WBS 121.06.05 - Linac Complex

S. Dixon, L2 Manager

DOE CD-2/3a ICE Review

February 4-7, 2020

A Partnership of:

US/DOE
India/DAE
Italy/INFN
UK/UKRI-STFC
France/CEA, CNRS/IN2P3
Poland/WUST

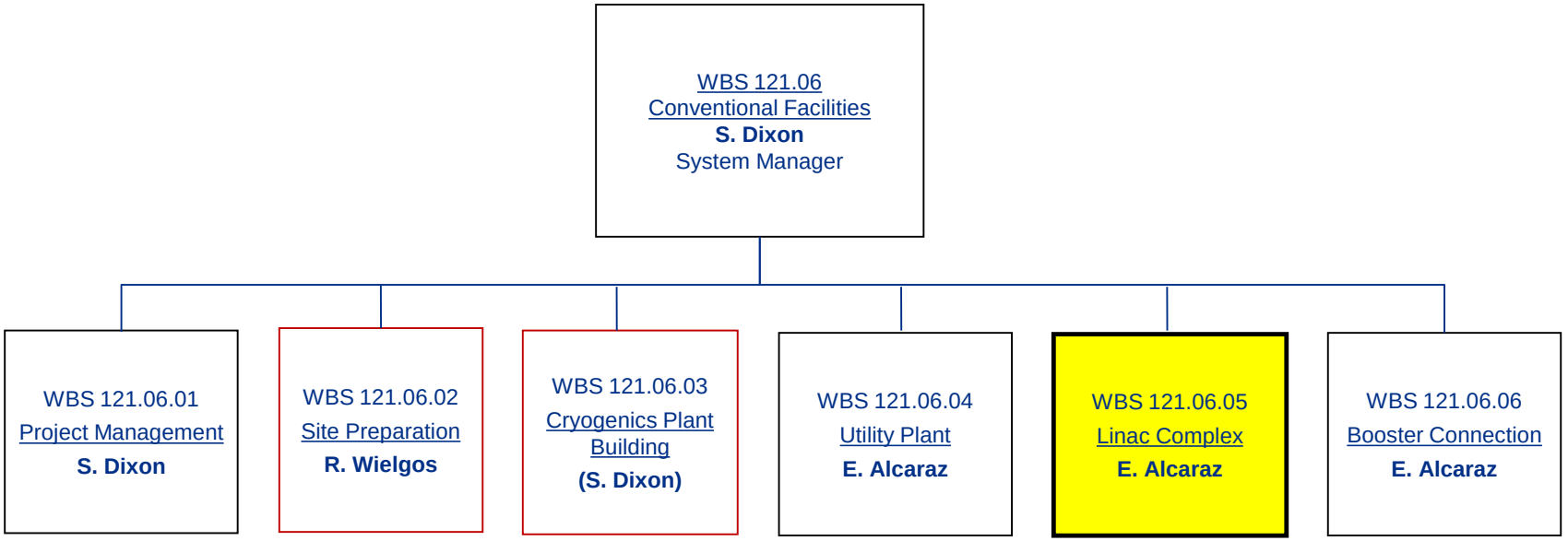
About Me

- 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;

Agenda

- Project Organization
- Scope
- Cost
- Schedule

Project Organization



Architect/Engineer Team

Gensler (architecture), **IMEG** (mechanical, electrical, plumbing)
TGRWA (structural),**CMT** (civil), **Jensen Hughes** (life safety), **Syska Hennessy** (commissioning), **Burns and McDonnell** (landscaping)

Scope and Deliverables

- Procurement and management for all contracted labor, materials, tools, equipment, and services needed for the construction of the Linac Complex work scope that consists of the High Bay Building, Linac Tunnel, and Linac Gallery. It describes the labor resources, materials and services necessary for management, organization, planning, oversight and engineering, design, inspection and administration (EDIA). [1]
- WBS
  - 121.06.05.01 – Project Management and Coordination
  - 121.06.05.02 – Detailed and Final Design
  - 121.06.05.03 – Construction on Site

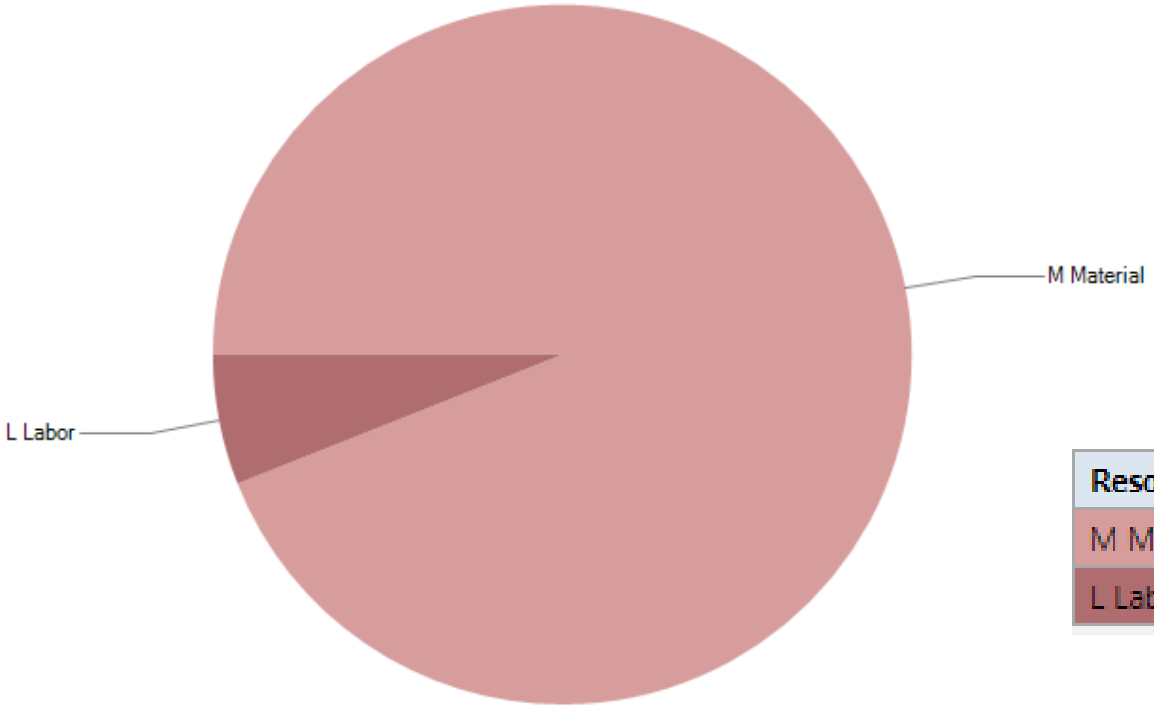
[1] See WBS Dictionary in PIP-II-doc-599 for complete description

Scope and Deliverables

Linac Complex (WBS 121.06.05)

