# USFCC HFSC-PED report 19 Sep 2024

Marcel Demarteau, **Sarah Eno**, Ritchie Patterson, Srini Rajagopalan

# US Higgs factory detector workshop

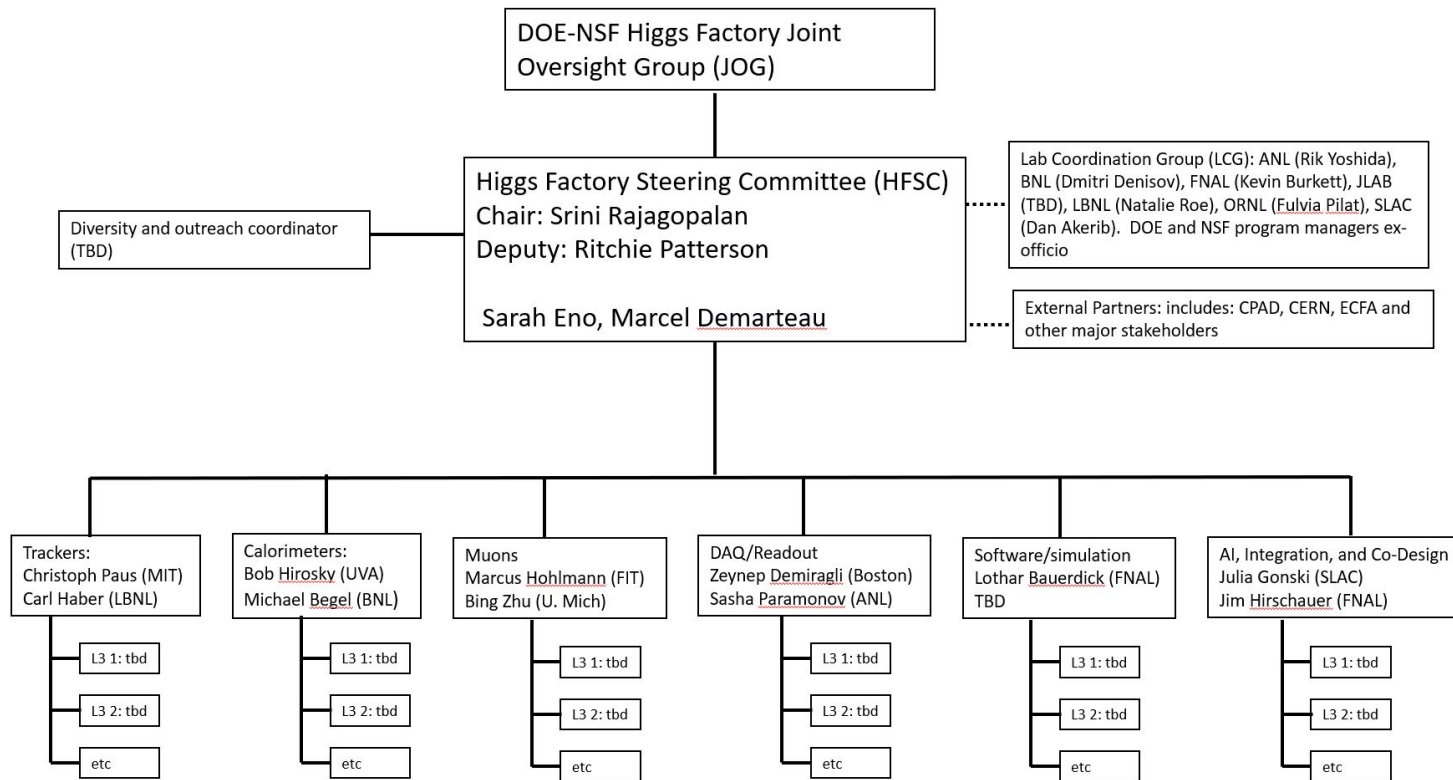Just for the US Higgs factory detector community.

- planning for near term US R&D efforts
- Planning for HFCC input to ESPP.
- Planning for EOIs discussed later in this slide deck.

