

Recycler 2.5 MHz RF System

Project Plan
February 2015



Fermi National Accelerator Laboratory

A Department of Energy National Laboratory
Managed by Fermi Research Alliance, LLC



The Project Plan 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 Project Plan (e.g., name changes to the positions cited in the Project Plan), 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.

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Recycler 2.5 MHz RF
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A. Submittal Page

Submitted, Accepted, and Approved by:

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Sergei Nagaitsev Date

Chief Accelerator Officer
Fermilab Directorate

S Nagaitsev 02/11/15
Sergei Nagaitsev Date

Accelerator Division Head

Mary Convery 2/10/15
Mary Convery Date

Muon Campus Program Coordinator

Ioanis Kourbanis 02/10/2015
Ioanis Kourbanis Date

Project Director

Ioanis Kourbanis 02/10/2015
Ioanis Kourbanis Date

Project Manager



B. Project Objectives

The Fermilab Recycler is a 3.3 km proton storage Ring using permanent magnets. It will be used for slip stacking 12 Booster batches and then injecting in the Main Injector thus reducing the MI Cycle to 20 Booster ticks from 33. Since slip stacking only takes 13 Booster ticks, Recycler will be available for beam delivery to the muon campus experiments. In order to provide the required longitudinal beam structure for the muon campus experiment 80 KV of 2.5 MHz RF are required in the Recycler. The Recycler 2.5 MHz project is a \$9.2M effort that is designed to provide the RF system required for the longitudinal beam structure for the muon campus physics experiments.



C. Project Scope

The Recycler 2.5 MHz project will assemble and install 7 2.5 MHz cavities and associated RF amplifiers, controls, cooling, and support hardware within the Recycler. Two extra 2.5 MHz cavities will be assembled and installed in the Delivery Ring. Those cavities will come with the RF amplifiers and a cooling system.

D. Project Organization 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 of and concurrence with this Project Plan;
- 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 Project Plan 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 Project Plan.
- 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 413.3-1. Other DOE Order 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 Integrated Project Team (IPT).

The IPT structure shown in 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. The Fermilab's Chief Accelerator Officer, and the Accelerator Division Head, Sergei Nagaitsev, is the Project Sponsor championing the project. The Project Sponsors establish and approve the mission need and allocate the funds from the Fermilab budget.

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



The Project Sponsors have designated Mary Convery of the Accelerator Division as the Muon Campus Program Coordinator (Program Coordinator) and Ioanis Kourbanis of the Accelerator Division as the Fermilab AIP Director (Project Director). The Program Coordinator and the 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 Muon Campus projects.

Fermilab has designated Ioanis Kourbanis (Accelerator Division Main Injector 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.

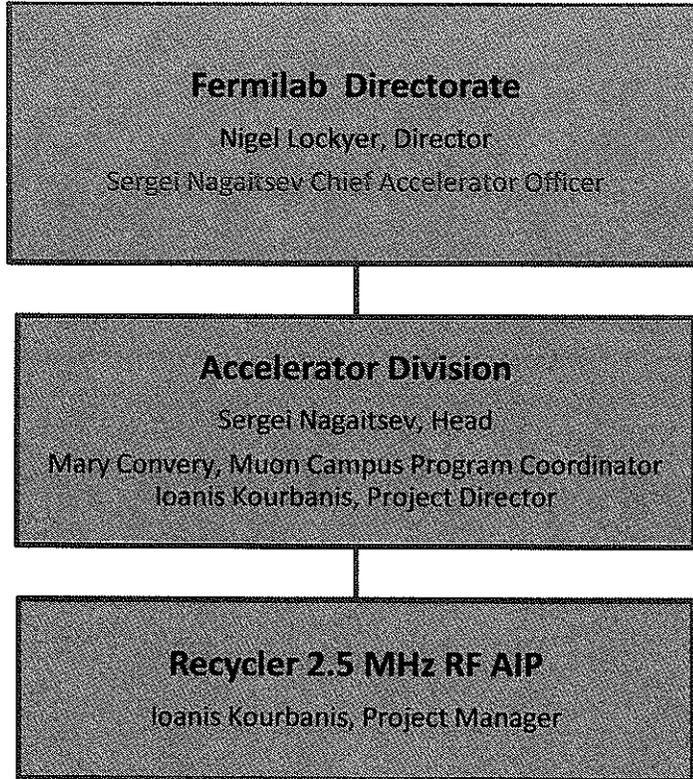
All project stakeholders are considered to be organizational project assets and are considered invaluable during the planning and execution of the project. The Program Coordinator and Project Manager will identify those key stakeholders and obtain the relative inputs critical to the project's success.

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

ES&H Management

The AD ES&H Department, headed by John Anderson, 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, 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.

Accelerator Division will be responsible for reviewing the project for NEPA compliance. We expect that the project will comply within the Fermilab Muon Campus Categorical Exclusion (CX) approved by DOE on June 8, 2012.





E. Resource Requirements

Funding

This project is an Accelerator Improvement Project (AIP) with a Total Project Cost (TPC) of \$9,231,101.

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 Task Coordinator/ Manager will coordinate with the Fermilab Time and Materials office to arrange all necessary craft support.



F. Project Baseline

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

Work Breakdown Structure (WBS) Dictionary

The WBS will follow the existing Recycler 2.5 MHz RF WBS. 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
RRF1	Recycler 2.5 MHz RF AIP
RRF1.01	Recycler Management
RRF1.01.01	Milestones
RRF1.01.02	Recycler AIP Oversight
RRF1.02	RF
RRF1.02.01	Cavities & Power Amplifiers
RRF1.02.02	RF Cooling
RRF1.02.03	Low Level RF
RRF1.02.04	Installation
RRF1.02.05	8Kw 2.4 Mhz Cavity System

For accounting purposes, the contingency 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 contingency for this project.

