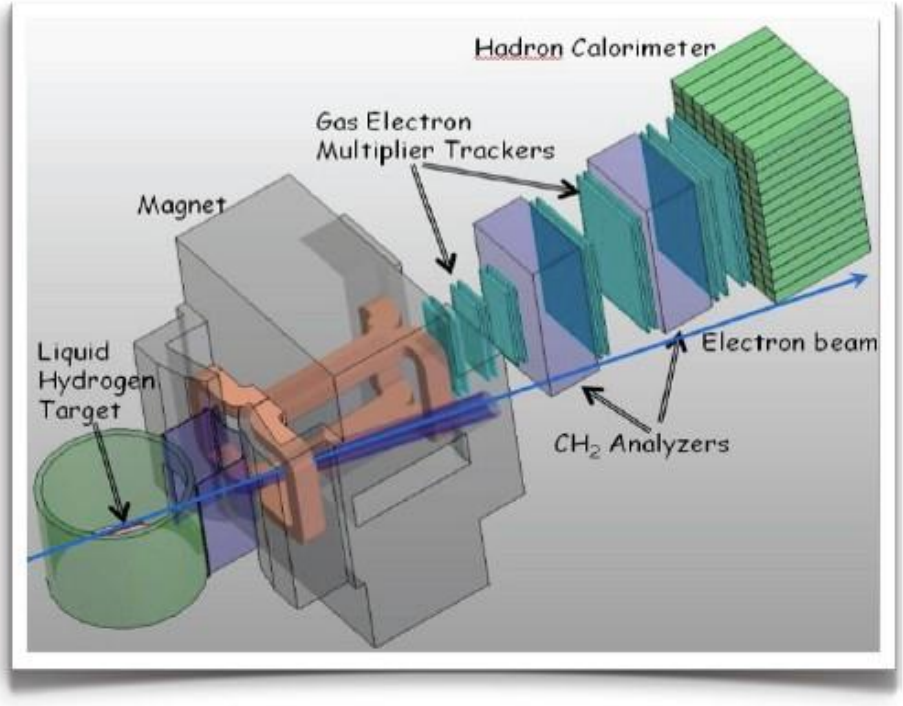
Jefferson Lab
Thomas Jefferson National Accelerator Facility

Super-BigBite-Spectrometer (SBS)

Monthly Progress Report

April 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 19th 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.

Work has started on an Estimate to Complete (ETC) for WBS 1.

Quarterly phone meeting with DOE was held on March 4th. A one page sheet to track the November 2013 DOE review recommendations was requested and is attached in Appendix 3.

The format of the Milestone tables presented in each WBS section and Appendix 1 was modified, so that the tables have a consistent layout and presentation.

The milestones presented for WBS 2 and 3 are still for the current PMP, until the updated PMP is approved. Milestones for WBS 1 are unchanged.

WBS 1: SBS Basic

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

WBS 1.01 Milestones: (see Appendix 1 for an alternate view of the milestones, including level 3 milestones)

ID #	Level	Milestone	Scheduled Date	Expected Date 3/1/2014	Expected Date 4/1/2014	Comment
1.1-01M	1	Project start	10/1/2012			**Completed 10/1/2012**
2-01M	2	Magnet delivered to JLab	4/30/2013			**Completed 8/21/2013**
1.2-10M	2	Platform parts received	6/27/2014	9/1/2014	9/1/2014	This item has a large float. Not needed for magnet test in TestLab
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 Mar 5 , 19 and 26th. 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:
  - Machining is completed and delivery scheduled for April 14th, 2014.
- Coils:
  - Racetrack coils: Vendor reported that the first coil will be ready by mid May 2014. Two months before the level 3 milestone to assemble magnet in Testlab (see Appendix 1)
  - Saddle coil: Have budgetary estimate from vendor. Ready for formal bids, but waiting to submit until we have a full beam line design and confirmation of budget estimates.
- The magnet assembly drawings have started. The LCW manifolds, assembly hardware and coil brackets are defined.
- Danfysik reported that all parts for power supply are in-house and they have started fabrication. They are on track to ship on June 27th. The power supply on order with Danfysik is not needed for the commissioning magnet test in the TestLab which is scheduled for Fall 2014. When the power supply arrives then it will be installed in Hall A.
- The assembling and commissioning tests of the magnet are planned in the Testlab with assembly starting in July. The test will use the original saddle coil and two of the racetrack coils. The test will be a low current test which uses an existing power supply and available cooling water.

