REPORT OF THE COMMITTEE OF VISITORS

Office of High Energy Physics

Facilities Division

to

the High Energy Physics Advisory Panel

Review of Fiscal Years 2016 – 2022

Germantown, Maryland
March 11-13, 2024

EXECUTIVE SUMMARY

A review of the Facilities Division of the DOE Office of High Energy Physics (HEP) for the fiscal years 2016 through 2022 was conducted by a Committee of Visitors (COV). The COV met at the Department of Energy in Germantown, Maryland, on March 11-13, 2024 and had virtual meetings on February 5, April 10, and June 18, 2024.

Since its release in 2014, the report of the Particle Physics Project Prioritization Panel (P5), "*Building for Discovery: Strategic Plan for U.S. Particle Physics in the Global Context*," has guided the U.S. particle physics program. HEP has largely adhered to the report's guidance, and today, most of the exciting new projects envisioned by 2014 P5 are either complete or under construction. At the Energy Frontier, ATLAS and CMS implemented their initial (Phase-I) LHC detector upgrades, and construction of the High Luminosity accelerator and detector upgrades is underway. At the Intensity Frontier, the Muon g-2 experiment produced the world's most precise measurement of anomalous magnetic moment of the muon, Belle II has accumulated a 400 fb^{-1} data sample, Mu2e and PIP-II are under construction, LBNF and DUNE construction has started thanks to generous DOE Office of Science budgets, and ACORN, Fermilab's new accelerator control system, has been launched. On the Cosmic Frontier, DESI has begun its studies of dark energy, the LSST camera at the Rubin Observatory will soon begin its survey of the universe, LuSEE-Night to study the Dark Ages of the universe is under construction, and CMB-S4 construction is planned to begin in this decade. LZ at SURF and SuperCDMS at SNOLAB has begun and will soon begin their searches for massive and low mass dark matter, respectively. At the Accelerator Frontier, FACET-II has started experimental tests with electron beams.

The breadth and depth of the project portfolio and facilities operations that was handled by HEP during the period of this COV, FY 2016 through FY 2022, are impressive. These experiments address some of humankind's deepest questions about nature and each is unique in the world; the ensemble comprises a world-leading program. The COV commends HEP on successful management of projects and facilities operations.

While investments over the past 10 years have focused on project construction, it will be critically important to balance the components of the HEP budget to continue successful execution of the P5 plan. Operations of the newly constructed experiments have received full support to reap their scientific goals. The research program also needs strong support to carry out the plan, throughout both theoretical (interpretations and developments) and experimental (design, construction, operations and data analysis phases of the experiments) efforts, and to lay a foundation for the future.

The 2023 P5 report was released in December 2023 and together with the 2014 P5 report, it will guide the U.S. particle physics program in the next decade.

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1. INTRODUCTION

This report documents the findings from a Committee of Visitors (COV) that was assembled under the auspices of the High Energy Physics Advisory Panel (HEPAP) to evaluate the processes and programs in the Facilities Division of the Office of High Energy Physics (HEP) during the fiscal years 2016-2022. The COV had a virtual meeting on February 5, 2024, a three-day in-person meeting on March 11-13, 2024 at the Department of Energy in Germantown, Maryland, and virtual meetings on April 10 and June 18, 2024.

2. THE CHARGE TO THE COMMITTEE OF VISITORS

The COV was charged to address the operations of the HEP Facilities Division during fiscal years 2016 through 2022. The charge letter from Sally Seidel, Interim Chair of HEPAP, to Young-Kee Kim, COV Chair, is attached as Appendix I. The COV was asked to assess: the efficiency and quality of the processes used to solicit, review, recommend, document, and propose actions, and to monitor active awards, projects and programs; and the quality of the resulting portfolio, including its breadth and depth and national and international standing. In addition, the COV was asked to comment on the effectiveness of DOE implementation of the long-term goals and priorities recommended in the 2014 report of the Particle Physics Project Prioritization Panel (P5), and to identify any significant issues that it is not able to consider appropriately within the limited timespan, but that deserve subsequent consideration.

3. THE COMMITTEE MEMBERSHIP

The COV membership was selected by the COV Chair, in consultation with the Interim Chair of HEPAP and the HEP leadership. The members were chosen to represent a cross-section of experts in scientific fields relevant to the activities supported by the Office of High Energy Physics. A balance was achieved between researchers who currently receive funding from HEP and those that do not, among academic and national laboratory researchers, and between those that have previously served on a COV and those that have not. There was an early career physicist in the COV.

The COV consisted of 10 members, plus the Chair, and were divided into two subpanels: Projects Subpanel and Operations Subpanel. They were led by Steven Kahn and Sergei Nagaitsev, respectively. Full lists of the COV members and their panel assignments are given in Appendix II and Appendix III, respectively.

4. THE COV REVIEW PROCESS

The COV assembled in Germantown at 8 AM on Monday, March 11, and adjourned at 2:00 PM on Wednesday, March 13. The Agenda for the review is attached as Appendix IV.

Prior to convening in Germantown, the COV met virtually with the HEPAP Interim Chair Sally Seidel, HEP Facilities Division Director Michael Procario and two Facility Division staff members on Monday, February 5. At this meeting, the charge from Asmeret Asefaw Berhe, Director of the Office of Science, to the HEPAP

Interim Chair was reviewed, and details of the overall review process, including projects and programs relevant to the COV evaluation and DOE Order 413.3B (Program and Project Management for the Acquisition of Capital Assets), were presented and discussed. On Friday, February 9, the COV Chair Young-Kee Kim, the subpanel leaders Steve Kahn (Projects) and Sergei Nagaitsev (Facilities Operations), and Facilities Division Director Michael Procario met virtually and drafted the agenda of the in-person meeting on March 11-13.

Prior to the in-person meeting, the COV was supplied with the HEP COV websites that included general reference materials such as short project summaries (PAMS) and additional documents (OneDrive). These documents were found to be helpful in setting the stage for the actual review and enabled the panel members to be prepared for the review. Additional documents were supplied during the in-person meeting of the COV review. The COV websites also included copies of the plenary and parallel presentations.

The first-day meeting on March 11th began with an overview of the COV process and a reiteration of the charge given to the COV Chair by the HEPAP Interim Chair. This was followed by presentations on overviews of the Facilities Division and the HEP Projects Oversight, and presentations on HEP's alignment to the 2014 P5 and HEP's response to the recommendations of the 2016 COV. The subpanel break-out sessions ("Projects" and "Facilities Operations") took place in the afternoon of the first day and in the morning of the second day. The COV met with the HEP Facilities Division staff, and met with Kurt Fisher, Director of the Office of Project Assessment, during the afternoon of the second day.

The COV focused on formulating recommendations and writing its report in the morning of the third day. In the afternoon of the third day, the COV presented the major findings and recommendations to Regina Rameika, the Associate Director for the Office of High Energy Physics, to the Facilities Division Director, and then to all Facilities Division staff.

The COV met virtually on April 10 to further discuss findings, comments and recommendations. The COV concluded that the Committee was not able to fully evaluate the efficiency and quality of the HEP processes for managing Fermilab operations, based on the information provided at the March 11-13 meeting – this is primarily due to its scale and complexity. On June 18, the COV had a virtual meeting with HEP to get further information on Fermilab operations.

5. GENERAL FINDINGS

The COV thanks the HEP Facilities Division staff for their presentations and for their thoughtful and detailed responses to the COV's many questions. The COV is extremely grateful to Christie Ashton who took care of every one of us and of logistics of the meeting.

The following sections address the general components of the committee's charge as follows: (5.1) Alignment to the 2014 P5 Recommendations; (5.2) Response to the recommendations of the 2016 COV; (5.3) HEP Processes for the COVID-19; (5.4) HEP Facilities Division staffing; and (5.5) Ethics, Diversity and Inclusion.

5.1 2014 P5 ALIGNMENT

In response to the 2014 P5 report, HEP has built or is starting an exciting suite of experiments addressing the science drivers. ***HEP has closely adhered to the guidance of the P5 report and almost all of the P5 recommended projects have been launched.*** Among them CMB-S4 took the longest to get Critical Decision (CD)-0 because NSF wanted a recommendation from the decadal survey before moving forward. Despite infrastructure problems at the South Pole, the COV was told that NSF continues to be interested in and hopes for the success of the project. CMB-S4 is one of the highest priorities in the 2023 P5 report.

