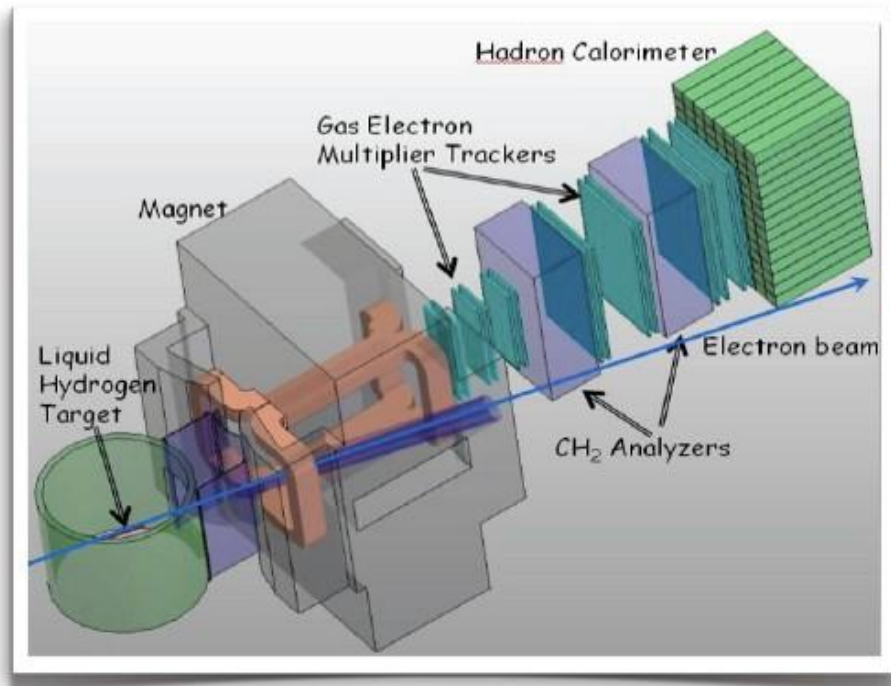


# ***Super-BigBite-Spectrometer (SBS)***

## **Monthly Progress Report**

**January 15, 2014**



## 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 sixteenth Monthly Progress Report for the SBS Program.

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 SBS Proton Form Factor (WBS 3) started on October 1, 2013.

A new PMP is being prepared to reflect the change from a GEM based to scintillator PMT based coordinate detector, which will improve performance, reduce risk, and add schedule float with no increase in cost.

A list of integration milestones for all equipment off-project, as well as key JLab readiness and safety reviews has been compiled and is attached in [Appendix II](#).

## 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:** (see [Appendix I](#) for an alternate view of the milestones, including level 3 milestones)

<b>Id #</b>	<b>Level</b>	<b>Milestone</b>	<b>Scheduled Date</b>	<b>Expected Date 12/1/2013</b>	<b>Expected Date 1/1/2014</b>	<b>Actual Date</b>
1.1-01M	1	Project start	10/1/2012			<b>10/1/2012</b>
1.2-01M	2	Magnet delivered to JLab	4/30/2013			<b>8/21/2013</b>
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, via tele and video conference were held on December 4, 11, and 18. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, and INFN Rome.
- Project is staffed appropriately for this stage, and includes a Jefferson Lab manager, scientist, and magnet engineer.

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

- Magnet Yoke Modifications:
  - Yoke pieces to be picked up for machining in January.
- Coils:
  - Racetrack coils awarded.
  - Saddle coils to be rebid with more vendors. Early indication is that they will then fit within the budget.
  - As a backup the existing BNL saddle coils have been tested. They are acceptable and in storage.
- Continuing on the magnet assembly drawings and hardware, detailing water cooling system.
- Power Supply contractor design review scheduled for January.

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

- Continuing on the magnet support structure details and drawings.
- Support structure internal review is in progress.

## **WBS 1.3 Beam Line:**

- A combined magnetic model of the SBS, beam line and BigBite was developed for optimization of the elements.

