

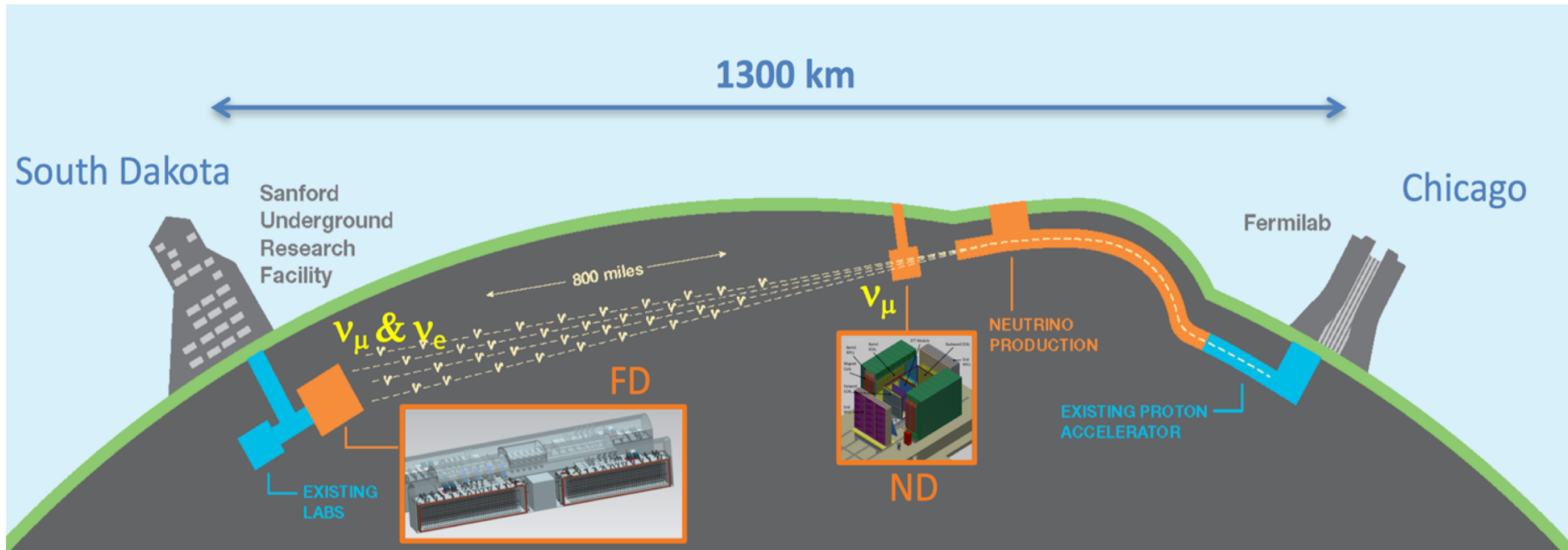
## LBNF / **DUNE** Update

Community Advisory Board

Chris Mossey, Deputy Director for LBNF

24 January 2019

# Overview of LBNF / DUNE project elements



“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



# Overview – “Far Site” – LBNF / DUNE at Sanford Lab, Lead, SD

- **Conventional Facilities:**

- Surface and shaft Infrastructure including utilities
- Drifts and two caverns for detectors
- Central utility cavern for conventional and cryogenic equipment

- **Cryostats:**

- Four membrane cryostats supported by external steel frames

- **Cryogenic Systems:**

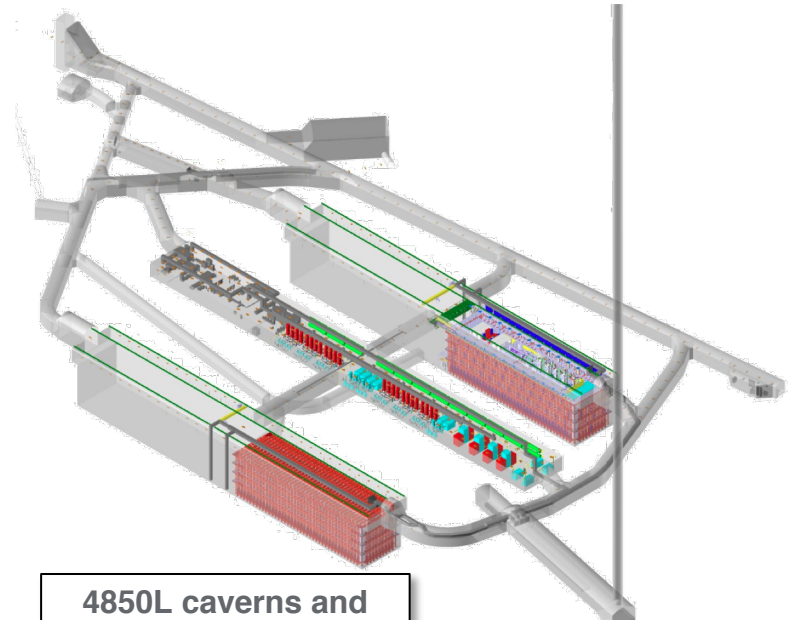
- LN2 refrigeration system for cooling and re-condensing gaseous Argon
- Systems for purification and recirculation of LAr

