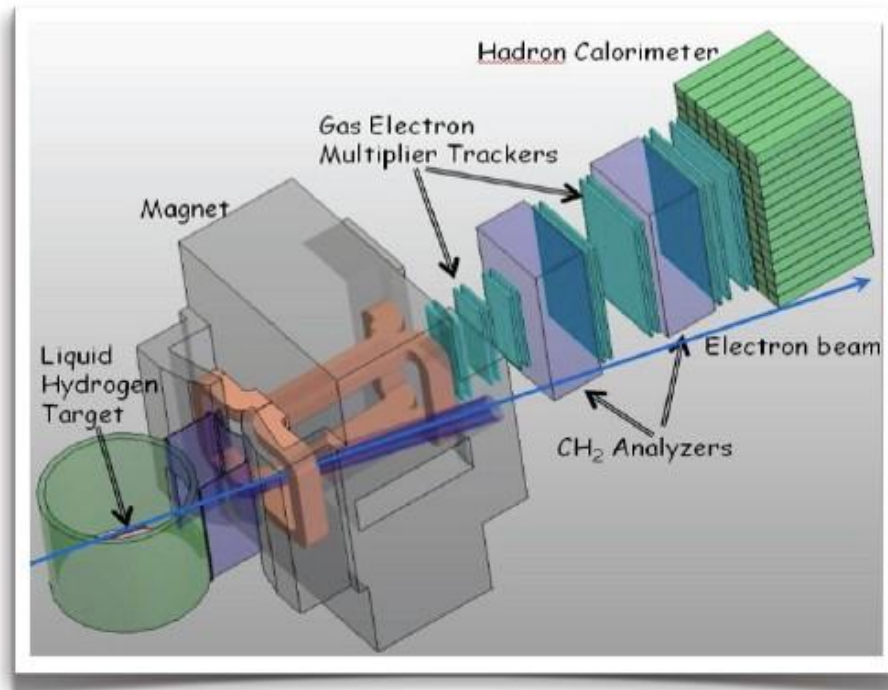


Super-BigBite-Spectrometer (SBS)

Monthly Progress Report

October 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 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 25th 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 GEM electronics review was completed. Decision was made to use the INFN GEM electronics for the rear tracker.
- Four new GEM readout foils arrived at UVa and all passed the quality assurance tests. Construction of GEM module #3 is complete and construction of GEM module #4 started on Sept 29th.
- Appendix 2 has short update on the Gas Cherenkov along with the usual list of milestones for all the SBS off-project equipment.

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 1.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on September 3rd, 10th, 17th, 24th. 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:

- In Testlab, water and power have been connected to the magnet. Testing of the magnet is planned to be completed by the end of October.
- The power supply is on route by boat and is expected to arrive at JLab on October 10th.
- Coils:
 - Racetrack coils: Seven coils are on site. Four coils remain to be delivered. The vendor has shipped the 8th. The 9th and 10th will ship by the end of October. The 11th one will ship mid-November.
 - Saddle coil: The procurement process has started and will be sent out for bids on Oct 7th with a deadline of two weeks for bids.
- The modeling and design of the beam line corrector magnets and passive magnetic shielding for the proton form factor experiment is complete. Studies are ongoing for the rest of the experimental settings. Once the studies are completed, then the beam line correctors can be ordered. The expected date for delivery of the beam line correctors is delayed by two months which still leaves a float of 11 months.

WBS 1.2 Magnet/Detector Platforms:

- Platform counterweight assembly had been completed. Local vendor is also constructing the platform. They will keep the assembly at their site. Once the platform is complete, it can be put together with counterweight assembly at their site for preassembly check.
- The main platform delivery is expected in November 2014. This is 4 months past the scheduled date, but item has large float.

WBS 1.3 Beam Line:

- The exit beam pipe detailing is ongoing and is expected to be completed by Oct 30th.
- Detailing the scattering chamber snout has been completed and is under final review before sending to procurement.

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 10/1/2014: \$927K (63%).
- The incremental budget for FY13+FY14+FY15 is \$1,694K.

