Intensity AIP

Project Plan

May 2018

The Project Plan (PP) describes the management, control systems, and procedures used by Fermi National Accelerator Laboratory (Fermilab) to meet the technical, cost, and schedule objectives of this project. This controlling document establishes the basis against which progress will be measured.

The Project Plan is to be viewed as a "living document," and as such, will be revised when necessary. The Project Manager is authorized to approve non-substantive changes to the PP (e.g., name changes to the positions cited in the PP), but will inform the DOE Project Director via e-mail of such changes. Baseline changes will require approval by the Department of Energy's (DOE) Fermi Area Office.

Booster Intensity AIP Project Management Plan
Change Log

Revision No.	Pages Affected	Effective Date
Initial Version	Entire document	April 12, 2018

Contents

1 Submittal Page

Submitted, Reviewed, and Approved by:

5/3/2018
Michael Lindgren — Date
Accelerator Division Head

5/31/18
Mary Convery — Date
AIP Program Coordinator

5-3-18
William Pellico — Date
Project Director

5/3/2018
Chandrashekhara Bhat — Date
Project Manager

2 Project Objectives

Further measures beyond those of the Proton Improvement Plan, which will be completed in FY18, are needed to keep beam losses in the Booster and Main Injector / Recycler at acceptable levels, even as intensity is increased. The Intensity AIP will provide the following upgrades. Additional collimators will be installed in the Booster. Booster transverse damper modifications will allow lower chromaticity at injection for reduced beam loss during injection, and Booster longitudinal dampers will help with beam loss in the Recycler and Main Injector as well as in the Booster. Beam physics will be studied with aperture scans, lattice changes, and high intensity studies to improve Booster performance. All of the upgrades performed by the Intensity AIP will be compatible with PIP-II.

The estimated Total Project Cost (TPC) is $5.1M.

3 Project Scope

The Intensity AIP will include the following scope.

1. Booster beam physics

   Studies will be performed to provide a better understanding of the Booster lattice. The Booster is one of the earliest rapid-cycling synchrotrons and until very recently was providing beam at a rather low duty factor. Detailed specifications on many devices in the Booster lattice built during the first two to three decades are not available, which makes understanding the Booster lattice a challenging task. Beam experiments will be conducted at higher beam intensities and new lattice simulations will be developed.

2. Booster dampers

   For the existing transverse dampers, new boards will be fabricated and firmware developed to control transverse beam instability from injection to the extraction as the beam intensity is increased. New pickups will be fabricated and installed in the Booster. New amplifiers will also be procured and implemented for high intensity operation of the Booster.

   A new longitudinal damper mode-2 cavity and amplifier will be designed and built to reduce the beam oscillations. This will reduce beam losses around the ring.

3. Booster collimators

   A new two-stage collimation system will be designed, built, and installed. This will help in near future as well as long term to localize the beam losses at injection energy thereby addresses environmental radiation safety issues.

4 Project Organizational Structure

DOE Management

The Fermi Site Office administers the M&O contract with FRA for operations of Fermilab and exercises oversight of Fermilab. The Fermi Site Office Manager, Michael J. Weis, has been delegated responsibility and authority for execution of the project. The specific responsibilities of the Fermi Site Office manager are:

- Supervision of DOE Project Director and Fermi Site Office staff;
- Review and approval of documents as required by federal regulations or departmental orders or notices;
- Approval of Fermilab subcontract actions, within the authority delegated to Fermi Site Office;

Funds will be made available to DOE for the project on an annual basis following passage of legislation in the U.S. Congress.

The Fermi Site Office Manager has delegated authority and responsibility for management and direction of the project to the DOE Project Director, Paul Philp. The specific responsibilities of the DOE Project Director include:

- Review of this PP and changes thereto
- Measurement of performance against established goals including technical performance, cost levels, and schedule milestones
- Making any necessary changes or as it pertains to taking corrective actions within the appropriate thresholds established in this PP
- Overseeing Fermilab's management of installation activities
- Monitoring project progress via reports prepared by the Project Manager.

The DOE has delegated the responsibility for this project to Fermilab.

Fermilab Management

This project will be managed based on the guidance provided in DOE Manual 413.3-1b. Other DOE orders and manuals, especially regarding design, engineering, contingency, and indirect costs have been used to determine the basis for estimating costs and establishing baselines. This identification, implementation, and compliance with other relevant orders, manuals, and requirements are the responsibility of the project team.

Figure 1 identifies the organizational structure that will be responsible for procurement and installation of this project.

As with all activities at Fermilab, the Directorate is at the highest level of responsibility. Michael Lindgren, the Fermilab Accelerator Division Head, is the Project Sponsor championing the project. The Project Sponsor establishes and approves the mission need and allocates the funds from the Fermilab budget.

