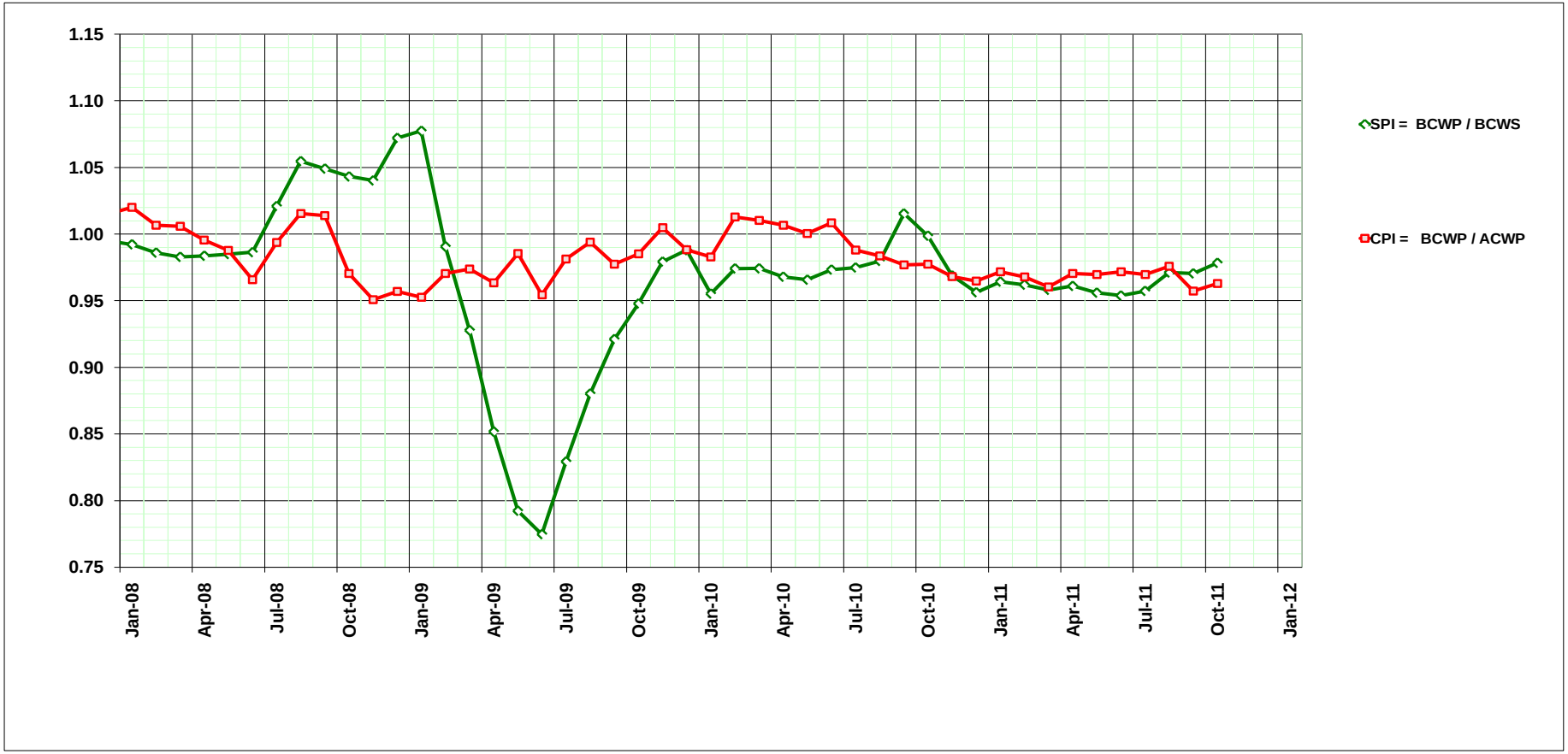
Project Status

John Cooper
Project Manager

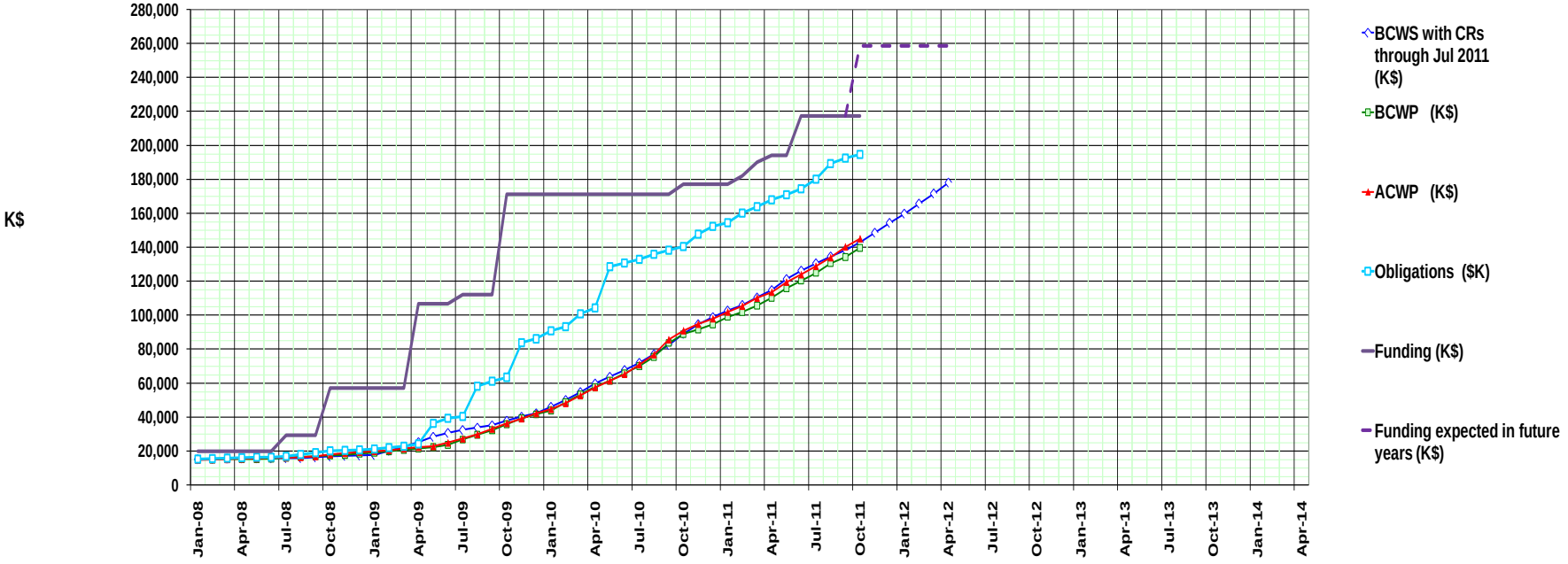
EVMS Reporting Overview

- Data now available through October 2011
  - SPI = **0.978**, compare to 0.970 in Sep, 0.971 in Aug, 0.957 in Jul
  - CPI = **0.963,** compare to 0.957 in Sep, 0.976 in Aug, 0.970 in Jul
- We are still "Green"



EVMS Reporting Overview

- Basic data in BCWS, BCWP, ACWP, **Funding** & **Obligations** through Oct 2011
  - BCWS = Budgeted cost of work Scheduled
  - BCWP = Budgeted cost of work Performed
  - ACWP = Actual cost of work Performed
- Project is 56.5 % complete (BCWP/BAC = 139.7 M$ / 247.3 M$)
  - BAC = Budget at Completion (using EAC, get 55.2%)
- Project is 78.7 % obligated (Obligations/BAC = 194.6 / 247.3)
  - EAC = Estimate at Completion (using EAC, get 76.9%)



CPR1 Oct 2011

COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

CONTRACTOR	CONTRACT	PROGRAM	REPORT PERIOD
NAME	NAME	NAME	FROM 01-Oct-2011
Fermi National Accelerator Laboratory		NOvA Project	TO 31-Oct-2011

PERFORMANCE DATA

CTC-FndSrc	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
WBS[2] Results...	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE			LATEST REVISED	
ITEM	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	ESTIMATE	VARIANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
DA DOE-ACEL MIE													
2.0 ANU Construction													
Fully burdened AY$k	611	816	1,100	205	(283)	18,794	16,519	19,456	(2,275)	(2,938)	32,954	36,261	(3,307)
CTC-FndSrcTotals:	611	816	1,100	205	(283)	18,794	16,519	19,456	(2,275)	(2,938)	32,954	36,261	(3,307)
DC DOE-CA													
2.1 Site and Building													
Fully burdened AY$k	0	0	297	0	(297)	35,060	35,060	34,872	0	188	35,060	34,872	188
CTC-FndSrcTotals:	0	0	297	0	(297)	35,060	35,060	34,872	0	188	35,060	34,872	188
DD DOE-ACEL R&D													
1.0 ANU R&D													
Fully burdened AY$k	0	193	32	193	161	7,025	7,022	6,584	(2)	439	7,121	6,682	439
CTC-FndSrcTotals:	0	193	32	193	161	7,025	7,022	6,584	(2)	439	7,121	6,682	439
DE DOE-DET MIE													
2.1 Site and Building													
Fully burdened AY$k	75	148	15	72	133	6,429	6,538	4,665	109	1,873	6,910	5,038	1,872
2.10 Project Management - Nova Project - Construction													
Fully burdened AY$k	197	197	224	0	(27)	6,651	6,651	5,459	0	1,192	11,652	10,469	1,183
2.2 Liquid Scintillator													
Fully burdened AY$k	852	1,039	123	186	916	6,260	6,619	6,846	359	(227)	22,189	22,448	(259)
2.3 WLS Fiber													
Fully burdened AY$k	392	404	417	12	(13)	7,388	8,144	8,436	756	(292)	12,403	12,687	(284)
2.4 PVC Extrusions													
Fully burdened AY$k	623	959	1,283	336	(323)	9,095	10,034	9,792	939	243	30,655	30,207	449
2.5 PVC Modules													
Fully burdened AY$k	360	364	429	4	(65)	8,600	7,949	6,549	(651)	1,399	20,250	18,824	1,426
2.6 Electronics													
Fully burdened AY$k	400	443	277	43	166	4,557	3,896	3,244	(662)	652	12,028	11,463	565
2.7 DAQ													
Fully burdened AY$k	275	351	141	76	210	1,632	1,397	1,863	(235)	(467)	3,891	4,368	(477)
2.8 Near Detector Assembly													
Fully burdened AY$k	12	8	60	(4)	(52)	975	863	2,130	(112)	(1,268)	5,925	7,214	(1,289)
2.9 Far Detector Assembly													
Fully burdened AY$k	544	437	371	(106)	66	6,067	4,823	6,444	(1,244)	(1,621)	21,479	23,219	(1,739)
CTC-FndSrcTotals:	3,732	4,350	3,339	618	1,011	57,655	56,913	55,429	(742)	1,484	147,383	145,937	1,446

