LBNF/DUNE Project Update

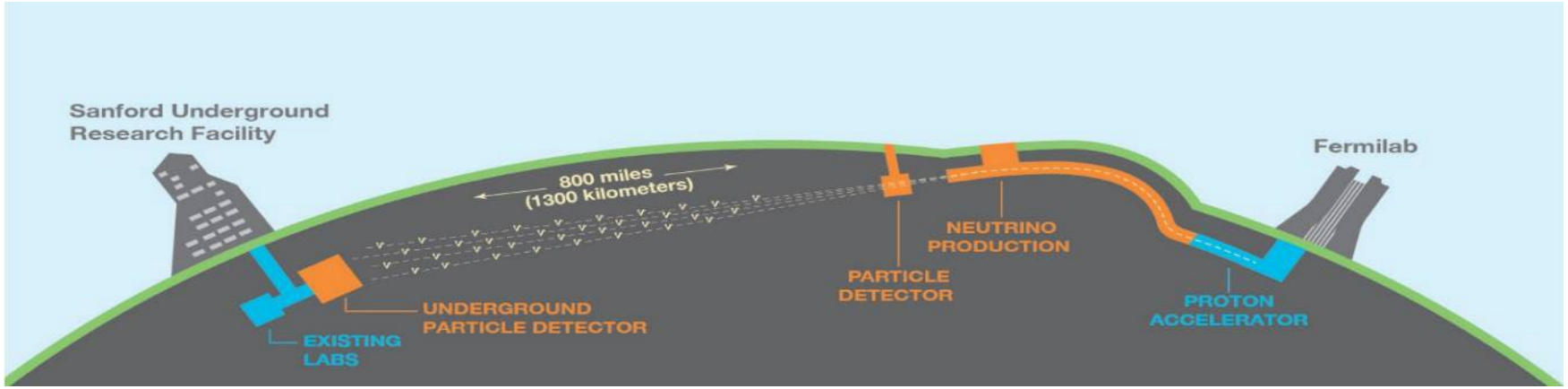
Community Informational Meeting

10 May 2023

Agenda

• **Introduction**	Joe Pygott, *South Dakota Services Division Deputy Director*
• **Excavation Progress**	James Rickard, *Resident Project Engineer*
• **Buildings & Site Infrastructure (BSI) Overview**	Tyler Apple, *KAJV Project Manager*
• **Far Detector and Cryogenics (FDC) Overview**	Jolie Macier, *FDC Project Manger* Luke Mickelson, *Recruiter*
• **SDSTA Update**	Will McElroy, *SDSTA Operations Division Director*
• **Comments/Questions**	

World-Class Facility supporting World-Class Experiment



- The **Deep Underground Neutrino Experiment** will be a **game-changing experiment for neutrino science**, potentially transforming our understanding of why the universe exists as it does.
- The **Long-Baseline Neutrino Facility** is the **infrastructure** necessary to send a powerful beam of neutrinos 800 miles through the earth, and measure them deep underground at South Dakota's Sanford Underground Research Facility.
- The DUNE/LBNF project will be the **first internationally conceived, constructed, and operated mega-science project** hosted by the Department of Energy in the United States.

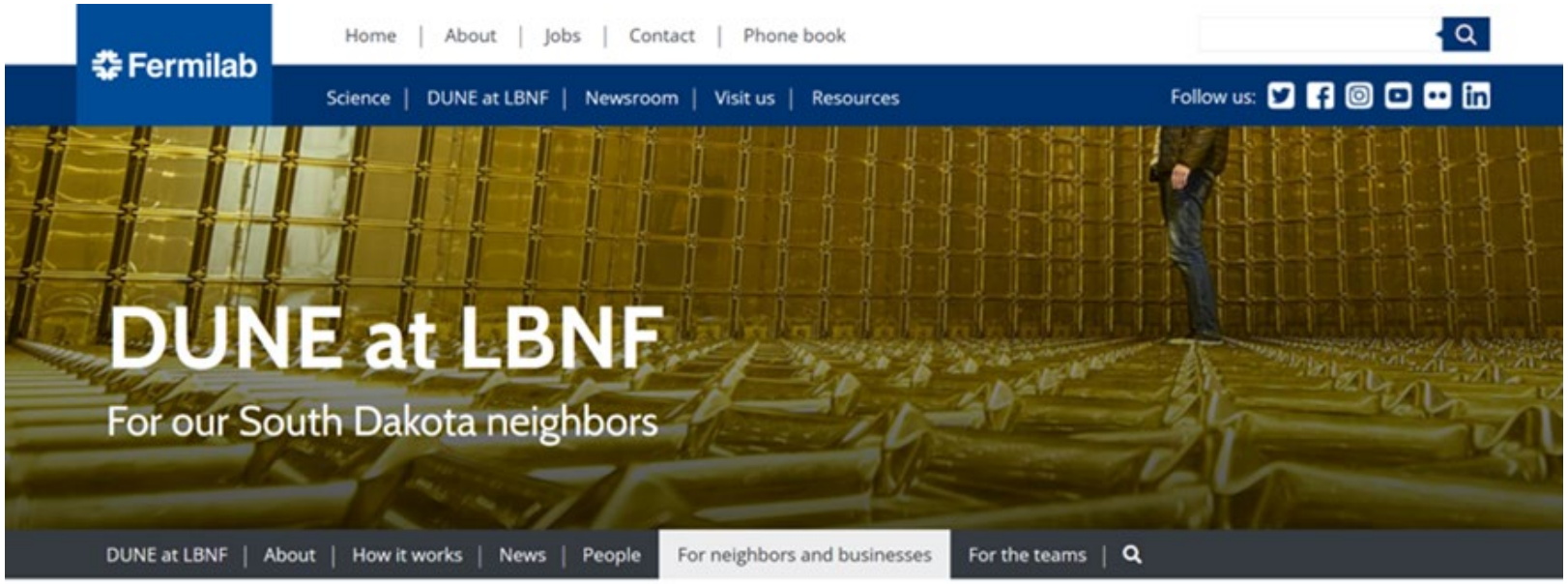
LBNF will drive neutrino science forward the way CERN's Large Hadron Collider drove Nobel Prize-winning Higgs discovery

Scale


LONG-BASELINE
NEUTRINO FACILITY
Far site underground location

Additional Resources

- www.fnal.gov/neighbors-sd
- https://www.fnal.gov/
- https://fermilab.jobs/



We think it is important to keep our neighbors informed about the construction of the Long-Baseline Neutrino Facility and the Deep Underground Neutrino Experiment. To ensure that you have the most up-to-date information, we have set up this website with information about LBNF and DUNE.

- Answers to frequently asked questions regarding LBNF/DUNE

Community updates

We understand the community's concerns about dust within Lead, emanating from the Open Cut. We apologize for the significant inconvenience and understand the community's frustration. We are committed to working to resolve this issue as quickly as possible.

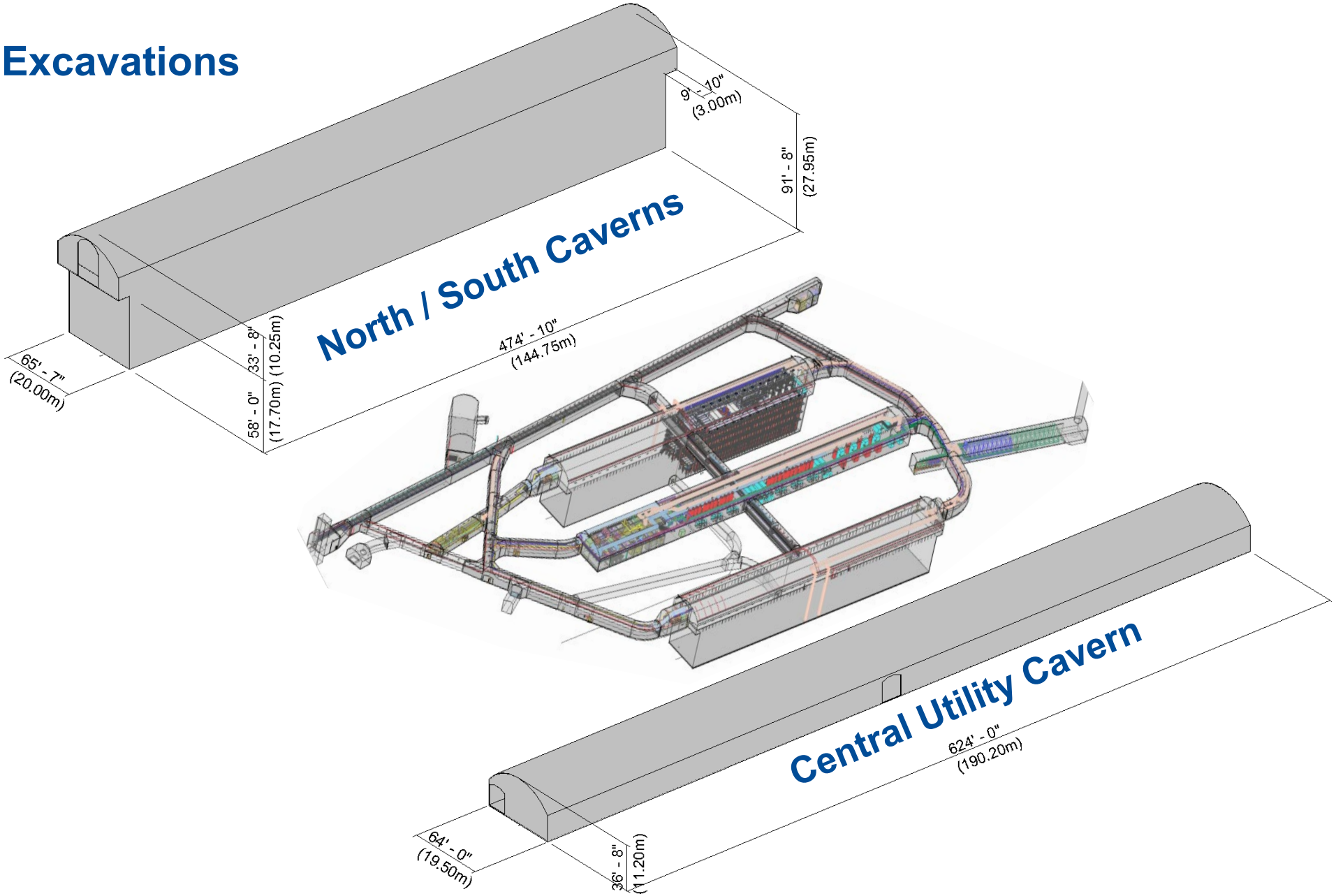
- Answers to commonly asked questions regarding the community's concerns with dust

