U.S. DEPARTMENT OF ENERGY

Office of Science

Department of Energy
Office of Nuclear Physics Report

on the

Annual Progress Review

of the

Super BigBite Spectrometer (SBS)

November 16-17, 2015

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Executive Summary

On November 16-17, 2015, the Department of Energy (DOE), Office of Science, Office of Nuclear Physics' Facilities and Project Management Division conducted an Annual Progress Review of the Super BigBite Spectrometer (SBS) program. The review was held at the Thomas Jefferson National Accelerator Facility (TJNAF, or JLAB) in Newport News, Virginia.

The SBS program provides equipment and detectors to measure of 3 of the 4 elastic nucleon form factors: GE(n) the electromagnetic form factor of the neutron, GM(n) the magnetic form factor of the neutron, and GE(p) the electric form factor of the proton, to a very high accuracy, which together may constrain theoretical values of the Generalized Parton Distributions.

The SBS program is divided into three phases (SBS Basic, Neutron Form Factor, and Proton Form Factor). The scientific program of the proposed SBS focuses on measurements of the nucleon electromagnetic form factors up to momentum transfers Q2 of 10 GeV^2, taking advantage of the new capabilities at the Continuous Electron Beam Accelerator Facility (CEBAF). The scientific goals are compelling. The experimental setup can be augmented to address other important physics topics such as measurements of the Collins and Sivers asymmetries in semi-inclusive deep inelastic scattering and measurements of the pion parton distribution function, which the panel was pleased to see. The Collaboration is encouraged to extend the effort on the simulation and analysis framework to include tracking the spin rotation of particles to extract polarization, analysis of accidentals, trigger efficiency, and the radiative corrections and form factor extraction methodology. To broaden the involvement of the theory community, it is desirable to organize a workshop concerning the impact and interpretation of the form factor measurements.

The SBS program has two distinct experimental configurations. In the use as a proton polarimeter it consists of the magnet followed by an array of gas-electron multipliers (GEMs) and analyzers and a position-sensitive scintillation coordinate detector (CDet) as the front face of a hadron calorimeter (HCAL) for proton identification. An electromagnetic calorimeter (ECAL) assists the non-magnetic CDet, and an unpolarized liquid hydrogen target is used. In the neutron detection configuration the GEMs and analyzers are not needed and the CDet acts as a charged particle veto for the HCAL. An existing magnetic spectrometer is used as the electron arm, and a polarized ^3He gas target is used in this configuration. Several pieces of this system are external dependencies not covered within the project work breakdown structure, but were included in the review – HCAL, ECAL, and the polarized ^3He target.

The team responded well to last year's review. The panel is pleased to see that the work on the magnet forming the SBS Basic project will finish on schedule January 2016. One issue noted during the last review, the possible effect of beam size on transport to the beam dump, has not been modeled. The HCAL is being developed by Carnegie Mellon and no issues are seen with its development. The ECAL design has changed, which has delayed the possible start of the proton form factor experiment. Continuous thermal annealing is called for to counter the expected radiation damage to the lead glass; a small prototype test provided a proof of principle, but annealing on the full scale device requires further research and development (R&D) to solve the hurdles of temperature uniformity and cool photomultipliers. The CDet, data acquisition, and trigger electronics are proceeding well and are on schedule. It is encouraging that the simulations are now using realistic responses for different detectors and the team is planning to build realistic data streams to test analysis code. The group should formulate a plan for measuring trigger efficiency. A clear path from raw data to interpreted form factors would be helpful. The GEM investigation at the University of Virginia (UVa) has uncovered and solved a number of difficult experimental issues through their careful analysis. The UVa group is commended for excellent progress of GEM chamber construction.

The budget and schedule for the SBS Basic project is on track with a completion date by January 2016. The SBS Neutron Form Factor project has a new completion date of January 31, 2017. The SBS Proton Form Factor project completion date is February 1, 2017. Workforce availability seems adequate. Key dependencies not included in the SBS program – HCAL, ECAL, and the polarized ^{3}He target, have added significant delay to the timeline for running the experiments, comprising the SBS scientific program.

The new program manager has been very effective over the past year. Monitoring of project progress and work on integration and installation are going well. It is anticipated that some of the equipment may be finished significantly earlier than it is used, and must therefore be placed in long-term storage. However, the current long-term storage plans do not include conditions that are proven for preservation of the performance of the detector. There are significant management challenges ahead to ensure the satisfactory scheduling of the suite of SBS experiments, as well as to ensure the capability of stored equipment.

