

SCIENTIFIC AND TECHNICAL COOPERATION

Neutrino Program

**Protocol I Between the
UNITED STATES OF AMERICA
and the EUROPEAN ORGANIZATION FOR
NUCLEAR RESEARCH**

To Agreement of May 7, 2015

Signed at Geneva December 18, 2015



NOTE BY THE DEPARTMENT OF STATE

Pursuant to Public Law 89—497, approved July 8, 1966
(80 Stat. 271; 1 U.S.C. 113)—

“ . . .the Treaties and Other International Acts Series issued under the authority of the Secretary of State shall be competent evidence . . . of the treaties, international agreements other than treaties, and proclamations by the President of such treaties and international agreements other than treaties, as the case may be, therein contained, in all the courts of law and equity and of maritime jurisdiction, and in all the tribunals and public offices of the United States, and of the several States, without any further proof or authentication thereof.”

**EUROPEAN ORGANIZATION FOR
NUCLEAR RESEARCH**

**Scientific and Technical Cooperation:
Neutrino Program**

*Protocol I to agreement of May 7, 2015.
Signed at Geneva December 18, 2015;
Entered into force December 18, 2015.*

NEUTRINO PROTOCOL I

between

**THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA (DOE)**

and

**THE EUROPEAN ORGANIZATION
FOR NUCLEAR RESEARCH (CERN)**

to

THE CO-OPERATION AGREEMENT

concerning

**SCIENTIFIC AND TECHNICAL CO-OPERATION
IN NUCLEAR AND PARTICLE PHYSICS**

2015

The Department of Energy of the United States of America ("DOE"),

and

The European Organization for Nuclear Research ("CERN"), an Intergovernmental Organization having its seat at Geneva, Switzerland,

(hereafter collectively referred to as "the Parties"):

CONSIDERING:

That the Parties continue to collaborate to their mutual benefit under the Co-Operation Agreement Concerning Scientific and Technical Co-Operation in Nuclear and Particle Physics signed May 7, 2015 (hereinafter the "2015 Co-Operation Agreement");

That the Parties have already demonstrated successful collaboration in the design, fabrication and operation of two major high energy physics detector facilities at CERN's Large Hadron Collider;

That the Parties, on the basis of reciprocity, have expressed their intent to further develop their scientific and technical co-operation;

That the 2015 Co-Operation Agreement expresses CERN's interest in participating in scientific programs of DOE;

That definitive measurements of neutrino properties that may explain our fundamental understanding of the presence of matter and the absence of antimatter in the universe, the dynamics of the supernovae, and the possibility of proton decay are to greatly enhance the research program at the "intensity frontier" of elementary particle physics; and

That it is in the mutual interest of the Parties to co-operate on an international neutrino program under this Neutrino Protocol I (hereinafter "Protocol"),

HAVE AGREED AS FOLLOWS:

Article 1

Purpose

- 1.1 The purpose of this Protocol is to define the framework under which the Parties will co-operate in the field of neutrino physics, including enabling technologies for neutrino detectors and particle beams. Each Party shall provide contributions to co-operative projects hosted by the other Party.
- 1.2 The largest co-operative activity covered by this Protocol is the Long Baseline Neutrino Program (hereinafter "LBNP"), located in the United States and hosted by DOE. It is comprised of the Long Baseline Neutrino Facility (hereinafter "LBNF") and the Deep Underground Neutrino Experiment (hereinafter "DUNE"). The former is a multi-site facility that enables a neutrino beam to illuminate a deep underground science laboratory that houses DUNE as well as provides the experiment with the required infrastructure and services.
- 1.3 This Protocol also establishes the framework under which the Parties may collaborate in the Short Baseline Neutrino program (hereinafter "SBN") located in the United States at the Fermi National Accelerator Laboratory (hereinafter "Fermilab") and in the CERN Neutrino Platform project to be hosted by CERN.

Article 2

Scientific Goals

- 2.1 The scientific goals of the Parties' co-operative activities in neutrino physics include, but are not limited to, the following:
 - (a) A comprehensive investigation of neutrino oscillations to test charge-parity violation in the lepton sector which could explain the absence of antimatter in the universe;
 - (b) A determination of the ordering of the neutrino masses;
 - (c) Testing of the three-neutrino paradigm;
 - (d) Measurement of neutrino scattering cross sections with various nuclei;
 - (e) A search for nucleon decay; and

- (f) Measurement of astrophysical neutrinos, particularly those from core-collapse supernovae.

