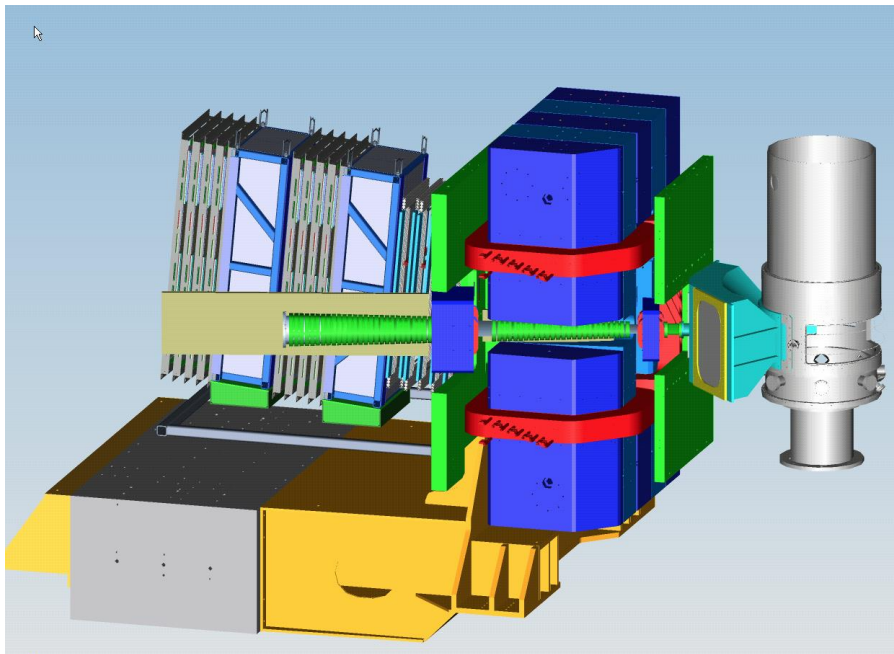


Super-Bigbite-Spectrometer (SBS)

Monthly Progress Report

January 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 39th 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 beamline corrector magnet coils were delivered in December. This completes a Level 3 milestone for WBS1. All WBS1 Level 2 and 3 milestones have been completed.
- The second GEM front tracker chamber (3 GEM modules) arrived at JLab from Italy in December. This completed a milestone for the Front Tracker dependency. A group from Italy came to JLab in December to setup the chamber and do an initial checkout.
- The initial quality assurance for the electronics for the GEM front tracker was completed in December which completes a milestone for the Front Tracker dependency.

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 December 2nd, 9th and 16th. 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 is at JLab.
- The corrector magnet coils were delivered on December 11th. The corrector magnet iron cores were already at JLab. This completes a Level 3 milestone.

WBS 1.2 Magnet/Detector Platforms:

- The floor plates were delivered on December 9th. The plates have been arranged in the TestLab with the magnet platform placed on top of the plates.

WBS 1.3 Beam Line:

- The vacuum beam pipe work continues. The vacuum beam pipe has been prepared for welding. It will be completed by January 20th.

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 1/1/2016: \$1741K (102.8%).
- The costed and obligated budget is \$47K above the allocated total budget in the PMP. Under the guidelines of the PMP, the program manager is allowed to approve this budget overrun, since the increase is below \$100K. The main reasons for the overrun were three roughly equal contributors: 1) increased labor costs to ensure timely completion of the beam pipe; 2) not correctly taking into account all beam pipe materials required in the Estimate-To-Complete; and 3) additional items required to complete the SBS platform. A small amount of work, estimated to be roughly \$4K, remains to be done on the beam pipe completion in January.

