Accelerator & NuMI Upgrades Update

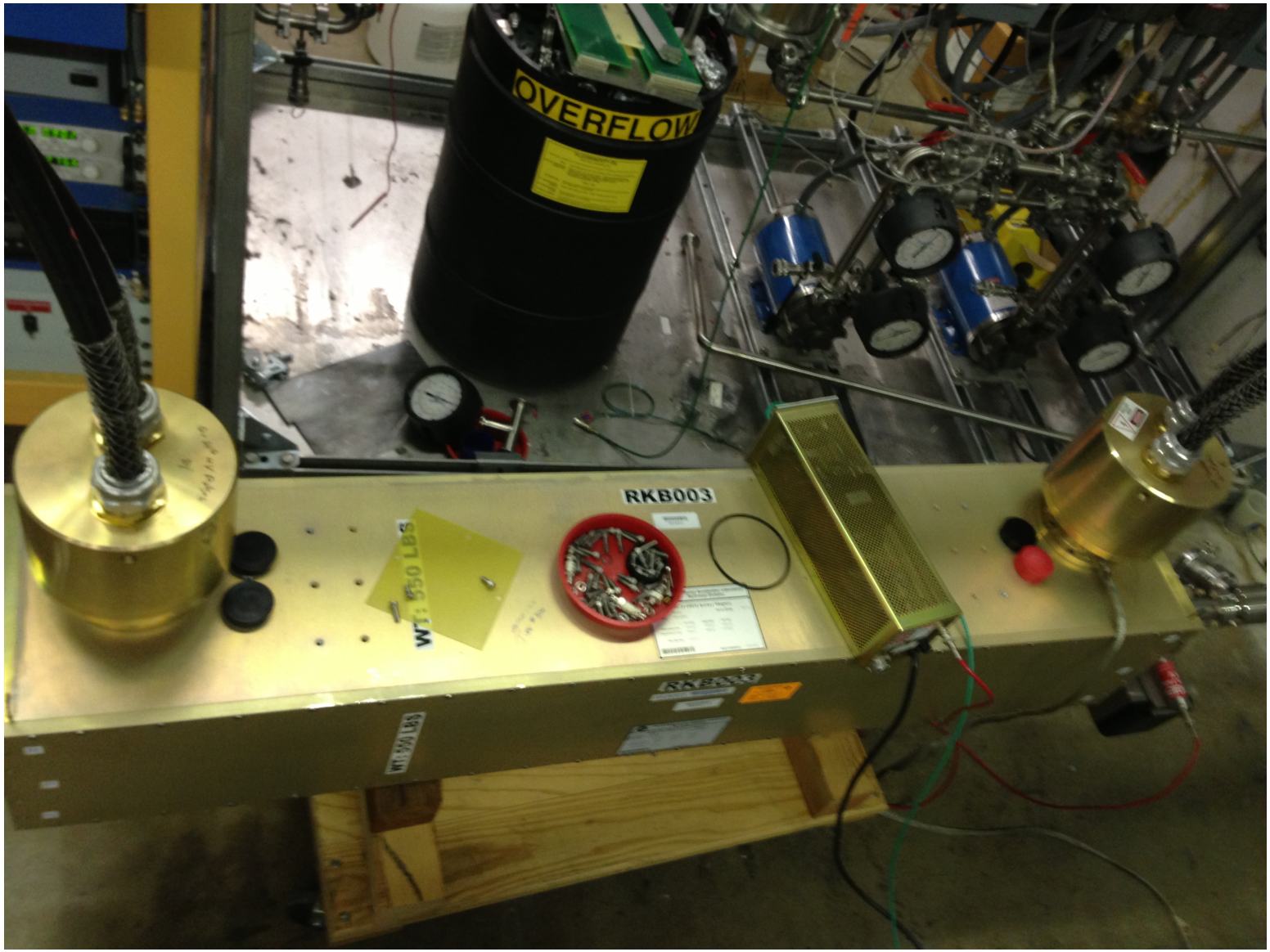
Paul Derwent

22 January 2013

Remaining Critical Path Hardware

- Remaining kickers are in fabrication
  - Long full turn RKB magnets in progress (2 through HV testing, 3 through LV testing)
- RF cavities:
  - First cavity through power tests
  - 2nd cavity (Phoenix) had major vacuum welds in June
    - Vacuum ports complete in December
    - Finishing on operations funds (SPS)
  - 3rd cavity (Rising Son) moved ahead of Phoenix in queue
    - Into test cave for power tests
- Beam Pipe & Vacuum components:
  - Coming in slowly
  - Injection line installation moving along
    - MI8 first, then RR8 line
  - Remaining components all on order

