



Conventional Facilities

WBS 121.06

S. Dixon, Level 2 Manager

DOE CD-2/3a Independent Project Review

January 28, 2020

A Partnership of:

US/DOE

India/DAE

Italy/INFN

UK/UKRI-STFC

France/CEA, CNRS/IN2P3

Poland/WUST



About Me

- PIP-II Level 2 Manager for Conventional Facilities
- Relevant Experience
 - Licensed Architect;
 - Project Management Professional (PMP);
 - LEED Accredited Professional;
 - 27+ years at Fermilab;
 - NOvA Project L2 Manager for Site and Buildings;
 - 2014 CD-4
 - 2015 U.S. DOE Secretary's Award for Excellence
 - General Plant Project Manager for 17+ years
 - Short Baseline Neutrino (SBN) Near Detector Building;
 - Short Baseline Neutrino (SBN) Far Detector Building;
 - Experimental Operations Center;

Outline

- Scope/Deliverables
- Organization
- Technical Progress to Date
- Requirements and Design Maturity
- Cost/Schedule
- Risks and Risk Mitigation
- ESH
- Quality Assurance
- Challenges/Path Forward
- Summary

1. Does the proposed technical design satisfy the performance requirements? Do the Key Performance Parameters (KPP's) provide a satisfactory indication of the project's completeness?

2. Are the interfaces to the existing accelerator complex identified and defined? Do the planned hardware upgrades to the existing complex fully support the ultimate performance goal of 1.2 MW operation of the complex?

3. Is the resource-loaded schedule complete, consistent and credible so that it can serve as the cost and schedule part of the project's performance baseline? Is it compatible with the funding guidance provided by High Energy Physics? Have the project's risks been fully analyzed and accounted for in the contingency estimate?

4. Is the project team properly staffed with individuals that have the required skills to deliver the proposed technical scope within the baseline budget and schedule?

5. In-kind international contributions are described in bi-lateral agreements called Project Planning Documents (PPD's). Does the project baseline and in-kind scope contributions defined in the PPD's present the complete scope required to meet the KPP's? Are the delivery dates for in-kind scope sufficiently understood to establish the credibility of CD-4 date? Does the Project have a credible plan for managing the deliverables including acceptance, Q/A, and risk management.

6. Does the project have a certified Earned Value Management System and have they demonstrated their ability to utilize it as an effective project management tool?

7. Is the documentation required by DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* for CD-2 complete and in good order?

8. Are Environment Safety and Health aspects being properly addressed?

9. Has the project responded satisfactorily to the recommendations from the previous independent project review?

10. In regard to CD-3a; is the scope of the 3a package appropriate and justified? Are the associated designs sufficiently mature to support the requested CD-3a cost and schedule? Have the appropriate design reviews been completed?

- Conventional Facilities includes the design, procurement and construction of the utilities, roads, structures, enclosures and buildings to support the installation, assembly and operation of the technical components. ^[1]
- WBS
 - 121.06.01 – Project Management and Coordination
 - 121.06.02 – Site Preparation
 - 121.06.03 – Cryogenics Plant Building (28,300 square feet)
 - 121.06.04 – Utility Plant
 - 121.06.05 – Linac Complex (88,600 square feet)
 - 121.06.06 – Booster Connection (7,800 square feet)