WBS 1.2 Magnet/Detector Platforms:

- Magnet support structure sent out for bid at end of March. The support structure is not needed for assembling and commissioning tests of the magnet that are planned in the Testlab.

WBS 1.3 Beam Line:

- Design of exit beam pipe is 40% complete. The exit pipe will provide the vacuum and magnetic shielding.
- Design of scattering chamber snout is 10% complete.
- In the final SBS, BigBite and beamline magnetic model, only correction coils are needed.

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 4/1/2014: $741K (50%).

WBS 2: Neutron Form Factor

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

WBS 2.01 Milestones:

Note that in the updated PMP, the GEM milestones move to WBS 3.

ID #	Level	Milestone	Scheduled Date	Expected date 3/1/2014	Expected date 4/1/2014	Comment
2.1-01M	1	Project start	10/1/2012			**Completed 10/1/2012**
2.3-1	3	Order GEM Parts	9/1/2013			**Completed 10/18/2013**
2.2-01M	2	UVa receives GEM parts	2/3/2014	4/1/2014	4/1/2014	All parts at UVa except the GEM foils. The foils are schedule to arrive during the 2nd week of April.
2.3-2	3	First module assembled and tested	3/3/2014	5/1/2014	5/1/2014	With scheduled delivery of GEM foils, should still meet this expected date
2.2-20M	2	UVa receives electronics parts	8/20/2014	8/20/2014	8/20/2014	In updated PMP, the scheduled date changes to 10/1/2014
2.2-10MA	3	UVa 5 GEM modules assembled and tested	6/2/2014	7/2/2014	7/2/2014	
2.2-10MB	3	UVa 15 GEM modules assembled and	9/30/2014	9/30/2014	9/30/2014	

		tested				
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	2/22/2015	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 Mar 5 , 19 and 26th. 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 set of frames arrived third week of March 2014. CERN has confirmed that shipment of GEM foils will be in the 2nd week of April. This still puts the project on track to produce first module by end of April. The draft design for the SBS chamber holding frame, which combines the GEM modules to form chambers, was completed. A microscope to inspect GEM chamber readout planes was acquired and installed. A parasitic test of two prototype GEM chambers in Hall A with beam is planned for the first week of April.

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:

- No activity this period.

WBS 2.4 Coordinate Detector:

- The response to the Coordinate Detector Review report was sent to the committee the last week of March. Discussions are ongoing to finalize the review report by mid April.
- Once the final review report is prepared, the coordinate detector will be ready for procurement.

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 4/1/2014: $622K (51%).

WBS 3: Proton Form Factor

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

WBS 3.01 Milestones: (see Appendix 1 for an alternate view of the milestones)

ID #	Level	Milestone	Scheduled Date	Expected date 3/1/2014	Expected date 4/1/2014	Comment
3.1-01M	1	Project start	10/1/2013	10/1/2013		**Completed 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	

WBS 3.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on Mar 5, 19 and 26th. 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 to initiate procurement for final 11 GEM modules. Have had discussions with procurement to have this procurement as add-on to the previous UVa GEM contract.

