HPS Response to DOE HEP Review Closeout Report of July 11, 2013

General Findings and comments:

Management from both SLAC and JLAB were present at the review. JLAB management is actively involved in coordinating HPS and the 12 GeV upgrade.

Comments:

1. A Technical Coordinator may be needed during the installation and operation phase of the HPS experiment.
HPS considers this an excellent suggestion, as does JLAB. We have already agreed with Volker Burkert, the leader of Hall B, that Stepan Stepanyan will serve in this capacity. Stepan has intimate knowledge of both Hall B and HPS and is uniquely qualified to fill this post.

2. HPS could potentially produce the first physics publication from the upgraded Hall B at TJNAF.

Charge 1: Did the HPS collaboration successfully demonstrate the technical feasibility of its detector design in its 2012 test run at the TJNAF?

Findings:

HPS clearly had a successful test run in many ways. Without such a Test Run, it would have been hard to consider the tight HPS schedule credible.

Comments:

1. HPS needs to fully analyze the test data and publish in peer-reviewed journals. This will help uncover possible problems. This is particularly true for the SVT alignment.
HPS already has plans to continue its analysis of test run data and publish a description of the test run apparatus and its performance in NIM, or an equivalent journal. We agree that work on the alignment should be brought to completion, and intend to pursue it aggressively

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2. If you have 30k photoelectrons/GeV in the ECAL, is an APD upgrade going to help overall resolution?

The number quoted at the review was 30 photons per MeV, not 30 photo electron/MeV. We apologize for the confusion. The number of photoelectrons is ~3/MeV. The factor 10 reduction is from the area and quantum efficiency of the Hamatasu S8664-55 APD. The use of large area APDs (S8664-1010) will increase this number by x4. Significant improvements in the resolution will come both from the increase in photoelectron statistics and also from the ability to lower the threshold. As prototype tests of a similar calorimeter in Hall-B have shown, threshold levels can be reduced to 5-6 MeV equivalent (for existing ECal modules it is ~10-12 MeV). This will allow improving the energy resolution to (2.5%-3%)/√E from its current value of 5%/√E.

3. The DAQ was only tested at 10% of final expected rate. HPS should consider high-rate tests of the full system before the full run.

Our schedule allows for thorough testing of the SVT DAQ at SLAC and full integration with the SVT. We have already planned high rate tests of the full system and intend to verify that it can handle rates of nearly 50khz.

Recommendations:

1. None

Charge 2: Has the HPS collaboration developed technical designs and construction and commissioning plans for its components (SVT, SVT DAQ, ECAL, muon detector, trigger, beam line, beam monitoring, DAQ, online and offline software) that are consistent with readiness to begin taking data in FY15 in the low energy beam (2.2 GeV, 1.1 GeV and if available 6.6 GeV) in Hall B at TJNAF?

Findings:

The design for the full experiment is based on the existing successful design from the Test Run.

Upgrades and modifications are evolutionary and modest, and several members of the collaboration are involved with software.

Given the experience at JLAB, the beamline monitoring and operation are clearly in good shape.

Comments:

1. Commissioning plans are not detailed enough, especially given the apparent short timeline for installation, commissioning and running. Doing this all on nights and weekends will require a very tight run plan with close cooperation and communication with JLAB and Hall B managers (daily contact).

We recognize the unusual setting for running the experiment and we are working on detailed plans for commissioning each detector component. We already have a draft document for the beam line commissioning, the highlights from which were presented in the beamline talk at the review. We will continue to improve the document and procedures as we learn more about CEBAF accelerator performance during the commissioning of the upgraded machine in Q2-Q3 of FY14. We believe that the time allocated for beam commissioning (off work hours and weekends during mid-October to end of December, 2014) is adequate for beam line commissioning.

We are also working on the commissioning plans for SVT and ECal. Simulations are in progress to study options for SVT alignment including the possible use of additional targets. We are also studying ECal calibration (e.g. use of neutral pions for ECal). We plan to produce commissioning documents for these detectors within a few months.

It must be noted that the installation and hot checkout for many subsystems (e.g., pump down vacuum, exercising HV/LV and the cooling systems, checking signals from readout channels without beam) can be done concurrently with CLAS12 installation, and consequently are not confined to nights and weekends. Also, to put some scale on the required activities, note that during the test run, installation and hot checkout was completed during just two shifts.

2. Online software development should continue so that they are able to quickly monitor and analyze data online during data taking. They could add a monitoring stream to the DAQ, for example.

We acknowledge the importance of immediate feedback of the data quality that an online monitoring system provides, and indeed we have already implemented such a system. The monitoring system that was used during the test run was capable of adding several monitoring streams to the DAQ for different levels of monitoring. For the next run period we plan to add a new low level event display and low level individual detector monitors. We also plan to further optimize the existing monitoring tools which use the full analysis framework and allow for high level monitoring. For this high level monitoring, in addition to analyzing the small fraction of live data that can be handled by the online computers, we plan to also fully analyze a much larger fraction of the data using the JLab offline farm, immediately after this data is available there. Full calibrations will also start as soon as the data for this is available, so that we minimize the delay between data taking and full data processing, with the intent to produce physics results as quickly as possible.

