



# SBS Program: Cost, Schedule, & Management

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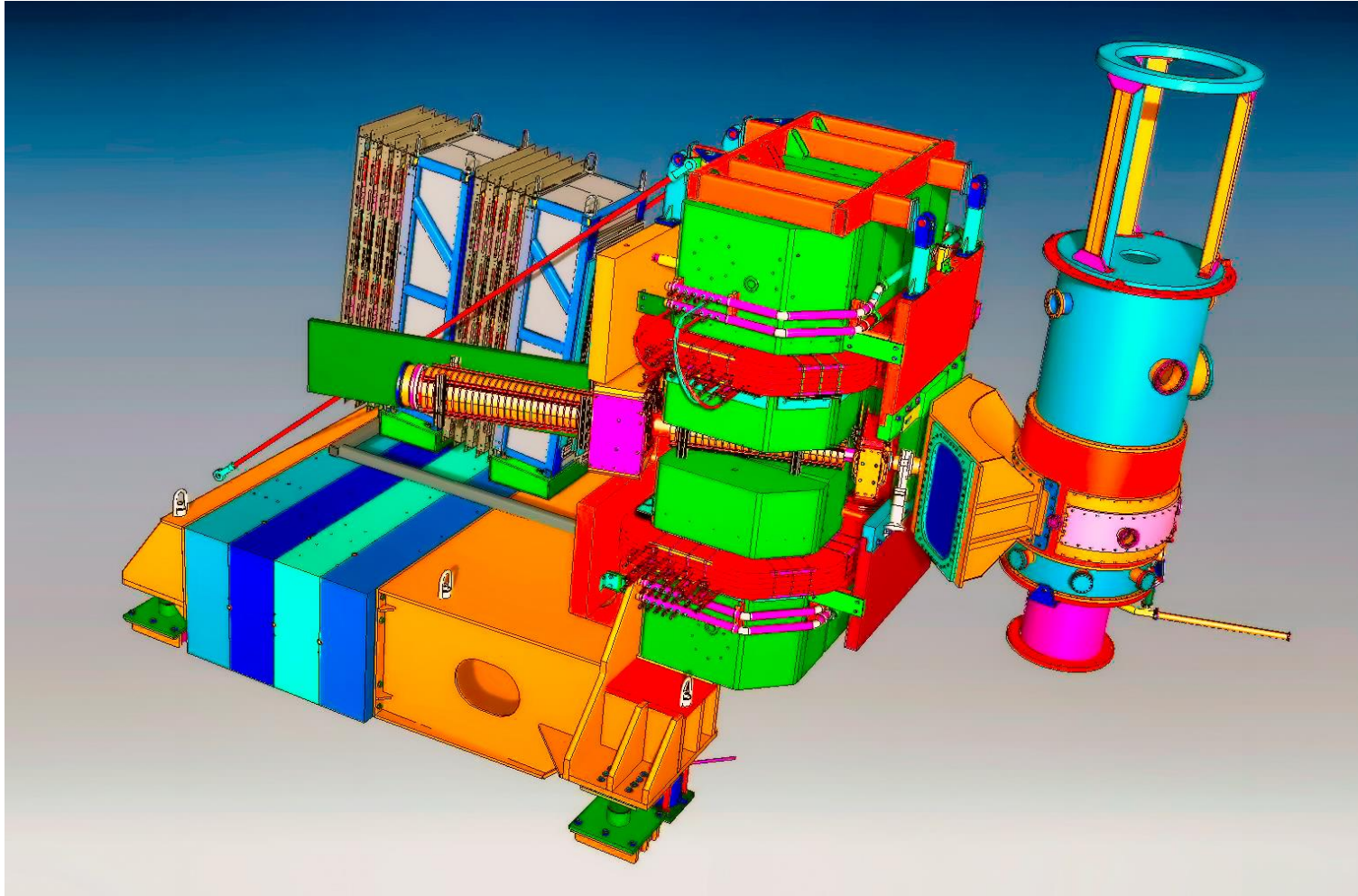
# Outline

- The Program overview
  - Define the Projects
  - General Operations
  - Management
- WBS status
  - Deliverables
  - Milestones
  - Costs
  - Outlook