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 1/1/2016	Expected Date 2/1/2016	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	12/18/2015		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	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 December 2nd, 9th and 16th. 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):

- Construction of 14-scintillator groups and 16-fiber bundles for the CDet modules is continuing on pace to meet the milestone for completion of one CDEt plane by March 15th. During December 49 groups out of 56 needed for two more modules have been completed. This is addition to the 28 groups of scintillators and 28 bundles of fibers for one module which were completed in November.
- Production rate is 2 14-scintillator groups per work day. After the fabrication of the remaining 7 scintillator groups in January, then the production all 84 14-scintillator groups need for one CDet plane will be completed. The fabrication of the 16-fiber bundles fabrication will continue after

the 14-scintillator group construction is completed. The plan is to have all three modules for one CDet plane to be completed by February which is on track for the March 15th milestone.

- Kieran Hamilton, a student from University of Glasgow, will continue with the quality control tests of each of the completed 14-scintillator groups individually during January and February.
- A new SBS collaborator, Peter Monaghan from Christopher Newport University, has agreed to participate in the CDet project.

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

- Detailed design of the integrated beam line stands for lead shielding and corrector magnets is ongoing.
- The steel for the roofs of the electronic huts will be delivered to JLab in January.

WBS 2.3 Pole Shims and field clamp

- The shims were delivered in December.

WBS 2.4 Trigger:

- The nine CPUs for the CDet FASTBUS crates are scheduled for delivery in February.
- Work continues on integration of the FASTBUS, pipelined VME and GEM MPD electronics DAQ.

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 1/1/2016: \$1,022K (75%).

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

Level	Milestone	Scheduled Date	Expected date 1/1/2016	Expected date 2/1/2016	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	12/18/2015	1/18/2016	
2	Trigger completed	10/4/2015	2/1/2016	2/1/2016	
3	Assembled one CDET plane	12/1/2015	3/15/2016	3/15/2016	
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 December 2nd, 9th and 16th. 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

- The construction of module #24 was completed. Testing of the module has started.
- X-ray testing of modules #23 was completed: all sectors are operational.
- Construction of modules #25 and #26 is underway.
- After the planned holiday shutdown, UVa will get back to the expected production rate of 2 modules per month which keeps production on track for meeting the WBS3 milestones.

WBS 3.2 GEM electronics

- During the December visit, Paolo Musico fixed problems with UVa rear tracker backplanes that hold the front end electronics.
- Work is continuing at Jefferson lab for the integration of the MPD-APV GEM readout system into CODA.

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 1/1/2016: \$1,662K (95.6%).

