FCC

Division of Particles & Fields

DPF

https://indico.global/event/17941/

DPF Community Meeting

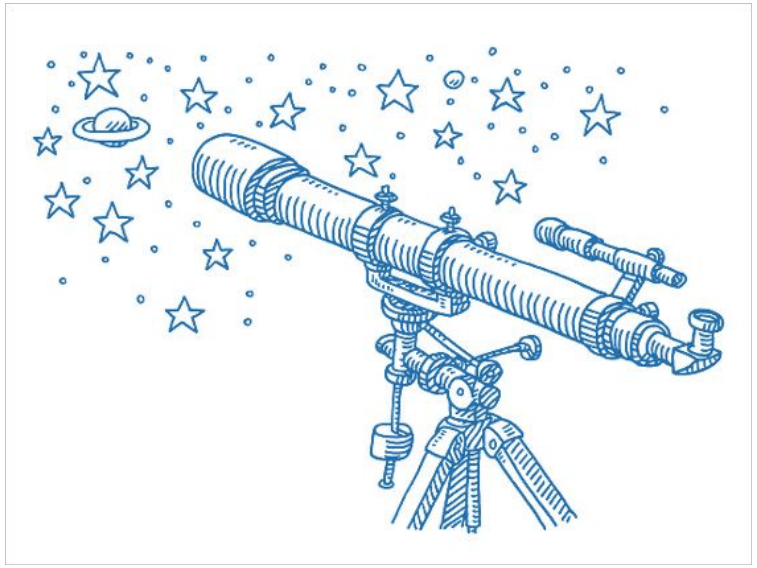
Thursday 21 May 2026, 08:45 → 23:45 America/New_York

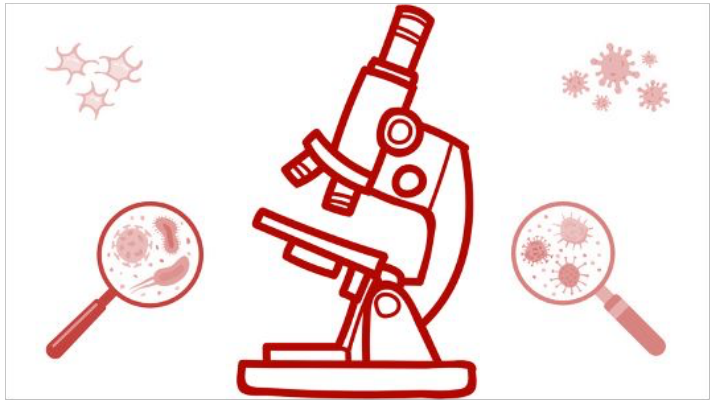
The Future Circular Collider from a US Perspective

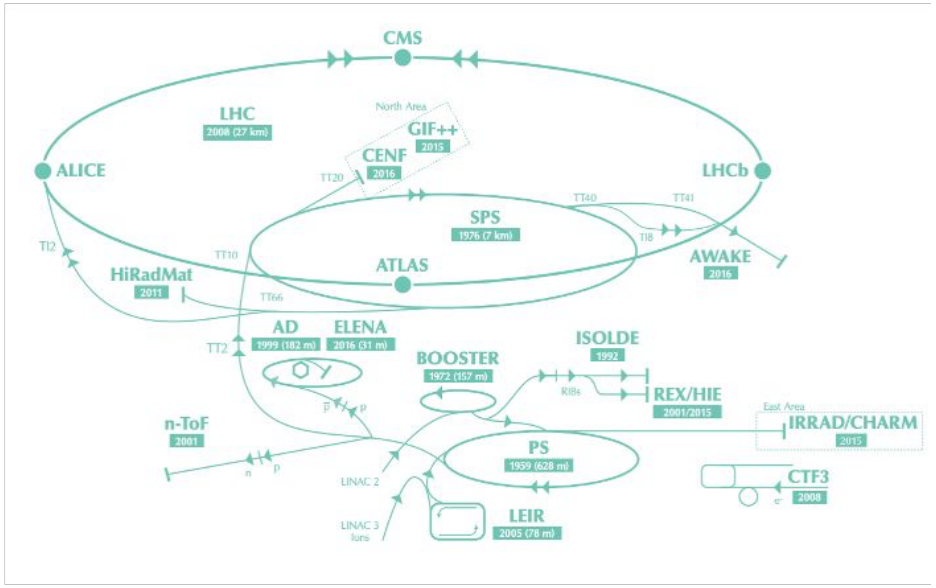
May 21, 2026

Valentina Cairo, Steve Gourlay, Srini Rajagopalan, Tor Raubenheimer
on behalf of the US-FCC community

