

Fermilab Physics Advisory Committee July 2024

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

Scientific Secretary: Sergo Jindariani

Report from the director (Executive Session)

Charge: For information only

Report from the LBNC

Charge: For information only

Status and plans for the Fermilab's accelerator complex

Charge: For information only

Vision and Strategy of Cosmic Program (Executive session)

Charge: We ask the committee to discuss preliminary strategic plans of the Cosmic program at Fermilab, including the Cosmic Physics Center (CPC), and to comment on how it integrates into the US program. The committee is also asked to review the status of the recommendations made at previous reviews:

1. Fermilab develop a comprehensive strategic approach (that includes prioritization) to light dark matter searches that leverages laboratory capabilities

2. The Laboratory works with DOE to secure adequate funding to support its Cosmic Frontier program and strategy.
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Status and plans for the Fermilab Test Beam Facility (FTBF)

Charge: We ask the PAC to review how FTBF enables progress in physics around the globe and to comment on the benefits of proposed evolution of this facility.

Overview of the theory program at the laboratory

Charge: We ask the PAC to review future plans for the theory group at the laboratory and comment on whether they are aligned with the recent P5 report. The PAC is also asked to review the status of open recommendations from the previous reviews:

1. We recommend that the division develop a systematic method of evaluating perception among the larger theory community of the added value of the DOE-funded programs led by the division.
 2. The department should continue its activities, including the educational component, and develop a plan to secure funding after the completion of the QuantISED grant.
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Update on the Strategic Plan for Software and Computing Program at the Laboratory

Charge: We ask the committee to review the strategic planning for S&C at Fermilab. The committee is also asked to review the status of the recommendations made at preview reviews:

1. Given the ambitious aspirations of the directorate, the PAC recommends showing the Computational Science and AI Directorate (CSAID) person power profile and planning at the next meeting.
2. We recommend the development of a complete model of FNAL long-term resource needs, including infrastructure, compute, tape, disk, and networking. Even if some

experiments initially have order of magnitude uncertainties in their projections, the exercise will push them to think about their long-term needs.

3. The PAC recommends that CSAID help the experiments define and implement their data management and data preservation plans.
4. We recommend that CSAID continues to contribute to major community HEP software tools like ROOT, GEANT, taking a leadership role for the Intensity Frontier aspects, and focusing on the needs of FNAL Physics Centers.
5. The PAC recommends that the Directorate works with the Astrophysics department as it refines the Cosmic strategic plan, as software support can strengthen participation and leadership in cosmic experiments.

Status of the CMS experiment operations

Status of the CMS experiment upgrades

Charge: We ask the PAC to review Fermilab CMS group's activities and scientific resources, with the emphasis on the Detector and S&C operations, as well as HL-LHC upgrades of the experiment.

Status of the SpinQuest commissioning and first data

Charge: We ask the PAC to review the status of the SpinQuest experiment.

Status of the AI/ML program at the laboratory (Executive session)

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. 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.

2. The PAC recommends the development of concrete mid- and short-term goals for technical scope that would enable Fermilab to become a leader in AI/ML for HEP.

Report on the long shutdown planning

Charge: for information only

Status of the SBND experiment

Charge: The status and plans of the SBND experiment will be presented. We ask the PAC to review the science goals and milestones under different beam delivery scenarios provided by the laboratory. We are also asking the PAC to review the scientific resources and activities on SBND with the emphasis on the Detector and S&C operations

Status of the ICARUS experiment

Charge: The status and plans of the ICARUS experiment will be presented. We ask the PAC to review the science goals and milestones under different beam delivery scenarios provided by the laboratory. We are also asking the PAC to review the scientific resources and activities on ICARUS with the emphasis on the Detector and S&C operations.

Status of the NOvA experiment

Charge: The status and plans of the NOvA experiment will be presented. We ask the PAC to review the science goals and milestones under different beam delivery scenarios provided by the laboratory. We are also asking the PAC to review the scientific resources and activities on NOvA with the emphasis on the Detector and S&C operations.

Status of the 2x2 experiment

Charge: The status and plans of the 2x2 experiment will be presented. We ask the PAC to review the science goals and milestones under different beam delivery scenarios provided by the laboratory.

Overview of the Fermilab's response to the P5 recommendations (Executive session)

Charge: We ask the PAC to review Fermilab's plan to respond to the P5 recommendations: The committee is asked to assess if the proposed plan enables the laboratory to set the foundations for the ambitious physics program recommended by the P5. The committee is also asked to evaluate Fermilab's plan to contribute to the upcoming European Strategy for Particle Physics Update.