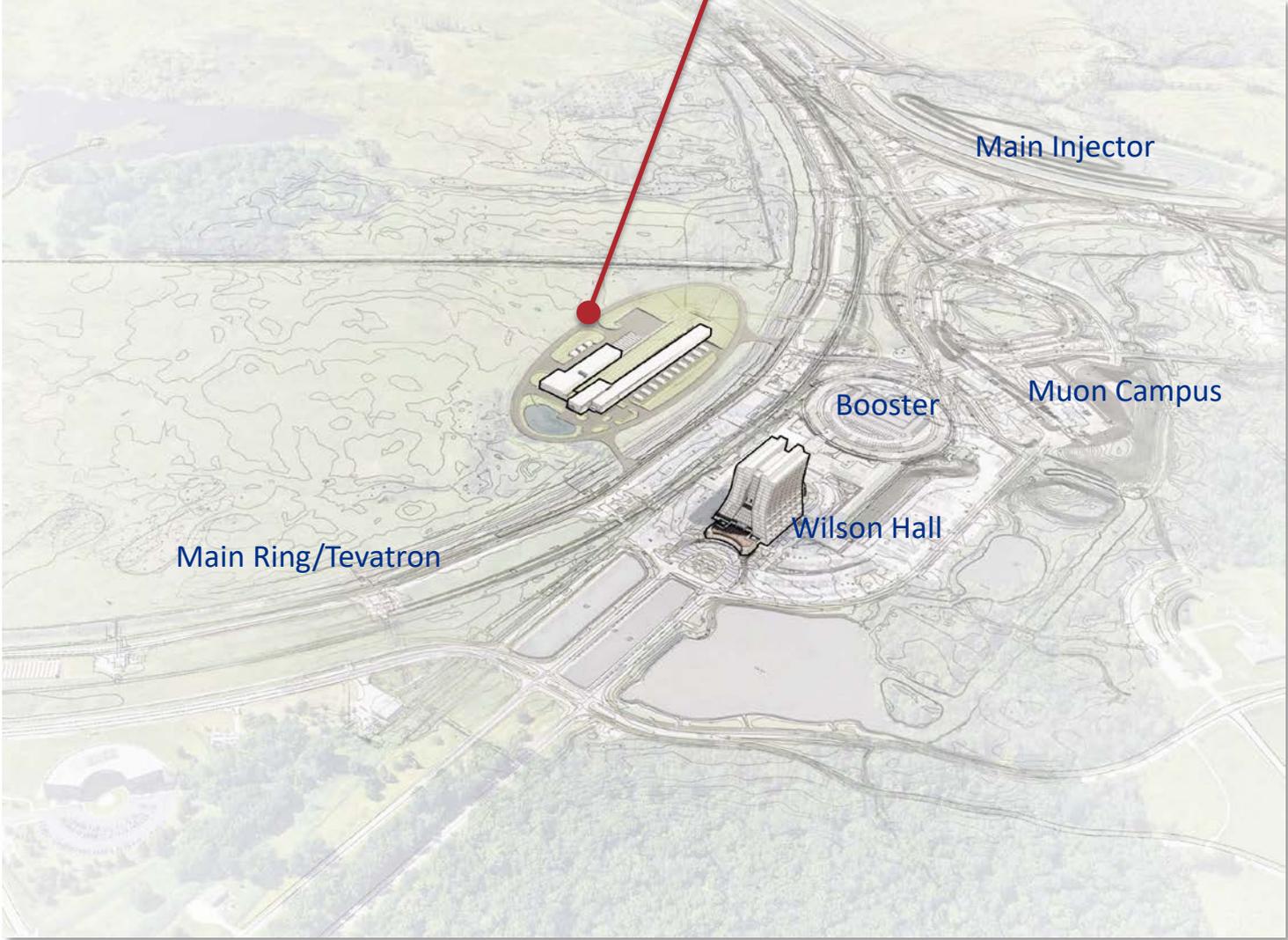
[1] See WBS Dictionary in PIP-II-doc-599 for complete description

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 - **121.06.02 – Site Preparation – CD-3a Request**
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Scope and Deliverables

PIP-II Location



Scope and Deliverables

Cryogenics Plant Building (WBS 121.06.03)

Utility Plant (WBS 121.06.04)

Booster Connection (WBS 121.06.06)



Site Preparation (WBS 121.06.02)

Site Clearing

Site Work

Site Restoration and Landscaping

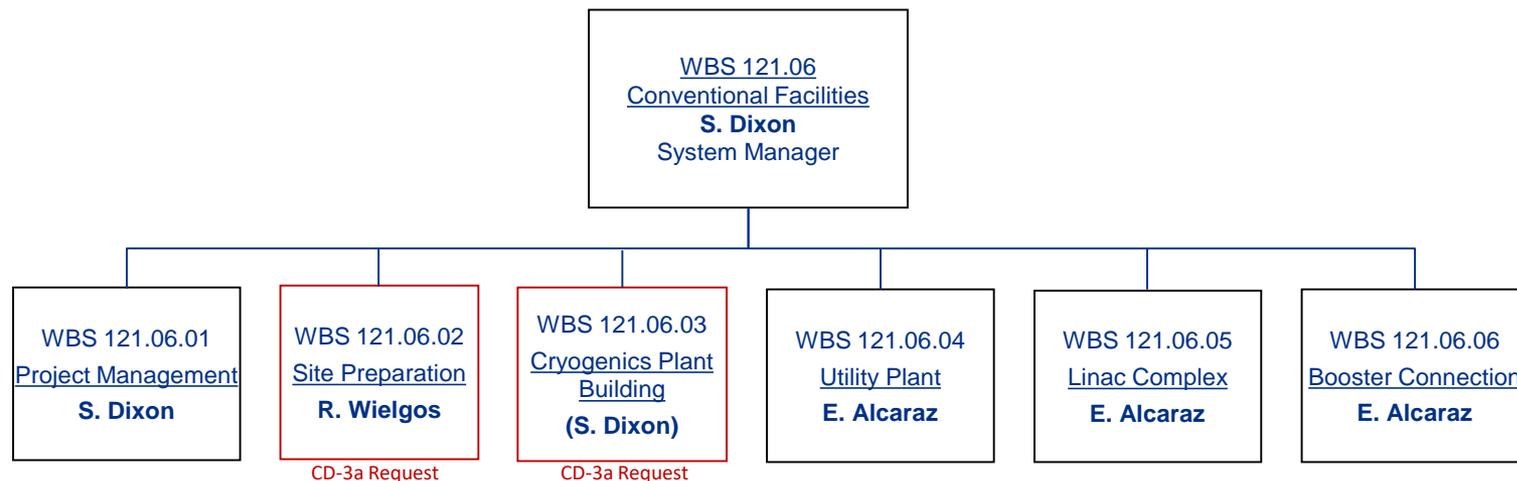
Linac Complex (WBS 121.06.05)