Procurement, installation, cost, and schedule for this project are the responsibility of the Accelerator Division (AD) which will manage the work associated with this project, as well as accept line management responsibility for safety.

The Project Sponsor has designated Mary Convery of the Accelerator Division as the AIP Program Coordinator (Program Coordinator) and William Pellico of the Accelerator Division as the Intensity AIP Project Director (Project Director). The Program Coordinator and Project Director are key stakeholders that have accepted the scope of work as described within this project's Project Plan. The Program Coordinator will initiate all scope changes and shall secure any additional funding authority as defined by the Fermilab Project manager and coordinate interaction with other AIPs.

Fermilab has designated Chandrashekhara Bhat of the Accelerator Division's Proton Source Department as Project Manager. The Fermilab Project Manager will utilize the resources of the Accelerator Division as appropriate for design, construction, installation, and testing coordination.

All stakeholders are considered to be organizational project assets and are considered invaluable during the planning and execution of the project. The Program Coordinator and project manager will identify those key stakeholders and obtain the relevant inputs critical to the project's success.

Prospective users, landlord ES&H personnel, and building managers are always key stakeholders that are included in the process.

ESH&Q Management

The ESH&Q Section, with Eric McHugh as the Accelerator Division Safety Officer, has the responsibility for providing Environmental, Safety, and Health coordination and oversight of ES&H throughout the project. As with all Fermilab projects, attention to ES&H concerns will be part of the project management and Integrated Safety Management (ISM) will be incorporated into all processes. Line management responsibility for ES&H will be maintained on this project. Safe coordination of installation activities will be accomplished through the Project Manager, Project ES&H Coordinator, Project Engineer, Shutdown Coordinator, and Task Manager. During installation, the Subcontractors, T&M Crafts, and all Fermilab personnel will utilize Project

Hazard Analyzes (PHA) to plan all work and mitigate hazards. The Project Manager and Project ES&H Coordinator will audit compliance with all applicable ES&H requirements.

The project has been found to comply with the NEPA Categorical Exclusion B3.6 DOE/EA-1570.

Organizational Chart

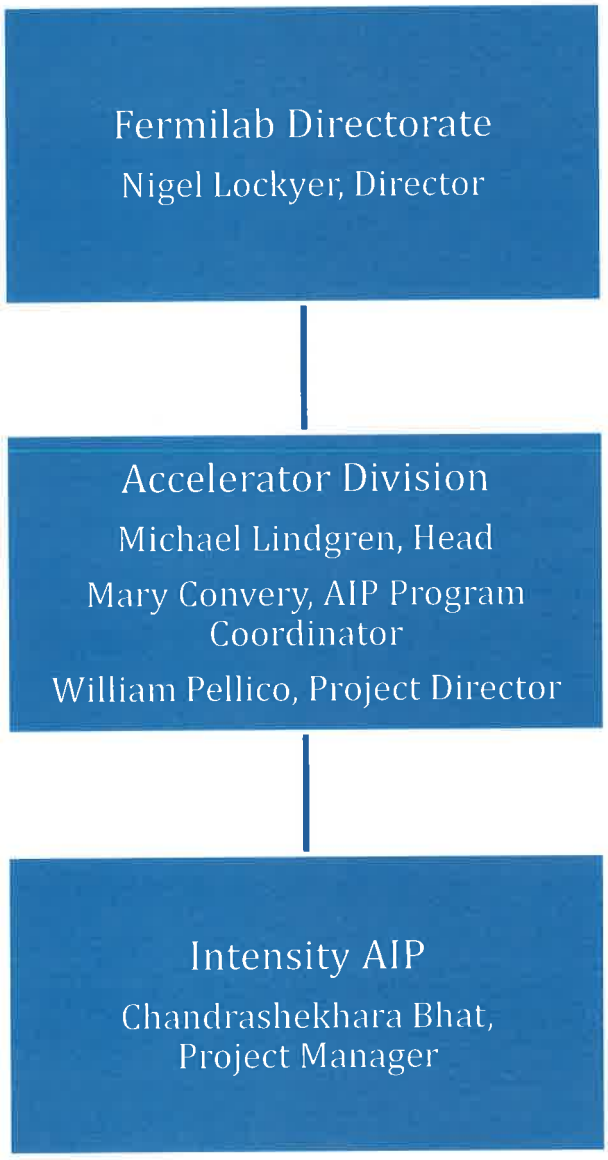

Figure 1: Intensity AIP organizational structure.

