TSIB HPT Lab Introduction and Overview

Frederique Pellemoine

TSIB HPT Lab Conceptual Design Review

01 April 2021

Scope of the Review

The intent of this review is to consolidate the concept of the High Power Targetry Lab with the priority on the design features that affect the construction design

- Concrete walls and shielding
- Safety features
  - Nonradioactive features and radioprotection features
  - Ventilation
- Functionality of the lab
  - Layout, scopes, workflow
  - size of the hot cell suite

Agenda

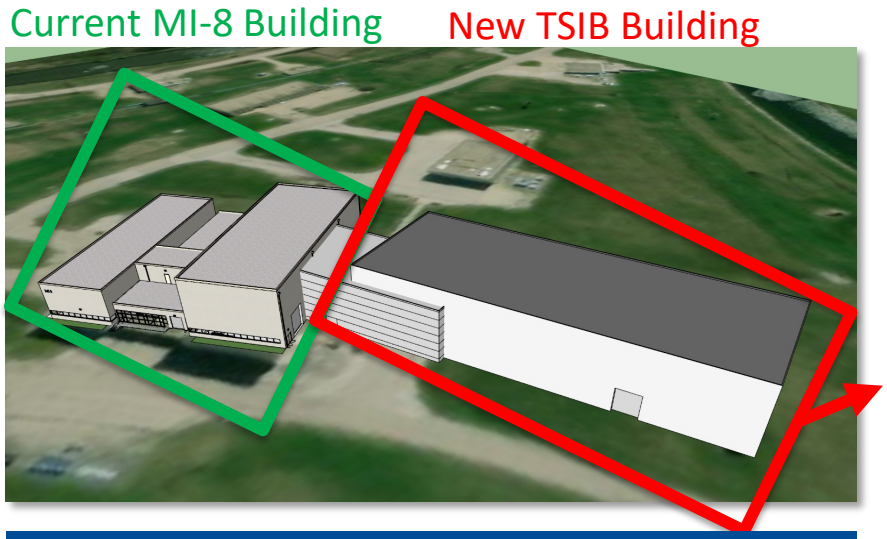
10:00 AM → 10:30 AM	**Opening Remarks and Project Overview** **Speaker**: Frederique Pellemoine (Fermilab -AD - TSD - TRD)	30m	
10:30 AM → 11:00 AM	**Scope and Requirements** **Speaker**: Frederique Pellemoine (Fermilab -AD - TSD - TRD)	30m	
11:00 AM → 11:20 AM	**Learned Lessons from other facilities** **Speaker**: Frederique Pellemoine (Fermilab -AD - TSD - TRD)	20m	
11:20 AM → 11:50 AM	**Break**	30m	
11:50 AM → 12:30 PM	**Design of the HPT Lab** **Speaker**: Keith Anderson	40m	
12:30 PM → 1:00 PM	**Workflow, Safety, Risks and Mitigation plan**	30m	
1:00 PM → 1:30 PM	**Discussion**	30m	
1:30 PM → 2:00 PM	**Break**	30m	
2:00 PM → 4:30 PM	**Executive Session** Report on the review	2h 30m	
4:30 PM → 5:00 PM	**Close out Session**	30m	

Charge Questions

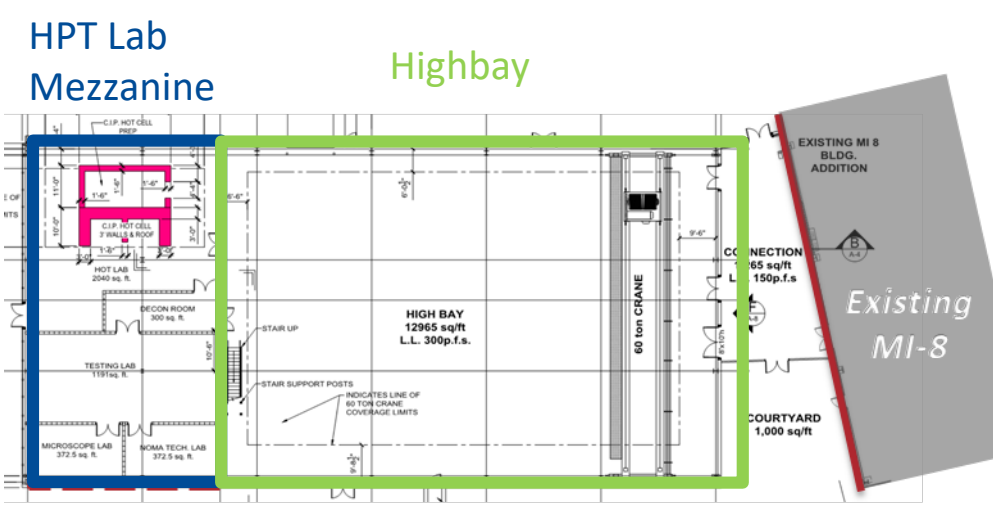
- 1/ Have the scope and requirements for the HPT Lab been adequately identified for this stage of the project? — Charge 1
  - Scope and Requirements presentation
  - Scope and requirements draft document
- 2/ Have the risks for operation of the HPT Lab been adequately identified for this stage of the project? — Charge 2
  - Workflow, Safety, Hazards and mitigation plan presentation
  - Workflow document
  - Scope and requirements document (for Hazards and mitigation plan)
- 3/ Does the conceptual design (and associated documents) presented satisfy the scope/requirements and adequately address the risks? — Charge 3
  - Design presentation
- 4/ Does the conceptual design reflect current best practices and incorporate lessons learned from other similar facilities? — Charge 4
  - Lessons Learned presentation

