle Physics decided by CERN Council 22 May 2026

https://cds.cern.ch/record/2950671

General considerations

- The full exploitation of the physics potential of the LHC and the HL-LHC….
- The unique ecosystem of particle physics research centres and universities in Europe should be further strengthened in order to address the objectives set out in this Strategy.
- The implementation of the Strategy should be pursued in strong collaboration with global partners and neighbouring fields
- The relationship between the particle physics community and the European Commission should be further strengthened, exploring funding opportunities for the realisation of infrastructure projects and R&D programmes in cooperation with other fields of science and industry.

The next CERN flagship collider project

- 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.

Other research directions in particle physics

- European contributions to both accelerator-based and non-accelerator neutrino and dark matter experiments are essential and should be supported.
- CERN should continue to provide support to the global long-baseline neutrino programme via the Neutrino Platform. The collaboration between CERN and non-accelerator-based experiments on technologies of mutual benefit should be continued.
- The ecosystem of European particle physics laboratories should continue to support a broad, diverse spectrum of key precision experiments in particle physics.

Theory

- Europe should maintain a strong and diverse particle theory landscape, from formal to phenomenological aspects, while further strengthening and leveraging connections to neighbouring fields.
- Collaborative efforts to improve the precision of theoretical predictions should be recognised and supported. Europe is world-leading in these areas and should strive to remain so by attracting, fostering and retaining early-career global talent. CERN should continue to be an integral part of all these efforts

More….

- Technologies
  - Accelerator science and technology
  - Detector development
  - Computing
  - Knowledge and Technology Transfer
- Project implementation
- Synergies with neighbouring fields
- Sustainability and environment impact
- Public engagement, education, communication, social and career aspects

The FCC process forward

- Has FCC been decided → **NO**
- The recommendations are been presented and it is for CERN:s management to convince member states to approve FCC.
- (some) point to be proven:
  - fully funded plan
  - risk management and mitigation strategy
  - plan to handle cost overruns
  - a governance model for FCC
  - operations costs

Decision objectives and timeline

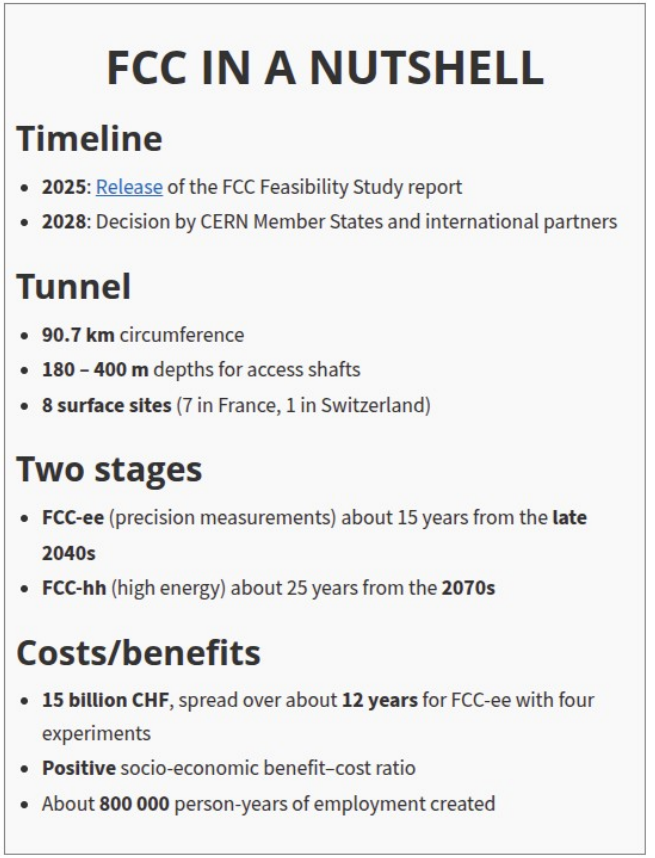
- Define a precise and coherent technical baseline for the FCC-ee project, covering accelerators, physics, experiments and detectors, civil engineering, technical infrastructure and territorial implementation.
- Consolidate all the design choices and parameters required to move from feasibility towards an executable project.
- Establish a project realisation model with a resource-loaded, integrated project schedule, covering the period from potential project approval through permitting, construction and commissioning.
- Reduce cost uncertainty through increased design maturity and integrated planning.
- Initiate environmental impact assessments and preparation of project authorisation procedures in the Host States and consultation with the public. While these activities will not be completed within this phase, they are expected to progress substantially.
- Identify, assess and develop mitigation measures for technical, organisational, schedule and external risks.
- Provide a procurement strategy including options for in-kind contributions.
- Define a framework concept for collaboration agreements and in-kind contributions for potential future FCC collaborators. General rules should be defined for Member State, Associate Member State and non-Member State collaborating institutes.
- Prepare a list of potential in-kind contributions, together with their approximate budget value in the CERN project account, that can be transparently shared with all potential in-kind contributing partner laboratories.
- Establish robust project governance, configuration management and interface control mechanisms.

