

Experiment Readiness Review

GlueX DIRC and Phase II running.

Jefferson Lab Monday June 25th, 2018

Committee:

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Observers:

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GlueX is installing a DIRC detector between the solenoid and the FCAL. The DIRC uses four fused silica bars that were used in the BaBar detector at SLAC. The goal is to have two of the bars operational for in-beam commissioning in the Fall of 2018. The DIRC will then be used in the GLUEX phase II high intensity running that begins in the Fall of 2019. This committee was charged with reviewing the state of readiness for these run periods. This committee was also charged with reviewing the general readiness of GlueX for the phase II high intensity running. The full charge is attached as appendix 1.

This was a half-day review with two presentations on the DIRC and one on the DAQ and computing status. The agenda is attached as appendix 2.

The remainder of this document will address each charge item in order.

Have the EHS&Q considerations been properly included in the design of the DIRC detector?

Finding:

Yes, EHS&Q considerations were found to be included in the design of the DIRC through the use of pressure system and structural documents that were presented and made available to reviewers.

Has the detector been completed, commissioned, and ready to operate? If not, what are the completion/commissioning schedule and tasks?

Finding:

No. The DIRC Detector has not been completed. However, it is believed that as long as the delivery schedule for the Optical box is maintained the detector will meet the presented schedule for commissioning in the fall of 2018 and be fully operational by the fall of 2019.

Recommendations:

- The schedule for DIRC installation and testing before the hall closes for GlueX operation is extremely tight. The installation plan should be carefully evaluated to ensure that it can be safely completed in the allowed time. An alternative plan for commissioning and testing should be developed in case installation and commissioning are not completed on time.
- List all of the goals and milestones for successful commissioning.
- The magnetic field on the PMTs and magnetic shielding were concerns raised in the 2015 review (Technical comments 23 and 24). Please present the results of these concerns.

Have all the tasks needed to safely mount and operate the detector been identified and defined adequately?

Findings:

- No. The first 2 detector bars are already installed. Detailed schedules, procedures and documentation need to be presented for the remainder of the detector system.
- No. The committee has concerns that the cooling for the electronics in the dark box may not be adequate to operate the detector. This is a concern for both safe and reliable operation.

Recommendations:

- Provide an evaluation of the cooling requirements and confirm that the cooling will be adequate. If the cooling is not adequate produce an updated schedule that reflects the steps needed to provide a system that can be reliably and safely operated.
- Water quality requirements and monitoring are necessary, should be carefully studied and a procedure documented.
- Provide a procedure for integration of the DIRC into the GlueX DAQ.
- A detailed plan for integrating the detector into the DAQ system should be developed. Similarly, the integration of the DIRC into the slow control system was not thoroughly documented and needs to be provided.
- Provide the projected background rate during high luminosity running and show the signal can be separated from the background.

Has the detector ownership, maintenance and control during beam operations been defined?

Finding:

- Partially, some operations manuals are available, and it was presented that user training and procedure documents are in process.

Recommendation:

- Complete maintenance and operational documentation

Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place?

Finding

- Partial. Resource laden schedules were presented and made available that indicate that each job has been identified and the resources are available for completion on time with the exception of the optical box.
- Maintenance and training plans not complete.

Recommendations:

- The optical box delivery is the critical path for this installation. A contingency plan for late delivery needs to be available as well as an independent verification of the status of the optical box.
- Complete maintenance plans and training plans
- Clarify which manpower is provided by non-JLab and JLab groups. Verify that the manpower and other resources will be available if the installation and/or commissioning schedule is changed.

Are the specific documentation and procedures to operate safely and efficiently the detector, in place and adequate? This includes initial operation.

Finding:

- Partial. It was presented that user training and procedure documents are in process.

Recommendation:

- Complete maintenance and operational documentation including completion of OSP.

Is trigger and DAQ configuration able to handle the event data rate expected for the high luminosity (5×10^7 photons/sec) running of the GLUEX detector in the Fall of 2019? Are the computing resources adequate?

Findings:

- The trigger rate for high luminosity has been studied and it was stated that there was small deviation from a linear extrapolation. The DAQ configuration and the event size has been studied as well. Currently, handling the data rate is on two paths.
- GlueX needs to be able to write a sustained 1.5 GB/s, which has not been achieved. Significant degradation was observed in live time writing at relatively modest 0.925GB/s.
- To use data compression which is the responsibility of the DAQ group.

While these two paths are correctly listed as remaining issues, no concrete plans were presented to establish the final configuration.