- **Argon:**

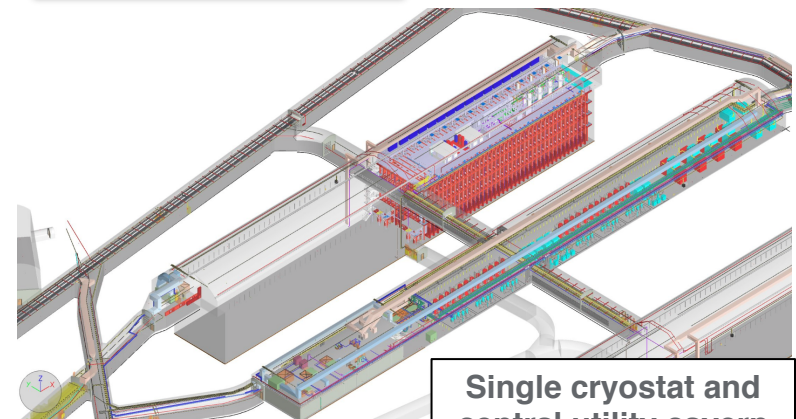
- 70kt LAr

- **DUNE Detectors**

- Four LAr TPC detectors

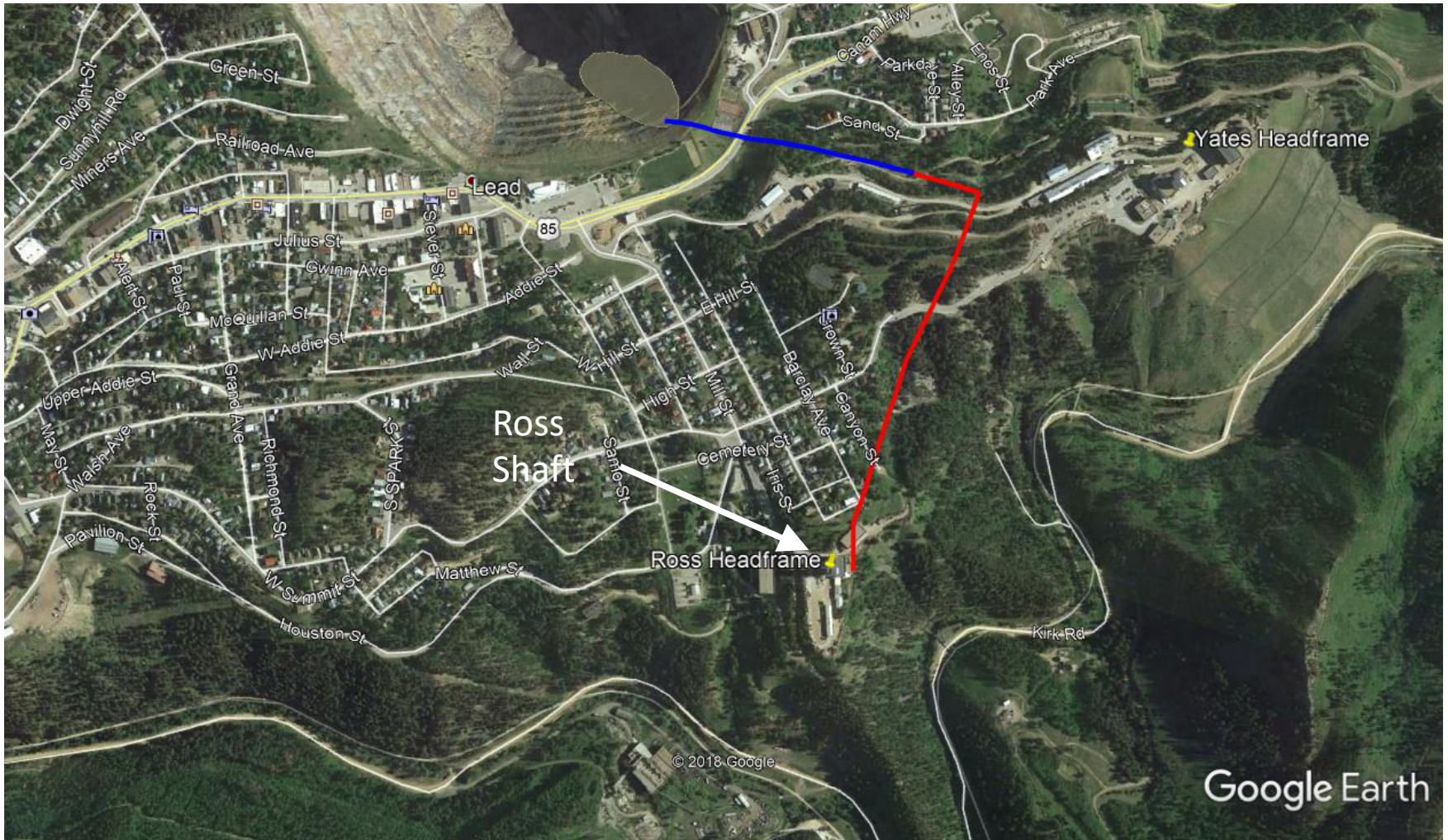


4850L caverns and drift layout



Single cryostat and central utility cavern

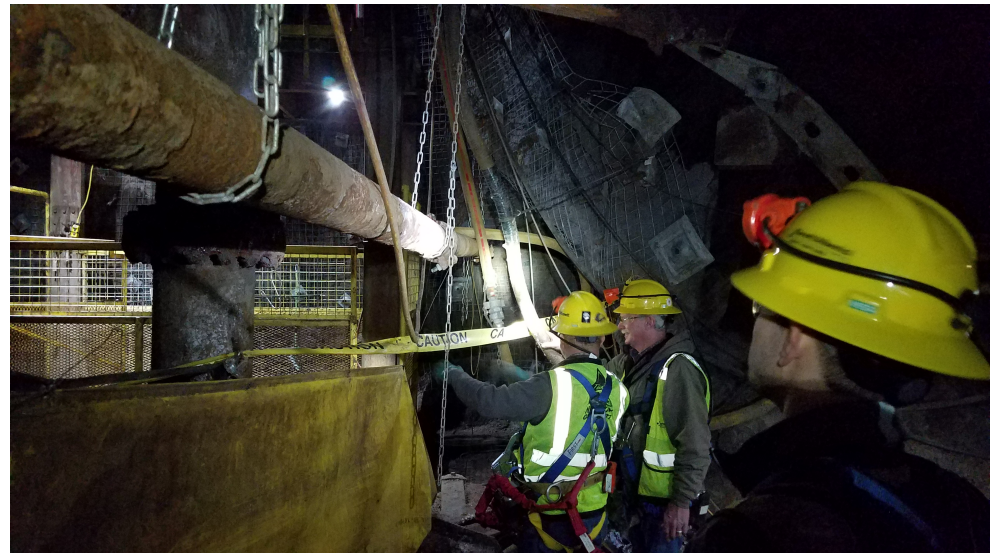
**875,000 tons of rock will be transported to the surface and deposited in the Open Cut using a conveyor system**