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

- No activity this month

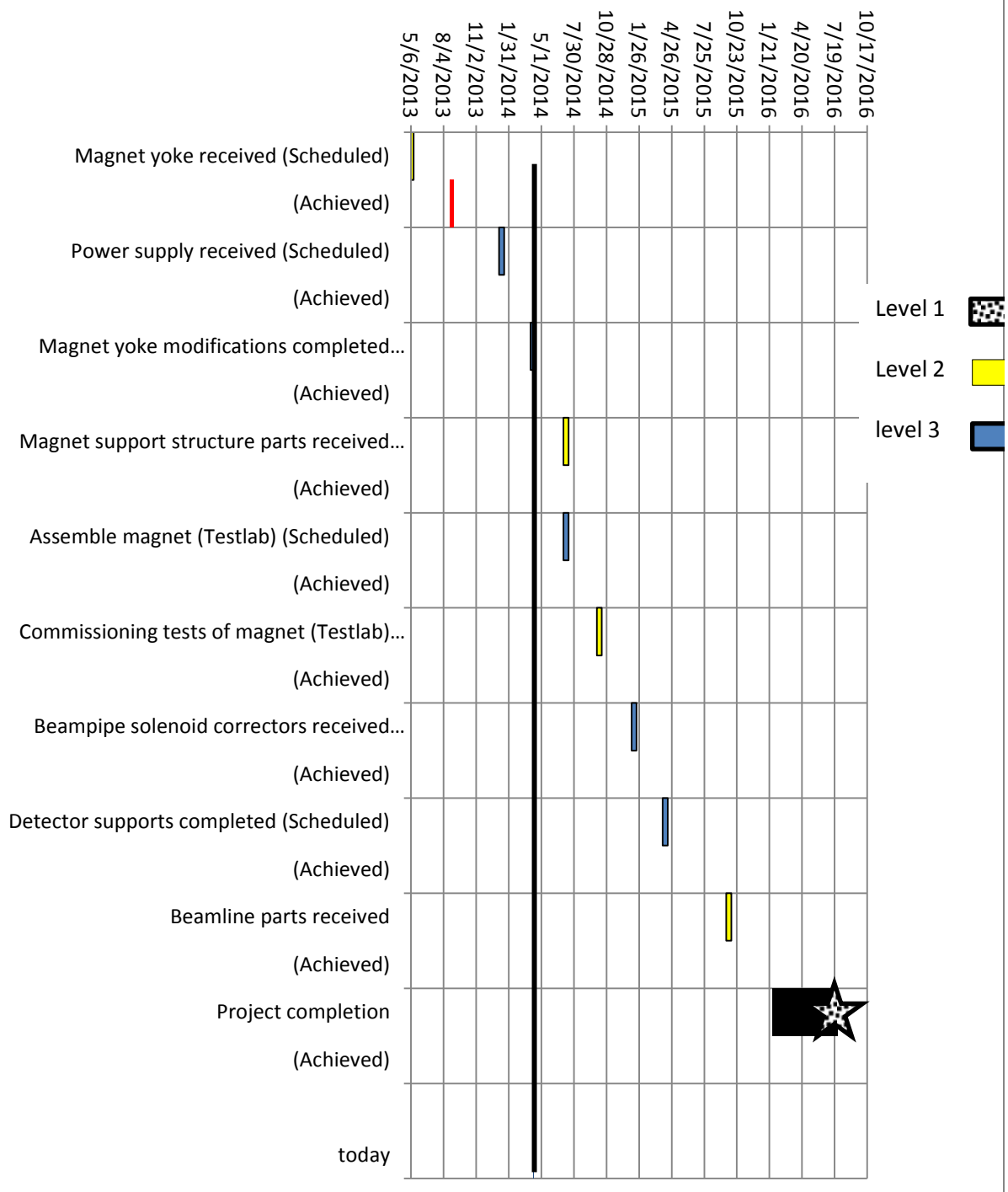
WBS 3 Costs:

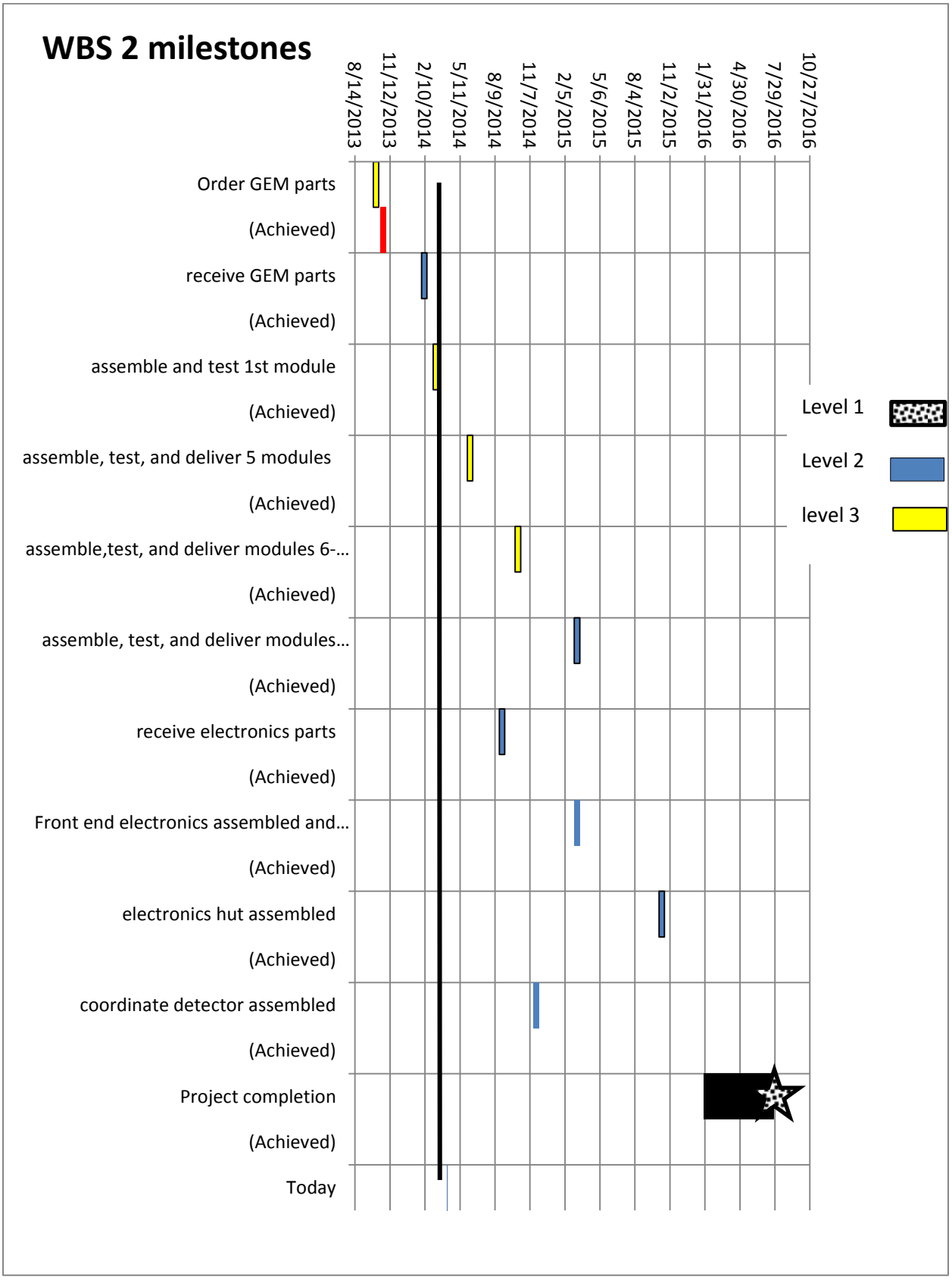
- Budget for this WBS for FY14 is $321K.
- Costed and obligated as of 4/1/2014: $8K (2.5%)