# Overview of Program

	Apparatus	Experiment
<b>Projects</b>		
WBS 1 SBSBAS	SBS Magnet with platform and power supply, beamline upgrades. Hall LCW and power upgrades	<b>GEn, GMn , GEp</b>
WBS 2 SBSNFF	Coordinate Detector HCAL trigger Detector frames, Electronics Hut, Lead shielding	<b>GEn, GMn , GEp</b>
WBS 3 SBSPFF	Rear GEM tracker	<b>GEp</b>
<b>SBS dependencies</b>		
	Front Tracker GEMS	<b>GEn, GMn , GEp</b>
	Polarized 3He target	<b>GEn</b>
	Gas Cherenkov (GRINCH) in BigBite	<b>GEn, GMn</b>
	Hadron Calorimeter (HCAL)	<b>GEn, GMn , GEp</b>
	Electron calorimeter (ECAL)	<b>GEp</b>
<b>Existing Hall A equipment</b>		
	BigBite Magnet and Platform , Scintillator Array BigBite PreShower /Shower calorimeter and HRS-Right	<b>GEn, GMn</b>
	LD2 and LH2 cryotarget	<b>GMn , GEp</b>

# SBS for GEp experiment



# SBS EH&S

- As with any endeavor at JLab, all SBS activities adhere to the protocols as spelled out in the JLab EH&S Manual ([link](#))
- Experiments in the Hall must go through a rigorous readiness review process
  - For details see:
    - [http://www.jlab.org/user\\_resources/PFX/NP-PFX/](http://www.jlab.org/user_resources/PFX/NP-PFX/)
    - [http://www.jlab.org/user\\_resources/PFX/NP-PFX/text.html](http://www.jlab.org/user_resources/PFX/NP-PFX/text.html)

# SBS General Operation

- The collaboration has weekly, ~1-hour, tele-conference, topical meetings. Separate meetings on CDET, GRINCH, MC.
- The Collaboration has an annual, 2-day, on-site meeting. Last meeting held on July 15 and 16<sup>th</sup> 2015.
- Hall A management (Thia Keppel, Mark Jones, Bogdan Wojtsekhowski, Robin Wines) meets weekly
- Meet with Rolf Ent monthly to review progress and Estimate-to-Complete for all projects.
- Written monthly status reports are submitted to DOE
- Have a Quarterly phone call with DOE (including Bob McKeown)

# DOE 2014 SBS review recommendations

## Two Recommendations:

- The schedule for WBS2 should be updated to reflect the realities as presented, namely the change in CDet to a scintillator based detector, and the effects of financial constraints on the DAQ (need to use Fastbus instead of FADC). The revised schedule should be submitted to DOE by February 15, 2015.

### **Response:**

- *Revised the PMP with new schedule for the CDET shifted by one year to 1/29/2017.*
- *Submitted revised PMP with Jan 15, 2015 report. Accepted by DOE in April 2015. Included updated PMP in prebrief materials.*
- *To answer the question about financial constraints on DAQ included a short response outlining the FASTBUS and other DAQ hardware available for CDET and other systems in March 15<sup>th</sup> SBS report (in prebrief materials).*
- The collaboration should test the continuous thermal annealing in a realistic radiation environment with constant monitoring of the detector response, before finalizing the design of the detector.

### **Response:**

- *Test successfully completed in Spring of 2015.*
- *Discussed in the “Dependency” talk and ECal breakout talk.*

