Fermilab Physics Advisory Committee Report January 2024

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Executive Summary

The PAC met in a new composition with, among the 13 members, five remaining from the previous composition. The meeting, though intended to be in person, ended up in a hybrid mode. This did not hinder the proceedings.

At the start of the meeting, the PAC heard reports from the Director of the laboratory (Lab), Lia Merminga, and from the chair of the LBNC, Niki Saoulidou. The PAC was pleased to hear about the marked progress on all fronts in the scientific program of the Lab and congratulated the Directorate on the achievements. The PAC also congratulates the Lab for presenting to the P5 a compelling case for a national program; the final P5 report is well-aligned with those presentations. The PAC looks forward to seeing Fermilab's plan for implementation at future meetings.

The rest of the meeting was dedicated to reports on the status of the activities in the Accelerator (AD) and Particle Physics (PPD) Directorates as well as in selected projects and experiments as detailed in the following.

The accelerator complex operations were severely limited in 2023 due to the need to upgrade the accelerator safety procedures and accelerator safety documents to comply with the updated DOE Order 420.2D “Safety of Accelerators”. The PAC congratulates the accelerator team for completing the first review of Linac/MTA safety procedures on schedule allowing for a start of operation in January 2024. The PAC also commends the AD for completing most of the milestones of the accelerator maintenance in FY23 and for achieving impressive results on the main injector quadrupole stability.

The PAC reviewed the impact of the reduced beam time in FY2024 on experiments and test facilities and recommended that the Directorate communicate the allocation of accelerator beam time as early as possible to allow the stakeholders to optimize their run strategy in coordination with the accelerator directorate.

The status of the on-going experiments led by PPD was reviewed in the context of the 2014 and 2023 P5 recommendations. The PAC notes significant progress on neutrino experiments, the muon program (Mu2e, g-2), CMS, the cosmic program (DES, ADMX, SENSEI, SPT) and commends the PPD for the success in executing the 2014 P5 program. It also commends the PPD for forming a task force to develop a program in accelerator based dark matter and dark sector searches that would position the Lab as a world leading laboratory.

The Mu2e experiment made excellent progress on all subcomponents. The schedule remains tight for the planned commissioning and physics run to start in 2027, at least seven months before the accelerator's long shutdown. The PAC commends the collaboration, the project, and the laboratory on the good progress made and recommends that a risk analysis on the length of the commissioning time and the data run be developed.

The Neutrino Physics Center (NPC) is providing a significant intellectual and educational value to the neutrino community, including those in the physics community not directly associated with Fermilab and/or DUNE. The NPC is intended to be part of the DUNE host lab plan, under “DUNE Central Operations.” In this plan, the NPC’s role would be expanded to become a user support organization. The PAC encourages the NPC to develop more specific goals and milestones in service of this mission. It also recommends that the NPC develop clear criteria for awarding fellowships as well as a list of metrics that will be used to track the added value associated with the fellowship awards and the effectiveness of the educational programs. The PAC believes that this will make it easier to establish the level of funding that would allow the fellowship program to better support a diverse, international community.

The ANNIE experiment was successful in deploying new technologies in detection of neutron capture signals with PMTs and neutrinos with LAPPDs. The PAC congratulates the ANNIE Collaboration on the significant progress towards a promising technology for neutrino experiments and looks forward to future results from ANNIE that can further demonstrate this potential.

In the AI/ML domain, an active FastML community exists with prominent Fermilab participation and contributions. Areas in which Fermilab is a leader include intelligent sensing, real-time efficient AI, and high data throughput applications. These offer a real potential for growth. The PAC congratulates the team for the development of AI/ML suite of algorithms, real-time operations and controls, computing hardware, and infrastructure and hardware-algorithm codesign (hls4ml, SONIC). The area of AI/ML is developing rapidly, with new techniques and toolkits appearing at a high rate. The PAC would like to see how the FNAL AI/ML team intends

to follow these activities and make the developments, which are relevant for HEP tasks, known and available to the user community.

