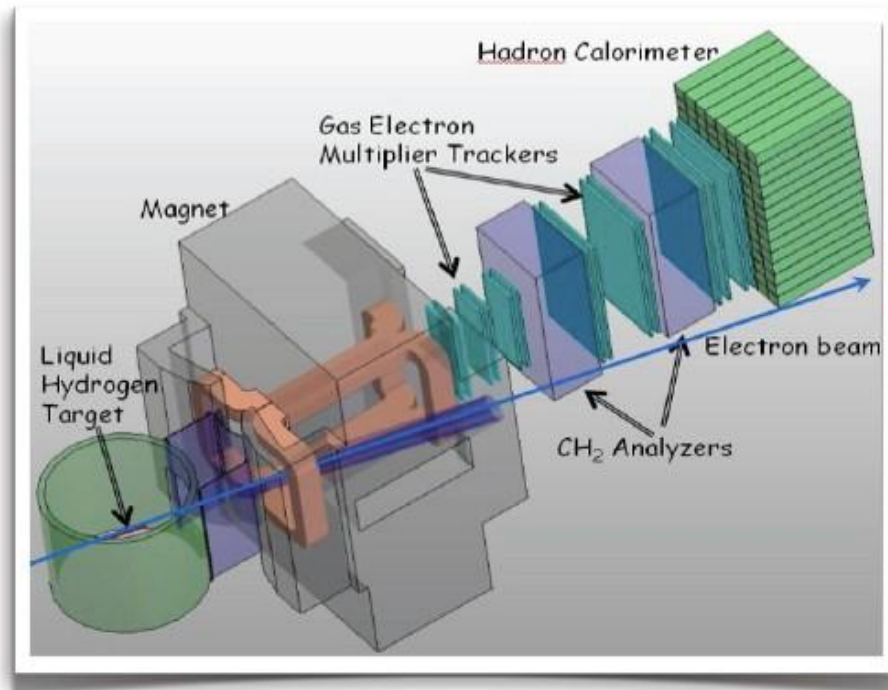


# ***Super-BigBite-Spectrometer (SBS)***

## **Monthly Progress Report**

**May 15, 2013**



## Introduction:

The SBS Program consists of three separate, but interrelated Projects.

- The first Project, **SBS Basic (WBS 1)**, involves the acquisition of an existing magnet and the associated work of preparing it for use during the SBS research program. The effort includes modifications to the magnet, including machining a slot in the yoke for beam passage, field clamps, and a solenoid to reduce the transverse magnetic field on the beam line, the design and development of the infrastructure needed to run the magnet, and the construction of the platform on which it will stand.
- The second Project, **Neutron Form Factor (WBS 2)**, involves the construction of twenty-nine GEM detector modules with associated front-end and DAQ modules to meet the requirements of the approved neutron form factor measurements.
- The third and final Project, **Proton Form Factor (WBS 3)**, involves the construction of thirty-five GEM detector modules with associated front-end and DAQ modules and the addition of pole shims for increased magnetic field integral to meet the requirements of the approved proton form factor measurements.

## Project Management Highlights:

This is the eighth Monthly Progress Report for the SBS Program. The collaboration is in place, and the Program Management Plan has been approved by Jefferson Lab management and by the DOE-NP Instrumentation Program Manager.

The first and second Projects within the SBS Program, SBS Basic (WBS 1) and Neutron Form Factor (WBS 2), started at the beginning of FY13.

The third Project, Proton Form Factor (WBS 3), isn't scheduled to start until FY14.

## WBS 1: SBS Basic

<b>WBS 1</b>	<b>SBS Basic: (Hall A Infrastructure)</b>	<b>WBS 1.01</b>	Milestones
		<b>WBS 1.02</b>	Project Oversight
		<b>WBS 1.1</b>	Magnet, power and construction
		<b>WBS 1.2</b>	Magnet/detector platforms
		<b>WBS 1.3</b>	Beam line

