The Summary of the IVth Super Bigbite Meeting

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Abstract

The IVth meeting of the SBS collaboration was held on March 19-20, 2010 at Jefferson Lab. Here we present a summary of the discussions on the urgent plans and organization of the collaborative efforts to address the concerns and recommendations of the Technical Review of the SBS project.

The recent meeting of the SBS collaboration on March 19-20, 2010, was the first after the JLab PAC provided grading and beam time allocation to a pilot set of SBS experiments, see PAC35 report [1]. It also took place after the collaboration received the report of the Technical Review (TR) [2]. There are very recent key developments in the funding arrangement of the SBS project, see an introductory talk by Kees de Jager [3]. The IVth SBS collaboration meeting had in 18 talks in total [4].

In this summary we present a plan which was formulated in the discussion sessions after the talks. These discussions were focused on the TR findings and ways to streamline the preparation of the complementary report addressing the concerns and recommendations of the TR. Below are the recommendations of the TR (*in italic*) and the plans of the collaboration to address them. **By the middle of July, each group of the SBS collaboration is expected to submit a report which will be incorporated into the TR response document.**

The TR recommendations, section 3.1

- *In view of the very large production of GEM foils and readout PCBs by the CERN workshop, the Committee strongly recommends to set up a list of specifications and QA acceptance criteria (e.g. max. leakage currents, inner/outer hole diameter range, max. mask misalignment, etc.) before the start of mass production this year. Strict QA rules and documentation of acceptance tests at the institutes receiving the GEM foils and PCB boards should be set up and followed. Depending on the details of the QA requirements, the level of required contingency should be discussed with the CERN workshop. The quality of GEM foils and PCB components during the mass production process has to be closely monitored, and rapid feedback to the CERN workshop should be ensured.*

  The INFN group (E. Cisbani *et al.*) is taking responsibility for the QA acceptance check of the GEM foils and communications with the CERN workshop. The foils will be shipped to Rome in small groups, e.g. every two weeks. The trained experts at INFN will check the foils in Rome just after their arrival and provide rapid feedback to the CERN workshop. The shipment of the foils to UVa will be in large groups, e,g. every two months. The UVa technical personnel trained in Rome and at CERN will perform additional checks before assembly of the GEM modules at UVa.

  The collaboration has assigned implementation of this plan to N. Liyanage and E. Cisbani. At least every month they will provide regular updates on the status of this item to the collaboration.

- *The Committee recommends investigating the possibility to reduce the number of spacer strips between GEM foils which will result both in a smaller dead area and a smaller amount of material.*

  The design of the GEM module will be evaluated in the fall of 2010 after a detailed study of the prototype module during a beam test in Hall A. The mechanical aspects will be tested experimentally at the University of Catania which will investigate further modifications of the module's mechanical design. At least every month E. Cisbani will provide regular updates on the status of the GEM design to the collaboration.

- *The Committee also proposes to investigate the possibility to increase the technical personnel for the construction and system integration aspects of GEM chambers and electronics for ST and TT at the University of Virginia.*

  The University of Virginia group (G. Cates & N. Liyanage) is considering increasing their technical resources in the GEM project by using their research funds. N. Liyanage will provide regular updates on the status of this issue to the collaboration.

- *The cost estimate for the construction of GEM trackers seems to be adequate. The Committee recommends to make sure that the cost estimates for the GEM foils and readout circuits include the contingency for the final yield, based on the QA procedures, and to review the cost estimate for the gas system which seems to be on the low side.*

  The NSU group (M. Khandaker) is taking charge of the gas system aspects of the GEM chambers. He will prepare a report with a detailed cost analysis. At least every two months M. Khandaker will provide regular updates on the status of this item to the collaboration.

The TR recommendations, section 3.2

- *Noise performance studies of the chamber with UV strip orientation, and therefore varying strip lengths, and an analysis of its impact on resolution and efficiency are of a great importance before the start of mass production. Special tests to estimate S/B performance should be also foreseen for the ST and TT chambers, where four strips are connected into a single readout channel (longer effective strip length mean higher capacitance, i.e. more noise).*

  The GEM electronics/test group has been formed with A. Camsonne of Hall A, JLab as the lead. The group is already doing noise/performance studies in the GEM prototype chambers assembled for the PREX experiment. At least every two months A. Camsonne will provide regular updates on the status of this issue to the collaboration.

- *In view of the high background levels ($\sim$500 kHz/cm^2) in the GEp(5) spectrometer, the Committee recommends that the 3-sample readout method of the APV25 be adopted as the default solution for all trackers (FT, ST, TT). This will increase the bandwidth requirement and data rates from tracking stations to the DAQ which, however, seems to be consistent with the plans for the Hall A DAQ upgrade.*

  The collaboration has adopted the 3-sample readout method for all GEM chambers. O. Hansen of Hall A will provide an update for the CDR on this item.

The TR recommendation, 3.3 section

- *The Committee strongly recommends that the response of a GEM detector to low energy photons should be measured using a prototype detector and electronics. The results should be compared to the GEANT modeling to confirm that the background levels in the Monte Carlo simulation are realistic. The expected level of occupancy in the GEM detectors, using an APV time window of 250 ns and an average number of strips in cluster per MIP particle ∼3.5, seems to be exceedingly high.*

  The UVa group (N. Liyanage) is developing a plan for such a measurement of the photon detection by the GEM chambers. Every two months N. Liyanage will provide regular updates on the status of this issue to the collaboration.