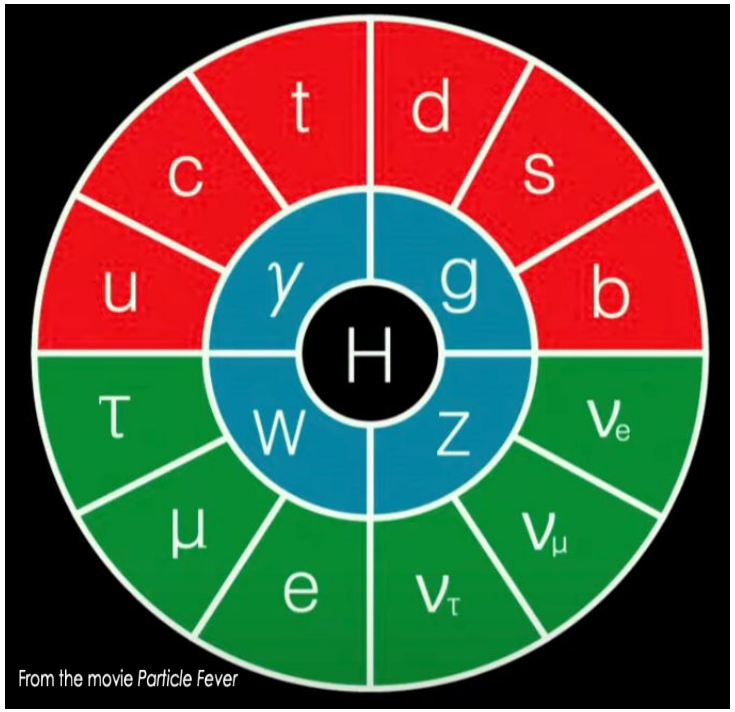
Exploring the Universe

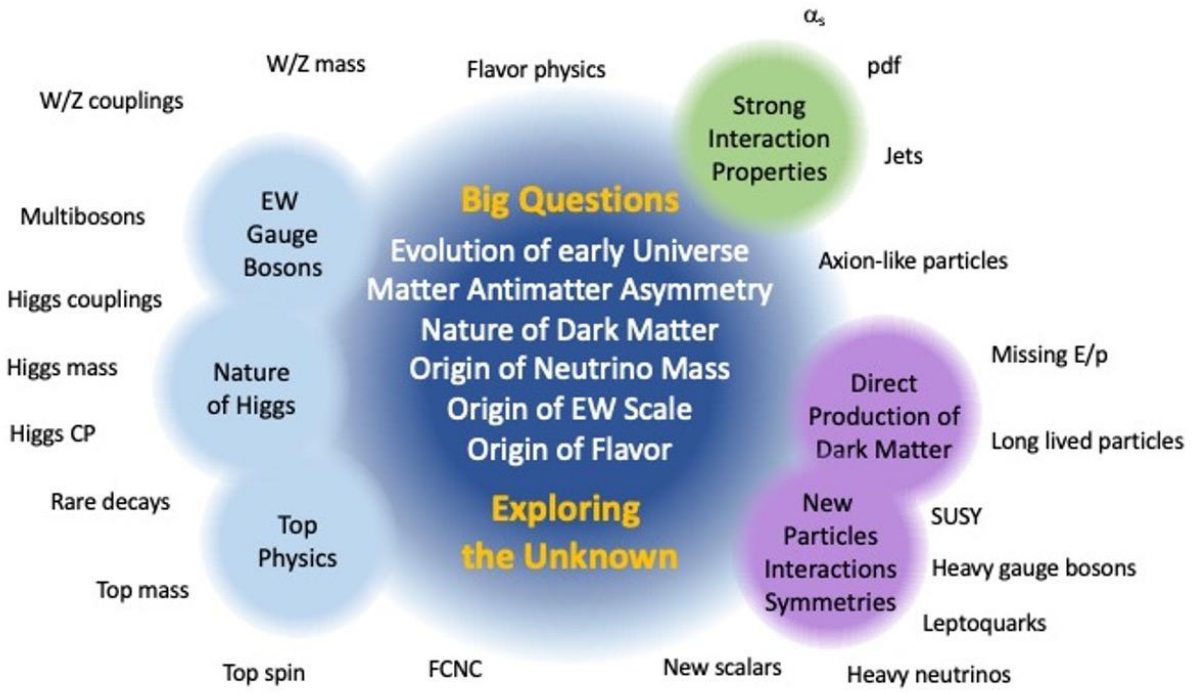






The post-Higgs-boson-discovery era





2211.11084

Colliders are unique instruments to study a number of phenomena and explore the connections between many of the fundamental questions we want to answer. While HL-LHC remains our highest priority in the next decade, future colliders will allow for a leap forward…

Future colliders

With **precision measurements** and **high-energy exploration**,
lepton and hadron colliders can shed light on some of several key questions

EU Strategy Update for Particle Physics

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

*Aim: 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.** → **European Strategy Group concluded its deliberations and recommendations are available***

