

57<sup>th</sup> Fermilab Users Meeting

# INSPIRATIONS FROM P5

## Closing Remarks

57th Annual User's Meeting (2024): Inspirations from P5

- Reception
- Panel session
- URA honorary awards session
- Festa Italiana

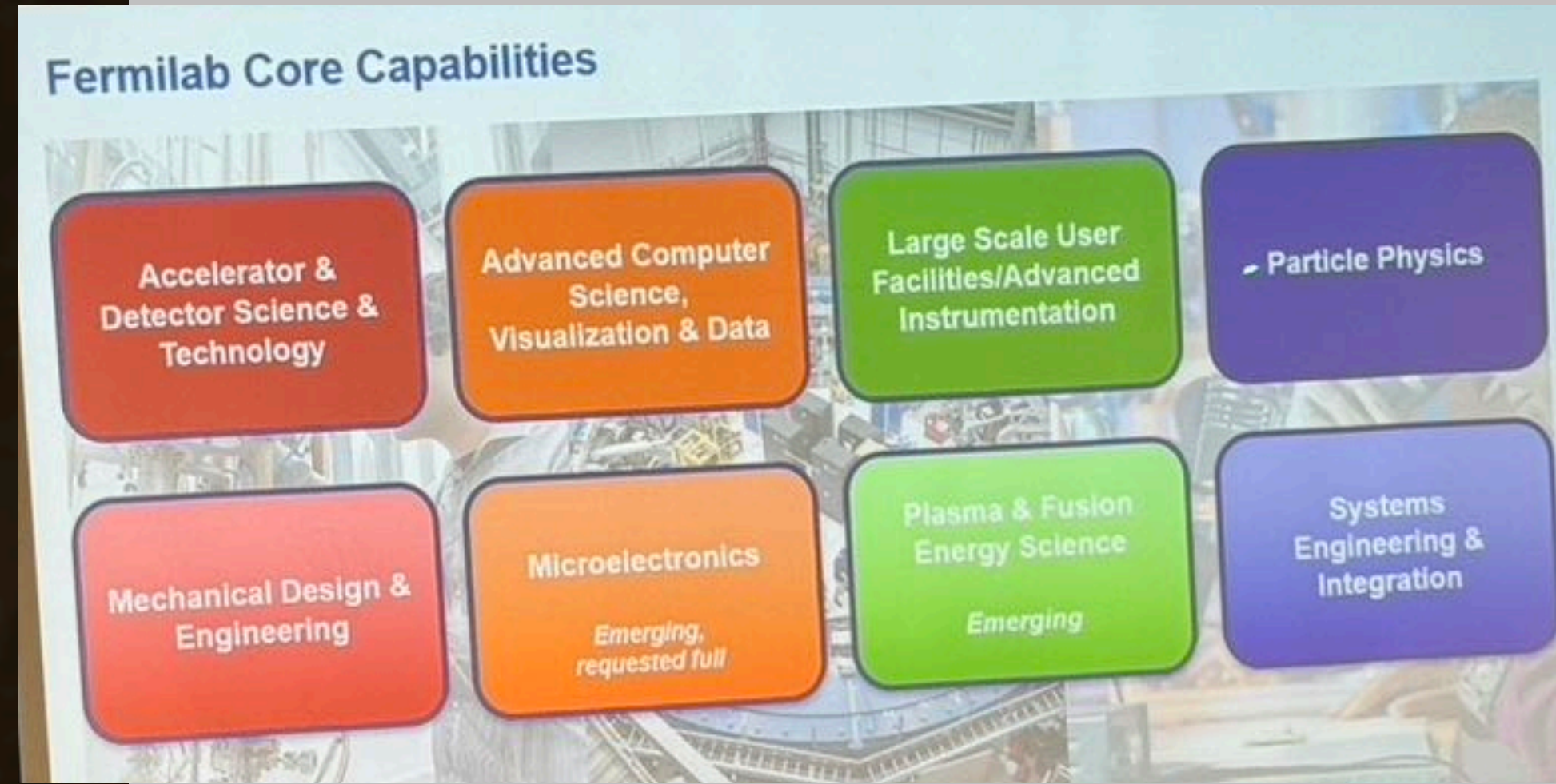
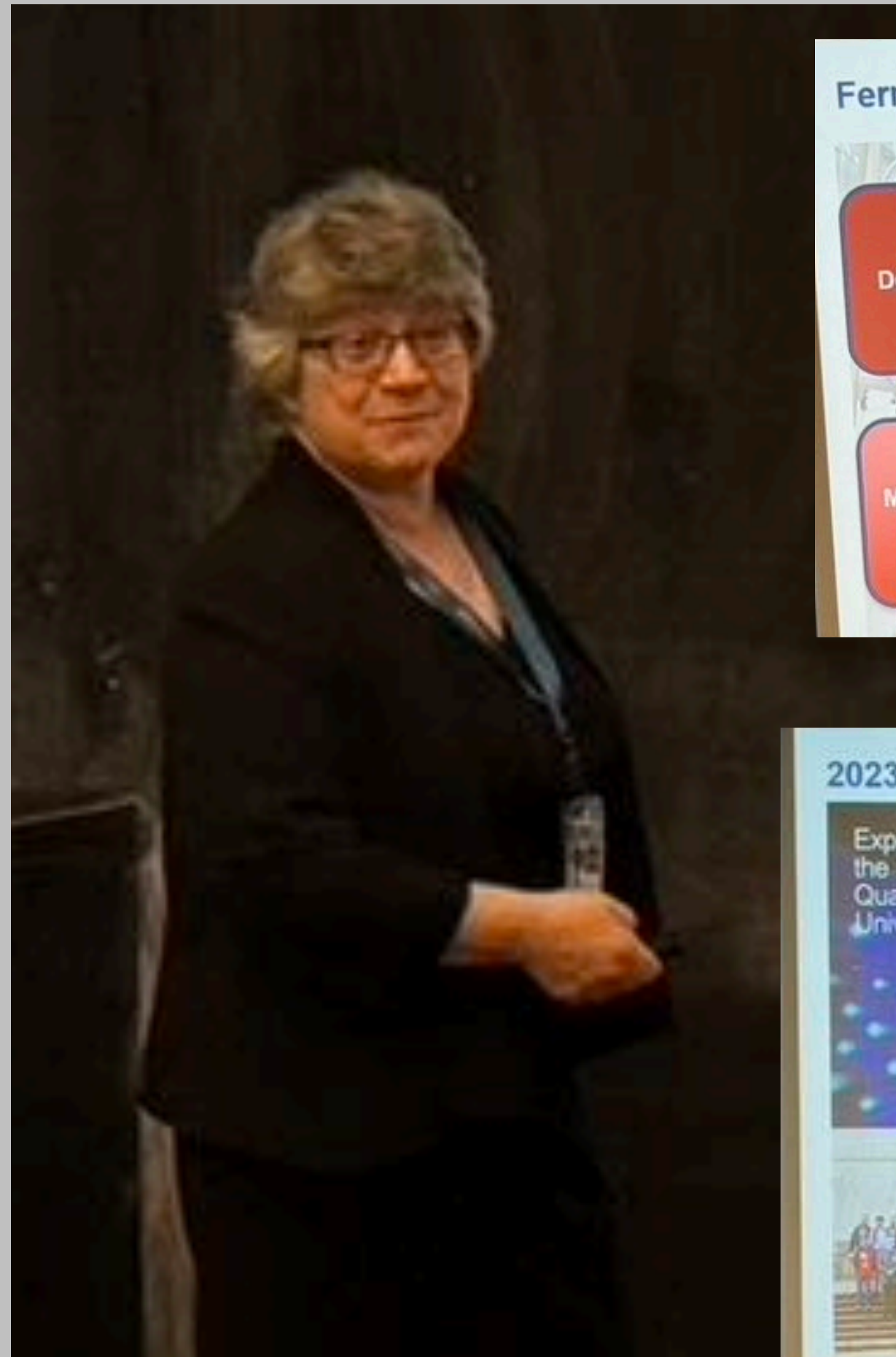
Prabhjot Singh, 12 July 2024

/64626





# Welcome & Director's Report



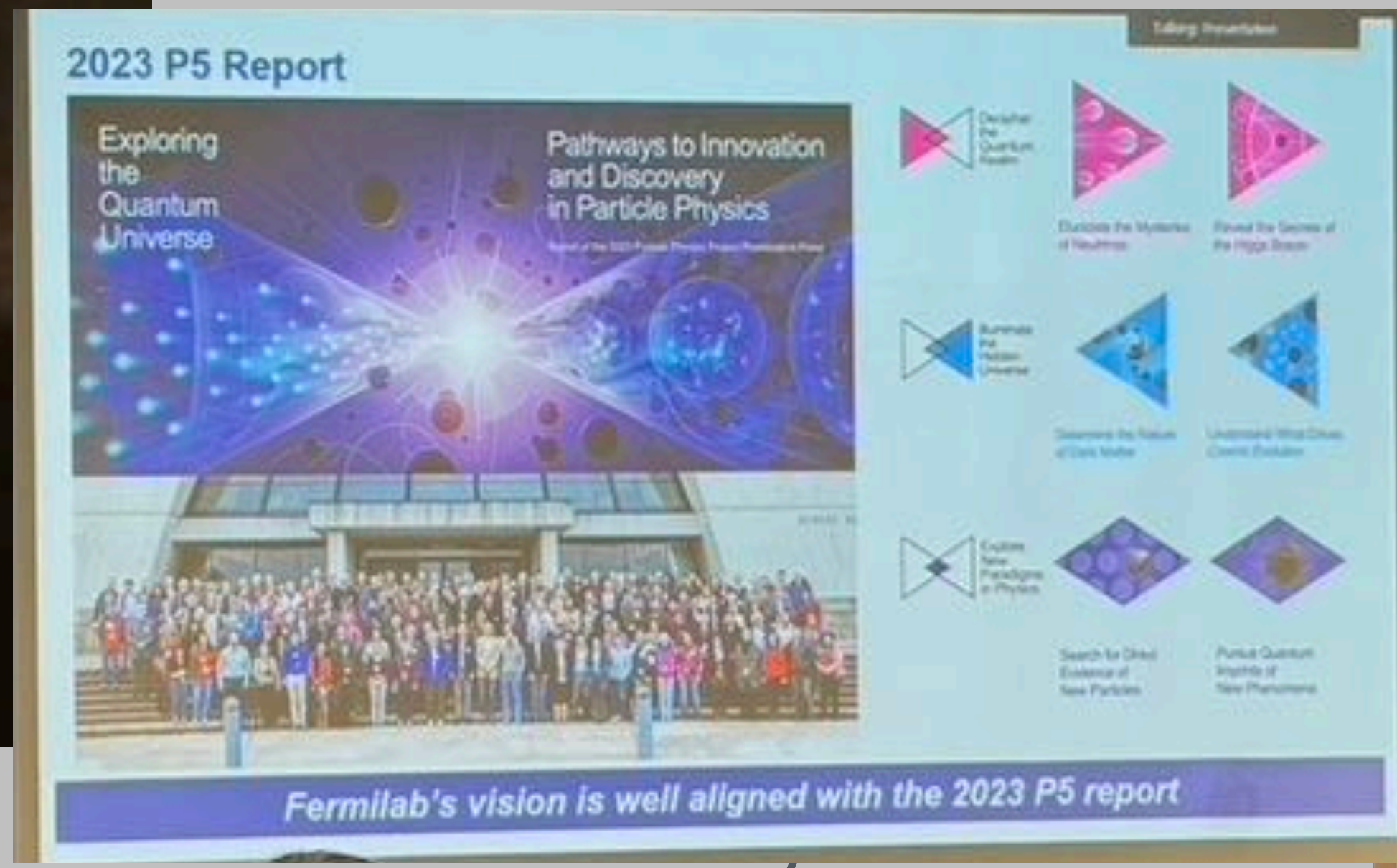
### Fermilab executes the P5 plans

	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32
IERC	\$86M	SLI	✓								
SuperCDMS	\$40M		✓								
LCLS-II HE	\$56M	DES									
Mu2e	\$316M	Muons									
HL-LHC AUP	\$286M	Higgs and the Energy Frontier									
HL-LHC CMS	\$200M	Higgs and the Energy Frontier									
PIP-II	\$978M	Neutrinos									
ACORN	\$142M	Accelerator Science and Technology									
LBNF/DUNE	\$3277M	Neutrinos									
UIP	\$314M	SLI									

**Total Investment \$5.6B DOE, \$1.1B International**

Other initiatives: SBN - \$50M, MAGIS-100 - \$19M, SQMS - \$115M

*Fermilab executes the largest project portfolio in DOE/SC; >40% scope complete*



Prabhjot Singh



# Users Executive Committee



57<sup>th</sup> Fermilab Users Meeting  
**INSPIRATIONS FROM P5**  
 Quality of Life  
 UEC



- Vast majority of US HE
- Congress appropriates 1
- off now (via *side benefi*
- Executive branch distri
- Department of Energ
- We visit Washington, D.C
- Provide information abo
- Convey our gratitude fo
- Reinforce community s

## UEC Government Relations Subcommittee

Kevin Pedro (Chair), David Yu (Deputy Chair)  
 July 12, 2024

Fermilab Users Meeting 2024  
 Welcome!

1. "Inspiration from P5"

2. Fermilab – a unique national laboratory, dedicated to basic research in particle physics, open to the world and to the public. A diverse and welcoming environment for collaboration and the exchange of ideas.

3. Particle physics – unique to the sciences in exploration of the smallest to the largest scale phenomenon.

4. The program: this week reflects that intellectual breadth and vigorous R&D program



### Fermilab Users Executive Committee Report

Jane Nachtman (University of Iowa)  
 Annual Fermilab Users Meeting  
 10 July 2024

Do you want to change the name of the UEC?

- <https://uec.fnal.gov/users-organization-constitution/>

**A. Membership**  
 Membership shall be open to individuals with a professional i

**F. Amendment**  
 This constitution may be amended by a vote of the members. Any proposed meeting. The final vote shall be taken no sooner than one week after such is required for passage.

