# Fermilab - PIP-II Interface Document

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# CHANGE LOG

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# 1 INTRODUCTION

The Proton Improvement Plan-II (PIP-II) Project ("the Project") is being undertaken by Fermilab to replace the existing 400-MeV, room temperature, linac with a modern, 800-MeV, superconducting linac (SCLinac) constructed of continuous wave (CW)-compatible components. The project also includes modifications to the existing Booster, Recycler, and Main Injector to provide enhanced performance throughout the accelerator complex. The primary goal of PIP-II is to support beam power in excess of 1 MW initially, and beyond 2 MW ultimately, to the Long Baseline Neutrino Facility (LBNF). Additionally, PIP-II is being implemented in a manner that will provide long term opportunities in particle physics research based on muons and, possibly, other elementary particles. Project participants include: the U.S. Department of Energy, Fermilab, the PIP-II Project Office, the Indian Department of Atomic Energy (DAE), the Istituto Nazionale di Fisica Nucleare (INFN) in Italy, the Science and Technology Facilities Council (STFC) in the United Kingdom, and the French Commissariat a l'energie Atomique (CEA) and the Institut National de Physique Nucléaire et Physique des Particules (IN2P3). .

The PIP-II Project Office resides in the Accelerator Division and is responsible for successful execution of the Project, drawing on the resources of the entire laboratory for support. Major Fermilab participants include the Directorate, the Accelerator, Technical, Particle Physics, Core Computing, and Scientific Computing Divisions, and the Facilities Engineering Services, Environment, Safety, Health, & Quality Assurance, Finance, and Workforce Development & Resources Sections. In addition, collaborations are ongoing with the DAE and INFN, which are expected to result in significant in-kind contributions to the PIP-II project.

The matrixed nature of project support within Fermilab and among the institutional partners implies many interfaces and the need for a common understanding of responsibilities across these interfaces. The purpose of this Interface Document is to establish such an understanding of the division of responsibilities for support of PIP-II between the Project and the Fermilab Directorate, Divisions, and Sections. This Interface Document accompanies *the PIP-II Assumptions Document* [1] and the *PIP-II Functional Requirements Specification* [2], both approved in March 2017. This document may be modified in response to future changing conditions within Fermilab or the Project.

# 2 INTEGRATION INTO THE FERMILAB COMPLEX

PIP-II will be integrated directly into the existing Fermilab accelerator complex. The laboratory's expectations for the performance of the accelerator complex following completion of the PIP-II Project are documented in the PIP-II Functional Requirements Specification. These requirements include development of PIP-II in a manner that will provide a platform for future enhancements to the accelerator complex. More specifically:

- The PIP-II Functional Requirements Specification is approved by the Fermilab Chief Research Officer and the Chief Accelerator Officer, signifying that these requirements meet the needs of the Fermilab research program.
- The scope of the PIP-II Project starts at the $H^-$ source and ends at the extraction kicker to the LBNF beamline in the Main Injector.
- The PIP-II SCLinac will be situated to allow construction and integration into the Fermilab complex of a future replacement for the existing 8-GeV Booster.
- The PIP-II SCLinac will be situated to allow future delivery of 800-MeV protons to the Mu2e Hall on the Muon Campus.
- The PIP-II schedule will be developed in a manner that will minimize disruption to ongoing Fermilab accelerator operations during the construction, installation, and commissioning phases.
- Fermilab Accelerator Division will support continuous improvements to the Booster, Recycler, and Main Injector capabilities during the PIP-II construction period. All such improvements will be implemented in a manner consistent with the PIP-II configuration.

# 3 INFRASTRUCTURE SUPPORT

The PIP-II R&D and construction phases are reliant on significant infrastructure that is maintained and operated by Fermilab:

- The Technical Division will provide access to superconducting radio frequency (SRF) test and production facilities during the PIP-II R&D and construction phases as necessary to maintain the project schedule. Such facilities include:
    - SRF Processing facilities at ANL and Fermilab
    - Test stands, including VTS, HTS, STC, and MTS
    - Cryogenic support for the above listed Test Stands
    - QC facilities, including Nb qualification, cavity inspection, and cavity tuning
    - Fabrication Facilities, including the Cryomodule Assembly Facility (MP-9 and ICB) and Lab 2
- The Accelerator Division will provide access to superconducting radio frequency (SRF) test facilities during the PIP-II R&D and construction phases as necessary to maintain the project schedule. Such facilities include:
    - CMTF, including PIP2IT

- Maintenance and operations support of the above facilities is provided through operating funds. The Project will pay for project-specific enhancements and utilization of the facilities, and for cryogens.

