



Integrated Engineering Research Center

Brian Rubik
All Engineer's Retreat - IERC
February 23, 2021

Agenda

- Introduction
- Mission Need / Campus Overview
- Quick Facts
- IERC Program
- Site Plan
- Sustainable Design
- Renderings
- Project Timeline / Status
- IERC Science Activities (Leo Bellantoni)

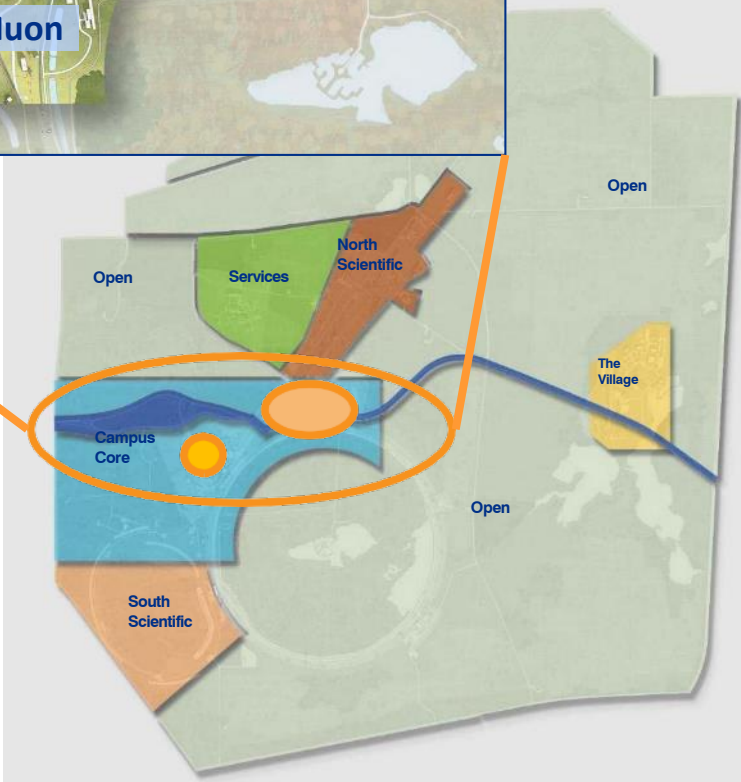
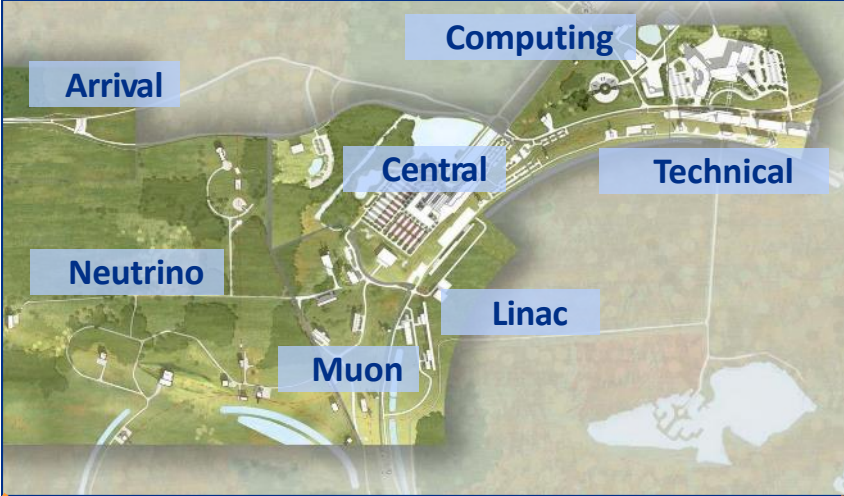
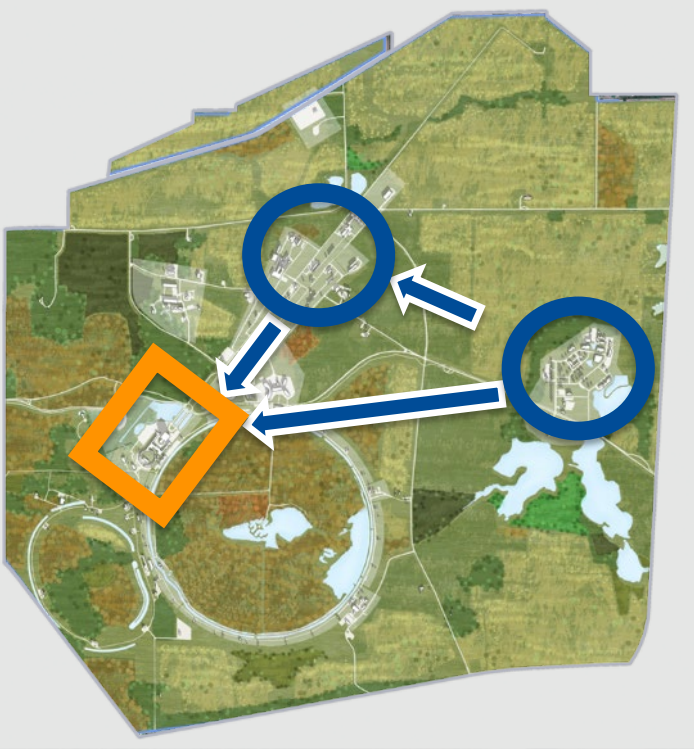
IERC Introduction



