



## Rebuilding Fermilab for Discovery

Lia Merminga

High Energy Physics Advisory Panel

December 5-6, 2024

# Outline

- Vision, Strategy, Near-Term Priorities
  - Particle Physics Initiatives
  - Emerging Technologies Initiatives
  - User and Stakeholder Initiative
- Operational Excellence
- Culture of Excellence Initiative
- Summary

# Fermilab at a Glance

- America's particle physics and accelerator laboratory
- Operates the largest US particle accelerator complex
- ~2,100 staff
- 6,800 acres of federal land
- Facilities used by 4,000 scientists from >50 countries

As we move into the next 50 years, our mission remains to solve the mysteries of matter, energy, space, and time for the benefit of all.



# Our Vision for Fermilab

***We lead the world in particle and accelerator physics and enabling technologies, underpinned by a diverse and empowered workforce, excellence in laboratory operations, a campus strategy integrated with our science vision and mission-ready infrastructure.***

***We embrace a culture of safety, discipline and accountability, where every employee exemplifies our core values in doing their work.***

# Fermilab Mission and Science & Technology Strategy

**Fermilab's core mission is to drive discovery, solving the mysteries of matter, energy, space, and time**

- Thousands of scientists, engineers, technicians, users, and students from around the globe contribute their expertise to advance the frontiers of knowledge and innovation
- As America's particle physics and accelerator laboratory, Fermilab hosts leading-edge facilities and experiments and develops technologies that support research around the world

**Fermilab's science and technology strategy** is founded on several strategic initiatives:

- **Five major particle physics initiatives:** Neutrinos, Higgs and the Energy Frontier, Muons, The Dark Universe, and Accelerator Science and Technology
- **Three major emerging technology initiatives:** Quantum Science and Technology, Microelectronics, and Artificial Intelligence
- **One new user and stakeholder engagement initiative**



# Fermilab Mission and Science & Technology Strategy

As our laboratory's mission can only be accomplished by integrating our science vision and our business processes, we prioritize:

- **Excellence in business and lab operations and campus strategy integrated with science vision**
- **Culture of Excellence Initiative**



FFDG\_204

# 2024 Challenges and Our Commitment

- Financial strain
  - Curtailed activities and hiring in FY24
  - Reduction in Force in FY25
- Operational challenges
  - Accelerator Safety Order 420.2D
    - Reduced Accelerator Complex operations in FY24
  - Infrastructure reliability issues
    - Only 3 of 8 substation transformers operational due to a fire and other failures
    - 2 out of 11 Main Injector LCW heat exchangers operational due to corrosion
      - Prevent Main Injector operations in FY25
- Culture, climate survey
  - In the face of these challenges, morale of the lab community has been impacted, as reflected in our climate survey and feedback from the user community
- Contract recompetition
  - Created uncertainty ...but also **opportunity given the strengths of our partners**

Majority can be traced to **accumulated compliance debt** and **deferred investments in infrastructure and mission support**



***We are committed to delivering Fermilab's mission with excellence – an imperative!***  
***We are engaging partners and working with urgency to develop plans to solve issues***

