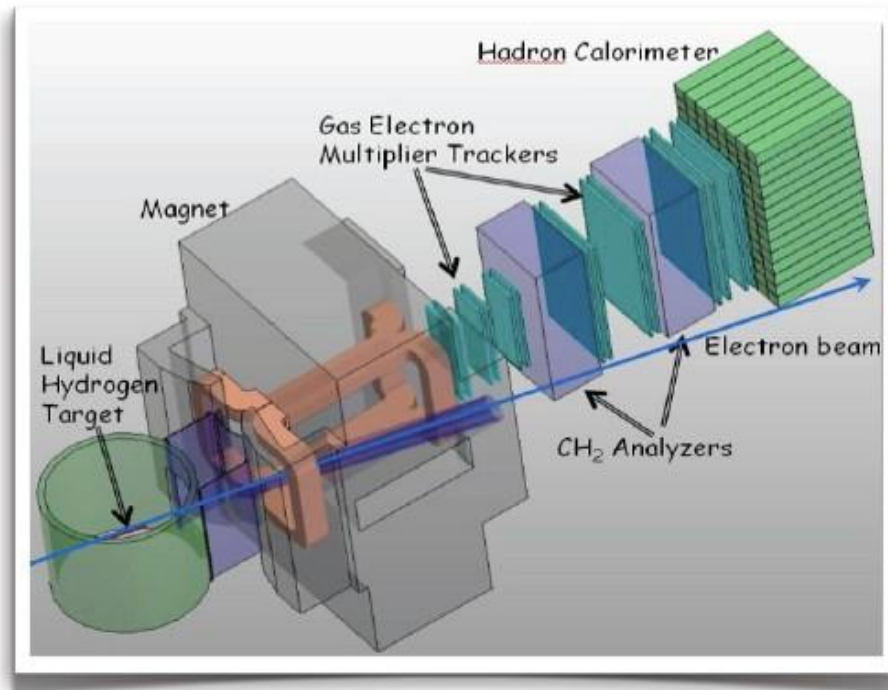


# ***Super-BigBite-Spectrometer (SBS)***

## **Monthly Progress Report**

**May 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 20<sup>th</sup> 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.

Finalized an Estimate to Complete (ETC) for WBS 1. Within parameters of the updated PMP, preliminary ETCs for WBS 2 and 3 were prepared for discussion. Will attached all ETCs in the next report.

Previously, the milestone table for each section had only the Level 1 and 2 milestones and Appendix 1 had a milestone table that added the Level 3 milestones. To make it easier to read, just have one milestone table with all Levels in each section. The graphical representation of the milestones is in the Appendix 1.

**The milestones presented for WBS 2 and 3 are still for the old PMP. With the approval of the updated PMP ongoing, we plan to change next monthly report. Milestones for WBS 1 are unchanged.**

## 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 1.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on April 9, 16, 23 and 30<sup>th</sup>. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, Saint Mary's University, Idaho State University, 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:
  - Delivery has been delayed by one month and is expected by May 16<sup>th</sup>. This has no impact on schedule. Robin Wines visited vendor. One more piece is left to cut.
- Coils:
  - Racetrack coils: Robins Wines spoke to vendor by phone. Vendor reported that the first coil is ready to be potted. Vendor sent photos of winding and potting fixtures. Vendor plans for coil testing witnessing the last week of May. Two months before the level 3 milestone to assemble magnet in Testlab.
  - Saddle coil: Decision about purchasing has been delayed until more items in WBS 1 have been purchased, since it would use a significant fraction of the contingency.
- The magnet assembly drawings are 95% complete. Magnet assembly hardware ready for procurement.
- Danfysik was contacted by phone and they are on track to ship on June 27<sup>th</sup>.

### WBS 1.2 Magnet/Detector Platforms:

- Bids due May 1<sup>st</sup>.
- Drawings 80% complete for the platform assembly.
- Detailing cleanup of counterweight blocks.
- In support of SBS dependency projects, design of the HCAL detector support structure has started.

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

- Design of exit beam pipe is 70% complete.
- Design of scattering chamber snout is 20% complete.

