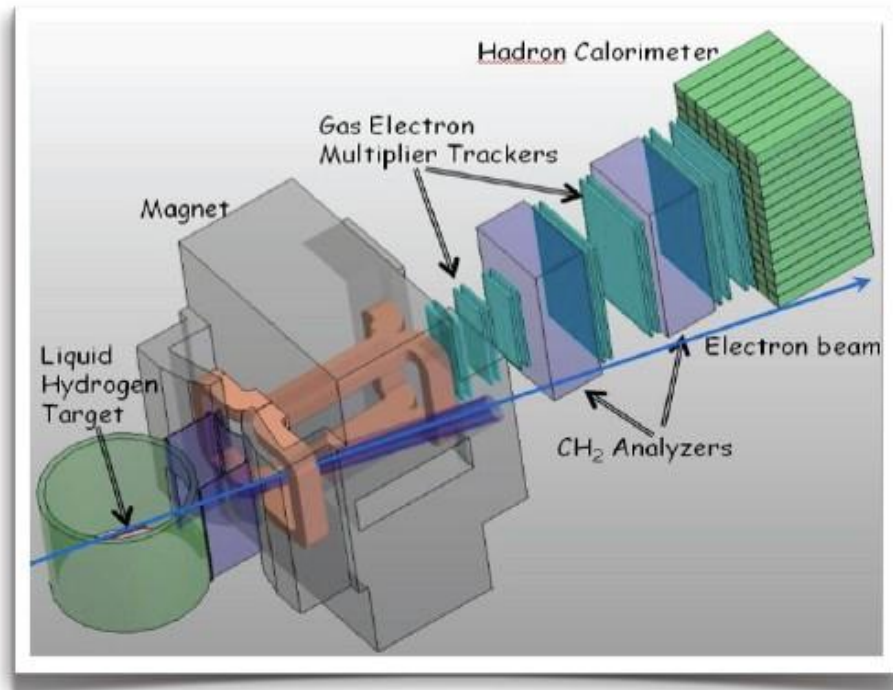


Super-BigBite-Spectrometer (SBS)

Monthly Progress Report

November 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 26th 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.

- Power supply arrived at Jlab on October 17th. This completes a Level 3 milestone.
- Magnet was commissioned on Oct 29th. This completes a Level 3 milestone.
- Preparations for DOE SBS review on Nov 4 and 5th.

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 October 8 and 15th. 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:

- Testing of the SBS magnet at 200A (10% of planned maximum running current) was completed on October 29th. This completes a Level 3 milestone. Measurements of the field was 2% off from the TOSCA calculation which maybe caused by incorrect B-H curve for the steel in TOSCA. Plan to make a B-H measurement of the steel from the beamline cut-out in the magnet.
- The power supply arrived at Jlab on October 17th. This completes a Level 3 milestone. The power supply was put in the hall before the hall was closed for beam and experiment commissioning in Hall A. It will have an acceptance test in Jan 2015 when the beam has a scheduled down.
- Coils:
 - Racetrack coils: Nine coils are on site. Remaining 2 coils will be delivered by Nov 15th.
 - Saddle coil: The bids have been received and procurement is in the award stage.
- Preliminary drawings of the beam line correctors are complete. Studies of the beam line corrector magnets and passive magnet shielding of exit beam pipe at all kinematic settings are 30% complete.

WBS 1.2 Magnet/Detector Platforms:

- JLab engineer visited the vendor for the magnet platform in October. The main platform delivery is delayed until late Jan 2015. The plan is still to do the assembly of counter weight and platform at the vendor before shipping to JLab.

WBS 1.3 Beam Line:

- The preliminary drawings of the exit beam pipe are complete.
- The scattering chamber snout contract was awarded. Expected delivery of the snout in February 2015. Vacuum windows have been designed. Test procedure for vacuum windows has been determined and the windows will be tested in March 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 11/1/2014: \$1133K (67%).