- High Bay Building
- Linac Tunnel
- Linac Gallery
- Beam Transfer Line

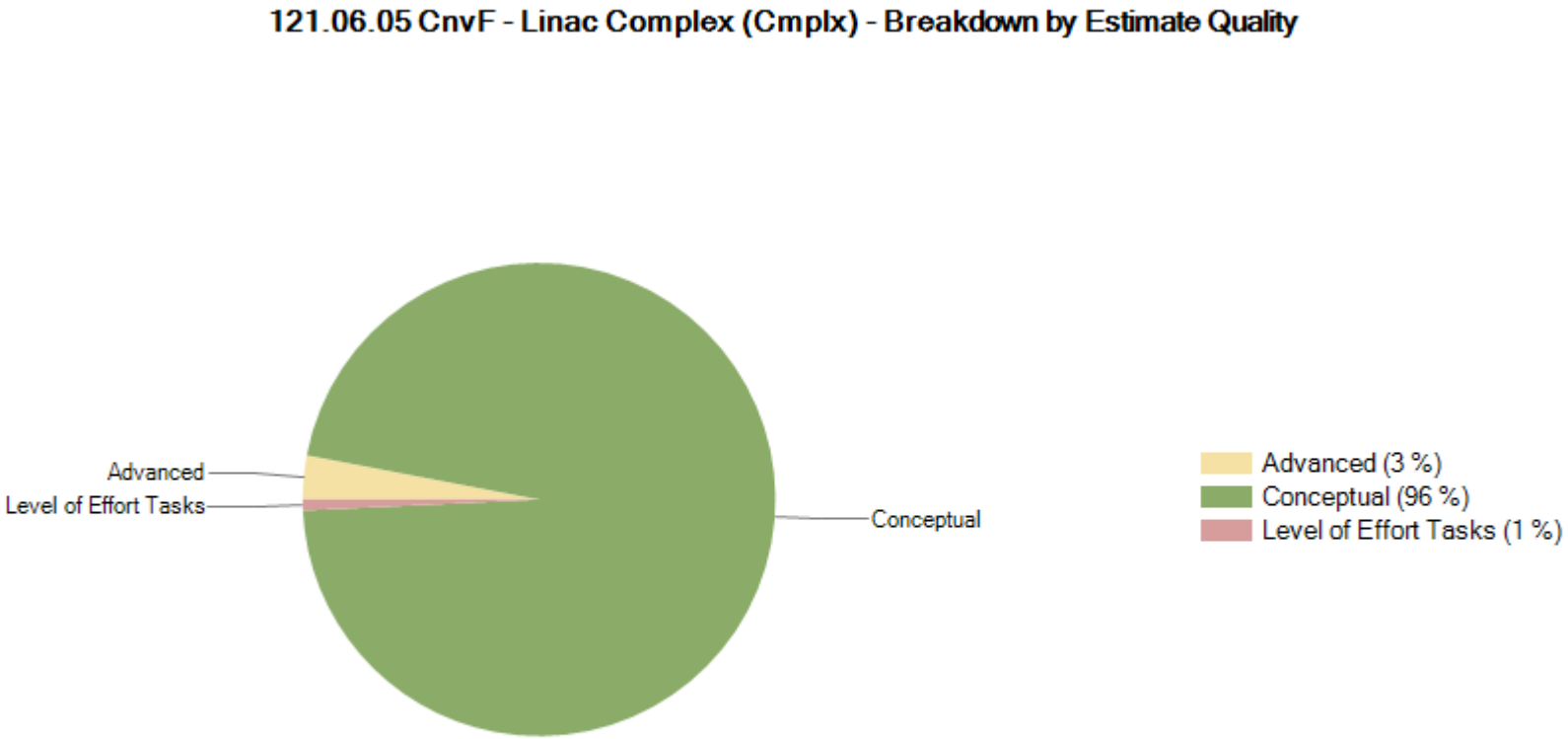
Cost Estimate



Resource Type	Value	%
M Material	$88,542,428	94.0 %
L Labor	$5,659,193	6.0 %

ControlAccount	Direct Hours	Direct M&S	Full Burden + ESC	EUC	% EU	Total Cost
121.06.05.01 CnvF - Cmplx - Project Management and Coordination (PM)	3,006	$0	$698,871	$69,887	10.0 %	$768,759
121.06.05.02 CnvF - Cmplx - Detailed and Final Design	12,394	$3,427,393	$6,283,232	$1,411,060	22.5 %	$7,694,293
121.06.05.03 CnvF - Cmplx - Construction on Site	11,622	$70,950,363	$87,219,517	$33,897,637	38.9 %	$121,117,153
Total	**27,022**	**$74,377,756**	**$94,201,621**	**$35,378,584**	**37.6 %**	**$129,580,205**

Cost – Estimate Maturity



- Estimate Uncertainty follows Project guidelines (PIP-II-doc-345)

Construction Cost Calculation

Gensler/Turner Estimate (PIP-II-doc-333)

Item No.	Item Description	Site Preparation 121.06.02	Cryogenics Plant Building 121.06.03	Utility Plant 121.06.04	Linac Complex 121.06.05	Booster Connection 121.06.06	
		$8,642,546	$18,718,615	$3,788,756	$56,626,914	$9,265,477	Base Cost (FY18 $)
001	Remove CW Cooling from Base Scope			$0			
002	Remove Wetland Credits from Base Scope	$0					Included in 100% cost estimate
003	Eliminate HX for Cryo Compressor			$0			Included in base estimate
004	Elminate Precast Shield Blocks				-$1,157,000		
005	Eliminate Gallery Space for 4 Cyromodules				$0		
006	Eliminate Sheilding Steel at Booster Connection					-$2,616,000	
007	Reduce Width of Linac Gallery by 5'				$0		
008	Demolish Booster Tower Southeast					$0	
009	Eliminate Tunnel Space for 2 cryomodules				$0		
010	Add Relocation of Helium/Nitrogen Tanks		$0				Included in 100% cost estimate
011	Remove Utility Cooridor Work Scope	$0					Included in 100% cost estimate
012	Increased Cooling in Linac Tunnel				$300,000		
013	Increased Cooling in Linac Gallery				$900,000		
014	Increased LCW Heat Load			$620,000	$400,000		
015	Increased CHW Heat Load			$300,000	$100,000		
016	Adjust Linac Gallery Width				$825,000		
017	Increased Linac Tunnel Length				$731,000		Shift 1, Lattice grows by 64'
018	Increased Linac Gallery Length				$2,229,000		Shift 1, Lattice grows by 64'
019	Laser Room				$100,000		
020	Combine UPB with CPB			$0			Included in base estimate
021	Remove Electrical Feeder Work Scope	$0					Included in 100% cost estimate
022	Linac Complex Scope Reduction from BCR007				-$2,291,400		Remove 75' of gallery for HB650
023	BCR009 Adjustments				$11,203,805		
024	Reduce Gallery Area based on F3 BCR00?				-$244,400		
025	Revised Booster Tower Connection					$1,250,000	PIP-II_0007
026	Reduce Gallery Area from Revised RF Seperator				-$763,800		Smaller gallery for RF Seperator
027	LB650 4 Cavity BCR 0035				$289,166		
028	Utilize CUB Make Up Water			$0			Included in base estimate
029	Linac Complex Scope Reduction - BCR 0064				$0		
030	Linac Complex/Booster Connection Interface				-$4,747,956	$4,747,956	
		$0	$0	$920,000	$7,873,415	$3,381,956	Scope Adjustment Total
		$8,642,546	**$18,718,615**	**$4,708,756**	**$64,500,329**	**$12,647,433**	Adjusted Base Cost Total

Construction Cost Adjustments

Materials and Supplies (M&S) Notes:

- Scope Adjustments from the Estimated Construction Package Base Cost include the following:
  - **Reduction of $1,157,000** for removing precast concrete shield block from the base estimate. This cost reduction is taken from the cost values contained in the cost estimate contained in PIP-II-doc-333;
  - **Addition of $300,000** for increased cooling loads in the Linac Tunnel over the base design. This is a placeholder for a system needed for handling the heat load to air (sensible cooling) in the linac tunnel to meet the environmental criteria, based on either a refrigerant fan coil system or airhandler system. This is based on similar systems recently installed at the Linac headhouse;
  - **Addition of $900,000** for increased cooling loads in the Linac Gallery over the base design. This is a placeholder for additional cooling units (CRAH) to handle the increase heat load to air in the Linac Gallery and is based on engineering judgement;
  - **Addition of $400,000** for increased LCW heat loads over the base design. This is a placeholder for additional cooling towers, pumps, piping and associated equipment to handle approximately 1,450 KW of additional heat load for the LCW system;
  - **Addition of $100,000** for increased CHW heat load over the base design. This cost is a placeholder for increased chiller capacity, pumps, piping and associated equipment to accommodate approximately 80 tons of additional chilled water over the base estimate requirements;
  - **Addition of $825,000** for an increased width of the Linac Gallery over the base design. This cost is based on an additional 2-foot width over 675-foot long (4,725 square feet) x $611.04/square foot cost of the Linac Gallery.
  - **Addition of $731,000** for the increased length of the Linac Tunnel over the base design. This cost is based on a 64-foot length increase x 21.83-foot tunnel width x $523.41/square foot tunnel cost;
  - **Addition of $2,229,000** for the increased length of the Linac Gallery over the base design. This cost is based on an additional 64-foot length x 57-foot width Linac Gallery (3,648 square foot) x $611.04/square foot cost of the Linac Gallery;
  - **Addition of $100,000** for the Laser Room that was not included in the base design. The cost is based on 160 square foot of space x $611.04/square foot cost of the Linac Gallery.
  - **Reduction of $2,291,400** for a Gallery Reduction associated with the removal from the base design of 75-foot of the Linac Gallery. This cost is based on a 75-foot length x 50-foot (3,759 square feet) x $611.04/square foot cost of the Linac Gallery;
  - **Addition of $11,203,805** for scope transfers associated with BCR PIP-II 007
  - Reduction of $244,400 for Gallery area associated with the relocation of equipment from the Linac Gallery to existing F3 Service Building contained in BCR PIP-II 0021
  - **Reduction of $763,800** for reduced Gallery area associated with refined space requirements for the RF Separator. The cost is based on a 25-foot x 50-foot area of the Linac Gallery (1,250 square feet) x $611.04/square foot cost of the Linac Gallery;
  - **Addition of $289,166** for additional space and electrical service associated with BCR PIP-II 0035.
  - **Reduction of $4,747,956** for a revised work due to an interface change between the Linac Complex and Booster Connection construction packages. Previously this interface point was north of South Booster Road. Due to the requirement to limit the duration impact of the work on the Main Ring operations, this interface point was shifted to a location south of the Main Ring. The calculation for this change is shown below:

Cost of Linac Complex/Booster Connection Interface Change	
Based on revised interface point between Linac Complex and Booster Connection construction packages	
Previously the interface point was South Booster Road. Current interface is east of Main Ring	
807	Beam Transfer Line Length (feet)
$9,555,113	Cost of Beam Transfer Line (FY18$)
$11,840	Cost per linear foot
807	Beam Transfer Line Distance (before)
406	Beam Trasfer Line Distance (after)
401	Difference
$4,747,956	Cost
	Deduct this cost from Linac Complex
	Add this cost to Booster Connection

Scope Adjustments Described in Basis of Estimate documents

- PIP-II-doc-2121 (Detailed and Final Design)
- PIP-II-doc-2124 (Construction on Site)

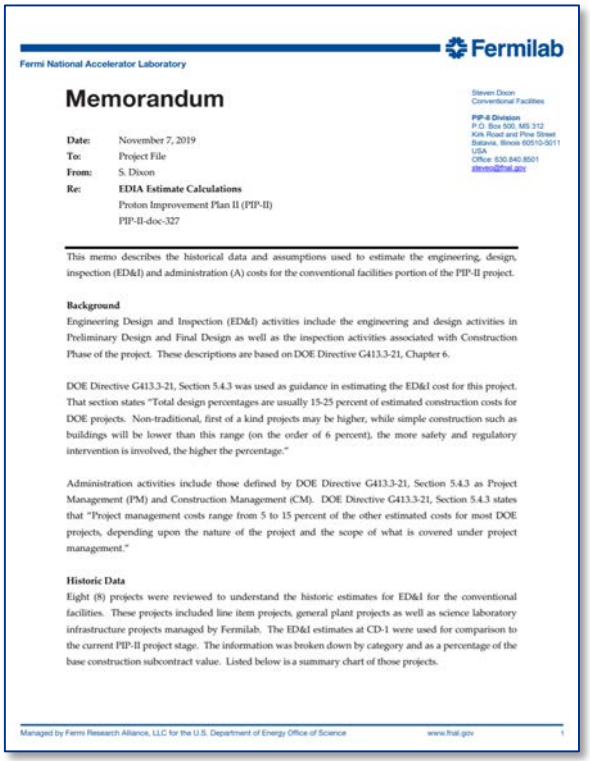
EDIA Calculation

$56,626,914	Estimated Construction Package Base Cost					
	See PIP-II-doc-333 for construction cost estimate					
$7,873,415	Scope Adjustments (see description below)					
$64,500,329	**Total**					
Engineering Design, Inspection and Administration Multipliers						
7.0%	Design Phase A/E ED&I				See PIP-II-doc-327 for basis of EDI and A description and analysis of multipliers by phase	
2.0%	Design Phase ED&I In-House					
1.0%	Design Phase A/E Support Percentage					
6.0%	Construction Phase A/E Construction Administration					
4.0%	Construction Phase A/E Construction Coordination					
2.0%	Construction Phase ED&I In-House					
Detailed Design/Final Design Assumptions						
80.0%	**Detailed Design** Portion of Design Phase Total					
20.0%	**Final Design** Portion of Design Phase Total					
Cost Breakdown						

		M&S			Labor	
		A/E		Construction	FESS/E	
		Design	Support		$	Hours
PM & Coordination						
Design Update		$122,418			$49,506	446
Mech System LCA		$8,875			$888	8
Detailed Design		5.6%	0.8%		1.6%	
		$3,612,018	$516,003		$1,042,550	9,392
Final Design		1.4%	0.2%		0.4%	
		$903,005	$129,001		$260,554	2,347
	Totals	**$4,646,316**	**$645,003**	$0	$1,353,498	**12,194**

		M&S			Labor	
		A/E		Construction	FESS/E	
		CA Support	CC Support		$	Hours
Construction Phase Support		$3,870,021	$2,580,013		$1,290,007	11,622
Construction				$64,500,329		
	Totals	**$3,870,021**	**$2,580,013**	**$64,500,329**	$1,290,007	**11,622**

Based on Historic Data (PIP-II-doc-327)



Fermilab

Fermi National Accelerator Laboratory

Memorandum

Steven Dixon
Conventional Facilities

PIP-II Division
P.O. Box 500, MS 312
Kirk Road and Pine Street
Batavia, Illinois 60510-5011
USA
Office 630.840.8501
stevec@fnal.gov

Date: November 7, 2019
To: Project File
From: S. Dixon
Re: **EDIA Estimate Calculations**
Proton Improvement Plan II (PIP-II)
PIP-II-doc-327

This memo describes the historical data and assumptions used to estimate the engineering, design, inspection (ED&I) and administration (A) costs for the conventional facilities portion of the PIP-II project.

Background

Engineering Design and Inspection (ED&I) activities include the engineering and design activities in Preliminary Design and Final Design as well as the inspection activities associated with Construction Phase of the project. These descriptions are based on DOE Directive G413.3-21, Chapter 6.

DOE Directive G413.3-21, Section 5.4.3 was used as guidance in estimating the ED&I cost for this project. That section states "Total design percentages are usually 15-25 percent of estimated construction costs for DOE projects. Non-traditional, first of a kind projects may be higher, while simple construction such as buildings will be lower than this range (on the order of 6 percent), the more safety and regulatory intervention is involved, the higher the percentage."

Administration activities include those defined by DOE Directive G413.3-21, Section 5.4.3 as Project Management (PM) and Construction Management (CM). DOE Directive G413.3-21, Section 5.4.3 states that "Project management costs range from 5 to 15 percent of the other estimated costs for most DOE projects, depending upon the nature of the project and the scope of what is covered under project management."

Historic Data

Eight (8) projects were reviewed to understand the historic estimates for ED&I for the conventional facilities. These projects included line item projects, general plant projects as well as science laboratory infrastructure projects managed by Fermilab. The ED&I estimates at CD-1 were used for comparison to the current PIP-II project stage. The information was broken down by category and as a percentage of the base construction subcontract value. Listed below is a summary chart of those projects.

Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science www.fnal.gov 1

Drill Down Example – 12.06.05.03

Costbook by CA

*To enable **Expand all**, select at most three columns.*

Filter | Columns: 5 options selected! | Responsible Lab: --- all labs --- | Expand all | CAM: 10086N Dixon, Steven | CA: 121.06.05.03 CnvF - Cmplx - Constru | From: mm/dd/yyyy | To: mm/dd/yyyy | Filter

