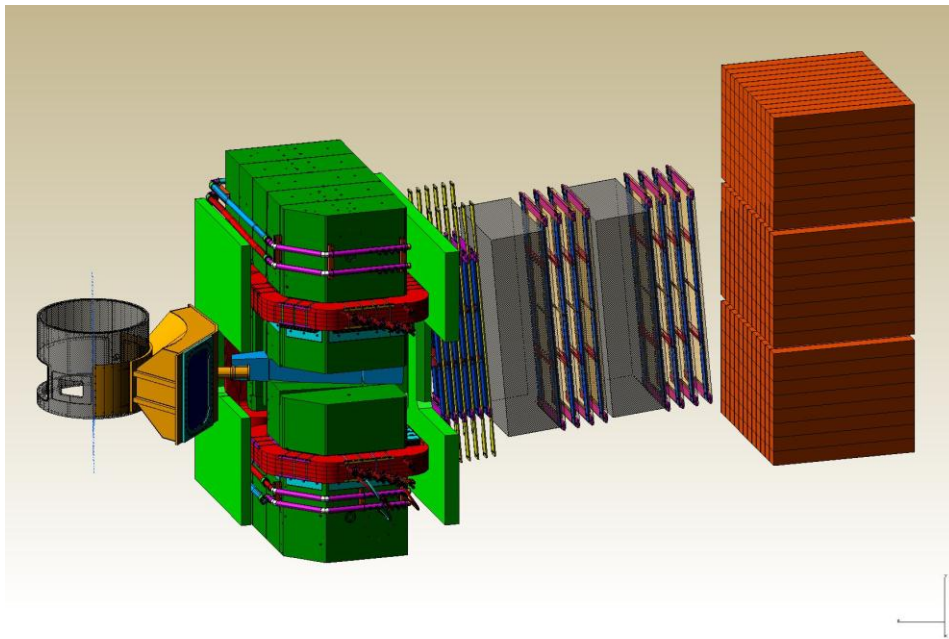


# ***Super-BigBite-Spectrometer (SBS)***

## **Monthly Progress Report**

**February 15, 2015**



## 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 The PMT-based Coordinate Detector (CDet), trigger electronics for the Hadron Calorimeter (HCal) 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 forty GEM detector modules with associated front-end and DAQ modules to meet the requirements of the approved proton form factor measurement.

## Project Management Highlights:

This is the 29<sup>th</sup> Monthly Progress Report for the SBS Program.

The SBS Basic (WBS 1) project started in FY13. The SBS Neutron Form Factor (WBS 2) started at the beginning of FY14. The SBS Proton Form Factor (WBS 3) started on October 1, 2012.

- The updated table with the WBS2 schedule with level 3 milestones is being used. It won't be official until DOE approval.

## 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 January 14<sup>th</sup> and 20<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:

- Drawings for modification of SBS magnet steel completed and ready to go to procurement in February. Hall A technicians will be free in March to dismantle the SBS magnet for shipment to vendor.
- Coils:
  - Racetrack coils: All coils are at JLab.
  - Saddle coil: Buckley contacted JLab and JLab approved tooling drawings. Scheduled for delivery by July 31, 2015.
- Studies of the beam line corrector magnets and passive magnet shielding of exit beam pipe at all kinematic settings are ongoing. Unanticipated work for HRS repair took priority and completion expected by end of February. After the study is completed, design of corrector magnets will start.
- Power supply will be tested in February.

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

- JLab contacted vendor. Subassembly test will be done at the local vendor in beginning of February with delivery to JLab at end of February.

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

- Contacted the vendor about vacuum snout status. The vendor is still expecting to meet the delivery date at end of Feb 2015.

### **WBS 1 Costs:**

- The budget for this WBS for FY15 is \$212K.
- The incremental budget (FY13+FY14+FY15) is \$1,694K.
- Costed and obligated as of 2/1/2015: \$1,159K (68%).