High Bay Building

Linac Tunnel

Linac Gallery

Beam Transfer Line



Architect/Engineer Team

Gensler (architecture), **IMEG** (mechanical, electrical, plumbing)

TGRWA (structural), **CMT** (civil), **Jensen Hughes** (life safety), **Syska Hennessy** (commissioning), **Burns and McDonnell** (landscaping)

- General Progress Milestones
 - January 2018 - Value Engineering Workshop ^[1]
 - April 2018 – Received updated cost/schedule estimate ^[2]
 - June 2018
 - Completed Geotechnical Engineering Investigation ^[3]
 - Chartered and held the first meeting of the PIP-II Architectural Advisory Board ^[4]
 - July 2018 - Received favorable wetland determination for the US ACOE ^[5]
 - December 2018 – Completed the A/E selection process
 - January 2019 – Finding of No Significant Impact ^[6]
 - November 2019 – PIP-II Preliminary Design Report ^[7]

[1] See PIP-II-doc-1377

[2] See PIP-II-doc-333

[3] See PIP-II-doc-1533

[4] See PIP-II-doc-1308_and PIP-II-doc-1548

[5] See PIP-II-doc-1630

[6] See PIP-II-doc-1151

[7] See PIP-II-doc-2261

Technical Progress to Date – WBS 121.06.02

Charge #10

SC4-Dixon

Site Preparation

- Design
 - Started design in April 2018
 - Completed design in January 2019
- Construction Packages
 - Site Clearing – Complete
 - Site Preparation – CD-3a Request
 - Site Restoration – CD-3a Request



Technical Progress to Date – WBS 121.06.03

Charge #10

SC4-Dixon

Cryogenics Plant Building

- Design

- Technical Requirements refinement started in May 2018
- Design began in January 2019
- Completed design in July 2019
- Design Reviews Complete

- Overview

- 28,300 square foot building
- Concrete foundations
- Structural steel frame
- Precast/Metal Siding
- Two 25 Ton Cranes



- Procurement

- Issued for Proposals in November 2019
- Proposal Received in December 2019

Technical Progress to Date

Utility Plant (WBS 121.06.04)

- The space for the utility plant space was incorporated in the Cryogenics Plant Building.
- This package will outfit the space with mechanical equipment and utilities.

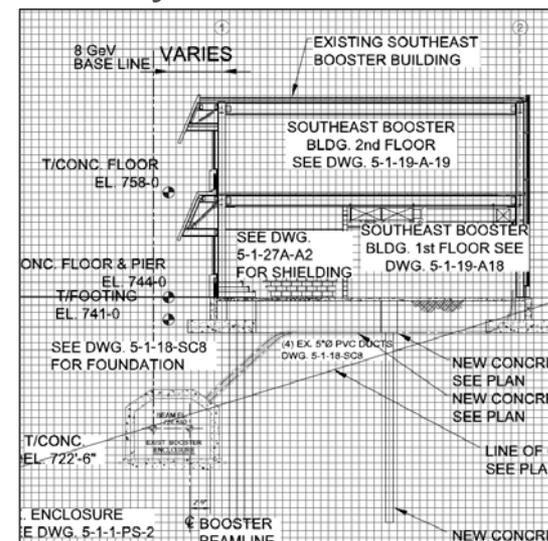
Linac Complex (WBS 121.06.05)

- Design Update
 - Coordination meetings with subprojects to understand requirement changes since the conceptual design.
 - Started in March 2019
 - Completed in October 2019
 - Used for the basis for the final design scope and cost/schedule update.

Technical Progress to Date

Booster Connection (WBS 121.06.06)

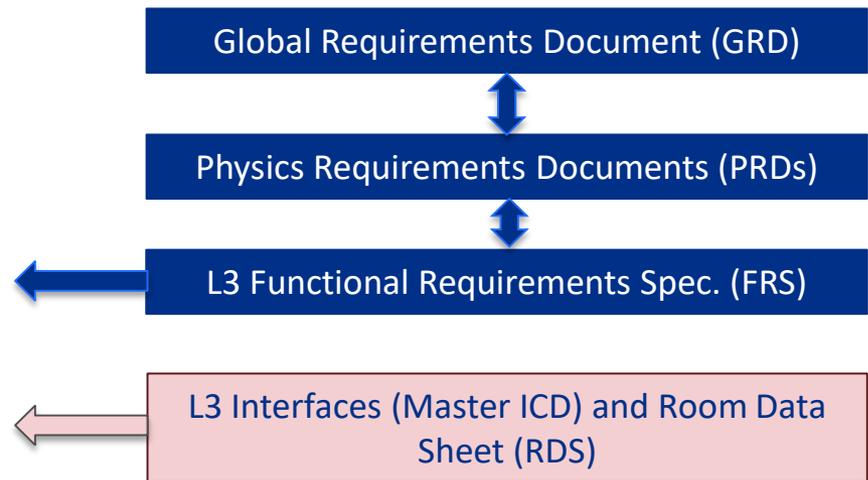
- Design Update in 2019
- Construction strategy change
 - Original design removed the Booster Tower Southeast and utilized open cut construction
 - Based on concerns about impact to the Booster Enclosure, an alternate strategy will utilize earth retention system and connect with a beam pipe.
 - Coordinated beam lattice adjustments with Accelerator Physics