### **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 5/1/2014: \$776K (52%).

**WBS 1.01 Milestones:** (see [Appendix 1](#) for graphic view of milestones)

Level (ID#)	Milestone	Scheduled Date	Expected Date 4/1/2014	Expected Date 5/1/2014	Comment
1 (1.1-01M)	Project start	10/1/2012			<b>Completed 10/1/2012</b>
2 (2-01M)	Magnet delivered to JLab	4/30/2013			<b>Completed 8/21/2013</b>
3	Power supply received	1/4/2014	7/1/2014	6/27/2014	Contacted vendor Expect delivery June 27th
3	Magnet yoke modifications Completed	4/1/2014	4/15/2014	5/15/2014	Delivery delayed by one month. Visited vendor. Expect delivery May 15th
2 (1.2-10M)	Platform parts received	6/27/2014	9/1/2014	9/1/2014	This item has a large float. Platform is not needed for test in the Testlab.
3	Assemble magnet in Testlab	7/1/2014	7/1/2014	7/1/2014	
3	Commissioning test of magnet in Testlab completed	10/1/2014	10/1/2014	10/1/2014	
3	Beampipe solenoid correctors received	1/5/2015	1/5/2015	1/5/2015	
3	Detector supports completed	4/1/2015	4/1/2015	4/1/2015	
2 (1.2-30M)	Beam-line parts received	9/24/2015	9/24/2015	9/24/2015	
1 (1.1-10M)	Project completion	1/29/2016	1/29/2016	1/29/2016	

## 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 2.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on April 9, 16, 23 and 30<sup>th</sup>. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, Saint Mary's University, Idaho State University, 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):

#### **GEMs:**

- The first batch of GEM foils and readout planes from CERN arrived April 21st. **This completes the milestone 2.2-01M.**
- Production of the first GEM module has begun and expected to be completed by May 15th. In parallel, work on the 2nd GEM module is also in progress. With the ability to work on building two GEM simultaneously, the expectation is to meet the milestone of completing 5 GEM modules by July 2, 2014.
- Analysis of data from the Hall A parasitic tests has begun with preliminary results shown at the weekly meeting. Updated analysis of the beam test of FNAL was also presented.

- The readout planes were examined using the newly acquired microscope to ensure that the readout plane defects observed in the pre R&D prototypes have been corrected. These defects caused the uneven charge division between x and y directions observed in the pre R&D prototypes. The inspection of the new readout shows them to be free of the defect.

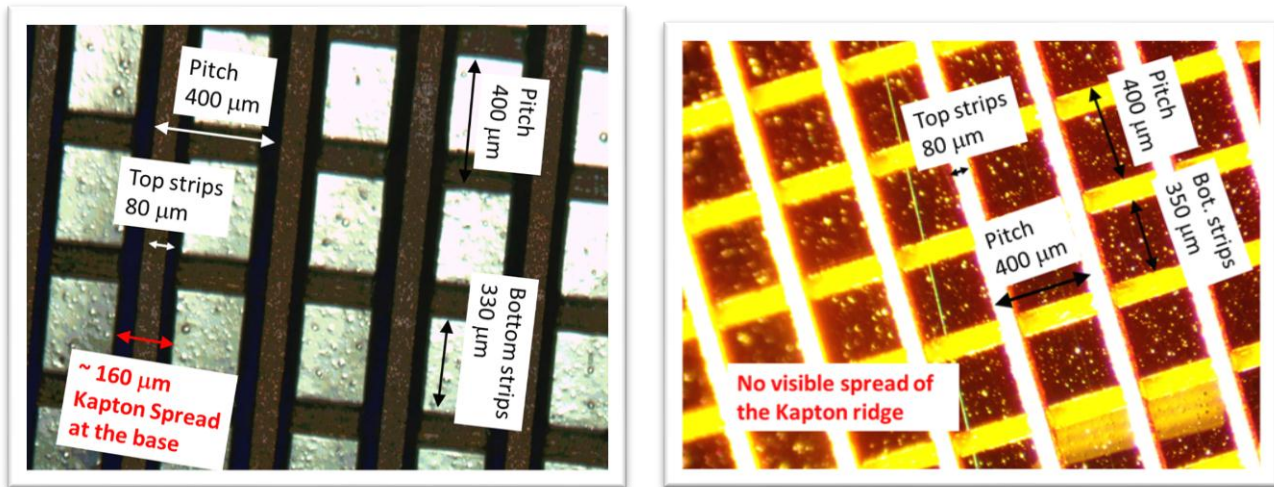


Figure 1 On the left is a photo of the Pre R&D Readout foil which shows that under the top strips there is a 160um Kapton spread at the base. This extra Kapton under the top strips caused the charge division between top and bottom strips to be unequal and have a rate dependence. On the right is the readout foil shipped for the GEM production and there is no visible Kapton spread under the top strips.