57<sup>th</sup> Annual  
 Inspirations from P5  
 July 10th, 2024

### Education Public Engagement (EPE) Subcommittee

Barbara Yaeggy & Adam Lyon  
 On behalf of the UEC



12 July 2024



Users Meeting



# Town Hall with the Directorate





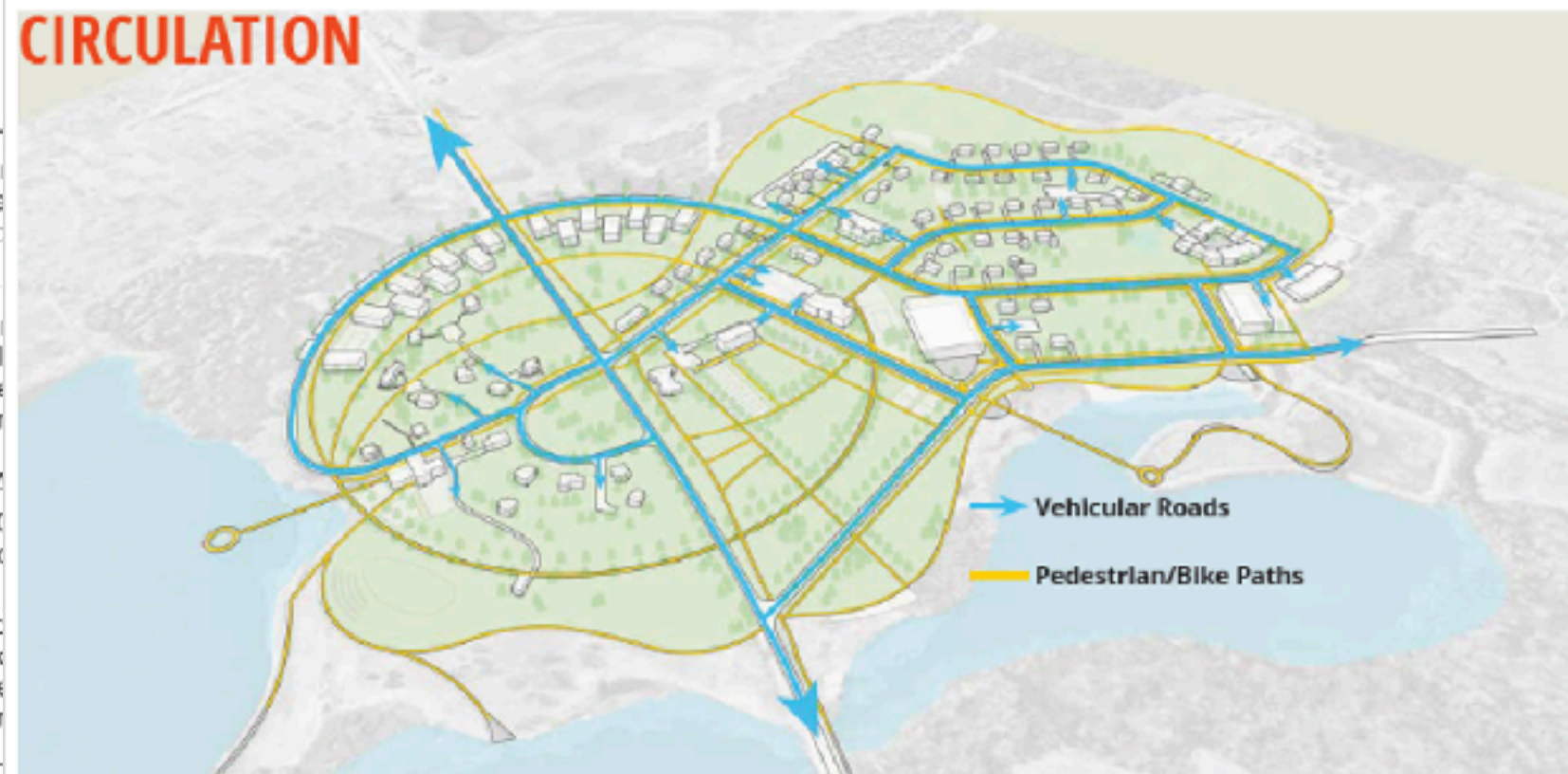
# Discovery on the Prairie



## The Fermilab Village

### LEGEND CIRCULATION

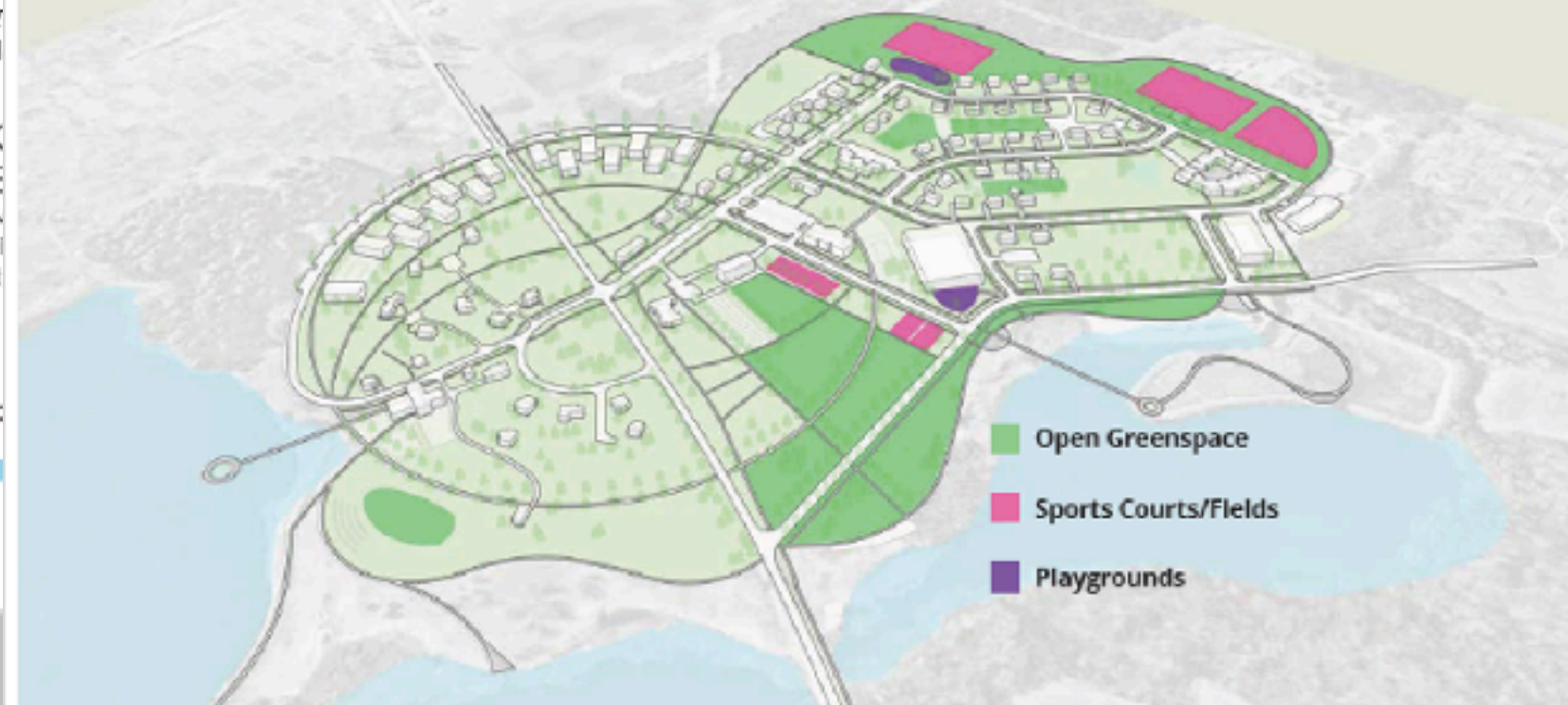
- ① PH
- ② PI
- ③ DA
- ④ US
- ⑤ RE
- ⑥ EX



### EXISTING/PROPOSED BUILDINGS



### RECREATION PROGRAMMING



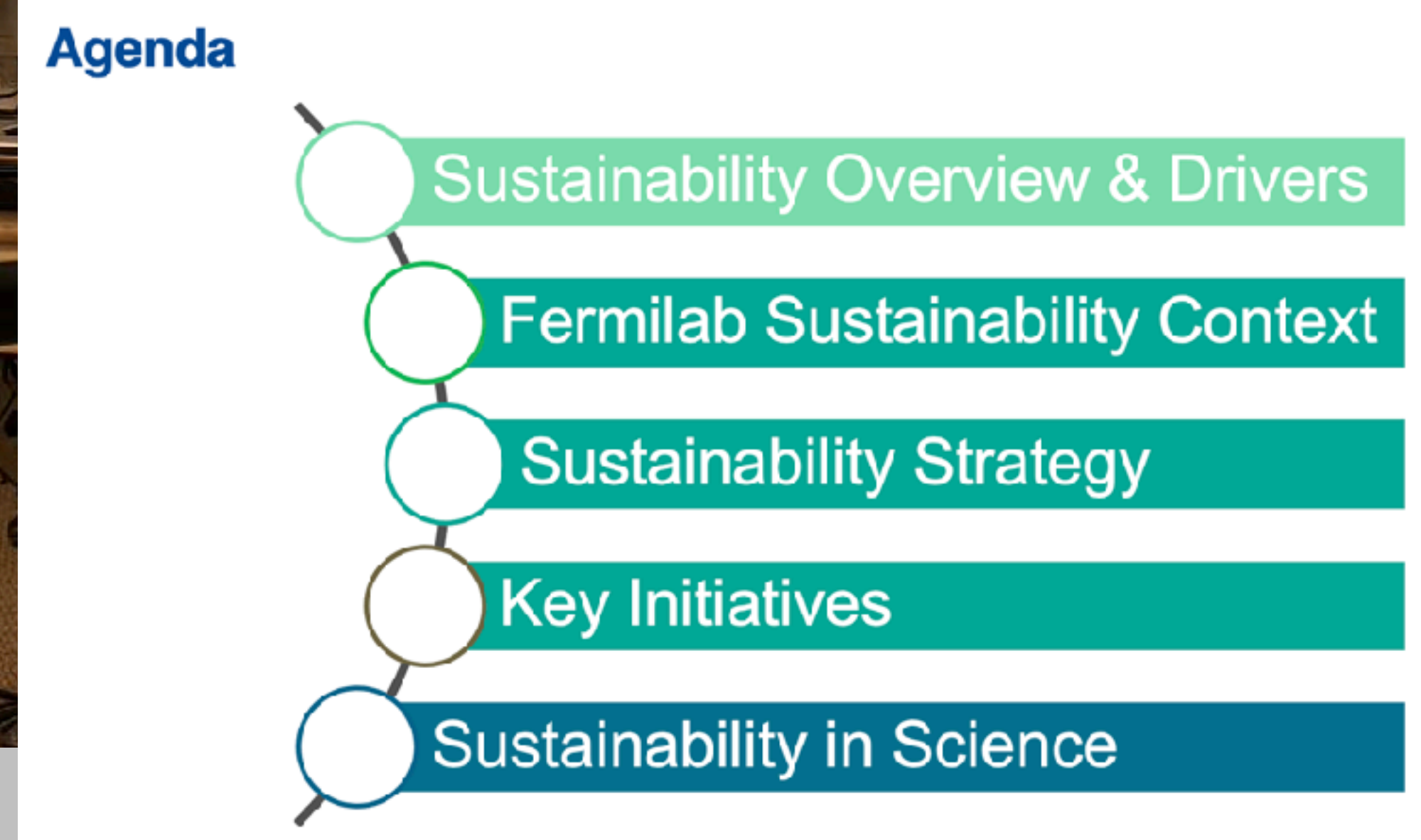
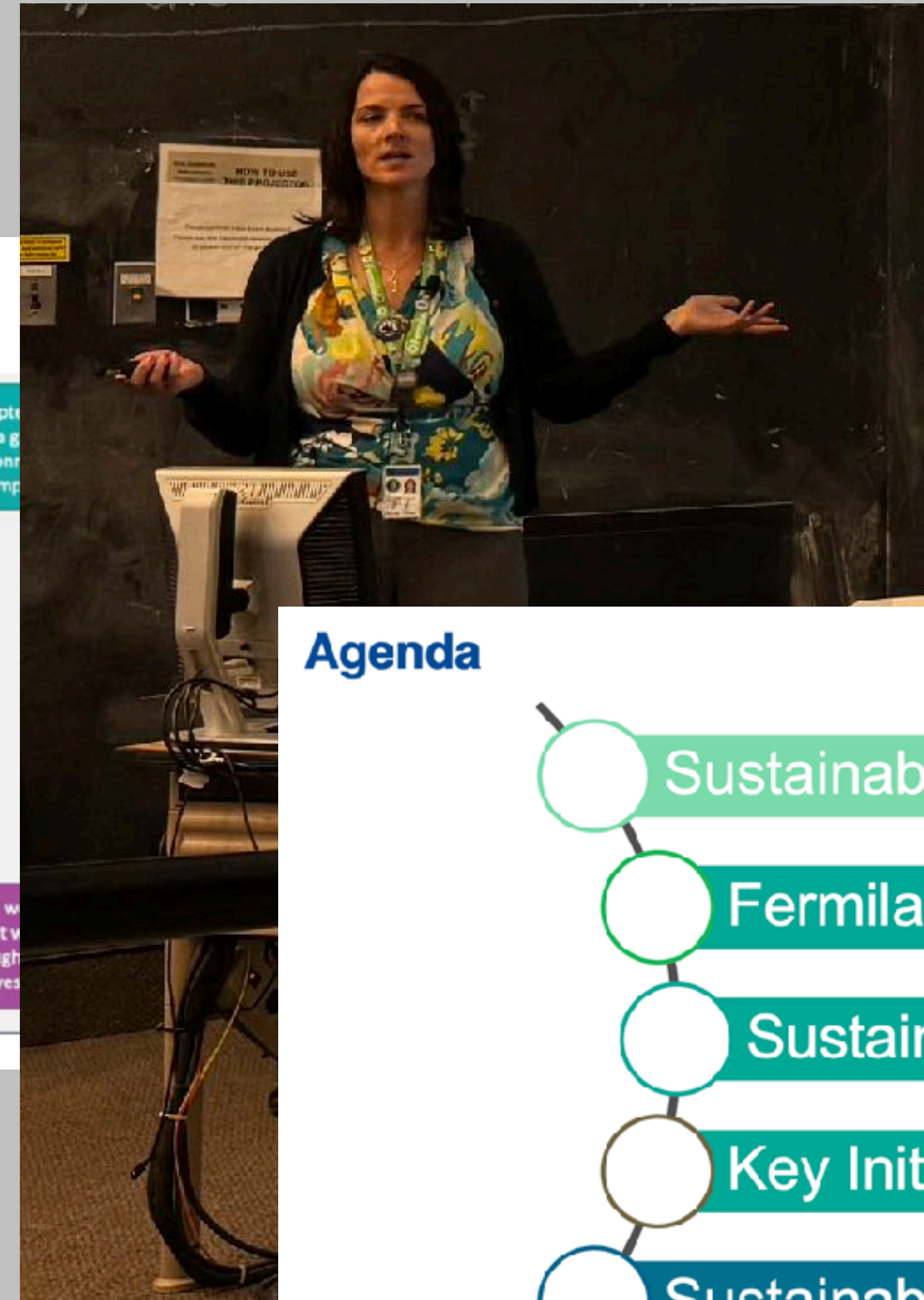
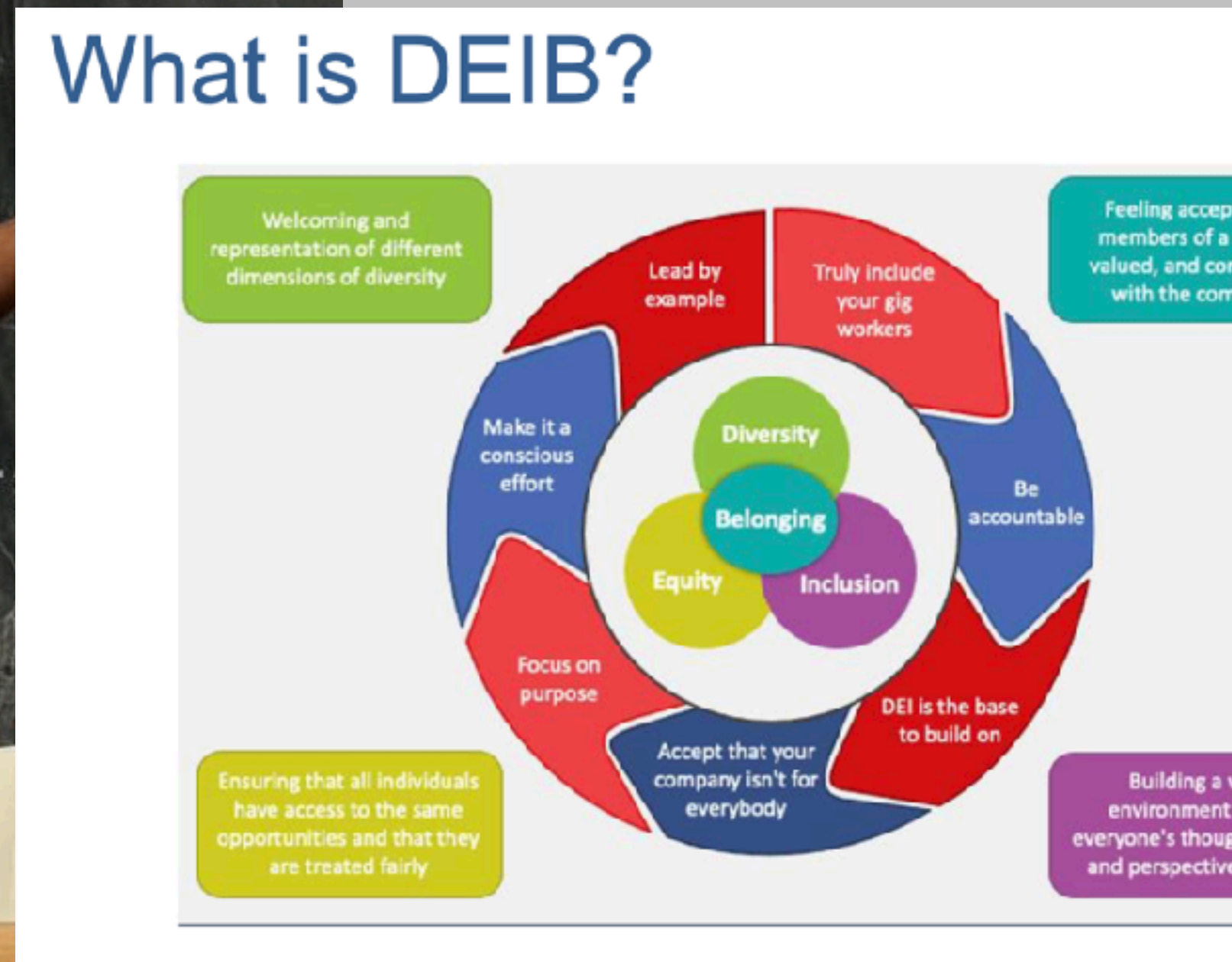
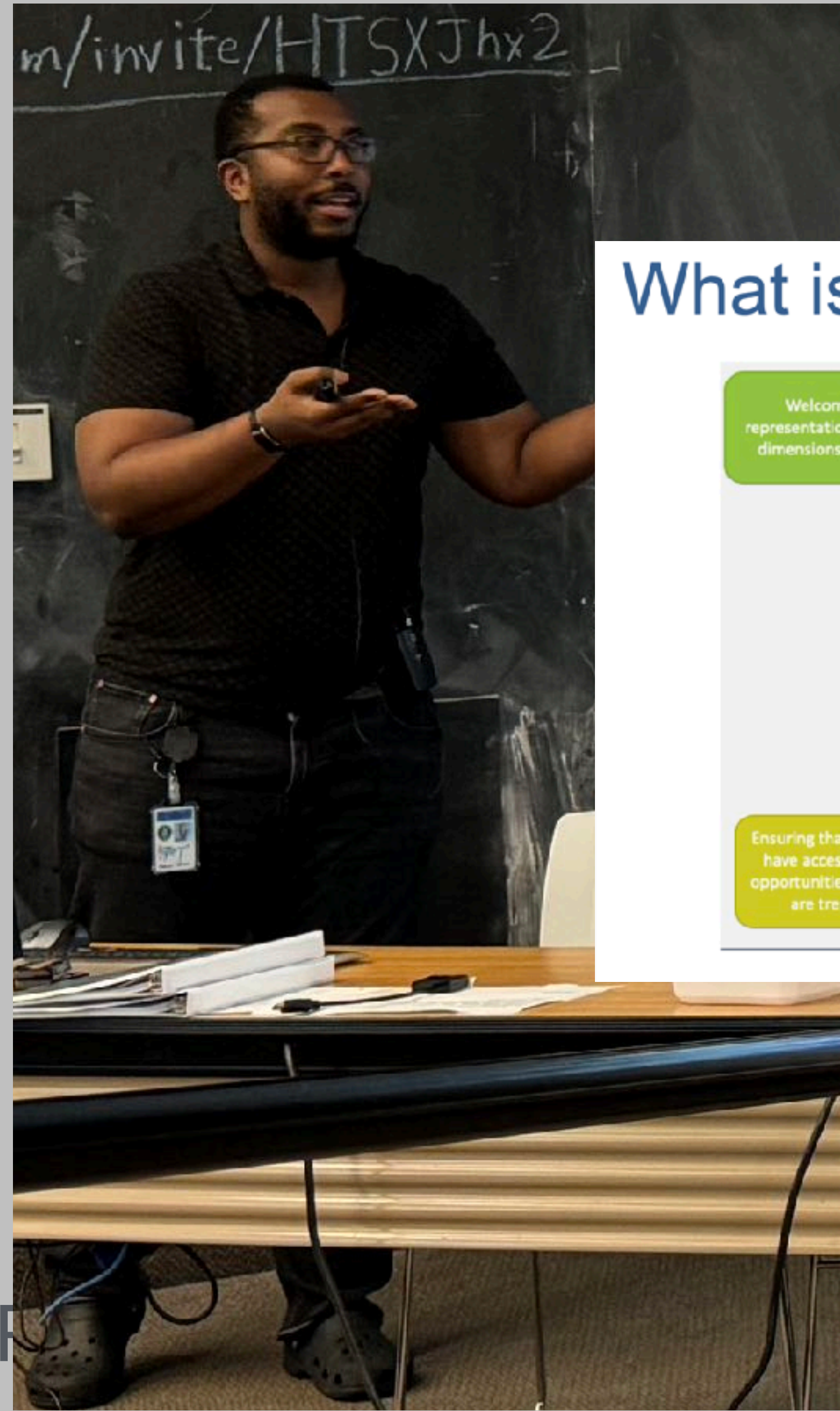
### SHUTTLE ROUTE