# The Individual WBS's

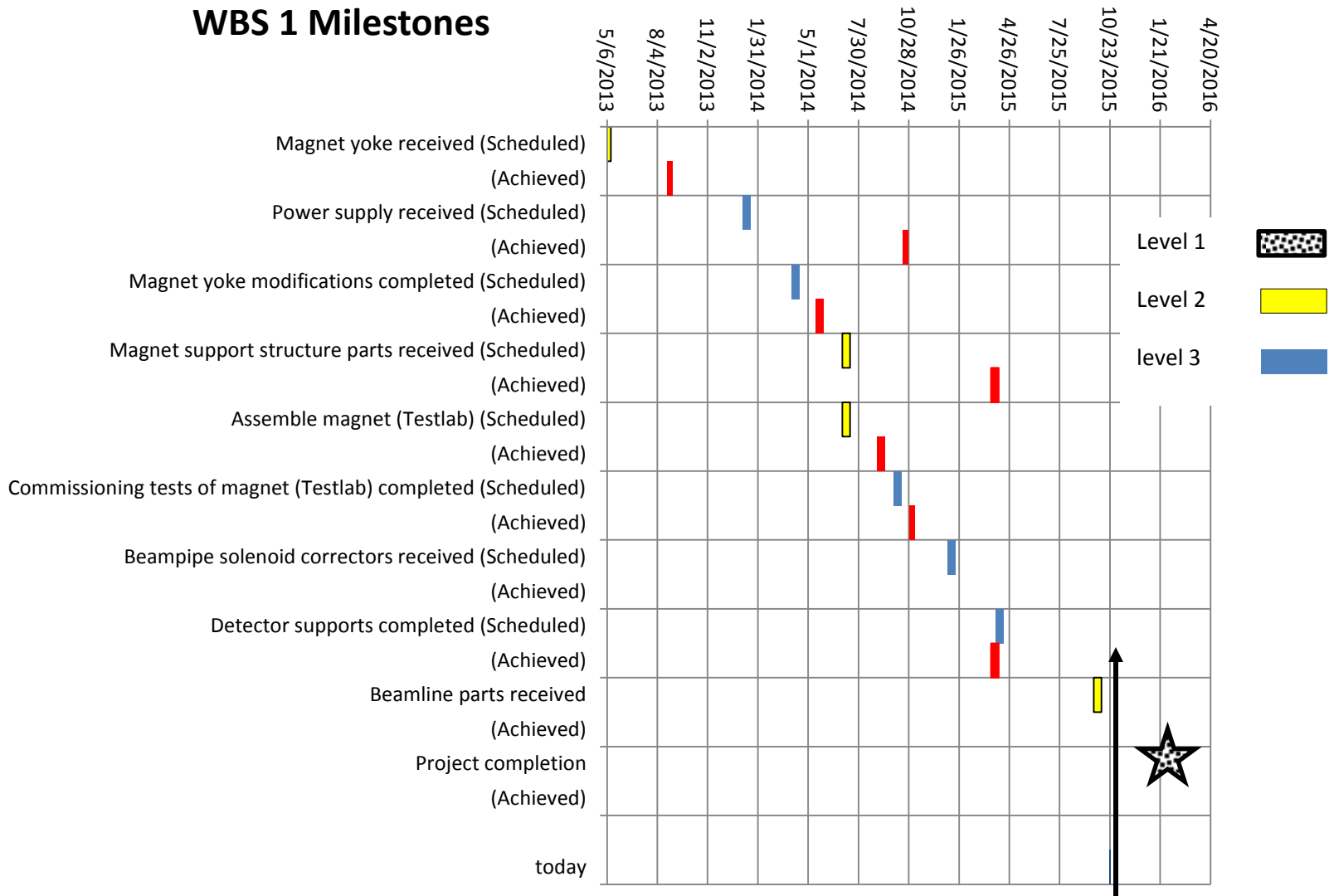


# WBS1: Deliverables

- 48D48 Magnet transportation and modifications
- 48D48 Magnet assembly and support platform
- Magnet power supply and its associated infrastructure
- Beam-line vacuum and shielding components
- Beam-line steering magnets and correctors

# WBS1: Progress

## WBS 1 Milestones



# WBS 1 Milestones

Level	Milestone	Comment
1 (1.1-01M)	Project start	Completed 10/1/2012
2 (2-01M)	Magnet delivered to JLab	Completed 8/21/2013
3	Power supply received	Completed 10/18/2014
3	Magnet yoke modifications	Completed 5/22/2014
2 (1.2-10M)	Platform parts received	Completed 3/24/2015
3	Assemble magnet in Testlab	Completed 9/4/2014
3	Commissioning test of magnet in Testlab	Completed 10/29/2014
3	Beampipe solenoid correctors received	Expect delivery by Dec 4, 2015
3	Detector supports	Part of Magnet platform
2 (1.2-30M)	Beam-line parts received	Expect delivery of all material by Dec 11, 2015
1 (1.1-10M)	<b>Project completion</b>	<b>1/29/2016</b>

# WBS 1 Highlights

- All racetrack coils delivered by Nov 2014.
- In March 2015, modified yoke so that SBS magnet can be on beam right. Reduces installation time and eases transition between experiments.
- SBS platform and counterweight delivered in March 2015.
- SBS snout delivered in June 2015.
- Saddle coil delivered on Oct 23<sup>th</sup> 2015.
- Front field clamp delivered on Nov 4<sup>th</sup> 2015.

## Fiscal highlights:

- Made 93% of expenditures by end of fiscal year 2015.
- In Oct 2016, ordered the SBS beamline vacuum to be built by Jlab machine shop.
- In Nov 2016, ordered remaining small items: window test rig, cylinder mount.
- At present, all expenditures completed.

