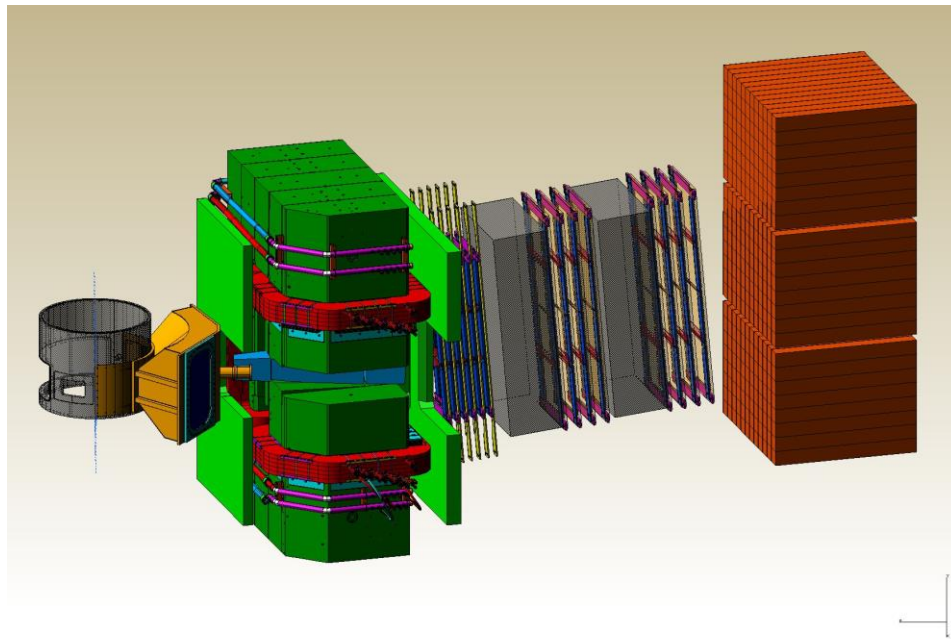


Super-Bigbite-Spectrometer (SBS)

Monthly Progress Report

October 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 36th 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 HCal has produced 72 of the 288 modules. This meets the milestone of completing 25% of the modules by September 2015.
- The CDet has started construction of the first module which completes a Level 3 milestone for the WBS2 project.
- The fabrication of the C200 frame has started at StonyBrook. This completes a milestone for the ECal dependency.
- The updated milestones for the polarized target (an SBS dependency) are in the Appendix II.

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 Sept 9, 16, 23 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: Shipment of the coil was delayed due to problems brazing the end of the conductors. After consultation with JLab engineers, the problem was resolved and shipment is expected on October 9th with a 4 week delivery time.
- The clamp supports were ordered in September with a delivery date of Nov 24th.
- Installation work for the SBS power was completed in September.
- The sieve slit was ordered in September.
- The vendor working on the front field clamp contacted JLab to clarify the pre-assembly procedure and is now working on machining the plates.

- The corrector magnets were ordered in September. It was split into two orders: a separate vendor for the coils (ordered Sept 22nd) and another one for the iron cores (ordered Sept 17th). Both have a deadline of Dec 4th 2015. The conductor for the coils has already been ordered.

WBS 1.2 Magnet/Detector Platforms:

- All of remaining equipment for the SBS magnet platform was ordered in September.

WBS 1.3 Beam Line:

- No vendor bid to build the beam pipe. The complexity of fabrication and short time period for construction was a deterrent for bids. The Jlab engineers redesigned the welds to allow vendors more fabrication options. With these changes, the beam pipe has gone out for bids with the bid due date on Oct 5th.

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 10/1/2015: \$1,591K (93%).
- The last major remaining item to be ordered is the beam pipe. The expected cost of the beam pipe was \$52K (burdened). There is \$50K of contingency left in the budget. Two other small items estimated at \$15K (burdened), but we are waiting until the beam pipe has been obligated before ordering the items.