Although the P5 report has established overall guidance of projects and HEP has managed them well within that framework, changing conditions (e.g., HEP budgets and project costs and scopes) mean that some corrections become necessary, and community involvement becomes essential especially when the scale of the decision is sufficiently large and affects other activities such as research programs that require successful project R&D, construction, operations, and data analysis efforts and theoretical efforts. With this in mind, the 2016 COV recommended (**2016 COV Recommendation 2**):

> ***"Adopt, in consultation with HEPAP, an annual mechanism to determine the best plan of action to implement the P5 vision. In such cases where HEP deviates from the strategic advice, the case should be clearly explained to the community through discussion with HEPAP."***

The 2020 COV, which reviewed the HEP Research & Technology Division, concluded that "HEP has responded with regular budget and status updates at HEPAP meetings describing actions that are complete or already planned. While these updates are useful and widely appreciated, they have not resulted in the active community involvement in the decision-making that the previous COV envisioned", suggested several mechanisms (a specially convened HEPAP subpanel to evaluate the options in a specific case; a standing national particle physics advisory committee to address issues as they arise; or the P5 subpanel to continue after the release of its report and meet as needed when significant unanticipated programmatic choices or conditions arise), and recommended (**2020 COV Recommendation 20**):

> ***"Establish a mechanism in consultation with HEPAP to advise HEP when a programmatic choice must be made that significantly deviates from the P5 plan or when the context for that choice has evolved significantly from P5 expectations."***

This COV reiterates the importance of the 2016 COV and 2020 COV Recommendations when implementing 2014 and 2023 P5 Recommendations. The COV particularly notes that significant deviations of the project costs from the P5 profiles can have broad implications for other programs.

Recommendation 1: Establish a mechanism in consultation with HEPAP to advise HEP when a programmatic choice must be made that significantly deviates from the P5 plan or when the context for that choice has evolved significantly from P5 expectations.

The P5 funding targets for project construction and research programs were 20-25% and >40% of overall HEP funding, respectively. As shown in Figure 1, the funding for project construction has increased

significantly, far exceeding the P5 target. However, the research funding (that is required for the success of projects) has been going down, although it went up to 40% in the last FY 2023.

Recommendation 2: Strengthen coordination between the Facilities Division and the Research & Technology Division and factor in research and operations support when making decisions about proceeding with projects.

It is important to note that much of the research budget since FY 2018 has been siloed into specific initiatives such as Artificial Intelligence/Machine Learning and Quantum Information Science, as indicated in Figure 2. While important, that provides less flexibility for university and laboratory scientists to deploy their efforts optimally in support of the overall program including projects.

5.2 RESPONSE TO THE RECOMMENDATIONS OF THE 2016 COV

The 2016 COV reviewed both projects and facilities operations and provided 30 recommendations. Five recommendations are relevant to this COV.

2016 COV Recommendation 3*: Work closely with the Laboratories and with Project Management and Program Management teams to develop a comprehensive strategic plan, consistent with P5 guidance, that anticipates the needs for future operating funds that will arise from improvement, upgrade and Major Items of Equipment (MIE) projects. The plan should account for the funding needs not only of accelerator and experimental operations, but also of software, computing, and technical support for the new experimental programs. Develop a similar comprehensive plan for future research program needs, once again taking into account the need for research efforts to maximize the scientific return on improved, upgraded, and new facilities and experiments.*

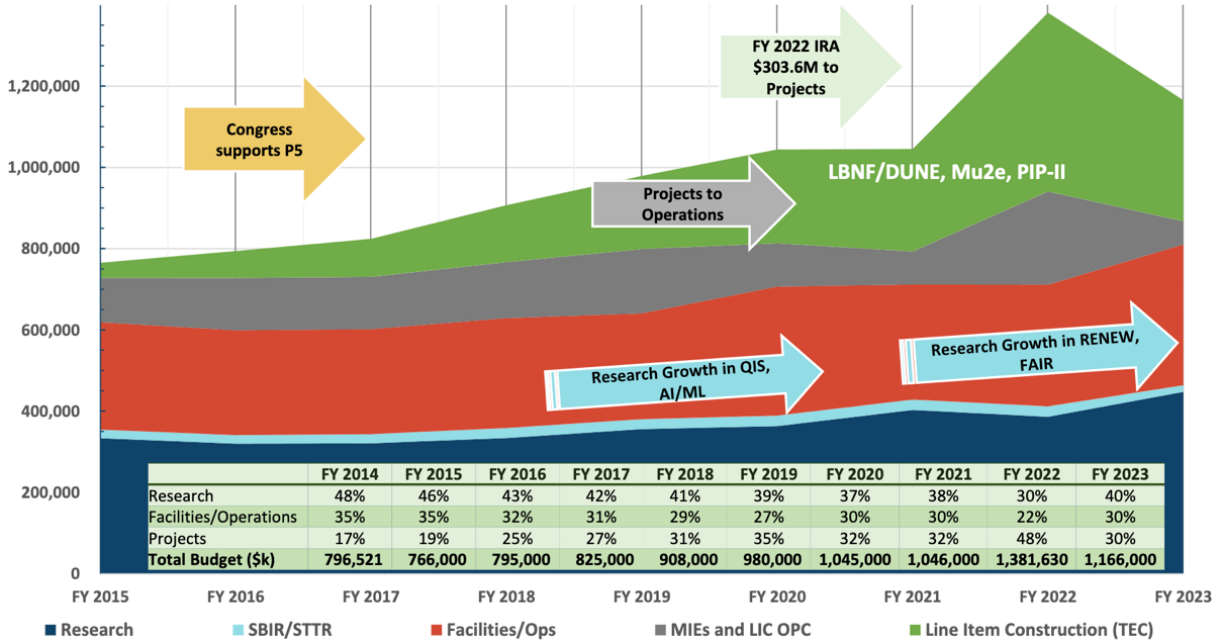
HEP has been doing operations planning reviews to understand the costs of running new experiments. So far, Rubin Observatory, DESI, LZ, SuperCDMS, and Mu2e have gone through these reviews. Planning for future operations of these projects has been successfully included in the project plans.

The COV commends HEP on successfully beginning many of the new projects as recommended in the 2016 COV recommendation 3.

The COV urges HEP to develop the recommended strategic plan including both research and operations in order to implement the P5 plan in a comprehensive manner that includes the P5 recommendation that the program be balanced between the various scientific goals of HEP, including both on-going and future projects, along with research.

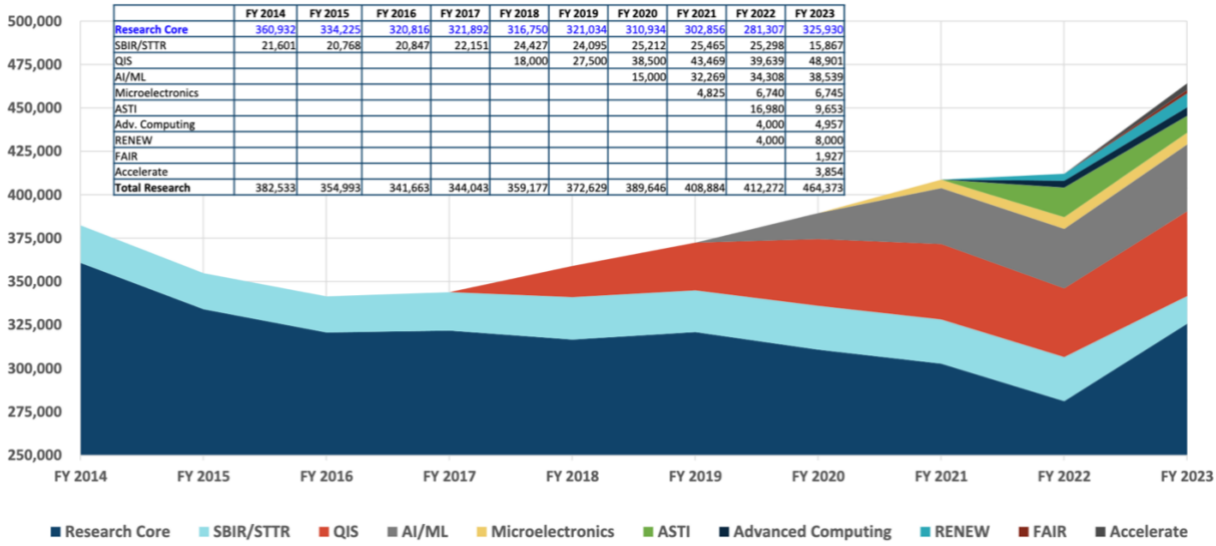
2016 COV Recommendation 4*: Include planning for computing and software development into the planning for projects and new initiatives.*

Planning for computing has been included as an essential part of current projects and the COV commends HEP on these efforts.