RKB in test cage



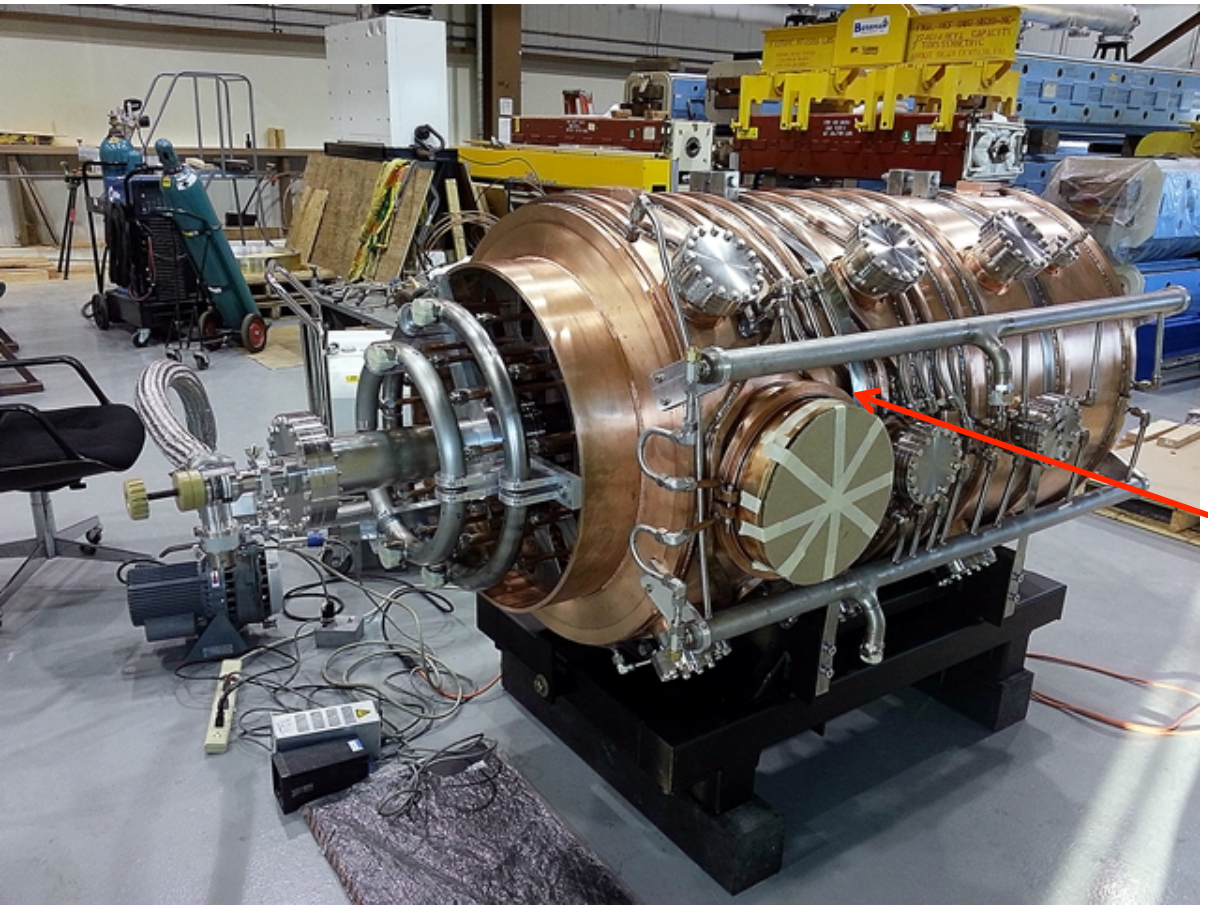
Preparing for RR30 installation

RR-30 straight:
Staging stands and other hardware in the tunnel in preparation for installation

RR-30 straight: At MI-60
beam pipe welding, leak checking, & alignment
-> minimize radiation exposure

Girders installed on the stands

RF Cavity status



Recycler RF #2

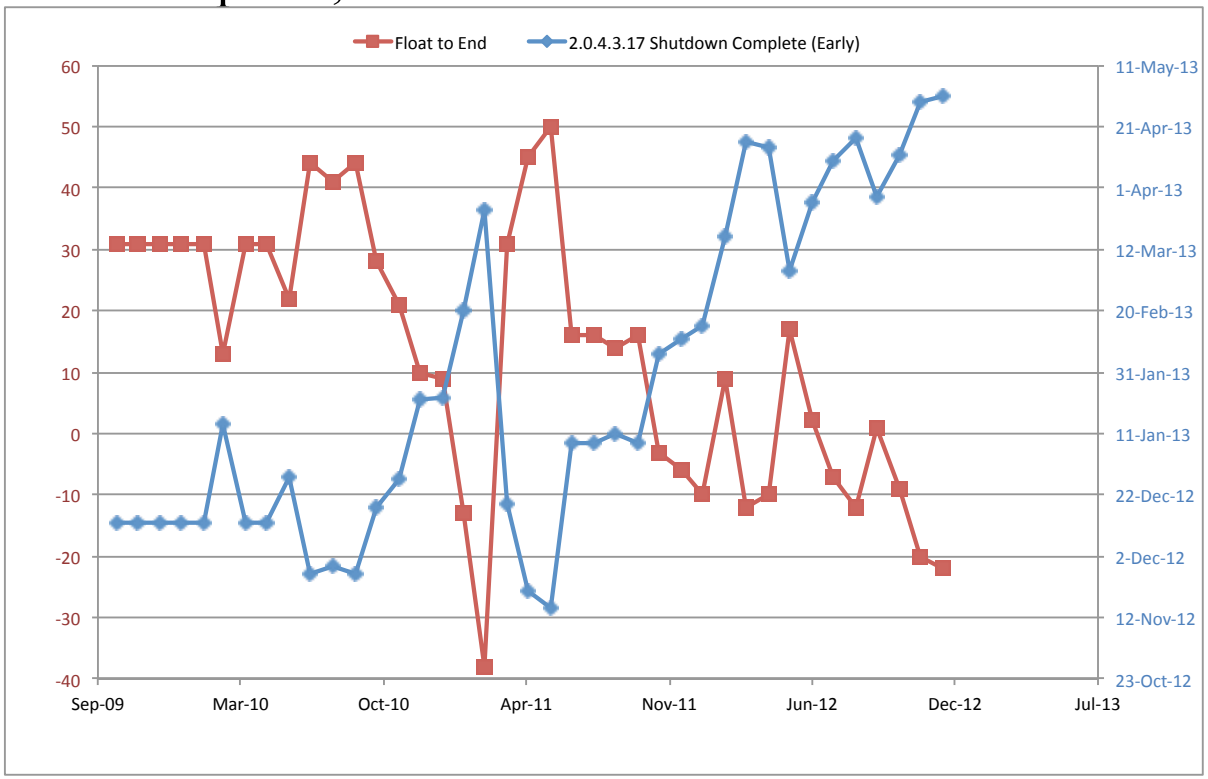
Recycler RF #1 Status

- **RF testing complete**
- **RGA scans and Leak checking is complete**
- **Water Hoop needs to be added to input interface coupler**
- **Stretched wire mode measurements coming**

2nd Cavity (Rising Son) ready to go into test cave, mounted on installation cradle

