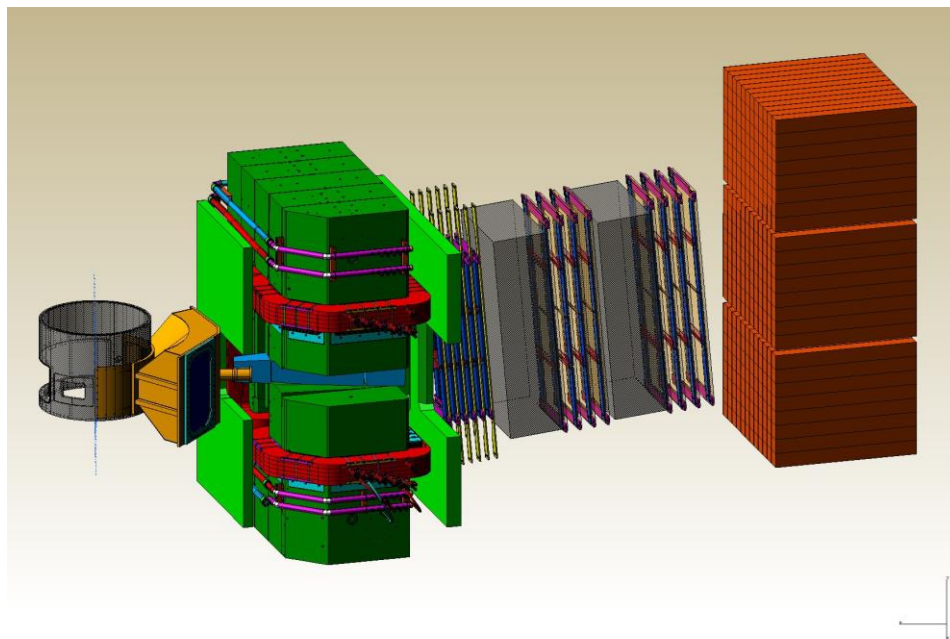


Super-Bigbite-Spectrometer (SBS)

Monthly Progress Report

July 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 34th 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.

- SBS Collaboration meeting is scheduled for July 15 and 16th.

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 June 3, 10, 24 and 30th. 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:

- The SBS magnet is in the TestLab.
- Coils:
 - Racetrack coils: All coils are at JLab.
 - Saddle coil: Vendor was contacted. The coil is in the winding process and photo of the winding is below. The vendor expects shipment by the end of August with delivery time of four weeks.
- The front clamp was sent to procurement on June 25th. The clamp supports drawings will be sent to procurement in middle of July.
- Sieve slit design was completed.
- A procurement for the conductor for the corrector coils was placed and awarded. This will take advantage of a large order of conductor that the vendor was making which reduces the cost of the conductor. The corrector coils will be sent to procurement in the beginning of July.



Figure 1 Winding of the saddle coil

WBS 1.2 Magnet/Detector Platforms:

- Components for setting the elevation of the magnet and for moving the magnet to different positions and angles will be purchased in August and September.

WBS 1.3 Beam Line:

- The vacuum snout was delivered at the beginning of June.
- Detailed design work for the beam pipe is ongoing. It will be ready for procurement by September.

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 7/1/2015: \$1,270K (75%).

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 6/1/2015	Expected Date 7/1/2015	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			Completed 10/17/2014
3	Magnet yoke modifications Completed	4/1/2014			Completed 5/22/2014
2 (1.2-10M)	Platform parts received	6/27/2014			Completed 3/24/2015
3	Assemble magnet in Testlab	7/1/2014			Completed 9/4/2014
3	Commissioning test of magnet in Testlab completed	10/1/2014			Completed 10/29/2014
3	Beampipe solenoid correctors received	1/5/2015	9/28/2015	9/28/2015	4 months of float until project completion.
3	Detector supports completed	4/1/2015			Completed 3/24/2015
2 (1.2-30M)	Beam-line parts received	9/24/2015	10/16/2015	10/16/2015	3 1/2 months of float until project completion.
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 June 3, 10, 24 and 30th. 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):

- All scintillator strips have been delivered by Eljen Technology and received at Carnegie Mellon University for cutting them into 51-cm long bars for the CDET modules. Several bars have been visually inspected at CMU and no damage is evident, they have been delivered in good condition. The cutting of the scintillators is planned for the second half of July.
- The fabrication of all the parts for six CDET modules is currently underway at Vision Machine & Fabrication Corp. in Hampton. The fabrication process was started in the second week in June and it will last for 10-12 weeks. The vendor is expected to deliver one complete module structure to JLab soon for checking the integrity of the module construction. This will insure that

the parts for assembling one module will be ready for the Sept 1st milestone of “Begin construction of CDET modules”.