TSIB | Target Systems Integration Building

- MI-8 is unable to accommodate the existing horn needs concurrent with an **accelerated LBNF schedule**, additional high bay space is needed to meet production capacity that are expected to double
  - Highbay: support area for Targetry component production and inspection
  - Mezzanine: LBNF Horn Component Storage and Remote Handling & Robotics Lab Area
  - **High Power Targetry (HPT Lab)**



Conceptual Massing Study of TSIB addition to existing MI-8 Service Building, March



Impact of Accelerated LBNF Schedule

***REMINDER**: from HEP presentation in March 2020*

- Existing future experiment schedules require additional space / capacity by October 2025.
- If LBNF schedule is accelerated, then demand for additional space & capacity will also need to be accelerated.

  - Current MI-8 facility is unable to accommodate the existing horn needs concurrent with an accelerated LBNF schedule.
  - LBNF risks losing a competitive advantage if delayed.

A. Federowicz | TSIB FSO Presentation

Impact of Accelerated LBNF Schedule

***REMINDER**: from HEP presentation in March 2020*

- Existing future experiment schedules require additional space / capacity by October 2025.
- If LBN
  for ad
  be accelerated.

As of Jan 2021, the accelerated LBNF schedule is affirmed

- Current MI-8 facility is unable to accommodate the existing horn needs concurrent with an accelerated LBNF schedule.
- LBNF risks losing a competitive advantage if delayed.