Details in WBS 1 talk

# WBS 1 Costs: Overview

Table from PMP

	<b>FY13</b>	<b>FY14</b>	<b>FY15</b>	<b>Total</b>
<b>WBS 1</b>	\$651	\$508	\$166	\$1,326
<b>Contingency (28%)</b>	\$181	\$141	\$46	\$368
<b>Total</b>	\$838	\$643	\$212	\$1,694

# WBS 1 Costs: Present Status

	Budget	Expenditures	Labor	Expenses	Overhead
FY13	\$838K	\$411K	\$57K	\$258K	\$96K
FY14	\$643K	\$517K	\$91K	\$286K	\$140K
FY15	\$212K	\$663K	\$18K	\$474K	\$171K
Total	\$1694K	\$1591K	\$166K	\$1018K	\$407K

## Expenditures in FY15

- Saddle coil (delivered to JLab) \$139K
- Vacuum snout \$64K
- Front field clamp \$42K
- Hall power upgrade \$90K
- Modify magnet iron \$52K
- Beamline corrector magnets \$84K
- Floor plates \$96K
- Magnet platform hardware \$100K

# WBS 1 Costs: Future

Total Budget	Expenditures Costed and Obligated	Estimate to Complete	Contingency
\$1,694K	\$1,591K	\$86K	\$17K

## Estimate to Complete

- Beamline vacuum pipe \$71K (spent in Oct/Nov 2015)
- Window test rig, cylinder mount \$15K (spent in Nov 2015)

All fiscal expenditures completed.

In expenditures, WBS 1 has incurred \$1,183K in costs and has \$407K in open commits.

# WBS 1 Outlook

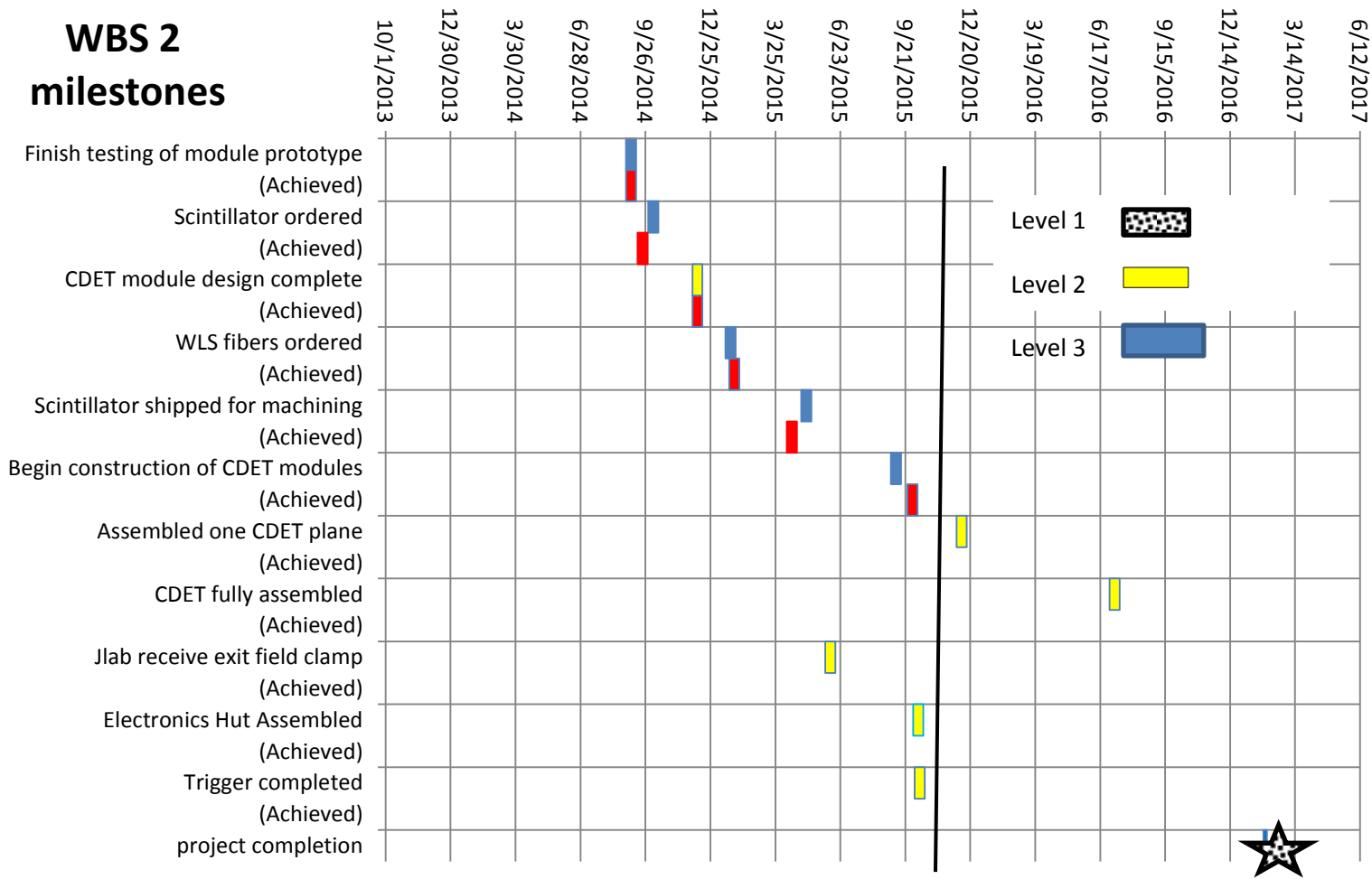
- SBS beamline corrector magnets:
  - Separate companies to build coils and iron core.
  - Coils have been wound and are being potted. Expect coils at JLab by Dec 4, 2015.
  - The iron cores expected at Jlab by November 20<sup>th</sup> 2015.
- Clamp side and top supports delivered by Nov 24<sup>th</sup> 2015.
- Floor plates delivered by Dec 9<sup>th</sup> 2015.
- Platform cylinders, jack housing and springs delivered by Dec 4<sup>th</sup> 2015.
- All materials for SBS beam pipe have been ordered and delivery by Dec 11<sup>th</sup>. SBS beamline vacuum pipe to be built by the JLab machine shop and completed by January 15<sup>th</sup> 2015 expected.