# Fermilab Core Capabilities

**Accelerator &  
Detector Science &  
Technology**

**Advanced Computer  
Science,  
Visualization & Data**

**Large Scale User  
Facilities/Advanced  
Instrumentation**

**Particle Physics**

**Mechanical Design &  
Engineering**

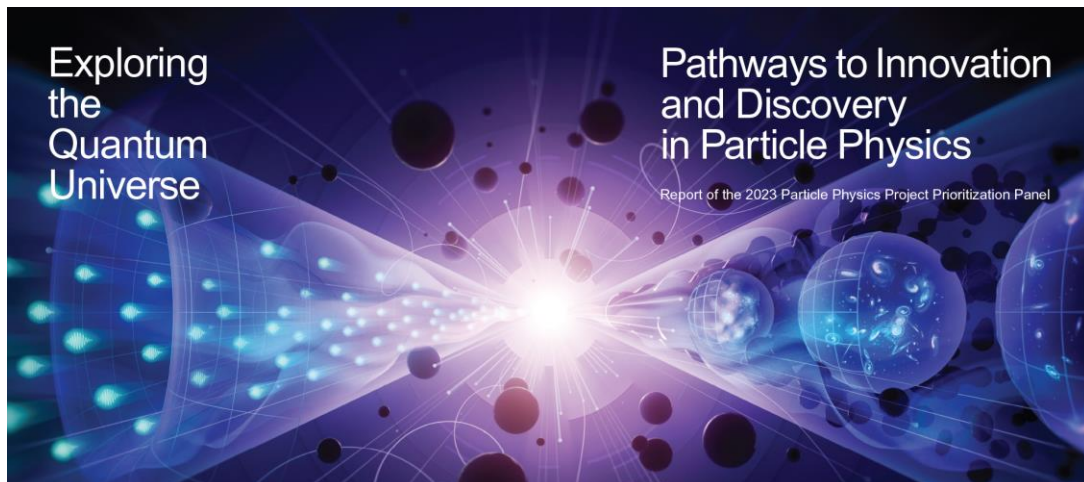
**Microelectronics**

**Plasma & Fusion  
Energy Science**

*Emerging*

**Systems  
Engineering &  
Integration**

# 2023 P5 Report



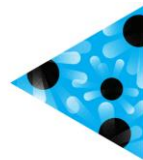
Elucidate the Mysteries of Neutrinos



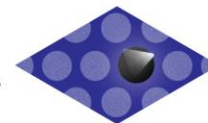
Reveal the Secrets of the Higgs Boson



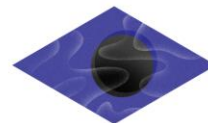
Determine the Nature of Dark Matter



Understand What Drives Cosmic Evolution



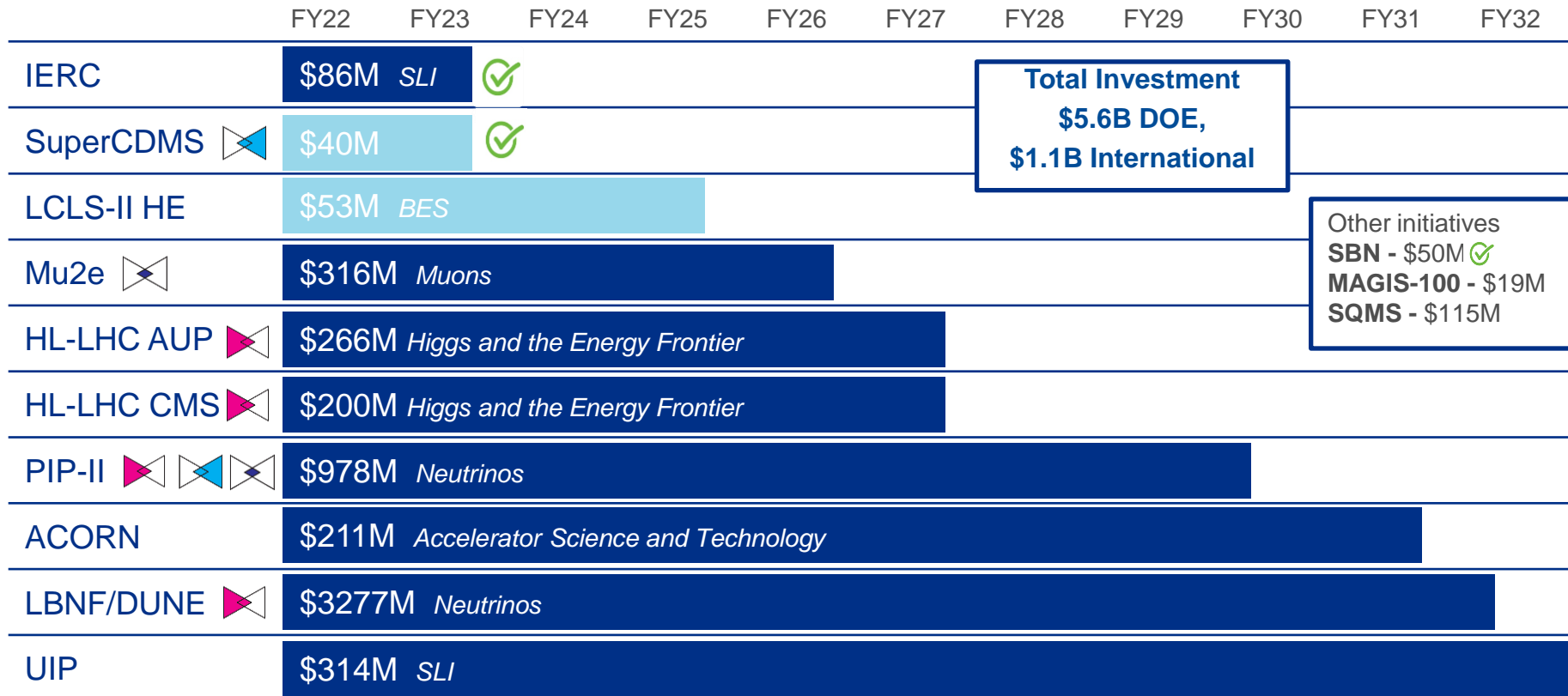
Search for Direct Evidence of New Particles



Pursue Quantum Imprints of New Phenomena

*Fermilab's vision is well aligned with the 2023 P5 report*

# Fermilab executes the P5 plans



**Fermilab executes the largest project portfolio in DOE/SC; >46% scope complete**

# Fermilab Science and Technology Strategy



## Major Particle Physics Initiatives

- Neutrinos
- Higgs and the Energy Frontier
- Muons
- The Dark Universe
- Accelerator Science and Technology



## Emerging Technology Initiatives

- Quantum Science and Technology
- Microelectronics
- Artificial Intelligence for Science

## User and Stakeholder Engagement Initiative

- Discovery on the Prairie



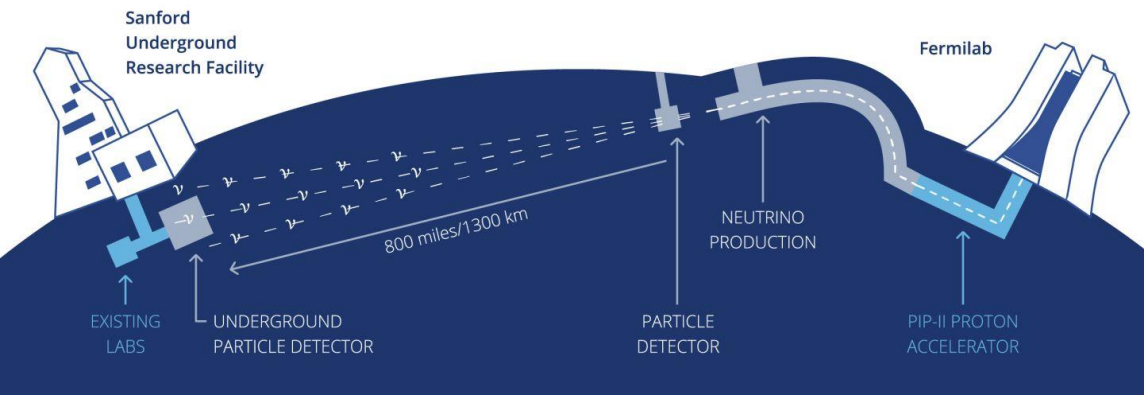
# America's Particle Physics and Accelerator Laboratory

- Neutrinos
- Higgs and the Energy Frontier
- Muons
- The Dark Universe
- Accelerator Science and Technology





### The *definitive* neutrino oscillation experiment, driven by LBNF and PIP-II



### Discovery Potential

- **Neutrino CP violation**
  - The origin of matter in the universe
- **Supernova neutrinos**
  - Origins of neutron stars and black holes
- **Neutrino surprises**
  - New forces, particles, or laws of nature connected to neutrinos
- **Proton decay**
  - Unified origins of particles and forces

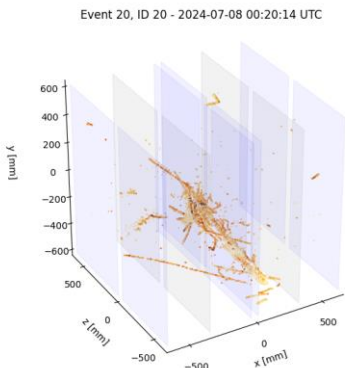


***The LBNF/DUNE project is the first internationally conceived, constructed, and operated mega-science project hosted by the Department of Energy on U.S. soil***



## Vision

Remain the undisputed global leader in neutrino science for decades to come, addressing many of the open questions in particle physics today



## Strategy

- Deliver the current neutrino program
- Complete LBNF/DUNE and PIP-II on time, within budget, meeting performance specs
- Realize early implementation of DUNE Phase II via ACE-MIRT and FD3
- Position Fermilab as the DUNE host lab



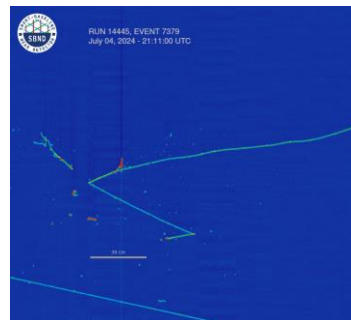
## Near-term Priorities

- Operate/Publish New Results
  - ICARUS, SBND, NOvA, DUNE 2x2 Demonstrator
- Construct LBNF/DUNE
  - Cryostat assembly in SD
  - Start Near-site construction
- Construct PIP-II
  - AUP for High Bay Building, Linac Tunnel
  - Commission Cryoplant
  - Complete two prototype cryomodules (SSR2, LB650)



## Recent Highlights

- LBNF/DUNE
  - Far site excavation 100% complete!
- PIP-II construction progressing at full speed
- SBND and DUNE ND 2x2 prototype are taking data!