## WBS 2.2 GEM Electronics (UVa):

### Readout Electronics pre-R&D:

- The UVa group is still preparing the report comparing the CERN SRS DAQ system to the DAQ system which was developed by the INFN group for their GEM detectors.

## WBS 2.3 Electronics Hut, Lead Shielding & platform, and Detector Frames:

- Activity will start in FY15 as planned in the PMP.

## **WBS 2.4 Coordinate Detector (CDet):**

- The Coordinate Detector Review Committee was satisfied with the response to their report. The design and prototyping of the Coordinate Detector (CDet) was modified to take into account recommendations of the committee.
- The CDet costs are incorporated into the preliminary WBS 2 ETC and work has begun on the procurement process.
- The present PMP has a milestone of Nov 17, 2014 for the CDet assembly. In the updated PMP, the milestone for the CDet assembly is Sept 30, 2014 with the float extending to the project completion of January 29<sup>th</sup> 2016. We would like to change the milestone for the CDet assembly to March 30, 2015 which would have 10 months of float.

## **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 5/1/2014: \$624K (51%).



**WBS 2.01 Milestones:** See [Appendix 1](#) for a graphic view of the milestones Note that in the updated PMP, the GEM milestones move to WBS 3.

Level (ID#)	Milestone	Scheduled Date	Expected date 4/1/2014	Expected date 5/1/2014	Comment
1 (2.1-01M)	Project start	10/1/2012			<b>Completed 10/1/2012</b>
3	Order GEM Parts	9/1/2013			<b>Completed 10/18/2013</b>
2 (2.2-01M)	UVa receives GEM parts	2/3/2014	4/1/2014	<b>Completed</b>	The foils arrived during the 3rd week of April and production has begun. <b>This completes the milestone</b>
3	First module assembled and tested	3/3/2014	5/1/2014	5/15/2014	With delivery of GEM foils, should complete by May 15th
2 (2.2-20M)	UVa receives electronics parts	8/20/2014	8/20/2014	8/20/2014	In updated PMP, the scheduled date changes to 10/1/2014
3	UVa 5 GEM modules assembled and tested	6/2/2014	7/2/2014	7/2/2014	
3	UVa 15 GEM modules assembled and tested	9/30/2014	9/30/2014	9/30/2014	
2 (2.2-10MC)	UVa 29 GEM modules assembled and tested	10/17/2014	3/9/2015	3/9/2015	
2 (2.2-40M)	Coordinate Detector Assembled	11/17/2014	11/17/2014	11/17/2014	
2 (2.2-30M)	UVa front-end electronics assembled and tested	2/22/2015	2/22/2015	2/22/2015	
2 (2.2-40M10)	WBS 2.3 completed (Electronics Hut Assembled etc.)	10/5/2015	10/5/2015	10/5/2015	
1 (2.1-10M)	Project completion	1/29/2016	1/29/2016	1/29/2016	

## **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 3.02 Project Oversight:**

- SBS weekly meetings, via tele and video conference were held on April 9, 16, 23 and 30<sup>th</sup>. Participants included Jefferson Lab, University of Virginia, Carnegie-Mellon University, William and Mary, Norfolk State University, University of Connecticut, University of Glasgow, Saint Mary's University, Idaho State University, 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**

- This project is linked to WBS 1.3. When the exit beam line design is completed, this project can move forward.

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

- In the updated PMP, GEM milestones and activities listed as part of WBS 2.1 will move here and include the building final 11 GEM modules that were in the current PMP for WBS 3.2.
- Ready for procurement of the final 11 GEM modules.

### **WBS 3.3 GEM electronics**

- In the updated PMP, GEM milestones and activities listed as part of WBS 2.2 will move here.

### **WBS 3.4 Trigger**

- Cost estimates were made for the trigger as part of the preliminary ETCs for WBS 2 and 3.

