

FCC-ee PED Task Force

Mon July 8th

Anadi Canepa

Extracts from the Charge

- The implementation plan should include relevant milestones, schedule, and resources needed at the laboratory. The plan should pertain the **incoming 4-5 years in the context of a 20-year vision**.
- The vision and implementation plan should address the scientific opportunities in physics, instrumentation, software, computing, and training of the next generation through:
 1. Development of short and long term deliverables in alignment with DOE and the US Higgs Factory Organization:
 1. **Short term (contributions to the European Strategy - 2024-2025).**
 2. **Long term (contributions to the formation of detector collaborations and to detectors design, R&D, prototyping and construction - 2027-2045).**
 2. Identification of strategies to **engage the broader user community and set FNAL on a path to implement an LHC-like model the FCC experiments (e.g. FNAL as host laboratory for USCMS).**
 3. Recommending models for training the next generation of experts.

Task Force Composition

- Anadi Canepa (Fermilab)
- Artur Apresyan (Fermilab)
- Daniel Elvira (Fermilab)
- Gordon Watts (University of Washington)
- Jim Hirschauer (Fermilab)
- Junjie Zhu (University of Michigan)
- Lothar Baurdick (Fermilab)
- Nicola Bacchetta (Fermilab)
- Pushpa Bhat (Fermilab)
- Stefan Hoeche (Fermilab)
- Tulika Bose (University of WI Madison)
- Verena Martinez Outschoorn (University of Massachusetts Amherst)

Resources

- P5 report <https://www.usparticlephysics.org/2023-p5-report/>
- “Detector R&D needs for the next generation e^+e^- collider”
<https://arxiv.org/abs/2306.13567>
- [Fermilab’s presentation to P5](#)
- Fermilab’s EoI at the USFCC Workshop MIT Spring 2024 (see back up slides)
- Dedicated presentations by proponents

Final Report

- Limited to 3-4 pages, plus appendices to be submitted by July 31
 - Introduction 1 page
 - Physics (inc. detector optimization) 1/2 page
 - Tracker 1/2 page
 - Calorimeters 1/2 page
 - Software 1/2 page
 - Computing 1/2 page
 - Community building 1 page
 - Summary
- Assigned editor leads the discussion within the team and drafts the report. Proposal is [here](#)
- We may share the document with external readers (e.g. J. Butler, D. Green)

Plan of Work - “mini-workshop”

- 2-day mini workshop in person (hybrid for those of us who can't travel on those days)
 - Sub-groups review material offline and editor may organize zoom-only discussion meetings
- Day 1
 - Morning: short and targeted presentations by proponents / relevant experts
 - Physics, tracker, calorimeter, software, computing, community building
 - Afternoon: sub-groups meet and discuss (speakers may be invited again for clarifications)
- Day 2
 - Morning: sub-groups draft the report
 - Afternoon: dry-run
- As of today, most of the committee members are available 7/23 + 7/24
 - Verena Gordo, Junjie not available week of July 15th. Junjie not available on 22nd
 - Jim Hirschauer busy week of July 22nd (lecture on Wed +grant submission)

Alternative Plan of Work

- Editor, together with AC, organizes short meetings during the week of July 8 and July 15
 - Presentation by proponents/experts
 - Sub-group internal discussion
 - Drafting of the report (can be offline)
- Task Force meets during the week of July 22nd for dry-run of the report (half a day meeting)

Template for technical presentations

- **3/4 slides**
 - Scientific goals
 - Role of Fermilab: Leadership vs partnership with other universities / labs
 - On-going activities (including participation in CPAD (RDCs), ECFA (DRDs), USFCC, FCC organizations)
 - Plans for contributions to the European Strategy (ES), plans for contributions to detector R&D construction
 - Resources available for ES contributions
 - Realistic resources needed to carry out R&D program (2025-2029)
 - Facilities, capabilities available at the laboratory
 - Facilities, capabilities to be developed at the laboratory

Speakers

Where possible invite FNAL physicist plus user

- Physics
 - Theory
 - Detector Optimization
- Trackers (including MDI). Trackers are both Si based and gaseous trackers.
- Calorimeters
- Software
- Computing
- Community building (incl. support to universities interested in FCC-ee with no FNAL collaboration, yet)
- Facilities (e.g. plastic scintillator for muon detectors)

Notes from the meeting

- Organize a meeting with the Muon Collider Task to discuss our plans for the center
- Discuss with AD about their involvement in MDI

FNAL EOI

Expression of Interest for US e⁺e⁻ collider studies

Presented by: **Anadi Canepa**
On behalf of: **Fermilab**



Second Annual U.S. Future Circular Collider (e⁺e⁻ collider) Workshop 2024

25 Mar - 27 Mar, 2024; hosted by MIT

Pls: Apresyan, Bacchetta, Bauerdick, Berry, Bhat, Berryhill, Butler, Canepa, Chlebana, Elvira, Gecse, Gray, Harris, Hirschauer, Merkel, Mrenna (and 8 members from the theory group)

Group: **[4]** postdocs, **[0]** students, large availability of tech. personnel (e.g. ~20 ASICs eng.)

Expertise, facilities, ongoing and past experience, efforts on physics, theory, accelerator or detector R&D:

- **Detector and computing: design/packaging/construction (vertex, trackers, timing detectors, calorimeters, triggers), computing facilities, software frameworks, detector simulation tools, analysis facilities, SW algorithms, project management.**
- **Critical/emerging technologies: Exascale data, AI/ML, microelectronics, QIS.**
- **Physics: model building, phenomenology, generators; QCD, EWK, Higgs, BSM.**
- **Facilities: Helen Edwards Engineering Research Center, Sidet, FTBF, ITA, Thin Film Deposition Facility, Scintillator Development and Production Facility, CMS Tier-1 center, CAF, LHC Physics Center, Remote Operations Center.**

Current efforts at CERN and other major experiments: **CMS**

FNAL EOI

Estimated short-term (FY24-FY25) involvement in e+e- collider activities:

(Scientific: Base program supported people, Technical: Other funding source)

Activity (Detector or Accelerator R&D, Software, Physics studies only until end of FY25)	Category DRD; RDC	Science (FTE)	Technical (FTE)
Development of LGADs, MAPS, 3D integrated sensors, 'smart' pixels, dual read-out calorimeters, real-time engineering (with AI/ML), mechanics	3,6,7 3,4,5,9,10,11	1	1.5
Design/optimizations of vertex sub-detectors, trackers, calorimeters, timing detectors, trigger systems and detector concepts	Other	0.5	0
Computing infrastructure and evolution and support of software frameworks	Other	0.5	0.5
Physics generators, detector simulation tools, physics object reconstruction, end-analysis framework	Other	0.5	0.5
Physics case studies for detector concepts and optimization	Other	0.5	0

(* Multi FTEs contribution is foreseen if additional funding is secured.

Are you interested in developing a US led detector concept for e+e- collider-ee? **Y (and to contribute to others)**

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