## **WBS 1 Costs:**

- The budget for this WBS for FY14 is \$643K. The incremental budget (FY13+FY14) is \$1,481K
- Costed and obligated as of 1/1/2014: \$816K (55%)

## 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:** (see [Appendix I](#) for an alternate view of the milestones, including level 3 milestones)

ID #	Level	Milestone	Scheduled Date	Expected date 12/1/2013	Expected date 1/1/2014	Actual Date
2.1-01M	1	Project start	10/1/2012			<b>10/1/2012</b>
2.3-1	3	Order GEM Parts	9/1/2013			<b>10/18/2013</b>
2.2-01M	2	UVa receives GEM parts	2/3/2014	2/1/2014	2/1/2014	
2.3-2	3	First module assembled and tested	3/3/2014	3/3/2014	3/3/2014	
2.2-20M	2	UVa receives electronics parts	8/20/2014	8/20/2014	8/20/2014	
2.2-10MA	3	UVa 5 GEM modules assembled and tested	6/2/2014	6/2/2014	6/2/2014	
2.2-10MB	3	UVa 15 GEM modules assembled and tested	9/30/2014	9/30/2014	9/30/2014	
2.2-10MC	2	UVa 29 GEM modules assembled and tested	10/17/2014	3/9/2015	3/9/2015	

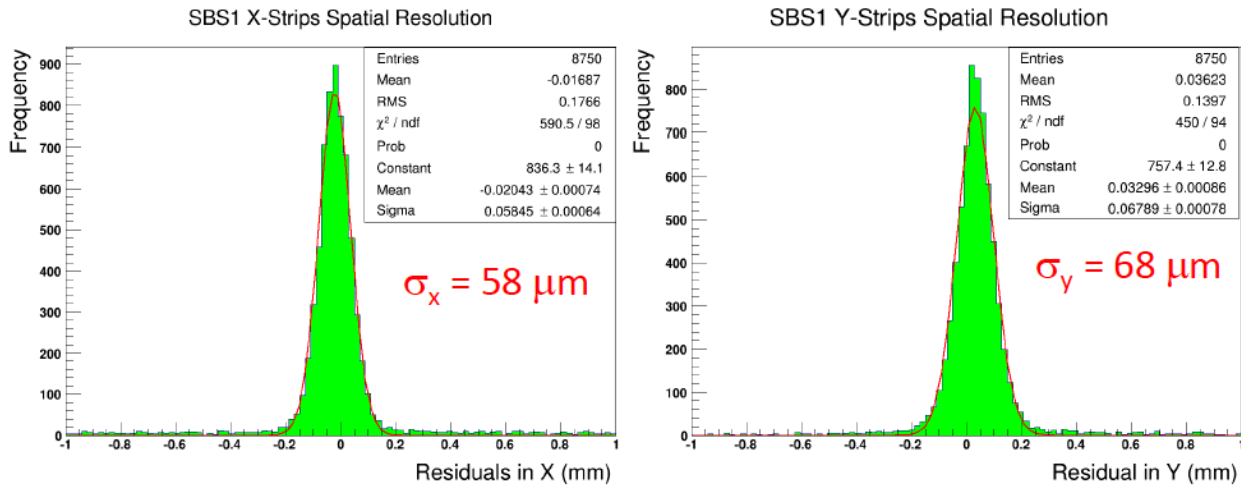
2.2-40M	2	Coordinate Detector Assembled	11/17/2014	11/17/2014	11/17/2014	
2.2-30M	2	UVa front-end electronics assembled and tested	2/2/2015	2/22/2015	2/22/2015	
2.2-40M10	2	WBS 2.3 completed (Electronics Hut Assembled etc.)	10/5/2015	10/5/2015	10/5/2015	
2.1-10M	1	Project completion	1/29/2016	1/29/2016	1/29/2016	

**WBS 2.02 Project Oversight:**

- SBS weekly meetings, via tele and video conference were held on December 4, 11, and 18. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, and INFN Rome.
- Project is staffed appropriately for this stage, and includes Jefferson Lab (manager, scientist), UVa (two scientists), and Idaho State University (one scientist).

**WBS 2.1 GEMs (UVA):**

**GEM pre-R&D:** The data analysis from the Fermilab test-run of SBS prototype chambers continued in December. Figures show the resolutions achieved in the x and y directions of for SBS prototype 1, indicating position resolutions that exceed the requirements set in the SBS PMP.



**GEMs:** Preparations for SBS GEM production are continuing at UVa. The orders for GEM foils have been placed and finalized. Tests are currently underway with the completed SBS prototype chambers to finalize the spacer configuration on the GEM frames. As soon as this is done (expected in the next week or two) the order for the frames will be placed. The chamber assembly hardware (foil stretchers, assembly templates and covers) for two assembly lines of SBS chamber production were completed in December. These items were installed in the clean room and were tested.