The workshop will take place Dec. 18-20.  Put this on your calendar.  Location TBD.

https://indico.cern.ch/event/1459069/

# Org chart

If you are interested in participating in any of these groups, please contact their L2

DOE-NSF Higgs Factory Joint Oversight Group (JOG)

Higgs Factory Steering Committee (HFSC)
Chair: Srini Rajagopalan
Deputy: Ritchie Patterson

Sarah Eno, Marcel Demarteau

Diversity and outreach coordinator (TBD)

Lab Coordination Group (LCG): ANL (Rik Yoshida), BNL (Dmitri Denisov), FNAL (Kevin Burkett), JLAB (TBD), LBNL (Natalie Roe), ORNL (Fulvia Pilat), SLAC (Dan Akerib). DOE and NSF program managers ex-officio

External Partners: includes: CPAD, CERN, ECFA and other major stakeholders

Trackers:
Christoph Paus (MIT)
Carl Haber (LBNL)
- L3 1: tbd
- L3 2: tbd
- etc

Calorimeters:
Bob Hirosky (UVA)
Michael Begel (BNL)
- L3 1: tbd
- L3 2: tbd
- etc

Muons
Marcus Hohlmann (FIT)
Bing Zhu (U. Mich)
- L3 1: tbd
- L3 2: tbd
- etc

DAQ/Readout
Zeynep Demiragli (Boston)
Sasha Paramonov (ANL)
- L3 1: tbd
- L3 2: tbd
- etc

Software/simulation
Lothar Bauerdick (FNAL)
TBD
- L3 1: tbd
- L3 2: tbd
- etc

AI, Integration, and Co-Design
Julia Gonski (SLAC)
Jim Hirschauer (FNAL)
- L3 1: tbd
- L3 2: tbd
- etc

# news

- Since 01-Sep-2024, FCC has a home in the EP department
  - Group Leader: Patrick Janot
  - Current composition: 6 Staff, 4 fellows, 1 doctoral student, 2 technical students, 1 scientific associate, and 3 (unpaid) visiting scientists
  - Budget for travel and a few months of visiting scientists granted by EP for 2024
  - Budget for staffs, fellows, students (MTP) starting in April 2025

- CERN EP/TH Faculty meeting might increase the participation with insiders
  - Friday 27 September 2024 (9h-13h), https://indico.cern.ch/event/1431830/

- To outside institutes
  - Don't hesitate to ask candidates interested in working on FCC (even if only 50% of the time) to apply to research fellowship or research LD staff positions
  - More generally, don't hesitate to advertise this new group in your institute / country. The absence of a group in the host lab was a longstanding criticism (or even a pretext), delaying the commitment of other institutes / physicists to the FCC project.

Guy Wilkinson will be the new FCC PED leader 01.01.2025
New Higgs/top conveners: Xunwu Zuo (KIT) and Andrew Mehta (Liverpool)

# EOI detector and detector concepts (Dams, Sefkow, Pleier)

## Process Timeline
### And Milestones

**Soon**: Send out **Calls for Expressions of Interest** (Sub-detectors, Detector Concepts)

• drafts already well advances, along the lines discussed in July

**Simultaneously**: open a **web page** for interested parties to sign up, declaring intent to prepare an EOI

- to foster cooperation between groups and facilitate common EoIs
- soft **deadline mid November**

Satellite **meeting** to FCC Physics Workshop (**Jan 17**)

• short presentations on upcoming EoIs

**Deadline Jan 31** for submission to **PED**

• for editorial feedback and inclusion in combined FCC submission summary

**Deadline Mar 31** for submission to **ESU**

• submission of executive summary and attached EoIs (optional)

ESU is European Strategy Update

# Detector Concepts

**Detector concepts form the link between performance requirements and technological capabilities**

- thus **guide the R&D** and give **feedback on performance** impact of technical solutions

**Two main ingredients:**

- a full **simulation** model
    - enable validation of single particle performance with prototypes
    - realistic prediction of full-event performance: will also need higher-level reconstruction tools
- overall **engineering**
    - to act and respond in the design of the MDI
    - to guide the optimisation of the global structure and parameters

**Collaboration forming at a later stage**

- maintain freedom to combine, e.g. tracking and calorimeter technologies ("plug & play")

