U.S. DEPARTMENT OF ENERGY | Office of Science

Welcome to Fermilab

Roger Snyder, Site Office Manager

March 1, 2023

General Information

- Building Awareness

- Protocol for the Day
  - All slides will be posted online
  - This session is intended to provide additional background
  - Informational purposes only
    - Presentations are somewhat interwoven/overlapping for context
    - Not intended to supersede anything in the SOW or RFP or Q&As
  - In general, no live Q&A in these sessions
  - Breaks are planned, if on schedule
  - Please leave the site promptly upon completion of the meeting (no other onsite business)

Disclaimer

By signing into this meeting, you consent the right of the U.S. Department of Energy to take sound, photographic, and film recordings of you while you are on-site, for internal use only. In addition, you are entering an operating research site with associated mechanical, electrical, chemical, and radiation exposure hazards inside and outside of the facilities. Areas with higher hazards are generally posted. For your safety, please stay within the authorized areas and observe all signs and postings.

Tour will involve stairs, attention to tripping and other hazards, as well as close proximity to operating hardware and controls.

Information Meeting Agenda

8:00	8:05	Welcome	Roger Snyder	Site Office Manager
8:05	8:25	Welcome/Missions of Fermilab	Dr. Harriet Kung	Deputy Director for Science Programs
8:25	8:40	Welcome/Objectives	Juston Fontaine	Deputy Director for Operations
8:40	8:50	Break (if on schedule)		
8:50	9:30	DOE and FNAL Overview	Roger Snyder	Site Office Manager
9:30	10:15	Major Projects/Status	Adam Bihary	LBNF/DUNE-US Federal Project Director
10:15	10:25	Break (if on schedule)		
10:25	10:50	Major Challenges/Risks (DOE perspective)	Whitney Begner	Deputy Site Office Manager
10:50	11:10	Procurement Process	Tonja Stokes	Source Evaluation Board Lead
11:10	11:20	Overview of Afternoon Tour	Whitney Begner	Deputy Site Office Manager
11:20	11:30	Break (if on schedule)		
11:30	1:00	Tour - bus departs at 11:30; Depart site 1:00p		DOE Staff

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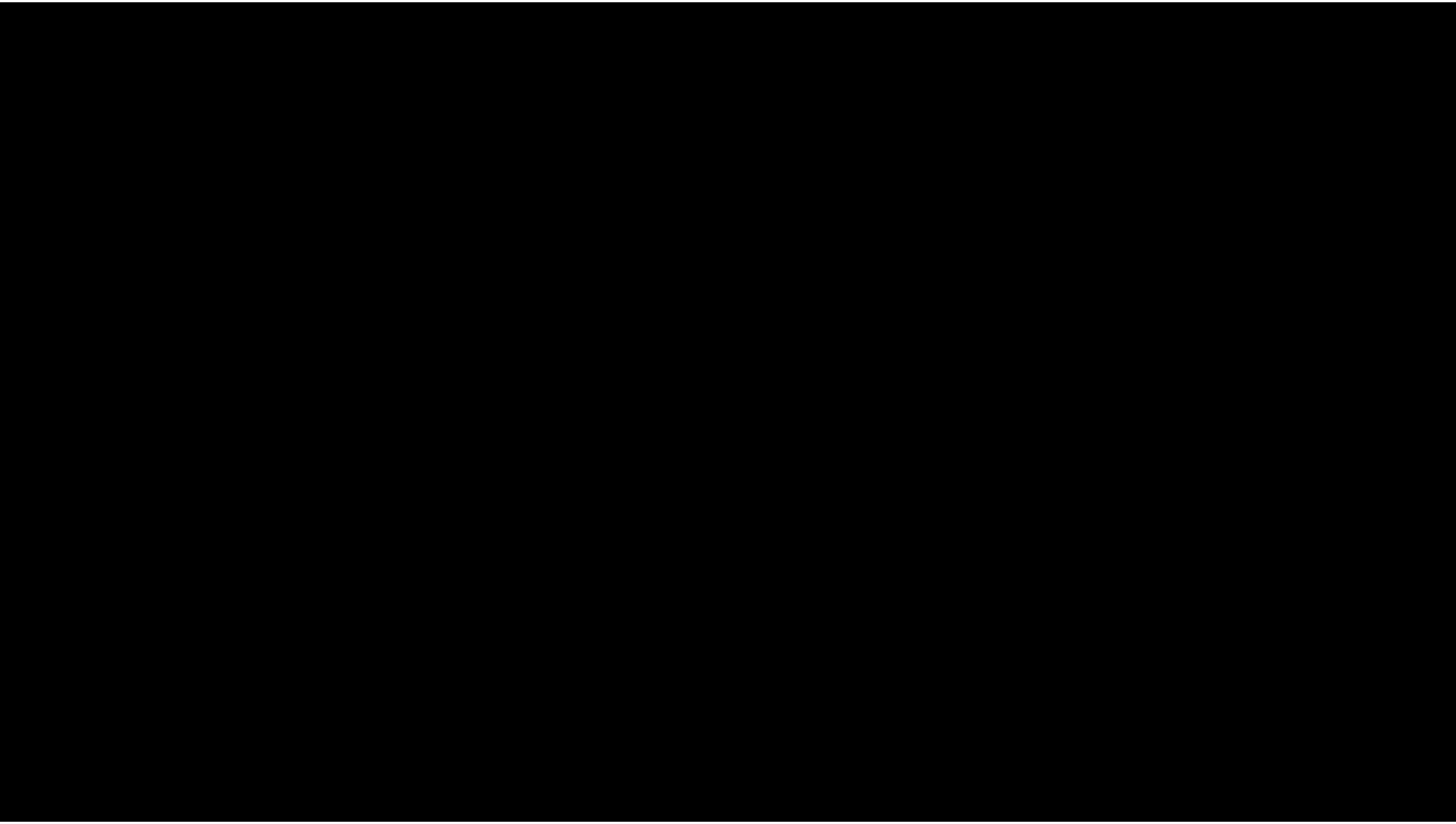
Welcome and Missions of Fermilab

Dr. Harriet Kung, Deputy Director for Science Programs

March 1, 2023

Missions of Fermilab



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Welcome and Objectives

Juston Fontaine, Deputy Director for Operations

March 1, 2023

BREAK

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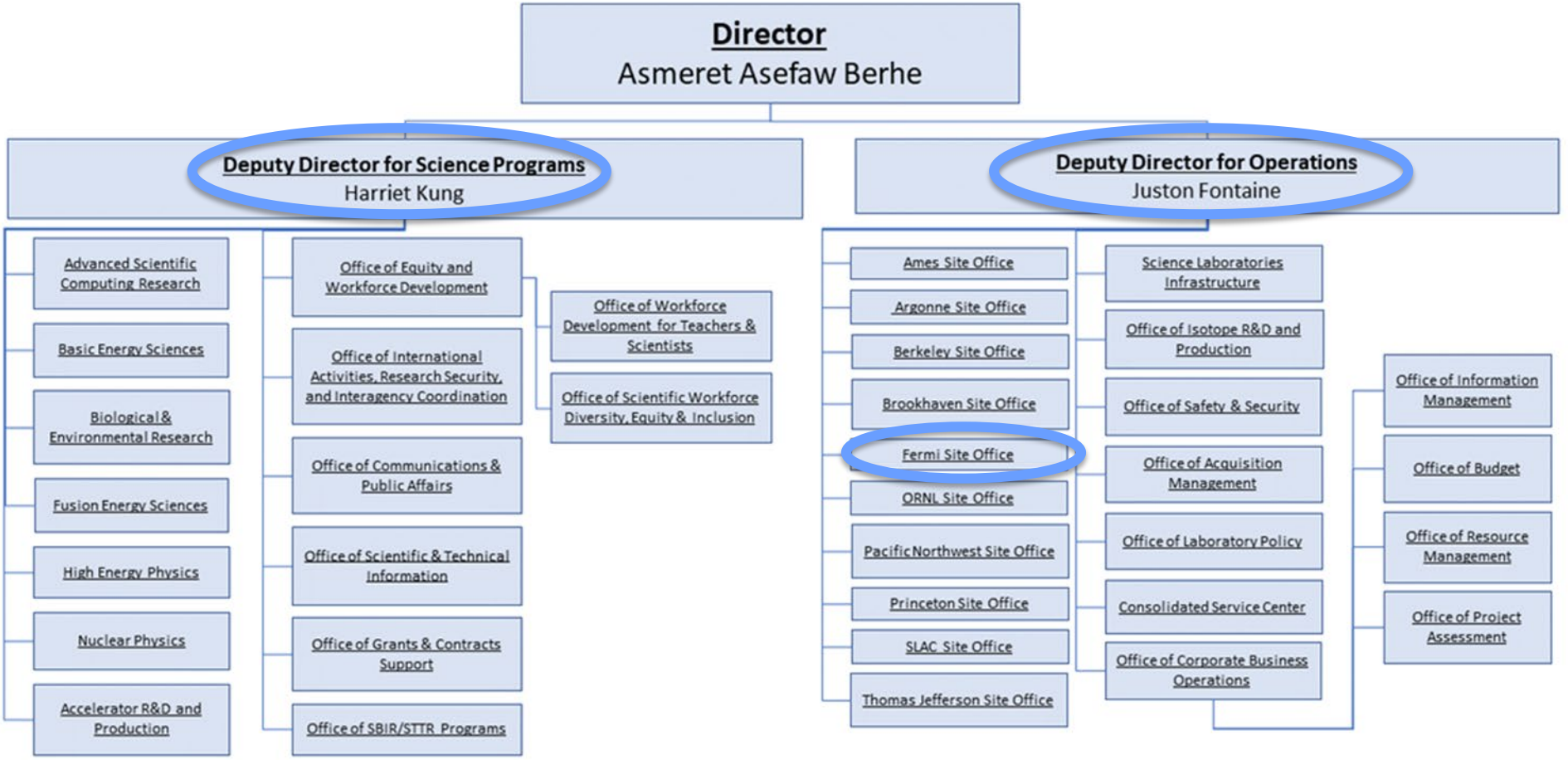
DOE/Fermilab Overview

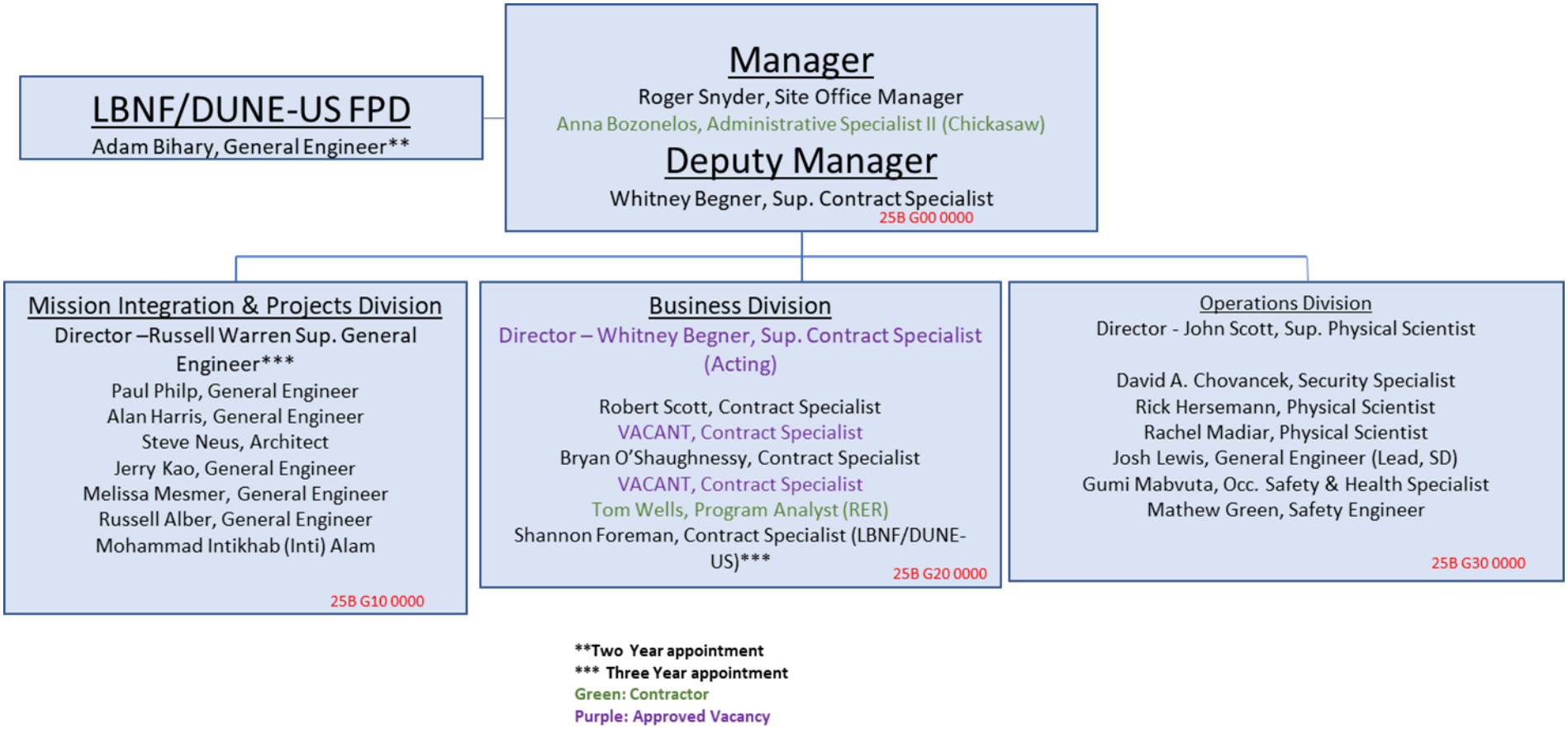
Roger Snyder, Site Office Manager

March 1, 2023

Office of Science



Fermi Site Office



**Two Year appointment
*** Three Year appointment
Green: Contractor
Purple: Approved Vacancy

Current Prime Contract

Type:	Cost Reimbursable with fee and award term incentive Management and Operating (M&O) as an FFRDC
Current Operator:	Fermilab Research Alliance, LLC (FRA)
Available Fee:	~$5M/yr All fee at risk Evaluated per SC standard PEMP process
Award Term:	No longer eligible (award term not awarded 3 times- no addl years allowed)
Period of Performance:	11/1/2006 – 12/31/2024
Sponsor/Steward:	Office of Science