The ECAL and the polarized ^{3}He target external dependencies are notably behind schedule. This introduces risk, including risk to costs, to the completion of the SBS detector system, but also adds risk to the achievement of the core scientific program. While the selection of the choice of design and the additional cost of the revised ECAL detector is now anticipated by mid-2016, a viable financial path forward for its construction needs be addressed. The start of the SBS experimental program is delayed due to lack of space in Hall A needed for each SBS project as other experiments are implemented. The Proton Form Factor, as well as the Neutron Form Factor, will not be staged until all portions, including the external dependencies, are ready. Both program management and laboratory support will be challenged to execute scheduling, storing, testing, and commissioning the systems in a timely manner while preserving detector performance.

Recommendations

- The team should provide to DOE a report on the ECal annealing tests by February 16, 2016. This report should use the beam test data to validate the heat annealing model, and use the model to predict performance under expected operating conditions.
- A document describing trigger and DAQ electronics including a timing diagram for the trigger should be provided one month before the next review.
- The Laboratory is urged to evaluate the ECal project including the technical feasibility of the annealing solution, and ECal project cost and schedule, by summer 2016.

Introduction

On November 16-17, 2015, the Department of Energy (DOE) Office of Science for Nuclear Physics (NP) held an Annual Progress Review of the proposed Super BigBite Spectrometer (SBS) program. The review panel consisted of five external peer review experts: Dr. Frank Maas (GSI), Professor Gerald Miller (University of Washington), Professor William Jacobs (Indiana University), Dr. Hank Crawford (Lawrence Berkeley National Laboratory), and Professor Ricardo Alarcon (Arizona State University). The review was chaired by Dr. Elizabeth Bartosz, Program Manager for Nuclear Physics Instrumentation. Other attendees included Dr. Gulshan Rai, Program Manager for Medium Energy Physics for the Office of Nuclear Physics.

Each panel member was asked to evaluate and comment on any relevant aspect of the SBS project. In particular, the purpose of this review was to assess all aspects of the project's plans—scientific, technical, cost, schedule, management, and environment, safety, and health (ES&H). The following main topics were considered at the review:

1. The significance and merit of the project's scientific goals;
2. The feasibility and merit of the technical approach for delivering the science, and the technical status of the project, including completeness of scope and fabrication progress;
3. The feasibility and completeness of the budget and schedule, including workforce availability;
4. The effectiveness of the management structure and the approach to ES&H; and
5. Other issues relating to the SBS project.

The two-day review was based on formal presentations given by the project team, separate follow-up discussions with the reviewers, and executive sessions. The second day included a question and answer session in which the project team responded to questions posed by the panel on the first day as well as a breakout session. The second day also included an executive session during which time the panel deliberated and prepared draft reports on their assigned areas of focus and ended with a brief closeout with the SBS project team and collaborators and laboratory management. The panel members were asked to submit their individual evaluations and findings in a "letter report" covering all aspects of the charge. The executive summary and the accompanying recommendations are largely based on the information contained in these letter reports. A copy of the charge letter and the agenda are included in Appendices A and B, respectively.

Significance and Merit

Findings:

The Super BigBite Spectrometer (SBS) program involves measurement of the elastic form factors of the neutron (GE(n)/GM(n) and GM(n)), GE(p)/GM(p). Measurement of the ratio of the neutron electric to magnetic form factor in a four momentum transfer range Q2 from 1.5 (GeV/c)2 up to about 10 (GeV/c)2. Measurement of the ratio of the proton electric to magnetic form factor in a four momentum transfer range Q2 from 5 (GeV/c)2 up to about 12 (GeV/c)2. Measurement of the neutron magnetic form factor in a four momentum transfer range Q2 from 3.5 (GeV/c)2 up to about 13.5 (GeV/c)2. The combination of the measurements allows for a SU(2) based quark flavor separation comparing u- and d-quark contributions to the form factors. These measurements are aimed at achieving a very high statistical and systematic accuracy.

The SBS spectrometer setup provides the unique capability for experiments requiring high luminosity and fairly large solid angle.

Additional experiments addressing different physics, extending SBS with additional equipment, have been proposed and evaluated by the JLAB Program Advisory Committee (PAC). Examples include a measurement of Collins and Sivers asymmetries in semi-inclusive deep inelastic scattering (SIDIS). Another example is the measurement of tagged deep inelastic scattering to measure the pion parton distribution function.