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TSIB Integrated Schedule

At MI-8 and TSIB

Assumes A/E Final Design Starts Q2 FY21 **February 2021**
2-month delay

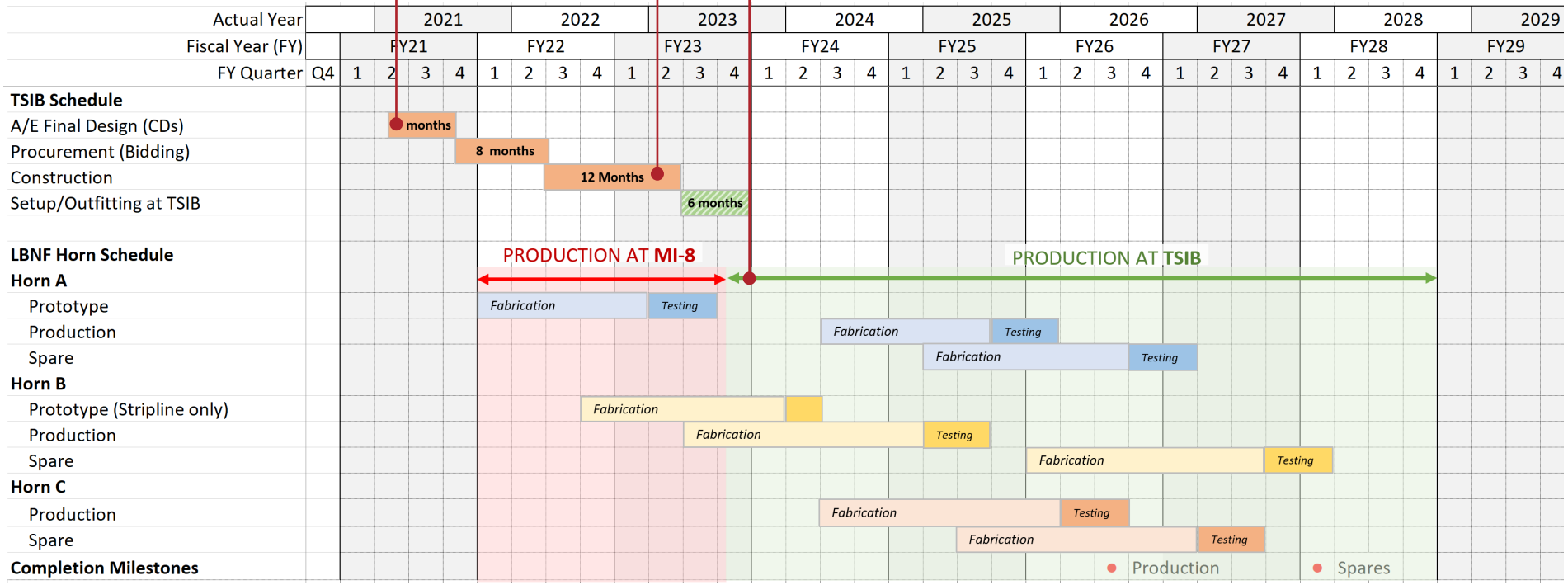
AT RISK

January 2023
Beneficial Occupancy

**At this time, setup/outfitting activities at TSIB need to start*

October 2023 **AT RISK**
Deadline to start LBNF Horn production at TSIB

**At this time, MI-8 is operating at capacity, unable to produce LBNF Horn's A, B, and C concurrently as scheduled.*



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PROJECT SCOPE

Contingency Spend Down VS. Funded off Project

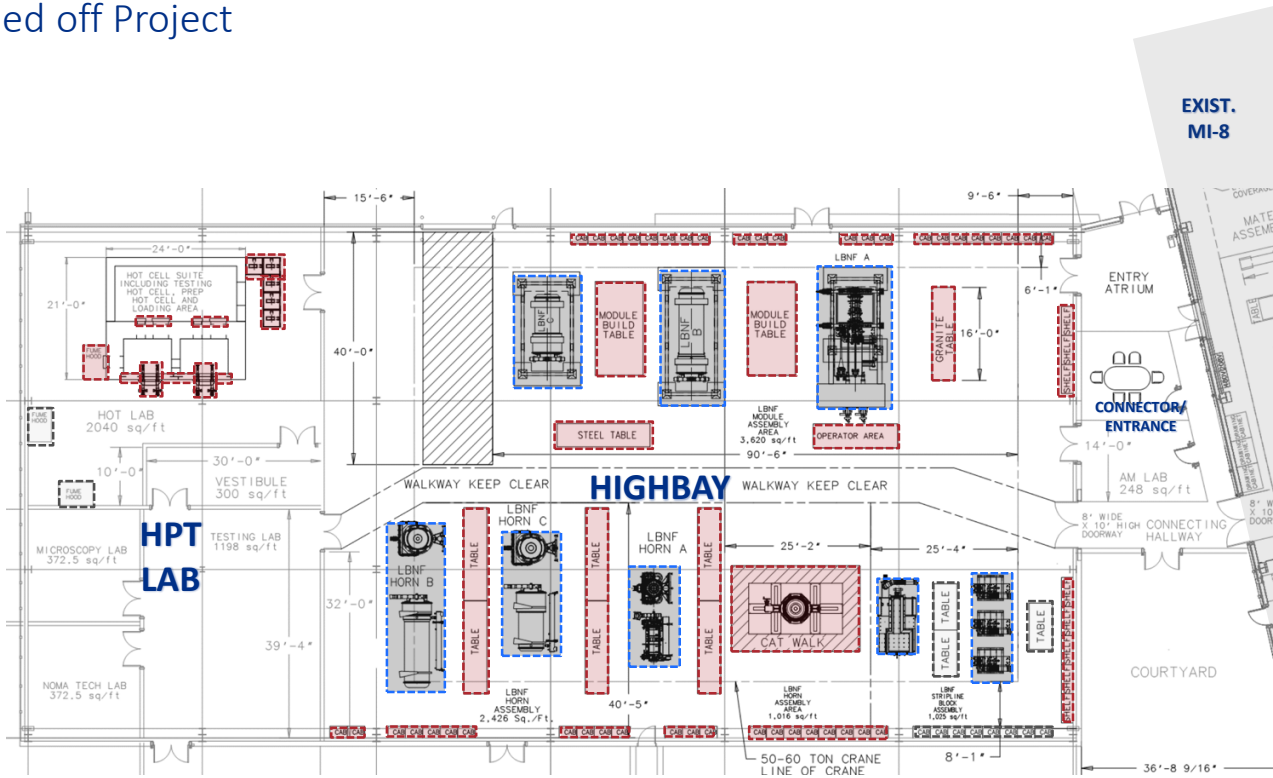
Contingency Spend Down
Funded by TSIB GPP (as risk is retired)