## WBS 2.2 GEM Electronics (UVa):

### Readout Electronics pre-R&D:

Work on the final report on the electronics for the SBS GEM trackers continued in December.

## 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 FY14 is \$1,137K. The incremental budget (FY13+FY14) is \$1,218K

- Costed and obligated as of 1/1/2014: \$639K (53%)

## WBS 3: Proton Form Factor

<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: (see [Appendix I](#) for an alternate view of the milestones)

ID #	Level	Milestone	Scheduled Date	Expected date 12/1/2013	Expected date 1/1/2014	Actual Date
3.1-01M	1	Project start	10/1/2013	10/1/2013		<b>10/1/2013</b>
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	





### **WBS 3.02 Project Oversight:**

- SBS weekly meetings, via tele and video conference were held on December 4, 11, and 18. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, and INFN Rome.
- Project is staffed appropriately for this beginning stage, and includes Jefferson Lab (manager, scientist), UVa (two scientists).

### **WBS 3.1 Magnet Pole shims and exit field clamp**

No activity this month

### **WBS 3.2 GEM's**

No activity this month

### **WBS 3.3 GEM electronics**

No activity this month

### **WBS 3.4 Trigger**

No activity this month

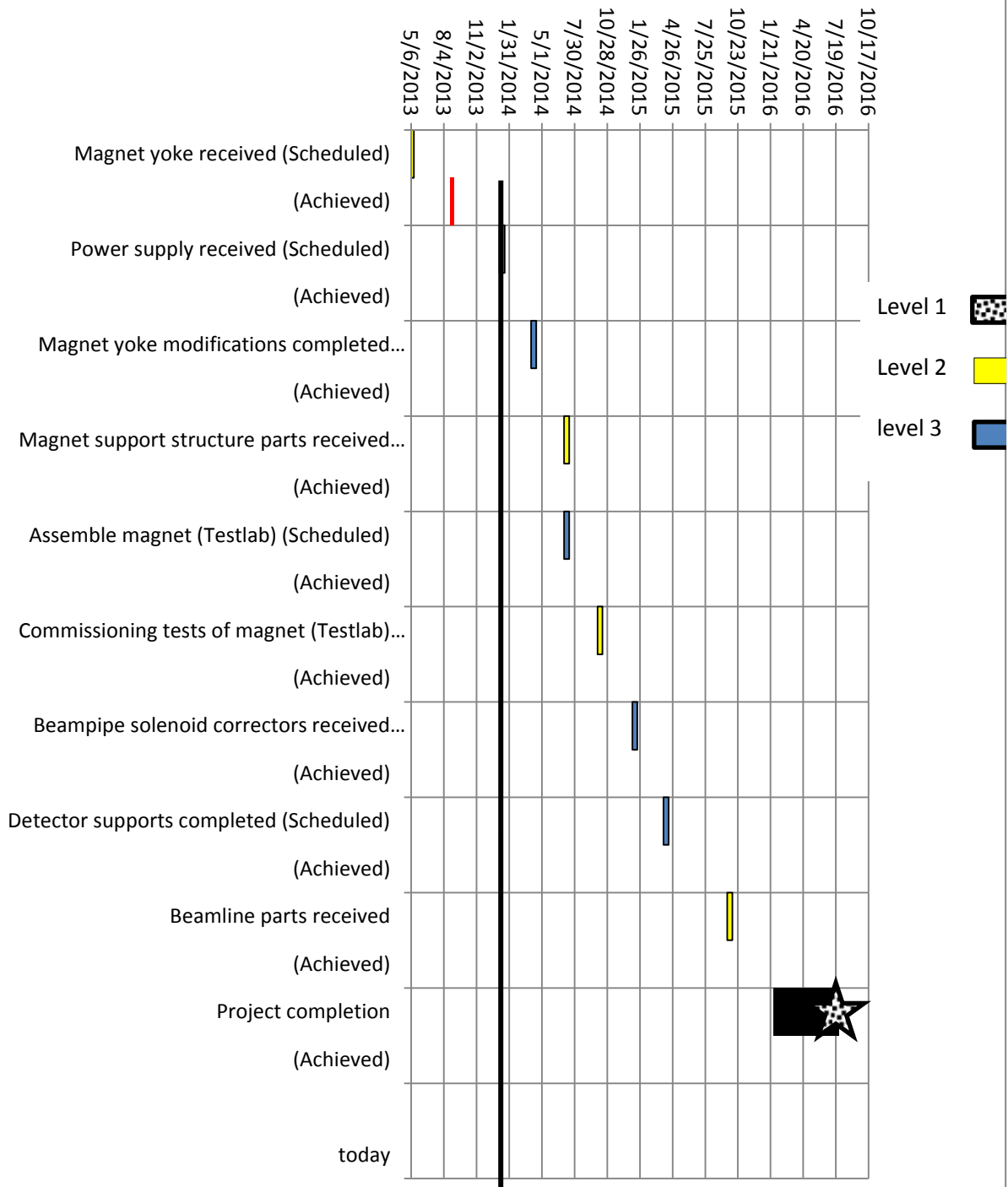
### **WBS 3 Costs:**

- Budget for this WBS for FY14 is \$321K.
- Costed and obligated as of 1/1/2014: \$4.5K (1.4%)