### WBS 1.01 Milestones:

<b>Id #</b>	<b>Level</b>	<b>Milestone</b>	<b>Scheduled Date</b>	<b>Expected Date 4/1/2013</b>	<b>Expected Date 5/1/2013</b>	<b>Actual Date</b>
1.1-01M	1	Project start	10/1/2012	10/1/2012	<b>10/1/2012</b>	<b>10/1/2012</b>
1.2-01M	2	Magnet delivered to JLab	4/30/2013	4/30/2013	5/30/2013	
1.2-10M	2	Platform parts received	6/27/2014	6/27/2014	6/27/2014	
1.2-20M	2	Magnet assembled on platform	3/19/2015	3/19/2015	3/19/2015	
1.2-30M	2	Beam-line parts received	9/24/2015	9/24/2015	9/24/2015	
1.1-10M	1	Project completion	1/29/2016	1/29/2016	1/29/2016	

### WBS 1.02 Project Oversight:

- SBS weekly meetings are being held via tele and video conference almost every Wednesday. During this Report period, meetings were held on Apr 3<sup>rd</sup>, Apr 10<sup>th</sup>, Apr 17<sup>th</sup> and Apr 24<sup>th</sup>. Participants included Jefferson Lab, University of Virginia, St. Mary's University, William and Mary, University of Massachusetts, Carnegie-Mellon University, University of Glasgow, Norfolk State University, Idaho State University, and INFN – Rome.
- Project is staffed appropriately for this beginning stage, and includes a Jefferson Lab manager, scientist, and magnet engineer.

- Milestone 1.2-01M's expected date has moved out by one month. There remains sufficient float to accommodate this, with the receipt of the platform parts required to assemble the magnet milestone not until 06/27/2014, and the magnet assembly completion milestone of 03/19/2015. The only related magnet task between milestone 1.2-01M and assembly is the magnet steel machining. We prefer to wait for shipment of the 48D48 magnet from BNL to JLab when the additional steel we are requesting has been cleared to ship. Both the magnet and the additional steel needs to be cleared by Health Physics at BNL. The extra steel is required as counterweight for the mounting structure. BNL has a lot of excess steel, but a lot of it is too radioactive to ship. We will wait an additional month to see if sufficient steel acceptable to ship can be located. As backup, we have requested a second magnet as counterweight, but this is less preferable from a geometry and engineering point of view. Should the delays continue into June we will reconsider the backup option.

### **WBS 1.1 Magnet, Power and Construction:**

- Continuing yoke modification drawings. (30% completed)
- Continuing detail drawings of new coils. (25% completed)
- Power supply specification completed, waiting for a vendor budgetary quote. (75% completed)
- Defining field clamps and design of clamp supports.(15% completed)
- BNL continues surveying the yoke and support material for transporting. JLab has submitted request for shipping, rigging and storage.

### **WBS 1.2 Magnet/Detector Platforms:**

- Continuing design work on magnet counter weight support to incorporate movement of support to relocate magnet as needed. Working on design details of rollers,jack mounts,magnet bracket,and floor plates. (65% completed)
  - Progress slow this month, mainly because we need to know the material we will use for the counterweight support in order to continue with the counterweight design details.
- Designing detector supports. ( 20% completed)

### **WBS 1.3 Beam Line:**

- Layout and design of shielded beam pipe and vacuum snout. (20% completed)

### **WBS 1 Costs:**

- Budget for this WBS for FY13 is \$838K.
- Costed and obligated to date (as of 5/1/2013): \$37,234 (4.44%)



## WBS 2: Neutron Form Factor

<b>WBS 2</b>	<b>Neutron Form Factor</b>	<b>WBS 2.01</b>	Milestones
		<b>WBS 2.02</b>	Project oversight
		<b>WBS 2.1</b>	GEMs (UVa)
		<b>WBS 2.2</b>	GEM Electronics (UVa)
		<b>WBS 2.3</b>	Electronics Hut, Lead Shielding, Lead platform, and Detector Frames
		<b>WBS 2.4</b>	Coordinate Detector