Please do not hesitate to contact us with additional questions at neighbors-sd@fnal.gov.

Excavation Progress

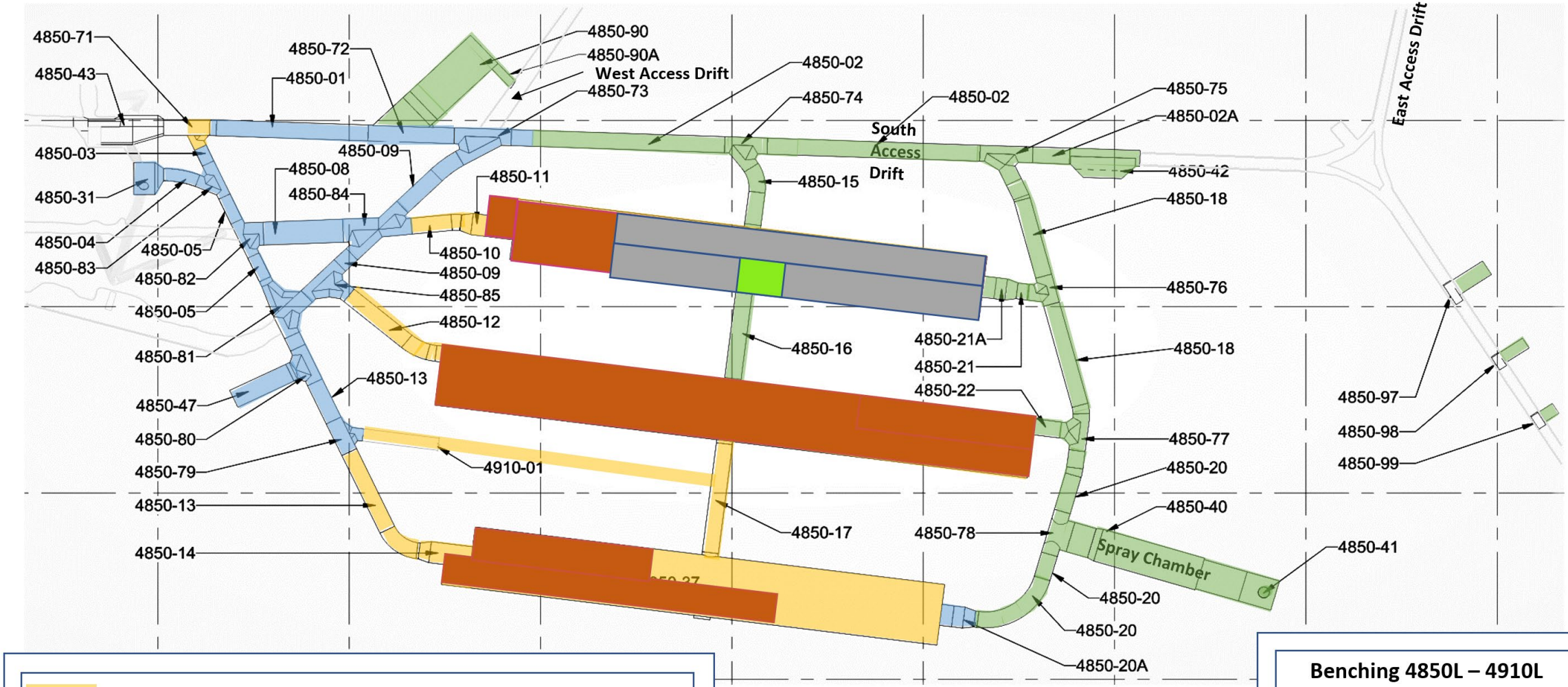
James Rickard

Size of Excavations



Total Excavation Completed to Date = 64%

May 8, 2023



4850L Excavation Completed

Excavation and Ground Support Complete and Accepted

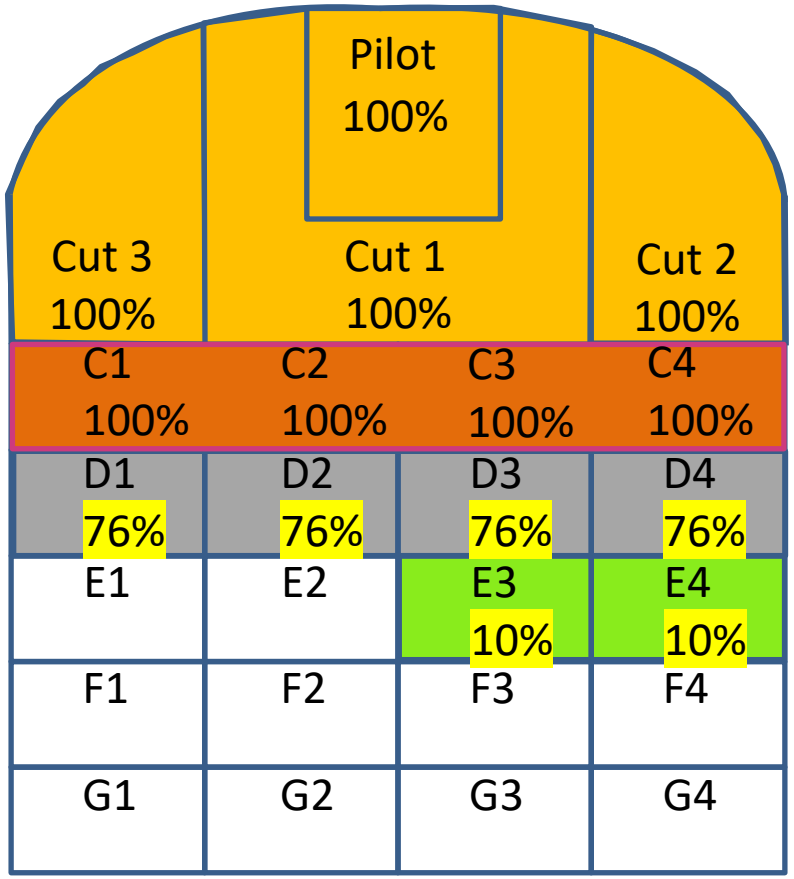
Concrete Complete

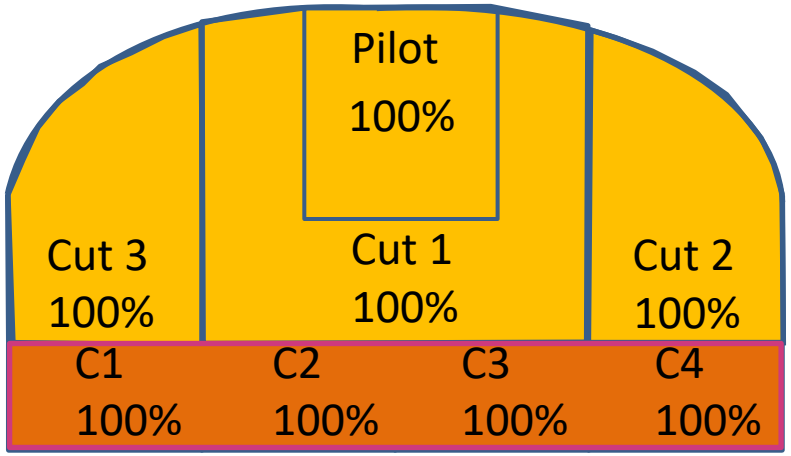
Benching 4850L – 4910L

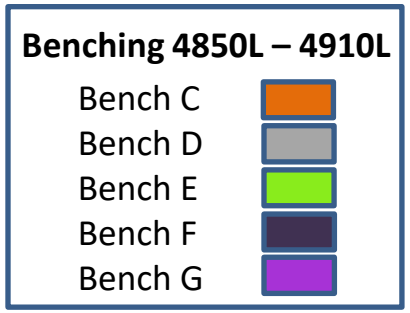
- Bench C
- Bench D
- Bench E
- Bench F
- Bench G