(2,246 last month) J. Cooper

CPR1 Oct 2011 continued

COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

CONTRACTOR	CONTRACT	PROGRAM	REPORT PERIOD
NAME	NAME	NAME	FROM 01-Oct-2011
Fermi National Accelerator Laboratory		NOvA Project	TO 31-Oct-2011

PERFORMANCE DATA

CTC-FndSrc	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
WBS[2] Results...	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE			LATEST REVISED	
ITEM	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	ESTIMATE	VARIANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
DO DOE-ACEL OPS													
1.0 ANU R&D													
Fully burdened AY$k	55	4	(1)	(51)	5	367	316	539	(51)	(223)	901	1,123	(222)
CTC-FndSrcTotals:	55	4	(1)	(51)	5	367	316	539	(51)	(223)	901	1,123	(222)
DR DOE-POST CD-1 DET R&D													
1.1 Site and Building R&D													
Fully burdened AY$k	0	0	0	0	0	3,630	3,630	3,168	0	462	3,630	3,168	462
1.2 Liquid Scintillator R&D													
Fully burdened AY$k	0	0	0	0	0	297	297	389	0	(92)	297	389	(92)
1.3 WLS Fiber R&D													
Fully burdened AY$k	0	0	0	0	0	341	341	375	0	(34)	341	375	(34)
1.4 PVC Extrusion R&D													
Fully burdened AY$k	0	0	0	0	0	1,369	1,369	2,083	0	(714)	1,369	2,083	(714)
1.5 PVC Module R&D													
Fully burdened AY$k	0	0	(1)	0	1	2,260	2,260	2,421	0	(160)	2,260	2,421	(160)
1.6 Electronics R&D													
Fully burdened AY$k	0	0	0	0	0	2,028	2,004	2,600	(24)	(596)	2,028	2,631	(603)
1.7 DAQ R&D													
Fully burdened AY$k	0	35	0	35	35	1,635	1,635	2,822	0	(1,186)	1,635	2,822	(1,186)
1.8 Detector Assembly R&D													
Fully burdened AY$k	0	0	0	0	0	3,123	3,123	4,929	0	(1,806)	3,123	4,929	(1,806)
1.9 Project Management R&D													
Fully burdened AY$k	0	0	0	0	0	383	383	559	0	(176)	383	559	(176)
CTC-FndSrcTotals:	0	35	(1)	35	36	15,067	15,043	19,345	(24)	(4,302)	15,067	19,376	(4,310)
DY DOE CD-0 TO CD-1 R&D													
1.9 Project Management R&D													
Fully burdened AY$k	0	0	0	0	0	8,801	8,801	8,801	0	0	8,801	8,801	0
CTC-FndSrcTotals:	0	0	0	0	0	8,801	8,801	8,801	0	0	8,801	8,801	0
Undist. Budget											0	0	0
Sub Total	4,397	5,398	4,766	1,001	633	142,767	139,674	145,026	(3,094)	(5,352)	247,285	253,051	(5,766)
Management Resrv.											30,715		
Total	4,397	5,398	4,766	1,001	633	142,767	139,674	145,026	(3,094)	(5,352)	278,000		

Actions taken relative to last month

- Eliminated Far Detector Block #30
  - Still 14.25 kt, KPP still satisfied
  - Saved 1.45 M$ Scint., 0.2 M$ Far Assembly
- Fixed the missing Scintillator Toll Blending
  - Cost 2.2 M$
- Updated the Electronics cooling scheme
  - ~ Series vs. more parallel, not new, planned for months…
  - Saved 0.75 M$
- Install the FY12 G&A changes
  - Cost 0.52 M$
- Updated ANU Management task to match FY11 actual costs
  - Saved 0.4 M$
- Put tasks in the schedule for DCM parts delivery so we could take credit for work completed (FPGA parts problem from last month)
- Plus some self-corrections
  - Accrued costs last month at end of FY, statused this month as done
    - Just difference between date cost was known and date we accepted delivery after QA

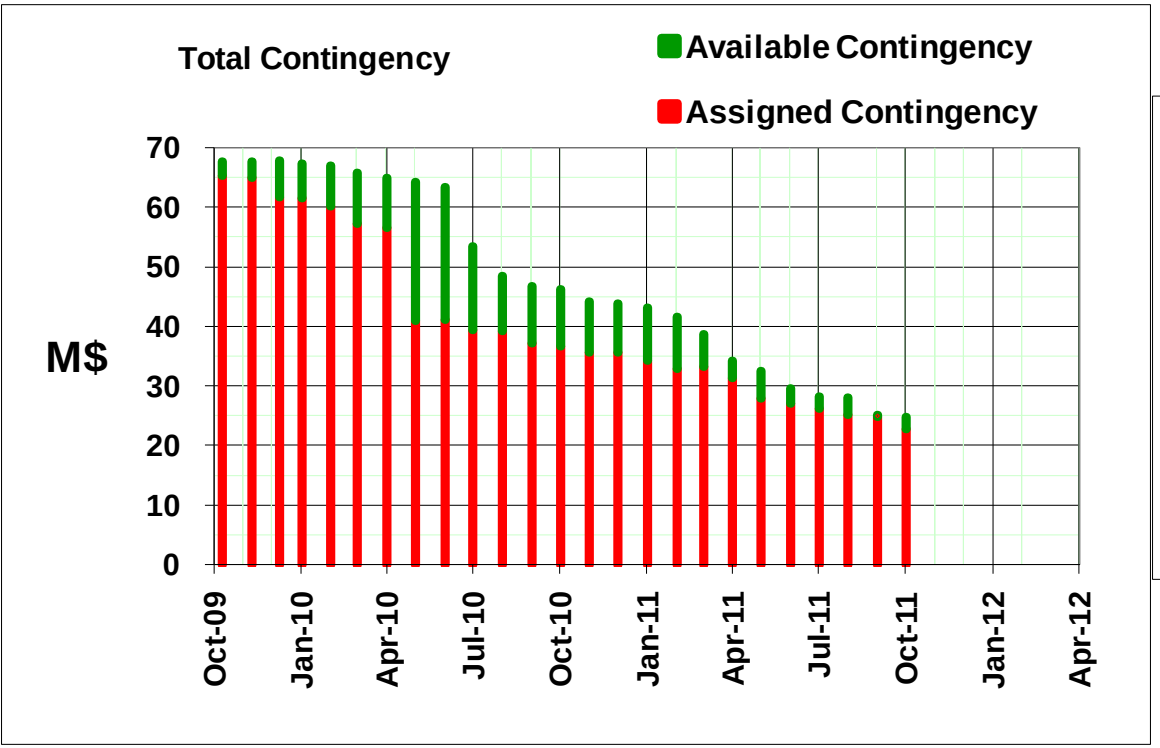
AY$ by Level 2 with MIE/OPC split

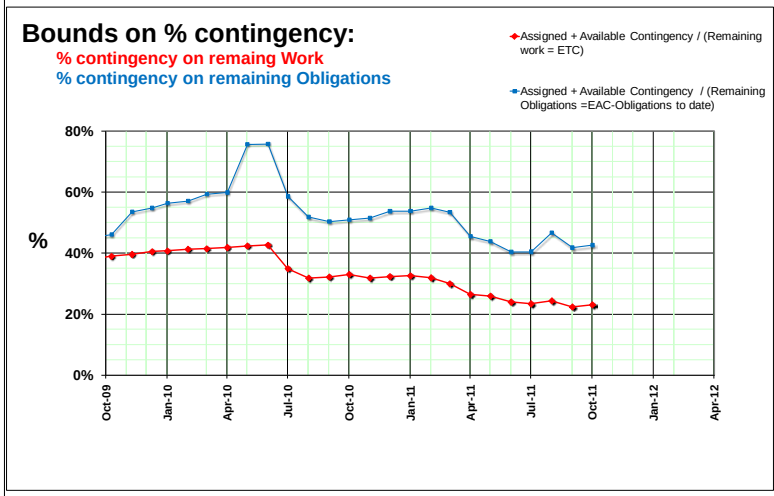
- Oct Available Contingency recovered from September's low 0.277 M$
- 1 – 2 M$ available is as low as I am comfortable with

	WBS	Items	NOvA Costs to Date ($M) as of 31-Oct-2011	NOvA 's Cost Estimate AY $M (for November 1, 2011 to project end) Estimated Cost (with indirects) M&S	Estimated Cost Labor[1]	Estimated Cost Total	Mgmt Reserve Estimate M&S	Mgmt Reserve Estimate Labor[1]	Mgmt Reserve Estimate Total	Contingency % M&S	Contingency % Labor[1]	Contingency % Total	Total Cost
TEC	2.0	Accelerator & NuMI Upgrades	$ 19.5	$ 5.5	$ 11.3	$ 16.8	$ 1.9	$ 3.7	$ 5.6	34%	33%	33%	$ 41.8
	2.1	Far Detector Site and Building	$ 4.7	$ 0.4	$ 0.0	$ 0.4	$ 0.1	$ 0.0	$ 0.1	16%	7%	15%	$ 5.1
	2.2	Liquid Scintillator	$ 6.8	$ 15.2	$ 0.4	$ 15.6	$ 3.8	$ 0.2	$ 4.0	25%	44%	25%	$ 26.4
	2.3	Wave-Length-Shifting Fiber	$ 8.4	$ 3.9	$ 0.3	$ 4.3	$ 0.2	$ 0.0	$ 0.2	5%	11%	6%	$ 12.9
	2.4	PVC Extrusions	$ 9.8	$ 19.6	$ 0.9	$ 20.4	$ 1.1	$ 0.2	$ 1.3	6%	21%	6%	$ 31.5
	2.5	PVC Modules	$ 6.5	$ 4.8	$ 7.5	$ 12.3	$ 0.5	$ 1.3	$ 1.8	11%	17%	15%	$ 20.6
	2.6	Electronics Production	$ 3.2	$ 7.2	$ 1.0	$ 8.2	$ 0.6	$ 0.3	$ 0.9	8%	28%	11%	$ 12.4
	2.7	Data Acquisition System	$ 1.9	$ 1.7	$ 0.8	$ 2.5	$ 0.4	$ 0.2	$ 0.6	22%	31%	25%	$ 5.0
	2.8	Near Detector Assembly	$ 2.1	$ 4.8	$ 0.3	$ 5.1	$ 1.6	$ 0.2	$ 1.7	33%	54%	34%	$ 9.0
	2.9	Far Detector Assembly	$ 6.4	$ 7.6	$ 9.1	$ 16.8	$ 1.7	$ 4.7	$ 6.4	23%	52%	38%	$ 29.7
	2.10	Project Management	$ 5.5	$ 0.2	$ 4.8	$ 5.0	$ 0.0	$ -	$ 0.0	25%	0%	1%	$ 10.5
		Subtotal Construction	**$ 74.9**	**$ 70.9**	**$ 36.5**	**$ 107.3**	**$ 11.9**	**$ 10.8**	**$ 22.7**	**17%**	**30%**	**21%**	**$ 204.9**
OPC		**R&D - Accelerator**	$ 6.6	$ -	$ 0.1	$ 0.1	$ -	$ 0.0	$ 0.0	0%	35%	35%	$ 6.7
		R&D - Detector	$ 28.1	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	100%	50%	58%	$ 28.2
		Cooperative Agreement	$ 34.9	$ -	$ -	$ -	$ -	$ -	$ -	0%	0%	0%	$ 34.9
		Operating	$ 0.5	$ 0.1	$ 0.5	$ 0.6	$ 0.0	$ 0.2	$ 0.2	42%	35%	36%	$ 1.3
		Total OPC:	**$ 70.1**	**$ 0.1**	**$ 0.6**	**$ 0.7**	**$ 0.0**	**$ 0.2**	**$ 0.3**	**46%**	**36%**	**37%**	**$ 71.1**
		Available Contingency							**$ 2.014**				**$ 2.0**
		TPC:	**$ 145.0**	**$ 70.9**	**$ 37.1**	**$ 108.0**	**$ 11.9**	**$ 11.0**	**$ 24.9**	**17%**	**30%**	**23%**	**$ 278.000**