Fermilab at a Glance

Our vision is to solve the mysteries of matter, energy, space and time for the benefit of all. We strive to:

- lead the world in neutrino science with particle accelerators
- lead the nation in the development of particle colliders and their use for scientific discovery
- advance particle physics through measurements of the cosmos

Our mission is to drive discovery by:

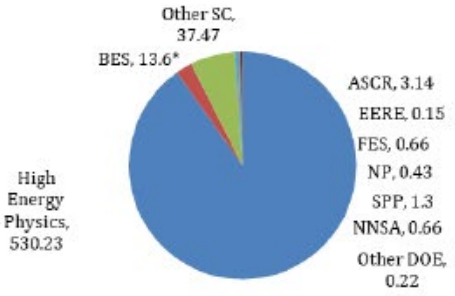
- building and operating world-leading accelerator and detector facilities
- performing pioneering research with national and global partners
- developing new technologies for science that support U.S. industrial competitiveness

Fermi National Accelerator Laboratory is a single program laboratory in Batavia, Illinois, managed by Fermi Research Alliance, LLC, and overseen by DOE's Fermi Site Office

Physical Assets
6,800 acres and 370 buildings
3.501 million GSF in buildings
Replacement Plant Value: $2.66B
28,913 GSF in 10 Excess Facilities
25,005 GSF in Leased Facilities

FY21 Human Capital
1,917 FTEs
30 Joint faculty
114 Postdoctoral Researchers
52 Undergraduate Students
273 Graduate Students
1,681 Facility Users
975 Visiting Scientists

FY21 Costs
Lab Operating Costs: $587.87M
DOE Costs: $586.57M
SPP (Non-DOE/Non-DHS) Costs: $1.3M
SPP as % Total Lab Operating Costs: 0.2%
**BES number reflects funding by SLAC: $1.684M for LCLS-II and $11.673M for LCLS-II HE*

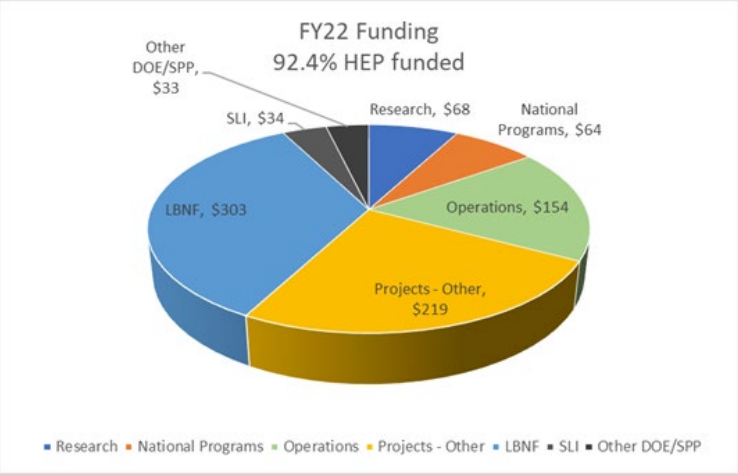


In general, key mission roles.. HEP User facility (beam), other physics, quantum, electronics, accelerator/magnet fabrication (and for others), STEM…

By the Headcounts & Funding* Numbers

	2021	2022	NOTES
Employees	1917	1968	143 openings as of today
Post Docs	114	126	
Undergrad Students	52	66	
Users	1681	2123	forecast is doubling over next decade

Lab population is growing



	2021	2022	NOTES
HEP funding	530	808	includes IRA
Total Funding	588	875	includes IRA

Lab funding is growing (IRA shifted curve)

Greater diversification believed to be possible

*Note: cost incurred is always lower than funding levels

The Fermilab research community

- More than 4,000 scientists in 55 countries use Fermilab and its particle accelerators, detectors and computers for their research
- Includes more than 2,200 scientists from 175 U.S. universities and labs in 41 states
- Fermilab is attracting and training the next generation of a diverse HEP scientific workforce: 114 postdocs, 273 graduate students, 52 undergraduate interns
- Fermilab scientists also work at CERN, Sanford Underground Research Facility, SNOLAB, Cerro Tololo Inter-American Observatory, South Pole Telescope, NOvA Ash River Laboratory, Matter-wave Atomic Gradiometer Interferometric Sensor

Fermilab research is both domestic and international
Fermilab is more like CERN than other National Labs
Strategic partnership between Fermilab/HEP and CERN
These numbers are dynamic and are expected to increase

Fermilab – User Facility

Fermilab Accelerator Complex

User Facility:

- Accelerator operations currently 120GeV protons at ~900kW (1.2MW) with a goal of 2.4MW to enable LBNF DUNE.
- Class 3B and 4 lasers for research and beam diagnostics

Accelerator Operations:

- One Safety Analysis Document (SAD), multiple chapters
- One Accelerator Safety Envelope (ASE)
- Driven by DOE O420.2C, Safety of Accelerator Facilities
  - New DOE O 420.2D updated order not yet implemented

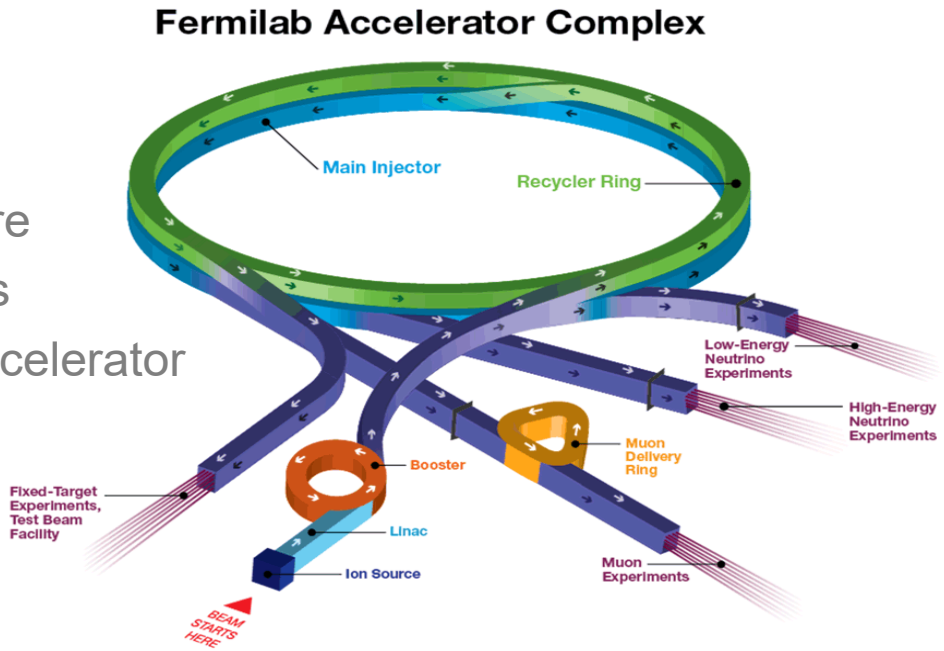
Fermilab – Everything Else (that isn't a user facility)

If not generating, using, or receiving beam from the Fermilab Accelerator Complex…

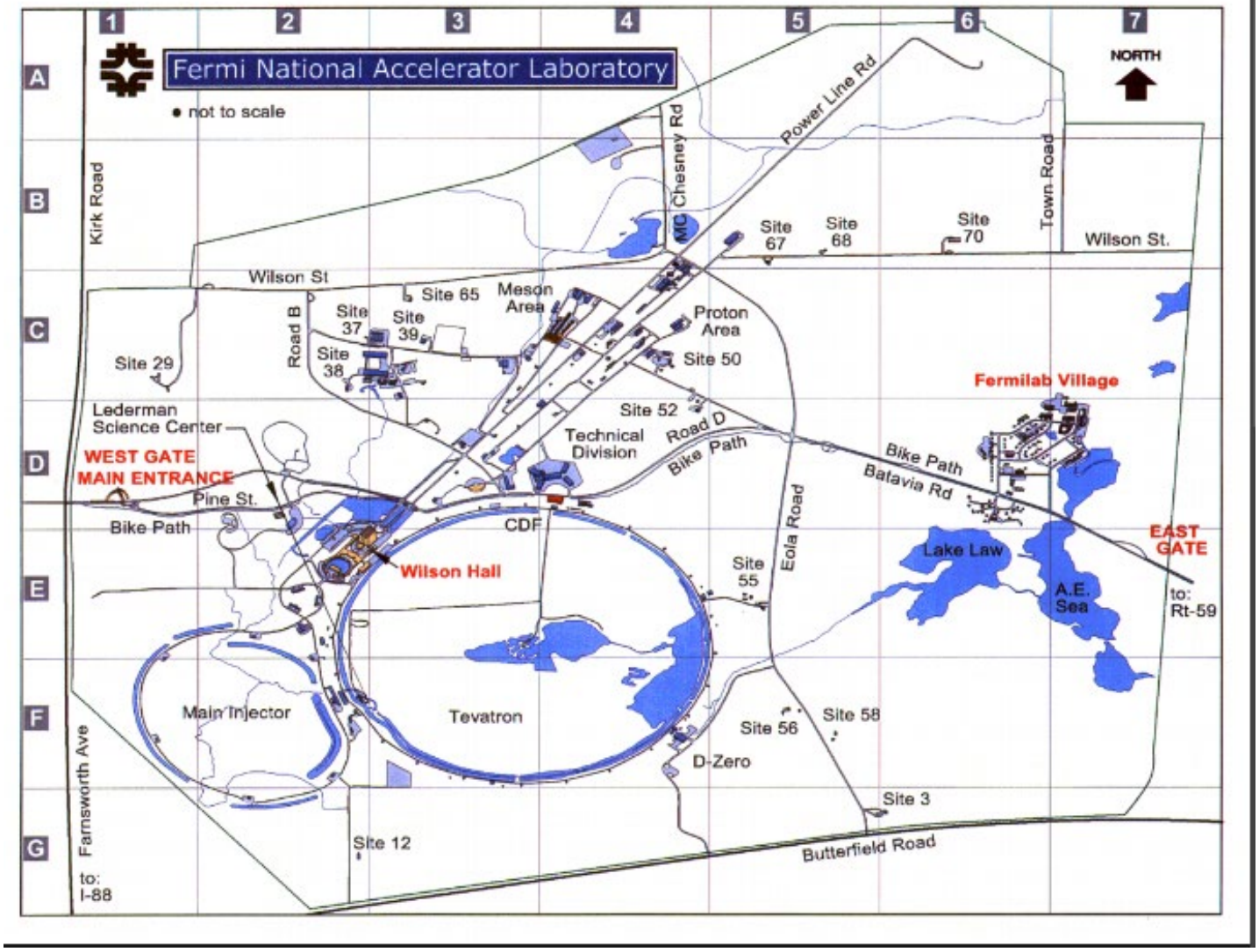
then not part of the User Facility…

Examples:

- Quantum
- Fabrication of accelerator hardware
- Other radiation generating devices
- FAST/IOTA - 150 MeV electron accelerator



Main Campus (Batavia, IL)