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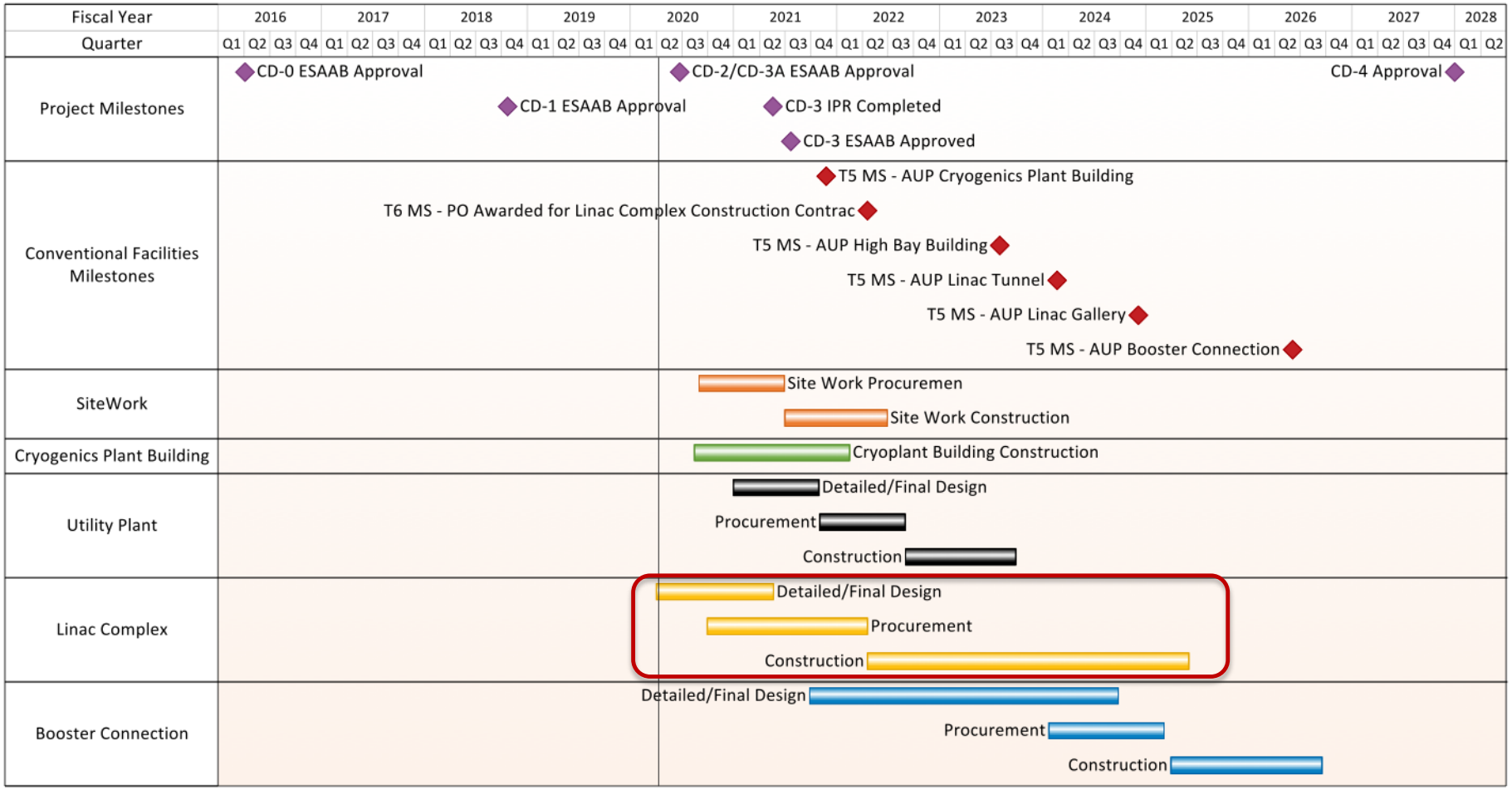
ControlAccount	WPCTC	WP	Resource_TYPE	Resource	Direct Hours	Direct M&S	Full Burden + ESC	EUC	% EU	Total Cost
121.06.05.03 CnvF - Cmplx - Construction on Site					11,622	~~$70,950,363.00~~	~~$87,219,516.76~~	~~$33,897,636.69~~	~~38.9 %~~	$121,117,153.45
	121T.060503CT 121.06.05 Temp CTC CnvF - Cmplx - Construction on Site				11,622	$70,950,363.00	$87,219,516.76	$33,897,636.69	38.9 %	$121,117,153.45
Total					11,622	$70,950,363.00	$87,219,516.76	$33,897,636.69	38.9 %	$121,117,153.45

1

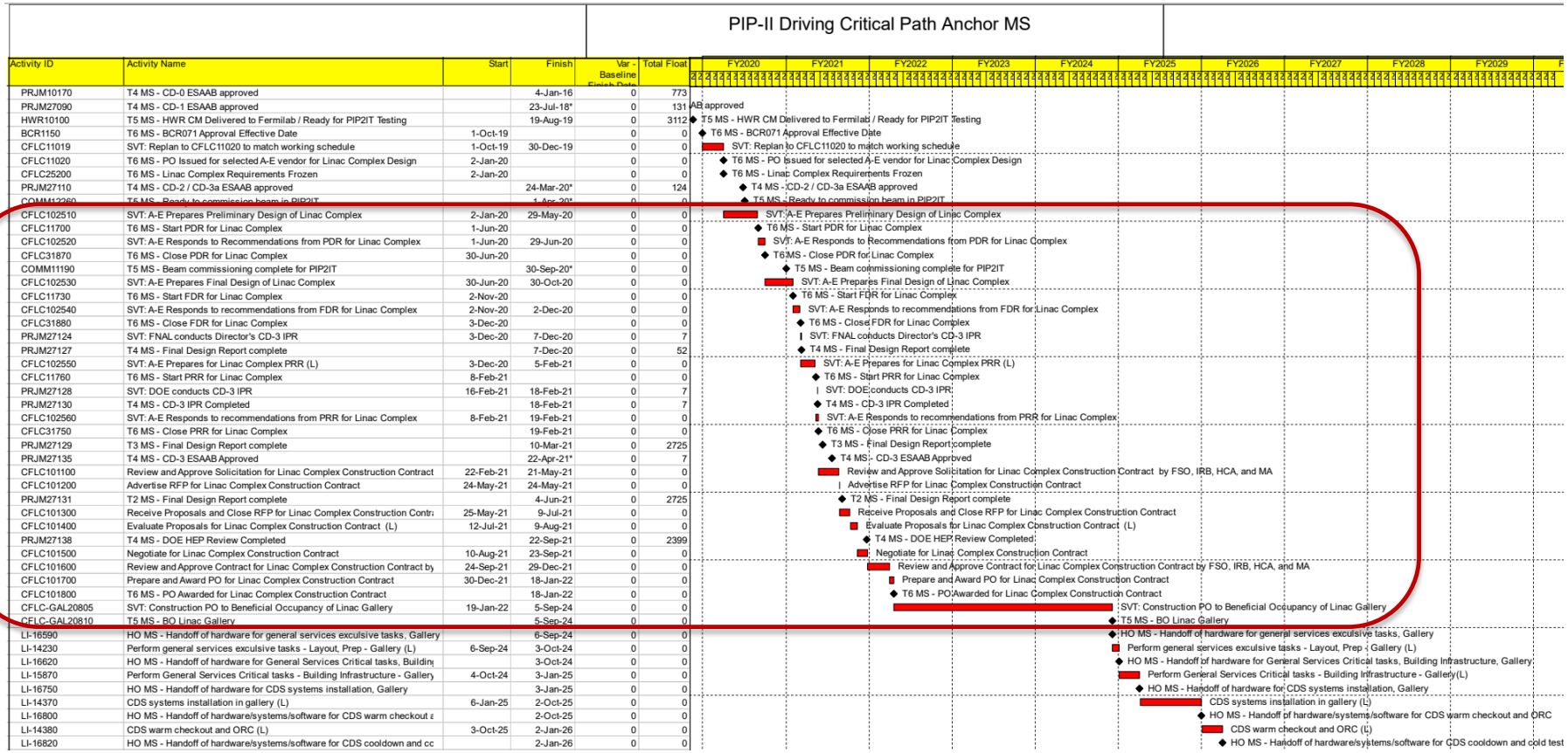
$3,870,021	CA Support
$2,580,013	CC Support
$64,500,329	Construction
$70,950,363	***Value In Cost Book***

		M&S			Labor		
		A/E		Construction	FESS/E		PIP-II
		CA Support	CC Support		$	Hours	
Construction Phase Support		$3,870,021	$2,580,013		$1,290,007	11,622	-
Construction				$64,500,329			
	Totals	**$3,870,021**	**$2,580,013**	**$64,500,329**	$1,290,007	**11,622**	**0**