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 9/1/2014	Expected Date 10/1/2014	Comment
1 (1.1-01M)	Project start	10/1/2012			Completed 10/1/2012
2 (2-01M)	Magnet delivered to JLab	4/30/2013			Completed 8/21/2013
3	Power supply received	1/4/2014	10/3/2014	10/12/2014	The power supply is on route to JLab by boat.
3	Magnet yoke modifications Completed	4/1/2014			Completed 5/22/2014
2 (1.2-10M)	Platform parts received	6/27/2014	11/1/2014	11/1/2014	Bid awarded. Expect delivery 11/1/2014. Platform is not needed for test in the Testlab.
3	Assemble magnet in Testlab	7/1/2014	8/1/2014		Completed 9/4/2014
3	Commissioning test of magnet in Testlab completed	10/1/2014	10/1/2014	10/30/2014	Power and water connected
3	Beampipe solenoid correctors received	1/5/2015	1/5/2015	3/5/2015	All experiment configurations are being checked. Still have 11 months are float.
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

WBS 2	Neutron Form Factor	WBS 2.01	Milestones
		WBS 2.02	Project oversight
		WBS 2.1	Coordinate Detector (ISU)
		WBS 2.2	Electronics Hut, Lead Shielding, Lead platform, and Detector Frames (JLab)
		WBS 2.3	Pole Shims and field clamp (JLab)
		WBS 2.4	Trigger (RU)

WBS 2.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on September 3rd, 10th, 17th, 24th. 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):

- Contract with ISU for construction of the coordinate detector was completed and signed.
- Scintillator order was completed and signed.
- Fermilab scintillator group started production tests on Sept 22nd to determine if a die that they already have can be used for CDET scintillators. If this works out, then it will save time and money for the production of the scintillator. Expect to have determined production scheme for scintillator by mid-October and at that point can set up the production schedule.
- Purchasing of wavelength shifting fiber has been delayed until finalizing the production of the scintillator. Delay in ordering WLS by one month will not affect overall schedule.

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

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

WBS 2.3 Pole Shims and field clamp:

- Purchasing will proceed in FY15 as planned in the PMP.

WBS 2.4 Trigger:

- Purchasing of the remaining part of the trigger will be in FY15 as planned in the PMP.

WBS 2 Costs:

- Budget for this WBS for FY14 is \$599K. The incremental budget, which includes the FADC for the trigger and the CDET frame which move forward from FY15, is \$834K.
- Costed and obligated as of 10/1/2014: \$677K (81%).
- The incremental budget for FY14+FY15 is \$1,309K.

WBS 2.01 Milestones: See [Appendix 1](#) for a graphic view of the milestones .

Level	Milestone	Scheduled Date	Expected date 9/1/2014	Expected date 10/1/2014	Comment
1	Project start	10/1/2013			Completed 10/1/2013
3	Scintillator and Wavelength Shifting Fibers ordered	7/30/2014	9/30/2014	10/30/2014	Delay in ordering WLS by one month will not effect overall schedule..
3	Finish testing of module prototype	8/30/2014	8/30/2014		Completed 8/30/2014
3	Scintillator shipped for machining	10/30/2014	12/30/2014	12/30/2014	
3	Complete plastic absorber structure design	11/15/2014	11/15/2014	11/15/2014	
3	Begin assembly of modules	12/15/2014	2/15/2014	2/15/2015	
3	Begin construction of plastic absorber structure	1/15/2015	1/15/2015	1/15/2015	
2	Coordinate Detector assembled	3/30/2015	5/30/2015	5/30/2015	
2	JLab receives exit field clamp	6/2/2015	6/2/2015	6/2/2015	
2	Electronics Hut Assembled	10/2/2015	10/2/2015	10/2/2015	
2	Trigger completed	10/4/2015	10/4/2015	10/4/2015	
1	Project completion	1/29/2016	1/29/2016	1/29/2016	

WBS 3: Proton Form Factor

WBS 3	Proton Form Factor	WBS 3.01	Milestones
		WBS 3.02	Project Oversight
		WBS 3.1	GEM's (UVa)
		WBS 3.2	GEM electronics (UVa)

WBS 3.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on September 3rd, 10th, 17th, 24th. 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) and UVa (two scientists).