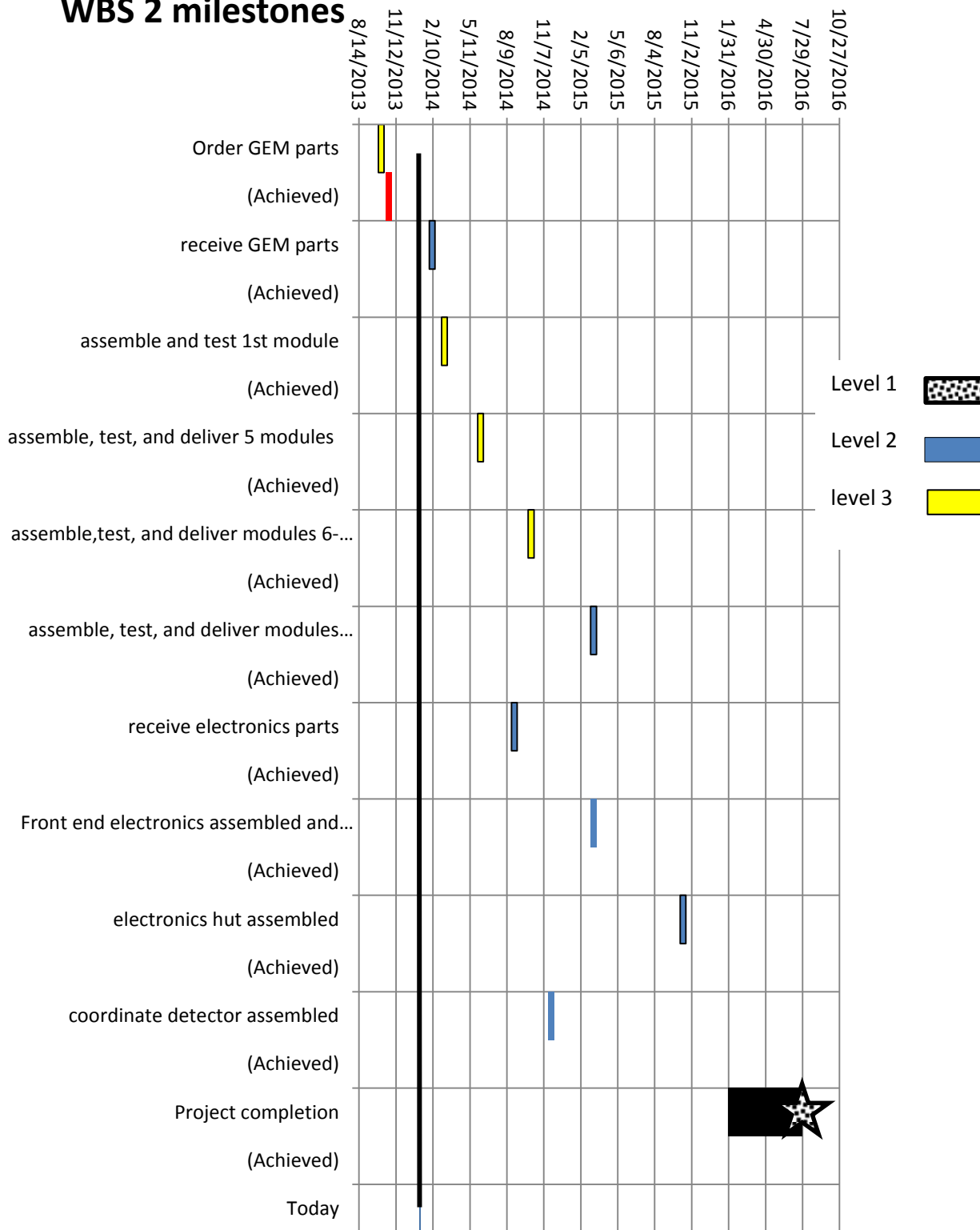
## Appendix I

The following are graphical representations of the milestones for SBS Basic (WBS 1), Neutron Form Factor (WBS 2,) and Proton Form Factor (WBS 2), updated on December 1, 2013. Black represents level 1 milestones as specified in the PMP. Yellow represents level 2 milestones from the PMP. Blue represents the new level 3 milestones to allow better quarterly tracking. The black vertical line indicates the day the chart was made. The red bar indicates when the milestone was achieved (e.g. Magnet yoke received). The milestones are presented in tabular form after the graphic representations.