### WBS 2.01 Milestones:

ID #	Level	Milestone	Scheduled Date	Expected date 4/1/2013	Expected date 5/1/2013	Actual Date
2.1-01M	1	Project start	10/1/2012	10/1/2012	10/1/2012	10/1/2012
2.2-01M	2	UVa receives GEM parts	2/3/2014	2/3/2014	2/3/2014	
2.2-20M	2	UVa receives electronics parts	8/20/2014	8/20/2014	8/20/2014	
2.2-10M	2	UVa GEM modules assembled and tested	10/17/2014	10/17/2014	10/17/2014	
2.2-40M	2	Coordinate Detector Assembled	11/17/2014	11/17/2014	11/17/2014	
2.2-30M	2	UVa front-end electronics assembled and tested	2/2/2015	2/22/2015	2/22/2015	
2.2-40M10	2	WBS 2.3 completed (Electronics Hut Assembled etc.)	10/5/2015	10/5/2015	10/5/2015	
2.1-10M	1	Project completion	1/29/2016	1/29/2016	1/29/2016	

## **WBS 2.02 Project Oversight:**

- SBS weekly meetings are being held via tele and video conference almost every Wednesday. During this Report period, meetings were held on Apr 3<sup>rd</sup>, Apr 10<sup>th</sup>, Apr 17<sup>th</sup> and Apr 24<sup>th</sup>. Participants included Jefferson Lab, University of Virginia, St. Mary's University, William and Mary, University of Massachusetts, Carnegie-Mellon University, University of Glasgow, Norfolk State University, Idaho State University, and INFN – Rome.
- Project is staffed appropriately for this beginning stage, and includes Jefferson Lab (manager, scientist), UVa (two scientists), and Idaho State University (one scientist).

## **WBS 2.1 GEMs (UVA):**

Pre R&D work on the production of GEM modules for WBS 2.1, aimed at starting production work, has continued. Below is a report on how that pre R&D work is progressing.

- In April the first 50 cm x 50 cm SBS GEM prototype was connected to gas and high voltage and everything was turned it on.
- All sectors of the prototype are working very well holding high voltage with no issues at all.
- The chamber is being tested with cosmic rays and radioactive sources.
- The signals from all parts of the chamber look very good with high signal to noise ratios.
- The construction of this prototype, which proceeded very smoothly without any major difficulties, and its operation indicate that this design is very close to being final for the SBS GEM modules.
- Currently making a few small adjustments are being made to the design for the next prototype to fabricated this summer.
- A report on the construction and characterization of the prototype is being written.

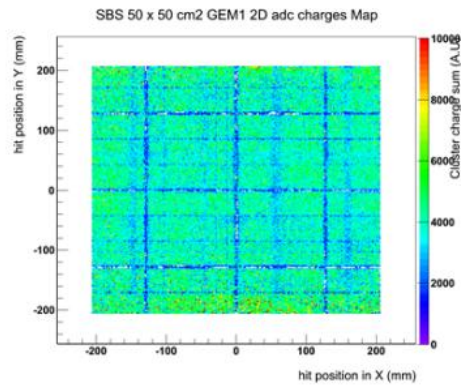
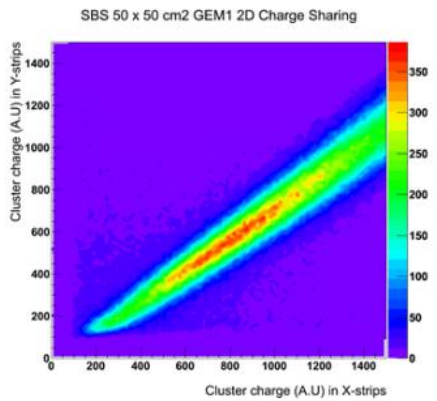
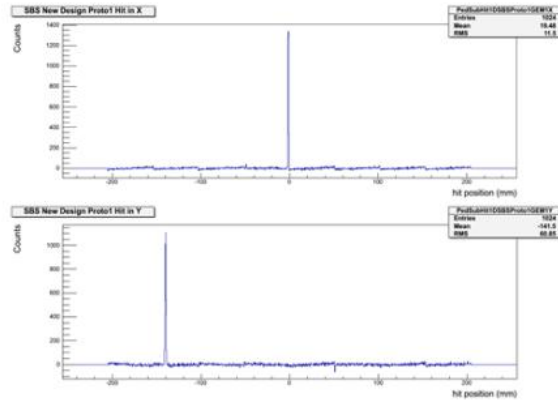
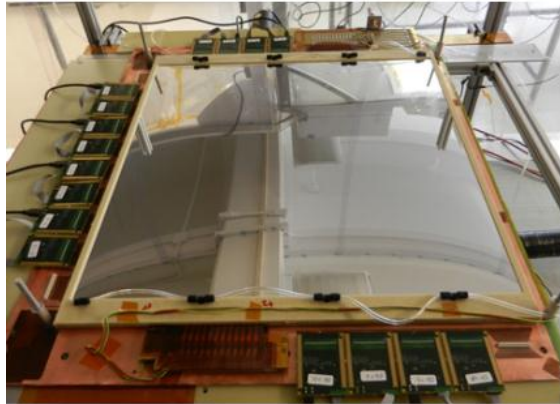