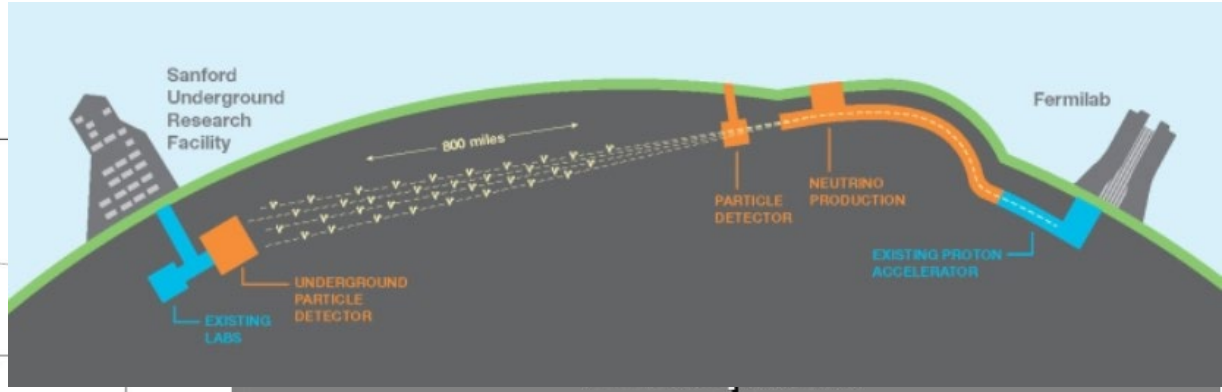
Site History

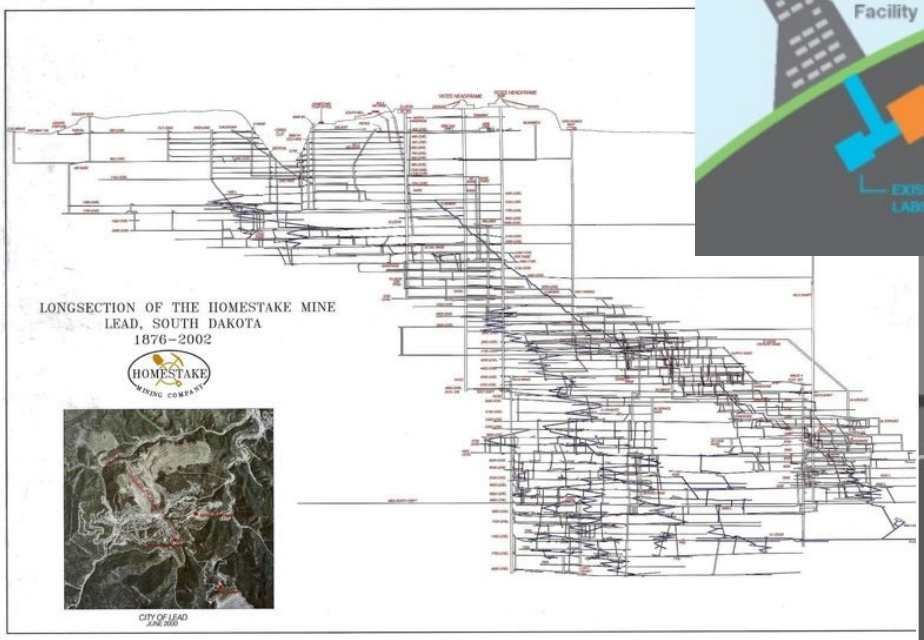
- National Accelerator Lab
- AEC siting competition
- State of IL proposal
- Land transfer to govt
- Federal but not enclave
- Reused/re-sited houses

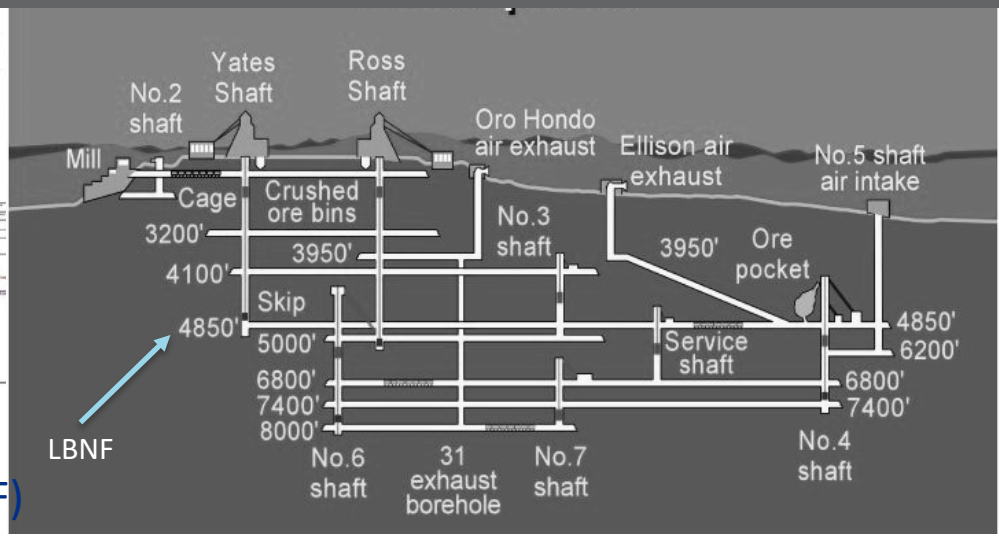
Noted Features

- Wilson Hall
  - Robert Wilson vision
  - Bison
  - Architecture
- Largest U.S Accelerator
- Partially abandoned Tevatron
- Village
  - Housing + Operations
  - Public or worker
- 3 active gates
- Current Public Access
- Licensed Farming
- Industrial Cooling Water sys
- Planned public barriers
- Future LBNF Near Facility
- Future PIP2
- Future badging/visitor facility

Lead, SD







Dates back to 1876 Gold Mine

Sanford Underground Research Facility (SURF)

SURF managed by South Dakota Science and Technology Authority (SDSTA)

SDSTA receives DOE operational support via a separate Coop. Agreement (not via Fermilab)

DOE holds leases for areas to develop and rights of access for project

DOE has invested in upgrades to improve operability for project (mainly Yates shaft)

DOE standards apply, limitations on # underground, active NO2 management, etc

https://www.youtube.com/watch?v=AYtKcZMJ_4c

Operating & Hosting here and in SD

- Operating at Batavia & SD
  - Modernization takes time & leveraging of windows of opportunity
    - Dependent on largely 70's era equipment on campus; even older in SD
    - Shutdowns: Annual Summer; Switchyard shutdown-2025 (2yr); accelerator complex-2027 (2yrs)
  - Prepping for SD operations
    - onsite vs deployable staff,
    - SDSTA interface and coordination
    - limitation on space/movements/capacities/etc

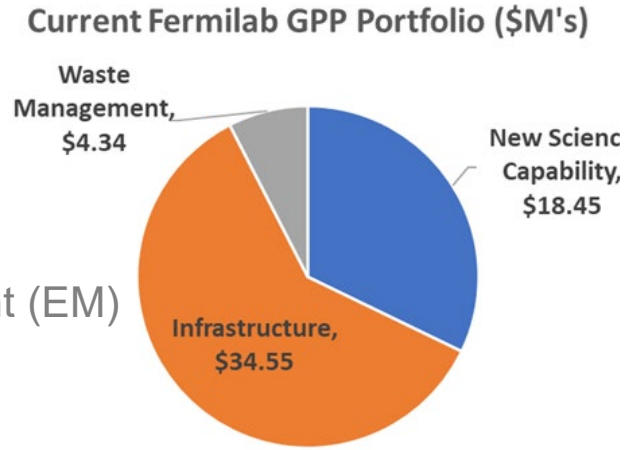
- Hosting at Batavia
  - Bevy of international agreements (local implementation, site protocols, etc.)
  - Domestic and International Users expectations, norms, aged housing
  - Coordination of Construction/Installation for International Contributions

- Hosting at SD
  - Future need – construction phase different than operations
    - Degree of lab support/services/protocols
  - No onsite housing
  - Limited local area accommodation capacity in town of 2900
    - forecast peak of ~200 lab/subs/users

General Plant Projects/Accelerator Improvement Projects

All AIPs/GPP's are direct funded by Programs (no Institutional GPPs)

- Current portfolio (all but 1 completed before 2025) includes
  - Science Laboratories Infrastructure (SLI)
  - High Energy Physics (HEP)
  - Nuclear Physics (NP) and Environmental Management (EM)



Shift in GPP strategy

- Over the past few years, the GPP portfolio focus has shifted towards addressing deferred maintenance and ensuring a capable and more resilient infrastructure

SC is moving toward 2-3 year execution windows

- Recent Fermilab experience has been 3-7 years
- Small projects have in the past not received sufficient attention
- Cost management has been a concern

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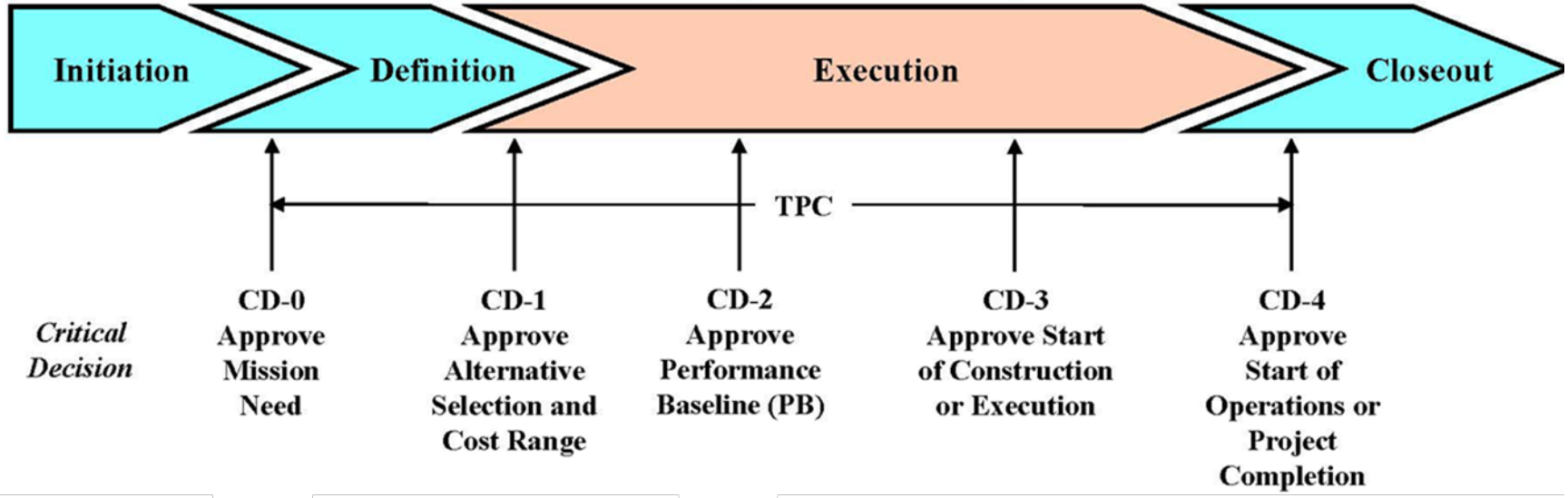
Major Projects & Status

Building the Future of Fermilab

Adam Bihary, Federal Project Director

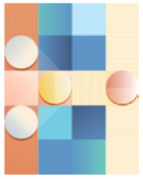
March 1, 2023

“Critical Decision” Definition per DOE Order 413.3b

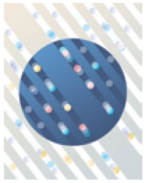


Projects are Primarily Driven by Priorities of the Science Community

- **A subset of the US's High Energy Physics Advisory Panel (HEPAP) conducts decadal prioritization and planning exercise called the Particle Physics Project Prioritization Panel or "P5"**
  - The last report from P5 was issued in 2014 and is commonly referred to as the "P5 Plan"

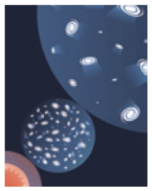


Higgs Boson
- LHC Project Portfolio

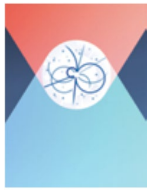


Neutrino Science
- Short-Baseline Program
- LBNF/DUNE
- PIP-II

Dark Matter
- Super-CDMS



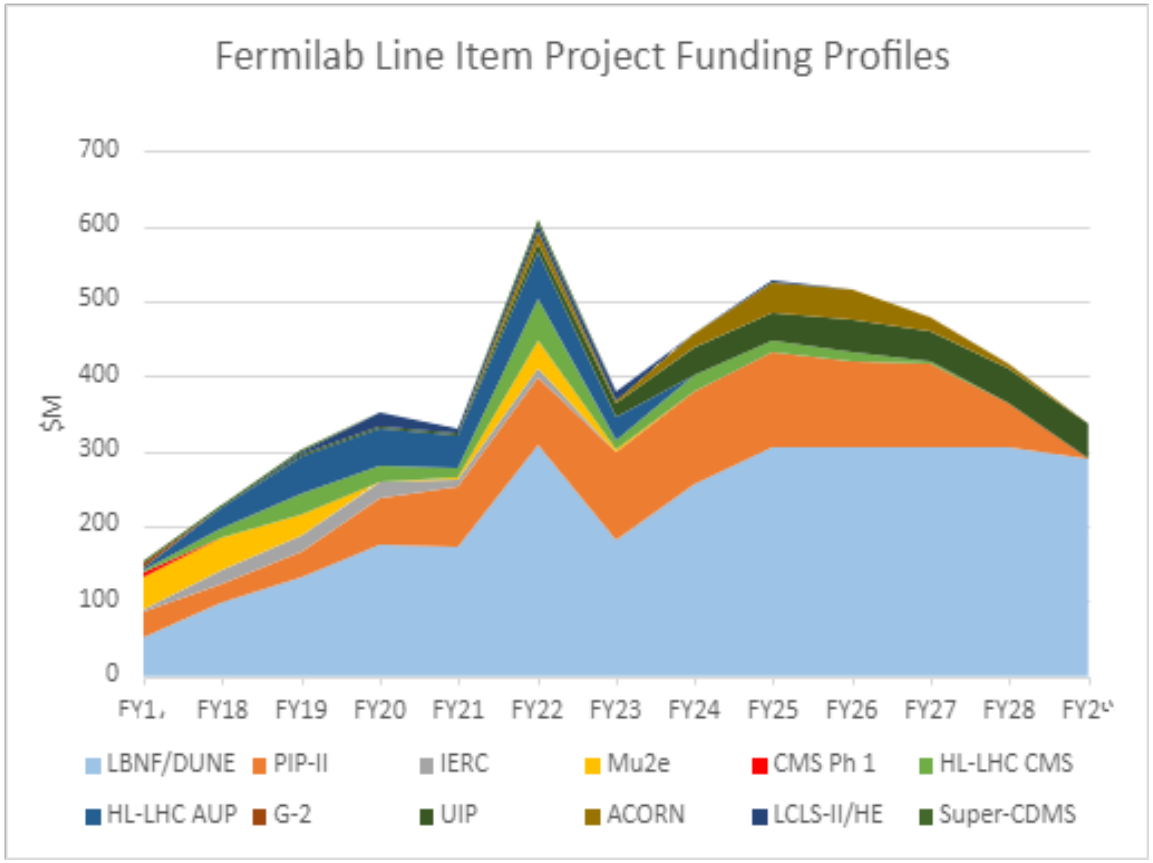
Cosmic Acceleration
- CMB S-4



The Unknown
- LBNF/DUNE
- PIP-II
- LHC Project Portfolio
- Mu2e
- SBN
- MAGIS-100