## LBNF far site excavation complete!



## LBNF/DUNE excavation celebration at 4850L – Aug. 15



# ProtoDUNE Detectors (Far Detectors 1 and 2) at CERN



# CERN Neutrino Platform: first time CERN invests outside Europe

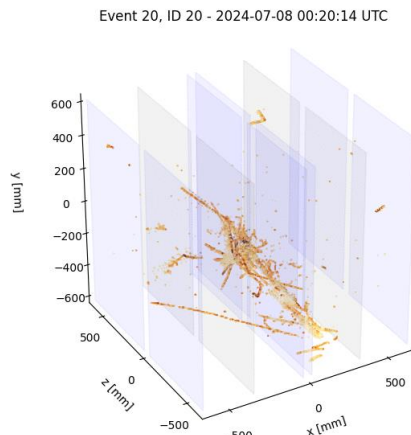


# 2x2 demonstrator for the DUNE Near Detector ND-LAr

- Physics performance demonstration
  - Study the highly complex topologies and pileup that we expect at DUNE
- In the NuMI neutrino beam line at Fermilab
- First neutrinos observed with a DUNE prototype July 2024

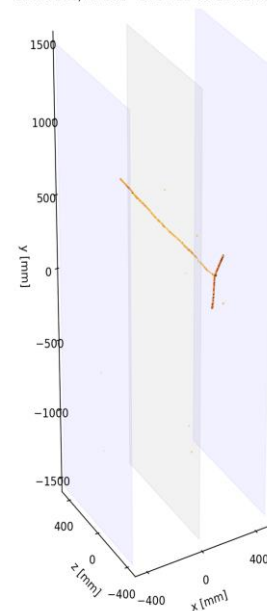


4 modules of the 2x2 hanging above the cryostat during installation



First neutrino interactions recorded on July 7 and 8

Event 132, ID 132 - 2024-11-06 21:02:59 UTC



3 weeks of cosmic data collected in the Full-Scale Demonstrator (FSD) facility at Bern Oct. 25 – Nov. 13, 2024

**u<sup>b</sup>** UNIVERSITÄT BERN

Caltech

THE UNIVERSITY OF CHICAGO

UC Irvine

BERKELEY LAB

MICHIGAN STATE UNIVERSITY

MIT Massachusetts Institute of Technology

UNIVERSITY OF ROCHESTER

SLAC NATIONAL ACCELERATOR LABORATORY

Syracuse University

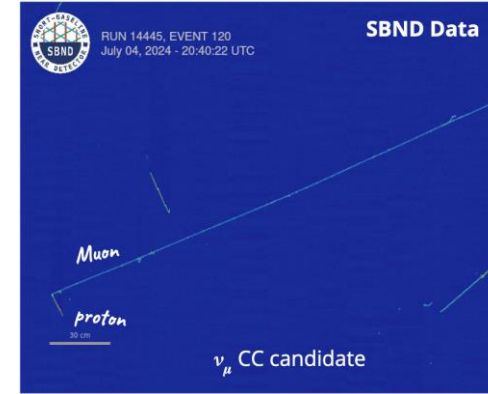
YORK UNIVERSITY

...and many more!

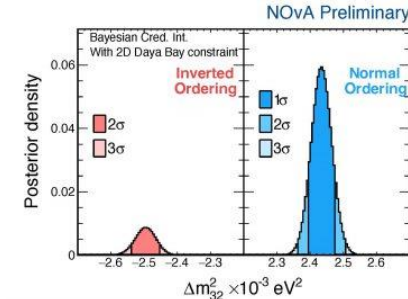
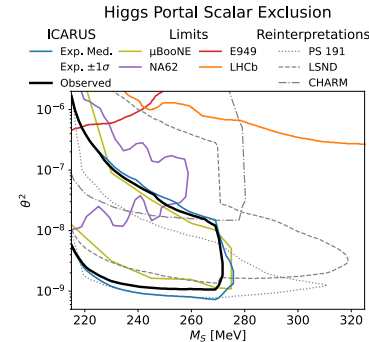
Fermilab

# NOvA and SBN highlights

- SBND construction completed and fully commissioned.
- First neutrino candidates recorded by SBND at end of FY24 accelerator run
  - Between now and the start of the Fermilab long-shutdown in early 2028, SBND is projected to collect 5-10M neutrino interactions (depending on beam delivery), an order of magnitude more than the existing neutrino-argon data sets.
- First search for new physics from ICARUS
- New NOvA results including recently doubled neutrino mode dataset. Most precise single-experiment measurement of  $\Delta m^2_{32}$



