



Fermilab

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HEPAP

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Result: From 450 institutions in 44 countries

- - More than 3,500 scientists use our facilities.
- - They are from more institutions and more countries than ever before; and we want to grow even more international

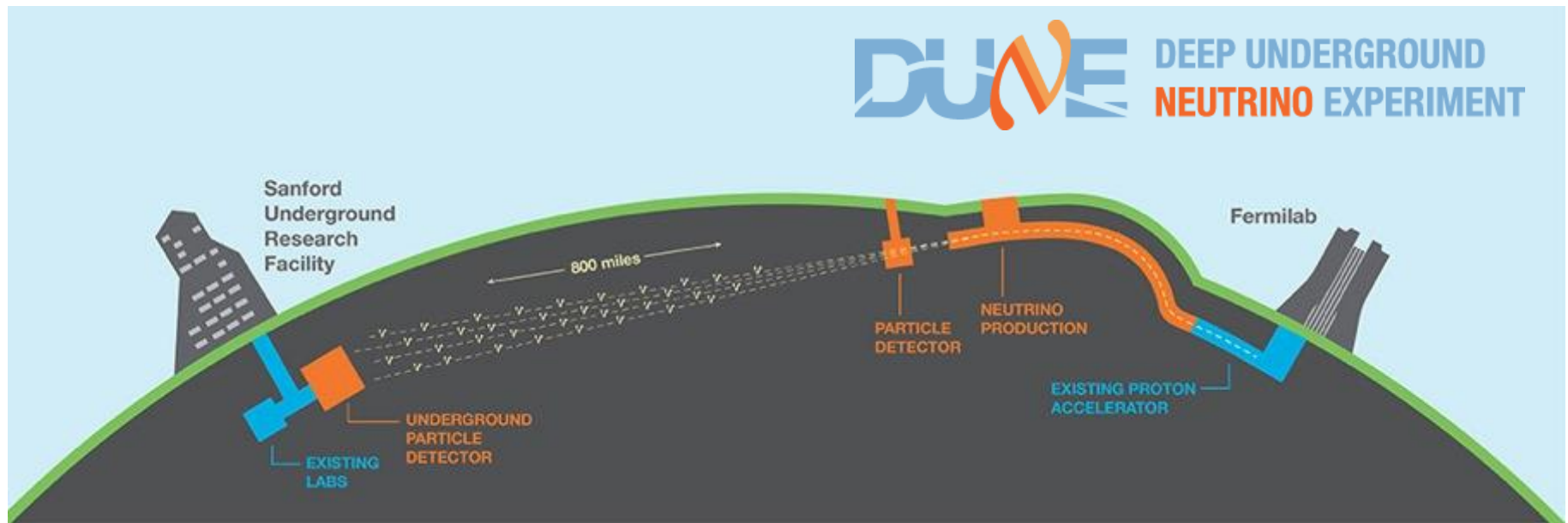


What's happening this coming year?

Our focus for 2016 will be:

- Advance US flagship: LBNF/DUNE
 - Do science...LHC/CMS, HL-LHC, neutrinos, DES, g-2, Mu2e, & DM exps (LZ, SuperCDMS) & DESI
 - Move infrastructure projects forward...IER (FY18)
 - Modernize accelerator complex (700kW is goal)
 - Advance a diverse workforce succession plan
-
- Fermilab turns 50: A half-century of discovery...plan to celebrate starting next year

What is DUNE?



Fermilab's proposed flagship experiment will be the "first international mega-science project on U.S. soil," according to Pat Dehmer, deputy director of the DOE Office of Science. It will be the game-changing experiment for neutrino research.

LBNF/DUNE Critical Milestones

- Develop protodune detectors to enable operation in beamline before LS2 in 2018
- Initiate detector installation in 2021
- Initiate detector commissioning in 2024
- Beam operation in 2026 for 20 kt fiducial mass detector

Italian PM visits “Fermi” Lab



- Emphasized CERN, Gran Sasso and Fermilab for Italian scientists

Huge part: The 800+ people working on DUNE

DUNE = Deep Underground Neutrino Experiment

 Collaborating Institutions

January 2016



The DUNE collaboration comprises 835 scientists from 146 laboratories and universities in 27 countries.

