



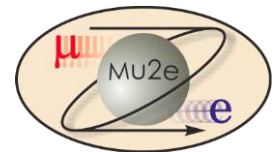
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# WBS 475.04.10 System Integration, Installation and Commissioning

Jeff Brandt

Mechanical Engineer

DOE CD-2/3b Review, October 21-24, 2014

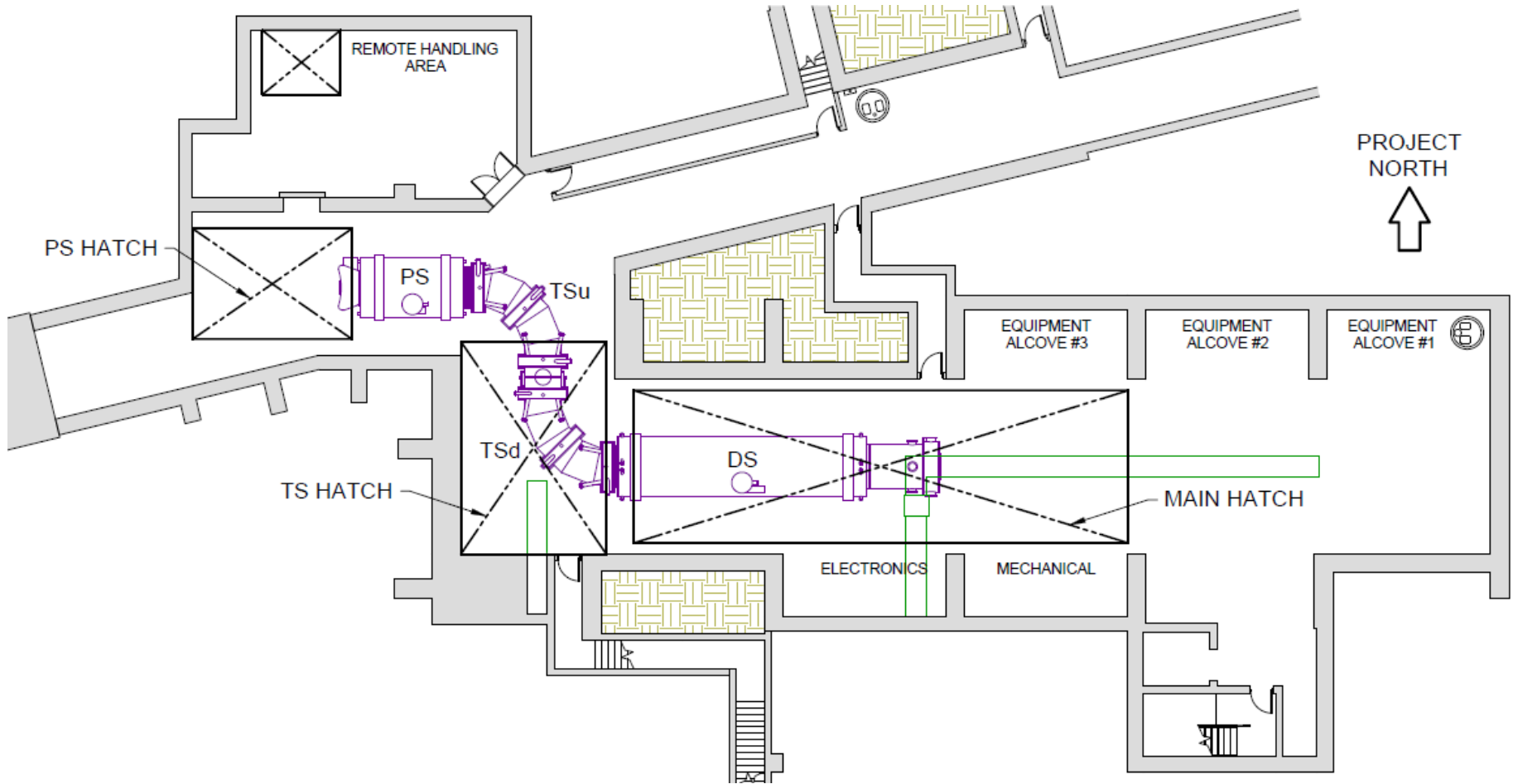


# Requirements

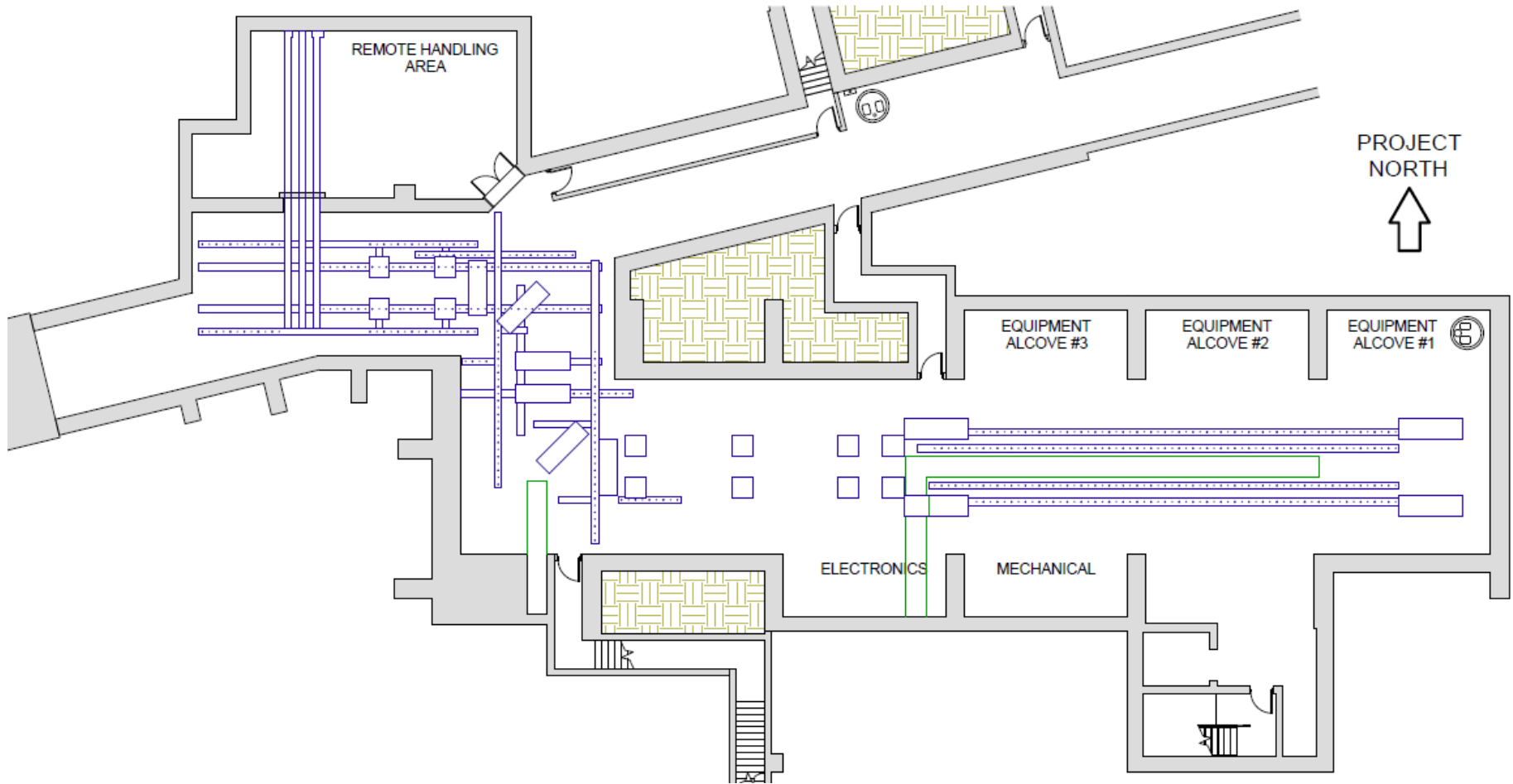
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- Two 30 Ton cranes which can be connected and controlled in tandem for use as a 60 Ton crane – needed for all solenoids.