- Requirements flow from the Global Requirements to Physics Requirements to Functional and Technical requirements;
- Requirements are supported by Interfaces and Room Data Sheet;

5 out of 30 L3 FRS's apply to Conventional Facilities (one for each L3 WBS)

104 out of 745 total interfaces involve Conventional Facilities (all interfaces are documented in the PIP-II Master ICD)

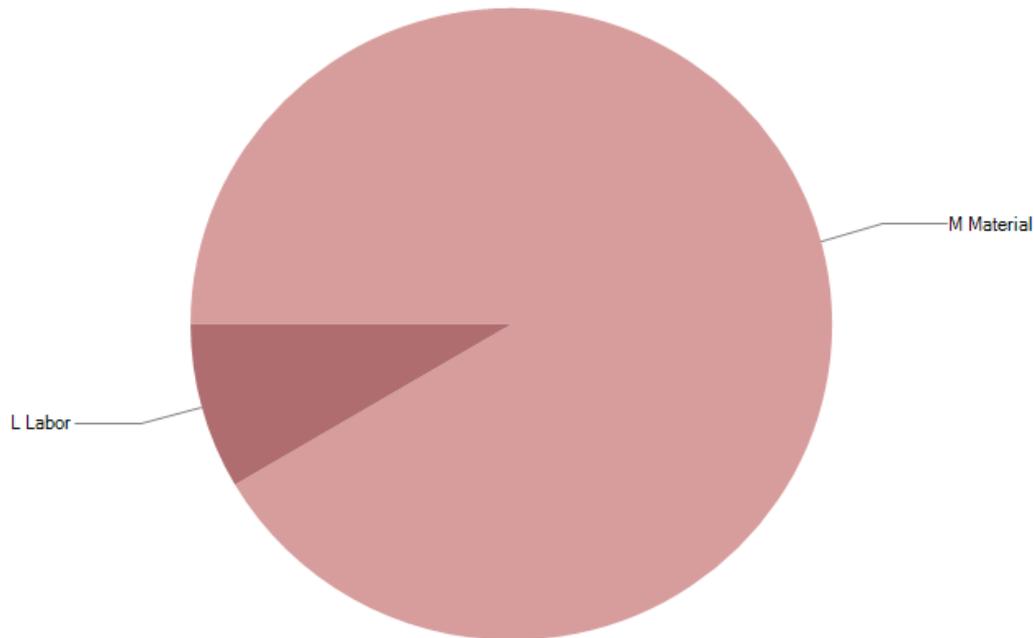


- Conv Fac System is at 59% cost-weighted Design Maturity.

WBS#	System Description	DM, [%]	Direct Cost, [M\$]
121.6	Conv Facilities	59	163

Cost Estimate

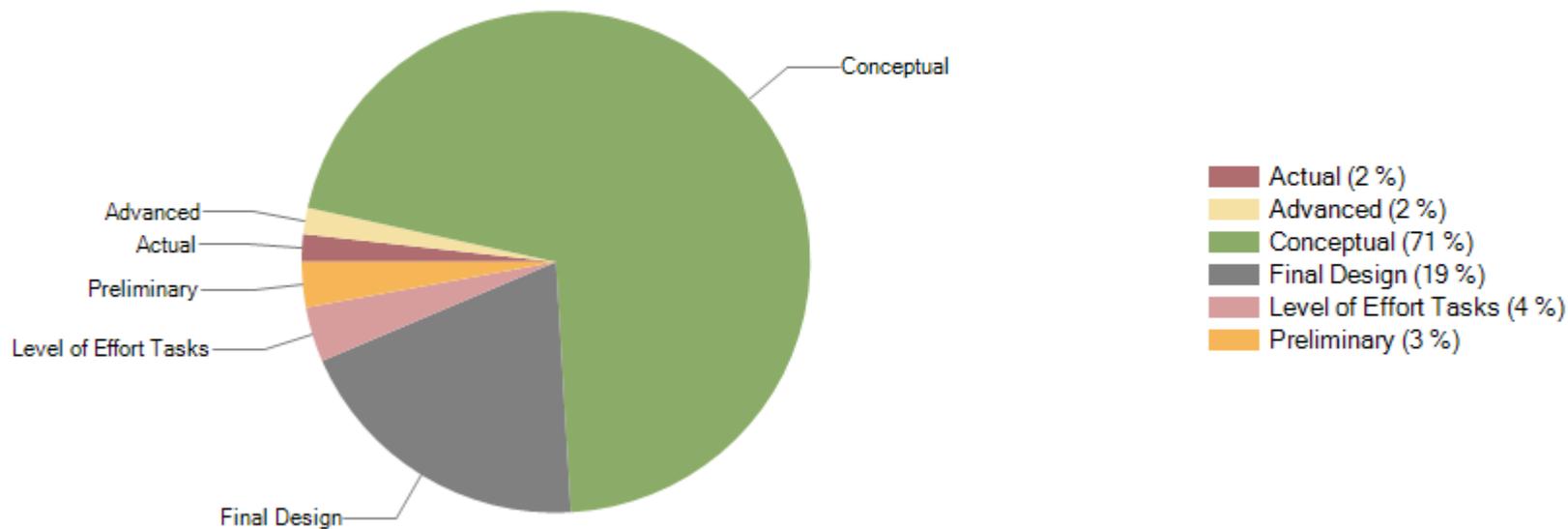
121.06 CONVENTIONAL FACILITIES (CnvF) - Breakdown by Resource Type