- The computing resources are likely adequate. GlueX has developed a procedure for making projections for computing resources that are tuned based on a thorough understanding of the 2017 usage. They have developed a plan that uses computing resources at Jefferson Lab, at NERSC for reconstruction, and on the Open Science Grid for Monte Carlo production. A data challenge is planned for August for the NERSC reconstruction. The data challenge in August is likely to expose some limitations with the WAN connection to ESnet, currently 10Gb/s. Recently, significant MC events have been generated in a relatively short time on OSG. Still, the current estimates for MC projection are a first cut and have to be refined. The MC is a driver for the requested resources beyond those that are currently planned for.
- GlueX has demonstrated that it is credible to perform large scale MC offsite on the OSG. This opens up other options for distributed computing—including cloud computing.
- ESnet will upgrade the network connectivity to 100 Gb/s in 2020. Stress testing the Jefferson Lab WAN in FY19 is a positive development.
- It has been recently discovered that the TOF rates are operating near their limit. The signal amplitudes drive current in PMTs. The upstream plane most affected.
- It is certainly within the spirit of ERRs to present important emerging information. The committee understands that the collaboration has started to understand this issue and appreciates that it was raised during the review. The committee suggests decoupling addressing the TOF solution from tests of the DIRC.
- The Hall-D trigger was estimated as 100 kHz at high luminosity. The analysis tree includes 160 reactions, a very impressive list. It was stated that at least 20% of events make it into a final stage of analysis but this tells nothing about the purity of the trigger. The Hall-D trigger is very simple and has very soft cuts. It was not demonstrated how these cuts were optimized from the point of view of the trigger rate and physics output.

Recommendations

- Add the plot that shows the dependence of trigger rate vs. luminosity to the documentation for this review.
- Five outstanding issues were listed. Please provide target dates for completion of:
 - Demonstration of 1.5GB/s sustained DAQ rate for full system to disk.
 - Demonstration of compression of data stream by a factor of two prior to writing to disk.
 - Reevaluation of MC requirements to better estimate computing requirement.
 - Perform Data Challenge for offsite reconstruction at NERSC.
- Develop a plan for mitigating the recently observed issues with the high rate TOF counters.
- Demonstrate that the Hall-D trigger cuts were optimized with respect to the trigger cuts and physics output.

Are the computing and manpower resources adequate for an expedient analysis towards timely publication?

Findings:

- The first targeted analyses are:
 - Excited hyperons: $\Xi^-(1820)$
 - Excited strangonium: $(s\bar{s}) : \phi(1680), \phi_3(1850)$.
- Based on the past experience It seems likely that computing and manpower resources will be adequate. The current plan is for 14 months from data collection to publication, compared to the 18 months for the first beam asymmetry publication. There are process improvements that could shorten the time by 4 or more months. These include fast turnaround calibrations, established procedures for producing MC events, and producing samples for analysis.
- The only information presented concerned the detectors and computing, and it is credible to see process improvements there. At the same time, a comparable level of preparation for the physics was not presented.

Recommendation:

- Develop a physics motivated plan for publication in 14 months after data collection.

Appendix 1 – Charge to the Committee.

The DIRC and GlueX II (High Luminosity) Experiments Readiness Review Jefferson Lab Jun 25, 2018

Charge

1. Have the EHS&Q considerations been properly included in the design of the DIRC detector?
2. Has the detector been completed, commissioned and ready to operate? If not, what are the completion/commissioning schedule and tasks?
3. Have all the tasks needed to safely mount the detector been identified and defined adequately?
4. Has the detector ownership, maintenance and control during beam operations been defined?
5. Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place?
6. Are the specific documentation and procedures to operate safely and efficiently the detector, in place and adequate? This includes initial operation.
7. Is trigger and DAQ configuration able to handle the event data rate expected for the high luminosity (5×10^7 photons/sec) running of the GLUEX detector in the Fall of 2019? Are the computing resources adequate?
8. Are the computing and manpower resources adequate for an expedient analysis towards timely publication?

Appendix 2 – Agenda

08:30-08:45 Executive session

08:45-09:30 [DIRC project: overview and status](#) (charge 2,4-6; 30+15 min) -- Justin Stevens

09:30-10:15 [DIRC installation Plans](#) (charge 1,3,4-6; 30+15 min) -- Tim Whitlatch

10:15-10:45 Coffee break

10:45-11:45 [GlueX at high intensity](#) (charge 7-8; 40+20 min) -- David Lawrence

11:45-14:30 Lunch + Executive session

14:30 Closeout