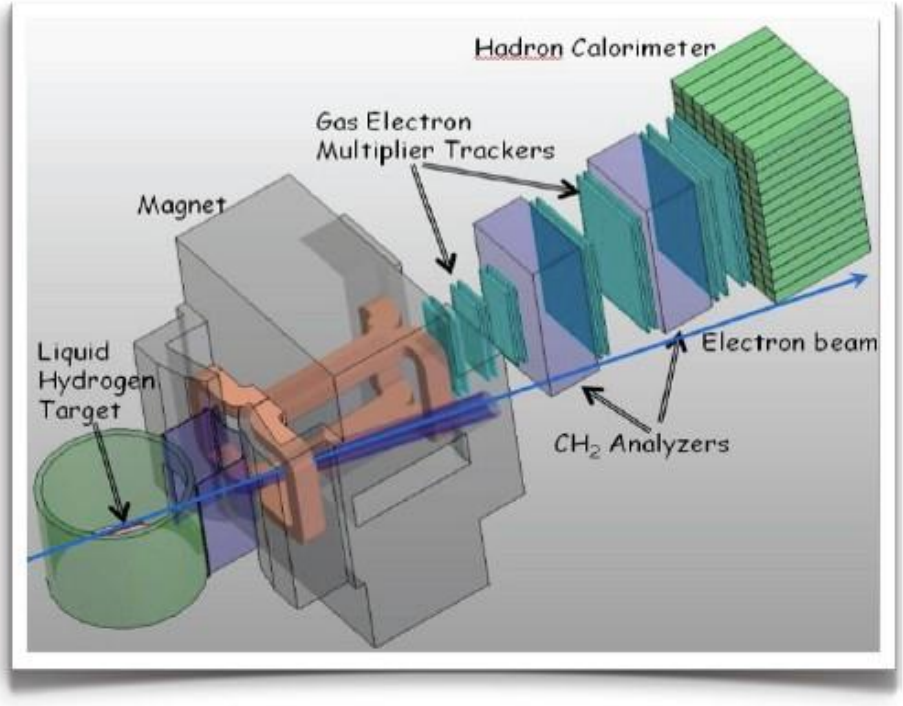
Jefferson Lab
Thomas Jefferson National Accelerator Facility

Super-BigBite-Spectrometer (SBS)

Monthly Progress Report

December 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 27th 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.

- DOE SBS review on Nov 4 and 5th.
- One of the two recommendations from the DOE SBS review was to update the schedule for the Coordinate Detector (CDET) in WBS2 by Jan 15th,2015. In Appendix III, an updated draft schedule is presented. The WBS 2 milestone table and chart are kept the same until approval of the updated WBS2 schedule.
- One comment from the DOE review was that the milestones for the SBS dependencies listed in Appendix II should be more fine-grained and increase in number. The milestones for the GRINCH have been updated and the rest of the dependencies will be updated in the next report.

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 November 12 and 19th. 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:

- Coils:
  - Racetrack coils: Last 2 coils were delivered by Nov 15th. All 11 coils at JLab.
  - Saddle coil: The contract was awarded to Buckley. Scheduled for delivery by July 31, 2015.
- Studies of the beam line corrector magnets and passive magnet shielding of exit beam pipe at all kinematic settings are ongoing with an anticipated completion date of January 23, 2015.

WBS 1.2 Magnet/Detector Platforms:

- Delivery of platform expected at end of January 2015.

WBS 1.3 Beam Line:

- Contacted vendor for vacuum chamber snout construction and work is proceeding. Expected delivery of snout in Feb 2015.

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 12/1/2014: $1147K (68%).

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 11/1/2014	Expected Date 12/1/2014	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			**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	1/1/2015	1/30/2015	Expect delivery Jan 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	3/5/2015	3/5/2015	
3	Detector supports completed	4/1/2015			Detector supports are part of the magnet platform which will be delivered in Jan 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 November 12 and 19th. 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):.

- Fermilab completed a test production run of scintillator bars. They were able to produce scintillators bars with the appropriate size hole for the wavelength shifting fiber and still keep the thickness and width of the bar large enough for machining. Fermilab will be able to do the production run in January 2015.
- Fermilab is sending the scintillator bars from the test run to JLab. They used to obtain requisition quotes for machining of the bars.
- With the successful test production run at Fermilab, ISU plans to order the wavelength shifting fiber in December.

- One of the two recommendations from the DOE SBS review was to update the schedule for the Coordinate Detector (CDET) in WBS2. In Appendix III, an updated draft schedule is presented.

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

- Design of the small hut for the GEM electronics is ongoing.
- Plan to start design work on the detector frames in January 2015.

