



# FCC-ee PED at FNAL: News

V. Daniel Elvira (Fermilab)

FCC FNAL Meeting

# The European Strategy for Particle Physics



The [European Strategy for Particle Physics](#) sets out the priorities for high energy physics in Europe

- **Updates to the strategy happen every ~5 years**
  - Mandated by and reports to the CERN Council (similar to the Snowmass process)
- **Third strategy update is now underway, chaired by Karl Jakobs (Freiburg, Germany)**
  - Approved in June 2024, will submit report to Council in January 2026
- **Ample period of consultation with the community**
  - Documents can be submitted until end of March 2025
  - Open symposium 23-27 June 2025

# The European Strategy for Particle Physics



## Full Timeline

### Timeline for the update of the European Strategy for Particle Physics



Proposed timeline for the European Strategy Update process

- Physics, Experiment, Detector (PED) web page
  - <https://fcc-ped.web.cern.ch>
- How to subscribe to relevant e-groups
  - Visit <https://fcc-ped.web.cern.ch>
  - Click on “contact/join us”, you’ll see two options. One is “join us”, “subscribe to mailing lists”. But most of the links are broken. What you should do is to go to follow the “Contact/join us” and then the “Contact us” link. You will see a very nice flow chart with the structure of the FCC PED mailing lists. The orange ones are closed; you can only join the green ones; they are actually “members” of the orange ones. That means that managers would send email to the orange ones to get them distributed to all the member (green) ones.
- New “IDEA Study Group” – announced by Paolo Giacomelli
  - e-mail list: [IDEA-international@cern.ch](mailto:IDEA-international@cern.ch)
    - People who already collaborate with some of IDEA's activities
    - People who expressed an interest in IDEA and its activities
    - People who just want to be informed about IDEA and its activities
    - First meeting: **Tuesday October 15th at 16:00** (GVA time) <https://agenda.infn.it/event/43596/>

# US FCC: organization



## Higgs Factory Steering Committee (HFSC) organization

- US FCC mailing list ([us-fcc@cern.ch](mailto:us-fcc@cern.ch))

### Tracker: Carl Haber (LBNL), Christoph Paus (MIT)

e-mail list: [us-hfcc-tracker@cern.ch](mailto:us-hfcc-tracker@cern.ch)

Sub-Groups (L3): Silicon<sup>1</sup>, Gaseous Tracker, Mechanics

### Calorimeter: Michael Begel (BNL), Bob Hirosky (Virginia)

e-mail list: [us-hfcc-calorimetry@cern.ch](mailto:us-hfcc-calorimetry@cern.ch)

Sub-groups: Dual Readout,<sup>2</sup> Si-W, Nobel Liquid, Tile-Sc

### Muons: Marcus Hohlmann (FIT), Bing Zhou (Michigan)

e-mail list: [us-hfcc-muons@cern.ch](mailto:us-hfcc-muons@cern.ch)

Sub-groups: Electronics, Drift Tubes, MPGDs

### AI, Integration and Microelectronics (AIM): Julia Gonski (SLAC), Jim Hirschauer (FNAL)

e-mail list: [us-hfcc-aim@cern.ch](mailto:us-hfcc-aim@cern.ch)

Sub-Groups: AI, Integrated Detector Concepts, Micro Electronics

### TDAQ: Zeynep Demiragli (Boston), Sasha Paramonov (ANL)

e-mail list: [us-hfcc-tdaq@cern.ch](mailto:us-hfcc-tdaq@cern.ch)

Sub-Groups: Trigger, DAQ

### Physics, Software, and Computing: Lothar Bauerdick (FNAL), Mike Hance (UCSC)

e-mail list: [us-hfcc-psc@cern.ch](mailto:us-hfcc-psc@cern.ch)

Sub-Groups: Physics/Simulation, Software, Computing

<sup>1</sup> Solid State Tracking & Fast Timing: Artur Apresyan

<sup>2</sup> Dual Readout calorimetry: Grace Cummings

# US FCC: annual meeting 2025



## Submitted a Fermilab/Argonne joint proposal to host the US FCC Annual Meeting in 2025

- Decision will be made by the USFCC-AC (Advisory Committee - not fully appointed yet)
- Full proposal attached to the agenda

### The area around the City of Chicago has a long and rich tradition in particle physics

- Two major National Laboratories: Argonne and Fermilab
- Premier public and private research universities