- The setup for adjusting the pixel-to-pixel gain variations of the PMTs was been completed in early June. Characterization and tests of all 186 of one type (Hamamatsu H8711) of the PMTs have been completed and tests of the other type (Hamamatsu R5900) are continuing.
- All cables and connectors for the equalizer board for the PMTs are in procurement.
- Two of the NINO-based A/D cards for the CDET frontend electronics have been received at JLab from Glasgow and they are undergoing final tests and design verifications. The production of all 185 cards will begin soon at Glasgow. Funds for production of all cards are being provided by the Nuclear Physics Group at the University of Glasgow.

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

- The radiation calculations for the large electronic shield hut were complete with the most recent hut design and the radiation rates were acceptable.
- The two frames to hold the plastic analyzer have been sent to procurement and awarded.
- Design work on the GEM frames is ongoing and the INFN and UVa collaborators are being consulted.

WBS 2.3 Pole Shims and field clamp:

- The rear clamp will be sent to procurement in the beginning of July. This means a delay in reaching the milestone and the date for milestone is changed to Oct 1st.

WBS 2.4 Trigger:

- The updated Trigger Supervisor module is being used in a DAQ test setup with FASTBUS modules.
- The two VXS crates arrived and will be used in DAQ test setups.

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 6/1/2015: \$867K (66%).

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

Level	Milestone	Scheduled Date	Expected date 6/1/2015	Expected date 7/1/2015	Comment
1	Project start	10/1/2013			Completed 10/1/2013
3	Finish testing of module prototype	8/30/2014			Completed 8/30/2014
3	Scintillator ordered	9/30/2014			Completed 9/15/2014
2	CDET module design completed	11/30/2014			Completed 11/30/2014
3	Wavelength Shifting Fibers ordered	1/15/2015			Completed 1/20/2015
3	Scintillator shipped for machining	4/30/2015	4/30/2015		Completed 4/10/2015
2	JLab receives exit field clamp	6/2/2015	7/31/2015	10/1/2015	
3	Begin preparation of WLS fibers	6/15/2015	7/15/2015	7/15/2015	
3	Begin construction of CDET modules	9/1/2015	9/1/2015	9/1/2015	
3	Assembled one CDET module	10/1/2015	10/1/2015	10/1/2015	
2	Electronics hut assembled	10/2/2015	12/18/2015	12/18/2015	
2	Trigger completed	10/4/2015	10/4/2015	10/4/2015	
3	Assembled one CDET plane	12/1/2015	12/1/2015	12/1/2015	
2	Coordinate Detector assembled	6/30/2016	6/30/2016	6/30/2016	
1	Project completion	1/29/2017	1/29/2017	1/29/2017	

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 June 3, 10, 24 and 30th. 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 and includes Jefferson Lab (manager, scientist) and UVa (two scientists).

WBS 3.1 GEMs

- Module # 13: All sectors fully functional. Cosmic tests are ongoing.
- Module # 14: Construction was completed. Module being prepared for HV testing.
- Module # 15: Final phase of construction.
- Module # 16: Construction is in progress.
- Module # 17: Construction is in progress.

WBS 3.2 GEM electronics

- Ordered 25 APV25-MPD FE cards and the back planes to fully equip 1 SBS back tracker GEM for the test to be performed here in the lab.
- The back planes are supposed to be shipped on July 10th, the APV25-FE would take 6 to 8 weeks from now (including two weeks summer break in Italy).

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 7/1/2015: \$1,428K (85%).

