Memorandum of Understanding between the GlueX Collaboration, Jefferson Lab and Carnegie Mellon University

27 April, 2004
Draft Version 3

1 Introduction

This Memorandum of Understanding (MOU) outlines the activities and responsibilities of the Carnegie Mellon University (CMU) Medium Energy 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 CMU 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

2.1 Commitments to GlueX R&D

By the end of 2005, the CMU group will complete work on construction, and testing of a prototype straw tube chamber to be used as the central tracking device of the GlueX detector. Based on both this work and continued Monte Carlo studies of both the detector and physics, the group will develop final design for the GlueX central tracking device. A rough time line for the completion of this work is shown if Figure 1 and detailed in Table **??**.

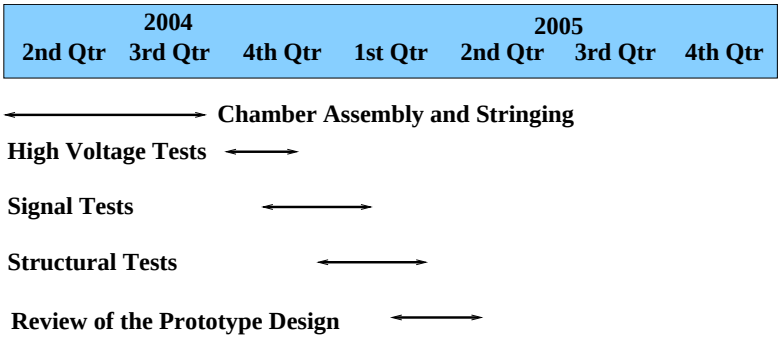

Figure 1: A time line showing the tasks necessary to complete the R& D work on the straw-tube chamber prototype.

Timetable for R& D	
+0 to +6 months	Chamber Assembly and Stringing
+6 to +8 months	High Voltage Testing
+7 to +10 months	Signal Tests
+10 to +12 months	Structural Tests
+11 to +13 Review of the Design	

Table 1: The time line for completion of the R&D effort. Start time is April 2004.

2.2 Hardware Deliverables for GlueX

Upon completion of the final design for the GlueX central tracking device, the Carnegie Mellon University group take on the responsibility of building the central tracking chamber for the GlueX experiment. This responsibility includes the detector itself. The electronics that mount directly on the detector and cables to take the signals to the Data Acquisition Electronics.

The tasks necessary to build this chamber are shown along with a time line in Figure **??**. The start date for this construction project is contingent

on funding for the GlueX experiment. The tasks outlined represent approximately three years of work by the CMU group. This plot is also detailed in Table 2. With a flexible purchasing procedure, it may be possible to preorder much of the material, and shorten the project by up to one year.

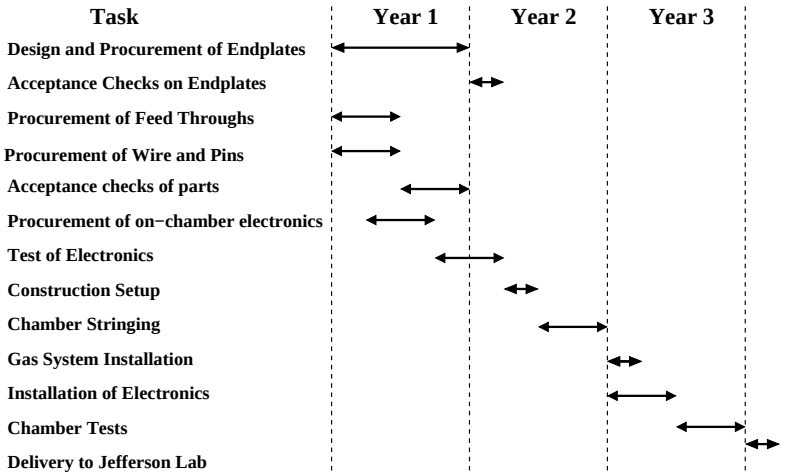

Figure 2: A time line for the construction of the straw-tube chamber for the GlueX experiment. The start date and schedule are dependent on funding.