Preparing for Hosting International: DUNE, LHC...



CD0
achieved
Excellent
support
from DOE
& site
office

We need robust infrastructure to support our future flagship program. Modernization of utilities is underway, and we have received first-stage approval for the new **Integrated Engineering Research Center**. It will serve as an international campus for scientists from around the world.

Lead, South Dakota



The location is picturesque...Black Hills

HEPAP heard from Deputy Director for LBNF and Project Leader: Chris Mossey

Success Requirements

- **Everything Must Shine**

- All projects must stay on schedule and within budget
- Deliver top quality science
- Excellence in operations and administration
- If things go wrong...ESH&Q
- A diverse workforce

- **Everything Must Align**

- DOE, Office of Science & OHEP, NSF & Fermilab must align
- Fermilab senior team must be aligned
- FRA
- Fermilab and CERN must be aligned (meet April 8th @ CERN)
- HEP community must be aligned

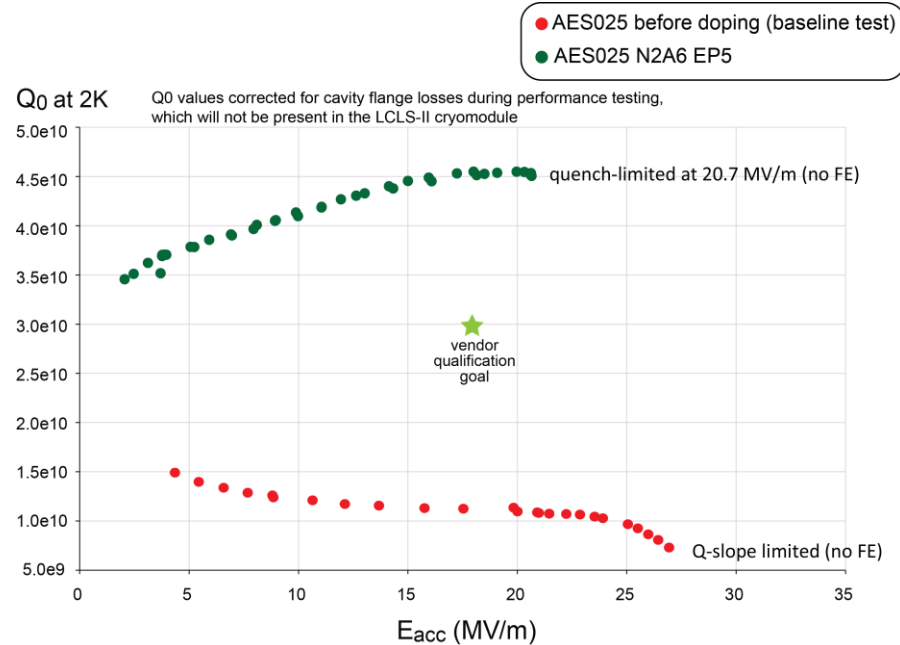
Alignment with DOE...concerted effort

- Obama Administration encourages international partnering
- Fermilab is aligned with DOE mission on discovery science
 - Looking to see if Mission Innovation opportunity with energy
- Fermilab aligned with Office of Science lab partnering theme
 - **BES: LCLS-II** and X-ray detector/ASIC development projects
 - Retreat with SLAC senior management
 - ASCR: Exascale computing...Big Data expertise to be useful
 - NP: Neutrino theory collaboration

First Dressed Cavities Emerge from Clean Room for LCLS-II



Successful nitrogen doping technology transfer to industry for LCLS-II production



Project advances our hi-tech infrastructure & know how
Debating whether we plan for additional projects...e.g. Brazil

LCLS-II 1st Cavity String Assembly for prototype cryomodule



this is an important project outside HEP...makes us relevant

Priorities: Activities ranked by Importance

1. LBNF/DUNE + SBN
2. LCLS-II
3. PIP-II
4. LHC upgrades (CMS Phase I, LARP)...CD0 Phase II coming soon
5. Muon g-2, and associated AIPs
6. Mu2e (go, go go)
7. UUP
8. Operations, in order
 1. NOvA (500 kW → 700 kW)
 2. MicroBooNE
 3. Everything else
9. Cosmic projects and ops
10. R&D for accelerators & detectors

Fermilab has most projects in Office of Science.....

