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Memorandum of Understanding
between the GlueX Collaboration,
Jefferson Lab
and Jefferson Lab

18 May, 2004
Draft Version 1

1 Introduction

This Memorandum of Understanding (MOU) outlines the activities and responsibilities of the Jefferson Lab (JLab) HallD 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 JLab 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 this section we outline the main commitments of Jefferson Lab to the GlueX project. The timelines assume that funding will be made available as needed, but in practice actual progress will be limited by external constraints and priorities.

2.1 Beamline and Civil Construction

The construction of the HALL D beamline, tagger hut, detector building and counting rooms must come early to allow for efficient installation and preparation of the experiment. All necessary ingredients for determining the parameters for civil construction have been considered and summarized in some detail in Appendix D of the Design Report. What remains is a final review of all components of the design and the preparation of a bid package. The schedule for civil construction is given in Fig. 1.

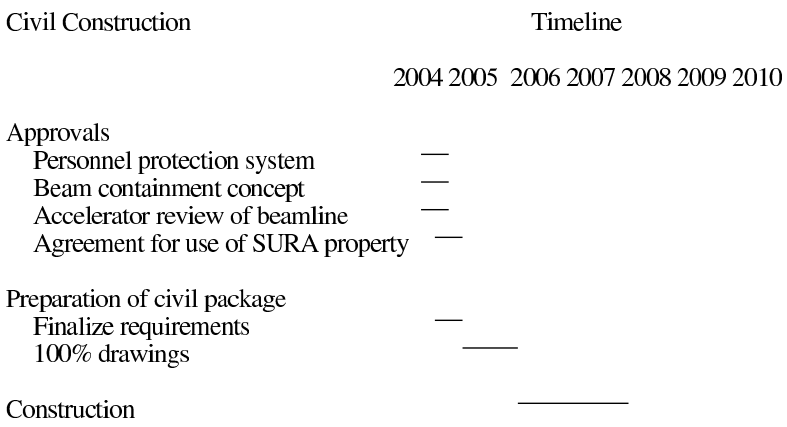

Figure 1: Timeline for civil construction of Hall D beamline, tagger, detector and counting room buildings.

The JLab accelerator division is responsible for delivery of the electron beam to the HALL D beamline. The production, monitoring and delivery of the coherent photon beam is a joint responsibility between GlueX, the HALL D staff and the accelerator. Various institutions within the GlueX collaboration (including the University of Glasgow, University of Connecticut and Catholic University of America) will contribute to the production and monitoring of the coherent beam, the design of the tagger magnet, collimation and monitoring of the photon beam. A division of responsibilities and schedule to produce the quality beam required for the experiment must be made by all contributors.

2.2 Engineering Design and Safety

The JLab engineering and design staff will provide support for many aspects of integration and installation of the experiment. A complete set of drawings of all components must reside at JLab for reference and future maintenance. In particular, the JLab staff is ultimately responsible for all aspects of safety in HALL D and must take appropriate steps to provide training and safe operation of equipment and healthy environment for personnel.

2.3 Solenoid

The refurbishment of the MEGA/LASS solenoid for use by the GlueX experiment is the responsibility of JLab. There are several modifications which are necessary to update this magnet for use with a modern experiment. These include fixing any cryogenic leaks in the four coils, updating the controls to modern technology, adding iron to the return yoke for improved magnetic performance, and building an cryogenic interface to the JLab refrigeration system. The first task of fixing any problems inside the coils is being conducted at IUCF in accordance with a MOU (May 16, 2002). The timeline of this and other work is given in Fig. 2. Completion of the refurbishment of the magnet, and bringing it into operation in the new Hall D is a critical-path item, limited presently by the availability of funding.

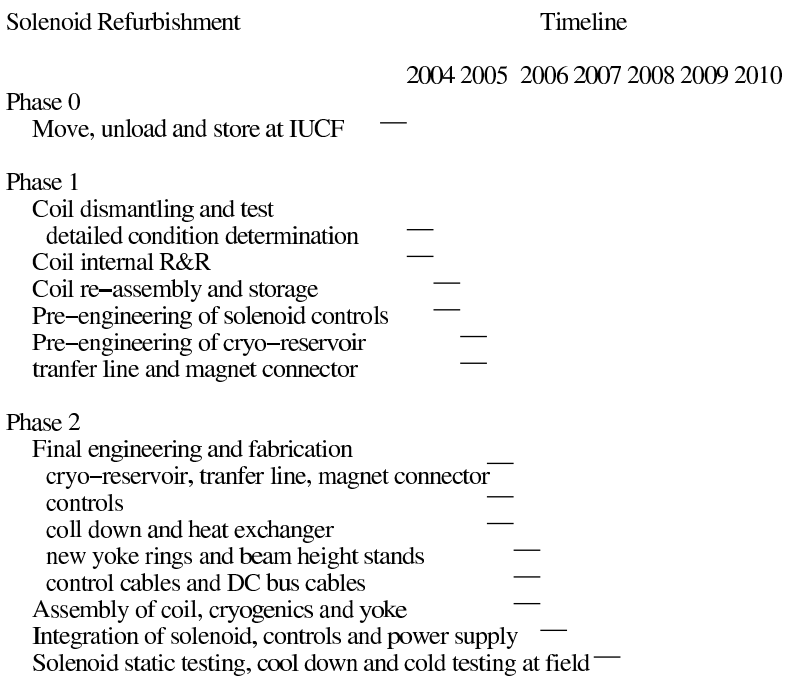

Figure 2: A time line showing the overall schedule for the solenoid for Hall D.

