PIP-II Beam Instrumentation Laser Wire Design Follow-Up Review Charge

Document number: ED000xxxx

Document Approval

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Revision History

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| Revision | Date Release | Originator:  Role: | Description of Change |
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Table of Contents

[1. Introduction 4](#_Toc10127097)

[2. Review Agenda 4](#_Toc10127098)

[3. Review Charge Statement 6](#_Toc10127099)

[4. Acronyms 6](#_Toc10127100)

[5. Reference Documents 6](#_Toc10127101)

# Introduction

A successful Preliminary Design Review (PDR) of PIP-II beam instrumentation was conducted in the Fall of 2021. Several recommendations were made regarding the PIP-II laser wire beam profile monitor system. The scope of this review is to address these recommendations and determine if the preliminary design of the laser wire systems align with the functional and technical requirements. Specifically this review will compare the cost and performance of a fiber-based laser wire system versus a free-space based laser wire system.

# Review Agenda

| Laser Wire Mini-Review Agenda |
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| Location: | Zoom |
| Date: | Monday, Nov 7, 2022 |
| Time:  Indico Site: | 9:00 AM to 1:00 PM (CDT)  <https://indico.fnal.gov/event/56764/> |

Participants:

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| --- | --- | --- |
| Vic Scarpine  scarpine@fnal.gov | Fermilab | Role: Coordinator |
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| Robert Steinberg  rstein@fnal.gov | Fermilab | Role: Presenter |
| Brian Drendel  drendel@fnal.gov | Fermilab | Role: Presenter |
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Agenda details:

## Review Charge and PIP-II Laser Wire Introduction – Vic Scarpine

### Review charge

### Laser Wire Requirements

### Laser Wire Systems

## Laser Wire Performance – Randy Thurman-Keup

### Signal to noise analysis for two laser wire systems

## Laser Options – Jinhao Ruan

### PIP2IT laser system

### Fiber-based laser

### Free-space laser

## Free-Space Laser Transport Line – Robert Steinberg

### Requirements

### Transport line design

## Laser Transport Optics and Alignment – Randy Thurman-Keup

### Requirements

### Order of installation

### Alignment sequence

### Laser alignment feedback system

## Laser Wire Cost Comparisons – Brian Drendel

### Cost of fiber-based system

### Cost of free-space based system

### Timeline

## Safety, Reliability and Quality – Vic Scarpine

## Summary – Vic Scarpine

## Closeout – Review Chair

### Summary Statement

### Preliminary Findings

### Preliminary Comments

### Preliminary Recommendations

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# Review Charge Statement

The reviewers are asked to perform an ‘mini review’ of the laser wire profile monitor system in the context of a recommendation from the Instrumentation Comprehensive Preliminary Design Review:

Non-Invasive Beam Profile Monitor PDR Recommendations:

* The need to resolve issues with the noisy signal seen in the PIP2IT laser wire (lower dynamic range due to lower laser power).
* Do a performance and cost comparison between fiber transport line and the free space transport line. This could help make the decision between the 2 systems.

Specifically, the panel is asked to answer the following charge questions:

1. Do both technologies meet the stated design requirements?
2. Is the free-space system architecture and technology sound and viable?
3. Have risk, safety, and system performance considerations been factored into the preferred choice?
4. Does the cost and schedule comparison information as presented appear accurate?
5. Has the PDR recommendation been satisfactorily addressed?
6. Does the committee affirm the free-space laser technology as the preferred path moving forward?

# Acronyms

List and define any relevant acronyms as necessary.

|  |  |
| --- | --- |
| BI | Beam Instrumentation |
| BProM | Beam Profile Monitor |
| PRD | Physics Requirement Document |
| FRS | Functional Requirement Specification |
| TRS | Technical Requirement Specification |
| ICD | Interface Control Document |

# 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 | 121.03 Accelerator Systems Design Plan DocDB # [2599](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2599) |
| 6 | 121.04 Linac Installation and Commissioning Design Plan DocDB # [2581](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2581) |
| 7 | 121.05 Accelerator Complex Upgrades Design Plan DocDB # [2593](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2593) |
| 8 | 121.06 Conventional Facilities Design Plan DocDB # [2587](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2587) |
| 9 | PIP-II Value Engineering Plan DocDB # [2830](https://pip2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2830) |

The review coordinator should populate this following table with the document list for this review from their SDP.

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

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| --- | --- | --- | --- |
|  | Document Title | Status  (preliminary, final, released) | Comments |
| 1 | PIP-II BI PRD | Final |  |
| 2 | PIP-II BI FRS | Final |  |
| 3 | Non-Invasive BProM TRS | Final |  |
| 4 | PIP-II BI Quality Control | Final |  |
| 5 | PIP2IT BI Final Report | Final |  |
| 6 | PIP-II Master ICD | Released |  |
| 7 | PIP-II Parameters PRD | Final |  |
| 8 | PIP-II Global Requirements Document | Final |  |
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