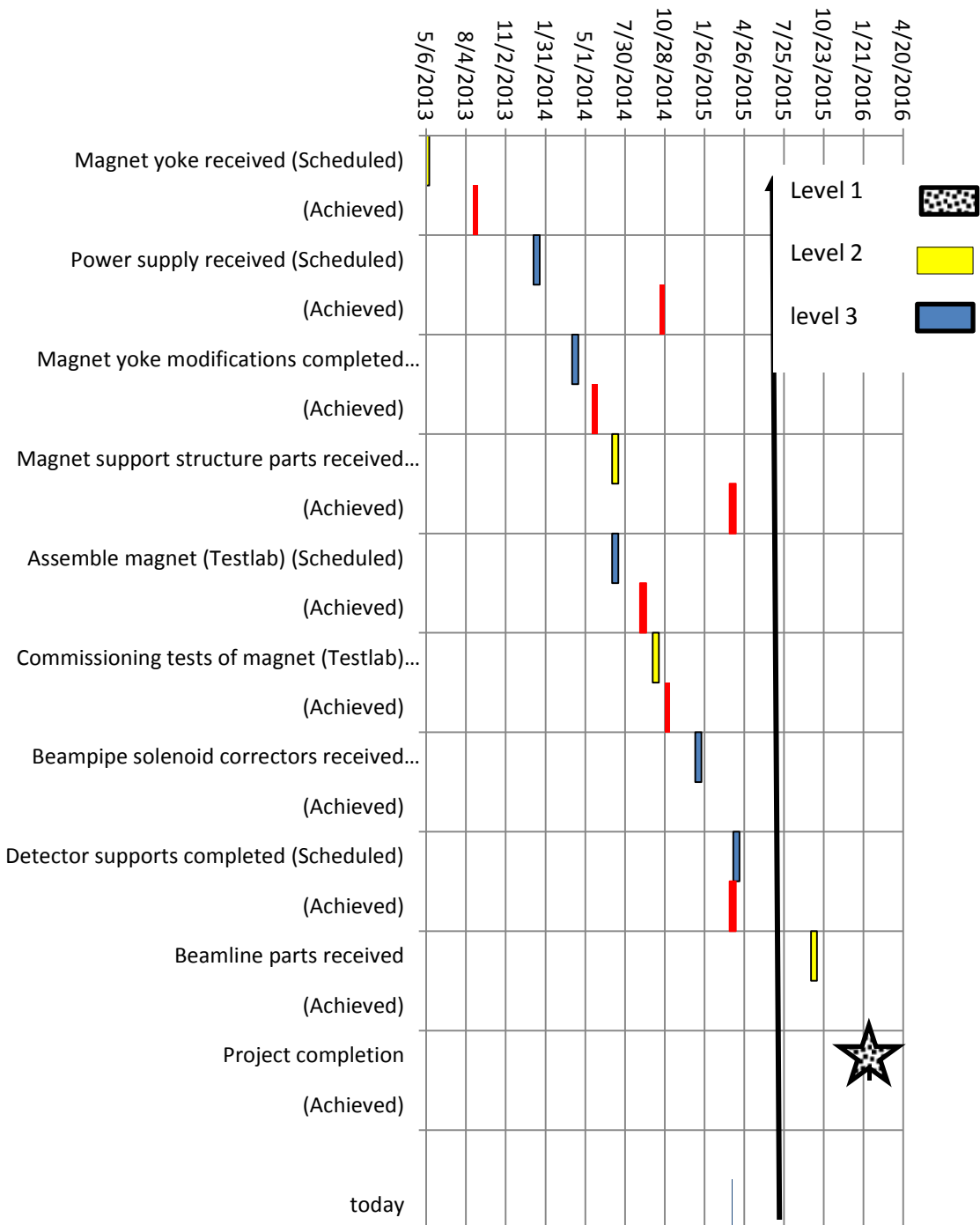
WBS 3.01 Milestones: (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 6/1/2015	Expected date 7/1/2015	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			Completed 12/23/2014
2 (3.2-20M)	UVa 6-16 GEM modules assembled and tested	9/30/2014	7/15/2015	7/15/2015	
2 (3.2-30M)	UVa 17-29 GEM modules assembled and tested	3/2/2015	3/15/2016	3/15/2016	
2 (3.2-40M)	UVa 30-40 GEM modules assembled and tested	7/15/2015	8/1/2016	8/1/2016	
2 (3.2-50M)	1st order of Front End Electronics	10/1/2014	3/15/2015		Completed 3/5/2015
2 (3.2-60M)	2nd order of Front End Electronics	10/1/2015	3/15/2015		Completed 3/5/2015
1 (3.1-10M)	Project completion	7/31/2017	7/31/2017	7/31/2017	