Contingency Status

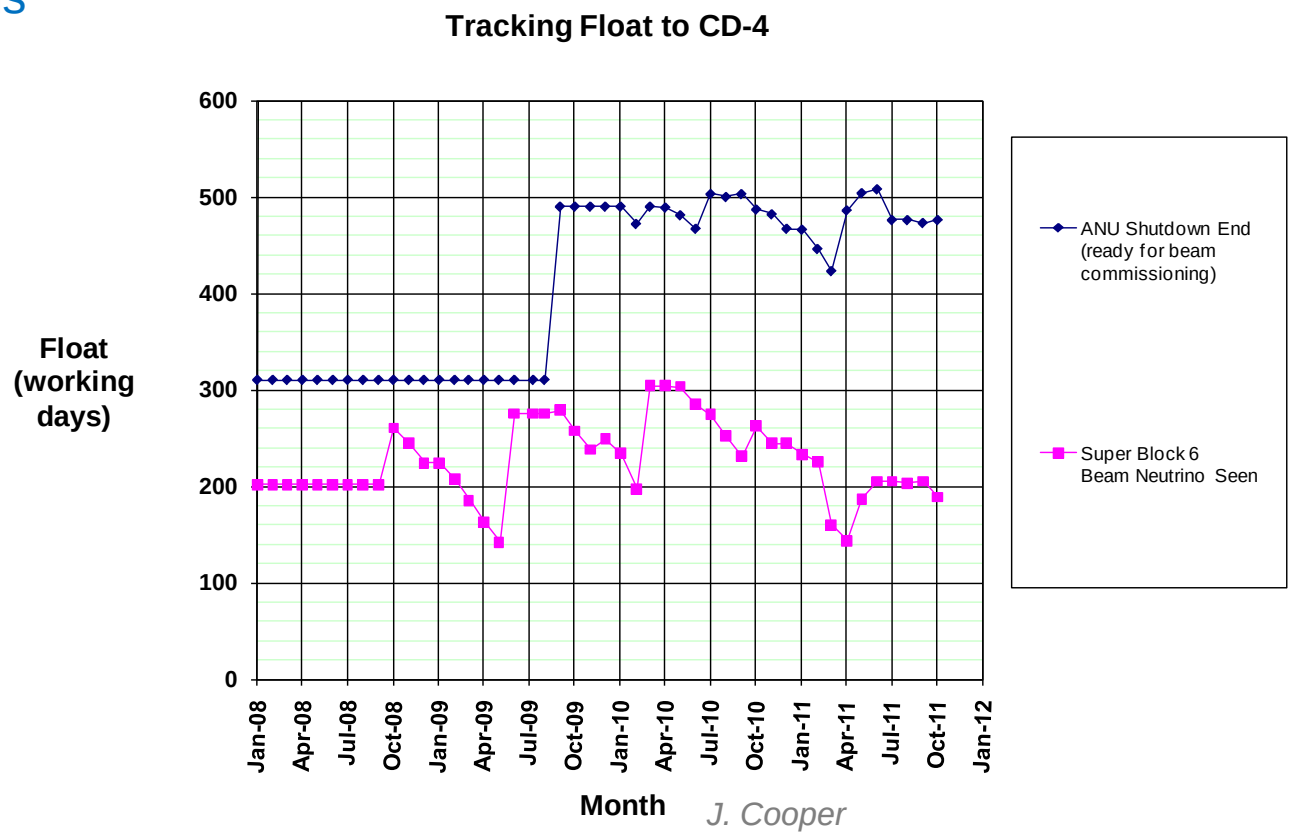
- Total Contingency is 24.9 M$
- Available Contingency = $ 2.01 M$ in Oct (Sep =0.28 M$, Aug=3.04 M$, Jul=1.97 M$)
- 23% Contingency on remaining work
- 43% on remaining Obligations





Milestones: What about CD-4 ?

- **ANU gained 3 days of float in Oct -- Now at 476 days**
  - Kicker schedule drives this float
- **The Detector lost 16 days of float in Oct -- Now at 189 days**
  - Pivoter readiness drives the float to assembly start, but Module Production at Minnesota is still only hours behind Pivoter
  - Float to CD-4 also pushed by a scintillator filling task on Block #1 (5 days) and a cable tray task prior to outfitting Block #1. These two probably have work-arounds

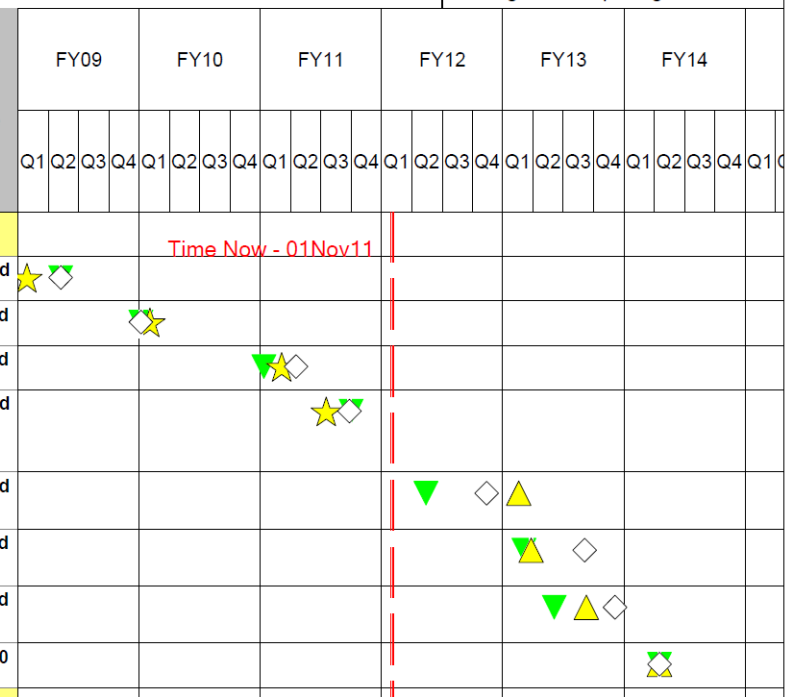


Milestones held by DOE - OHEP

Nova_Project
Milestone Gantt Chart
Nova_Milestones_L1_L2 = [BOOL.T] and ESDATE >= {10/1/08}
October 2011 Status
TimeNow: 01Nov11

Baseline Date
Completed Milestone
Current Forecast Date
Management Reporting Date

Activity Desc.	Baseline Date	Forecast / Actual Date	Management Reporting Date	Reporting Milestone Float	Baseline Variance
L.1 -- DOE - OHEP Associate Director Milestone					
CD-3a	02Feb09	24Oct08	02Feb09	63d	63d
CD-3b	01Oct09	29Oct09	01Oct09	-21d	-21d
IPND ready to take data	11Oct10	30Nov10	12Jan11	27d	-35d
Beneficial occupancy (Substantial completion) - far detector building construction	30Jun11	13Apr11	22Jun11	48d	54d
Beneficial occupancy of near detector cavern	10Feb12	15Nov12	10Aug12	-69d	-196d
NuMI neutrino event observed in Superblock 1	03Dec12	21Dec12	03Jun13	109d	-14d
Near detector completed and ready to operate	01Mar13	06Jun13	03Sep13	60d	-68d
14 kt installation completed	16Jan14	16Jan14	16Jan14	-1d	0



We need to move the Beneficial Occupancy of the Near Cavern

Currently baselined before start of March 1, 2012 shutdown

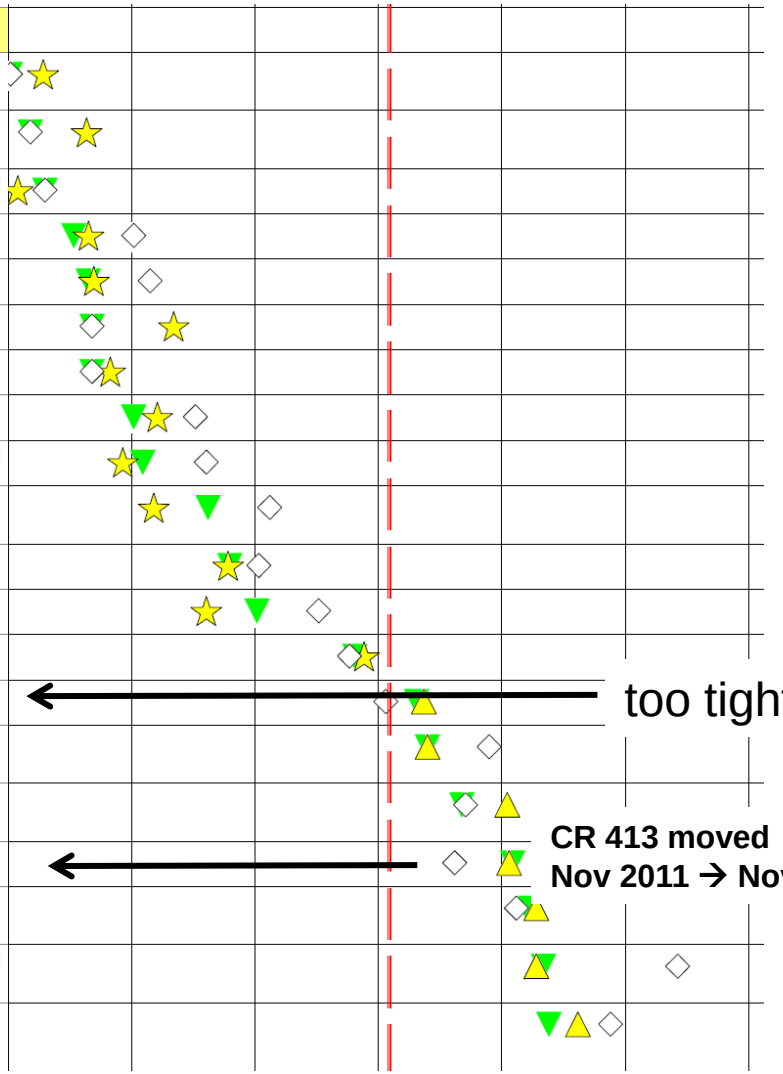
But really need to move all four of these in a coordinated way