	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Research	48%	46%	43%	42%	41%	39%	37%	38%	30%	40%
Facilities/Operations	35%	35%	32%	31%	29%	27%	30%	30%	22%	30%
Projects	17%	19%	25%	27%	31%	35%	32%	32%	48%	30%
Total Budget ($k)	**796,521**	**766,000**	**795,000**	**825,000**	**908,000**	**980,000**	**1,045,000**	**1,046,000**	**1,381,630**	**1,166,000**

Figure 1. HEP Budget ($k): Research, Facilities & Operations, and Projects from FY 2014 to FY 2022



	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Research Core	360,932	334,225	320,816	321,892	316,750	321,034	310,934	302,856	281,307	325,930
SBIR/STTR	21,601	20,768	20,847	22,151	24,427	24,095	25,212	25,465	25,298	15,867
QIS					18,000	27,500	38,500	43,469	39,639	48,901
AI/ML							15,000	32,269	34,308	38,539
Microelectronics								4,825	6,740	6,745
ASTI									16,980	9,653
Adv. Computing									4,000	4,957
RENEW									4,000	8,000
FAIR										1,927
Accelerate										3,854
Total Research	382,533	354,993	341,663	344,043	359,177	372,629	389,646	408,884	412,272	464,373

Figure 2. HEP Research Breakdown ($k) from FY 2014 to FY 2022

2016 COV Recommendation 10*: Inform review panels about special information obtained by DOE program managers concerning project operational or infrastructure responsibilities and experiment leadership roles.*

The information about project roles and responsibilities has been conveyed to reviewers in the cosmic and energy frontiers in an *ad hoc* manner and the process seems effective.

2016 COV Recommendation 19*: Develop a plan for increasing diversity in the programs HEP supports.*

HEP made an effort to reach out to women and underrepresented groups to create a diverse pool for new staff hires and to improve the balance on its review committees. Greater attention should be paid to promoting a diverse and inclusive environment in the workplace for projects and facilities operations. It is important for HEP and project / facilities operations teams to have a code of conduct. ***[See further discussion and recommendations in Section 5.5.]***

2016 COV Recommendation 30*: Re-evaluate the staffing needed to successfully support the multiple larger projects on the horizon*

HEP made new hires in the last three years. The COV commends HEP on making these hires, but encourages them to seek detailees or part-time consultants with specific expertise in needed areas such as experience with mega scale projects. Detailees or part-time consultants can bring a wealth of expertise to the office, transferring technical knowledge and strengthening links to the laboratories. ***[See further discussion and recommendation in Section 5.4.]***

5.3 PROCESSES IN RESPONSE TO COVID-19

A novel analysis methodology was developed to bracket the broad range of possible COVID-19 outcomes using three (Low, Medium, and High impact) "what if" scenarios. This methodology was used by all the HEP projects to quantify their COVID-19 risks and implemented in monthly reports to the Office of Project Assessment (OPA). The COVID-19 response was successfully tailored to the needs of each individual project. For example, projects close to the end were completed with threshold Key Performance Parameters (KPPs), while for others the baselining was pushed back. All national labs were very slow in opening up after the initial COVID-19 surge and this has hampered projects and operations and increased costs. ***The COV commends HEP for demonstrating an understanding of the most effective path forward for each project and partnering with the Labs and project teams to implement optimized solutions.***

Currently HEP uses a hybrid workplace model: remote work for three days and in-office work for two days. The staff pick two days out of Tuesday, Wednesday and Thursday for their in-office work. The management team tries to come in for all three days. A long-term plan for the staff is in-office work for three days from Tuesday to Thursday. Recently HEP had an in-person meeting on the P5 response that everyone enjoyed. ***The COV encourages HEP to pay special attention to recently hired junior staff since a hybrid model can be a challenging environment when they are learning HEP systems, processes, and practices.***

5.4 DOE HEP STAFFING

With three junior hires in the last three years, the HEP Facilities Division team is more age-diverse, providing a variety of experiences and points of view. The COV acknowledges that this is a positive change, and commends the HEP Facilities Division for its successful recruitment. Nurturing and mentoring junior staff should be taken as a critical task.

The HEP Facilities Division used to have two experienced detailees on average, but at present there are none. Although the HEP Facilities Division is successfully overseeing a number of large and complex projects with significant challenges, ***the COV encourages them to seek detailees or part-time consultants with specific expertise in needed areas***. They can bring a wealth of expertise to the office, transferring technical knowledge and strengthening links to the laboratories.

Recommendation 3: Seek detailees or part-time consultants with specific expertise in needed areas.

5.5 ETHICS, DIVERSITY AND INCLUSION

The COV commends the HEP Facilities Division staff for their effort to reach out to women and underrepresented groups to create a diverse pool for new staff hires and to improve the balance on its review committees.

Concerning the climate of the projects and facilities operations workplace, HEP does not have direct information. The COV encourages HEP to pay greater attention to promoting a diverse and inclusive environment and a respectful atmosphere in the workplace for projects and facilities operations. The COV acknowledges that an essential step to address diversity, equity and inclusion at the workplace is documenting the demographics of the project and operations teams, and the transparent processes for assigning project and operations tasks to groups at national laboratories and universities.

Recommendation 4: Regularly solicit demographic information from the external entities including HEP project and facilities operations teams and project leaders at national laboratories and universities, and encourage project/operations leaders to employ transparent mechanisms in allocating project/operations tasks to groups at national labs and universities.

Codes of conduct clarify expectations for behavior and support accountability. By calling for respectful, professional interactions, codes of conduct will help create a climate in which all groups feel welcome and valued. Violations of such principles compromise the science and can lead to attrition. HEP's codes of conduct can be used as guidelines for all participants in HEP projects, operations, and programs to follow.

Recommendation 5: Create a code of conduct for the Office of High Energy Physics.

6. REPORT FROM PROJECTS SUBPANEL

6.1 SELECTION OF THE PROJECTS

The Facilities Division Director laid out the processes invoked by HEP to select candidate projects for execution. The decisions are made by the AD for HEP. The process is primarily based on the recommendations from P5. However, within that rubric, many factors may affect the timing and budget envelopes allotted to individual projects, ranging from residual technical risks to the ability of individual labs to execute multiple projects simultaneously. Occasionally, projects move forward without explicit P5 recommendations. Examples include FACET-II, ACORN, and LuSee-Night.

When realistic budgets become available for candidate projects, some reevaluation should take place to ensure that balance between subfields, between large and small opportunities, and between the laboratories is maintained. It was not clear to the committee how such balance considerations are evaluated by HEP.

6.2 TIMING OF CD-0

A key issue that the Facilities Division staff need to face involves the timing of requests for CD-0 approval for potential projects in their initial phases of development. Typically the putative host laboratory and the project proponents push for obtaining CD-0 as early as possible. There are numerous reasons for this. Approval of CD-0 is usually interpreted as a sign that DOE is committed to carrying out the project, which can be extremely important for securing international or other US agency participation. In addition, it is often difficult to obtain adequate funding for critical R&D associated with the project before CD-0 approval. Since CD-0 is formally only a "statement of mission need", this can, in principle, be evaluated on the basis of the physics case alone.

However, proceeding to CD-0 too early is often fraught with problems. After CD-0, the project begins spending other project costs (OPC) funding, which counts against the total project costs (TPC). If there are unresolved technical or programmatic issues that will delay subsequent critical decision approvals, this can drive up the TPC unnecessarily. In addition, after CD-0, the host lab may establish a project office and start charging project management, project controls, and project engineering staff that may not be efficiently utilized if the project is still primarily dealing with pre-conceptual R&D issues. This is wasteful of HEP funding that could be better deployed elsewhere in the program.