The PAC was presented with an overview of the Quantum Information Science (QIS) activities in the Lab. The activities are now spread over three complementary and partly overlapping "units", the SQMS center, the Quantum Division within the Emerging Technologies Directorate (ETD), and the Quantum Theory Department (QTD) in PPD. The SQMS mission is to bring transformational advances in QIS. Its strength is expertise in superconducting materials and superconducting RF and in the development of novel Qbits using in particular superconducting 3D devices. There are two additional areas of the science thrust in the SQMS, development of algorithms for quantum simulations in QFT and of quantum sensors for fundamental physics, focusing on dark matter. The PAC was very impressed by the breadth and high-level of activity carried out within the SQMS center and commends the center for becoming a productive hub for collaboration between Fermilab and non-Fermilab scientists from a variety of disciplines producing novel ideas. Within the Quantum Division of ETD, topics of research include quantum networks and using SNSPDs and SC Qbits for low mass dark matter detection. The PAC congratulates the ETD for the application of new sensor technologies to light dark matter searches. The scientific goals of the QTD are twofold, the development of new sensor concepts to search for sub-eV BSM wave-like particles and quantum simulations on the lattice. The PAC was impressed with the program and its connection with the other QIS and theory activities at Fermilab and recommended that the QTD develop a plan to secure funding after the completion of the QuantISED grant.

The Office of EDIA (OEDIA) contributes and executes strategic initiatives aimed at equity, diversity, inclusion, and accessibility across the laboratory. Areas of focus include recruiting a diverse workforce, development and retention of that workforce, partnerships and collaboration with minority-serving institutions, EDIA education and training, and cultivating a safe, respectful, equitable, and inclusive research environment. The PAC was happy to hear that the OEDIA developed metrics to track progress and effectiveness of programs. Although manifesting slowly, the trends seen in the data so far are vectored in a positive direction. It will be important to continue to monitor and amplify effective programs to increase these trends. The PAC congratulates the Lab on the current statistics that indicate that a large fraction of former interns from under-represented groups are currently working in STEM. More work is needed to ensure that these gains are propagated to the Fermilab workforce in addition to the larger STEM community. The PAC looks forward to seeing future results once available.

The Physics Advisory Committee: Halina Abramowicz (Chair), Zeeshan Ahmed, Klaus Blaum, Paolo Calafiura, Allen Caldwell, Albert de Rock, Scott Dodelson, Joseph Formaggio, Elisabetta Gallo, Cecilia Gerber, Stefania Gori, Atsuko Ichikawa, Niki Saoulidou (Ex Officio), David Schuster, Elizabeth Worcester.

Scientific Secretary: Anadi Canepa **Directorate**: Lia Merminga, Bonnie Fleming.

Report from the LBNC

Charge: For information only.

Findings

1. The LBNC is charged by the Fermilab Director to provide external scientific peer review and monitor the technical progress of the International DUNE collaboration. The LBNC executes this charge through reviews of TDRs and CDRs, and by holding special reviews as requested by the Fermilab directorate.
2. Recent reviews include those of the Far Detector Vertical and Horizontal Drifts. In their recent executive summary, the LBNC commends the DUNE collaboration for their continued progress on multiple facets of the program, including the Near, Far, and Prototype detectors, computing infrastructure, and beamline components.

Comments

1. The PAC commends the LBNC for continuing to serve a vital role in evaluating the progress of the DUNE experiment.

Recommendations:

None.

Report from the Mu2E experiment

Charge: We ask the PAC to review the status of the Mu2e experiment. The PAC is also asked to review the status of open recommendations from previous reviews.

1. The PAC recommends the collaboration work with the funding agencies to secure the needed person power from non-FNAL institutions as soon as possible.
2. The PAC recommends the proponents to carefully evaluate the person power involved in the upgrade studies and avoid any diversion of personnel or resources from Mu2e to Mu2e-II.
3. The PAC recommends the Lab to follow closely the readiness for the commissioning phase.
4. The PAC recommends the experiment monitor at a regular pace a resource-loaded schedule for all items needed to be ready for data taking with clear "need by" dates.
5. The collaboration should consider a physics run before 2027 as a priority and should strive to respect the current schedule. Any delay should be discussed as early as possible with the lab management.