Schedule


Fiscal Year
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
Quarter
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2
Project Milestones
CD-0 ESAAB Approval
CD-1 ESAAB Approval
CD-2/CD-3A ESAAB Approval
CD-3 IPR Completed
CD-3 ESAAB Approved
CD-4 Approval
Conventional Facilities Milestones
T5 MS - AUP Cryogenics Plant Building
T6 MS - PO Awarded for Linac Complex Construction Contrac
T5 MS - AUP High Bay Building
T5 MS - AUP Linac Tunnel
T5 MS - AUP Linac Gallery
T5 MS - AUP Booster Connection
SiteWork
Site Work Procuremen
Site Work Construction
Cryogenics Plant Building
Cryoplant Building Construction
Utility Plant
Detailed/Final Design
Procurement
Construction
Linac Complex
Detailed/Final Design
Procurement
Construction
Booster Connection
Detailed/Final Design
Procurement
Construction

Schedule – Critical Path

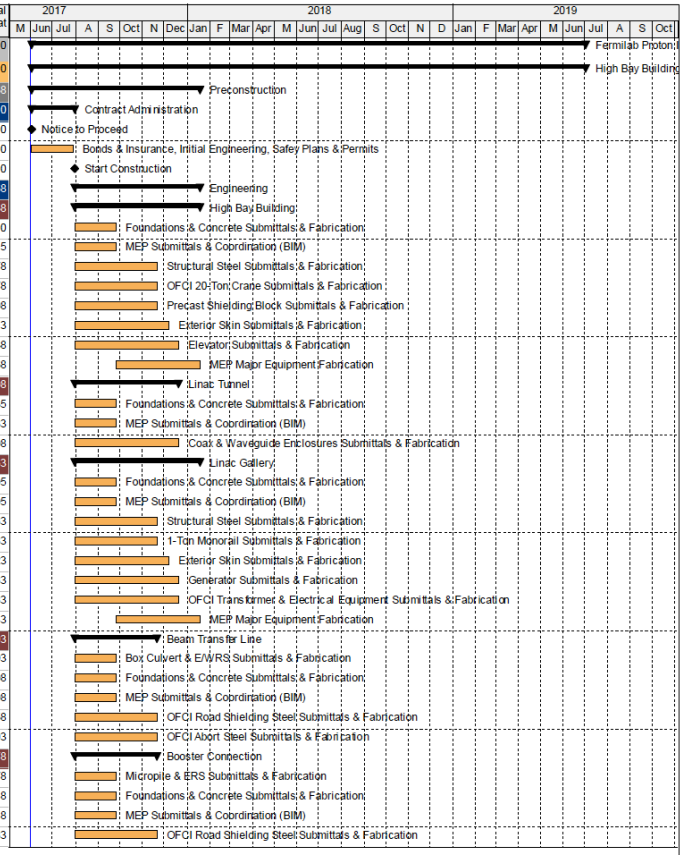


Activity ID	Activity Name	Start	Finish	Var - Baseline Finish Date	Total Float
PRJM10170	T4 MS - CD-0 ESAAB approved		4-Jan-16	0	773
PRJM27090	T4 MS - CD-1 ESAAB approved		23-Jul-18*	0	131
HWR10100	T5 MS - HWR CM Delivered to Fermilab / Ready for PIP2IT Testing		19-Aug-19	0	3112
BCR1150	T6 MS - BCR071 Approval Effective Date	1-Oct-19		0	0
CFLC11019	SVT: Replan to CFLC11020 to match working schedule	1-Oct-19	30-Dec-19	0	0
CFLC11020	T6 MS - PO Issued for selected A-E vendor for Linac Complex Design	2-Jan-20		0	0
CFLC25200	T6 MS - Linac Complex Requirements Frozen	2-Jan-20		0	0
PRJM27110	T4 MS - CD-2 / CD-3a ESAAB approved		24-Mar-20*	0	124
COMM12260	T5 MS - Ready to commission beam in PIP2IT		1-Apr-20*	0	0
CFLC102510	SVT: A-E Prepares Preliminary Design of Linac Complex	2-Jan-20	29-May-20	0	0
CFLC11700	T6 MS - Start PDR for Linac Complex	1-Jun-20		0	0
CFLC102520	SVT: A-E Responds to Recommendations from PDR for Linac Complex	1-Jun-20	29-Jun-20	0	0
CFLC31870	T6 MS - Close PDR for Linac Complex	30-Jun-20		0	0
COMM11190	T5 MS - Beam commissioning complete for PIP2IT		30-Sep-20*	0	0
CFLC102530	SVT: A-E Prepares Final Design of Linac Complex	30-Jun-20	30-Oct-20	0	0
CFLC11730	T6 MS - Start FDR for Linac Complex	2-Nov-20		0	0
CFLC102540	SVT: A-E Responds to recommendations from FDR for Linac Complex	2-Nov-20	2-Dec-20	0	0
CFLC31880	T6 MS - Close FDR for Linac Complex	3-Dec-20		0	0
PRJM27124	SVT: FNAL conducts Director's CD-3 IPR	3-Dec-20	7-Dec-20	0	7
PRJM27127	T4 MS - Final Design Report complete		7-Dec-20	0	52
CFLC102550	SVT: A-E Prepares for Linac Complex PRR (L)	3-Dec-20	5-Feb-21	0	0
CFLC11760	T6 MS - Start PRR for Linac Complex	8-Feb-21		0	0
PRJM27128	SVT: DOE conducts CD-3 IPR	16-Feb-21	18-Feb-21	0	7
PRJM27130	T4 MS - CD-3 IPR Completed		18-Feb-21	0	7
CFLC102560	SVT: A-E Responds to recommendations from PRR for Linac Complex	8-Feb-21	19-Feb-21	0	0
CFLC31750	T6 MS - Close PRR for Linac Complex		19-Feb-21	0	0
PRJM27129	T3 MS - Final Design Report complete		10-Mar-21	0	2725
PRJM27135	T4 MS - CD-3 ESAAB Approved		22-Apr-21*	0	7
CFLC101100	Review and Approve Solicitation for Linac Complex Construction Contract	22-Feb-21	21-May-21	0	0
CFLC101200	Advertise RFP for Linac Complex Construction Contract	24-May-21	24-May-21	0	0
PRJM27131	T2 MS - Final Design Report complete		4-Jun-21	0	2725
CFLC101300	Receive Proposals and Close RFP for Linac Complex Construction Contr	25-May-21	9-Jul-21	0	0
CFLC101400	Evaluate Proposals for Linac Complex Construction Contract (L)	12-Jul-21	9-Aug-21	0	0
PRJM27138	T4 MS - DOE HEP Review Completed		22-Sep-21	0	2399
CFLC101500	Negotiate for Linac Complex Construction Contract	10-Aug-21	23-Sep-21	0	0
CFLC101600	Review and Approve Contract for Linac Complex Construction Contract by	24-Sep-21	29-Dec-21	0	0
CFLC101700	Prepare and Award PO for Linac Complex Construction Contract	30-Dec-21	18-Jan-22	0	0
CFLC101800	T6 MS - PO Awarded for Linac Complex Construction Contract		18-Jan-22	0	0
CFLC-GAL20805	SVT: Construction PO to Beneficial Occupancy of Linac Gallery	19-Jan-22	5-Sep-24	0	0
CFLC-GAL20810	T5 MS - BO Linac Gallery		5-Sep-24	0	0
LI-16590	HO MS - Handoff of hardware for general services exculsive tasks, Gallery		6-Sep-24	0	0
LI-14230	Perform general services exculsive tasks - Layout, Prep - Gallery (L)	6-Sep-24	3-Oct-24	0	0
LI-16620	HO MS - Handoff of hardware for General Services Critical tasks, Buildin		3-Oct-24	0	0
LI-15870	Perform General Services Critical tasks - Building Infrastructure - Gallery	4-Oct-24	3-Jan-25	0	0
LI-16750	HO MS - Handoff of hardware for CDS systems installation, Gallery		3-Jan-25	0	0
LI-14370	CDS systems installation in gallery (L)	6-Jan-25	2-Oct-25	0	0
LI-16800	HO MS - Handoff of hardware/systems/software for CDS warm checkout a		2-Oct-25	0	0
LI-14380	CDS warm checkout and ORC (L)	3-Oct-25	2-Jan-26	0	0
LI-16820	HO MS - Handoff of hardware/systems/software for CDS cooldown and cc		2-Jan-26	0	0