### A regional center of experimental and theoretical particle physics

- World class accelerator and detector R&D, construction facilities
- Critical technologies: micro-electronics, AI/ML, quantum science
- Domestic and international users community

### Joint Fermilab/Argonne US FCC Annual Meeting - week of March 3<sup>rd</sup> or 10<sup>th</sup>

- Mon-Wed or Wed-Fri
- Days 1 & 2 (Fermilab - plenary/parallel sessions, tours)
- Day 3 (Argonne - plenary in the morning, tours in the afternoon)

(International  
FCC Annual  
Meeting in May)

Fermilab/Argonne jointly hosting builds on the resident expertise of one of the largest populations of collider physicists in the US, and capitalizes on the already existing user communities (**Option A**)

Fermilab commits to host the full event should the HFSC decides on a single site (**Option B**)

Two LDRDs related generally to future colliders were submitted:

- CODE4hep (Collider Optimization Development Environment for HEP): Modern Software Infrastructure to Explore Computing Model and Framework Solutions for Potential Future Collider Experiments (K. Pedro - PI, L. Gray, D. Elvira, Liz S-K co-PIs)
- Bridging sensor design with HLS4ML towards iMAPS: Intelligent Monolithic Active Pixel Sensors (L. Gray – PI, Giuseppe Di Guglielmo – co-PI)

# US FCC: upcoming events



## US Higgs Factory Planning

(Dec. 19-20, 2024, at SLAC)

- Discussion of the near-term needs for detector R&D and software development
- Initial discussion on the U.S. HFCC input to ESPP, both technical and strategic.
- discussion on US expression of interest to international partners

## US Higgs Factory – PED leaders meeting

L2's only event – meeting with “agencies”

(Nov. 8-9, 2024, at BNL)

- Review the activities that were funded in FY24
- Discuss and prepare a prioritized scope/resources request
- Explain: Why should we pursue the R&D now?
- Describe how additional funding would help. Justify, and articulate the impact.



# Original agenda for Today



**FNAL FCC-ee PED**

Monday Oct 14, 2024, 2:00 PM → 4:00 PM US/Central

WH1 1NE - Sunrise (Wilson Hall)

Daniel Elvira (Fermilab)

---

**2:00 PM** → 2:10 PM **News** ⌚ 10m  
Speaker: Daniel Elvira (Fermilab)  
USFCC-FNAL-Argon...

**2:10 PM** → 2:25 PM **US FCC leadership and community events (Nov. - BNL, Dec. - SLAC)** ⌚ 15m  
Speaker: All  
Critical to build user community, claim FNAL candidacy for US host of an FCC-ee experiment (leverage community resources)

**2:25 PM** → 2:55 PM **LPC extension to FCC-ee - implementation details** ⌚ 30m  
Speaker: All  
Critical for integration of FNAL to international FCC, important if opportunity for additional funding request

**2:55 PM** → 3:25 PM **Fermilab concrete contributions to detector benchmarks/physics** ⌚ 30m  
Speaker: all

Fermilab strategy – in “Report of the FCC-ee PED Task Force”  
<https://docs.google.com/document/d/1TuGtR07015f7N1Sul0VvoU4YNIszj5SLiJP5TJMs10/edit?tab=t.0>

Delivered to FNAL Directorate

But we need a short-term tactical plan for near future – concrete & prioritized contributions (to tap on potential additional funding).

Strategy document and Jan 24 google doc (potential partners) are a good starting point

<https://docs.google.com/document/d/1jxGhj9IBakIKIY-qStDefwXib4KwwLsDf3039Jr0FJ0/edit?tab=t.0>

A 3-5 years plan has become more urgent because of ...

# A call for expression of interest (EOI) – from PED leadership



## Call for Expressions of Interest for the Development of Sub-detectors for the FCC

The Physics Experiments and Detectors (PED) Pillar of the Future Circular Collider (FCC) Study invites Expressions of Interest (EOI) by institutes or consortia of institutes to pursue the development of sub-detector (e.g. calorimeter, tracker) designs for FCC experiments. EoIs for work towards integrated full detector concepts are being invited in a separate call.

With this we encourage the federation of international efforts focussing on one or more technologies for a given sub-detector. These activities are expected to be well connected to technological R&D pursued in the framework of the CERN-anchored DRD collaborations and complement these with a focus on system integration aspects at the level of the sub-detector as well as its integration into one or several overall detector concepts. They should support the R&D with simulation and optimisation of system performance and, together with detector concept groups, provide guidance to the R&D via feedback on system design and performance.