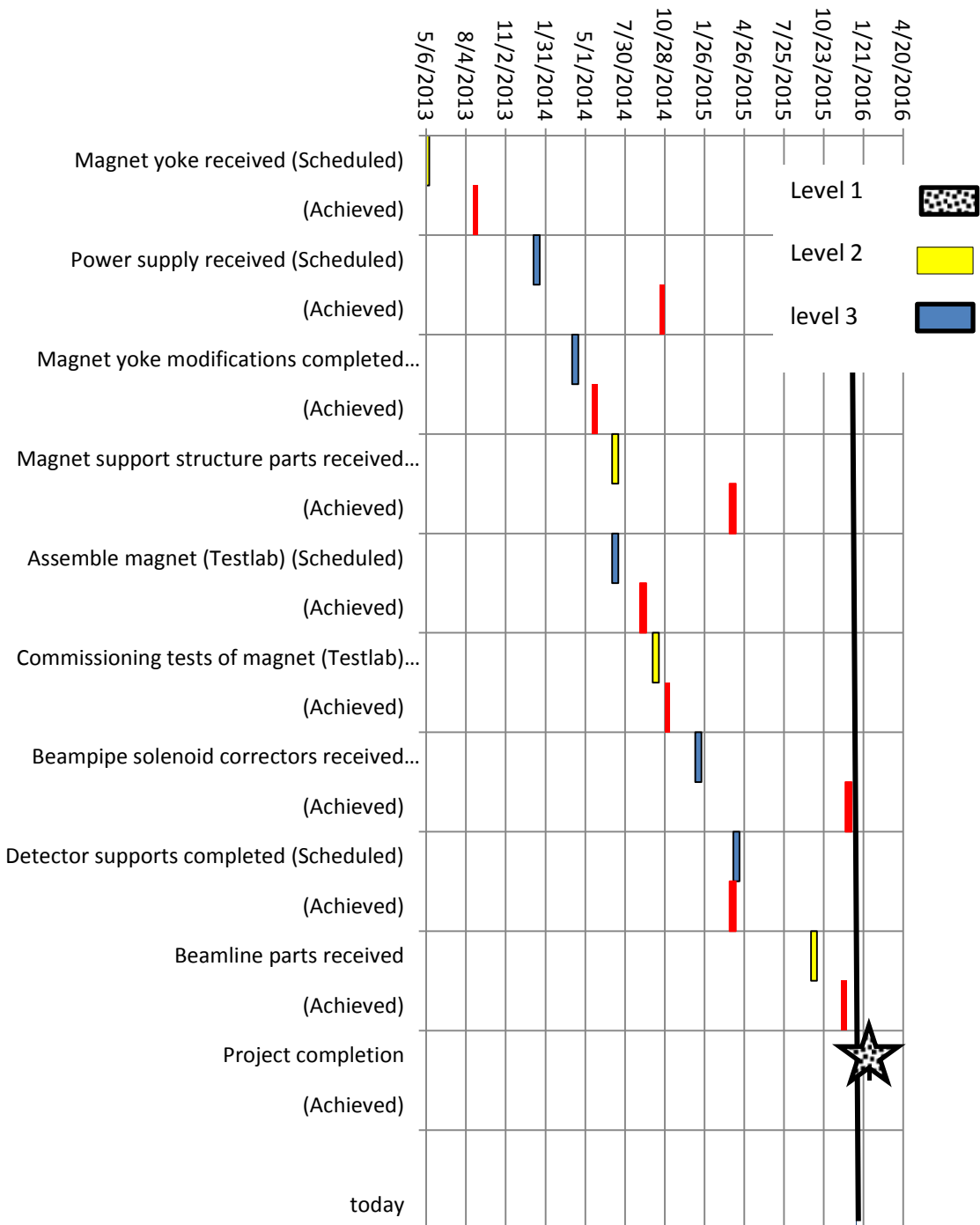
WBS 3.01 Milestones: (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 1/1/2016	Expected date 2/1/2016	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	3/15/2016	
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			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	