Findings:

1. The Mu2e experiment has reached a milestone with the upstream transport solenoid delivered in December 2023.
2. Excellent progress has been made on all subcomponents, even if the schedule remains tight.
3. On the detector side, the construction is in excellent shape, with students, postdocs, and technical support moving to Fermilab for the installation and commissioning.

4. In answer to the past recommendations, the experiment has presented a schedule with the commissioning tasks that are already underway. The schedule was delayed by the delivery schedule of the detector solenoid, but the Collaboration is advancing all the work they can, and a cosmic run is foreseen in 2025.
5. The commissioning/first physics run will start in 2027, just before the Long Shutdown. About seven months are needed for this run in order to commission the experiment and to collect 10% of the foreseen total amount of data. This 10% allows the Mu2e experiment to remain internationally competitive by achieving 10^3 better limits than the existing ones and 10 times better sensitivity than that expected for the competing COMET experiment in Japan, which is scheduled to start taking data in 2025.
6. In the staffing plan, Mu2e aims to have 25 postdocs and 25 graduate students working full time on the experiment.
7. Several milestones are anticipated by the Mu2e project in 2024, among others, with the deliveries of the downstream transport solenoid, the detector solenoid, the calorimeter, and the tracker.

Comments:

1. The PAC commends the collaboration, the project team, and the laboratory on the good progress made.
2. There is very little, if any, room for further delay.
3. The PAC commends the directorate for working closely with the project team and the collaboration to avoid further delays.

Recommendations:

1. The PAC recommends that a staff profile plan (lab personnel and collaboration) for the period 2024-2028 be developed and provided.
2. The PAC recommends that a risk analysis on the length of the commissioning time and the data run be developed.

Status and plans for the Fermilab's accelerator complex

Charge: For information only.

Findings:

1. Accelerator complex operations were severely limited in 2023.
2. The Accelerator Directorate and ES&H committed extensive resources to upgrade the accelerator safety procedures and accelerator safety documents [Safety Assessment Document (SAD) and Accelerator Safety Envelope (ASE)] to comply with the updated DOE Order 420.2D "Safety of Accelerators".
3. The AD has implemented measures to address the 12% turnover in the last two years, and these seem to be working.
4. The PAC was presented with some milestones concerning the accelerator maintenance shutdown in FY23. Over 90% of shutdown jobs were completed with, among others, impressive results on the main injector quadrupole stability improvements.
5. Fermilab's capabilities and facilities will enable the laboratory and its user community to make significant contributions to the development of novel accelerator technologies for future HEP projects.

Comments:

1. The PAC congratulates the accelerator team for completing on schedule the first review of Linac/MTA safety procedures allowing for a foreseen start of operation in January 2024.
2. The PAC notes impressive results on the main injector quadrupole stability improvements.
3. The outlook for reaching >= 2MW beam power for LBNF/DUNE was presented and commended by the PAC.
4. The allocation of the foreseen limited beam time is a point of great concern to the experimental groups. The Directorate is working with the AD to optimize the available time given fiscal constraints.
5. Preparing for the future of HEP by developing novel accelerator technologies will attract new talent and is seen as a key area for potential growth.

Recommendations:

None.

Status of experiments led by the Particle Physics Directorate

Charge: We ask the PAC to review the status of on-going experiments led by the PPD in the context of the 2015 and 2023 P5 recommendations. The PAC is also asked to review the status of the open recommendations from previous reviews.

- Recommendations to CMS:
    1. Fermilab should streamline site access for US CMS collaborators so that they can easily access the LPC and ROC.
    2. Fermilab should work with DOE to restore adequate funding for the LPC to rebound from the COVID remote-work lull.
    3. The LPC ensures regular on-site presence of Fermilab-based experts.
    4. US CMS investigates ways to expand the usage of the Fermilab ROC to help alleviate the current shortage of shifters at CERN.
    5. The Fermilab CMS group has a stable presence at CERN sufficient to contribute to data-taking operations with experts on shift and on call.