## Current Status of LBNF in South Dakota

- Contract for construction/ renovation of the systems to move rock from a mile underground to the surface, where it will be crushed, then moved 4000 LF on a conveyor system to an open cut in downtown Lead, SD was awarded in November and work started in Dec 2018.
- Finalizing underground cavern designs by this summer.



# The Team in South Dakota

- Kiewit/Alberici Joint Venture – Construction Manager/General Contractor
- Arup – Architect/Engineer Design
- Fermilab LBNF Team + CERN Team



# ARUP

**Global Tunnelling Project of the Year (over \$500M)**

global-tunnelling-project-of-the-year-over-500m\_400.png

**Winner:** Vegas Tunnel Contractors - Arup, **Lake Mead Intake No. 3 Shaft and Tunnel**

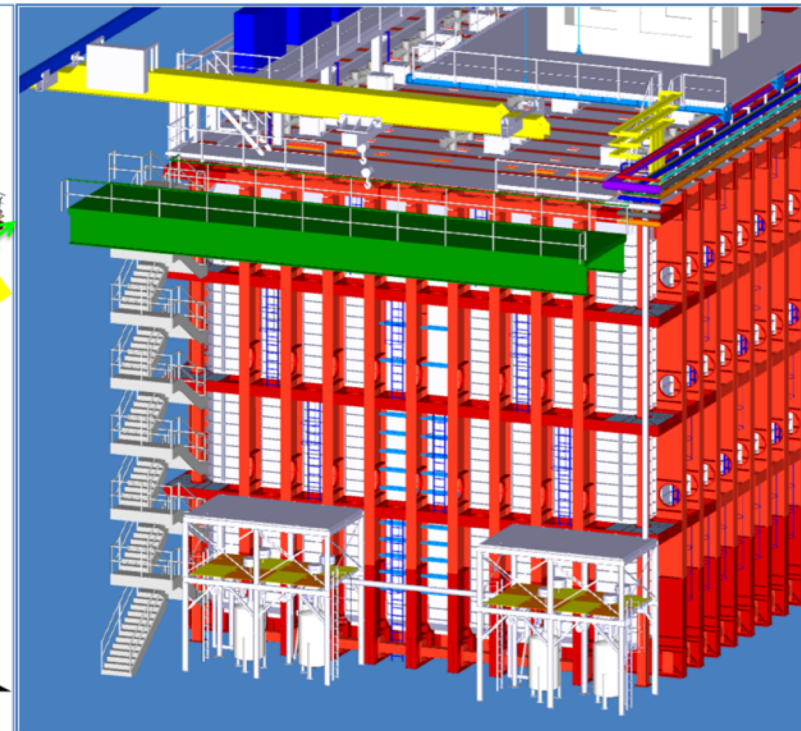
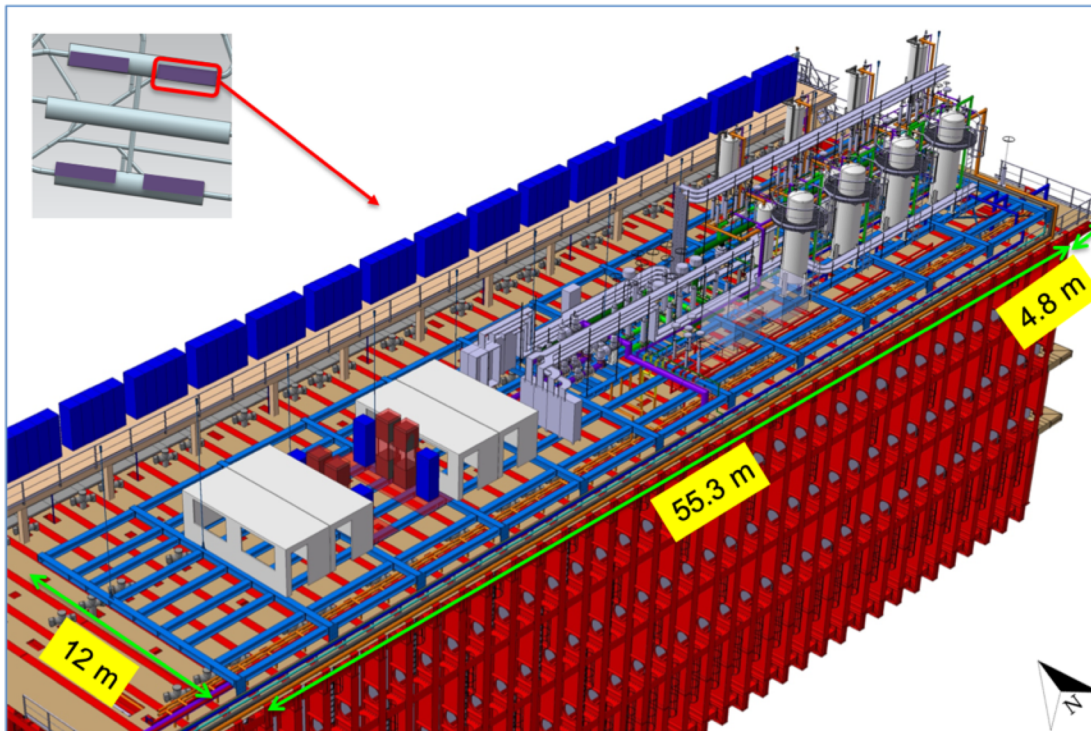
**ENR** THE TOP 400 CONTRACTORS