WBS 2.3 Pole Shims and field clamp:

- Steel from BNL will be used for the rear clamp. In December, drawings for the clamp will be updated and procurement expected in January.
- Preliminary analysis of the pole shims to evaluate using on-site steel has started and is ongoing.

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 12/1/2014: $710K (54%).

WBS 2.01 Milestones: See Appendix 1 for a graphic view of the milestones .

Level	Milestone	Scheduled Date	Expected date 11/1/2014	Expected date 12/1/2014	Comment
1	Project start	10/1/2013			**Completed 10/1/2013**
3	Scintillator and Wavelength Shifting Fibers ordered ordered	7/30/2014	11/30/2014	12/15/2014	With test production completed, can proceed with order of WLS
3	Finish testing of module prototype	8/30/2014			**Completed 8/30/2014**
3	Scintillator shipped for machining	10/30/2014	4/30/2015	4/30/2015	With test production completed, expect full production run in Jan 2015
3	Complete plastic absorber structure design	11/15/2014	12/15/2014	12/15/2014	Delay of one month will not effect overall assembly schedule
3	Begin assembly of modules	12/15/2014	6/15/2015	6/15/2015	
3	Begin construction of plastic absorber structure	1/15/2015	2/15/2015	2/1/2015	
2	Coordinate Detector assembled	3/30/2015	9/30/2015	9/30/2015	
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 November 12 and 19th. 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

- As part of the final QA for GEM module #5, the high voltage (HV) was turned on for testing with source and cosmic rays. The full operating HV can be reached at relatively low gas flows. Unfortunately, the HV becomes unstable as the gas flow is increased to operational flow levels. The module is kept under dry N2 while this issue is studied further.
- GEM module #6 has been constructed and is being prepared for final QA tests.
- The foil shipment #5 arrived from CERN on 11/13. The 11 GEM foils and 3 readout foils passed the initial QA. This gives a total of 7 readout foils and 19 GEM foils that have passed the initial QA and are on-hand to be used in module construction.
- The x-ray tube testing shielding box passed the radiation safety inspection. A prototype chamber is being installed in the box for initial testing of the system. These actions are in sync with the comment by the DOE SBS review that "The X-ray test set up should be

completed expeditiously so that the early production modules can be tested under extreme rates."

WBS 3.2 GEM electronics

- The statement of work for GEM electronics was completed. A purchase requisition was submitted on Dec 1. The purchase requisition orders all electronics in this fiscal year which moved forward $209K from FY16.

WBS 3 Costs:

- Budget for this WBS for FY15 is $371K.
- The incremental budget of FY13+FY14+FY15 is $1,440K
- Costed and obligated as of 12/1/2014: $987K (69%).