Findings:

1. FNAL has successfully pursued the science drivers recommended by the 2014 P5 report. Significant progress was made and continues across several programs: neutrino experiments, muon program (Mu2e, g-2), CMS, the cosmic program (DES, ADMX, SENSEI, SPT), and other experiments (SpinQuest).
2. The performance of the Fermilab Computing facilities (Tier-1 and Analysis Facilities) remains excellent. Plans are in place for transferring data service from NCSA to FNAL and from the DES Collaboration to FNAL.
3. The new P5 recommendations are well aligned with the FNAL particle physics program.
4. First studies of possible small-scale experiments to search for Dark Matter in the context of the new P5 ASTAE program were performed.

Comments:

1. The PAC commends Fermilab PPD for their success in executing the 2014 P5 program.

2. Fermilab can become a world leading laboratory for accelerator-based Dark Matter searches. The forming of a task force to develop a more detailed picture of what would be required to realize these opportunities is commended.
3. The PAC encourages continuing studies of potential experiments utilizing the 1 GeV, 8 GeV and 120 GeV beams.

Recommendations:
None

Overview of the Neutrino Physics Center

Charge: We ask the PAC to review the activities and programs at the NPC. The PAC is also asked to review the status of open recommendations from previous reviews.

1. The NPC should clearly articulate its goals, stakeholders, methods, and needs to continue to promote a rich intellectual environment in the Fermilab and broader neutrino community of today, while keeping in mind the need for evolution to the DUNE era in about 5 years.
2. The PAC would like to see a short document describing the strategic plans of the NPC.

Findings:
1. The NPC's mission is to "foster a stimulating, neutrino-focused community, bringing together theorists and experimentalists, early-career scientists and senior researchers, visitors and Fermilab residents."
2. Currently operating NPC programs are the NPC Fellowship Program, the "Neutrino University" lectures, the Neutrino seminar series, the International Neutrino Summer School, a Slack workspace for the Fermilab neutrino community, and ad-hoc workshops.
3. In 2023, the NPC fellowship program supported 22 fellows, which was fewer than in prior years due to reduced funding. The seminar series has regular attendance of ~100 physicists from the broader neutrino community. The Neutrino University is attended by ~100 undergrad and graduate students. The summer school has ~150 in-person participants.
4. The NPC is part of the DUNE host lab plan, under "DUNE Central Operations." In this plan, the NPC's role would be expanded to become a user support organization. In addition to its ongoing activities, in the future, the NPC envisions providing both administrative and scientific support for DUNE collaborators, both at Fermilab and at SURF, to streamline and provide guidance for onboarding, practical matters, and quality of life issues, as well as scientific issues such as computing and making intellectual connections. A plan is developing for an NPC computing school, focused on Art/LArSoft which are common among many Fermilab-based neutrino experiments. A physical space for informal discussions/collaboration is also envisioned.

Comments:
1. The NPC is providing significant intellectual and educational value to the neutrino community, including those in the physics community not directly associated with Fermilab and/or DUNE. The summer school and seminar series have been widely

embraced by the neutrino community. This is a role that cannot be effectively filled by individual collaborations and is well-suited to the NPC.

2. The NPC is working towards articulating a clear mission with a scope that is significantly broader than the current suite of programs and has begun to define its strategic plan, which has been incorporated into the DUNE host lab plan. The PAC encourages the NPC to develop more specific goals and milestones in service of the mission statement.
3. The PAC notes that the NPC Fellowship Program will need to be able to demonstrate added value to the neutrino community, beyond that which would be achieved by some other means of travel support.
4. The PAC commends the NPC's policy of centering DEI in all their activities and encourages the NPC to continue to develop strategies to increase their effectiveness in supporting neutrino physicists from historically underrepresented groups. The PAC also encourages the NPC to make sure the fellowship is advertised broadly, including to the international community, to ensure the opportunity is provided to as diverse a group as possible.