- **Next P5 process is underway now and the report is expected in summer of 2023**
- **Enabling these scientific objectives requires more reliable and resilient infrastructure and those investments can be seen in the Lab's project portfolio**

Ambitious Project Portfolio



Scale of Project Investment

- Largest in Office Of Science
- Significance when compared to overall Lab budget
- Growth mainly attributable to the support of the 2014 P5 Plan

Inflation Reduction Act Funds

- $260.5M influx in FY22
- Offset known impacts from Covid and other external economic conditions but also allowed some projects to accelerate their schedules
- Majority of the project portfolio is still under a funding-constrained schedule

Evolution of Fermilab Project Management System

- Fermilab invested significant effort in past several years to improve policies, processes and tools to support projects driven by the larger projects
- Challenges given the diversity of the project portfolio and the need for all projects (large or small) to follow disciplined principles and be successfully executed

Earned Value Management System (EVMS)

- A critical component of the overall Fermilab Project Management System
- Certification of the Fermilab EVMS is required by DOE Order 413.3b
- Last certified on 12/8/2021

DOE Line-Item Projects

(expected to be active after FY24)

Utilities Infrastructure Project (UIP)
TPC: $150M - $314M

PROGRAM, MISSION, SCOPE, ACQUISITION STRATEGY

Location: Fermi National Accelerator Laboratory

MISSION NEED

FNAL's utilities infrastructure is aging, obsolete, and severely deteriorated. This results in decreased reliability, safety, availability, and operational efficiency of the Lab's world-class facilities. This has led to the Lab's maintenance program being more reactive than preventative, with an unsustainable amount of resources being used to respond to outages.

PROJECT SCOPE

Recapitalization of Fermilab's utility infrastructure:

- **Subproject 1**: New Chilled Water Plant and Central Utility Building Upgrades
- **Subproject 2**: Kautz Road Substation Replacement
- **Subproject 3:** Linear Utilities Replacement

ACQUISITION STRATEGY

Project will be executed in three subprojects with their own distinct CD-2 through CD-4.

STATUS & ACTIONS

PROJECT STATUS

CD-0 was approved in 2019. Conceptual design is complete and preparing for CD-1 approval.

CURRENT CHALLENGES/ISSUES/RISKS

Project intends to align execution with the planned long-shutdown of the Fermi Accelerator Complex in FY27, 28, 29. This will be challenging if long-term funding remains uncertain.

UIP's TOP TAKE-AWAYS

UIP Addresses Critical Infrastructure Needs

UIP will take steps to address antiquated facilities and deferred maintenance. The improvements planned by UIP will support multiple SC Program Offices and the UIP's Sanitary System scope is necessary to stop overflows that are impacting two neighboring municipalities.

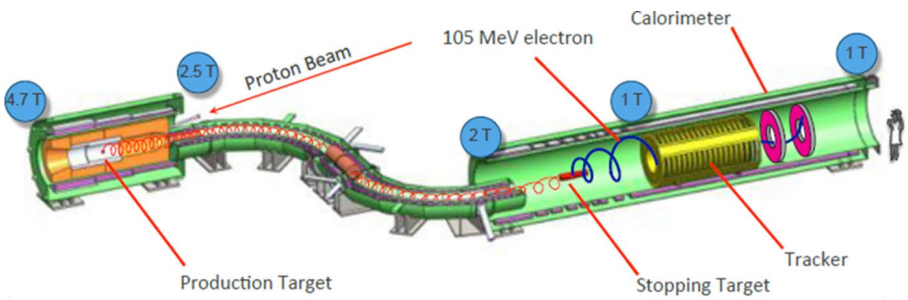
Executing Within Constrained Funding

UIP must align with external scheduling constraints and develop an execution plan within available annual funding.

PLANNED CD's (FY Dates)

	CD-3a	CD-2	CD-3	CD-4
Subproject 1	3rd QFY24	1st QFY25	1st QFY26	1st QFY30
Subproject 2	2nd QFY25	3rd QFY26		2nd QFY31
Subproject 3		1st QFY29		3rd QFY31

Muon to Electron Conversion (Mu2e)
TPC: $315.7M



STATUS & ACTIONS

PROJECT STATUS
The re-baseline was approved on December 21, 2022. Project is in the process of resetting the baseline and new EVMS reporting.

CURRENT CHALLENGES/ISSUES/RISKS
1. Maintaining schedule on the superconducting solenoid fabrication.

PLANNED CD's (FY Date)
CD-4
2QFY28

PROGRAM, MISSION, SCOPE, ACQUISITION STRATEGY

Location: Fermi National Accelerator Laboratory

MISSION NEED
The conversion of a muon to an electron in the field of a nucleus provides potential new physics discoveries and allows access to new physics at very high mass scales. The Particle Physics Project Prioritization Panel (P5) identified this opportunity as a top priority, but no capacity currently exists to exploit such a measurement.

PROJECT SCOPE
The scope of the Mu2e Project is to design, construct and install the Mu2e detector, beam line and accelerator modifications to meet the scientific and technical objectives necessary for the Mu2e experiment.

ACQUISITION STRATEGY
Fabrication of components/subsystems is being done at Fermilab, at vendor facilities, and at Mu2e collaborating institutions.

Mu2e's TOP TAKE-AWAYS

Progress is Being Made on Technically Challenging Vendor Scope
The superconducting solenoid vendor for the Production and Detector Solenoids got behind schedule due to troubles with the coil winding machine. DS coils are being fabricated, and PS cold mass is being assembled.

Contingency and Float Are Being Monitored and Managed Closely
Project was re-baselined on December 21, 2022. Due to re-baseline, there is higher scrutiny on performance and contingency.

Proton Improvement Plan- II (PIP-II)
TPC: $978M

STATUS & ACTIONS

PROJECT STATUS

Project received CD-2 approval on December 16, 2020, CD-3a approval on March 16, 2021, and CD-3 approval on April 18, 2022. As of Dec 2022, the project is 31% complete with 28% cost contingency to go and 49 months of schedule contingency.

CURRENT CHALLENGES/ISSUES/RISKS

- Maintaining schedule alignment with international partners.
- Market and economic uncertainties with procurements

PROGRAM, MISSION, SCOPE & ACQUISITION STRATEGY

Location: Fermi National Accelerator Laboratory

MISSION NEED

Based on P-5, PIP-II enables the world's most intense beam of neutrinos to the DUNE experiment, and a broad physics research program, powering new discoveries for decades to come.

PROJECT SCOPE

PIP-II will double the energy of the accelerator complex's frontend to enable a 1.2 MW proton beam to DUNE. It is also designed to be a flexible platform for future science by being upgradeable for: multi-MW beams, customizable beam operations, and high-power beam to multiple users simultaneously. Scope includes a new linac with supporting conventional facilities, connection to the existing Booster, and upgrades to various portions of the accelerator complex to allow higher intensity beam operations.

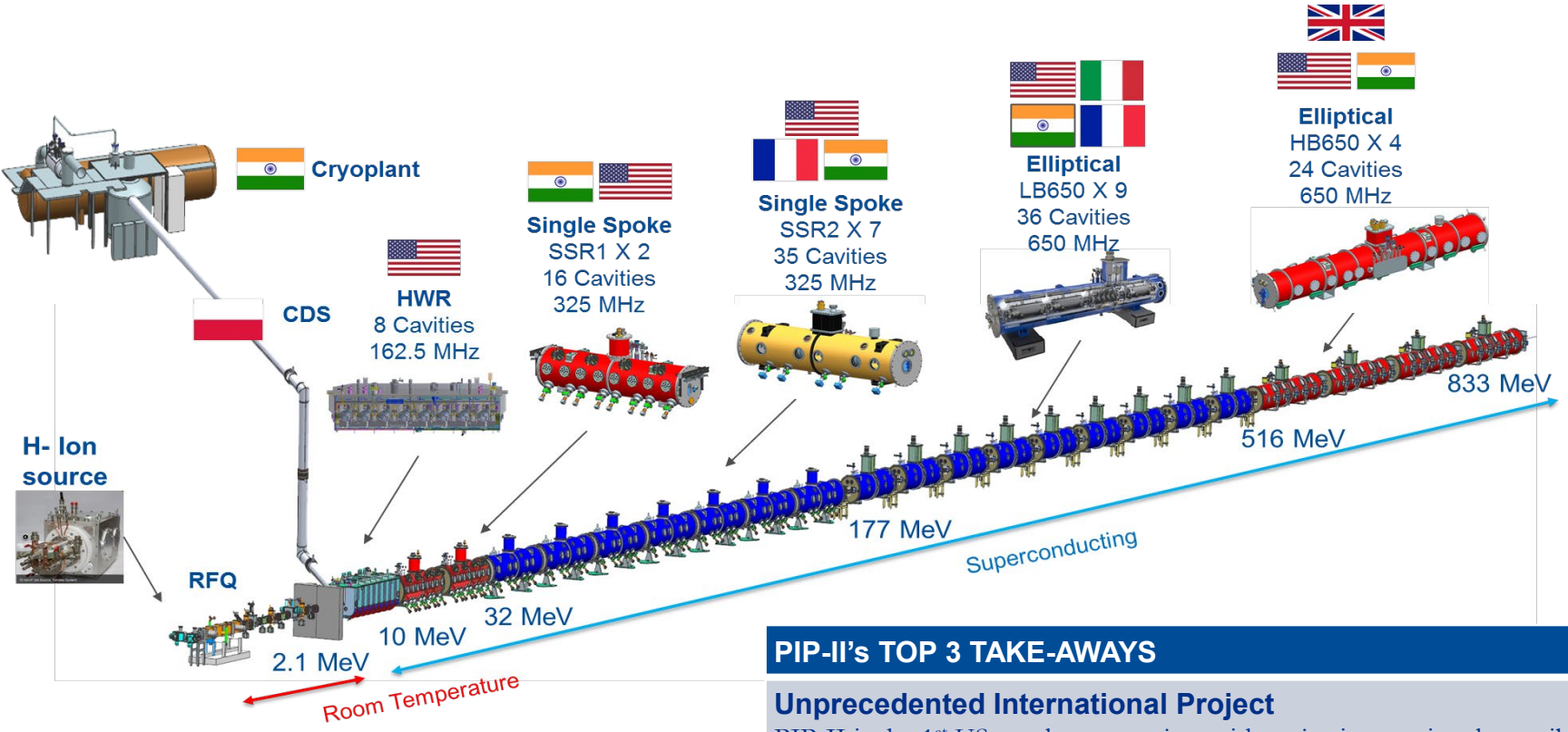
ACQUISITION STRATEGY

DOE project with significant in-kind contribution of labor and hardware from international partners. Subcontracts used to deliver conventional facilities and procure technical components that are integrated, installed and commissioned by Lab labor.

PLANNED CD's (Early Dates in FY)
CD-4
1QFY29

PIP-II Contd.
TPC: $978M

First U.S. accelerator with significant in-kind contributions from international partners. These partnerships are based upon common interests in science and technology.



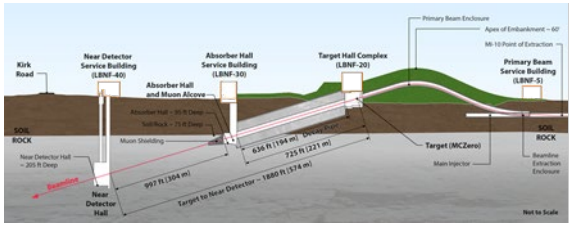
PIP-II's TOP 3 TAKE-AWAYS

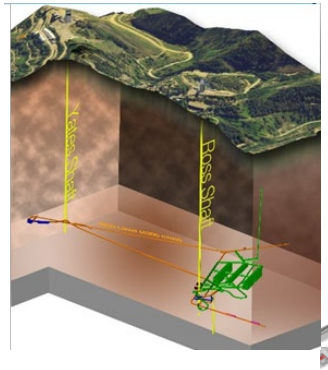
Unprecedented International Project
PIP-II is the 1st US accelerator project with major international contributions. The technically complex scope and a new delivery method poses planning challenges to both the Lab and DOE. Both are adapting and learning in this new paradigm.