### **WBS 3 Costs:**

- Budget for this WBS for FY14 is \$321K.
- Costed and obligated as of 5/1/2014: \$9.1K (2.9%)

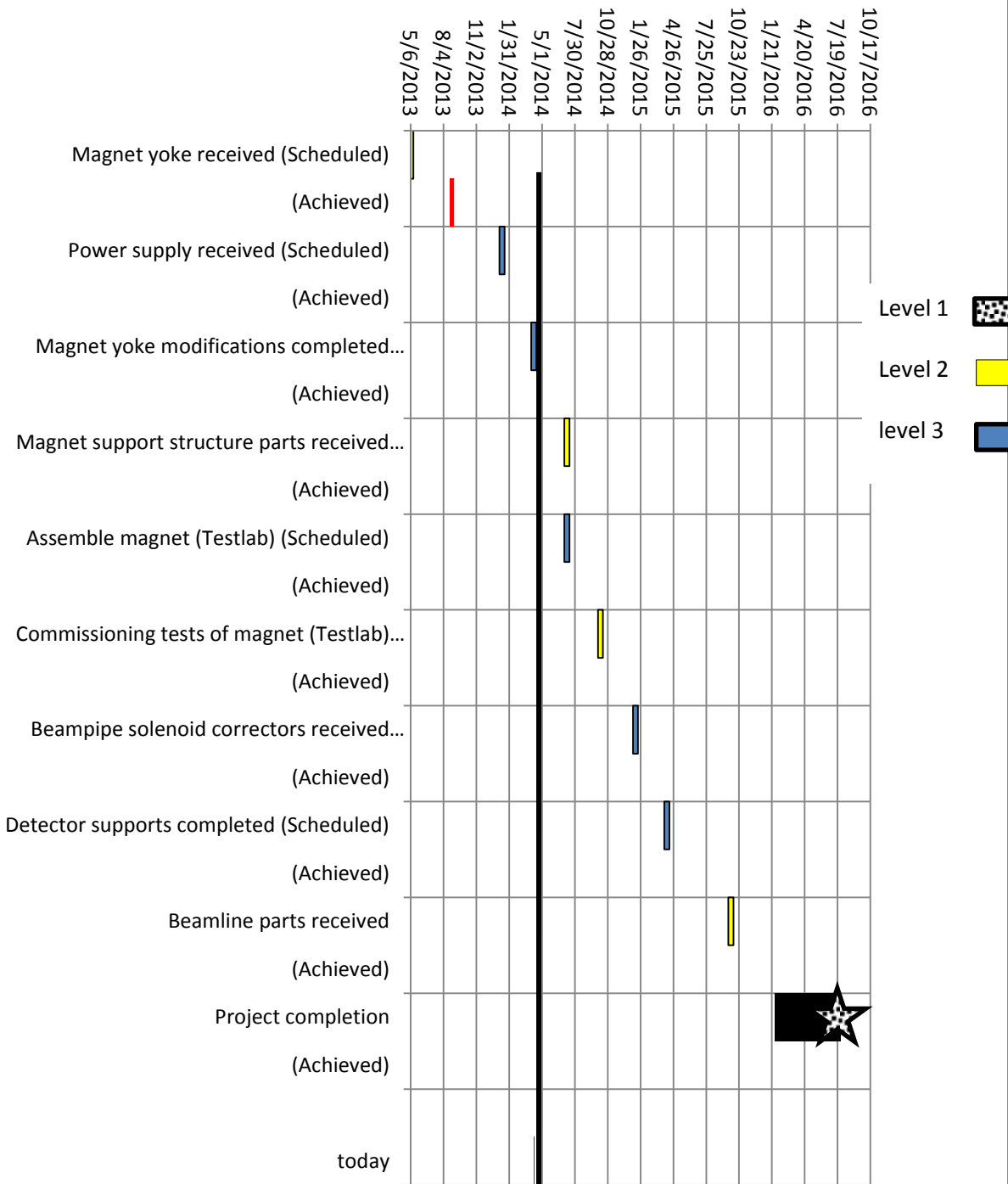
- **WBS 3.01 Milestones:** (see [Appendix 1](#) for a graphic view of the milestones)