CONFLUENCE



# Fermilab Efforts in EDI & STEM and Sustainability



12 July 2024

57th Users Meeting

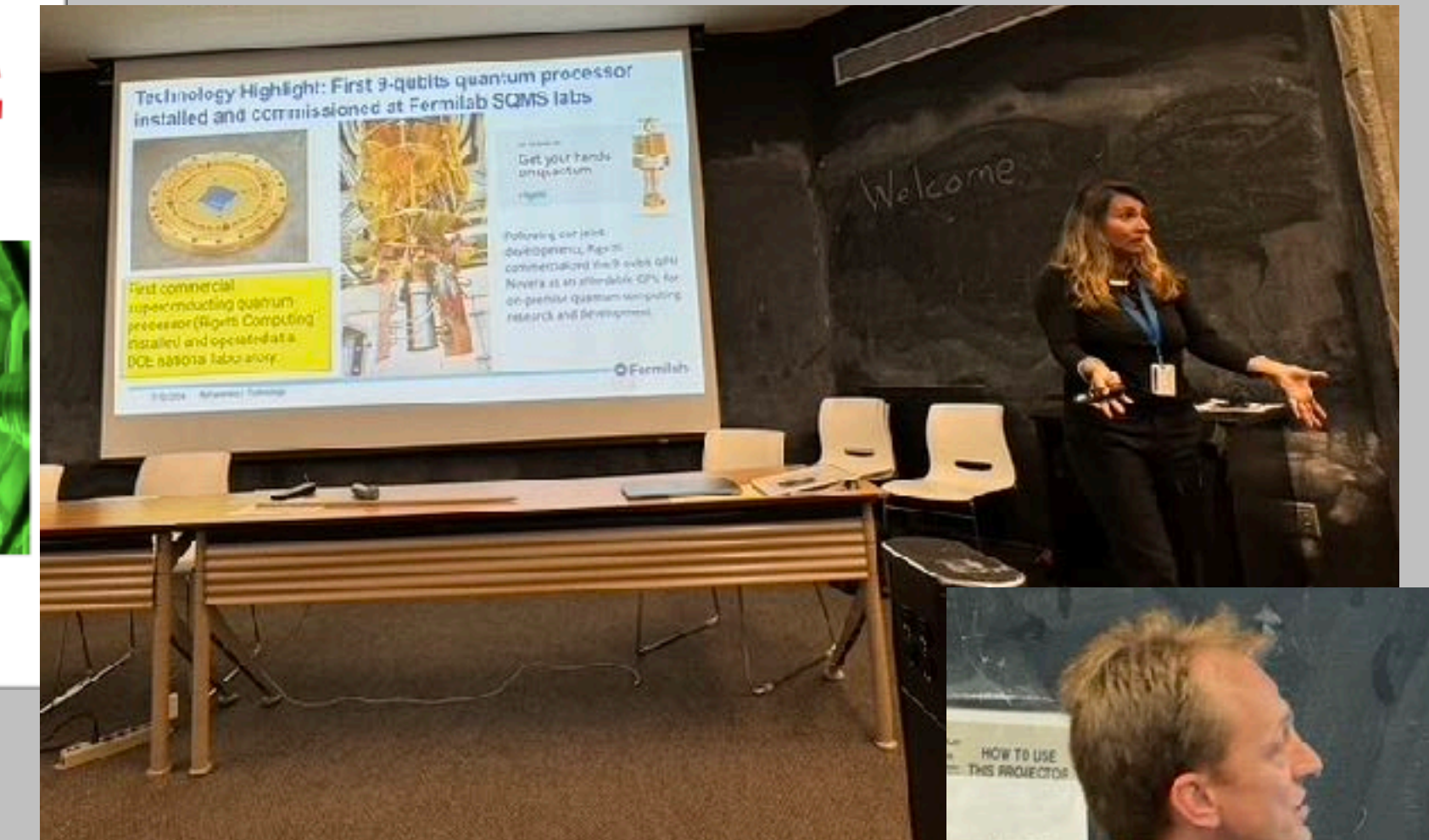
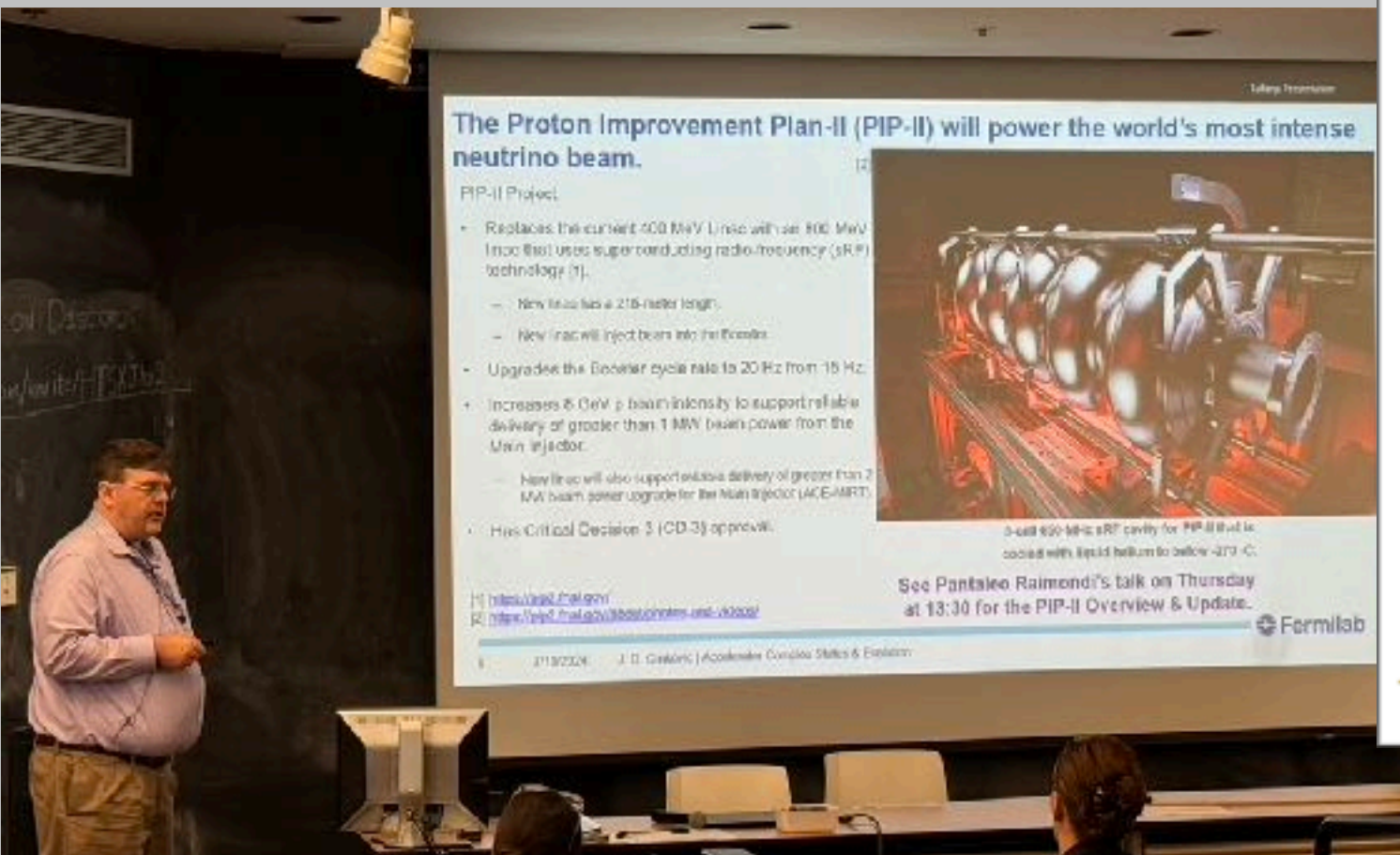


