PIP-II CDS FDR Charge and Agenda

Document number: ED0008570

Document Approval

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| --- | --- |
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Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision | Date Release | Originator:  Role: | Description of Change |
| 0 | 03 Aug 2020 | CAM | Initial release |
| 1 |  | CAM | Update schedule, document status, Finalize |

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# Introduction

The PIP-II Cryogenic Distribution System (CDS) is within Work Breakdown Structure (WBS) 121.2.06 and consists of the equipment needed to supply and return helium from the PIP-II Cryoplant via vacuum insulated cryogenic pipe lines and warm gas headers to the PIP-II Linac. The CDS includes cryogenic transfer lines, Distribution Valve Box, bayonet cans and turnaround can, warm gas headers, U-tubes, and a cryogenic controls system. A simplified CDS schematic is shown in Figure 1. Primary CDS helium cryogenic process circuits include:

* 4.5 K Supply
* 2 K Return, sub-atmospheric
* Low Temperature Thermal Shield (LTTS) Return
* High Temperature Thermal Shield (HTTS) Supply
* High Temperature Thermal Shield (HTTS) Return
* Cool Down (CD) Return

A screenshot of a cell phone

Description automatically generated

Figure 1. Scope of the PIP-II Cryogenic System (Cryomodules and Cryoplant not in CDS Scope)

# Final Design Review (FDR) Agenda

| Location: | Zoom, connection information sent through Outlook invitation |
| --- | --- |
| Date: | 12 August 2020 |
| Time:  Indico Site: | 0800 - 1730  <https://indico.fnal.gov/event/43804/> |

Participants:

|  |  |  |
| --- | --- | --- |
| Andrew Dalesandro  [andrewd@fnal.gov](mailto:andrewd@fnal.gov) | PIP-II CDS | Role: Review Coordinator |
| Jay Theilacker  [theilacker@fnal.gov](mailto:theilacker@fnal.gov) | APS-TD | Role: Review Chair |
| Josh Kaluzny  [kaluzny@fnal.gov](mailto:kaluzny@fnal.gov) | LCLS-II-HE | Role: Reviewer |
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## Introduction: Dalesandro

### Introduction of Reviewers and Approvers

### PDR Recommendations

### Scope of the FDR

### Items not covered in the FDR

## Management: Dalesandro

### In-Kind Collaboration

### Design Deliverables

### Schedule and Resources

### Procurements

### Risks

### Prevention through Design

### Acceptance Plan

### QC Plan

### Pending BCRs

## Requirements and Interfaces : Dalesandro

### Functional Requirements

### Technical Requirements

### Interfaces

## Reference Design: Dalesandro

### Piping and Instrument Diagrams

### 3D Models

#### Distribution Valve Box

#### Intermediate Transfer-Line

#### Tunnel Transfer Line - Bayonet Can

#### Tunnel Transfer Line - Turnaround Can

#### U-tubes

#### Warm Headers

## Process Design: Shukla, Dhuley

### Operating Modes

### Pressure Drop, valve sizing, flow rates

### Pressure Safety

### Vacuum Safety

### Heat load

### Installation Plan

## Stress and Flexibility: Dhuley

### Thermomechanical Analysis - DVB

### Thermomechanical Analysis - ITL

### Thermomechanical Analysis - BC

### Thermomechanical Analysis – TC

### Stress analysis – ITL Fixed Support

## Closeout: Review Chair

### Summary Statement

### Findings

### Comments

### Recommendations

### Final Report

# Review Charge Statement

This document provides the PIP-II Cryogenic Distribution System (CDS) Final Design Review (FDR) overview and agenda, and is intended to consolidate relevant CDS FDR information sources to a central document. The scope of the CDS FDR includes the design deliverables presented in the PIP-II 121.02 SRF and Cryo Systems Design Plan (docdb # 2605) as well as the reference designs of CDS 3D model components and the schedule and planning outlined to accomplish the PIP-II project objectives.

The purpose of the CDS FDR is to engage a panel of independent reviewers and seek guidance regarding the design maturity of the CDS at the time of FDR, specifically to request a thorough evaluation of the CDS reference design maturity compared to the review committee’s expectations for a Final Design Review. To assist the CDS FDR committee in this evaluation the following charge questions, and any other questions in which the committee deems appropriate, should be addressed in the final evaluation and report.

## Technical Scope

1. Are all CDS specifications, requirements, and interfaces identified and documented at the level of maturity commensurate with a FDR?
2. Are all external specifications, requirements, and interfaces identified and documented sufficiently to adequately evaluate the CDS design, at the current stage of the project?
3. Is the reference design technically sufficient to satisfy the functional requirements?
4. Have preliminary installation and commissioning issues been identified?
5. Have all of the major technical risks been identified?
6. Is the reference design maturity sufficient for FDR approval?

## Design Management

1. Have all recommendations from previous reviews been addressed?
2. Are engineering support and resources sufficient to
   1. successfully complete the reference design?
   2. successfully manage the In-Kind collaboration and procurement deliverables?
   3. successfully manage installation?
3. Is the current budgeted effort and staffing level sufficient to complete the CDS on schedule?
4. Are procurement and In-Kind management strategies appropriate to successfully deliver the CDS components?
5. Are the reference design models at sufficient level of detail to satisfy CDS scope and interface requirements?
6. Does the Distribution Valve Box design or functionality include any unnecessary redundancy?