A potentially better approach would be to enable "directed R&D" funding that could be used to retire technical and programmatic risks prior to CD-0 approval. This would require cooperation from the Research & Technology Division. At present, technical R&D prior to CD-0 is funded out of general purpose R&D Budget and Report (B&R) codes in accelerators and detectors. These are intended to support "blue sky" research to enable future capabilities, not for highly directed studies designed to retire risks for a particular program. They are also awarded on the basis of comparative laboratory reviews, which are not appropriate for project-specific R&D efforts led by a specific host lab. Further, the budgets for Detector

R&D and Accelerator R&D are typically flat from year to year, which does not allow sufficient flexibility to retire risks for proto-projects planned for particular timeframes.

The COV suggests HEP investigate the possibility of establishing a directed R&D line for proto-projects, stewarded by the Facilities Division or Research & Technology Division (but with strong involvement of Facilities Division staff). Some form of process must be devised to decide which proto-projects are eligible for such funding, but that need not be substantially different from the processes used to decide on candidate projects for CD-0 approval. Presumably, it would be guided by the P5 recommendations. If there are competing technical solutions to meet a particular mission need (possibly led by different labs), these could be funded in parallel from such a program, leading to down-select at the completion of the directed R&D phase.

Recommendation 6: Investigate the possibility of establishing a "directed R&D" line to retire major technical and programmatic risks for proto-projects prior to CD-0 approval.

6.3 SUCCESSES

The breadth and depth of the project portfolio that was handled by HEP during the period of this COV, FY 2016 through FY 2022, was impressive. The total portfolio included 17 projects with extensive technical diversity, stages of completion from CD-0 to CD-4, and funding received during this period ranging from $15M to $1,100M. The average annual funding for the sum of HEP projects was ~$300M (see Figure 3). One project, SuperCDMS at SNOLAB, was rebaselined, resulting in a TPC increase of $5.3M and a shift in CD-4 date of 18 months.

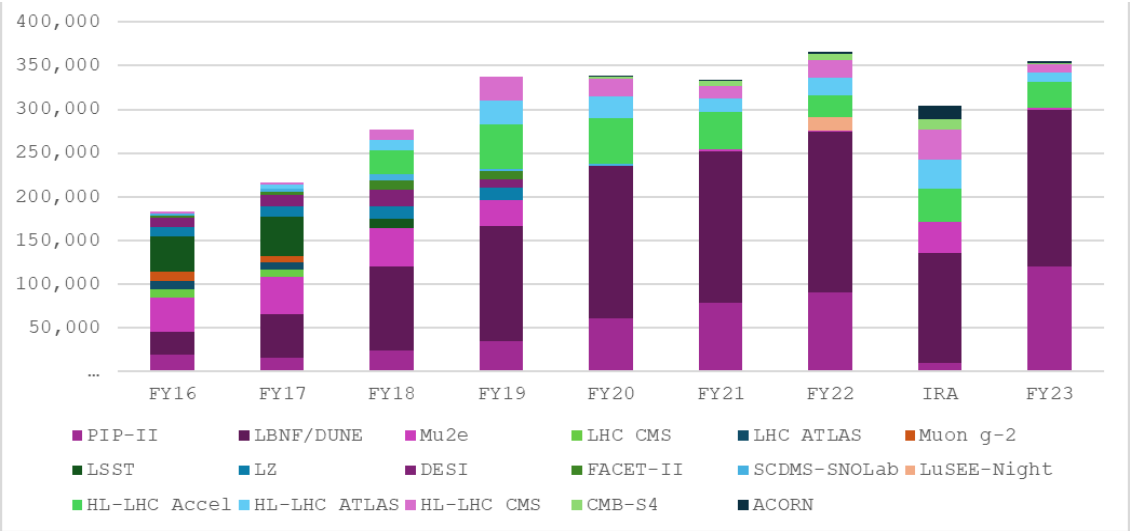


Figure 3. HEP funding ($k) for projects by FY from FY 2016 through FY 2023 in Actual Year. Note that the Inflation Reduction Act (IRA) funding from FY 2022 is shown as a separate bar.

The quality of the project performance and delivered capabilities is evident in the five Secretary Awards of Achievement and one Secretary Award of Excellence received from 2016 through 2023. The COV was

impressed with the detailed knowledge of the HEP staff on the history, successes, challenges, and status of individual projects. HEP engages with project teams through participation in Integrated Project Teams (IPTs) and Office of Project Assessment Independent Project Reviews, and also through required monthly status reports which are followed by meetings with the HEP AD and the relevant Federal Program Manager. Due to its scale and complexity, the LBNF/DUNE project also reports quarterly to the Director of the Office of Science.

Seven projects were successfully completed with CD-4 approval and a summed TPC value of $426M (see Table 1) from FY 2016 to FY 2022. These include Belle II, Muon g-2, LHC CMS Upgrade, LHC ATLAS Upgrade, DESI, LZ, FACET-II, and the LSST Camera.

Project	**CD-4 Date**	**TPC ($M)**
Belle II	July 2016	15.5
Muon g-2	January 2018	46.2
LHC CMS Upgrade	June 2019	33.2
LHC ATLAS Upgrade	August 2019	33.2
DESI	May 2020	54.2
LZ	September 2020	53.5
FACET-II	September 2021	25.5
LSSTCam	September 2021	165.3

Table 1. List of HEP projects that were completed between FY 2016 and FY 2022 in chronological order by the CD-4 approval date.

During this time period, significant events beyond the control of HEP or the project teams occurred such as the COVID-19 pandemic. The effect of the pandemic was greatest for projects that were already in construction, such as PIP-II, and less for projects still in early planning prior to CD-2 baseline. The continuing impacts related to supply chain issues and overall increase in escalation have affected all projects. Given the size and diversity of the HEP project portfolio, it was necessary for them to exercise flexibility and agility in working with the Labs and project teams to plan and sometimes replan project execution. The COVID-19 response by HEP was successfully tailored to the needs of each individual project, e.g., projects close to the end were completed achieving CD-4 approval with demonstration of the threshold KPPs, while for others the baseline date was pushed back to allow replanning.

HEP is to be commended for demonstrating an understanding of the most effective path forward for each project and partnering with the Labs and project teams to implement optimized solutions.

6.4 PROJECTS WITH CHALLENGES AND LESSONS LEARNED

The following three cases illustrate a variety of problems that HEP can face as they make their way through the process. In response, the COV makes our recommendations.

Mu2e

The Mu2e experiment, which probes lepton flavor violation, received CD-0 in 2009, CD-1 in 2012, and CD-2 in 2015. During those stages, the TPC increased from $145-205M to $274M and in December 2022, it was rebaselined with a new TPC of $315.7M. At the time of CD-1, the substantial cost for the secondary beam, cryoplant, and site preparation was recategorized to the Muon Campus facility that could serve a broad scientific program. This allowed significant civil construction costs to be covered by General Plant Projects (GPPs) and moved off-project.

Mu2e requires two large solenoids, and in 2015 the contract for them was competitively awarded to General Atomics, which had fabricated the ITER solenoid in its San Diego site. Unfortunately, GA elected to do construction at its Tupelo, Mississippi site, which had no similar experience. Today, the solenoids are five years late and their cost and associated delays are the main source of a $42M increase in the TPC. Fabrication is nearly complete and barring unforeseen problems, they will be in operation in advance for CD-4, planned for January 2028.

The risk of similar future experiences could be reduced by specifying in vendor contracts details such as the location, tools and personnel and by identifying backup vendors.

Recommendation 7: Where possible, maintain multiple sources of contracts for large projects until one particular vendor has demonstrated the capability and commitment to deliver successfully. Large contracts with industrial contractors require extra attention and should be subject to a higher level of scrutiny by Facilities Division personnel. Contracts should explicitly identify key personnel and details of the fabrication that are crucial to vendor success.

Another blow was dealt by COVID, which caused delays and increased costs. The impact of COVID was greatly exacerbated by limited site access, which continues to be an unresolved issue in 2024.

SuperCDMS

SuperCDMS was jointly funded by NSF, DOE and the Canadian Foundation for Innovation (CFI). DOE awarded CD-0 in 2012, prior to the down-select among G2 Dark Matter searches and R&D was still active when CD-1 was awarded in 2015. A new project management team appointed in 2017 ended R&D and produced a design, resulting in CD-2/3 approval in mid-2018. At that point, the DOE project, with a price of ~$20M, was delegated for oversight to SLAC as the lead lab. Unfortunately, SLAC had other priorities at the time, so experienced personnel were directed elsewhere, and delays and a failed CD-2 review followed. Ultimately the cost was 25% higher than the original baseline, there was room for only 6 detector towers (down scoped from 31), and CD-4 was one and a half years late. The COV was informed

that HEP never intended to support a 31 tower design although the project was allowed to continue into a very late stage (passed CD-2/3) with this design. A descope/right scope discussion between HEP, the lead lab and the project prior to the CD-2/3 review would have been helpful and should have triggered a review of the scientific relevance of the more affordable 6 tower design.