# WBS 2 Deliverables

- WBS 2.1 PMT-based Coordinate Detector.
  - Subproject manager: Mahbub Khandaker, Idaho State University
- WBS 2.2 Electronics Hut, Detector Frames, and materials needed to construct beam line shielding
- WBS 2.3 Pole shims and exit field clamp
- WBS 2.4 Hadron Calorimeter trigger

# WBS 2 Progress



# WBS 2 Milestones

Level	Milestone	Comment
1	Project start	<b>Completed 10/1/2013</b>
3	Finish testing of module prototype	<b>Completed 8/30/2014</b>
3	Scintillator ordered	<b>Completed 8/30/2014</b>
2	CDET module design completed	<b>Completed 11/30/2014</b>
3	Wavelength Shifting Fibers ordered	<b>Completed 1/20/2015</b>
3	Scintillator shipped for machining	<b>Completed 4/10/2015</b>
2	JLab receives exit field clamp	Expected completion 10/28/2015
3	Begin preparation of WLS fibers	<b>Completed 7/6/2015</b>
3	Begin construction of CDET modules	<b>Completed 9/24/2015</b>
3	Assembled one CDET module	Expected completion 10/15/2015
2	Electronics Hut Assembled	Expected completion 12/18/2015
2	Trigger completed	Expected completion 2/1/2016
3	Assembled one CDET plane	Expected completion 12/15/2015
2	Coordinate Detector assembled	Expected completion 6/30/2016
1	<b>Project completion</b>	<b>1/29/2016</b>

# WBS 2.1 CDET Highlights

- In Jan 2015, PMP updated with new milestones and project completion date of Jan 31<sup>st</sup> 2017.
- Ordered WLS fiber in January 2015 and arrived at JLab in April. Preparation of the WLS began in July 2015 and ,by October, 300 fibers had been cut and polished.
- After extensive testing of production methods at Fermilab, all the scintillator bar material was produced by April 7<sup>th</sup> 2015 and shipped to Eljen for machining to 5mm thickness. By end of May 14<sup>th</sup> 2015, Eljen had machined all the scintillator bars and shipped to CMU for final cut to 51 cm length. The finished bars were shipped from CMU to JLab and arrived on August 20<sup>th</sup> 2015.
- Fabrication of the six module frames began in June 2015 and was completed by September 2015 with the module frames at JLab.
- Construction of the modules began on Sept 24<sup>th</sup> 2015.
- The 28 groups of 14 scintillator bars and the corresponding WLS fiber bundles needed for a module have been fabricated by Nov 4<sup>th</sup>.