Resource Type	Value	%
M Material	\$152,635,522	91.5 %
L Labor	\$14,145,882	8.5 %

WP_WBS2	WP_WBS3	Direct Hours	Direct M&S	Full Burden + ESC	EUC	% EU	Total Cost
☐ 121.06 CONVENTIONAL FACILITIES (CnvF)		70,740	\$128,666,046	\$166,781,404	\$54,248,110	32.5 %	\$221,029,514
	121.06.01 CnvF - Project Management and Coordination (PM)	17,401	\$212,200	\$3,414,708	\$330,080	9.7 %	\$3,744,789
	121.06.02 CnvF - Site Preparation (SitePrep)	8,113	\$11,777,193	\$14,852,836	\$2,176,411	14.7 %	\$17,029,247
	121.06.03 CnvF - Cryoplant Building (CryoB)	6,535	\$21,818,594	\$26,170,115	\$4,970,293	19.0 %	\$31,140,408
	121.06.04 CnvF - Utility Plant (UtilP)	3,918	\$5,556,332	\$7,336,799	\$2,045,376	27.9 %	\$9,382,175
	121.06.05 CnvF - Linac Complex (Cmplx)	27,022	\$74,377,756	\$94,201,621	\$35,378,584	37.6 %	\$129,580,205
	121.06.06 CnvF - Booster Connection (BstrC)	7,751	\$14,923,971	\$20,805,326	\$9,347,366	44.9 %	\$30,152,692
Total		70,740	\$128,666,046	\$166,781,404	\$54,248,110	32.5 %	\$221,029,514

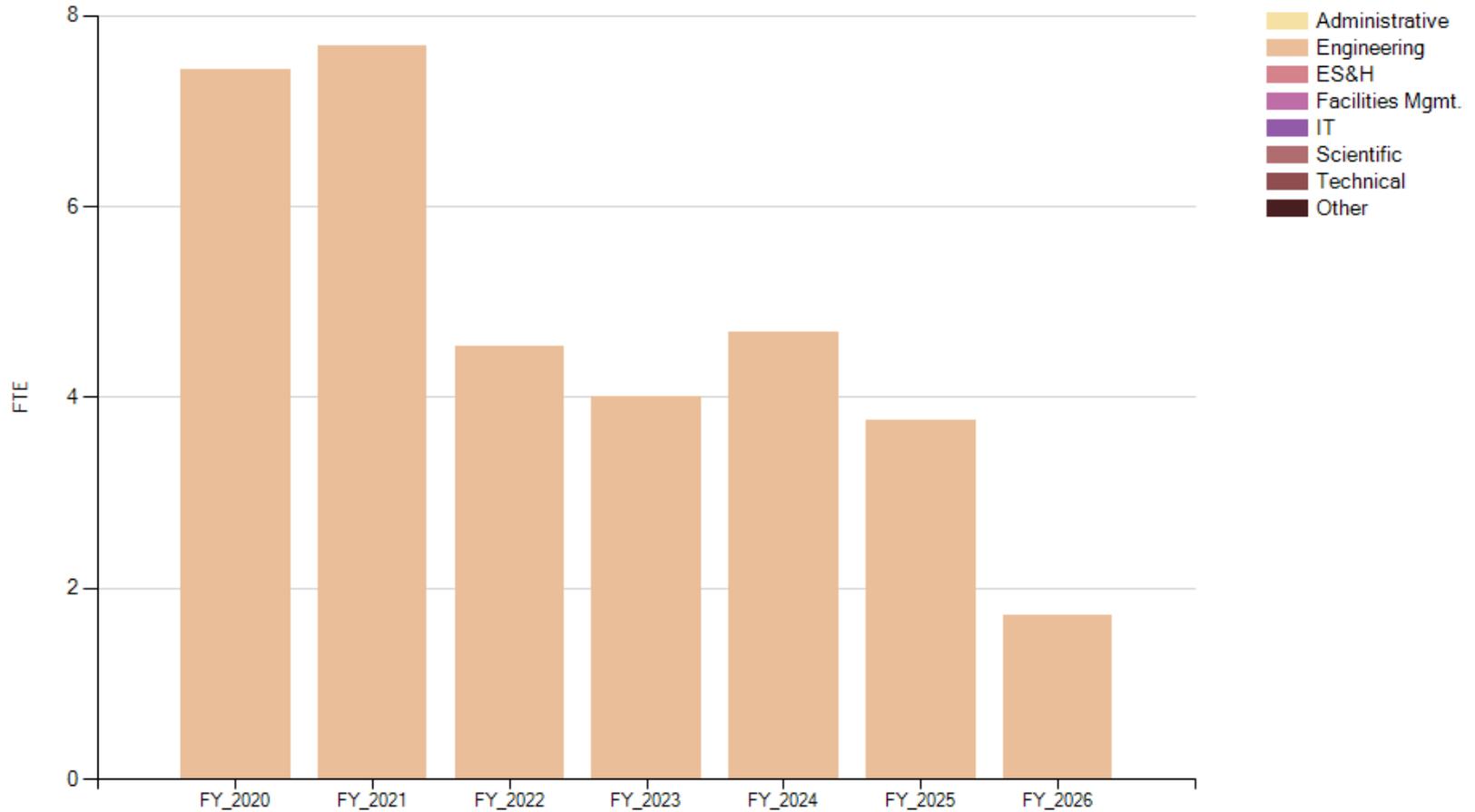
121.06 CONVENTIONAL FACILITIES (CnvF) - Breakdown by Estimate Quality