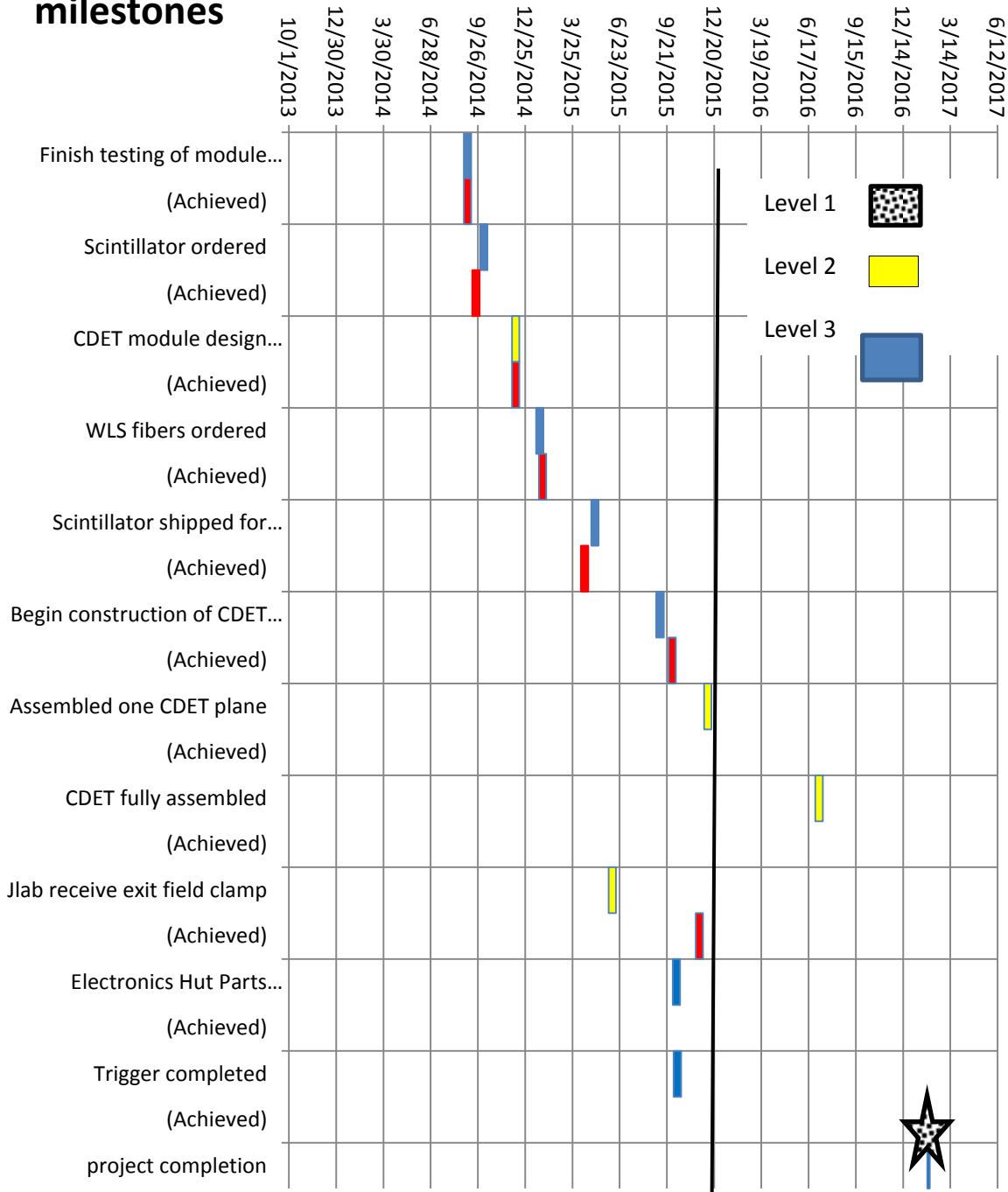
Appendix I

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).

