Draft Whitepaper on LBNF International Governance
Version 3
15 January 2015

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Introduction

A new international science collaboration is forming that brings together a global neutrino community to pursue an accelerator-based long-baseline neutrino experiment, as well as neutrino astrophysics and nucleon decay, with a large liquid argon detector located deep underground, and a high-resolution near detector. Several independent worldwide efforts, developed through many years of detailed studies, have now converged around the opportunity provided by the megawatt neutrino beam facility planned at Fermilab and by the new significant expansion with improved access foreseen at the Sanford Underground Research Facility in South Dakota. The new international team has the necessary expertise, technical knowledge, and critical mass to design and implement this exciting discovery experiment in a relatively short timeframe. The proto-collaboration has presented a Letter of Intent to the Fermilab PAC in January 2015, with a first collaboration meeting to follow shortly thereafter.

To design, build and execute this world-class program in long-baseline neutrino oscillation, nucleon decay and neutrino astrophysics research, two distinct but closely linked entities will be created:

- An international science collaboration (placeholder name 'ELBNF'), which will design, build, operate, and do scientific research with a system of neutrino detectors, and also enable other research opportunities such as searches for baryon number violating processes and neutrino astrophysics.
- A Long Baseline Neutrino Facility providing the neutrino beam that will illuminate the neutrino detectors, as well as conventional facilities and major technical infrastructure to support the beamline and the detectors.

This note sketches a proposed framework and high-level organization for this program, focused on issues of international governance and oversight of the management of the design and construction of the two projects. The organization will evolve as the program

moves from construction to operations and research. The internal management of the science collaboration is outside the scope of this document.

Overview of responsibilities

Fermilab will host LBNF and ELBNF, with substantial international participation in both. The Department of Energy Office of High Energy Physics (DOE-HEP) represents the U.S as the host country, and management of LBNF and oversight of ELBNF are delegated to Fermilab by DOE-HEP.

International contributions to the design and construction of LBNF and ELBNF will be defined in the context of bi-lateral agreements between the United States and other participating countries. The country-to-country negotiations and the formalities of the agreements are beyond the scope of this document. However, mechanisms are outlined in this document to facilitate joint consultation between the partner funding agencies, such that coordinated oversight and actions will be taken to ensure the success of the overall program.

International Joint Oversight Group

An International Joint Oversight Group (IJOG) will be made up of representatives from each funding agency involved in the program to provide global coordination across the entire enterprise. The IJOG will be chaired by the DOE Office of Science Associate Director for High Energy Physics. During the formative stages of the program, the IJOG will develop the overall division of responsibilities for the construction of LBNF and ELBNF, which will then be codified in the bi-lateral agreements. As the program matures, the IJOG would meet annually or as needed to review progress, approve annual updates to the overall strategic plan presented by Fermilab as host lab, and resolve issues that may require re-allocation of resources between the facilities and experiment projects.

The IJOG will provide oversight of the two projects through the Resource Review Board (see below), and by coordinating reports from reviews initiated, charged, and conducted by the relevant funding agencies, and by relevant laboratories such as Fermilab and CERN. In particular the DOE Office of Project Assessment will conduct reviews of the facilities project, and of U.S. contributions to the detector project, as charged by DOE-HEP. It is expected that each funding agency will carry out periodic reviews according to its own procedures, and that the reports from these reviews will be made available to the IJOG, Fermilab management, and the ELBNF collaboration.

Resource Review Board

To provide more focused monitoring of each of the two projects, the IJOG will create a Resource Review Board (RRB) made up of representatives of that project's funding agencies and Fermilab management. The management of the ELBNF collaboration and the LBNF project participates in the RRB meetings. The RRB will be chaired by a representative of the Fermilab Director. The RRB may spawn sub-entities focused, e.g., on the facilities project or on costing. The role of the RRB will include:

- Coordinating the development of international agreements
- Monitoring the Common Projects and the use of the Common Funds
- Monitoring the general financial and manpower support
- Resolving issues that may require reallocation of responsibilities among the project's funding agencies
- Reaching agreement on a maintenance and operation procedure and monitoring its functioning

The management of the ELBNF collaboration or the facilities project will provide regular reports to the RRB on technical, managerial, financial and administrative matters. The RRB meets twice a year or as needed, and reports to the Fermilab Director and to the IJOG.

Fermilab roles and responsibilities

Fermilab is directly responsible for LBNF, including the design, construction, installation, commissioning and operation of the facilities and infrastructure that support the entire program:

- The neutrino beamline, including the primary proton beamline, target, horn, decay pipe, absorber, and all primary and secondary beamline instrumentation.
- The major technical infrastructure necessary to support the ELBNF near and far detectors, including cryogenic systems and cryostats.
- The conventional facilities for the beamline and near detector on the Fermilab site
- The conventional facilities for the far detector at the Sanford Underground Research Facility (SURF). Although the South Dakota Science and Technology Authority owns and operates SURF, Fermilab would serve as the single point of contact for the ELBNF collaboration on all matters pertaining to the far site.

