Report
Experiment Readiness Review for the Hall D experiments E12-13-008/E12-13-008A

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Reviers:
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The experiment readiness review for the Hall-D Charged (E12-13-008) and Neutral (E12-13=008A) Pion Polarizability experiments took place on February 10, 2021, in a remote setting over the *bluejeans*. The meeting agenda and presentations can be found on the review page: https://halldweb.jlab.org/wiki/index.php/CPP_and_NPP_Readiness_Review

The review committee thanks the CPP/NPP collaboration for preparing the presentations, providing ancillary information, and patiently answering our questions during the review. Below are our answers to the Review Charge questions with comments and recommendations.

Review Charge:

1. *What are the running conditions for the experiments? Please state clearly the target, detectors, beamline configurations and operation as well as the integration of the Muon Detector (for E12-13-008) in Hall D. Has the detectors ownership, maintenance and control during beam operations been defined?*

Findings:
The running conditions were defined but are not final. The collimator diameter and the beam current are still in question. Design and planning of the integration of the muon detector are underway. The ownership, maintenance, and control during the operations are defined.
Comments:
There are plans to do checks with the beam for the trigger during the 2021 Hall-D run. Collaboration should plan to test the smaller collimator and the stable running at low currents (~25 nA to 30 nA) at the same time.
Recommendation: None

2. *What is the status/performance requirements of the new installations required for these experiments? Specifically:*

- The Multi-wire proportional chambers –

Findings:

Presentations indicated that 8 MWPC are planned to be available at JLab by the end of Summer 2021. Of those, only 6 are needed for production. That leaves a healthy margin of 2 spares. As stated in the presentation, 5 planes are ready to go and are awaiting shipping from UMass. Three planes still need some modest work but should be ready and shipped in plenty of time to meet the projected schedule. Space has been allocated for delivery and testing of the chambers. In the hall, the CDC gas system will be utilized for the new wire chambers.

Comments:

Plans/procedures and equipment needed to support access to the top and side of muon detectors during the experimental program should be outlined in the relevant OSPs/documentation.
Chris Cuevas (JLab Fast Electronics Group) should be consulted to ensure that the new muon detector systems conform to current JLab electrical requirements (may require some formal approval). Repurposing of the CDC gas system for new chambers should be reviewed by pressure system DA and documented.

Recommendations:

- Please provide a status summary of the as-built 8 MWPC planes. This summary should include the following information for each plane whether it is ready for Production or not.
  - If it is "Production-ready", then:
    - Include some plots with data supporting that assessment. This could include some combination of:
      - HV plateauing plots
      - ToF histograms from cosmic data
      - Plane/wire efficiencies extracted from cosmic data,
      - etc.
  - If a plane is not “Production-ready”, then:
    - Tabulate what still needs to be done, a timeline for completion, and who is assigned to the work
- Come up with a plan/procedure to measure the efficiency of MWPC since it will affect the physics results

- The downstream platform, support structure and iron absorbers –

Findings:

The platform is designed, some parts are on hand, part of the drawings have been released.
A concept has been developed for assembly, alignment, and installation of the chambers and iron absorbers. Chamber and absorber materials and alignment requirements are known. Design and analysis have been completed for the detector stand. Results indicate design is within acceptable safety margins. Drawings of the stand exist and are ready for procurement. A concept has been developed for the platform modifications to accommodate the installation of the detector. Rails and adjusters exist for the install and alignment of the detector.

Comments:

Platform modifications should be analyzed and documented to ensure planned and future needs are accommodated. Load limits and access routes on the platform should be noted with signs. Documentation on the Darkroom access would be beneficial to prevent safety issues after

modification. Physics driven specification for iron absorbers from stating material, coating allowances, and air gap allowance between plates would be beneficial in fabrication. Detector assembly documentation should be completed before fabrication.
Recommendation: None

- *The Pb target –*
Findings:
Both experiments will utilize the 0.30 mm thick (5% RL), 25mm diameter 208Pb (99.1% enrichment) target from the Hall B PRIMEX experiment. The target sample's thickness was well-characterized by the PRIMEX collaboration, with an uncertainty of 0.4% at its center. Target In/Target out operations will be performed periodically, but the frequency is not so high as to require an automated process. It can be done manually by the user. The target should be placed in the beam with positional reliability of about 1 mm. The target will be placed about 64 cm upstream from the nominal GlueX target center. The target will be placed in the air, about 1 cm downstream from a 5 mil Kapton beam window. Target mounting mechanism design is to be completed by end of summer '21.
Comments:
The design of the target mounting mechanism is in a "pre-conceptual" phase. A hand-drawing of a rotating design was shown, but it is not far enough along for a worthwhile review. While positional reliability of less than 1 mm should not be difficult to achieve, the collaboration should confirm that this is acceptable before proceeding with the final design. The 1 cm separation between the lead and Kapton beam window should be confirmed as well. Consider a simple in-beam contact (switch) that can be read into EPICS to display the target position.
Recommendation: None