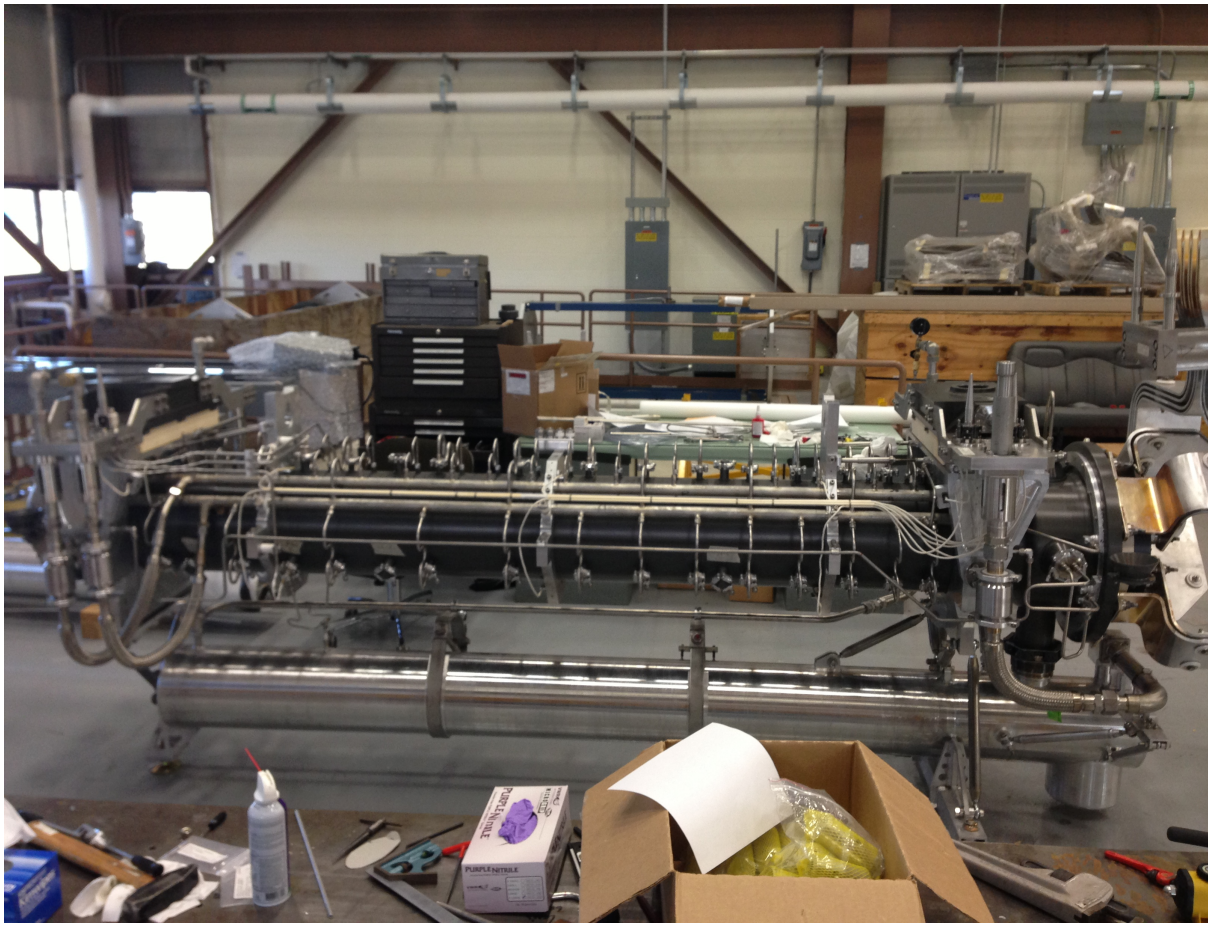
Shutdown float

- OpenPlan end of shutdown: May 1st
  - Kicker Power Supply work in Service Building -> underway now
  - RR30 installation -> starting in February
  - RF Cavity -> starting in February
  - -22 days of float to April 1, 2013

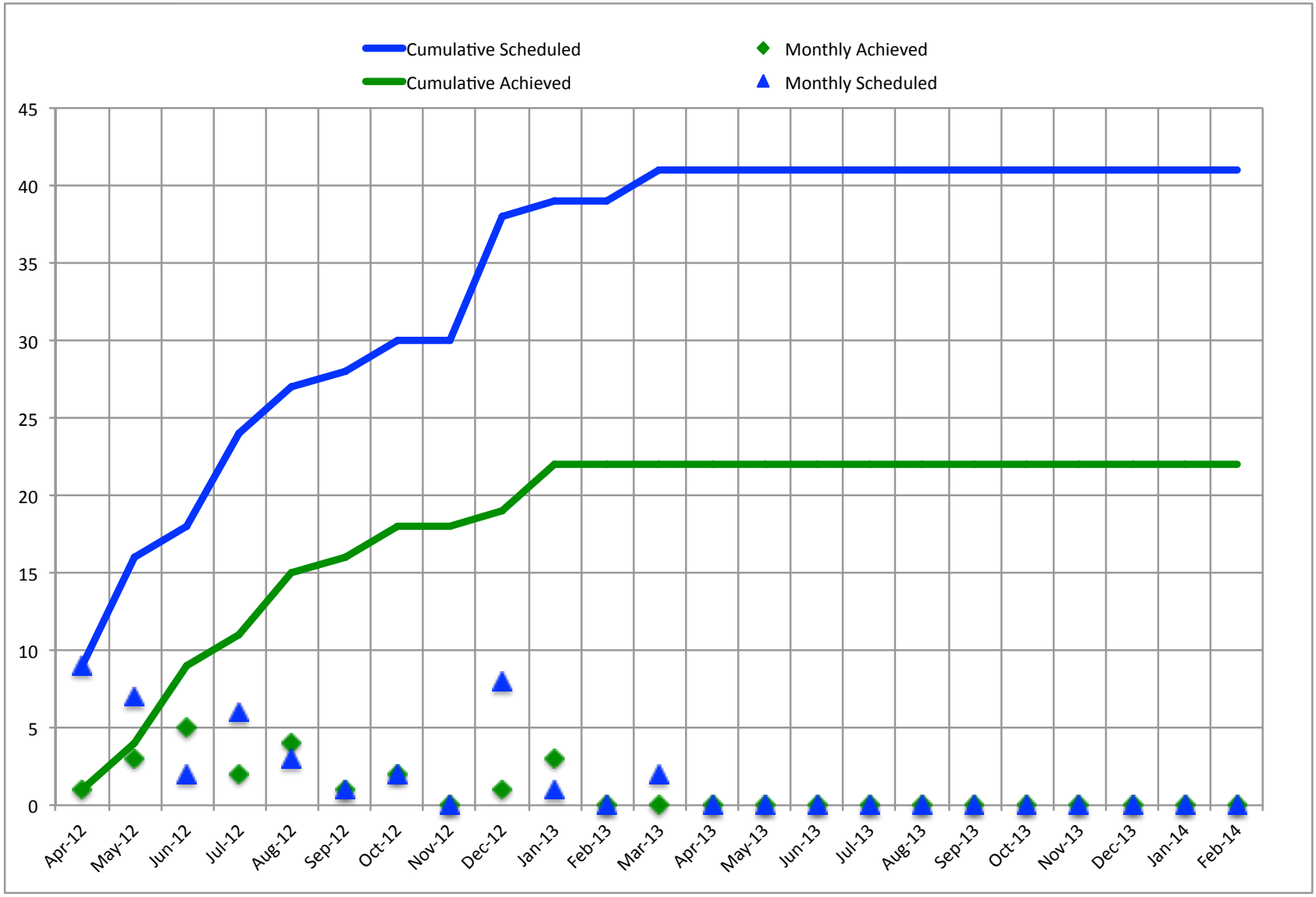


Target Hall installation

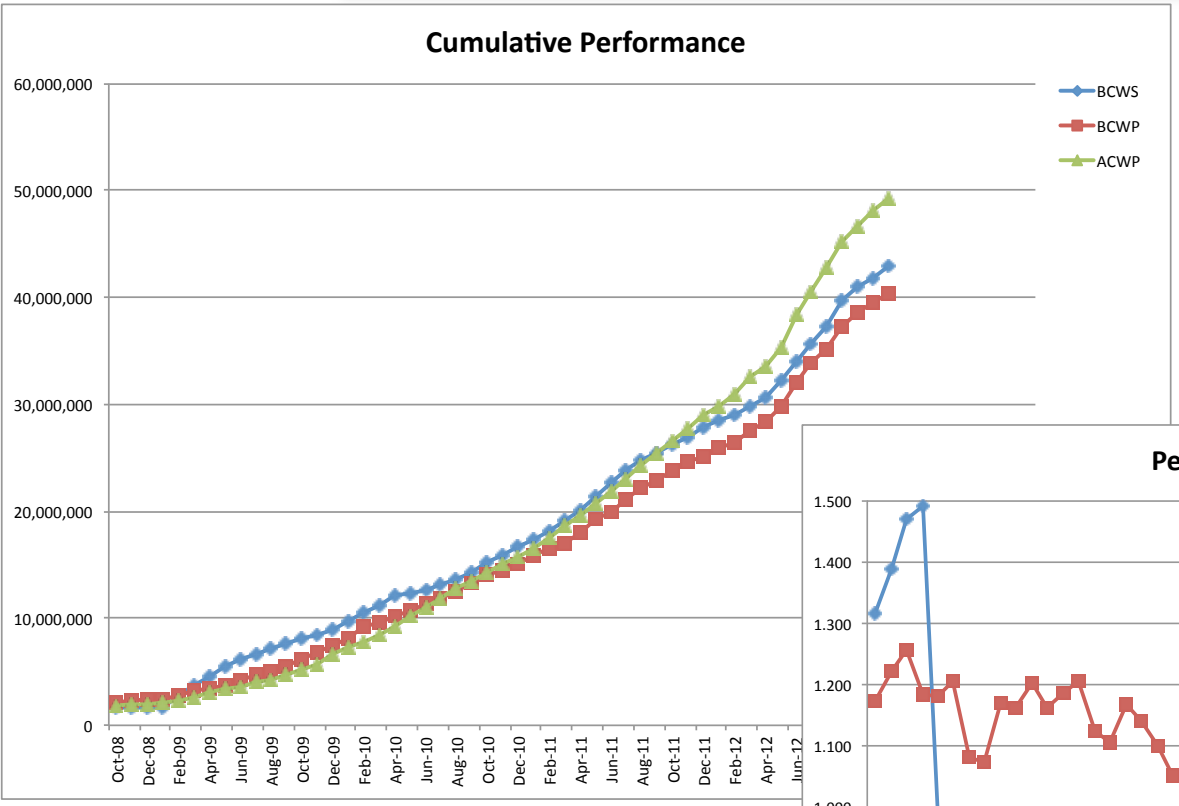
- Target & Horn 1 ready to go!
  - Horn 1 Installation (off project)
    - 11 – 22 February
  - Horn 1 power testing, beam pipe window installation, dehumidification work in March
  - Target installation
    - 1 – 12 April
  - Target hall buttoned up and ready for beam by 26 April