CERN/3984/RA/Rev.

- Reference design phase **(2026-2028)**
- Collider and booster lattice and options frozen **(Q3 2026)**
- Proposal for civil engineering strategy and draft procurement handbook including collaboration agreements and in-kind contributions **(Q4 2026)**
- Integrated technical baseline completed,updated cost estimate with uncertainty,resource-loaded master schedule, project risk register with mitigation and updated civil engineering cost and schedule estimate **(Q4 2027)**
- Launch of Council approval process, Member State consultations, funding finalisation **(Q1 2028)**
- Independent reviews (SPC, Finance Committee,etc.) **(Q2 2028)**
- Decision on the FCC-ee **(Q3 2028 +)**

FCC and Sweden

- <u>FCC reference group in Sweden:</u> Lars Börjesson (CTH), Anders Karlhede (SU), Sara Strandberg(SU), Lisbeth Ohlsson (VR), Olof Lundberg (VR), Mathias Hamberg (Nordforsk), Mathias Marklud (CTH), Anna Carlmark Malkoch (VR), R.Brenner (UU), Dag Hanstorp (GU), Paula Eerola (AKA), Marika Edoff (VR), Johan Holmberg (VR) , Mikael Dahlgren (Hitachi)



FCC IN A NUTSHELL

Timeline

- **2025**: Release of the FCC Feasibility Study report
- **2028**: Decision by CERN Member States and international partners

Tunnel

- **90.7 km** circumference
- **180 – 400 m** depths for access shafts
- **8 surface sites** (7 in France, 1 in Switzerland)

Two stages

- **FCC-ee** (precision measurements) about 15 years from the **late 2040s**
- **FCC-hh** (high energy) about 25 years from the **2070s**

Costs/benefits

- **15 billion CHF**, spread over about **12 years** for FCC-ee with four experiments
- **Positive** socio-economic benefit–cost ratio
- About **800 000** person-years of employment created

https://home.cern/science/accelerators/future-circular-collider

Focus areas

- Physics case
- Technical feasibility for FCC
- Reduce uncertainty in FCC cost
- Reduce uncertainty in FCC risks
- Present different funding scenarios for FCC alt. flagship project
- Investigate alternatives to FCC → Future Colliders Comparative Evaluation

Swedish input about FCC

- VR has submitted input to government office based on the FCC reference group work.
- VR has submitted to CERN DG a list with questions to be addressed/conditions for approval.
- Report by M. Marklund and D. Hanstorp
  Genomlysning av det svenska CERN-medlemskapet

To be continued …..

Thank you!