From PIP-II-doc-4095

Schedule – Basis

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Fermilab Proton Improvement Plan - II 18.04.27		528	01-Jun-17	02-Jul-19	0
High Bay Building, Linac Tunnel, Linac Gallery, Beam Transfer Line & Booster Connection		528	01-Jun-17	02-Jul-19	0
Preconstruction		160	01-Jun-17	19-Jan-18	368
Contract Administration		40	01-Jun-17	31-Jul-17	0
HIGH-CA-1000	Notice to Proceed	0		01-Jun-17*	0
HIGH-CA-1100	Bonds & Insurance, Initial Engineering, Safey Plans & Permits	40	02-Jun-17	28-Jul-17	0
HIGH-CA-1200	Start Construction	0	31-Jul-17		0
Engineering		120	31-Jul-17	19-Jan-18	368
High Bay Building		120	31-Jul-17	19-Jan-18	368
HIGH-ENGR-1000	Foundations & Concrete Submittals & Fabrication	40	31-Jul-17	25-Sep-17	0
HIGH-ENGR-1100	MEP Submittals & Coordination (BIM)	40	31-Jul-17	25-Sep-17	215
HIGH-ENGR-1300	Structural Steel Submittals & Fabrication	80	31-Jul-17	20-Nov-17	178
HIGH-ENGR-1400	OFCI 20-Ton Crane Submittals & Fabrication	80	31-Jul-17	20-Nov-17	178
HIGH-ENGR-1600	Precast Shielding Block Submittals & Fabrication	80	31-Jul-17	20-Nov-17	408
HIGH-ENGR-1200	Exterior Skin Submittals & Fabrication	90	31-Jul-17	06-Dec-17	213
HIGH-ENGR-1500	Elevator Submittals & Fabrication	100	31-Jul-17	20-Dec-17	238
HIGH-ENGR-1700	MEP Major Equipment Fabrication	80	26-Sep-17	19-Jan-18	368
Linac Tunnel		100	31-Jul-17	20-Dec-17	298
TUN-ENGR-1000	Foundations & Concrete Submittals & Fabrication	40	31-Jul-17	25-Sep-17	35
TUN-ENGR-1100	MEP Submittals & Coordination (BIM)	40	31-Jul-17	25-Sep-17	333
TUN-ENGR-1200	Coax & Waveguide Enclosures Submittals & Fabrication	100	31-Jul-17	20-Dec-17	298
Linac Gallery		120	31-Jul-17	19-Jan-18	263
GAL-ENGR-1000	Foundations & Concrete Submittals & Fabrication	40	31-Jul-17	25-Sep-17	95
GAL-ENGR-1100	MEP Submittals & Coordination (BIM)	40	31-Jul-17	25-Sep-17	195
GAL-ENGR-1200	Structural Steel Submittals & Fabrication	80	31-Jul-17	20-Nov-17	183
GAL-ENGR-1300	1-Ton Monorail Submittals & Fabrication	80	31-Jul-17	20-Nov-17	183
GAL-ENGR-1400	Exterior Skin Submittals & Fabrication	90	31-Jul-17	06-Dec-17	223
GAL-ENGR-1500	Generator Submittals & Fabrication	100	31-Jul-17	20-Dec-17	283
GAL-ENGR-1600	OFCI Transformer & Electrical Equipment Submittals & Fabrication	100	31-Jul-17	20-Dec-17	283
GAL-ENGR-1700	MEP Major Equipment Fabrication	80	26-Sep-17	19-Jan-18	243
Beam Transfer Line		80	31-Jul-17	20-Nov-17	403
BEAM-ENGR-1000	Box Culvert & E/WRS Submittals & Fabrication	40	31-Jul-17	25-Sep-17	193
BEAM-ENGR-1100	Foundations & Concrete Submittals & Fabrication	40	31-Jul-17	25-Sep-17	198
BEAM-ENGR-1200	MEP Submittals & Coordination (BIM)	40	31-Jul-17	25-Sep-17	198
BEAM-ENGR-1300	OFCI Road Shielding Steel Submittals & Fabrication	80	31-Jul-17	20-Nov-17	258
BEAM-ENGR-1400	OFCI Abort Steel Submittals & Fabrication	80	31-Jul-17	20-Nov-17	403
Booster Connection		80	31-Jul-17	20-Nov-17	378
BOOST-ENGR-1000	Micropile & ERS Submittals & Fabrication	40	31-Jul-17	25-Sep-17	178
BOOST-ENGR-1100	Foundations & Concrete Submittals & Fabrication	40	31-Jul-17	25-Sep-17	218
BOOST-ENGR-1200	MEP Submittals & Coordination (BIM)	40	31-Jul-17	25-Sep-17	418
BOOST-ENGR-1300	OFCI Road Shielding Steel Submittals & Fabrication	80	31-Jul-17	20-Nov-17	283



Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary
High Bay, Linac Tunnel & Linac Gallery

Fermilab Proton Improvement Plan - II 18.04.27

HIGH BAY BUILDING, LINAC TUNNEL, LINAC GALLERY, BEAM TRANSFER LINE & BOOSTER CONNECTION

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Turner Fermilab

Gensler | Fermilab PIP II VE Report

Documentation can be found at PIP-II-doc-581 and in each Basis of Estimate file

Schedule – Analysis

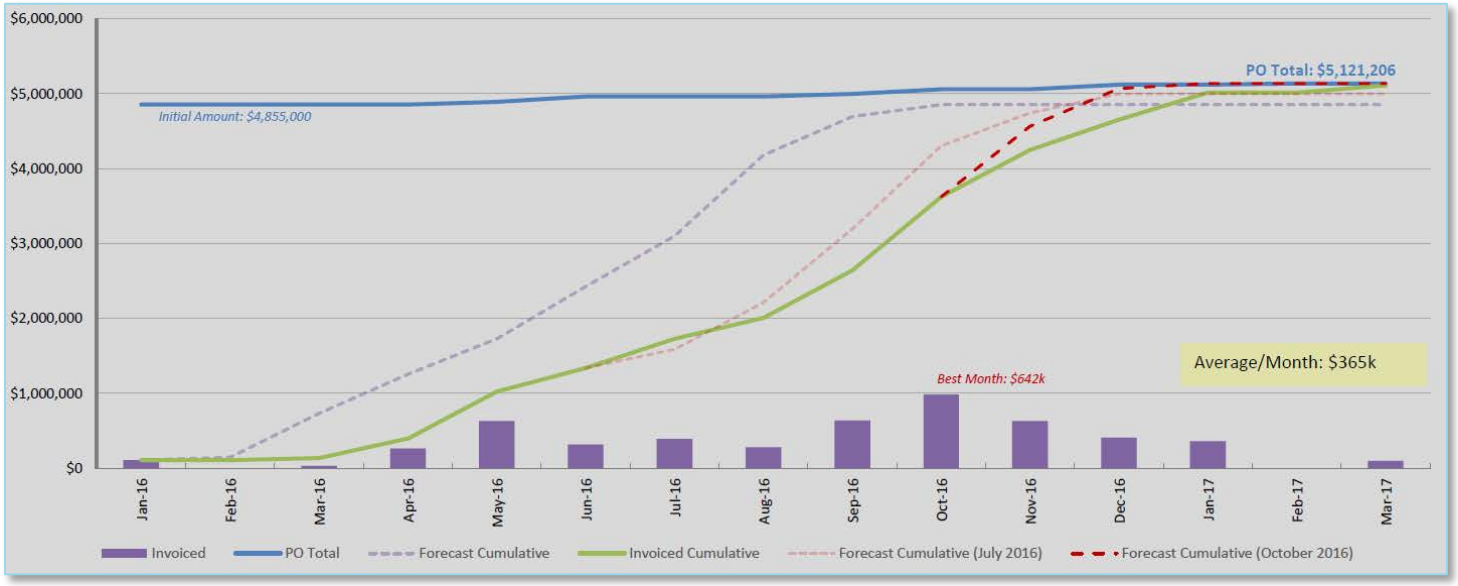
		Notice To Proceed		Start Construction		Authorization for Use and Possession		Final Acceptance	
		Date	Work Days from NTP	Date	Work Days from NTP	Date	Work Days from NTP	Date	Work Days from NTP
121.06.02	Site Preparation	1-Jun-17	0	31-Jul-17	43	30-Nov-18	392	3-Dec-18	393
121.06.02.03	*Site Work*	*1-Jun-17*	*0*	*1-Jul-17*	*22*	*1-May-18*	*239*	*1-Jun-18*	*262*
121.06.02.04	*Site Restoration and Landscaping*	*1-Jun-17*	*0*	*1-Jul-17*	*22*	*1-Dec-17*	*132*	*30-Dec-17*	*152*
121.06.03	Cryogenics Plant Building	1-Jun-17	0	31-Jul-17	43	24-Aug-18	322	19-Nov-18	383
121.06.04	Utility Plant	1-Jun-17	0	30-Jun-17	22	21-Mar-18	210	14-Jun-18	271
121.06.05	Linac Complex	1-Jun-17	0	31-Jul-17	43			2-Jul-19	544
	High Bay Building					*28-Aug-18*	*324*		
	Linac Tunnel					*31-Jul-18*	*304*		
	Linac Gallery					*28-Aug-18*	*324*		
	Beam Transfer Line					*23-Jan-19*	*430*		
121.06.06	Booster Connection	1-Jun-17	0	30-Jun-17	22	7-Aug-18	309	31-Oct-18	370