Estimate Uncertainty follows Project guidelines [1]

[1] Contingency Rules for Basis of Estimates is at PIP-II-doc-345

121.06 CONVENTIONAL FACILITIES (CnvF) - FTE Breakdown



Cost Performance Report

- BAC = \$166,781,404.28
- CPI=1.14; SPI=1.00

WP_WBS2	WP_WBS3	Current Period								Cumulative to date									
		Budget	Earned	Actuals	SV	SV (%)	CV	CV (%)	Budget	Earned	Actuals	SV	SV (%)	CV	CV (%)	SPI	CPI	BAC	
121.06 CONVENTIONAL FACILITIES (CnvF)		\$58,608.83	\$53,393.70	\$311,266.74	(\$5,215.12)	-8.9 %	(\$257,873.04)	-483.0 %	\$5,903,660.45	\$5,907,577.42	\$5,185,482.06	\$3,916.97	0.1 %	\$722,095.36	12.2 %	1.00	1.14	\$166,781,404.28	
	121.06.01 CnvF - Project Management and Coordination (PM)	\$27,313.04	\$27,313.04	\$94,133.47	\$0.00	0.0 %	(\$66,820.43)	-244.6 %	\$757,087.96	\$757,087.96	\$728,889.37	\$0.00	0.0 %	\$28,198.59	3.7 %	1.00	1.04	\$3,414,708.32	
	121.06.02 CnvF - Site Preparation (SitePrep)	\$23,990.47	\$7,349.95	\$0.00	(\$16,640.53)	-69.4 %	\$7,349.95	100.0 %	\$3,221,358.01	\$3,237,998.54	\$2,706,334.53	\$16,640.53	0.5 %	\$531,664.01	16.4 %	1.01	1.20	\$14,852,835.66	
	121.06.03 CnvF - Cryoplat Building (CryoB)	\$5,467.83	\$9,520.70	\$183,901.74	\$4,052.87	74.1 %	(\$174,381.04)	-1,831.6 %	\$1,717,516.81	\$1,715,898.72	\$1,527,737.12	(\$1,618.09)	-0.1 %	\$188,161.60	11.0 %	1.00	1.12	\$26,170,115.04	
	121.06.04 CnvF - Utility Plant (UtilP)			\$0.00	\$0.00	0.0 %	\$0.00	0.0 %			\$41.72	\$0.00	0.0 %	(\$41.72)	-41,720.0 %			\$7,336,798.84	
	121.06.05 CnvF - Linac Complex (Cmplx)	\$1,837.49	\$9,210.02	\$33,231.53	\$7,372.54	401.2 %	(\$24,021.51)	-260.8 %	\$207,697.66	\$196,592.20	\$222,479.32	(\$11,105.47)	-5.3 %	(\$25,887.12)	-13.2 %	0.95	0.88	\$94,201,620.63	
	121.06.06 CnvF - Booster Connection (BstrC)			\$0.00	\$0.00	0.0 %	\$0.00	0.0 %			\$0.00	\$0.00	0.0 %	\$0.00	0.0 %			\$20,805,325.79	
Total		\$58,608.83	\$53,393.70	\$311,266.74	(\$5,215.12)	-8.9 %	(\$257,873.04)	-483.0 %	\$5,903,660.45	\$5,907,577.42	\$5,185,482.06	\$3,916.97	0.1 %	\$722,095.36	12.2 %	1.00	1.14	\$166,781,404.28	