Does no good to move “B.O. of cavern” to after “Near Det. Completed”

And “Neutrino event in SuperBlock #1 will impact 14 kt installation complete

DOE Milestones – Fed Project Director

L.2 -- DOE- NOVA Project Director Milestone					
DOE OECM - FRA EVMS Readiness Assessment	01Oct08	09Jan09	01Oct08	-67d	-67d
DOE OECM - FRA EVMS Certification Review	01Dec08	15May09	01Dec08	-115d	-114d
DOE OHEP CD-3a Mini-review	15Jan09	24Oct08	15Jan09	52d	52d
Site preparation purchase order released	06Apr09	22May09	06Oct09	93d	-34d
Waveshifter PO issued	22May09	08Jun09	23Nov09	117d	-10d
DOE OECM - FRA EVMS Certified	01Jun09	28Jan10	01Jun09	-165d	-164d
DOE OHEP CD-3b Review	01Jun09	23Jul09	01Jun09	-38d	-37d
Extrusion PO issued	01Oct09	11Dec09	01Apr10	73d	-49d
WLS fiber PO issued	02Nov09	01Sep09	03May10	165d	42d
Decision point for buying additional waveshifter powders	11May10	01Dec09	11Nov10	238d	109d
IPND blocks (4 of 6) completed	12Jul10	09Jul10	08Oct10	63d	0
Mineral oil PO issued	01Oct10	07May10	01Apr11	225d	101d
APDs PO issued	18Jul11	15Aug11	01Jul11	-31d	-21d
Block pivoter completed	20Jan12	08Feb12	20Oct11	-73d	-13d
Decision point for buying additional WLS fiber	23Feb12	23Feb12	23Aug12	128d	0
MI Ring Modifications Ready for Beam Transport	01Jun12	16Oct12	14Jun12	-87d	-95d
Decision point for buying additional APDs	01Nov12	19Oct12	11May12	-112d	9d
RR Modifications Ready for Beam Transport	13Dec12	08Jan13	09Nov12	-37d	-14d
Ready to Commission Upgrades with Medium Energy Neutrino Beam	01Feb13	08Jan13	03Mar14	287d	16d
Decision point for buying additional extrusions, modules, mineral oil, pseudocumene	13Feb13	13May13	13Aug13	64d	-63d



too tight?

CR 413 moved Nov 2011 → Nov 2012

2 additional "Decision Point to buy" – Fiber too early; Extrusions,...OK ?

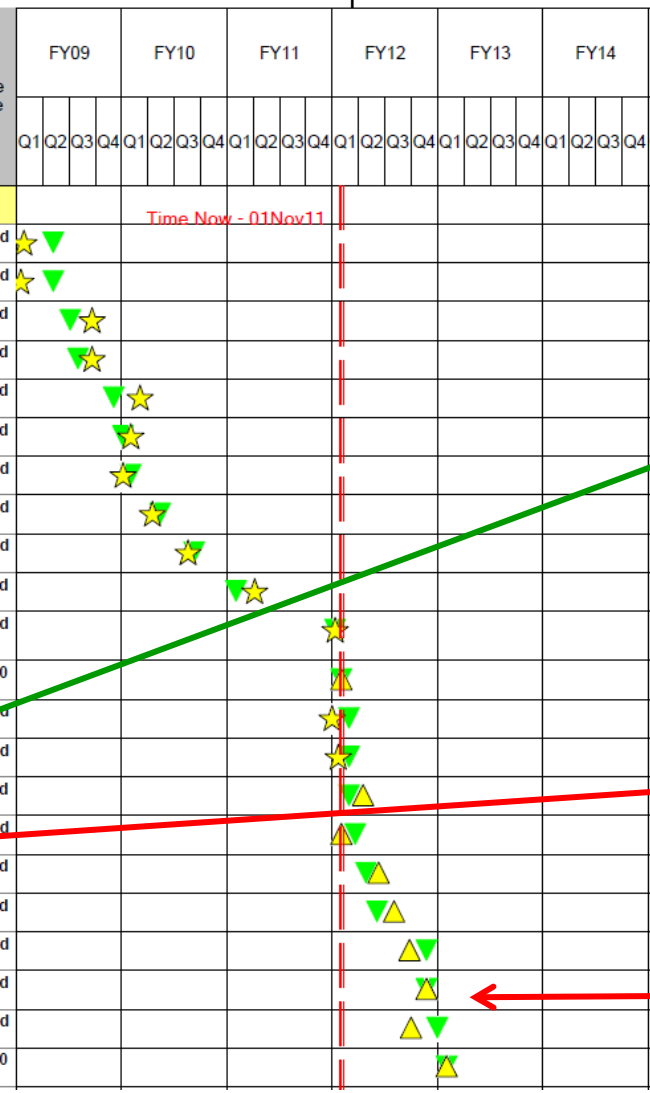
3 connected with shutdown dates, move when shutdown is set?

Milestones held by Directorate

Nova_Project
Milestone Gantt Chart
/ilestone_L3_L4 = [BOOL.T] and (ESDATE >= {10/01/08} or BSDATE >= {10/01/08}) and BFDATE NOT_EMPTY
October 2011 Status
TimeNow: 01Nov11

Baseline Date ▼
Completed Milestone ☆
Current Forecast Date △

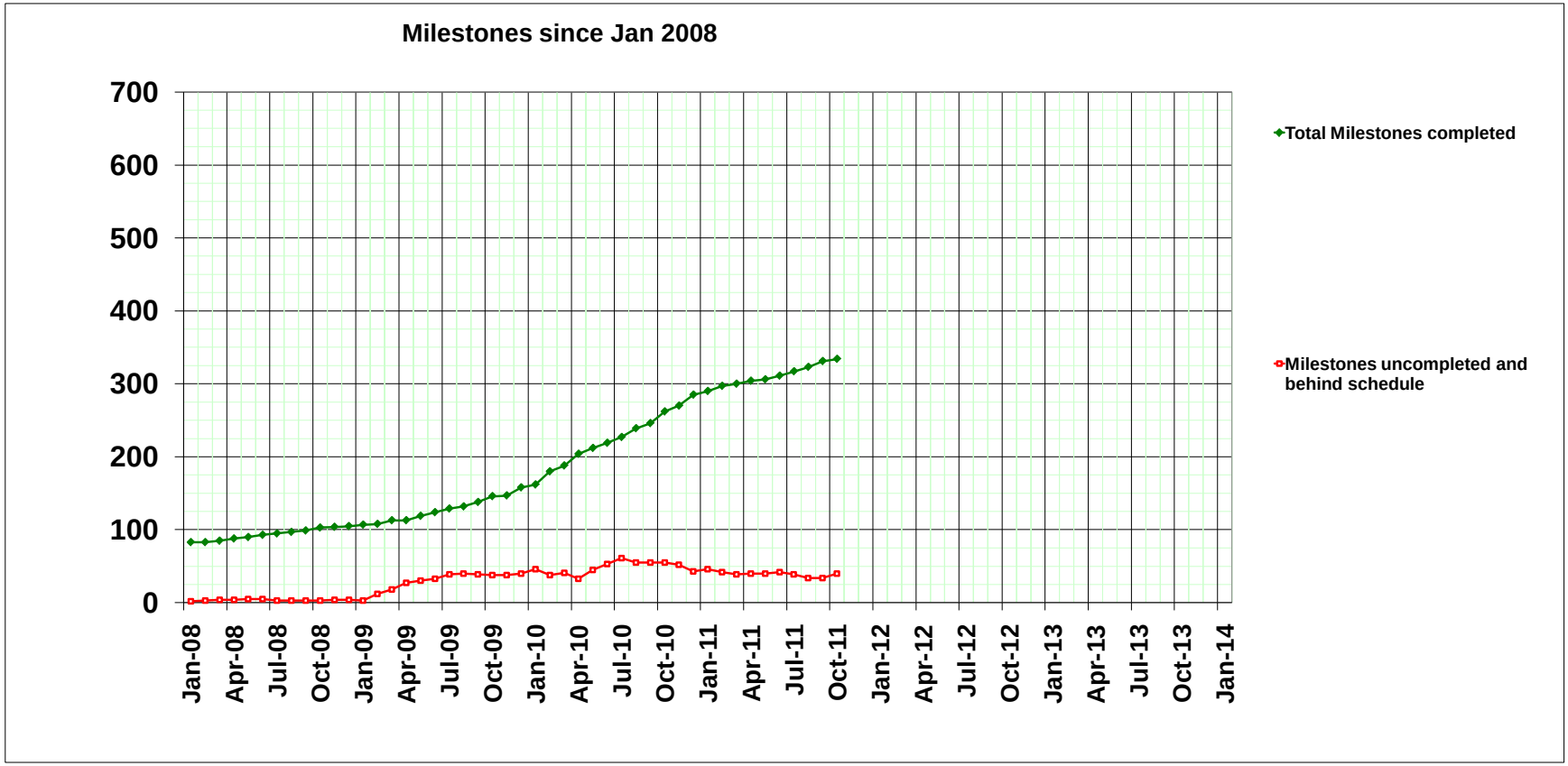
Activity ID	Activity Desc.	Baseline Date	Forecast or Actual Date	Baseline Variance
L.3 -- Fermilab Associate Director Milestone				
2.10.9.5	CD-3a Funds Available	02Feb09	24Oct08	63d
2.10.9.7	FY09 Funds Available	02Feb09	14Oct08	71d
2.10.10.3	2009 Shutdown Begun	06Apr09	15Jun09	-50d
2.10.9.24	Director's CD-3b Review	01May09	18Jun09	-34d
2.0.1.2.8.1	Gap Clearing/RR Inj Kicker Magnet Design Complete	01Sep09	01Dec09	-63d
2.10.9.6	CD-3b Funds Available	01Oct09	29Oct09	-21d
2.10.9.8	FY10 Funds Available	02Nov09	01Oct09	21d
2.3.2.1.6	WLS fiber production begins	09Feb10	12Jan10	18d
1.5.7.3.9	IPND block 4 module production completed	04Jun10	17May10	12d
2.10.9.9	FY11 Funds Available	01Nov10	03Jan11	-41d
2.1.2.5.23	Final acceptance/project completion - far detector building construction	10Oct11	10Oct11	-1d
2.10.9.10	FY12 Funds Available	01Nov11	01Nov11	0
2.0.3.3.4.1	NuMI Shielding Blocks & Carriage Complete	28Nov11	28Sep11	40d
2.0.3.3.4.3	NuMI Stripline Assembly Complete	28Nov11	19Oct11	25d
2.5.3.3.2.45.44	Far detector module assembly started	28Nov11	12Jan12	-29d
2.0.4.3.13	ANU Shielding Assessment Updates Complete	20Dec11	01Nov11	33d
2.7.2.1.2.8	Production data concentrators received	25Jan12	06Mar12	-29d
2.10.10.5	Accelerator Shutdown Begun	01Mar12	30Apr12	-43d
2.0.3.2.4.3	NuMI ME Target/Carrier/Baffle Assembly Complete	20Aug12	21Jun12	41d
2.10.10.7	NuMI Upgrades Shutdown Begun "eliminate"	21Aug12	22Aug12	-1d
2.0.2.2.5.4	MI RF Cavities (2) Installation & Testing Complete	28Sep12	26Jun12	65d
2.10.9.11	FY13 Funds Available	01Nov12	01Nov12	0