CERN Neutrino Platform



# The PIP-II Project



# Prototype SRF Cryomodules



Prototype HWR Cryomodule



Prototype SSR1 Cryomodule



Prototype HB650 Cryomodule

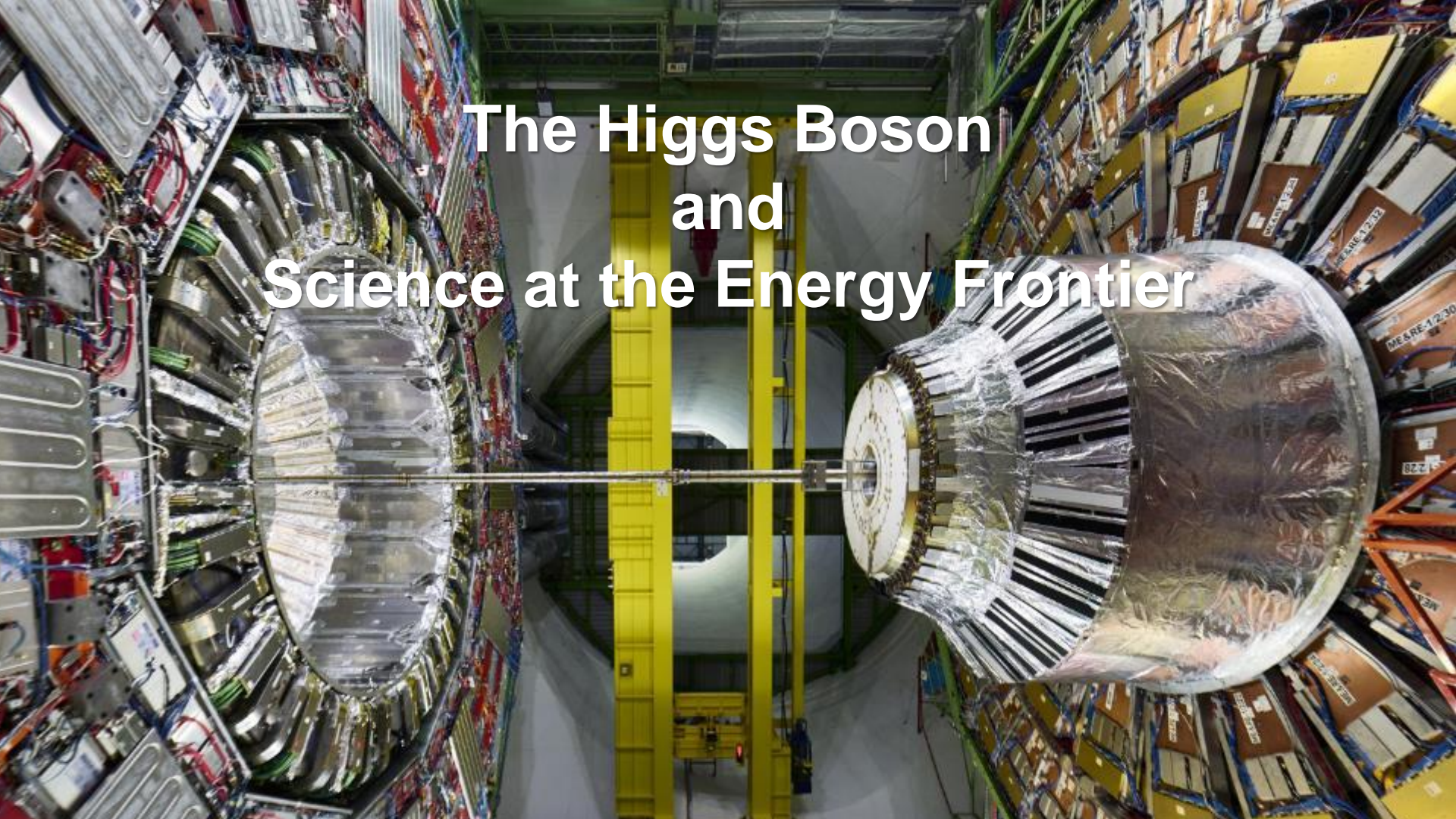


The HWR, SSR1, and HB650 prototype cryomodules provided critical results, mitigating risks of the production phase

# PIP-II coldbox enroute to Fermilab

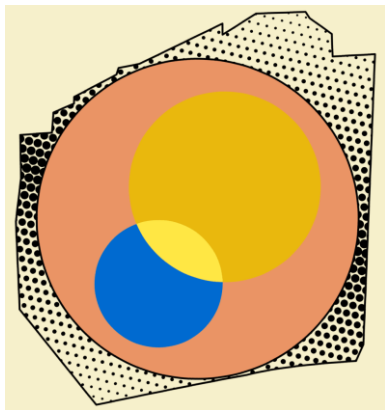


# The Higgs Boson and Science at the Energy Frontier



## Vision

Be a world leader in the energy frontier science, an essential partner to an offshore Higgs factory, and poised to host a muon collider.



## Strategy

- Continue to lead U.S. CMS operations and LHC physics analysis, and host US CMS collaboration
- Complete the HL-LHC Upgrade Projects
- Lead accelerator and detector R&D toward an off-shore Higgs factory
- Lead international efforts for a U.S.-hosted muon collider



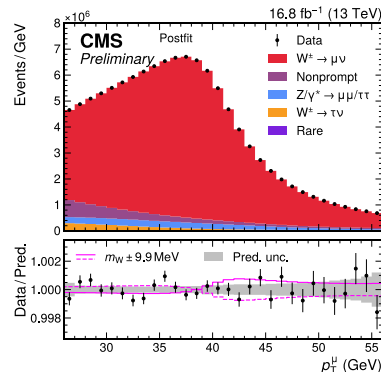
## Near-term Priorities

- LHC CMS Operations
- Construct HL-LHC AUP
  - Deliver 7 cryoassemblies to CERN, all crab cavities
- Construct HL-LHC CMS Upgrade
  - Full production
- FCC-ee
  - Apply core capabilities to R&D, prototyping



## Recent Highlights

- HL-LHC
  - HL-LHC CMS Upgrade achieved CD-3
  - First U.S.-built cryoassembly delivered to CERN
- Excellence in U.S. CMS Science and Ops
  - Recent measurement of W Mass
  - CMS night shifts covered from ROC
  - High performing Tier-1 center
  - LPC is a key element of U.S. CMS providing education, training, user support



# Status of the HL-LHC AUP Project

- Deliverables to CERN: 10 Q1/Q3 cryoassemblies (containing a total of 20 Nb<sub>3</sub>Sn Magnets) and 10 Jacketed RFD (Radio Frequency Dipole) Cavities.
- Technical Status:
  - 12 magnets (out of 20) passed acceptance on Vertical Test at BNL
  - 2 cryoassemblies met “acceptance” on Horizontal Test at FNAL and shipped to CERN
  - 1 cryoassembly ready for Horizontal test, ~3 cryoassemblies under production @FNAL
  - 2 bare RFD cavities met field “acceptance”. Some hiccups with top-of-the-line vendor, under active control and resolution with CERN involvement
- Project Status: ~85% complete, on track to complete on schedule and budget



Brookhaven  
National Laboratory



CA01 at CERN (Dec. '23)



CA02 Departure to CERN  
(Dec. '24)



Completed CA03 at FNAL, being  
prepared for horizontal test



Cold Mass 04 at FNAL



Cold Mass 05 at FNAL



Series Cavities Production



# HL-LHC CMS Detector Upgrade Project – Production Liftoff!

- Diverse array of novel deliverables to CMS for both DOE (\$200M) and NSF (\$88M)
  - Trigger-capable Tracker Modules, Imaging Endcap Calorimeter, Cutting-edge Triggering system, New Timing detector, Increased Muon Coverage, Upgrades to electronics bandwidth everywhere
  - Fermilab + 4 dozen US Institutes = large domestic participation
- Project passed final CD-3/FDR gate, 2-3 year production phase started or imminent