Building for Discovery as per P5 Plan

CERN/DOE/NSF Agreement: Signers...Moniz, Heuer, Cordova



CERN Chiefs Visit Washington...encourage support for LHC



Fermilab aligning with CERN & Congress

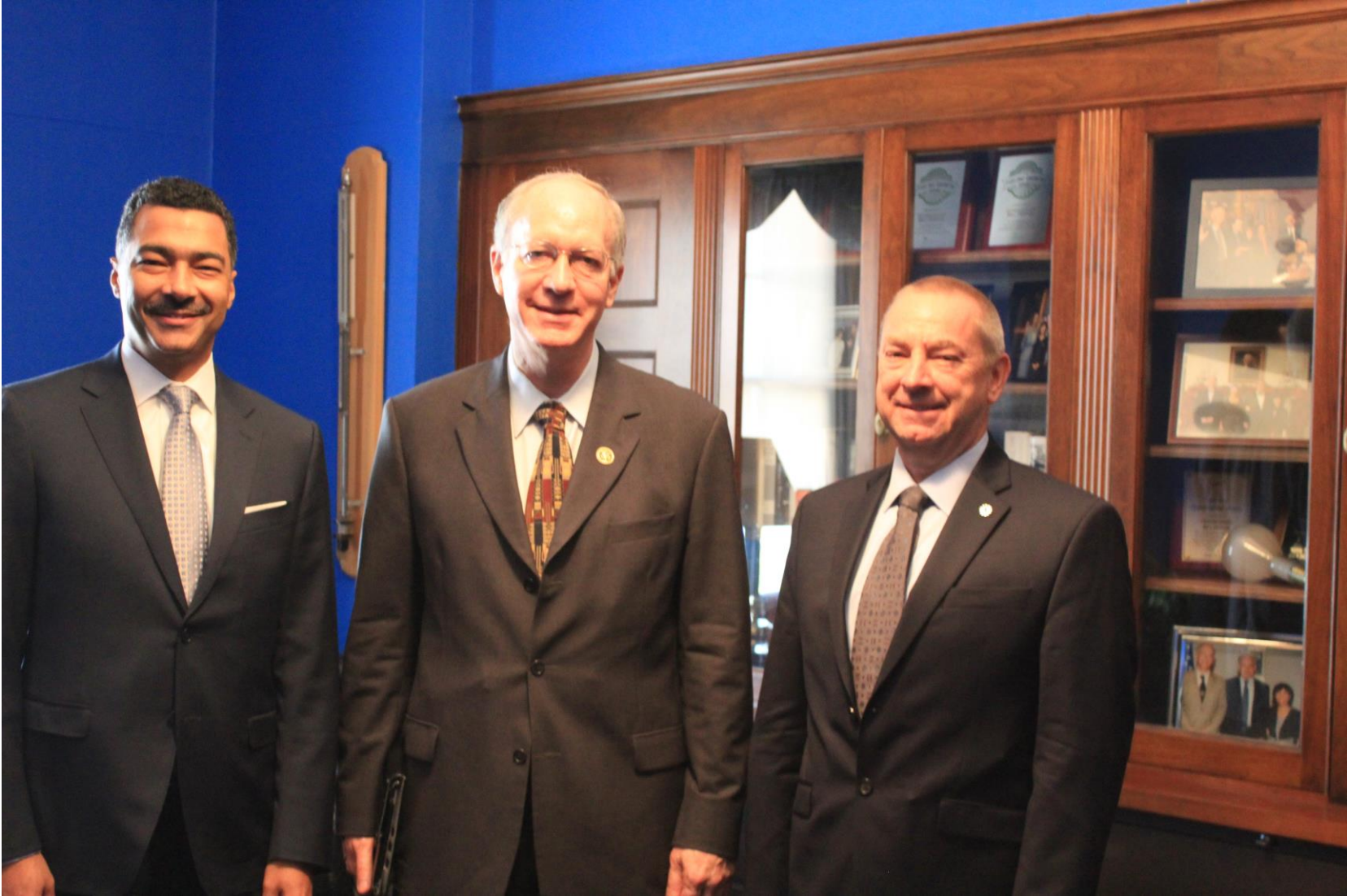
Senator Dick Durbin...strong science supporter



