

121.2, 121.3.1, 121.3.2: Project Management, Linac Project Management, Accelerator Physics

Project Management Breakout

Steve Holmes

PIP-II Director's Review

10-12 October 2017

In partnership with:

India Institutes Fermilab Collaboration

Istituto Nazionale di Fisica Nucleare

Science and Technology Facilities Council

Outline

- Scope & Requirements
- Deliverables
- Organization/Interfaces
- Progress to Date
- Risk
- Cost
- Schedule
- Summary

Project Management Plan (Draft): PIP-II-doc-172

Scope and Requirements

- Project Management (WBS 121.2)
 - Responsible for executing and managing the PIP-II Project to the approved scope, cost, and schedule
 - Conform with requirements of DOE413.3b
 - Provide a safe working environment for all project participants and minimize environmental impacts
 - Coordinate with external stakeholders
- Linac Project Management (WBS 121.3.1)
 - Coordinate Level 3 linac activities
- Accelerator Physics (WBS 121.3.2)
 - Establish and control the configuration of the PIP-II accelerators
- L3 Management (WBS 121.3.X.2)
 - Note: All L3 activities have a management and coordination task assigned at L4

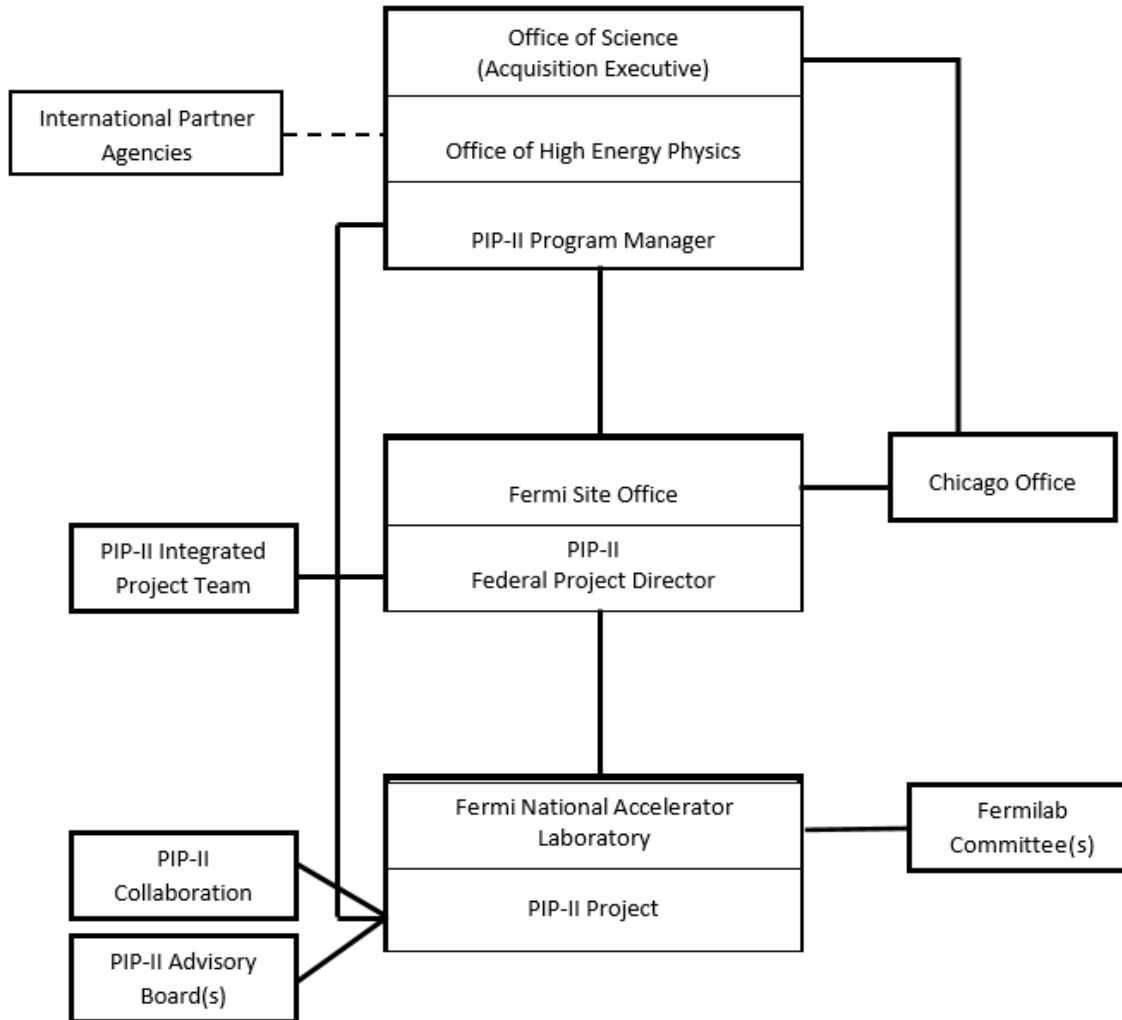
Project Management Deliverables

- Project Management (WBS 121.2)
 - KPPs
 - Project Office
 - Coordination of L2, L3, and CAMs
 - Resource planning
 - Configuration control
 - Systems engineering/integration
 - ESH and QA coordination
 - Risk Management
 - Monthly Reporting
 - Primary interface to DOE/HEP and Fermilab management
 - Coordination with external collaborators
- Linac Project Management (WBS 121.3.1)
 - Installed & commissioned accelerator
- Accelerator Physics (WBS 121.3.2)
 - Design Reports (conceptual, technical)
 - Complete set of Functional Requirements Specifications
 - Accelerator configuration management
 - Technical Board