The Top 400 List

| RANK<br>2018 | RANK<br>2017 | FIRM                                      | 2017 REVENUE (\$ MIL) |          | 2017 NEW<br>CONTRACTS | GENERAL BUILDING | MANUFACTURING | POWER | WATER / SEWER / WASTE | INDUS. / PETROLEUM | TRANSPORTATION | HAZARDOUS WASTE | TELECOM | % CM-AT-RISK |
|--------------|--------------|---|-----------------------|----------|-----------------------|------------------|---------------|-------|-----------------------|--------------------|----------------|-----------------|---------|--------------|
|              |              |   | TOTAL                 | INT'L    |                       |                  |               |       |                       |                    |                |                 |         |              |
| 1            | 1            | BECHTEL, San Francisco, Calif.†           | 18,267.0              | 10,018.0 | 7,198.0               | 0                | 0             | 11    | 1                     | 54                 | 26             | 5               | 1       | 32           |
| 2            | 2            | FLUOR CORP., Irving, Texas†               | 15,777.6              | 7,384.9  | 12,566.0              | 7                | 3             | 16    | 0                     | 56                 | 6              | 10              | 1       | 19           |
| 3            | 3            | THE TURNER CORP., New York, N.Y.          | 11,766.1              | 620.4    | 15,385.9              | 83               | 1             | 0     | 0                     | 3                  | 5              | 0               | 7       | 100          |
| 4            | 5            | AECOM, Los Angeles, Calif.†               | 10,574.3              | 1,196.7  | 7,412.6               | 64               | 1             | 9     | 2                     | 9                  | 11             | 0               | 2       | 74           |
| 5            | 6            | KIEWIT CORP., Omaha, Neb.†                | 7,988.0               | 1,048.5  | 11,001.3              | 9                | 1             | 20    | 9                     | 27                 | 33             | 0               | 0       | 9            |
| 6            | 7            | SKANSKA, New York, N.Y.†                  | 7,254.1               | 39.2     | 7,567.3               | 45               | 8             | 3     | 1                     | 7                  | 33             | 0               | 1       | 51           |
| 36           | 38           | CLAYCO INC., Chicago, Ill.†               | 2,021.8               | 0.0      | 2,200.0               | 50               | 12            | 0     | 0                     | 0                  | 0              | 0               | 0       | 0            |
| 37           | 34           | ALBERICI-FLINTCO, St. Louis, Mo.†         | 1,984.4               | 554.5    | 2,395.4               | 47               | 8             | 5     | 10                    | 28                 | 3              | 0               | 0       | 50           |
| 38           | 36           | MICHEL'S CORP., Brownsville, Wis.         | 1,935.0               | 93.1     | 2,220.0               | 2                | 0             | 24    | 7                     | 50                 | 14             | 0               | 2       | 0            |
| 39           | 39           | THE YATES COS. INC., Philadelphia, Miss.† | 1,927.4               | 0.0      | 2,244.4               | 30               | 44            | 3     | 0                     | 14                 | 8              | 0               | 0       | 22           |
| 40           | 41           | BLACK & VEATCH, Overland Park, Kan.†      | 1,775.3               | 452.6    | 143.1                 | 0                | 0             | 61    | 11                    | 5                  | 0              | 0               | 22      | 15           |

# Cryostat Design Update

- Final design of NE membrane cryostat on going by GTT.
- Completed testing of pieces of warm structure at Coimbra, Portugal.



