

MEMORANDUM OF UNDERSTANDING

between

JEFFERSON SCIENCE ASSOCIATES, LLC,
THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

and

KYUNGPOOK NATIONAL UNIVERSITY
DAEGU, REPUBLIC OF KOREA

Jefferson Science Associates, LLC, the management and operating contractor of the Thomas Jefferson National Accelerator Facility (JSA/Jefferson Lab), for the United States Department of Energy under U.S. DOE Contract No. DE-AC05-06OR23177, located at 12000 Jefferson Avenue, Newport News, Virginia 23606, and Kyungpook National University (KNU) located at 80 Dae-hak-ro, Buk-gu, Daegu 702-701, Republic of Korea, collectively herein the "Participants",

SHARING an interest in collaborating to advance nuclear physics using the 12 GeV Upgrade facility at Jefferson Lab,

HAVE REACHED THE FOLLOWING UNDERSTANDING:

I. OBJECTIVE

1. The Participants intend to work together to develop key components of the Hall B CLAS12 spectrometer as part of the 12 GeV CEBAF Upgrade Project. The Central Time-of-Flight (CTOF) detector is an important component of the particle identification system of the CLAS12 spectrometer.
2. The entities expected to collaborate in the activities under this Memorandum of Understanding (MOU) include:
 - a. JSA is a Southeastern Universities Research Association/Computer Sciences Corporation, limited liability company created specifically to manage and operate Jefferson Lab. The DOE Office of Nuclear Physics within the Office of Science operates the Continuous Electron Beam Accelerator Facility (CEBAF) as a national user facility at Jefferson Lab. CEBAF is a world leading facility in the experimental study of hadronic matter. The 12 GeV CEBAF Upgrade directly addresses a major scientific opportunity identified in both the 2002 and the 2007 Long Range Plans in which the Nuclear Science Advisory Committee of the U.S. Department of Energy and the U.S. National Science Foundation recommends the 12 GeV CEBAF Upgrade as one of its highest priorities for the program of the Office of Science's Office of Nuclear Physics. The full scope of the 12

GeV CEBAF Upgrade project includes upgrading the electron energy of the main accelerator from 6 GeV (billion electron volts) to 12 GeV, constructing a new experimental area (Hall D), and enhancing the capabilities in the existing experimental halls. Construction started in 2009 and the start of commissioning is scheduled for 2014.

- b. The KNU group is expected to provide a substantial contribution to the CLAS12 upgrade by providing assistance in the construction, testing, and commissioning of the CLAS12 detector.

II. PLANNED AREAS OF COOPERATION

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

1. KNU:

- a. Participate as a member of the Hall B Collaboration,
- b. Participate in the construction of the Hall B experimental equipment, particularly the CTOF detector,
- c. Develop software for monitoring and control of experimental equipment,
- d. Provide regular updates on progress and schedule to the Hall B 12 GeV Assistant Project Manager and other key personnel, and
- e. Participate as necessary in related 12 GeV Upgrade project reviews.

2. JSA/Jefferson Lab:

- a. Provide an appropriate on-site work environment including space, computer access, necessary training, and other resources as required for all user scientists,
- b. Anticipates providing some travel support for KNU personnel while working at Jefferson Lab. Any such support is to be implemented under a separate agreement,
- c. Provide a sufficiently detailed Statement of Work describing the goals and expectations,
- d. Keep key KNU personnel informed of overall project status and requirements for the joint scope of work, and
- e. Develop and provide the forum for regular progress updates by the KNU personnel.

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

III. FORMS OF COOPERATION

Cooperation may include, but is not limited to:

- a. Exchange of information, publications, reports, and technical data;
- b. 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.

IV. MECHANISMS OF COOPERATION

A. KEY PERSONNEL

1. The spokesperson for 12 GeV participants of KNU is Dr. Wooyoung Kim (KNU professor). It is anticipated that the collaborative effort contributed to the construction is to include up to 0.2 full-time equivalent FTEs of a professor, 0.2 FTE of a research professor, 0.3 FTE of a postdoctoral researcher, and 2.0 FTEs of Ph.D. students.