For accounting purposes, the indirect costs of the above listed WBS items will be included in the WBS items. For reference purposes, Indirect Costs rates are defined by DOE Order 4700.1 that states indirect costs are "...costs incurred by an organization for common or joint objectives and which cannot be identified specifically with a particular activity or project. The multipliers used in this document are based on current Fermilab rates in effect as of January 2013.

Baseline Project Costs

Listed below are the baseline project costs for this project.

Escalation

WBS	Item Description	Base Cost w/Escalation	Contingency	Indirect Costs	Total
RRF1	Muon Campus Recycler RF AIP	\$4,934,734	\$2,007,849	\$2,288,518	\$9,231,101
RRF1.01	Recycler Management	\$218,544	NA*	\$131,555	\$350,099
RRF1.02	RF	\$4,716,190	NA*	\$2,156,963	\$6,873,153
RRF1.02.01	Cavities & Power Amplifiers	\$3,328,485	NA*	\$1,674,130	\$5,002,616
RRF1.02.02	RF Cooling	\$368,297	NA*	\$122,811	\$491,108
RRF1.02.03	Low Level RF	\$112,469	NA*	\$63,439	\$175,907
RRF1.02.04	Installation	\$274,490	NA*	\$97,474	\$371,963
RRF1.02.05	8kW 2.4 Mhz RF Cavity System	\$632,449	NA*	\$199,109	\$831,559



The baseline estimates have been escalated by task using the following escalation rates:

M&S= 2.7% /year (FY14, FY15, FY16)

SWF= 2.7% /year (FY14, FY15)

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

Baseline Project Milestones

The baseline milestones listed below sets forth the major activities essential for the completion of the project. Note that tunnel and service building installation milestones are tied to accelerator shutdowns that are outside the control of this project.

MILESTONE	DEFINITION	BASELINE
Start Project	Project Plan signed	Month 0
Finish RF Cavity Cooling Tests		Month 8
Receive all Ferrites	All extra Ferrites required for the assembly of 9 2.5MHz cavities are received.	Month 12
Testing of SS drivers complete		
Cooling system for DR cavities complete.		
Finish Cavity Assembly		Month 31
Begin Tunnel Installation		Month 39
Tunnel Installation Complete		Month 41
Begin Service Building Installation		Month 39
Service Building Installation Complete		Month 41
Project Complete	Project Closed	Month 42



Funding Profile

Listed below is the anticipated total Obligation Profile for this project as contained in the Fermilab Project Request Form.

	FY13	FY14	FY15	FY16	Total
Labor					
SWF Base Escalated	\$83,586	\$790,884	\$788,230	\$134,465	\$1,797,166
SWF Indirect Costs	\$82,993	\$785,269	\$575,327	\$114,820	\$1,558,409
Subtotal	\$166,579	\$1,576,154	\$1,363,557	\$249,285	\$3,355,575
SWF Contingency	*NA	*NA	*NA	*NA	*NA
Total	\$166,579	\$1,576,154	\$1,363,557	\$249,285	\$3,355,575
M&S					
M&S Base Escalated	\$275,114	\$1,825,474	\$264,507	\$772,474	\$3,137,569
M&S Indirect Costs	\$30,035	\$384,892	\$133,420	\$181,762	\$730,109
Subtotal	\$305,149	\$2,210,366	\$397,927	\$954,236	\$3,867,677
M&S Contingency	*NA	*NA	*NA	*NA	*NA
Total	\$305,149	\$2,210,366	\$397,927	\$954,236	\$3,867,677
Total					
Base Escalated	\$358,700	\$2,616,358	\$1,052,737	\$906,939	\$4,934,734
Indirect Costs	\$113,028	\$1,170,161	\$708,747	\$296,582	\$2,288,518
Subtotal	\$471,728	\$3,786,519	\$1,761,484	\$1,203,521	\$7,223,252
Contingency	*NA	*NA	*NA	*NA	\$2,007,849
Total	\$471,728	\$3,786,519	\$1,761,484	\$1,203,521	\$9,231,101



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.

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 and TD personnel.

A Davis-Bacon determination has been prepared for this project and a copy is attached in the appendix.



G. 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 on a report issued by the Finance Section. 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 his 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 contingency's funds.

The Funding Profile, depicted in Section F, 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 obligations 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 F of this report, depicts 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 with DOE Fermi Site Office concurrence, thus 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.



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Change	Approval Required	Change Request Form
In scope \leq \$100k or \leq 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
Non-Emergency required for ES&H regulations	Control Board	Required
Change to Project Scope	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 Directorate	S. Nagaitsev
Fermilab AD	S. Nagaitsev
Program Manager	M. Convery
Project Director	I. Kourbanis
Project Manager, Chair	I. Kourbanis

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.



H. Design and Construction Principles

Integrated Safety Management (ISM)

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM), in accordance with Department of Energy Order 413.3 "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 Conceptual Design through Title III 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

All potential risks will be identified and tracked to insure that sufficient budget and schedule contingency are incorporated into the baseline plan. These risks will be monitored and reported, at a minimum at the monthly PMG, and retired as appropriate.



J. 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 order to prepare a Quarterly AIP report.

Reviews

Directorate Level Review – If appropriate and 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 Project Oversight Group meetings.