# WBS 2.2 & 2.3 Highlights

- The two plastic analyzers and frames delivered to Jlab on July 28<sup>th</sup> 2015.
- Pole shims delivery by Nov 9<sup>th</sup> 2015.
- Rear clamp delivery by Nov 6<sup>th</sup> 2015.
- Radiation calculations were completed for designing the electronics huts. One large hut uses existing blocks with steel roof. A small hut for GEM electronics located close to GEMs will use blocks with steel.

# WBS 2.4 Trigger Highlights

- Received FADC250 modules.
- Ordered and received 2 CPUs and VXS crates.
- Test DAQ setup for HCAL cluster trigger with FADC250 modules and SSP is underway.
- The CODA “crate flipping” firmware for the Trigger Supervisor was written and tested in a DAQ setup with 3 Fastbus crates with TI modules and a VXS crate with Trigger Distribution, Signal Distribution and Trigger Supervisor modules.
  - Measured 7% deadtime with 5 KHz readout rate and 200 kHz local trigger rate with “flipping” between 3 FASTBUS crates.
- Test DAQ GEM setup with MPD and working on CODA integration.

# WBS 2 Costs: Overview

Table from PMP

	FY14	FY15	FY16	FY17	Total
WBS 2	\$461	\$517	\$59	\$9	\$1,045
Contingency (31%)	\$138	\$168	\$18	\$3	\$327
Total	\$599	\$710	\$63	\$12	\$1,372

# WBS 2 Costs: Present Status

	Budget	Expenditures	Labor	Expenses	Overhead
FY14 + items moved forward from FY15	\$868K	\$667K	\$15K	\$570K	\$107K
FY15	\$441K	\$260K	\$26K	\$130K	\$79K
FY14 + FY15	\$1309K	\$927K	\$41K	\$700K	\$186K

## Expenditures in FY15

- WBS 2.1
  - CDet additional manpower and hardware \$55K
- WBS 2.2 and 2.3
  - FPP Analyzer material & structure \$26K
  - Rear field clamp \$53K
  - Pole shims \$32K
- WBS 2.4 Trigger
  - Two CPUs and 2 VXS crates \$60K



# WBS 2 Costs: Future

Total Budget	Expenditures Costed and Obligated	Estimate to complete	Contingency
\$1,382K	\$927K	\$420K	\$35K

## Estimate to Complete

- WBS 2.1 CDet
  - Manpower for gain-matching boards \$75K
- WBS 2.2 and 2.3
  - Beamline passive magnet shielding \$75K
  - Beamline support for lead shielding and corrector magnets \$60K
  - Detector frames \$22K
  - Electronic huts \$68K
- WBS 2.4 Trigger
  - Trigger Interface, Distribution, Supervisor modules \$66K
  - Two VTP modules \$24K

In expenditures, WBS 2 has incurred \$602K in costs and has \$325K in open commits.