Senator Kirk and Brett Hart (FRA Board)



Congressman Foster, Brett Hart (FRA, United Airlines)



Senator Rounds & Governor Daugaard South Dakota



Fermilab aligns with Senator Rounds and Governor Daugaard vision for South Dakota



International....John Holdren...offered to help



Neutrinos are opening gateways to other countries and allow opportunities for partnering in a range of projects

e.g. Brazil FEL (with SLAC & JLAB, ANL), Italy DM & PIP-II, UK PIP-II, France PIP-II

Neutrino Protocol...signed recently at CERN

NEUTRINO PROTOCOL I

between

THE EUROPEAN ORGANIZATION
FOR NUCLEAR RESEARCH (CERN)

and

THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA (DOE)

to

THE CO-OPERATION AGREEMENT

concerning

SCIENTIFIC AND TECHNICAL CO-OPERATION
IN NUCLEAR AND PARTICLE PHYSICS

2015

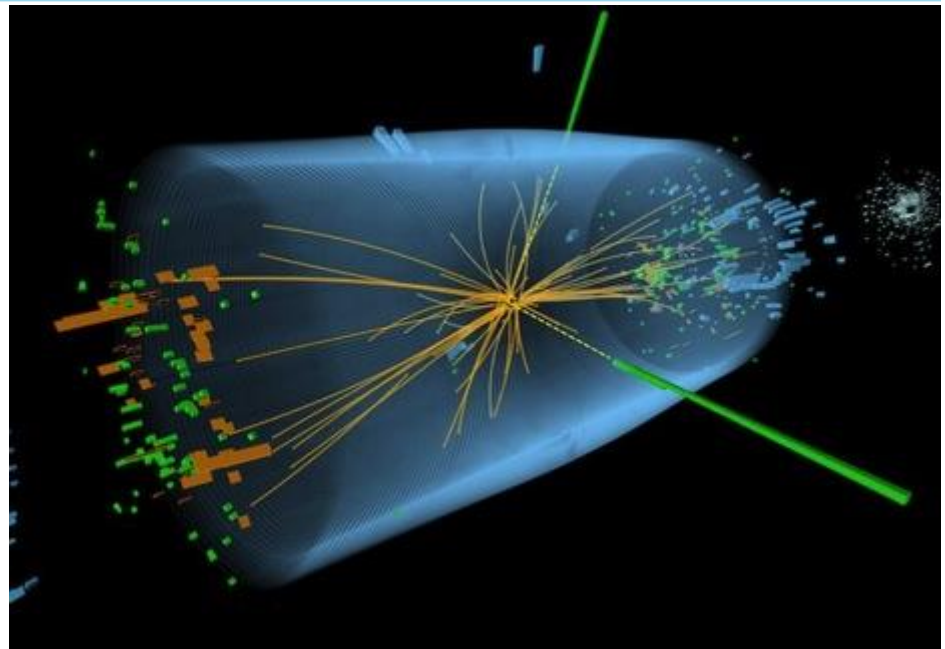
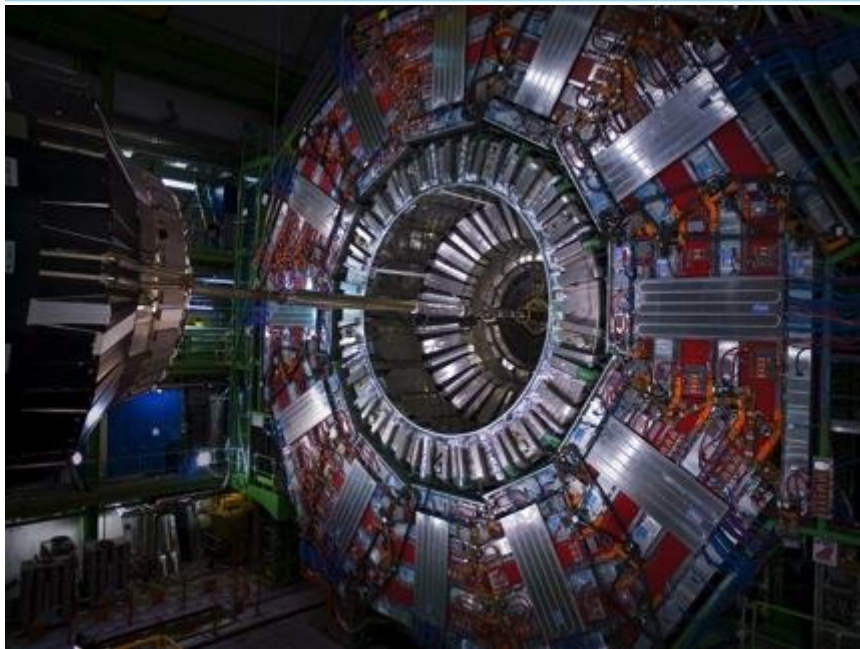
CERN and Fermilab's futures
are completely intertwined for
next several decadesas
never before