Organization and Interfaces

Charge #1

PIP-II Project Management Organization



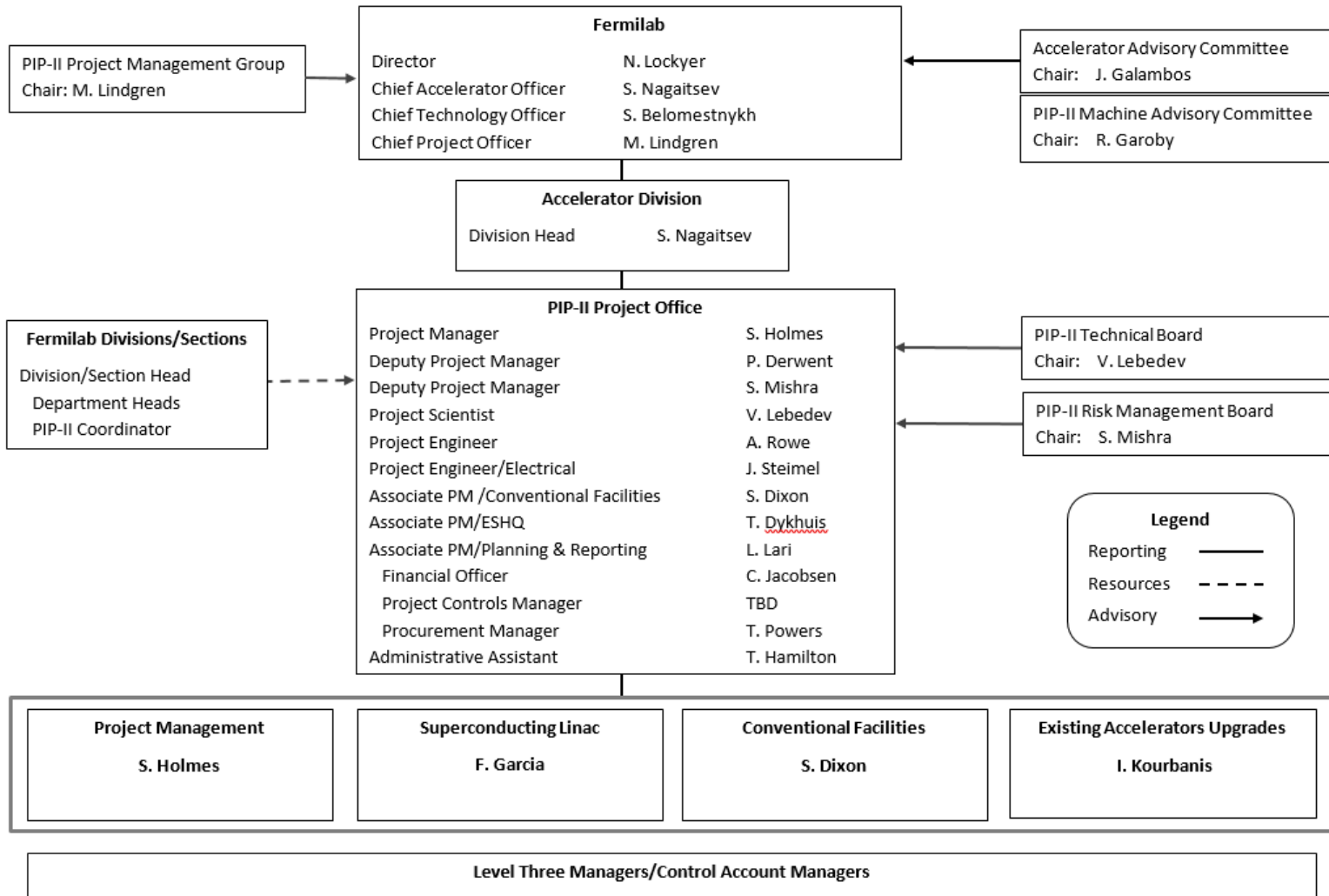
PIP-II: DOE/SC Project

- HEP responsible for funding and oversight
- Fermilab responsible for execution
- IPT responsible for coordination

PIP-II-doc#172

Organization and Interfaces

Charge #1



PIP-II-doc#172

Progress to date

- Organization provides high-level oversight of all key project aspects:
 - Project Scientist
 - Project Engineer(s)
 - Associate PMs for
 - Conventional Facilities
 - ESH&Q
 - Planning and Reporting
- High level positions filled with the exception of Project Controls Manager
- Team has successfully:
 - Transitioned from R&D to R&D + project activities
 - Completed the Analysis of Alternatives report and developed a Conceptual Design Report based on the preferred alternative
 - Organized and developed CD-1 deliverables
 - Managed the India Institutions and Fermilab Collaboration (IIFC)
 - Engaged INFN, STFC, and CEA
 - Coordinated interactions with national partner institutions
- CD-1 cost estimate based on the current organization chart
 - We expect to modify the organization post-CD-1 in order provide more effective alignment with project goals (see Holmes/Plenary)

Design Review Plan

- PIP-II Machine Advisory Committee (P2MAC)
 - Chartered to provide advice to the Directorate on PIP-II technical design and development activities
 - Meets annually and reports to the Fermilab Director through the Chief Accelerator Officer
 - CAO provides the charge for each meeting
 - Project Scientist develops the meeting agenda
 - Closeout followed by written report
 - April 2017 meeting reviewed the Conceptual Design suitability for CD-1:
“As it stands, the conceptual design is supported by convincing results of studies and experimental tests that provide a sound technical basis for CD-1.”
 - Full report at PIP-II-doc-605
- Engineering reviews
 - Engineering design reviews are the responsibility of the Project Engineer(s)
 - The requirements are outlined in the Fermilab Engineering Manual
FRS/TRS → PDR → FDR → PRR → ORC
 - Requirements are applied to international partners

ESH&Q

Charge #4

- Responsibility of the Associate Project Manager for ESH&Q
 - ESH&Q professional with more than a decade of experience at Fermilab
 - Expertise in NEPA
 - All CD-1 requirements met
 - NEPA strategy in place
 - Preparing for CD-2
 - More details in T. Dykhuis presentation

Risk: PIP-II Enterprise Risk

Top Five Enterprise Risks

- Increase in Laboratory Overhead Rate - Large Procurements
- Delay in access to SRF testing and fabrication infrastructure
- Failure of SRF cavity processing equipment
- Cryogenic plant Failure
- Major Accident/Incident on Fermilab Site

Title	Probability	Probability Score	P * Impact (k\$)	P * Impact (months)	Impact Score - Cost	Impact Score - Schedule	Risk Rank
Increase in Laboratory Overhead Rate - Large Procurements	75.00%	5 (VH)	4,050	0.0	3 (H)	0 (N)	3 (High)
Delay in access to SRF testing and fabrication infrastructure	50.00%	4 (H)	317	3.8	2 (M)	3 (H)	3 (High)
Failure of SRF cavity processing equipment	10.00%	2 (L)	20	0.4	2 (M)	2 (M)	2 (Medium)
Cryoplant Failure	15.00%	2 (L)	94	0.9	2 (M)	2 (M)	2 (Medium)
Major Accident/Incident on Fermilab Site	10.00%	2 (L)	0	0.1	0 (N)	1 (L)	1 (Low)

Risk: Project Management

Top five Project Management risks:

- Insufficient Scientific, engineering and technical human resources including T&M
- Delay in Transition from R&D to Operations Funding
- Assumed R&D funding profile not achieved
- NEPA approval is delayed
- Effect of US Continuing Resolution

Title	Probability	Probability Score	P * Impact (k\$)	P * Impact (months)	Impact Score - Cost	Impact Score - Schedul	Risk Rank
Insufficient Scientific, engineering and technical human resources including T&M	50.00%	4 (H)	1,500	4.8	2 (M)	3 (H)	3 (High)
Delay in Transition from R&D to Operations Funding	50.00%	4 (H)	1,500	3.5	2 (M)	3 (H)	3 (High)
Assumed R&D funding profile not achieved	50.00%	4 (H)	0	8.0	0 (N)	3 (H)	3 (High)
NEPA approval is delayed	50.00%	4 (H)	50	3.0	1 (L)	2 (M)	3 (High)
Effect of US Continuing Resolution	50.00%	4 (H)	0	2.0	0 (N)	2 (M)	3 (High)

BOE Summary

Charge #2

WBS Number	Title	Docdb #
121.2	Project Management	229
121.3.1.2	Linac Project Management	1019
121.3.2.2	AP PM & Coord	887
121.3.2.3-7	AP Support for PIP-II	890

Cost Summary

- Cost estimate based on org chart displayed on slide 6
- Labor activity is all level-of-effort (LOE)
 - Covers period Q1FY18 to Q3FY26 (8.5 years)
 - Project Management (121.2): 133 FTE-years
 - Linac Project Management (121.3.1): 8 FTE-years
 - Accelerator Physics (121.3.2): 11 FTE-years
- M&S is dominated by travel and import duties
 - Conference travel \$0.4M
 - 10 domestic and 6 foreign conferences/year
 - International collaboration travel \$0.3M
 - 5 trips/year up to CD-2, 8 trips/year after
 - (Note: This is for collaboration meetings only. Additional int'l travel is found in individual L3s)
 - International short-term visitor support \$0.5M
 - 2 short term visitors continuously over project duration
 - Import duties on international contributions \$2.2M
 - 2.6% x \$86M (estimated value of int'l deliverables)
 - Environmental Assessment \$0.2M