Several coming in short order, should move to better estimates (+ contingency?)

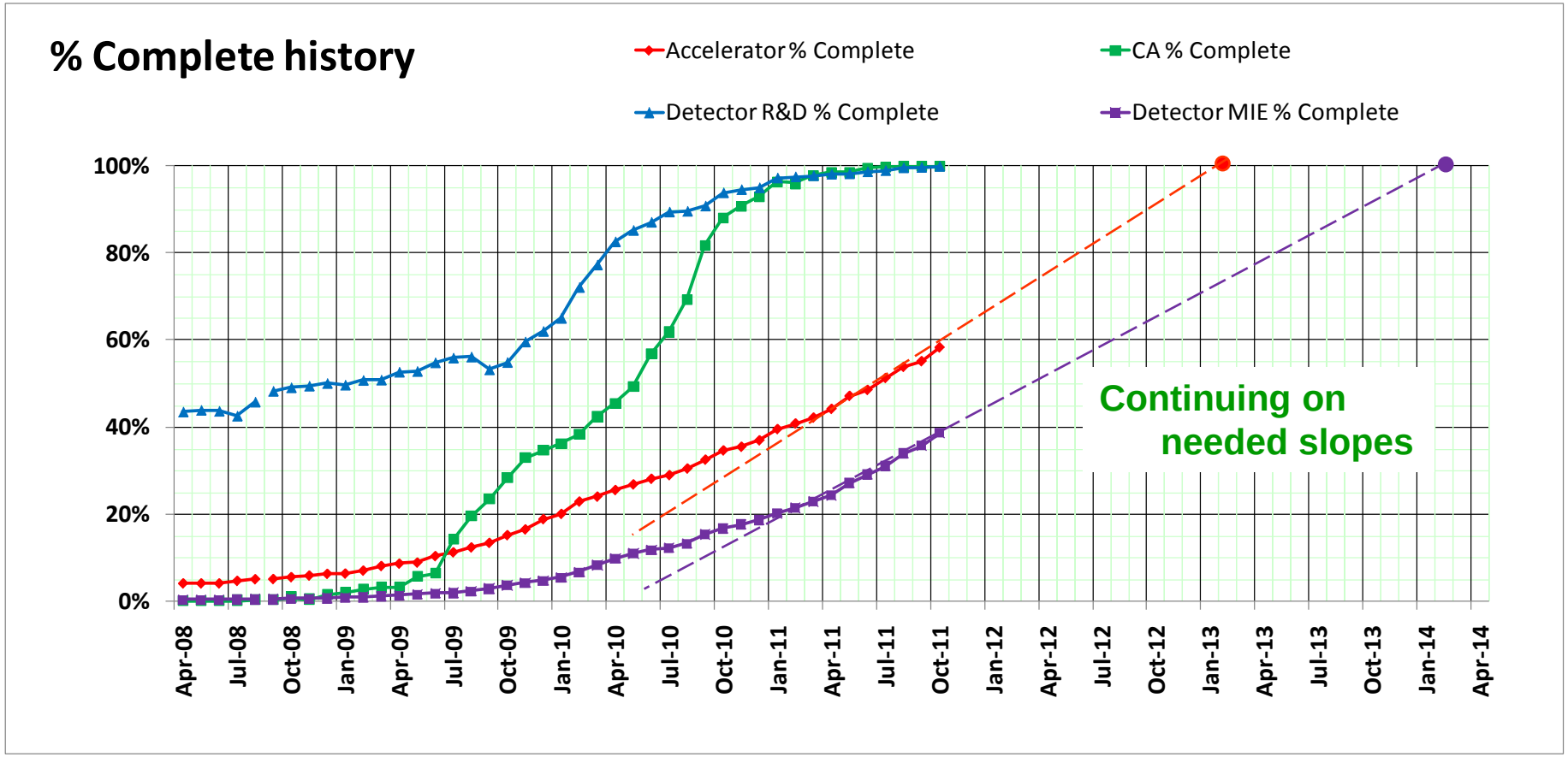
Analysis of all milestones

- **334 of 696 now complete**
  - 3 completed in October
- **Behind on 40**



% Complete history

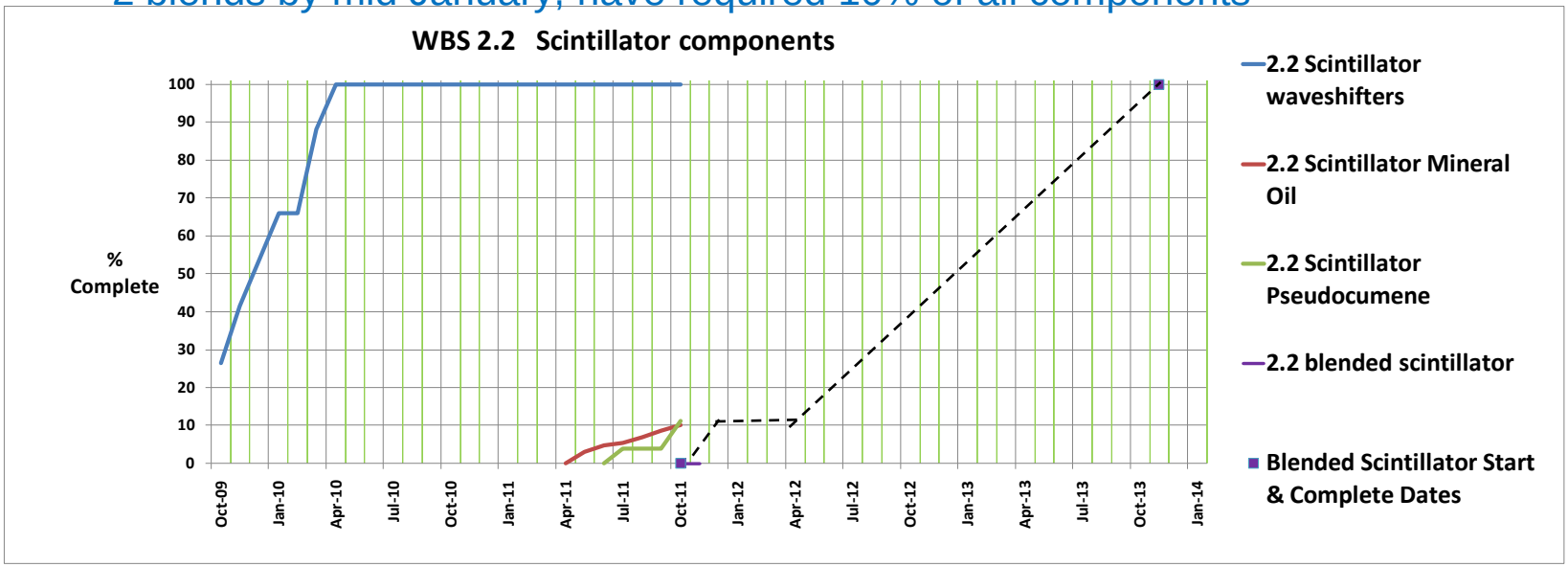
for the 4 Main parts of the Project



- Building & Detector R&D & ANU R&D done
- ANU to be complete by ~ Feb 2013
- Detector complete by ~ Feb 2014 (**DETAILS NEXT**)

Scintillator

- We have waveshifters, mineral oil, pseudocumene **and Blending Facility**
  - We blended the first 6,000 gallons of Fluor (pseudocumene + waveshifters on Nov 15
  - 13 hour mixing time. **Preliminary tests show the Fluor mix is good.**
- The dotted line shows the plan.
  - We plan to blend the first 115,000 gallons of Scintillator the week of Dec 5
  - This is 2 months later than our plan, but we have float to April here.
  - 2 blends by mid January, have required 10% of all components



- You will see similar graphs for all the detector parts on this and next slides:
  - % Complete vs. date, dates for production start and production complete.