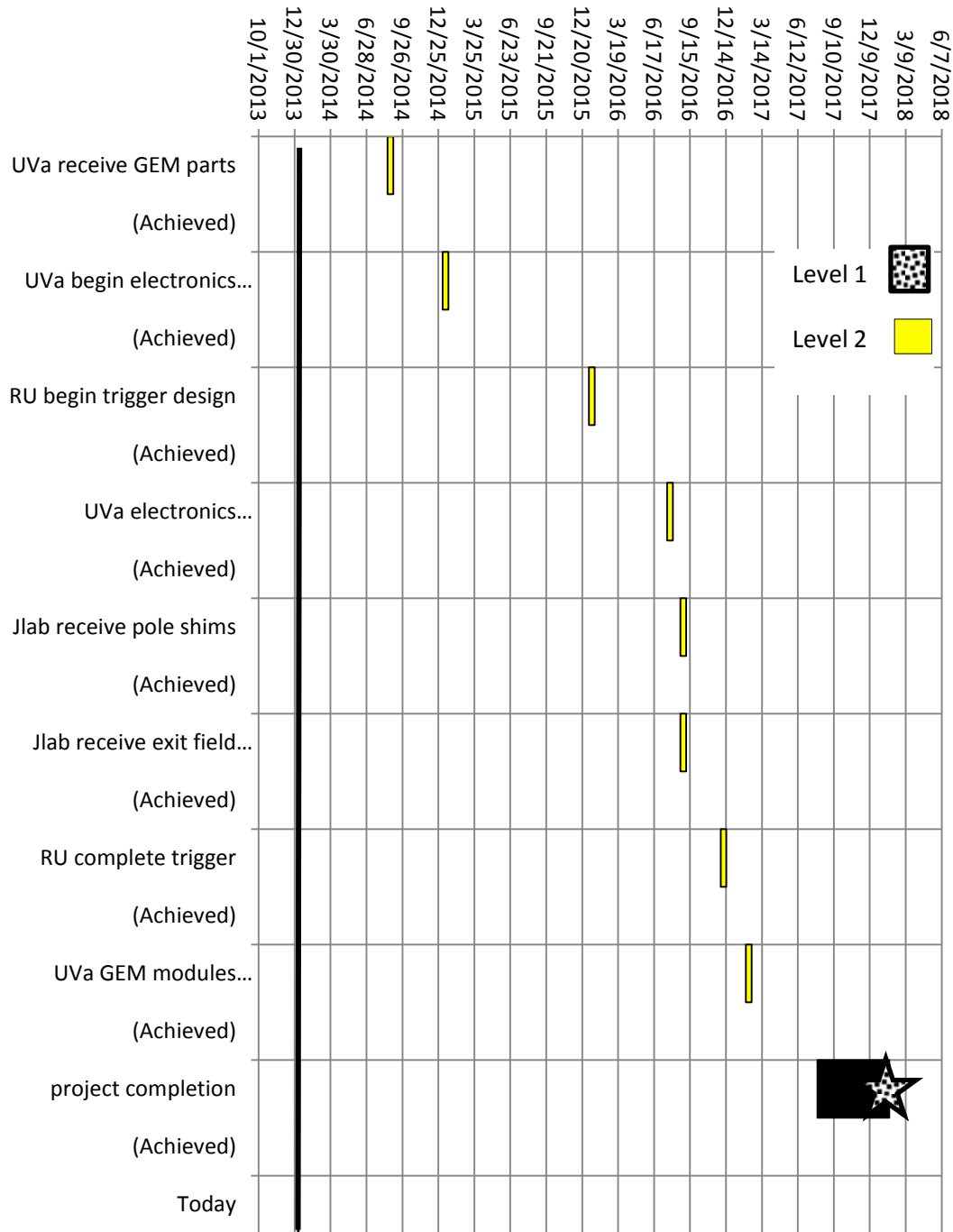
## WBS 1 Milestones



## WBS 2 milestones



## WBS 3 milestones



<b>WBS 1 Milestone</b>	<b>date</b>
Magnet yoke received (Scheduled)	4/29/2013
(Achieved)	<b>8/21/2013</b>
Power supply received (Scheduled)	1/4/2014
(Achieved)	
Magnet yoke modifications completed (Scheduled)	4/1/2014
(Achieved)	
Platform parts received	6/27/2014
(Achieved)	
Assemble magnet (Testlab) (Scheduled)	7/1/2014
(Achieved)	
Commissioning tests of magnet (Testlab) completed (Scheduled)	10/1/2014
(Achieved)	
Beampipe solenoid correctors received (Scheduled)	1/5/2015
(Achieved)	
Detector supports completed (Scheduled)	4/1/2015
(Achieved)	
Beamline parts received	9/24/2015
(Achieved)	
Project completion	1/29/2016
(Achieved)	

<b>WBS 2 Milestone</b>	<b>date</b>
Order GEM parts	9/30/2013
(Achieved)	<b>10/18/2013</b>
receive GEM parts	2/1/2014
(Achieved)	
assemble and test 1st module	3/3/2014
(Achieved)	
assemble, test, and deliver 5 modules	5/30/2014
(Achieved)	
assemble, test, and deliver modules 6-16	9/30/2014
(Achieved)	
assemble, test, and deliver modules 17-29	3/1/2015
(Achieved)	
Front end electronics assembled and tested	3/1/2015
(Achieved)	
electronics hut assembled	10/5/2015
(Achieved)	
coordinate detector assembled	11/17/2014
(Achieved)	
Project completion	1/29/2016
(Achieved)	

<b>WBS 3 Milestone</b>	<b>date</b>
UVa receive GEM parts (Achieved)	8/20/2014
UVa begin electronics assembly (Achieved)	1/5/2015
RU begin trigger design (Achieved)	1/6/2016
UVa electronics assembled and tested (Achieved)	7/20/2016
Jlab receive pole shims (Achieved)	8/22/2016
Jlab receive exit field clamp (Achieved)	8/22/2016
RU complete trigger (Achieved)	12/1/2016
UVa GEM modules assembled and tested (Achieved)	2/2/2017
project completion (Achieved)	7/31/2017