- All heavy lifts through MAIN and TS hatches.
- An embedded floor track system to transport PS, TSu, and TSd solenoids into place.
- Embedded solenoid floor pads must accommodate large forces from magnet system interaction.
- Infrastructure to support solenoid power and cryogen delivery, insulating vacuum, and instrumentation needs.

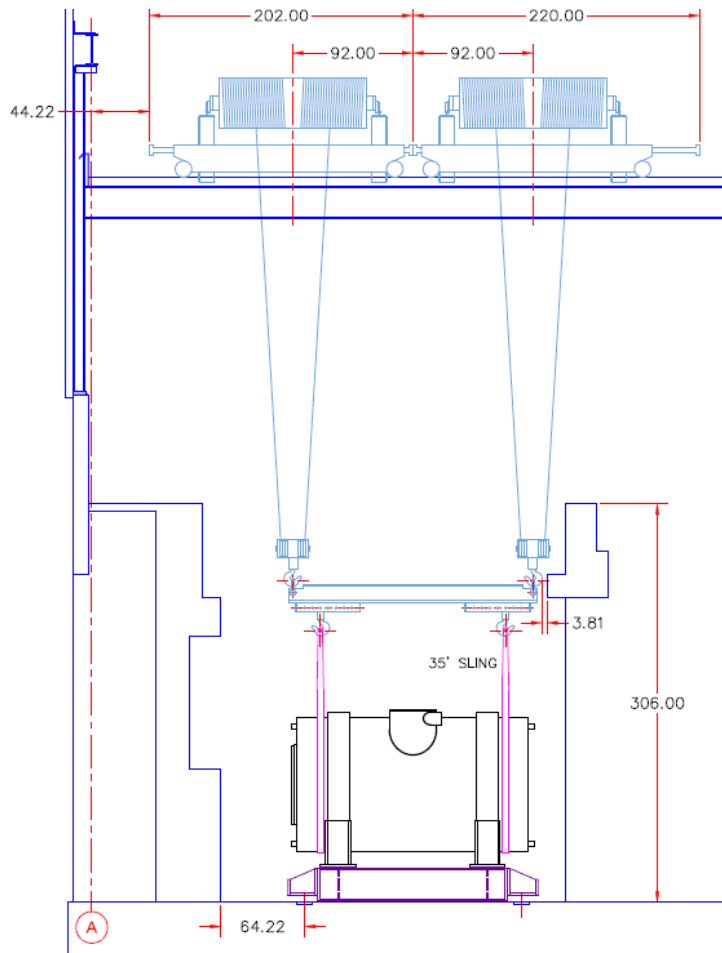
# Design – Solenoids, Building and Hatches