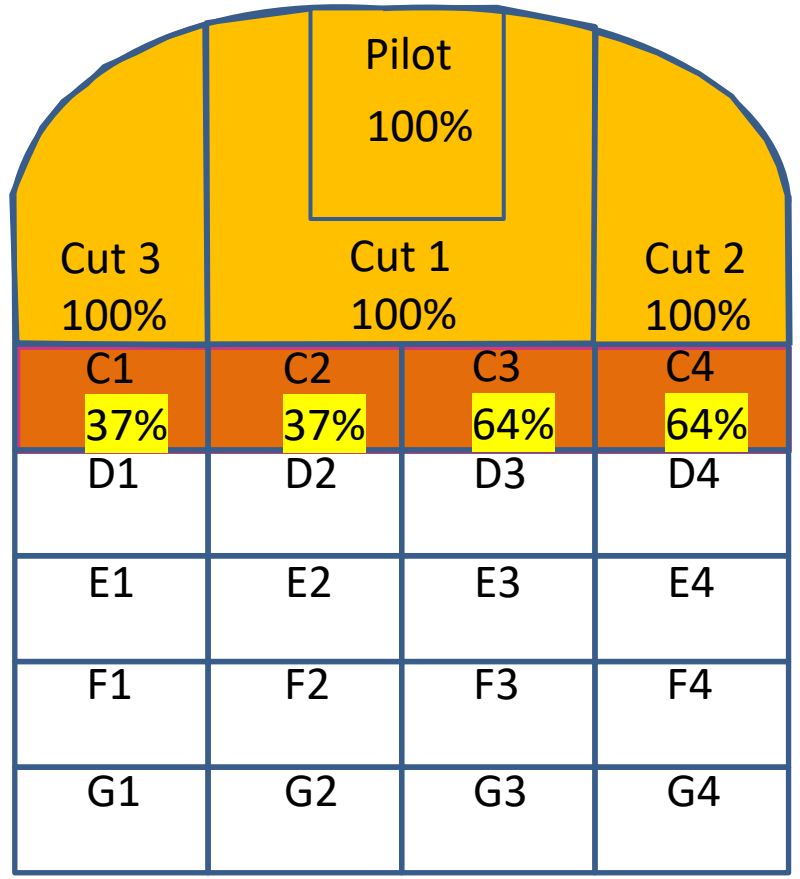
Cavern Excavation Completion Percentage

May 8, 2023









North Cavern **CUC Cavern** **South Cavern**

LBNF/DUNE

Excavation Factoids

Excavation Factoids

Safety Statistics:

TMI Safe Work Hours	**644,916**	Hours	**(LBNF Safety Record)**
Day Without LTI	**852**	Days	**(Since October 2020)**

Excavated Material to Date:

Excavated Rock (Muck)	**185,000 Cubic Yards**	**Equivalent to 56 Olympic Sized Swimming Pools**
Rock Conveyed (Skipped)	**435,000 Tons**	

Quantity of Ground Mesh Installed to Date:

Galv Sheets (6’ x 11’) 783,430 SF **Equivalent to 18 Acres or 14 Football Fields (including End Zone)**

Ground Support:

Support Anchors (CT, Dags, Split Sets) 17,894 Bolts **Equivalent to 127 miles of Installed Bolts**

Total Drilled (Blasting and Bolting) 1,100,000 Linear Feet

Poured Concrete Products:

Concrete and Shotcrete 8,300 Cubic Yards **Equivalent to a standard sidewalk 4” thick x 32 miles**

LBNF FSCF Project Highlights (North Cavern Excavation)

North Cavern (4850-33) Bench D

North Cavern (4850-33) Looking East

LBNF FSCF Project Highlights (North Cavern Excavation)

North Cavern (4850-33) CT Bolting & Grouting

North Cavern (4850-33) CT Bolting

LBNF FSCF Project Highlights (Central Utility Cavern Excavation)

CUC (4850-36) Installing CT Bolts

CUC (4850-36) Bolting & Mucking

CUC (4850-36) Shotcrete Setup

LBNF FSCF Project Highlights (Shotcreting)

Access Drift (4850-16)

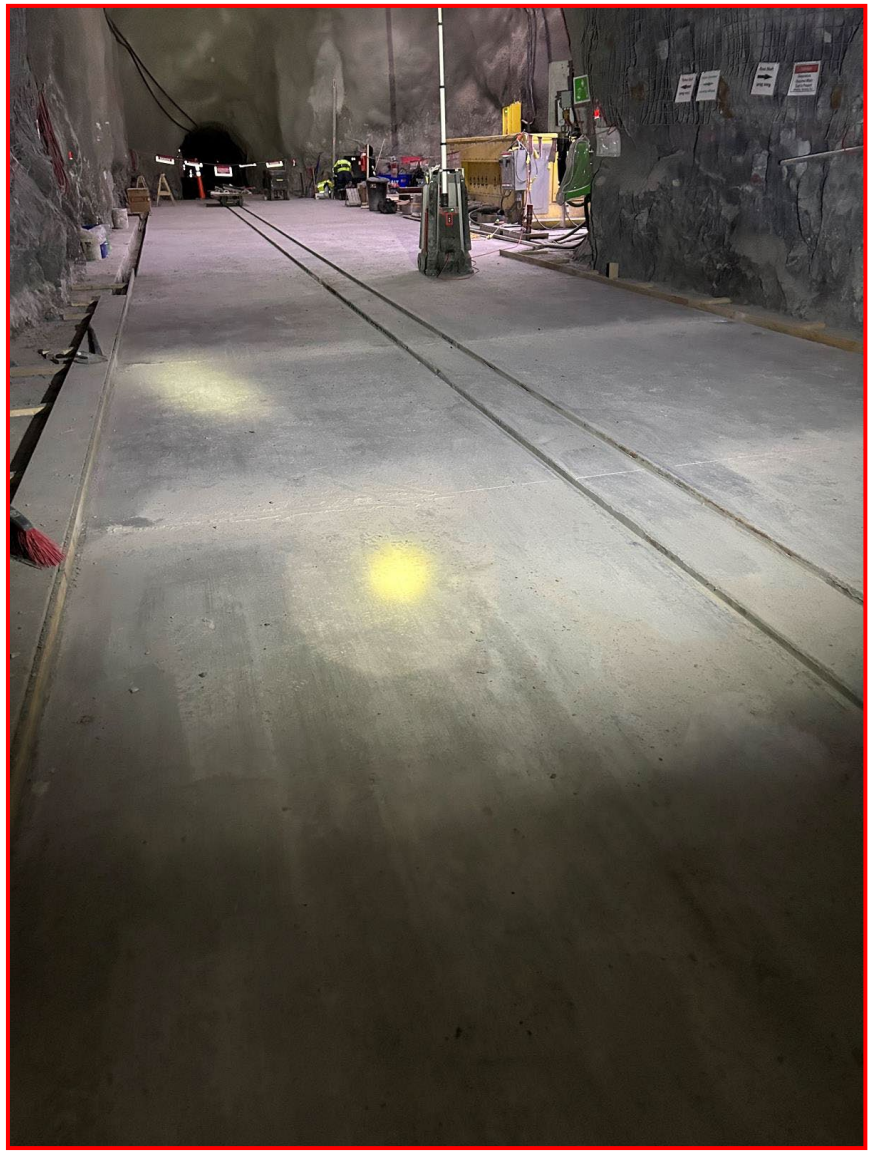
South Cavern (4850-37)

LBNF FSCF Project Highlights (Concreting)

South Access Drift (4850-02)

LBNF FSCF Project Highlights (Concreting)