BTL-Tracker Support Tube delivered to CERN Nov. 15



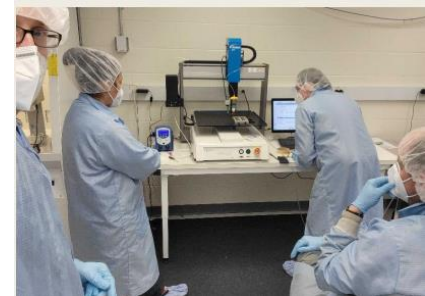
Production Timing Layer modules at UVA



"Pilot" production Trigger electronics at UW



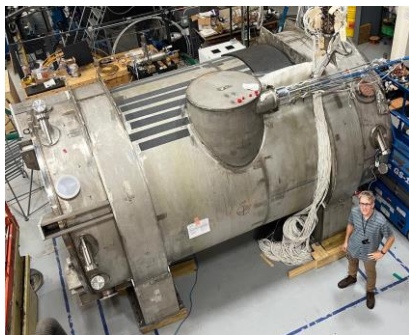
Cassette Assembly and Testing Area at FNAL



Tracker Module Assembly at Brown

## Vision

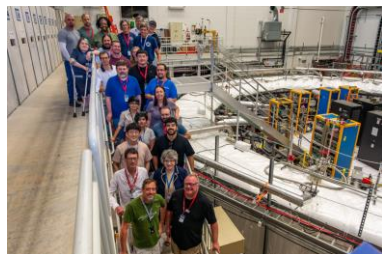
Fermilab is a world center for accelerator-based Charged-lepton flavor violation (CLFV) and Dark Matter experiments, driven by intense particles beams and PIP-II/ACE



Production Solenoid manufacturing complete, successfully cooled down. Currently ongoing final leak check.

## Strategy

- Complete Muon g-2 and Mu2e experiments
- Use the upgraded accelerator complex to enable a next generation of muon experiments, e.g. beam dump experiments at PIP-II
- Begin an R&D program for a next-generation muon facility

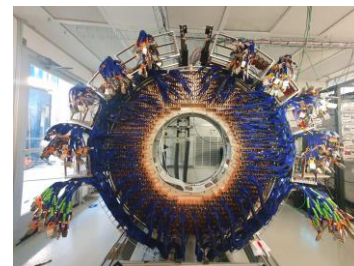
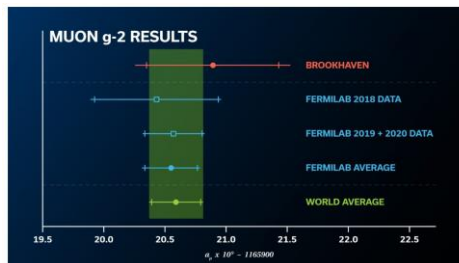


## Near-term Priorities

- Muon g-2
  - Publish result of full dataset, updates from theory initiative
- Mu2e
  - Mu2e Project Complete
  - Transition to operations

## Recent Highlights

- Muon g-2
  - Published world's most precise measurement of muon g-2
- Mu2e
  - Mu2e Project is 93% complete
  - Two transport solenoids were safely delivered to the Mu2e experimental hall



Calorimeter Disk 1 cabling & testing complete

# Mu2e experimental hall



# The Dark Universe

## Vision

Fermilab is an essential partner in cosmic science experiments, producing a continuous stream of scientific results, and contributing innovative R&D towards future dark matter and cosmic microwave background (CMB) experiments

## Strategy

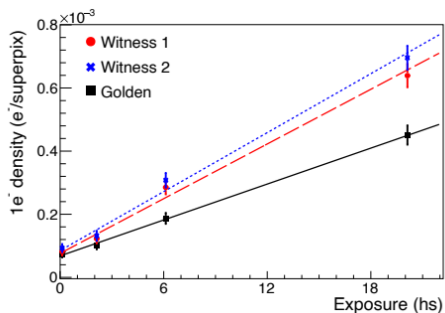
- Leverage core capabilities for focused program exploring light dark matter and CMB.
- Support of broader DOE projects
- Leveraging our university partners, e.g. UChicago

## Near-term Priorities

- Maintain leadership on SPT-3G
- Support current operations: Rubin/LSST, SCDMS
- ADMX-G2: Continue run searching for the QCD axion
- R&D towards Dark Matter New Initiatives (DMNI)

## Recent Highlights

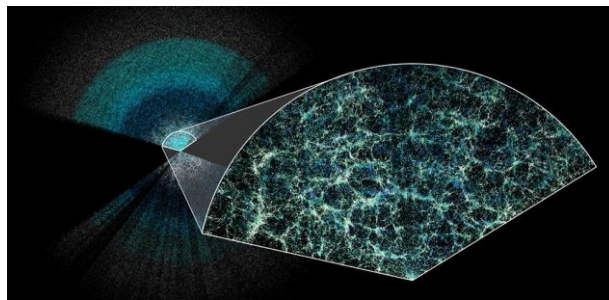
- ADMX-G2
  - Began a two-year run in December searching for the QCD axion in the 1020-1390 GHz region
- 100+ science papers in 2024, including an SPT measurement of the Hubble constant from CMB polarization only



Skipper CCDs break record  
([2410.18716](#))



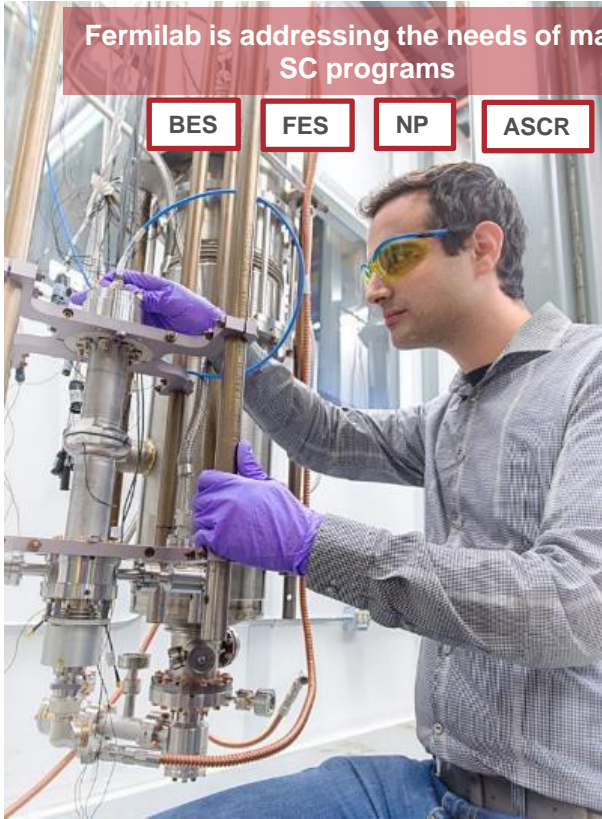
South Pole Telescope (SPT)-3G  
team at the South Pole



The Dark Energy Spectroscopic Instrument (DESI) has  
made the largest 3D map of our universe to date.