Cost Summary/Project Management

Charge #2

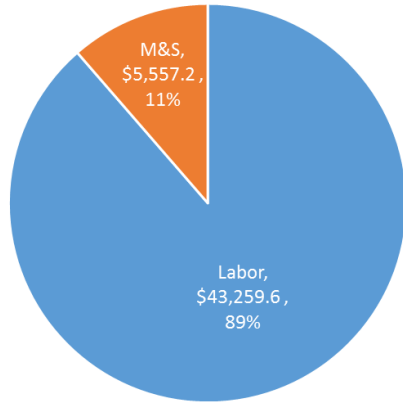
WBS Element	Hours	Labor (\$000)	M&S (\$000)	Est. Uncertainty (\$000)		Total Cost Incl. Uncrty.
	P6 Hours	P6 Base Cost	P6 Base Cost	Total	% of Base	
121.2 - PIP-II - Project Management						
121.2.2 - PM - Fermilab & USA Coordination (Fermi&USACoord)	83,317	\$ 15,379.8	\$ 729.8	\$ 73.0	0.5%	\$ 16,182.6
121.2.3 - PM - International Coordination (IntCoord)	7,381	\$ 2,029.3	\$ 4,229.1	\$ 1,251.7	20.0%	\$ 7,510.2
121.2.4 - PM - Business Office (BO)	107,337	\$ 19,766.1	\$ 275.2	\$ 1,978.7	9.9%	\$ 22,020.0
121.2.5 - PM - Environmental Safety, Health & Quality (ESH&Q)	7,514	\$ -	\$ 323.0	\$ 96.9	30.0%	\$ 420.0
121.2.6 - PM - System Engineering & Electrical and Mechanical Integration (SE&EMI)	22,011	\$ 4,787.0	\$ -	\$ 957.4	20.0%	\$ 5,744.4
121.2.7 - PM - Conventional Facilities Management (CF)	6,011	\$ 1,297.3	\$ -	\$ -	0.0%	\$ 1,297.3
Grand Total	233,571	\$ 43,259.6	\$ 5,557.2	\$ 4,357.7	8.9%	\$ 53,174.4
Note: P6 base cost = BOE + overheads and escalation						

- Costs generated from resource loaded schedule
- Overall contingency is small (9%) because this activity is dominated by LOE and can be managed to a nearly fixed budget.

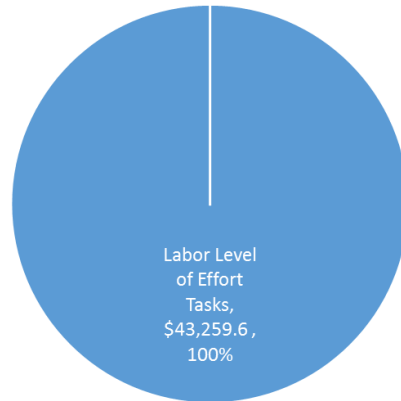
Cost Drivers and Estimate Maturity

Charge #2

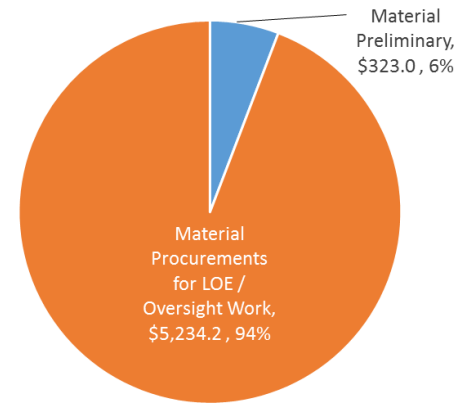
Cost Distribution - P6 Base Cost



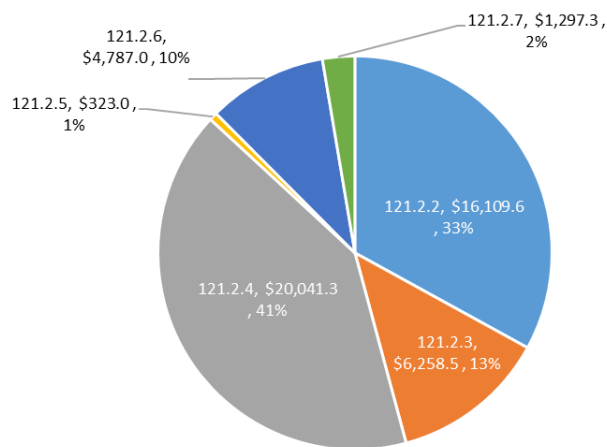
Labor Cost Distribution - P6 Base Cost



M&S Cost Distribution - P6 Base Cost



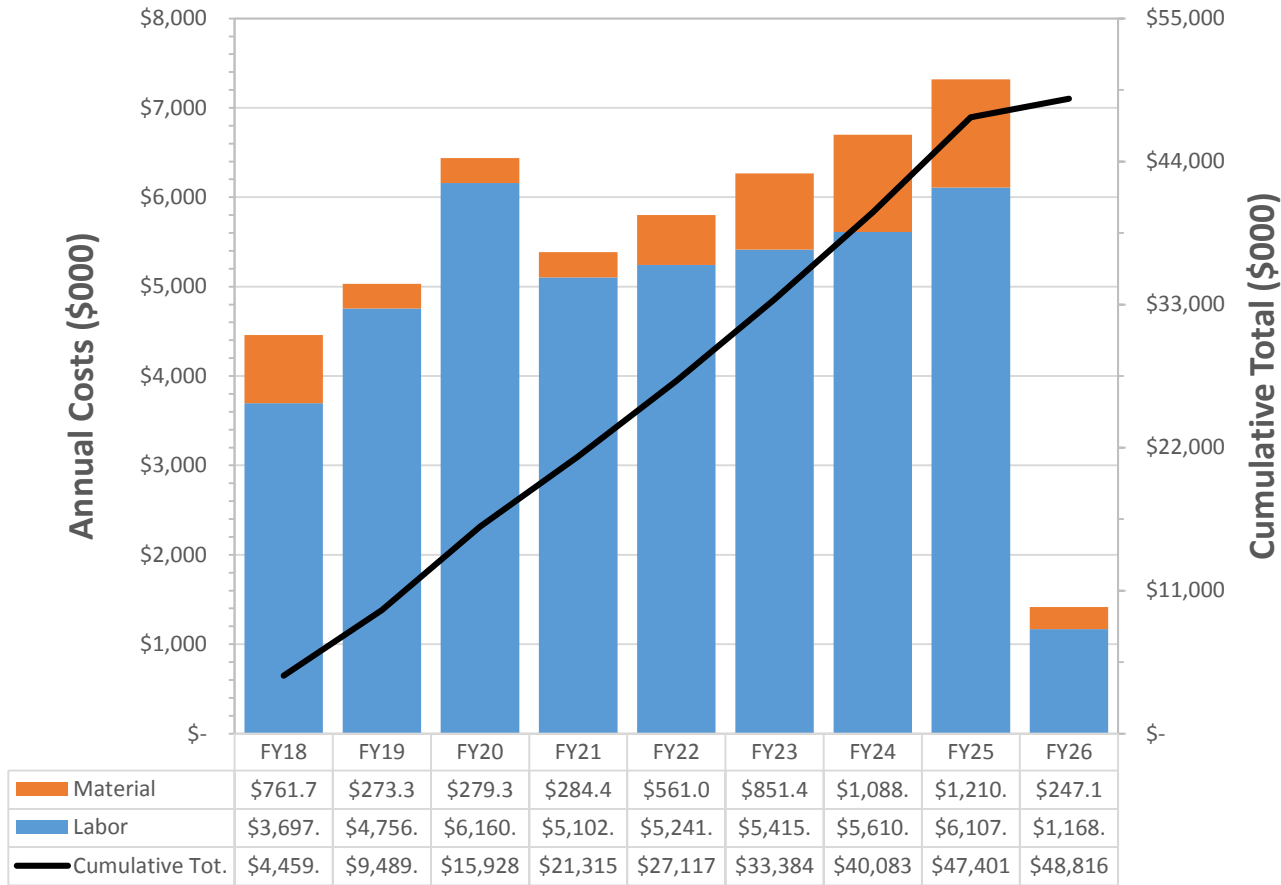
Level 3 Cost Distribution - P6 Base Cost