Level	Milestone	Scheduled Date	Expected date 4/1/2014	Expected date 5/1/2014	Comment
1	Project start	10/1/2013	10/1/2013		<b>Completed 10/1/2013</b>
2	UVa receives parts for GEM modules	8/20/2014	8/20/2014	8/20/2014	
2	UVa begins assembly of electronics	1/5/2015	1/5/2015	1/5/2015	
2	RU begins trigger design	1/6/2016	1/6/2016	1/6/2016	
2	UVa electronics assembly and tests completed	7/20/2016	7/20/2016	7/20/2016	
2	JLab receives pole shims	8/22/2016	8/22/2016	8/22/2016	
2	JLab receives exit field clamp	8/22/2016	8/22/2016	8/22/2016	
2	RU completes trigger	12/1/2016	12/1/2016	12/1/2016	
2	UVa GEM modules assembled (and tested)	2/2/2017	2/2/2017	2/2/2017	
1	Project completion	7/31/2017	7/31/2017	7/31/2017	

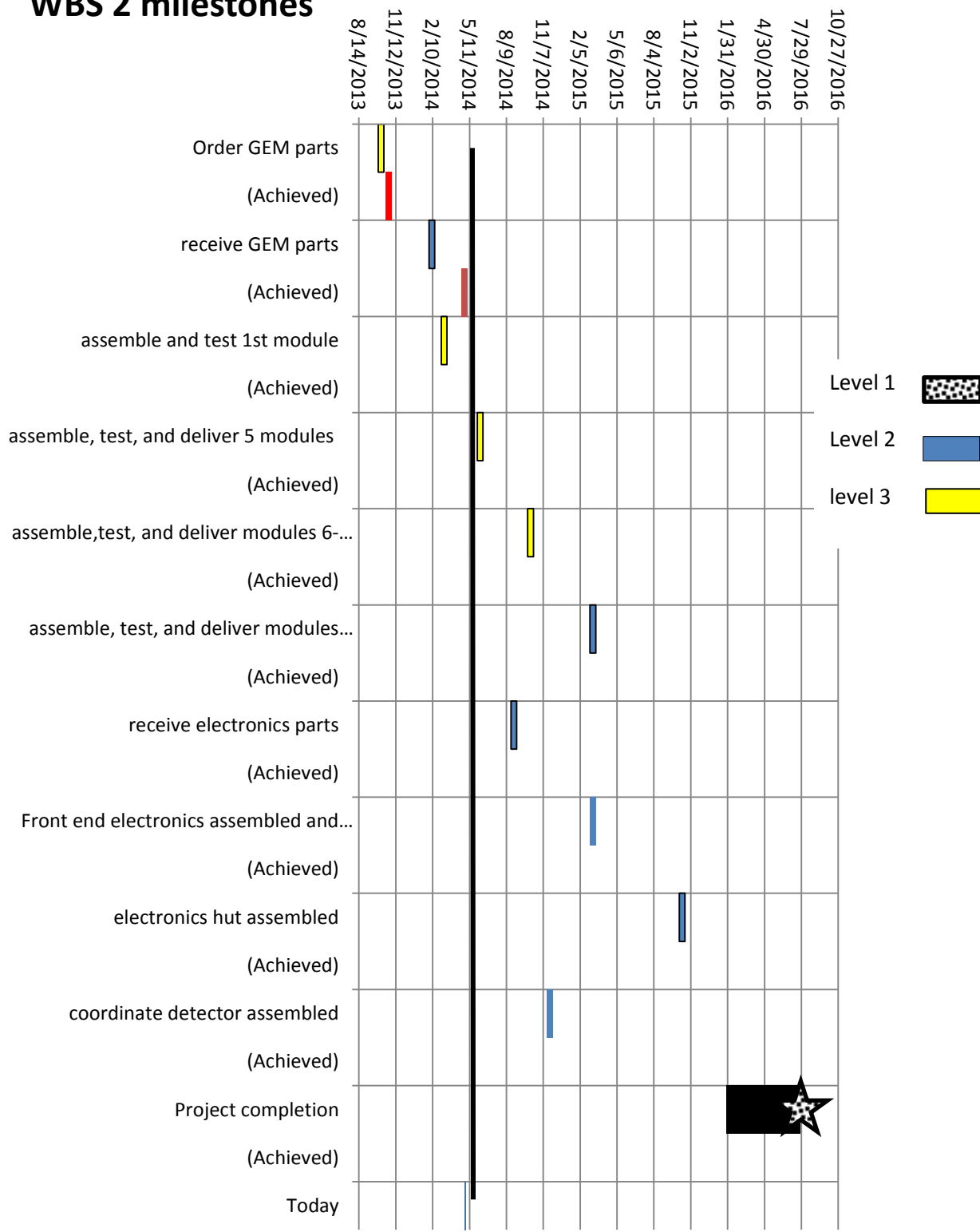
## Appendix I

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).