CUC (4850-36) Installing CT Bolts

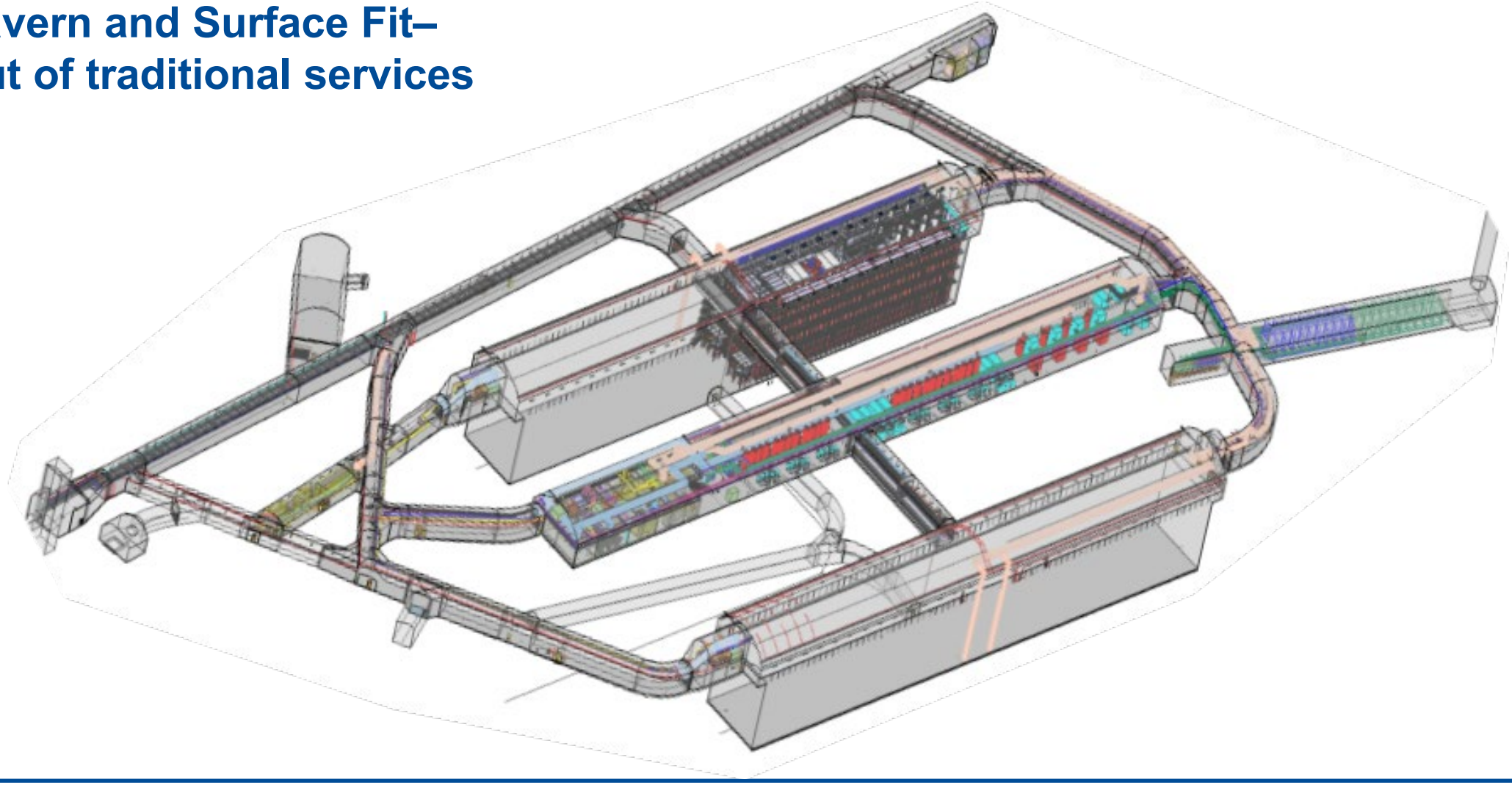


North Cavern (4850-33)

Buildings & Site Infrastructure

Tyler Apple

Generally: BSI is the Cavern and Surface Fit– Out of traditional services



Scope of BSI Work

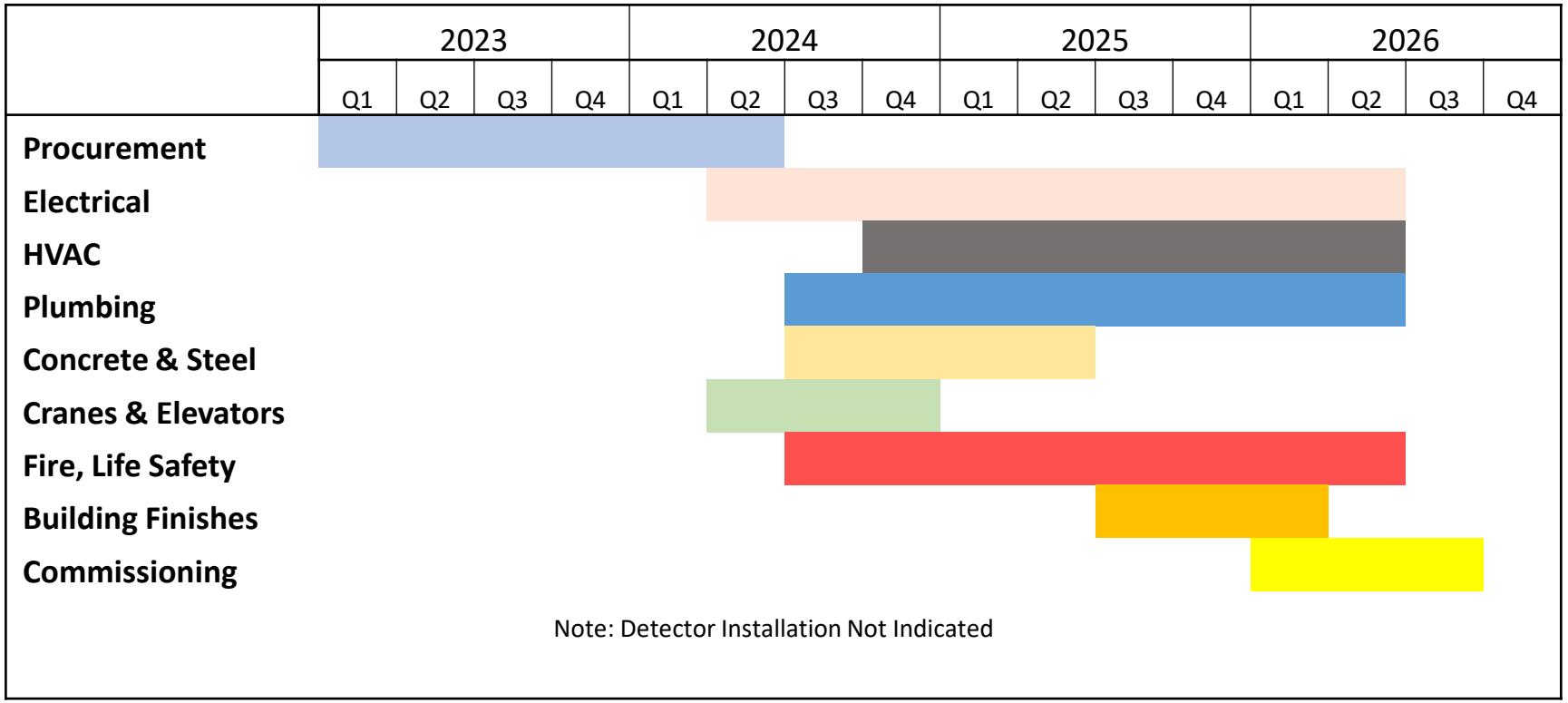
- Temporary and Permanent Electrical
- Heating, Ventilation, and Air-Conditioning
- Plumbing
- Fire Detection & Protection
- Telecommunications & IT
- Structural Steel
- Elevators & Overhead Cranes
- Masonry
- Building Finishes

BSI Procurement Schedule

Electrical	bids in hand
Telecommunications	bids in hand
HVAC	out to bid
Plumbing	out to bid
Fire Detection	bids in hand
Fire Protection	Q1 2024
Cavern Cranes and Elevators	bids in hand
Surface Building & Concrete	Q1 2024
Masonry	Q1 2024
Painting	Q1 2024
Commissioning	Q3 2023

Note: Bids in hand are primarily local Subcontractors which we anticipate remaining the case

BSI Schedule of Work



BSI Staffing - KAJV

- Construction Management 30-35
- Field Personnel 20-30
- Sub-Subcontractors 80-100
- Services ~10