Mission Need

- Integrate engineering resources currently scattered across the laboratory
- Provide state of the art facilities that enables the design and construction of high-performance particle physics detectors to address P5 science drivers
 - P5: Particle Physics Project Prioritization Panel → now called the DOE and NSF Plan for High Energy Physics
- Reestablish vital interconnects between international science community to Fermilab engineering and technical teams
- High level building requirements
 - Adjacent to Wilson Hall
 - Collaborative environment
 - Flexibility of laboratory and office spaces
 - Preserve and strengthen the iconic stature of Wilson Hall

Campus Overview



Quick Facts

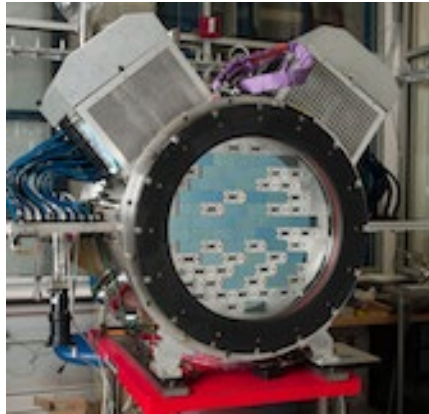
- 80,000 Gross Sq. Ft. / 2 stories
- \$86M Total Project Cost
 - Funded by the Science Laboratories Infrastructure (SLI) Program
- Subcontractor Team:
 - Architect: **Perkins & Will**
 - Engineer (Mech., Elec., Plumbing, Fire Prot., Structural): **Arup**
 - Engineer (Civil): **Terra**
 - Construction Manager / General Contractor: **Mortenson**
 - Commissioning Agent: **Burns & McDonnell**
- Current Status: CD-2/3 achieved, building construction ongoing
- Target Completion Date: October 2022

Program Groups

IERC Program Groups are the people in 3 divisions (ND, PPD, SCD) with the science, engineering & technical expertise needed to work on IERC activities.



Liquid Argon Detector Engineering Group (ND/LAEG)



Detector Development & Operations Department (PPD/DDOD)



Mechanical Engineering Department (PPD/MED)



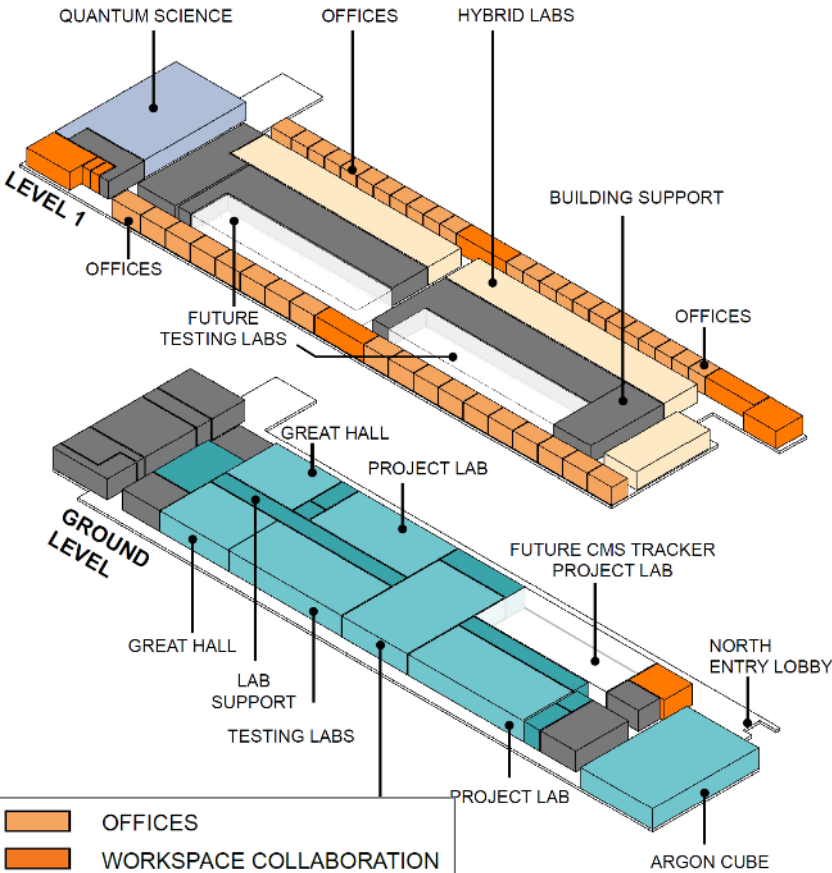
Real-time Systems Engineering (SCD/RSE)

Electrical Engineering Department (PPD/EED)