Appendix I

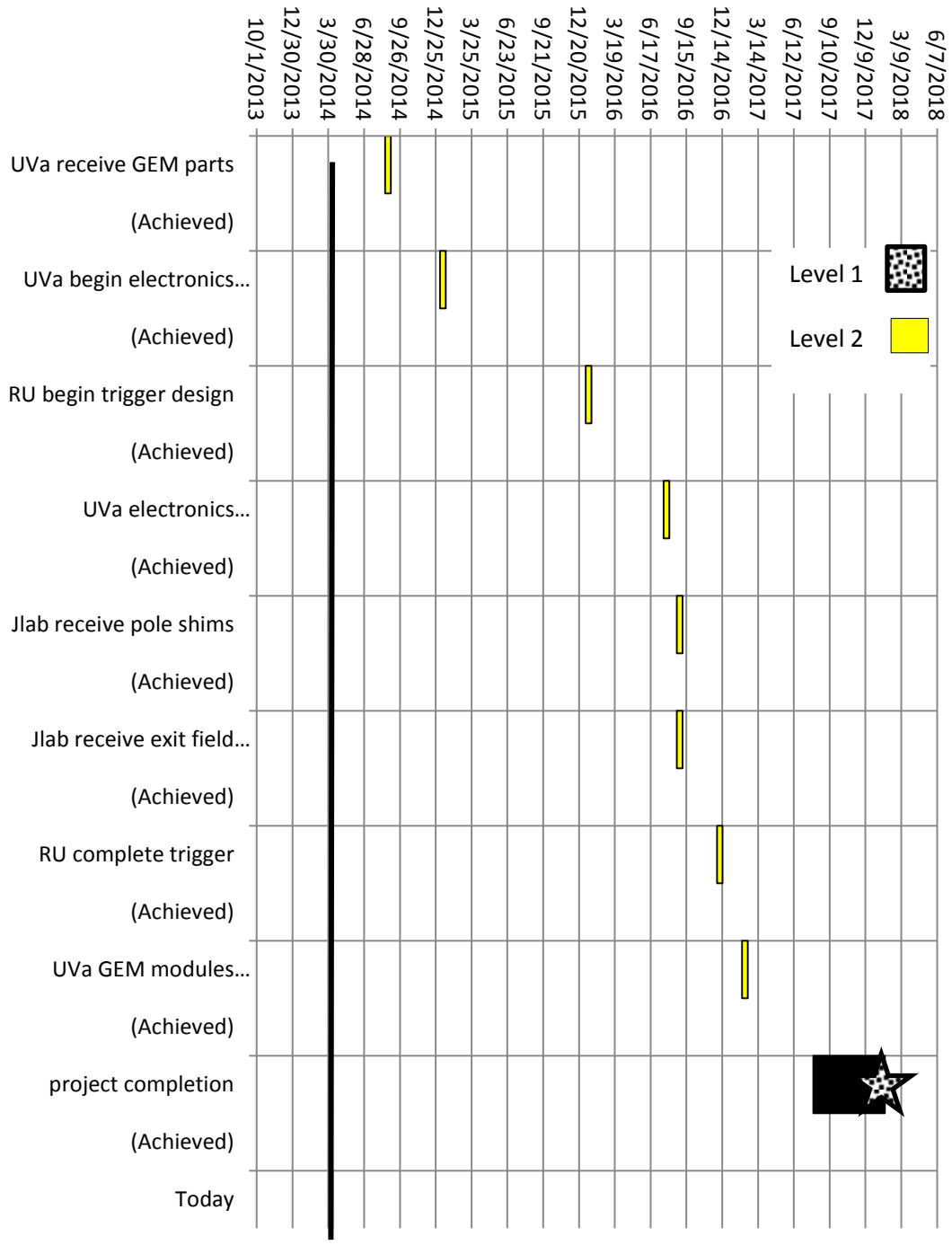
The following are graphical representations of the milestones for SBS Basic (WBS 1), Neutron Form Factor (WBS 2,) and Proton Form Factor (WBS 2), updated on December 1, 2013. Black represents level 1 milestones as specified in the PMP. Yellow represents level 2 milestones from the PMP. Blue represents 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
8/14/2013
11/12/2013
2/10/2014
5/11/2014
8/9/2014
11/7/2014
2/5/2015
5/6/2015
8/4/2015
11/2/2015
1/31/2016
4/30/2016
7/29/2016
10/27/2016
Order GEM parts
(Achieved)
receive GEM parts
(Achieved)
assemble and test 1st module
(Achieved)
assemble, test, and deliver 5 modules
(Achieved)
assemble,test, and deliver modules 6-...
(Achieved)
assemble, test, and deliver modules...
(Achieved)
receive electronics parts
(Achieved)
Front end electronics assembled and...
(Achieved)
electronics hut assembled
(Achieved)
coordinate detector assembled
(Achieved)
Project completion
(Achieved)
Today
Level 1
Level 2
level 3