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A. The electron–positron Future Circular Collider (FCC-ee) is recommended as the preferred option for the next flagship collider at CERN. ~15 billion CHF over ~12 years, civil engineering for tunnel about 1/3

Broadest high-precision particle physics programme

- Outstanding discovery potential through the Higgs, electroweak, flavour and top sectors, as well as advances in QCD, Its technical feasibility is demonstrated via the FCC feasibility study, Scope and costs are well defined, plausible funding models exist

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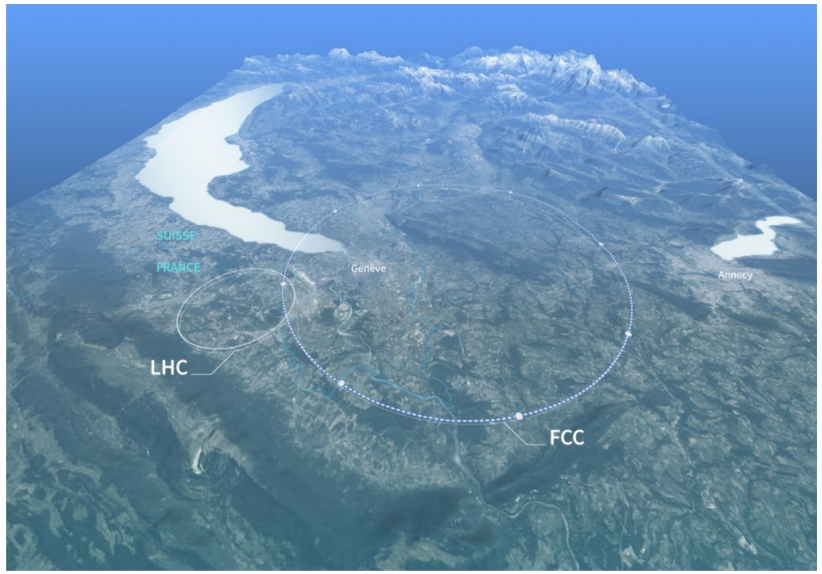
FCC-ee would pave the way towards a hadron collider reusing tunnel and infrastructure → direct discovery reach beyond the 10 TeV parton energy scale, in line with the community's ambition for exploration at the highest achievable energy.