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 1/1/2015	Expected Date 2/1/2015	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			<b>Completed 10/17/2014</b>
3	Magnet yoke modifications Completed	4/1/2014			<b>Completed 5/22/2014</b>
2 (1.2-10M)	Platform parts received	6/27/2014	1/30/2015	2/27/2015	Short delay has no impact on project schedule
3	Assemble magnet in Testlab	7/1/2014			<b>Completed 9/4/2014</b>
3	Commissioning test of magnet in Testlab completed	10/1/2014			<b>Completed 10/29/2014</b>
3	Beampipe solenoid correctors received	1/5/2015	6/1/2015	6/1/2015	This delay has no effect on other parts of the project and still leaves 7 months of float until project completion.
3	Detector supports completed	4/1/2015			Detector supports are part of the magnet platform which will be delivered in Feb 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>	Coordinate Detector (ISU)
		<b>WBS 2.2</b>	Electronics Hut, Lead Shielding, Lead platform, and Detector Frames (JLab)
		<b>WBS 2.3</b>	Pole Shims and field clamp (JLab)
		<b>WBS 2.4</b>	Trigger (RU)

### WBS 2.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on January 14<sup>th</sup> and 20<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) and Idaho State University (one scientist).

### WBS 2.1 Coordinate Detector (ISU):

- Idaho State ordered the WLS fiber at end of January. **Completes a level 3 milestone.**
- Sample bars were successfully machined by JLab. Another set of bars were sent to Eljen at the end of January. Once the bars are returned by end of February, the decision will be made on where to have the machining of the bars done.
- Production of the scintillator bars is scheduled for the end of February at Fermilab.

## **WBS 2.2 Electronics Hut, Lead Shielding & platform, and Detector Frames:**

- Solution to problem of noise on long HDMI cables used for the GEM detectors is being investigated by JLab and INFN.
- Plan to start design work on the detector frames in March 2015.

## **WBS 2.3 Pole Shims and field clamp:**

- Work on the pole shims and clamps is waiting until beam line studies are finished.

## **WBS 2 Costs:**

- Budget for this WBS for FY15 is \$710K.
- The incremental budget for FY14+FY15 is \$1,309K.
- Costed and obligated as of 2/1/2015: \$728K (56%).

**WBS 2.01 Milestones:** See [Appendix 1](#) for a graphic view of the milestones . These are the updated milestones as requested by the DOE Nov 2014 Review. Waiting for final DOE approval.

Level	Milestone	Scheduled Date	Expected date 1/1/2015	Expected date 2/1/2015	Comment
1	Project start	10/1/2013			<b>Completed 10/1/2013</b>
3	Finish testing of module prototype	8/30/2014			<b>Completed 8/30/2014</b>
3	Scintillator ordered	9/30/2014			<b>Completed 9/15/2014</b>
2	CDET module design completed	11/30/2014			<b>Completed 11/30/2014</b>
3	Wavelength Shifting Fibers ordered	1/15/2015			<b>Completed 1/20/2015</b>
3	Scintillator shipped for machining	4/30/2015		4/30/2015	
2	JLab receives exit field clamp	6/2/2015		6/2/2015	
3	Begin preparation of WLS fibers	6/15/2015		6/15/2015	
3	Begin construction of CDET modules	9/1/2015		9/1/2015	
3	Assembled one CDET module	10/1/2015		10/1/2015	
2	Electronics hut assembled	10/2/2015		10/2/2015	
2	Trigger completed	10/4/2015		10/4/2015	
3	Assembled one CDET plane	12/1/2015		12/1/2015	
2	Coordinate Detector assembled	6/30/2016		6/30/2016	
1	Project completion	1/29/2017		1/29/2017	



## 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>	GEM's (UVa)
		<b>WBS 3.2</b>	GEM electronics (UVa)

### WBS 3.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on January 14<sup>th</sup> and 20<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 at this stage, and includes Jefferson Lab (manager, scientist) and UVa (two scientists).

### WBS 3.1 GEMs

- Construction of GEM module #7 was completed at end of January and final QA has started.
- Construction of GEM module #8 has started. A new dedicated technician has been hired who is replacing a graduate student.
- Diagnosis and resolution of the HV problems with GEM modules caused a 2 month delay. Production will go back to 2 GEM modules per month. The 2 month delay has been integrated into the schedule in the milestones table. This leaves 13 months of float.
- The foil shipment #6 arrived in Charlottesville. This shipment contains 11 GEM foils and 3 readout foils. Since UVa currently has sufficient foils for the ongoing chamber fabrication, the new package has not been opened for testing yet.

