



Conventional Facilities (WBS 121.06)

Steve Dixon

PIP-II Independent Project Review

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
- Design Review Plan
- Technical Progress to Date
- Organization
- Steps to CD-2
- ESH&Q
- Risks and Mitigations
- Responses to CD-1 recommendations
- Breakout Session topics
- 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;
 - 2014 CD-4
 - 2015 U.S. DOE Secretary's Award for Excellence
 - General Plant Project Manager for 15+ years
 - Short Baseline Neutrino (SBN) Near Detector Building;
 - Short Baseline Neutrino (SBN) Far Detector Building;
 - Experimental Operations Center;

- 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 (23,245 square feet)
 - 121.06.04 – Utility Plant Building (21,275 square feet)
 - 121.06.05 – Linac Complex (88,550 square feet)
 - 121.06.06 – Booster Connection (7,750 square feet)

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

Scope and Deliverables

- 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.
- WBS
 - 121.06.01 – Project Management and Coordination
 - **121.06.02 – Site Preparation – CD-3A Request**
 - **121.06.03 – Cryogenics Plant Building – CD-3A Request**
 - 121.06.04 – Utility Plant Building
 - **121.06.05 – Linac Complex – CD-3B Request**
 - **121.06.06 – Booster Connection – CD-3B Request**

Scope and Deliverables



Conventional Facilities Systems Function and Configuration Document ^[1]

- Facility Scope

Associated conventional facilities including enclosures, equipment galleries, and utilities. The linac enclosure will be constructed with a length to accommodate at least two HB650 cryomodules beyond the nominal compliment required for 800 MeV.

- Functional Requirements

- The siting of the PIP-II facility will be consistent with future replacement of the existing 8-GeV Booster with either an 8 GeV Rapid Cycling Synchrotron or superconducting pulsed linac.
- The siting of the PIP-II facility will be consistent with future upgrades to provide 100 kW beams to the Mu2e hall on the Muon Campus.
- The SC Linac will be constructed in a manner that allows installation and commissioning without interruption to ongoing accelerator operations.
- Facility Lifetime equal to or greater than 40 years

- Safety Requirements

The Project will be built to applicable DOE and FNAL engineering, safety, and radiation standards as outlined in the Fermilab Engineering Manual and Fermilab ES&H Manual.

[1] Conventional Facilities Systems Function and Configuration Document, TeamCenter Document ED0008133

- Project Interfaces

- *Managed through PIP-II processes* ^[1]
- ED0007697 – Site Preparation
- ED0007698 – Cryogenic Plant Building
- ED0007699 – Utility Plant Building
- ED0007700 – Linac Complex
- ED0007702 – Booster Connection

Conventional Facilities interfaces with all Level 2 subprojects

- Fermilab Interfaces

- Infrastructure Connections (*Managed through FESS processes*)
- General Plant Projects (*Managed through FESS processes*)
- Accelerator Operations (*Managed through AD 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
FESS is Facilities Engineering Services Section

Preliminary Design and Design Maturity

Charge #1

- Site Preparation (WBS 121.06.02) **SC4-Wielgos**
 - Site Clearing construction package^[1]
 - Site Work construction package^[2]
 - Electrical Feeder construction package^[2]
 - Site Restoration/Landscaping construction package^[2]
 - Final Design Completion scheduled for January 2019
- Cryogenics Plant Building (WBS 121.06.03) **SC4-Dixon**
 - Technical Requirements Complete^[3]
 - Final Design Completion scheduled for Q2 FY19



View Looking Southwest

[1] See TeamCenter ED0008374

[2] See TeamCenter ED0008459

[3] See TeamCenter ED0008373

Preliminary Design and Design Maturity

Charge #1

- Conceptual Design Complete:
 - Utility Plant Building (WBS 121.06.04)
 - Linac Complex (WBS 121.06.05)
 - High Bay Building
 - Linac Tunnel
 - Linac Gallery
 - Beam Transfer Line
 - Booster Connection (WBS 121.06.06)