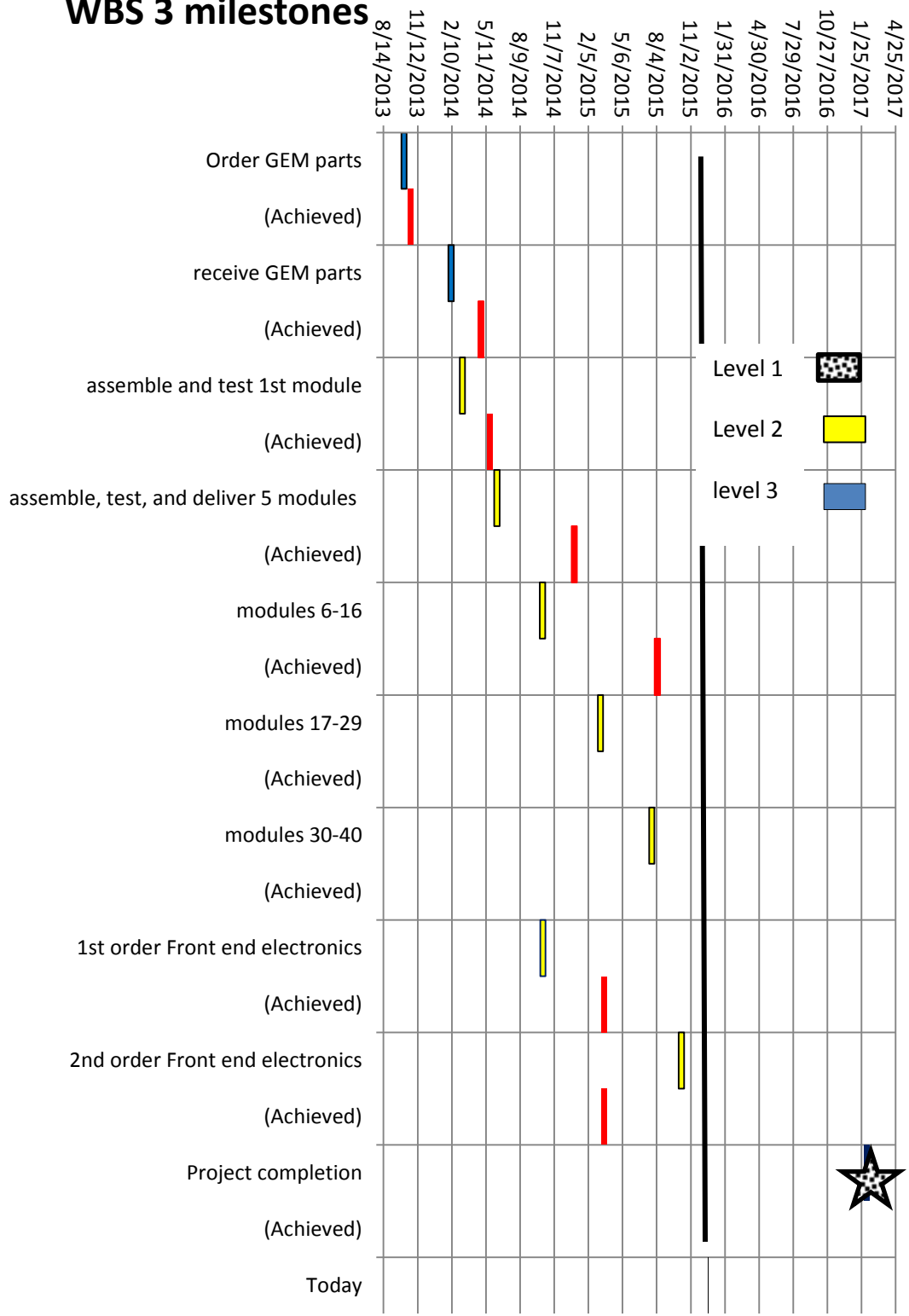
WBS 1 Milestones



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	Cards and cables finished at Glasgow. Shipment in October
Purchase order issued for vessel	Oct 15, 2015	Completed Aug 2015
Full DAQ system ready	Dec 1, 2015	Expected March 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

Status update:

- The vessel was delivered on December 21st.
- Using an external Helmholtz coil, the Photon Detector Array was tested for residual magnetic fields. The initial results show that the residual fields were at the expected level and a final report on the tests will be written.

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	
Module assembly completed	Sept 2016	

Status update:

- Module production is ongoing. Have produced 93 modules (includes 36 modules at JLab) of the total of 288 modules in HCal.
- By January 13th, 9 more modules will be completed and 66 modules will be shipped to JLab.

- Counting the 36 modules already at JLab, we will have 102 completed modules at JLab by the end of January. We expect to make another shipment by late March. This will meet our goal of 50% (144 modules) by March.

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 second GEM chamber (3 GEM modules) was delivered to JLab on December 8th . Evaristo Cisbani, Paolo Musico and three technicians came to JLab from December 7th to 17th. They worked on setting up the chamber and testing the electronics.
- The initial electronics quality assurance has been completed. All of the 345 front end cards and 28 MPD modules has passed the initial tests.
- Cosmic ray testing of the three GEM modules for chamber 3 is ongoing at INFN-Rome.

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	
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 complete 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 C200 assembly is expected to be completed in January and testing can start.
- The start of the design of the ECAL platform modification is delayed until February 2016, since JLab design manpower was needed for other tasks. The delay does not affect the C200 work and can be absorbed into the long term ECAL schedule.

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	
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	