- *The new trigger configuration (for E12-13-008) -*
Findings:
There is a plan for modifying the existing TOF trigger using a different grouping and coincidence between two planes. The timeline for development, implementation, and testing are reasonable. Trigger rates of 30 kHz have been quoted for CPP using a 40ns coincidence window. This rate was estimated from the measured rates with the nominal target and the collimator for Gluex after correcting for the target thickness and the collimator size. The calorimeter trigger rate for NPP is expected to be 10 kHz (FCAL/BCAL). The target position was not folded in the estimate of the neutral trigger. The Hall-D DAQ can handle 80 kHz.
Comments:
A plan for TOF gain matching should be clearly defined during the commissioning of the experiment. Some efficiency numbers were mentioned in the rate estimates document, but it was not clear how they were determined (thresholds, type of particle, logic to obtain the sample). It would be good to add to the existing document or spell it out in a separate document since the efficiency of the trigger is required for cross-section measurement. Some provision for a muon trigger could be useful to check the muon detector efficiency.
Recommendations:
Provide the real measured rates and the details of how the 30 kHz rate was estimated. The provided estimates (for CPP and NPP) were based on the measured rates with the target at the nominal position. How much rate increase is expected from having the target ~60 cm upstream, including the rate from additional air downstream of the target.

3. *If not completed, what are the completion/commissioning schedules, tasks and user commitment?*

Findings:
A high-level schedule for the hardware installation, trigger design, and commissioning has been presented and discussed.
Comments:
Make sure all tasks are discussed and resources identified, especially for the pre-run test of MWPC in ESB. The platform area will have limited space during the last phase of installation. Review installation schedule to ensure resources are available and not conflicting in the last phase of installation. Include items to be removed in the installation schedule.
Recommendations:
- The remaining tasks must have names assigned.
- Timeline for completion of simulation and reconstruction work must be provided.

4. *Are there any potential non-standard hazards or tasks, for example is there any temporary structure needed for the experiments that require access?*

Findings:
There are no non-standard hazards or tasks. The potential hazards are known and have been addressed. An additional staircase is being provided for additional access and egress of the platform.
Comments:
Make sure planned work for assembly, testing, and installation are included in DList, THA's done, and properly reviewed.
Recommendations: None

5. *What are the expected data rates for the experiments (both physics data rate and background rates)?*

Findings:
Only trigger rates have been discussed, no data rate was provided.
Comments:
The trigger rate is within the limits of the Gluex DAQ and one expects the data rate to be the same. Nevertheless, an estimate of the expected data rate will be useful since the inclusion of the ToF trigger for CPP may require lowering the thresholds on this detector and therefore increase the data rate.
Recommendation:
Provide rates per-plane for MWPC and the total expected data rate for the experiments.

6. *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:
The responsibility for the design, fabrication, and installation of the platform, detectors, and the target in the hall resides on the Hall-D engineering and service group, responsibilities are defined. The schedule allows for 6-8 weeks of float.

Comments:
Integration of all activities would be beneficial to ensure resources and spaces are not dually allocated.

Recommendations:
The remaining tasks must have names assigned. Make sure this includes software tasks.

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

Findings:
The beam commissioning procedures and machine protection systems were not discussed. The beam delivery will use the same procedures as for the nominal GlueX runs.
Comments:
There might be some issues with the running at relatively low beam currents (~27 nA vs. 150 nA of GlueX) due to the bleedthrough or beam position stability. The stable running at the proposed beam current should be tested during the next Hall-D beam run.
Recommendations: None

8. *What is the simulation and data analysis software status for the experiment? Has readiness for expedient analysis of the data been demonstrated? What is the projected timeline for the first publication?*

Findings:
Work for the integration of the MWPC simulation and reconstruction has started but is not completed. No completion dates for the remaining software tasks have been set. The readiness for the expedient analysis of data and the first publication timeline were not given.
Comments:
Only one person was quoted for the software tasks who is not a member of Hall-D.
Recommendation:
The analysis plan and timeline for the first publication weren't addressed in the presentation, as well as the readiness of the software for muon-pion separation. These items, including how the efficiency of MWPC and the TOF trigger will affect the physics results should be submitted to the Committee.

9. *What is the status of the specific documentation and procedures (COO, ESAD, RSAD, ERG, OSP's, operation manuals, etc.) to run the experiments?*

Findings:
The preliminary versions of the COO, ESAD, RSAD, ERG, and some of OSPs are in reasonably good shape.
Comments:
Two ESAD's were provided, one for the existing equipment in the hall and the second with added muon detector. Please clarify with DSO which one you need. Will need an OSP for the target, as well as OSPs for MWPC tests in ESB.
Recommendations: None