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 10/1/2015	Expected Date 11/1/2015	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	12/04/2015	12/04/2015	.
3	Detector supports completed	4/1/2015			Completed 3/24/2015
2 (1.2-30M)	Beam-line parts received	9/24/2015	12/18/2015	12/18/2015	
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 Sept 9, 16, 23 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):

- Construction of CDET modules started on 9/24/2015. This completes a Level 3 milestone.
- The fabrication of all the parts for assembling all six CDET modules by Vision Machine & Fabrication Corp. in Hampton has been completed and delivered to JLab.
- Parts for gluing jig (of final module design) arrived at JLab on 9/21/2015 and the new parts were mounted on the jig.
- First 14 scintillators for module construction has been glued together to form a group for the new design. Three such groups of scintillators have been assembled to date.
- Approximately 300 WLS fibers have been cut to 88 cm and 74 cm lengths and they have been machined and polished at one end.

- First 16-fiber bundle and WLS adapter has been accurately glued together. A new jig is required for mass production. It has been designed and ordered.

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

- The preliminary design of the small GEM electronics hut was completed.
- Work continues on the detailed design of the integrated beam line stands for lead shielding and corrector magnets.
- Preliminary drawings for the steel roof and supports for the large DAQ electronics hut have been completed.

WBS 2.3 Pole Shims and field clamp:

- The shim insertion device was ordered in September.
- The steel for the rear field clamp was shipped from BNL to the vendor.

WBS 2.4 Trigger:

- Work continues on the DAQ test of the FASTBUS for ECal and for the VME trigger for HCAL.

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 10/1/2015: \$927K (71%).

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

Level	Milestone	Scheduled Date	Expected date 10/1/2015	Expected date 11/1/2015	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			Completed 4/10/2015
2	JLab receives exit field clamp	6/2/2015	11/18/2015	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	9/15/2015		Completed 9/24/2015
3	Assembled one CDET module	10/1/2015	10/15/2015	10/15/2015	
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	12/15/2015	12/15/2015	
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 Sept 9, 16, 23 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

- The construction of modules # 19 and #20 was completed.
- X-ray testing of module 19 will start on Oct 1st and module #20 is being prepared for testing.
- X-ray testing of modules #17 and 18 was completed. All sectors of both modules are fully operational.
- Construction of module #21 is underway.
- Received two GEM foil shipments from CERN.

WBS 3.2 GEM electronics

- Work is continuing at Jefferson lab for the integration of MPD-APV GEM readout system into CODA. Currently waiting for the MPD electronics units from Italy for the MPD system to be setup at UVa.

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 10/1/2015: \$1430K (85%). This number dropped from the previous month, because procurement was not able to finish the order with UVa for the extra five modules by Oct. 1. The order is being done in the beginning of October.