We welcome EoIs both on technologies already under study by existing detector concept groups as well as new ideas still to be evolved towards embedded systems. Such new technology approaches should be motivated with reference to performance requirements as well as technological considerations.

EoIs should be compact documents (2-4 pages) including

- The scope of planned activities for the next 3-5 years
- The Partners (Institutes) and their expertise
- The names of one or two contact persons
- The connection with technological activities in the DRD framework
- The engineering and simulation connections with concept groups
- References to relevant more detailed documentation of the technologies

We plan to prepare a document combining the EoIs received in response to this call for a submission to the ESU process, together with an executive summary. Groups may choose to submit their EoIs independently as stand-alone contribution in addition to, or instead of inclusion in the combined PED submission. For inclusion in combined submission, or for reference in the summary, we are asking to send them in final or close-to-final form by end of January 2025.

## Call for Expressions of Interest for the Development of Detector Concepts for the FCC

The Physics, Experiments and Detectors (PED) Pillar of the Future Circular Collider (FCC) Study invites Expressions of Interest (EoIs) by groups of institutes to pursue the development, or further development, of an integrated conceptual detector design for FCC experiments. EoIs for the development of sub-detector designs are being invited in a separate call.

With this, we encourage the federation of international efforts focussing on full detector concepts, to establish the link between the FCC physics performance requirements and the technological capabilities of the sub-detectors to be developed; to guide the R&D on sub-detectors and to give feedback on the full-detector performance impact of technological choices.

In this phase of the FCC project, the work of concept groups should primarily focus on

- A consistent simulation model with full simulation in all sub-systems, and the support of high-level reconstruction tools for full-event properties like di-jet masses or flavour tagging, to evaluate the full-event performance of the detector as a whole
- An overall engineering model informing the simulations, simplified, but with realistic material budget and dead spaces,
  - to guide the optimisation of the global detector parameters and structures
  - to support the development of the machine detector interface (MDI)
  - to provide boundary conditions for sub-detector integration

These concepts should be well connected to the developments of sub-detector systems and to technological R&D pursued in the framework of the CERN-anchored DRD collaborations, and complement these with studies at the full-detector level.

Simulation and reconstruction software should be integrated into the Key4HEP system, provide an interface to the sub-detector developments and an environment for studying their integration, and enable full-simulation-based physics studies.

The forming of (proto-) collaborations will start at a later stage, while presently the combination of different sub-detector technologies inside a given concept should remain open where technically reasonable and supported by the common software framework.

We welcome EoIs for work both on already existing detector concepts as well as new concepts, which are not variants of existing ones; in that case we rather encourage to intensify collaboration.

EoIs should be compact documents (3-6 pages) including

- The scope of planned activities over the next 3-5 years, as well as the partner institutes and their expertise, and the names of one or two contact persons.
- The connection with technological activities in the DRD framework
- References to relevant more detailed documentation of the technologies

Reflect institutional interest in the Google Sheet as soon as possible, ideally by end-October:

<https://docs.google.com/spreadsheets/d/1P36xEBj121DKDokJfBZK1p322U2CIP AottQIBFSSA/edit?gid=0#gid=0>

To create entry in list:

<https://docs.google.com/forms/d/e/1FAIpQLScLHtwbNSoFFia57zR-AxjpY62yOndYFUmvRIsHuQap3gbH5Q/vie wform>

New – as of  
10/11/24

# Rephrase into action items for today



- **US FCC leadership and community events (Nov. – BNL, Dec. – SLAC)**
  - US L2s Jim Hirschauer, Lothar Bauerdick attending **BNL meeting: goals/debriefing**
  - Plan on **attendance and goals for SLAC meeting**
  - Please inform Bo/Daniel in advance of your interest to attend Higgs Factory events
    - Coordination, budgetary constrains
- **Fermilab concrete contributions to detector R&D, benchmarks/physics**
  - **Compose it from FNAL strategy document**
  - **Define role of LPC and discuss implementation details**
- **PED request for EOI by “institutes or consortia” on “subdetectors” and “detector concepts**
  - **Coordinate FNAL entries to the EOI list**
  - Two EOIs, one on subdetectors (detector R&D connected to DRDs), and one on detector concepts (S&C infrastructure, simulation/reconstruction, physics), a third one for theory
    - Or do we want to have more granularity and submit more?