Smaller projects are especially vulnerable to issues emanating from not being afforded a sufficiently high priority at the labs.

Recommendation 8: Negotiate with the host lab leadership of small projects to ensure that they will have the resources they need to successfully execute the projects.

Recommendation 9: Make delegation oversight to a national laboratory be at the discretion of the HEP Associate Director based on demonstrated commitment and capabilities of the laboratory.

CMB-S4

DOE has long contributed to CMB instrumentation and computing. In 2014, P5 recommended CMB-S4 as a joint program shared between DOE and NSF, and development began, largely through Laboratory Directed Research and Development (LDRD) funds. In 2017, the CMB-S4 Concept Definition Task Force recommended a selection of small and large aperture telescopes to be sited in Chile and the South Pole, and this was developed into a 2019 proposal from HEP, NSF-Astronomy and NSF Office of Polar Programs, which was evaluated by the NAS decadal survey of astronomy and astrophysics, Astro2020. At the same time, DOE approved CD-0 for the joint DOE-NSF program with a DOE MIE (Major Items of Equipment) TPC of $320-395M. In September 2020 and the following year, Congress approved funding, with LBNL as lead lab, and the Astro2020 recommended implementation of the CMB-S4 program. Then in January 2022, NSF informed DOE and the CMB-S4 collaboration that the plan was incompatible with Antarctica Infrastructure and Logistics capabilities. The earliest date for new efforts at the South Pole is 2029/2030.

This remains a major programmatic obstacle for the project to proceed on its intended path. In the meantime, CMB-S4 is running on life support with flat funding for the project office at the level ~$4M per year. While significant technical progress has been made, this level of funding is insufficient to maintain the project team for much longer. Options for a staged deployment to Chile and the Pole, or a Chile only solution could potentially provide the flexibility required to adapt to the changing NSF plans.

The COV suggests that HEP continue to work with CMB-S4 and NSF to develop a plan in light of NSF's current inability to support new large projects at the Pole.

Recommendation 10: In cases of interagency partnerships, negotiate and document detailed arrangements between the agencies before a project gets advanced to CD-0.

PIP-II

The Proton Improvement Plan II (PIP-II) project is an essential upgrade to Fermilab's accelerator complex to enable the world's most intense high-energy beam of neutrinos for the Deep Underground Neutrino Experiment (DUNE) at LBNF, and a broad intensity-frontier physics program at Fermilab. PIP-II is connected timewise with LBNF/DUNE, Mu2e and ACORN. All are coupled by Fermilab's Long Shutdown.

PIP-II comprises a new 800-MeV superconducting radio-frequency linear accelerator that will enable the Fermilab complex to deliver more than a megawatt of beam power to LBNF (upgradeable to multimegawatt levels), a beam transfer line to the Booster, and modifications to the Booster, the Recycler and the Main Injector synchrotrons for accommodating a significantly increased beam intensity.

PIP-II is the first US accelerator project to be built with significant international contributions, which implies some additional risks. HEP has been monitoring how the PIP-II project successfully addressed various challenges. These included lots of personnel turnover due to promotions, cycling roles, and departures for other projects and other labs (e.g., LCLS-II and EIC).

Newly introduced "PIP-II periodic briefings to OPA" (2 hour long) are scheduled as needed. These briefings provide more incentive and better communication than Independent Project Reviews (IPRs).

LBNF/DUNE

The LBNF/DUNE project is the next generation long-baseline neutrino oscillation experiment (DUNE) with the space, infrastructure and particle beam for DUNE (LBNF). LBNF includes the underground caverns that will house DUNE's detectors — a near detector at Fermilab and a far detector 800 miles away at the Sanford Underground Research Facility (SURF) in South Dakota.

It received CD-0 in August of 2010, and CD-1 in December 2012 established the detector choice as an underground liquid argon based TPC (as "LBNE"). The 2014 P5 report named it a priority of the field and the focus of US-based particle physics. This led to a CD-1 refresh in November 2015 with a realization that the project would never fit in the original and arbitrary $1B cap without substantial international contributions, increasing the estimated TPC to a still too low $1.86B. The longest lead time item in the project was cavern excavation, which required SURF infrastructure improvements. Thus CD-3a was established in June 2016, then revised in October 2020 to accommodate the larger than expected bids.

Given the scale and complexity of the project, it was decided to split LBNF/DUNE into subprojects to allow the flexibility to run the different aspects of this megaproject in more bite-size pieces, something done elsewhere in DOE but the first time this approach was applied in HEP. This required a re-refreshed CD-1RR in February 2023, reducing its scope to two Far Detector (FD) modules (space for four modules has been excavated) and establishing five sub-projects, three of which quickly proceeded in the project timeline:

- **FSCF-EXC** far site excavation (CD-2/3 August 2022)
- **FSCF-BSI** far site building and site infrastructure (CD-2/3 March 2023)

- **FDC** far detectors and cryogenics infrastructure (CD-3a for long lead time procurement February 2023 and CD-3b IPR February 2024)
- **NSCF-B** near site conventional facilities and beamline (CD-3a for site prep March 2023, CD-2/3 expected later in 2024)
- **ND** near detectors (CD-2/3 expected in 2024-25)

This sub-project split makes managing this project tractable at the cost of careful coordination between subprojects, all of which are still in a unified project management plan. In hindsight, this split should have happened at CD-1. CD-4 for the overall project will be at the completion of the final sub-project sometime in 2032. Currently the DOE cost estimates are:

- FSCF-EXC $664M
- FSCF-BSI $211M
- FDC $1,119M
- NSCF-B $1,103M
- ND $200M

for a TPC of $3,277M, not including international commitments. Note that this does not include other projects needed for the success of the project: PIP-II $1,278M (to supply the 1.2 MW beam intensity) and ACORN $135M (Fermilab can't operate future beams on the current obsolete controls infrastructure), SURF operations costs (headed to $35M per year) and a ~$200M major shaft renovation at SURF. The only subproject with substantial scope contingency is the ND. The overall project is 37% complete with 32% remaining contingency.

The original $1B price tag was unrealistic. Although the current huge costing is in retrospect understandable (comparable to construction of the Large Hadron Collider), after the more than several times cost increase (not even including off-project costs) this project becomes the largest one the Office of Science has attempted and is having the unfortunate effect of squeezing the other projects and programs that HEP is doing. This generates a concern for having a balanced portfolio going forward and being able to start other larger projects on the horizon.

While the overall project is much more well defined and costed now after the CD-1RR, there is not a lot of room for error. There are also substantial threats to resolve: increasing Fermilab overhead, a ramping funding profile with an uncertain budget situation due to Continuing Resolutions, and vital international contributions that might not materialize.

As part of the push to better define the project as it currently stands, the HEP project team has increased in size, and oversight is now looking much better than it has been. ***More could be done, e.g. by adding someone with experience with billion dollar projects from elsewhere in DOE or the government [See Recommendation 3]. Fermilab (and HEP) did not have experience with projects of this magnitude. Symptoms of this include some current problems such as its contracting, procurement, and ES&H capabilities still not quite there, and the lack of a Project Director at Fermilab, the previous one having retired without a succession plan, with a search still ongoing.***

7. REPORT FROM OPERATIONS SUBPANEL

7.1 GENERAL COMMENTS

HEP operations include two National User Facilities (Fermilab Accelerator Complex and FACET-II), SURF (aspiring to become a National User Facility), Cosmic experiments Operations, US CMS and ATLAS at LHC, Fermilab detectors, and Fermilab computational operations.

