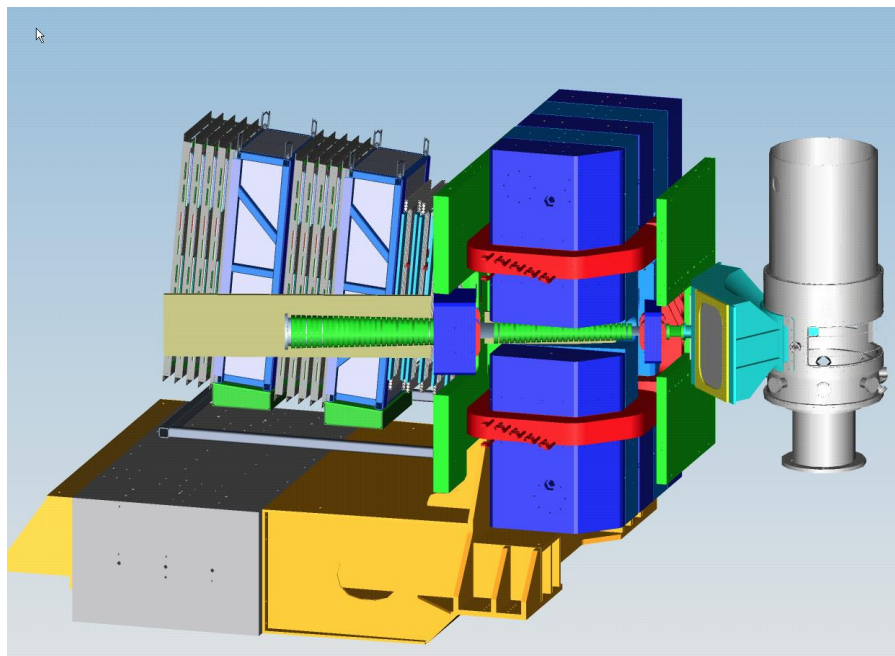


Super-Bigbite-Spectrometer (SBS)

Monthly Progress Report

March 15, 2016



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 40th Monthly Progress Report for the SBS Program.

The SBS Basic (WBS 1) project started in FY13 and was completed in January 2016. 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.

- On February 24th, the report on annealing tests done with beam was sent to the DOE. This fulfills one of the two recommendations from the November 2015 DOE review.

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

WBS1 Project was completed on January 22nd, 2016.

WBS 1 Costs:

- The budget for this WBS for FY15 is \$212K.
- The incremental budget (FY13+FY14+FY15) is \$1,694K.
- At project completion, costed and obligated: \$1738K (103%).

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

Level (ID#)	Milestone	Scheduled Date	Expected Date N/A	Expected Date N/A	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			Completed 12/11/2015
3	Detector supports completed	4/1/2015			Completed 3/24/2015
2 (1.2-30M)	Beam-line parts received	9/24/2015			Completed 11/30/2015
1 (1.1-10M)	Project completion	1/29/2016			Completed 1/22/2016

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 February 3, 10, 17 and 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, Christopher Newport 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):

- To improve efficiency of production, it was decided to first complete the construction of all 14-scintillator groups needed for all modules and then complete the remaining 16-fiber bundles. This does not change the expected completion date of all six modules (Aug 15th 2016), but shifts the expected date of the Level 3 milestone, "Assembly one CDet plane (3 modules)", to May 30th.
- 14-scintillator "group" status:
 - 36 of the 84 groups for module #s 4, 5, and 6 were completed.
 - The 84 groups for modules #1,2 and 3 were already done.
 - Production rate is 1.6 groups/day and expect completion of all 168 by April 22nd.

- 16-fiber "bundle" status:
 - Completed 28 bundles for module #1.
 - 14 bundles for module #2 have been machined only on one side.
 - Need to produce 140 more bundles for modules #s 2, 3, 4, 5, and 6.
 - Production rate is 4 bundles/day.