Recommendations:

1. The PAC recommends that the NPC develop clear and intentional criteria for awarding fellowships and a list of metrics that will be used to track the added value associated with the fellowship awards and the effectiveness of the educational programs.
2. The PAC recommends the Laboratory work with DOE to establish a level of support that would allow the fellowship program to better support a diverse, international community.

Status of the ANNIE experiment

Charge: We ask the PAC to review the status of the ANNIE experiment, including the results of early data taking with LAPPDs and the test run with a small volume of Water-based Liquid Scintillator (WbLS). We also ask the committee to review the progress on the plans for a combined analysis with SBN and future R&D efforts. Finally, the PAC is asked to review the status of past recommendations:

1. We recommend that the Collaboration plan carefully for the long-term needs of future operations and the analysis of the data, including personnel needs.

Findings:

1. The ANNIE Collaboration has succeeded in detecting neutrinos with LAPPDs. The 8 MeV photon signals from neutron capture on gadolinium were clearly observed using the PMT system and the multiplicity of neutron captures per beam event was shown.
2. Deploying LAPPDs is expected to significantly improve the vertex resolution for neutrino events.
3. A vessel containing 365 kg of water-based liquid scintillator (WbLS) was installed to demonstrate Cherenkov/Scintillation (C/S) separation and scintillation-only event detection. The plan is to install Gd-loaded WbLS as a next step and then increase the volume to 8-tons as well as increasing coverage by adding second-generation LAPPDs.

4. ANNIE was successful in deploying new technologies, and now more than 10 of their Postdocs/PhD students have moved to university faculty or national laboratory staff positions.

Comments:

1. The PAC congratulates the Collaboration on the detection of neutron capture signals using the PMT system and the detection of neutrinos with LAPPDs.
2. The measurement using well-separated Cherenkov and scintillation photons using WbLS together with LAPPDs is a promising innovative technology for neutrino experiments. The ANNIE Collaboration has made significant progress towards realization of this vision and the PAC looks forward to future results from ANNIE that can further demonstrate this potential.

Recommendations:

None.

Status of the AI/ML program at the laboratory

Charge: We ask the PAC to review the status of the AI/ML activities at the laboratory and of the recommendations made at past meetings:

1. Formulate a strategy to respond to future AI/ML calls, not necessarily just for AI/ML centers.

Findings:

1. An active FastML community exists with prominent Fermilab participation and contributions. These AI/ML development activities directly benefit HEP and cover areas where commercial products are not aligned with the needs of the field.
2. Areas in which Fermilab is a leader include Intelligent sensing, real-time efficient AI, and high data throughput applications. The latter creates innovation that can then be used in industry.
3. The hls4ml tool and SONIC are the results of collaborations between Fermilab and other US CMS institutions catalyzed by the LPC. The hls4ml tool is deployed in HEP experiments and has garnered interest in academia and industry outside of HEP. A two-year award from NSF will fund user support for hls4ml.
4. Further growth in ML aims to utilize new broad strengths in intelligent sensing and real-time efficient AI, adding robustness and autonomy to their efficient ML codesign practices as part of the FastML ecosystem.

Comments:

1. The PAC congratulates the team for the development of AI/ML suite of algorithms, real-time operations and controls, computing hardware, and infrastructure and hardware-algorithm codesign.
2. The team is encouraged to promote and track the adoption of hls4ml and SONIC within the HEP community and to explore opportunities for continued support and further development as part of the AI/ML Fermilab strategy.

Recommendations:

1. The area of AI/ML is developing rapidly, with new techniques and toolkits appearing at a high rate. The PAC would like to see how the FNAL AI/ML team intends to follow these

activities and make the developments, which are relevant for HEP tasks, known and available to the user community.

Overview of the quantum theory program at the laboratory

Charge: For information only.