The COV noted that operations of detectors relies heavily on uncosted labor funding through research B&Rs (lab scientists, university faculty, postdocs, and students). This operations work is not reviewed and funded by the Facilities Division. Closer coordination between the Facility and Research teams at HEP is recommended to ensure operations success ***[See Recommendation 2]***. ***Good coordination is already apparent in some frontiers, but less so in others.***

HEP processes are in place for the long-term maintenance and modernization of Accelerators and Detectors such as Accelerator Improvement Projects (AIPs) and General Plant Projects (GPPs), but it was not clear from the HEP presentations how HEP approaches the long-term maintenance and modernization of experimental data and the corresponding software. The preparation of such data products could be part of operations, but the continued support is not possible in this way once operations funding ends for a given experiment. The 2014 P5 report specifically called this out in **Recommendation 29**: "Strengthen the global cooperation among laboratories and universities to address computing and scientific software needs…including long-term data and software preservation". Given that this same topic is called out again in the most recent P5 report, ***the COV recommends that HEP develop a mechanism, in collaboration with the experiments, the national labs, and international partners such as the CERN Open Data Portal, to manage data preservation after operations ends. Sufficient information should be publicly available so that generic data analysis is possible with modern computing environments.***

Recommendation 11: Develop a mechanism, in collaboration with the experiments, the national labs, and international partners such as the CERN Open Data Portal, to manage data preservation after operations ends.

7.2 FERMILAB OPERATIONS

At Fermilab, HEP supports Accelerator, Detector and Computing Operations, and invests in GPPs and AIPs.

1) Accelerator Operations

The Fermilab Accelerator Complex is a National User Facility. The Office of Science upholds a set of core principles for national user facilities. The COV was told that the Fermilab User Facility is in good standing at the Office of Science level and its performance metrics are well received. HEP tracks and reports the following performance metrics to the Office of Science Management (quarterly reports):

- Uptime of Accelerator Complex in Weeks and Hours

- Compare actuals to Fermilab's Plan

Typically, the HEP base plan is 85% of Fermilab's operations schedule dedicated to science. In order to maintain this high level of facility availability, HEP tracks beam operations with:

- Protons on Target (POT);
- Beam Power (kW or MW); and
- Uptime

The Fermilab Accelerator Complex runs from October to July and has downtime[1] for maintenance during the three summer months. Scheduled weeks and hours of beam are affected by maintenance needs and other project needs at the lab.

The FY2023 and FY2024 (which is outside of this COV review period) results are reported to be poor and HEP may be requiring a mediation plan from Fermilab as discussed at the May 9, 2024 HEPAP meeting.

In addition to regular operations, HEP funded a targeted campaign, the Proton Improvement Plan (PIP), from FY2013 to FY2018. The PIP tripled the power of the NuMI beam and was organized and funded out of Accelerator Operations. With a total investment of $43.5M, these improvements were required for the lab to meet the scientific goals of the NOvA experiment. PIP increased the Booster beam repetition rate from ~7.5 Hz to 15 Hz and eliminated major vulnerabilities to maintain reliability at present levels (>85%) at the full repetition rate. It also increased the Fermilab proton source throughput, with a goal of reaching >2E17 protons/hour (Operating at <1E17 protons/hour before PIP) and ensured a useful operating life of the proton source through at least 2025 (now extended to 2030 to accommodate the PIP-II schedule). ***The Committee congratulates HEP on a well-executed campaign.***

2) AIPs and GPPs

AIPs are planned typically over ten-year periods. However, plans change due to other lab priorities and the availability of funds. The DOE Financial Management Handbook changed their guidance, by order of the DOE CFO, to require that GPPs/AIPs must be fully funded in a single FY (except design can be a year early). This order limits HEP's execution. In the past HEP could provide modest funding to many AIPs/GPPs each year, but now HEP can usually only afford 1 or 2 at a time since HEP must fully fund each. ***With changed DOE rules regarding the AIP/GPP funding model, HEP should now pay more attention to Fermilab providing accurate estimates to allocate all projected funding in one year.***

3) Detector and Computing Operations

Detector Operations supports the running of the on- and off-site experiments, and the Fermilab Remote Operations Center (ROC) West control room. The overarching Detector Operations goal is to provide the

[1] In FY2020, COVID-19 impacts stopped operations for ~6 months

facilities and expertise in support of the research programs with neutrino and muon beams. The PIP upgrades ended in FY2018 and its funding has been redirected to Fermilab Detector and Computing Operations (Ops). The increases in Detector and Computing Ops funding from FY2016 to FY2018 were used for:

- MicroBooNE and NOvA that received the full benefit of proton power upgrades in FY2018;
- Computing that took responsibility for GENIE and made an operations group to help experimentalists; and
- ICARUS installation, ProtoDUNE support, start of Muon g-2 operations, and testing of Mu2e.

Past detector operations at Fermilab have relied on regular HEP funding, requested through an annual Field Work Proposal (FWP) process. The 2019 Mu2e and 2020 DUNE preliminary operations review revealed that a different detector operations funding model may be needed in the future. ***HEP should continue to work with Fermilab and the experimental community to refine the operations impact on Ops budgets.***

The Fermilab Computing operations are responsible for the computing needs of the Intensity Frontier experiments hosted at the laboratory. The management and review of these resources in terms of the allocation of resources to users and the personnel (which includes many matrixed FTEs) are largely delegated to Fermilab. HEP does not collect performance metrics in this area as they do for accelerator Ops. HEP relies on Ops reviews and the FWPs. Reviews are intended to be on a three-year cycle, but the last review (joint with detector/accelerator operations) was in 2016 and it seems it was too much to cover in one review (the next computing review is planned for summer FY2024). ***[See discussion under the "Review Process" below.]***

Intensity frontier computing (both IT and generic software maintenance and modernization) is done generically, shared across experiments. This seems like an ***effective strategy, even though it is quite different from the way computing operations are managed for the other frontiers***.

4) Review Processes

The annual process used by HEP starts with a Fermilab Ops FWP submission and review at the HEP Facilities level. Maintenance, spares and AIPs are also considered and reviewed. Once the FWPs are reviewed and the annual Ops budget is established, HEP has weekly and monthly oversight meetings with the Fermilab management through monthly planning and reporting meetings, Status of Ongoing AIPs, and Monthly Deep-Dive Topics (e.g., maintenance). To perform assessments of and corrections to the annual FWP review process, HEP organizes and runs Lab Facility Operations reviews on a regular basis. The Fermilab Computing FWP process is used to address both maintenance and upgrades. For example, the last review recommended the acquisition of GPUs to prepare users to utilize HPC resources for machine learning and other tasks. In response, HEP supported the integration of a modest GPU component into the intensity frontier cluster at Fermilab.

The ramp-up of the P5 projects dramatically increased the workload on both HEP and Fermilab, resulting in fewer Ops reviews. Recent reviews of the Fermilab Facilities are:

- May 2016 - Fermilab Accelerator/Detector/Computing Operations review
  - Comprehensive review of all facility operations, including bottom-up budget analysis and funding validation
- January 2020 - DUNE Support Review
  - Discovered that the level of operational support expected from the project was too large for operations to handle and had to move much of that scope onto the project.
- May 2020 - Mu2e Preliminary Operations Plan Review
  - Analyzed plans to transition from project to commissioning and operations
- August 2022 - Fermilab Accelerator Operations Review
  - Emphasized workforce, staffing, personnel turnover and succession planning

These reviews with a frequency of 3~4 years (balanced with other HEP priorities) provide important feedback to supplement the annual Fermilab FWP process and should be strengthened, especially in computing that evolves at a fast pace. If personnel and financial resources for the reviews are challenging, light-weight computing reviews could be implemented.

The annual Fermilab FWPs break out the lab's funding requests for each B&R code into reasonable sized individual Thrusts for HEP to manage. Challenging budgets have motivated HEP's requirement that there be "Walkdowns" in each FWP where Fermilab can prioritize their funding requests and work with HEP to make decisions that protect the lab's most important activities. For example, in FY2020 the optimal funding for the Accelerator Complex was $93M. However, HEP was able to provide $83M, and Fermilab followed the priorities in their Walkdown table as intended. ***The COV agrees that this is an effective management tool.***

5) Site Access

National Lab site access has improved as COVID eased, but strict rules continue to impede progress, particularly at Fermilab. For example, approvals for international collaborators to enter the site take months to process and sometimes fail to come through in time. The site access issues are well known to HEP and SC leadership. The Deputy Directors of the Office of Science have a common position that this needs to be fixed.

Recommendation 12: Continue to work with Fermilab and the DOE site office to find solutions for the site access issues.