Design Review Plan

Charge #2

Review Class	L2 WBS	L3 WBS	Activity ID	Key Design Elements Reviewed / Activity Name	Review Date	Teamcenter ED#	Indico Link	Other Review Record Link
Conceptual Design Review	121.6			Conventional Facilities	19-Sep-16	ED0005473		
Conceptual Design Review	121.6			Value Engineering of CF	18-Jan-18			PIP-II-doc-1377
Requirements Review	121.6			Conventional Facilities	6-Apr-18	ED0007517		
Preliminary Design Review	121.6	121.6.02	CFSP10150	CnvF_SitePrep_Des: T6 MS - PDR for Site Prep	4-Sep-18	ED0008236		
Final Design Review	121.6	121.6.02		Site Clearing Package	8-Oct-18			FESS CCR Database
Preliminary Design Review	121.6	121.6.03	CFCB21990	CnvF_CryoB_Des: T6 MS - PDR for Cryopant Building	18-Mar-19			
Preliminary Design Review	121.6	121.6.05	CFLC11700	CnvF_Cmplx_Des: T6 MS - PDR for Linac Complex	1-May-20			
Preliminary Design Review	121.6	121.6.06	CFBC21790	CnvF_BstrC_Des: T6 MS - PDR for Booster Connection	1-May-20			
Preliminary Design Review	121.6	121.6.04	CFUB21890	CnvF_UtilB_Des: T6 MS - PDR for Utility Building	2-Mar-20			

- General Progress Milestones
 - January 2018 - Value Engineering Workshop with the CF team [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]
 - Developed preliminary shielding strategy for Cryogenics Plant Building with 121.03 (Accelerator Systems)
 - November 2018 – Preliminary Design Report
 - December 2018 – Completed the A/E recompile process

[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

Progress to Date Since CD-1

Charge #1, 2

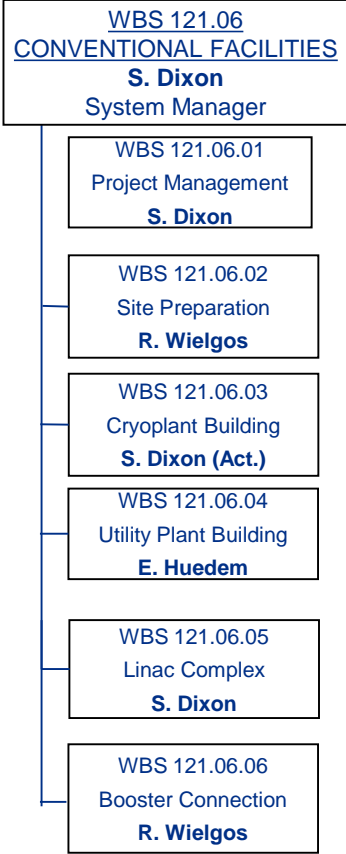
- Site Preparation – WBS 121.06.02
 - Design is ~90% Complete (scheduled for completion in January 2019)
 - Developed a Site Clearing construction package [1]
 - Received Authorization for Site Clearing package [1]
- Cryo Plant Building – WBS 121.06.03
 - Completed Technical Requirements Design [2]
 - Completed Water Quality Testing [3]