Back-up slides

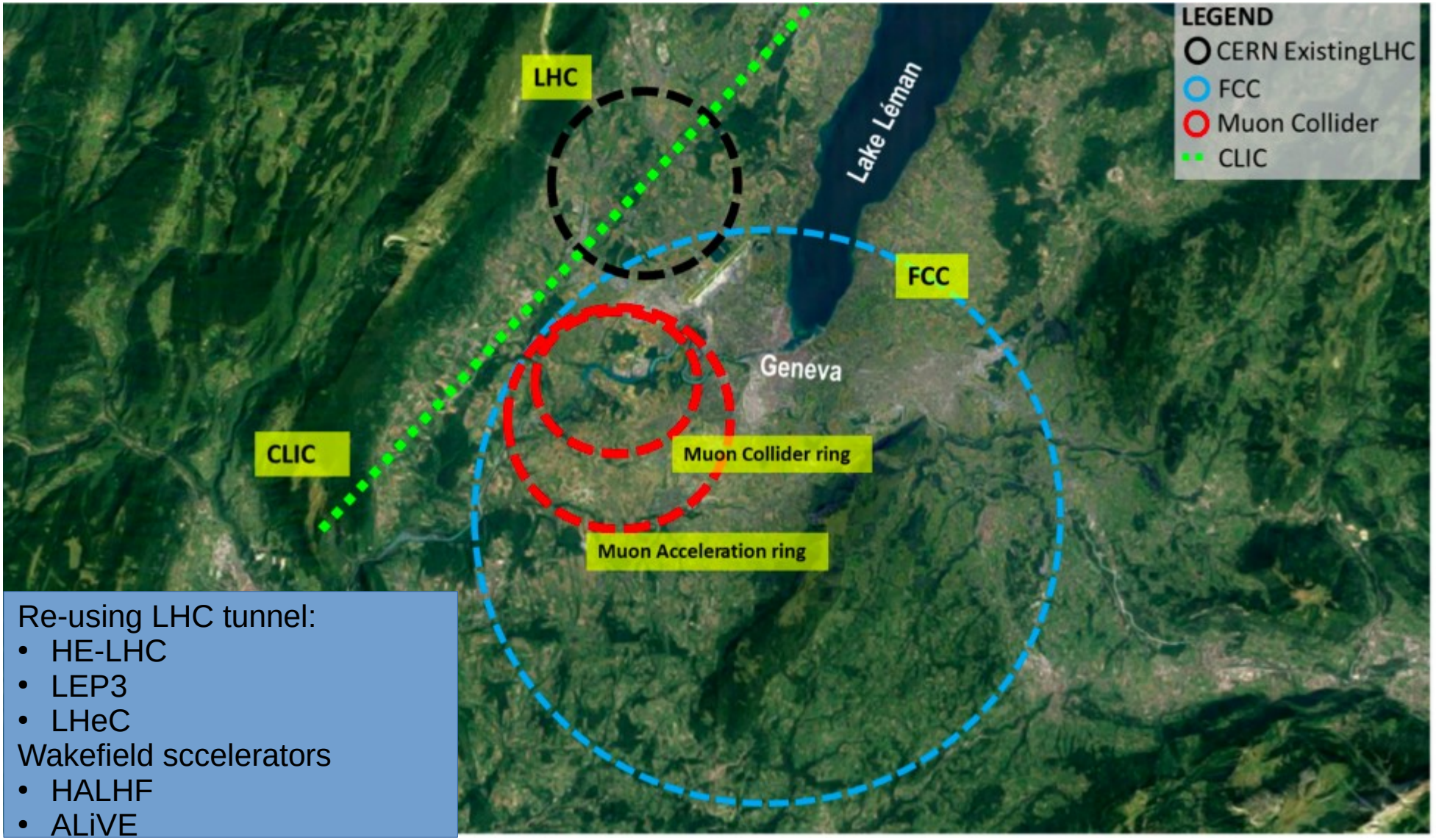
Future Colliders Comparative Evaluation

- Goal: compare FCC and alternative scenarios in a consistent way, using common assumptions and methodology, in view of the ESPP Update in 2026.

Deliverables:

- Summaries of FCC-ee and alternative options for implementation at CERN
- Metrics for comparison
- Comparative evaluation of the potential options for realization at CERN
- Credible and consistent timelines for implementation and time to first physics
- Summary of options considered elsewhere in the world that could be realized within the given time frame

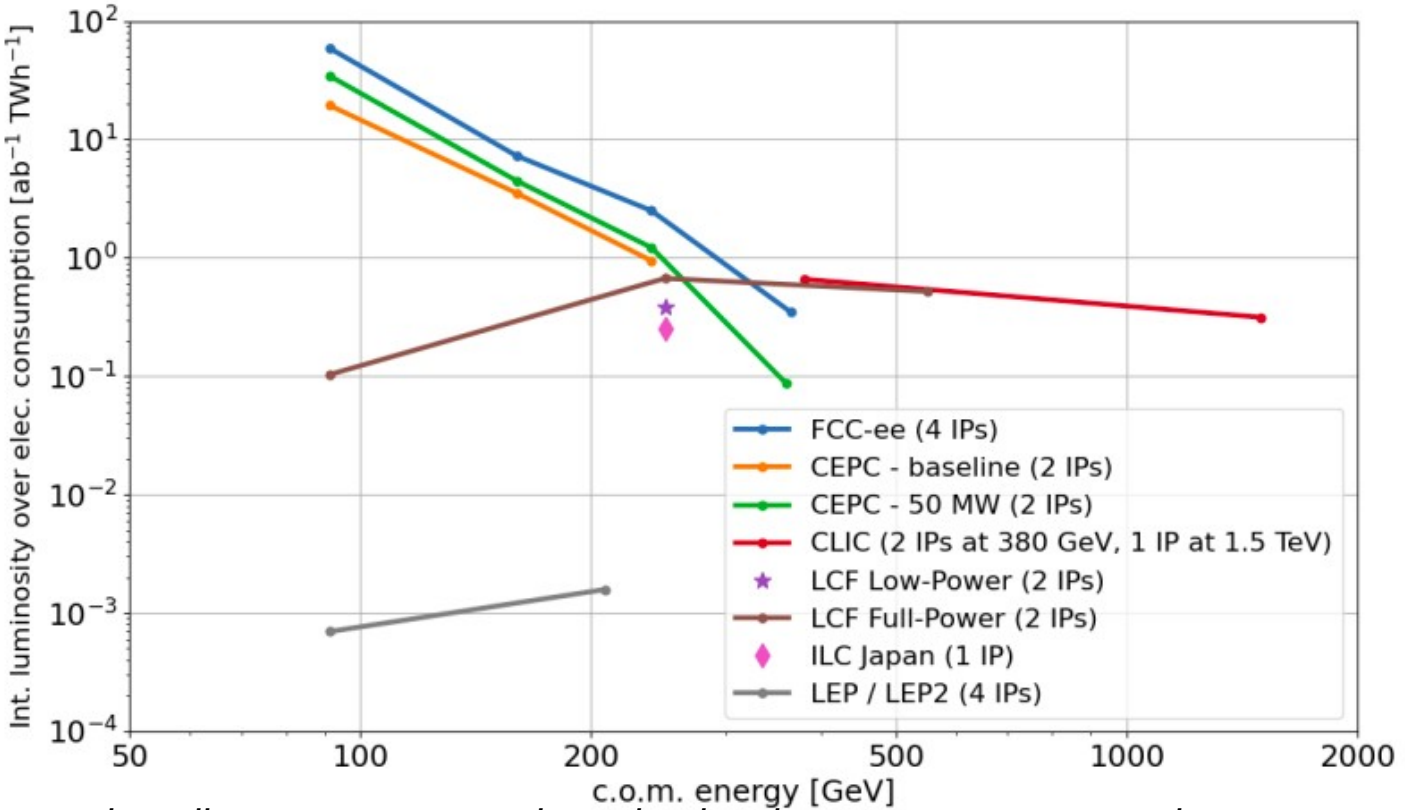
https://indico.cern.ch/event/1439855/contributions/6542430/