# Accelerator S&T – World-leading Capabilities



Fermilab is addressing the needs of many SC programs

BES

FES

NP

ASCR

## Accelerator and Beam Physics

- IOTA/FAST beam-test facility advances critical R&D enabling next-gen accelerators for DOE/SC

## Superconducting Radio-frequency

- Fermilab continues to produce world-class cryomodules for LCLS-II HE, PIP-II, applying developments to FCC-ee

## High-power Targetry

- Fermilab leads the Radiation Damage in Accelerator Target Environments (RaDIATE) collaboration

## High-field Magnets

- HEP and FES: New high field magnet cryogenic test stand at Fermilab to perform R&D of high-temp superconducting cables for future fusion reactors

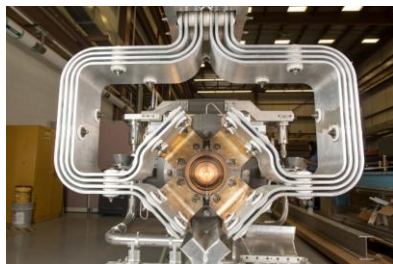
# Accelerator S&T and Operations

## Vision

Be the world's preeminent particle accelerator facility and advance leading-edge accelerator science and technologies



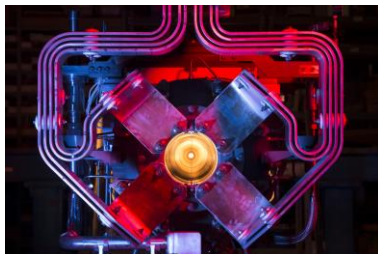
SSR2 Cryomodule Cavity



NuMI 1 MW horn stripline

## Strategy

- Modernize accelerator operations
- Complete DUNE as the world's definitive neutrino experiment
- Enable an offshore Higgs factory
- Develop a 20-year strategic plan for accelerator complex
- Leverage and develop Fermilab accelerator S&T in support of HEP and broader DOE/SC programs

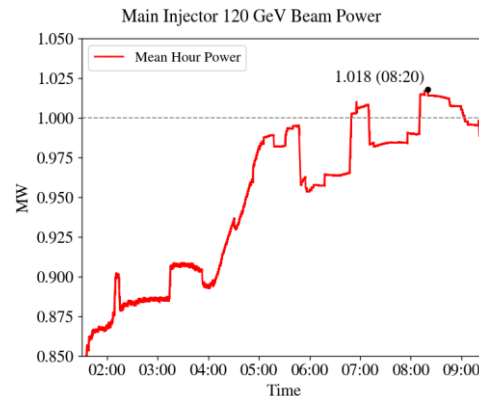


## Near-term Priorities

- Prepare the complex to run effectively and reliably for LBNF/DUNE after the long shutdown
  - AIRForce
  - PIP-II
  - ACE-MIRT
- Prepare the complex for Mu2e's first data run and carry it out.
- Provide BNB running in FY 2025 for SBND, ICARUS
- Execute ACORN
- Advance Accelerator R&D in SRF, high power targetry, high field magnets for FCC-ee, future accelerators

## Recent Highlights

- Accelerator Complex operates under fully approved Accelerator Safety Documentation O 420.2D
- Achieved beam power record of 1 MW at 120 GeV by reduced Main Injector cycle time



# Plan for Recovery of Accelerator Operations in FY26

- **Phased recovery plan is in motion**

- **Short term (FY25):**

- Relocation of a transformer from Master Substation to Kautz Road Substation being planned
    - Replacement of failed or suspect bushings have been ordered
    - Main Injector heat exchangers will be repaired

- **Recover Main Injector capability in FY26**

- **Long-term (FY26-):** Replacement of all transformers and heat exchangers at or near end-of-life to restore resiliency



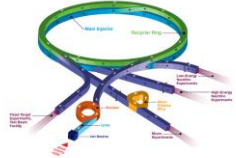
345kV Transformer and Circuit Breaker to be replaced

# Accelerator Infrastructure Readiness Task Force – Long-term Plan

- **AIRForce** charge: Develop a plan that ensures the laboratory infrastructure enabling accelerator complex operations will be ready to support reliable beam delivery in the LBNF/DUNE era and beyond.
  - **Identifying vulnerabilities** and **assessing critical risks** in equipment and systems supporting beam production, acceleration, and transport
  - **Identifying dependencies and interfaces** with current and future infrastructure systems and projects, e.g. UIP, ACORN, PIP-II, LBNF/DUNE, ACE-MIRT
  - **Detailing near term activities and outlining a long-term integrated plan** for all accelerator-related maintenance, repairs, and improvements
- The task force covers all equipment that has potential of inhibiting or significantly limiting beam delivery to LBNF.
- The prioritization methodology includes criteria such as: estimated impact, MTBF, MTTR, lead time for procurement, end-of-life or out of production status, and cost.
- The task force works across organizational boundaries. Report due January 1, 2025.

# Fermilab Accelerator Complex Evolution (ACE)

Fermilab Accelerator Complex



## Accelerator Complex

Campaign of upgrades, modernization, investments critical for the success of DUNE

## PIP-II Project

Other projects, e.g. ACORN, to ensure accelerator complex is compatible with PIP-II

## ACE-MIRT

Faster delivery of DUNE science: capability x capacity x reliability

## 20-year strategic plan

ACE-BR, Muon Collider Demonstrator, Muon Collider



**Deliver  
groundbreaking  
science & technology  
innovation**

# Emerging Technologies/ National Initiatives

- Quantum Science and Technology
- Microelectronics
- Artificial Intelligence for Science



## Vision

Be a world leader in developing and deploying innovative quantum technologies **at scale**.

Utilize quantum technologies as **new tools to address grand challenges** facing particle physics, and the broader DOE/SC programs.