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

- The integrated beam line stands for lead shielding and corrector magnets has been divided into three phases for the form factor experiments. The first phase is when the corrector magnet stands are supported by the magnet. Production drawings for the first phase are completed and undergoing final review before being sent to procurement. The second phase is when the corrector magnets need a movable support bench. The detailed modeling and layout were completed and production drawing for the second phase will start in the middle of March. The third phase is the support for the lead shielding and it is in the detailed modeling and layout stage.
- The passive magnetic shielding for the beam line has been constructed and the only remaining work is painting which will be completed in March.
- The steel for the roof of the electronic huts was delivered in the beginning of February. The posts for supporting the roof were ordered on February 15th with delivery expected on April 11th.

WBS 2.3 Pole Shims and field clamp

- The pole shims and field clamp are at JLab.

WBS 2.4 Trigger:

- The nine CPUs for the CDet FASTBUS crates are scheduled for delivery on March 14th. This delay in meeting the "Trigger Complete" milestone has no effect on other aspects of the project.
- The initial work on the individual FASTBUS, pipelined VME and GEM MPD electronics DAQ is complete. The plan is during the next two months to test the combined DAQ system.

WBS 2 Costs:

- Budget for this WBS for FY16 is \$77K.
- The incremental budget for FY14+FY15+FY16 is \$1,361K.
- Costed and obligated as of 3/1/2016: \$1,150K (84.5%).

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

Level	Milestone	Scheduled Date	Expected date 3/1/2016	Expected date 4/1/2016	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			Completed 4/10/2015
2	JLab receives exit field clamp	6/2/2015			Completed 11/18/2015
3	Begin preparation of WLS fibers	6/15/2015			Completed 7/6/2015
3	Begin construction of CDET modules	9/1/2015			Completed 9/24/2015
3	Assembled one CDET module	10/1/2015			Completed 11/15/2015
2	Electronics hut parts received	10/2/2015	1/18/2015	4/15/2016	Delivery of support posts from vendor expected by April 15
2	Trigger completed	10/4/2015	2/1/2016	3/15/2016	Shipment of CDet CPUs delayed by 1.5 months
3	Assembled one CDET plane	12/1/2015	3/15/2016	5/30/2016	
2	Coordinate Detector assembled	6/30/2016	8/15/2016	8/15/2016	
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 February 3, 10, 17 and 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, Christopher Newport University and INFN Rome.
- Project is staffed appropriately and includes Jefferson Lab (manager, scientist) and UVa (two scientists).

WBS 3.1 GEMs

- The construction of module 27 was completed and module 28 is nearly complete.
- Modules 25 was successfully tested and module 26 is undergoing tests.
- Construction of module 29 will begin in March.
- Beyond module 29, UVa has GEM foils available to make 6 modules which are enough for 3 months of production. The production of readout foils from CERN was slightly delayed due to personnel issues. CERN will be delivering a readout foil at the beginning and middle of March. In April, CERN will resume regular delivery of readout foils.
- CERN has found an issue with the uniformity of the raw material for the GEM foils. CERN has decided to suspend production of foils until the issue is resolved with the manufacturer of the raw material. At present, no time estimate for when production will resume.

WBS 3.2 GEM electronics

- Order for all electronics for all GEM modules was put into procurement at UVa in February.
- As part of the order, testing of the electronics will be done by ESS (the Italian company making the electronics). Evaristo Cisbani (INFN-Rome) and Paolo Musico (INFN-Genoa) are preparing test setups for the company.

WBS 3 Costs:

- Budget for this WBS for FY16 is \$309K.
- The incremental budget of FY13+FY14+FY15+FY16 is \$1739K.
- Costed and obligated as of 3/1/2016: \$1665K (96%).