Cumulative to date									
Budget	Earned	Actuals	SV	SV (%)	CV	CV (%)	SPI	CPI	BAC
\$5,903,660.45	\$5,907,577.42	\$5,185,482.06	\$3,916.97	0.1 %	\$722,095.36	12.2 %	1.00	1.14	\$166,781,404.28
\$757,087.96	\$757,087.96	\$728,889.37	\$0.00	0.0 %	\$28,198.59	3.7 %	1.00	1.04	\$3,414,708.32
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		\$41.72	\$0.00	0.0 %	(\$41.72)	-41,720.0 %			\$7,336,798.84
\$207,697.66	\$196,592.20	\$222,479.32	(\$11,105.47)	-5.3 %	(\$25,887.12)	-13.2 %	0.95	0.88	\$94,201,620.63
\$0.00	\$0.00	\$0.00	\$0.00	0.0 %	\$0.00	0.0 %			\$20,805,325.79
\$97.00	\$97.00	\$97.00	\$0.00	0.0 %	\$0.00	0.0 %	1.00	1.14	\$166,781,404.28

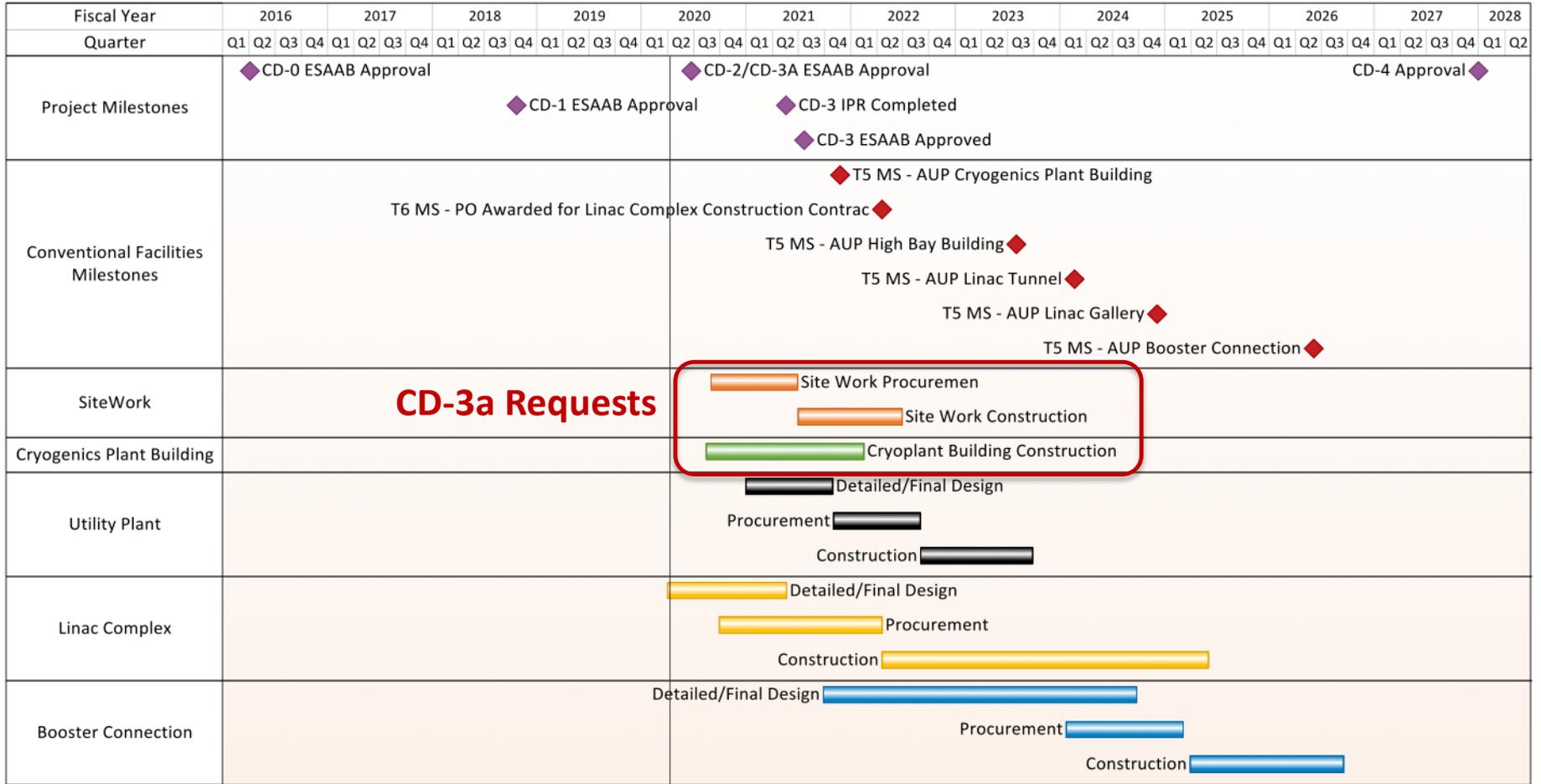
Cost Variance:
 The cumulative cost variance (\$329) is a remnant of previous variances associated with a timing issue related to the start of the EVM reporting. The start date of the reporting was chosen as 01FEB19 while the majority of the design work was completed prior to this date.