- Dominated by Labor (LOE)
- M&S dominated by import duties and travel
 - 20% estimate uncertainty assigned to import duties
 - 10% estimate uncertainty assigned to travel

Cost Profile – P6 Base Cost Only

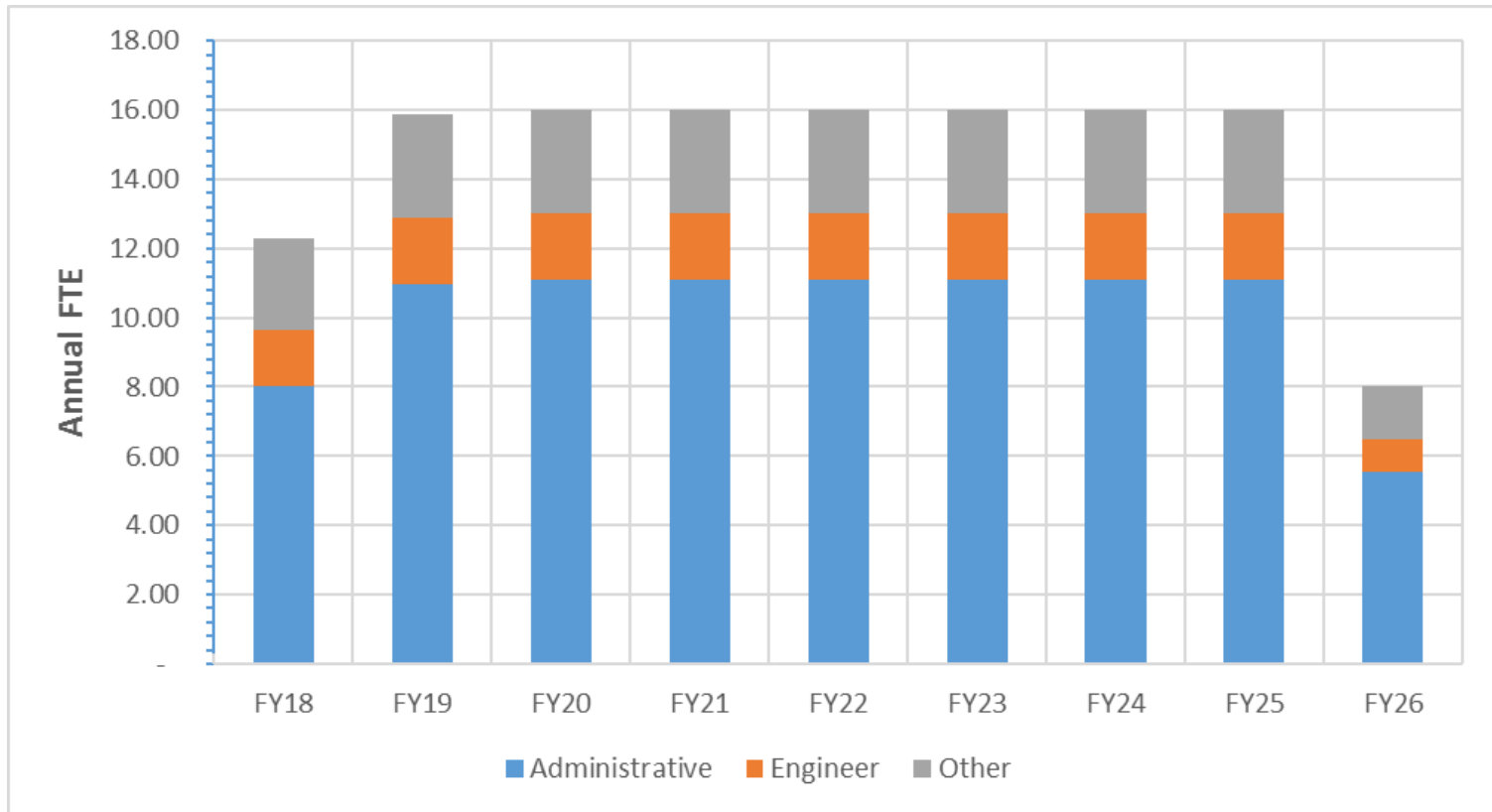
Charge #2



- Note: Assumes project completion in 2026
 - Standing army associated with these tasks is ~16 FTE

Labor Profile – P6 Hours/FTE

Charge #2



- Essentially all required labor for FY18 is currently on-board
- Modest build-up required in FY19-20
 - Primarily project controls staff

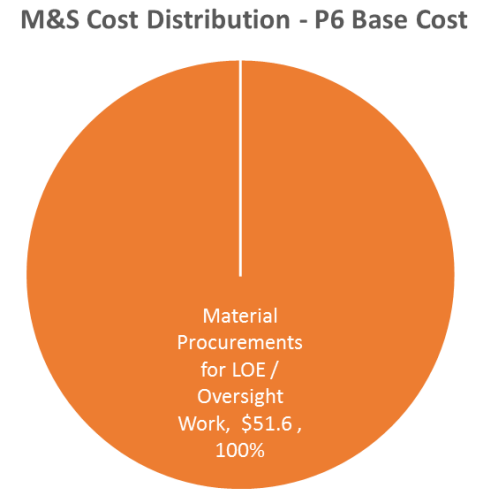
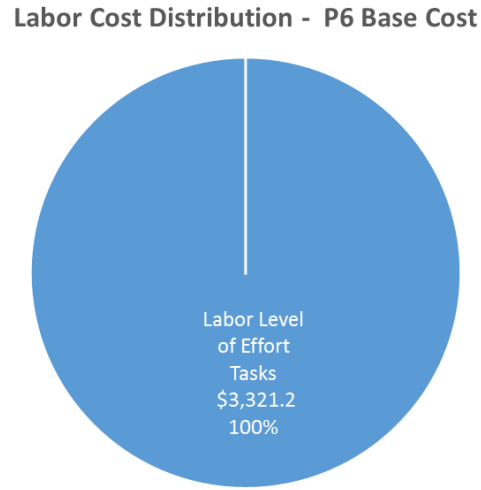
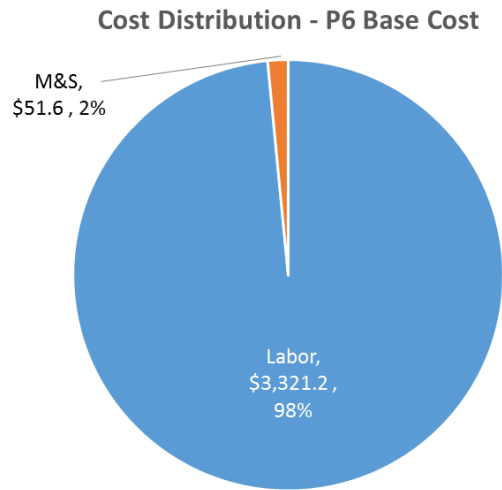
Cost Summary/Linac Proj Man

Charge #2

WBS Element	Hours	Labor (\$000)	M&S (\$000)	Est. Uncertainty (\$000)		Total Cost Incl. Uncrty.
	P6 Hours	P6 Base Cost	P6 Base Cost	Total	% of Base	
121.3.1 - Linac - Project Management (PM)						
121.3.1.2 - Linac - PM - Project Management & Coordination	14,940	\$ 3,321.2	\$ 51.6	\$ 337.3	10.0%	\$ 3,710.1
Grand Total	14,940	\$ 3,321.2	\$ 51.6	\$ 337.3	10.0%	\$ 3,710.1
Note: P6 base cost = BOE + overheads and escalation						