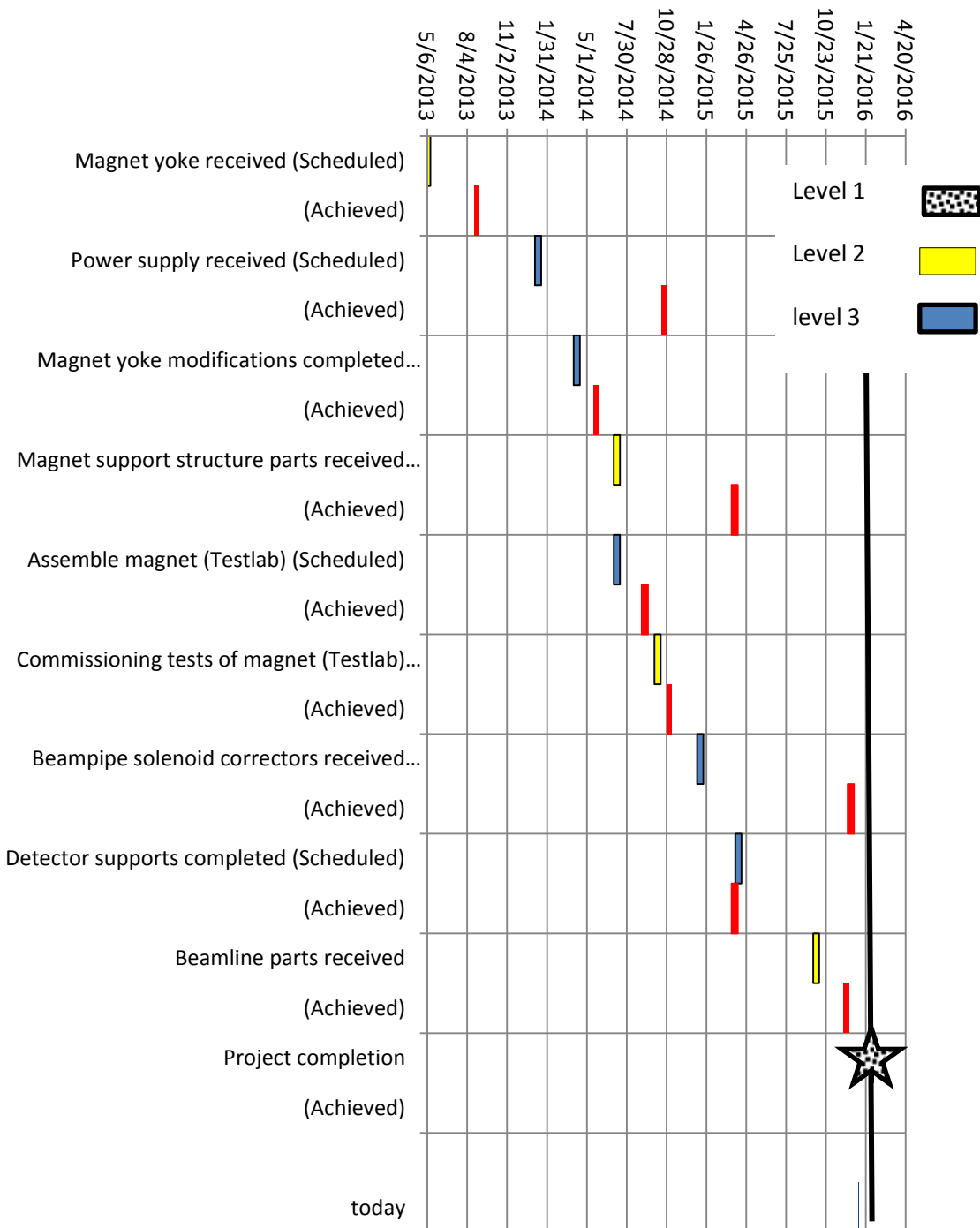
WBS 3.01 Milestones: (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 3/1/2016	Expected date 4/1/2016	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			Completed 7/28/2015
2 (3.2-30M)	UVa 17-29 GEM modules assembled and tested	3/2/2015	3/15/2016	3/30/2016	
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			Completed 3/5/2015
2 (3.2-60M)	2nd order of Front End Electronics	10/1/2015			Completed 3/5/2015
1 (3.1-10M)	Project completion	2/1/2017	2/1/2017	2/1/2017	

