Memorandum of Understanding between the GlueX Collaboration, Jefferson Laboratory, and The Nuclear Physics Group at the University of Glasgow.

Following the award of Critical Decision 0 (CD-0) by the Department of Energy in April 2004 to upgrade the Jefferson Laboratory, part of which includes building a new experimental hall for the GlueX project, it is agreed the existing Memorandum of Understanding between the Jefferson Laboratory and the Nuclear Physics Group at the University of Glasgow, will be amended as follows.

The amended Memorandum of Understanding is the same as the existing Memorandum of Understanding (copy attached) apart from:

a) the explicit inclusion of the GlueX Collaboration, and
b) the removal of Dan Watts from the list of personnel included in the Glasgow Group since he is no longer based in Glasgow.

SIGNATURE PAGE.

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Prof. Guenther Rosner Date
Group Leader
Glasgow Nuclear Physics Group.

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Dr. Jim Kellie Date
Contact Person
Glasgow Nuclear Physics Group.

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Prof. Curtis A. Meyer Date
Contact Person
Carnegie Mellon University.

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Prof. Alex Dzierba Date
Spokesperson
GlueX Collaboration.

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Dr. Elton Smith Date
Jlab HALL D Group Leader
Jefferson Lab.

Memorandum of Understanding
between the
Thomas Jefferson National Accelerator Facility
and
The Nuclear Physics Group
at the
University of Glasgow.

1. Introduction.

This Memorandum of Understanding (MOU) outlines the activities that the members of the Nuclear Physics Group in the Department of Physics and Astronomy at Glasgow University are carrying out as part of their participation in R&D for the Hall D project, and also describes how it is perceived these activities will develop.

The Hall D project is part of a general upgrading of the Jefferson Laboratory (JLab) which will increase the accelerator beam energy from 6 to 12 GeV. Hall D will require the development of a completely new experimental area which will be specifically designed to accommodate an experimental program whose main objective is to search for gluonic excitations in photoproduction reactions. The project is one of four major projects in the US recently given NSAC approval, and at present is awaiting a decision from the Department of Energy, who will fund the project, to move forward from the R&D phase.

2. Personnel.

1. The contact person for the Glasgow group is Jim Kellie (Senior Lecturer) who is a member of the Hall D Collaboration Board.
2. The following personnel are included in the Glasgow group:

Person	Position	% Research Effort
John Annand	Senior Research Fellow	20%
Dave Ireland	Lecturer	40%
Jim Kellie	Senior lecturer	50%
Ken Livingston	Research Fellow	40%
Guenther Rosner	Professor and group leader	20%
Dan Watts	Research Associate	20%

3. Since joining Hall D, the Glasgow group has contributed to the R&D program in 3 areas.

a) Bringing past experience and knowledge to the acquisition and assessment of high quality diamond radiators, which are necessary for providing linearly polarized photons. This is an essential part of the experimental program, and one to which Glasgow can make a unique contribution, since it has been supplying diamonds to the Mainz tagged photon facility for at least 10 years, has developed a good working relationship with De Beers, and has, as part of its current grant, beam time at the Daresbury Synchrotron (SRS) where X-ray analysis of the diamonds is carried out.

b) Supplying expertise in designing the goniometer system in which the diamond radiator will be mounted. Ken Livingston is an expert in this field and has been closely involved in developing the control software and setting up goniometers in both the Institut fuer Kernphysik in Mainz and in Hall B at JLab. The first experiment using linearly polarised photons in JLab was successfully completed during the summer of 2001.

c) Participating in the design and development of the new tagger and focal plane array which form one of the key components in the Hall D facility. Jim Kellie was responsible for designing the 180 MeV and 850 MeV taggers in Mainz, and the Glasgow Group as a whole has a great deal of experience in designing, building and commissioning focal plane arrays.