The Future Circular Collider in a nutshell

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

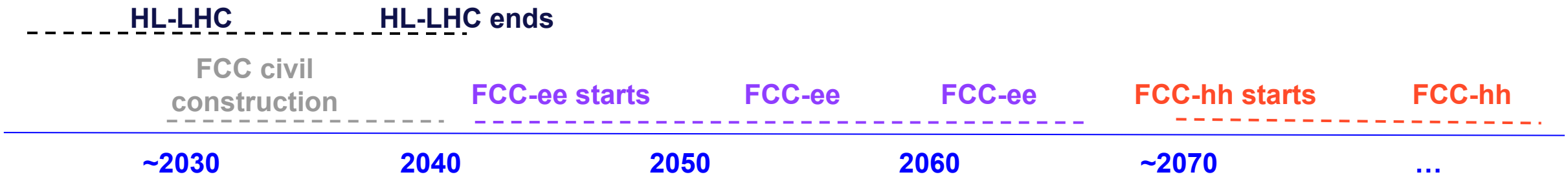


The future collider would be built in a circular underground tunnel some 91 kilometres in circumference located at a depth of between 180 and 400 metres beneath the French departments of Haute-Savoie and Ain and the Swiss canton of Geneva.

90.7 km	**200 m average depth**
4(2) detectors	**Decades of scientific research**

A project with an integrated 2-stage program

Stage 1: **FCC-ee** (Z, W, H, tt) as electroweak, Higgs & top factory at highest luminosity
Stage 2: **FCC-hh** (~100 TeV) as natural continuation at energy frontier, pp & AA collisions; e-h option



The FCC-ee in the US

https://us-fcc.web.cern.ch/mandate/

US Higgs Factory

Coordination Consortia

charged by DOE and NSF

Provide strategic direction and leadership for the US community to **engage, shape and thereby advance the development of physics, experiment and detector program at various Higgs Factories**

