Hall A E12-17-004
Experiment Readiness Review Committee Report
Jefferson Lab May 29, 2019

Preamble:

The Committee wishes to thank Patrizia Rossi and the organizers for the well-planned agenda and arrangements, and the speakers for their informative and efficient presentations as well as for their patience when explaining their material and answering our questions.

Committee: Howard Fenker (Chair), Chris Cuevas, Pavel Degtiarenko, Bert Manzlak, Lubomir Pentchev
Observers: Ed Folts, Javier Gomez

Charge Items & Committee Responses

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

Yes, the detector configuration has been defined, as well as the people associated with the detectors.

2. What is the status of the equipment required for this experiment (i.e not in common with E12-09-019) towards operation? What is the completion/commissioning schedule and tasks? This should include:
    a. GEMs and associated electronics

All modules for GEM planes have been produced except for two planes (from INFN) that will be further evaluated this summer. See recommendations.

    b. Neutron-scattering analyzer blocks

The active analyzer is operational, requires minor changes to be adapted for the JLab HV supply.

    c. Mechanical supporting frames and all the mechanical components needed to move in-and-out the polarimeter

Design detailing and fabrication procurements are on track for delivery by the end of August, 2019.

    d. large-angle proton detectors and associated electronics

The individual modules for the two scintillator walls have been tested and are ready to be installed in their frames.

e. Integration in the DAQ and the slow controls

DAQ testbed already in use in ESB. Most hardware for non-GEM readout is on site. Major components for GEM readout largely in-hand or committed. Some smaller items still to be identified.

3. Have the specific equipment required by this experiment been demonstrated for readiness to operate and to achieve the scientific goals of the experiment? This includes demonstrating:
    a. GEM reconstruction efficiency at high rate

Simulations indicate 70%, compared to 80% assumed in the proposal. See recommendations.

    b. Correct estimate of the polarimeter analyzing power (to achieve science goal in the approved beam time)

The measurements at Dubna confirm the prediction about the analyzing power and give confidence that the estimates are correct.

4. 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? Please provide a documented track record from previous experiments.

GEANT4 simulations are running using simplified/preliminary geometry model. Analysis software is in beginning stages now; plan exists for developing it prior to the run. First publication is forecast for 36 months after data-taking. Collaboration has relevant successful experience in previous experiments at DESY, PSI, and JLab.

5. What is the impact of running this experiment on E12-09-019. Is a plan been developed and agreed upon with the E12-09-019 spokespersons?

Impact is minimal but only verbally coordinated with E12-09-019. See recommendations.

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?

Yes. Sufficient manpower is available to be ready in time for running in 2021.

7. 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 equipment?

Radiation levels are predicted to be typical and acceptable. Local shielding is planned to protect the GEM electronics from background radiation. Simulations

indicate that a shield wall between the beamline and the PR detectors will be needed to reduce the background particle rate in those detectors.

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

Detector and electronic technologies are substantially the same as already in use in Hall-A experiments, but this does not provide an umbrella for all of the equipment to be used for this experiment. Documents specific to some GEn hardware are probably required. See comments.

Comments

- There is some uncertainty about the scope of existing SBS documentation and what new documentation is or is not required for GEn. The Physics DSO (Ed) & Deputy Associate Director (Patrizia) are available to help make this determination.
- Remaining procurements include copper analyzer plate, optical fibers, HV modules, HDMI cables, and others. Although none of them appear to be challenging to obtain, it would be useful to create a comprehensive list of all remaining procurements and the plans for accomplishing them so that the spokespersons can monitor their progress.
- It would be a good idea to formulate a high rate test with the MPD and SSP DAQ hardware to fully test these devices as close as possible to the simulated rates of the experiment.

Recommendations

1. Outline a plan and schedule to pursue realistic simulations of high-rate tracking performance in the presence of anticipated backgrounds, and to take advantage of any opportunities to validate the simulations using real data.

2. Update simulation geometries to the latest CAD model of the final installation and include fringe magnetic fields.

3. Obtain a written agreement with the E12-09-019 which includes a high-level schedule showing how installation and deinstallation of all experiment hardware interleave with the run plans of the two experiments.

4. Provide an evaluation of the expected INFN GEM performance or present a plan for using alternate detectors.

5. Provide updated reports and expected performance evaluations for both UVa and INFN GEM detectors based on the most recent test results. Present a plan that assures the availability of detectors having suitable performance for the experiment.

Findings

- Downstream field clamp weighs 16,500 lbs. There is 17.5" clearance between field clamp and CE detector frame outside edge to install and remove field clamp. It can be put in position using the crane if needed.
- Other than the Copper Analyzer plate and the Glasgow CH analyzer assembly, all components of GEn will be installed, tested, and left in place prior to and during the first phase of the GMn run. When GMn reaches a 4.5GeV run point, there will be ample time (one 8-hour shift) to install the new devices (Copper plate, GEM and side Hodoscope).
- The experiment makes extensive use of existing SBS and Big Bite (BB) equipment. Equipment added consists of several additional GEM detectors, PMT-based scintillator hodoscope arrays, copper analyzer, and a PMT-based active CH analyzer. Although some design drawings remain to be detailed, the beamline, spectrometers, and detectors configuration is either pre-existing or fully defined.
- Existing BigBite hadron stack bars will be restacked in new frames for GEn.
- The Glasgow CH active analyzer will be outfitted with negative HV bases when it arrives at JLab in 2019.
- The Hall-A detector gas system is being upgraded to be able to supply the quantity of gas needed by the SBS detectors. This system will also support the GEn detectors.
- Cables and electronics for all non-GEM detectors is on site.
- Plans are in place for where to obtain remaining needed GEM electronic hardware, although several procurements remain.
- Rails and movement system that supports the RP assemblies will require an OSP.
- Collaborators made a measurement of the analyzing power of copper in an experiment at Dubna and used the result to validate their model. Very good job on the experimental verification, and other studies of the analyzing power of the polarimeter.
- Added equipment which is specific to this experiment is similar to equipment already in place for the SBS experimental program.
- Results from the UVa cosmic ray test stand show the GEM detector efficiencies are ~95%. The test stand offers a nice way to verify the GEM operation for a few weeks and also verifies the front end APV boards and interface back-planes.
- Status of the Multi-Purpose-Digitizer[MPD] units was explained and 19 remaining modules have been ordered by the Italian group. There are several spare MPD which is good. The MPD boards and the JLAB SSP module have been tested and are

running in a test stand in the EEL124 clean room. Readout electronic racks and layout was presented for the experiment and the cabling a layout makes sense and will be accessible for any maintenance during the experiment.

- Preliminary tests indicate that the INFN GEM chambers operate with relatively low efficiency. With the extra modules being produced, one can optimize the configuration so that the chambers with lower efficiency are placed in the SBS arm where they are used only to veto the protons.
- After the presentations to the full committee, Robin Wines provided the following in private conversation/email:
    1. We are in the process of evaluating if GEn is an additional fire load to the Hall or not. If so, then we will have Facilities advise us.
    2. An engineering review will be performed for the upgraded hall gas system. Hall A engineer, Whit Seay, has been the system Design Authority for the GEn test setups and will continue as such for the experiments.
    3. An Oxygen Deficiency Hazard Review (w/ ESH&Q - J. Williams) and a Confined Space Assessment (w/ ESH&Q - J. Williams) will be performed for the electronics hut. This is how we will decide the design of the GEM electronics hut as being under the structure or to the side.
    4. An engineering review of the proposed floor rail system is planned.
    5. The platform fall-protection guard rail design will be completed by March 2020.