# WBS 2 Outlook

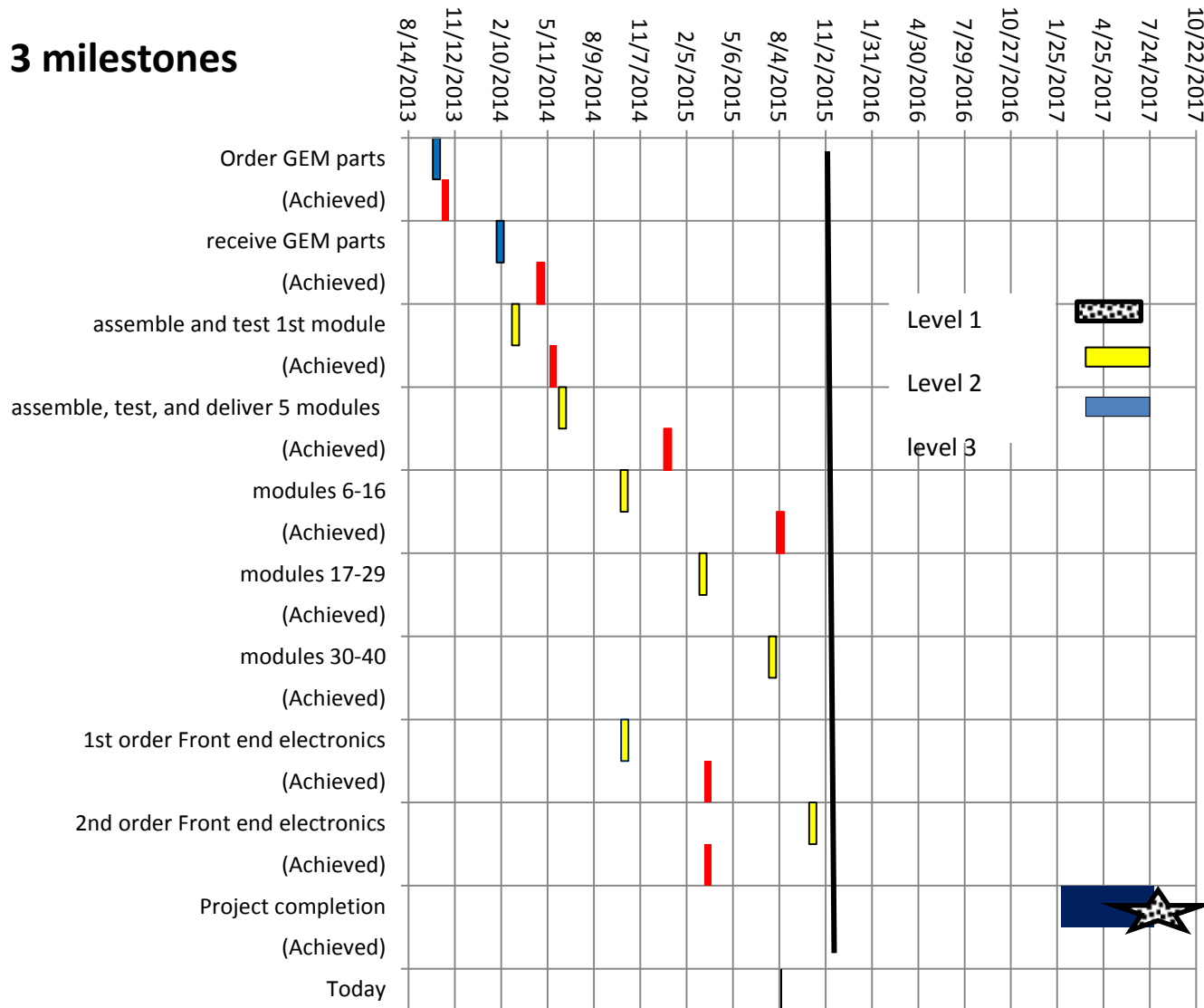
- WBS 2.1 CDET
  - Module construction has began and nearly finished first module of six needed.
  - Estimate the module construction time is 6 weeks with completion of CDET by 6/30/2016.
  - Project end date is Jan 31,2017
- WBS 2.2 and 2.3
  - Passive magnetic shielding design is finished and will be built by JLab machine shop.
  - Large electronic hut is designed. Existing concrete blocks at Jlab will be used with steel from BNL for roof. Roof supports have been designed.
- WBS 2.4 Trigger
  - VME modules purchases are complete.
  - Combined FASTBUS, pipeline VME and GEM DAQ planned.

# WBS 3 Deliverables

- Gas Electron Multiplier (GEM) tracking detectors (40 modules) for rear tracker
- Front-end and Data Acquisition Electronics to accompany these GEM modules

# WBS 3 Progress

## WBS 3 milestones



# WBS 3 Milestones

Level (ID#)	Milestone	Comment
1 (3.1-01M)	Project start	<b>Completed 10/1/2012</b>
3	Order GEM Parts	<b>Completed 10/18/2013</b>
3	UVa receives GEM parts	<b>Completed 4/23/2014</b>
2 (3.2-01M)	First module assembled and tested	<b>Completed 5/15/2014</b>
2 (3.2-10M)	UVa 5 GEM modules assembled and tested	<b>Completed 12/23/2014</b>
2 (3.2-20M)	UVa 6-16 GEM modules assembled and tested	<b>Completed 7/28/2015</b>
2 (3.2-30M)	UVa 17-29 GEM modules assembled and tested	3/15/2016
2 (3.2-40M)	UVa 30-40 GEM modules assembled and tested	8/1/2016
2 (3.2-50M)	1st order of Front End Electronics	Signed contract with UVa <b>Completed 3/5/2015</b>
2 (3.2-60M)	2nd order of Front End Electronics	Combined with 1 <sup>st</sup> order
1 (3.1-10M)	<b>Project completion</b>	<b>7/31/2017</b>

# WBS 3 Highlights

- ❑ Finished 20 GEM modules at a rate of 2 modules/month. 40 modules are needed for the SBS rear tracker. On track for completion by August 2016.
- ❑ As advised in the last DOE Review Report:
  - Used contingency to increase the amount of materials and manpower to build 8 spare modules. This enables that experiment to have one spare chamber (4 modules) for “hot” swapping of chambers.
  - By Jan 2015, an X-ray source test setup was operational at UVa which had multiple benefits:
    - The study of issues with high photon flux on GEM.
    - Quick evaluation of GEM modules after they are built.
- ❑ Completed contract with UVa for the GEM readout electronics.
  - Included electronics for spare module.
- ❑ In a move to insure that GEM expertise is available to UVa for the SBS GEMs and future Hall A experiments, we plan to use contingency to give 50% support for a 5 year joint Jlab/UVa research scientist position for Kondo Gnanvo . SBS WBS3 funds will support for the 1.5 years and Hall A for remaining 3.5 years.