2.4 Fast Electronics

The fast electronics group at JLab is capable of contributing to several electronics projects for GlueX. The three main tasks that should be worked on locally are general electrical infrastructure, a new version of the pipeline TDC, and support for the Level 1 trigger logic (working closely with David Doughty at Christopher Newport University). In Fig. 3 we provide a timeline for each of these topics. Additional projects which the fast electronics group has the expertise to contribute to, in full or in part, are the development of the Flash ADC board, and front-end electronics. Based on discussions within the collaboration, we can focus our efforts on these or other topics. We briefly discuss the three projects to which we are committed.

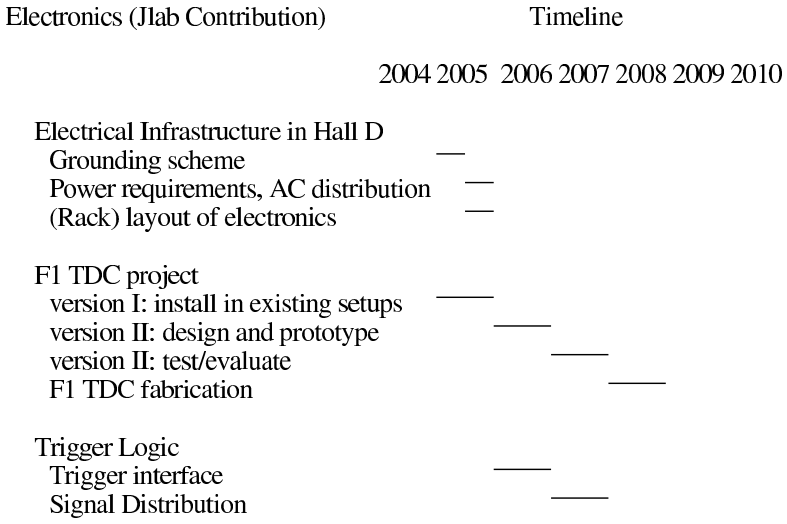

Figure 3: Timeline for selected electronic projects to be carried out at JLab.

Very soon we need to finalize plans for civil construction. This will require a grounding plan for the hall, definition of power requirements, scheme for the distribution of clean and dirty AC power, signal conditioning, shielding, etc. This task needs to be completed early for input to any civil plans for the hall and is a task which logically falls to local expertise.

The fast electronics group at JLab has developed a TDC board with 64-channels based on the F1 pipeline TDC chip from ACAM. This design is a significant first step in the development of a module which satisfies the requirements for time measurements for the GlueX experiment. Fifty boards have been fabricated and will be installed in existing experimental setups at JLab. Based on this experience, a new board will be developed with all the capabilities required for GlueX. The proposed timeline for version II of this board is given in 3.

The Level 1 trigger is being designed by David Doughty at CNU and must interface closely to both the DAQ hardware (e.g. trigger supervisor)

and software, as well as to the signal distribution across electronic crates. Therefore, the trigger interface and crate-to-crate communications logically falls to the fast electronics group and will be developed at JLab.

2.5 Data Acquisition

The data acquisition group is committed to update the JLab CODA DAQ framework to accommodate the high data rates required for the GlueX experiment. These updates will require that the system be extended to optimize use of pipeline electronics and associated trigger logic, additional parallel and staged event builders, and the integration of a software Level 3 farm. The present runcontrol interfaces, online monitoring, and slow controls framework will also be integrated for future experiments. The timeline for this project is given in Fig. 4. The work of the DAQ group needs to be supplemented by a strong effort within the Hall D group in order to develop an efficient online system which achieves the goals of our experiment.