**Detector R&D is organised and funded through the DRD Collaborations**

- avoid duplication, join forces - and corresponds to plug & play approach

# Sub-detector EoIs

**We invite EoIs of consortia focussing on a given sub-detector**
- e.g. vertex detector, drift chamber, ECAL, HCAL, muon instrumentation
- focus on one or few technologies: e.g. silicon ECAL
- international in principle

**Link to DRDs**
- technological R&D done in DRDs, connection should be explained

**Added value:**
- system integration aspects: the "last mile"
- system performance evaluation and optimisation
- system design and performance feedback and guidance to DRDs

**Link to Detector Concepts**
- for calorimeters unique
- for trackers: ideally keep pick & play capabilities, but of course needs a working model for guidance
- simulation and engineering links should be explained

**New technologies are welcome**
- e.g. straw tracker, TPC, Grainita-based calorimeter system,…
- should be motivated with reference to performance requirements and by technological considerations

# Detector Concept EoIs

**We invite EoIs of consortia focussing on a given Detector Concept**

- overall engineering and engineering-informed integrated simulation model
  - realistic materials and dead spaces
- full-event reconstruction and optimisation of full-event performance
  - e.g. di-jet mass resolution, flavour tagging, tau ID

**Software integration into Key4HEP eco-system**

- reinforce software effort, provide environment for integration studies
- interface to physics studies and sub-detector efforts

**No invitation to proto-collaboration forming at this stage**

- activities should remain or be fully embedded in PED structure

**New concepts are welcome**

- but should be more than just variants of the existing - in which case efforts should be joint
- variants should be **motivated** with reference to performance requirements and benchmarks

# Postdoc for FCC software

https://puwebp.princeton.edu/AcadHire/apply/application.xhtml?listingId=36262

## Application for Postdoctoral Research Associate in Computational High Energy Physics

Princeton University is seeking one (or more) postdoctoral or more senior research associates to work with the Princeton Institute for Computational Science and Engineering (PICSciE) and the High Energy Experiment group in the Princeton Physics Department on computational research in experimental High Energy Physics (HEP). HEP experiments advance the understanding of elementary particles that are the fundamental constituents of matter and their interactions. Obtaining scientific results from these experiments requires complex software and computing systems, developed by international teams of researchers over decades. The resulting scientific data sets are among the largest in the world.

The successful applicant(s) will be part of the Institute for Research and Innovation in Software for High Energy Physics (IRIS-HEP, http://iris-hep.org/), which is developing innovative solutions to the computational and data challenges of the High Luminosity Large Hadron Collider (HL-LHC), which will collect data starting in 2029 and continue into the 2030's. Our research program also includes detector component simulation and data reconstruction algorithms of the key4hep software ecosystem being developed in the context of the future collider community (specifically Future Circular Collider (FCC) and muon collider concepts). The candidate(s) is expected to play a leadership role in one of several R&D projects, including research into highly performant data analysis systems, the application of novel machine learning techniques to HEP, and/or the implementation of other innovative event reconstruction algorithms for HL-LHC and future collider concepts. The successful applicants will also have the opportunity to do their own research on the CMS experiment at the Large Hadron Collider at the European Laboratory for Particle Physics (CERN) in Geneva, Switzerland.

For additional information, contact Dr. Peter Elmer (Peter.Elmer@cern.ch). This position will be based at Princeton University, at CERN in Geneva, Switzerland or at Fermilab near Chicago, Illinois, subject to discussion with the principal investigator. Appointments are initially for one year, with renewal possible based on satisfactory performance and funding.

Applicants must apply online at https://www.princeton.edu/acad-positions/position/36262 and include a curriculum vitae, a one-page statement of research experience and interests, and a cover letter with the names and contact information of three references. The position is subject to the University's background check policy.