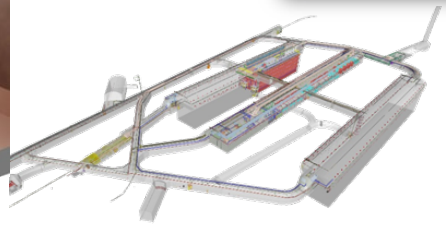
Project has experienced supply chain related delays
Technical progress continues, but supply chain delays have affected the civil construction schedule and partner deliverables.

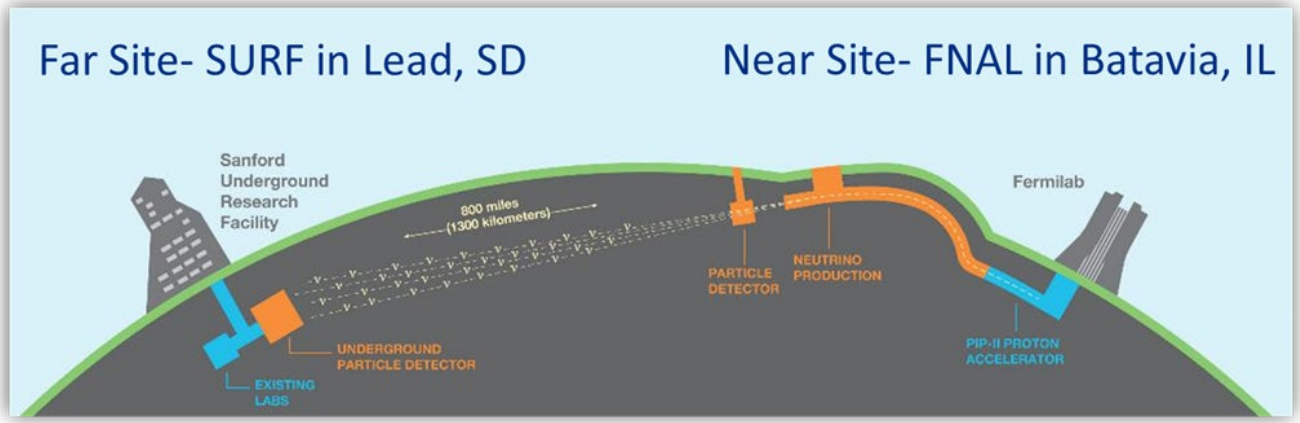
Project has begun start of Full Construction
Project is entering a work heavy phase of the project. Maintaining schedule is a top priority for the project.

Long-Baseline Neutrino Facility/ Deep Underground Neutrino Experiment (LBNF/DUNE) TPC Point Estimate: $3,277M









STATUS & ACTIONS

PROJECT STATUS

FSCF-EXC & BSI: EXC is post CD-3 and BSI is preparing for CD-2/3 approval.
NSCF+B: Preparing for CD-3a approval
FDC: CD-3a approved and preparing for CD-2/3 reviews
ND: Defining plan for objective scope

CURRENT CHALLENGES/ISSUES: Executing the new subproject model. Maintaining alignment with international partners. Managing economic and market risks. Access and dependencies with a 100+ year old former mine. Preparing to host an international effort at a remote site.

PROGRAM, MISSION, SCOPE & ACQUISITION STRATEGY

Location: FNAL & Sanford Underground Research Facility (SURF)

MISSION NEED: **Origin of matter**- Are neutrinos the reason the universe is made of matter? **Neutron Star and Black hole formation**-Use neutrinos to study the formation of neutron stars and black holes in real time. **Unification of forces-** Move closer to realizing Einstein's dream. Highest Priority in timeframe per P5.

PROJECT SCOPE

FSCF-EXC: excavation of far site caverns and ancillary spaces
FSCF-BSI: outfitting and utilities to support far detectors
FDC: 2 x 10 kton Far Detector Modules and supporting cryogenic systems
NSCF+B: 1.2 MW upgradeable beam, and all facilities to support beamline and near detector
ND: Near Detector and supporting cryogenic systems

ACQUISITION STRATEGY

DOE project with significant in-kind contribution from international partners. Construction Management approaches utilized for conventional facilities. Subproject execution model being used due to varying maturity across the project.

LBNF/DUNE Contd.
TPC: $3,277M

LBNF/DUNE's TOP 3 TAKE-AWAYS

"The LBNF/DUNE project will be the first internationally conceived, constructed, and operated mega-science project hosted by the Department of Energy in the United States" - DOE SC-2

DOE Recently "Reaffirmed" the Project

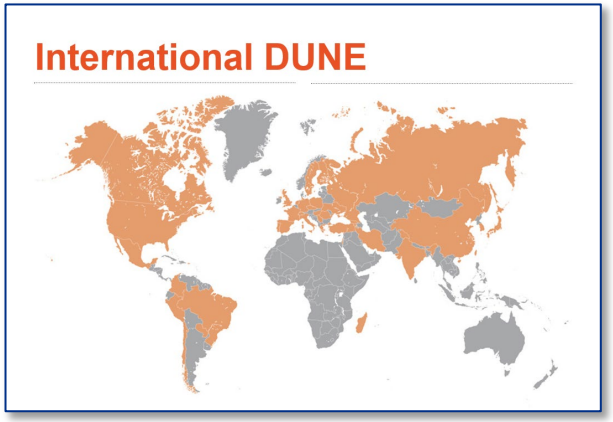
In Feb 2023, the Undersecretary for Science & Innovation approved the CD-1 Reaffirmation which reaffirmed the scope, established a new cost range, and approved the overall subproject execution strategy. The approved DOE Cost Range went from $1.26B → $1.86B to the current range of $3.16B → $3.677B.

Management Complexity

LBNF/DUNE has many complexities and challenges (international partnerships, multiple sites, interface with SDSTA/SURF, interface to international collaboration, etc.) that continue to pose challenges and opportunities which require effective communication and alignment with key stakeholders and leadership.

PLANNED CD's (FY Early Dates)

	CD-3a	CD-2	CD-3	CD-4
FSCF-EXC (CD-2/3)	-	-	-	2QFY25
FSCF-BSI (CD-1)	n/a	2QFY23		2QFY26
FDC (CD-3a)	-	2QFY24		3QFY30
NSCF+B (CD-1)	2QFY23	3QFY24		4QFY31
ND (CD-1)	n/a	FY24/FY25		1QFY32

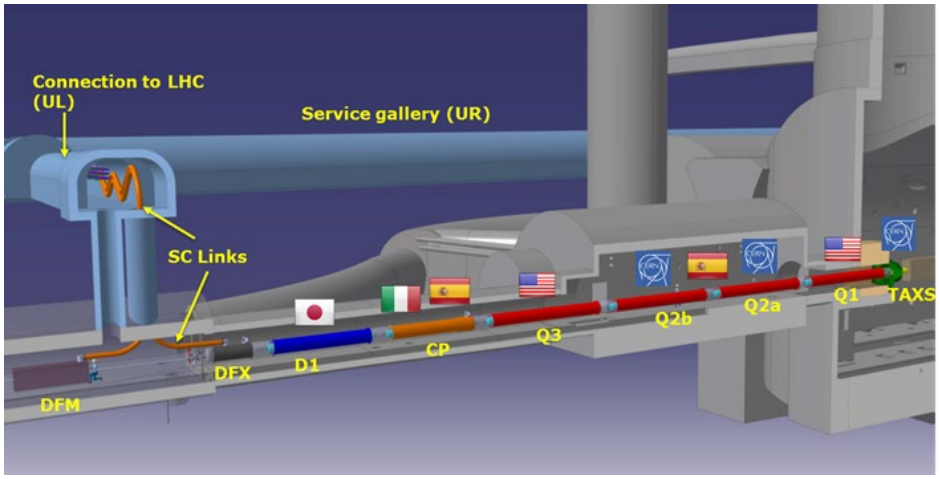


DUNE Collaboration statistics

- >1,400 collaborators, 48% U.S./52% non-US
- 217 institutions from 37 countries including CERN

Major Items of Equipment (MIE) Projects

High Luminosity Large Hadron Collider Accelerator Upgrade Project (HL-LHC AUP) TPC: $242.72M (re-baseline anticipated)



STATUS & ACTIONS

PROJECT STATUS

Project received CD-3 approval on December 21, 2020. As of Dec 2022, the project is 69.3%.

CURRENT CHALLENGES/ISSUES/RISKS

1. Project was baselined before COVID. Project has experienced significant cost/schedule impacts due to COVID. Re-baseline ESAAB is pending. Would revise TPC and completion date.
2. The project will be testing their first production cryoassembly and dressed crab cavity in 2023. Successful tests will be needed to maintain schedule.

PLANNED CD's (Early Dates in FY)
CD-4
1QFY27

PROGRAM, MISSION, SCOPE, ACQUISITION STRATEGY

Location: CERN

MISSION NEED

Profound new discoveries that will change the way the world is viewed are anticipated from the LHC. These potential discoveries are looked for in the very high energy collisions of the LHC in order to probe fundamental particles and their interactions at extreme conditions. The increase from an instantaneous luminosity to an ultimate value of 7.5 x 1034 cm-2 s-1 in 2026 is the capability gap.

PROJECT SCOPE

Design, construct, and deliver to CERN inner triplet focusing quadrupoles (Q1/Q3 cryoassemblies) and dressed SRF Crab Cavities to meet the necessary scientific and technical objectives.

ACQUISITION STRATEGY

Majority of project is being completed with labor from FNAL, BNL, and LBNL. There are no remaining large procurements for DOE review.

HL-LHC AUP's TOP 3 TAKE-AWAYS

Technology Developed in the US

US is contributing technology developed in the US where Fermilab holds specific expertise.

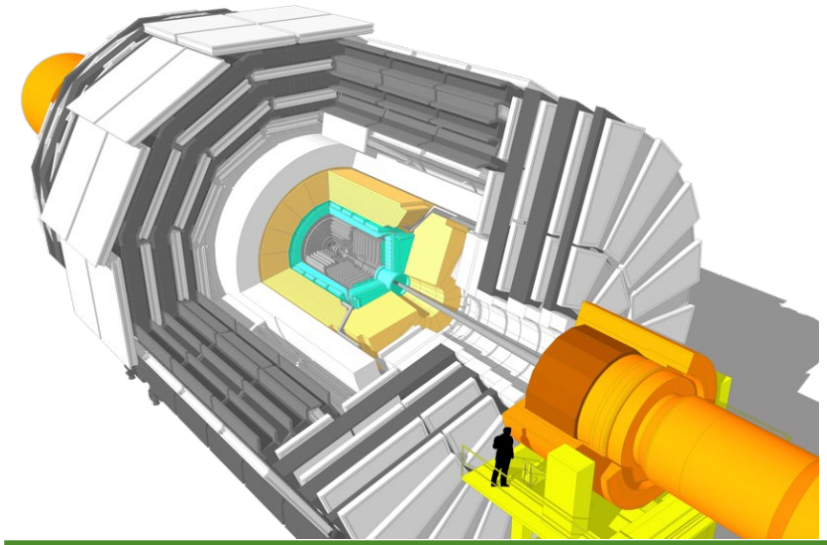
Magnet testing has recently been successful

The project has successfully tested 6 out 8 magnets, which is near baseline yield. Source of failed magnets has been identified. Magnet completion represents majority of project scope.

Project was baselined before the COVID pandemic

Re-baseline review completed Dec 2022. Proposed adjustment to TPC is due to COVID impacts.

High Luminosity Large Hadron Collider Compact Muon Solenoid (HL-LHC CMS) (HL-LHC CMS) TPC: $200M



STATUS & ACTIONS

PROJECT STATUS

Phase: CD-3b approved June 24, 2022. The project is currently working toward CD-2/3c approval.

CURRENT CHALLENGES/ISSUES/RISKS

The project has to maintain schedule alignment with CERN need-by dates for delivery of components to collaboration partners. The project has well developed mitigation strategies it can use. Additional contingency and long-lead procurement authorities being used to manage escalation and supply chain risks.

PLANNED CD's (Early Dates in FY)		
CD-2/3c	CD-3	CD-4
4/3/23	Q1FY24	Q4FY27

PROGRAM, MISSION, SCOPE, ACQUISITION STRATEGY

Location: CERN

MISSION NEED

HL-LHC upgrades will increase peak luminosity from 300 fb^{-1} to 3000 fb^{-1} and pile-up conditions factors of 5-8 times higher. HL-LHC upgrades are in line with recommendations from the 2014 P5 Report.