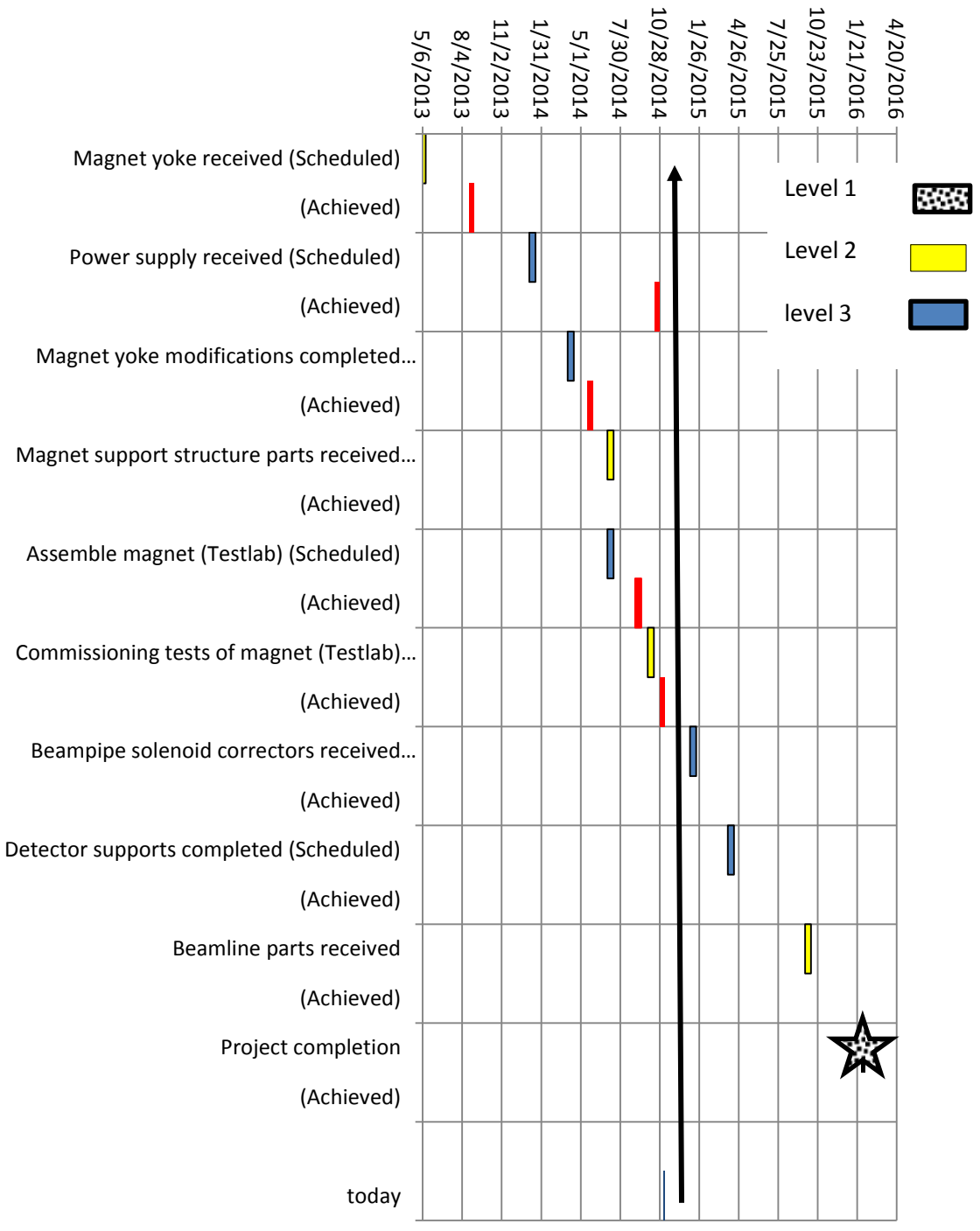
- **WBS 3.01 Milestones:** (see Appendix 1 for a graphic view of the milestones)

