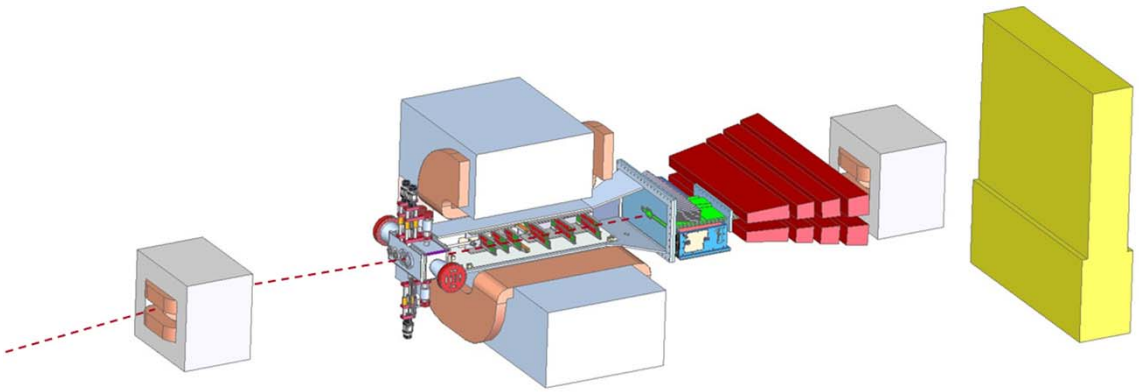

# HPS SVT&DAQ review

## Closeout

November 8, 2013

U.S. DEPARTMENT OF ENERGY
Office of Science

SLAC NATIONAL ACCELERATOR LABORATORY

# Review Panel

| | | |
|---|---|---|
| Marco Oriunno | SLAC | Chair |
| John Jaros | SLAC | Co-Chair |
| Stepan Stepanian | JLAB | Co-Chair |
| Tim Nelson | SLAC | Link Person to the SVT Project |
| Ryan Herbst | SLAC | Link Person to the SVT DAQ Project |
| Chris Kenney | SLAC | External Reviewer |
| Sven Hermann | SLAC | External Reviewer |
| Philippe Grenier | SLAC | External Reviewer |
| Leonid Sapoznikhov | SLAC | External Reviewer |

Link to the Web Page of the Review with the agenda and the documents submitted to the Review Panel:

https://confluence.slac.stanford.edu/display/hpsg/SVT+and+SVT+DAQ+Review+Nov.5%2C+2013

## Charge

SLAC

Thank you for agreeing to review the SVT and the SVT DAQ Project of Heavy Photon Search (HPS) experiment. It is expected that electron beams for HPS engineering run in Hall-B will be available early October-November of 2014. The HPS collaboration aims to have detectors installed and ready for commissioning with beam in October of 2014. In your review, please evaluate how ready the SVT and the SVT DAQ Projects are to move forward to the construction phase, and towards the installation at JLAB by September'14.

# General Remarks

The Review panel congratulates the project for the high quality of the talks presented, which addressed all the points in the Charge. The SVT detector has a strong team, who were key for the success of the HPS Test Run which provided the proof of concept. The new design is an incremental modification of existing solutions, addresses the reliability problems encountered at the Test Run, and extends the physics performance, all with low technological risk. Since the schedule is tight, the project needs to move forward with a fast and steady pace, and to track more closely the tasks being developed in parallel.

## 1. Are the detector specifications clearly defined and reflect the physics requirements?
## 2. Does the detector design meet the required specifications?

SLAC

Findings:

1. The Project is an upgrade of an existing detector, with clear physics requirements, tested in the field during the Test Run, which corrects problems noted and extends capability. The proposed changes, wider detector modules, new hybrid, a sixth layer, the Analog-to-Digital conversion and power distribution in vacuum have low technological risks compared to the benefit of increased performances.
2. The ability to reconstruct the time of hits at the 2 ns level will be crucial in rejecting backgrounds.

Comments:

None

Recommendations:

None

## 3. Are the interfaces with the other sub-system sufficiently understood, e.g. Beamline, Slow Control, TDAQ.

SLAC

Findings:

The integration the SVT on the Beamline is critical and the project has a good communication with the Beamline and the Slow Control projects and they are consistently attending their meetings.