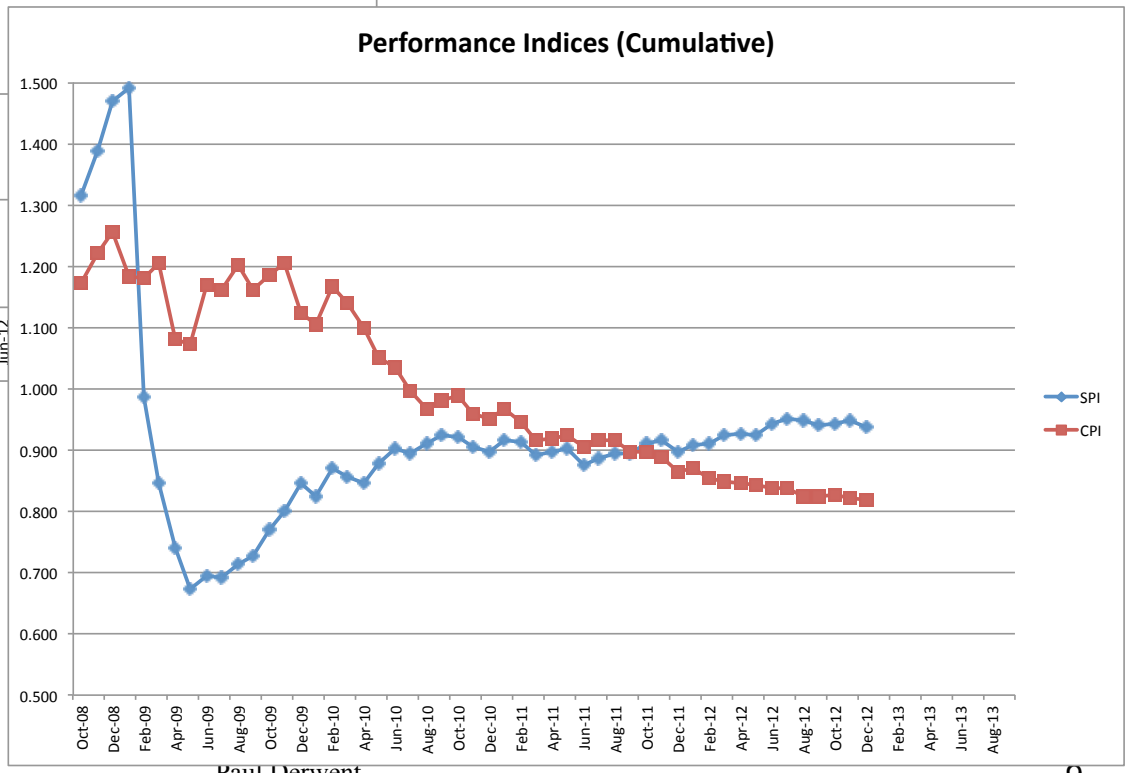


Remaining milestones



EVMS Performance





Estimates to Complete

- November 14: started polling the L3/L4s in ANU on remaining budget vs remaining work
  - Showed them the budget and asked if it was enough
  - Results went into the McCluskey ETC assessment in December

NB: week before Lehman review!

- January 3: started another round with L3/L4s
  - Asked a different question: how much effort is required to complete the work?
  - Broke it down into 27 pieces and went to speak with responsible parties
  - Labor in major categories (techs, engineers, drafting, machining, welding, electricians, riggers)
  - Making a comparison between budget and estimate
  - A bottoms up estimate, with top down multipliers from me (in 10 of the 27 sections, 50-100%)

Budget – Estimate Result

	Tech Days	Welder Days	Electrician Days (or maybe pipefitters!)	Rigger Days	Engineering Days	
total	264	(178)	7	(185)	184	
II Beam Pipe & Vacuum Installation	(18)	(15)	0	0	0	
MI 60 Staging Crew	29	0	0	0	0	
MI 60 Girder Work	(80)	(15)	0	0	0	
RR 30 Straight Installation	(17)	0	0	(203)	5	
EL Installation	45	0	0	(75)	5	
Multiwire/DCCT/Toroid fabrication	(132)	12	0	0	(36)	
DCCT Installation	34	0	0	0	3	
MI 614 Reconstruction	(33)	(2)	0	0	0	
RR RF Installation	137	(3)	0	39	15	
Damper Installation	32	(2)	12	32	3	
BPM Hardware Installation	(90)	0	0	0	(12)	
Vacuum Hardware & Prep	(187)	(214)	0	0	3	
RR RF cavity 1 Retrofit	(27)	38	0	0	8	
RR RF mid & hi level	(100)	0	0	0	(5)	
RR RF low level	4	0	0	0	(14)	
RR Water	48	(2)	15	0	25	
NuMI Water	50	0	50	0	4	
Recycler Shims	66	0	0	0	0	
Cable Pulls	0	0	(70)	0	0	
RKB Fabrication	94	20	0	0	72	
Kicker Power Supplies & Testing	297	(8)	0	0	96	
Installation Planning	(35)	12	0	0	(75)	
Target & Horn 1 Installation	111	0	0	0	18	
Target Hall Infrastructure	26	0	0	23	13	
Timing & Controls	(23)	0	0	0	(2)	
RBEX and Ramped Supplies	58	0	0	0	55	
Ramped Correctors	(26)	0	0	0	3	
Dollars?	$195,287	($192,939)	$6,619	($225,674)	$218,478	$1,771

Balance to $1,771!!!

