

GLUEX High Intensity readiness review

On May 11, 2017, a follow-up review to the July 22, 2016 GLUEX Level 3 trigger system ERR review was held. The reviewers were asked to assess progress toward the implementation, testing and deployment of data acquisition improvements required for high intensity flux (5×10^7 photons/sec) running in Hall D with the GLUEX detector in the Fall of 2018. The committee was comprised of Amber Boehnlein, Graham Heyes and Stephen Wood. David Lawrence presented an update on progress since the last review.

Since the last review, the collaboration has made tremendous progress. While more work remains, the collaboration has convincingly established the feasibility of sustained data acquisition at high intensity with minimal downtime.

Observations:

At the date of the last review, estimated trigger rates and event sizes at the desired flux significantly exceeded the proposed values. Improvements to the trigger and the data acquisition have reduced both those to essentially the proposed values. The improvements have come from the addition of the start counter to the trigger, tuning the threshold for a trigger, reducing timing windows and suppressing redundant header information.

As the new lower data rate now can be accommodated by the system, including disk and tape storage, L3 filtering before storage is not required. The collaboration is not planning to implement L3 filtering in the near term.

Networking, computing and disk bottlenecks are being addressed by the use of two event builders on different machines feeding two RAID arrays.

The collaboration has a good understanding of where remaining bottlenecks in data acquisition are.

The beam flux is currently limited by the CAEN 1290 TDCs limiting the trigger rate to 90 kHz. The group believes that these limitations can be overcome so that front end modules do not limit the trigger rate. The group intends to switch to the JLab F1TDC if this limitation cannot be overcome.

In order to reach the required flux of 5×10^7 photons/sec, the collaboration has changed the focus from implementing a level 3 trigger to a broader approach of tightening the trigger, improving hardware, software, networking and storage, and identifying bottlenecks. This has removed the need for a level 3 trigger, so the collaboration has suspended work on such online event filtering.

While the high luminosity (5×10^7 photons/sec) is only required for E12-13-003, the GlueX collaboration intends to use the highest DAQ supported luminosity, up to this flux, for running that precedes this experiment.

The Computer Center is prepared to support the expected data rates into the tape library.

Suggestions/Recommendations:

Acquiring a second RAID array should be the highest priority (or a high priority) for DAQ related spending.

Continue to pay attention to networking to insure that it is not a limiting factor in the trigger and data rates.

Do a full rate end to end test without beam and repeat the test with beam.

Continue to explore compression (and other techniques) to achieve additional headroom.

The current trigger rate estimate of 90 kHz and the physics efficiency seem to be based on qualitative arguments rather than on trigger tests and simulations. An effort should be made to quantify and document statements about various triggers and efficiencies through simulations or other means.

The collaboration should establish a schedule with milestones, consistent with the experimental needs, for improvements to the data acquisition system. This schedule should include:

- Deadline for making decision on TDC 1290 replacement.
- Deadline for acquisition of second RAID array.
- Schedule for component and system rate testing.
- Network upgrade schedule (particularly for tagger)

The collaboration should develop prioritized wish list of things that could be purchased to improve things each year of the 5 year run if extra money shows up.

In order to make data analysis more efficient, it may be desirable to do a relatively prompt filtering or reconstruction of data after it is written to tape. This would also have the benefit that a smaller volume of data would need to be kept online in the tape robot. Streamlining and stabilizing the calibration process would be required to gain these efficiencies and likely have other positive long term benefits.

Comment:

The collaboration is to be commended for recognizing that that an L3 trigger is no longer required for high intensity running, thus freeing up manpower and resources.