Comments:

1. Regular meetings with TDAQ group at JLAB should be established well before installation.
2. Online monitoring, especially during movement of the upstream modules, will be critical, which is recognized by the team.
3. Detailed plans for the Beamline Interlocks where not presented, which need to be discussed with the Beamline project and implemented by the Slow Control group.

Recommendations:

1. Installation, Commissioning and Alignment on beam need more work. The Beamline meeting should coordinate but SVT must review.

## 4. Does the team have a schedule for the project that allows the installation of the SVT in September'14?

Findings:

1. Detailed Schedules, loaded with resources, were presented, showing the readiness for installation by end of August'14, only one month before the expect delivery of the first beam.

Comments:

1. The SVT and the SVT DAQ projects are six weeks and four months behind the schedule, respectively.
2. Project Leader and PM schedule do not match on the achievement of the intermediate milestones, which is a concern for the readiness for installation on August'14.

Recommendations:

1. Implement as soon as possible a new schedule with actions to absorb the delays already by March 2014.
2. Work with the PM to develop a master schedule, which will be used as reference to track the progress of the SVT&DAQ project.

## 5. Is planning underway for initial "rough" calibration, final calibration, and commissioning? Who will have responsibility for these areas?

SLAC

Findings:

A general overview of the Commissioning and Calibration was presented, which are key to the HPS readiness in October‘14.

Comments:

1. The project should develop calibration and commissioning procedures, and come up with a clear list of special runs/setting/triggers needed to accomplish the goal.

Recommendation:

None

# 6. Are there remaining issues in the project that require additional R&D and/or design changes?

SLAC

Findings:

1. The SVT must operate by design very close to the beam (~1mm). The first layer will see high radiation doses on some spots.
2. The Vacuum Flange Board is a new design

Comments:

1. Although unlikely, a failure of the sensor plans due to the highly non-uniform radiation fluence, ASICs, or other circuitry could be serious.
2. The Development of the Vacuum Flange Board is shared with other projects (LSST), which may be moving on a different schedule. This may have an impact on the costs and the schedule and will involve coordination of Electrical and Mechanical engineering.
3. Plans exist to study these possible failure modes and we encourage this to be done as soon as feasible.

Recommendations:

1. Continue beam tests as soon as feasible to assess the behavior of the sensors in a realistic environment.

# 7. Can the project adequately justify the cost and are the necessary funds secured?

SLAC

Findings:

The Costs are well detailed, based in many cases on the past experience with the Test Runs

Comments:

The project seems to be well managed financially and on budget. However, schedule delays may signal the need for increased manpower or expenditures in the future, requiring some contingency funds. The HPS costs are very reasonable given the scope of the experiment. They are doing a lot with modest funding and all the projected costs are well justified.

Recommendations:

None

# 8. Has a quality assurance plan be developed and put in place?

SLAC

Findings:

A quality assurance plane was not shown

Comments:

Although the SVT&DAQ is not a large project, a minimum set of QA procedures for the detector modules as well as for the other components should be developed.

Recommendations:

None.

# 9.Other Comments

Findings:

None

Comments:

1. The schedule is very tight with many activities going in parallel. A basic risk analysis of the tasks on the critical path would help to prevent costs overrun or delays on the key milestones.
2. The mechanical design of the global support structures as well as the integration and definition of surveying procedures needs to be started soon, with a set of well defined resources, not interfering with tasks already in development.
3. The Routing for flex cables was not shown, which is critical for the exact definition of the lengths.
4. HV issues on flex and high density connectors are a concern.
5. The transformers and air cores will be exposed up to 1.5 Tesla while they were tested only up 1T.

# 9.Other Comments

6. Can electronics tolerate runs without magnetic field ? The beam will scatter into the hybrids and metal cooling plates.
7. SEUs within the FPGA SRAM from low neutron flux could be monitored constantly. The proposed FPGA includes this option quite easily. Most likely the SEU rate will be very low as calculation suggests.
8. Components like the ADCs and the regulators could be checked for already existing radiation (TID) qualification (from CERN, ESA, NASA, etc). If no radiation qualification data is available the use of higher voltage components (>3.3V) should be minimized as a general rule (TID, latch up).
9. It is advised to test some of the existing front end modules with a prototype of the new proposed back end and power supply electronics as soon as possible to mitigate the remaining risk.

Recommendations:

Test transformers and air cores with a  1.5 Tesla field