The work in progress concerning the development of a simulation and analysis framework (MC) has been presented. The ultimate goal is the analysis of the experiment with the help of pseudo data. The simulations now include events generated by Pythia feeding Geant4.

A discussion of how to extract the electromagnetic form factors from the measurements proposed here in terms of quantum electrodynamics radiative corrections has not been presented.

Comments:

The measurement of the electromagnetic form factors at high values of momentum transfer Q2 with the SBS spectrometer setup remains a high scientific priority.

Including radiative corrections is critical. Due to the high energies involved a strategy to address the radiative corrections is needed since calculations of radiative corrections and producing of event generators for simulations take time.

The Collaboration is encouraged to extend the effort on the simulation and analysis framework to include:

- Higher level analysis including tracking, clusters, etc.
- Tracking the spin rotation angle of particles through the spectrometer in order to be able to extract the transverse polarization of the nucleon.
- Analysis of accidentals, by mixing events.

- Trigger efficiency simulations.
- Radiative corrections and form factor extraction methodology.

To broaden the involvement of the theory community, it would be desirable to organize a workshop concerning the impact and interpretation of the form factor measurements.

The panel is pleased to see the SBS can be used for the proposed SIDIS measurement. The new Tagged Deep Inelastic Scattering (TDIS) experiment is innovative and involves development of a novel time projection-chamber detector for the low-energy tagged protons.

Recommendations:

- None

Technical Approach and Status

Magnet/Infrastructure

Findings:

Work Breakdown Structure-1 (WBS 1) is close to completion and appears to be on time and on budget. The 48D48 magnet modifications are complete and the new racetrack and saddle coils have been delivered and their acceptance tests completed.

The new 2200A power supply for the SBS magnet was installed in Hall A and has successfully passed acceptance tests.

The counter-weighted support structure for the SBS has been delivered and block modifications completed. The floor plates to be used with the already procured hydraulic cylinders and existing Hillman rollers will be delivered in December 2015.

Verification of the design of the exit beam pipe, associated magnetic shielding and dipole corrector magnets was completed using the modeling code TOSCA, and was shown to meet the requirement on the integral of < 3000 G-cm in the critical regions at the SBS magnet entrance and exit.

The beam pipe design is for a welded tapered tube structure with multiple (18 inner, 68 outer) half ring magnetic shielding pieces that can be assembled to accommodate the different experimental setups/magnet configurations. The pipe and magnetic shielding will be built in-house (by January 2015) due to lack of outside bids within the budget envelope; corrector magnet coils have been wound and cores machined and to be delivered in November 2015.

A snout has been delivered for use with an existing scattering chamber; a setup is ready to test the delivered windows in November 2015; front and back field clamps for the SBS magnet have recently been fabricated.

Shims (WBS 2) are scheduled for delivery November 2015; detector support designs have been completed, some fabricated and delivered with the remaining components scheduled for completion in March 2016.

Comments:

The panel is pleased to hear of the progress and see the growing completion list for all aspects of WBS 1 with projected completion of all items by January 2016. An issue noted from the last review, the possible effect of beam size on transport to the beam dump, has not been modeled. An estimate should be made in conjunction with the JLAB beam experts.

The remaining relevant infrastructure included in WBS 2 is in the design and fabrication stages and several task deadlines are coming in the next months and early 2016. It appears there are sufficient workforce resources to meet these deadlines. It is strongly encouraged that all effort be made to complete WBS 2 items as anticipated.

Recommendations:

- None

HCAL and ECAL

Findings:

The design review of HCAL was completed in December 2014 and module construction was initiated in March of 2015. Improved light guides delivered about twice the photoelectrons resulting in an improved time resolution, 277 compared with previous 300 ps measured with cosmic rays. This translates into a predicted time resolution of ~ 0.7ns for neutrons, significantly better than the requirement of < 1ns.

All outside vendor work has been completed and all the major components needed for HCAL module assembly have been delivered to Carnegie Mellon University (CMU), apparently on budget.

Ongoing module production has produced 72 of the 288 total modules; submodule frames will be delivered in March 2016 and design of base support, back plate and cable scaffolding are under design (WBS 2). HCAL module production should produce ~ 50% of the total number of required modules by March 2016, with the rest completed before the September 2016 target date of completion.

