Cryogenics Plant Building (WBS 121.06.03)

Breakout Session

Steve Dixon

PIP-II IPR

4-6 December 2018

In partnership with:
India/DAE
Italy/INFN
UK/STFC
France/CEA/Irfu, CNRS/IN2P3

Outline

- Scope/Deliverables
- Requirements
- Interfaces
- Preliminary Design, Maturity
- Technical Progress to Date
- ESH&Q
- Risks and Mitigations
- Summary

About Me:

- PIP-II Level 2 Manager for Conventional Facilities
- Relevant Experience
  - Licensed Architect;
  - Project Management Professional (PMP);
  - LEED Accredited Professional;
  - 26+ years at Fermilab;
  - NOvA Project L2 Manager for Site and Buildings;
  - General Plant Project Manager for 15+ years
    - Short Baseline Neutrino (SBN) Near Detector Building;
    - Short Baseline Neutrino (SBN) Far Detector Building;
    - Experimental Operations Center;

Scope and Deliverables [1]

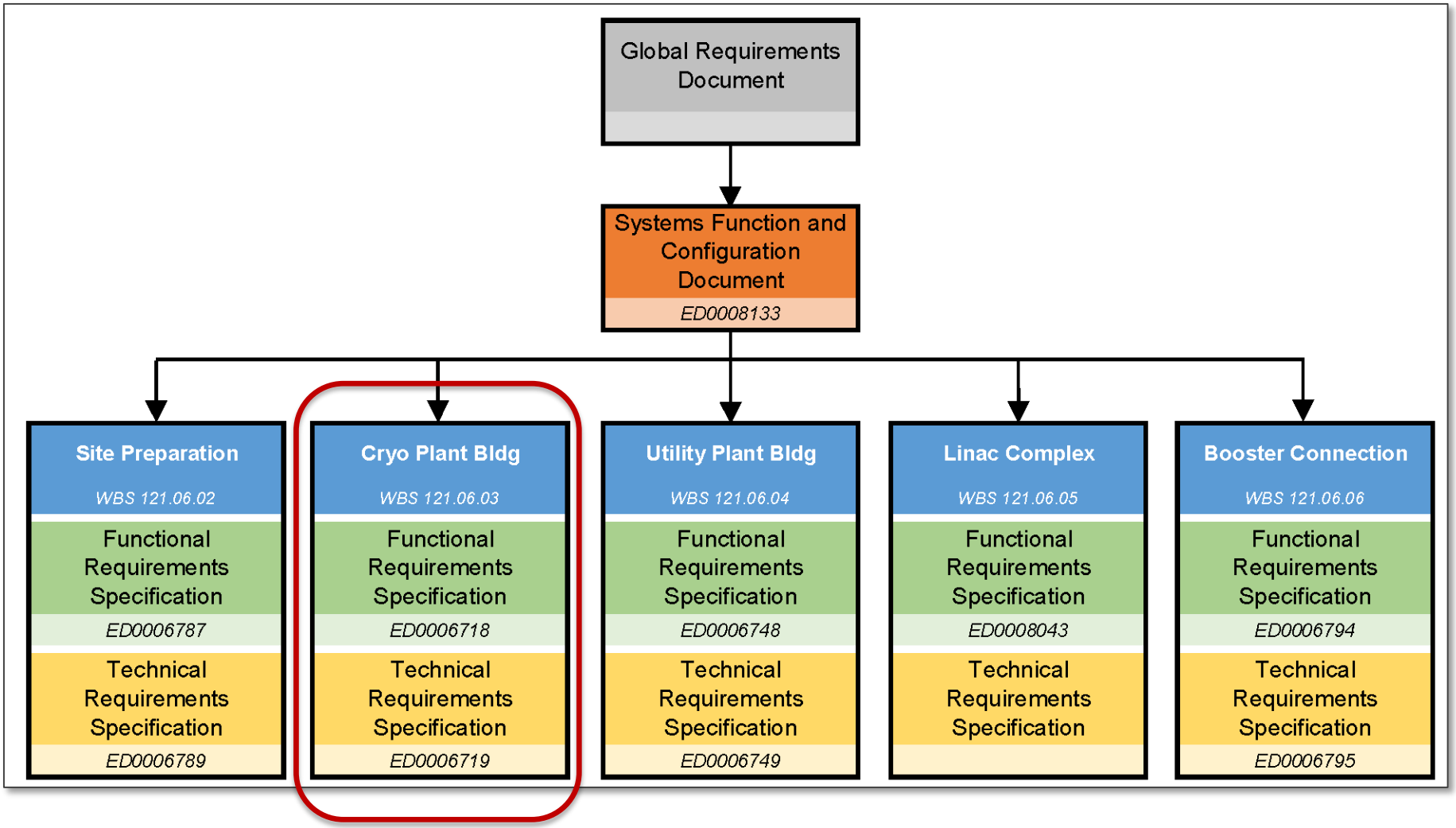
Charge #2

- **WBS 121.06.03.01 – Project Management and Coordination**
  Project management for the Cryoplant Building including the oversight and coordination of the technical effort, project planning and scheduling, cost estimating, risk and contingency analysis, and reporting. Includes travel costs for management, technical coordination, and vendor visits.
- **WBS 121.06.03.02 – Detailed and Final Design**
  Services needed for the design of the Cryo Plant Building work scope. It describes the labor resources, materials and services, including architectural/engineering services, necessary for planning, oversight and engineering and design.
- **WBS 121.06.03.03 – Construction on Site**
  Procurement and management for all contracted labor, materials, tools, equipment, and services needed for the construction of the Cryo Plant Building work scope. It describes the labor resources, materials and services necessary organization, planning, oversight and engineering, design, inspection and administration (EDIA) of the construction work on the Fermilab site.