The TR recommendations, section 4.1

- *1) Execute a letter property transfer of the 48D48 magnet, spare coils, and power supply with BNL to secure the ownership of the magnet for JLab.*

- *2) Transfer of the SBS magnet, spare coils, and power supply to JLab should occur as soon as funds can be obtained for shipping and storage. The 48D48 magnet (and its power supply) is an excellent general purpose device and will be a valuable asset for JLab for many uses including its obvious value to the SBS project.*

- *3) A JLab representative should be dispatched to BNL to inspect the 48D48 DC power supply(s) to ascertain the suitability for continued use at JLab as part of the SBS Spectrometer. DC Power Supply documentation, spare parts inventory, and overall power supply condition should be determined by on site first hand inspection.*

- *4) The SBS magnet should be operated with all coils in series for best spectrometer stability and accuracy.*

- *5) The magnetic modeling of the 48D48 magnet as modified for the SBS that has been performed using "Mermaid" should be cross-checked against a fresh TOSCA model. The field plots shown during the presentations show some evidence of a grainy mesh especially in the angled beam pass through the channel. According to the presenters this was a result of limitations of the Mermaid installation. A TOSCA model with higher resolution would provide confirmation of the efficacy of the beam pass through shielding and the field in the gap including fringe fields.*

- *6) The SBS optics that was presented was based on model fields to represent the SBS dipole. The results presented indicate that the SBS magnet optics, resolution, and acceptance are well matched to the experimental requirements. The optics calculations and evaluation of the resolution and acceptance should be repeated with calculated 3D fields from a high resolution TOSCA model or at least the present Mermaid model. Using actual calculated SBS magnet fields will necessarily include the effects of the field gradient along "Z", a complete fringe field description, and information about actual fields along the beam pass through.*

  The magnet group (J. LeRose *et al.*) is working on implementation of the recommendations. Every two months J. LeRose will provide updates on the status of the magnet to the collaboration.

The TR recommendation, section 4.2

- *Provide calculations of the energy and spatial resolution with the 20 cm Al absorber taking into account the average radiation damage. Evaluate the impact of the resolutions on the general performance including tracking and trigger rate. Clarify the impact of the expected energy resolution not meeting the requirement on page 107. Provide evidence or arguments that a 5 fold increase in the UV light intensity will increase the rate of curing by a factor of about 5.*

  The ECal group (M. Jones *et al.*) is going to do a test of high intensity UV curing. The available UV system from the RCS E99-114 experiment has a 10 kW lamp and will be used as an initial option. At least every two months M. Jones will provide regular updates on the status of this item to the collaboration.

The TR recommendation, section 4.3

There are no identified issues regarding the Hadron Calorimeter. The HCal group (G. Franklin *et al.*) is going to do tests of several modules at high luminosity in Hall A. G. Franklin will provide regular updates on the status of the HCal project to the collaboration.

The TR recommendations, section 4.4

- *Develop a plan for routing the signals from all boards in the backplane to the FPGAs that is consistent with the expected data rates.*
- *Clarify the consequences of the multi-mode readout of the APV25S1 chip for event size and data acquisition rates.*
- *Specify the mechanical details of the FEC electronics, in particular the support for the electronics and the routing of the cables.*
- *Examine the signal quality of the GEM chambers as a function of cable length to make sure that the GEM performance is not compromised by the 7 - 10 meter cable run.*

The INFN group (E. Cisbani *et al.*) has a plan to address these issues in the process of the development a GEM module. Every two months E. Cisbani will provide regular updates on the status of this item to the collaboration.

The TR recommendations, section 5

- *Clarify the pattern recognition in the CD, taking into account showers in the 20 cm thick Al absorber in front and the backsplash from the calorimeter.*

  L. Pentchev is going to address the CD Monte Carlo study issue.

- *Simulate the full chain of track reconstruction in the first SBS tracker, starting with the signal readout, taking into account the realistic pulse lengths and cluster widths. Demonstrate the expected tracking efficiency and the level of contamination by false tracks using an algorithm for hit recognition and projection matching.*

  O. Hansen will lead the development of the Monte Carlo and the track reconstruction in the SBS trackers. He will provide regular updates to the collaboration.

The TR recommendation, section 6

The SBS Collaboration should develop a bottoms-up cost estimate for the project. Include all required components and activities. Make sure that realistic yields for delicate production items are taken into account.

The project manager (J. LeRose) is taking charge of this issue. At least every two months J. LeRose will provide regular updates on the status of this item to the collaboration.

The TR recommendation, summary

Remaining uncertainties in background rates and electronics performance can be reduced by performing experimental tests under similar conditions. This should be done as soon as possible since the results could lead to modifications of the segmentation scheme and the readout rates which need to be known before the start of mass production.

The collaboration is developing a plan for performing these measurements. It will include the parasitic tests in Hall A during the DVCS experiment and a dedicated run at a small angle which will require formal approval by the JLab management. M. Khandaker will provide regular updates on the status of this item to the collaboration.

The most recent updates on the issues mentioned in this summary above will be reported to the SBS collaboration through the SBS Newsletter.

References

[1] http://www.jlab.org/exp_prog/PACpage/PAC35/

[2] http://www.jlab.org/~bogdanw/SBS-CDR/SBS_Report_final_02_22_2010.pdf

[3] http://www.jlab.org/~kees/SBS_HallA.pdf

[4] http://hallaweb.jlab.org/12GeV/SuperBigBite/meetings/06/index.php