Cost Drivers and Estimate Maturity

Charge #2

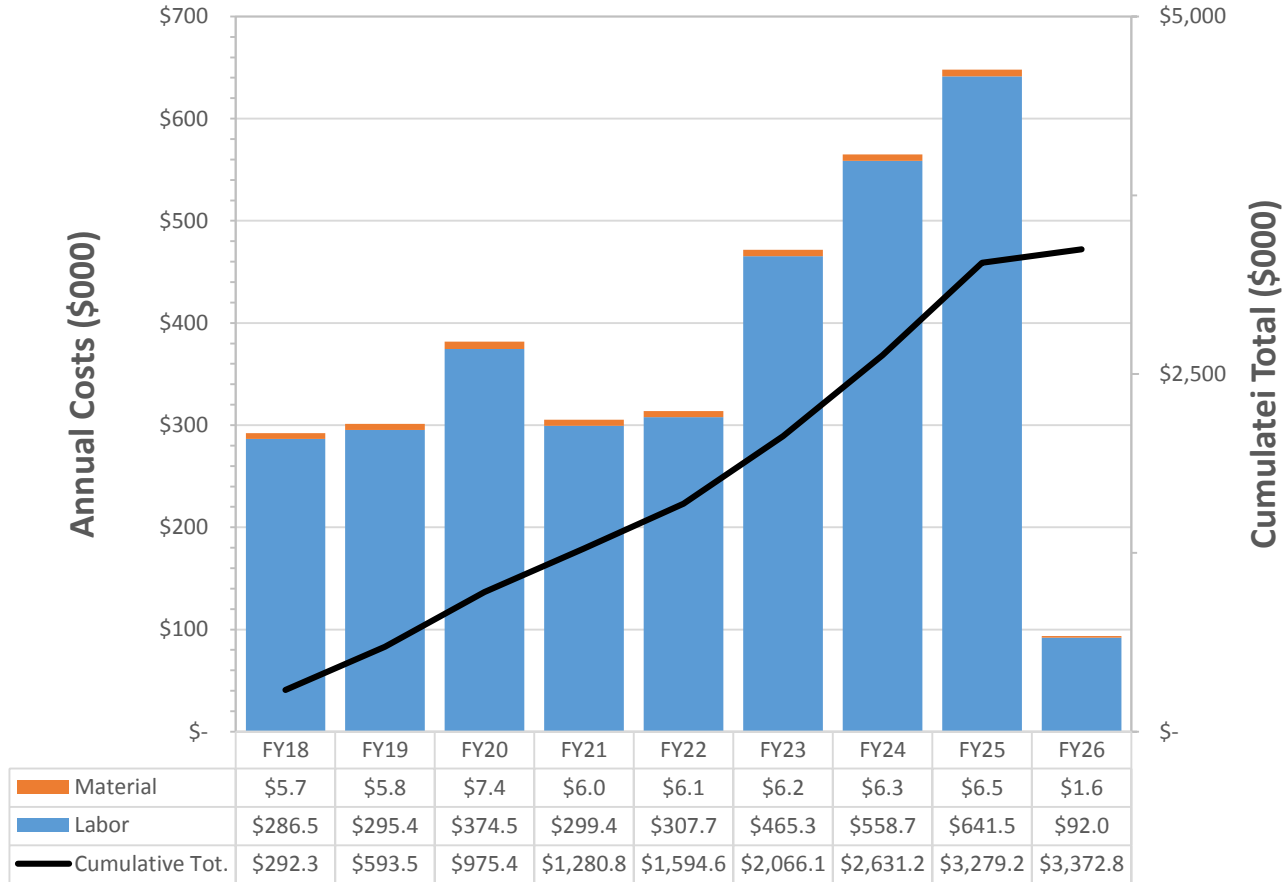


P6 Base Costs = BOE + Overheads + Escalation

- Essentially all LOE

Cost Profile – P6 Base Cost Only

Charge #2

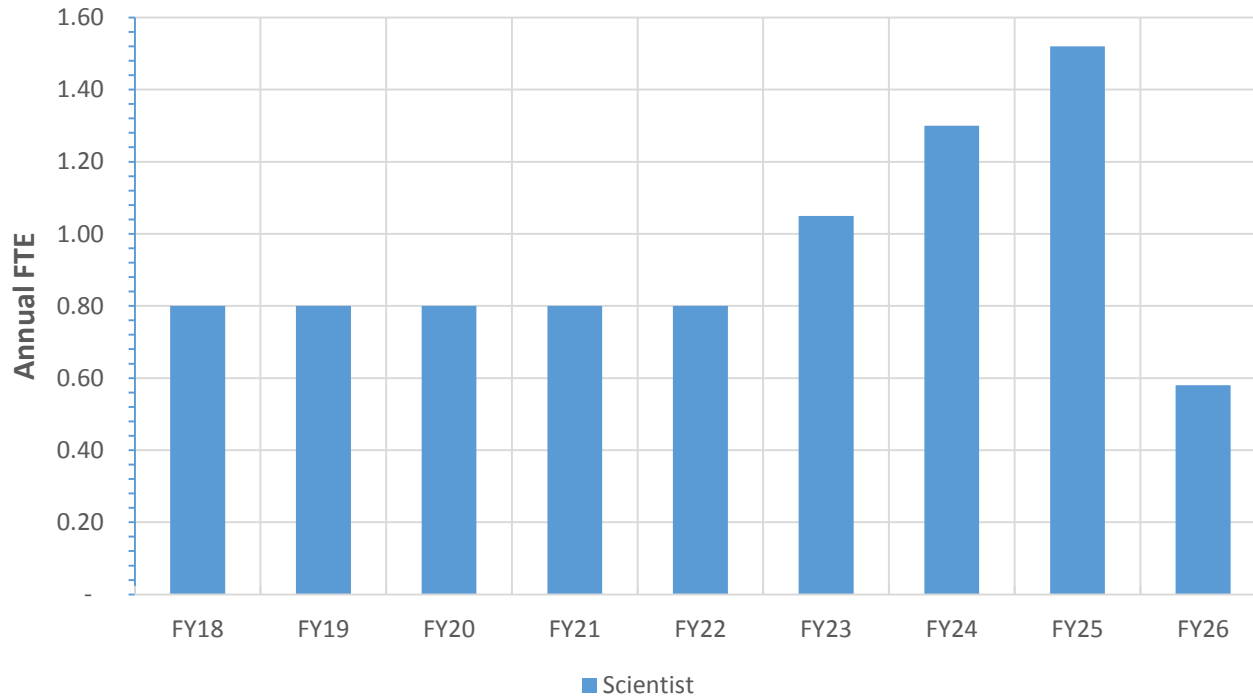


P6 Base Costs = BOE + Overheads + Escalation

Build up is preparation and coordination of commissioning

Labor Profile – P6 Hours/FTE

Charge #2



Cost Summary/Accelerator Physics

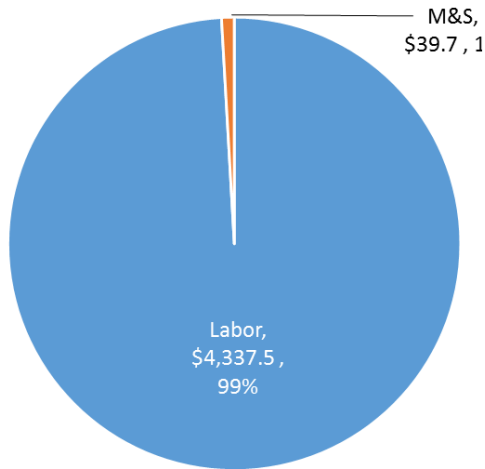
Charge #2

WBS Element	Hours	Labor (\$000)	M&S (\$000)	Est. Uncertainty (\$000)		Total Cost
	P6 Hours	P6 Base Cost	P6 Base Cost	Total	% of Base	Incl. Uncrty.
121.3.2 - Linac - Accelerator Physics (AP)						
121.3.2.2 - Linac - AP - Project Management & Coordination	7,514	\$ 1,648.3	\$ 19.4	\$ 168.7	10.1%	\$ 1,836.4
121.3.2.3 - Linac - AP - Accelerator Physics Studies for CD-1 documentation	442	\$ 89.6	\$ -	\$ 17.9	20.0%	\$ 107.5
121.3.2.4 - Linac - AP - Accelerator Physics Studies for TDR and CD-2 documentation	884	\$ 179.8	\$ -	\$ 36.0	20.0%	\$ 215.7
121.3.2.5 - Linac - AP - Beam Physics Studies at PIP2IT	2,652	\$ 553.3	\$ 7.0	\$ 112.1	20.0%	\$ 672.4
121.3.2.6 - Linac - AP - High Level Software Development	5,304	\$ 1,217.4	\$ 13.2	\$ 246.1	20.0%	\$ 1,476.7
121.3.2.7 - Linac - AP - Beam Physics Support to Beam Commissioning	<u>2,652</u>	<u>\$ 649.3</u>	<u>\$ -</u>	<u>\$ 129.9</u>	<u>20.0%</u>	<u>\$ 779.1</u>
121.3.2.7 - Linac - AP - Beam Physics Support to Beam Commissioning	19,448	\$ 4,337.5	\$ 39.7	\$ 710.6	16.2%	\$ 5,087.8