3. A mock data challenge before running would be useful.
We agree. We already have plans in the works to develop a full analysis package, which will be exercised on Monte Carlo data. The Monte Carlo simulation fully mimics the actual data, so this analysis package will be available for real analysis as soon as the real data is recorded. The idea a mock data challenge has arisen before in the collaboration; we agree that it would be useful; and we are planning to conduct this exercise.

4. A high rate full system test as soon as possible is crucial since the Test Run was performed at only 10% of the expected rate.

We agree. We plan to conduct such tests for the full system when it is integrated, before installation Fall 2014. See also Charge 1/Comment 3 above which addresses plans for the SVT DAQ.

5. Consider techniques, like using extra targets and off-axis beam, to assist with aligning the SVT which will be crucial for needed vertex resolution
We agree that SVT alignment is very important, and are presently completing new track fitting algorithms, and correcting track reconstruction bugs, that have impeded our attempts to use general alignment routines. We will certainly consider taking non-standard data (e.g. field off, extra targets, off-axis beam) to help provide robust alignment procedures.

6. Offline software for the muon system was discussed, but muon ID using the ECAL might be a higher priority.
We have begun the process of evaluating a mip trigger using the Ecal data alone. We are presently incorporating the necessary hadron physics backgrounds into the simulation, and generating the appropriately simulated raw data, to proceed with these studies.

7. The collaboration should consider adding additional design reviews for the ECAL, DAQ, etc.
We agree. Additional design reviews will be added to the schedule.

Recommendations:

1. None.

Charge 3: Has the HPS collaboration identified and costed for the appropriate manpower and other resources consistent with readiness to take data in FY15?

Comments:

1. A schedule which showed both hours and durations by task would have been most helpful in assessing the appropriateness of resources.

We agree, and will add this information to our project schedule.

2. Essentially the same team that executed the successful 2012 HPS experiment will be responsible for the proposed experiment, which lends a level of confidence to the cost and schedule estimated.

Recommendations:

1. Create (or maintain) a resource loaded schedule which includes the non-costed scientific time.

We will do so. Although scientific time was not fully accounted in the schedule originally submitted with the proposal, we have since been acquiring the needed information from each of the subsystems, and are already close to incorporating all this data into our project schedule.

2. Add "off-project" interface milestones related to Jlab's 12 GeV schedule to the HPS schedule.

We are already aware of these "off project" milestones although we did not describe them in the proposal or the presentations at the review. They include: (a) PCAL and FTOF are installed on Forward Carriage (FC); FC ready to be moved upstream to allow access to alcove; (c) Torus assembly fixtures ready to be installed and FC moves downstream to allow installation of assembly fixtures: (d) Torus hub is installed, ready for installation of 3'' vacuum beam pipe through it; (e) RF separators are commissioned.

Charge 4: Has the HPS collaboration presented estimates of cost and schedule that are consistent with readiness to take data in FY15?

Findings:

Estimated costs and schedule by task were presented.

Comments:

1. Schedule slack is not specifically identified within task lines, which makes it difficult to assess overall schedule contingency.

We will revisit the schedules of each of the HPS subsystems, and will identify schedule float more explicitly.

2. It may be informative to make a copy of the schedule and perform a "what if" analysis, removing float from tasks and determining the earliest possible finish date.

We agree, and plan to conduct this exercise.

3. A critical path analysis was not presented. It would be very helpful for reviewing and managing the project.

In fact, much of the critical path has been identified, although it was not called out explicitly in the presentations at the review. We will review and update the critical path analysis.

Recommendations:

1. None.

Charge 5: Has the HPS collaboration developed a credible staging plan for installation of detector components that will allow for data taking in FY15?

Findings:

It has recently been proposed that the location for the HPS experiment be changed from an upstream position to a downstream position in JLAB's Hall B.

Comments:

1. A detailed staging schedule was not shown for either upstream or downstream option.

We agree a detailed staging schedule should be developed, and will do so. The details of the plan will depend on how the CLAS12 installation is proceeding, and what detailed schedule is developed as installation approaches, so will be most sensibly developed closer to the actual installation time.

2. No ES&H milestones or reviews were mentioned.

Construction of detector components is proceeding at different laboratories (SLAC, JLAB, Orsay and INFN). Each sub-group will follow ES&H guidance of their respective institutions. Jefferson Lab has established procedures (now being updated) for an experiment readiness review that will include safety assessment of the detector installation and beam running. Experiments provide information based on which experimental safety assessment and radiation safety document will be written, reviewed and eventually approved. HPS will work closely with JLAB Physics division Safety office to conduct experiment readiness reviews, and prepare and approve HPS operating procedures.

Recommendations:

1. Additional integration planning with JLab 12 GeV personnel relating to Hall B progress (regardless of the upstream/downstream decision) is crucial to HPS success. The HPS project team should clearly identify a technical coordinator to address these issues.

Stepan Stepanyan from the HPS project management team will be the liaison (technical coordinator) between HPS and the Hall-B 12 GeV project, as agreed to with JLAB management. He will hold regular meetings with Hall-B lead engineer Robert Miller and the lead engineer of the CLAS12 Torus project Dave Kashy. Stepan will report 12 GeV progress to the HPS Executive board and to the HPS project management team on a regular basis.