# Several Talks

## Status of the Short-Baseline Near Detector Experiment

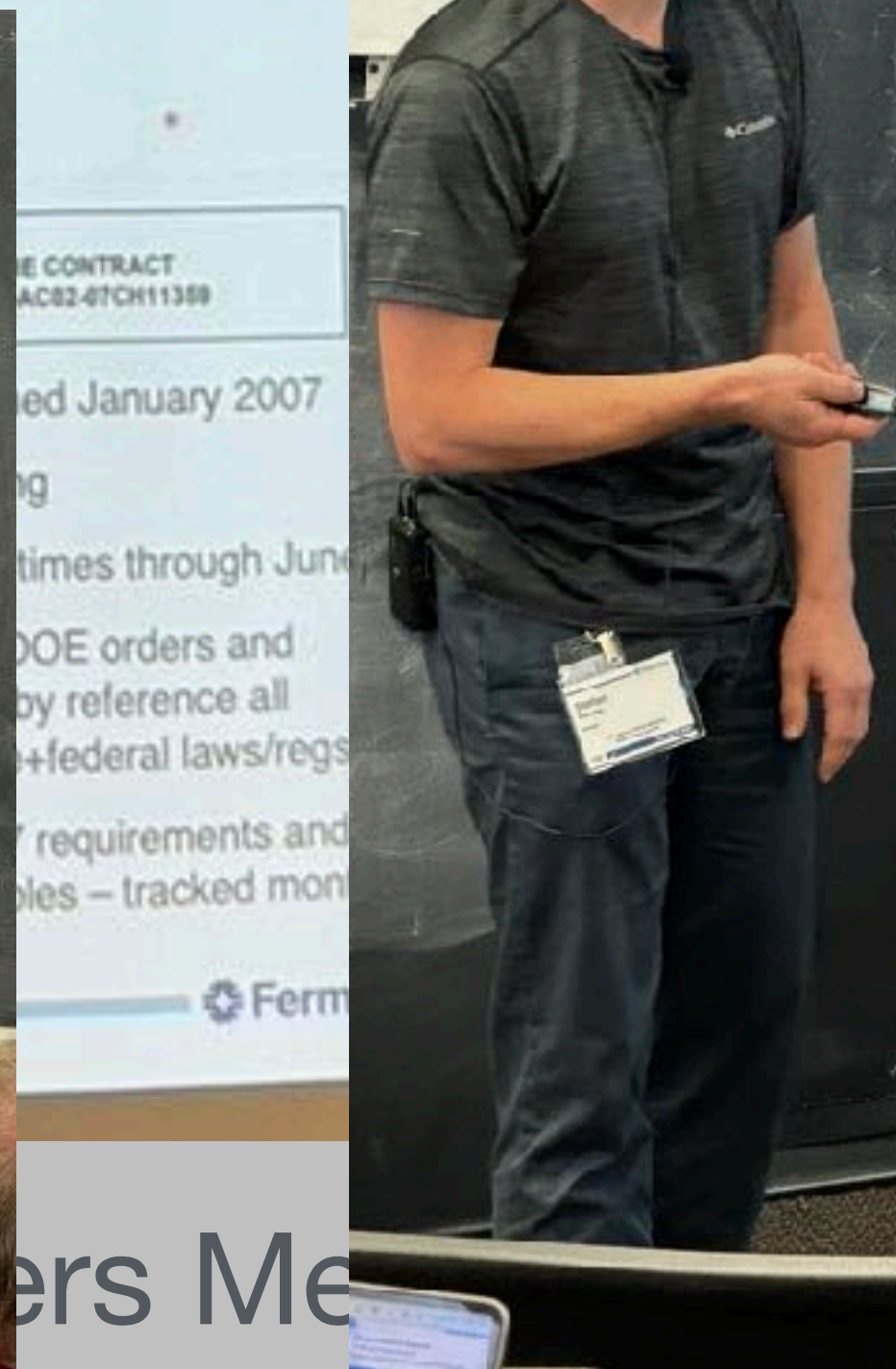
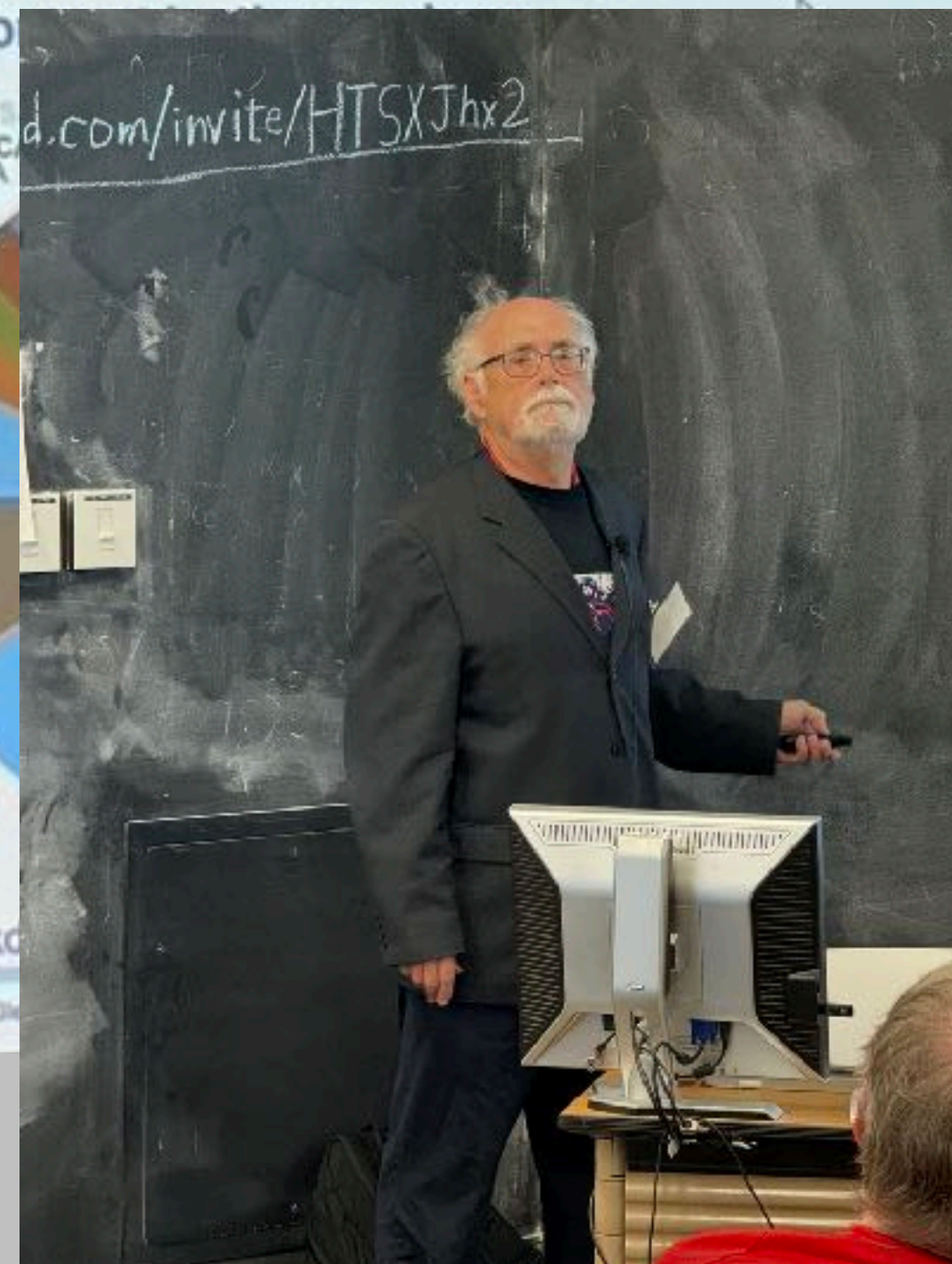
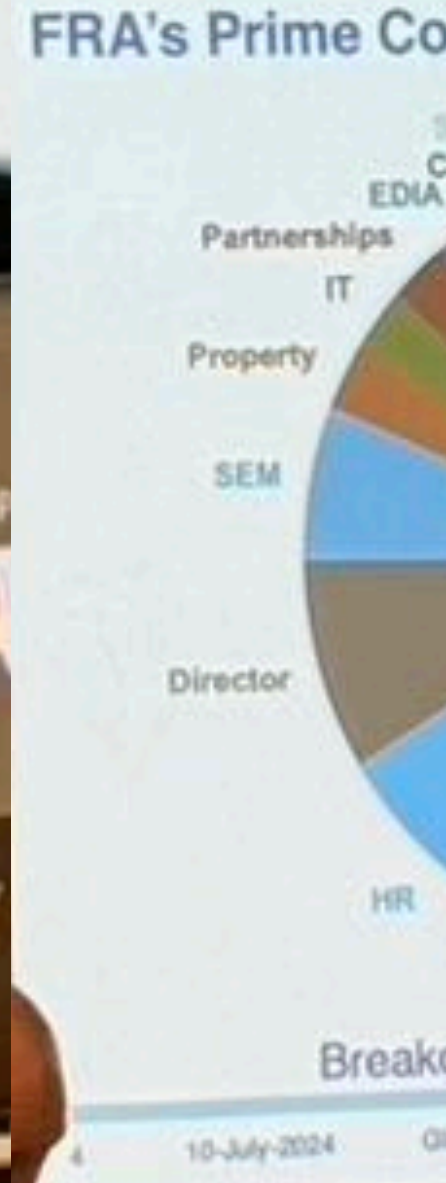
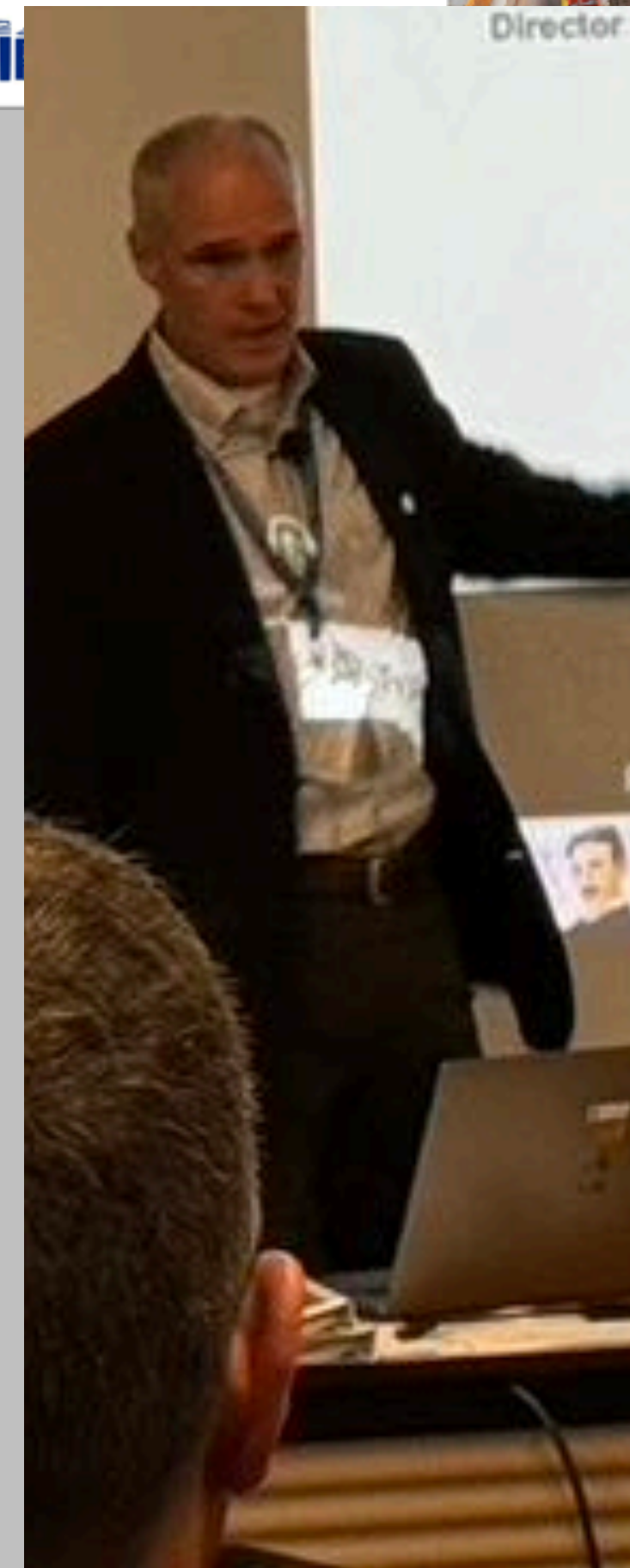
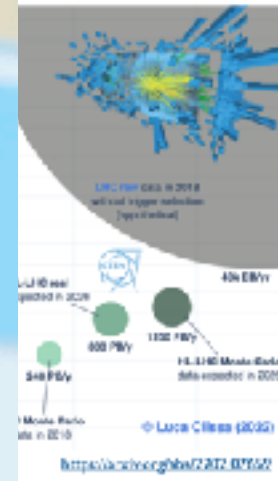
Fermilab 57th Annual Users Meeting - Inspirations from P5, July 10 2024

Daisy Kalra, Columbia University (on behalf of the SBND Collaboration)



