Short Term R&D Work Plans for GlueX FDC System

D.S. Carman – November 12, 2007– V.1

This document contains information on several aspects of the manpower needed for the full-scale prototype design and construction. The time period involved is roughly 8 months starting November 1, 2007. The individuals included here are Brian Kross, Kim Shinault, Bill Crahen, Roger Flood, Fernando Barbosa, Joe Beaufait, Simon Taylor, and Denny Insley. The contributions of manpower from Tim Whitlatch and Chuck Hutton are not considered here as they are expected to be much less significant. In addition, the work on simulations provided by David Lawrence and Mark Ito is not considered here.

1 Brian Kross Work Plans for GlueX FDC System

The required work plans for Brian Kross for this period includes the tasks for the final R&D required to complete the design of the FDC full-scale prototype through the construction of this prototype.

1.1 Work Tasks

1). Complete stress test of the composite wire frame using the nominal FDC wire load on the two completed composite frames. This work should be carried out in consultation with Tim Whitlatch.

2). Develop an assembly jig for the construction of the composite wire frames that will allow for alignment of the pieces to within our specified tolerances. Act as liaison with JLab machine shop to complete procurement of this assembly jig.

3). Complete the design of the wire frame transport/storage containers.

4). Procure the wire frame transport/storage containers.

5). Complete construction of the 5 composite wire frames that will be used for test stringing studies at FNAL. These frames will employ the dummy STB and HVTB circuit boards that we have designed and procured. Act as liaison with JLab machine shop to complete the machining of the o-ring grooves and through-holes on these pieces.

6). Complete construction of a complete composite cathode sandwich with our dummy 3-piece cathode boards to develop final procedures for board alignment and attachment. Act as liaison with JLab machine shop to complete the machining of these pieces.

7). Work with cathode board manufacturers to ensure delivered cathode boards are free from the defects that have been inherent in all boards ordered to date, including wrinkles, creases, pitting, etc.

8). Complete the frame mounting of the $\pm 75^\circ$ cathode boards for the small-scale prototype.

9). Develop test plan for studying the performance of the electronics cooling system. Carry out test plan with input from project engineers. Work with engineers to finalize the system design.

10). Oversee the test winding of the 3 composite wire frames. This includes transporting the wire frames to FNAL, working with the FNAL technicians on the frame winding, and transporting the completed wire frames back to JLab.

11). Complete procurement of all parts and materials for the construction of the full-scale prototype. This includes all G10 skins, Rohacell, epoxies, components, and wire frame transport/storage containers.

12). Complete design of gas port system and the on-chamber gas distribution system.

13). Complete design of compression tube system for FDC package assembly.

14). Oversee construction and assembly of the full-scale prototype.

15). Construct the 6 composite wire frames for the full-scale prototype with the first design STB and HVTB boards. This work includes oversee the stuffing of the STB and HVTB boards with all components that can be installed before wire winding. Also act as liaison with the JLab machine shop to complete the machining of the o-ring grooves and through-holes on these pieces.

16). Construct the 12 composite cathode frames for the full-scale prototype. This includes construction of the 5 cathode sandwiches and attachment of all ground planes. Install daughter board connectors on all cathodes and oversee attachment of flex cables from daughter boards to cathodes. Act as liaison with JLab machine shop on the machining for these pieces.

17). Complete the construction of the 6 composite spacers for the full-scale prototype. Act as liaison with JLab machine shop on the machining for these pieces.

18). Oversee the winding of the full complement of wire frames for the full-scale prototype. This includes transporting the wire frames to FNAL, working with the FNAL technicians on the frame winding, and transporting the completed wire frames back to JLab.

19). Oversee the attachment of the daughter board connectors on the STBs and the attachment of the high-voltage pigtails and connectors on the HVTBs for the full-scale prototype.

20). Complete construction and assembly of the full-scale prototype.

21). Install cooling system on the full-scale prototype.

22). Finalize cable attachment and packing schemes, as well as plans for cable strain relief.

1.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Brian Kross Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. Load Stress Test	x																															
2. Assembly Jig	x	x	x																													
3. Container Design	x																															
4. Container Procure		x	x																													
5. Wire Frames I		x	x																													
6. Comp. Cathodes I				x																												
7. Cathode Defects						x																										
8. 75 deg Cath. Mount							x																									
9. Cooling Tests										x	x																					
10. Wire Wind I				x	x																											
11. Procurements										x	x	x	x																			
12. Gas Port Design											x																					
13. Compress Tube Des.												x																				
14. Construction														x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
15. Wire Frames II														x	x	x																
16. Comp. Cath. II																	x	x	x	x												
17. Spacers																					x	x										
18. Wire Wind II																							x	x								
19. Board Stuffing																									x							
20. Assembly																										x	x	x				
21. Cooling Install																													x	x		
22. Cable Attachment																															x	x

2 Kim Shinault Work Plans for GlueX FDC System

The required work plans for Kim Shinault include completion of the designs of the STB, HVTB, and filler circuit boards for the FDC wire frames.