WBS 3.1 GEMs

- The CERN GEM fabrication team agreed to replace the 3 inferior quality readout boards received in July. In addition, CERN has agreed to have a senior technician oversee the production to insure quality control.
- A shipment of 4 readout boards arrived from CERN on September 15th. These readout boards were inspected in the following three ways: Visual inspection, inspection under the microscope (especially to ensure that no extra Kapton covers the lower readout layer) and a measurement of the electronic noise readout by connecting all channels to the SRS readout system and collecting pedestal data. The results of these tests for all 4 readout were satisfactory and the readout boards were accepted.
- The 3rd shipment of SBS GEM foils containing 10 GEM foils, 4 readout foils and other components has been shipped from CERN on September 29th and is expected at UVa in the next couple of days. The schedule is for CERN to ship all foils needed for 3 modules each month.
- The fabrication of SBS module #3 was completed. This module is currently being prepared for testing. The production of SBS module #4 started on September 29th. The production is

reaching a steady state of 2 GEM modules per month which is assumed in the present milestones. UVa has the equipment and space for a parallel production line to increase the production rate if needed.

- The replacement frames for the seven defective frames arrived from Resarm Inc. in Belgium. These frames were inspected and accepted.
- The contract modification for the additional 11 GEM modules was completed and signed.

WBS 3.2 GEM electronics

- The GEM electronics reviews were completed. Two of the reviewers clearly favored the INFN GEM electronics. The third gave no clear recommendation but gave clear delineation of the pluses and minuses of both systems. Using these reviews in internal discussions, the decision was made to purchase the INFN GEM electronics.
- Expect to have GEM electronics ordered by Feb 1, 2014. Plan to order all electronics at once, instead of two stages as is in the PMP. After discussions with the vendor, we expect one year to fill order.

WBS 3 Costs:

- Budget for this WBS for FY14 is \$665K. The incremental budget, which includes moving the production of an additional 11 GEMs forward from FY15, is \$1,134K.
- Costed and obligated as of 10/1/2014: \$975K (86%).
- Budget for incremental budget of FY13+FY14+FY15 is \$1,440K.