# WBS 3 Costs: Overview

Table from PMP

	FY13	FY14	FY15	FY16	FY17	Total
WBS 3	\$34	\$598	\$595	\$241	\$26	\$1,493
Contingency (19%)	\$10	\$66	\$136	\$68	\$7	\$288
Total	\$44	\$665	\$731	\$309	\$32	\$1,781

# WBS 3 Costs: Present Status

	Budget	Expenditures	Labor	Expenses	Overhead
FY14 + items moved forward from FY15	\$1134K	\$975K	\$39K	\$870K	\$66K
FY15 + items moved forward from FY16	\$553K	\$455K	\$16K	\$409K	\$30K
Total	\$1687K	\$1430K	\$55K	\$1279K	\$96K

## Expenditures in FY15

- Rear Tracker GEM Electronics \$433K  
(moved forward \$210 from FY16)



# WBS 3 Costs: Future

Total Budget	Expenditures Costed and Obligated	Estimate to Complete	Contingency
\$1,781K	\$1430K	\$315K	\$36K

## Estimate to Complete

- Research Scientist Position \$89K
- Additional spare chamber + other contingencies \$167K (Spent in Oct 2015)
- Administration \$59K

In expenditures, WBS 3 has incurred \$827K in costs and has \$603K in open commits.

Contingency is low, since we are spending contingency on spare GEM modules and to insure GEM expertise at UVa.

# WBS 3 Outlook

## ➤ WBS 3.1 GEM modules

- Have completed 20 GEM modules with 20 more to produce.
- Present UVa GEM production schedule assumes 2 GEM modules per month with completion by Aug 1, 2016.
- The additional 8 spare modules would be completed by Jan 15, 2017.
- When including spares, this leaves 6 ½ months of float to project completion date of July 31, 2017.
- Assuming 1.5 GEM modules per month would leave 2 months of float.

## ➤ WBS 3.2 GEM electronics

- Contract with UVa signed in Feb 2015.

# SBS Dependencies

<b>Dependency</b>	<b>Institution</b>	<b>Contact</b>	<b>JLab Contact</b>
<b>Polarized 3He target</b>	University of Virginia	Gordon Cates	J. P. Chen
<b>Gas Cherenkov detector (GRINCH)</b>	College of William and Mary	Todd Averett	Bogdan Wojtsekhowski
<b>Front tracker GEMs</b>	INFN-Rome	Evaristo Cisbani	Alexandre Camsonne
<b>Hadron calorimeter HCAL</b>	Carnegie Mellon University and INFN-Catania	Gregg Franklin	Mark Jones
<b>Electron calorimeter ECAL</b>	Jefferson Lab	Bogdan Wojtsekhowski	

# Highlights of SBS Dependencies

- All dependencies have updated milestones
- ECal
  - Successfully showed that continuous annealing works under beam conditions in Spring 2015 with small 4x4 prototype.
  - At Stonybrook U, construction of C200 prototype has begun.
- HCal
  - At CMU, construction of modules began in March 2015. By Sept 2015, they had built 72 of the 288 modules. (36 are at JLab)
- Front Trackers
  - First GEM chamber (3 modules) delivered to JLab in March 2015. The 2<sup>nd</sup> GEM chamber arrives in late November 2015.
- GRINCH
  - The gas vessel was ordered in August 2015.
  - The Photon Detector Array shielding box delivered to JLab in August 2015.
- Polarized  $^3\text{He}$  target
  - Extensive tests of prototype metal/glass targets

# Conclusion

## WBS 1:

- All money committed.
- Weekly tracking of outstanding orders.
- Expect all outstanding orders delivered to Jlab by mid December

## WBS 2:

- CDet construction start on Sept 24, 2015

## WBS 3:

- 22 of 40 modules completed.
- Steady 2 modules/month for last 6 months
- Used contingency to have 8 spare modules and insure GEM expertise at UVa.