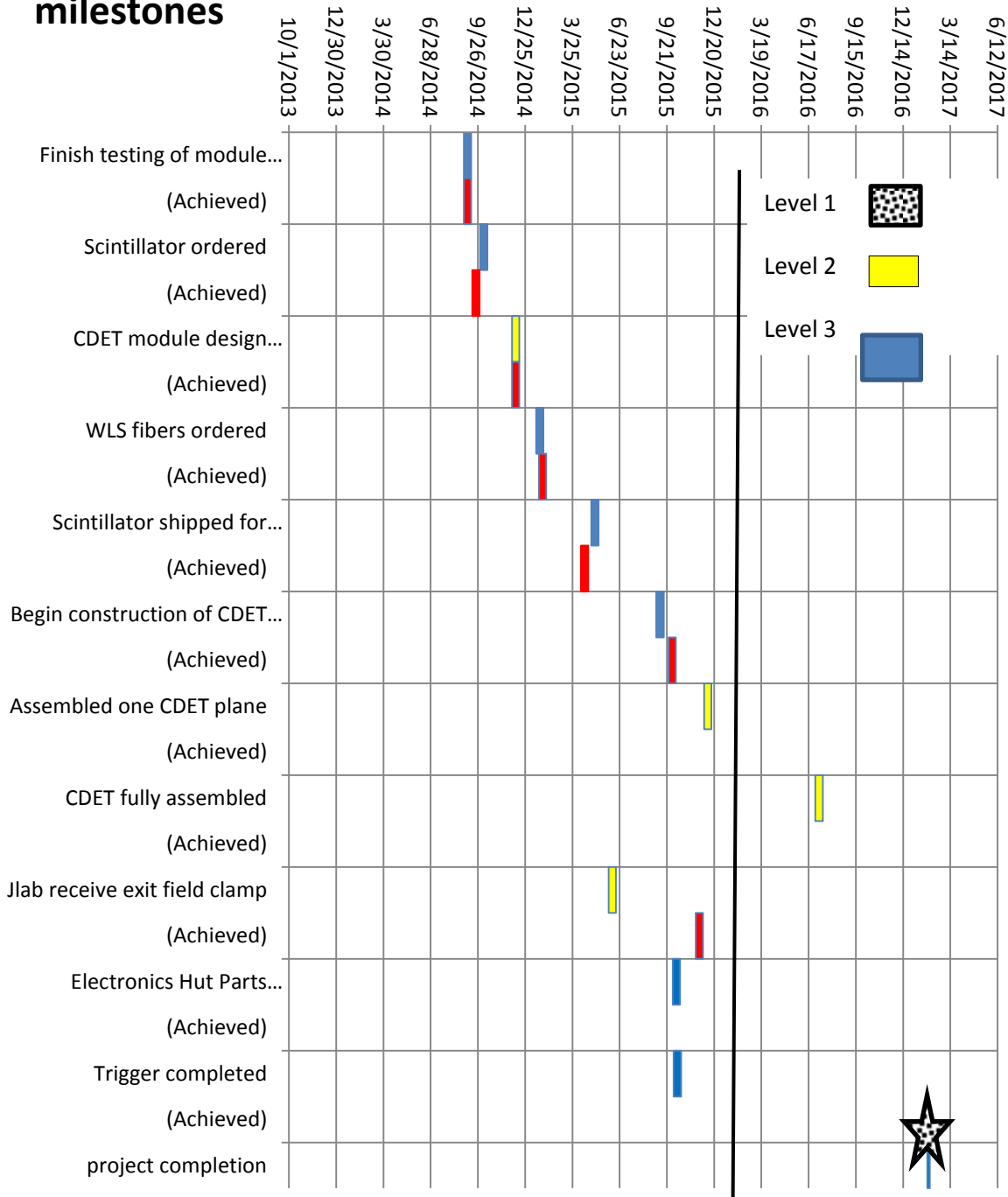
Appendix I

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).