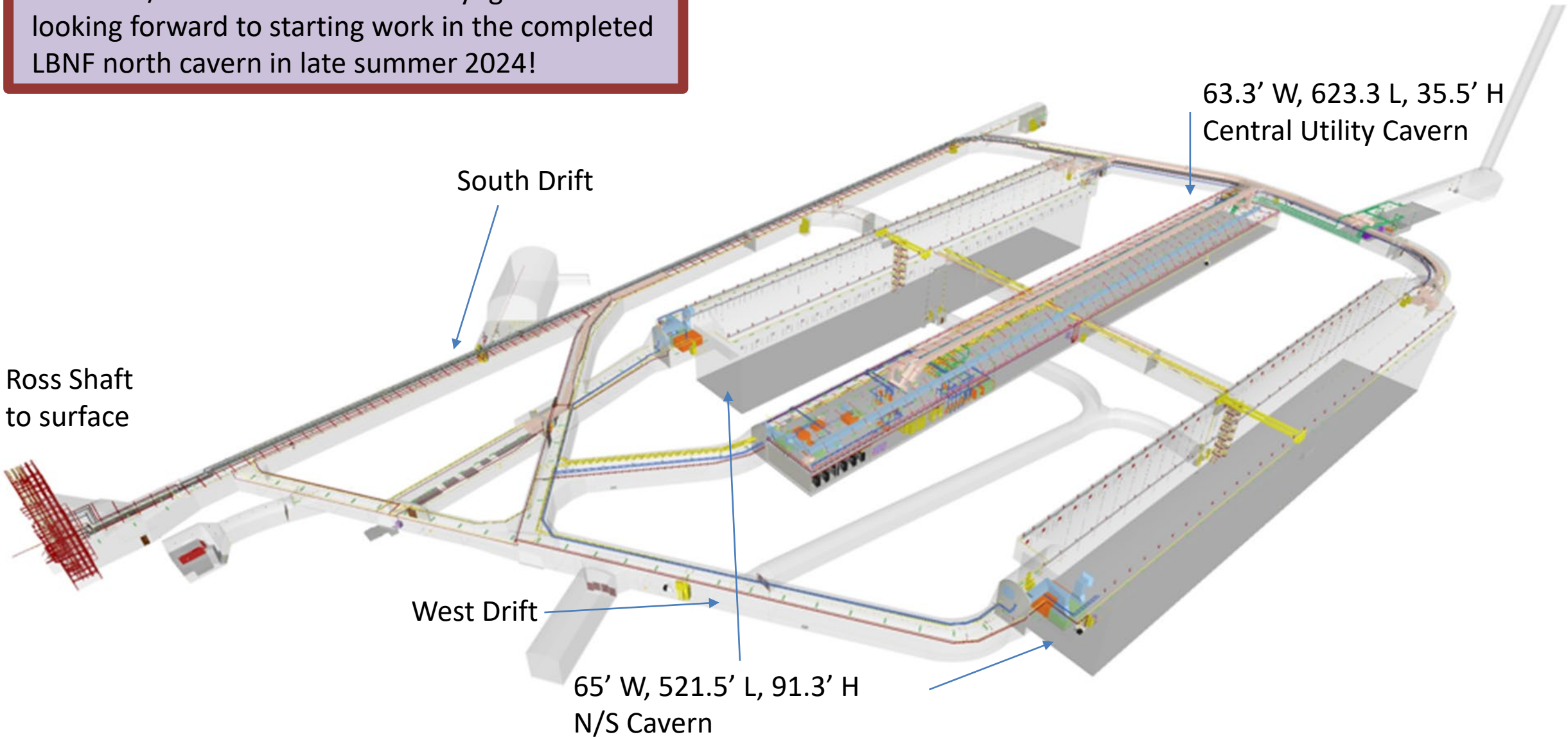
BSI – Site Activities

- Work schedule 5 days/week with material handling on Sat/Sun
- Work two shifts per day
- Material deliveries to site on daily basis (to support approximately 200 cage loads per week of material and equipment)
- Main storage offsite by individual subcontractors
- Staging at Ross and Yates campus
- Surface work limited to Ross campus

Far Detector and Cryogenics Overview

Jolie Macier

The LBNF/DUNE Far Detector & Cryogenics team is looking forward to starting work in the completed LBNF north cavern in late summer 2024!



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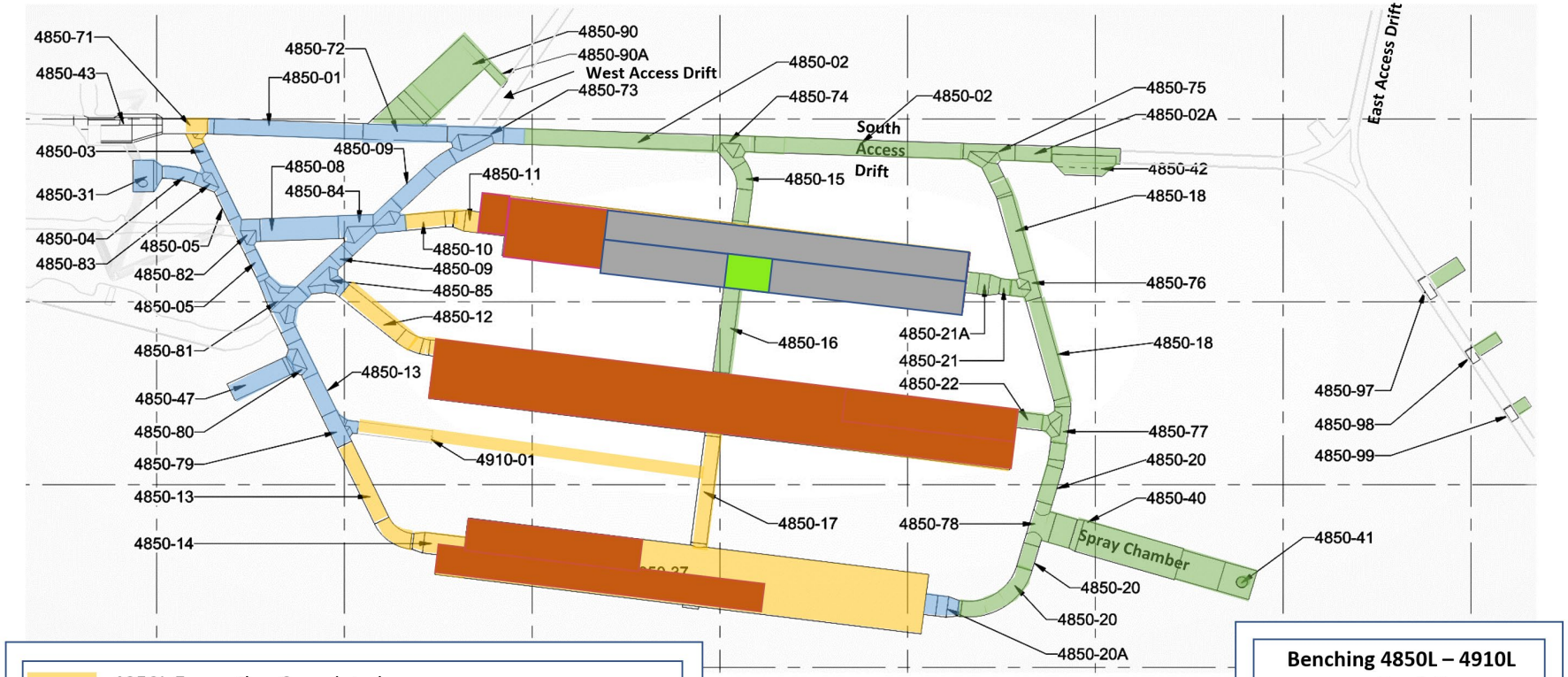

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Bench C

Bench D

Bench E

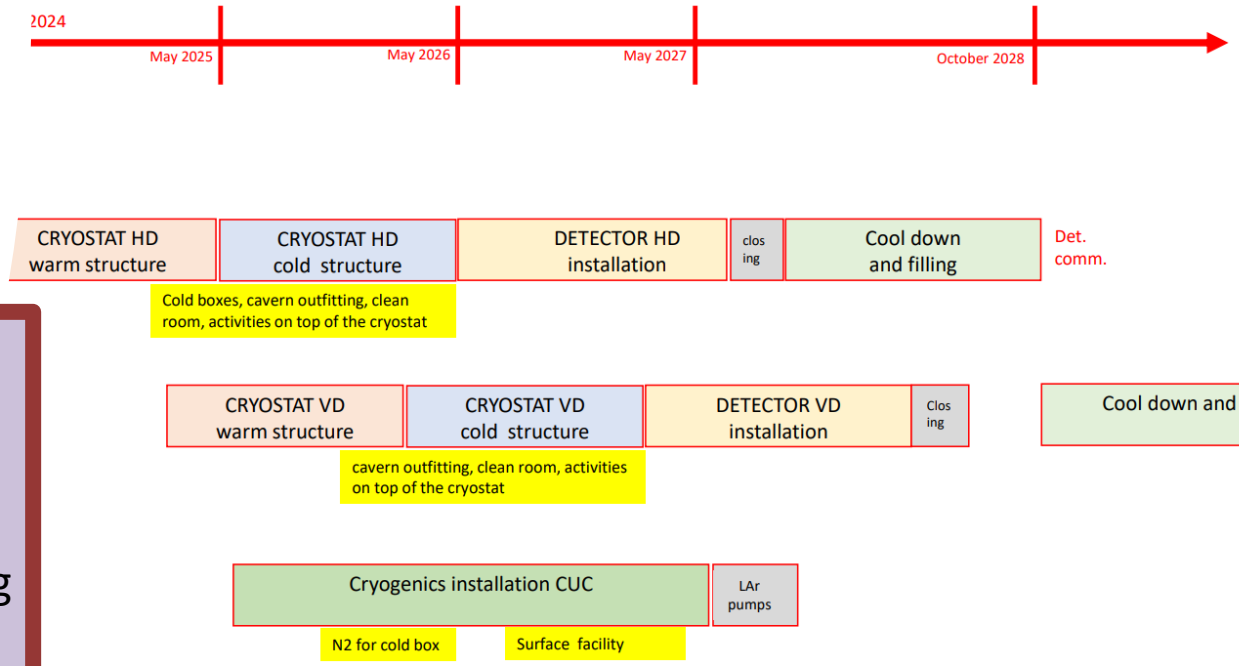
Bench F

Bench G

Thanks to the Conventional Facilities team, KAJV and TMI for all of the work to deliver beautiful underground caverns!