## Appendix II

### **List of integration milestones for all equipment off-project, as well as key JLab readiness and safety reviews**

#### Polarized $^3\text{He}$ target from UVa (for GEN)

1. Selection of target-cell design for high luminosity: August 2014 (+3 months float)
2. Simulated-beam test (bench test) of selected design: June 2016 (+6 months float)
3. Design for target hardware and instrumentation complete: January 2017 (+6 months float).
4. GEN Polarized  $^3\text{He}$  target is ready, June 2017 (+6 months float)

#### The Gas Cherenkov detector (GRINCH) from W&M (for GMN and GEN)

1. GRINCH detector design complete and components are ordered, August 2014 (+4 months float).
2. GRINCH detector fully assembled and tested for gas and light tightness, January, 2015 (+4 months float).
3. GRINCH is installed and tested in the BB detector frame, September 2015(+6 months float).
4. GRINCH is ready, September 2016 (+4 months float).

#### Front tracker from INFN (for GMN, GEN, and GEP)

1. Electronics in production: September 2014
2. Four GEM chambers completed and available at JLab (each chamber has 3 GEM modules): Feb 2016 (+3 months float)
3. Rest of GEM chambers (Two) completed and available at JLab (each chamber has 3 GEM modules): Sep 2016 (+3 months float):

#### HCal-J from CMU (for GMN, GEN, and GEP)

1. Detailed design completed: June 2014 (+2 months float)
2. Design review: September 2014 (+3 months float)
3. Module construction initiated: October 2014 (+4 months float)
4. Module assembly 50% completed: March, 2016 (+4 months float)
5. Construction is completed: September 2016 (+9 months float)

#### ECal from JLab (for GEP)

1. Develop concept of annealing: July 2014 (+2 months float)
2. Design review: July 2015 (+ 4 months float)
3. ECAL electronics is ready: May 2016 (+6 months float)
4. ECAL is ready: Sept. 2017 (+9 months float)