7.3 LHC US CMS AND ATLAS OPERATIONS

Over 1200 physicists from US institutions participate in the ATLAS and CMS experiments, contributing to world class measurements at the LHC. HEP LHC operations cover contributions to US ATLAS and US CMS operations. The operations program includes detector maintenance and operations, along with software

and computing. The operations program is coordinated with NSF, along with multiple international partners, most notably CERN, and is overseen by a joint oversight group. Both the research program and operations are managed by a single program officer and the operations program relies heavily on uncosted labor from the research program. The operations program also includes the critical R&D funds focused on meeting computing needs in the future. During the period of this COV review, there were program reviews in FY 2017, FY 2019, and FY 2022. The Program Manager followed the 2016 COV Recommendations to communicate project priorities to the reviewers.

The interactions between all parties seem to be relatively smooth. The management of the research program and operations by a single program officer is working well and the effective use of uncosted labor from research is aided by the current management arrangement. The HEP review process is working well with good communications between HEP and the ATLAS and CMS Program Managers at the lead laboratories. HEP coordinates effectively with ATLAS and CMS management and with CERN management.

The COV commends HEP on successful management of the LHC operations program.

7.4 SURF OPERATIONS

The Sanford Underground Research Facility (SURF) is America's deepest underground research facility and is owned by the South Dakota Science and Technology Authority (SDSTA) with operations funded by DOE-HEP. Currently several midsize experiments (for example LZ) and several other smaller experiments operate at SURF. SURF will also be the host laboratory for the DUNE far detector, but DUNE construction is not part of the Cooperative Agreement (CA). DOE funds the operations and routine maintenance at SURF via a CA with SDSTA. The budget is annually directed by Congress to be 'not less than' the approved value, currently $35M, which is split between routine operations and supplemental infrastructure projects. The Homestake mine is 150 years old and requires major infrastructure maintenance of about $5-10M per year to remain operational.

Major infrastructure improvements must be requested through the HEP supplemental award process where new scope can be peer-reviewed. An example of a major infrastructure improvement was the refurbishment of the Ross shaft which was completed in 2021. It took 10 years and cost about $100M. There is a second shaft, the Yates shaft, that must be upgraded at a cost of close to $200M and could be considered as a hidden cost of DUNE. The HEP office has a staff member on site where there is consistent face-to-face communication with SDSTA staff. There was a SURF operations review in 2022, and it resulted in 14 recommendations, directed at SDSTA, that would better manage the SURF site and planning for the future. No major issues with current operations were mentioned in the recommendations.

It is the view of the COV that the HEP management of SURF has been effective and that there is significant value in having staff on site.

7.5 FACET-II OPERATIONS

The Facility for Advanced Accelerator Experimental Tests II (FACET-II) provides a 10 GeV electron beam at SLAC for accelerator R&D primarily aimed at research projects related to plasma wakefield acceleration. FACET, the predecessor, was quite successful, producing numerous results published in Nature and other high-profile journals. The upgrade to FACET-II occurred during the period 2016 – 2021. Its construction began as National User Facility of HEP in FY 2020, and was commissioned in FY 2022. User experiments began in Spring 2022, with an expected run period of about 6 years.

HEP Program Managers for FACET-II engage via monthly video conferences, frequent emails, and occasional video calls with the FACET-II facility director and SLAC management. FACET-II operations are limited somewhat by the fact that it is in close proximity to the LCLS-II beamline, which adds uncertainty to the operation cost, but they have stabilized to about $15M per year. Reviews were carried out in 2019, 2020, and 2022. A risk has been identified that the legacy "VAX" control system from the 1980's should be upgraded.

During review presentations HEP oversight was clearly explained and the process for decision making communicated. ***Overall, FACET-II operations have been effective and are actively managed by HEP.***

7.6 COSMIC OPERATIONS

Operations of five experiments are supported by HEP: DESI, LSSTCam, Rubin Observatory, LZ and SuperCDMS. All of these transitioned from project to operations (including commissioning) during the period 2016-2023. The Program Manager (PM) provided a "project summary" for each experiment. The PM stated that she requests monthly or quarterly reports from each operating experiment. ***This process is commendable and ensures the PM is well informed about successes and troubles in a timely way. HEP should adopt a uniform approach for all the Program Managers, building on lessons learned and best practices.***

Recommendation 13: Share best practices and lessons learned between frontiers for coordinating project, operations and research resources.

Out of the five experiments, only LZ and DESI are in "operations" in the traditional sense of collecting scientific data and producing scientific results. LSSTCam and Rubin Observatory are proceeding well through the integration phase. The SuperCDMS project achieved CD-4 in 2023 but challenges continue to surface as installation at SNOLAB proceeds.

The PM is well connected to the research program, and with the cosmic projects. The PM prioritizes research grants and awards to people and groups with critical project or operations roles. ***This prioritization is communicated through presentations but unfortunately is not explicitly mentioned in the Funding Opportunity Announcement (FOA), leading to potential confusion of the PIs.*** Estimates of operations costs are now "projectized" and cost increases are tracked with "baseline" change requests. The PM provided funding tables for 2017-2023 in the project summary files.

APPENDIX I: CHARGE FROM THE INTERIM CHAIR OF HEPAP SALLY SEIDEL TO THE CHAIR OF THE COV YOUNG-KEE KIM

DEPARTMENT OF PHYSICS & ASTRONOMY

12 February 2024

Prof. Young-Kee Kim, Louis Block Distinguished Service Professor
Department of Physics and Enrico Fermi Institute
University of Chicago
Eckhardt, 5720 S. Ellis Ave. #201
Chicago, IL 60637

Dear Young-Kee,

Thank you for agreeing to chair the 2024 Committee of Visitors (COV) review of the Department of Energy (DOE) High Energy Physics (HEP) Facilities Division. The review should be conducted in accordance with the Guidance for DOE Office of Science Committee of Visitors Reviews, found at the following URL: https://science.osti.gov/DDSP/Committees-of-Visitors.

The COV subpanel is asked to assess the operations of the HEP Facilities Division during fiscal years 2016 through 2022. As noted in the guidance, the subpanel should assess: (1) the efficiency and quality of the processes used to solicit, review, recommend, document, and propose actions, and to monitor active awards, projects and programs; and (2) the quality of the resulting portfolio, including its breadth and depth and national and international standing. The COV should comment on the effectiveness of DOE implementation of the long-term goals and priorities recommended in the 2014 report of the Particle Physics Project Prioritization Panel (P5). Are the recommendations of the 2015 P5 and the 2016 COV being reasonably followed? The COV should also identify any significant issues that it is not able to consider appropriately within the limited timespan, but that deserve subsequent consideration.

The results of this review should be documented in a report with findings, comments, and recommendations clearly articulated. The report should be completed for consideration by HEPAP at its May 9-10, 2024 meeting and submitted to the agency shortly thereafter. I appreciate the COV's willingness to take on this important activity and look forward to its final report.

Sincerely,

Sally Seidel

Sally Seidel
Professor of Physics, University of New Mexico
Interim Chair, High Energy Physics Advisory Panel

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APPENDIX II: COV MEMBERS AND CONTACT INFORMATION

First Name	Last Name	Institution	COV Role	Email Address
Sally	Dawson	BNL	Member	sdawson@bnl.gov
Brenna	Flaugher	FNAL	Member	brenna@fnal.gov
Craig	Group	University of Virginia	Member	rcg6p@virginia.edu
Alec	Habig	University of Minnesota, Duluth	Member	ahabig@umn.edu
Steven	Kahn	University of California, Berkeley	Subpanel Chair	stevkahn@berkeley.edu
Young-Kee	Kim	University of Chicago	Chair	ykkim@hep.uchicago.edu
Allison	Lung	JLab	Member	lung@jlab.or
Benjamin	Nachman	LBNL	Member	bpnachman@lbl.gov
Sergei	Nagaitsev	BNL	Subpanel Chair	snagaitsev@bnl.gov
Ritchie	Patterson	Cornell University	Member	jrp3@cornell.edu
Frank	Zimmermann	CERN	Member	frank.zimmermann@cern.ch

APPENDIX III: COV PANEL ASSIGNMENTS

Panel	First Name	Last Name	Institution	Chair/Subpanel Chair/Panelist
	Young-Kee	Kim	University of Chicago	COV Chair
Projects	Steven	Kahn	University of California, Berkeley	Projects Subpanel Chair
Projects	Alec	Habig	University of Minnesota, Duluth	Projects Panelist
Projects	Allison	Lung	JLab	Projects Panelist
Projects	Ritchie	Patterson	Cornell University	Projects Panelist
Projects	Frank	Zimmermann	CERN	Projects Panelist
Operations	Sergei	Nagaitsev	BNL	Operations Subpanel Chair
Operations	Sally	Dawson	BNL	Operations Panelist
Operations	Brenna	Flaugher	FNAL	Operations Panelist
Operations	Craig	Group	University of Virginia	Operations Panelist
Operations	Benjamin	Nachman	LBNL	Operations Panelist