FDC Scope Overview

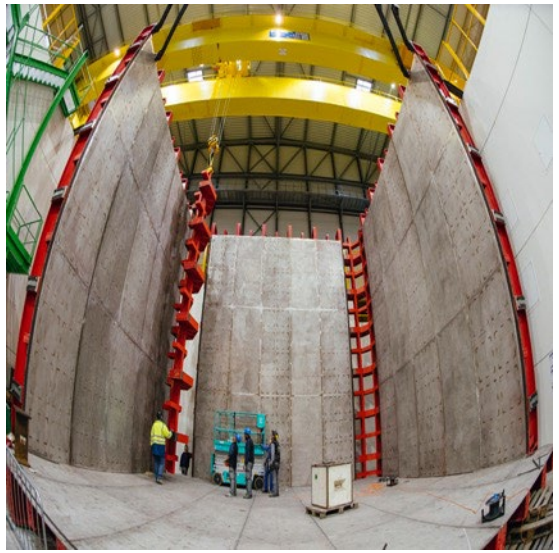
- Construct **cryostats**
  - Steel structure (right) is 1/20 the size of LBNF cryostats (2x higher, 2x wider, 10x longer)
- Install **detectors**
- Install **cryogenics systems**
- Have completed full-scale prototyping of all elements: cryostat, cryogenics, detector & installation processes
- Planning for movement of all material (steel, detector components through Ross Shaft); all elements modular for transport
- Small team to be retained for DUNE Experimental Operations following installation

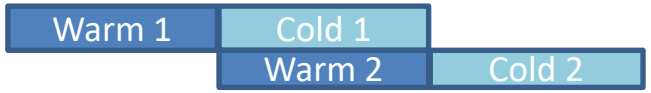


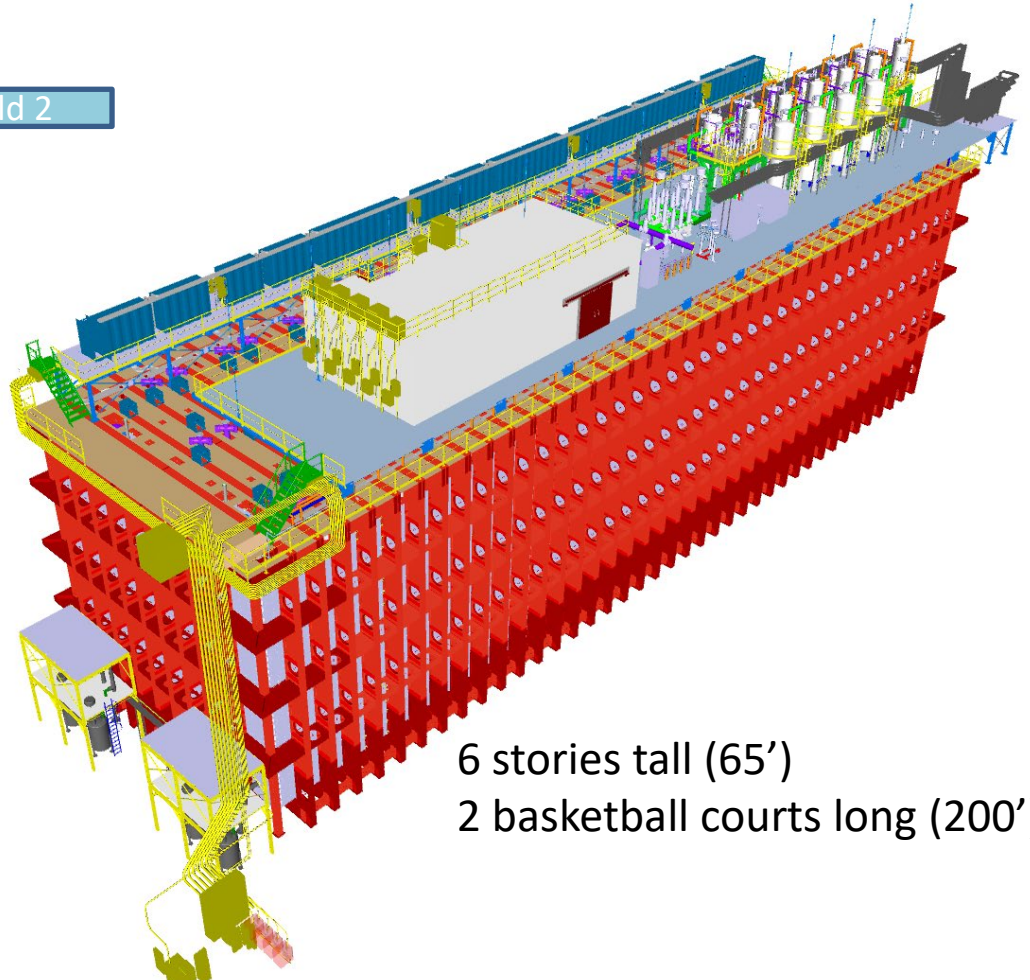
Onsite Integration & Installation Team
- Lead-based: 80, including FNAL staff + subcontractors starting in 2024, up to 130
- Visiting: 20/year, FNAL Staff + subcontractors + visitors (other national lab & universities) starting at AUP (Authorization for Use & Possession)

Cryostat Installation

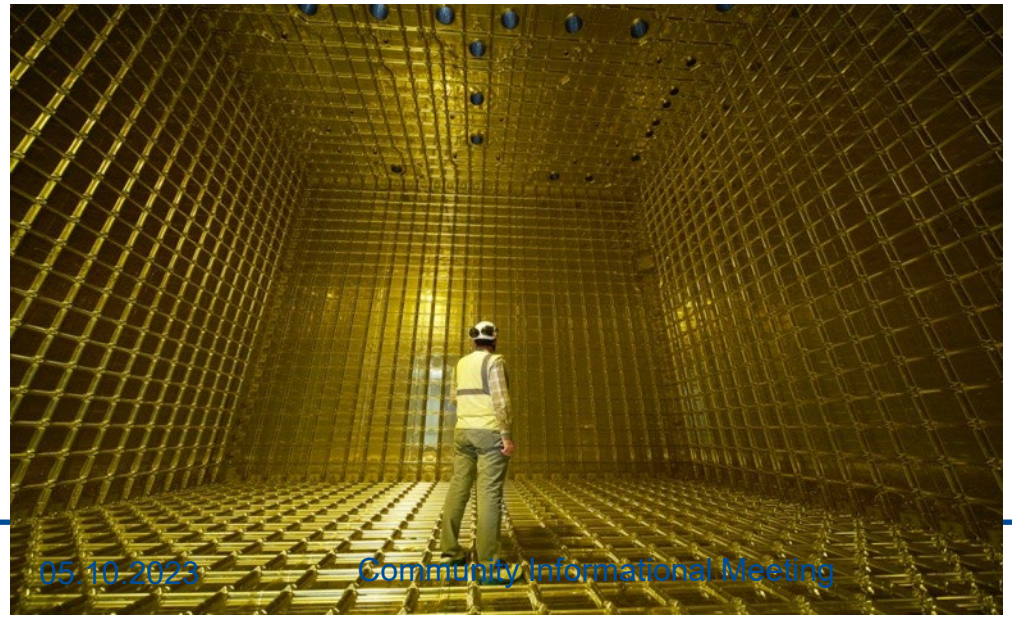
- First activity after AUP in August 2024
- Two phases: 1 - warm (steel structure, left) and 2 - cold (insulation, bottom left)
- 50 persons per phase
- Phase 1: mostly subcontractors (US) + non-US CERN visitors
- Phase 2: all non-US subcontractors + non-US CERN visitors
- NOTE: phase 1 and Phase 2 overlap, starting in mid-2025 with work occurring in both North and South Caverns.