The scheme for the continuous ECAL annealing uses a temperature profile along the length of the lead glass blocks, ~ 250 degree C at the entrance with a "hockey stick" drop to 50 degrees C at the readout end where an air jet cools the phototube on an extended light guide.

A test comprising a 16-bar ECAL prototype for continuous annealing of radiation damage was carried out in May 2015; measurement of the resolution of the bars before and after a large radiation dose indicated a slightly elevated average sigma but acceptable and within errors; an associated average gain factor compensation was observed to be approximately 25%.

A dynamical model of the radiation damage and annealing has been developed with parameters determined from a series of bench tests using damaged cells under heat treatment annealing; included in the model is some increase in absorption arising from the heating of the lead glass bars themselves.

The fabrication of an ECAL C200 frame is ongoing as the next stage of testing in order to understand the heating and mechanical issues associated with a large array of ECAL blocks (~ 10% of final ECAL array). The finite element analysis program "COMSOL" has been found useful to evaluate the thermal and mechanical issues of the design

A sequence of milestones was presented for further testing and design of the final ECAL frame and oven; a goal of lead glass installation starting January 15, 2017 and cosmic ray tests finished and detector ready for installation January 15, 2018.

Comments:

There are no known or projected issues to prevent HCAL detector completion as anticipated. Further work in progress (using neural networks) may improve the HCAL rms timing resolution of neutron response to ~ 0.6ns, closer to the nominal initial goal of 0.5ns.

The ECAL design has changed from the original proposal. The change in design has caused a considerable delay of the possible start of the SBS proton form factor physics program. While the 16 bar prototype test was a significant proof-of-principle for in-beam heat annealing, it appears not to be scalable. A validated model will be critical for design of the full scale equipment. The available observations should be used to further tune and refine the model, an effort that so far appears not to have been done.

Judging from the presentations so far, implementation of an ECAL annealing scheme on the scale of the full detector assembly will take some further R&D which poses some risk. The C200 prototype test appears to be a reasonable next step in order to understand what is required to construct the full ECAL array with continuous heat annealing.

Recommendations:

- The team should provide to DOE a report on the annealing tests by February 16, 2016. This report should use the beam test data to validate the heat annealing model, and use the model to predict performance under expected operating conditions.

Coordinate Detector (CDet), DAQ, and Trigger Electronics

Findings:

There is a new optical readout scheme for the gas-electron multiplier (GEM) multi-purpose digitizer (MPD) electronics that allows data acquisition rates up to 5kHz. Trigger tests using 3 Fastbus systems have been performed showing 7% dead time at rates of 5kHz.

The CDet introduces 2.5% deadtime in the 1877 TDC system. The CDet uses 168 MaPMTs of 16 channels each, all of which have been characterized for gain and selected for the detector. The threshold for the discriminator that feeds the TDC is set to 50% of the mean signal from a 3 GeV electron, yielding a detection efficiency of 98%.

The GEM readout will now include 112k channels, 1 for each strip rather than doubling up the strips as we heard last year. All GEM electronics will be from the Instituto

Nazionale di Fisica Nucleare (INFN, Italy's National Institute for Nuclear Physics) design. CODA can now read out the INFN MPD electronics.

A Finite Impulse Response (FIR) filter is needed to suppress noise in early channels of the 128 channel GEM readout because of propagation of digital levels of 1 or 0 at the beginning of each readout cycle.

The DAQ has not yet been tested with Fastbus, FADC, and MPD acting together.

The trigger (T1) is initiated by a nuclear instrument module (NIM) based sum of patches of ECal PMT signals that have been split three times to also feed the 1881 ADCs. Once T1 is received, the FADCs investigate their pipes to see if HCal also had a patch above threshold to produce a T2 trigger that initiates readout. The T1 rate is expected to be ~100 kHz, with the T2 rate at ~5kHz.

Comments:

It is encouraging that the simulations are now using realistic responses for different detectors and planning to build realistic data streams to test analysis code. It appears possible to investigate trigger efficiencies by loading the memories of the FADC and Fastbus systems with simulated data. The group needs to formulate a plan for measuring trigger efficiency. The CDet has made great progress and is on schedule for August 2016 delivery.

A slow controls system should be developed.

Recommendations:

- A document describing trigger and DAQ electronics including a timing diagram for the trigger should be provided one month before the next review.