Figure 1: The first 50 × 50 cm<sup>2</sup> SBS GEM prototype built at UVa (top left) with associated characteristic plots from cosmic-ray tests; 1) top-right: x and y signals due to a typical cosmic signal showing the very high signal to noise ratio of the detector, 2) bottom-left: charge deposited on x strips versus charge deposited on y strips; events in the diagonal area show correctly registered hits and lack of off-diagonal events again shows the very low level of noise events, 3) bottom-right: y versus x hit distribution; only 45 cm x 45 cm area of the chamber has been covered with electronics; the lines show the locations of thin spacers used to keep the GEM foils apart.

## **WBS 2.2 GEM Electronics (UVa):**

As with WBS 2.1, pre R&D continues on the GEM electronics. Below is a report on that work.

- The new SRS readout cards were used for the readout of the new prototype chamber.
  - These cards operate very well and show a average RMS noise level of approximately 6-7 ADC channels (~ 1500 ENC). The top right plot in figure 1 above shows the very high signal to noise ratio achieved by these readout cards.



## **WBS 2.3 Electronics Hut, Lead Shielding, Lead platform, and Detector**

### **Frames:**

- No activity this period.

## **WBS 2.4 Coordinate Detector:**

- No activity this period.

## **WBS 2 Costs:**

- Budget for this WBS for FY13 is \$81K.
- Costed and obligated to date (as of 5/1/2013): \$15,723 (19.4%)

## WBS 3: Proton Form Factor

This Project is not scheduled to start until FY14: October 1, 2013. The WBS structure and milestone table are included below for completeness.

<b>WBS 3</b>	<b>Proton Form Factor</b>	<b>WBS 3.01</b>	Milestones
		<b>WBS 3.02</b>	Project Oversight
		<b>WBS 3.1</b>	Magnet Pole shims and exit field clamp
		<b>WBS 3.2</b>	GEM's (UVa)
		<b>WBS 3.3</b>	GEM electronics (UVa)
		<b>WBS 3.4</b>	Trigger (RU)

### WBS 3.01 Milestones:

ID #	Level	Milestone	Scheduled Date	Expected date 3/1/2013	Expected date 4/1/2013	Actual Date
3.1-01M	1	Project start	10/1/2013	10/1/2013	10/1/2013	
3.2-01M	2	UVa receives parts for GEM modules	8/20/2014	8/20/2014	8/20/2014	
3.2-10M	2	UVa begins assembly of electronics	1/5/2015	1/5/2015	1/5/2015	
3.2-50M	2	RU begins trigger design	1/6/2016	1/6/2016	1/6/2016	
3.2-20M	2	UVa electronics assembly and tests completed	7/20/2016	7/20/2016	7/20/2016	
3.2-30M	2	JLab receives pole shims	8/22/2016	8/22/2016	8/22/2016	
3.2-40M	2	JLab receives exit field clamp	8/22/2016	8/22/2016	8/22/2016	
3.2-70M	2	RU completes trigger	12/1/2016	12/1/2016	12/1/2016	
3.2-60M	2	UVa GEM modules assembled (and tested)	2/2/2017	2/2/2017	2/2/2017	
3.1-10M	1	Project completion	7/31/2017	7/31/2017	7/31/2017	