- Progress has been made with high background test using the high intensity X-ray source. Data was taken in January with a  $^{90}\text{Sr}$  source as the main signal and the X-ray source providing a background of low energy x-rays. Preliminary data indicates that the setup is working properly and the x-ray tube is capable of delivering photon fluxes equal to the photon rates expected under most stringent SBS conditions. Below are plots of the raw cluster position with no timing cuts.

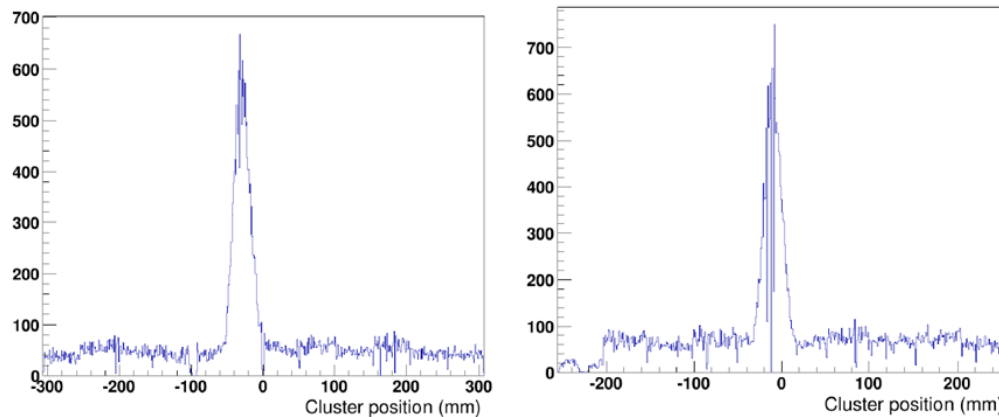


Figure 1 The X (left figure) and Y (right figure) cluster position. The peak is the  $^{90}\text{Sr}$  source and the flat background is random coincidence from the X-ray source.

## WBS 3.2 GEM electronics

- The purchase requisition for UVA to purchase the GEM electronics is in the final stage.

## WBS 3 Costs:

- Budget for this WBS for FY15 is \$371K.
- The incremental budget of FY13+FY14+FY15 is \$1,440K.
- With the addition of the moving the \$209K plus contingency forward from FY16 makes an incremental budget of \$1,687K.
- Costed and obligated as of 2/1/2015: \$1,423K (84%).