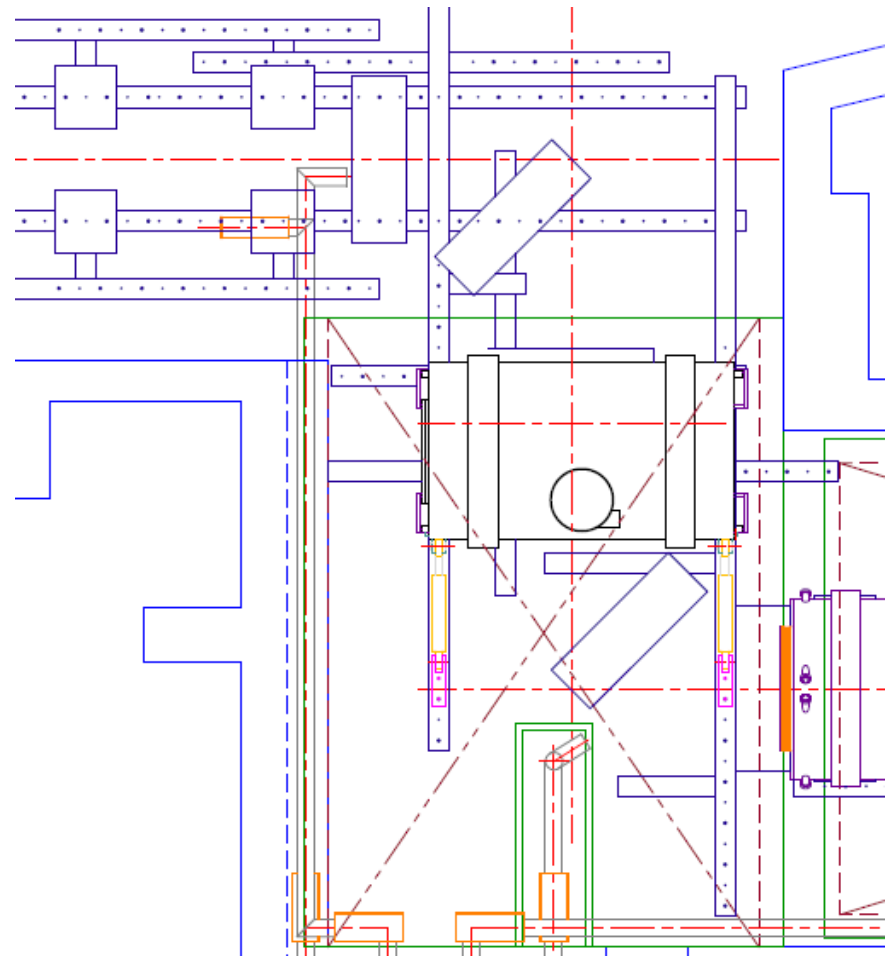
# Design – Floor Tracks and Floor Pads



# Design – PS Installation

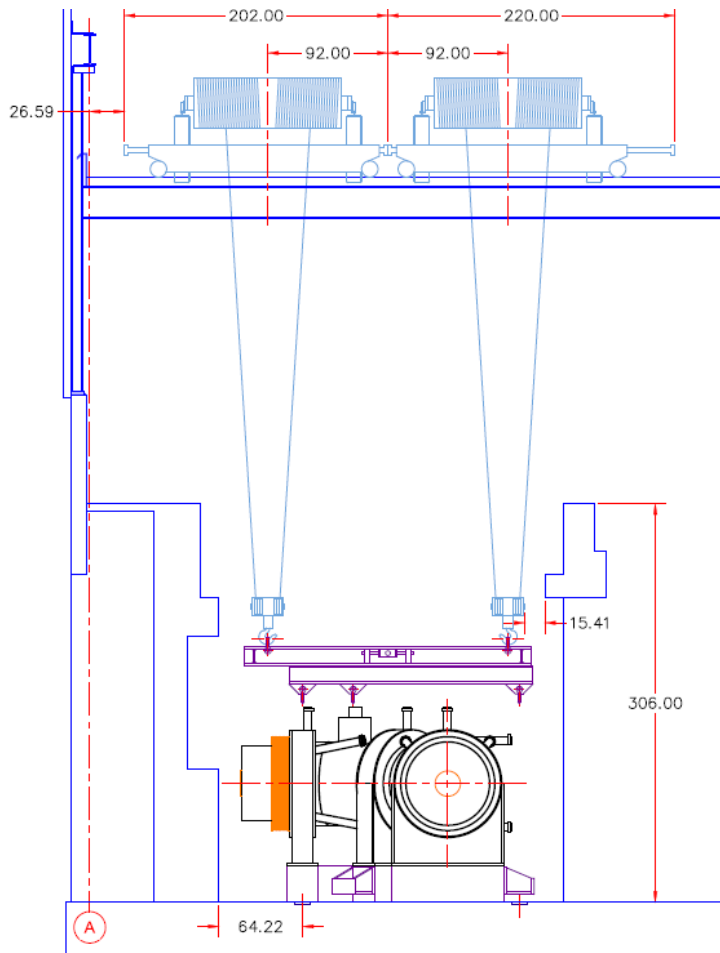


Side view – lowered into place

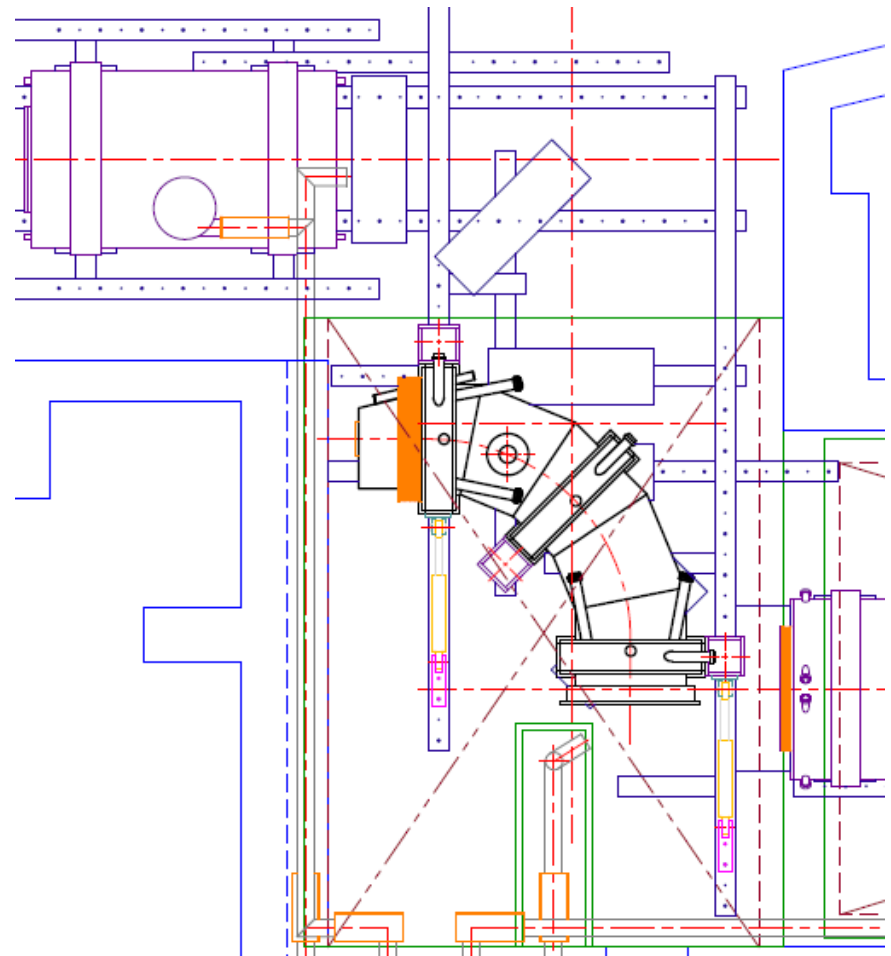


Top View – ready for transport

# Design – TSu Installation

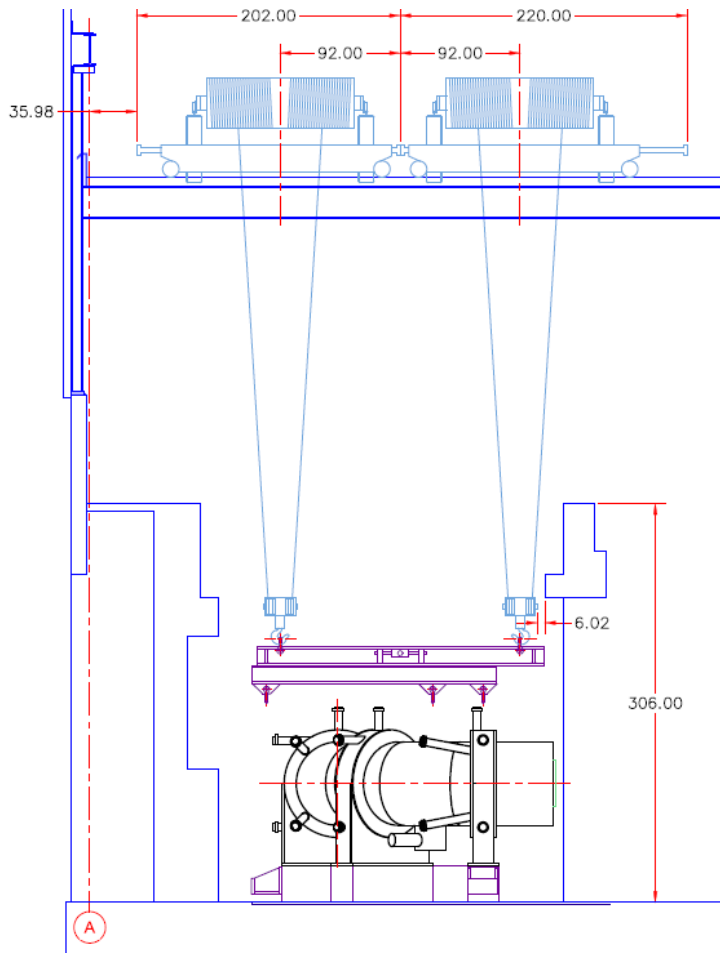


Side view – lowered into place

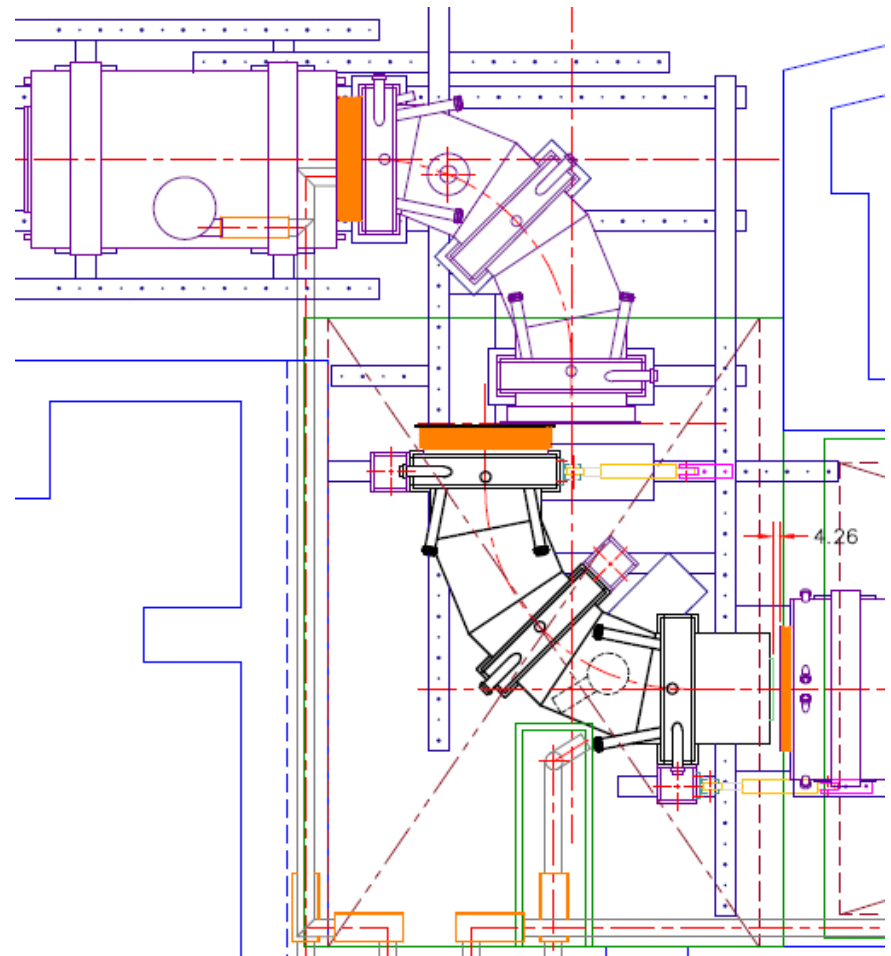


Top View – ready for transport

# Design – TSd Installation

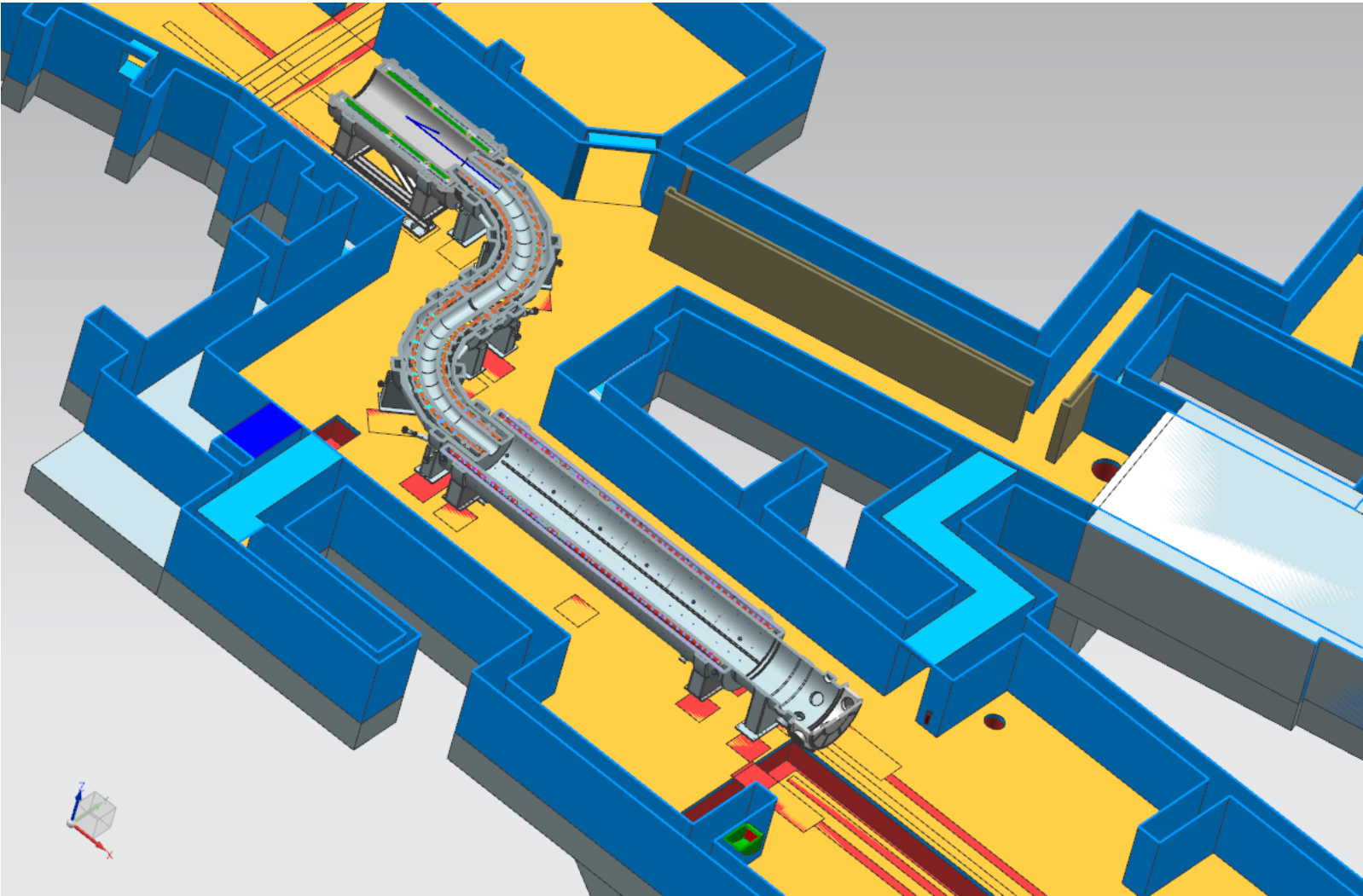


Side view – lowered into place



Top View – ready for transport

# Design – 3D Integration Model





# Improvements since CD-1

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- Decision to perform all heavy lifts through MAIN and TS hatches, avoiding crane and climate issues with PS hatch.
- Revisions and additions to embedded floor track system.
- Location of transfer line routing and connection to each solenoid – addition of cross trench for TSd connection.

# Value Engineering since CD-1

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- Significant cost savings in avoiding large crane rentals for PS hatch lifts.
- Common outriggers attach to all solenoid support feet and frames, as well as Heat and Radiation Shield (HRS) tooling.
- Transport and jacking system tooling shared across other WBS sub-projects, common for all major solenoid, equipment, and shielding moves.

# Remaining work before CD-3

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- Finalize solenoid interfaces.
- Finalize alignment designs for solenoids.
- Complete detailed installation and commissioning plans integrated across project.
- Generate design documentation per chapter 4 of the Fermilab Engineering Manual and review per chapter 5.
- Produce final design engineering drawings.
- Complete incorporation of all systems into 3D Integration Model.

# Quality Assurance

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- Building will be fully networked by metrology experts.
- Detailed installation and commissioning plans, integrated across project, will be implemented using Travelers.
- All tasks will be signed off, critical tasks will be verified by metrology and responsible engineer.
- Responsible engineer is L3 and CAM, is heavily involved in building, infrastructure, interface, and installation tooling designs, and is L4 for Support Frames and Interconnects.