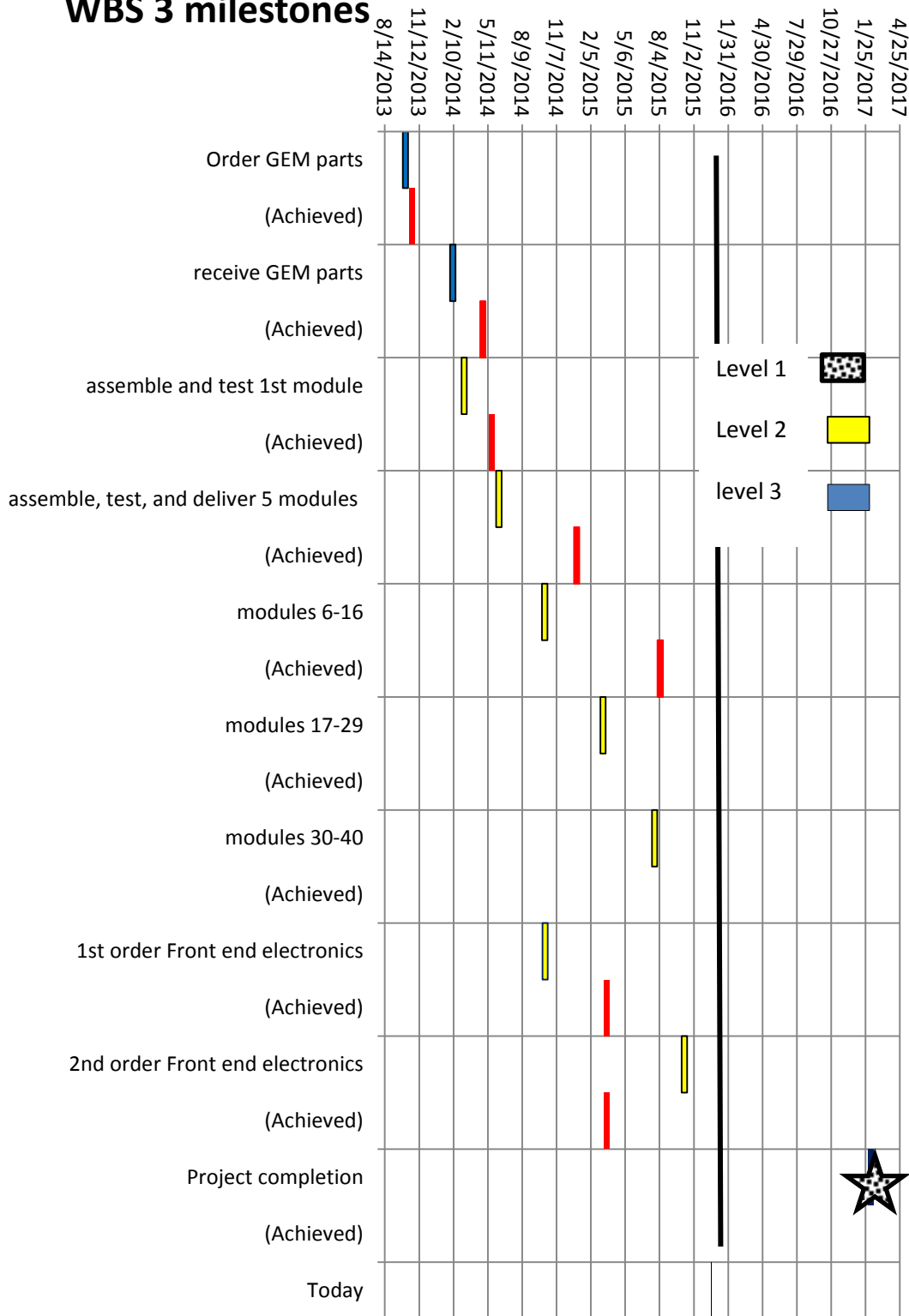
WBS 1 Milestones



WBS 2 milestones



WBS 3 milestones



Appendix II

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	Received by JLab in Aug 2015. Testing complete by Aug 2016
NINO chip front end cards system shipped to JLab	Jul 1, 2015	Completed Oct 2015
Purchase order issued for vessel	Oct 15, 2015	Completed Aug 2015
Full DAQ system ready	Dec 1, 2015	Expected August 2016
Vessel completely assembled	Mar 15, 2016	Expected July 2016
GRINCH ready for installation	Jun 15, 2016	Expected Sept 2016
Final analysis software complete	Jun 15, 2016	Expected Sept 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	Completed Sept 2015
Module assembly 50% complete	Mar 2016	Expect April 2016
Module assembly completed	Sept 2016	

Status update:

- Module production is ongoing. Have produced 108 modules (includes 102 modules at JLab) of the total of 288 modules in HCal.
- With the departure of the CMU technician in March, the CMU machinist was cross trained by the technician before she left CMU. A new technician has been hired and will start by the middle of March.
- The CMU machinist is working on the completion of aluminum back plates. After this is finished, CMU will have enough of the separate components (back plates, front plates and light guides) to assembly the remaining 36 modules.
- CMU expects to complete 144 modules by the end of April. This is a one month delay in meeting the goal of 50% (144 modules) by March. CMU expects to hire a summer student who will work on the assembly of the modules and help speed production to meet the goal of completion by September 2016.

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	Completed Dec 2015
Initial Electronics QA completed	Dec 2015	Completed Dec 2015
GEM chambers 3 and 4 completed	May 2016	
GEM chambers 5 and 6 completed	Dec 2016	

Status update:

- The three GEM modules for chamber 3 are undergoing cosmic tests in Rome as part of final QA.
- At Catania, two modules for chamber 4 are completed and the third is under construction.