Ensure cooperation with our partners in the international program

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2026

European Strategy for Particle Physics Update process

US Higgs Factory

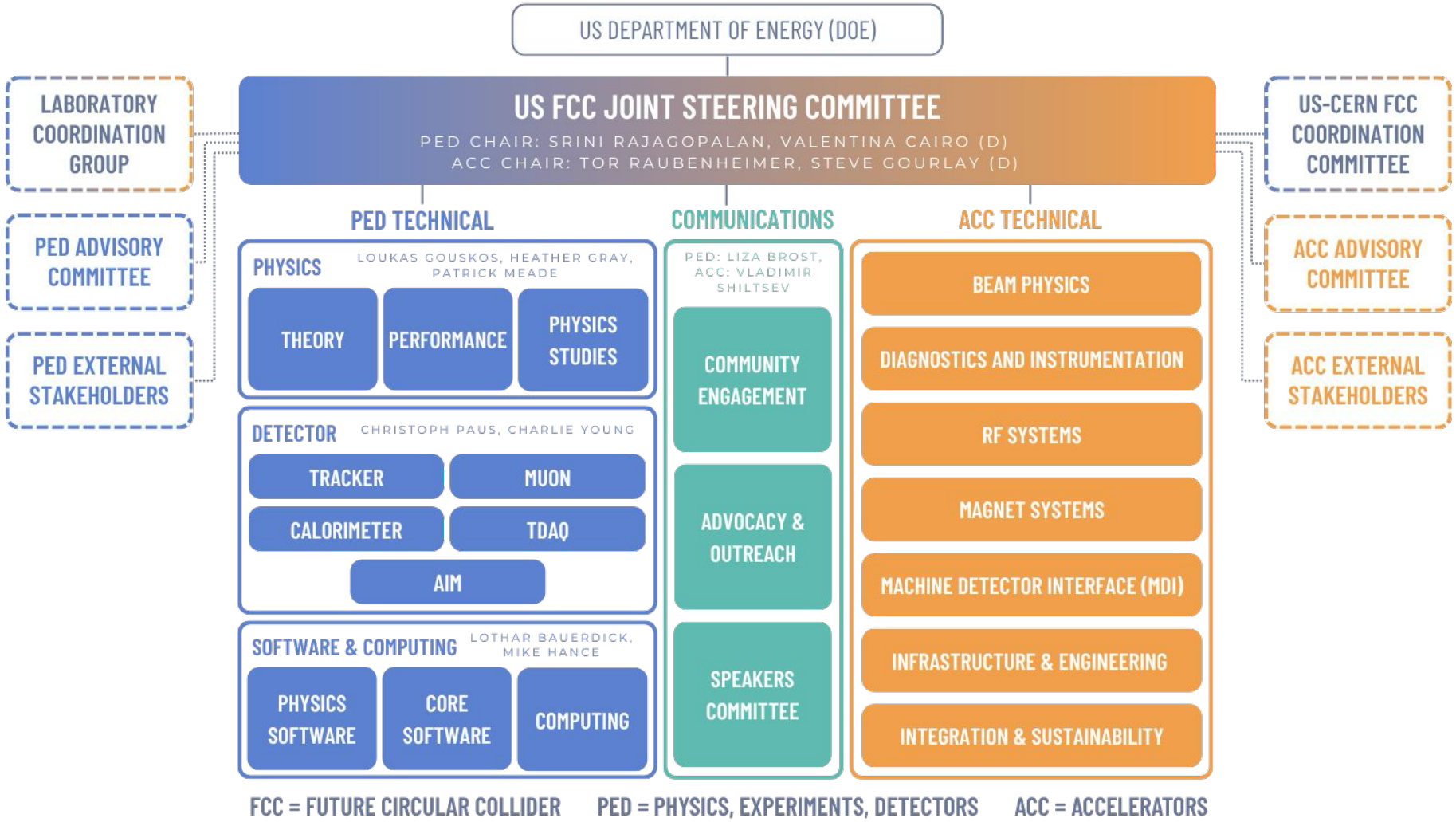
Circular Collider

Current US effort focused on defining strong international collaborations and unique areas of technological contribution to both **FCC accelerator and detectors**, including proposing detector concepts

The FCC-ee in the US

https://us-fcc.web.cern.ch/

Aspires to significant contributions to Physics, Experiments & Detectors (PED) as well as Accelerators (ACC).



Cultivating unique US expertise with strong international collaborations

PED

(*) partially or fully supported in FY 2026

Physics

AI detector optimization pipelines*
Development of Digitization framework for TDAQ*

Higgs, EWK, QCD physics, flavour tagging, particle identification, unique theory & experiment synergies
+...

Detectors

Muon Drift Tube & Micro-Rwell*
DR Crystal and Fiber Calo*
LAr design of turbine structures*
Strawtube*
MAPS*
Tracker Simulation*
Low Mass Mechanics*
+...

Software & Computing

Docs and Training support*
Core SW in Key4HEP*
MC Production*
Analysis Facilities
+...

Communication, Engagement, In and Outreach (shared with ACC)

Some workshop/travel support*
Website development*

+...

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RF Systems

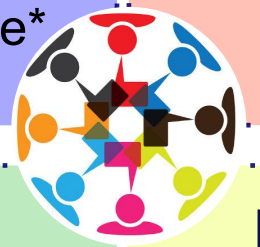
Leverage expertise in bulk Nb SRF technology, recent SRF CM fabrication, & RF power sources

→ 800 MHz Superconducting RF Cryomodule*
800 MHz+ high efficiency RF Sources

Beam Physics

Leverage beam-physics modelling using DOE complex supercomputing capabilities

Model FCC and SuperKEKB*



Machine Detector interface

Leverage expertise from e+/e- and EIC

Luminosity measurement systematics*
IR cryostat engineering*
Expect future work on IR magnets