[1] Definitions from WBS Dictionary, PIP-II-doc-599

WBS L3 System Requirements

Charge #2



Functional Requirements Specification [1]

Charge #2

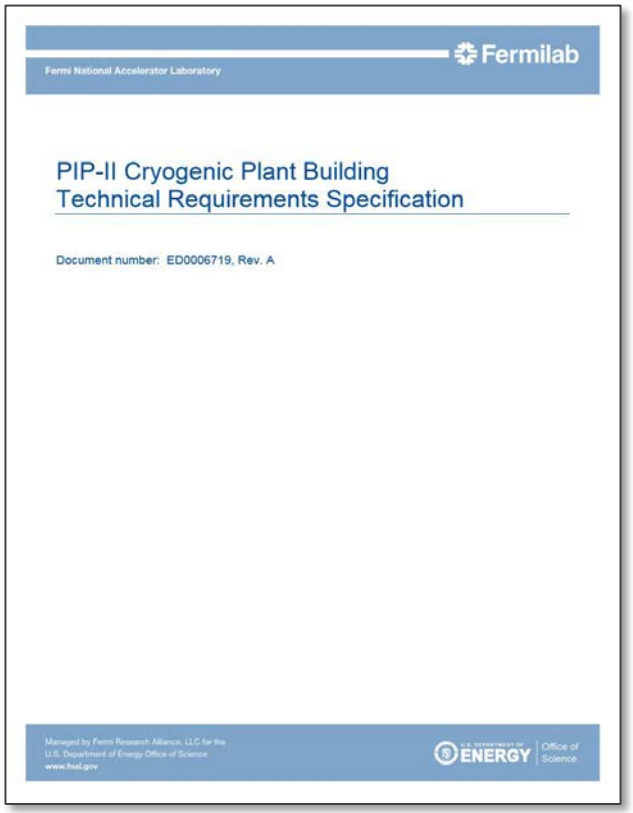
Requirement #	Requirement Statement
F-121.06.03-A001	The CPB shall provide a safe environment for employees and the public.
F-121.06.03-A002	The CPB shall provide space and infrastructure with the proper floor load rating for the warm compressors.
F-121.06.03-A003	The CPB shall provide space and infrastructure with the proper floor load rating for the cold box.
F-121.06.03-A004	The CPB shall provide space and infrastructure for unloading/loading activities
F-121.06.03-A005	The CPB shall provide exterior space for storage tanks/dewars.
F-121.06.03-A006	The CPB shall provide space for operating the cryoplant including control room space, meeting/planning space and support space.
F-121.06.03-A007	The CPB shall comply with the overall character of the PIP-II campus and applicable portions of the Fermilab Campus Plan.
F-121.06.03-A008	The CPB shall connect to existing Fermilab infrastructure. This includes electrical, domestic water, industrial cooling water, sanitary sewer, chilled water and data/communication.
F-121.06.03-A009	The CPB shall be located adjacent to the PIP-II Linac Complex such that the cryogenic distribution system feeds the front end of the Linac.
F-121.06.03-A010	The CPB shall provide foundations for gaseous helium storage tanks.
F-121.06.03-A011	The CPB shall provide foundations for a liquid helium dewar.
F-121.06.03-A012	The CPB shall provide foundations for a liquid nitrogen dewar.
F-121.06.03-A013	The CPB shall provide truck access for helium and nitrogen deliveries.
F-121.06.03-A014	The CPB shall provide space and infrastructure to support a 4.5 K cold box upgrade option