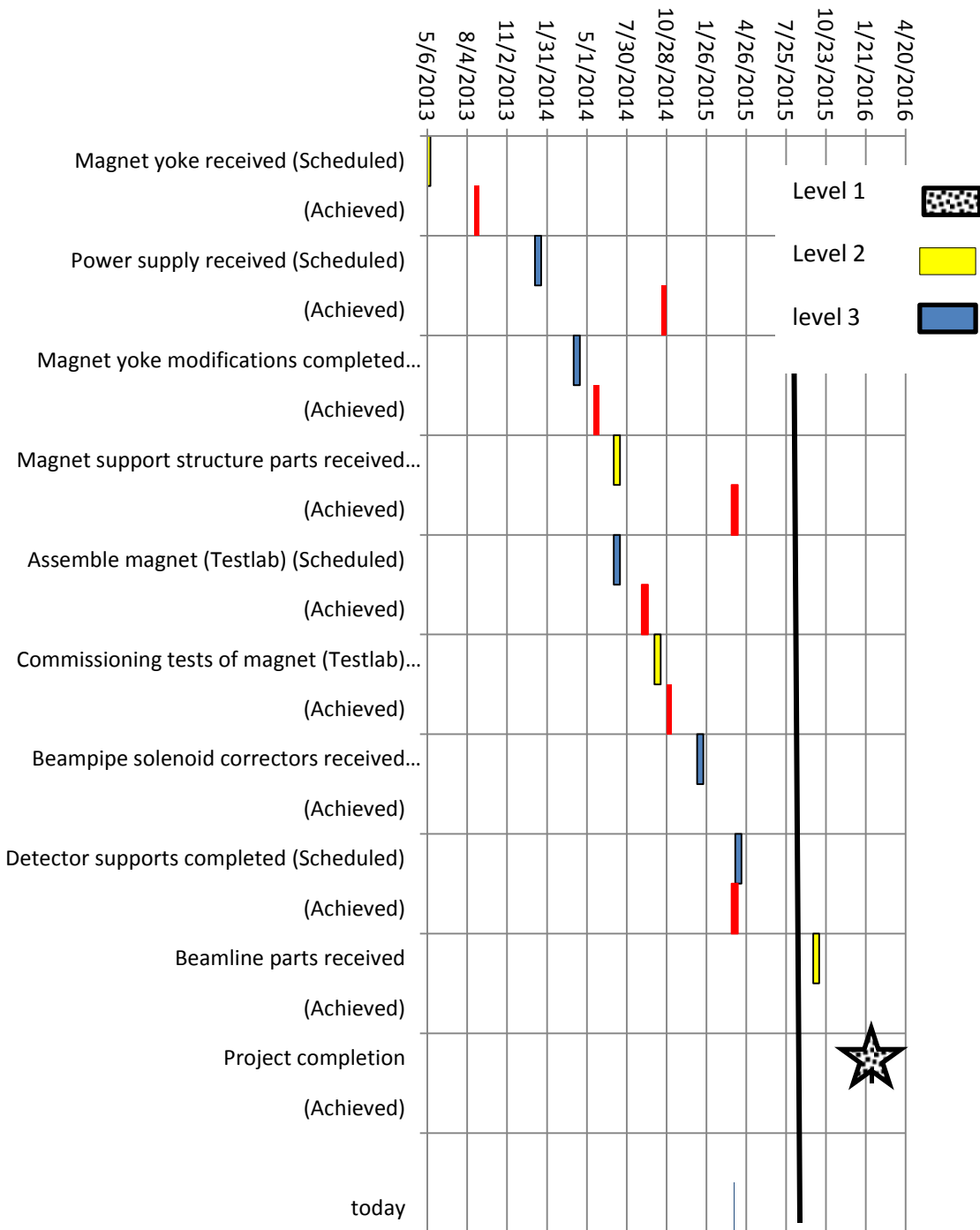
WBS 3.01 Milestones: (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 10/1/2015	Expected date 11/1/2015	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			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	7/31/2017	7/31/2017	7/31/2017	

