

**Memorandum of Understanding
between the GlueX Collaboration,
Jefferson Lab
and Florida International University**

27 April, 2004

Draft Version 3

1 Introduction

This Memorandum of Understanding (MOU) outlines the activities and responsibilities of the Florida International University (FIU) Experimental Nuclear Physics Group within the Jefferson Lab (JLab) GlueX collaboration. It describes the commitments of all three parties to the successful completion of the GlueX experiment and is subject to regular review and updating by all three parties. The manpower commitment and deliverables described in this document are contingent on continued funding of the FIU group.

The goal of the GlueX experiment is a mapping of the spectrum of gluonic excitations with the ultimate objective being a quantitative understanding of the nature of confinement in QCD. To achieve this goal a hermetic detector, the GlueX spectrometer, optimized for amplitude analysis, will be constructed in a new experimental hall (HALL D). A tagger facility will produce 9GeV linearly polarized photons via coherent bremsstrahlung radiation of 12GeV electrons through a diamond wafer. To achieve 12GeV photons CEBAF will be upgraded to 12GeV with additional cryomodules, modified arcs and an additional arc. Critical Decision 0 (CD-0) for the upgrade and GlueX was awarded by the Department of Energy (DOE) in April, 2004. The GlueX collaboration was formed in 1998. The fourth and most recent version of the GlueX Design Report was issued in 2002. The project has been reviewed externally and by the JLab PAC. The GlueX management has been in place since 2000 with a Spokesman, Deputy-spokesman, HALL D group leader and an elected Collaboration Board.

This MOU does not constitute a contractual obligation on the part of any collaborating GlueX institution or JLab. No contractual obligations shall arise except pursuant to appropriate written authorizations by each party. All foregoing work is subject to the appropriate written contractual agreement of the parties.

2 Institutional Commitments to GlueX

In general all commitments described in the following sections are contingent on appropriate funding levels by the funding agencies.

2.1 Commitments to GlueX R&D

The FIU group is currently studying the ultimate timing resolution that can be obtained from 3 double layers of scintillating fibers in combination with a VLPC readout system. This study is expected to be completed by the end of 2005. It's result will determine if a vertex detector consisting of scintillating fibers and VLPC readout can provide the necessary position and timing information.

At the same time the FIU group will adapt techniques developed at FERMI-LAB for the mounting of scintillating fiber layers in stereo super-layers. These cylindrical, helical layers will constitute the main part of the vertex and start detector. We will also investigate various detector possibilities to achieve the necessary forward coverage (down to 3° scattering angle with respect to the photon beam). Possible candidates would be 3 super-layers of scintillating fibers mounted on a spherical surface segment with a hole for the photon beam or other possible detector techniques such as a GEM detector which is capable of handling the high rates.

Depending on the updated requirements for the start and vertex detector we will modify the detector concept to achieve the necessary properties. If the necessary technologies exceed the capabilities of the FIU group we will discuss this issue with the collaboration to obtain additional help.

By the end of 2005 the concept of the vertex detector has to be finalized.

Assuming the scintillating fiber detector remains the detector of choice we expect the following time line:

- 2004 2nd Qtr : Test of a simple small double layer in a test beam at KEK.
- 2004 3rd Qtr : Procurement of the cryostat for the VLPC and adaption to the 128 channel cassette from FERMI-LAB. Construction of 3 (straight) double layers of scintillating fibers with connector.
- 2004 4th Qtr: Construction of light guides and procurement of additional electronics
- 2005 1st Qtr: Setup of test system and DAQ.
- 2005 2nd Qtr: Measurements at FIU. Setup for cylindrical geometry
- 2005 3rd Qtr: Measurements at JLAB.
- 2005 4th Qtr: Construction of 1st prototype cylindrical double layer.

2.2 Hardware Deliverables for GlueX

Depending on the results of our efforts in 2004 and 2005, the final design of the start and vertex detector will be completed by the end of 2005. The FIU experimental nuclear physics group will then be responsible for its construction and testing including the connection to the cryostat and the VLPC cassette. This includes the appropriate readout electronics.