Fermilab's open -source Quantum Instrumentation Control Kit (QICK)

## Strategy

**Leverage** core HEP S&T capabilities and partnerships with industry and academia to advance QIS&T

**Lead** the NQI Center SQMS, the international leader in superconducting computing and sensing QIS systems

**Lead** the devices and sensors thrust of the NQI QSC center

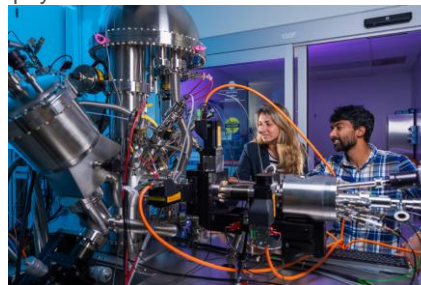
**Advance** DOE/SC QIS programs

**Foster interdisciplinary research** to grow the **national QIS ecosystem** and a diverse quantum workforce



## Near-term Priorities

- **SQMS and QSC renewal proposals**
- Large-scale QIS facility infrastructure at mK temperatures
- Sensor testing and characterization facilities
- Low-cost, scalable quantum control and readout systems
- Systems for demonstrating quantum internet and distributed sensing
- Algorithms for HEP quantum field theory simulation and fundamental physics



## Recent Highlights

- Deployed first quantum processor prototypes on-premise at SQMS garage
- Deployed underground (QUIET) and above-ground (LOUD) sensor test facilities
- Deployed metropolitan scale quantum network connecting FNAL, ANL, Northwestern
- Deliver FPGA-based controls system (QICK)



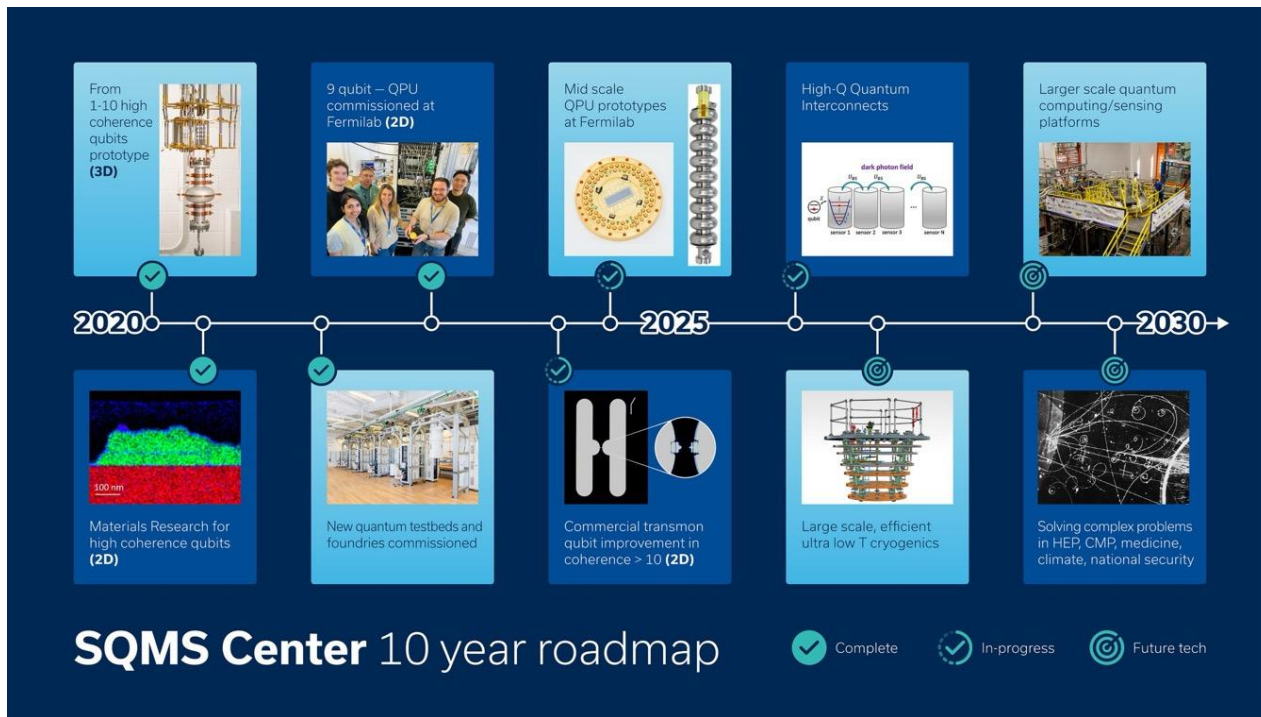
New underground qubit testing facility

# SQMS: delivering on the plan, ambitious roadmap for the future

- Mission-driven DOE National Quantum Information Science Research Center with deliverables and milestones

## Delivered on the plan

- Advanced the understanding of materials losses in qubits
- Demonstrated world leading coherence time for 3D and 2D qubit devices and systems
- Developed unique large-scale quantum facilities
- Deployed first mid-scale processor prototypes at FNAL, in collaboration with industry
- Advanced quantum computing and sensing platforms for particle physics

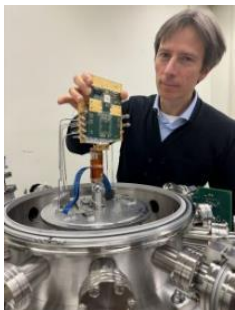


SQMS coordinates important QIS national activities with the other 4 DOE quantum centers, including the development of the DOE QIS roadmaps, the first national quantum database, the yearly U.S. QIS school, joint technical workshops and more.

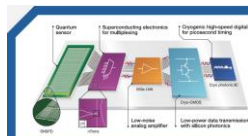
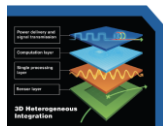
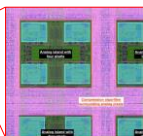
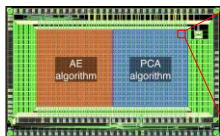
# Microelectronics

## Vision

Become a technology leader in developing the next generation of energy-efficient, extreme-environment-capable microelectronics for science. Create disruptive technologies to achieve societal impact.



Davide Braga,  
lead PI of the  
SPICE: DOE  
MSRC project



## Strategy

**Leverage core capabilities developed for our HEP program and work with academic and industry partners with complementary expertise**

- Enable breakthrough science discovery through precision instrumentation
- Develop impactful hardware for advancing applications of QIS, edge AI, and beyond
- Support U.S.-based manufacturing technology



## Near-term Priorities

**Design application-specific integrated circuits (ASICs), sensor codesign, and system integration for HEP experiments and other DOE/SC programs.**

- Edge-AI, AI-on-chip (real-time data filtering)
- 3D Heterogeneous Integration (future detectors)
- **Sensors-on-chip:** monolithic integration of sensor and readout electronics.
- **Cryogenic electronics** for QIS and computing applications.
- **Extreme environment characterization & testing** of integrated circuits, sensors, and systems, leveraging Fermilab's facilities.
- **Workforce development** through chip design internships.