2.1 Work Tasks

1). Complete the design of the signal translator boards (STBs).

2). Complete the design of the high voltage translator boards (HVTBs).

3). Complete the design of the connector boards.

4). Vet board designs.

5). Perform final board design updates based on feedback.

6). Complete procurements of all circuit boards.

7). Complete full set of drawings for these boards.

2.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Kim Shinault Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. STB Design	x	x	x																													
2. HVTB Design			x	x	x																											
3. Connector Design					x																											
4. Vet Board Design						x																										
5. Final Updates							x																									
6. Procurements										x																						
7. Design Drawings											x	x																				

3 Bill Crahen Work Plans for GlueX FDC System

The required work plans for Bill Crahen for this period include completion of the preliminary design of the preamplifier cooling system for the FDCs, as well as completion of the design for the placement of the daughter board connectors on the FDC cathode frames and wire frames, the completion of the preliminary design for the FDC cable support exoskeleton, and the preliminary design for the FDC HV system connections and LV system connections and fusing system.

3.1 Work Tasks

1). Finalize the placement of the daughter board connectors for compatibility with the design of the preamplifier cooling system.

2). Complete the preliminary design of the FDC preamplifier cooling system.

3). Model the cooling system performance with regard to optimizing the temperature profile for stable and long term operation of the FDC preamplifier boards.

4). Develop a cooling system prototype for final validation of design. This prototype system should most likely be developed for installation on the full-scale prototype.

5). Vet cooling system preliminary design with FDC group.

6). Incorporate feedback into cooling system design.

7). Construct the prototype cooling system and optimize performance parameters.

8). Test the prototype cooling system and work with Brian Kross to install on the full-scale prototype.

9). Design the FDC exoskeleton that ensures proper package to package separation and provides for local strain-relief of cables.

10). Finalize plans for on-chamber cable routing and placement.

11). Design the local HV connection system to each FDC package and each FDC layer.

12). Design the local LV connection system to each FDC package and each FDC layer.

13). Provide final design drawings for FDC cooling system.

14). Provide final design drawings for FDC exoskeleton.

3.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Bill Crahen Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. Daughter Placement	x	x	x	x																												
2. Cooling Design I	x	x	x	x																												
3. Model Cooling			x	x																												
4. Cooling Prototype					x	x	x																									
5. Cooling System Vet										x																						
6. Cooling Design II											x	x																				
7. Cooling Construct													x	x																		
8. Cooling Test															x	x																
9. Exoskel Design																	x	x														
10. Local Cable Routing																			x													
11. Local HV connect											x	x																				
12. Local LV connect													x	x																		
13. Cooling Drawings																				x	x											
14. Exoskel Drawings																						x	x									

4 Roger Flood Work Plans for GlueX FDC System

The work plans for Roger Flood for this work period include the completion of the design of the connections between the cathode daughter boards and the cathode planes, as well as the completion of a mechanical prototype of this connection scheme.

4.1 Work Tasks

1). Provide preliminary design for the connection scheme from the FDC cathodes to the daughter board connector.

2). Procure parts for a mechanical prototype of cathode connection scheme.

3). Construct the mechanical prototype.

4). Test the mechanical prototype.

5). Vet design of connection scheme to the FDC group.

6). Incorporate final updates into the design.

7). Provide final design drawings for cathode connection scheme.

4.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Roger Flood Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. Prelim. Design	x	x																														
2. Procure			x																													
3. Construct					x																											
4. Proto Tests					x																											
5. Vet Design						x																										
6. Design Updates							x																									
7. Final Drawings										x																						

5 Fernando Barbosa Work Plans for GlueX FDC System

The work plans for Fernando Barbosa for this work period include the final design and procurement of the preamplifier daughter boards, as well as the stuffing and QA tests on the daughter boards.

5.1 Work Tasks

1). Act as contact with Kim Shinault on the layout and design of the STB and HVTB boards.

2). Attend weekly meetings with Kim Shinault to review STB and HVTB board design.

3). Provide completed daughter boards and interposer boards to FDC group for small-scale prototype types.

4). Act as contact between Mitch Newcomer and the FDC group for the ASIC/daughter board test results.

5). Complete design of FDC daughter boards.

6). Procure FDC daughter boards for full-scale prototype.

7). Oversee stuffing of FDC daughter boards.

8). Oversee final QA checkout of the complete anode and cathode daughter boards.

9). Provide final design drawings for daughter boards.

5.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Fernando Barbosa Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. PCB Design Meetings	x	x	x	x	x	x																										
2. Board Delivery			x																													
3. FDC ASIC Tests				x	x	x	x																									
4. Daughter Board Design										x	x	x	x																			
5. Procure Daughter Boards														x	x	x																
6. Stuff Boards																				x	x	x										
7. QA Testing																							x	x								
8. Design Drawings																									x	x	x					

6 Joe Beaufait Work Plans for GlueX FDC System

The work plans for Joe Beaufait for this work period include the design of the LV system including the associated fusing system.

6.1 Work Tasks

1). Complete the conceptual design of the LV system layout for the FDC chambers.