- All required Engineering Notes will be written. All personnel will follow Hazard Analyses and Procedures written to cover the following ES&H concerns:
  - Very large and very heavy objects.
  - Overhead lifts with cranes connected in tandem.
  - Pressurized hydraulic fluid in jack and transport systems.
  - Working at heights and working overhead.
  - Welding, cutting, and grinding during fit-up and installation.
  - Working with hand and power tools using proper PPE.

# Cost Table

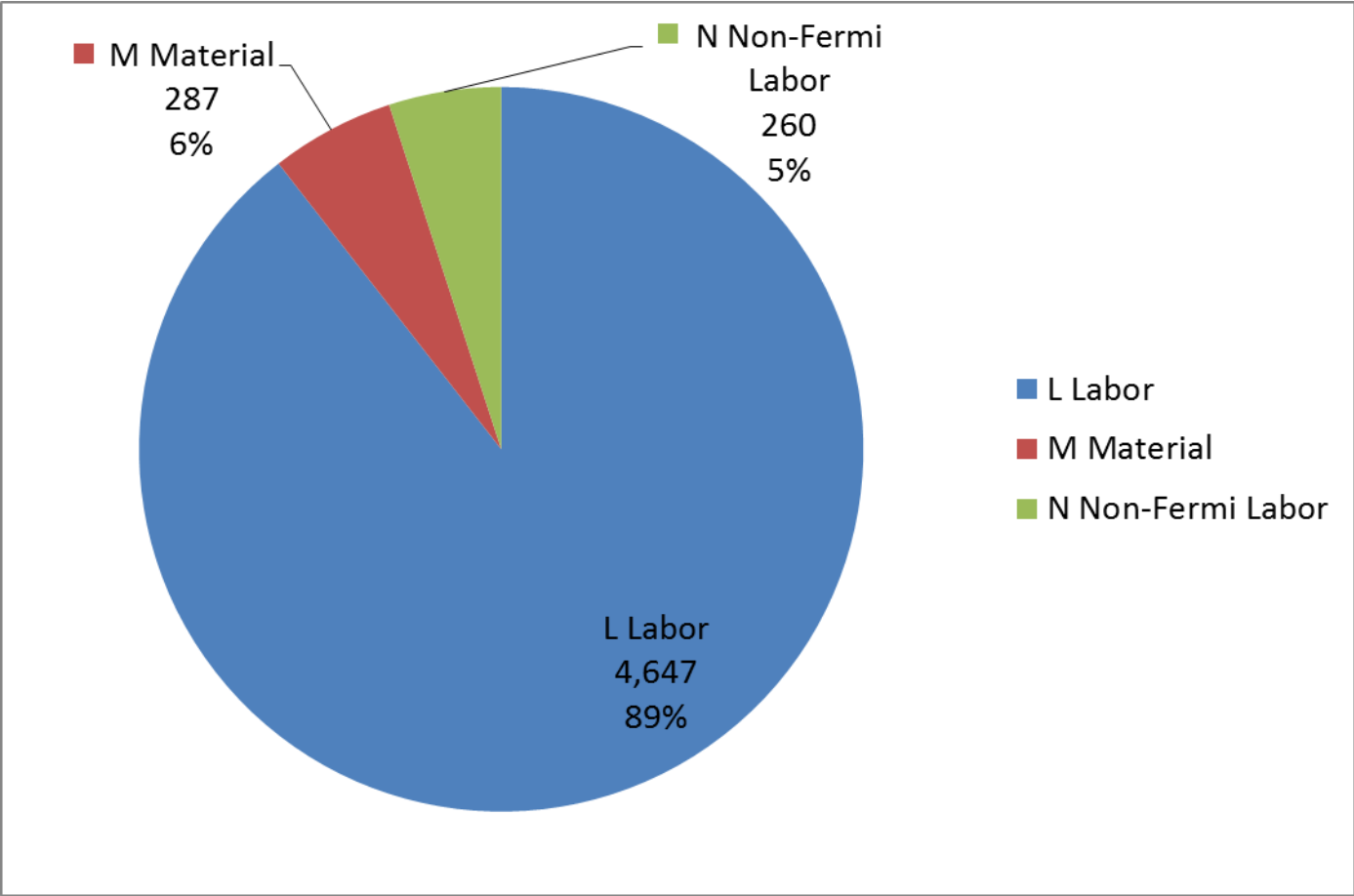
WBS 475.04.10 System Integration,  
Installation and Commissioning

Costs are fully burdened in AY \$k

	Base Cost (AY k\$)			Estimate Uncertainty (on remaining costs)	% Contingency on ETC	Total Cost
	M&S	Labor	Total			
475.04 Solenoids						
475.04.10 System Integration, Installation and Commissioning	548	4,647	5,195	1,870	39%	7,065
Grand Total	548	4,647	5,195	1,870	39%	7,065