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

Level (ID#)	Milestone	Scheduled Date	Expected Date 10/1/2014	Expected Date 11/1/2014	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	11/1/2014	1/1/2015	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	1/5/2015	3/5/2015	Completed 30% of the experimental configurations Still have 11 months are float.
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 Oct 8 and 15th, 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):

- Initial test by the Fermilab scintillator group with a die were not successful. With a different die they were able to produce a scintillator bar with the correct hole size for the wavelength shifting fiber, but the thickness is 7mm instead of 10mm. JLab has obtained a sample and testing whether the machining is possible with this 7mm thickness. At the same time, Fermilab is investigating whether a thicker bar can be made from this die.
- If new die is needed, then there will be a delayed in production. After talking with Fermilab, this would be about a 4 month delay. Decided to use the more conservative estimate and modify expected date by 4 months. This leaves 4 months float to project completion.

- Purchasing of wavelength shifting fiber has been postponed by one month until the production method of the scintillator is finalized. Delay in ordering WLS will not affect overall schedule.
- Completion of the plastic absorber structure design is delayed until Dec 15, 2014.

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

- Work has started on the design of the electronics hut.
- Plan to start design work on the detector frames in January 2015.

WBS 2.3 Pole Shims and field clamp:

- The preliminary drawing of clamp is complete. Investigating the use of BNL steel.
- Preliminary analysis of the pole shims to evaluate using on-site steel has started and is ongoing.

WBS 2.4 Trigger:

- A document about the DAQ for the SBS experiments has been written for the Nov 2014 review. This will be used to plan the trigger purchases.

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 11/1/2014: \$704K (54%).

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

Level	Milestone	Scheduled Date	Expected date 10/1/2014	Expected date 11/1/2014	Comment
1	Project start	10/1/2013			Completed 10/1/2013
3	Scintillator and Wavelength Shifting Fibers ordered	7/30/2014	10/30/2014	11/30/2014	Delay in ordering WLS by will not affect overall schedule.
3	Finish testing of module prototype	8/30/2014			Completed 8/30/2014
3	Scintillator shipped for machining	10/30/2014	12/30/2014	4/30/2014	Shifted by 4 months due to uncertainty in production method.
3	Complete plastic absorber structure design	11/15/2014	11/15/2014	12/15/2014	Delay of one month will not effect overall assembly schedule
3	Begin assembly of modules	12/15/2014	2/15/2014	6/15/2015	
3	Begin construction of plastic absorber structure	1/15/2015	1/15/2015	2/1/2015	
2	Coordinate Detector assembled	3/30/2015	5/30/2015	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	GEMs (UVa)
		WBS 3.2	GEM electronics (UVa)

WBS 3.02 Project Oversight:

- SBS weekly meetings, via tele and video conference were held on October 8 and 15th. 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

- Construction and testing of GEM module #4 is complete.
- GEM module #5 has been constructed and is undergoing final QA tests.
- Construction of GEM module #6 has begun.
- Tests of the GEM chambers at high rate are planned using an X-ray source. The X-ray source will also speed up QA testing of the chambers compared to using cosmic rays. A lead-lined box is being constructed.
- Received the first batch of extra frames (to address the readout foil deflection issue). These frames were glued onto module #5 already and will be glued to the other completed modules soon.

WBS 3.2 GEM electronics

- A document about the DAQ for the SBS experiments has been written for the Nov 2014 review. This will guide the decision on the DAQ hardware needed by the GEMs to interface with the rest of the DAQ system.
- Writing the statement of work for GEM electronics has begun. The plan is to submit the purchase requisition in November.

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 11/1/2014: \$982K (68%).