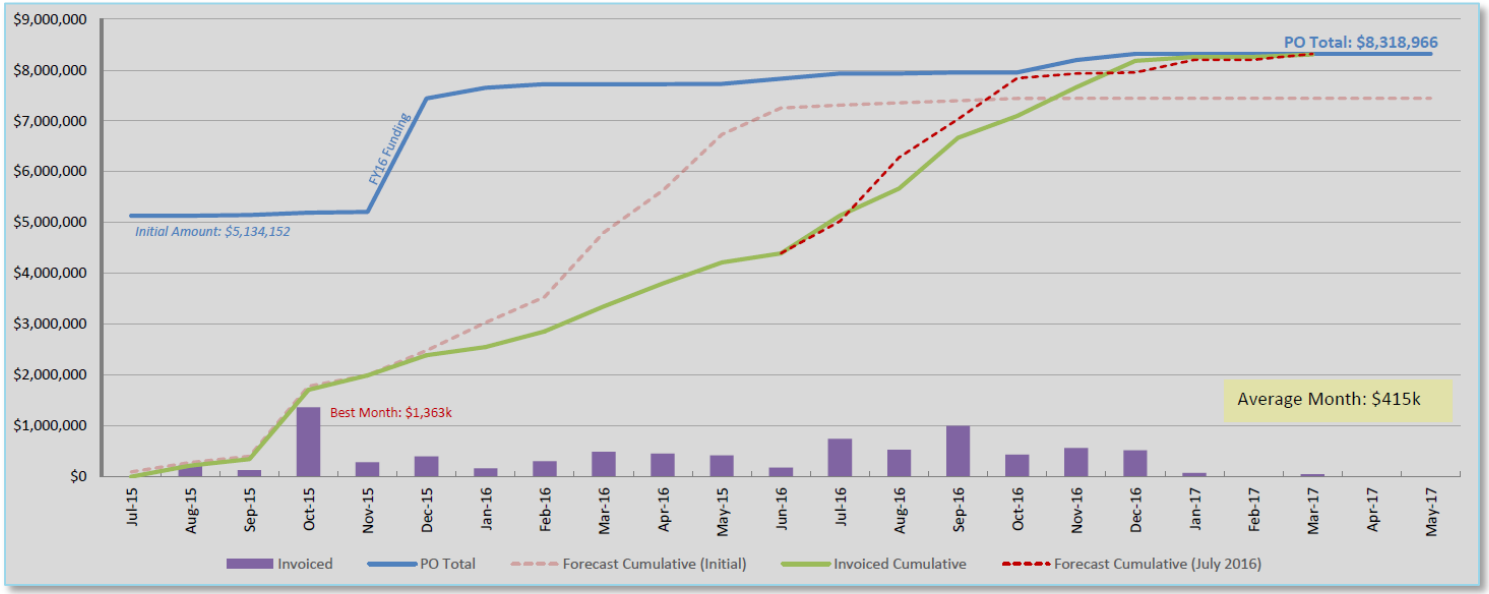
Based on 19MAY17 Schedule Information

Based on 04MAY18 Schedule Information

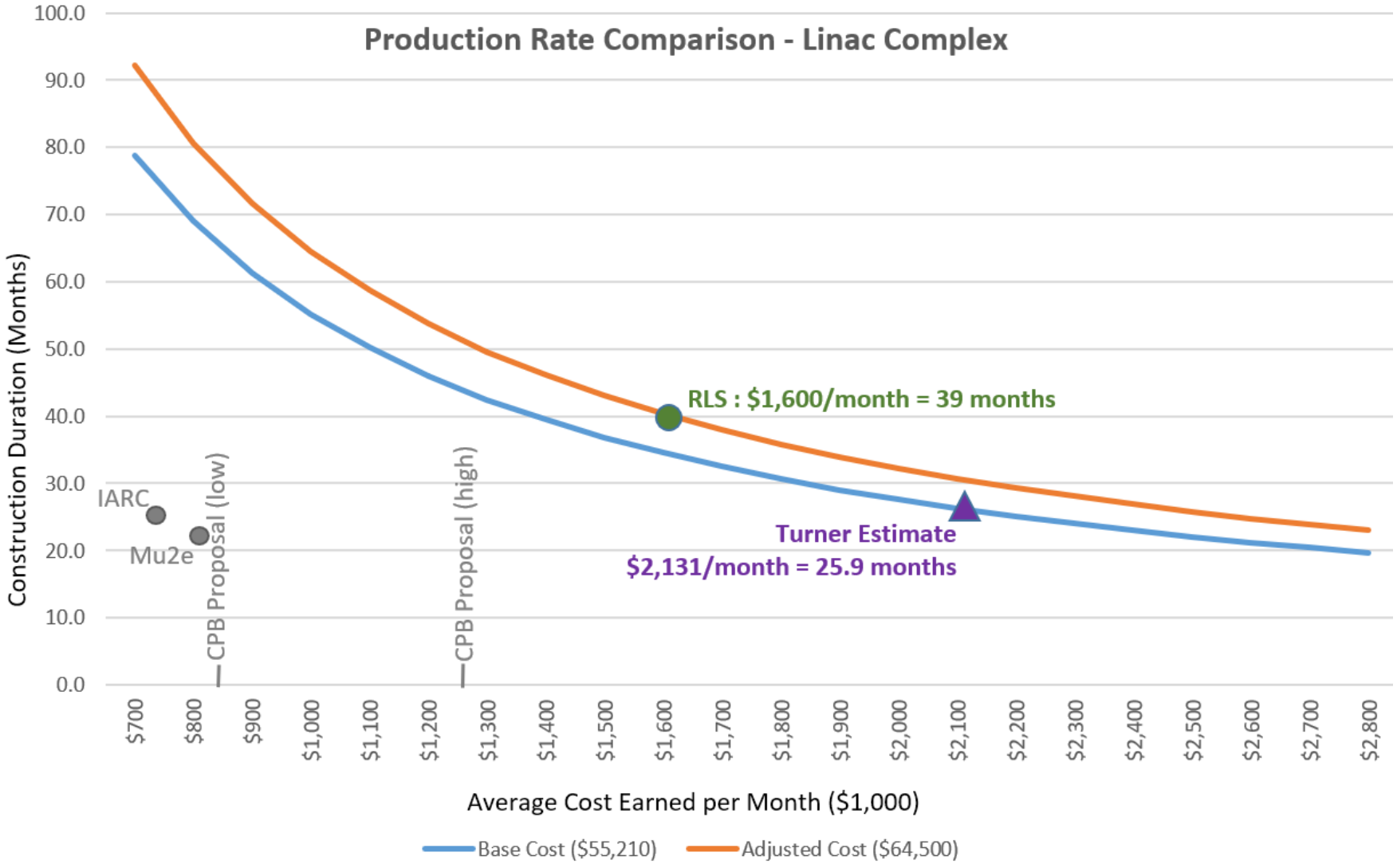
		Cost	Months	$ per Month
121.06.04	Utility Plant	$4,708,756	12.3	$382,261
121.06.05	Linac Complex	$55,209,561	25.9	$2,131,251
	High Bay Building			
	Linac Tunnel			
	Linac Gallery			
	Beam Transfer Line			
121.06.06	Booster Connection	$12,647,433	16.8	$752,010