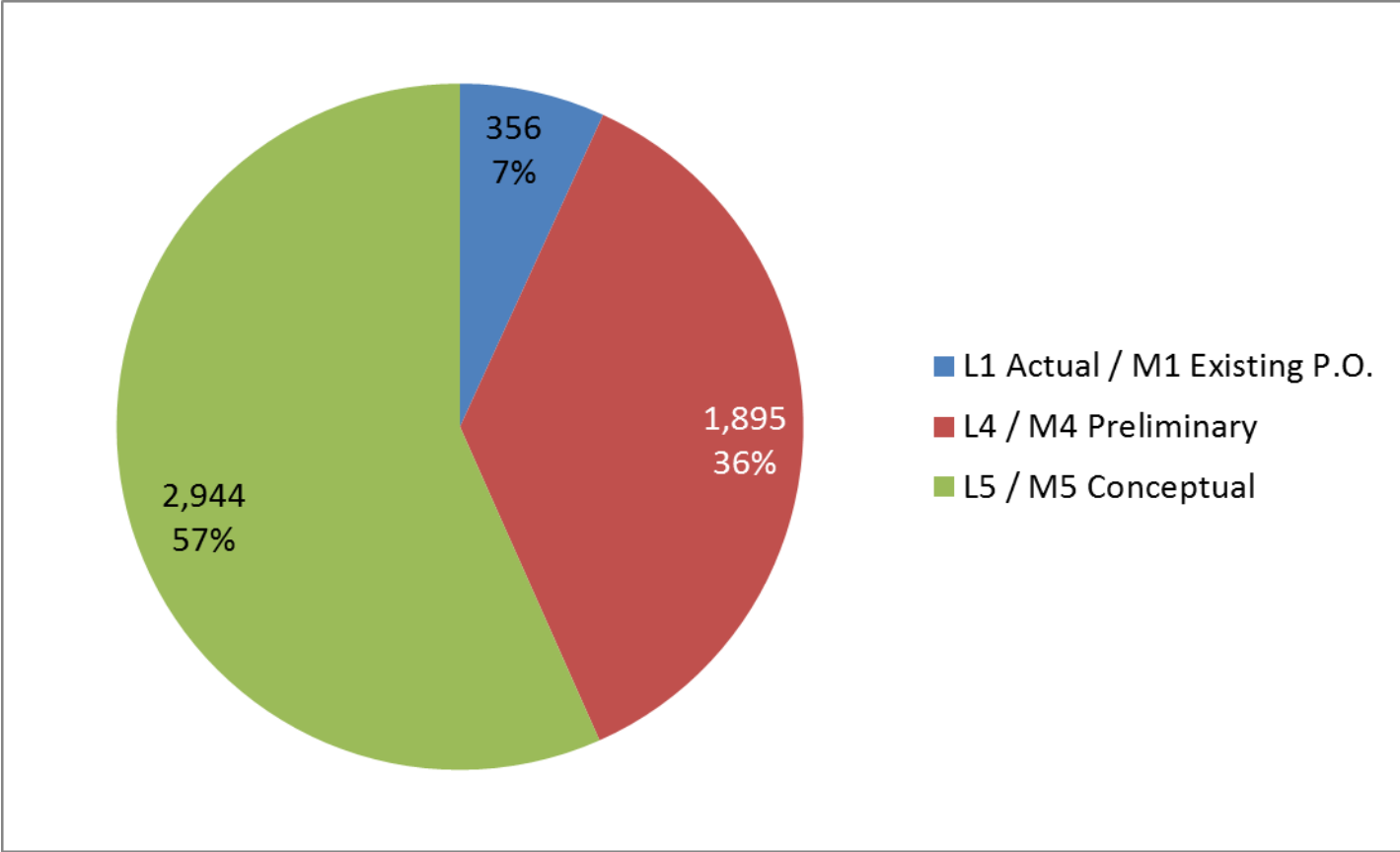
# Cost Distribution by Resource Type

Base Cost (AY \$k)



# Quality of Estimate

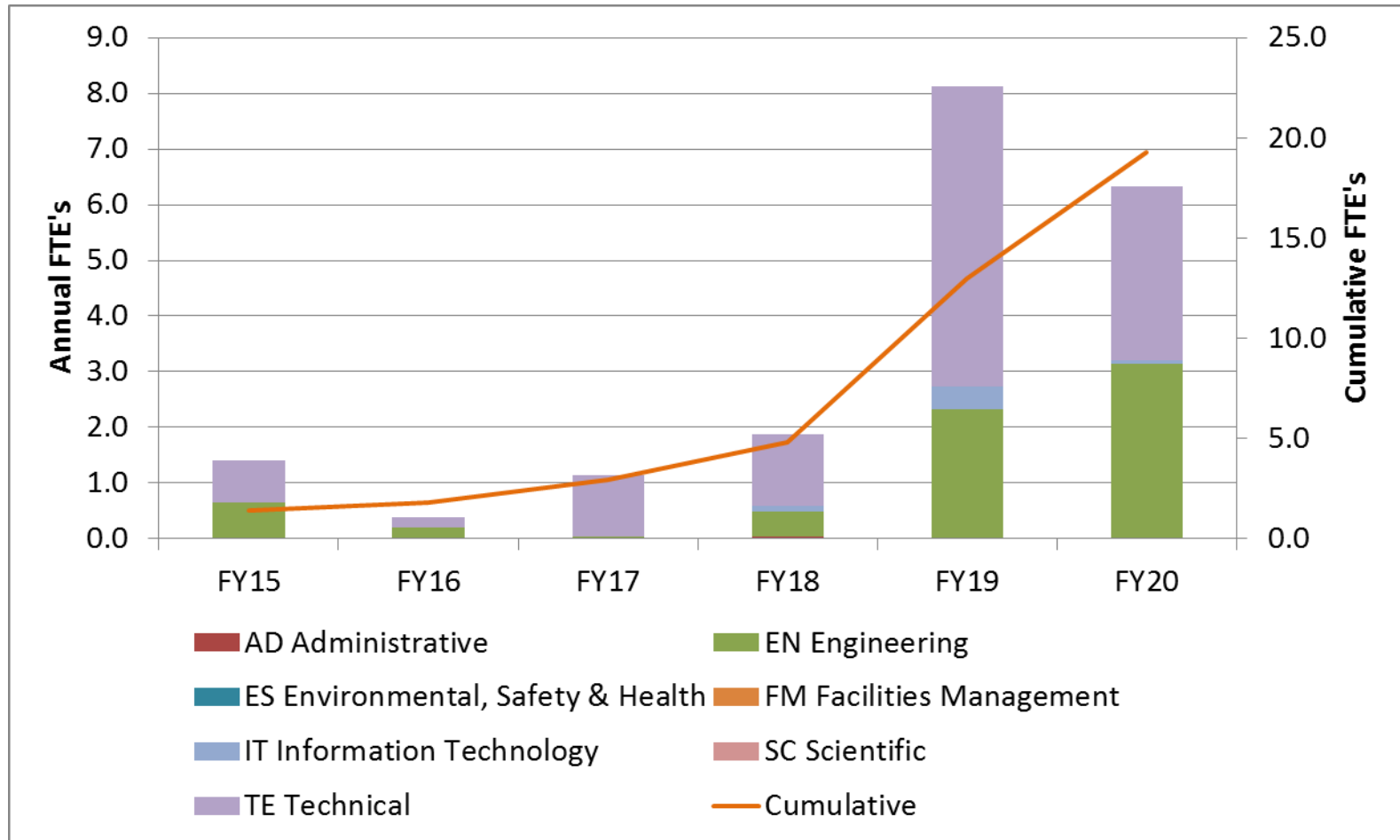
## Base Cost by Estimate Type (AY \$k)