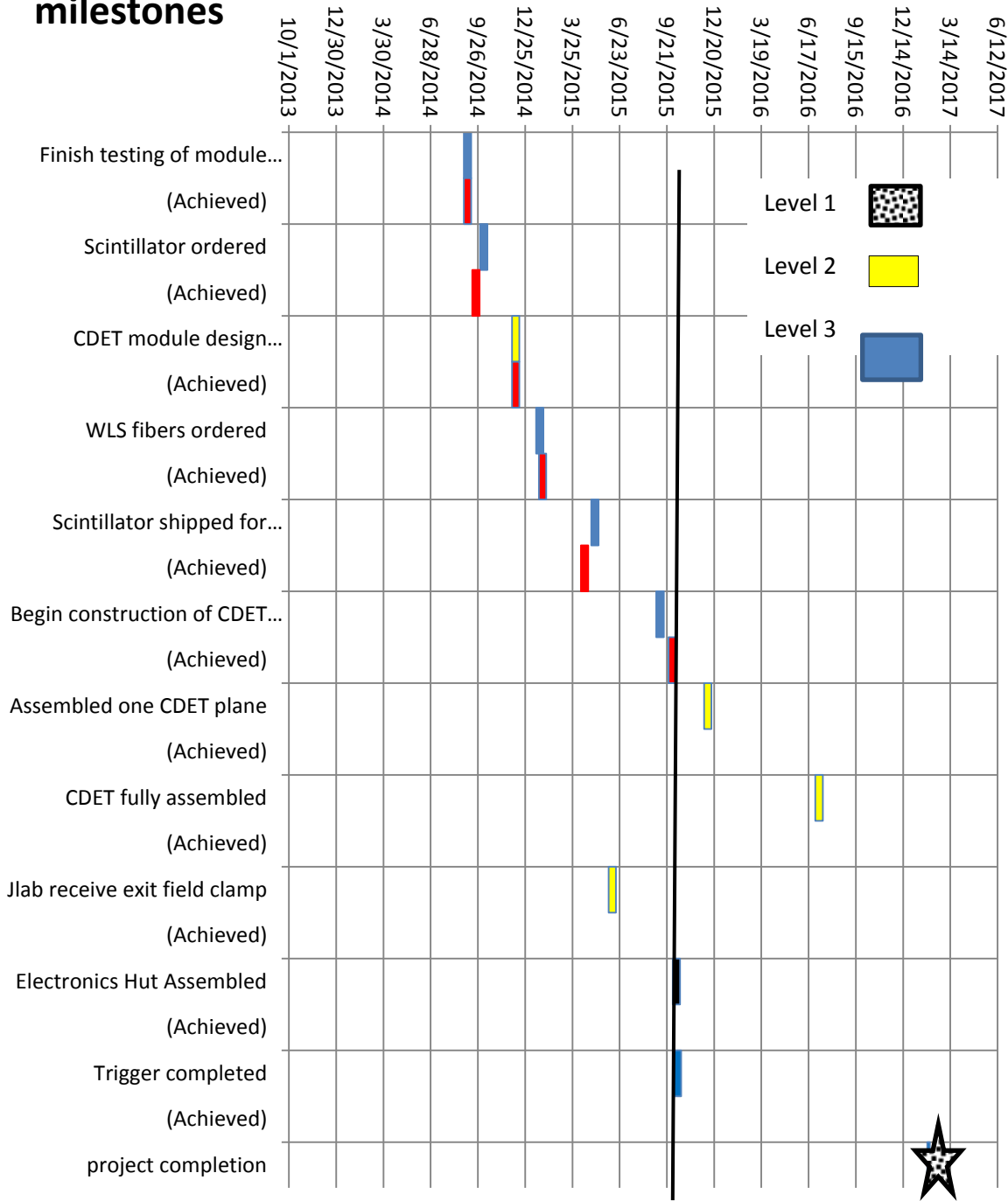
Appendix I

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).