On the other hand

- ($415k) in November
- ($434k) in December
- Labor CPI (Sep-Dec) : 0.89
  - Have finished with Pipefitters (-$1.1M) and almost finished with electricians (-$550k)

- Money tied up in Performance Measurement Techniques?
  - Type E: 50-50 (50% BCWP when start, 50% BCWP when finish)
  - Type F: 0-100 (100% BCWP when finish)
  - $231k of progress reported but not in BCWP
  - Continue through April
    - $1.26M in unstarted tasks of type E,F
    - $900k in unstarted tasks of type C
- Money tied up in Pump Vault 9 Construction
  - Went off project in November – from the budget perspective but not the actual cost perspective
  - Through December PO 607695: $41,550 direct costs
    - $51,060.08 fully loaded costs in ACWP with no BCWP
  - PO and charges moved to AD code on January 14
    - Positive variance from this next month

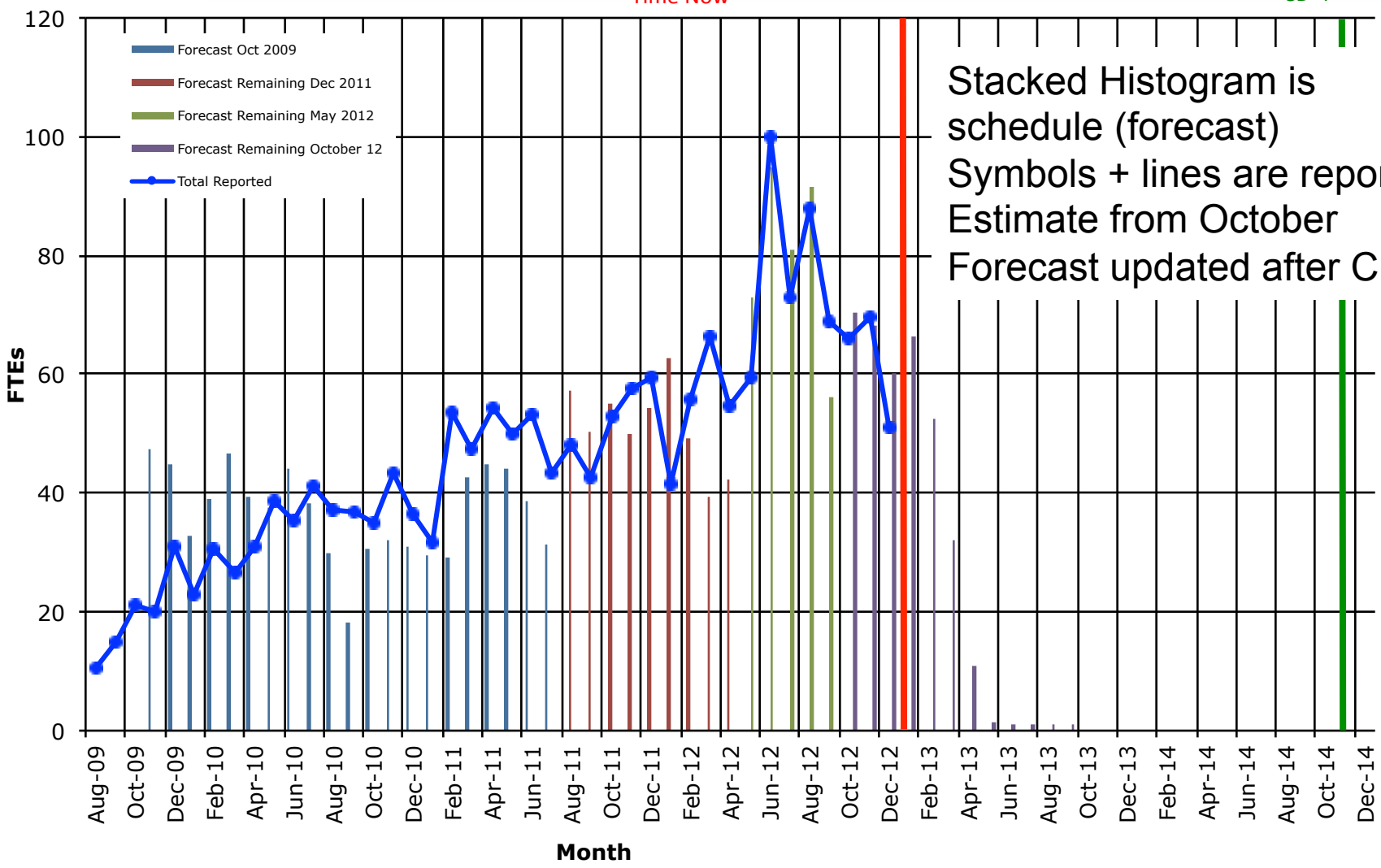
Summary

- Shutdown work progressing
  - Start the RR30 work in February
  - Start Horn 1 and Target installation in February
- No longer on schedule for 1 April 2013 completion
  - End of April is current estimate
- Doing regular ETC
  - January estimate: minimal CV in next 4 months
  - looking for ways to recover costs

Additional information if necessary to discussion

Aka Backups!

ANU Resource Requirements



FTE := 147.3 hours/month

ANU Work Force

- Changes in staffing over last several years
  - Shuffling people around
  - Bringing new people in
  - Leads to Inefficiencies

  - Concrete Example: Recycler Low Level RF Development
    - Summer 2011, expert (10+ years experience with MI and RR LLRF) left the laboratory as found another job, ‘did not like the direction’
    - Fall 2011, replaced with two new members coming from other areas (Pbar and Tev) but neither had direct LLRF experience
    - Took 2 people 2x as long as the estimate
      - 4x the cost to the project ($240k additional expense)

Budget for remaining tasks

through December Status		Tech Days	Welder Days	Electrician Days	Rigger Days	Engineering Days		M&S (loaded $)	M&S (unloaded $)
									1.16
total		2751.5025	88.65	96.75625	310.5	740.87625		$348,591	$300,509.39
II Beam Pipe & Vacuum Installation		100						$2,923	$2,519.61
MI 60 Staging Crew		269.0625				30			
MI 60 Girder Work		0							
RR 30 Straight Installation		198.75			66.75	5		$11,833	$10,200.86
EL Installation		150			60	5		$17,811	$15,354.31
Multiwire/DCCT/Toroid fabrication		4.725	15			1.5		$0	
DCCT Installation		72				3.2		$0	
MI 614 Reconstruction		0						$0	
RR RF Installation		305			129	15		$34,401	$29,656.34
Damper Installation		92.25		12	32.25	3		$52,061	$44,880.17
BPM Hardware Installation		42						$0	
Vacuum Hardware & Prep		3.24				3.24		$41,834	$36,064.05
RR RF cavity 1 Retrofit (includes testing in budget)		37.755	40.95			38.27375		$3,056	$2,634.24
RR RF mid & hi level		0						$0	
RR RF low level		4.35				41.1		$0	
RR Water		75.83125		15.01875		34.7625		$5,614	$4,839.50
NuMI Water		90.15625		49.7375		18.75		$43,219	$37,257.97
Recycler Shims		146.0625						$0	
Cable Pulls				20				$0	
RKB Fabrication		94.42	20.28			71.88625		$19,211	$16,561.59
Kicker Power Supplies & Testing		484.26875				245.58125		$40,362	$34,794.83
Installation Planning		55.4	12.42			30.47		$0	
Target & Horn 1 Installation		210.95625				42.28125		$35,521	$30,621.85
Target Hall Infrastructure		106.05			22.5	15.9		$5,673	$4,890.52
Timing & Controls		26.725				28.48125		$16,935	$14,599.40
RBEX and Ramped Supplies		158				104.95		$8,649	$7,455.69
Ramped Correctors		24.5				2.5		$9,487	$8,178.45
Dollars?		$2,035,328	$96,171	$94,792	$379,792	$877,907	$3,483,990		
value of a single day		$740	$1,085	$980	$1,223	$1,185			