Major news: Signing of US-CERN Protocols



In December, the United States and the European physics laboratory CERN signed an agreement to partner on continued research at the Large Hadron Collider, upcoming neutrino research and a future particle collider.

We will continue research at the LHC



Fermilab will continue to be one of the main contributors to the CMS experiment on the Large Hadron Collider.

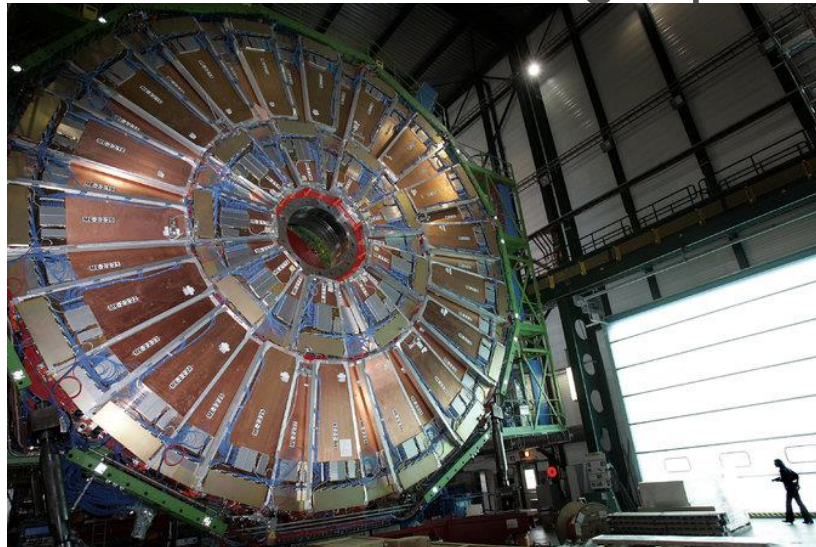
- Phase I upgrades
- HL-LHC upgrades
- LPC, CMS Tier-1, and operations

Does the Higgs Boson have a cousin?

The New York Times

Physicists in Europe Find Tantalizing Hints of a Mysterious New Particle

“The more nonstandard the better,” said Joe Lykken, the director of research at the Fermi National Accelerator Laboratory and a member of one of the CERN teams. “It will give people a lot to think about. We get paid to speculate.”



NOvA...our present flagship neutrino experiment



MicroBooNE: collecting data....Short Baseline soon

- MicroBooNE is the newest neutrino experiment at Fermilab to come online and is the first step in the short-baseline neutrino program.
- MicroBooNE saw its first neutrinos and first laser events, and has been collecting neutrino beam data since October!



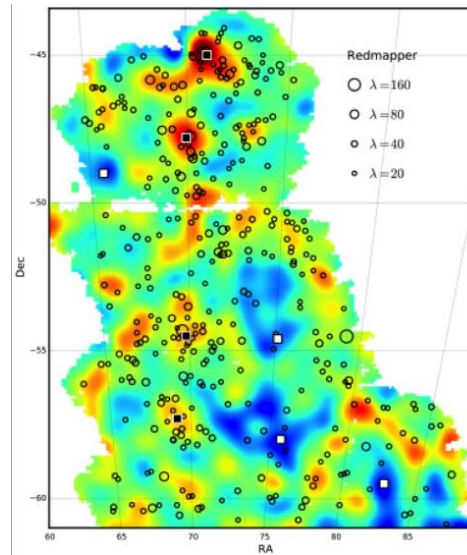
Dark Energy Survey (DES)

Fermilab and collaborators built a sophisticated camera for the existing Blanco telescope in Chile to conduct a 5-year (105 nights per year) 5000 sq deg optical survey to measure more galaxies and supernovae than ever before to constrain parameters that describe dark matter and dark energy.