APPENDIX IV: AGENDAS OF COV MEETINGS

Agenda of the COV In-Person Meeting on March 11-13

AGENDA
Committee of Visitors Review of the Office of High Energy Physics - Facilities
March 11-13, 2024, DOE Germantown Complex

Monday, March 11, 2024			
Time	**Activity**	**Participants/Lead**	**Location**
8:00 – 9:00 am	COV Executive Session	Young-Kee Kim	E-301
9:00 – 9:50 am	Introduction: • Facility Division Mission, Team Members, Projects & Operations in period 2016-2023 • HEP staffing	Mike Procario	E-301
9:50 am – 10:40 am	Oversight mechanism at DOE/HEP: • IPT participation; monthly reports; monthly meetings with Director; PMG attendance; Watchlist; Briefings to SC	Simona Rolli	E-301
10:40 am- 11:10 am	Refreshment Break (coffee/snacks/drinks)		G-426
11:10 am – 11:30 am	Implementation of 2016 COV Recommendations	Mike Procario	E-301
11:30 am – 11:50 am	Implementation of 2014 P5 Recommendations	Mike Procario	E-301
12:00 pm - 1:00 pm	Working Lunch		G-426
1:00 pm – 2:30 pm	Project Panel – E-301 • PIP II – CD-3 • Mu2e – CD-3 • HL-LHC Accelerator Upgrade Project (AUP) - CD-3 DOE OHEP Personnel: Ted Lavine, Athans Hatzikoutelis	Operations Panel (include Project-to-Ops Transition) – G-207 Fermilab Operations: • Accelerator Facilities including AIPs, GPPs • Detector Operations DOE OHEP Personnel: John Kogut	
2:30 pm - 3:00 pm	Refreshment Break (coffee/snacks/drinks)		G-426
3:00pm – 4:30 pm	Project Panel – E-301 • LBNF/DUNE – CD-1RR with two subjects at CD-3 • HL-LHC ATLAS – CD-3 • HL-LHC CMS – CD-3c DOE OHEP Personnel: Simona Rolli, Joe Diehl, Athans Hatzikoutelis	Operations Panel (include Project-to-Ops Transition) – G-207 • US ATLAS Operations • US CMS Operations DOE OHEP Personnel: Abid Patwa	
4:30 pm – 6:00 pm	Executive Session • Collect panel questions and give them to DOE OHEP Facilities Division • Report Writing	HEP Staff and COV Members	E-301
6:30 pm – 8:30pm	Working Dinner – Mi Rancho	COV Members	

Tuesday, March 12, 2024			
Time	**Activity**	**Participants/Lead**	**Location**
8:00 – 9:00 am	COV Executive Session	Young-Kee Kim	E-301
9:00 am – 10:30 am	Q/A with DOE OHEP	HEP Staff and COV Members	E-301
10:30 am- 11:00 am	Refreshment Break (coffee/snacks/drinks)		G-426
11:00 am – 12:30 pm	Project Panel – E-301 • CMB S4 – CD-0 • ACORN – CD-0 • LUSee-Night – PD-3 DOE OHEP Personnel: Kathy Turner, John Kogut, Ted Lavine	Operations Panel (include Project-to-Ops Transition) – G-207 • FNAL Computer Facilities: • FACET II • SURF DOE OHEP Personnel: Eric Feng, Clayton Hollowell, John Kogut	
12:30 pm – 1:30 pm	Working Lunch		G-426
1:30 pm – 3:00 pm	Project Panel – E-301 Short Presentation on Completed Projects – emphasis on: • [BELLE II (2016) • DESI (2020) • FACET II (2021) • LSSTcam (2021) • LZ (2020) • Muon g-2 (2018) • ATLAS/CMS Upgrade (2019) • SuperCDMS (2023) DOE OHEP Personnel: Ted Lavine, Simona Rolli	Operations Panel (include Project-to-Ops Transition) – G-207 • LSSTcam • DESI • Rubin Observatory • LZ • SuperCDMS DOE OHEP Personnel: Kathy Turner	
3:00 pm – 3:30 pm	Refreshment Break (coffee/snacks/drinks)		G-426
3:30 pm – 4:30 pm	Meeting with DOE OHEP staff	HEP Staff and COV Members	E-301
4:30 pm – 6:30 pm	Executive Session • Collect panel questions and give them to DOE OHEP Facilities Division • Report Writing		E-301
6:30 pm – 8:30 pm	Working Dinner – India Palace	COV Members	

Wednesday, March 13, 2024			
Time	**Activity**	**Participants/Lead**	**Location**
8:00 – 9:30 am	Q/A with DOE OHEP	HEP Staff and COV Members	E-301
9:30 am – 10:30 am	Executive Session: Finalize Recommendations	COV Members	E-301
10:30 am- 11:00 am	Refreshment Break (coffee/snacks/drinks)		G-426
11:00 am – 12:00 noon	Executive Session: Report Writing	COV members	E-301
12:00 pm – 1:00 pm	Working Lunch		G-426
1:00 pm – 2:00 pm	Executive Session: Produce Draft Report	COV Members	E-301
2:00 pm – 3:00 pm	Executive Session – Close-out	HEP Staff and COV Members	E-301
3:00 pm	Adjourn		

Agenda of the COV Virtual Meeting on Feb. 5

Time (ET)	Topic	Presenter(s)
4:30 pm – 5:00 pm	Charge to the COV	Sally Seidel Michael Procario
5:00 pm – 5:30 pm	Projects to be evaluated	Michael Procario
5:30 pm – 6:30 pm	DOE Order 413.3B – Program and Project Management for the Acquisition of Capital Assets	Joe Diehl

Agenda of the COV Virtual Meeting on April 10 (Executive Session)

Time (ET)	Topic
10:00 am – 11:00 am	Discussion of the COV's Findings, Comments, and Recommendations

Agenda of the COV Virtual Meeting on June 18

Time (ET)	Topic	Presenter(s)
10:00 am – 11:00 am	Fermilab Operations	John Kogut Michael Procario
11:00 am – 12:00 pm	COV Executive Session	

APPENDIX V: LIST OF 2024 COV RECOMMENDATIONS

Recommendation 1: Establish a mechanism in consultation with HEPAP to advise HEP when a programmatic choice must be made that significantly deviates from the P5 plan or when the context for that choice has evolved significantly from P5 expectations.

Recommendation 2: Strengthen coordination between the Facilities Division and the Research & Technology Division and factor in research and operations support when making decisions about proceeding with projects.

Recommendation 3: Seek detailees or part-time consultants with specific expertise in needed areas.

Recommendation 4: Regularly solicit demographic information from the external entities including HEP project and facilities operations teams and project leaders at national laboratories and universities, and encourage project/operations leaders to employ transparent mechanisms in allocating project/operations tasks to groups at national labs and universities.

Recommendation 5: Create a code of conduct for the Office of High Energy Physics.

Recommendation 6: Investigate the possibility of establishing a "directed R&D" line to retire major technical and programmatic risks for proto-projects prior to CD-0 approval.

Recommendation 7: Where possible, maintain multiple sources of contracts for large projects until one particular vendor has demonstrated the capability and commitment to deliver successfully. Large contracts with industrial contractors require extra attention and should be subject to a higher level of scrutiny by Facilities Division personnel. Contracts should explicitly identify key personnel and details of the fabrication that are crucial to vendor success.

Recommendation 8: Negotiate with the host lab leadership of small projects to ensure that they will have the resources they need to successfully execute the projects.

Recommendation 9: Make delegation oversight to a national laboratory be at the discretion of the HEP Associate Director based on demonstrated commitment and capabilities of the laboratory.

Recommendation 10: In cases of interagency partnerships, negotiate and document detailed arrangements between the agencies before a project gets advanced to CD-0.

Recommendation 11: Develop a mechanism, in collaboration with the experiments, the national labs, and international partners such as the CERN Open Data Portal, to manage data preservation after operations ends.

Recommendation 12: Continue to work with Fermilab and the site office to find solutions for the site access issues.

Recommendation 13: Share best practices and lessons learned between frontiers for coordinating project, operations and research resources.