2). Design the LV fusing system for the FDC chambers.

3). Procure the LV system for the full-scale prototype.

4). Construct the LV system for the full-scale prototype.

5). Provide final design drawings for the complete FDC LV system.

6.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Joe Beaufait Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. LV Concept Design										x	x	x																				
2. LV Fusing System													x	x	x																	
3. LV Procure																x	x	x	x													
4. LV Construct																				x	x											
5. Design Drawings																						x	x									

7 Simon Taylor Work Plans for GlueX FDC System

The work plans for Simon Taylor for this work period include testing of the ASICs on the small-scale prototype, analysis of the data collected in the B-field test run, continued work on the tracking algorithm development in the solenoid field, and preparations for the upcoming FDC reviews.

7.1 Work Tasks

1). Clear out all of the FDC equipment in Hall B used for the FDC magnetic field tests.

2). Reassemble the Test Lab FDC cosmic ray test facility.

3). Test the readout of the small-scale prototype in the Test Lab.

4). Work with Brian on mounting of the $\pm 75^{\circ}$ circuit boards.

5). Install the new cathodes into the small-scale prototype.

6). Perform resolution measurements with the new cathode planes to compare to expectations and existing baseline.

7). Install the daughter boards and interposer boards on the small-scale prototype.

8). Perform system checkout of new preamplifier system.

9). Perform baseline noise measurements and perform optimization.

10). Perform detailed pulse characterization of ASIC preamplifiers.

11). Prepare ASIC test result document for Fernando Barbosa and Mitch Newcomer.

12). Complete magnetic field test data analysis.

13). Prepare report of analysis results for collaboration review.

14). Continue work on algorithm development for charged particle tracking in magnetic field of solenoid.

15). Work on preparation of materials for December 2007 FDC mini-review.

16). Work on preparation of materials for March 2008 FDC review.

17). Work on preparation of NIM or IEEE paper on FDC design and test results.

18). Work on design of FDC system within FDC group.

19). Participate in the test wind of the FDC wire frames.

20). Participate in the winding of the wire frames for the full-scale prototype.

21). Provide assistance to Brian Kross during FDC full-scale prototype construction.

7.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Simon Taylor Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. Move FDC Equipment	x																															
2. Reassemble Test Lab		x	x																													
3. S.S. Prototype I				x																												
4. Cathode Mount							x																									
5. Cathode Install							x																									
6. Resolution Meas.										x																						
7. ASIC Install				x																												
8. ASIC Checkout				x	x																											
9. ASIC Document						x																										
10. B-field Data Anal.	x	x	x	x	x	x	x																									
11. Algorithm Develop	x	x	x	x	x	x																										
12. B-field Document										x	x																					
13. Mini-Review Prep					x	x																										
14. Monte Carlo Work	x	x	x	x	x	x																										
15. FDC Review Prep															x	x	x															
16. FDC Design Work	x	x	x	x	x	x	x			x	x	x	x																			
17. Wire Wind I				x	x																											
18. Wire Wind II														x	x	x																
19. Prototype Const.														x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
20. NIM Paper														x	x	x	x															

8 Denny Insley Technician Work Plans for GlueX FDC System

The required work plan for Denny Insley for this period includes helping Simon Taylor set up the cosmic ray test station for the FDC small-scale prototype in the Test Lab, working with Brian Kross on the R&D work related to the construction of prototype wire frames and cathode frames, working with Brian Kross on the construction and assembly of the full-scale FDC prototype, and overseeing the local effort to measure the flatness of our cathode planes.

8.1 Work Tasks

1). Work with Simon Taylor on the re-establishment of the FDC cosmic ray test stand and readout electronics in the Test Lab.

2). Work with Brian Kross on the construction of the composite wire frames for the test string studies at FNAL.

3). Work with Brian Kross on the construction of the composite cathode frames and construction of the cathode sandwich.

4). Oversee flatness measurements of the completed cathode sandwich to ensure the surfaces are within our flatness tolerances.

5). Work with Brian Kross on the construction of the composite wire frames for the full-scale prototype chamber.

6). Work with Brian Kross on the construction of the composite cathode frames for the full-scale prototype.

7). Work with Brian Kross on the construction of the composite spacers for the full-scale prototype.

8). Oversee flatness measurements of all cathodes constructed for the full-scale prototype.

9). Work with Brian Kross on the assembly of the full-scale prototype.

8.2 Work Time Line

The chart on the next page shows the work time line for each of the assigned tasks. The individual tasks are discussed in full details in the previous section of this document.

Denny Insley Work Plans for GlueX FDC System

Task	Nov				Dec				Jan				Feb				Mar				Apr				May				June			
1. Test Lab Work		x	x	x																												
2. Wire Frames I		x	x																													
3. Comp. Cathodes I				x																												
4. Flatness I					x																											
5. Construction														x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
6. Wire Frames II														x	x	x																
7. Comp. Cath. II																	x	x	x	x												
8. Spacers																					x	x										
9. Assembly																										x	x	x				