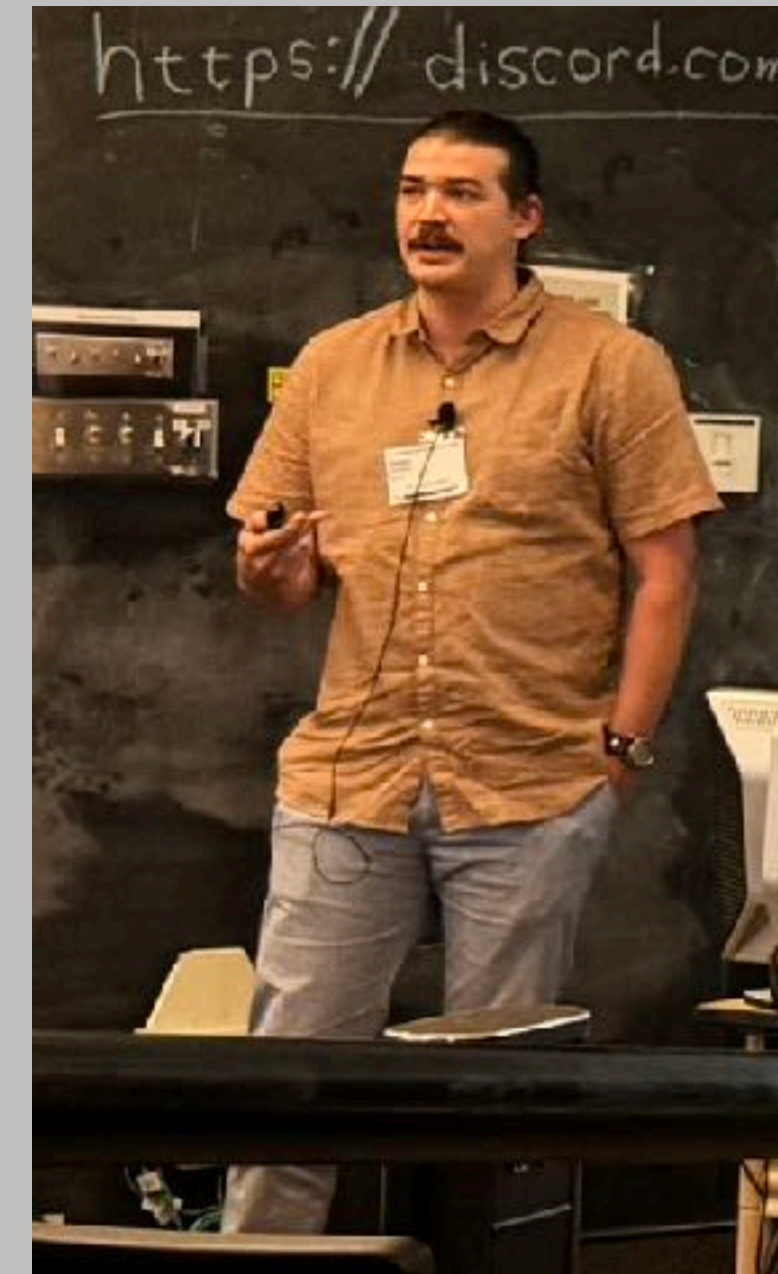
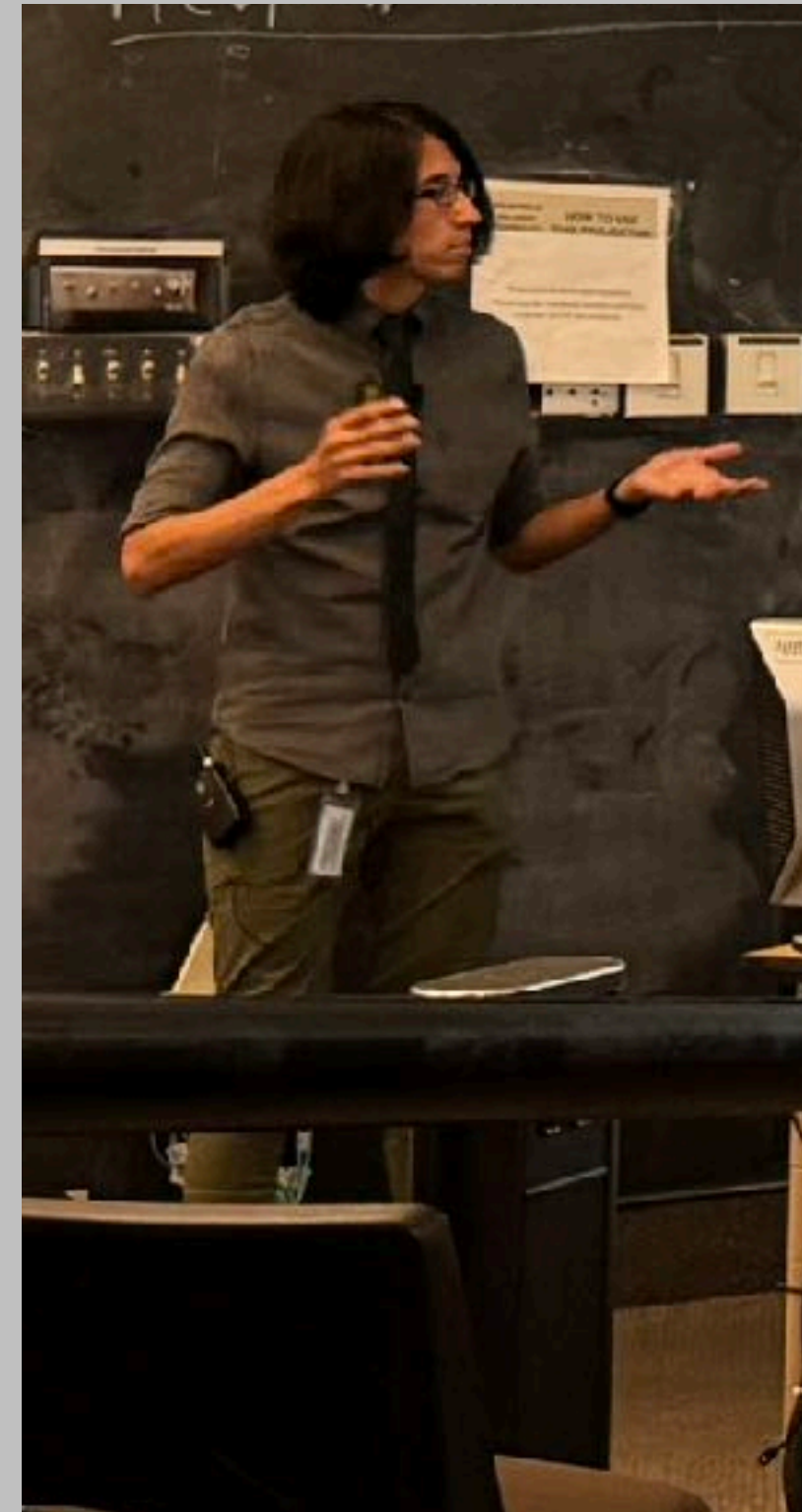
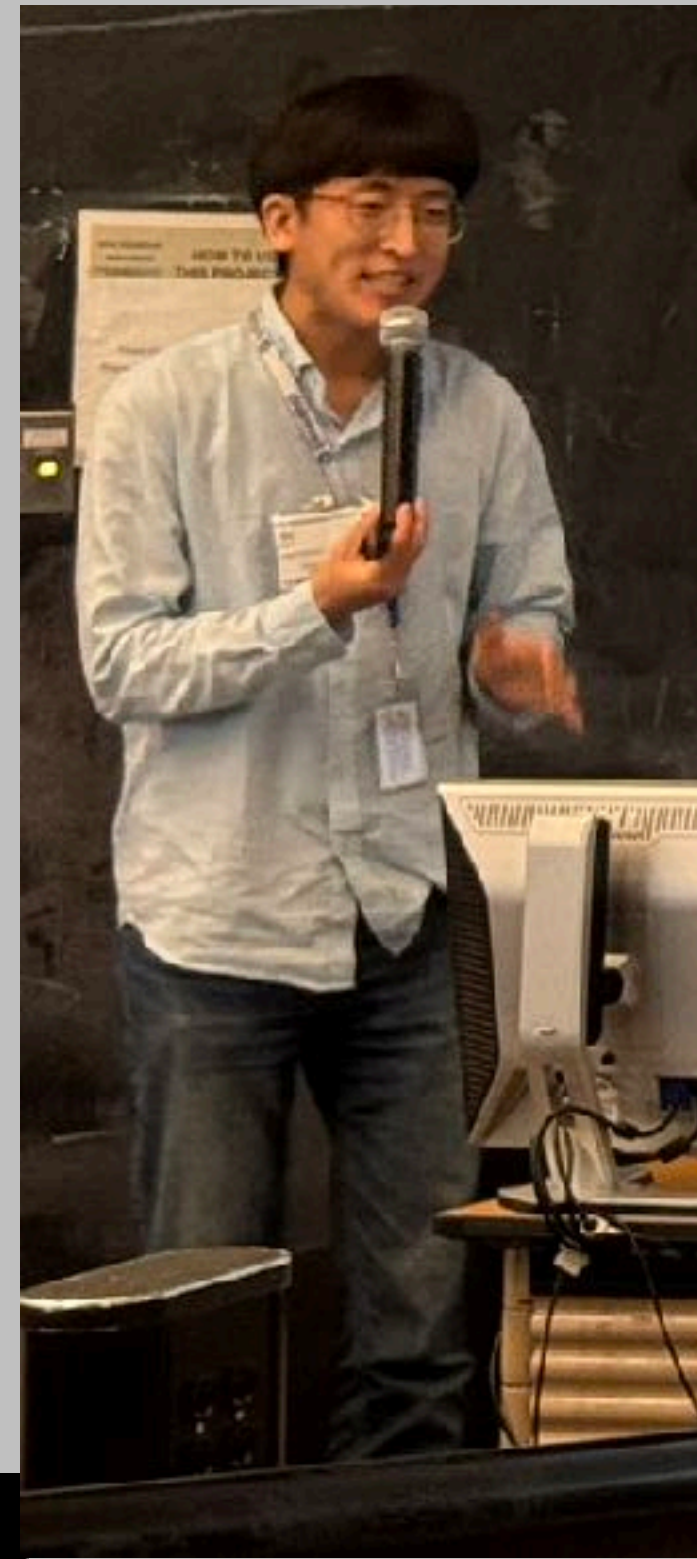
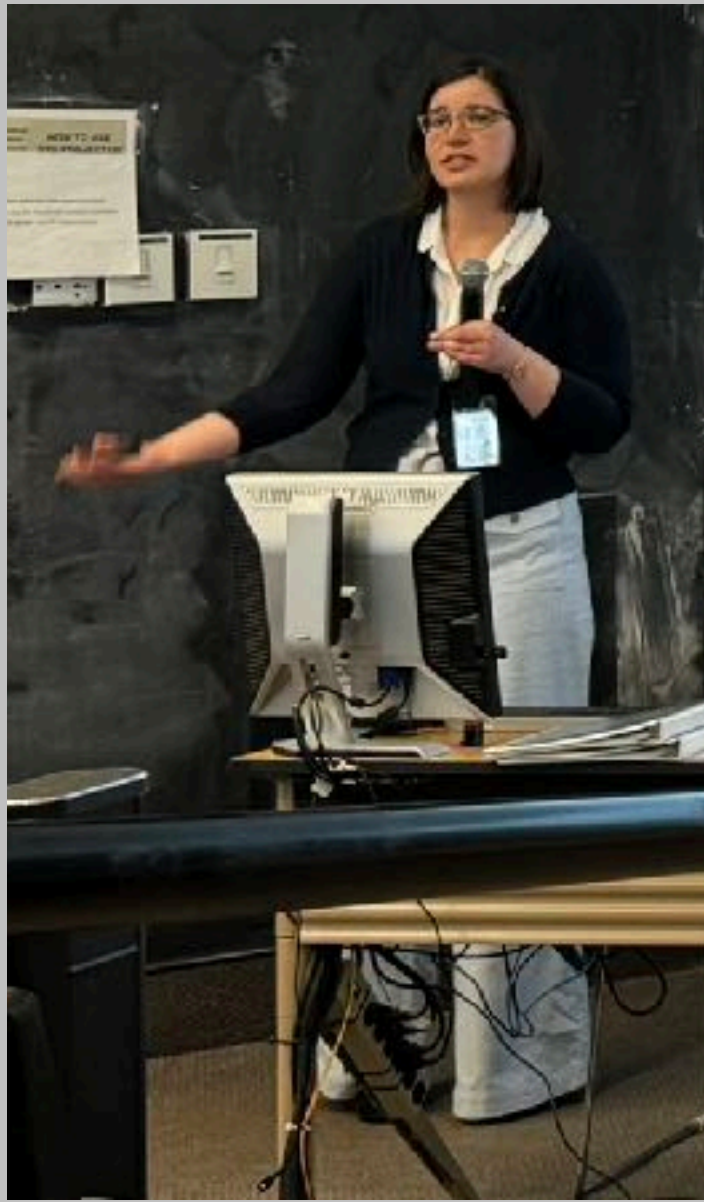
### Why AI & ML for physics ?

- We are collecting with huge amounts of data in HEP experiments
- AI & ML approaches are key to addressing these problems
- Challenging set up to find insights & accelerate time-to-physics & improve operational efficiency



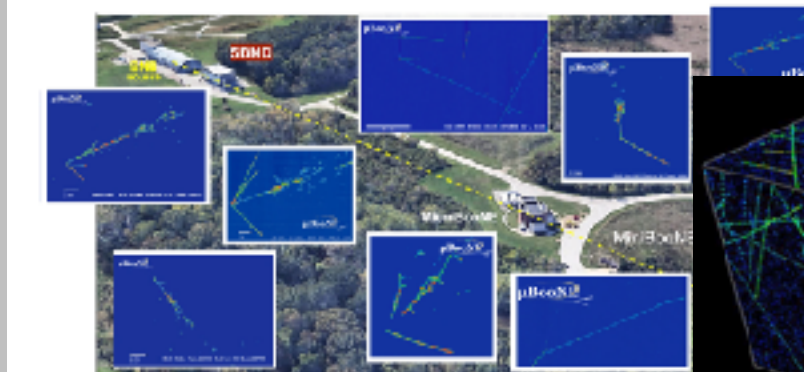


# Several Talks:

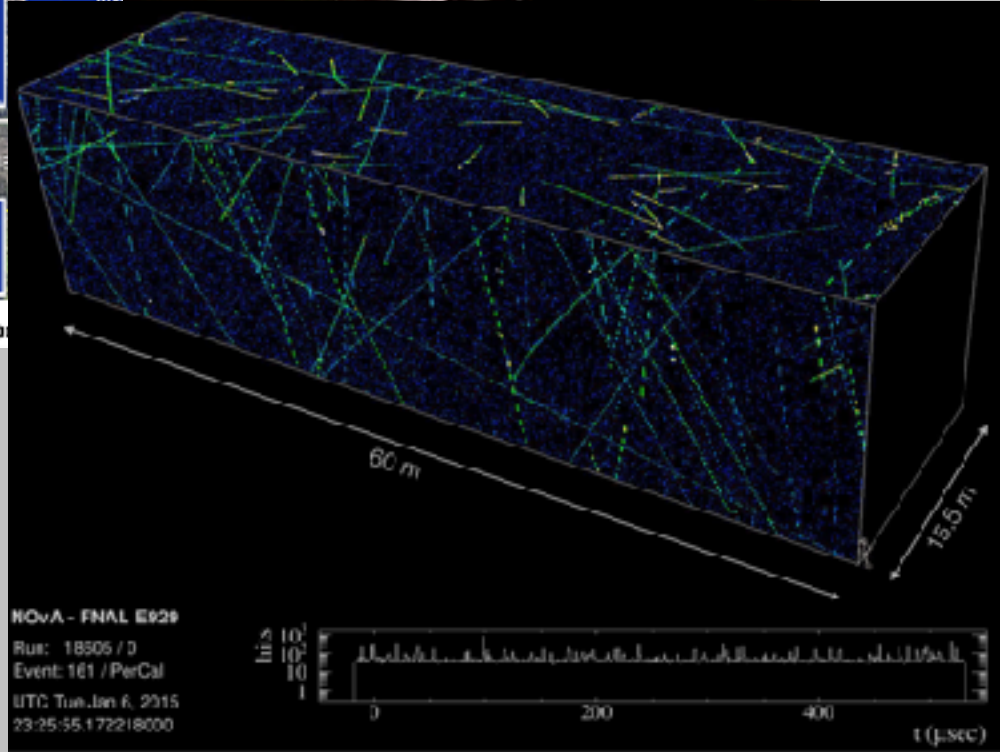


## MicroBooNE

Longest operating LArTPC detector, with world's largest data set of neutrino



Thank you to everyone at Fermilab who has made this possible



NOvA - FNAL E929  
Run: 18505 / 3  
Event: 161 / ParCal  
UTC: Tue, Jan 8, 2015  
23:25:55.172218000



## Experimental Overview

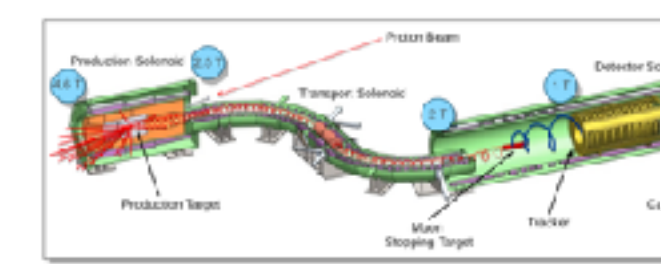


- Muons are stored in the storage ring (~25 m diameter) under a 1.5 T homogeneous magnetic field.
- Muon spin precesses under the magnetic field.