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
Fabrication of C200 frame started	Sept 15 2015	Completed Sept 2015
Design of ECAL platform modification started	Dec 1 2015	Delayed until February 2016
C200 assembly completed and testing begins	Jan 15 2016	Completed Jan 2016
C200 report results, recommendations completed	June 1 2016	
Design of ECAL frame/oven started	July 1 2016	
ECAL platform in testlab .	Nov 1 2016	
Installation of lead glass started	Jan 15 2017	
Lead glass installation compete and cabling started	July 15 2017	
Cabling completed and cosmic tests started	Nov 1 2017	
Finished cosmic tests and ECAL is ready to install	Jan 15 2018	

Status update:

- The report which compares the costs, risk factors and experimental figure of method for three different options for ECal will be finished next month.
- Below is a photo of the C200 frame at Stonybrook University.



Polarized ^3He target from UVa (for GEN)

Milestone	Completion date	Comment
Selection of target-cell design for high luminosity	Nov 2014	Completed Oct 2014
Conceptual design document complete	Jan 2016	Draft available in Feb
Conceptual design review	Mar 2016	
Start bench test of 3 liter glass convection target	April 2016	
Conceptual design frozen	June 2016	
Test of glass/metal technology complete	June 2016	
Begin engineering and design	July 2016	
Bench test of 3 liter glass/metal target	Jan 2017	
Simulated beam test on the bench for full scale 6 liter cell	Sept 2017	
Begin production of full-scale cells	Nov 2017	
Engineering complete	Jan 2018	
Design of target hardware and instrumentation complete	June 2018	
Target is ready for installation	Jan 2019	

Status update:

- A draft of conceptual design report was ready in early February.
- Designers and engineers responded to draft with list of questions.
- Meetings have been held to discuss the draft, answer questions and work towards completion of the CDR.
- Steps needed to increase designer manpower have been started.
- The review of the CDR has been scheduled for March 28th.