Timetable for R& D	
+0 to +12 months	Design and Procurement of chamber end plates.
+0 to +6 months	Procurements of feed throughs.
+0 to +6 months	Procurement of wires and crimp pins.
+3 to +9 months	Procurement of on chamber electronics
+6 to +15 months	Acceptance checks of parts.
+9 to +15 months	Tests of electronics.
+15 to +18 months	Construction Setup.
+18 to +24 months	Chamber stringing.
+24 to +27 months	Gas System Installation.
+24 to +30 months	Installation of electronics.
+30 to +36 months	Chamber tests.
+36 to +39 months	Delivery to JLab.

Table 2: The time line for construction and delivery of the final straw tube chamber for GlueX. Start time is defined as start of construction funding.

The current scope of this work does not include the *High Voltage* control and monitoring system, nor the final gas mixing and control system. The most efficient use of resources in this regard would be to have a common *High Voltage System* for the entire experiment and common controls and hardware for all gaseous detectors in the experiment.

2.3 Software Deliverables and Support for GlueX

The CMU group has historically provided support for the GlueX Fast Monte Carlo, (HDFast). The group will continue to provide this support and assistance to groups wanting to run the code.

The CMU group will work to develop and test tools for Partial Wave Analysis that will be generally applicable to understanding and GlueX data. Of particular interest to the CMU group is a systematically correct way of removing or handling baryon resonances in the GlueX data. A large portion of this work will be working with unpolarized photoproduction data from the JLab CLAS experiment. These efforts will involve the study of both the Baryon and the Meson systems with primary goal of developing better tools and techniques to analyze the two systems together.

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

Curtis Meyer currently serves as Deputy Spokesperson of the GlueX collaboration. The CMU group fully supports this effort and any other efforts deemed necessary by the collaboration.

3 Funding and Infrastructure

3.1 Carnegie Mellon University

The Carnegie Mellon University group will provide funds associated with support of personnel and travel to carry out the tasks outlined in this MOU.

The Carnegie Mellon University group will request funding from the Department of Energy and from Jefferson Lab to carry out work beyond the scope covered by this MOU.

The Carnegie Mellon University group maintains a fully equipped shop and a full time technician, (Gary Wilkin). These will be available to carry out the fabrication work covered by this MOU. Carnegie Mellon University will also provide many of the smaller components needed for the fabrication as part of their normal operating budget.

The Carnegie Mellon University group controls lab space necessary to both build hardware and perform tests of the resulting equipment. This space exists and is assigned to the CMU group involved in GlueX. In addition, the CMU group has or will obtain sufficient electronics, test equipment and

infrastructure top carry out all needed tests on both the prototype and the final chamber.

The Carnegie Mellon 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

The construction of the final central tracking chamber will be contingent on securing additional funds from outside sources specifically for this project. The GlueX collaboration will develop a global plan for the timely funding and construction of all elements of the GlueX detector. The collaboration as a whole will seek funds to build all parts of the detector in a coordinated fashion.

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 CMU provided and installed equipment while located on JLab property.
- JLab will provide reasonable assistance to the CMU group to assure smooth flow of information regarding DOE procedures and protocols as they affect the funding of the work agreed between JLab and Carnegie Mellon University.
- JLab will provide physical space to CMU personnel and for their equipment to facilitate their work on GlueX. The CMU group will convey such requirements to JLab with reasonable advance notice in the spirit of good relations and sound planning.
- Official contact between the CMU 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 Carnegie Mellon University group is Curtis A. Meyer.
2. The following personnel are included in the CMU GlueX group:

Person	**Positions**	**Percent of Research Effort**
Matt Bellis	Post Doc	25%
Angella Biselli	Post Doc	25%
Joachim Kuhn	Post Doc	50%
Zebulan Krahn	Graduate Student	75%
Gregg Franklin	Professor	15%
Curtis A. Meyer	Professor	75%
Reinhard Schumacher	Professor	15%
Gary Wilkin	Technician	75%

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 renegotiate this MOU if the technical requirements, performance, physical specifications, time schedules and costs cannot be met by the Carnegie Mellon 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 Carnegie Mellon 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. Curtis A. Meyer Contact Person Carnegie Mellon University	Date
_____	_____
Prof. Alex Dzierba Spokesperson GlueX Collaboration	Date
_____	_____
Dr. Elton Smith JLab HALL D Group Leader Jefferson Lab	Date