Blending Facility at Wolf Lake, Indiana

(600 K$) **(ignore dates on pictures, bad camera setup)**

Pre mix tank inside shed
(waveshifters + 300 gallons PC)

Transfer to mix tank

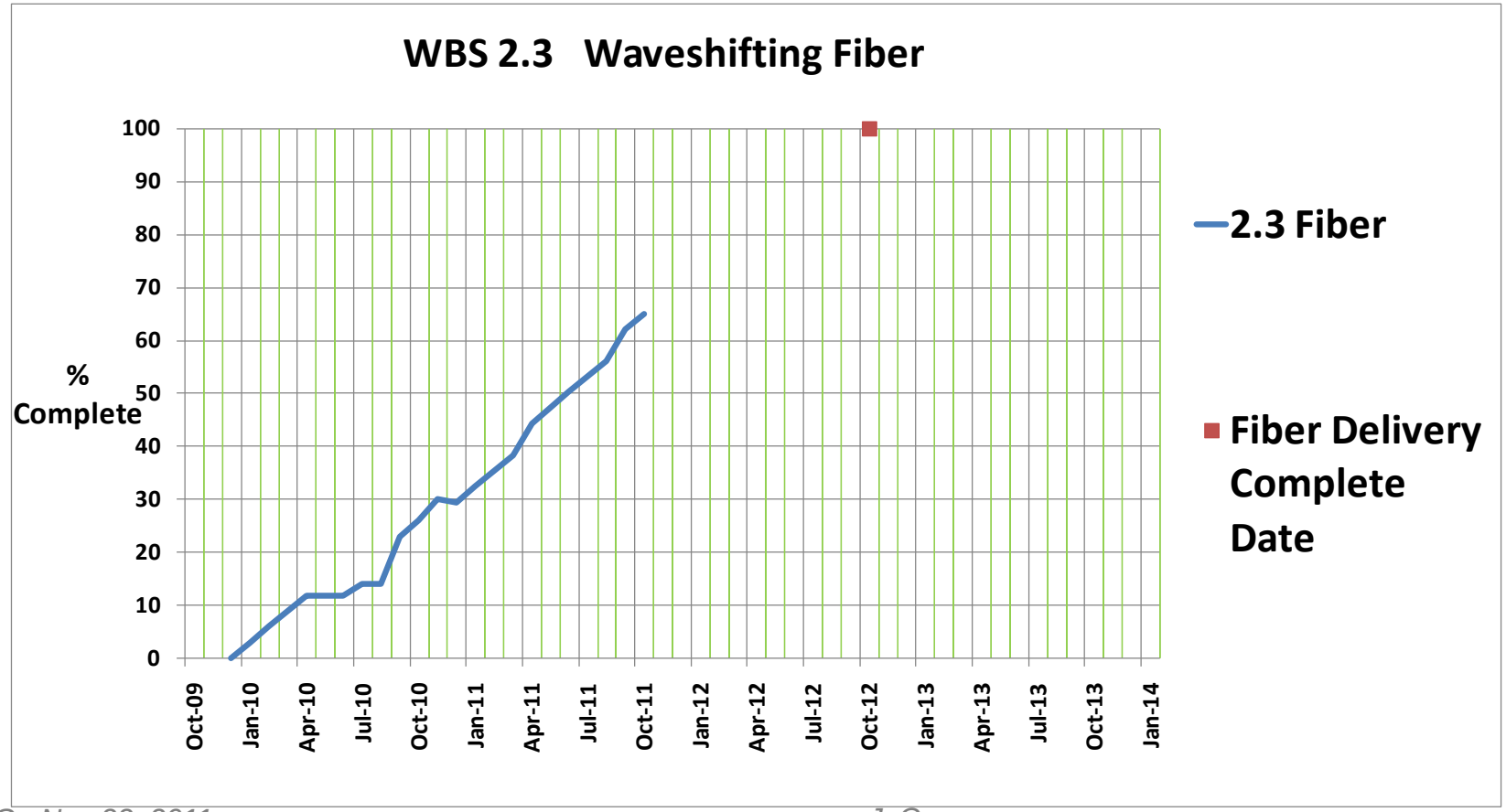
Mix Tank: mix with correct amount of PC(~ 6,000 gallons)

Transfer to one of two 120,000 gallon tanks with mineral oil, mix

All tanks and lines verified clean with our qualified mineral oil and tintometer

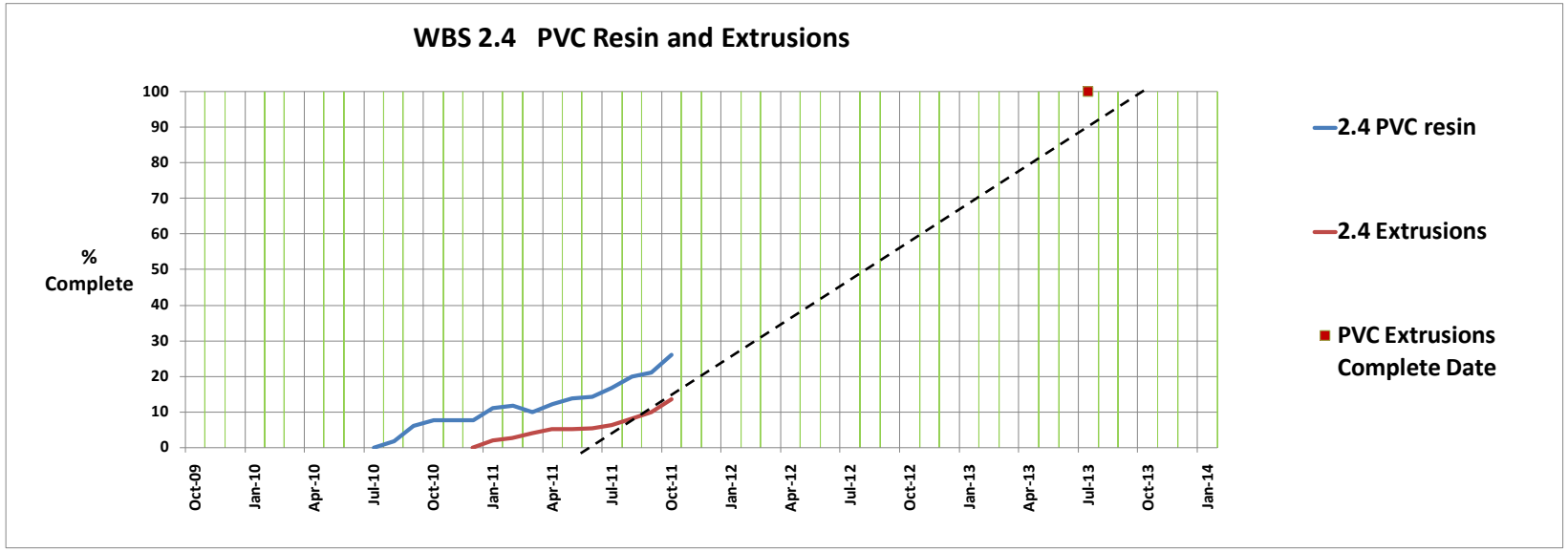
Fiber

- We have 65% of the fiber in hand
  - Clearly on schedule to complete as planned.
- We still need to know the waste rate in the Minneapolis factory to see if we need to buy more fiber than in the current purchase order.
  - Need to exercise our option in the March – May 2012 timeframe (before they stop production)



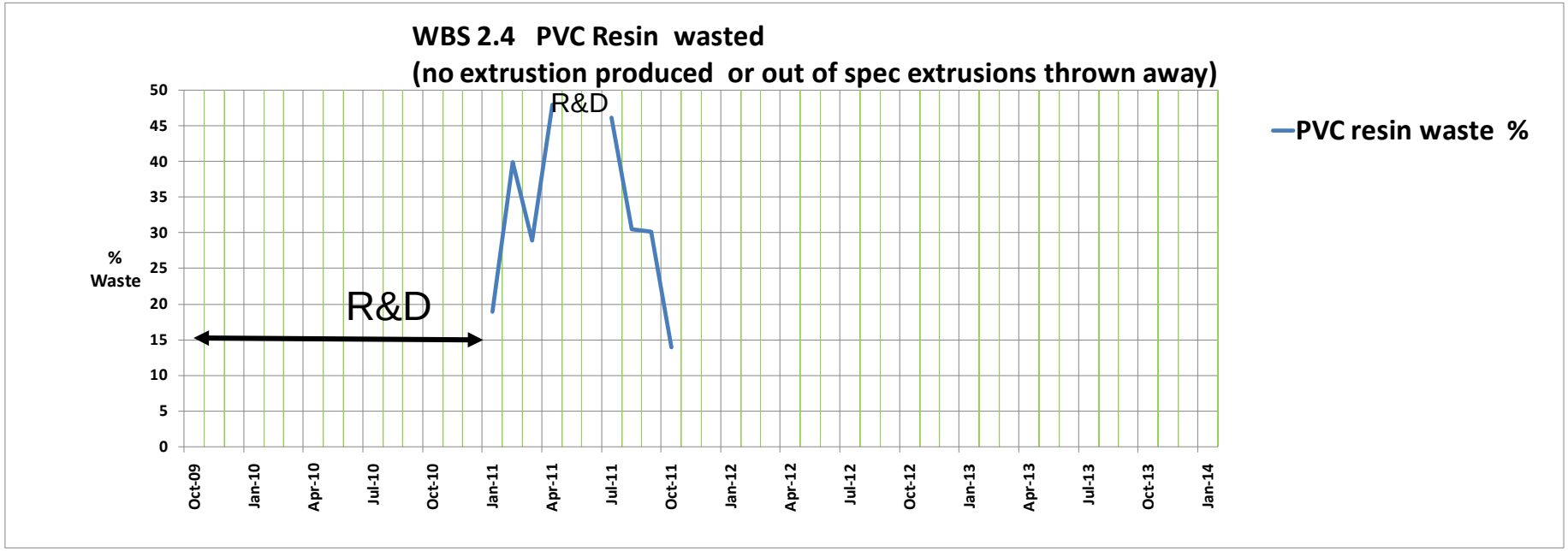
PVC Extrusions

- We have 13.5% of the extrusions in hand, 26% of the PVC resin
- Pushing the current die / resin / extruder / waste rate during Oct & Nov to determine “the” rate
  - 6 x 24 operations
  - Got 837 good extrusions in October, now have 3108 in total
  - Waste rate has dropped from ~30% to 12%
    - Extrusions out of spec now down to 0%
    - November change at PolyOne (resin vendor) seems to have made resin more consistent
    - They switched to a more sensitive scale for our 3 adhesive additives (now “measuring” 10 pounds more accurately.
- Looks like continuing at this rate will only be 3 months later than planned