[1] See TeamCenter Document ED0006718

Technical Requirements Specification [1]

Charge #2

Requirement ID	FRS Reference	Requirement Statement
General		
T-121.06.03-A001	*F-121.06.03-A009*	The CPB shall be located at the upstream end of the Linac Complex
Architectural		
T-121.06.03-B001	*F-121.06.03-A007*	The CPB shall be developed based on the 2018 Fermilab Campus Master Plan including the desire that the "design of buildings and open spaces should encourage interaction, creating the settings to bring staff, users and visitors together, becoming vibrant centers of laboratory life." To this end, the CPB will incorporate the appropriate portions of the design guidelines including: • Entrances and ground floors that are welcoming and provide an opportunity for interactions; • Entrances that are evident in the daytime and at night; • The ground floor will emphasize transparency; • Service and utilities areas will be located so as to not negatively affect pedestrian paths or building entrances; • Provide long term flexibility and life cycle value; and • Uphold the unique character of Fermilab.
Cold Box Station		
T-121.06.03-C001	*F-121.06.03-A004*	The Cold Box Station (CBS) shall be include an overhead bridge crane with the following criteria: • Capacity of 25 tons (50,000 pounds); • Hook limits to provide coverage for the major equipment and loading dock; • Hook height of 20 feet above finished floor;
T-121.06.03-C002	*F-121.06.03-A004*	The CBS shall include at grade loading dock space to accommodate a standard 55-foot-long semi-trailer.
T-121.06.03-C003	*F-121.06.03-A004*	The CBS shall include, as a minimum, a 16-foot-wide by 16-foot-tall overhead door;
T-121.06.03-C004	*F-121.06.03-A003*	The flatness and levelness of the new floor slabs built as part of the conventional facilities shall be designed for normal construction tolerances and a ASTM E1155 floor flatness value of F(F) 25 and a floor levelness F(L) of 20.


Fermilab

Fermi National Accelerator Laboratory

PIP-II Cryogenic Plant Building
Technical Requirements Specification

Document number: ED0006719, Rev. A

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[1] See TeamCenter Document ED0006719

Interfaces

Charge #2

- Project Interfaces *(Managed through PIP-II processes)* [1]
  - ED0007698 – Interface Control Document
  - WBS 121.02 - SRF & Cryo Systems
    - WBS 121.02.05 – Cryo Plant (B. Hansen)
    - WBS 121.02.06 – Cryogenic Distribution (A. Dalesandro)
- Fermilab Interfaces
  - Infrastructure Connections *(Managed through FESS processes)*
  - General Plant Projects *(Managed through FESS processes)*
- International Interface *(Managed through WBS 121.02)*
  - Cryogenic plant is Indian partner deliverable