The cumulative variance reflects journals transfers in previous reporting periods to

- 1) correct timing issues related to the start of EVMS reporting
- 2) adjust costs related to the transfer of work scope off project
- 3) adjustments to funding types (from OPC to PED)

From 30NOV19 121.06.02.02 Variance Analysis Report





CD-3a Requests



Risks and Risk Mitigation

Charge #3,5

- Following the procedures contained in the PIP-II Risk Management Plan [1]
- 16 currently managed risks
- Managed through the [Risk Register](#)

Type	Quantity
High	1
Medium	2
Low	7
Negligible	4
Opportunity	2

Top Five Risks

RI-ID	Title
RT-121-06-001	CnvF: Changes in subproject requirements affect Conventional Facilities
RT-121-06-042	CnvF: Construction activities impact the Booster
RT-121-06-043	CnvF: Construction subcontractor performance
RT-121-06-010	CnvF: Interfaces between subprojects and conventional construction
RT-121-06-013	CnvF: Construction package has omissions, errors or is unclear

Construction Escalation Strategy Updated in December 2020 [2]

[1] – Risk Management Plan can be found in PIP-II-doc-163

[2] – Construction Escalation Strategy can be found in PIP-II-doc-1299

Environment Safety and Health

Consider and plan for ESH issues throughout the project life cycle

- PIP-II Integrated ESH Management Plan ^[1]
- Design Phase:
 - Prevention Through Design ^[2]
 - Sustainability Goals and Requirements ^[3]
- Procurement Phase
- Construction Safety and Health Plan ^[4]

These processes are in place and operating: No incidents for the Site Clearing work

[1] PIP-II Integrated ESH Management Plan is at PIP-II-doc-141

[2] Prevention Through Design Implementation is at PIP-II-doc-2237

[3] PIP-II HPSB Strategy is at PIP-II-doc-184

[4] PIP-II Construction Safety and Health Plan is at PIP-II-doc-2507

Quality Assurance

Quality: Integrated Team Approach

SC4-Alcaraz

- PIP-II Project Processes [1]
- Architect/Engineer Design Processes *
- Independent Commissioning Agent Processes *
- FESS Subject Matter Experts
- Laboratory Experts
- Construction Subcontractor *

[1] PIP-II Quality Assurance Plan is at PIP-II-doc-142

(*) Quality requirements are incorporated into consultant selection and subcontract terms and conditions

Previous Review Recommendations

Charge #9

SC4-Dixon

- 16 Recommendations from previous reviews related to Conventional Facilities
- All are closed

Challenges/Path Forward

- **Cost/Schedule Estimate Update**
 - Final Report anticipated in January 2020
 - Reconcile results with resource loaded schedule
- **Cryogenics Plant Building**
 - Bids in hands (all within budget)
 - Following the evaluation process contained in the acquisition plan.
 - Notice to Proceed anticipated in May 2020 (*Bids are valid until May 18, 2020*)
- **Remaining Packages**
 - Technical Requirements are known and approved
 - Linac Complex
 - Start of detailed/final design phase anticipated in early 2020.
 - Utility Plant
 - Start of detailed/final design phase anticipated in FY21.
 - Booster Connection
 - Start of detailed/final design phase anticipated in FY21.

Breakout Sessions

Time	Topic	Duration	Speaker
Wednesday, 8:00	Cryogenics Plant Building (joint session with SC-3)	90'	S. Dixon
Wednesday, 9:30	Break	15'	
Wednesday, 9:45	CD-3a Scope – Site Preparation	20'	S. Dixon
Wednesday, 10:15	Path to CD-3	30'	S. Dixon
Wednesday, 10:45	Lab Interfaces	20'	R. Wielgos
Wednesday, 11:05	ESH Strategy	20'	R. Wielgos
Wednesday, 11:25	Quality Assurance Strategy	20'	E. Alcaraz
Wednesday, 11:45	Previous Review Recommendation	15'	S. Dixon
Wednesday, 12:00 – 2:00 pm	Lunch, PIP2IT tour	120'	
Wednesday, 2:00	Open Discussion	120'	all

Summary

- Conventional Facilities scope is understood.
- Project Management processes (ESH, Quality, Risks and EVMS) are in place and functioning.
- CD-3a requests are ready:
 - Site Preparation (design complete)
 - Cryogenics Plant Building (bids in hand)
- Plan in place to reach CD-3.
- Thank you for your time.