Findings:

1. The quantum theory department established itself at the interface between quantum information science and HEP theory. It was initiated in 2018 thanks to the QuantISED grant in collaboration with Caltech and the University of Washington.
2. The department saw substantial growth with the recent hire of two associate scientists and several postdocs. This leverages the local theory expertise in lattice and BSM physics. In addition, the collaboration with university partnerships was recently broadened to include UIUC, MIT, and Purdue University (the last two institutions will be replaced by Johns Hopkins University soon).
3. The department has good synergy with the other quantum efforts at Fermilab (SQMS, ETD). The scientific goals of the department are twofold: on the one hand, the development of new sensors to search for sub-eV BSM wave-like particles; on the other hand, quantum simulations on the lattice. This program has, therefore, both short-term and long-term goals.
4. In 2021, the department initiated an annual three-week summer school on quantum computing for undergraduate students paired with a one-year long internship program for interested candidates from the school, targeting MSI participation.

Comments:

1. PAC was impressed with the program and its connection with the other quantum science and theory activities at Fermilab.
2. The goals of the quantum theory department appear to align well with the 2023 P5 report calling out cutting-edge sensing to enable discovery and quantum computing approaches to fundamental problems.
3. PAC is fully supportive of the quantum theory department and encourages them to pursue this two-fold approach of short and long-term goals. The summer school and internship program are commended.

Recommendations:

1. The department should continue its activities, including the educational component, and develop a plan to secure funding after the completion of the QuantISED grant.

Recent results of on-going experiments led by the SQMS Center and spin-off applications for HEP

Charge: We ask the PAC to review recent results from experiments led by the SQMS Center in the context of Fermilab's scientific portfolio as well as the status of early applications of quantum computing and quantum sensing to HEP. The PAC is also asked to review the status of open recommendations from previous reviews:

1. The PAC recommends the Laboratory streamline procedures to improve the efficiency of the procurement process for SQMS Center in coordination with the overall lab efforts to improve procurement.
2. The PAC recommends the SQMS center explore opportunities for collaboration with other groups at FNAL, particularly on quantum sensors.

Findings:

1. SQMS is one of the five national information research centers, with a 10-year strategy. FNAL is the lead institution of 31 partners, among academia, industry, and international institutes, like INFN, and institutes in the UK and Canada. It is funded from 2020 through 2025 with a renewal up to 2030. It has a multidisciplinary collaboration, with 170 papers in three years, 85 in peer reviewed journals.
2. The SQMS mission is to bring transformational advances in QIS and become an impactful leader in the field. The results that have been achieved so far on the 2D as well as 3D devices are commended.
3. The Quantum Garage opened in November 2023, and it is now fully operational for testing quantum devices.
4. SQMS hosted a very successful QIS school, a hands-on school in the lab, drawing international participation.
5. The SQMS collaborates with 10 other sites to exchange and measure Qbit devices, to understand their reproducibility. Further collaborative plans include using quantum technology to synchronize future Gravitational Waves observatories.
6. There are two additional areas of the science thrust in the SQMS:,
    a. Development of algorithms for quantum simulations in QFT, e.g. in QCD
    b. Development of quantum sensors for fundamental physics, focusing on dark matter (especially axions) and dark sectors searches.

Comments:

1. The PAC was very impressed by the breadth and high-level of activity carried out within the SQMS center.
2. In response to previous PAC recommendations, large procurements were completed.
3. Opportunities to collaborate with other groups were taken and results presented in the context of several different activities.
4. The SQMS has become a productive hub for collaboration between Fermilab and non-Fermilab scientists from a variety of disciplines producing novel ideas, which the PAC commends.
5. In future presentations, PAC would appreciate it if the contributions of Fermilab in collaborative results were highlighted.

Recommendations:

None.

Recent results of on-going experiments led by ETD and spin-off applications for HEP

Charge: We ask the PAC to review recent results from experiments led by the ETD in the context of Fermilab's scientific portfolio as well as the status of early applications of quantum internet

and quantum sensing to HEP. The PAC is also asked to review the status of open recommendations from previous reviews:

1. Coordinates with DOE to have FQI projects reviewed and possibly extended to match timing of upcoming funding opportunities.
2. Develops a long-term strategy towards quantum science and how it integrates with HEP goals.

