Experimental Readiness Review for E12-09-019 (SBS GMn)
Dates: June 15-16, 2017, CC Rm L102
Final Report: June 21, 2017

Review Committee:
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E12-09-019, *Precision Measurement of the Neutron Magnetic Form Factor up to Q^2=13.5 $(GeV/c)^2$*, has been approved for 25 days in Hall A allowing measurement of the neutron form factor up to Q^2=13.5 $(GeV/c)^2$. The experiment will make use of the BigBite spectrometer with the new Super BigBite Spectrometer (SBS) and will determine the neutron magnetic form factor using the ratio method, measuring the D(e,e'n) and D(e,e'p) processes simultaneously. The SBS spectrometer and associated detectors, a new Cerenkov, scintillator plane and GEM detectors for the BigBite, as well as the downstream beamline represent new equipment and/or changes to the standard Hall A equipment.

The committee would like to thank the collaboration for the clear and concise presentations as well as their thorough discussion of the charge elements. The agenda and list of talks presented during the meeting is given in the Appendix.

In this report, we answer the questions posed in the charge point by point, and then provide general feedback in the form of findings, comments, and recommendations as defined here:

FINDINGS: describing the major relevant points presented to the committee or observations made during the presentations.

COMMENTS: Suggestions or other remarks that do not rise to the level for inclusion in the formal recommendations.

RECOMMENDATIONS: Describing more definite statements that must be addressed in the future.

Response to the elements of the review charge

1. Has the entire beamline, spectrometers, detector configuration been defined, including ownership, maintenance and control during beam operations?

FINDINGS:

- The general experimental configurations, including the SBS (spectrometer and detectors), Big Bite, and target are sufficiently defined at this stage.
- Responsibilities for SBS detectors and spectrometer, Big Bite, target are defined.
- Responsibilities for the GMn installation are sufficiently defined at this stage.
- EHS&Q issues have been considered for each step of the design process and examples were provided.

COMMENTS:

- None.

RECOMMENDATIONS:

- A plan for integration of the slow controls for each new detector system needs to be developed – a single coordinator for slow controls must be assigned.
- A point of contact from the collaboration for the downstream beamline needs to be clearly identified.

2. What is the status of the equipment towards operation? What are the completion/commissioning schedule and tasks?

FINDINGS:

- Not all experimental equipment is yet complete. Detectors and instrumentation are planned for completion (including testing) by the end of 2018.
- A timeline was presented that would appear to meet the goal of being ready for installation in early 2019. However, a unified schedule of all work that needs to be completed in order to run the experiment (detector assembly, software, technical support tasks) was not presented.
- A plan is in place for providing all necessary hall infrastructure.

COMMENTS:

- A plan for tracking the CDET PMT gain over time would likely be useful.
- A concrete plan for how the HCAL gain monitoring system will track the detector response over time should be developed.

RECOMMENDATIONS:

- Produce a list of milestones and a schedule, integrating detector assembly, testing, movement to the hall, and the hall installation plan to track experiment progress as one project.

- A single point of contact must be assigned that will oversee the execution and coordination of the tasks in the above schedule.
- Draft OSPs are required that include a description of the hazards and identify subject matter experts for assessments.
- The JLab Fire Protection Engineer must be consulted to perform an assessment of flammable materials in the hall due to the large quantity of new detectors and associated cables that will be installed. This will be included as part of the OSP process, but an early conversation with the relevant expert will benefit all parties.
- A plan for managing the C4F10 needed for the Grinch needs to be developed.

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

FINDINGS:

- Responsibilities for the SBS (magnet, stand, etc.) and associated detector systems, as well as the Big Bite related tasks are well defined.
- A plan (with associated workforce) for development of the DAQ system was presented.
- Responsibility for overall software development was described, but no specific responsibility for online analysis was assigned.
- A rough plan for post-run analysis was described.
- The remaining design and engineering effort of 4-5 months assumes SBS would have the highest design priority just below the running experiment.
- 153 person-months are available for detector commissioning in the hall.

COMMENTS:

- It is difficult to assess whether the workforce for completing all the remaining jobs is adequate without a more detailed schedule (see recommendations from charge element 2).
- It is not clear who will be responsible for the C4F10 and GEM gas systems.
- A runplan, including the time needed for changing the experimental configuration (SBS/BB angle, BB removal, etc.) needs to be developed to make it clear how much time this experiment will require “on the floor.”
- Given the estimated 10-month installation, a schedule that clearly identifies tasks that can be carried out quasi-independently and/or in parallel with other tasks should be developed.

RECOMMENDATIONS:

- None.

4. Provide the target and scattering chamber configuration and requirements.

FINDINGS:

- The standard Hall A cryotarget system will be used, with one loop fitted with an additional copper radiator.
- The standard scattering chamber with modified chamber windows will be used.

COMMENTS:

- None.

RECOMMENDATIONS:

- None.

5. Have the specific equipment been demonstrated for readiness to operate the spectrometers (SBS and BigBite) and to achieve the scientific goals of the experiment? This includes demonstrating:
    a. GEM reconstruction efficiency at high rate
    b. High trigger rate capabilities. What are the expected accidentals?
    c. Determination of calibration efficiency.