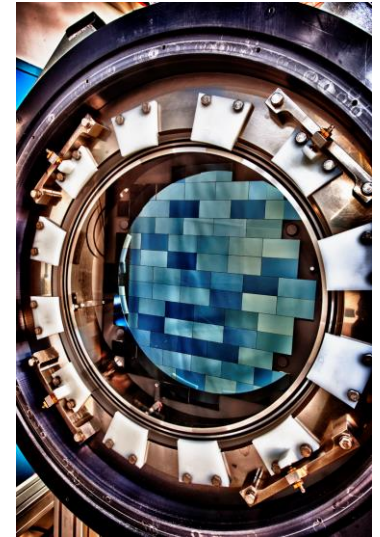


CTIO including Blanco
4m telescope (center)
450 scientists:

Univ. of Chicago, Illinois, Michigan, Ohio State, Pennsylvania, Texas A&M, and Univ. College London
along with Fermilab, Argonne, LBNL, SLAC, NCSA, NOAO, CTIO, and Spain, UK, Brazil consortia

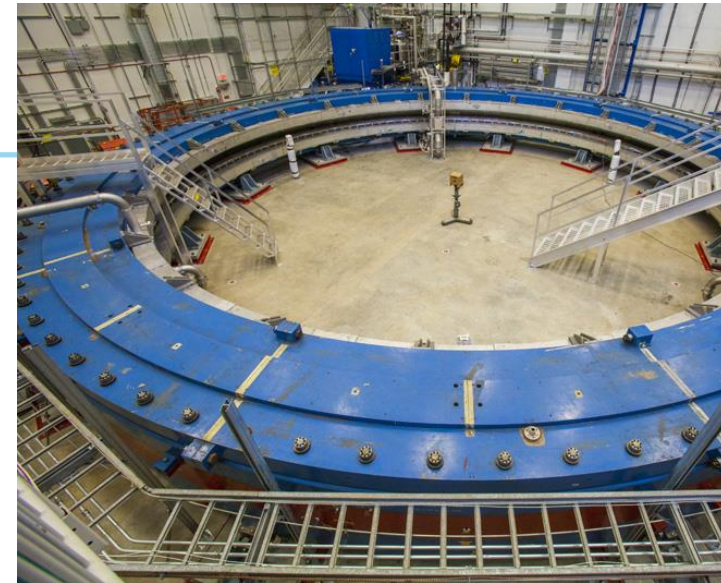


Mass map of universe



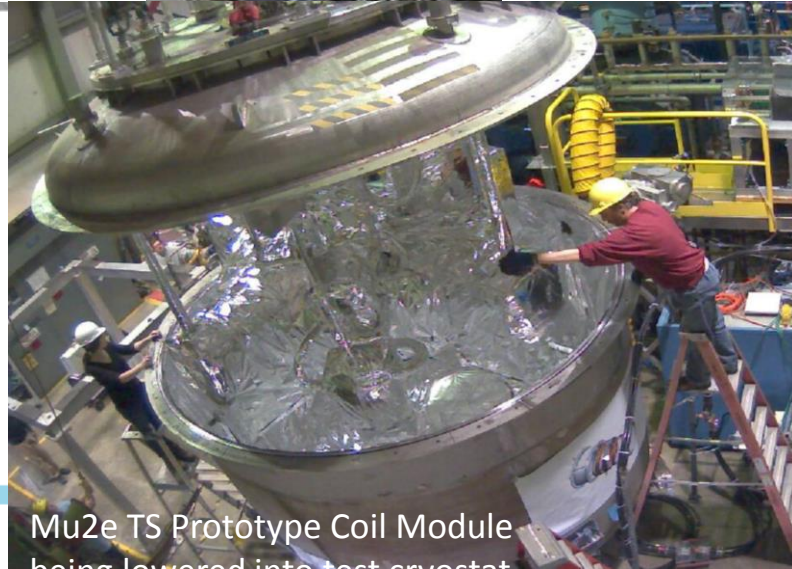
focal plane

Muon Campus beam line installation



New connection from Recycler to Muon Campus installed during shutdown

Obtained CD-2/3b



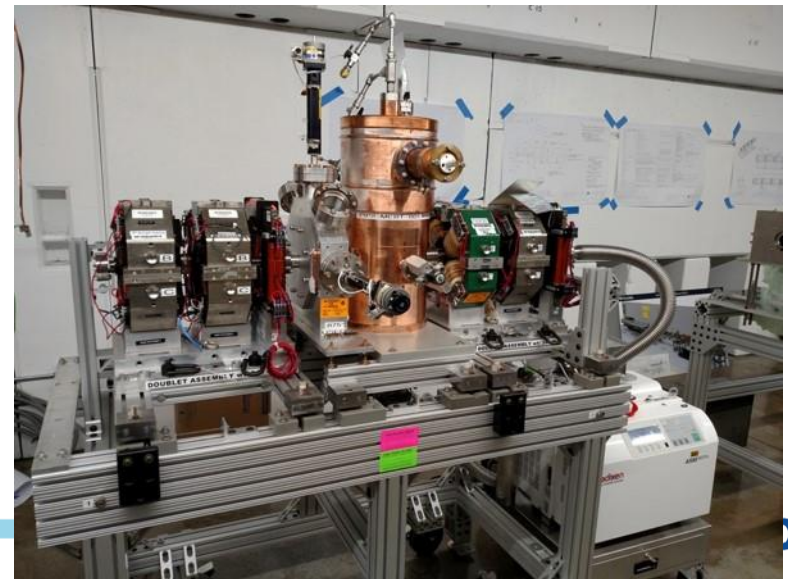
Mu2e TS Prototype Coil Module being lowered into test environment



Mu2e Tracker Panel Prototype

PIP-II: Receives CD0 & Progress at PXIE (beam thru MEBT)

- Ion Source and Low Energy Beam Transport assembled, fully commissioned
- RFQ delivered from LBNL in September
- Medium Energy Beam Transport assembly with BARC India....works great!



Performance Evaluation & Measurement Plan (*PEMP*)

	Numerical Score	Weight	Final Score
Initial S&T Score	3.6 (A-)	0.75	
Goal 4.0	3.8 (A)	0.25	
Final S&T Score			3.6 (A-)
Initial M&O Score	3.5 (A-)	0.75	
Goal 4.0	3.8 (A)	0.25	
Final M&O Score			3.6 (A-)

Good scores.

Repeat performance is our challenge

Concerns and Challenges

- Need to grow OHEP budget...top priority of field
- LBNF funding ramp insufficient for international community
- PIP-II funding ...concerns not ready for DUNE start
- International partners need to be convinced to invest in US