Fermilab will work with the ELBNF collaboration and international partners in designing and building these facilities.

The LBNF project will be led by a Project Manager who is appointed by the Fermilab Director, with the concurrence of DOE-HEP and the IJOG. The LBNF Project Manager is a Fermilab employee who reports to Fermilab management. The LBNF Project Manager is

responsible for the successful execution of the facilities project, ensuring that it meets all scientific, technical, cost and schedule goals.

The LBNF project will be organized as a standard line-managed project, with a WBS, and WBS sub-project managers assigned to an appropriate level. WBS sub-project managers may be drawn from any of the countries or institutions that contribute to the design and construction of LBNF, taking account of the required technical and management expertise and of the countries or institutions that plays a significant role in that aspect of the project.

The existing Fermilab Physics Advisory Committee (PAC) will provide regular international scientific peer review of the program. In addition Fermilab is creating a new peer review committee, the LBNC, which will meet more often than the PAC and focus on the scientific and experimental program of LBNF. Reports from the LBNC to the Fermilab Director would be shared with the IJOG and the ELBNF collaboration management.

Fermilab, as host lab, will also provide oversight of the ELBNF collaboration and detector construction project through:

- Regular meetings with the Collaboration leadership
- Approving the selection of Collaboration Spokespeople,
- Providing the Technical and Resource Coordinators (see below),
- Convening and co-chairing the Resource Review Board,
- Regular scientific reviews by the PAC and LBNC
- Director's Reviews of specific management, technical, cost and schedule aspects of the detector construction project
- Other reviews as needed

Collaboration roles and responsibilities

The ELBNF Collaboration is a self-organized entity bringing together scientific groups from around the world to perform this experiment. It is responsible for:

- The definition of the scientific goals and strategy of the experiment
- The corresponding definition of the scientific and technical requirements on the detector systems
- The corresponding definition of the scientific and technical requirements on the conventional facilities including the neutrino beam line
- The design, construction, installation, commissioning and operation of the near and far detector systems
- The scientific research program conducted with the detectors

ELBNF is an international collaboration involving many countries and funding agencies

that support its work and support the design, construction and operation of the detectors. Its organization will be determined by the Collaboration in consultation with the funding agencies (IJOG) and Fermilab. Some key organizational structures are likely to include: Spokespeople, an Institutional Board, an Executive Board, scientific and technical working groups, and a project structure to design and build the detector systems. The roles and responsibilities described here are specifically those that pertain to the detector construction project and do not pertain to the broader role of the Collaboration and its leadership in the scientific research program.

Spokespeople will be selected by the Collaboration according to its own rules. They are the scientific leaders of the Collaboration, responsible for scientific, technical, and organizational decisions pertaining to the Collaboration. They are the principal representatives of the Collaboration in interactions with Fermilab and its committees, with the wider physics community and with the general public. The Spokespeople are responsible to the constituent funding agencies, through the Fermilab Director, for the successful design, construction and operation of ELBNF, ensuring that it meets all scientific, technical, cost and schedule goals.

The management of the detector construction project will be delegated to a project management team led by the Technical Coordinator and Resource Coordinator. The Technical Coordinator is responsible for the common project construction and the technical integration of all detector components and systems, which are provided by the collaborating institutions. The Resource Coordinator is responsible for the overall resource planning and for ensuring that the resource planning is consistent with the constraints of different national budget circumstances and planning cycles. The Technical and Resource Coordinators report to the Spokespeople, and are selected by the Collaboration with the agreement of the Fermilab Director. They will be Fermilab employees for the duration of the project, heading a project office within the Fermilab Neutrino Division.

Experiment-Facility Interface Group

Close and continuous coordination between ELBNF and LBNF will be required to ensure the success of the combined enterprise. An Experiment-Facility Interface Group (EFIG) will be established to oversee and ensure the required coordination both during the design and construction and the operational phases of the program. This group will cover areas including:

- Interface between the near and far Detectors and the corresponding conventional facilities.
- Interface between the detector systems provided by ELBNF and the technical infrastructure provided by LBNF.

- Design and operation of the LBNF neutrino beamline. This is a particularly important activity, since the neutrino-energy spectrum and other characteristics of the neutrino beam, and the ability to measure those characteristics, are a crucial part of the long-baseline experimental program.

The EFIG comprises representatives of Fermilab management, the ELBNF collaboration, and other members as this group may deem necessary to carry out the coordination function.