[1] See TeamCenter ED0008374

[2] See TeamCenter ED0008373

[3] See PIP-II-doc-155

Organization



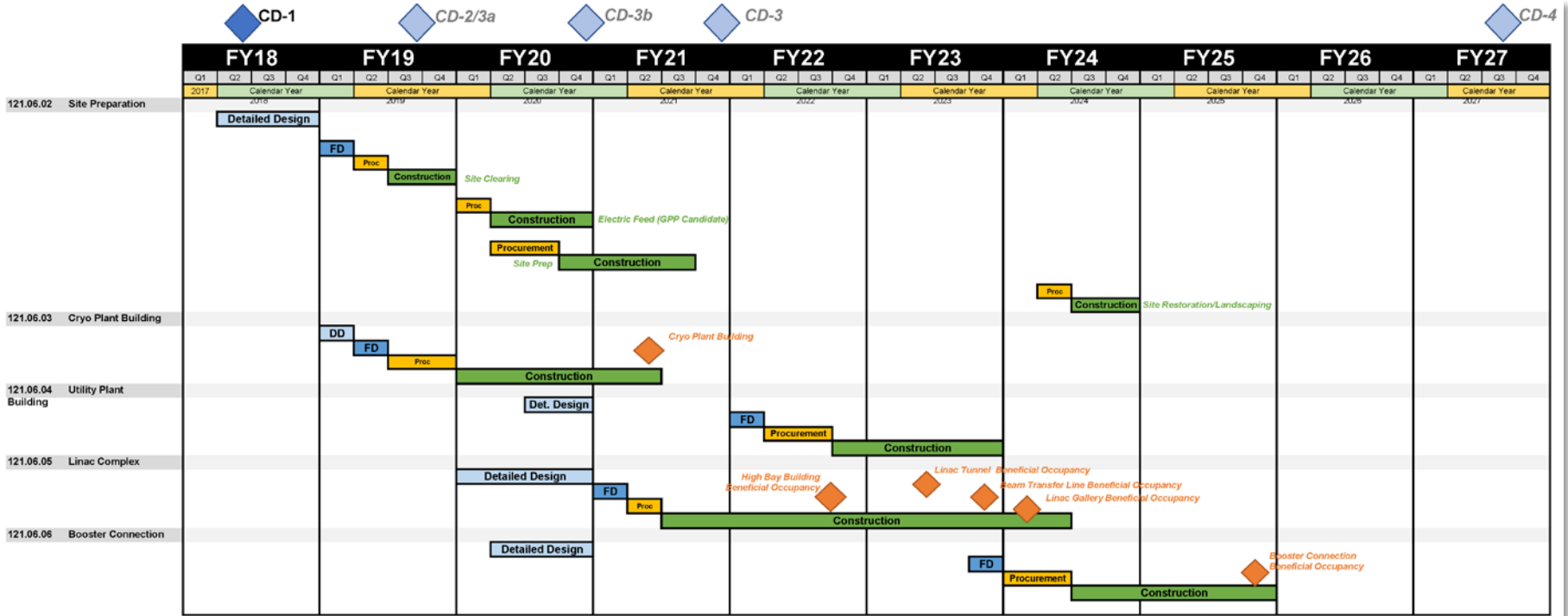
Next Steps toward CD-2/3A

Charge #5

- Site Preparation – WBS 121.06.02 (CD-3A Request)
 - Complete the Site Clearing construction (FY19)
(Goal: Ready to start construction at the time of the Groundbreaking)
- Cryo Plant Building – WBS 121.06.03 (CD-3A Request)
 - Complete Final Design (anticipated for Q3 FY19);
 - Initiate Procurement Processes to be ready to start construction (anticipated for Q2 of FY19);
 - Construction start dependent CD-3A approval and EA FONSI.
- CD-2 Activities
 - Coordination Mock Up of Linac Tunnel (anticipated in FY19);
 - External Independent Cost Estimate.