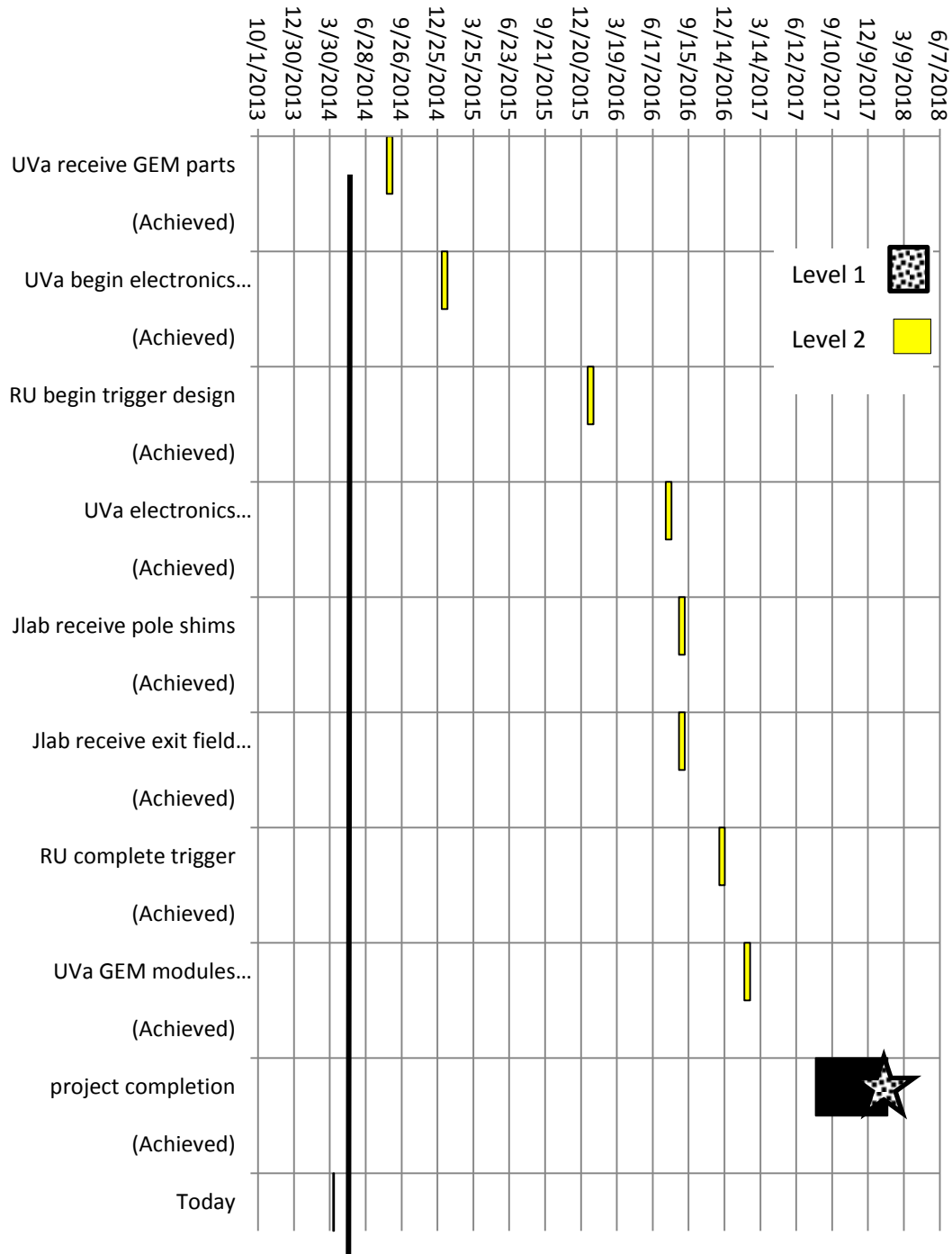
## WBS 1 Milestones



## WBS 2 milestones



## WBS 3 milestones





## Appendix II

**List of integration milestones for all equipment off-project, as well as key JLab readiness and safety reviews. For each milestone the additional float is indicated.**

### **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 month 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**

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**

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)