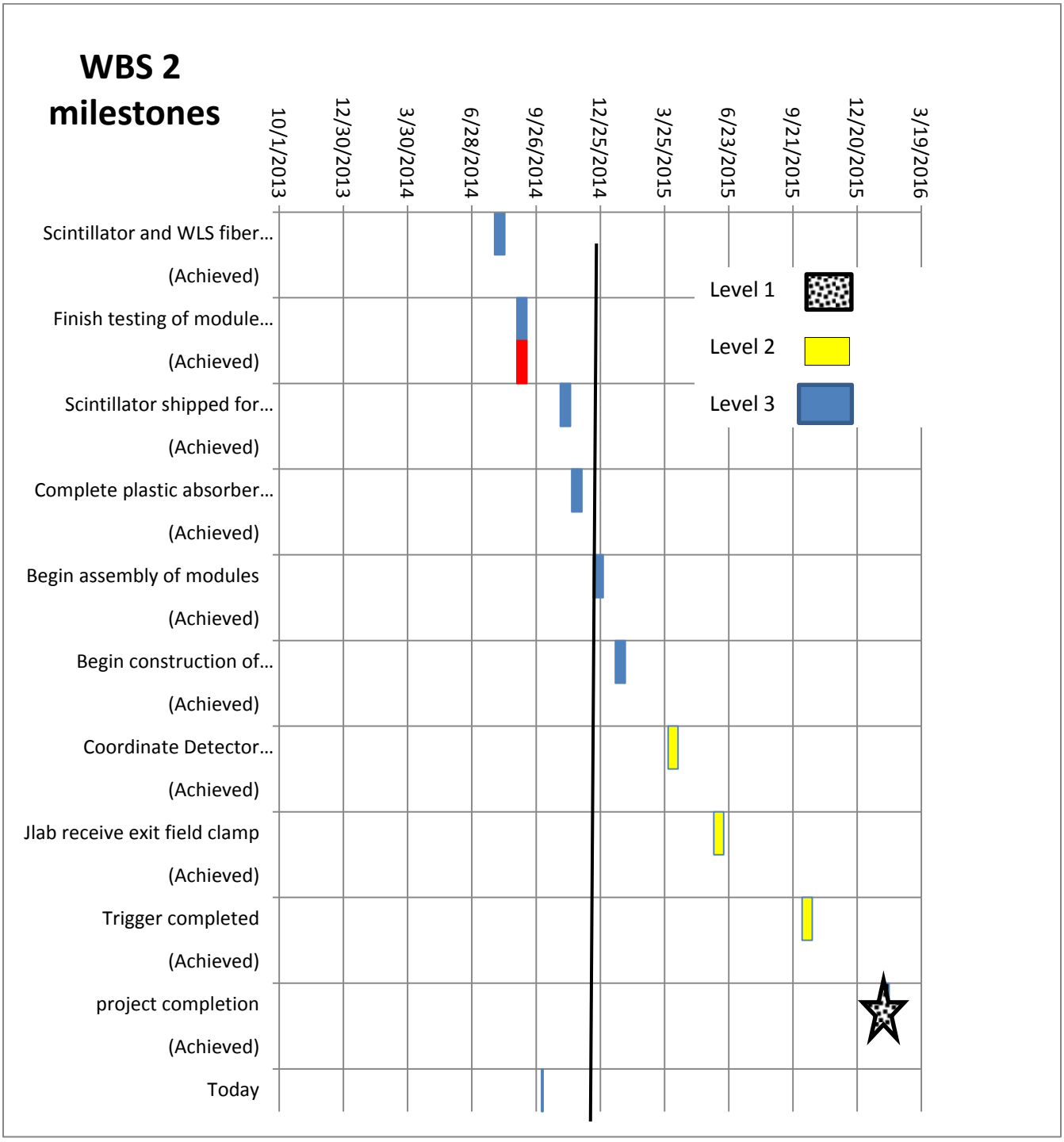
Level (ID#)	Milestone	Scheduled Date	Expected date 11/1/2014	Expected date 12/1/2014	Comment
1 (3.1-01M)	Project start	10/1/2012			**Completed 10/1/2012**
3	Order GEM Parts	10/1/2013			**Completed 10/18/2013**
3	UVa receives GEM parts	2/3/2014			**Completed 4/23/2014**
2 (3.2-01M)	First module assembled and tested	3/3/2014			**Completed 5/15/2014**
2 (3.2-10M)	UVa 5 GEM modules assembled and tested	6/2/2014	11/10/2014	12/15/2014	Investigate problem with holding HV in module #5 that was found in final QA.
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	2/1/2015	2/1/2015	
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
10/1/2013
12/30/2013
3/30/2014
6/28/2014
9/26/2014
12/25/2014
3/25/2015
6/23/2015
9/21/2015
12/20/2015
3/19/2016
Scintillator and WLS fiber…
(Achieved)
Finish testing of module…
(Achieved)
Scintillator shipped for…
(Achieved)
Complete plastic absorber…
(Achieved)
Begin assembly of modules
(Achieved)
Begin construction of…
(Achieved)
Coordinate Detector…
(Achieved)
Jlab receive exit field clamp
(Achieved)
Trigger completed
(Achieved)
project completion
(Achieved)
Today
Level 1
Level 2
Level 3


WBS 3 milestones
8/14/2013
11/12/2013
2/10/2014
5/11/2014
8/9/2014
11/7/2014
2/5/2015
5/6/2015
8/4/2015
11/2/2015
1/31/2016
4/30/2016
7/29/2016
10/27/2016
1/25/2017
4/25/2017
7/24/2017
10/22/2017
Order GEM parts
(Achieved)
receive GEM parts
(Achieved)
assemble and test 1st module
(Achieved)
assemble, test, and deliver 5 modules
(Achieved)
modules 6-16
(Achieved)
modules 17-29
(Achieved)
modules 30-40
(Achieved)
1st order Front end electronics
(Achieved)
2nd order Front end electronics
(Achieved)
Project completion
(Achieved)
Today
Level 1
Level 2
level 3

Appendix II

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 ^{3}He target from UVa (for GEN)

1. Selection of target-cell design for high luminosity: August 2014 (+3 months float) **Completed Oct 2014**
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 ^{3}He target is ready, June 2017 (+6 months float)

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

Milestone	Completion date	Comment
Design and drawings for vessel are complete	Feb 1, 2015	
Photon Detector Array assembled and tested	Aug 1 , 2015	
NINO chip front end cards system shipped to JLab	Jul 1, 2015	
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	

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)

Appendix III

Proposed updated schedule for CDET construction in WBS2

Level	Milestone	New Scheduled Date
1	Project start	10/1/2013
3	Scintillator ordered	9/30/2014
3	Finish testing of module prototype	8/30/2014
3	Wavelength Shifting Fibers ordered	1/15/2015
3	Scintillator shipped for machining	4/30/2015
3	Begin preparation of WLS fibers	6/15/2015
3	Begin construction of CDET modules	9/1/2015
3	Assembled one CDET module	10/1/2015
3	Assembled one CDET plane	12/1/2015
2	Coordinate Detector assembled	9/30/2016
1	Project completion	1/29/2017