MEMORANDUM OF UNDERSTANDING

between

JEFFERSON SCIENCE ASSOCIATES, LLC OPERATOR OF THE THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

and

SCHOOL OF SCIENCE, TOHOKU UNIVERSITY FOR COOPERATION IN THE EXPLORATION OF HIGH RESOLUTION HYPERNUCLEAR SPECTROSCOPY

Jefferson Science Associates, LLC (JSA), the management and operating contractor of the Thomas Jefferson National Accelerator Facility (JLab) for the United States Department of Energy under U.S. DOE Contract No. DE-AC05-06OR23177, and the School of Science, Tohoku University in Sendai, Japan, collectively herein the "Participants",

SHARING an interest in collaborating to advance nuclear physics using the 12 GeV Upgrade Facility at JLab,

HAVE REACHED THE FOLLOWING UNDERSTANDING:

I. OBJECTIVE

. •

, ,

This Memorandum of Understanding (MOU) outlines the activities that members of the Strange Nuclear Physics (SNP) Collaboration plan to carry out in collaboration with JLab. The SNP Collaboration is based on the joint research activity on experimental and theoretical investigations of strangeness nuclear physics by real and virtual photons to be carried out by JLab and the School of Science, Tohoku University. The collaboration plans to pursue exploring high resolution hypernuclear spectroscopy, taking advantage of the high quality high energy electron beam at JLab and the state-of-art spectrometer systems. This research is anticipated to principally take place with the High Resolution Kaon Spectrometer (HKS) and High Resolution Electron Spectrometer (HES) which have been manufactured in Japan, transported to JLab by Tohoku University and previously used by the SNP Collaboration at JLab. In particular, it foresees reinstallation and use at JLab of the hypernuclear spectrometer systems.

II. PLANNED AREAS OF COOPERATION

Proposed collaboration may include, but is not limited to, the following:

1) School of Science, Tohoku University:

1

- a) Anticipates providing financial and technical support to the design and construction of the HKS spectrometer and other equipment referred to above in paragraph 1 of this MOU. Any such support is to be implemented under an appropriate contractual agreement.
- b) Plans to send to JLab the SNP Collaboration members for purposes of discussion and planning of experiments for carrying out the joint program.
- c) Plans to host physicists from JLab who are taking part in the SNP Collaboration.
- 2) JLab:

••*

- a) Plans to provide equal treatment of SNP Collaboration members with respect to the scientific utilization of the facility and the assumption of primary responsibility for an appropriate number of experiments by the School of Science, Tohoku University physicists and their Japanese collaborators.
- b) Plans to provide, subject to the availability of funding, a contribution toward the expenses of the members of the SNP Collaboration (both physicists and technicians) while they are working at JLab. Any such support is to be implemented under an appropriate contractual agreement.

Other collaborative activities may be added by the Participants' mutual consent in writing.

III. PERSONAL PROPERTY/EQUIPMENT:

The Participants anticipate the loan and transfer of equipment as part of the planned collaborative activity. All such loans will be implemented under an appropriate written agreement:

- 1) It is anticipated that all items brought or fabricated by Tohoku University (Japanese government) are to be identified by a tag of the owner. In particular, the equipment that Tohoku University anticipates loaning to JLab for experiments to be undertaken are
 - a) Splitter magnet;
 - b) Magnets and a power supply as part of the HKS spectrometer;
 - c) Time-of-flight walls as part of the HKS detector package;
 - d) Water Cherenkov counter arrays as part of the HKS detector package;
 - e) Aerogel tiles and some of the PMT's for the Aerogel Cherenkov counters as part of the HKS detector package;
 - f) Magnets, their support, and a power supply as part of the HES spectrometer detector package;
 - g) A Honeycomb-type drift chamber as part of the electron spectrometer detector package;
 - h) Scintillator hodoscopes as part of the electron spectrometer detector package;

- i) Other specific equipment that may be required for the experiments associated with the HKS and HES spectrometers.
- 2) Property of Tohoku University is to remain the property of Tohoku University.
- 3) The Participants plan to assist each other and to take all appropriate actions to ensure expeditious resolution of customs entry and other requirements.

IV. FORMS OF COOPERATION

. .

Cooperation may include, but is not limited to:

- 1. Exchange of information, publications, reports, and technical data;
- 2. Exchange of scientists, engineers, students and other specialists for participation in project activities. Each Participant is to abide by the health, safety and environmental requirements of the host Participant when on an exchange assignment at the host Participant's facility.

V. MECHANISMS OF COOPERATION

Key personnel to act as liaison and primary point of contact for this collaboration:

JLab: Dr. Cynthia Keppel, Hall A Group Leader & Dr. Steven Wood, Hall C Group Leader

School of Science, Tohoku University: Prof. Satoshi N. Nakamura, SNP Collaboration

VI. GENERAL CONSIDERATIONS

- 1. This MOU does not create any legally binding obligations between the Participants.
- 2. The conduct of cooperative activities contemplated by this MOU is subject to the availability of funding, personnel and other resources.
- 3. Each Participant should conduct the cooperation under this MOU in accordance with applicable laws and regulations to which it is subject, including export control laws and regulations, and international agreements to which its Government is party.
- 4. Each Participant is to be responsible for the costs it incurs in participating in cooperative activities under this MOU, except as provided in Section II, paragraph 2(b).
- 5. The Participants intend to acknowledge in publications all institutions that contribute to results achieved from activities conducted under this MOU and in the manner customary for scholarly publication. Each Participant intends to utilize its institutions' review procedures for all publications (to include presentations) developed under this MOU.

VII. COMMENCEMENT, MODIFICATION AND DISCONTINUATION

- 1. Cooperative activities under this MOU may commence upon signature by the Participants and continue for a 5-year period unless discontinued in accordance with paragraph 2 of this Section VII.
- 2. The Participants may discontinue this MOU at any time by mutual consent in writing. A Participant that wishes to discontinue its participation in this MOU should endeavor to provide at least ninety (90) days written notice to the other Participant.
- 3. This MOU may be modified in writing by the mutual consent of the Participants, and may be extended for additional periods.

VIII. INTELLECTUAL PROPERTY

.

,. **.**

If the Participants decide to engage in collaborative R&D, they intend to conclude an appropriate contract agreement to provide for the adequate protection and allocation of any intellectual property created or furnished in connection therewith.

4

Signed in duplicate:

•

, **•**

Jefferson Science Associates, LLC:

Rolf Ent Assoc. Director, Physics Thomas Jefferson National Accelerator Facility

Date: 11/11/2013

ъß 11

Dr. Hugh Montgomery Director Thomas Jefferson National Accelerator Facility

Date:

Robert McKeown C Deputy Director of Science Thomas Jefferson National Accelerator Facility

11/13/13 Date:

Tohoku University:

して 4

Satoshi N. Nakamura SNP Spokesperson

Date: November 1, 2013

Prof. Hiroshi Fukumura Dean of the School of Science

Date: November 1. 2013