PIP-II HB650 Transportation Frame Final Design Review Charge

Document number: ED0012593

Document Approval

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Revision History

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| --- | --- | --- | --- |
| Revision | Date Release | Originator:  Role: | Description of Change |
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# Introduction

The production HB650 Cryomodules for PIP-II will be produced at STFC-UKRI and transported, mostly assembled, to FNAL. The prototype HB650 module will be produced at FNAL and transported to STFC-UKRI and back to validate the performance of the integrated transport system. Central to the transportation system is a mechanical frame which provides:

* a protective stay-clear boundary during transport
* mounting/storage area for transportation instrumentation
* mechanical vibration isolation for the cryomodule and
* lifting attachment points for the entire transport system.

The scope of this review includes these features of the transport frame.

# Review Agenda

| HB650 Transport Frame FDR Agenda |
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| Location: | Online Only - Teams |
| Date: | 22/9/2020 |
| Time:  Indico Site: | 7:30-12:30 CDT (FNAL), 13:30-18:30 GMT+1 (UK), 14:30-19:30 GMT+2 (CERN)  https://indico.fnal.gov/event/43802/ |

Participants:

|  |  |  |
| --- | --- | --- |
| Jeremiah Holzbauer | FNAL – PIP-II | Role: Coordinator |
| Mitchell Kane | STFC-UKRI | Role: Presenter |
| Josh Helsper | FNAL – TD | Role: Presenter |
| Sergey Cheban | FNAL – TD | Role: Presenter |
| Saravan Chandrasekaran | FNAL – TD | Role: Presenter |
| Brian Hartsell | FNAL – AD | Role: Review Chair |
| Ed Daly | JLab | Role: Reviewer |
| Kurt Artoos | CERN | Role: Reviewer |

Agenda details:

## Introduction: Jeremiah Holzbauer - FNAL

### Overview of the HB650 Transportation Plan

### Overview of the HB650 Transportation Specification

### Document management structure

### Project Perspective: Risks and Mitigations

## Transportation Frame Design: Mitchell Kane – STFC-UKRI

### Transportation System Overview

### Mechanical Design of the Transport Frame

### Expected Isolation System Performance

### Transport Frame as Lifting Fixture

### Interface Description including drawing/model review

## Prototype Frame Procurement and Validation: Jeremiah Holzbauer/Mitchell Kane

### Proto Frame Procurement

### Dummy Load Procurement and Testing at FNAL

### Dummy Load Shipment to STFC-UKRI/Validation Testing at STFC-UKRI

### Local Road Testing at FNAL with Prototype HB650

### Integrated Validation Transport to and from STFC-UKRI

### Integrated QC and Safety Efforts

## Summary of HB650 Cryomodule Transportation Design: S. Cheban/J. Helsper

### Brief summary of the HB650 transportation design calculations

## Closeout – Review Chair

### Summary Statement

### Preliminary Findings

### Preliminary Comments

### Preliminary Recommendations

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# Review Charge Statement

This is a Final Design Review of the HB650 Transportation Frame. The scope of this review includes the form and function of the frame itself as part of the overall transport system up to and including Cryomodule interfaces (envelope and mounting points). While the Cryomodule internal transport design is not within the scope of this review, the transport configuration and internal calculations will be summarized for context. The specific charge questions are as follows:

1. Is the documentation (Transport Specification, Transport Plan, Interface drawings/model, and others) sufficiently mature and complete to drive a successful Transport Frame design?
2. Is the Transport Frame design, as presented, likely to successfully meet the specified performance?
3. Is the Transport Frame design, as presented, at the final design level (90%)?
4. Are the Procurement and Validation plans, as presented, likely to result in a successful Transport System while minimizing the technical and schedule risk?
5. Have the lessons learned from previous projects been incorporated into this design?

# Acronyms

List and define any relevant acronyms as necessary.

|  |  |
| --- | --- |
| L2M | WBS Level 2 Manager |
| L3 | WBS Level 3 System |
| L3M | WBS Level 3 Manager |
| PIP-II | Proton Improvement Plan II Project |
| FNAL | Fermi National Accelerator Laboratory |
| STFC-UKRI | Science and Technology Facilities Council – United Kingdom Research and Innovation |
| CM | Cryomodule |
| HB650 | High-Beta 650 MHz |
| protoCM | Prototype Cryomodule |
| GPS | Global Positioning System |
| FMEA | Failure mode and Effects Analysis |
| RF | Radio Frequency |
| LCLS-II | Linac Coherent Light Source II |

# Reference Documents

List any relevant documents referred to in the Review Charge Statement. Include reference links or locations where the references are found. This list should include all documents with which the review committee should be familiar prior to the review.

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| --- | --- |
| 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) |
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A snapshot of these documents has been cloned from Teamcenter item (PIP-II-doc-4975) for the purposes of this review.

Table 1 - Document Deliverables for this review from the System Design Plan

|  |  |  |  |
| --- | --- | --- | --- |
|  | Document Title | Status  (preliminary, final, released) | Comments |
| **Requirements and Specifications** | | | |
| 1 | PIP-II HB650 Cryomodule STFC-UKRI Transportation Specification | Released | ED0012328 |
| **Interfaces** | | | |
| 2 | HB650 Cryomodule Long Range Transportation Configuration Envelope Drawing | Released | F10141930 |
| 3 | HB650 Long-Range Transportation Configuration Interface Drawings | Released | F10143970, F10138314 |
| **Risk and Safety** | | | |
| 4 | HB650 Cryomodule Transportation FMEA | Released | ED0012325 |
| 5 | HB650 Cryomodule Transportation Prevention through Design Table | Released | ED0012559 |
| **Design Documents** | | | |
| 6 | HB650 Transportation Design Report | In workflow | ED0012420 |
| 7 | HB650 Transportation Frame Design Report | Released | ED0012560 |
| 8 | Transport Frame Drawing Package | Released | ED0012560 |
| **Validation and Procurement** | | | |
| 9 | PIP-II HB650 Transportation Plan | Released | ED0012594 |
| 10 | HB650 Transport Frame Procurement Plan | Preliminary | In presentation slides |