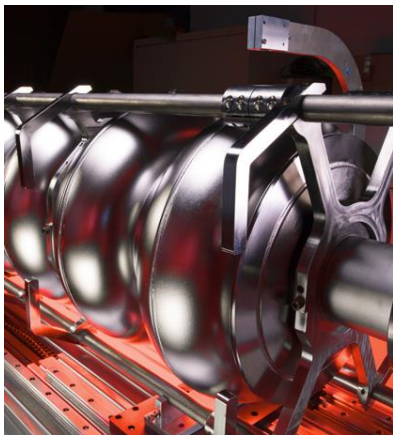
## Recent Highlights

- Lead 2 DOE ME Science Research Center projects and participate in 3
- Participate in a DoD Microelectronics Commons project
- Participate in NSF Chip Design Hub for 3D Heterogeneous Integration workforce
- **AI-on-chip demonstrated by the HL-LHC CMS upgrade chips (ECON-T).**
- Participate in efforts for DoC NSTC/NATCAST/NAPMP projects with university partners
- Establish a regional microelectronics consortium to expand the community and train the future workforce

# Artificial Intelligence for Science

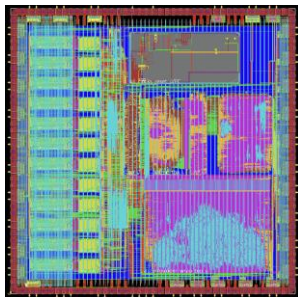
## Vision

Lead the development of transformative AI capabilities to accelerate the DOE HEP science mission and create new technologies that impact the broader scientific community



## Strategy

- Infuse AI techniques into and develop a workforce for HEP research and operations
- Leverage Fermilab strength in real-time AI and intelligent sensing across domains
- Cultivate community and industry collaborations through advancements in sensing, control, and design of state-of-the-art facilities and experiments



## Near-term Priorities

- Coalesce HEP and DOE SC AI research priorities around scientific grand challenges and applications
- Spearheaded AI-enhanced controls and digital twin data and technology development for HEP accelerators and experiments. Members of the SMART USA Digital Twin Manufacturing Institute (selected for CHIPS funding)
- Champion development of real-time AI benchmarks and tools to catalyze novel scientific capabilities

## Recent Highlights

**Fermilab is a leader in intelligent sensing and real-time AI**

- Driven by extreme data rates from HEP science
- Leveraging capabilities in microelectronics and efficient AI codesign
- Driver of the Fast ML for Science community and hls4ml tool flow
- Developing cross-domain and industry partnerships

# User and Stakeholder Initiative: Discovery on the Prairie



# Discovery on the Prairie

*An integrated, long-term vision for Fermilab that expands our impact for the nation, high-energy physics, and our state and local communities*

## Plan

- Revitalization of campus and infrastructure driven by community needs in the DUNE era
  - **Phase-I housing development - \$30M investment from State of IL**
  - Reimagined Fermilab Village
  - Modern daycare, recreational and community amenities
  - A new, world-class STEM and community-outreach facility
- Technology and Innovation Park with university and industrial partners for maximizing Fermilab's impact in science, society and industry

## Near-term priorities

- Move Labs out of the Village
- Release IL State funding, begin construction of Phase I housing facility
- Plan a new centralized Machine Shop



# Excellence in Business and Laboratory Operations



# Excellence in Business and Laboratory Operations



Focus on leadership, strategy, people, partnerships, processes, customer expectations, and key performance results to drive improvement and foster innovation – *to enable safe and effective execution of our science mission*

- Strengthen safety performance and culture – improve WP&C and ESH programs
- Manage our budgets with greater precision – maintain accurate/auditable practices
- Drive improvements in business systems – IT, Finance, and Procurement
  - Implement response to DOE Financial Management review
- Provide assurance that requirements are being met

# Campus Strategy Enabling Science Vision

Particle  
Physics  
Initiatives



Discovery on  
the Prairie

Infrastructure



# Fermilab Sustainability Strategy

**Sustainability Vision:** Be a global leader for sustainability in particle and accelerator physics and technology innovation



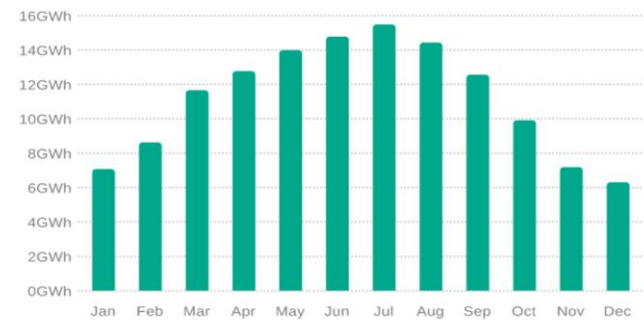
Fermilab's Sustainability Program honored with 3 awards

**Project Summary:**

- 20-97 MW Solar PV System
- Max Capacity ~ 100,000 MWh/yr
- Offset 95% of 2 meters of base (house) loads



**Energy production**



Fermilab Solar PV Project Selected for \$10M DOE Grant (Project in Development)

# Building a Culture of Excellence



## Culture of Excellence Initiative Goals

- Establish a mission-oriented Culture of Excellence to maximize the performance of our organization
- Drive culture change through exemplifying our Core Values
- Keep what's working and deliver positive change where needed

### Create Project Plan

- Conceptualize Framework
- Collect industry best practices
- Consult partners
- Plan employee engagement forums

### Develop Framework

- Establish Core Values through forums with lab leadership, supervisors, laboratory resource groups
- Collect list of principles and behaviors consistent with Core Values directly from employees
- Assemble Core Values, principles, and behaviors into a framework that represents the vision of our Culture

### Implementation

- Communicate Culture Vision consistently and continuously
- Incorporate Core Values into all aspects of doing business

### Validate and Maintain End State

- Employees trust leadership and each other
- Employees feel their work is meaningful, significant, and purpose-based
- Employees take pride in their work and feel accountable
- Positive reinforcement of behaviors that exemplify the Core Values
- Organization is flexible and continuously learning
- 2026 Climate Survey reflects progress

### Continuous Employee and User Engagement Throughout

Senior leadership meets with small groups of employees and users

Listening tours

Input on Framework

Feedback during Rollout

Climate Survey

# Summary

- Fermilab continues to deliver world-class science, project execution, and technology innovation, with safety as the highest priority.
- FermiForward has a bold, yet realistic 10-year vision aligned with DOE-SC program and the 2023 P5 Report.
- Through continuous engagement, I am determined to work with our community, lab leadership, DOE, FermiForward, and all stakeholders, to drive the lab to unprecedented heights of scientific discovery, technology innovation, and inspiration.

***We are grateful to the DOE Office of Science, HEP and FSO for tremendous support and to our community of users and partners!***