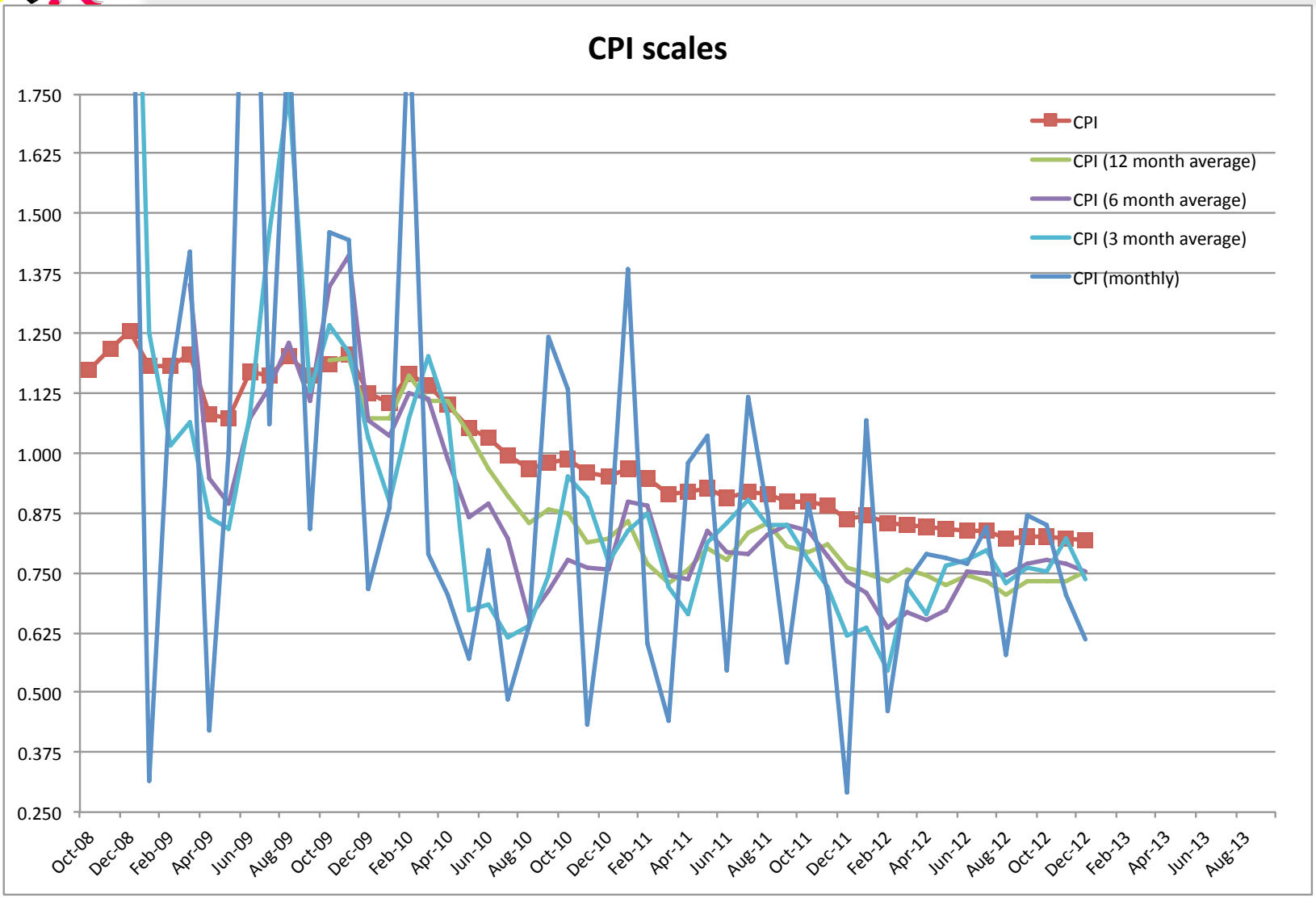
Estimates for remaining tasks

	Tech Days	Welder Days	Electrician Days	Rigger Days	Engineering Days			scale factor
total	2487.5	266.5	90	495	556.5			
II Beam Pipe & Vacuum Installation	118	15						
MI 60 Staging Crew	240				30			
MI 60 Girder Work	80	15						
RR 30 Straight Installation	216			270			50% more	1.5
EL Installation	105			135			50% more	1.5
Multiwire/DCCT/Toroid fabrication	137	3			37.5		using Sep-Nov and extrapolating for 4 months Jan-April	
DCCT Installation	38							
MI 614 Reconstruction	33	2						
RR RF Installation	168	3		90			50% more	1.5
Damper Installation	60	2						
BPM Hardware Installation	132				12		double	2
Vacuum Hardware & Prep	190	214					double	2
RR RF cavity 1 Retrofit	65	3			30			
RR RF mid & hi level	100				5			
RR RF low level					55			
RR Water	28	2			10			
NuMI Water	40				15			
Recycler Shims	80							
Cable Pulls			90					
RKB Fabrication	0				0			
Kicker Power Supplies & Testing	187.5	7.5			150		50% more	1.5
Installation Planning	90				105		50% more drafting (as tech) and engineering	1.5
Target & Horn 1 Installation	100				24		guess hadron monitor at same level as target installation?	
Target Hall Infrastructure	80				3		double this	2
Timing & Controls	50				30		double this	2
RBEX and Ramped Supplies	100				50			
Ramped Correctors	50						Extrapolate from FY12 to FY13 (probably an overestimate)	
Dollars?	$1,840,041	$289,110	$88,173	$605,466	$659,429	$3,482,219		
value of a single day	$740	$1,085	$980	$1,223	$1,185			

EVMS Performance

Month	BCWS	BCWP	ACWP	SPI	SV ($)	CPI	CV ($
Oct-11	$452,944	$616,798	$716,328	1.36	347,719	0.86	(118,116)
Nov-11	$732,319	$834,344	$1,178,574	1.14	102,025	0.71	(344,231)
Dec-11	$1,017,305	$369,795	$1,274,208	0.36	(647,510)	0.29	(904,412)
Jan 12	$581,113	$860,305	$805,092	1.48	279,192	1.069	56,587
Feb-12	$561,330	$544,809	$1,180,131	0.97	(16,521)	0.46	(635,322)
Mar-12	$759,409	$1,128,324	$1,541,540	1.49	368,914	0.73	(413,216)
Apr-12	$845,830	$820,307	$1,041,863	0.97	(25,523)	0.79	(221,555)
May-12	$1,561,287	$1,372,793	$1,757,983	0.88	(188,494)	0.78	(385,190)
Jun-12	$1,785,348	$2,327,656	$3,027,918	1.30	542,308	0.77	(700,263)
Jul-12	$1,624,540	$1,762,817	$2,084,021	1.09	138,277	0.85	(321,203)
Aug-12	$1,534,787	$1,361,180	$2,360,712	0.89	(173,607)	0.58	(999,532)
Sep-12	$2,426,730	$2,035,864	$2,341,862	0.84	(390,866)	0.87	(305,998)
FY12	$14,097,119	$14,433,033	$19,725,484	1.02	335,914	0.73	(5,292,451)
Oct-12	$1,353,600	$1,320,683	$1,552,026	0.98	(32,917)	0.85	(231,343)
Nov-12	$834,116	$996,748	$1,412,398	1.195	162,632	0.71	(415,650)
Dec-12	$1,127,000	$689,000	$1,127,111	0.611	(438,000)	0.611	(438,111)

Shorter term trending?