Essential Qualifications:
Ph.D. in Experimental Particle Physics or a closely related field (Research or Scientific Computing Software, Computational Science, Data Science, and Machine Learning), or advanced degree in Computer Science or a related field with a focus on applications
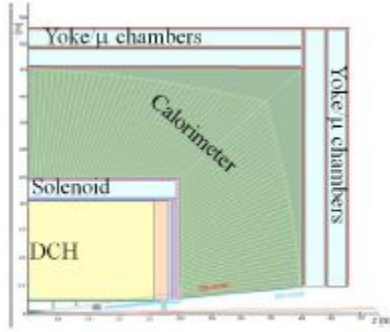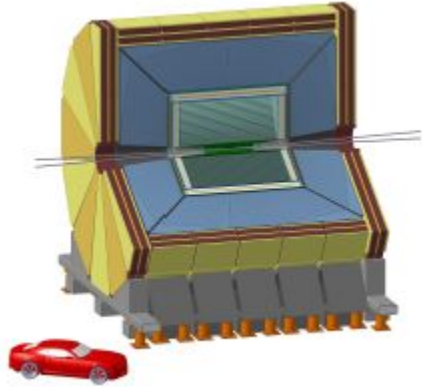Strong programming skills, in particular with C++ and/or Python
Experience developing scientific or data science software applications such as those being developed by IRIS-HEP

# We have a web page: us-fcc.web.cern.ch



Send suggested changed to Eno, Palmer and Lee (eno@umd.edu, capalmer@umd.edu, jakedlee@umd.edu)

# IDEA Study group mailing list





IDEA-international@cern.ch

(but please remember the main way to participate in detectors is via the meetings run by Felix Sefkow, Morgens Dams, and Marc-Andre Pleier https://indico.cern.ch/category/15054/ )

# News from this morning's meeting of national contacts

IFNC meeting on FCC Eoi's for individual country or region. Thursday 19/9, 17h00-18H30      🖨  ↗

Inbox ×

**Gregorio Bernardi**                    Fri, Sep 13, 9:34 AM (4 days ago)    ☆    ↰    ⋮
to FCC-Informal-Forum-National-Contacts ▾

Dear National Contacts,

We will hold next week,  on Thursday 19/9 at 5PM CERN time,  an IFNC meeting to discuss the possibility of submitting EoI's on the FCC activities in a given country/region. These would be short notes to underline the specific work done in a given country (or in a given region) since in the feasibility study we treat all aspects without insisting on which part of the collaboration is realizing it. These notes could also underline the strength of the collaboration.  After a few short presentations on how they could look like, we will have a general discussion on the pros and cons of this approach.

the preliminary agenda is available at
https://indico.cern.ch/event/1457032/
and the zoom link
https://cern.zoom.us/j/64218432038?pwd=srIAI321ZtQuxJIGw7VMwK18VupBOI.1

The meeting is also open to the FCC institute contacts, so please forward this invitation to the institute contacts of your country.
Do not hesitate to contact us if you have any comments or questions.

See you on Thursday at 5PM CERN time,

Best regards,
Tadeusz and Gregorio

Put news here

# News on "small" caverns



## Detector opening (to access the central part)

- Andrea Gaddi initially thought of a "transverse" opening of the endcaps
  - Mostly to avoid moving the final focus elements
  - Either by splitting the end-caps in two halves (left and right)
    - Made difficult on one of the two sides by the presence of the booster
      - Would require to investigate the removal of the booster in shutdowns
    - Barely enough space in the small caverns
  - Or by moving the whole end-caps opposite to the booster
    - Already difficult in the large caverns, probably impossible in the small caverns

- Then we realised that we have to (re)move the final focus elements anyway
  - As it is the only way to access/maintain/extract the very central part of the detector
    - Support tube, luminometers, vertex detector
  - This allow the endcaps to be open longitudinally (away from the central part)
    - Makes the booster issue irrelevant
    - Removes the size issue (we have 65 meters longitudinally)
    - Reduces stability and acceptance issues in the endcaps (important!)
    - Still, the option of opening end-caps transversally in large cavern can be kept as well
  - Of course this requires a complex (rail?) moving system for the final focus elements

## Longitudinal opening (cont'd)

- (Re)Moving the final focus elements longitudinally would not be a first
  - It is already the case at SuperKEKB to open the Belle II detector
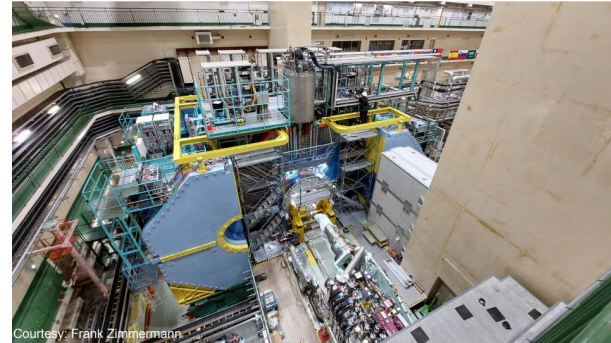