## The Mu2e experiment

Mu2e will look for a muonless, collect muon-to-electron conversion in the field of an act  $\mu^- \rightarrow e + \gamma$  ( $Z, A$ )  $\rightarrow e^- + \gamma$  ( $Z, A$ )  
The chosen nucleus is aluminum ( $Z = 13$ ), different from the SINDRUM II experiment which used



## Matter-wave Atomic Gradiometer Interferometric Sensor

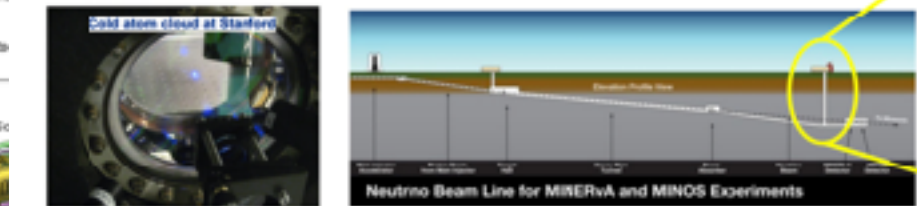
**MAGIS-100:** Atom interferometry over ~100-meter vertical baseline

- Three strontium atom sources + imaging system
- Atoms: freely-falling clocks & inertial reference
- Common interferometry laser beam

Searching for dark matter, new forces, gravitational waves, and more!

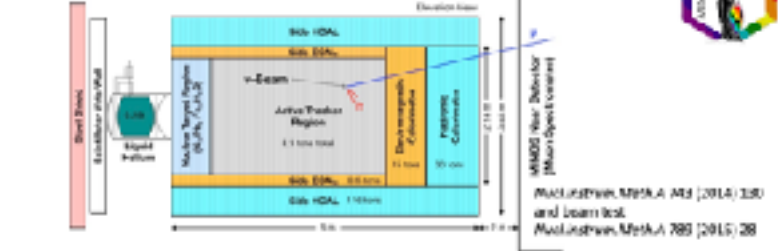
To be installed in the existing MINOS access shaft at Fermilab

Leverage precision AMO techniques for HEP+ science goals



7/11/24 D. Temples | FNAL Users Meeting | MAGIS-100: Current Status and Outlook

## MINERvA's Detector



Three views:  
A: Vertical  
J/V:  $\pm 60^\circ$



Spatial resolution ~3mm  
Timing resolution ~3ns  
Fermilab



# Several Talks:

## The Compact Muon Solenoid experiment

**CMS 'cheat sheet'**  
 Weight: 14,000 tons  
 Diameter: ~15m  
 Length: ~25m

**Largest silicon tracker ever made**  
 $[\sigma(p_T)/p_T \sim 1.5 \cdot 10^{-4} p_T(\text{GeV}) \oplus 0.005]$

**ECAL: 76K scintillating PbWO<sub>4</sub> crystals**  
 $[\sigma(E)/E \sim 2.9\%/E(\text{GeV}) \oplus 0.5\% \oplus 0.13\text{GeV}/E]$

**HCAL: Brass + plastic Scintillator (~7K channels)**  
 $[\sigma(E)/E \sim 120\%/E(\text{GeV}) \oplus 5.9\%]$

**Muon System: CSC, RPC, DT**  
 $[\sigma(p_T)/p_T \sim 1 (5\% \text{ for low } p_T \text{ muons})]$

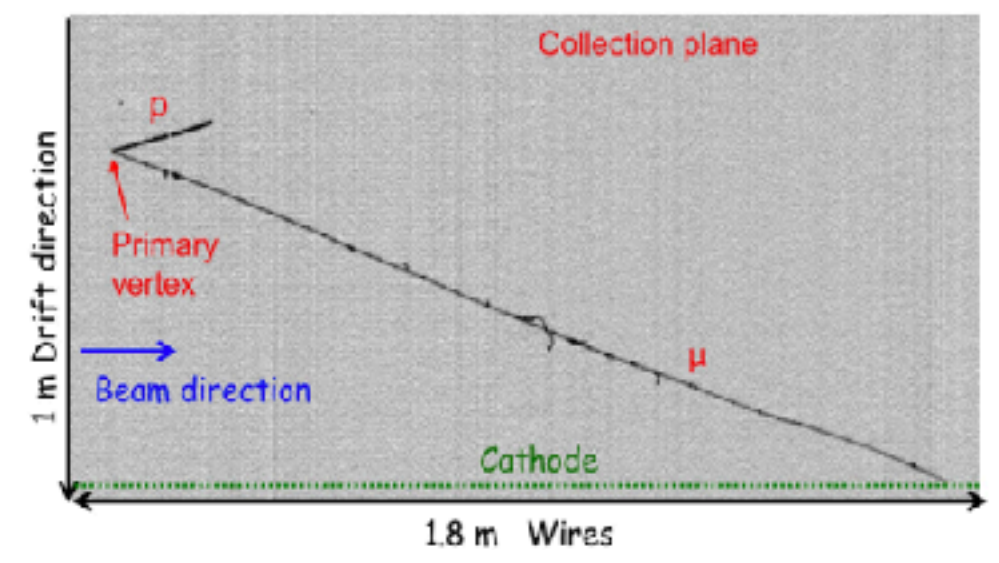
**4T superconducting solenoid**



## Elements of the Fermilab Computing Strategy

Data Centers, Mass Storage, Compute Resources, Software Development, Engineering, Data Analysis, Diversity, Equity, Inclusion, and

## Imaged Neutrinos @ ICARUS

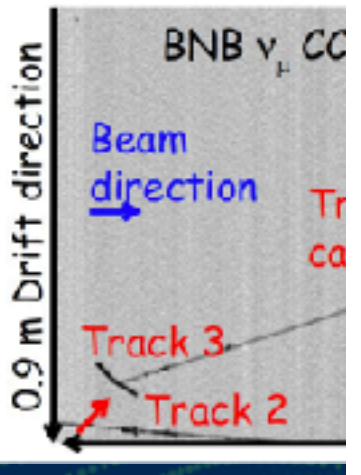


## NEXUS/QUIET at MINOS

- Low-background R&D facilities for cryogenic detectors
- NEXUS: SuperCDMS, MKIDs, qubits, and more
  - ▶ Identifying and reducing backgrounds for SuperCDMS HVeV detectors with single-electron charge resolution
  - ▶ Measuring impact of ionizing radiation on superconducting qubits and investigating possibilities for qubit-based DM detection
  - ▶ Now transitioning to a dedicated facility for NR calibration
- QUIET: new dedicated facility for quantum detectors, with a companion surface facility (LOUD)



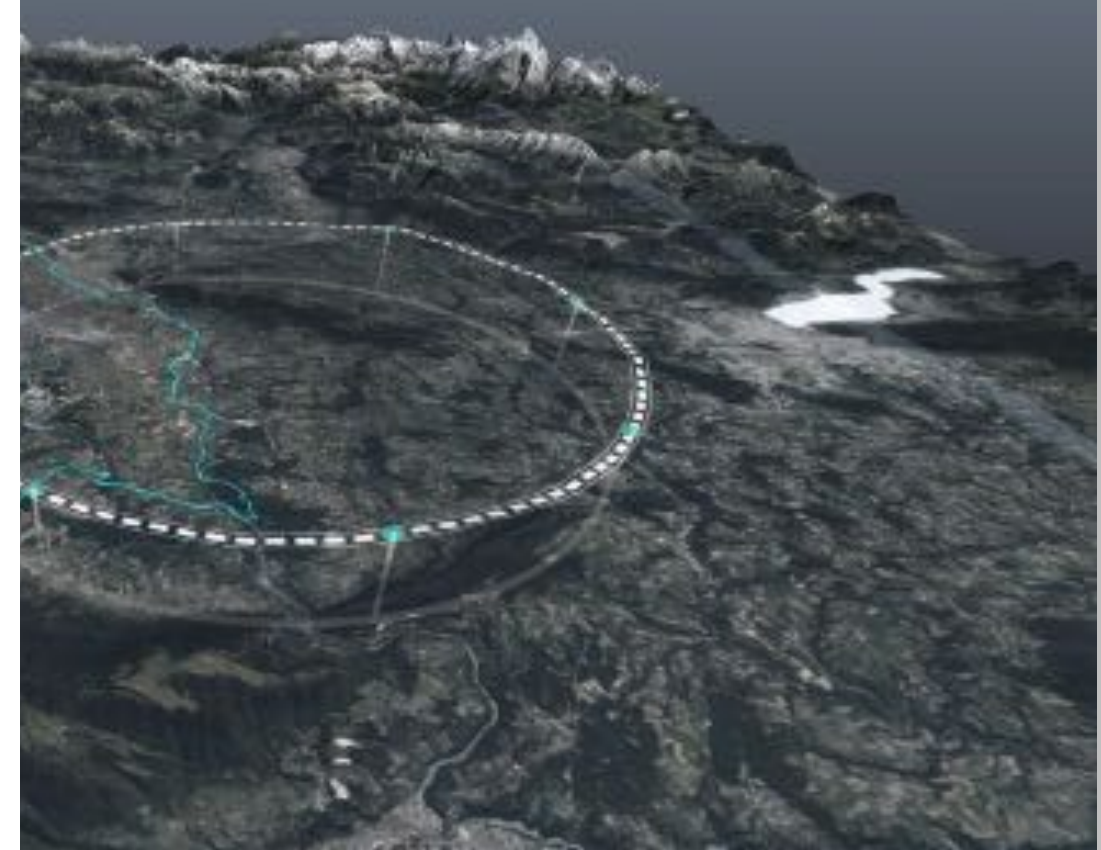
Fermilab, entanglement, classical, gate, qubit, state, quantum, measurement, computation, probability



## Fermilab's Cosmic History

- Lab Director Leon Lederman creates Fermilab Astro theory group with David Schramm, 1983. Hires Kolb and Turner.
- Rocky Kolb & Michael Turner: NASA-Fermilab theory center. Inner Space/ Outer Space conference, 1984.
- Lab Director John Peoples initiates experimental program with Sloan Digital Sky Survey beginning in late 1980s.

*People would remind me that the A in FNAL is Accelerator, not Astrophysics. But I always thought an accelerator is a tool. You don't say, "A carpenter is a person who uses a hammer. If you don't use a hammer, you're not doing carpentry." You know, there are other tools that you can use to get to the physics.*  
 - Rocky Kolb, AIP Oral History, 2020.