Task Breakdown

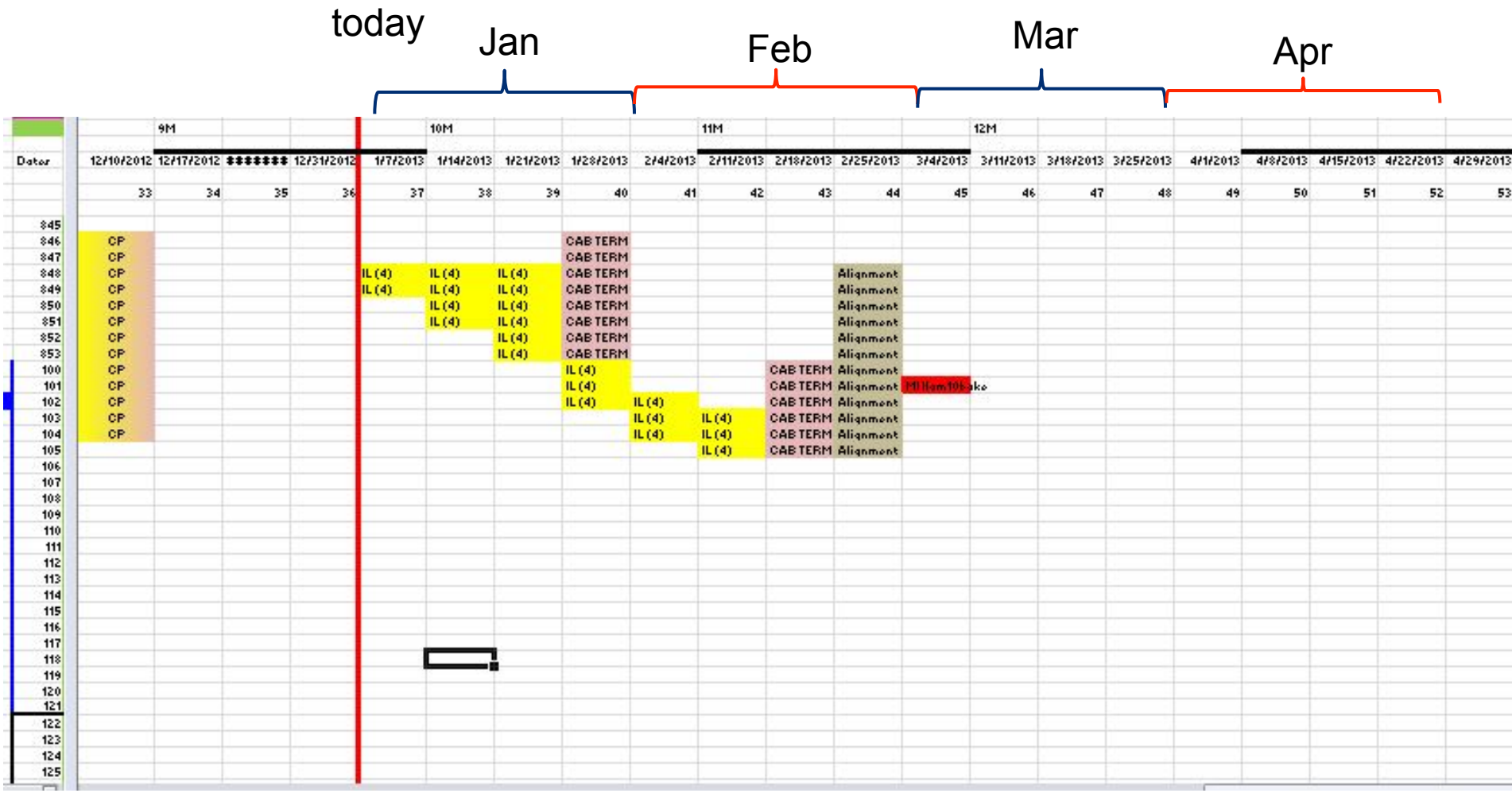
Row Labels	Values Count of PMT Type	Sum of Total Money	Sum of Remaining Money
In Progress	134	$8,360,421	$1,830,681
A	2	$211,895	$158,921
C	80	$7,207,393	$1,362,178
E	28	$685,531	$243,680
F	24	$255,602	$65,902
(blank)		$0	$0
Planned	69	$2,302,376	$2,160,715
A	4	$0	$0
C	19	$1,025,712	$902,669
E	9	$542,808	$542,808
F	37	$733,856	$715,238
(blank)		$0	$0
Grand Total	**203**	**$10,662,797**	**$3,991,396**