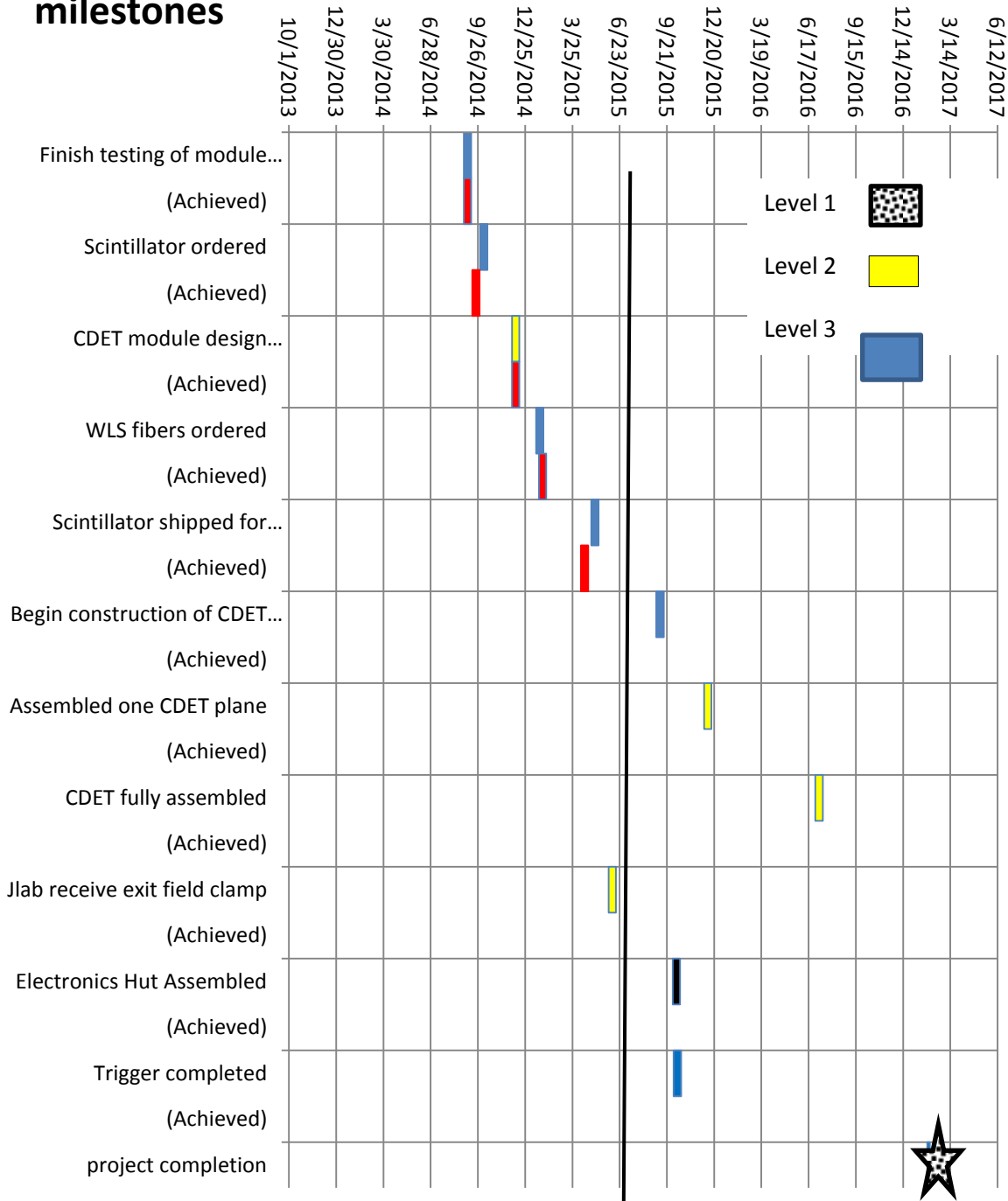
Appendix I

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).