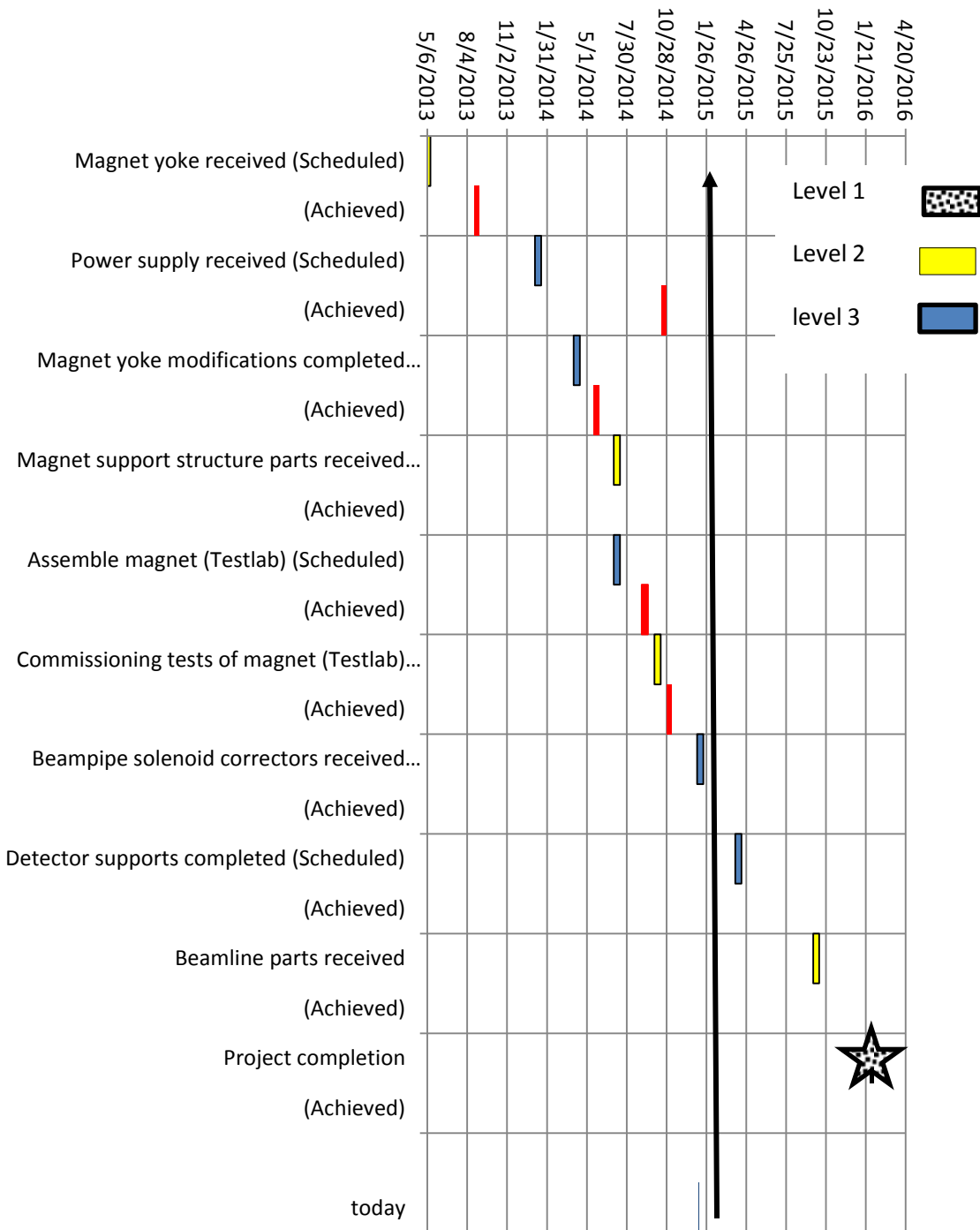
**WBS 3.01 Milestones:** (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 1/1/2015	Expected date 2/1/2015	Comment
1 (3.1-01M)	Project start	10/1/2012			<b>Completed 10/1/2012</b>
3	Order GEM Parts	10/1/2013			<b>Completed 10/18/2013</b>
3	UVa receives GEM parts	2/3/2014			<b>Completed 4/23/2014</b>
2 (3.2-01M)	First module assembled and tested	3/3/2014			<b>Completed 5/15/2014</b>
2 (3.2-10M)	UVa 5 GEM modules assembled and tested	6/2/2014			<b>Completed 12/23/2014</b>
2 (3.2-20M)	UVa 6-16 GEM modules assembled and tested	9/30/2014	4/15/2015	6/15/2015	The 2 months delay for diagnosis and fix of HV problem has been integrated into schedule. Leaves 13 months of float.
2 (3.2-30M)	UVa 17-29 GEM modules assembled and tested	3/2/2015	11/1/2015	1/1/2016	
2 (3.2-40M)	UVa 30-40 GEM modules assembled and tested	7/15/2015	4/15/2016	6/15/2016	
2 (3.2-50M)	1st order of Front End Electronics	10/1/2014	2/1/2015	2/1/2015	
2 (3.2-60M)	2nd order of Front End Electronics	10/1/2015	10/1/2015	10/1/2015	
1 (3.1-10M)	Project completion	7/31/2017	7/31/2017	7/31/2017	