[1] See PIP-II Systems Engineering Management Plan at PIP-II-doc-1539

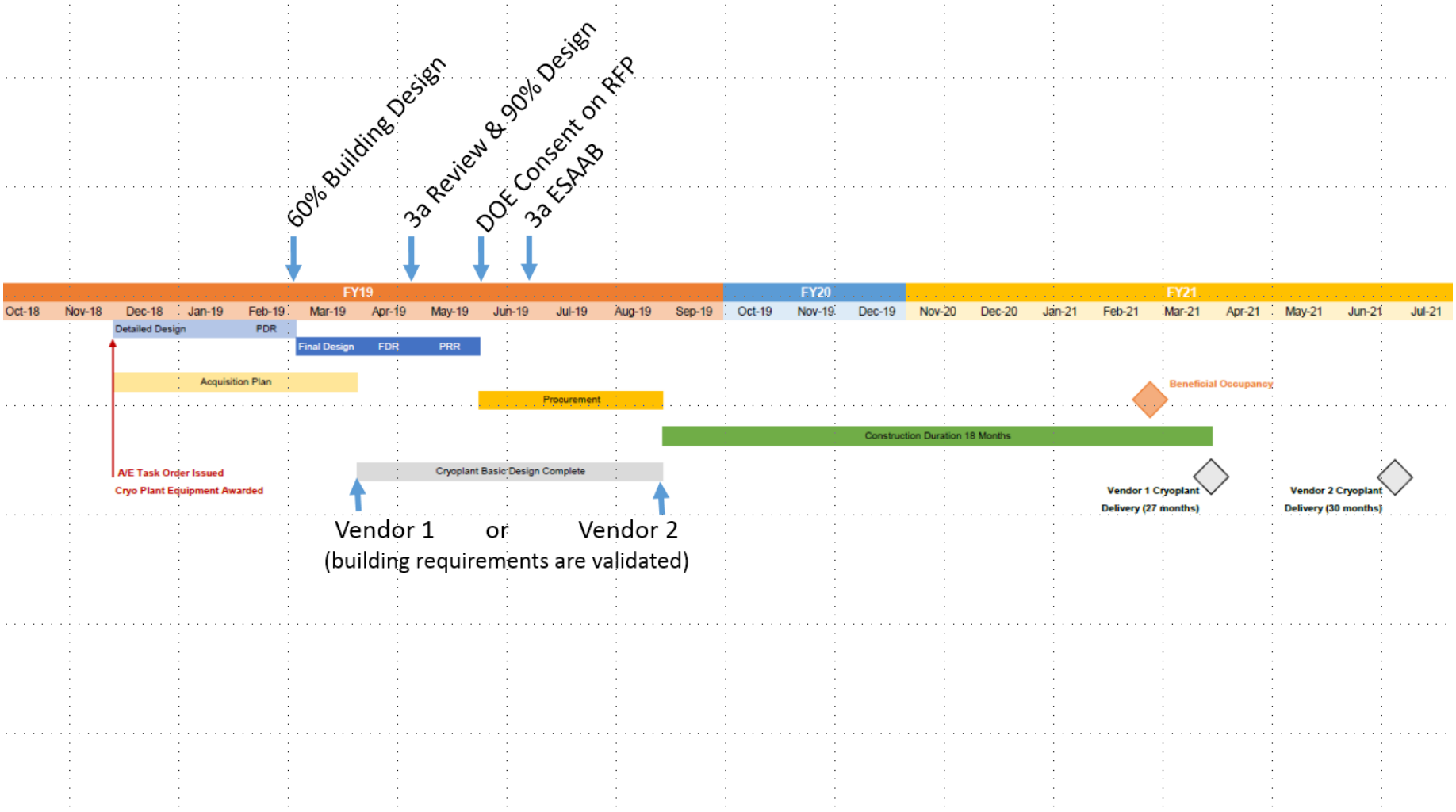
Preliminary Design and Design Maturity

Charge #2

- Technical Requirements Phase (~40% Design)
  - Started in May 2018;
  - Completed in September 2018;
- Detailed/Final Design
  - Dependent on A/E re-compete;
  - Reviewed the technical proposal;
  - Goal is to start in December 2018
  - Complete in May 2019