A: Level of effort
C: % Complete (can have peg points)
E: 50-50
F: 0-100

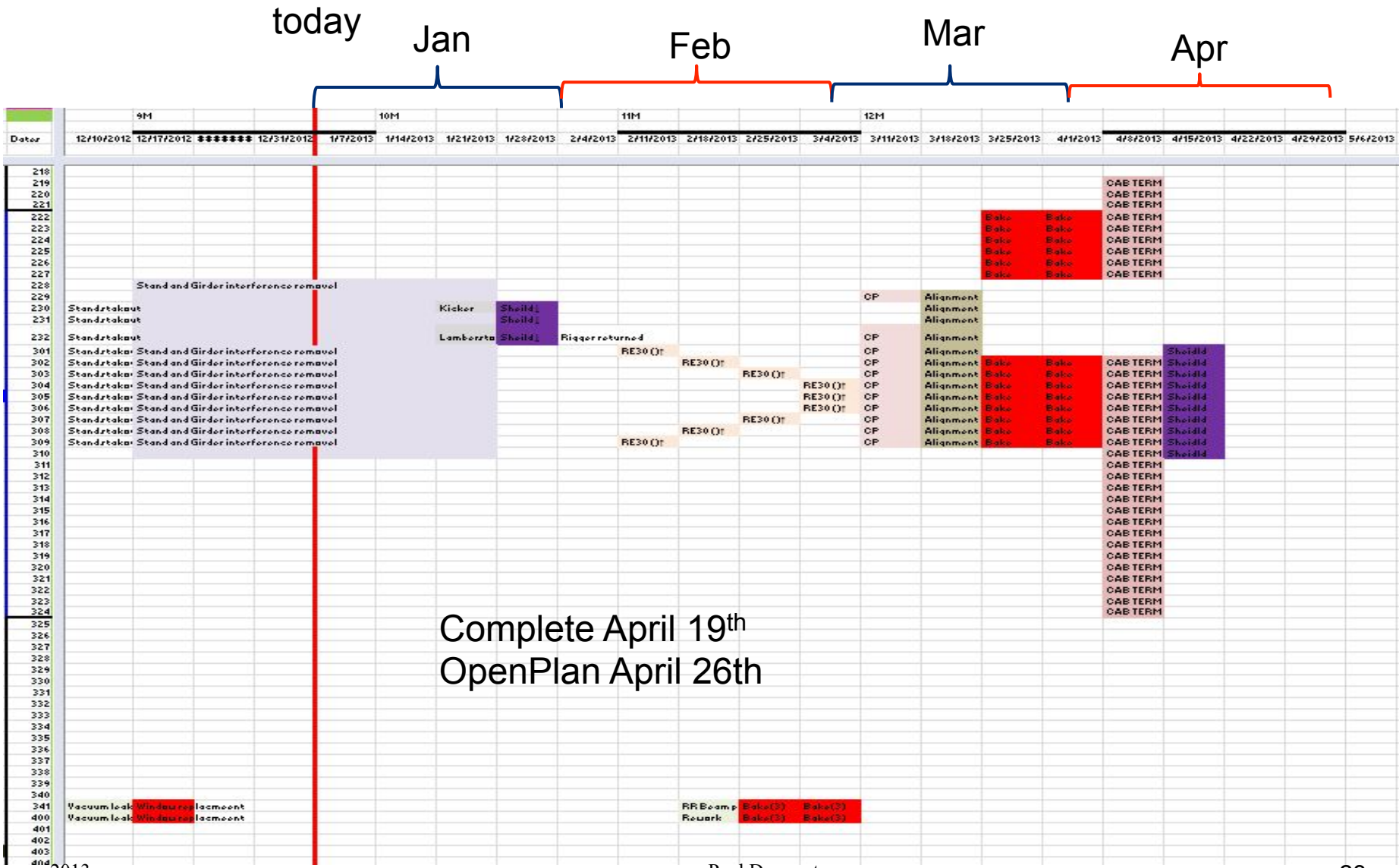
Remaining Money is budget*(1-% complete), not BCWR

$231K in those two types ($189k in type F)

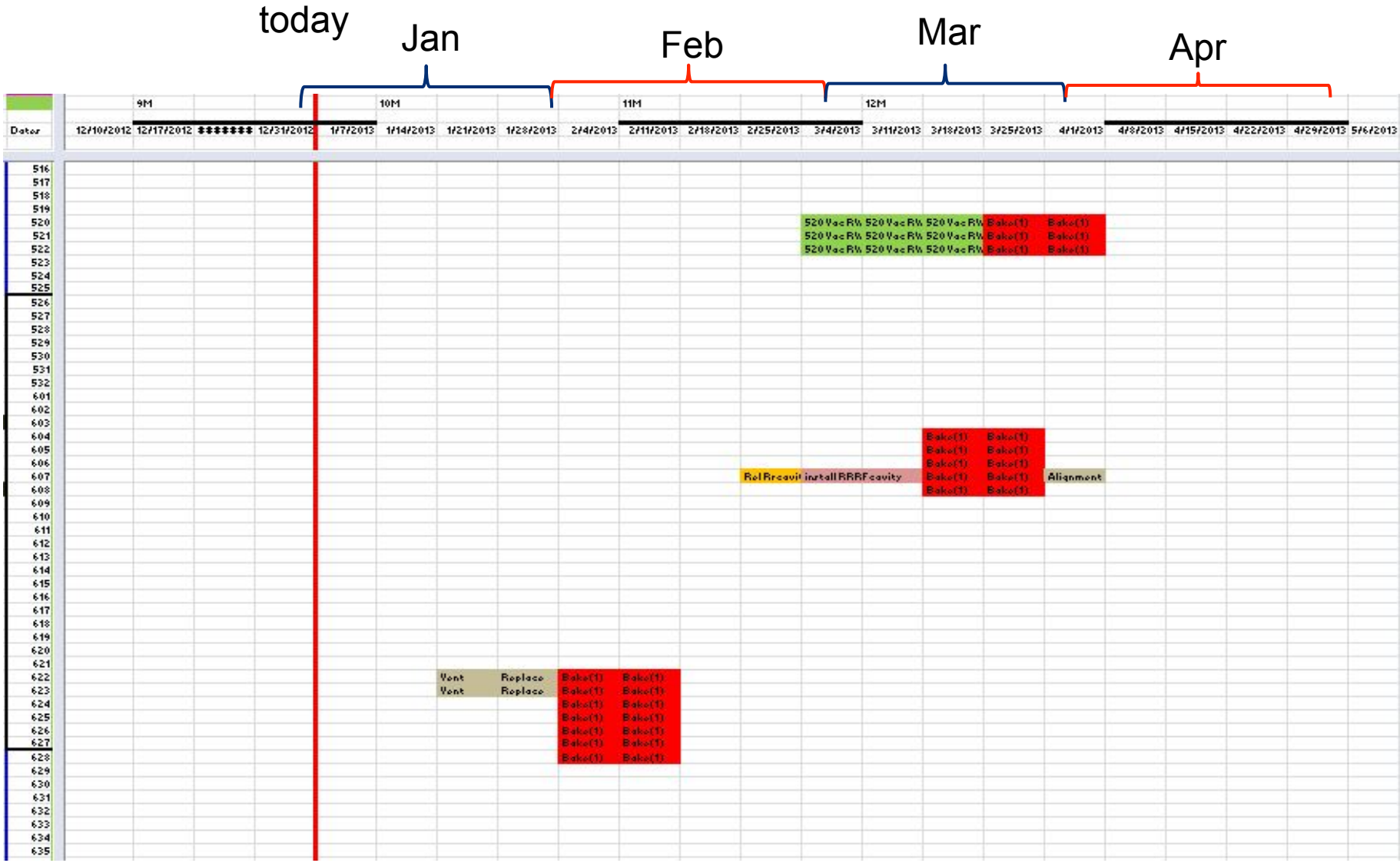
Injection line Schedule



RR30 and 40 Schedule



RR52/60/62 RF Installation



NuMI Target Hall schedule

- We will complete a Hi-Pot test of the walkway stripline on Tuesday January 22nd.
- The stripline protective fence will be installed January 23nd through February 1st.
- We will be installing the Horn 2 stripline jumper the week of January 28th.
- We will be replacing the Horn 1 stripline block the week of February 4th.
- The scheduled installation date for Horn 1 is February 11th through February 22nd.
- We plan to complete three days of Horn 1 & 2 Pulse Testing including thermal imaging of the stripline at the new rep rate the week of February 25th.
- Complete power supply testing the week of February 25th.
- The scheduled installation date for the Target is April 1st through April 12th.

- We will ready for low intensity beam to complete beam scans on April 26th.

- This is a partial schedule which addresses installation and testing of the primary components. If you have questions please call.