Article 3 Scope

- 3.1 The Parties plan to co-operate in the following projects of mutual interest:
- (a) Research and development of experimental techniques related to neutrino detectors and neutrino beam lines;
 - (b) Scientific research activities related to co-operative projects in neutrino physics;
 - (c) A CERN Neutrino Platform project that is designed as a test facility for large detector prototypes and demonstrators. As host laboratory for this project, CERN shall establish the facility, and DOE shall provide scientific support and in-kind contributions through Memoranda of Understanding ("MOUs") in accordance with Article 7 of this Protocol and/or implementing arrangements in the form of Addenda to this Protocol in accordance with Article 8 of this Protocol;
 - (d) Support for activities related to the construction and operation of the Fermilab SBN program. CERN, in co-operation with its European partner agencies, shall provide portions of detector subsystems and part of the cryogenic infrastructure. As host laboratory for the program, Fermilab shall provide needed infrastructures including laboratory complexes and general utilities. The Parties plan to develop Fermilab SBN program contribution criteria, which will be documented in an implementing arrangement in the form of an Addendum to this Protocol in accordance with Article 8 of this Protocol. In-kind contributions consistent with such criteria will be documented through MOUs in accordance with Article 7 of this Protocol and/or implementing arrangements in the form of Addenda to this Protocol in accordance with Article 8 of this Protocol;

- (e) LBNF, which will provide infrastructure in the form of a deep underground scientific laboratory located at the Sanford Underground Research Facility (hereinafter "SURF") and a Fermilab accelerator complex that will deliver high-intensity neutrino beams for DUNE.
 - i. The underground laboratory will have sufficient size and infrastructure to support detectors containing tens of kilotons of liquid argon target mass.
 - ii. Infrastructure will be provided for detector components located at Fermilab.
 - iii. The Fermilab accelerator complex is expected to provide megawatts of beam power for the production of its neutrino beam.
- (f) The design, construction, and operation of DUNE, which will be guided by an international collaboration (hereinafter the "DUNE Collaboration") and to which the Parties shall contribute resources; and
- (g) Exchanges between the Parties through visits of scientists and specialists in activities related to this Protocol.

Article 4

Organization and Management

- 4.1 An International Neutrino Council for LBNP shall be composed of representatives from regional funding agencies and CERN that make major contributions to the LBNP infrastructure. It shall be chaired by a representative from DOE and shall act as a consulting body to DOE concerning LBNP.
- 4.2 The Fermilab LBNP Resources Review Boards for LBNF and the DUNE Collaboration, composed of representatives of each participating funding agency and chaired by the Fermilab Directorate, shall monitor and oversee resource-related matters concerning LBNF and DUNE, respectively, and provide advice to the Fermilab Directorate on these

issues. CERN shall be a member of these LBNP Resources Review Boards.

4.3 The organization of DUNE shall be determined by the Executive Committee of the DUNE Collaboration in consultation with the International Neutrino Council for LBNP, the Fermilab Directorate, and such other institutions as the Executive Committee of the DUNE Collaboration finds appropriate. The upper-management level of the DUNE Collaboration shall consist of the following:

- (a) Spokespeople, selected by the DUNE Collaboration, shall act as the principal representatives of the DUNE Collaboration and are responsible to the constituent funding agencies for meeting the scientific, technical, cost and schedule goals of the project.
- (b) The Technical Co-ordinator of the DUNE Collaboration shall be a Fermilab staff member, and shall have overall responsibilities for technical aspects of detector construction. In particular, the responsibilities shall include project planning, fabrication, installation, integration, support services and safety for DUNE.
- (c) The Resource Co-ordinator of the DUNE Collaboration shall be a Fermilab staff member, and shall have overall responsibility for monitoring the financial aspects of the DUNE detector project, including budget and resource planning. The Resource Co-ordinator shall also have managerial responsibility for Common Projects as well as for corresponding Common Funds that support these Common Projects.

4.4 The organization of LBNF shall be determined by the Fermilab Directorate. The upper-management level of the LBNF Project shall consist of the following:

- (a) The Project Director of LBNF shall be a Fermilab staff member, and shall have overall responsibilities for technical aspects of construction of LBNF. In particular, the responsibilities shall include project planning, construction, installation, integration, support services and safety for the LBNF Project.

- (b) The Project Director of LBNF shall be assisted by a Management Board whose composition shall be defined by the Fermilab Directorate and shall at all times include a CERN representative.

4.5 An Experiment-Facility Interface Group shall be established to monitor all relevant issues that cut across the boundaries of DUNE and LBNF and provide appropriate guidance to the Fermilab Directorate. Its members shall be appointed by the Fermilab Directorate and shall at all times include a CERN representative.

Article 5 CERN Contributions to LBNP

5.1 Contributions to DUNE shall conform to the following:

- (a) CERN, in co-operation with its European partner institutions, shall contribute, in whole or in part, to the provision of items for DUNE considered as part of common projects which are the responsibility of the overall DUNE Collaboration (hereinafter "Common Projects"). Such items shall be funded directly or indirectly by all participants in the Collaboration, and their provision shall be subject to approval by the Fermilab Resources Review Boards in accordance with Article 5.2 of this Protocol. CERN's contributions shall be specified in MOUs in accordance with Article 7 of this Protocol and/or implementing arrangements in the form of Addenda to this Protocol in accordance with Article 8 of this Protocol.
- (b) Cash contributions from CERN, in co-operation with its European partner institutions, including contributions to "Common Funds" for costs associated with Common Projects, shall be specified in MOUs in accordance with Article 7 of this Protocol and/or implementing arrangements in the form of Addenda to this Protocol in accordance with Article 8 of this Protocol.
- (c) MOUs for DUNE shall be used to cover the construction of the relevant detectors and their installation in the experimental areas, and shall include the distribution of tasks and other

responsibilities for all participating institutions, including those from CERN and its partner institutions, as well as the organizational, managerial, and financial guidelines to be followed by the DUNE Collaboration. Technical Design Reports on the scientific and technical aspects of DUNE shall be submitted by the DUNE Collaboration to Fermilab for approval and shall be a basis for the commitments specified in such MOUs for DUNE in accordance with Article 7 of this Protocol.