PVC scrap rate

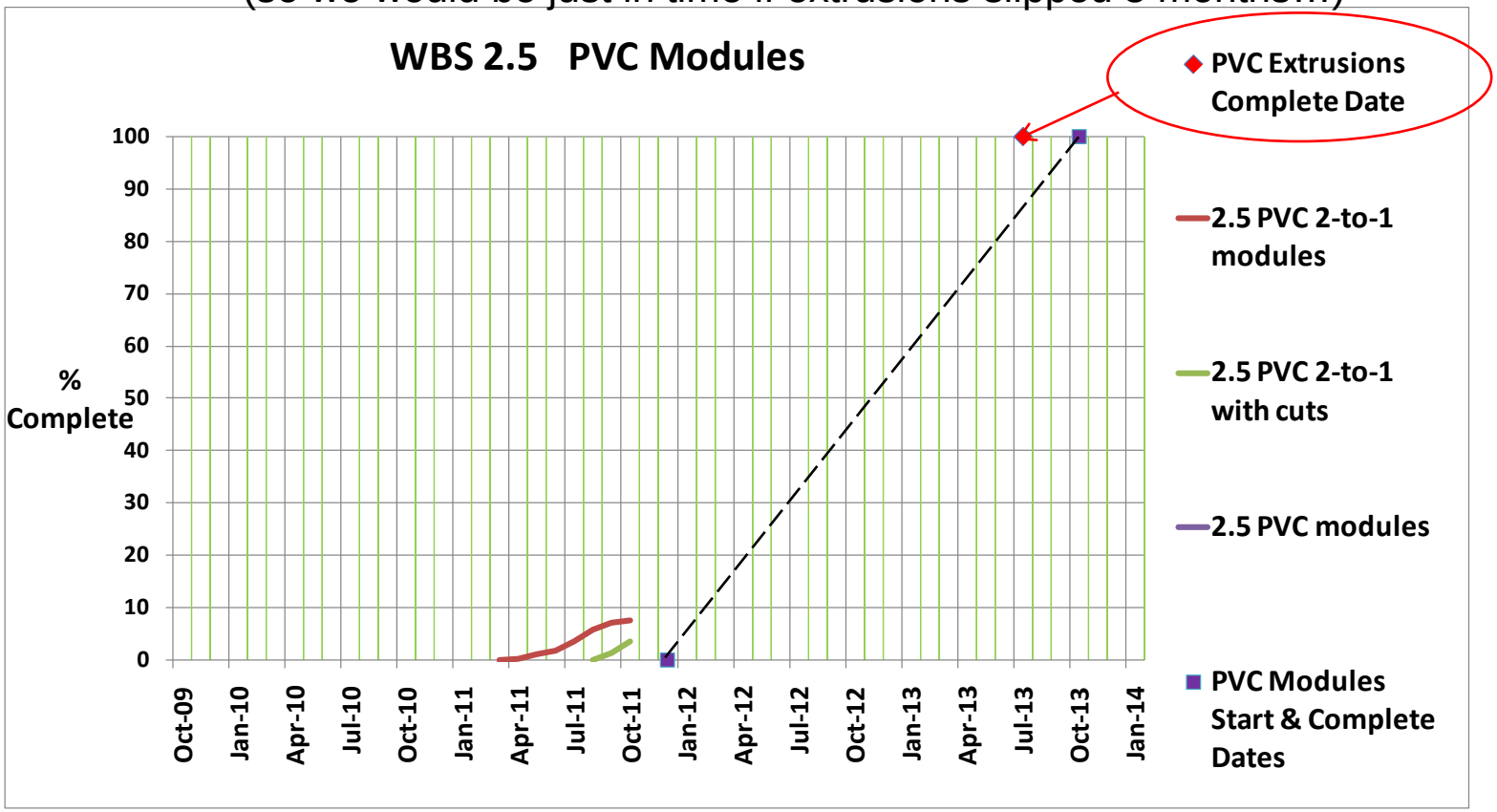
- Our schedule assumes a 6% rate
  - Minimum is ~ 2% due to 6” QA samples at end of each 51’ extrusion



PVC Modules

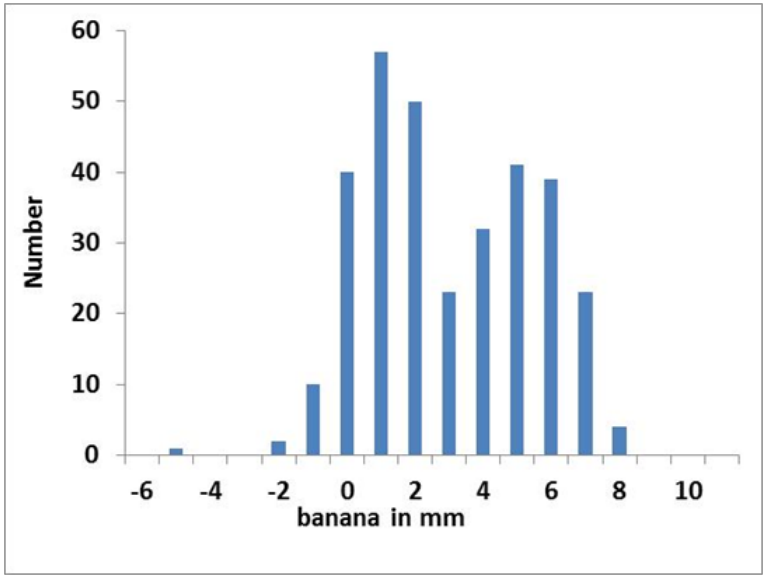
- We continue making modules from two extrusions
  - Now have 869 2-to1 modules from 1738 extrusions
  - Now have 411 modules cut to length with good perpendicular cuts at both ends
- Note the link between Modules and Extrusions below
  - There are only 3 months of float between the end points.

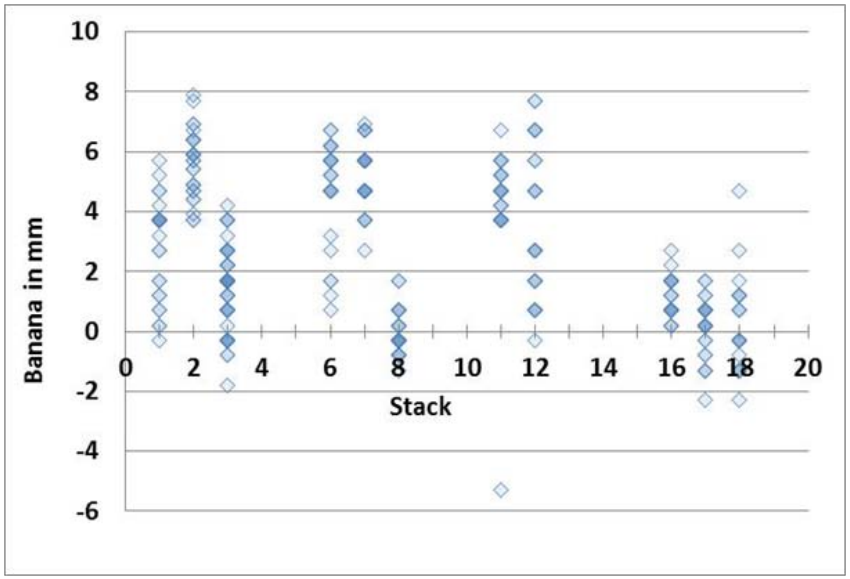
(so we would be just in time if extrusions slipped 3 months…)



PVC Modules progress

- We looked at the specs for flatness, length and squareness last PMG
- One new spec now being worked out: "banana" or straightness of the modules
  - Tolerance build up from non-straight modules placed next to each other in Ash River assembly





- Expect to agree on an 8mm wide window
  - This still works (just) for the detector space available at Ash River.
  - Note within a shipped stack the distribution seems to be tighter, investigating.

PVC Modules progress

- Failures relative to specs so far:
  - 5 / 874 failed flatness spec (0.6%)
  - 16 / 427 failed cut to length & squareness (3.7%)
- Goal is 2% for all causes

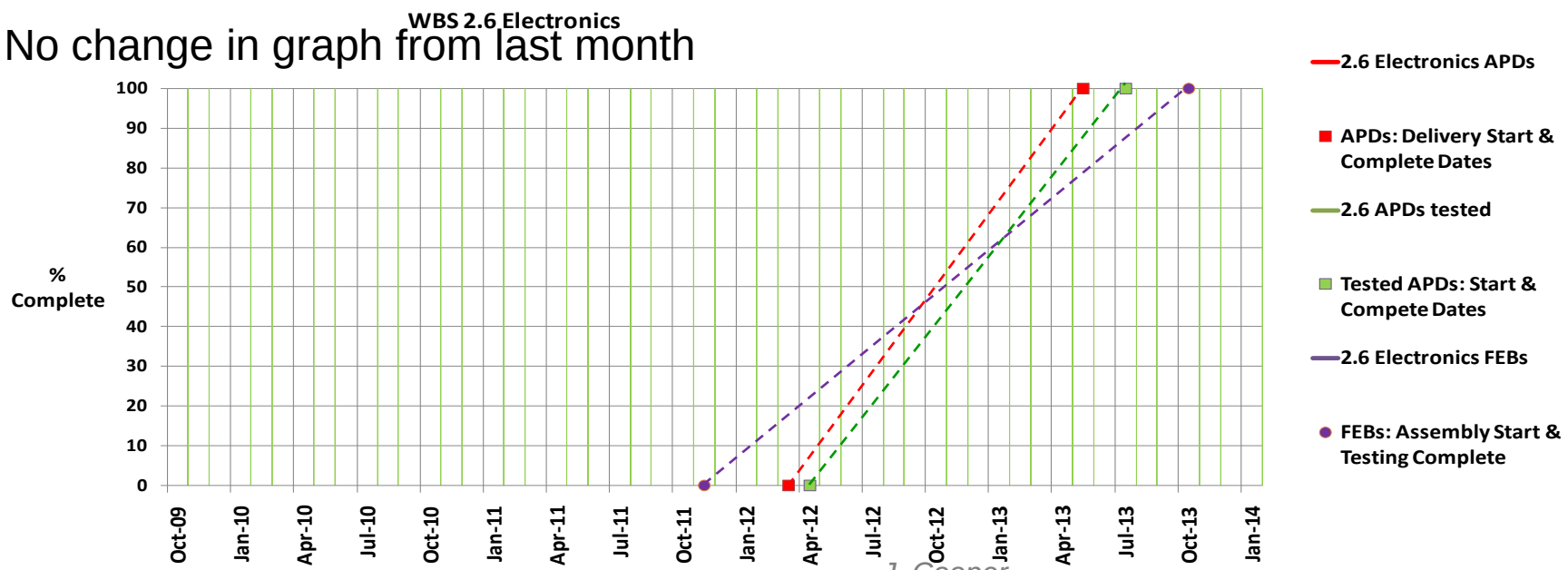
- Now have 1st 100 articles of all parts except only mold proofs of fiber raceways.
  - Starting production with these
- Full production is scheduled to start in December.