- Steel Tables
- Scaffolding
- Telemanipulators
- Pb-glass Windows
- Small Passthroughs
- Large Passthrough
- Fume Hood

Not pictured:

- Sampling & Storage System
- Portable Jib Crane
- Horn Transport Carts
- Remote Vision System
- Vestibule storage cabinets
- Shelving rack

Module Assembly
Funded off project (LBNF and AD Operations)

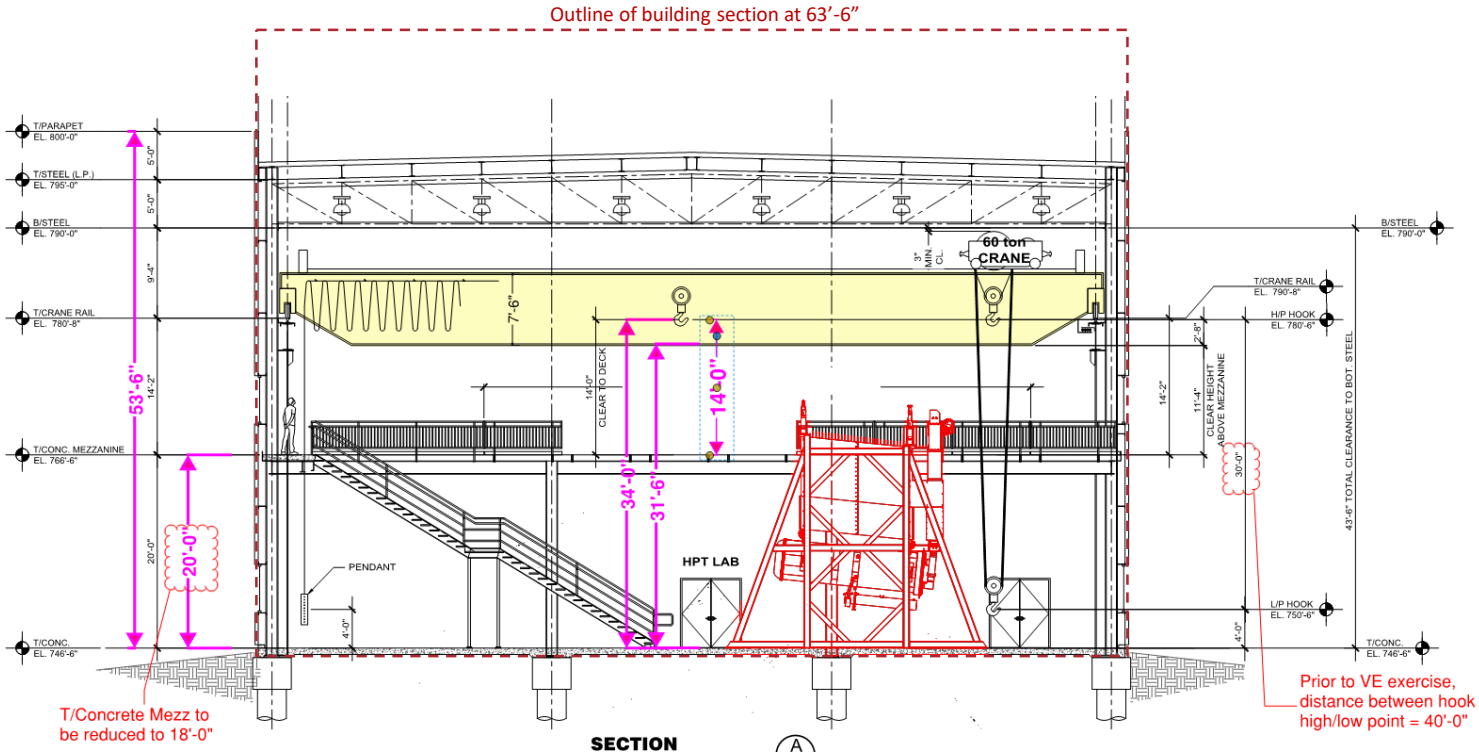


Conceptual Development

Method of horn construction changes allowing shorter building height

Reduced Height = **53’-6”**

(10’-0” shorter than previous)