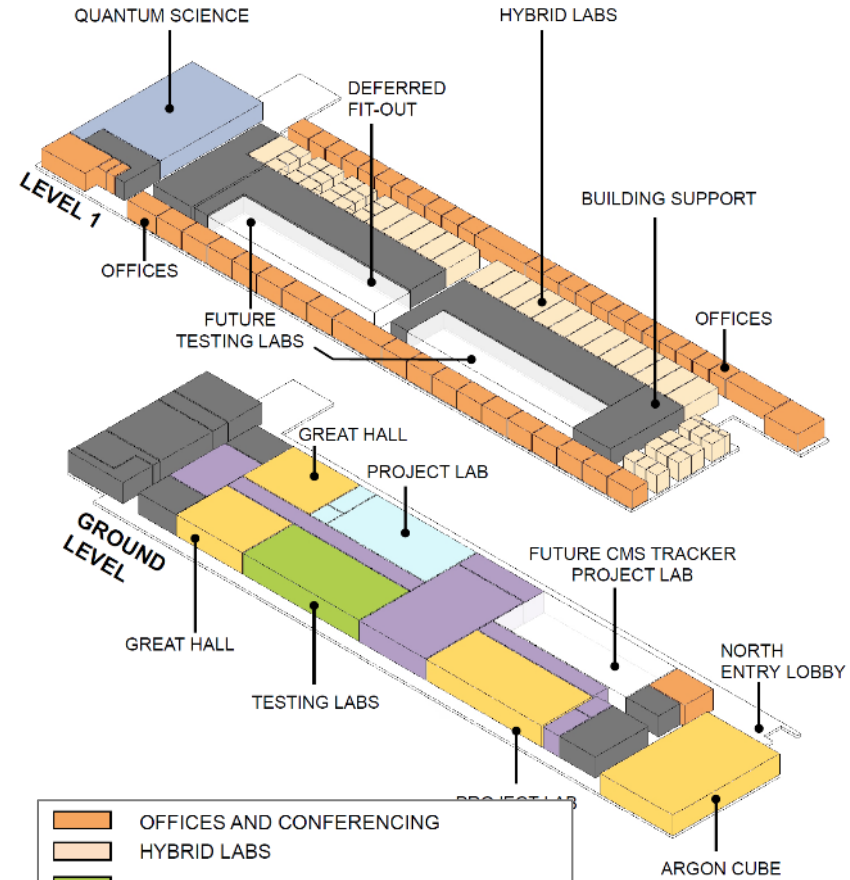
Programming

Space Diagram



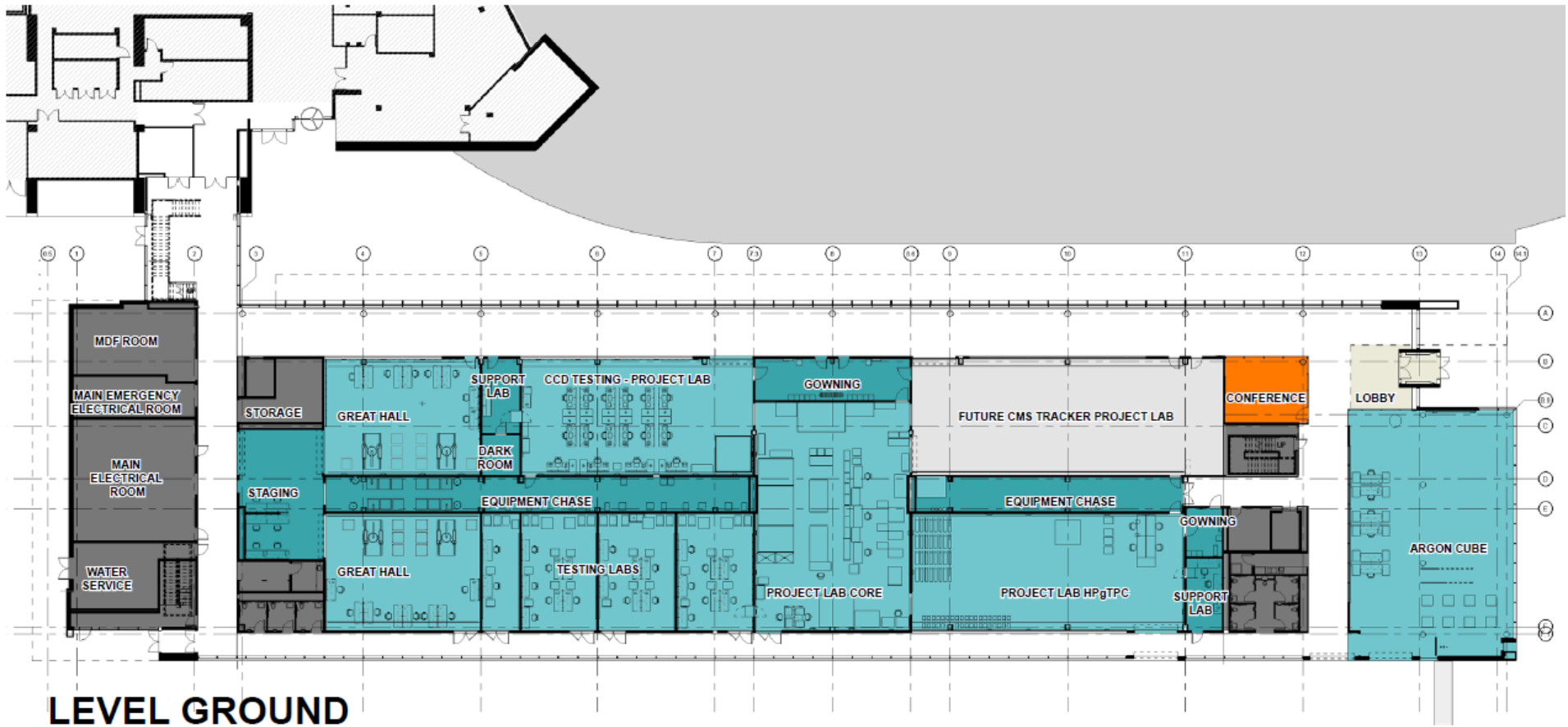
- OFFICES
- WORKSPACE COLLABORATION
- HYBRID LABS
- LABORATORY
- LAB SUPPORT
- QUANTUM SCIENCE
- BUILDING SUPPORT
- DEFERRED FIT-OUT