5 Resource Requirements

Funding

This project is an Accelerator Improvement Project (AIP) with a Total Project Cost (TPC) of $5,100,000.

Personnel

Fermilab Divisions and Sections will be responsible for assigning the responsibilities of individuals within the project organization. The Project Engineer will be responsible for coordinating within the Accelerator Division and other divisions to obtain the appropriate technicians and project support personnel. The Installation Coordinator will coordinate with the Fermilab Time and Materials office to arrange all necessary craft support.

6 Project Baseline

The Project Baseline identifies the basis for evaluating project performance, including the Work Breakdown Structure, which identifies each component of the project, the Baseline Costs, and Baseline Schedule and Milestones.

Work Breakdown Structure (WBS) Dictionary

Listed below is the breakdown of the WBS for this project. Further breakdown of the WBS may be applied as required for accounting purposes.

WBS	Name
A1802	Intensity AIP
A1802.01	Project Management
A1802.02	Booster Beam Physics
A1802.03	Booster Dampers
A1802.04	Booster Collimators

For accounting purposes, the management reserve of the above listed WBS items will be included in the WBS items. DOE Guide G430.1-1, Chapter 11 was used as guidance in estimating the appropriate management reserve for this project.

For accounting purposes, the indirect costs of the above listed WBS items will be included in the WBS items.

Baseline Project Costs

Listed below are the baseline project costs for this project.

WBS	Name	Fully-loaded Cost	Contingency	TPC
A1802	Intensity AIP	$3,953k	$1,147k	$5,100k
A1802.01	Project Management	$308k	$31k	$339k
A1802.02	Booster Beam Physics	$1,027k	$308k	$1,335k
A1802.03	Booster Dampers	$1,408k	$434k	$1,842k
A1802.04	Booster Collimators	$1,210k	$374k	$1,584k

Escalation

The baseline estimates have been escalated by task within P6 using the lab standard escalation rates.

The rates utilized for Materials and Service (M&S) are as suggested by the most recent published escalation rates. The escalation rates for Salary with Fringe (SWF, Labor) costs are based on input from the Fermilab Directorate based on their latest understanding of out-year labor costs.

Baseline Project Milestones

The baseline milestones listed below sets forth the major activities essential for the completion of the project. Note that all milestones are tied to funds availability within thirty days of the beginning of each fiscal year. Note that installation milestones tied to accelerator shutdowns are outside the control of this project.

Milestone	Definition	Baseline
Start Project	Directive signed and funding available	Month 0
Transverse Damper Design	Transverse damper design complete	Month 6
Longitudinal Damper Design	Longitudinal damper design complete	Month 10
Collimator Design	Collimator design complete	Month 13
Transverse Dampers	Transverse dampers installed and tested with beam	Month 18
Beam Physics Studies	Booster beam physics studies complete	Month 25
Longitudinal Dampers	Longitudinal dampers installed	Month 29
Collimators	Collimators installed and tested with beam	Month 32
Project Complete	Project closed	Month 32

Obligation Profile

Listed below is the anticipated total Obligation Profile for this project.

		FY18	FY19	FY20	FY21	Total
Labor						
	FTE	1.5	5.2	3.6	0.6	10.9
	SWF direct+indirect +escalation	$414k	$1,412k	$977k	$160k	$2,963k
	SWF mgt reserve	$286k	$529k	$22k	$0k	$837k
	Total	$700k	$1,941k	$999k	$160k	$3,800k
M&S						
	M&S base (FY17 $)	$90k	$414k	$266k	$0k	$770k
	M&S direct+indirect +escalation	$115k	$530k	$341k	$0k	$986k
	M&S mgt reserve	$185k	$129k	$0k	$0k	$314k
	Total	$300k	$659k	$341k	$0k	$1,300k
Total						
	Direct+indirect +escalation	$414k	$2,057k	$1,318k	$160	$3,949
	Management reserve	$586k	$543k	$22k	$0	$1,151
	Total	$1,000k	$2,600k	$1,340k	$160k	$5,100

7 Acquisition Execution Plan

The project management, construction management, installation and inspection for this project are being performed in compliance with the applicable DOE Orders, Laboratory Policy and Procedures and in accordance with the Work Breakdown Structure.

Procurement Strategy

Nearly all components required for the Intensity AIP will be subject to the Fermilab procurement guidelines, which requires an open bidding process to ensure competitive bids on cost, value, or technical requirements.

A Davis-Bacon determination has been prepared for this project.

Engineering, Design, Inspection and Administration

Preliminary Engineering designs were performed in conjunction with the research and development efforts and are not included herein. Engineering Design, Inspection and Administration efforts for the fabrication and installation will consist of Fermilab AD personnel.