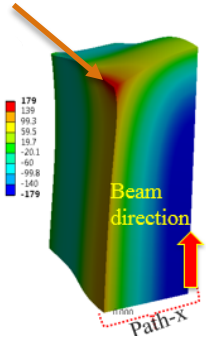


High Power Targetry (HPT) R&D is a Critical Need for HEP

- **Capability of High Power Targetry is critical for current and future accelerators as beam intensity and associated challenges increase.**
- **R&D will enable high-power accelerator target facilities (e.g. LBNF/DUNE, PIP-II experiments, future HEP Program)**
  - Recognized by HEPAP: “Realizing a multi-MW proton source to provide neutrino beam intensities at Fermilab beyond PIP-II project will require significant further R&D on targets and focusing systems, concentrated on tolerance of materials to radiation effects of intense beams.”*
  - RaDIATE collaboration (Radiation Damage In Accelerator Target Environments)
    - Fermilab founded in 2013 and acts as Program Coordinator
  - Fermilab’s HPT R&D Program supported by DOE OHEP General Accelerator R&D Program since 2012 (GARD)
- **Materials research has been the primary path of advancement**
  - Radiation damage modification of material properties
  - Novel material development
- **Additional Challenges are:**
  - Thermal Shock
  - Radiation Transport Simulation and Validation
  - Modeling to better predict target lifetime
  - Remote Handling


NuMI-MINOS target: cracked graphite fins

Stress Concentration

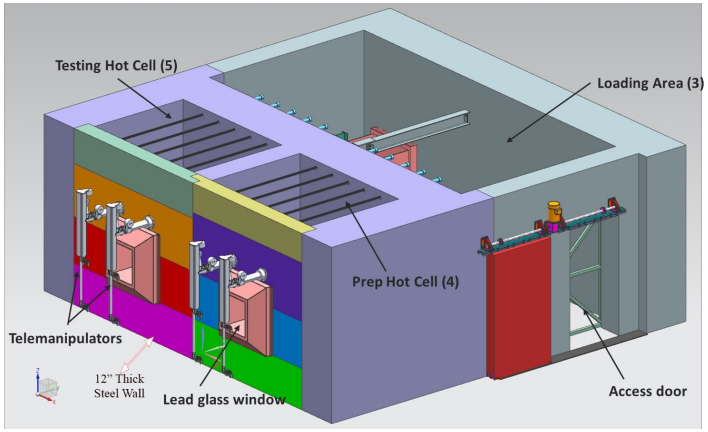


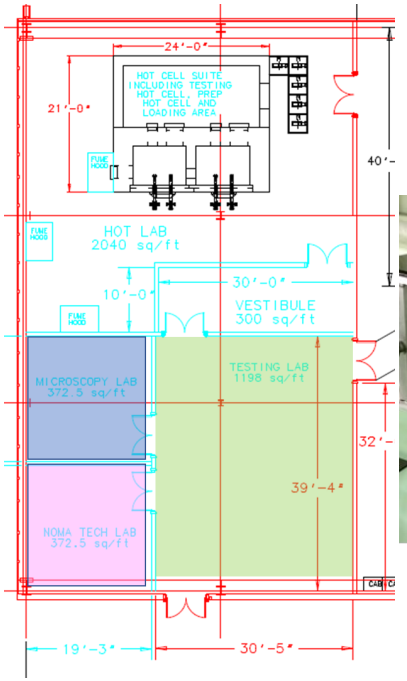
Accelerating Discovery," [Online]. Available: https://science.energy.gov/hep/hepap/reports/
Particle Physics Project Prioritization Panel (P5), "Building for discovery: Strategic Plan for U.S. Particle Physics in the Global Context," 2014.

High Power Targetry (HPT) R&D is central to TSIB's Purpose

- **Activated materials lab area (including hot cells)**
  - Targetry material research on items removed from service and specimens from dedicated accelerator irradiations
  - Quality assurance and post-service investigations of used target station devices as part of continuous improvement within operations
- **In conceptual design stage**
  - Project Plan (being finalized)
  - HPT R&D Group (F. Pellemoine) working with ES&H on finalizing scope of work and developing planning/design documentation
  - Development and operation of the HPT R&D Lab will fall within the scope of the Fermilab SAD (Safety Assessment Document) and comply with the FRCM (Fermilab Radiological Control Manual), FESHM (Fermilab Environment, Safety and Health Manual), and FEM (Fermilab Engineering Manual)

Integral part of TSIB scope since inception





P. Hurh | TSIB FSO Presentation

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