## Schedule

1. Have all of the major schedule risks been identified?
2. Is the CDS P6 schedule reasonable to achieve the planned scope?

## ESHQ

1. Have all related ES&H aspects been identified and planned to be properly addressed?
2. Is the CDS QC Plan sufficient to ensure successful CDS installation and operation?

## Miscellaneous

1. Are there any other issues that have been identified that need to be addressed?

# Acronyms

|  |  |
| --- | --- |
| BC | CDS Bayonet Can |
| CDS | Cryogenic Distribution System |
| CM | Cryomodule |
| CP | Cryogenic Plant |
| DVB | CDS Distribution Valve Box |
| FRS | Functional Requirements Specification |
| ICD | Interface Control Document |
| IO | Input / Output modules and/or electronics |
| ITL | CDS Intermediate Transfer Line |
| PIP-II | Proton Improvement Plan II Project |
| TC | CDS Turnaround Can |
| TRS | Technical Requirements Specification |
| TTL | CDS Tunnel Transfer Line |
| QC | Quality Control |
| WBS | Work Breakdown Structure |

# Reference Documents

The following list of documents is presented for the review committee as guidance of review expectations.

|  |  |
| --- | --- |
| 1 | PIP-II Technical Review Plan – TC ED0008163 |
| 2 | PIP-II Quality Assurance Plan DocDB # [142](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=142) |
| 3 | PIP-II Systems Engineering Management Plan – TC ED0008164 |
| 4 | PIP-II IESH Management Plan DocDB # [141](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=141) |
| 5 | 121.02 SRF and Cryo Systems Design Plan DocDB # [2605](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2605) |
| 6 | 121.03 Accelerator Systems Design Plan DocDB # [2599](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2599) |
| 7 | 121.04 Linac Installation and Commissioning Design Plan DocDB # [2581](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2581) |
| 8 | 121.05 Accelerator Complex Upgrades Design Plan DocDB # [2593](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2593) |
| 9 | 121.06 Conventional Facilities Design Plan DocDB # [2587](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2587) |
| 10 | PIP-II Value Engineering Plan DocDB # [2830](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2830) |

The following list of documents comprise the scope of CDS deliverables to satisfy the FDR requirements as outlined in 121.02 SRF and Cryo Systems Design Plan (DocDB # [2605](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2605)). Documents within the scope of the CDS FDR are located on OneDrive in the following directory: [PIP-II CDS FDR Deliverables](https://fermicloud-my.sharepoint.com/:f:/g/personal/andrewd_services_fnal_gov/Ekv2aPbqJ-VKiAjs6cr5J6gBBHXiSbZx6aFvAlDe8e7ApA?e=xVqA5F).

Table 1 - [PIP-II CDS FDR Deliverables](https://fermicloud-my.sharepoint.com/:f:/g/personal/andrewd_services_fnal_gov/Ekv2aPbqJ-VKiAjs6cr5J6gBBHXiSbZx6aFvAlDe8e7ApA?e=xVqA5F) from the System Design Plan

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| --- | --- | --- | --- | --- |
|  | Doc. Number | Document Title | Status | Comments |
| 1 | ED0008570 | FDR Agenda and Charge Questions | final |  |
| 2 | ED0008569 | Close-Out of previous Recommendations | released |  |
| 3 | ED0008022 | Functional Requirements Specification | final |  |
| 4 | ED0008552 | Technical Requirements Specification | final |  |
| 5 | ED0010433 | Interface Control Document | released |  |
| 6 | ED0007572 | Interface Specification Documents | final |  |
| 7 | ED0008561 | Updated Risk Assessment Document | final |  |
| 8 | ED0012444 | Up-to-date Risk Register | final |  |
| 9 | ED0010908 | ODH Analysis | final | Submitted to PIP-II CSS for review |
| 10 | ED0012445 | Installation Hazard Analysis | final |  |
| 11 | ED0008560 | Failure Mode and Effect Analysis (FMEA) | final |  |
| 12 | ED0011373 | Prevention through Design | final |  |
| 13 | F10124028 | P&ID | final |  |
| 14 | ED0008560 | Valve & Instrument List | final |  |
| 15 | ED0008554 | Heat Leak Analysis | final |  |
| 16 | ED0008555 | Pressure Drop Analysis | final |  |
| 17 | ED0008556 | Pressure Relief Analysis | final |  |
| 18 | ED0008562 | Vacuum Relief Analysis | final |  |
| 19 | ED0008558 | Flexibility Analysis | final |  |
| 20 | ED0012446 | Layout Drawings | final |  |
| 21 | ED0011560 | Installation Plan | final |  |
| 22 | ED0011565 | Management Plan | final |  |
| 23 | [DocDB, #3415](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=3415) | SRF QA Plan | released |  |
| 24 | ED0011346 | Quality Control Plan | final |  |
| 25 | ED0012361 | Operating Procedures | final |  |