4. The Glasgow group will continue to play an active role in each of the 3 areas to which it has already contributed. So far Ken Livingston and Jim Kellie have been most heavily involved, but as the project develops, other members of the group will participate to a larger extent as the needs for their specific skills arise.

5. At the Hall D collaboration meeting in November 2001, the Executive Group and Collaboration Board agreed to provide R&D funds to support a Hall D Post Doctoral Fellowship based in Glasgow, and also agreed that the Collaboration would make every effort to support the position for 3 years.

   The Post Doc will be expected to:

   i) Participate in and eventually be responsible for assessing diamond radiators.
   ii) Run and develop existing computer codes which calculate coherent bremsstrahlung spectra etc.
   iii) Develop techniques for aligning diamonds and optimising the degree of linear polarisation of the coherent bremsstrahlung.
   iv) Work on the optimisation of the Hall D electron beam optics.
   v) Contribute to the design of the Hall D tagger and focal plane detector array.
   vi) Work on the construction techniques used for large magnets and if necessary become familiar with the requirements of superconducting coils.

   A research student Guangliang Yang from Jilin University in China has already expressed a keen interest in the post-doc position. The student is expected to obtain his Ph.D. in July 2002 and has excellent references.

3. Details and Funding.

Contribution from the Glasgow Group.

The Glasgow group will:

a) Supply Hall D with suitable diamond radiators. This will involve acquiring diamond slices from De Beers, assessing their quality using the Daresbury SRS and arranging for the firm Drukker to polish the diamonds to the desired thickness. At present Glasgow has beam time at Daresbury until its present grant ends in April 2005. Further beam time will be requested as part of a new grant application. The number of diamonds supplied cannot be specified since at present there is no guaranteed method for obtaining good diamonds.

b) Provide input towards specifying the new goniometer system, develop the control software, and install and commission the device in the Hall D beamline

c) Continue to play an active role in the design of the Hall D tagger and focal plane. Jim Kellie has already looked at alternative tagger configurations which become possible if superconducting rather than room-temperature coils are used.

d) Cover travel and accommodation expenses incurred by members of the Glasgow Group engaged in Hall D business (see 2.2.)

e) Fund these commitments from EPSRC grant GR/R11933/01.

Contribution from Hall D/JLab.

Hall D/JLab will:

a) Support a Hall D Post Doctoral Fellowship in the Nuclear Physics group at Glasgow for a period of 3 years at a rate of $35,000 for each of the three years.

b) Cover additional expenses related to the post-doctoral fellowship, in particular travel and accommodation costs up to $8,500 p.a.

Item	**Cost($)**
Post-doc support per annum	$35,000
Additional costs (e.g. travel and accom.) p.a.	$8,500
Total cost per annum	$43,500
Total cost for 3 years	$130,500

4. Special considerations.

A. JLab will have the final responsibility for the acceptance of all deliverables and retains the right, in conjunction with the Hall D collaboration management to terminate or renegotiate this MOU if the requirements of specification, schedule and costs cannot be met by the Glasgow Nuclear Physics Group.

B. All items bought or fabricated using JLab funds will remain the property of JLab.

C. The continuation of this agreement is dependent on the approval of funds for all parties.

D. This agreement (MOU) may be amended as necessary.

MOU between JLab and the University of Glasgow.

Signature Page

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Dr. Jim Kellie — Date
Contact Person
Glasgow Nuclear Physics Group.

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Prof. Guenther Rosner — Date
Group Leader
Glasgow Nuclear Physics Group.

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Dr. Lawrence Cardman — Date
Associate Director of Physics
Jefferson Laboratory.

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Prof. Alex Dzierba — Date
Spokesman
Hall D Collaboration.

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Dr. Elton Smith — Date
Hall D Group Leader
Jefferson Laboratory.

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Signature Page (continued).

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Head of Department of Physics and Astronomy. Date
Glasgow University.

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Dean of Faculty of Physical Sciences. Date
Glasgow University.

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Office of Research and Enterprise. Date
Glasgow University.