Engineered by CERN





# Destructive Testing of Cryostat Structural Steel Components



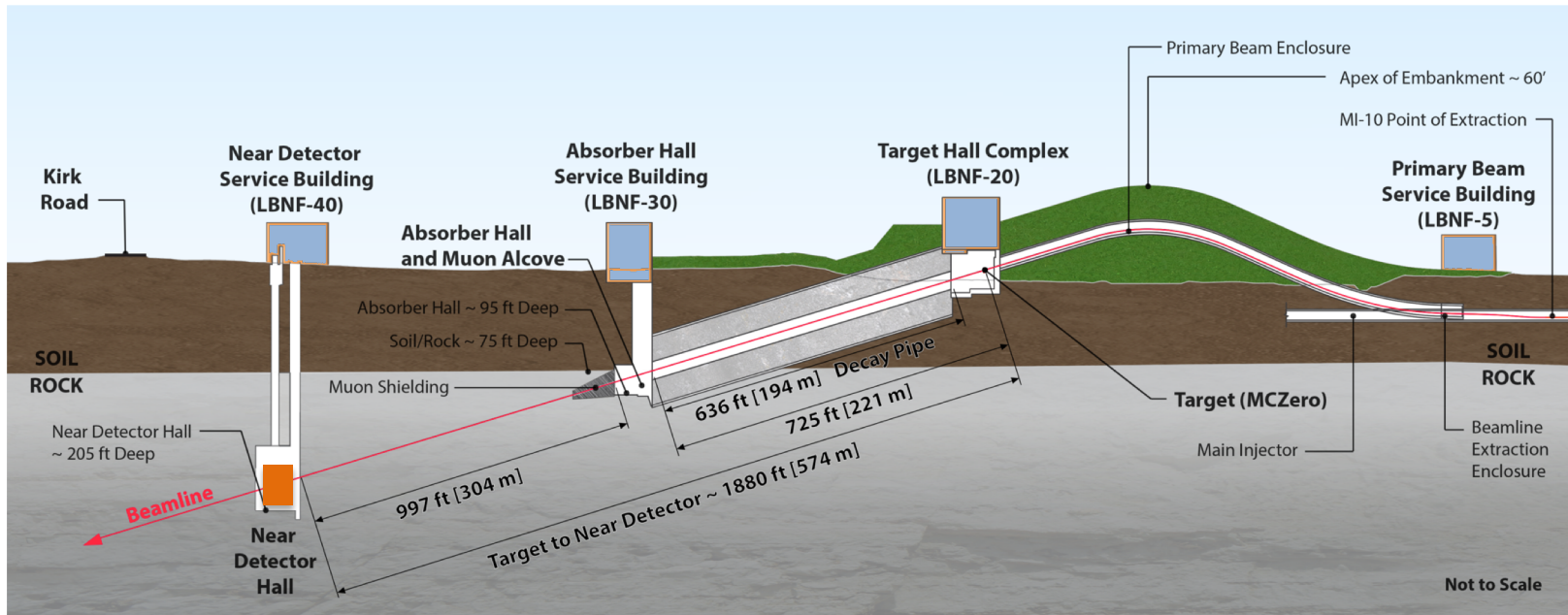
# Fermilab at Sanford Underground Research Facility (SURF)

- Fermilab operations at SURF continue to mature.
  - In June of 2018, Fermilab created the South Dakota Services Division.
  - Division administers the SURF Services Subcontract, provides a single point of contact for Fermilab operations at SURF, and will fulfil host laboratory functions in South Dakota for LBNF/DUNE.
- South Dakota Science and Technology Authority (SDSTA), who owns and operates SURF, is transitioning to a direct contractual relationship with DOE.



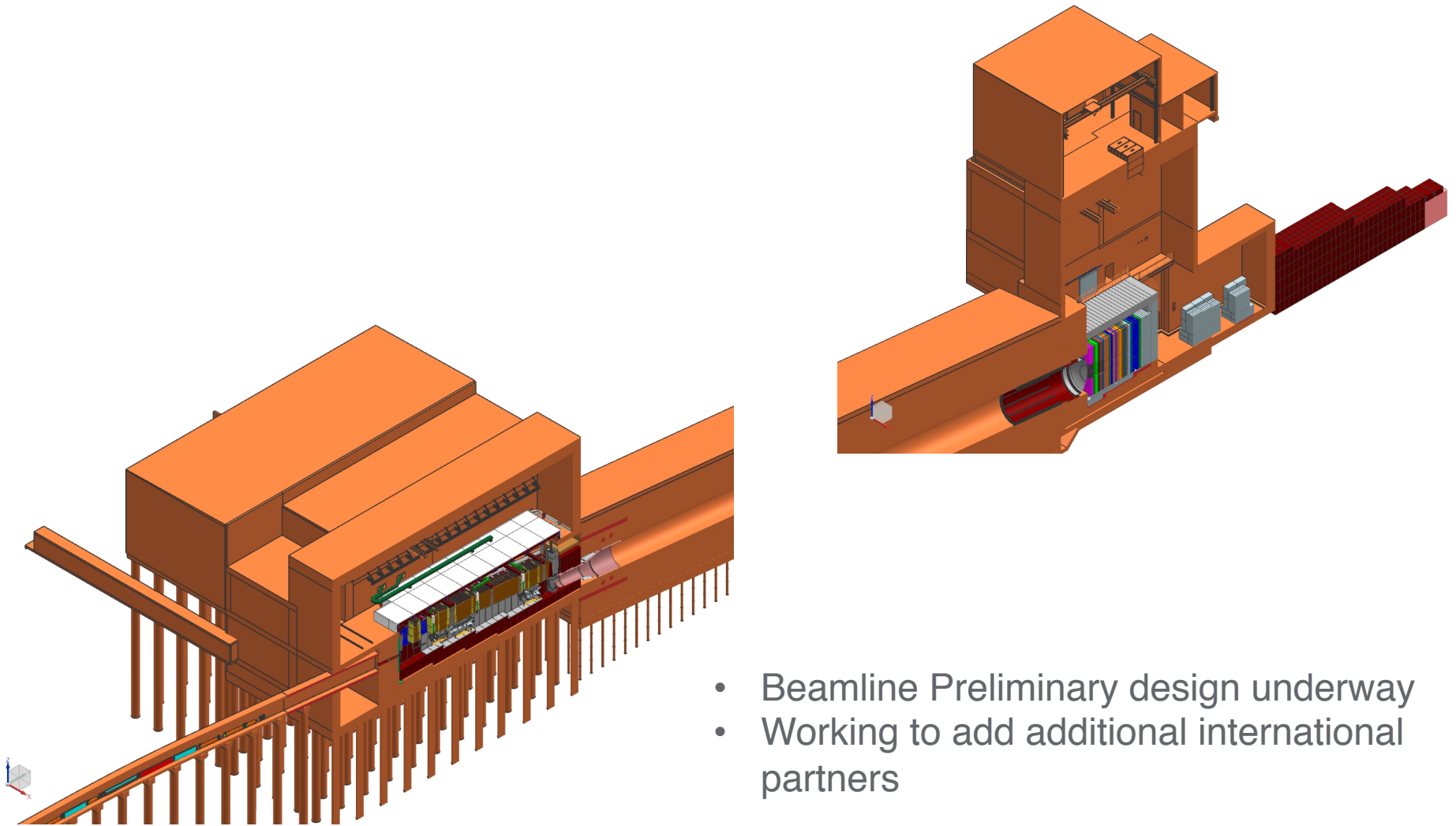


# Overview - “Near Site” – LBNF / DUNE at Fermilab, Batavia, IL



- Primary proton beam @ 60-120GeV extracted from Main Injector
- Initial 1.2 MW beam power, upgradable to 2.4 MW
- Embankment allows target complex to be at grade and neutrino beam to be aimed to SURF
- Decay region followed by absorber
- Four surface support buildings
- Near Detector facility
- **DUNE Near Detector**