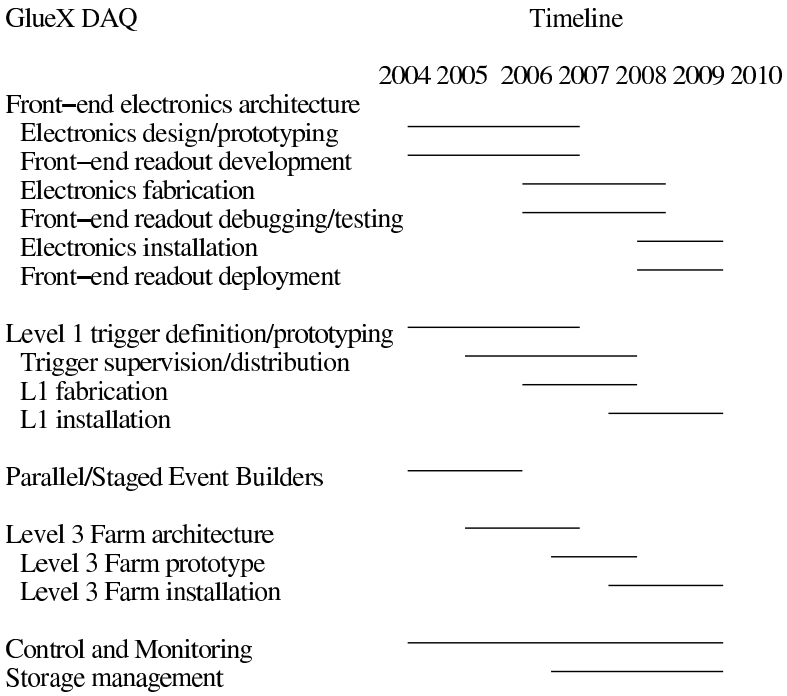

Figure 4: A time line showing the overall schedule for the GlueX DAQ effort.

2.6 Software Deliverables and Support for GlueX

The primary responsibilities of JLab to the software effort will be to provide the underlying infrastructure which begins with the efficient collection of data to the production of reconstructed data. This is designated in Fig.9.1

of the design report as "JLab infrastructure." This framework begins the the DAQ system, described above, followed by integration provided by Hall D personnel and supported by the JLab computer center staff to provide a productive environment for offline computing. Some of the tasks which are part of the support required are given in Fig. 5.

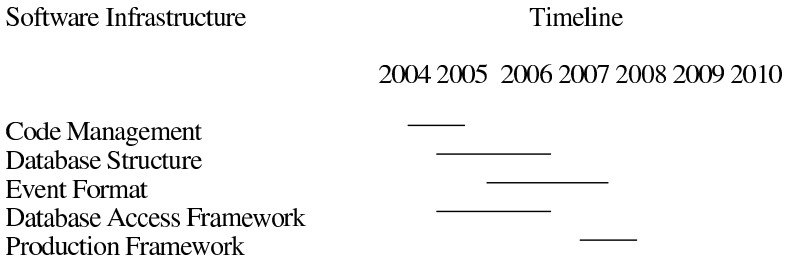

Figure 5: A time line showing the selected topics contributing to the GlueX software effort by JLab.

2.7 Support for Running The GlueX Experiment

2.8 Support for Analysis of GlueX Data

2.9 Theoretical Support to GlueX

2.10 Collaboration Responsibilities

Elton Smith currently serves as the Physics Division Liaison for the GlueX collaboration. The JLab group fully supports this effort and any other efforts deemed necessary by the collaboration.

3 Funding and Infrastructure

3.1 Jefferson Lab

The proposal for the 12-GeV upgrade includes the hire of sufficient personnel to support the construction and maintenance of a new experimental facility to house the GlueX experiment. The HALL D group will require staffing comparable to existing halls, or approximately 13 persons. In addition, technical staff for support of this effort is also required, and needs to be allocated to existing groups within the Physics Division. The rate of hires and final staffing levels are under discussion between JLab and the Department of Energy.

Jefferson Lab is committed to support all activities which are required to achieve a successful experimental program in HALL D. Resources of infrastructure and personnel will be made available based on priorities of the 12-GeV program.

The Jefferson Lab 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 these projects are contingent on securing additional funds 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

Note: This section of the MOU is not meaningful for Jefferson Lab, but has been left unchanged to conform with other collaboration documents.

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

Group	**Person**	**Percent of Research Effort**
Computing Center	Graham Heyes	10%
Data Acquisition	David Abbott	25%
Data Acquisition	David Lawrence	80%
Data Acquisition	Ed Jastrzemski	25%
Data Acquisition	Elliott Wolin	50%
Data Acquisition	Vardan Gyurjyan	25%
Detector	Stan Majewski	10%
Engineering	Paul Brindza	25%
Engineering	Ravi Anumagalla	100%
Fast Electronics	Chris Cuevas	15%
Fast Electronics	Fernando Barbosa	25%
Fast Electronics	James Proffitt	15%
Hall B	Elton Smith	50%
Hall B	Dennis Weygand	10%
Hall C	Steve Wood	15%
Hall C	Howard Fenker	15%
Theory	Andrei Afanasev	15%
Theory	Wally Melnitchouk	25%

Table 1: ***DRAFT***DRAFT*** 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 Jefferson Lab 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 Jefferson Lab 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

_____	_____
Dr. Elton S. Smith Physics Division Liaison HALL D Jefferson Lab	Date
_____	_____
Prof. Alex Dzierba Spokesperson GlueX Collaboration	Date
_____	_____
Dr. Larry Cardman Associate Director for Physics Jefferson Lab	Date