Department Diagram

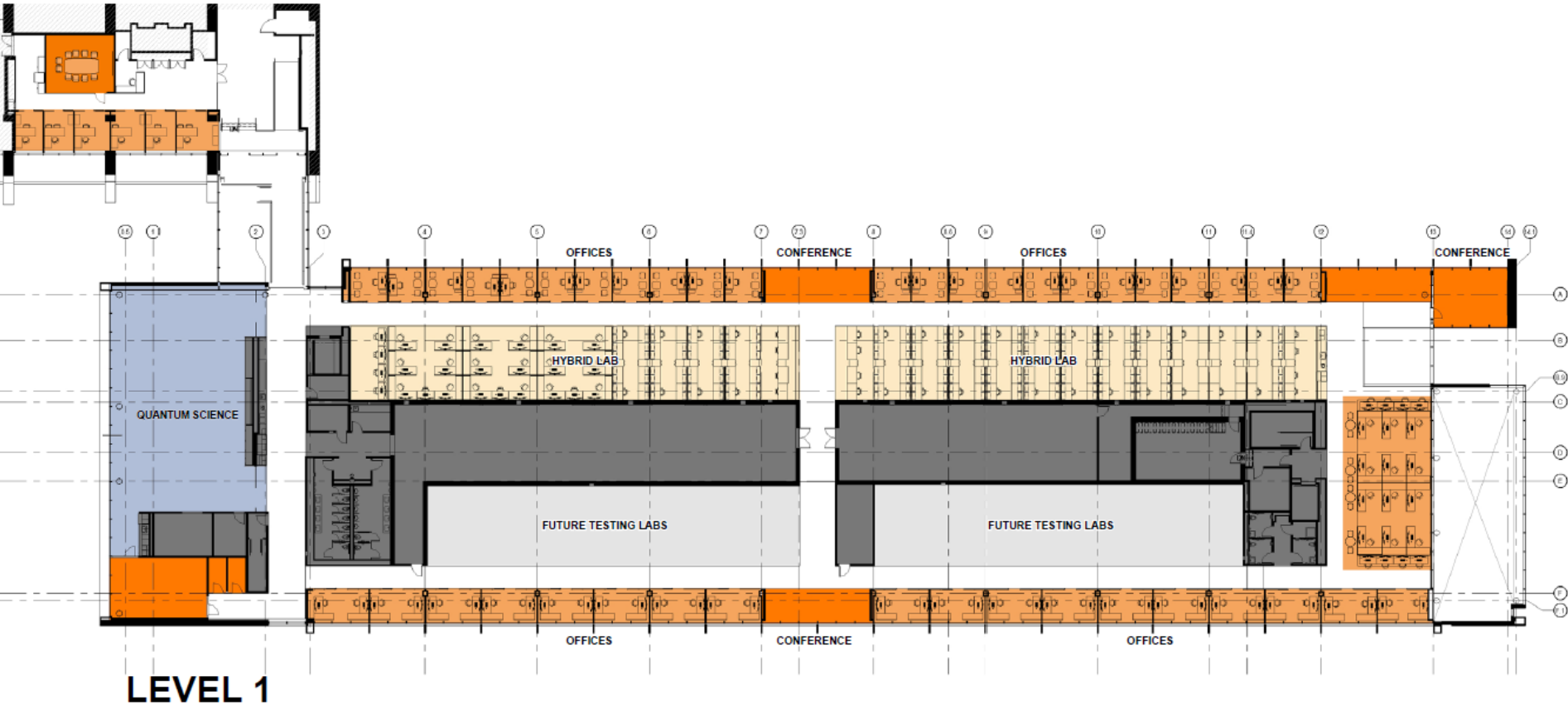


- OFFICES AND CONFERENCING
- HYBRID LABS
- ELECTRICAL & MECHANICAL ENGINEERING
- DETECTOR R&D CONSTRUCTION
- DUNE / LAR
- QUANTUM SCIENCE
- SHARED LAB AND SUPPORT
- BUILDING SUPPORT
- DEFERRED FIT-OUT