# Integration of Target Hall Complex and Absorber Complex



- Beamline Preliminary design underway
- Working to add additional international partners

## Near Site Conventional Facilities efforts are ramping up

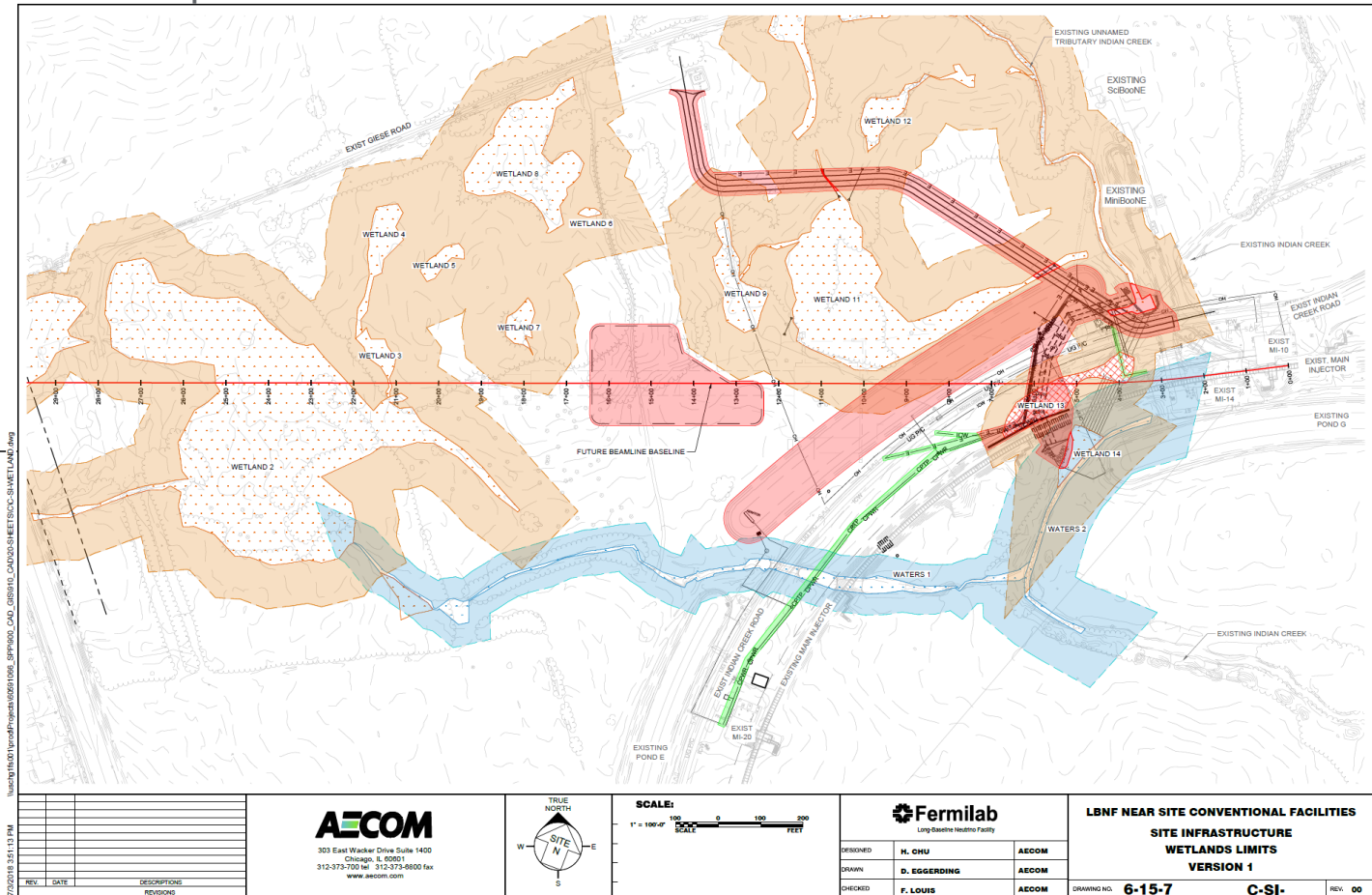
- Planning early “Site Preparation” contract to clear site of conflicting utilities and other existing features
- Includes work on critical path / Improves overall schedule
- Design in CY2018 & 2019 / Construction planned for CY2020





## Near Site Conventional Facilities Update

- Site Preparation progressing well:
  - 100% Design due 6/17/19
  - Construction planned for CY2020