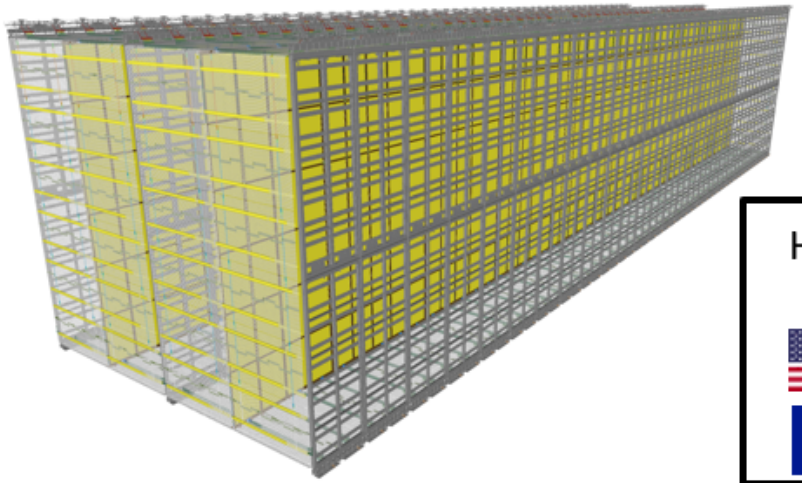


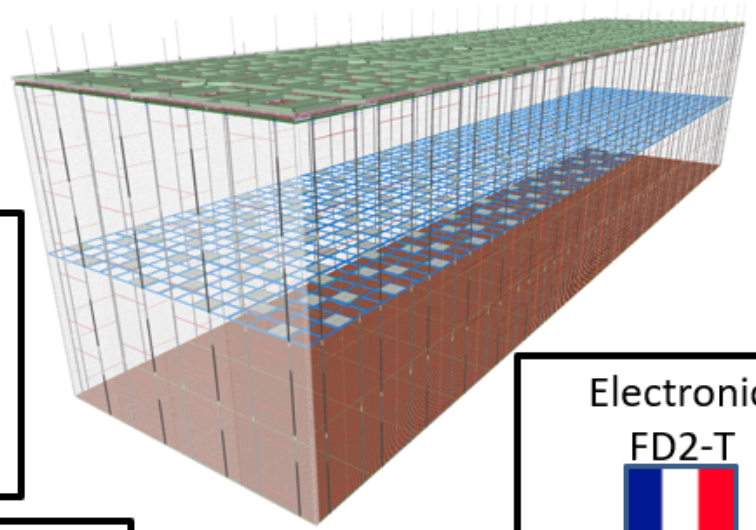


6 stories tall (65’)
2 basketball courts long (200’)



Far Detector Partners





High Voltage
FD1, FD2

Electronics
FD2-T

Anode Plane
Assemblies - FD1

Photon Detection
FD1, FD2

Charge Readout
Planes - FD2

TPC
Electronics
FD1, FD2-B

CALCI
FD1, FD2

Data Acquisition
FD1, FD2, ND

Detector components are installed inside the cryostats

- 1300+ collaborators
- 204 institutions in 33 countries + CERN
- Expect 40 scientists / month starting mid-2026 (US/nonUS)

Building a Team to Install Detectors

- Key skills: material handling, work planning, mechanical acumen
- Hiring starts in summer 2024
- Build the world's largest neutrino detector
- Work side-by-side with engineers, physicists from around the world

- Work from heights (39 feet)
- Modular components
- Operate forklifts, scissor lifts, pallet jacks
- Team of 30 technicians support cryostat & detector installation

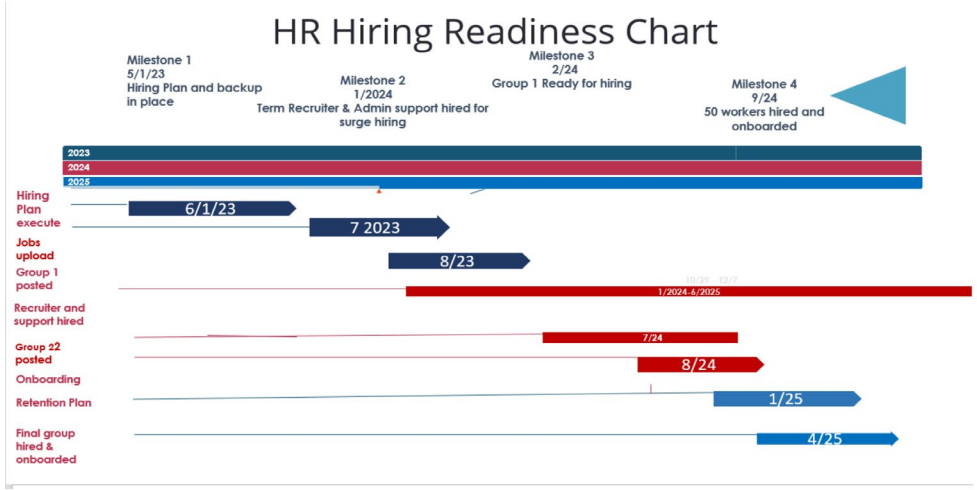
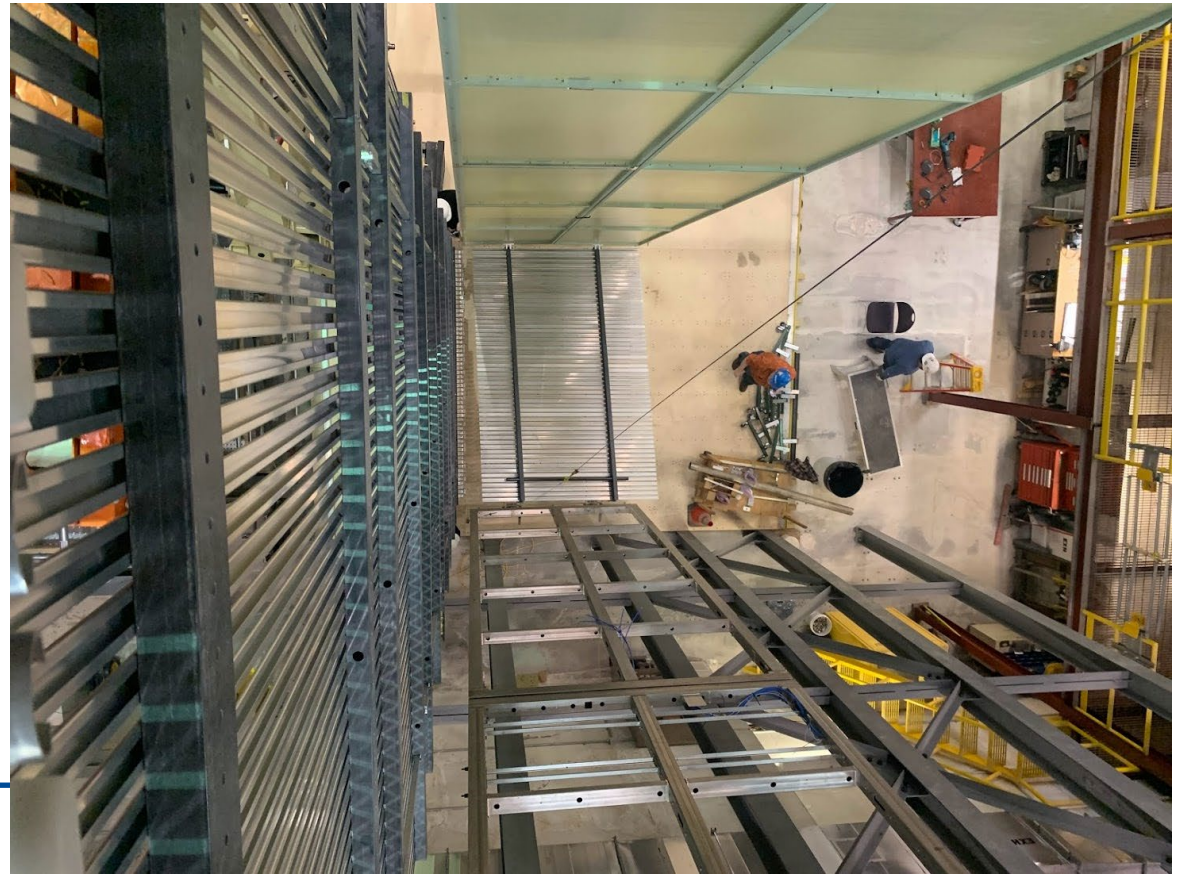
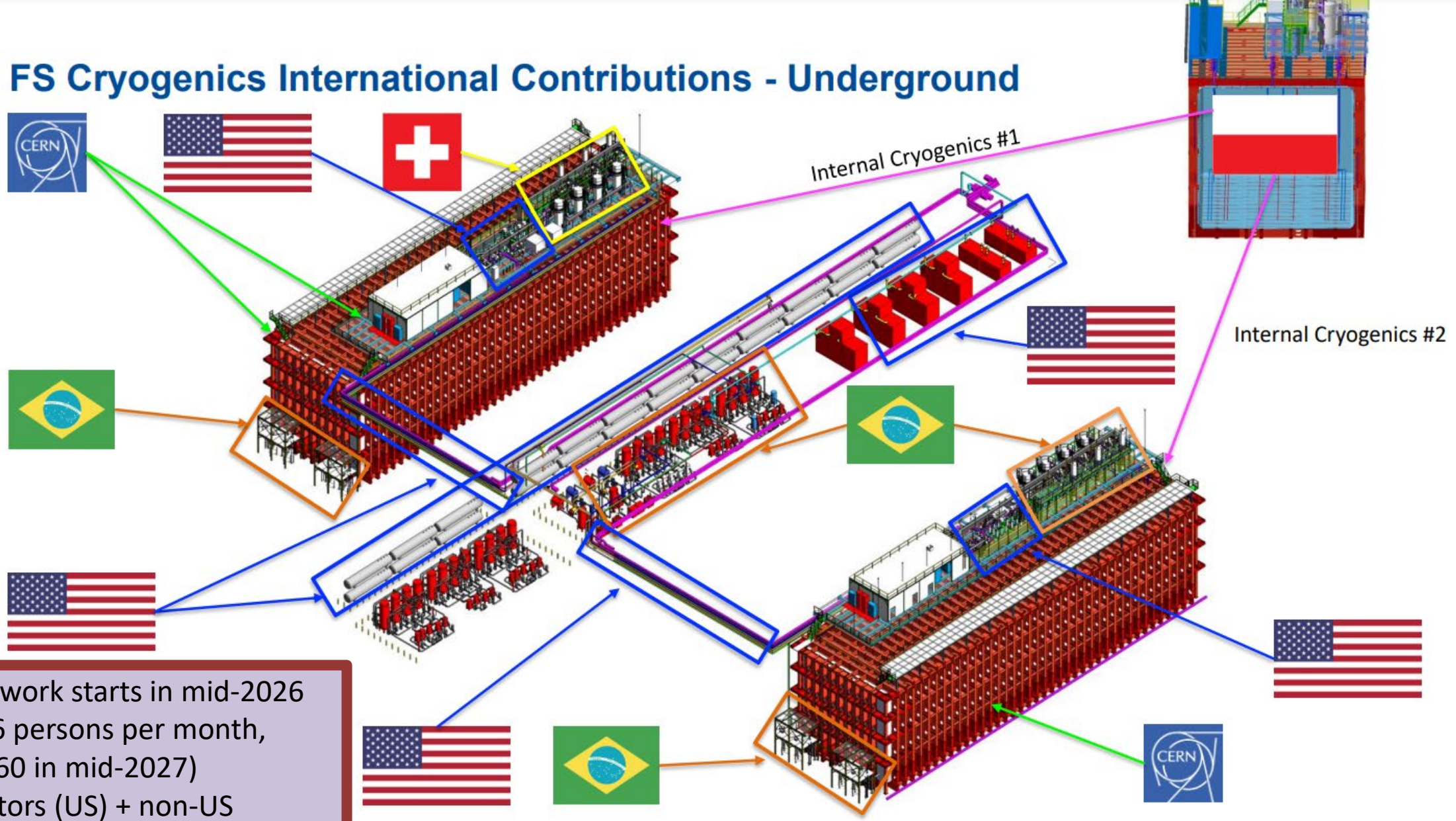