5.2 Contributions to LBNF shall conform to the following:

- (a) CERN shall contribute in-kind deliverables for the detector infrastructure and the cryogenic infrastructure as shall be specified in MOUs in accordance with Article 7 of this Protocol and/or implementing arrangements in the form of Addenda to this Protocol in accordance with Article 8 of this Protocol. Specifications of the value of in-kind contributions by CERN shall follow standard CERN accounting practices.
- (b) MOUs shall cover the construction and installation of LBNF infrastructure and related components, and shall include the distribution of tasks and other responsibilities for all participating institutions, including those from CERN and its partner institutions, as well as the organizational, managerial, and financial guidelines to be followed by the LBNF Project. Technical Design Reports on the technical aspects of LBNF shall be submitted by the LBNF Project to Fermilab for approval and shall be a basis for the commitments specified in such MOUs for LBNF in accordance with Article 7 of this Protocol.

Article 6

Responsibilities of DOE

- 6.1 DOE shall represent the United States as the host nation of LBNP, and is ultimately responsible for the success of the entire program. In particular, DOE shall be responsible for the development, maintenance, and operation of all infrastructure and supporting equipment required for the successful execution of LBNP.

- 6.2 The Fermilab Directorate will have responsibility for the management of LBNF and the oversight of DUNE. Such responsibilities, to the extent they are consistent with the Fermilab Directorate's management and operations contract with DOE, shall include:
- (a) Responsibility for the organization and successful execution of LBNF;
 - (b) Responsibility to co-ordinate resources and activities related to LBNF with its international partners. In furtherance of this responsibility, regular reports concerning LBNF shall be provided to the LBNP International Neutrino Council; and
 - (c) Responsibility for approving the appointments of the Technical and Resource Co-ordinators for the DUNE Collaboration, and ensuring that they have the staff and engineering support required to carry out their responsibilities. It shall be Fermilab's overall responsibility to use reasonable efforts to ensure that there is a satisfactory match between the available resources (including funding and manpower) and the approved detector projects.
- 6.3 DOE shall be responsible for maintaining safe working environments for LBNF, DUNE, and all SBN experiments hosted at Fermilab. DOE has the authority to intercede in any such co-operative activity to ensure that all applicable environmental, safety and health regulations are being observed. Periodic reviews shall be held by DOE with the participation of representatives from CERN.

Article 7

Memoranda of Understanding

- 7.1 MOUs may be exchanged between the Parties or their delegated laboratories to memorialize specific co-operative activities to be conducted under this Protocol. Such MOUs may cover, but are not limited to, specifications of equipment or personnel to be exchanged, definition of task responsibilities within a specific project, contributions, and adjustments of organizational structure as needed. MOUs may be written and exchanged at the project level, subject to the internal policies of each Party.

- 7.2 Institutions of Member States and Associate Member States of CERN, and of States and International Organizations participating in CERN's scientific program on the basis of International Co-operation Agreements and similar instruments, may elect to memorialize their contributions in appropriate legal instruments to be concluded with CERN. Their contributions shall be received and integrated as appropriate by CERN before delivery to Fermilab, and as such shall be considered as contributions from CERN.

Article 8 Amendment

The Parties may amend this Protocol at any time by mutual written consent, so long as the 2015 Co-Operation Agreement remains in force. Implementing arrangements in the form of Addenda to this Protocol, which shall be subject to formal review by the Government of the United States and by CERN, are the preferred vehicles for legally-binding alterations or additions.

Article 9 Entry into Force, Duration, and Termination

This Protocol shall enter into force upon signature by both Parties. This Protocol shall remain in force for an initial period of five years and shall thereafter be renewed automatically, each time for a new period of five years, unless a written notice of termination is given by one Party to the other Party, or the Parties have agreed on its renewal by another period, at least six months prior to the renewal date, so long as the 2015 Co-Operation Agreement remains in force.

Article 10
Final Provisions

- 10.1 Each Party's participation in the activities contemplated by this Protocol is subject to the availability of appropriated funds, personnel, and other resources.
- 10.2 This Protocol is subject to and governed by the terms of the 2015 Co-Operation Agreement.

DONE at Geneva, Switzerland, in duplicate in the English language, on 18 December 2015

**FOR THE DEPARTMENT
OF ENERGY OF THE UNITED
STATES OF AMERICA:**

**FOR THE EUROPEAN
ORGANIZATION FOR NUCLEAR
RESEARCH:**



Pamela Hamamoto

Rolf Heuer

Permanent Representative of the
United States of America to the
United Nations and Other
International Organizations in
Geneva

Director-General