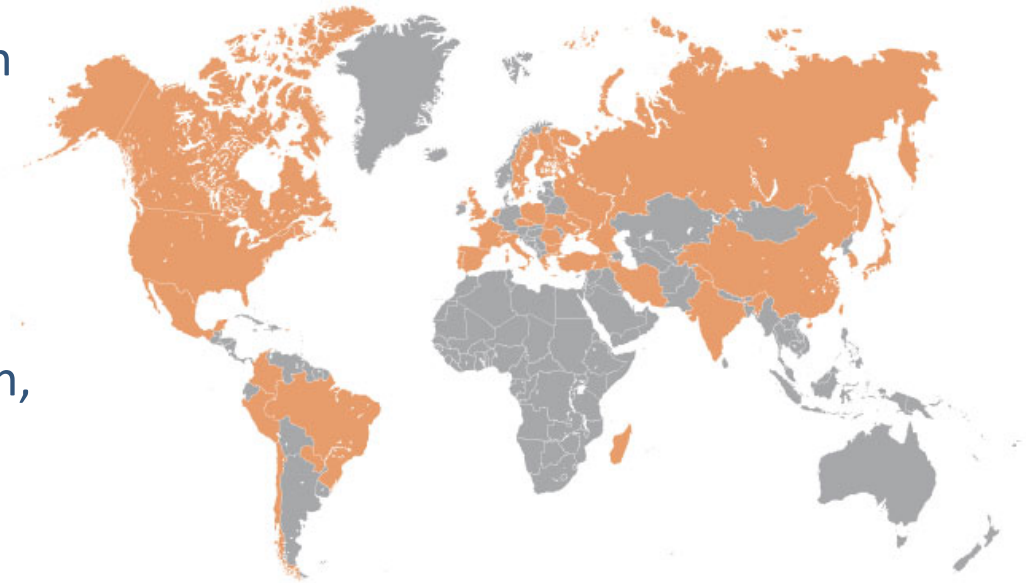
# The DUNE Collaboration

## As of today:

**60 % non-US**

# 1180 collaborators from 178 institutions in 32 nations

Armenia, Brazil, Bulgaria, Canada, CERN, Chile, China, Colombia, Czech Republic, Spain, Finland, France, Greece, India, Iran, Italy, Japan, Madagascar, Mexico, Netherlands, Paraguay, Peru, Poland, Portugal, Romania, Russia, South Korea, Spain, Sweden, Switzerland, Turkey, UK, Ukraine, USA

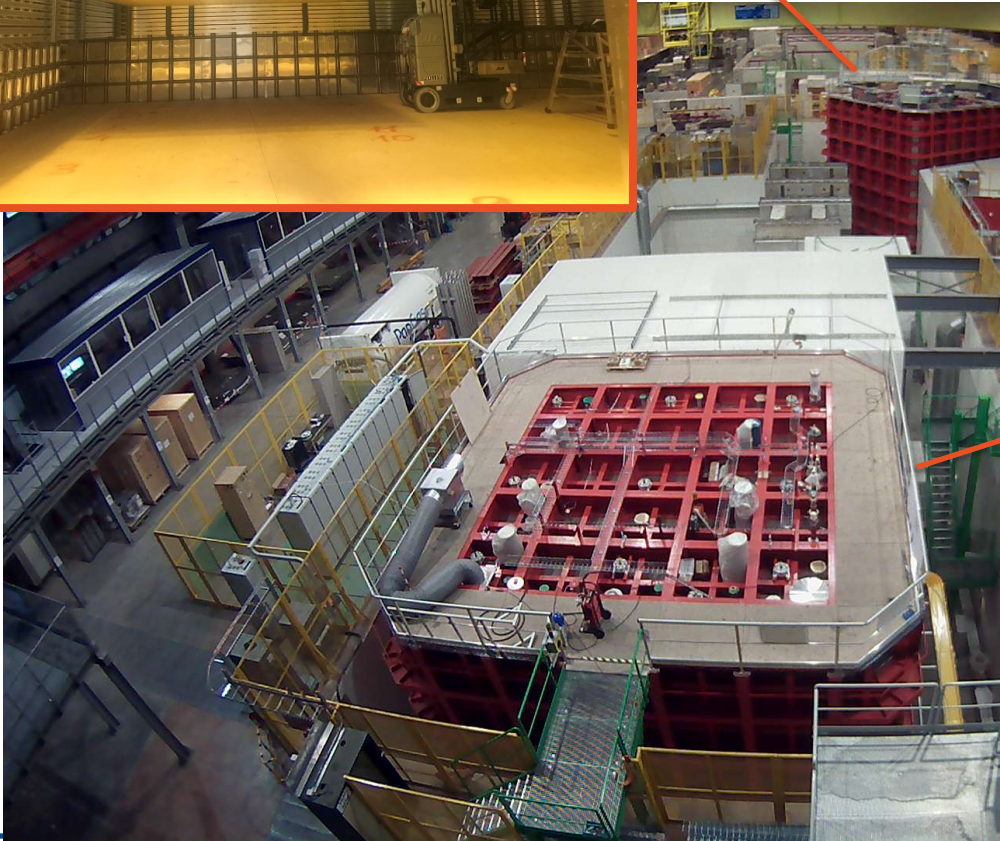
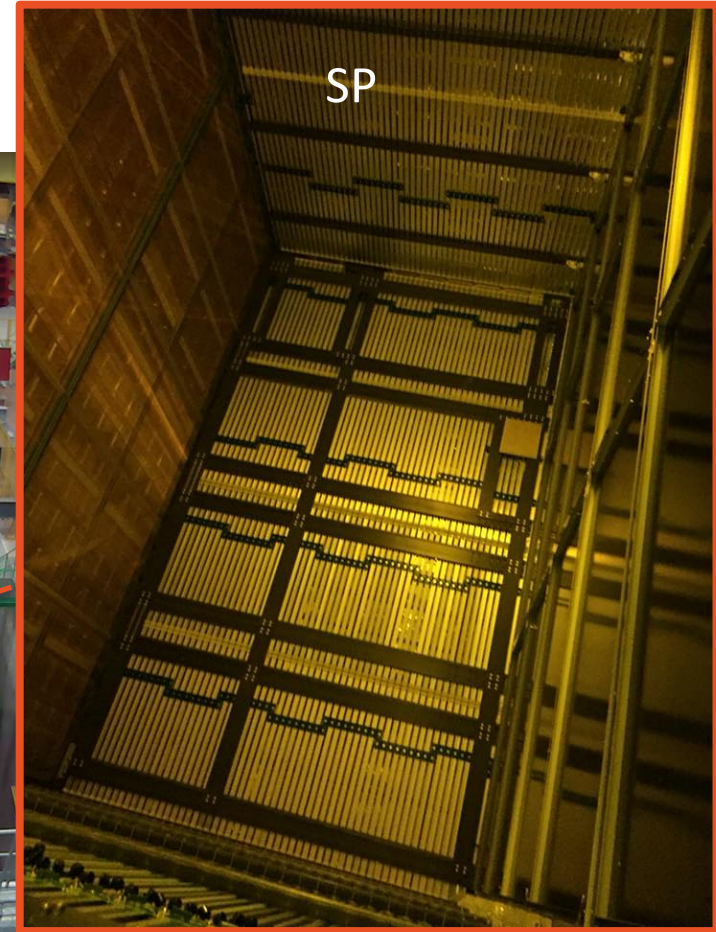