Courtesy: Frank Zimmermann

The superconducting final focus system of SKB moving (on rails) in/out along the beamline direction

Detectors in small caverns will have longitudinal, not transverse, opening

# Call for host for USFCC meeting

We are happy to announce a call for institutions to host the next USFCC meeting.  If you are interested, please send an email to us-fcc-ac@cern.ch with a date proposal that does not conflict with the 13-17Jan FCC physics week or the 19-23 May FCC week.  Please discussion of your ability to satisfy the following goals:

- Ability to host 250 participants
- At least 4 meeting rooms very close together that the participants can wander  freely and easily between
- Good food nearby
- Low air fares and multiple flights with good international connections.
- Estimate of the total cost of attending including registration fee so we can look for an inexpensive choice.  Dorm rooms for low cost housing if possible.
- housing/hotels that allow transport to hotel without a car
- Video remote connections to meetings allowed.  Strong internet bandwidth.
- Activities of local interest
- Any other pertinent information

**We asked for an intention to submit.  Two institutions indicated intention.**
Decision will be made by the US FCC AC (Eno, Rajagopalan, Paus, Hobbs, Demarteau, Patterson, Bauerdick, Gonski, Raubenheimer, Gourlay, Vay, Liepe)
Members of the AC from submitting institutions will recuse themselves.  Please contact the AC if you have input to share.

# Colloquium campaign

We need to build excitement for FCC not only within our community, but in the broader physics community. We encourage you to invite and give colloquia. Please find a data base at: https://docs.google.com/spreadsheets/d/16ft0UeMhzG8V4hc8is0CKWHI54akNODqJufryauWkyI/edit?usp=sharing

Also, can you please let the FCC speakers committee (FCC-PED-SpeakersBuro@cern.ch) and our rep Christoph Paus know if you are submitted an APS abstract related to FCC (https://summit.aps.org/attend/abstracts)?

# Upcoming FCC meetings

- Next USFCC meeting 17 Oct 18:00 cern time
  https://indico.cern.ch/event/1458057/  (always the 3rd thursday of the month)
- ECFA Paris 9-11 October https://indico.in2p3.fr/event/32629/overview
- FCC innovation study 24 Oct, Brussels
- FCC Physics week. 13-17 Jan  At CERN.  Free for students.
- FCC week.  19-23 May Vienna

# Technical focus

Please nominate yourself to give a short "technical focus" talk at an upcoming USFCC meeting by emailing Sarah Eno [eno@umd.edu](mailto:eno@umd.edu)

Next meeting: US-lead straw tracker proposal

# reminder:

Sign up for USFCC mailing lists as follows:

- Go to https://groups.cern.ch/Pages/default.aspx
- In the box with the red arrow pointing towards it, type us-fcc. **Also type us-hfcc**
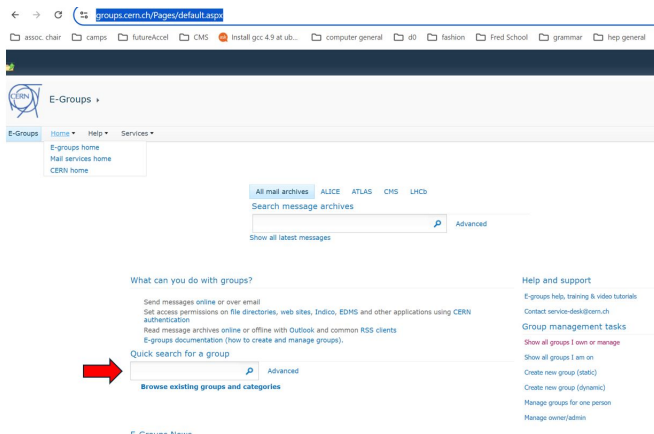


Sign up for FCC mailing lists as described at: https://fcc-ped.web.cern.ch/##