Programming

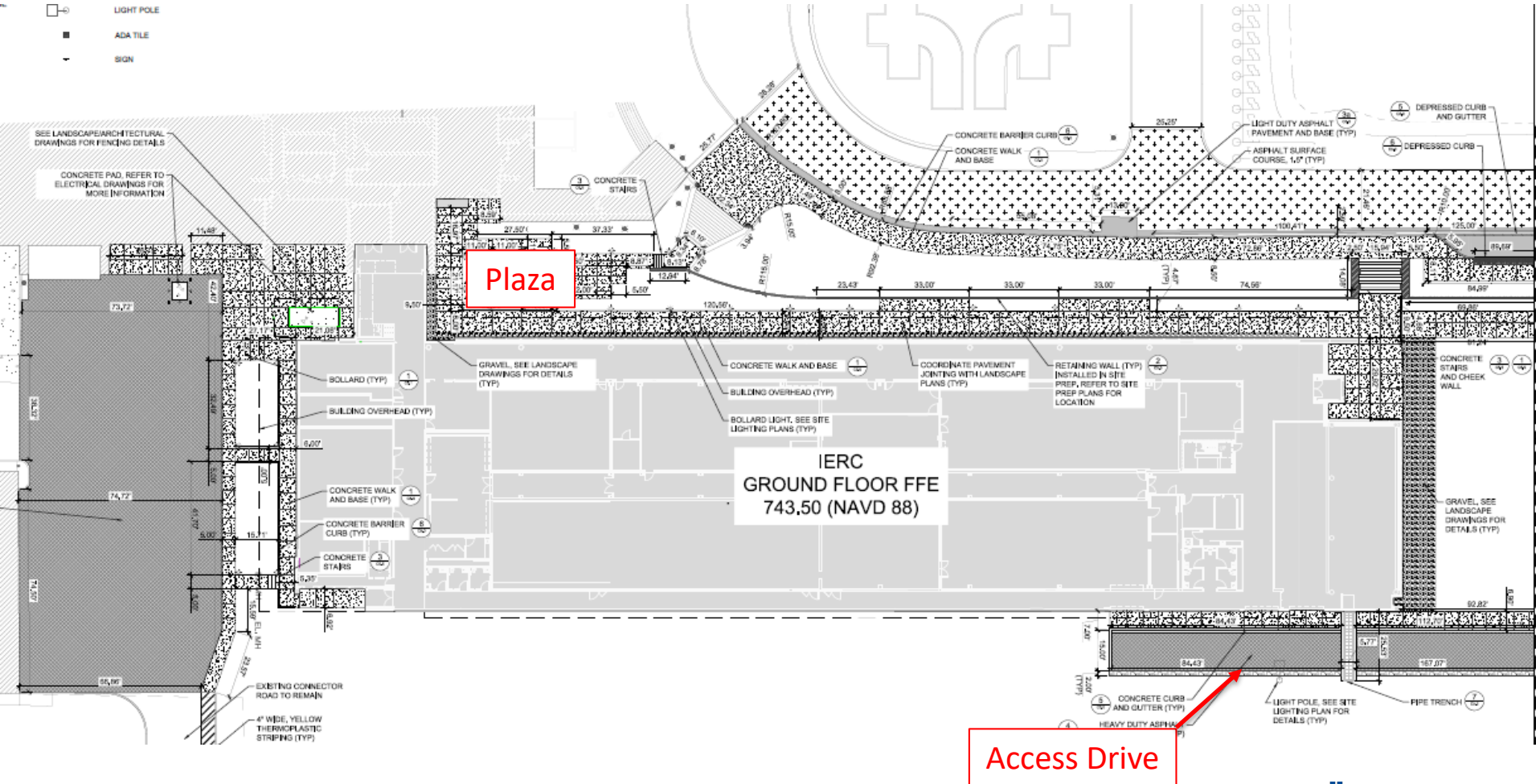


Programming

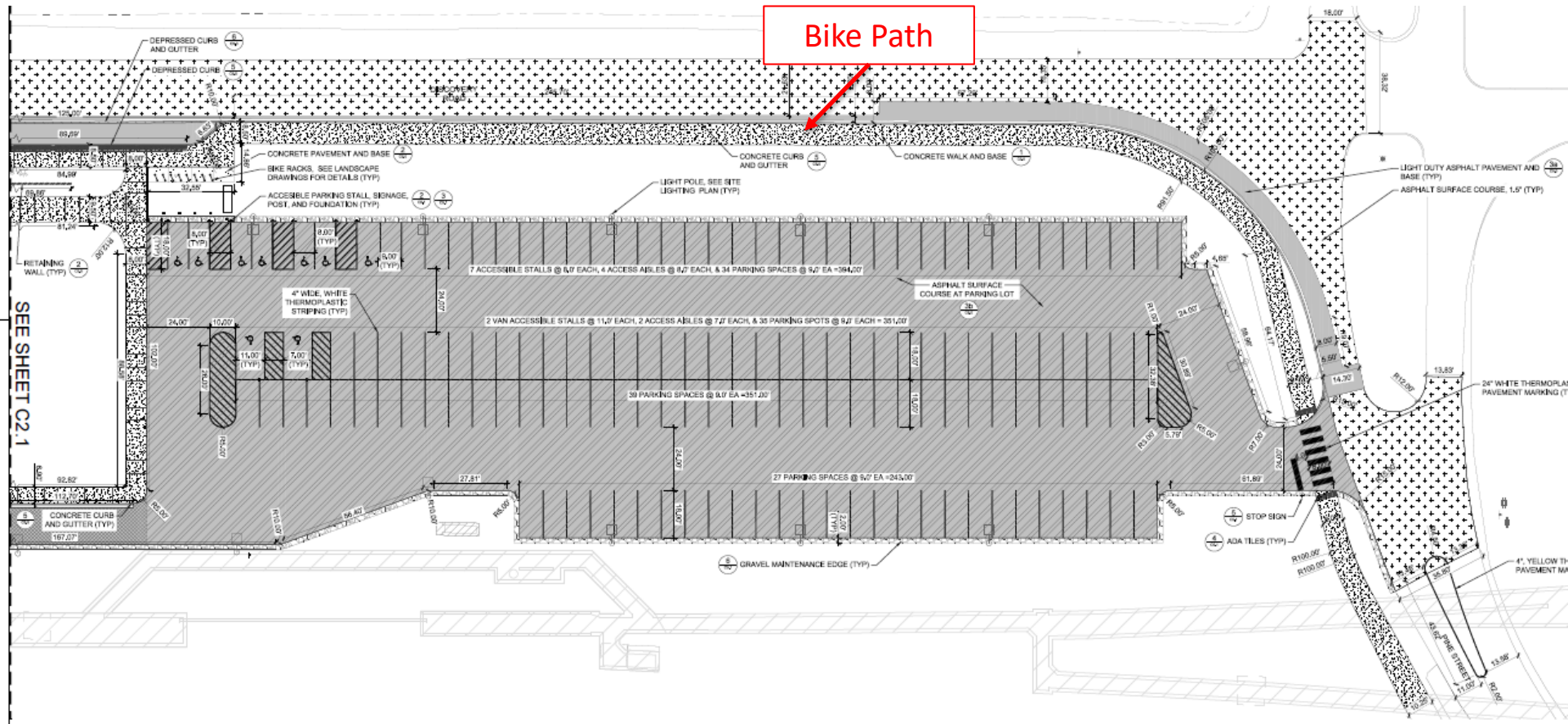


Site Plan

- LIGHT POLE
- ADA TILE
- ▼ SIGN



Site Plan



Sustainable Design

- Project is meeting the DOE High Performance Sustainable Building (HPSB) Guiding Principles
- Sustainable design features include:
 - High-performance energy efficient building enclosure
 - Building automation systems (mechanical, lighting, etc.)
 - Stormwater management (bioswale, retention tanks, etc.)
 - Green roof