Depending on appropriate funding (including manpower) we expect the following steps for the construction of this detector:

- design of final double layer and support structure
- design of support/mounting and integration of the entire detector into the GlueX system.
- design and construction of optical connectors
- construction of fiber preparation setup (polishing, aluminizing)
- design and fabrication of special tools for layer construction
- design and construction of test stand for fiber detector.
- procurement of materials and fibers.
- construction of support structure for fibers
- fabrication of double layers
- position measurements of fibers
- construction of optical connectors
- construction of light guides
- procurement of VLPC cassettes
- procurement/construction of VLPC cryostat
- design and construction of readout electronics (front end)
- electronics ?
- test of entire detector system (using cosmics and particle beams)

Several steps in the previous list will require the help, expertise and collaboration of Dr. Alan Bross' group at FERMILAB.

2.3 Software Deliverables and Support for GlueX

The FIU group will carry out monte carlo studies for the detector response and develop the algorithms to determine track counts and track positions. We will also provide the necessary software for calibration and optimization of the detector.

2.4 Support for Running The GlueX Experiment

2.5 Support for Analysis of GlueX Data

2.6 Theoretical Support to GlueX

2.7 Collaboration Responsibilities

3 Funding and Infrastructure

3.1 Florida International University

The FIU group will request funding from the Department of Energy and Jefferson Lab to carry out the work described above.

The FIU group has access to a electronics engineer with a complete workshop and a mechanical workshop with two full time mechanics. The electronics engineer will be able to address parts of our need for the readout system. Since this detector is rather small we expect that the internal parts can be built in our mechanics shop.

The FIU group controls lab space which is currently used for detector development and testing. A cosmic ray test stand with tracking in combination with a CODA data acquisition system is already in operation and will be used for detector testing.

The FIU group will obtain the necessary electronics and other test equipment and infrastructure to complete the construction and testing of the start and vertex detector.

The Florida International University group will provide written time lines for the completion of various phases of the project and written reports on the outcome of each of these various phases.

3.2 The GlueX Collaboration

3.3 Jefferson Lab

- JLab will retain ownership of all deliverables as specified under individual contracts and MOUs.

- JLab is responsible for all engineering aspects of GlueX and all aspects of the detector integration that require legal and certified engineer approval.
- JLab assumes all legal liabilities related to FIU provided and installed equipment while located on JLab property.
- JLab will provide reasonable assistance to the FIU group to assure smooth flow of information regarding DOE procedures and protocols as they affect the funding of the work agreed between JLab and Florida International University.
- JLab will provide physical space to FIU personnel and for their equipment to facilitate their work on GlueX. The FIU group will convey such requirements to JLab with reasonable advance notice in the spirit of good relations and sound planning.
- Official contact between the FIU group and JLab will be through the HALL D project management office and its JLab appointed staff.

4 Personal

1. The contact person for the Florida International University group is Werner Boeglin.
2. The following personnel are included in the FIU GlueX group:

Person	Positions	Percent of Research Effort
TBD	Post Doc	50%
Elliott Brown	Graduate Student	100%
Werner Boeglin	Professor	50%
Brian Raue	Professor	25%
Joerg Reinhold	Professor	xx%
Laird Kramer	Professor	xx%
Pete markowitz	Professor	10%
Andi Klein	LANL consultant	20%

The percentages refer to the approximate percentage of research time to be spent by the person on all GlueX activities during FY2004–FY2006 time period. These commitments will be updated as the project matures.

5 Special Considerations

- 1 The GlueX collaboration will have final responsibility for the acceptance of all deliverables and retains the right, to terminate or rene-

gotiate this MOU if the technical requirements, performance, physical specifications, time schedules and costs cannot be met by the Florida International University group.

- 2 The GlueX collaboration retains the right to assign additional manpower and/or additional groups to this project if it is deemed that this is necessary for timely and within budget completion of the project.
- 3 The continuation of this agreement is dependent on the approval for continuing funding for all parties in the MOU.
- 4 This agreement may be amended as necessary.
- 5 The Florida International University group, the GlueX Collaboration management and the JLab management of GlueX agree to commit themselves on a collegial, open and effective working relationship for the benefit of the project.

SIGNATURE PAGE

Prof. Werner U. Boeglin
Contact Person
Florida International University

Date

Prof. Alex Dzierba
Spokesperson
GlueX Collaboration

Date

Dr. Elton Smith
JLab HALL D Group Leader
Jefferson Lab

Date