# Labor Resources

## FTEs by Discipline

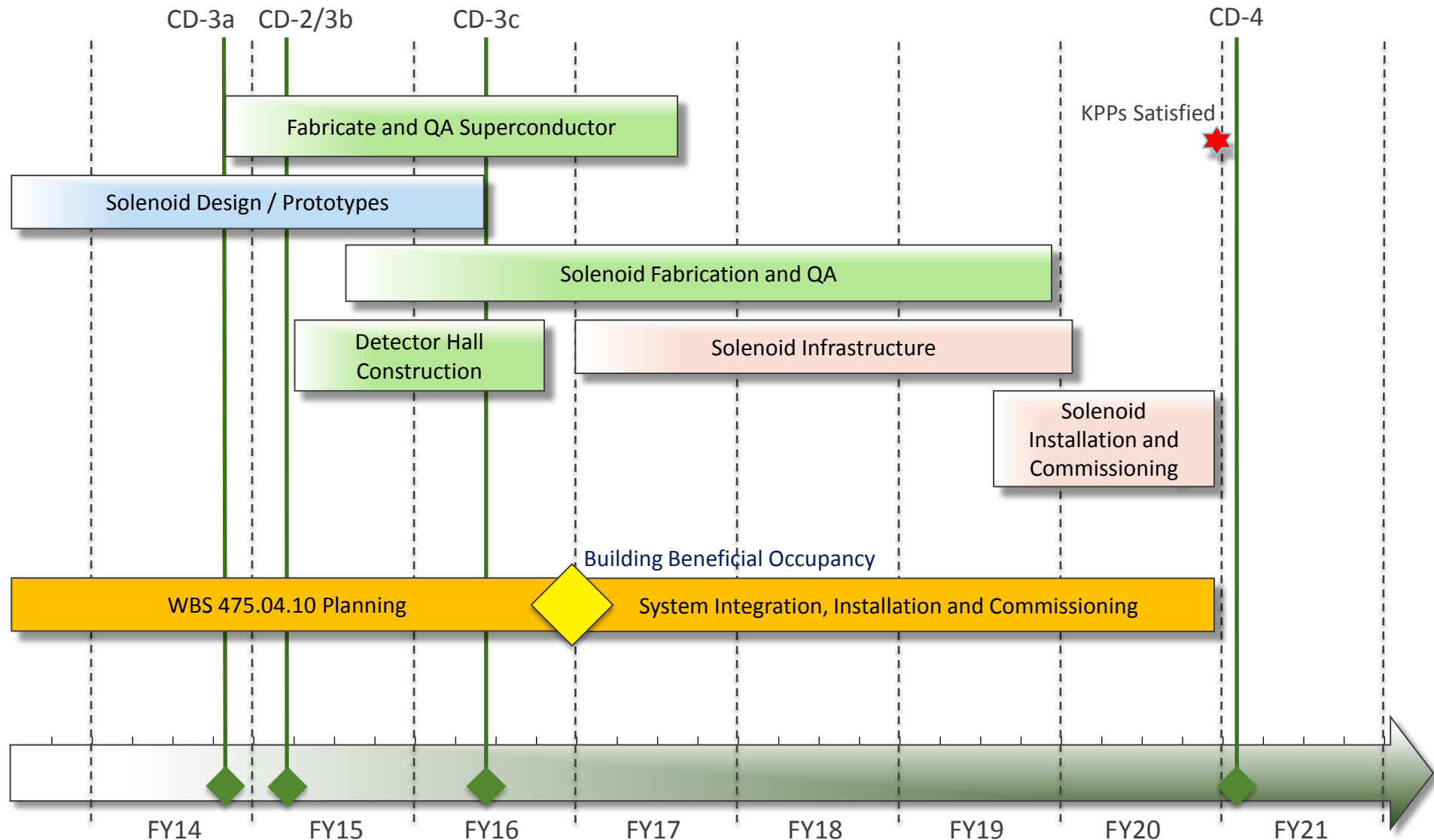


# Major Milestones

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Activity ID	Activity Name	Date
47504.10.000550	Final design complete	7/1/2015
47504.10.000950	Building ready for solenoid installation	8/7/2018
47504.10.002850	Transfer line from cryo-plant complete (by GPP)	7/17/2017
47504.10.002900	Cryo plant operational (by GPP)	7/17/2017
47504.10.005950	Solenoid install complete, ready for cool-down	4/9/2020
47504.10.006850	KPP on-project solenoid commissioning complete	9/29/2020

# Schedule



# Summary

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- Solenoid installation and commissioning needs are fully integrated with conventional construction design.
- Systems required for solenoid operation are well defined, supported by building, and included in preliminary design.
- ESH&Q, Labor, and M&S well understood.
- Integrated installation and commissioning plans in process.
- WBS 475.04.10 System Integration, Installation and Commissioning ready for CD-2.