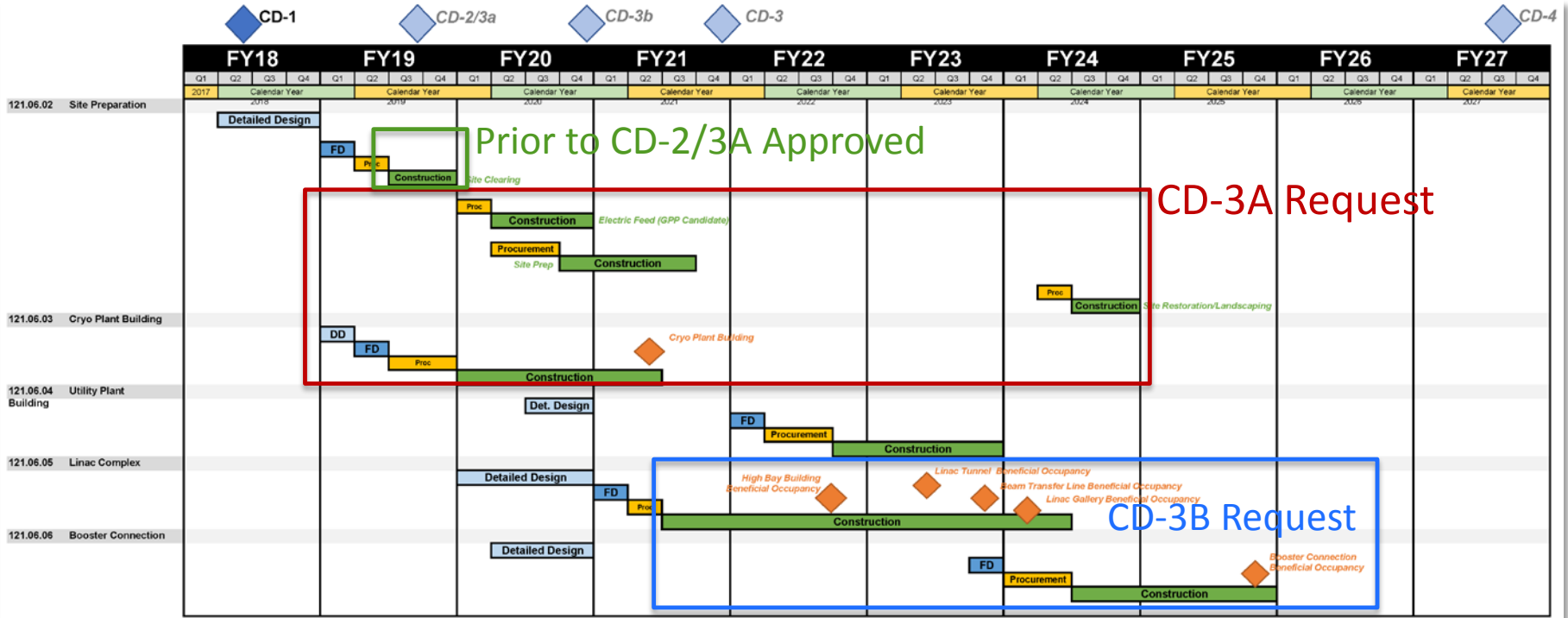
Schedule

Charge #3



Schedule With CD Approval Requests

Charge #3



T5 Milestones

Charge #5

L3	T5 Milestone	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
Site Preparation	End Site Clearing		◆								
Site Preparation	Beneficial Occupancy-Final Acceptance of Electrical Feed			◆							
Cryoplant Building	Beneficial Occupancy Cryo Building				◆						
Site Preparation	End Site Prep - Remaining Conventional Facilities				◆						
Linac Complex	Beneficial Occupancy High Bay Building					◆					
Linac Complex	Beneficial Occupancy Linac Tunnel						◆				
Linac Complex	Beam Transfer Line Ready							◆			
Utility Building	Beneficial Occupancy Utility Building							◆			
Linac Complex	Beneficial Occupancy Linac Gallery							◆			
Site Preparation	End of Site Restoration								◆		
Booster Connection	Booster Connection ready									◆	

Consider and plan for ES&H issues throughout the project life cycle

- Conceptual Design Phase
 - ES&H input includes review of the design, input from Tritium Task Force and Life Safety Analysis [1]
- Design Phase
 - ES&H is considered in A/E selection process;
 - ES&H is included in design reviews;
 - Implement Safety by Design process;
 - Incorporate Hazard Analysis Report hazards in the design process [2]
- Procurement/Construction Phase
 - Include safety performance as part of the subcontractor selection process;
 - Detail the responsibilities for team members including the Construction Subcontractor and Fermilab Construction Coordinator;
 - Independent oversight by ESH&Q Section

[1] Life Safety Analysis can be found at PIP-II-doc-120

[2] Hazard Analysis Report can be found at PIP-II-doc-140

Quality Management

Integrated Team Approach

- PIP-II Project Processes [1]
- A/E Design Processes *
- A/E Commissioning *
- FESS Subject Matter Experts
- Laboratory Experts
- Construction Subcontractor *