Findings:

1. The Quantum S&T program effort, outside of SQMS scope, resides in the Quantum Division within the new Emerging Technologies Directorate (ETD) and is supported by competitive awards from DOE/HEP (QuantISED), DOE/ASCR, and private foundations.
2. Topics of research include quantum networks and using SNSPDs and SC Qubits for low mass dark matter detection.
3. The cold atom interferometer MAGIS-100 installation project is progressing well.
4. ETD has partnered with regional and national collaborators and achieved advances in quantum sensors and quantum networks.
5. Unique Fermilab facilities are attracting physicists interested in quantum applications to HEP experiments.

Comments:

1. The committee congratulates the ETD for the application of new sensor technologies to light Dark Matter searches.
2. The development of a business model for funding of long-term user support for open-source code associated with QICK should be explored.
3. In future presentations, PAC would appreciate having the contribution of Fermilab in collaborative results highlighted.

Recommendations:

None.

Overview of the P5 recommendations

Charge: For information only.

Findings and Comments:

1. The PAC is excited by the vision for the future of particle physics in the US as presented in the 2023 P5 report.
2. The PAC congratulates Fermilab for presenting a compelling case for a national program; the final P5 report is well-aligned with those presentations.
3. The PAC encourages FNAL to develop a plan for the evolution of the Fermilab accelerator complex and accelerator R&D activities consistent with the long- term vision in the P5 report.
4. The PAC looks forward to seeing Fermilab's plan for implementation at future meetings.

Recommendations:

None.

Overview of the DEIA activities and programs at the laboratory

Charge: We ask the PAC to review the status of the DEIA activities and programs at the laboratory and the status of the open recommendations from previous reviews:

1. Develops metrics on diversity to be shared in future PAC meetings.
2. Present its efforts on accessibility in an upcoming PAC meeting.

Findings:

1. The Office of EDIA contributes and executes strategic initiatives aimed at equity, diversity, inclusion and accessibility across the laboratory. The goals span from the laboratory leadership to individual accountability.
2. Recruitment is considered important, but so is retention, a mantra strongly emphasized during the presentation.
3. Areas of focus for the strategy include recruiting a diverse workforce, development and retention of that workforce, partnerships and collaboration with minority-serving institutions, EDIA education and training, and cultivating a safe, respectful, equitable, and inclusive research environment.
4. The OEDIA has developed a detailed rubric across all these efforts, enabling development of metrics to track progress and effectiveness of programs.
5. Data on workforce composition, hiring and retention was collected and presented. Slight increase in female participation from 2016 to 2023 is seen (23.9% to 28.1%). More significant increases in the participation of under-represented minorities were seen over the last five years, albeit starting from much lower fractions.
6. Similar data was also collected for summer internships, with higher numbers and trends.
7. A climate survey was taken in 2023 and is currently under analysis. The results will be cross-compared with an earlier (2019) survey to study trends.
8. The Fermilab Alumni Network is currently collecting data from their internship programs to see the career progression of past participants. Current data collected shows alumni of the program do move into STEM-related fields.

Comments:

1. The PAC commends the OEDIA for the comprehensive effort in implementing EDIA initiatives across all levels of the laboratory. The PAC also commends the OEDIA for the development of metrics –now being collected– to track the progress and effectiveness of these efforts.
2. Although manifesting slowly, the trends seen in the data so far are vectored in a positive direction. It will be important to continue to monitor and amplify effective programs to increase these trends. Particularly, the data collected by the Fermilab Alumni Network is important because this information will help in understanding pipeline loss issues as students transition to early STEM careers.
3. FNAL should be congratulated on the current statistics that indicate that a large fraction of former interns from under-represented groups are currently working in STEM. More work is needed to ensure that these gains are propagated to the Fermilab workforce in addition to the larger STEM community.
4. With OEDIA now distinct from HR, it will be important to continue a close partnership with the HR office to ensure that EDIA best practices continue to be exercised.

5. Evaluating the efficacy of these various programs and initiatives will require tracking and analysis of both demographic data and climate. Data collection and analysis should continue, and the PAC looks forward to seeing future results once available.

Recommendations:

None.