



Review Charge and Laserwire Scope

Vic Scarpine

PIP-II Beam Instrumentation Laser Wire
Final Design Review

May 2, 2024

A Partnership of:

US/DOE

India/DAE

Italy/INFN

UK/UKRI-STFC

France/CEA, CNRS/IN2P3

Poland/WUST



PIP-II Laserwire Review Scope

- This final design review (FDR) is intended to **evaluate the overall mechanical design of the Laser Wire system**, with a focus on the modifications, since the 2022 Mini Design Review (<https://indico.fnal.gov/event/56764/>) as well as the laser system.
- **ONLY** the following components will be covered in detail:
 - **Laser system and laser hut**
 - **Beamline components – vacuum chamber, Faraday cup, magnet design, optical boxes, and mounting stands**
 - **Optical beam transport line**
- Details of the corresponding electronics for signal processing and data acquisition will only be presented at a high level. Details will be covered in a future final design review.

Review Attendees

Role: Coordinator	M.A. Ibrahim	cadornaa@fnal.gov	Fermilab
Role: Reviewer	Yun Liu	Liuy2@ornl.gov	SNS
(*- Committee Chair)	Dave Johnson	dej@fnal.gov	Fermilab
	Lucy Nobrega	lnobrega@fnal.gov	Fermilab
	Brian Hartsell*	hartsell@fnal.gov	Fermilab
Role: Presenter	Vic Scarpine	scarpine@fnal.gov	Fermilab
	Randy Thurman-Keup	keup@fnal.gov	Fermilab
	Jinhao Ruan	ruanjh@fnal.gov	Fermilab
	Parker Landon	landonp@bu.edu	Boston University
	Robert Steinberg	rstein@fnal.gov	Fermilab
	Tiffany Price	tprice@fnal.gov	Fermilab
	Raul Campos	rcampos@fnal.gov	Fermilab
	Sajini Wijethunga	swijethu@fnal.gov	Fermilab
	Sherese Humphrey	sherese@fnal.gov	Fermilab

Review Schedule

Review Welcome	<i>Jeremiah Holzbauer</i>	10'	9:00a-10:30a
Technical Integration	<i>Christopher Becker</i>	5'	
Review Charge and BI Scope	<i>Victor Scarpine</i>	5'	
PIP-II Laser Wire Introduction <ul style="list-style-type: none"> Team Overview System overview Documents overview 	<i>Victor Scarpine</i>	30'	
Free-space Optical Transport Line Design and Installation Plan	<i>Robert Steinburg</i>	30'	
Laser System	<i>Jinhao Ruan & Parker Landon</i>	40'	
Break		15'	11:00a-11:15a
Laser Wire Mechanical Design	<i>Tiffany Price & Raul Campos</i>	45'	10:45a-11:30a
Lunch		90'	12:00-1:30p
Laser Transport Optics and Alignment	<i>Randy Thurman-Keup</i>	30'	1:30p-3:00p
Signal Performance <ul style="list-style-type: none"> Faraday Cup Electron Collection 	<i>Sajini Wijethunga & Randy Thurman-Keup</i>	30'	
Risk, Safety, and Quality Control	<i>Vic Scarpine</i>	15'	
Schedule, Cost/Labor Estimates, Procurements	<i>Sherese Humphrey</i>	15'	
Path Forward / Closing Remarks	<i>Vic Scarpine</i>	5'	
Wrap Up Discussion		TBD	3:00p-5:00p
Executive Session (Thursday)	Full committee	TBD	

Review Charge

The committee is requested to review the mechanical assembly of the Laser Wire System as well as to comment on the rationale that led to the configuration of the elements as presented in detail during the review. Lastly, general comments are welcome if deemed necessary by the committee.

More specifically, we would like the committee to consider the following questions:

1) Have recommendations from the Mini Design Review been adequately addressed?

- a) *Conduct more research on the pulse energy density limits of the optical window to determine limits with appropriate safety factors. A better guideline for the maximum allowable laser power density on vacuum windows should be expressed using a unit J/cm^2 for particular laser pulse width.* **Mechanical Design Talk and Risk Talk**
- b) *Laser beam position sensing in the middle of transport line is critical for alignment and feedback based pointing stabilization. Consider implementing a system in multiple places throughout the transfer line and continuously monitor this system.* **Optics and Alignment Talk**
- c) *Ensure that all valves, windows, and other locations that might see vacuum loading are adequately supported.* **Transport Line Talk**
- d) *Verify that friction supports can adequately support a longitudinal load.* **Transport Line Talk**

Review Charge

- Are the designs presented at the final design level (90%) and consistent with requirements?
 - Are the available technical drawings and documentation consistent with this level of design? **Mechanical Design Talk and Transport Line Talk**
 - Are connections and interfaces to other systems sufficiently identified and understood? **Introduction Talk**
 - Have QA/QC (quality aspects) been appropriately considered, and an approved QC plan released? **QC Talk**
- Have ES&H (safety and environmental) aspects been appropriately considered? Have Failure Modes Effects & Analysis (FMEA) and *Prevention through Design* activities been satisfactorily conducted and documented? **Risk and Safety Talk**
- Are the costs, labor allocations, and schedule credible and consistent with the technical scope presented?
 - Is the procurement plan presented generally reasonable and consistent with the technical scope? **Schedule and Cost Talk**
- Does the committee recommend approval of the final design and endorse initiating procurements?