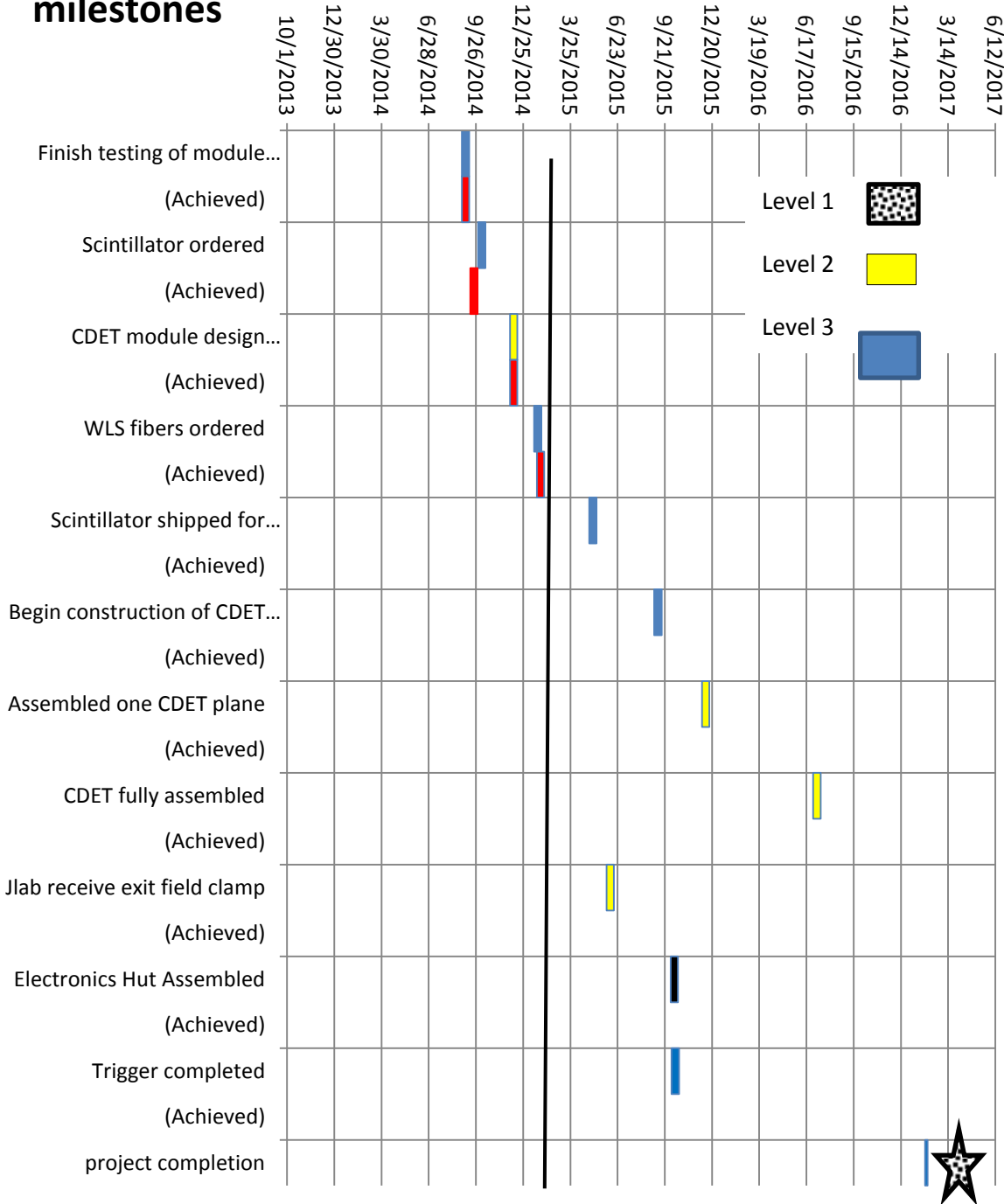
## Appendix I

The following are graphical representations of the milestones for SBS Basic (WBS 1), Neutron Form Factor (WBS 2,) and Proton Form Factor (WBS 3), 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).