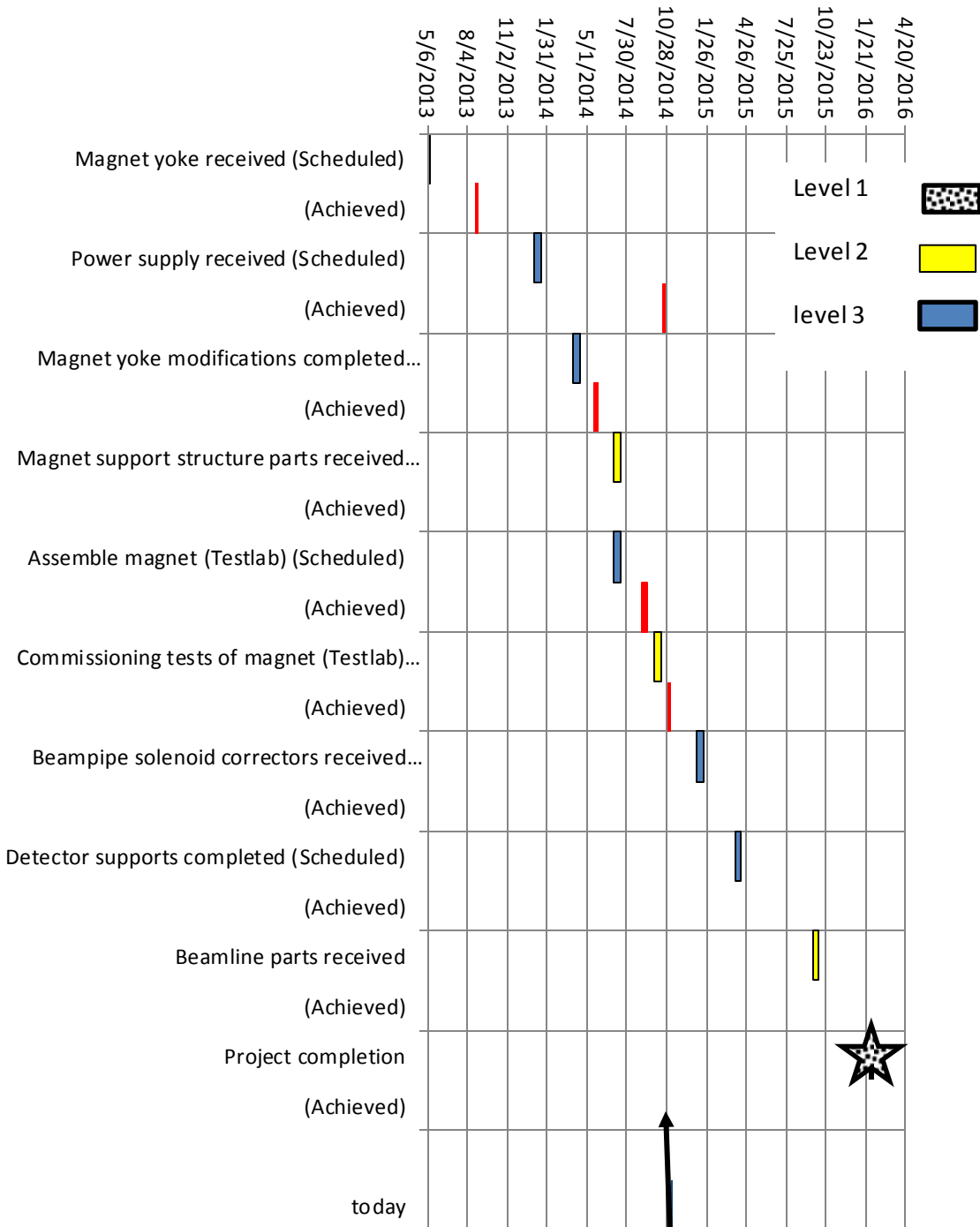
- **WBS 3.01 Milestones:** (see [Appendix 1](#) for a graphic view of the milestones)

Level (ID#)	Milestone	Scheduled Date	Expected date 10/1/2014	Expected date 11/1/2014	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	11/1/2014	11/10/2014	Module 5 is constructed and in final QA test. Construction on module 6 has begun.
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	10/1/2014	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	