Preliminary Design and Design Maturity

Charge #2

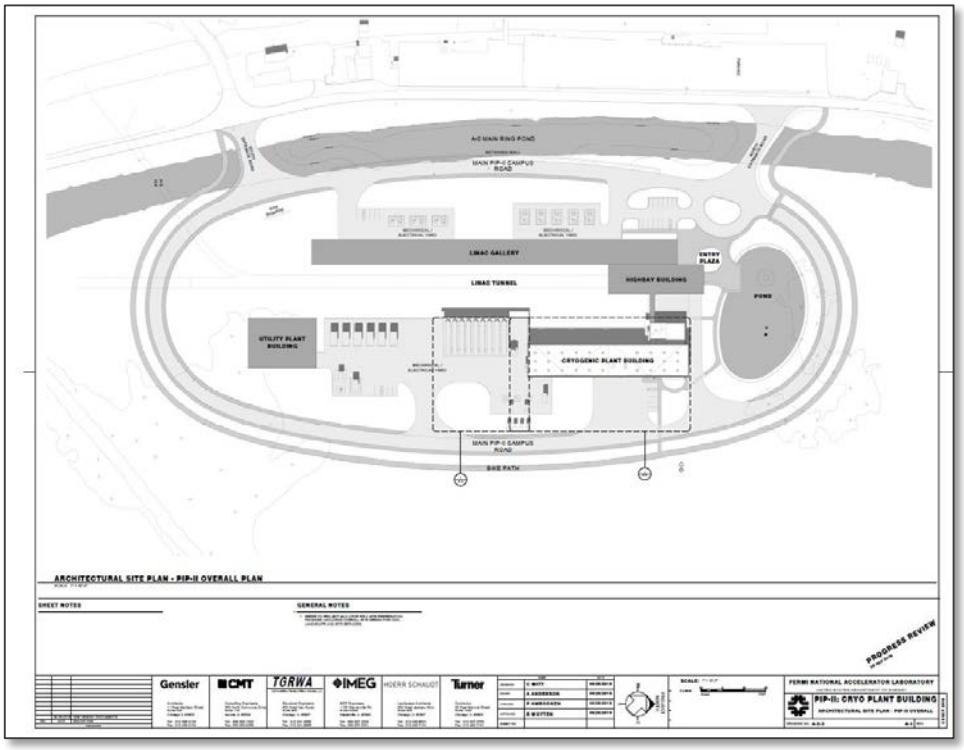


From 18OCT18 Integrated Project Team Meeting

Progress to date

Charge #1

- Requirement ands Specification Review [1]
- Industrial Cooling Water Quality Testing Complete [2]
- Technical Requirements Phase (40% Design) [3]