- Commissioning Agent will help us meet these goals



Renderings



Renderings



Renderings



Renderings



Renderings



Renderings



Renderings



Renderings



Renderings



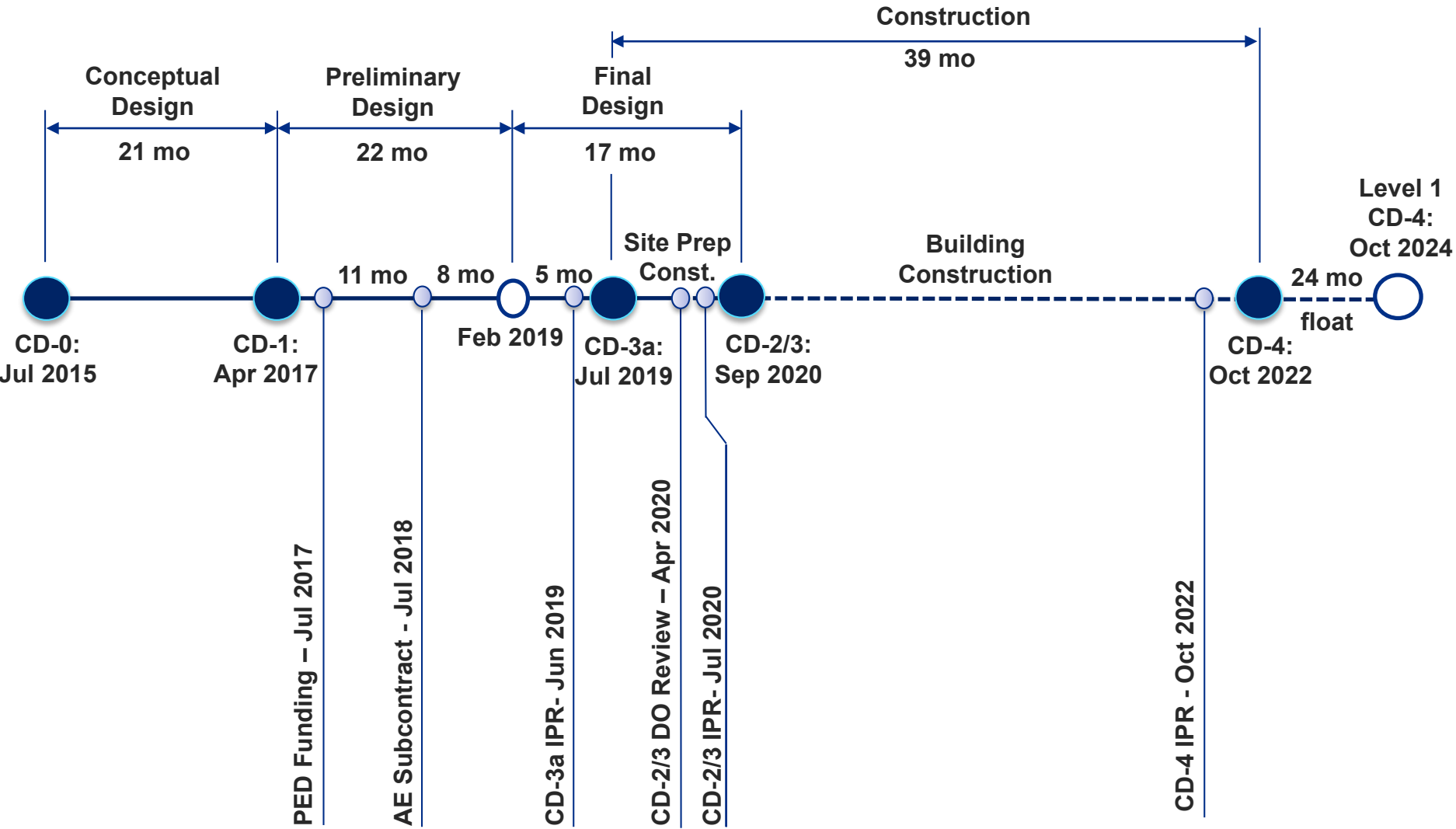
Renderings



Renderings



Project Timeline



Project Status

- Building construction underway, activities include:
 - Foundations (nearly complete)
 - Installing underground building utilities
 - Structural steel installation
 - Demo / renovation inside Wilson Hall for connection to IERC (coming soon)