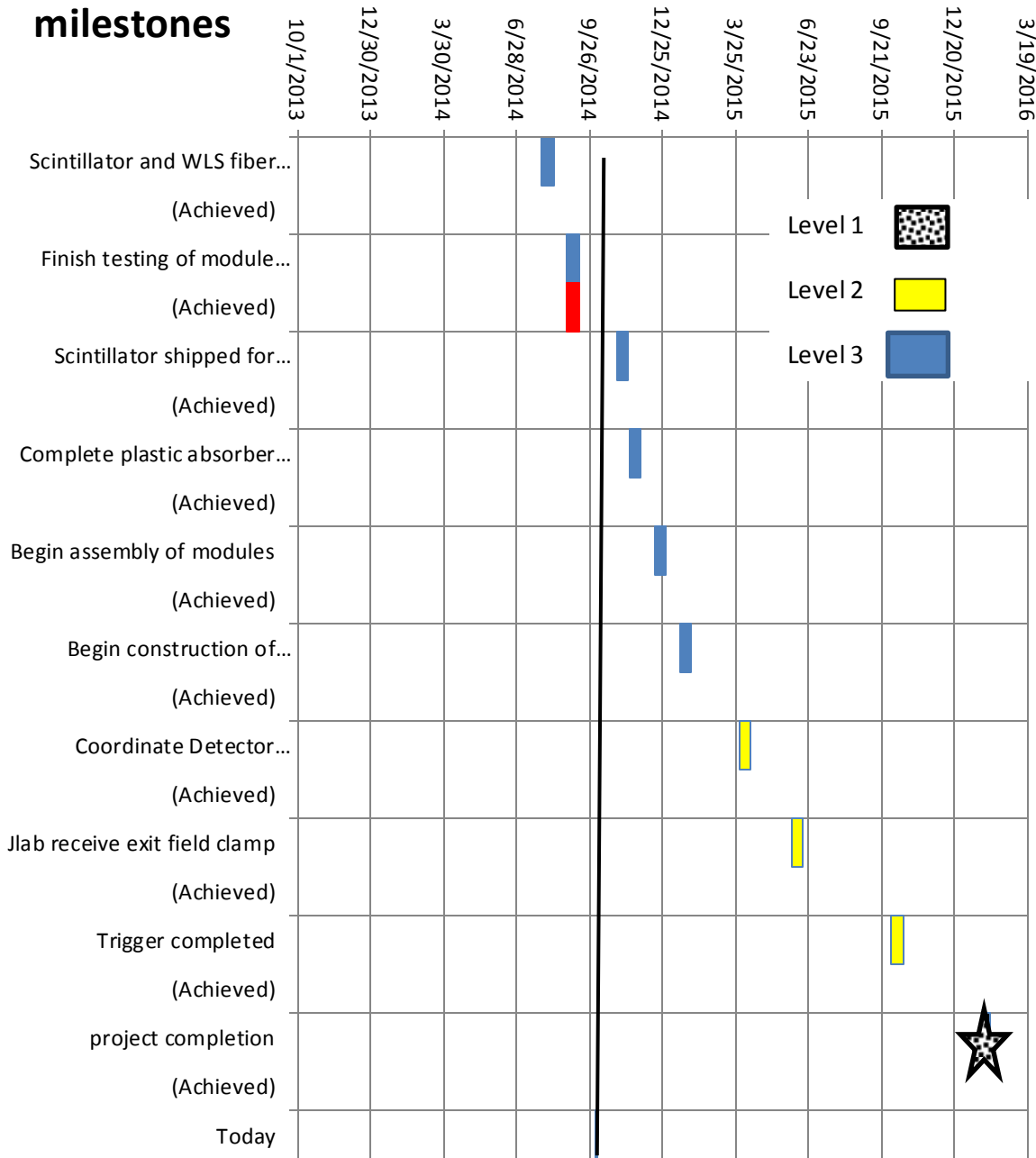
Appendix I

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).