# 4 TRANSITION TO OPERATIONS

The PIP-II scope includes installation and commissioning of all equipment, components, and systems, with commissioning criteria defined through the Key Performance Parameters (KPPs) in the *Preliminary Project Execution Plan (PPEP)* [3]. The maintenance and operation of these systems will become the responsibility of the Accelerator Division once commissioning criteria are met. More specifically:

- The Accelerator Division will make operating funds available to support maintenance and operations of the 800-MeV linac, Booster, Recycler, and Main Injector once Key Performance Parameters (KPPs) associated with each of these systems are achieved.
- The Project will fabricate an adequate complement of spare components to achieve all threshold KPPs and supporting objective KPPs. Such spares will be included in the Project cost.
- The Project, in consultation with Accelerator Division, will identify and fabricate an initial complement of spare components adequate to sustain operation. Such spares will be fabricated by the Project and then will be transferred to, and reimbursed from, the Fermilab special process spares account prior to CD-4.
- The Accelerator Division will assume responsibility for the maintenance of PIP-II systems/buildings/structures at the time of Beneficial Occupancy.
- The Project will develop a Transition to Operations Plan that will document the above agreements and estimate the cost and labor necessary for continuing accelerator operations in advance of CD-2.

# 5 CONVENTIONAL FACILITIES

The PIP-II Project includes significant new on-site Conventional Facilities. These facilities must be developed to tie into existing conventional infrastructure. The Conventional Facilities effort will be led by the Project with assistance from the Facilities Engineering Support Section (FESS) and an outside Architectural Engineering (and possibly Construction Management) firm. More specifically:

- The PIP-II Project is accountable and holds responsibility for the planning, design, and construction of the Conventional Facilities necessary to house the apparatus and related support equipment for the PIP-II accelerator and beamlines on the Fermilab site. This includes buildings, below grade enclosures, shielding berms and related site improvements.
- The PIP-II Conventional Facilities will be managed, planned, designed and constructed by an integrated team of design and construction professionals consisting of consultants and in-house experts, including members of FESS, to achieve the project goals. The PIP-II Associate Project Manager for Conventional Facilities will manage this integrated team, and collaborate with FESS for all necessary design and construction resources to ensure the Project's needs are satisfied and long-term engineering expertise is maintained within FESS.
- To promote coordination and continuity with existing laboratory processes, procedures, and facilities, FESS will assign a PIP-II project liaison to facilitate the management of FESS resources during the design, procurement and construction phases.
- FESS will be responsible for providing knowledgeable technical subject matter experts to oversee specific technical aspects of the work during planning, design, and construction of the PIP-II conventional facilities.
- The PIP-II Project and FESS will assure that the conventional facilities comply with the Fermilab Engineering Manual and will utilize FESS Engineering's Comment and Compliance Review and Construction Document Signoff processes, tailored to PIP-II's requirements, to capture design approvals and to ensure dissemination of design information and allow FESS and Fermilab to comment on, and therefore influence, PIP-II conventional facilities designs.
- Electronic documentation related to the PIP-II conventional facilities will be stored on the FESS servers during project development. PIP-II project documentation will follow standard FESS project naming conventions as well as applicable CAD standards.
- Fermilab will assure that access to existing site infrastructure is provided for tie-in to the PIP-II Conventional Facilities. Detailed requirements are contained in Section 4 of the PIP-II Assumptions Document.

The primary interface between the PIP-II conventional facilities and the existing accelerator complex is located at the connection of the PIP-II Beam Transfer Line into the Booster. To accommodate this connection, the Booster Tower Southeast (FIMS No. 208) will be demolished as part of the PIP-II work scope. Listed below are the specific items and responsibilities of this work:

- Fermilab will relocate the existing occupants and functions currently housed in the building;
- Fermilab will mitigate lead, asbestos and activated components within the building;
- Fermilab will terminate existing utilities (electrical, industrial cooling water, domestic water, sanitary sewer, natural gas, data/communication) to a point outside the building demolition limits;

- Fermilab will prepare and submit paperwork and notification of demolition in accordance with current procedures;
- Fermilab demolition preparation will be completed by October 2023;
- PIP-II will demolish the Booster Tower Southeast building;
- At the conclusion of the PIP-II work an earthen shielding berm will be installed above the existing Booster enclosure and new PIP-II enclosures;
- PIP-II will replace the existing exit stair from the Booster enclosure;
- PIP-II will install a weathertight entrance to the east Booster Gallery.