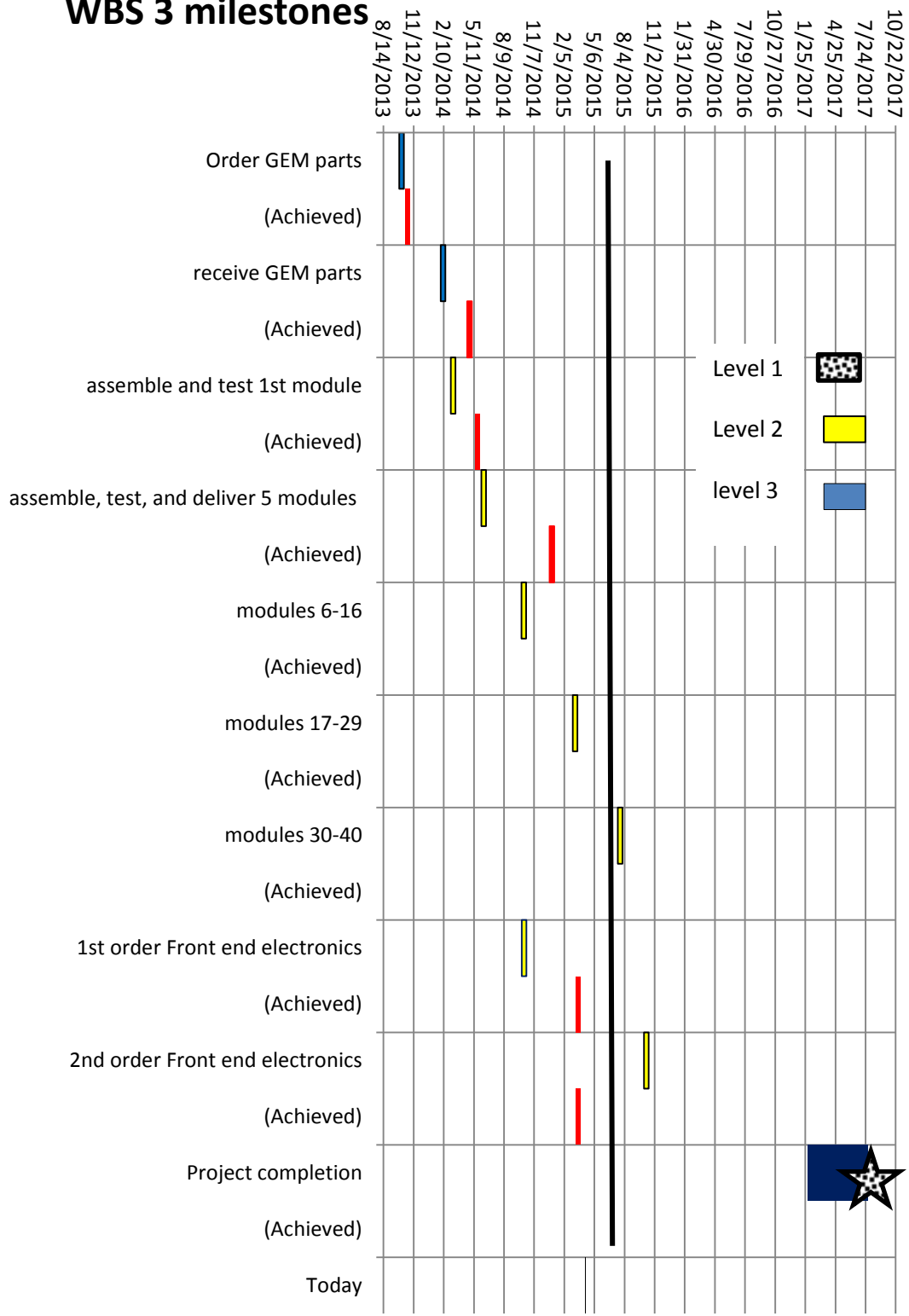
WBS 1 Milestones



WBS 2 milestones



WBS 3 milestones



Appendix II

List of milestones for all equipment off-project.

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

Milestone	Scheduled date	Comment
Design and drawings for vessel are complete	Feb 1, 2015	Completed Feb 2015
Photon Detector Array assembled and tested	Aug 1, 2015	Expect shipment to JLab by Aug 2015.
NINO chip front end cards system shipped to JLab	Jul 1, 2015	Expect by Jan 2016
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	

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

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

Status update:

- Module production is ongoing. Have produced 31 modules of the total of 288 modules in HCal.
- Have machined the endplates for 19 more modules and should have 50 modules ready for shipment to JLab in the middle of July.
- A machinist will work on completing endplates for 50 modules in July.
- Have started to test a HCal module with JLab FADCs. Will be used to spot check modules.

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

Milestone	Completion date	Comment
Electronics in production	Sept 2014	Completed Sept 2014
GEM chambers 1 and 2 completed	Sept 2015	Chamber 1 is at JLab
Initial Electronics QA completed	Dec 2015	
GEM chambers 3 and 4 completed	May 2016	
GEM chambers 5 and 6 completed	Dec 2016	

ECal from JLab (for GEP)

Milestone	Completion date	Comment
Develop concept of annealing	July 2014	Completed July 2014
Test of annealing with prototype	Nov 2015	Completed May 2015
Design review	Nov 2015	
Electronics are ready	Nov 2016	
ECAL is ready	July 2017	

Status update:

- Design of the large ECAL prototype using 200 blocks (C200) was completed by Yerevan collaborators. Stonybrook collaborators are reviewing the design before starting procurements and construction.

Polarized ³He target from UVa (for GEN)

Milestone	Completion date	Comment
Selection of target-cell design for high luminosity	Nov 2014	Completed Oct 2014
Simulated-beam test (bench test) of selected design	Dec 2016	
Design for target hardware and instrumentation complete	July 2017	
GEN Polarized ³ He target is ready	Jan 2018	