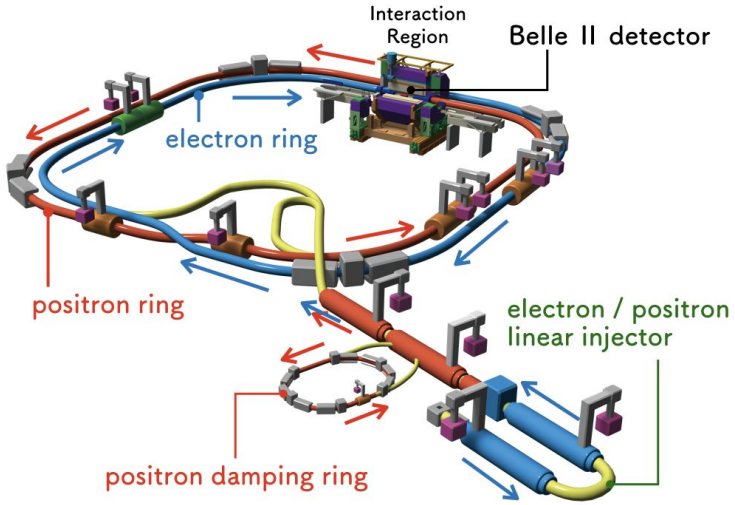
Magnet and Diagnostic Technologies

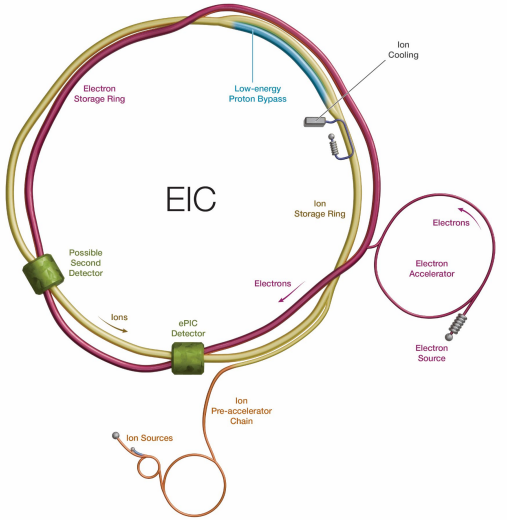
Leverage HFM expertise and consider applications of HTS and Nb3Sn

Leverage expertise in diagnostics from synchrotron radiation sources

Synergies with other projects

- Synergies with other ongoing/future projects
  - SuperKEKB
    - e.g. luminosity
  - Electron-Ion Collider
    - e.g. MDI, tracking systems, etc
      - Recent US-FCC tracking meeting
        - https://indico.global/event/17982/
  - And more…
- Potential to establish strong long-term collaborations as in current times, e.g. HL-LHC and LBNF/DUNE





Given today's funding realities and priorities, how do we not only sustain but grow the expertise and collaboration needed to move science forward?

What can we do to make the FCC a reality?

A multi-prong approach

No new project likely to start before ~2030 in the US → funding for FCC needs a multi-prong approach

- **Traditional DOE support**
  - Likely limited up to ~$1 million for FY 2027 ($0.5 million each for PED & ACC) and probably for FY 2028 itself. More on the next slide.

- **LDRD/PD support from the National Labs**
  - BNL, FNAL, SLAC, ANL and LBNL; BNL, FNAL & SLAC already have established LDRDs/PDs
  - We are discussing with respective laboratory management to seek additional LDRDs/PD

- **University funding**
  - Must explore possibilities; potentially to obtain matching contributions from Universities (travel support to help community engagement?).

- **AI-focussed funding**
  - Plan to document AI-specific activities for FCC into a white paper and submit for consideration
    - Building on the general AI white paper 2602.17582

FY 2027

Need to begin now to develop a bottom-up prioritized request for FY 2027. Work with the L1/L2 coordinators and the community to develop the planning over the next couple of months.
Prioritization must be based on:

- Why US? (local expertise, leverage infrastructure, maintain leadership and engagement)
- Why now? Importance of engaging in the proposed R&D in FY 2027 rather than later.
- What is the impact if not done now?

Two additional points are considered:

- **Uniqueness of activity:** US uniquely positioned to deliver; international FCC relies on US.
- **FCC & AI:** Explicitly spell out connections with AI.