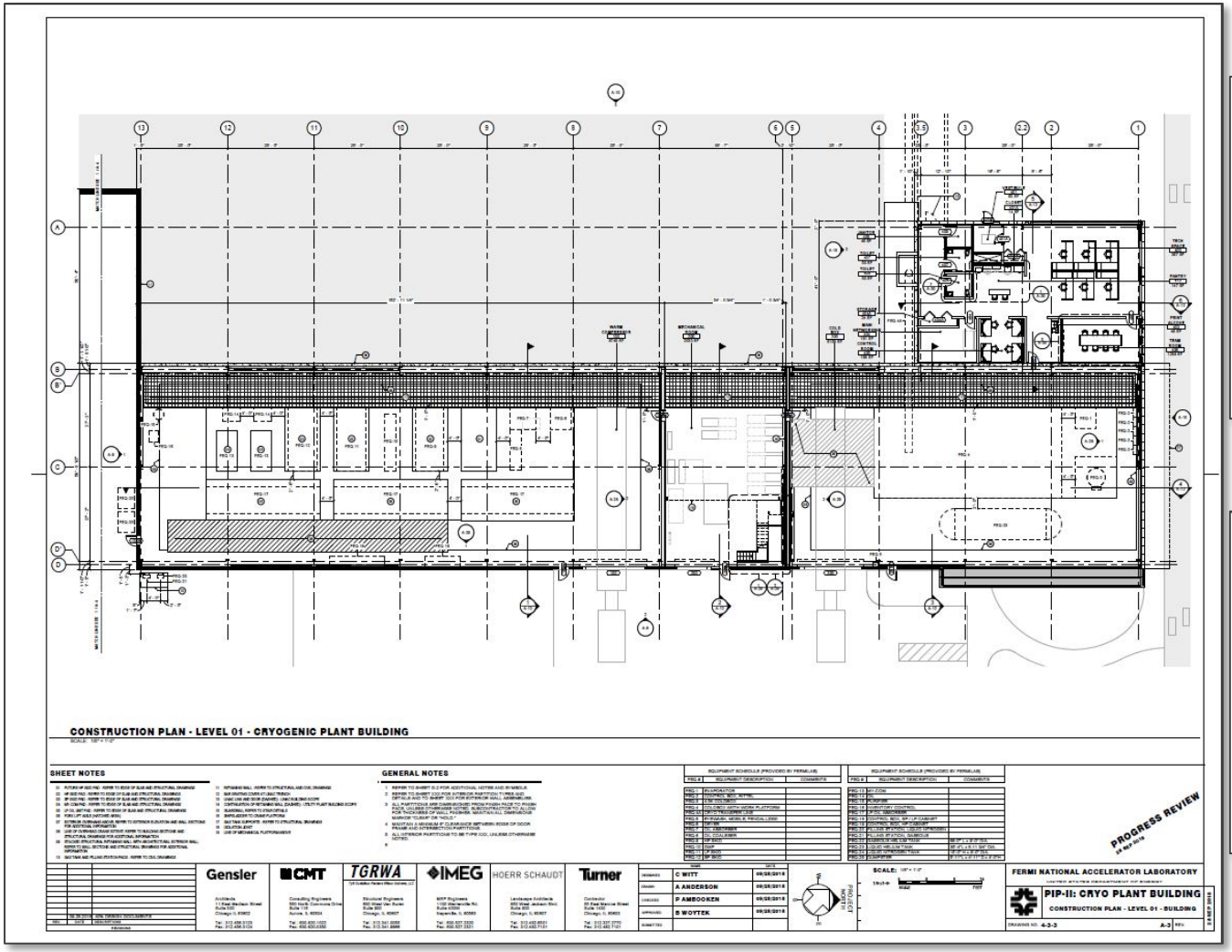


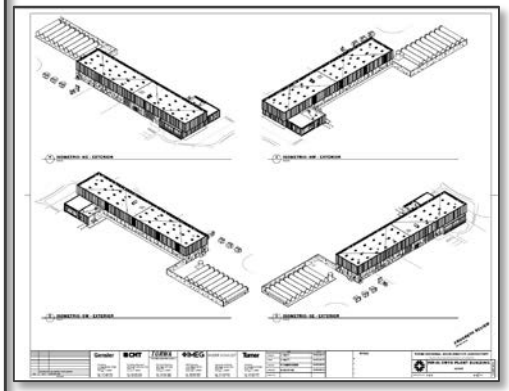
From TeamCenter Document ED0008373

[1] See TeamCenter ED0008588
[2] See PIP-II-doc-155
[3] See TeamCenter ED0008373

Progress to date

Charge #1





From TeamCenter Document ED0008373

ESH

Charge #6

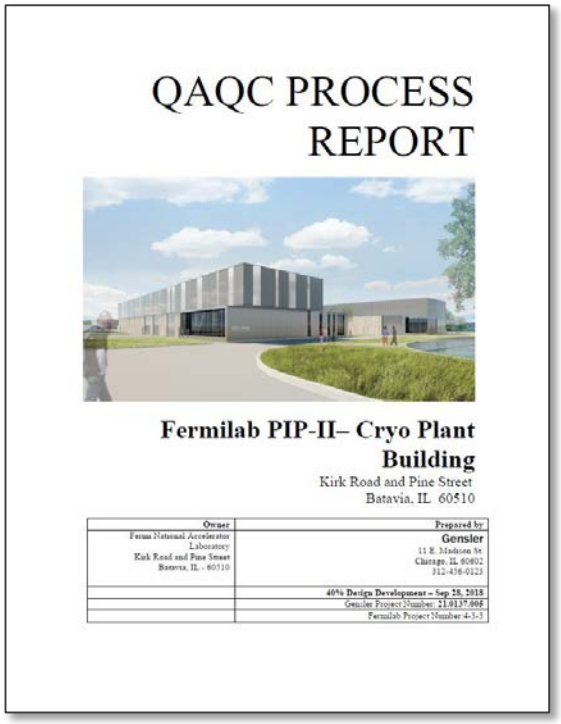
- Design Incorporates:
  - A/E selection included ES&H considerations
  - Life Safety Assessment requirements [1]
  - Input from Tritium Task Force
  - Input from PHAR hazards [2]

[1] Life Safety Analysis can be found at PIP-II-doc-120
[2] Preliminary Hazard Analysis Report can be found at PIP-II-doc-140

Quality Management

Charge #6

- Process to date include:
  - Requirement and Specification Review (PIP-II process)
  - Comment and Compliance Review (FESS/E process)
  - QAQC Process Report (A/E process)



QAQC PROCESS REPORT

Fermilab PIP-II– Cryo Plant Building

Kirk Road and Pine Street
Batavia, IL 60510

Owner	Prepared by
Fermi National Accelerator Laboratory Kirk Road and Pine Street Batavia, IL - 60510	**Gensler** 11 E. Madison St Chicago, IL 60602 312-456-0123
	40% Design Development – Sep 28, 2018
	Gensler Project Number: 21.0137.005
	Fermilab Project Number 4-3-3

Risk Management

Charge #2,7

Cryogenic Plant Building Related Risks

- RT-121-06-001 – Subproject Requirement Change
- RT-121-06-003 – Construction Bids Exceed Estimates
- RT-121-06-005 – Cryoplant Design Requirements Poorly Documented
- RT-121-06-008 – Cryoplant Cooling Water
- RT-121-06-039 – Cryogenic Plant Building BO Delayed

Summary

- Good progress on the design since CD-1;
- Design is based on the requirements from two potential vendors;
- On track to complete the design and start construction in FY19;
- Goal of having the building ready in advance to equipment arrival

END