The time commitment of members of the KNU research group in the 12 GeV construction efforts described in this MOU is anticipated to be as follows:

Name	Position	2014 (FTE)	2015 (FTE)	2016 (FTE)	2017 (FTE)
Wooyoung Kim	Professor	0.2	0.2	0.2	0.2
Samuel Stepanyan	Research Professor	0.2	0.2	0.2	0.2
Sanghoon Hwang	Postdoc	0.3	0.0	0.0	0.0
Sergey Chebotaryov	Grad. Student	0.5	0.1	0.0	0.0
Evgeniy Milman	Grad. Student	0.5	0.5	0.5	0.5
Vladimir Kavtanyuk	Grad. Student	0.5	0.5	0.5	0.5
Aleksey Gladkov	Grad. Student	0.5	0.5	0.5	0.5
Joshua Artem Tan	Grad. Student	0.1	0.5	0.5	0.5
TBD	Grad. Student	0.0	0.5	0.5	0.5

NOTE: FTE in the above table represents the fractional full time equivalent.

2. Key personnel from Jefferson Lab include: Dr. Latifa Elouadrhiri (Assistant Project Manager for the Hall B 12 GeV Upgrade). Dr. Elouadrhiri is to act as the liaison and primary point of contact for this collaboration will be responsible for the coordination of the technical work.

V. GENERAL CONSIDERATIONS

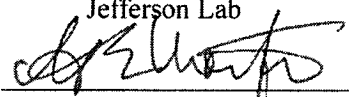
1. This MOU does not create any legally binding obligations between or among the Participants. If commitment, obligation, or transfer of funds is required, a specific contractual agreement, or other reimbursable arrangement is to be developed between JSA/Jefferson Lab and the participating organization to provide specific funding, obligation, and billing data.
2. The conduct of cooperative activities contemplated by the MOU is subject to the availability of funding, personnel, and other resources.
3. Each Participant should conduct the cooperation under the 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 responsible for the costs it incurs in participating in cooperative activities under this MOU, except as provided in Section II.
5. Any transfer or loan of equipment is to be implemented under a separate agreement.
6. 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 publications. Each Participant intends to utilize its institutions' review procedures for all publications (to include presentations) developed under this MOU.
7. If the Participants decide to engage in future collaborative R&D, they intend to provide for the adequate protection and allocation of any intellectual property created or furnished in connection therewith.

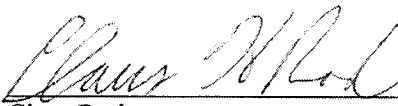
VI. COMMENCEMENT, MODIFICATION, AND DISCONTINUATION

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 VI.
2. The Participants may discontinue this MOU at any time 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 Participants.
3. This MOU may be modified in writing by the mutual consent of the Participants, and may be extended for additional periods.

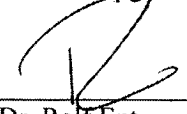
Signed in duplicate.

Jefferson Lab


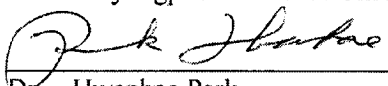
Dr. Hugh Montgomery
Date May 12, 2014
Director



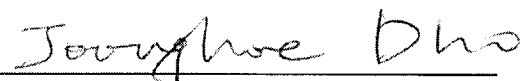
Claus Rode
Date 12-MAY-2014
12 GeV Upgrade Project Manager



Dr. Rolf Ent
Date 04/18/14
Associate Director for Physics

Kyungpook National University


Dr. Hwanbae Park
Date April 10, 2014
Dean of the College of Natural Science



Dr. Joonghoe Dho
Date April 2, 2014
Chairperson of the Department of Physics



Dr. Latifa Elouadrhiri

Date 4/17/2014

Assistant Project Manager, Hall B



Dr. Wooyoung Kim

Date April 2, 2014.

Spokesperson