WBS 3 GEM

Findings:

The University of Virginia (UVa) group has progressed on chamber construction to finish over half the modules. The GEM test setup at UVa now includes a Sr90 electron source that can be operated in parallel with an x-ray source thereby enabling investigations of the electron response in the presence of a high photon flux.

Using this X-ray test stand the group was able to find a problem with the cathode and gas barrier in the first chambers. This was corrected by using an aluminized gas barrier.

It was found necessary to reduce the output impedance of the gas lines to avoid excessive bowing of the gas barrier and distortion of the GEM frames.

The decision has been made to use the Italian design for chamber readout. The small changes needed to adapt the electronics to the UVa chambers have been designed. A sample of the full readout chain is being built with expected test on chambers at UVa in January/February 2016. The full order is expected to be placed after evaluation of the sample with expected delivery time of approximately 6 months.

Comments:

The group is commended for excellent progress on chamber construction.

The GEM investigations at UVa have uncovered and solved a number of sticky experimental issues through their careful analysis.

Use of contingency for more spare chambers and to expand the skilled workforce on the project is commended.

The UVa plan to test the full readout chain with production chambers and in a realistic radiation environment in Hall A is excellent and should be pursued with priority.

Pedestal noise results from cable dispersion causing the digital header from the APV to bleed into the analog data of the first channels. The group might consider making an adaptor to allow the use of low dispersion cable from the APV to the digitizer.

Zero suppression should be considered for both trackers to reduce the data volume.

Recommendations:

- None

Budget and Schedule

Findings:

Completion date for WBS 1 is expected by January 2016 and all expenditures are projected to be completed on budget. Following one of the recommendations of the last review, the WBS 2 (CDet) was rebaselined with a new project completion date of January 31, 2017, expenditures (including open commitments) are 68% of the total budget and about 28% of the contingency remains. WBS 3 completion date is Feb 1, 2017, 20% of the budget remains to be committed and about 50% of contingency is still available which could be used for spare chambers.

The Program Management Plan has a discrepancy, indicating in one chart a completion date of July 31, 2017 for WBS 3. An overall workforce plan was not presented formally. The workforce needs were discussed for individual WBS elements.

The high level budget and schedule were presented.

Critical external dependencies including the electron and hadron calorimeters, polarized ^{3}He and high power hydrogen targets, are not contained in the presented WBS's. These dependency projects have updated their milestones.

The anticipated experimental readiness for the full set of experiments shifted since the last review by 1.5 years.

JLAB requires that a Readiness Review, requiring finalized engineering design for all experimental elements, must be done prior to the scheduling of the experiment.

Comments:

The SBS project is progressing well toward its successful completion. However, the external dependencies have added significant delay to the timeline for running the experiments.

Management seems to have considered workforce adequately, and the anticipated availability seems adequate to complete the SBS project.

The off-project dependencies, ECal and ^{3}He target, are the key components of the science program which now appear to be driving the experimental schedule.

Recommendations:

- None

Management and ES&H

Findings:

The Project Management Plan was updated to reflect the recommendations of the last review.

To keep track of the project, the Project Manager (PM) works closely with Hall A management and the collaboration.

All SBS activities adhere to the protocols as spelled out in the JLab EH&S Manual. Experiments in the Hall must go through a rigorous readiness review process.

Comments:

The panel, which expressed their confidence in the new program manager at the last review, is pleased to see that confidence appears well founded.

There have been significant advances in the project since the last review.

There are significant management challenges ahead to ensure the satisfactory scheduling of the suite of experiments, and the lasting capability of the equipment, which may be finished significantly earlier than it is used. Both program management and laboratory support will be challenged to execute scheduling, storing, testing, and commissioning the systems in a safe and timely manner.

The ECAL and the polarized ^{3}He Target external dependencies have introduced a significant schedule and potentially cost risks to the completion of the SBS detector system. The earliest measurements with the ^{3}He target are projected to be realized around 2019 – 2 years beyond the nominal completion of the SBS project. The ECAL has changed from the original proposal and includes a significant R&D component directed at developing a scaled-up solution for a continuous hot annealing system. The ECAL and ^{3}He are key components of the scientific program without which only the Gm(n) measurements could be realized using a standard, but available cryotarget. The proton form factor measurements and the neutron electric form factor measurements using the beam-target polarization may be at risk.

The ^{3}He target engineering design timeline appears to be long, and is driven by technical workforce availability at JLAB. The Laboratory and the collaboration are strongly urged to explore options to accelerate the ^{3}He target project schedule.