Re-using LHC tunnel:
- HE-LHC
- LEP3
- LHeC

Wakefield sccelerators
- HALHF
- ALiVE

One figure of merit



LEP3 pre- conceptual studies are too uncertain on luminosity an power consumption

Cost CLIC/LCF/FCC-ee

- **Breakdown** of construction costs:

Domain	CLIC – 380 GeV Cost [MCHF]	Cost class
Collider	2471	3–4
Main beam production and transfer lines	1046	3–4
Drive beam production and transfer lines	1060	3–4
Civil engineering	1403[a]	4
Technical infrastructures	1361	3–4
Experiments	795	4
TOTAL	**8136**	

Domain	FCC-ee – 240 GeV Cost [MCHF]	Cost class
Booster and collider	4140	3
Pre-injectors and transfer lines	590	3
Civil engineering	6160	3
Technical infrastructures	2840	3
Experiments	1590	4
TOTAL	**15320**	

Domain	LCF LP – 250 GeV Cost [MCHF]	Cost class
Collider	3864	3
Injectors and transfer lines	1181	3
Civil Engineering	2338[a]	4
Technical infrastructures	1109	4
Experiments	795	4
TOTAL	**9287**	

Costs include **construction**, **tooling**, **reception tests**, **pre-conditioning, hardware commissioning**, **total detector costs** (CERN contribution will actually be 10% of the total), and **land-related and administrative costs**.

CLIC will require a large demonstrator to be built (not included in table) before the main project.

Cost CLIC/LCF/FCC-hh/MuCOL

- **Breakdown** of construction costs:

Domain	CLIC – 1.5 TeV Cost [MCHF]	Cost class
Collider	4684	3 – 4
Main beam production and transfer lines	23	3 – 4
Drive beam production and transfer lines	302	3 – 4
Civil engineering	703	4
Technical infrastructures	1404	3 – 4
Experiments	N/A	
TOTAL	**7116**	

Domain	LCF FP – 550 GeV Cost [MCHF]	Cost class
Collider	4204	3
Injectors and transfer lines	86	3
Civil Engineering	0	
Technical infrastructures	1174	4
Experiments	N/A	4
TOTAL	**5464**	

Domain	FCC-hh Cost [MCHF]	Cost class
FCC-ee dismantling	200	4
Collider	13400	4
Injectors and transfer lines	1000	4
Civil Engineering	520	4
Technical infrastructures	3960	4
Experiments	N/A	
TOTAL	**19080**	

Options summary: Traffic Light Table

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
CLIC 380 GeV, 1.5 TeV		4 - 6 / 5.2							
FCC-ee 91-365 GeV		4 - 7 / 6.0							
FCC-hh 85 TeV		4 - 7 (Nb_3Sn) / 4.3 2 - 7 (HTS) / 3.2							
FCC-hh - SA 85 TeV		4 - 7 (Nb_3Sn) / 5					Nb_3Sn		
LCF 250 - 550 GeV		5 - 7 / 5.5							
LEP3 91 - 230 GeV		3 - 6 / 4.0							
LHeC: HL-LHC + 50 GeV ERL		3 - 6 / 4.5							
MC 3.2 TeV, 7.6 TeV		3.2 TeV: 3 - 5 7.6 TeV: 2 - 5							

TRL = Technical Readiness Level