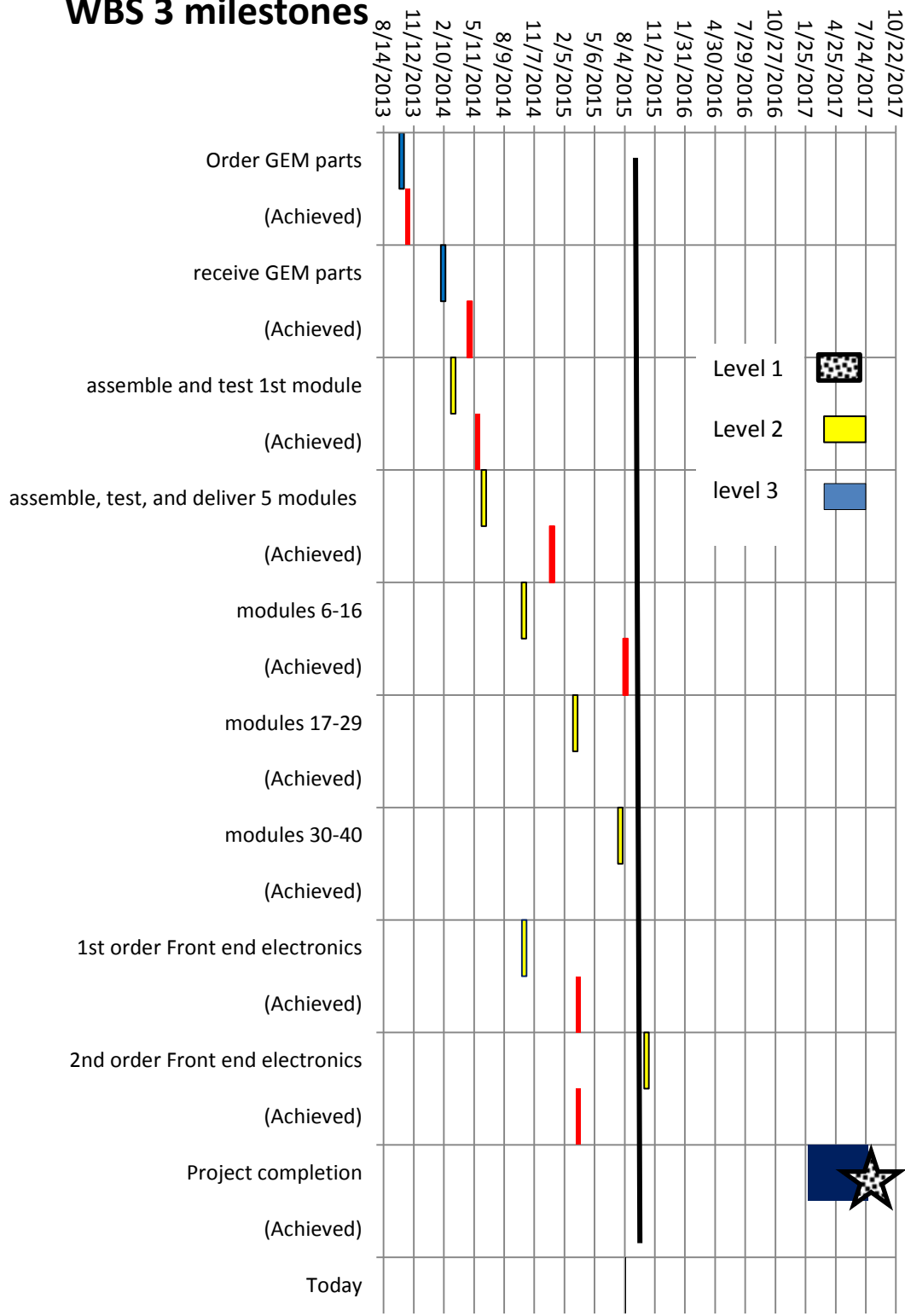
WBS 1 Milestones



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	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

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 72 modules of the total of 288 modules in HCal. This meets the milestone of 25% completion by Sept 2015.
- The last delivery of modules shells, lids, and ribs were delivered to CMU by VersaFab yesterday. All work by outside vendors is completed.
- The CMU machinist is working on the next 60 pairs of end plates. In the beginning of October, the CMU technician will shift from assembly to help with production of end plates.
- The HCal subassembly frames were ordered at the end of September and have a delivery date of March 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	Chamber 1 is at JLab Expect 2 nd chamber Oct 2015
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
Fabrication of C200 frame started	Sept 15 2015	Completed Sept 2015
Design of ECAL platform modification started	Dec 1 2015	
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 fabrication of the C200 frame has started at StonyBrook. This completes a milestone for this dependency.

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	