PIP2IT 650MHz HPRF Distribution Final Design Review Charge

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| Name: Victor GrzelakOrg: PIPII/TIContact: x6442Role: Review Committee Coordinator | Date: 8/4/2020 |
| Name: Ding SunOrg: AD/ENG/RFContact: x3073Role: Primary Engineer |  |
| Name: Jim SteimelOrg: PIPII/TIContact: x4826Role: L3 Manager |  |

Revision History

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| Revision | Date Release | Originator:Role: | Description of Change |
| A | 8/12/2020 | Coordinator |  |
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*Revision control is managed via Fermilab Teamcenter Workflows.*

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# Introduction

The PIP2IT HPRF distribution system in review today will be used for the transfer of RF power to the HB650 SRF cavities. The system must be capable of delivering power to the cavities safely and efficiently and must protect the amplifiers. The content of review today begins at the output flange of the high power amplifier, and ends at entrance of the input coupler to the cryomodule.

For the HB650 cryomodule there are 6 transmission lines with independent amplifiers and cryomodule couplers for each line. Each line is equipped with its own circulator and two directional couplers, one at the amplifier and one at the cavity. The HB650 cavity location will also be the testing location for the LB650 cryomodule. The HB650 distribution design should be capable of handling LB650 power levels which are lower than HB650.

Upon completion of this review, the engineering team can procure and install the equipment.

# Review Agenda

| 650MHz HPRF Distribution Review Agenda |
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| Location: | Microsoft Teams |
| Date: | 8/25/2020 |
| Time:Indico Site:Participants: | 9AM<https://indico.fnal.gov/event/24092/>

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| --- | --- | --- |
| Victor Grzelak | PIPII/TI | Role: Coordinator |
| Curt Hovater | JLab | Role: Reviewer |
| John Reid | AD/ENG/RF | Role: Reviewer |
| Doug Horan | Argonne | Role: Reviewer |
| Chris Nantista | SLAC | Role: Reviewer/Chair |
| Brian Chase | AD/ENG/RF | Role: Reviewer |
| Ding Sun | AD/ENG/RF | Role: Presenter |
| Jim Steimel | PIPII/TI | Role: Presenter |

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Agenda details:

## Welcome: Elvin Harms ~10’

Charge presentation and goals for review

## Introduction: Jim Steimel~20’

Charge presentation and goals for review

## PDR response: Victor Grzelak~20’

Response to PDR review

## Technical Design: Ding Sun~45’

Functional requirements & physical layout

Technical requirements & other considerations

How the design satisfies the need

## Cost Schedule: Jim Steimel ~30’

Resource loaded schedule & Distribution BOE,

## Reviewer discussion

##  Closeout – Chair

Discussion and closing remarks

# Review Charge Statement

The primary charge of this committee is to technically evaluate the efficacy of the RF power distribution system design for the LB650. The secondary charge is to determine if the system would sufficiently protect itself.

The committee is asked to respond to the following questions:

1. Is the 650 MHz RF distribution design at the Final design level (80%)?
2. Is the design consistent with system and project requirements?
3. Are the available technical drawings and documentation consistent with this level of design maturity?
4. Are the budget, schedule, identified interfaces and risks, and procurement and quality control plans consistent with this level of design maturity?
5. Have the previous response issues review recommendations been suitably addressed?
6. Have lessons learned from previous projects been included in this design?
7. Are there any impediments to implementing the final design work?

# Acronyms

List and define any relevant acronyms as necessary.

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| PIP2IT | Proton Improvement Plan 2 Injector Test |
| HPRF | High Power Radio Frequency  |
| PDR | Preliminary Design Review |
| LB650 | Low-Beta 650MHz Cavity |
| HB650 | High-Beta 650MHz Cavity |

# Reference Documents

The below documents are to be considered in the review, the documents denoted with parenthesis are courtesy documents and are not under review.

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| **Requirements** |
| 1 | HPRF L3 Functional Requirements Specification | ED0008023-A |
| 2 | PIP2IT 650MHz RF Distribution Functional Requirements Specification | ED0012138 |
| 3 | PIP2IT 650MHz RF Distribution Technical Requirements Specification | ED0012142 |
| 4 | PIP2IT 650MHz Circulator Specifications | **Included in presentation** |
| 5 | (Linac RF System PRD) | ED0010220-A |
| 6 | Response to PDR |   |
| **Interfaces** |
| 7 | ISD 650MHz RF Distribution - LB650 RF Power Amplifier | ED0006360 |
| 8 | ISD 650MHz RF Distribution - 650MHz LLRF/RFPI System | ED0012144 |
| 9 | Master ICD | ED0010433-E |
| 10 | (Interface Specification Document LB650) |  |
| 11 | (Interface Specification Document HB650) | ED0007562 |
| **Quality** |
| 12 | 650MHz RF Distribution Updated Prevention Through Design Assessment Table | ED0012145 |
| 13 | Failure Mode and Effect Analysis | ED0010159 |
| 14 | HPRF QC Plan |  |
| 15 | Distribution Risk assessment | **Included in presentation** |
| **Design** |
| 16 | 2D 650 MHz RF System schematic | ED0012426 |
| 17 | Component list/Bill of materials | ED0012426 |
| 18 | P & ID for PIP2IT 650 MHz Distribution Cooling (Circulator) | ED0012442 |
| 19 | RF Loss Calculations and Thermal Test plan | In presentation |
| 21 | Preliminary standing wave calculations | **Included in presentation** |
| 21 | 3D Model of RF Distribution Connecting Amplifier and 650MHz Coupler | F10129146 |
| **Budget** |
| 22 | Updated HPRF RLS | PIP-II docdb #1848-v17 |
| **Procurement, Production and Installation** |
| 23 | Preliminary Procurement Plan (stock parts, directional coupler, circulator) | RAPTR Acquisition Plan #027 |
| 24 | Component Inspection and Validation Plan | In TRS |
| 25 | Circulator Acceptance Test Plan | **Included in presentation** |