PIP-II will maintain access to the electrical substation located southeast of the Booster Tower Southeast;

# 6 RESOURCE SUPPORT

The PIP-II Project is dependent on significant personnel support that will be provided largely from within the Fermilab line organization, i.e. the Divisions and Sections. This support must be provided in a timely manner, and in appropriate quantity, to enable successful completion of the Project. More specifically:

- The Fermilab Divisions/Sections will provide access to the technical, managerial, and administrative resources required for the successful execution of the PIP-II Project in a timely manner.
- The Accelerator Division will host the PIP-II Project Office and provide the required administrative support. Administrative support will be funded as indirect expenses to the Project.
- The Fermilab Divisions/Sections will provide the line management of personnel supporting the Project.
- The Accelerator and Technical Divisions will each designate a primary point of contact, from within their management, to provide coordination of activities between the Division and the Project.
- It is expected that the Divisions/Sections will solicit input from the Project on the performance of Fermilab staff assigned to the PIP-II Project as part of the annual performance appraisal process.
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- The Project will develop and maintain the Project Resource Loaded Schedule (RLS). The RLS will be the primary mechanism for planning of resource needs.
- The Project will pay for all Fermilab labor applied to PIP-II with exceptions as noted in this section. In particular, all scientific labor applied to the Project in the form of either technical or managerial tasks, will be charged against the Project.
- The Fermilab Divisions/Sections will support activities related to engineering, documentation, ESH, and QA via their normal process.
- The Fermilab ESH&Q Section will provide ESH&Q support at the Project level. ESH&Q support will be funded as indirect expenses to the Project.
- The Fermilab Finance Section will provide procurement support for the Project. Such support will be funded as indirect expenses against the Project with the exception of the Procurement Manager, described in the next section.

# 7 PROCUREMENT SUPPORT

The PIP-II Project will rely on the Finance Section for the procurement of materials and services for the Project. More specifically:

- The Finance Section will assign a dedicated point of contact for all PIP-II procurements with his/her effort funded as an indirect expense to the Project.
- The Finance Section will assign dedicated Procurement Manager support to the PIP-II Project as required to manage complex procurements, by the time of CD-2. The ProcurementSupportwill report his/her effort directly to the appropriate PIP-II Project task code.
- The Finance Section will solicit competitive, best-value proposals for all major procurements. The Project will provide technical support for the development and evaluation of such solicitations.

# 8 PROJECT SUPPORT

The PIP-II Project will work directly with the Fermilab Office of Project Support Services (OPPS) to assure that the Project is developed and executed in conformance with all DOE and Fermilab policies and procedures concerning projects. More specifically:

- The PIP-II Project will hold the primary responsibility for the development of all project documentation required by DOE and Fermilab. The OPSS will provide support and guidance to the Project in developing this documentation.
- The PIP-II Project will develop a Resource Loaded Schedule, in Primavera P6. The RLS will include all tasks required to complete the DOE-funded scope of work and will be developed to meet all DOE and Laboratory reporting requirements.
- The PIP-II Project will maintain the Project Risk Register within the Fermilab Sharepoint system. On an annual basis, the Project and the Fermilab Directorate will agree upon which risks are appropriately assigned to the project and which to the laboratory.
- The Project will hold the primary responsibility for implementation of the Earned Value Management System (EVMS), in advance of CD-2. The OPSS will provide support and guidance to the Project in implementing the FRA EVMS.
- The OPSS will organize and conduct Directors Reviews in advance of DOE Independent Project Reviews associated with all Critical Decisions, and at other times as agreed to between the Project and the Fermilab Directorate.
- The Accelerator Division will sponsor the PIP-II Machine Advisory Committee (P2MAC) for the duration of the Project. The Accelerator Division will be responsible for developing the charge for each P2MAC meeting and the Project will be responsible for developing an agenda responsive to this charge.
- The Project will be responsible for the management of contributions from international partners, with assistance from the Fermilab Directorate. It is anticipated that deliverable schedules for international in-kind contributions to the construction phase will be formalized in advance of CD-2.
- The Project will be responsible for the management of contributions from national partners, with assistance from the Fermilab Directorate.

# 9 REFERENCES

[1] "PIP-II Assumptions Document (PIP-II document #144)," March 2017. [Online]. Available: http://pip2-docdb.fnal.gov:8080/cgi-bin/ShowDocument?docid=144.

[2] "PIP-II Functional Requirements Specification (TeamCenter Document ED0001222)," March 2017. [Online].

[3] U.S. Department of Energy, *PIP-II Preliminary Project Execution Plan,* 2017.