FINDINGS:

- The DAQ as described seems to be capable of coping with the high detector rates, although without much margin for error.
- Tests of the new detectors with cosmic rays are either in progress or planned to begin very soon.
- A plan for determining the HCAL proton and neutron efficiency is in place.
- The GEM slow controls will use a standalone LabView system.
- The Cosmic-ray testing of the GEM is very positive, in particular the commissioning of detectors such as HV scan, efficiency etc.

COMMENTS:

- A plan for online analysis should be developed in light of the higher than usual (for Hall A) data rates.

RECOMMENDATIONS:

- A plan for online monitoring for all the detectors still needs to be worked out.
- A complete and realistic simulation of the full detector response, in particular for the HCAL and CDET, is needed.
- We strongly encourage further tests of the GEMs, ideally in one of the experimental halls, to lend additional confidence in the high-rate tracking capabilities. In addition, it is recommended to maintain at least 6 samples in the readout. Reducing the number of samples should only be done once a longer period under identical beam conditions

demonstrates high efficiency performance with a smaller number of samples, such as three samples.
- Development of the use of the SSP to reduce the data readout size needs to be pursued with very high priority. The backup solution would be an expensive upgrade of the Hall A network to 10 Gigabit/s.

6. Is the beam delivery affected by the running configuration of BigBite and SBS? If yes, have the fringe field effects been properly mitigated?

FINDINGS:
- The field from the SBS will impact the beam steering. In addition to passive magnetic shielding, correctors will be installed downstream of the target to steer the beam to the dump.

COMMENTS:
- The optimum solution for the use of the downstream correctors is unclear at this point, although it seems that there is more than one adequate configuration.

RECOMMENDATIONS:
- None

7. Are the beam commissioning procedures and machine protection systems sufficiently defined for this stage?

FINDINGS:
- No new procedures have been developed for beam delivery to Hall A with SBS.
- No new ion chambers or other MPS elements are planned for this experiment.

COMMENTS:
- Given the significant changes to the layout of large equipment in the hall, it is likely that a new sweep procedure will be needed. If a new sweep procedure is needed, a modified ERG will also be required.
- While the dump ion chambers will provide protection against beam miss-steering, we believe the addition of an interlock that will trigger fast shutdown of the beam in the event of loss of field/power to the SBS and downstream corrector magnets will be beneficial.

RECOMMENDATIONS:
- Develop beam delivery procedure to establish beam on the dump for the various beamline/SBS configurations.

8. Are the radiation levels expected to be generated in the hall acceptable? Is any local shielding required to minimize the effects of radiation in the hall equipment?

FINDINGS:

- The boundary dose evaluation indicates there will not be any problems running this experiment.
- Thorough background simulations have been performed to optimize the performance of the Big Bite detectors. Local shielding is planned to reduce backgrounds.

COMMENTS:

- Detailed simulations will be done by RadCon to assess activation of the downstream beampipe.
- The studies of steering of particles into the detectors due to magnetic fields need to be completed.
- Once beamline activation studies have been completed, the runplan may need to be revisited.

RECOMMENDATIONS:

- None.

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Agenda

June 15-16 2017

Thursday Morning		
8:30	*Closed Session*	(30)
9:00	Remarks from Chair and Charge	Chair (10)
9:10	**Charge Item 5**: Overview, general requirements	Brian Quinn (15+10)
9:35	**Charge Item 1,5**: Apparatus ownership, maintenance and control Equipment to achieve the scientific goals; Safety Docs	Mark Jones (20+20)
10:15	Break	(15)
10:30	**Charge Item 2,3**: Beamline, supports, SBS and BigBite magnets, major engineering hardware	Robin Wines (30+15)
11:15	**Charge Item 2,3**: HCal	Gregg Franklin (15+5)
11:35	**Charge Item 5c**: HCal efficiency calibration	Brian Quinn (10+5)
11:50	**Charge Item 2,3**: Bigbite non-GEMs	Todd Averett (20+15)
12:25	*Working Lunch*	
Afternoon		
13:30	**Charge Item 2,3**: GEMs	Nilanga Liyanage (20+20)
14:10	**Charge Item 2,3**: CDet	Peter Monaghan (15+5)
14:30	**Charge Item 2**: Installation	Jessie Butler (20+20)
15:10	Break	(15)
15:25	**Charge Item 3,5a**: Software; GEM reconstruction efficiency at high rate	Seamus Riordan (30+20)
16:15	**Charge Item 4**: Target, scattering chamber, and radiator	David Meekins (15+5)
16:35	**Charge Item 5b**: High trigger rate capabilities. What are the expected accidentals?	Alexandre Camsonne (15+15)
17:05	End	

Friday Morning

9:00	**Charge Item 6,7**: fringe field effects; Beam commissioning / machine protection	Jay Benesch (15+15)
9:30	**Charge Item 8**: radiation levels, local shielding; RSAD	Andrew Puckett (20+20)