8 Project Controls

Cost Control

The baseline budget for each element will be shown on all reports. Costs accrued by these accounts will be reported monthly. The Project Manager will review the report and verify the validity of all cost charges during the reporting period that commitments are correct and that projections of costs can be covered by the baseline budget for each work element.

The Project Manager has the responsibility for the use and commitment of project funds. Any costs or commitments that are made without the Project Manager's signed approval or that of higher Laboratory management may be rejected.

The Project Manager, within authorized limits, will be responsible for the administration of the project's management reserve funds.

The Funding Profile, depicted in Section 6, is based on the current DOE funding profile. This plan reflects the best estimate of funding levels and the baseline schedule. The Funding Profile establishes the planned rate of accrued costs for the life of the project. The Project Manager is responsible for updating, as needed, the project Estimate at Completion (EAC) for each work element to reflect changes in design and construction, and for overall project fiscal management.

Schedule Control

The Baseline Milestones, shown in Section 6 of this report, depict the milestones and their expected achievement dates. The Project Manager shall have the responsibility to monitor and control these tasks within the baseline. The baseline may be revised through the change control process.

Change Control Procedures and Authorities

Changes to the project baseline can occur to the scope, cost, or schedule aspects of the project. Changes at WBS Level 1 and below will be made with the approval of the Project Manager for cost changes up to $100,000 and schedule changes up to 3 months. Cost and schedule changes above these amounts and changes to the scope of the project will require the approvals of the Change Control Board. Any change to the Total Project Cost will require the approval of the Change Control Board and DOE Fermi Site Office. Project change control will be accomplished in accordance with practices listed below.

Change	Approval Required	Change Request Form
In scope ≤$100k or ≤3 months schedule change	Project Manager	Required
In scope >$100k or >3 months schedule change	Control Board	Required
Total Project Cost	Control Board DOE Fermilab Directorate	Required
Change to Project Scope or Schedule	Control Board DOE Fermilab Directorate	Required

The Change Control Board (Control Board) will be comprised of the following named individuals or the designees:

DOE Fermi Site Office	P. Philp (non-voting)
Fermilab AD	M. Lindgren
Program Coordinator	M. Convery
Project Director	W. Pellico
Project Manager, Chair	C. Bhat

The Project Manager will act as Chair to the Control Board. The Control Board will consider the change requests promptly and, in cases not requiring additional information or discussion, will respond within two weeks.

9 Design and Construction Principles

Integrated Safety Management

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM), in accordance with Department of Energy Order 413.3b "Program and Project Management for the Acquisition of Capital Assets." Fermilab requires its subcontractors and sub-tier subcontractors to do the same. ISM is a system for performing work safely and in an environmentally responsible manner. The term "integrated" is used to indicate that the Environment, Safety & Health (ES&H) management systems are normal and natural elements of doing work. The intent is to integrate the management of ES&H with the management of the other primary elements of construction: quality, cost, and schedule.

Quality Assurance

All aspects of this project will be periodically reviewed with regard to Quality Assurance issues from design through project completion. This review process will be completed in accordance with the applicable portions of the Director's Policy Manual, Section 10. The following elements will be included in the design and construction effort:

- An identification of staff assigned to this project with clear definition of responsibility levels and limit of authority as well as delineated lines of communication for exchange of information;
- Requirements for control of design criteria and criteria changes and recording of standards and codes used in the development of the criteria;
- Periodic review of design process, drawings and specification to insure compliance with accepted design criteria.

Reliability and Maintainability

Both reliability and future maintenance are considered in the design of all components of Fermilab site. Materials and construction techniques are selected during the design process to provide adequate design life, accessibility, and minimal maintenance.

Risk Management

Sufficient budget and schedule contingency are incorporated into the baseline plan to accommodate known risks. New risks which are identified during the project execution will be discussed at the monthly PMG and appropriate action taken, if necessary with baseline change requests.

10 Reporting and Reviews

The objective of the reporting and review activity is to provide the assemblage and integration of project related cost data, schedule status and performance progress into reports for the monitoring and management of the project.

Reporting

Daily – The Project Manager will hold meetings as necessary to discuss progress and issues.

Quarterly – The Project Manager will review progress and changes in a Quarterly AIP report.

Reviews

Directorate Level Review – If requested, the project team will meet with the Directorate to review the project related cost data, schedule status, and performance progress.

DOE Review – Occasional site visits will be arranged between the Project Manager and DOE Project Director.

PMG – Status will be reported monthly to Fermilab Division Heads and the DOE at Project Management Group meetings.

POG – Status will be reported monthly to the Fermilab Directorate at Project Oversight Group meetings or as requested.