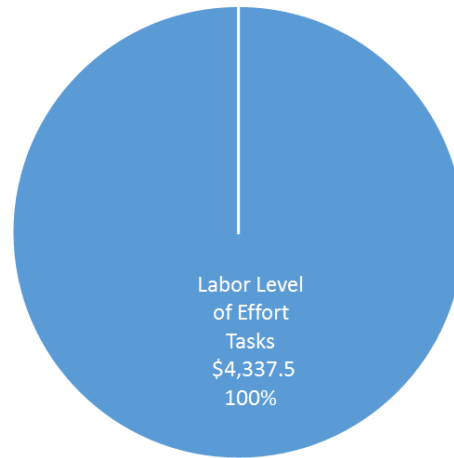
Cost Drivers and Estimate Maturity

Charge #2

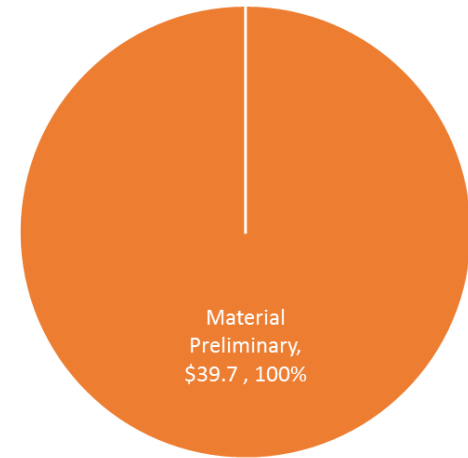
Cost Distribution - P6 Base Cost



Labor Cost Distribution - P6 Base Cost



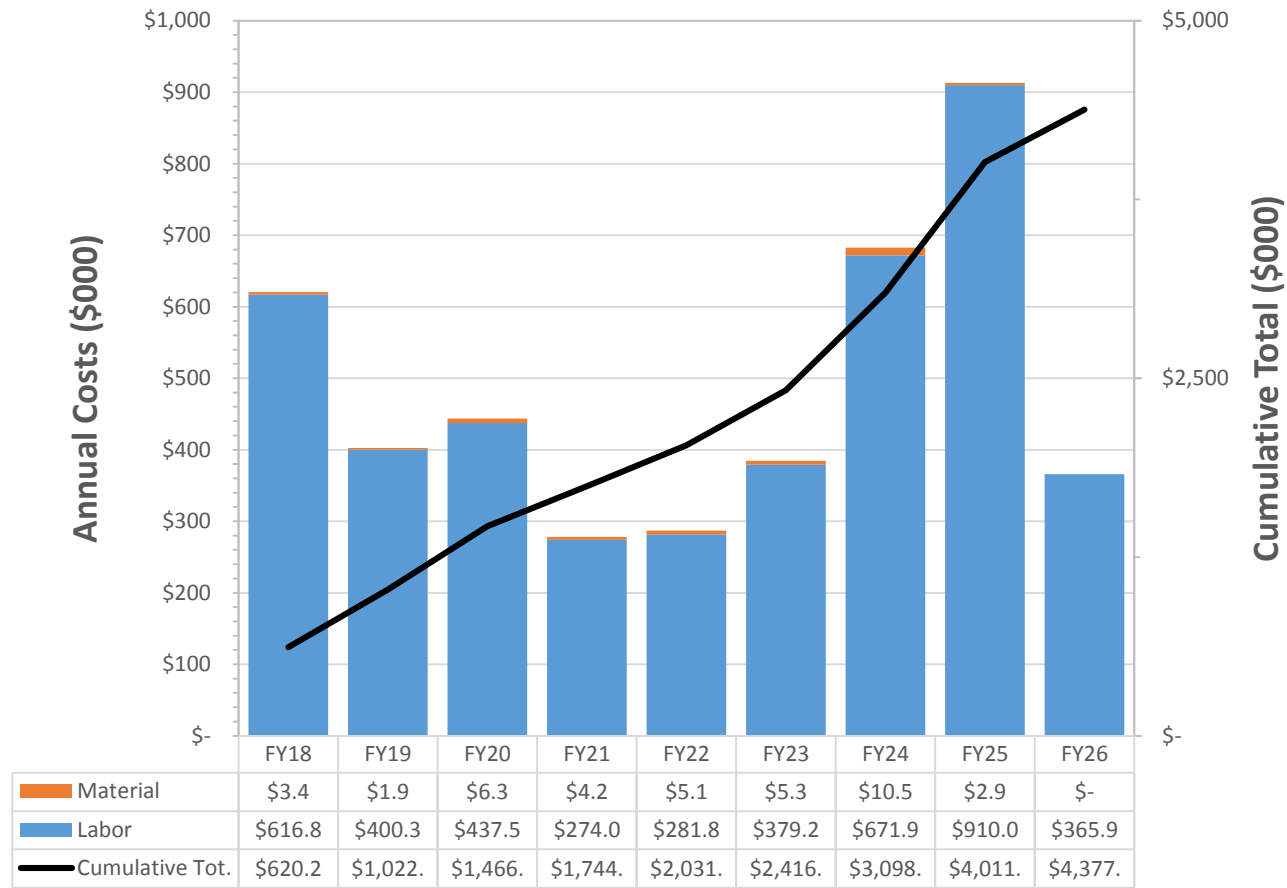
M&S Cost Distribution - P6 Base Cost



P6 Base Costs = BOE + Overheads + Escalation

Cost Profile – P6 Base Cost Only

Charge #2

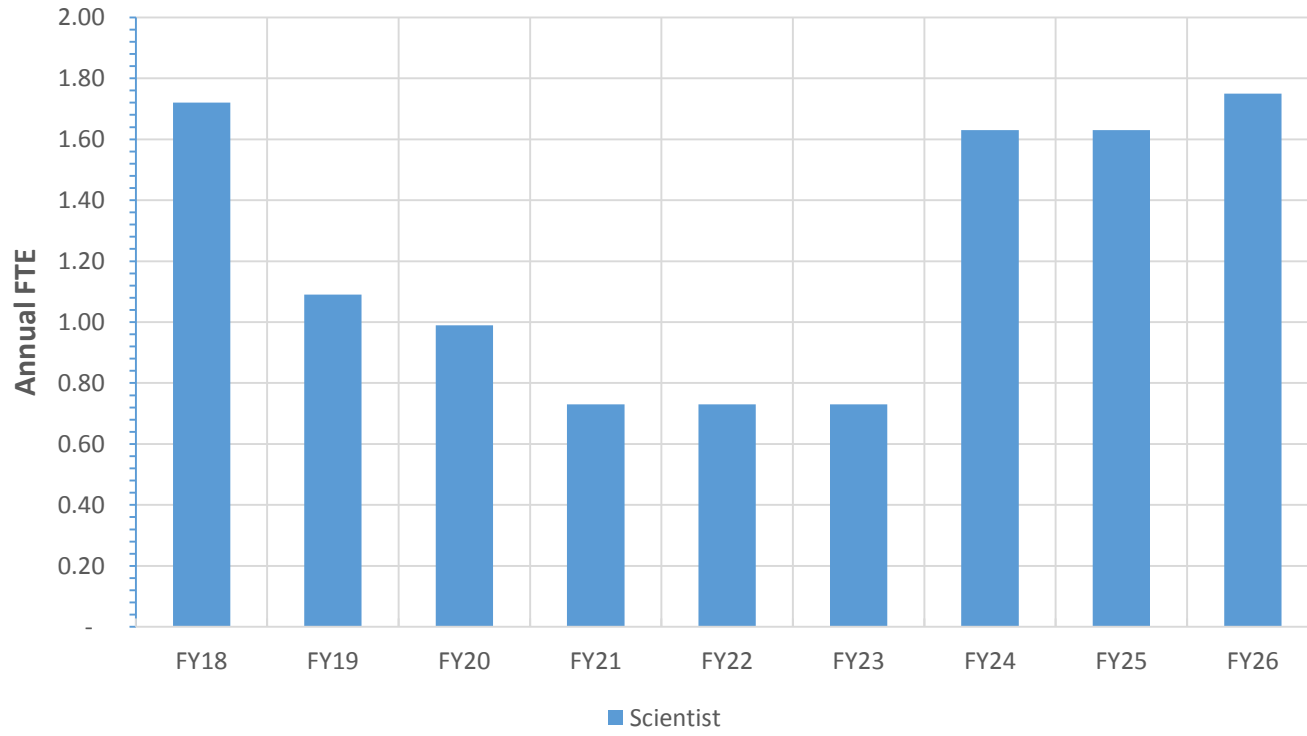


P6 Base Costs = BOE + Overheads + Escalation



Labor Profile – P6 Hours/FTE

Charge #2



End buildup is preparation for commissioning

Schedule – PIP-II Project Management

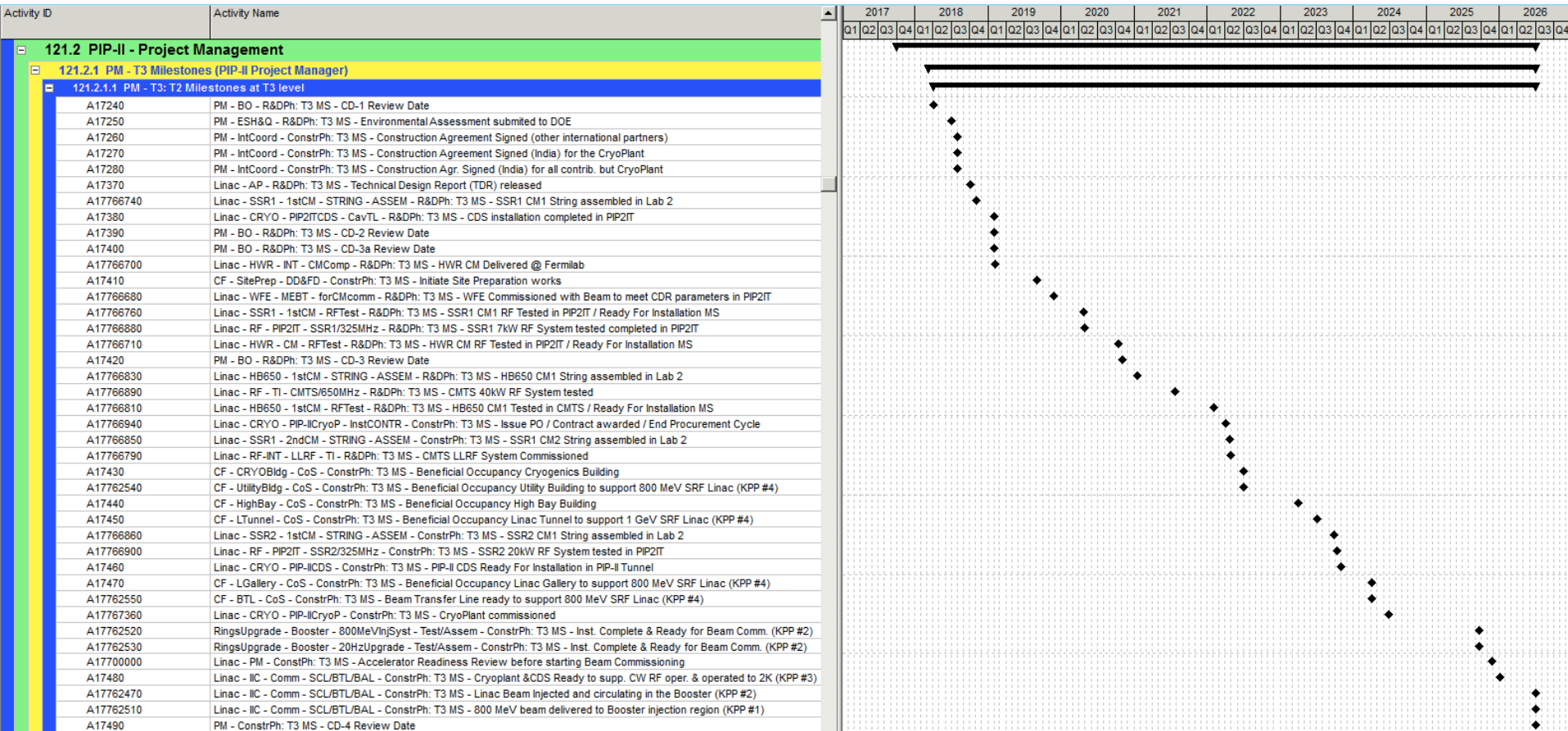
Charge #2

- [-] **121.2 PIP-II - Project Management**
 - [-] **121.2.1 PM - T3 Milestones (PIP-II Project Manager)**
 - [+] 121.2.1.1 PM - T3: T2 Milestones at T3 level
 - [+] 121.2.1.2 PM - T3: Review dates before CDs
 - [+] 121.2.1.3 PM - T3: Ready For Installation (RFI) Milestones
 - [+] 121.2.2 PM - Fermilab & USA Coordination (Fermi&USACoord)
 - [+] 121.2.3 PM - International Coordination (IntCoord)
 - [+] 121.2.4 PM - Business Office (BO)
 - [+] 121.2.5 PM - Environmental Safety, Health & Quality (ESH&Q)
 - [+] 121.2.6 PM - System Engineering & Electrical and Mechanical Integration (SE&EMI)
 - [+] 121.2.7 PM - Conventional Facilities Management (CF)