PROJECT SCOPE

The project will improve the capabilities of 4 elements of the CERN CMS detector. **Tracking System:** Replaced by a more radiation tolerant system that will increase readout speeds for the increased data at higher luminosities. **Trigger/DAQ system:** Significantly modified to enable the trigger to retain capability at lower thresholds and to utilize additional information for interesting signal events at high pile-up; the DAQ will need to handle increased data rates and better data flow. **Calorimeters**: Replaced with radiation hard technology that will increase granularity allowing both endcap and barrel calorimeters to provide better trigger information for higher luminosity events. **MIP Timing Layer:** New subsystem that provides new timing information to allow for better reconstruction of vertices in the 'busy' detector environment. This project isn't baselined yet.

ACQUISITION STRATEGY

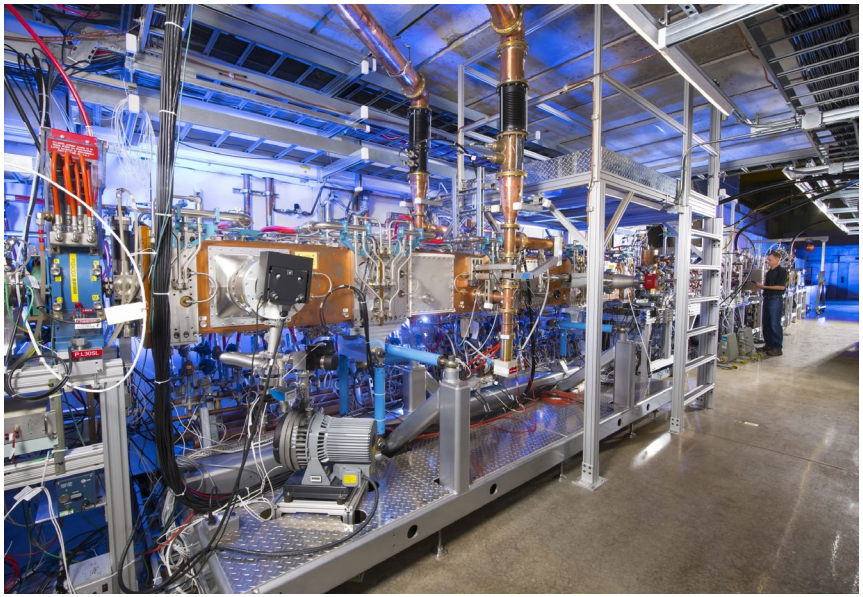
Procurements are done through the prime contract with FRA, most work is performed by partner universities with some testing and assembly at FNAL. Final testing and detector integration is done at CERN

HL-LHC CMS's TOP TAKE-AWAY

Complex International Dependencies

HL-LHC CMS experiment is an international collaboration with involvement from 198 institution from 46 countries. The US portion of the collaboration is funded through DOE and NSF, both requiring different project management oversight criteria based on each agency's regulations. The Project needs to align its planning and schedule to the international collaboration.

Accelerator Controls Operations Research Network (ACORN)
TPC: $142M



STATUS & ACTIONS

PROJECT STATUS
Project received their CD-0 approval in 2020. Currently working on AoA.

CURRENT CHALLENGES/ISSUES/RISKS
The addition of IRA funding to the project is allowing the project to bring on additional staff needed to prepare for CD-1. Developing requirements and refining scope based off of resource availability.

PLANNED CD's (Early Dates in FY)			
CD-1	CD-2	CD-3	CD-4
Q2 FY24	TBD	TBD	FY 27

PROGRAM, MISSION, SCOPE, ACQUISITION STRATEGY

Location: Fermi National Accelerator Laboratory

MISSION NEED
To meet future needs of the future research program, Fermilab will need to replace the aged and obsolete accelerator control system as well as end-of-life power supply systems with new or modernized systems.

PROJECT SCOPE
The project is currently evaluating it's alternative, they are:
- Replace accelerator control and power supply regulation and control systems with new systems. Replacement of both systems provides an opportunity to remove legacy systems that impose limitations on accelerator operations and accelerator R&D capabilities.
- Modernize the accelerator control and power supply regulation and control systems by replacing hardware and software components using standards-based and/or commercially available components while retaining the modular design of existing systems.
- Modernize the accelerator control and power supply regulation and control systems hardware using standards-based and/or commercially available components.

ACQUISITION STRATEGY – Being developed

ACORN's TOP TAKE-AWAY

Complex Installation Scheme
The current plan is to install as much of the upgraded equipment and control systems during operations and install equipment that requires a shutdown during normal scheduled maintenance shutdowns. Also, the project will need to ensure that all accelerator safety devices/equipment function seamlessly with the upgraded equipment and controls.

Summarizing Line Item & MIE Portfolio

FY25 cumulative annual budget of >$525M

Total portfolio TPC in FY25 is expected to be ~$5.2B → ~$5.9B

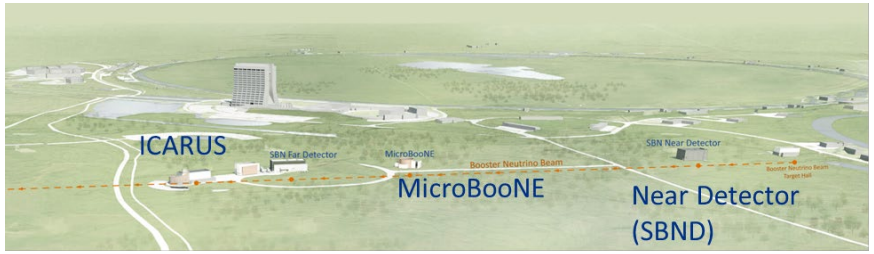
Common themes of challenges

- Annual funding constraints
- State of the art technologies
- Economic risks (inflation, supply chain, etc.)
- International complexities

Science-Driven Project-Like Initiatives

Project-Like Initiatives

Short-Baseline Neutrino (SBN) Program



- **Scope**: SBN is coordinated effort to explore neutrino oscillations by utilizing three LAr Time-projection Chamber detectors along Fermilab Booster Neutrino Beam.
- **Drivers**: Exploring neutrino mass ordering and potential 4th neutrino types by leveraging existing assets
- **Cost / Planned Completion**: ~$50M / Plan to fill last detector with LAr in FY23
- **Status**: MicroBooNE and ICARUS are operational, SBND is being installed

MAGIS-100

- **Scope**: A next generation quantum sensor with a 100-meter-long atom interferometer inside a vacuum tube in the existing MINOS shaft at Fermilab.
- **Drivers**: Search for ultralight dark matter and testing quantum mechanics in new regimes by extending the amount of time an atom spends in superposition. This has potential application for future gravitational wave detectors.
- **Cost / Planned Completion**: $14M / still establishing baseline
- **Status**: In the preliminary design phase

Minor Construction Projects
(General Plant Projects)

General Plant Projects- Active after FY24

Fermilab Welcome and Access Center (FWAC)

- **Scope**: New multi-functional facility to serve as the main public access point to the Lab.
- **Drivers**: Enhance security and access functions like badging and certain user services and locating these functions outside the secure access point.
- **TPC / Planned Completion**: $12.5M / TBD
- **Status**: Re-design phase to mitigate construction cost escalations.

Leveraging Fermilab's Strengths for SC

LCLS-II-HE (hosted by SLAC)

Super-CDMS (hosted by SLAC)

PPU (hosted by ORNL)

- Leveraging Fermilab's strengths in SRF, magnets, cryogenics and electronics

Current and Future Challenges

Current and Future Challenges

- **Executing projects under funding-constrained schedules**
- **New paradigm of challenges when hosting international efforts**
  - Schedule alignment, equivalency of codes and standards, execution of international agreements, security and S&T risk requirements, providing expected "Host Lab" services and support to a remote site, etc.
- **Ensuring both major projects and the portfolio of minor construction follow disciplined project management systems**
- **Ensuring facilities and infrastructure can reliably meet the future needs of science and federal policies**
  - Federal energy goals, addressing a backlog of deferred maintenance of facilities/infrastructure, managing external risks associated with operating within a 100-year-old former mine
- **Ensuring business and other support functions address the challenges of a large and complex project portfolio**
- **Addressing the operational implications of these projects**

BREAK

U.S. DEPARTMENT OF ENERGY | Office of Science

Major Challenges/Risks – DOE Perspective

Whitney Begner, Deputy Site Office Manager

March 1, 2023

Risks/Challenges

Overcoming existing culture

- Science focused
- Need to emphasize a questioning attitude
- Opportunity to strengthen root cause analyses

Changing Environment

- Keeping staff safe and productive while moving toward a hybrid workplace
- Implementing formalized Safeguards and Security Program focused on security while respecting the desire and excitement of the staff and local community for onsite activities
- Need to protect and manage sensitive technologies (ex: accelerator technologies and quantum) especially given the open culture

Risk/Challenges – Radiation

- Informality of Accelerator/Radiation Protection Program Operations; Many operations rely upon Expert Based vs Procedural Based Processes
- Environmental Liabilities have evolved
- Unfenced radiation exposure above background levels – with the potential for public access

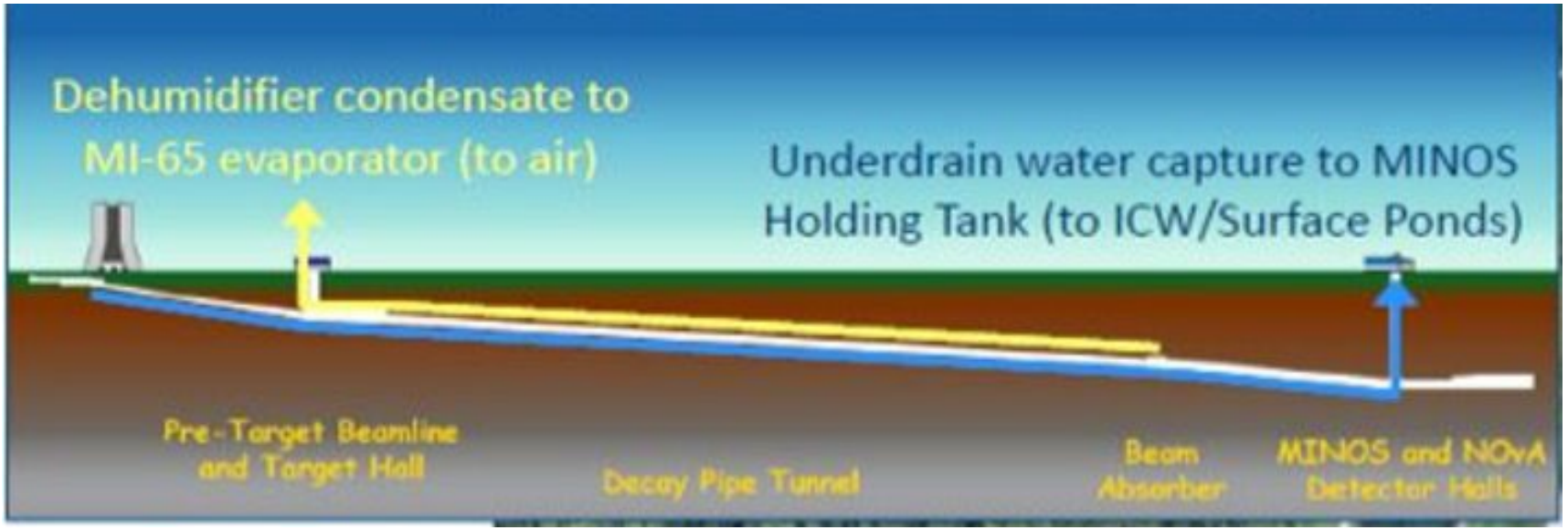
ACCELERATOR BEAM POWER INCREASE

- PIP-II will take the current beamline complex from 900kw to 1.2MW (Potential for 2.4MW with Booster improvements)

- Postings and notifications on the site are changing to ensure the public and non-badged visitors are aware of the hazards and exposure potential for an operating laboratory. (radiological, chemical, mechanical, etc)

Risk/Challenges – Tritium

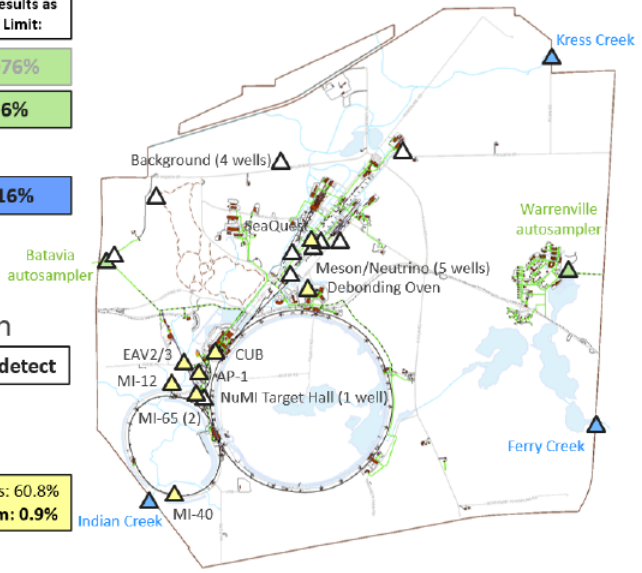
- Tritium, a radioactive isotope of hydrogen, primarily originates from MI-65.
- MI-65 flows to the MINOS Sump, which feeds into the Industrial Cooling Water System (used across the campus)