WBS 3 milestones



WBS 1 Milestones

Level	Milestone	Scheduled Date	Expected Date 3/1/2014	Expected Date 4/1/2014	Comment
1	Project start	10/1/2012			**Completed 10/1/2012**
2	Magnet delivered to JLab	4/30/2013			**Completed 8/21/2013**
3	Power supply received	1/4/2014	7/1/2014	7/1/2014	
3	Magnet yoke modifications Completed	4/1/2014	4/1/2014	4/15/2014	Modifications are completed Shipment scheduled 4/15/2014
2	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	Beam-line parts received	9/24/2015	9/24/2015	9/24/2015	
1	Project completion	1/29/2016	1/29/2016	1/29/2016	

WBS 2 Milestones

Level	Milestone	Scheduled Date	Expected date 3/1/2014	Expected date 4/1/2014	Comment
1	Project start	10/1/2012			**Completed 10/1/2012**
3	Order GEM Parts	9/1/2013			**Completed 10/18/2013**
2	UVa receives GEM parts	2/3/2014	4/1/2014	4/1/2014	All parts at UVa except the GEM foils. The foils are schedule to arrive the 2nd week of April.
3	First module assembled and tested	3/3/2014	5/1/2014	5/1/2014	With scheduled delivery of GEM foils, should still meet this expected date
2	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	UVa 29 GEM modules assembled and tested	10/17/2014	3/9/2015	3/9/2015	
2	Coordinate Detector Assembled	11/17/2014	11/17/2014	11/17/2014	
2	UVa front-end electronics assembled and tested	2/22/2015	2/22/2015	2/22/2015	
2	WBS 2.3 completed (Electronics Hut Assembled etc.)	10/5/2015	10/5/2015	10/5/2015	
1	Project completion	1/29/2016	1/29/2016	1/29/2016	

WBS 3 milestones

Level	Milestone	Scheduled Date	Expected date 3/1/2014	Expected date 4/1/2014	Comment
1	Project start	10/1/2013	10/1/2013		**Completed 10/1/2013**
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 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}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}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: August2014 (+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)

Appendix III : **Track DOE Nov 2013 SBS review recommendations**

1. GEM detectors:

   Recommendations:

   - Update the workflow for the GEM module construction to include workforce (by type) required for each step. Submit by Dec 15,2013.
     Action: *Attached workflow plan to December 15th monthly report.*
   - Develop a written Quality Assurance /test plan , including acceptance criteria fro foils and assembled chambers that will be used for both UVa and INFN.
     Action: *Attached QA/test plan to December 15th monthly report.*

2. Electronics, DAQ, Trigger

   Recommendations:

   - Conduct a background assessment for each experimental program that includes background rejection and signal efficiency as a function of trigger cuts and present at the next review.
   - Develop a document describing the interface between the DAQ system and each of the 3 types of electronics (FADC, GEM and FASTBUS) and present at next review.

3. Feasibility and completeness of the proposed budget

   Recommendations:

   - Integration milestones for all equipment off-project, as well as key Jlab readiness and safety reviews, should be incorporated into a list of milestones. Provide updated list of milestones to DOE by Jan 1 , 2014.
     Action: *Updated list of off-project milestones in Appendix of January 15th monthly report*

4. Effectiveness of the proposed management structure

   Recommendations:

   - Develop a Technical Specifications Document for all experimental components in the SBS program and present it at the next annual review.
   - Develop an integration plan for all experimental components (on and off project) needed for the SBS project, which includes activities, schedules and goals.
   - Updated the Research Management Plan to capture current plans for scientific effort needed to implement the project. Submit to DOE by Feb 15, 2014.
     Action: *Updated Research Management Plan in Appendix of February 15th monthly report*
   - The Project Management Plan should be updated to reflect changes in scope to the WBS components and evolving list of off-project equipment. Submit an updated PMP to Doe by Jan 1, 2014.
     Action*: Updated Project Management Plan in Appendix of January 15th monthly report.*