

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE SCIENCE AND TECHNOLOGY FACILITIES COUNCIL
AND
FERMI NATIONAL ACCELERATOR LABORATORY

CONCERNING
COOPERATION IN THE AREA OF PROTON ACCELERATORS FOR SCIENCE AND
INNOVATION

The Science and Technology Facilities Council in Swindon, Wiltshire, United Kingdom and Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois, USA, hereinafter collectively the Participants,

Recognizing their mutual interest in promoting cooperation and collaboration in proton accelerator studies and related applications,

State their understanding as follows:

1. The Participants intend to facilitate scientific cooperation which could lead to:
 - a. Proton, nucleon, muon and neutrino beams of very high power across a broad range of energy;
 - b. Making particle-beam therapy widely available through the use of compact accelerators;
 - c. Contributing substantially to the provision of low-carbon energy through accelerator-driven sub-critical nuclear reactors; and
 - d. The use of accelerator technology in cargo-scanning systems for security applications.

2. Possible cooperation under this MOU may include, but is not limited to, the following areas:
 - a. High-power, continuous and pulsed proton sources:
 - i. ISIS and Project X;
 - ii. Ion source;
 - iii. Beam chopping;

- iv. High-gradient normal and superconducting accelerating structures; and
 - v. Laser stripping
 - b. High-power particle production target:
 - i. ISIS and Project X;
 - ii. The Long Baseline Neutrino Experiment (LBNE);
 - iii. Charged particle production including pions, muons, kaons; and
 - iv. Neutral particle production including neutrinos and neutrons.
 - c. Ionization cooling:
 - i. 4D for Neutrino Factory; and
 - ii. 6D for Muon Collider
 - d. Rapid acceleration of (unstable) particles:
 - i. Scaling and non-scaling Fixed Frequency Alternating Gradient (FFAG) accelerators
 - e. Accelerator theory, code studies, and studies of conceptual designs:
 - i. Non-linear tracking (e.g., including space charge);
 - ii. Exploitation of parallel computing;
 - iii. Spallation neutron sources, the Neutrino Factory and the Muon Collider; and
 - iv. Beam dynamics in circular machines.
 - f. The interface between the accelerator and the end-user instrument.
 - g. Component studies:
 - i. High-field magnets (also high- T_c);
 - ii. High-gradient radio-frequency(RF) resonators, normal and superconducting;
 - iii. High reliability, high-power switched RF sources;
 - iv. Rapid rise time magnet power supplies; and
 - v. Beam diagnostics including novel techniques such as laser-wire beam-profile measurement.
- 3. The above areas of cooperation may support elements of a coherent program that may include (but is not limited to):
 - a. Design studies:
 - i. The International Design Study for the Neutrino Factory
 - ii. The Muon Collider Design Study; and
 - iii. The upgrade of ISIS to provide a multi-megawatt pulsed proton source.
 - b. Joint projects:
 - i. Pulsed high-power proton source
 - ii. The international Muon Ionization Cooling Experiment
 - iii. Studies for an experiment to provide the engineering demonstration of 6D ionization cooling; and

iv. Studies of the techniques required for future high-power, particle production targets.

4. Forms of Cooperation

- a. Short and long-term visits to each other's facilities, subject to appropriate written arrangements;
- b. Exchange of publicly available information; and
- c. Conduct of workshops, seminars, and other meetings.

5. General Considerations

- a. To coordinate the activities under this Memorandum of Understanding (MOU), each Participant should designate a contact person to whom correspondence is to be addressed.
- b. Cooperative activities under this MOU may commence upon signature by the Participants and continue for a 5-year period unless earlier discontinued. A Participant that wishes to discontinue its participation in the activities contemplated by this MOU should endeavor to provide the other Participant at least 30 days written prior notice. This MOU may be modified by the mutual consent of both Participants in writing.
- c. This MOU does not create any legally binding obligations between the Participants.
- d. Each Participant is responsible for the costs it incurs in participating in cooperative activities under this MOU.
- e. The cooperation contemplated by this MOU may be undertaken by a Purchase Order, a Cooperative Research and Development Agreement, a Work for Others Agreement, or other written agreement, as appropriate.

FOR: The Science and Technology Facilities
Council

FOR: Fermi National Accelerator Laboratory

BY 

BY 

TITLE CHIEF EXECUTIVE

TITLE DIRECTOR

DATE 2 NOV 2012

DATE Sept 29/12