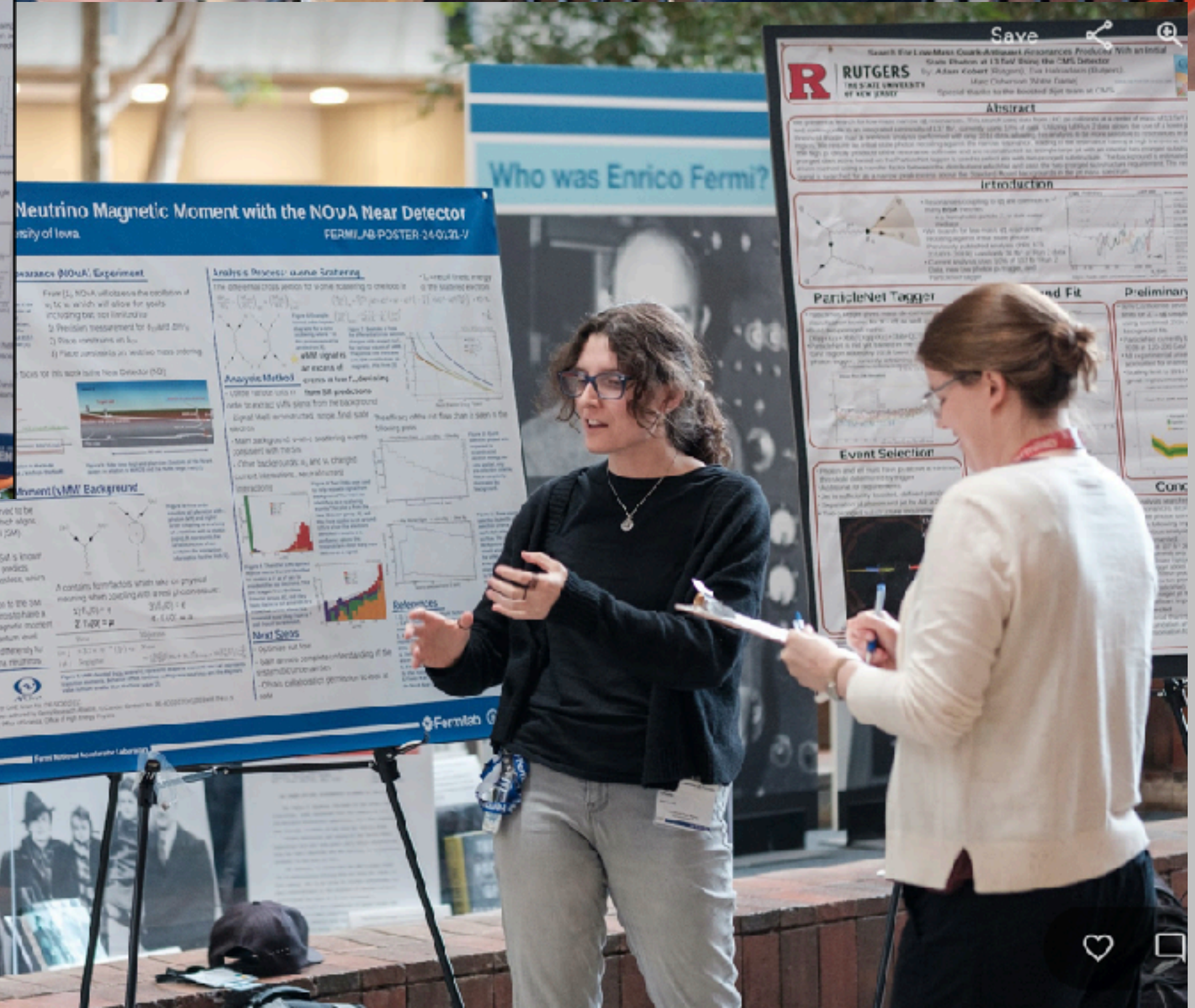
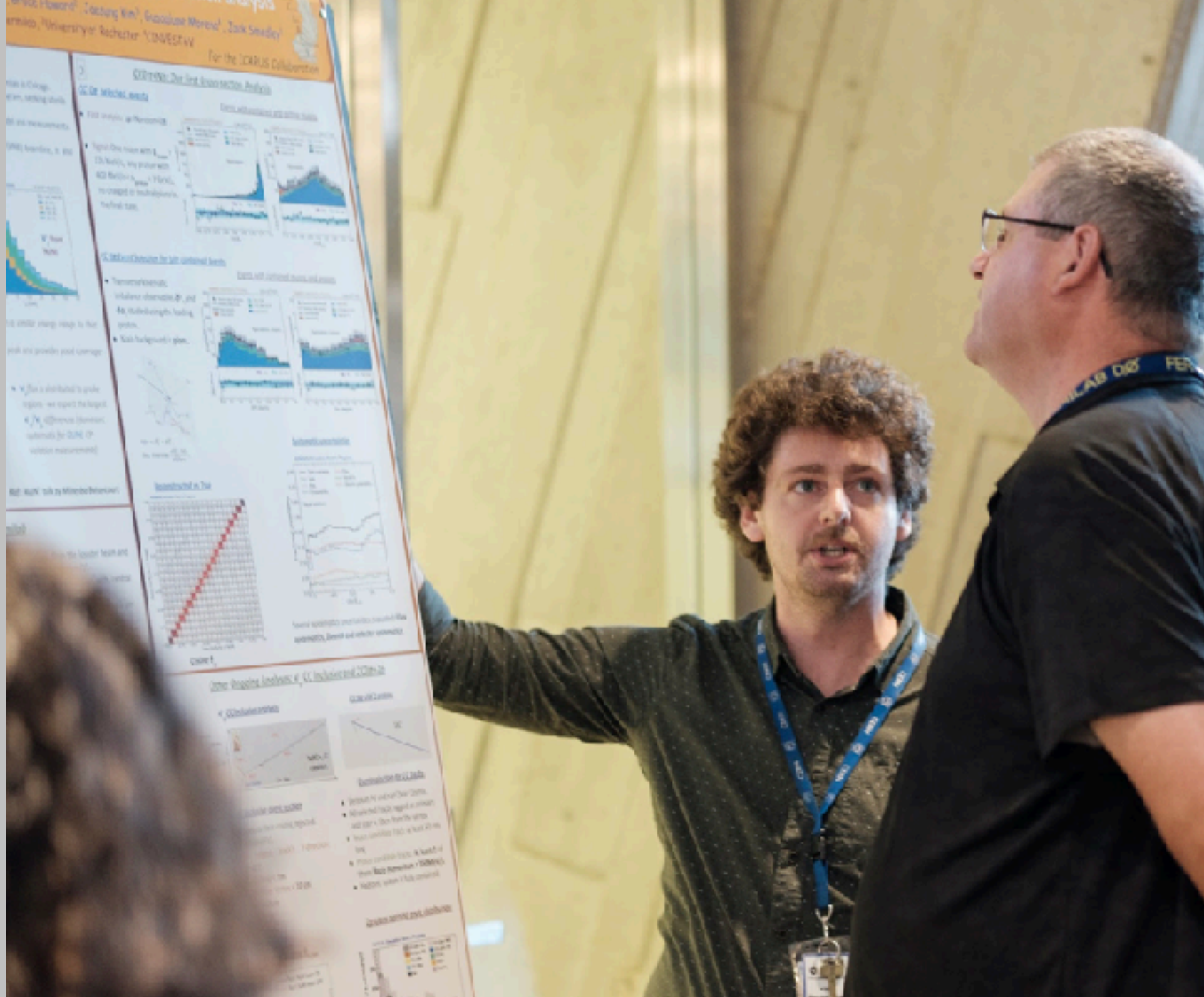
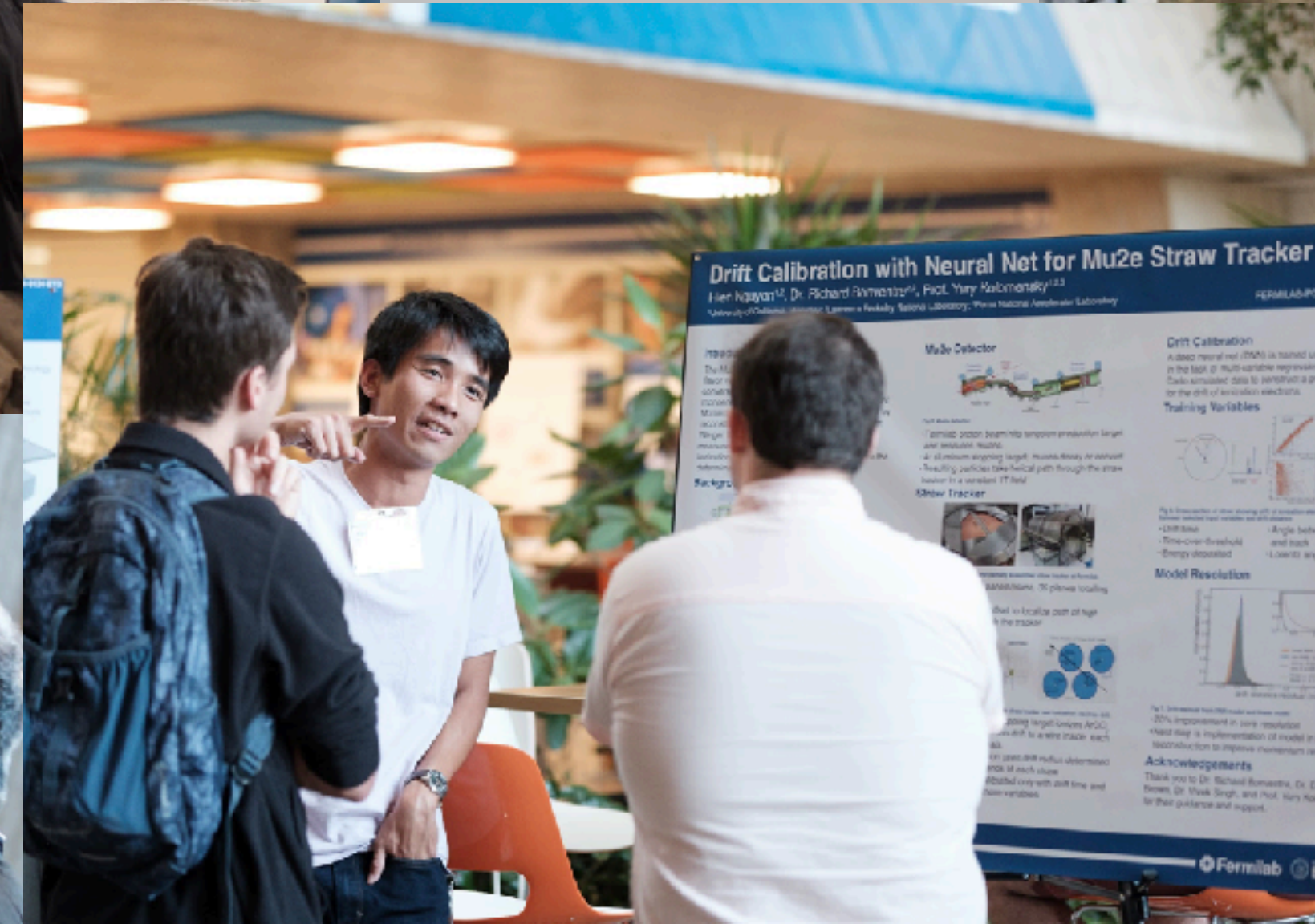
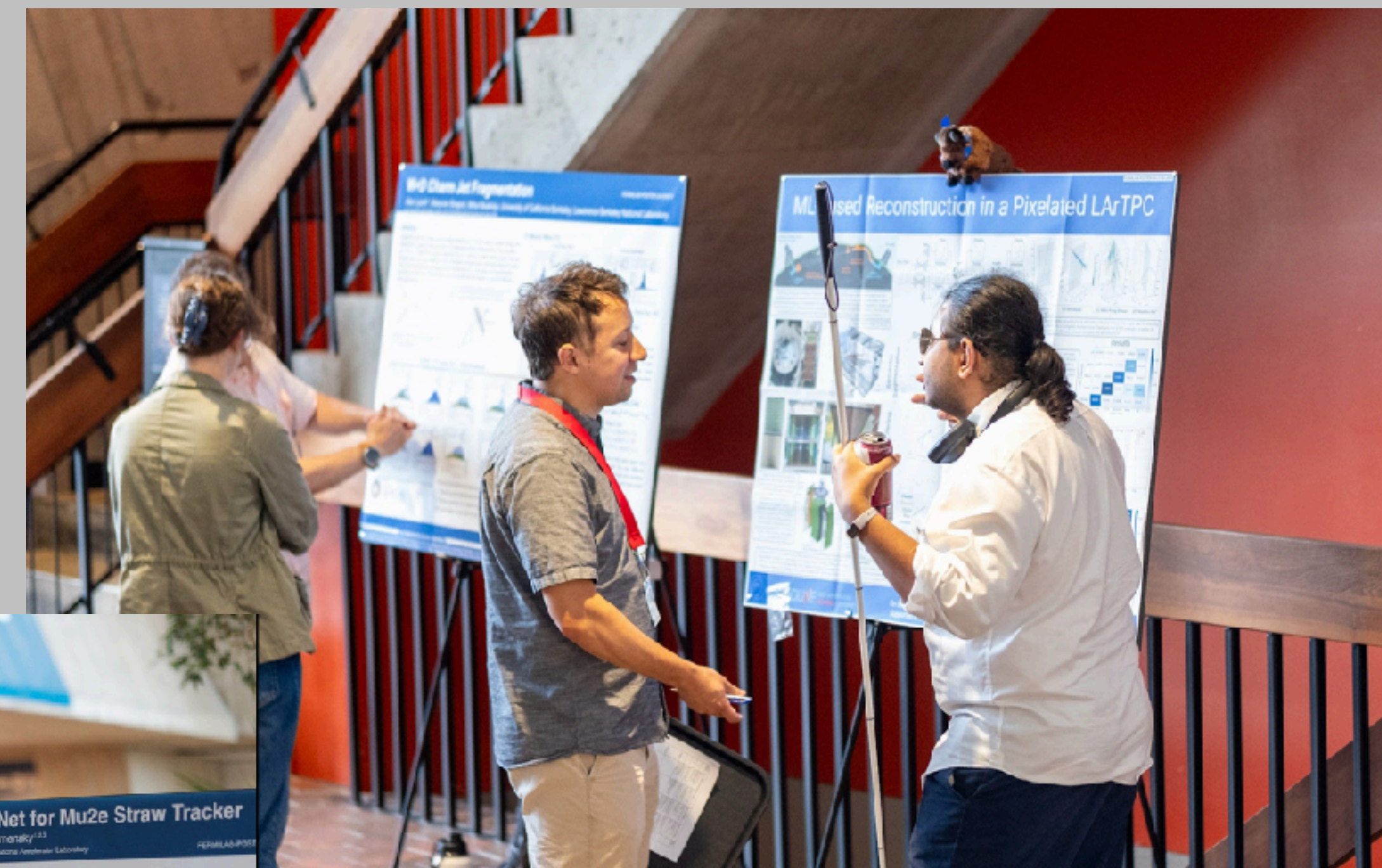
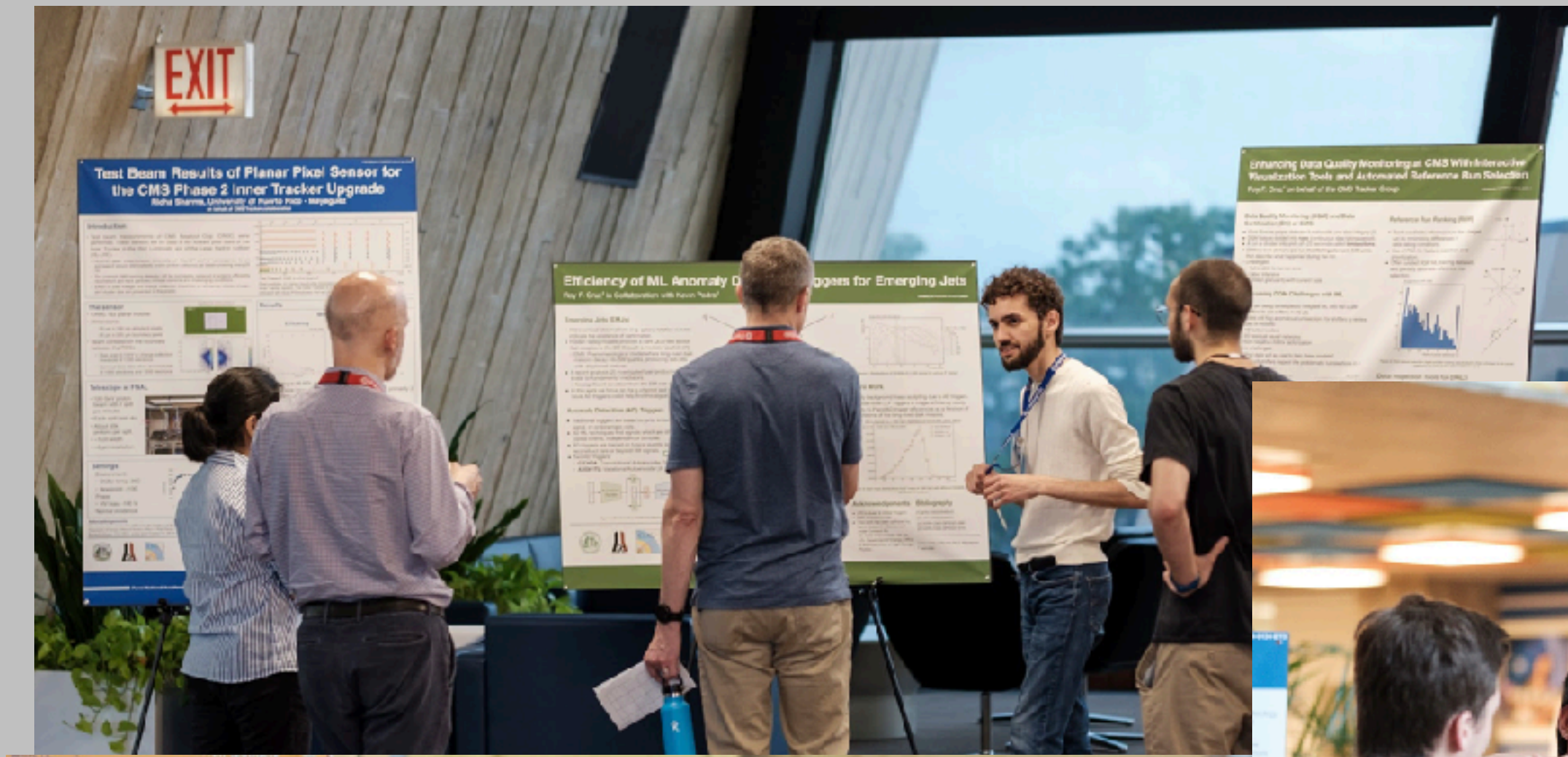