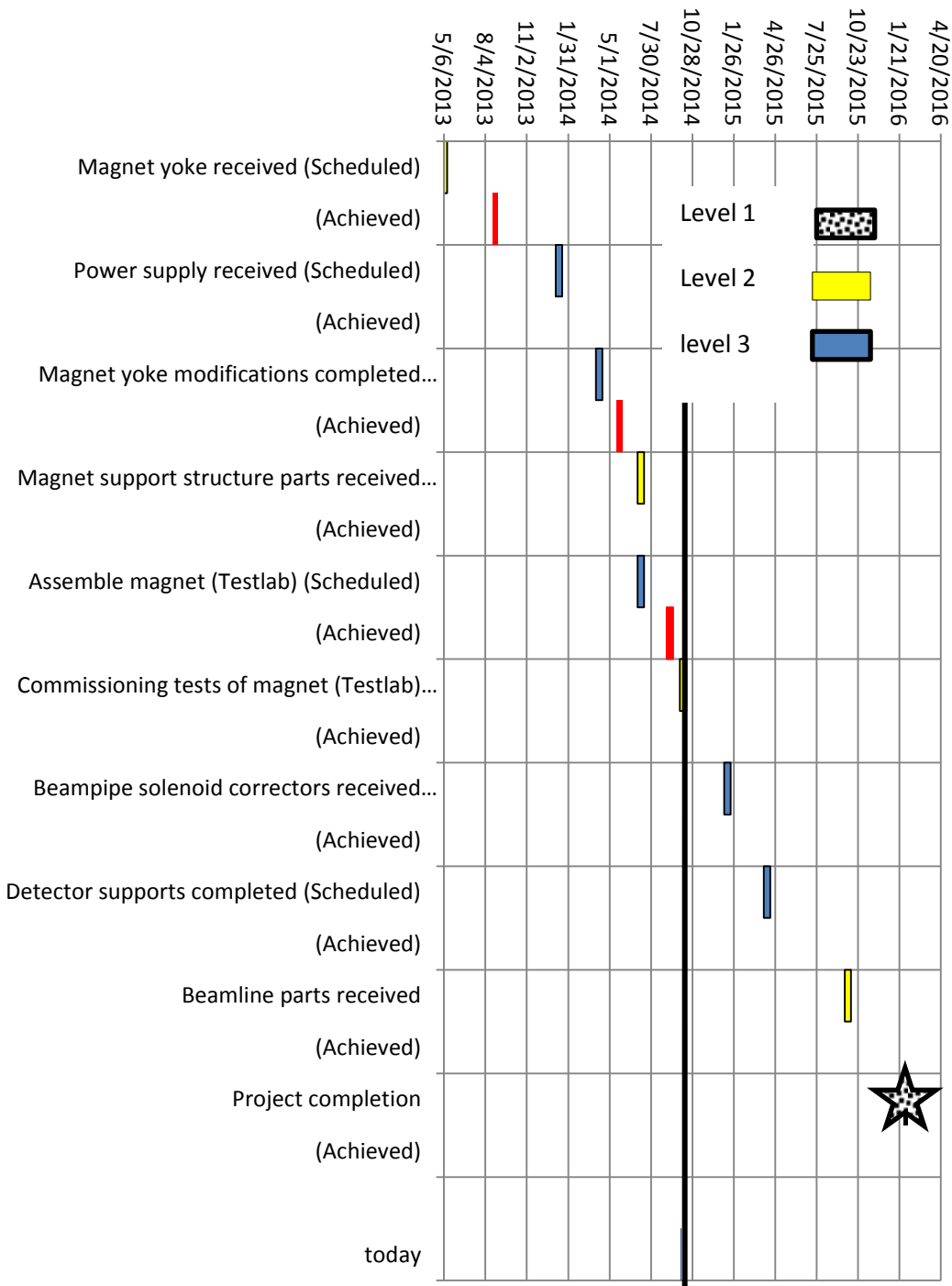
- **WBS 3.01 Milestones:** (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 9/1/2014	Expected date 10/1/2014	Comment
1 (3.1-01M)	Project start	10/1/2012			Completed 10/1/2012
3	Order GEM Parts	10/1/2013			Completed 10/18/2013
3	UVa receives GEM parts	2/3/2014			Completed 4/23/2014
2 (3.2-01M)	First module assembled and tested	3/3/2014			Completed 5/15/2014
2 (3.2-10M)	UVa 5 GEM modules assembled and tested	6/2/2014	11/1/2014	11/1/2014	Construction of GEM module #4 is underway
2 (3.2-20M)	UVa 6-16 GEM modules assembled and tested	9/30/2014	4/15/2015	4/15/2015	
2 (3.2-30M)	UVa 17-29 GEM modules assembled and tested	3/2/2015	11/1/2015	11/1/2015	
2 (3.2-40M)	UVa 30-40 GEM modules assembled and tested	7/15/2015	4/15/2016	4/15/2016	
2 (3.2-50M)	1st order of Front End Electronics	10/1/2014	10/1/2014	2/1/2015	Review is completed. INFN GEM electronics were selected.
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	