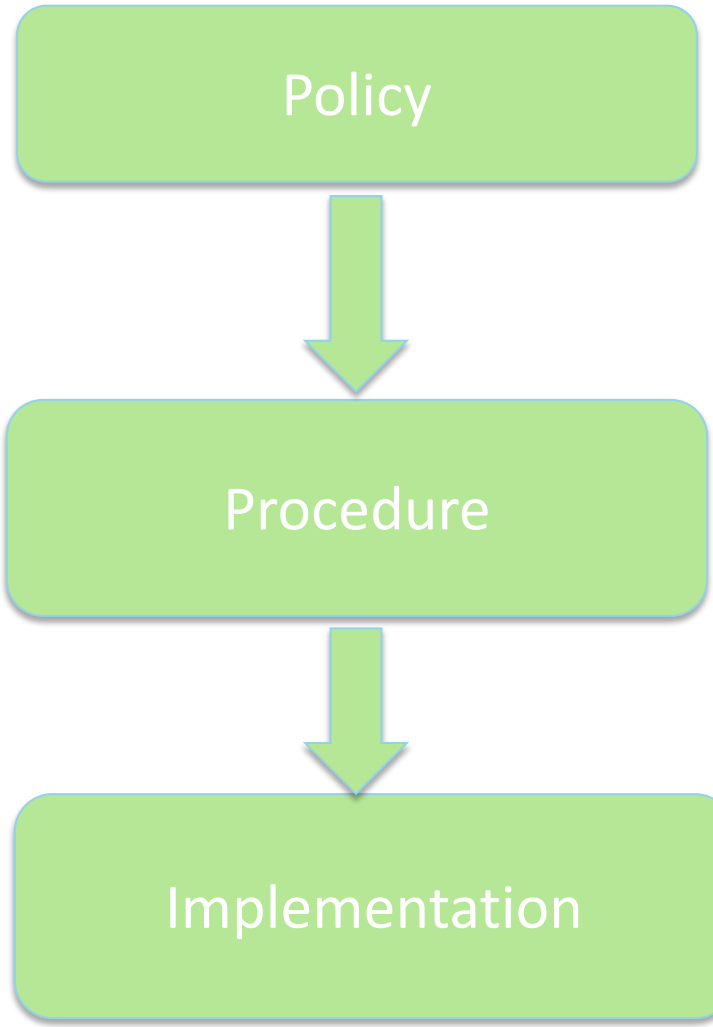
Risk/Challenges – Tritium

- 2021 tritium results were well below regulatory discharge limits
  - Increases through 2019 indicated a need for additional monitoring to identify migration route(s) and develop effective mitigations

	2021 results as % of Limit:
Sanitary Sewer	
– 13,000 pCi/ml	0.076%
– 5 Ci in a year	5.6%
Surface Water	
– 2,600 pCi/ml	0.16%
Groundwater	
– 1 pCi/ml (Class 1 Resource Aquifer in bedrock)	Non-detect
Air	
– 0.1 mrem/year (all radionuclides)	All APIs: 60.8% **Tritium: 0.9%**



Risks/Challenges – System Overview



- DOE Approved System

- Select DOE Approved
- Desk Guides
- Standard Operating Procedures

- Tools and Software Platforms
- Training
- People

Risks/Challenges – Business Systems

- Legacy, antiquated systems and chronic under investment in maintenance and modernization have resulted in a lack of agility, fragility, and operational business challenges – weakness to varying degrees

- The Laboratory continues to have challenges in Financial Management and Acquisition Management. Audits repeatedly highlight the same deficiencies and control failures year after year. Any corrective actions implemented have resulted in little to no progress. Significant procurement issues have hindered the laboratory's ability to successfully deliver efficient and effective business systems/resources to enable the Science Mission. Substantial concerns remain regarding the ability to expend Government funds in an effective, efficient, and compliant manner.

- Recent OIG audit highlighted numerous challenges related to indirect rates. Ongoing efforts have made significant progress in this area

- Compensation structures and incentives are not always aligned to recruiting the best talent.

Risks/Challenges – Facilities

- Some FIMS information not considered credible (but improving)
- Deferred Maintenance and repair estimates are rising annually
- Site investment has historically been lower than accepted norms
- Rad and Tritium management programs are undergoing maturation
- Tritium contamination is largely throughout research complex
- Asbestos is common facility hazard based on age of facility

Risks/Challenges – Programmatic and Funding

- Single program steward (~92% HEP funded) narrows funding/investment options and forces reliance upon direct HEP funds
- HEP has a high percentage of funds directed to Fermilab – LBNF/DUNE project funding, PIP-II, and base research consumes vast majority of HEP budgets
- Growth/emergent capabilities in Quantum, Artificial Intelligence, Machine Learning, and Microelectronics represent new potential to diversify the site and funding streams
- Fermilab is also a key contributor and supplier of accelerator components to other national labs (in support of HEP and BES)

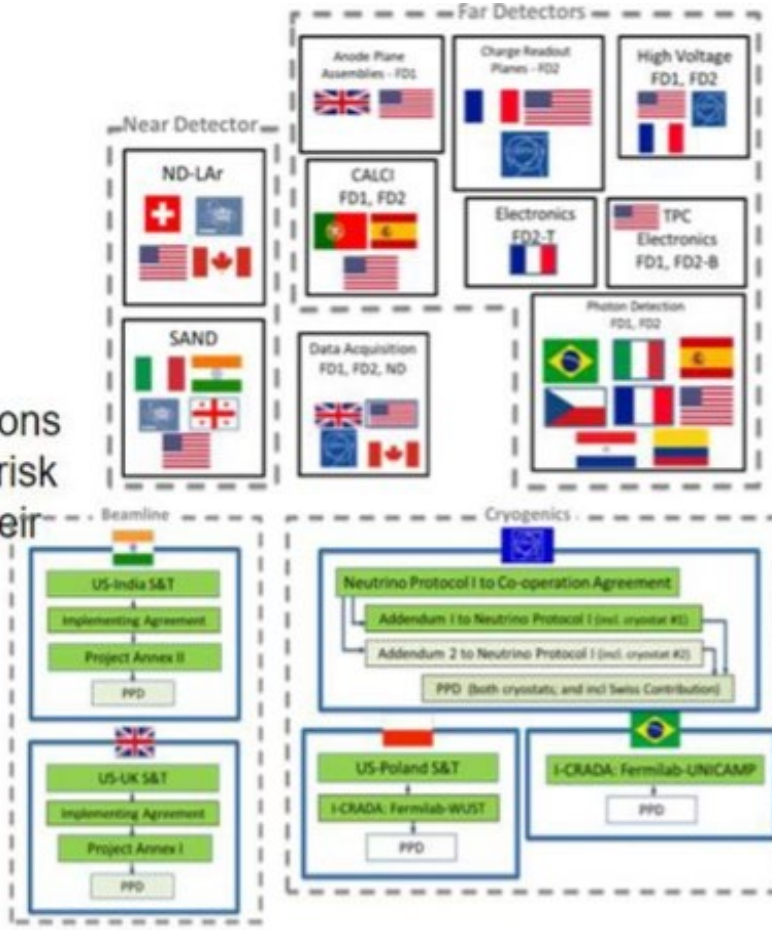
Risk/Challenges – International Considerations

Context:

- Largest international project ever hosted by DOE

Challenges:

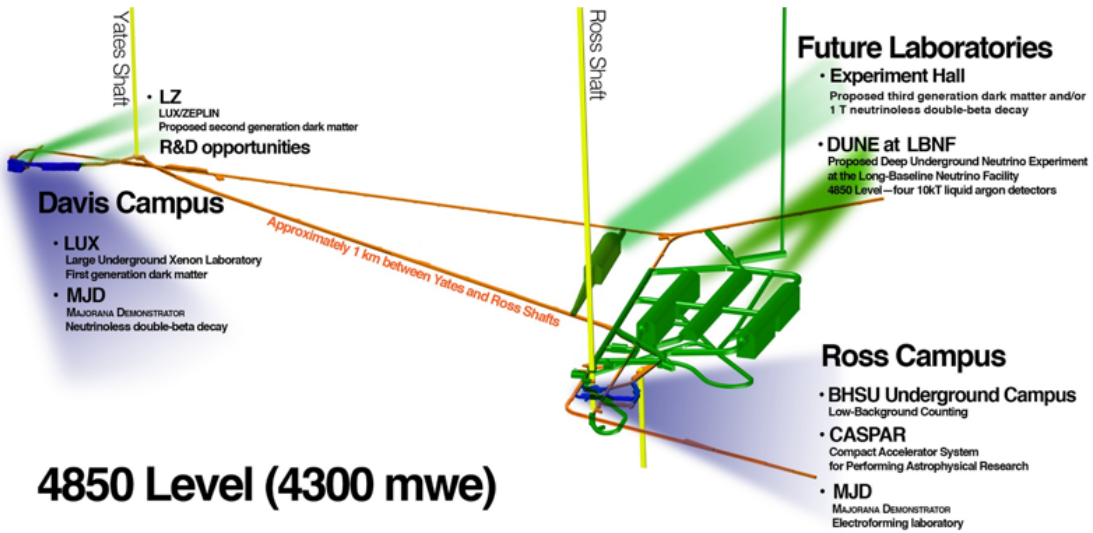
- Agreements and planning documents
- S&T Matrix compliance
- "Host" responsibilities at a remote site
- Equipment designed to non-US codes and standards
- Importing an unprecedented volume of foreign contributions
- Effective strategies to maintain compliance with SDSTA risk transfer requirements while international partners and their vendors work onsite



Risk/Challenges – Codes and Standards

- To facilitate the large-scale international involvement, Fermilab/DOE will be accepting in-kind contributions from many partners outside the U.S., and purchasing specific equipment needed to integrate with contributor's equipment.
- While some countries design to U.S. Codes and Standards, others do not.
- 10 CFR 851 (Worker Safety and Health) allows for alternative means of compliance within the respective codes (such as Structural, NFPA, etc), with the exception of pressure safety.
- There has been a recognition by DOE that projects are continuing to become more international in nature. Despite that, a variance is required for use of pressure equipment complying to international standards such as Pressure Equipment Directive (PED) - EU Standard.
- Development of a variance at Fermilab is currently underway.

Risks/Challenges – LBNF Governance in SD



Context

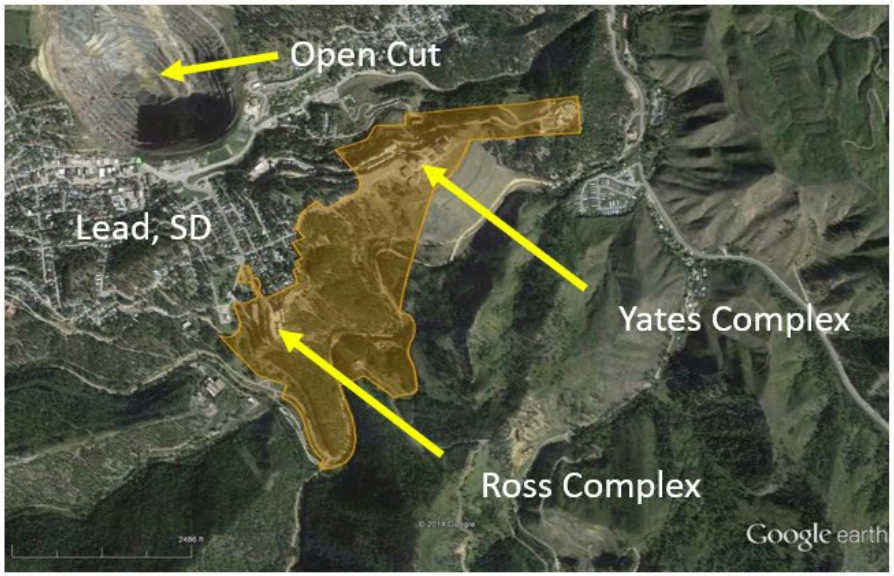
- SURF is owned by SDSTA & DOE leases space within SURF to house LBNF/DUNE
- SURF Operations are primarily funded by a SC Cooperative Agreement

Challenges:

- "Jurisdictions"
- Improvements to Non-Govt property
- Personal property stewardship
- Avoiding waste liabilities
- Risk transfer requirements

Risks/Challenges – LBNF Far Site

Depositing 800,000 Tons of Excavated Rock



Rock Conveyor crossing road and public spaces

Depositing Rock in Open Cut

Risks/Challenges – LBNF Far Site

Deposited Rock in Open Cut

Challenges:

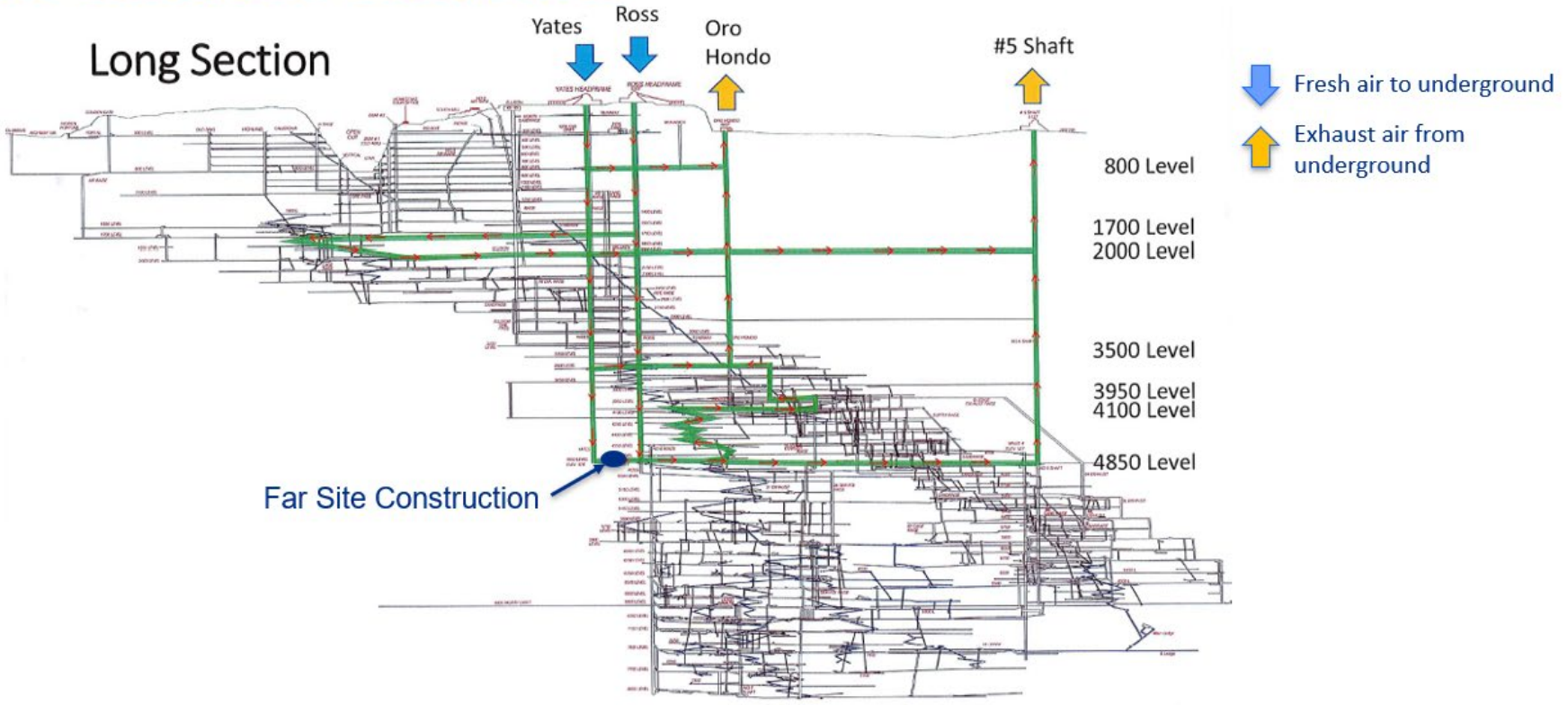
- Noise
- Dust Management


Mar 31, 2022- Dust migration to public park


The rock is very abrasive on distribution systems

Risks/Challenges – LBNF Air Quality

SURF Underground Sectional View



LBNF/DUNE construction site at SURF is inside a complex former mine and relies on a significant amount of legacy infrastructure

Risks/Challenges – LBNF Air Quality

ACGIH 2016 Abatement Plan Nitrogen Dioxide (NO2)

- Abatement Plan approved on June 14, 2021
- Limit not achievable due to type of work activity and location
- NO2 Abatement Plan reporting level 3ppm (1.5ppm TWA for a 12-hr shift)
- Engineering & administrative controls implemented
- As low as reasonably achievable

OSHA 1926.800(k)(3) Ventilation Variance

- Final variance documentation approved on April 8, 2022
- OSHA requirement- a linear velocity of 30 fpm across the working face where blasting & drilling is conducted
- Variance adopts a localized ventilation vs. dilution ventilation approach utilizing additional controls to monitor the air quality inside the excavation area

Risks/Challenges – Hosting

Science and User Facility	Operations and Business
Control Room Integration	Housing and Local Services
Understand the User Population • Visa Processing • Site Access	Security Plan: • Badging and Site Access • Guard Force
	Fermilab Office Space (Employees, Users, and subcontractors)
	HR Planning: • Technical Staff to support infrastructure, assembly, and operations • Business and Administrative staff (SD and IL)

Conclusions and Take-Aways

- Exciting time to be at Fermilab
- Project workload and investment have never been higher
- The challenges are not insurmountable but will take a focused effort
- DOE and stakeholders and committed to Laboratory success

U.S. DEPARTMENT OF ENERGY | Office of Science

Procurement Process

Tonja Stokes, Source Evaluation Board Lead

March 1, 2023

Procurement Process

- The Office of Science is committed to ensuring a fair, full and open, collaborative, and transparent process.

- Major Goals
  - Select the best contractor
  - Improve the process
  - Maximize competition

Source Evaluation Board

- Source Evaluation Board (SEB) appointed
  - DOE employees
  - Voting and non-voting members
- SEB is responsible for all aspects of the procurement
  - Developing and issuing the RFP
  - Responding to questions
  - Evaluating the proposals
- Source Selection Authority (SSA) will make selection
- We are in the midst of an active contract competition. Conversations and communications between members of the SEB and prospective offerors or other interested parties outside of the official procurement process are prohibited.

What We've Done

- Announced the intent to compete – September 8, 2022
- Launched competition website – January 24, 2023
- Issued Request for Information (RFI) – January 24, 2023
  - Due February 23, 2023
- Issued Expression of Interest (EOI) notice – February 6, 2023
  - Due March 20, 2023
- Held Informational Meeting – March 1, 2023

Competition Website

- Official source of information and primary means of communication
- Contains information and direction critical to the competition and all official documents
  - RFP and amendments
  - Questions and Answers
  - Event information (e.g., registration instructions, presentations, attendee list, etc.)
  - Document library
- **Interested parties are responsible for frequently monitoring the website for information, notices, and updates regarding the solicitation.**

Question and Answer Protocol

- Questions will not be answered verbally
- A careful and deliberate Q&A process has been established to
  - Protect the integrity of the procurement process
  - Ensure the consistent transfer of information
- Questions may be summarized or synopsized
- Duplicative questions will not be repeated
- Questions must be submitted to FNALcompetition@science.doe.gov
- All responses will be prepared by the SEB and posted on the competition website

Questions and Answers

- **Question:** Will there be another opportunity to tour the site for individuals who cannot attend the Informational Meeting?
  - ***Answer:*** *Yes. Site tours will be made available during the pre-solicitation conference, which will be held approximately three weeks after issuance of the draft Request for Proposals (RFP).*

- **Question:** Does DOE expect an Oral Interview to be part of the solicitation? If so, please provide details on the format.
  - ***Answer:*** *It is anticipated that Oral Presentations will be a part of the solicitation process. However, the exact format has not been determined at this time. Additional information regarding the Oral Presentation will be included in the Draft Request for Proposals (RFP).*

Questions and Answers

- **Question:** The Request for Information (RFI) states that the contract will require modernization of business and operational systems/processes. Will bidders be provided with details on the systems currently in place? Will bidders be expected to deliver new systems during the contract transition, and over what time period does DOE expect the modernization to occur?
  - ***Answer:*** *It is not anticipated, at this time, to provide a detailed list of business and operational systems/processes currently in place at FNAL. The focus of the statement in the RFI is to set the expectation for offerors to address business and operational systems/processes. Business systems and processes, in this context, refer to broad categories such as procurement, human resources, property, accounting, etc. Similarly, operational systems may include worker safety and health, radiation protection, quality assurance, contractor assurance, etc. Systems are generally comprised of tools, training, procedures, controls, etc. It is expected that the laboratory will always operate under approved systems; therefore, change will take time. However, substantive modernization/adaptation/enhancement is necessary.*

RFP Highlights

- Contract type – performance-based; cost-reimbursement w/ award term incentive
  - 5 year base period
  - Potential to earn up to 15 additional years of award term
- Current contract expires December 31, 2024
- 90-day transition period anticipated
- Similar, but not identical, to the BNL competition
  - Tailored to the unique needs of FNAL
- General themes
  - Offeror's plan for implementing DOE vision
  - Laboratory operations, small business involvement, DEI
  - Lab Director and other key personnel
  - Experience, past performance

Tentative Schedule (SUBJECT TO CHANGE)

- Release Draft RFP – 4th quarter FY23
- Pre-Solicitation Conference – approximately 3 weeks after Draft RFP release
- Close Draft RFP – 30 days after release
- Release Final RFP – 1st quarter FY24
- Pre-Proposal Conference – approximately 4 weeks after Final RFP release
- Receipt of Proposals – 60 days after release
- Oral Presentations – approximately 4 weeks after receipt of proposals
- Award – 4th quarter FY24
  - Anticipate award without discussion; however, DOE reserves the right to hold discussions if deemed necessary.

DOE looks forward to engaging with the community, industry, and other interested parties in a transparent and collaborative manner throughout the solicitation process for a contractor to manage and operate FNAL.

Questions must be submitted to FNALcompetition@science.doe.gov.

U.S. DEPARTMENT OF ENERGY | Office of Science

Tour Overview

Whitney Begner, Deputy Site Office Manager

March 1, 2023

Tour Agenda

Heavy Assembly Building
- Mu2e
- Quantum

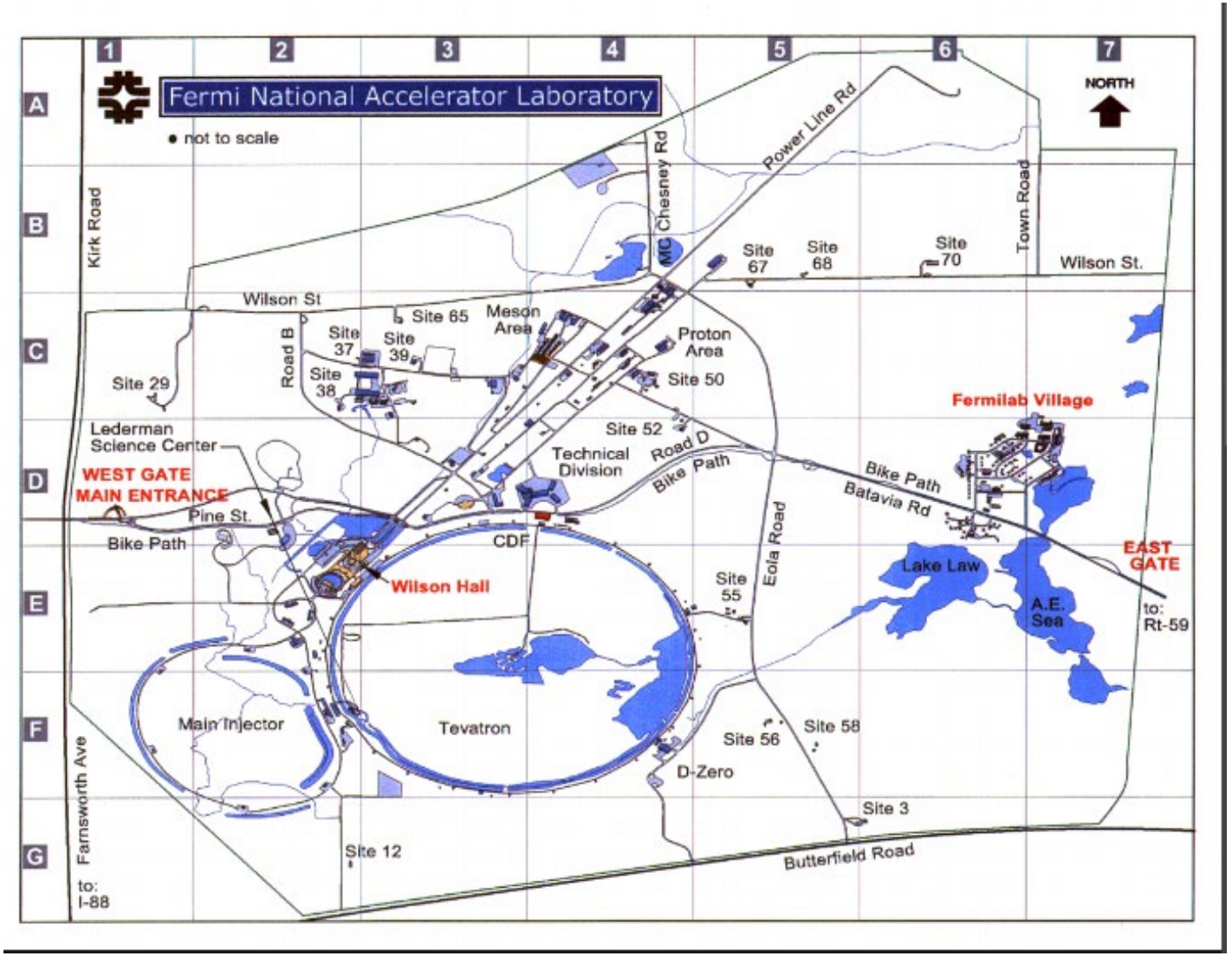
Fermilab Village

Driving Tour of Beamline Complex

Wilson Hall Infrastructure

Linear Accelerator
- Scientific Infrastructure
- Main Control Room

MI-65
- Tritium



BREAK – BUS DEPARTS AT 11:30