## Fermilab Quantum Institute -> Quantum Division

Joe Lykken  
 Director, Quantum Division  
 Emerging Technologies Directorate



# Poster Session



2 July 2024



# User & Affiliate Fellowship Support Programs



## **Fermilab User and Affiliate Support Programs**

Jonathan Paley

w/ help from Bo Jayatilaka and Joseph Zennamo

July 11, 2024



# URA Awards



12 July 2024

57th Users Meeting

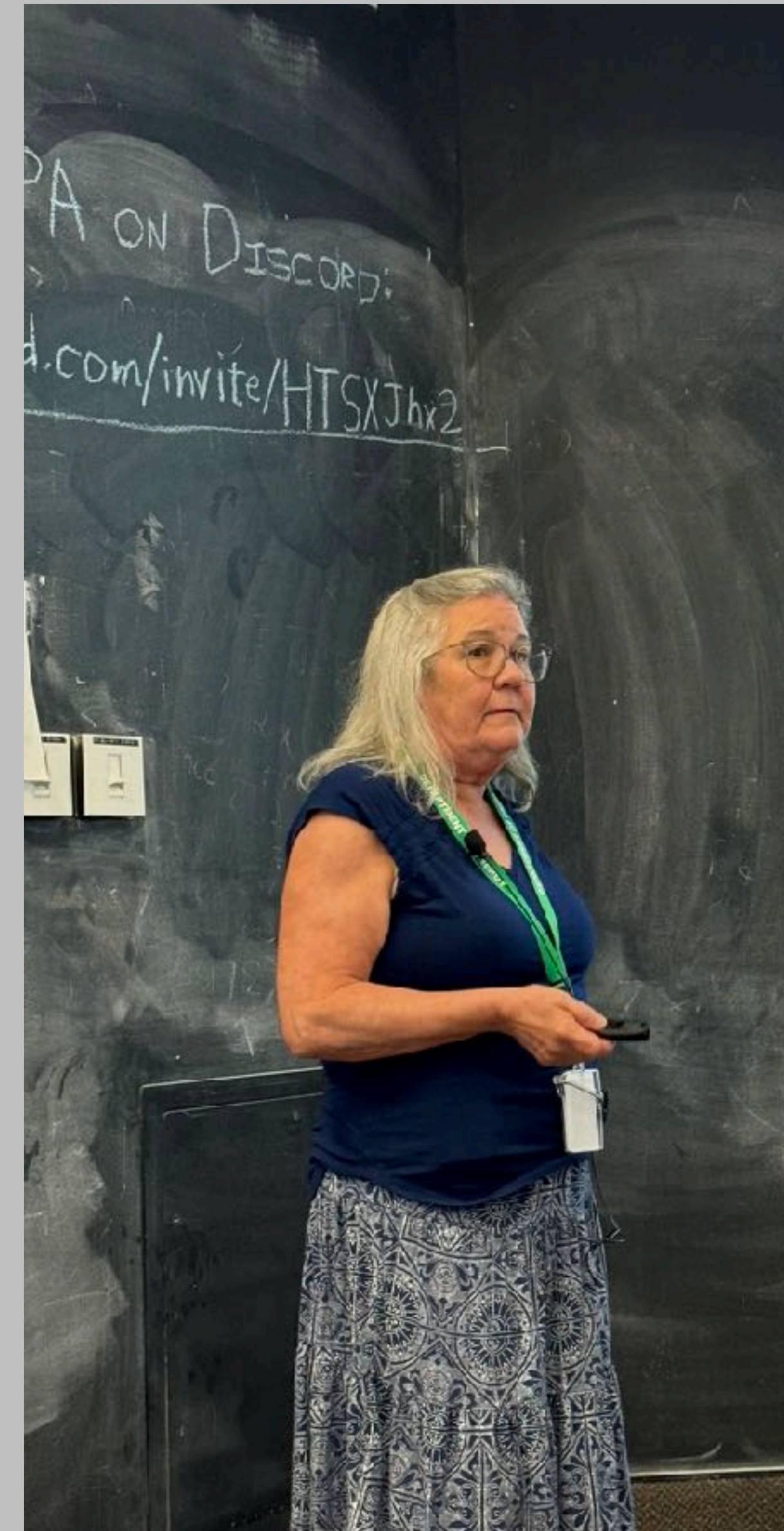


# Special Address: Congressman Bill Foster



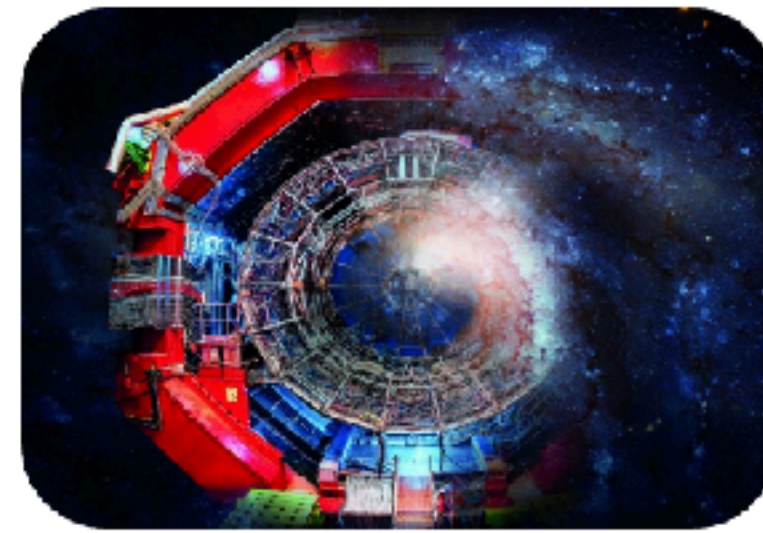


# Department of Energy Future Outlook



## Office of High Energy Physics at a Glance

FY 2024 Enacted: \$1.2B



Largest Supporter (~85%) of Particle Physics in the U.S.



Funding at >180 Institutions, including 12 DOE Labs



[Snowmass, July 2022, Seattle]  
Over 1,120 Ph.D. Scientists and 515 Grad Students Supported



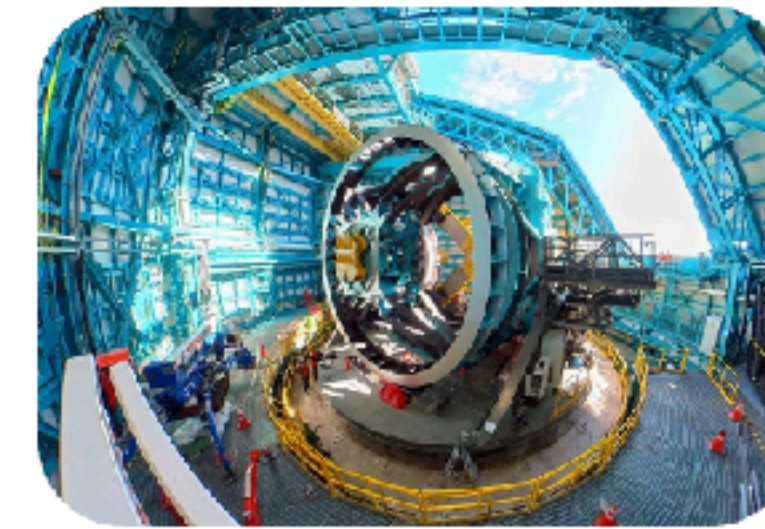
[Fermilab Accelerator Complex]  
Over 2,345 Users at 2 SC Scientific Facilities



~30% of Research to Universities



Research:  
36%, \$426.3M



[Vera Rubin Observatory, Chile]  
Facility Operations:  
29%, \$348.5M



[LBNF/DUNE Cavern, SURF, SD]  
Projects:  
35%, \$425.2M



# Users Meeting Tours – Friday, July 12

- **G-2 & Mu2e (Muon Facility)** – Meet in Atrium @ 1:00 pm (Adam Lyon & Anne Ferguson) WALKING
- **Dark Matter & Dark Energy Detector Area (IERC)** – Meet in Atrium @ 1:20 pm (Claudio Chavez) WALKING
- **IOTA - Accelerator Development Lab (NML)** – Meet in Atrium @ 1:15 pm (Maxwell Bernstein) FERMI SHUTTLE (from Horseshoe)
- **SBN-ND (Neutrino Campus)** – Group 1: Meet in Atrium @ 1:00 pm; Group 2: Meet in Atrium @ 1:50 pm (Mary Anne Cummings) FERMI SHUTTLE (from Horseshoe)
- **SQMS Quantum Computing Lab (IARC)** – Meet in Atrium @ 1:00 pm (Prabhjot Singh) WALKING

*\*\*\*\*If you are not there at your designated time, the group WILL leave without you!*



# Special Colloquium

- Special Colloquium by Chris Quigg at 4 PM CT in 1-West with Wine and Cheese at 3:30 PM CT on 2nd Floor Crossover



# Acknowledgments



Lia Meringa



Bonnie Fleming



Stephany Unruh



Anne Ferguson



Festa Italiana



Dr. John C. Mester



Dr. Claudetta  
Rosado-Reyes



Lourdes Garcia-Ruiz



Neeti Kaur

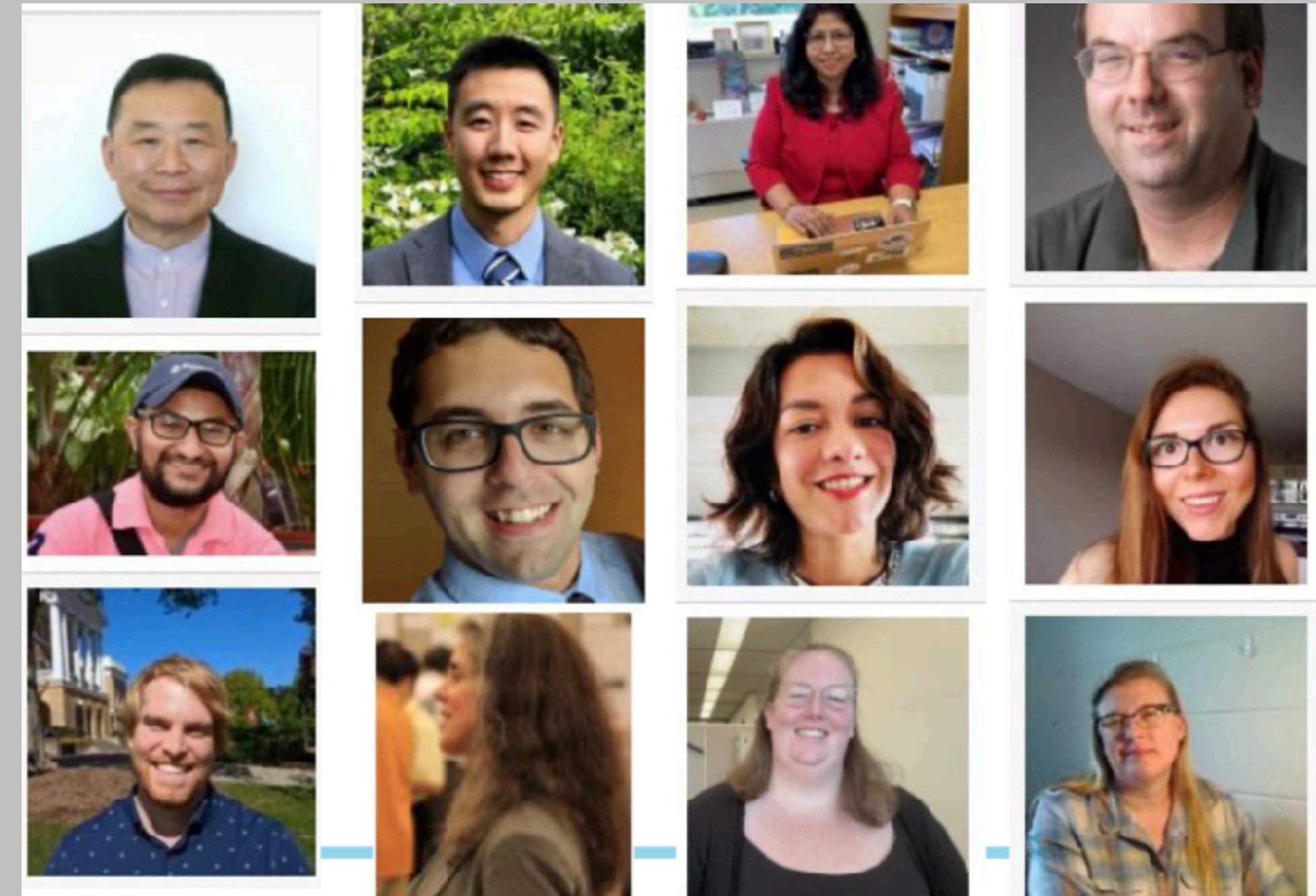


Use **Cindy Arnold**

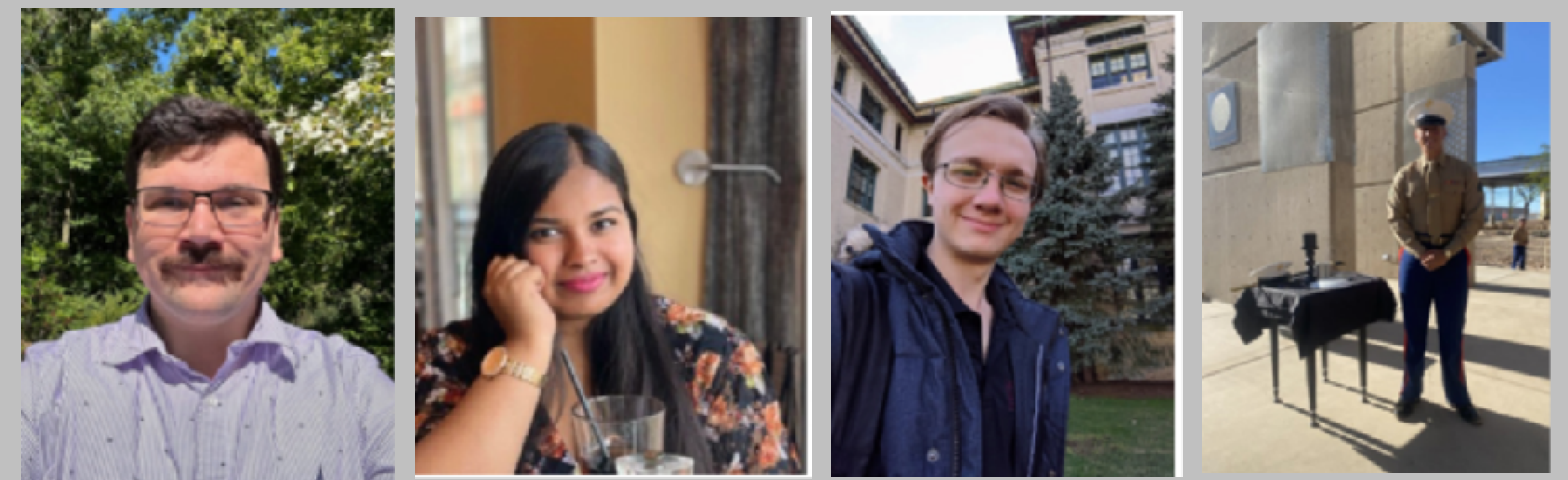


# Acknowledgments

## UEC 2023-24 Members



## FSPA 2023-24 Members





57<sup>th</sup> Fermilab Users Meeting

# INSPIRATIONS FROM P5

July 9 - 12, 2024

**Learn, connect and collaborate:**

- Reception
- Poster session
- Panel session
- URA honorary awards session
- Festa Italiana



Register today: [indico.fnal.gov/event/64626](https://indico.fnal.gov/event/64626)