Version Date: October 8, 2018

	PIP-II CONVENTIONAL FACILITIES QUALITY ASSURANCE RESP				Architect/Engineering Team		Construction Subcontractor	Notes
	PIP-II Leadership	Stakeholders		PIP-II CF TEAM	Fermilab SME	Design Team		
		PIP-II Subprojects	Fermilab					
PRELIMINARY PHASE								
Functional Requirement Specification (FRS)	Review and Approve FRS	Develop and Document Functional Requirements	Develop and Document Functional Requirements	Review Requirements and Incorporate into FRS	Review and Approve FRS			
Goals for High Performance Sustainable Building (HPSB) criteria	Review and Approve HPSB goals			Review Conceptual Design and Establish Goals				See PIP-II doc 104
Technical Requirements Specification (TRS)	Review and Approve TRS	Develop and Document Technical Requirements	Develop and Document Technical Requirements	Review Requirements and Incorporate into TRS	Review and Approve TRS			
DESIGN PHASE								
Basis of Design (BoD) Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Develop BoD Document based on FRS and TRS	Review BoD Document	
Energy Model/HPSB Support Materials						Review	Review	
Design Documents		Provide input	Provide input			Provide input	Provide input	
Preliminary Design Review (60%)	Participate and Approve	Participate and Approve	Review Design Documents	Lead, Collect Comments and Develop Report	Participate	Review Design Documents	Review Design Documents	
3rd Party Independent Review						Participate	Participate	
Value Engineering Exercises		Participate	Participate	Coordinate and Lead	Participate			
CONSTRUCTION PHASE								
Request for Proposal		Provide Technical Response	Provide Technical Response	Assess and Submit to Procurement	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information	Review as Separated	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Proposal		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
COMMISSIONING PHASE								
Request for Proposal		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Proposal		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
OPERATIONAL PHASE								
Request for Proposal		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Proposal		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	
Request for Information		Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	Provide Technical Response	

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

Version Date: October 8, 2018

	PIP-II CONVENTIONAL FACILITIES QUALITY ASSURANCE RESP				Notes
	PIP-II Leadership	Stakeholders		PIP-II CF TEAM	
		PIP-II Subprojects	Fermilab		
PRELIMINARY PHASE					
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Goals for High Performance Sustainable Building (HPSB) criteria	Review and Approve HPSB goals			Review Conceptual Design and Establish Goals	
Technical Requirements Specification (TRS)	Review and Approve TRS	Develop and Document Technical Requirements	Develop and Document Technical Requirements	Review Requirements and Incorporate into TRS	Review and Approve TRS
DESIGN PHASE					
Basis of Design (BoD) Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document
Energy Model/HPSB Support Materials				Review	Review
Design Documents		Provide input	Provide input	Provide input	Provide input
Preliminary Design Review (60%)	Participate and Approve	Participate and Approve	Review Design Documents	Lead, Collect Comments and Develop Report	Participate and Approve
3rd Party Independent Review				Participate	Participate
Value Engineering Exercises		Participate	Participate	Coordinate and Lead	Participate

[1] PIP-II Quality Assurance Plan is at PIP-II-doc-142
See PIP-II-doc-2291 for Quality Assurance Responsibility Matrix

WBS 121.06 Risk Management

Charge #2,7

SC4-Dixon

Conventional Facilities Risks

- High Risks: **0**
- Medium Risks: **13**
- Low Risks: **30**

Top 3 Risks

RI-ID	Title
RT-121-06-001	Subproject requirements changes impact the Conventional Facilities
RT-121-06-002	Accelerator shutdown schedule changes
RT-121-06-003	Construction bids exceed estimates

Note: RT-121-01-006 – Inflation Exceeds Assumption is a Project Management Medium Risk

Response to Recommendations

Charge # 8

SC4-Dixon

- Director's CD-1 Review (October 2017) ^[1]
 - 2 Recommendations, both closed
- DOE CD-1 Review (December 2017) ^[2]
 - 3 Recommendations, all closed
- P2MAC Review (March 2018) ^[3]
 - 3 Recommendations, all closed

[1] Review ID 47866

[2] Review ID 48107

[3] Review ID 48469

Breakout Sessions

- Conventional Facilities In Depth **SC4-Dixon**
 - Schedule, Risks, Interfaces, ESH&Q and Review Recommendations
- Site Preparation **SC4-Wielgos**
- Laboratory Interfaces **SC4-Wielgos**
- Cryogenics Plant Building (Joint Session with SRF/Cryo)
- Requirements Documentation **SC4-Dixon** **SC3-Hansen**
SC2-Hunt **SC4-Dixon**

Summary

- Conventional Facilities scope and deliverables are understood and are based on requirements;
- Project Processes are in place and functioning;
(Risk Management, ES&H, Quality Management, Reviews)
- CD-3A Scope (Site Preparation and Cryo Plant Building) is understood and progressing;
- We are on track for CD-2/3A
- Thank you for your attention and we look forward to your feedback

END