This process allows the US HFCC to develop the case to seek appropriate funding through multiple funding streams

Upcoming activities: First BNL-CERN School on Physics at Future Colliders

Co-funded with CERN first School on Physics at Future Colliders, **in collaboration with muon collider and EIC**

- **August 27 – September 4, 2026 @ CERN**
- https://indico.cern.ch/event/1661010/

Targets advanced PhD students (those who have completed their course work and are deep into their ongoing research) as well as early postdocs

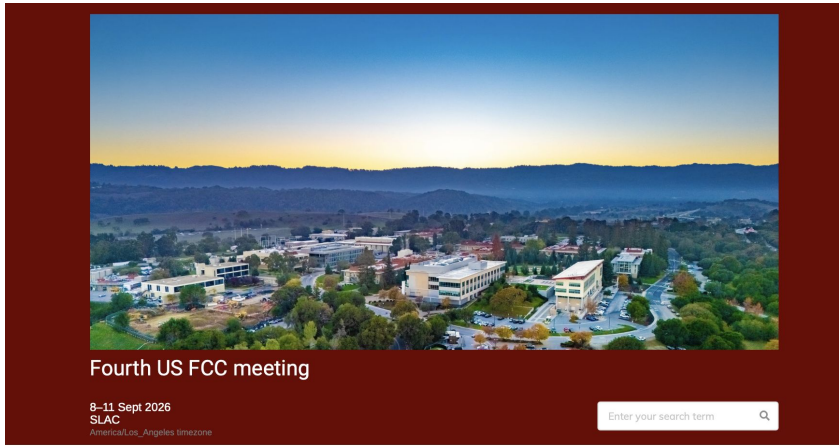
Max participants ~50

This school focuses on the future of particle colliders, exploring the core scientific motivations and the ways in which evolving accelerator and detector technologies can be exploited to address fundamental science questions. Designed for advanced PhD students and early-career post-docs in experimental and theoretical particle physics, the program is tailored for those interested in **Physics, Experiments, and Detectors (PED)** who aspire to contribute to these global efforts. Participants will gain the technical insight and strategic vision needed to bridge the gap between theoretical goals and experimental execution, preparing them for a career in characterizing the fundamental nature of matter and revealing underlying physics.

The electron-positron Future Circular Collider (FCC-ee), recommended by the European Strategy Group as CERN's preferred flagship option, serves as a primary case study for these PED challenges. Operating at the Z, W, Higgs, and top quark thresholds, it aims to provide unprecedented precision to test the Standard Model and search for new physics. This long-term vision includes a ~100 TeV FCC-hh in the same tunnel following the completion of FCC-ee operations. The other major collider planned to be built is the Electron-Ion Collider (EIC) at Brookhaven National Laboratory in the United States which offers significant synergies with the proposed FCC-ee program at CERN. By examining these machines alongside other proposed options like the Muon Collider, students will learn how accelerator and detector technologies and machine-detector interfaces are critical to the success of the next generation of high-energy physics.

Upcoming activities: Meetings & Workshops

- Virtual **US-FCC Physics kick-off meeting**
  - **June 3rd, invited contributions + possibility to submit contributions, please do!**
  - https://indico.global/event/17891/
- **4th US-FCC workshop**
  - **September 8-11, 2026 @ SLAC**
  - https://indico.slac.stanford.edu/event/10213
  - The fee for students is waived
- Rich agenda with tutorials, plenary and parallel sessions on both accelerators and PED activities
- Representatives from CERN, FCC international and DOE will be present



We strongly encourage the participation and engagement of early career scientists

Conclusions

Thus far, **the Standard Model rules**, even if it **has its shortcomings** and it's not able to describe everything we observe in nature

Exciting science ahead to shed light on some of the yet-to-be answered questions about the Universe

The Future Circular Collider has the potential to become a unique driver in our fundamental understanding of nature, its physics reach will advance the state-of-the-art in an unprecedented way

Interplay between **accelerator, detector design**, **algorithms and analysis techniques** is of paramount importance to achieve the FCC physics goals → **US involvement ensures a leading role in cutting-edge technology** and provides **valuable training for the next generation of physicists**

Particle Physics programs of CERN and the US are interdependent to the mutual benefit of both

Following the HL-LHC legacy, the Future Circular Collider will push open a new window onto the laws of nature…

Relative view point, by F. Cairo

We are getting ready to discover ***what we know*** and also ***what we did not know*** we were missing

We have a **unique opportunity to drive it as a community** and shape technologies, theories, and the scientific vision of the future