DUNE is still growing:  $dN/dt > 100$  collaborators/year.

## Ultimate size: 1500?

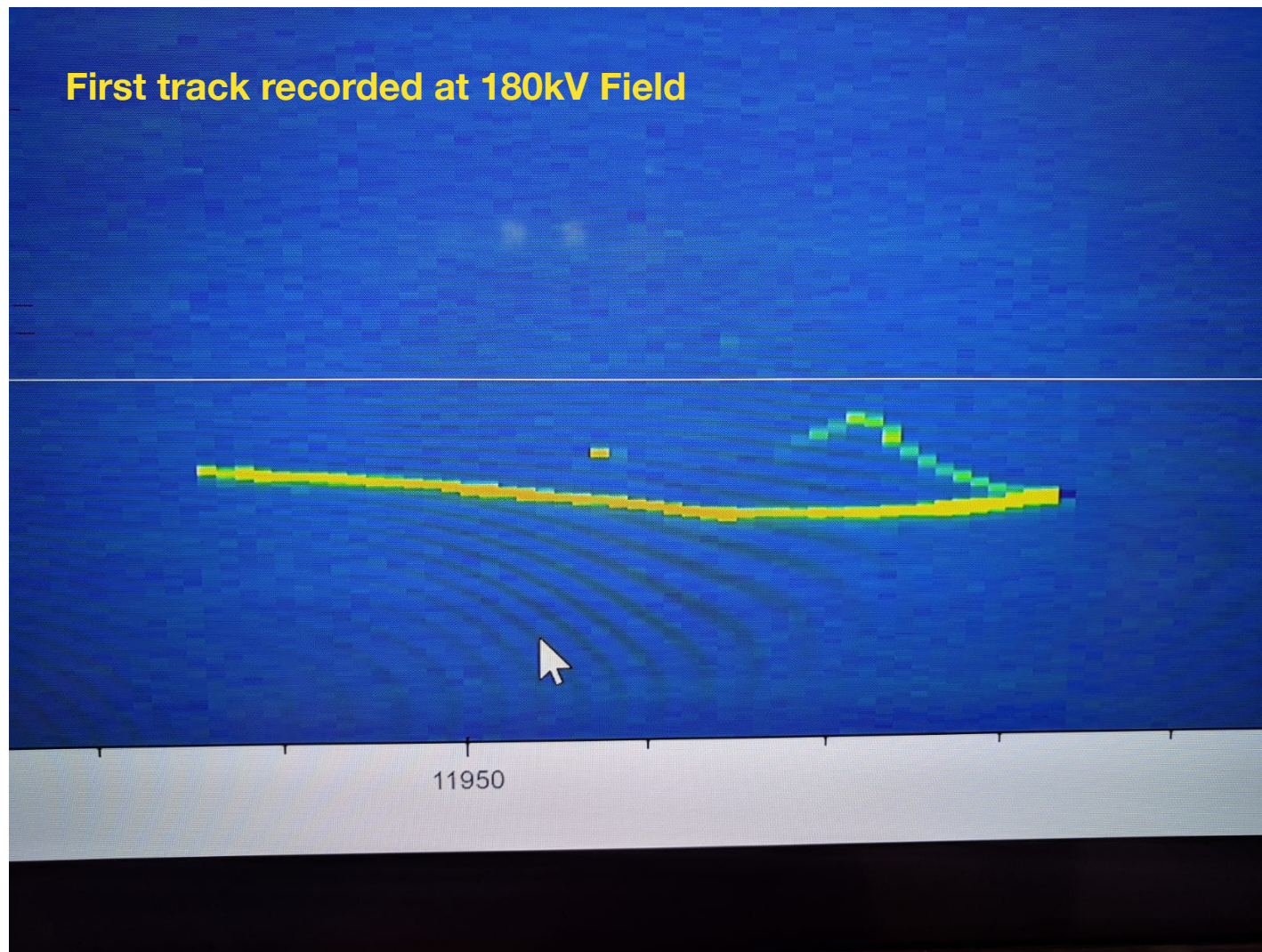


# Role of ProtoDUNE





First track recorded at 180kV Field



Field + purity = operational TPC



# Some Events

*EM showers and a pion interaction with 4 outgoing particles*  
*Run 4696, Ev 103*

Beam halo (high energy) muon with bremsstrahlung initiated EM shower

- Questions?