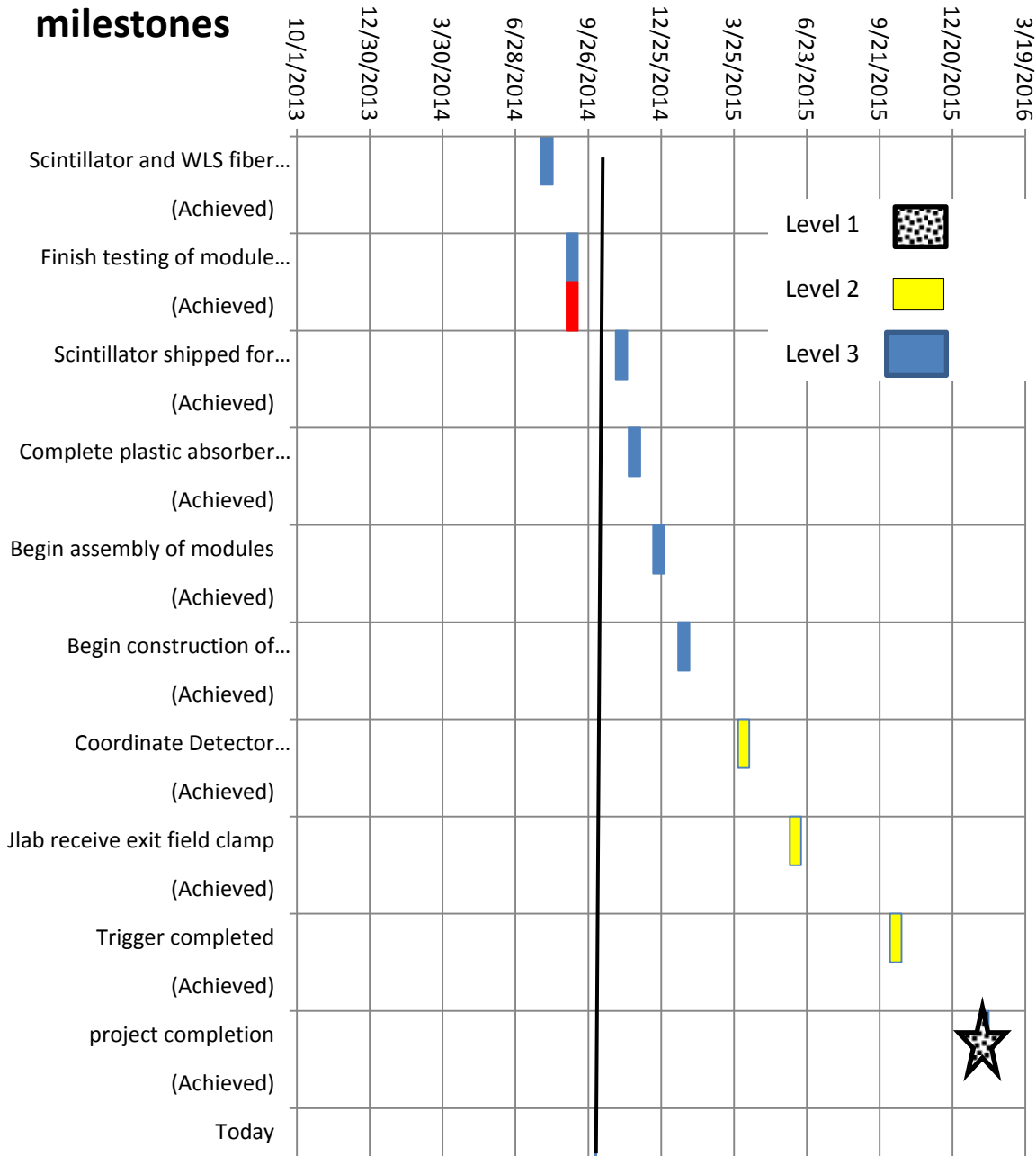
Appendix I

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).