Project Status



Project Status



Project Status



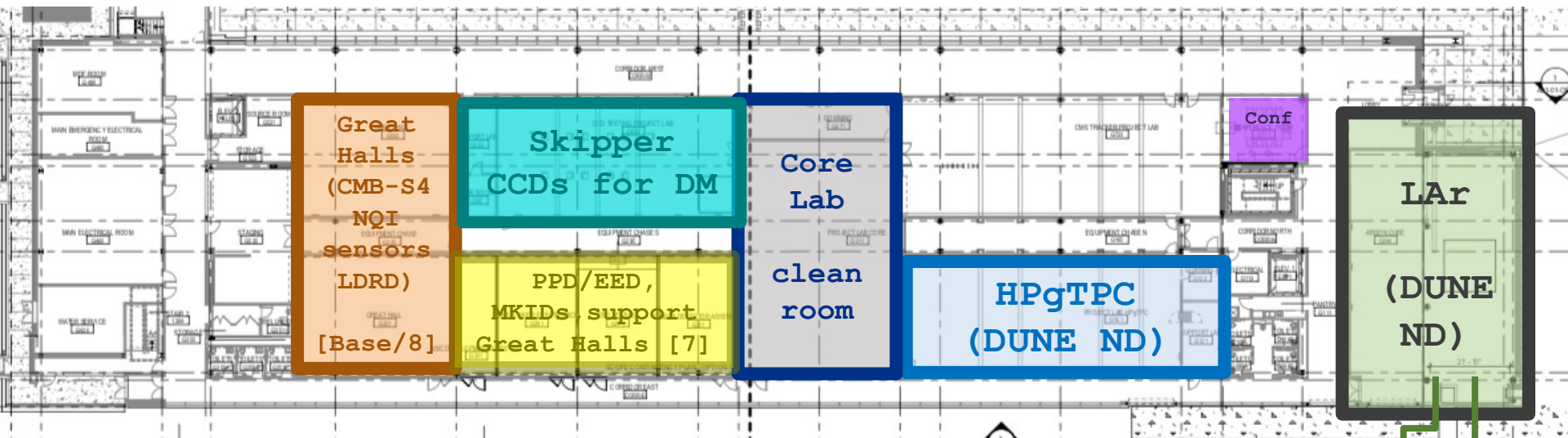
IERC Science Activities

Leo Bellantoni, IERC Science Operations & Integration Coordinator

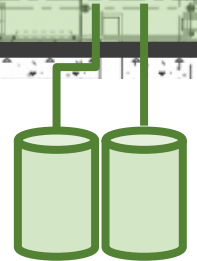
The Integrated Engineering Research Center - 5¢ tour