Recommendations:

- The Laboratory is urged to evaluate the ECal project including the technical feasibility of the annealing solution, and ECal project cost and schedule, by summer 2016.

Appendix A: Charge Letter

Thank you for agreeing to participate as a panel member for the Annual Progress Review of the Super BigBite Spectrometer (SBS) for Hall A at the Thomas Jefferson National Accelerator Facility (TJNAF). This review is being organized by the Department of Energy (DOE) Office of Nuclear Physics Facilities and Project Management Division and is scheduled to take place at TJNAF on November 16-17, 2015. A list of the review panel members and anticipated DOE participants is enclosed.

Each panel member is being asked to evaluate and comment on any relevant aspect of the SBS project. In particular, the purpose of this review is to assess all aspects of the project's plans—scientific, technical, cost, schedule, management, and environment, safety and health (ES&H). The following main topics will be considered at the review:

a. The significance and merit of the project's scientific goals;
b. The feasibility and merit of the technical approach for delivering the science, and the technical status of the project, including completeness of scope and fabrication progress;
c. The feasibility and completeness of the budget and schedule, including workforce availability;
d. The effectiveness of the management structure and the approach to ES&H; and
e. Other issues relating to the SBS project.

Each panel member is asked to review these aspects of the SBS project and write an individual "letter report" on his/her findings. These letter reports will be due at DOE two weeks after completion of the review. The review will be chaired by Dr. Elizabeth Bartosz, Program Manager for Nuclear Physics Instrumentation. As Chairperson, she will accumulate the "letter reports" and compose a final summary report based on the information in the letters. We take care to keep the identity of the reviewers confidential in the summary report. It would be convenient if you would prepare your response in a form suitable for transmittal to the proponents devoid of potentially identifying information. The cover letter may include other remarks you wish to add.

The project team has been asked to provide relevant background materials prior to the review. This documentation, along with a current agenda, will be distributed in the near future. If you have any questions about the review, please contact Dr. Bartosz at (301) 903-0189, or E-mail: Elizabeth.Bartosz@science.doe.gov. If you have any questions regarding local travel or lodging, please contact Pat Stroop at TJNAF at (757) 269-7553, or E-mail: stroop@jlab.org.

I greatly appreciate your willingness to assist us in this review. It is an important process that helps our office to understand the status of the project. I look forward to a very informative and stimulating review.

Sincerely,

Jehanne Gillo
Director
Facilities and Project Management Division
Office of Nuclear Physics

Enclosure

Appendix B: Agenda

November 16-17, 2015

Monday, November 16 – Plenary Sessions in CEBAF Center L102

8:00 – 8:50	Executive Session
8:50 – 9:00	Welcome (McKeown)
9:00 – 9:30 (20+10)	SBS Science Update and Overview (Wojtsekhowski)
9:30 – 10:30 (40 +20)	SBS Project: Cost, Schedule and Management (Jones)
10:30 – 10:45	Break
10:45 – 11:30 (30+15)	Dependency overview (Keppel)
11:30 – 12:15 (30 +15)	WBS 1 – SBS Basic: Magnet and Infrastructure (Wines)
12:15 – 1:30	Lunch (Executive session – Room L102)
1:30 – 2:15 (30+15)	WBS 2 – Neutron Form Factor: CDet (Khandaker)
2:15 – 3:00 (30+15)	WBS 3 – Proton Form Factor: GEM (Liyanage)
3:00 – 3:30 (20+10)	DAQ: VME and Fastbus (Moffitt)
3:30 – 4:00 (20+10)	Background MC – all experiments (Riordan)
4:00 – 4:30	Break
4:30 – 7:00	Executive session
7:00	Reception – CEBAF Center Atrium

Tuesday, November 17 – Plenary Sessions in CEBAF Center L102

8:00 – 9:00	Q&A
9:00 – 10:30	Breakout: Dependencies **(Room B207)**
	Polarized ^{3}He target (Cates), HCal (Franklin),
	ECal (Riordan), GRINCH (Averett)
9:00 – 10:30	Breakout: GEM and Coordinate Detector **(Room L102)**
9:00 – 10:30	Breakout: Project Management **(Room F224-225)**
10:30 – 1:00	Executive session
12:30 – 1:30	Lunch (Executive session – Room L102)
1:30 – 3:00	Executive session
3:00	Closeout