Schedule – Historic Data

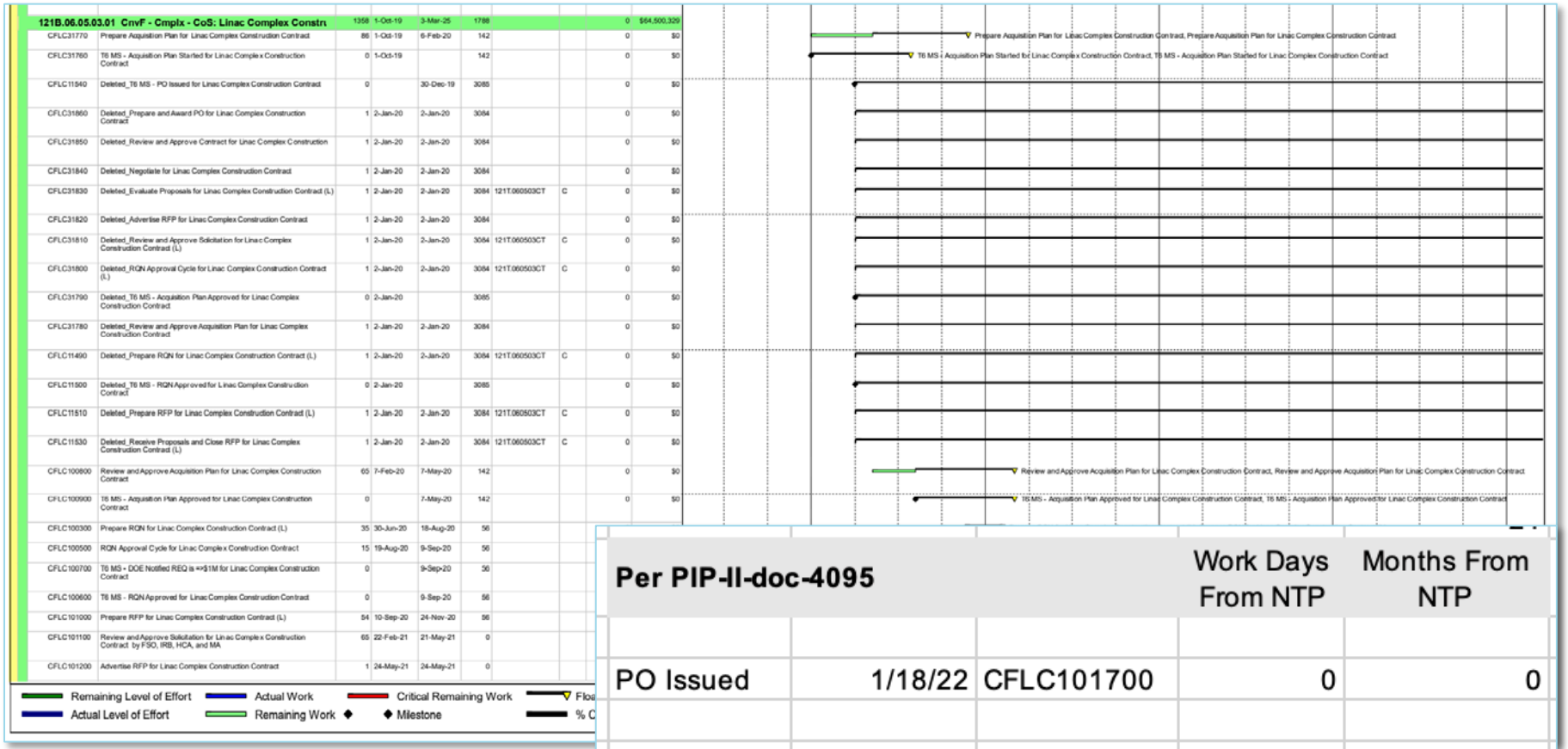




Schedule – Adjustments



Schedule – RLS



121B.06.05.03.01 CnvF - Cmplx - CoS: Linac Complex Constrn		1358	1-Oct-19	3-Mar-25	1788				0	$64,500,329
CFLC31770	Prepare Acquisition Plan for Linac Complex Construction Contract	86	1-Oct-19	6-Feb-20	142				0	$0
CFLC31760	T6 MS - Acquisition Plan Started for Linac Complex Construction Contract	0	1-Oct-19		142				0	$0
CFLC11540	Deleted_T6 MS - PO Issued for Linac Complex Construction Contract	0		30-Dec-19	3085				0	$0
CFLC31860	Deleted_Prepare and Award PO for Linac Complex Construction Contract	1	2-Jan-20	2-Jan-20	3084				0	$0
CFLC31850	Deleted_Review and Approve Contract for Linac Complex Construction	1	2-Jan-20	2-Jan-20	3084				0	$0
CFLC31840	Deleted_Negotiate for Linac Complex Construction Contract	1	2-Jan-20	2-Jan-20	3084				0	$0
CFLC31830	Deleted_Evaluate Proposals for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC31820	Deleted_Advertise RFP for Linac Complex Construction Contract	1	2-Jan-20	2-Jan-20	3084				0	$0
CFLC31810	Deleted_Review and Approve Solicitation for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC31800	Deleted_RQN Approval Cycle for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC31790	Deleted_T6 MS - Acquisition Plan Approved for Linac Complex Construction Contract	0	2-Jan-20		3085				0	$0
CFLC31780	Deleted_Review and Approve Acquisition Plan for Linac Complex Construction Contract	1	2-Jan-20	2-Jan-20	3084				0	$0
CFLC11490	Deleted_Prepare RQN for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC11500	Deleted_T6 MS - RQN Approved for Linac Complex Construction Contract	0	2-Jan-20		3085				0	$0
CFLC11510	Deleted_Prepare RFP for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC11530	Deleted_Receive Proposals and Close RFP for Linac Complex Construction Contract (L)	1	2-Jan-20	2-Jan-20	3084	121T.060503CT	C		0	$0
CFLC100800	Review and Approve Acquisition Plan for Linac Complex Construction Contract	65	7-Feb-20	7-May-20	142				0	$0
CFLC100900	T6 MS - Acquisition Plan Approved for Linac Complex Construction Contract	0		7-May-20	142				0	$0
CFLC100300	Prepare RQN for Linac Complex Construction Contract (L)	35	30-Jun-20	18-Aug-20	56					
CFLC100500	RQN Approval Cycle for Linac Complex Construction Contract	15	19-Aug-20	9-Sep-20	56					
CFLC100700	T6 MS - DOE Notified REQ is =>$1M for Linac Complex Construction Contract	0		9-Sep-20	56					
CFLC100600	T6 MS - RQN Approved for Linac Complex Construction Contract	0		9-Sep-20	56					
CFLC101000	Prepare RFP for Linac Complex Construction Contract (L)	54	10-Sep-20	24-Nov-20	56					
CFLC101100	Review and Approve Solicitation for Linac Complex Construction Contract by FSO, IRB, HCA, and MA	65	22-Feb-21	21-May-21	0					
CFLC101200	Advertise RFP for Linac Complex Construction Contract	1	24-May-21	24-May-21	0					

Per PIP-II-doc-4095			Work Days From NTP	Months From NTP
PO Issued	1/18/22	CFLC101700	0	0
BO HBB	5/3/24		599	28.5
BO LT	11/21/23		481	22.9
BO LG	9/5/24		688	32.8
BTL Ready	7/8/24		645	30.7
Complete	3/3/25	CFLC102300	815	38.8

Schedule – Update Plan

PRELIMINARY

		Turner	Cumming
121.06.04	Utility Plant	*in progress*	16 Months
121.06.05	Linac Complex	*in progress*	40 Months
121.06.06	Booster Connection	*in progress*	22 Months

- Site Preparation (121.06.02) and Cryogenics Plant Building (121.06.03) not included in table above
- Reconciliation Required: Still require discussions about production rate from Turner

Documents

- PIP-II-doc-2492 - Functional Requirements Specification
- PIP-II-doc-2492 – Technical Requirements Specification
- PIP-II-doc-2118 – WBS 121.06.05.01 Basis of Estimate
- PIP-II-doc-2121 – WBS 121.06.05.02 Basis of Estimate
- PIP-II-doc-2124 – WBS 121.06.05.03 Basis of Estimate
- PIP-II-doc-4518 – Conceptual Design Documents

End