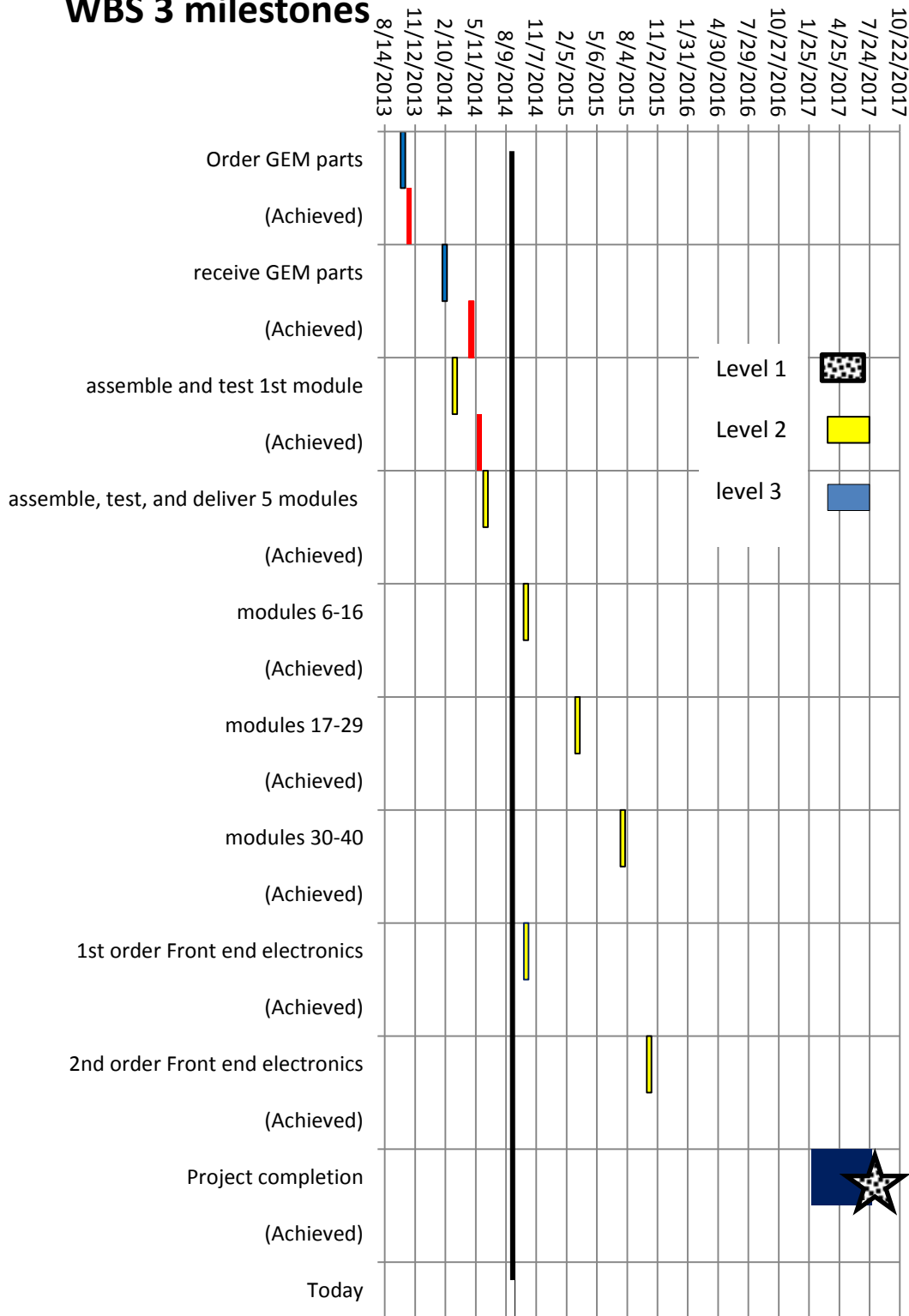
WBS 1 Milestones



WBS 2 milestones



WBS 3 milestones



Appendix II

Update on the off-project equipment.

Status of the Gas Cherenkov detector (GRINCH)

- Mirror assembly is completed, tested and documented with dummy mirrors. Ready to order the final mirrors.
- PMT array and magnetic shielding box is designed. Bids have been received and vendor was chosen. NC A&T University is generating the purchase order.
- PMT testing at James Madison University is well-underway with expectation to have a full set of gain-matched tubes chosen before the end of the year. 600 PMTs are fully characterized with 200 left. Grouping of gain-matched tubes has started.
- NINO front-end cards design is complete and cards are being manufactured.
- Design of the Cherenkov vessel is almost complete. Expect to have a complete set of drawings before the end of October.

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 ^3He 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 ^3He 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). *Expected completion Dec 2014*
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 **Completed Sept 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) **Completed July 2014**
2. Design review: September 2014 (+3 months float) *Expected Completion: Dec 2014*
3. Module construction initiated: October 2014 (+4 months float) Expected Completion : *Expected Completion: Mar 2015*
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) . **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)