Figure 2-1: HR Hiring Readiness Chart



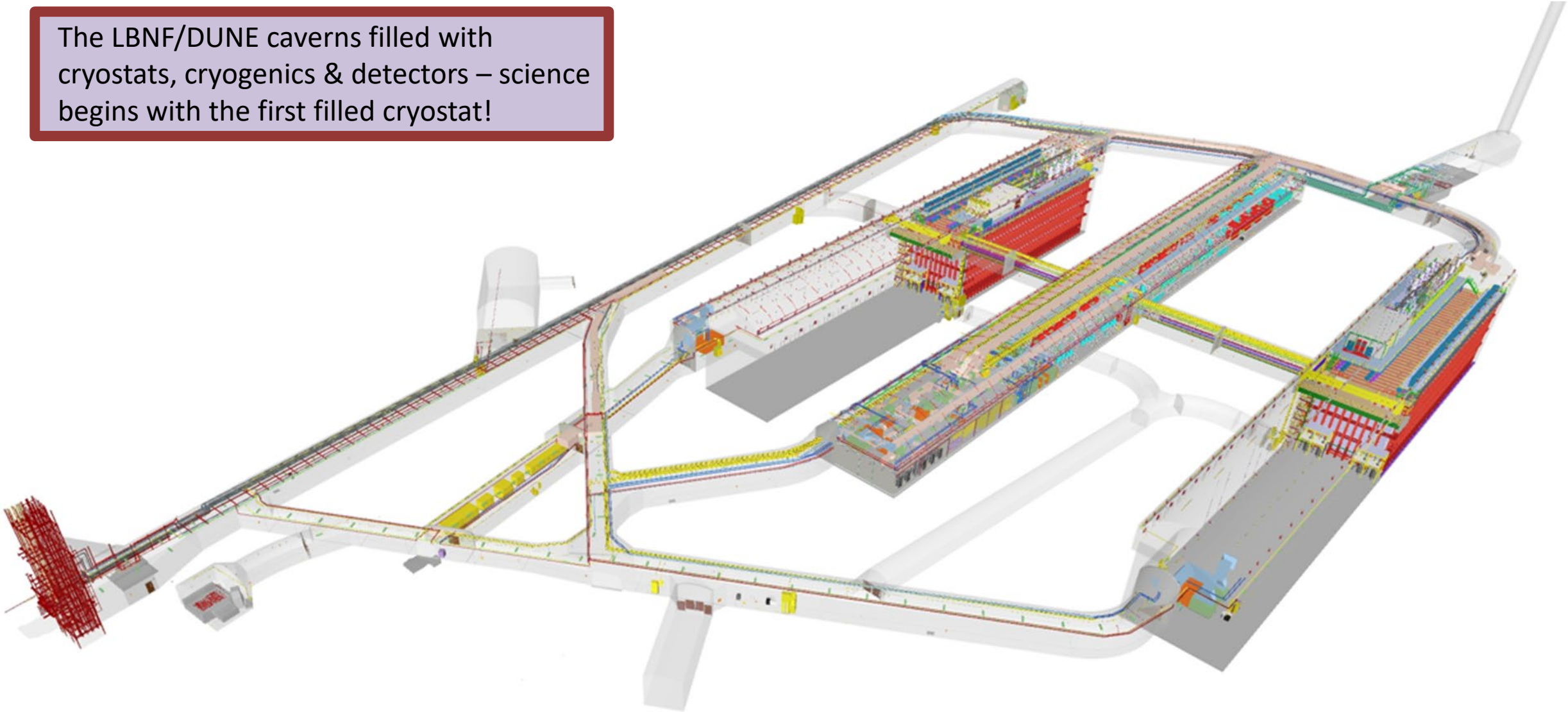
FS Cryogenics International Contributions - Underground



- Cryogenics work starts in mid-2026 (Average 26 persons per month, peaking at 60 in mid-2027)
- Subcontractors (US) + non-US experts
- Filling of cryostats is the final LBNF Project activity

Warm 1 | Cold 1 | Detector 1
Warm 2 | Cold 2 | Detector 2
Cryogenics

The LBNF/DUNE caverns filled with cryostats, cryogenics & detectors – science begins with the first filled cryostat!



SDSTA Update

Will McElroy

Questions?

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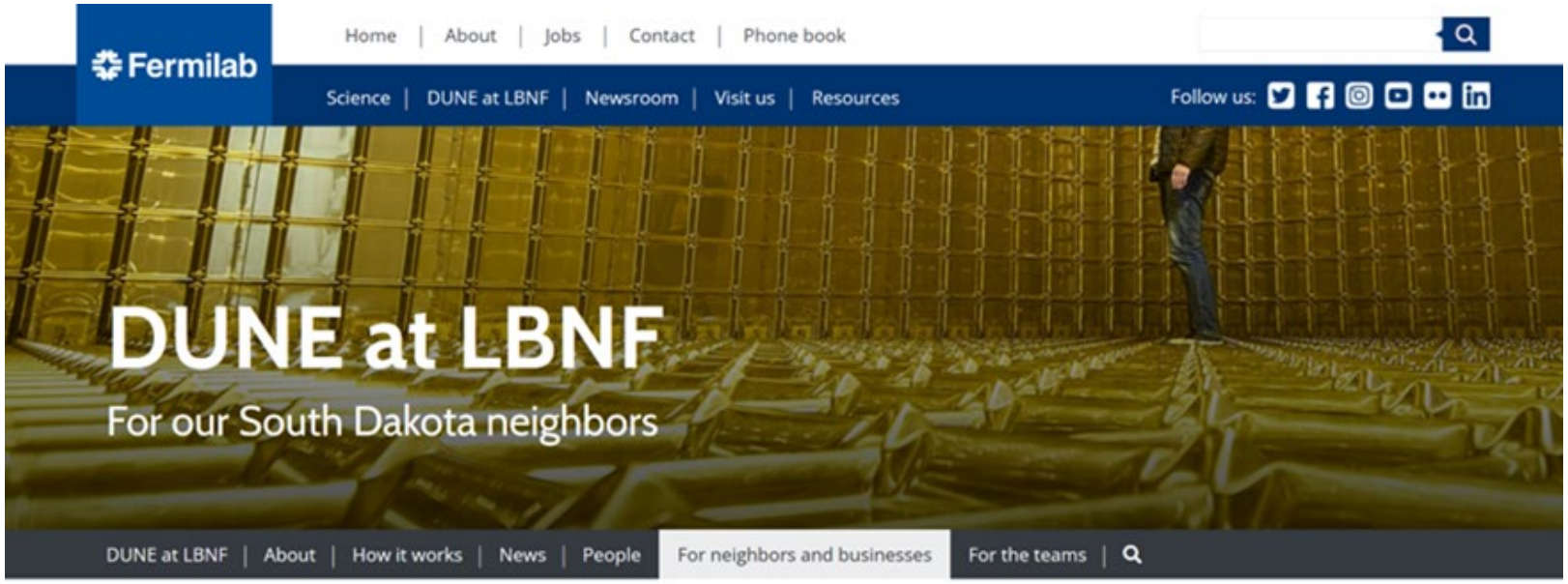

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