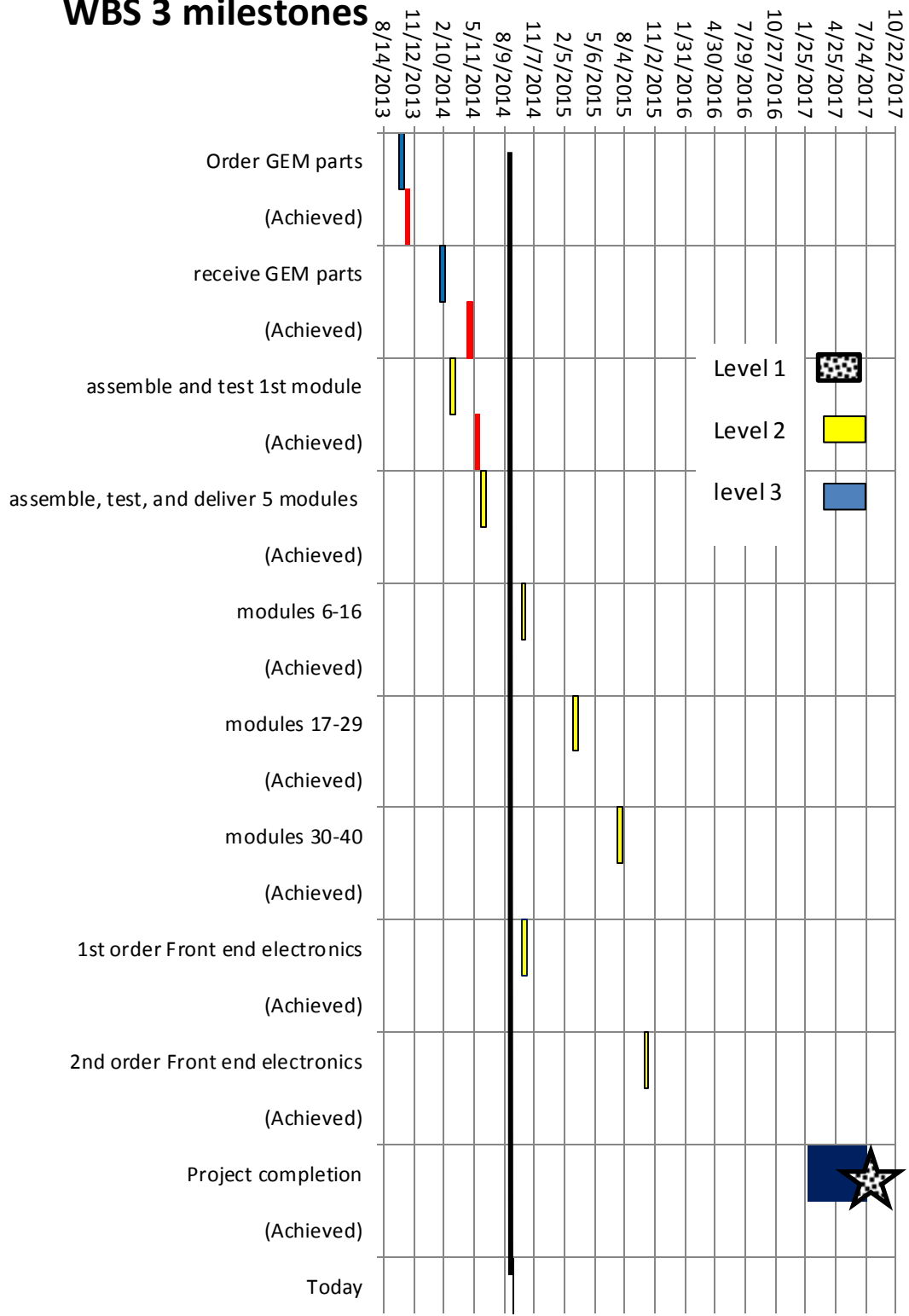
WBS 1 Milestones



WBS 2 milestones



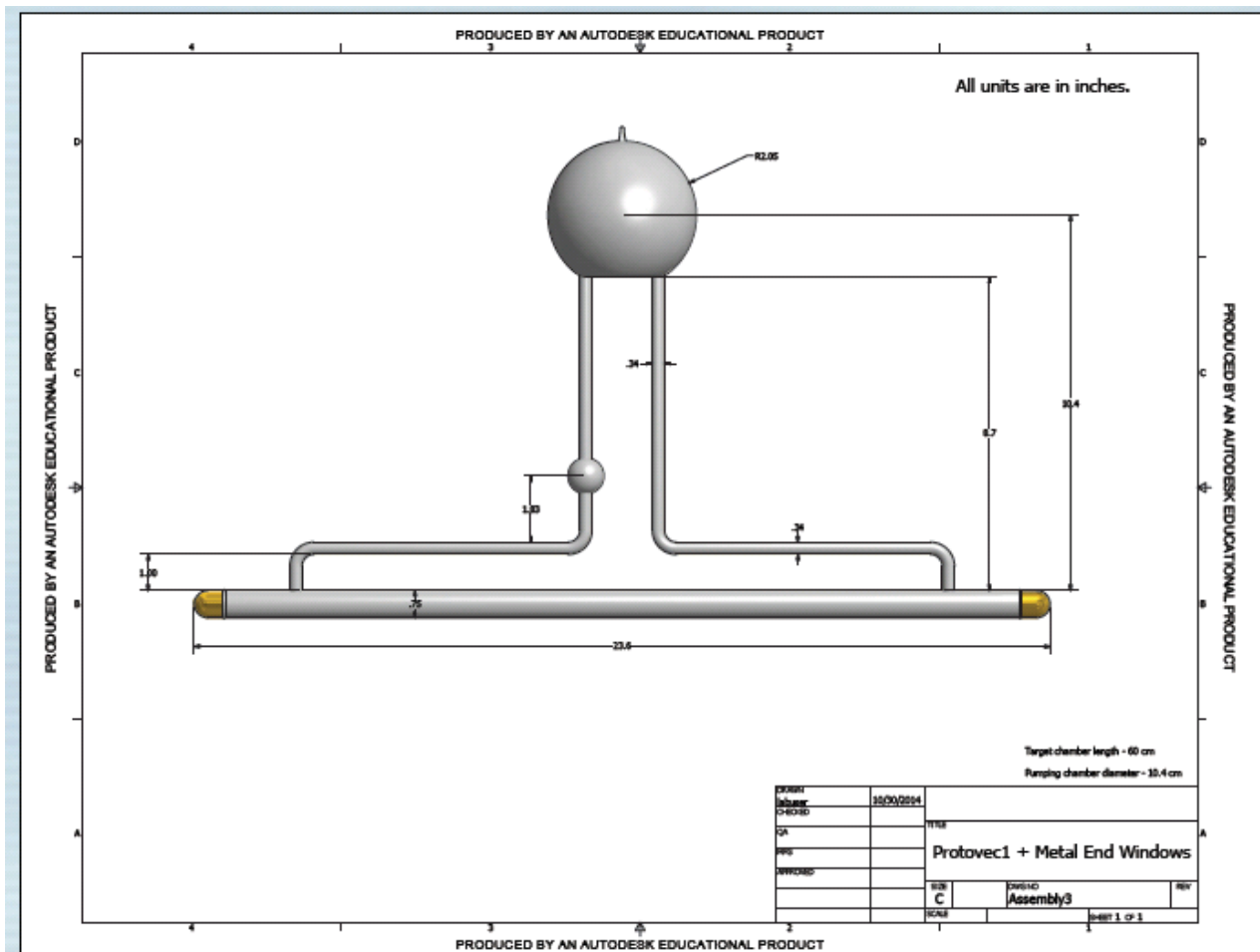
WBS 3 milestones



Appendix II

Update on the polarized ^3He target

The polarized ^3He 60 cm target-cell design for high luminosity has been selected. The design is shown in the figure below. Over the past year, glass and metal test cells have been successful implemented. A potential alternative advanced conceptual design of target hardware that makes maximal use of “transversity-target” hardware has been completed. The decision between the two designs will be value engineering based. Tests of Protovect-style cells at JLab are now in full swing with both convection and pulse-NMR polarimetry. The design, prototyping and preliminary testing of new optics design that is particularly well suited for the selected target-cell design has been completed.



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 ^3He 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 ^3He target is ready, June 2017 (+6 months float)

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

1. GRINCH detector design complete and components are ordered: August 2014 (+4 months float). *Expected completion Dec 2014*
2. GRINCH detector fully assembled and tested for gas and light tightness: January, 2015 (+ 4 months float). *Expected completion May 2015*
3. GRINCH is installed and tested in the BB detector frame: September 2015 (+6 months float). *Expected completion Jan 2016*
4. GRINCH is ready: September 2016 (+ 4 months float).

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)