- LHC program ...very aggressive schedule for high-field magnets
- Detector upgrades ambitious and schedule challenging

The Way Forward

- Fermilab has developed unprecedented **strong partnership** with CERN intertwining LHC & neutrinos
- CERN is investing **outside of Europe** for the first time in 60 years
- Many international funding agencies informed and involved
- DUNE is an experienced, well-organized **international team** that has assembled quickly motivated by the prospect of installing the first detector module **beginning in 2021**
- President's Budget to Congress has **requested construction authority** for far site initial work starting in FY2017 (e.g., just ~7 months from now)
- Project enjoys **strong DOE, administration, and congressional support.**
- Strong international interest to participate in design and construction of LAR TPC far detectors, fine-grained tracker near detector, and MW-class neutrino beam
- LBNF/DUNE will drive **game changing science** in neutrino and astro-particle physics

Next Steps

- Work to get CD3a for LBNF & understand DUNE baseline
- Advance diversity/succession and infrastructure initiatives
- Advocate:
 - for increased funding to appropriations
 - Work with DOE on FY18 budget...significant increase needed
 - Goal grow OHEP budget
- International:
 - Sign addenda with CERN this year
 - Move major partner nations forward...esp. UK, Italy, India, Brazil, CERN
- Transition:
 - Work with DOE at all levels
 - OSTP & OMB & Congress