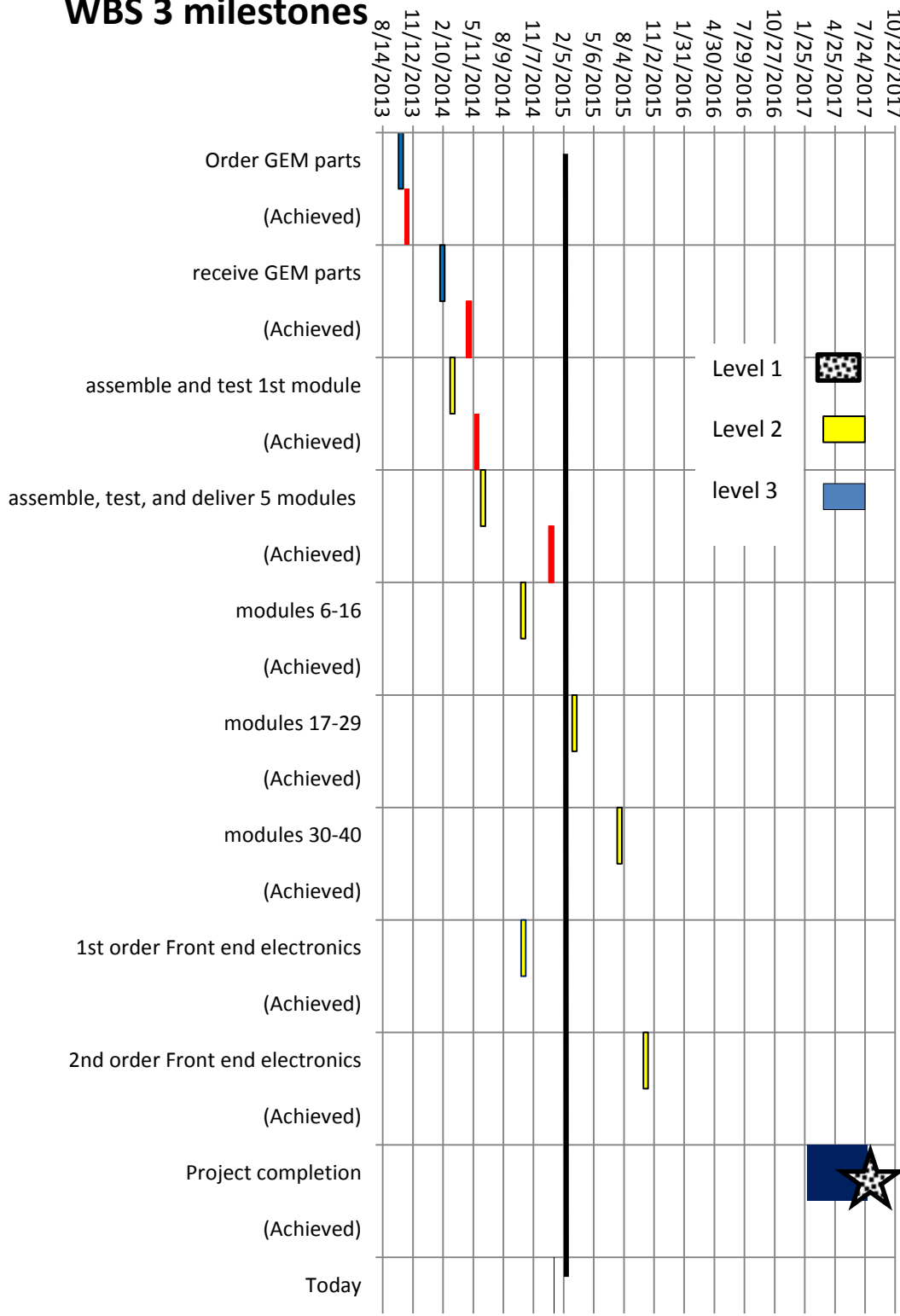
## WBS 1 Milestones



## 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.**

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

Milestone	Completion date	Comment
Design and drawings for vessel are complete	Feb 1, 2015	Design near completion (99%)
Photon Detector Array assembled and tested	Aug 1, 2015	
NINO chip front end cards system shipped to JLab	Jul 1, 2015	
Purchase order issued for vessel	Oct 15, 2015	
Full DAQ system ready	Dec 1, 2015	
Vessel completely assembled	Mar 15, 2016	
GRINCH ready for installation	Jun 15, 2016	
Final analysis software complete	Jun 15, 2016	

**Front Tracker from INFN** (for GMN, GEN and GEP)

Milestone	Completion date	Comment
Electronics in production	Sept 2014	<b>Completed Sept 2014</b>
GEM chambers 1 and 2 completed	Sept 2015	
Initial Electronics QA completed	Dec 2015	
GEM chambers 3 and 4 completed	May 2016	
GEM chambers 5 and 6 completed	Dec 2016	

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

Milestone	Completion date	Comment
Detailed design completed	June 2014	<b>Completed July 2014</b>
Design review	Sept 2014	<b>Completed Dec 2014</b>
Module construction initiated	Mar 2015	
Module assembly 25% complete	Sept 2015	
Module assembly 50% complete	Mar 2016	
Module assembly completed	Sept 2016	



**ECal from JLab** ( for GEP)

1. Develop concept of annealing: July 2014 ( +2 months float) . **Completed July 2014**
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)

**Polarized  $^3\text{He}$  target from UVA** ( for GEN)

1. Selection of target-cell design for high luminosity: August 2014 (+3 months float) **Completed Oct 2014**
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).  
GEN Polarized  $^3\text{He}$  target is ready, June 2017 (+6 months float)