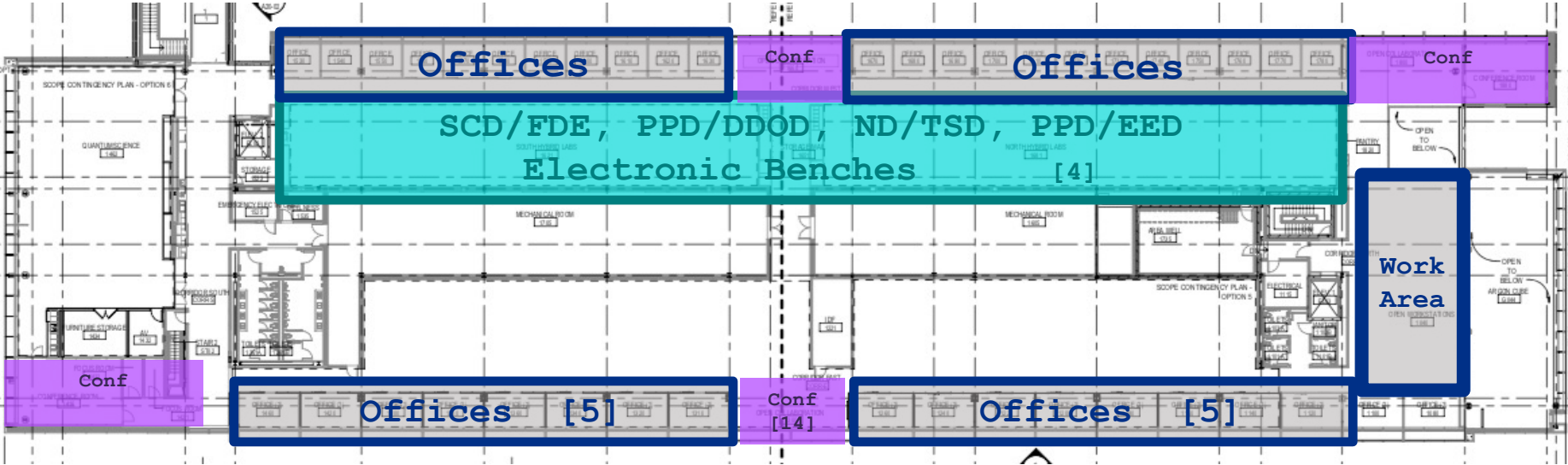
IERC GF – FY23



External
Dewars



IERC 1stF – FY23



LAr (Ar³) lab

- The DUNE experiment will warm- and cold-test liquid Argon (LAr) modules from its various collaborators before they are installed into the ND Cavern. To do so, they need a pair of cryovessels each large enough to hold a module and a supporting cryogenic system.
- The intent is to test in one cryovessel while installing or deinstalling in the other. The LAr can be shuttled from cryovessel to cryovessel, reducing consumption and greatly reducing the requirements on the cryosystem providing the LAr.
- The entire system consists of (a) the cryovessels; (b) the components internal to the cryovessels; (c) the components in close proximity to the cryovessels, i.e. in the Ar³ room and (d) the supply of cryogens external to the Ar³ lab.

GAr TPC lab

- The HPgTPC lab will be used for the testing of readout modules for the high pressure Ar gas TPC of the DUNE Near Detector. It will also be the new site of R&D and prototyping activities for the HPgTPC.
- Those activities are now being conducted in PAB where floor space is at a premium and crowding is a recurring problem with safety/egress implications.
- The testing will be done in a 10 atm pressure vessel, which will need a gas control system and electronics for readout and monitoring. A class 1000 clean tent is also needed.

Core Lab

- This Day-1 cleanroom contains precision metrology and equipment used for detectors requiring high precision construction techniques – wirebonders, an optical gauging station, coordinate measuring machines, microscopes etc
- FY23 needs are driven by: R&D into the use of quantum bits as detectors, CCD based dark matter searches, cosmic microwave background measurements
- \geq FY24 needs: I expect to see ASIC and Si detector R&D projects, but the details still need to be worked out
- 4 of the 6 other labs on the ground floor require having the Core Lab equipped for their utilization. Ultimately, this lab will support a wide range of IERC programs in the way that Lab D supports a wide range of SiDet work.

CCD lab

- For testing and assembling Skipper readout CCDs for dark matter searches. An adiabatic demagnetization refrigerator (ADR) now in Lab C and used for the development of MKIDs should be moved into IERC, to either here or the Dry Labs



Great Halls

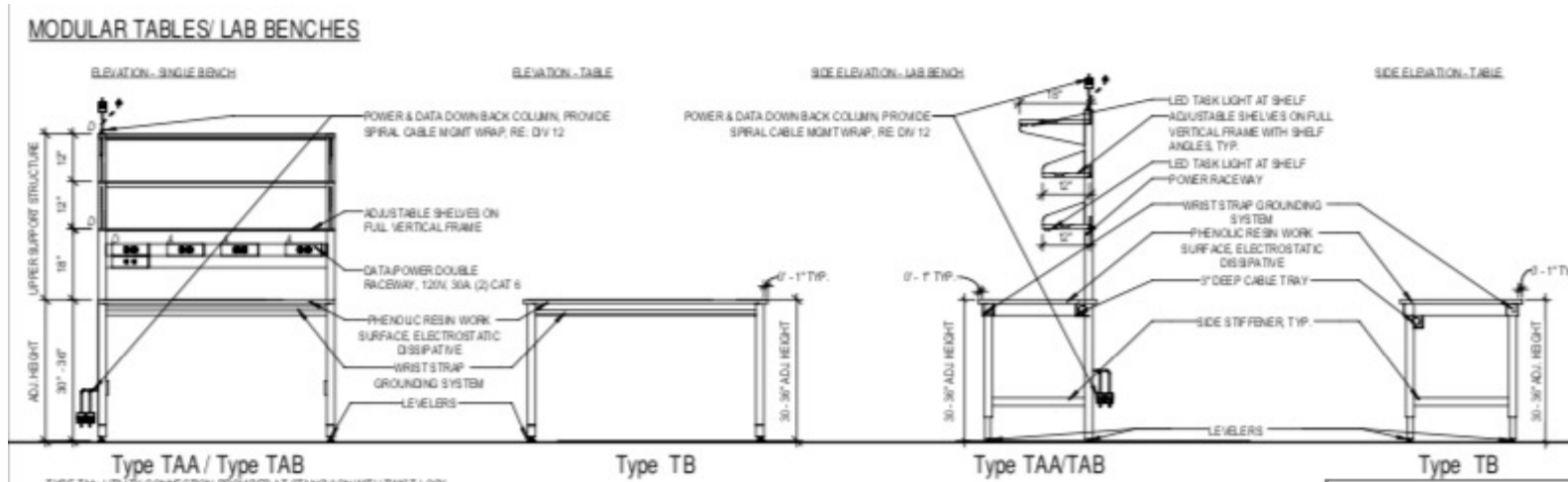
- There are two “Great” Halls – both should be ready by FY23
- The collective noun for dilution refrigerators is grove



- CMB-S4, NQI, LDRD (I hope)

Hybrid, Dry Labs

- Hybrid labs designed for ordinary lab bench work



- Initial users from SCD/FDE, PPD/EED, PPD/HPDE, ND/DUNE, ND/TSD
- Dry labs similar but, with access to chase, where noisy equipment can be placed behind a wall with sound insulation

IERC Coming Soon!

Thank you! Questions?