- T3 Milestones belong to Project Manager
 - Reside in 121.2.1
 - Three flavors

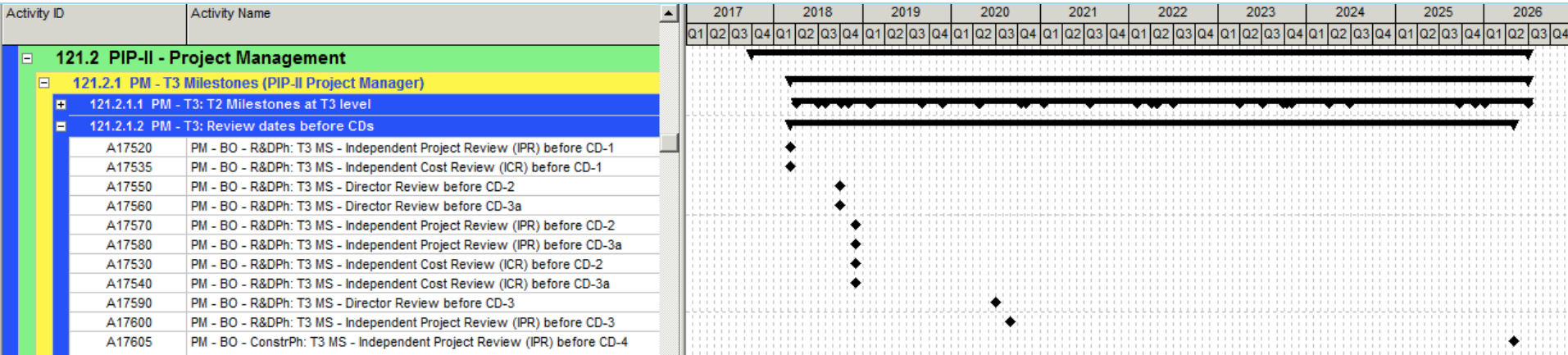
Schedule – T2 MS @ T3 Level

Charge #2



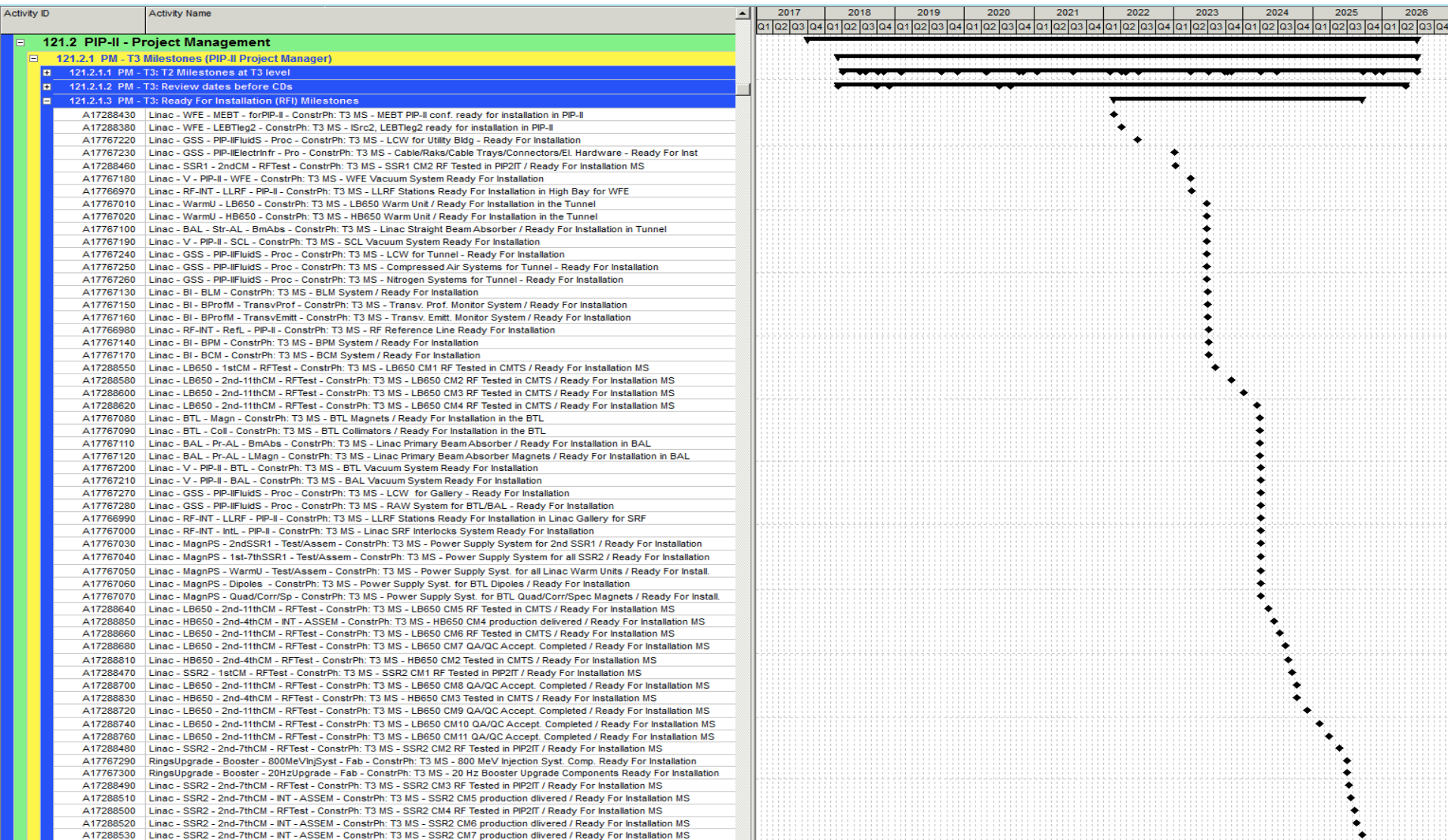
Schedule – T3 Review Date before CDs

Charge #2



Schedule – T3 Ready For Installation

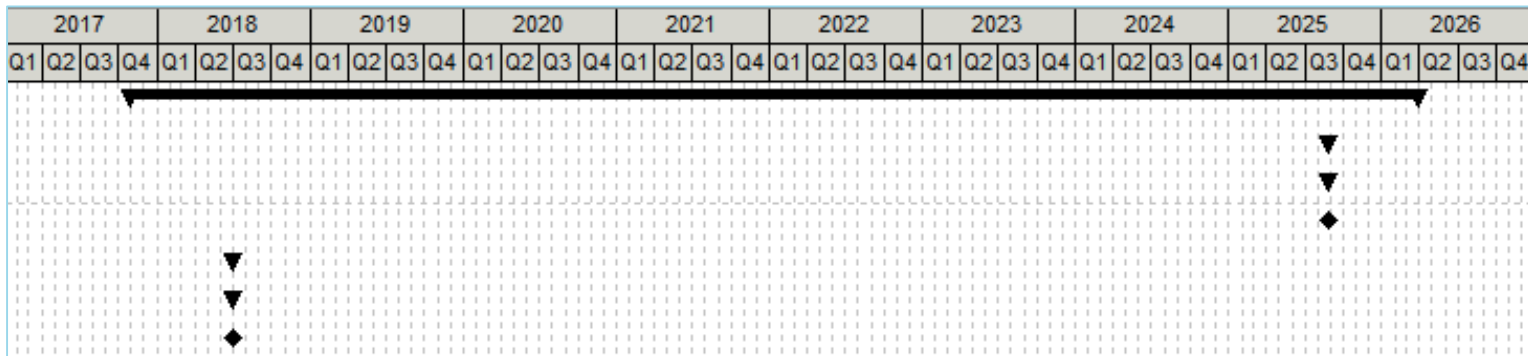
Charge #2



Schedule – Linac PM and Accelerator Physics

Charge #2

Activity ID	Activity Name
[-] 121.3 PIP-II - Linac	
[-] 121.3.1 Linac - Project Management (PM)	
[-] 121.3.1.1 Linac - PM - T4 Milestones	
A17698	Linac - PM - ConstPh: T4 MS - Early Accelerator Readiness Review before starting Beam Commissioning
[-] 121.3.2 Linac - Accelerator Physics (AP)	
[-] 121.3.2.1 Linac - AP - T4 Milestones	
A1720240	Linac - AP - R&DPh: T4 MS - Early Technical Design Report (TDR) released



Summary

- Project Management tasks are well-defined
 - Based on (current) project organization chart
 - Nearly all positions filled
 - Modest adjustments to org chart & WBS anticipated after CD-1
- Project Team is well-qualified to deliver this project
 - Many years experience in accelerator development, operations, and projects
- Groundwork is being laid for CD-2 and we are ready to move forward following CD-1

Thank you for your attention