- Student workforce is now up to 135

Electronics

- APDs on hold while we investigate solutions to Near Detector losses
  - Delivery of 12,000 production APDs likely delayed March 2012 to _____?
- Front End Boards (FEBs)
  - We have 99% of the off-the-shelf parts in hand
  - All the boards have been delivered.
  - The ASIC amplifier production was delayed again by package availability at the vendor, now expect delivery November 28. This is the limiting component.
- Have 1st 100 TEC controllers in hand, testing
  - 3 failed visual inspection, 7 from assembly related problems

No change in graph from last month



J. Cooper

Status of APD tests

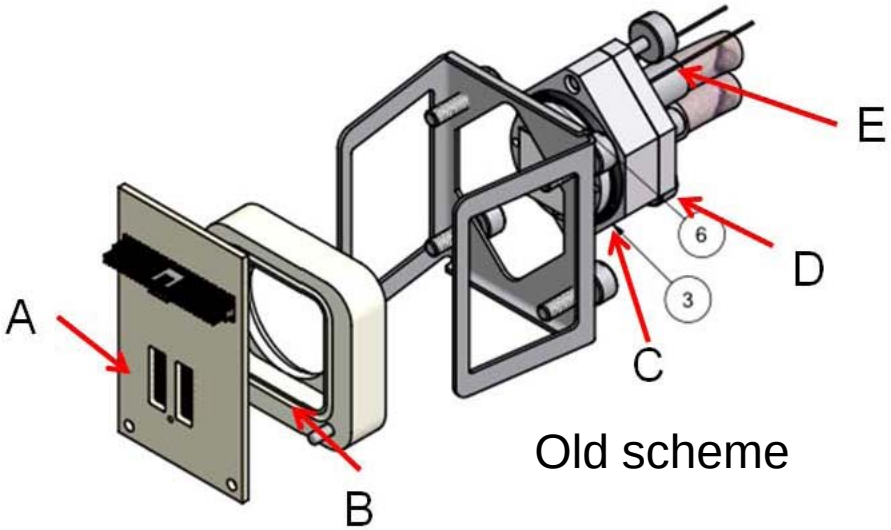
- Test Plan:
  - Silicone Coated APDs:
    - One unit to be installed with a leak
    - no o-ring between HS and spacer frame
  - Silicone Coated APDs:
    - 10 coming from Hamamatsu at end of October.
    - These will get sealed & tested heat sinks
  - Parylene Coated APDs:
    - One unit in hand.
    - Will be mounted with a leaky heat sink. (VERY leaky, no o-ring between HS and spacer frame)
  - Parylene Coated APDs:
    - Getting 10 of our "recovered" APDs coated
    - These will get sealed & tested heat sinks

- Results so far:
  - 1 installed with leak, 1 with good seal
    - Leaky one too noisy to run (=dead)
    - Sealed one is still good cold
  - 10 arrived
    - Tested at Caltech, sent to Fermilab
    - Coating thickness measured at Fermilab
    - Back to Caltech for retest next (this week)
    - After retest, will install with new mounting scheme
  - 1 Parylene installed with leak
    - Still running cold
    - Slowly stopped working (assume ice), warmed up
    - Cooled again, **still works!**
  - 4 Parylene installed with good seals
    - All are still running cold
    - Only 90% of pixels work due to Parylene vendor
  - Now looking at a new vendor in L.A.
    - Easier to watch that they handle silicon properly
    - They note a slow deposition is clearer, so perhaps we can recover the 5% of light loss seen with vendor #1. Will do 5 recovered APDs
  - Conclusions?
    - Parylene does protect silicon from damage
    - Parylene worth continuing

MORE Status of APD tests

- Test Plan:
  - Uncoated APDs:
    - 10 **recovered** after cleaning and drying
    - These will get sealed & tested heat sinks
  - Uncoated NEVER USED APDs:
    - 10 never used yet
    - These will get sealed & tested heat sinks
  - **Show & Tell on new mounting scheme from Rick**

- Results so far:
  - 9 uncoated installed with good seals
    - 8 are too noisy to run (=dead)
    - Only 1 is still running cold
  - Conclusion
    - "recovered" APDs aren't recovered.
    - Stop trying to recover more
  - This test not started yet
    - waiting for complete set of parts for new mounting scheme



Old scheme

APD Expert Recommendations with DRAFT responses

- Devise test plans that separately address:
  - **1 a)** The long-term reliability and susceptibilities of the APD array itself. This could consist of testing bare die from Hamamatsu, mounted and wire-bonded onto a suitable test board.
  - **While these APDs required new masks, they are modifications to the structure of existing devices, S8550s, used extensively in medical imaging, and the whole class of single channel devices, such as those in use on CMS. The changes were considered low risk by Hamamatsu and others.**
  - **As such, these types of tests were not planned. They can be performed as a test that might be useful <u>if there are further problems</u> at some point down the line, and we will investigate involvement of other groups that might perform these tests.**
  - **We are exploring help from the Fermilab Particle Physics Division and from Czech NOvA collaborators.**

APD Expert Recommendations with DRAFT responses

- Devise test plans that separately address:
  - **1 b)** The long-term reliability and susceptibilities of the packaged device from Hamamatsu (i.e. APDs which have been bump-bonded on to a carrier)
  - **Leon Mualem (L2) will do this test on the new parts coming from Hamamatsu in February 2012. An environmental chamber exists at Caltech for such "aging studies" with cycling between low and high temperatures.**
  - **1 c)** The long-term reliability and susceptibilities of the assemblies mounted on the detector.
  - **This was and still is the object of the prototype Near Detector. We intend to run the new Hamamatsu parts (and likely Parylene coated existing parts) on the prototype before giving the go-ahead to Hamamatsu for production of 12,000.**

APD Expert Recommendations
with DRAFT responses

- These (above) tests should be performed with a statistically significant number of devices (~ 20 or more) so that reliable predictive data may be obtained. The test should follow industry standards for qualification of sensitive electronics, including heat cycling, and for the assembled modules humidity testing. The environmental tests should continue after the detector installation is complete and operation has begun, in order to detect any early signs of failure.
  - **We will start with 10 for the first two tests**
  - **For tests on the Near Detector we will have ~230 Hamamatsu silicone-coated parts and would aim for ~ 150 Parylene-coated parts.**
- Document, with milestone dates, which tests must be passed by which date in order to demonstrate that the APD array, its packaging, and the installation process have demonstrated sufficient reliability for production.
  - **As indicated above, we are thinking to insert a 2 month test of Hamamatsu silicone coated (in parallel with Parylene coated) on the prototype Near Detector. We need to demonstrate a success rate of ~ 95% to have a viable plan for Ash River.**
  - **Need to set "passing mark" for the rapid aging tests at Caltech**

APD Expert Recommendations
with DRAFT responses

- **2)** Develop a production qualification plan. As the APDs are delivered lot samples should be tested to ensure continuity of production quality. Equally, lot samples of the space frame need to be tested to assure the continued quality of their production.
  - **The test plan already called for every APD to be tested on the APD test stand at room temperature and cooled to operating temperature of -15C. This is in addition to Hamamatsu factory qualification tests.**
  - **In addition the components will all be tested for seal quality before being sent for installation.**
  - **The tests and procedures developed in response to the rapid aging test at Caltech will also be used to sample test new lots of production of all components. Monitoring would use the same procedures developed for those tests.**

APD Expert Recommendations
with DRAFT responses

- **3)** Fully qualify the installation procedure, with the steps minimized and simplified and, if necessary, any special tooling produced; this could include a further optimization of the mechanics for ease of installation.
  - **A preliminary updated installation procedure exists based on the problems seen to date, but does not yet include the details of the new mounting scheme.**
  - **The procedure will be updated prior to the installation of 400 coated devices in February, based on installation of the 10s of test devices in December.**
  - **In addition we intend to train the Ash River workforce in installation by having them here at Fermilab for the February installation work.**
- **4)** Appoint a member of the collaboration with appropriate semiconductor detector experience to oversee the APD qualification and testing.
  - **Leon Mualem (L2) is it.**
- **5)** Perform a Production Readiness Review, before launching the production of the APDs.
  - **We will hold such a review near the end of the 2 month test on the prototype Near Detector in late April, 2012.**

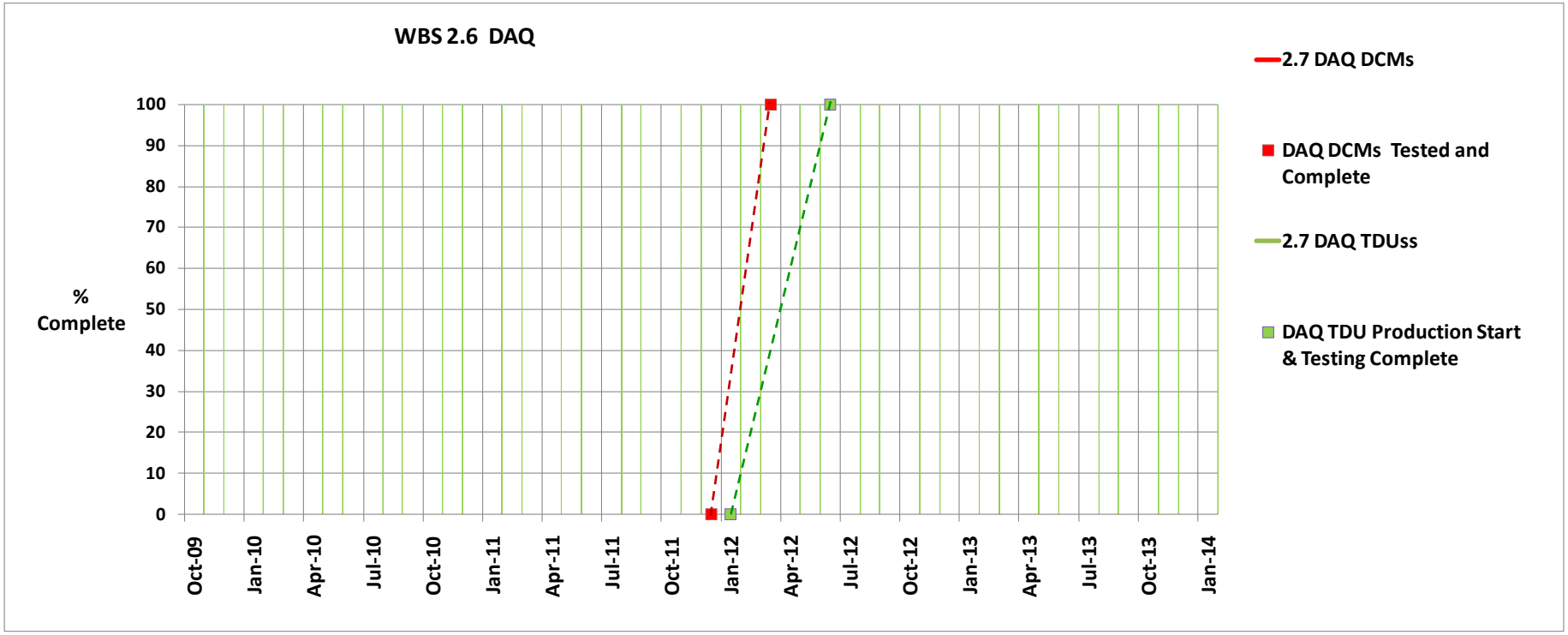
APD Expert Recommendations
with DRAFT responses

- **6)** Perform an Electronics Systems Readiness Review before installation of the APD assemblies on the far detector.
  - **We expect to do this review , working on an appropriate date now.**
  - **The review will include operation of the final FEBs on the prototype detector.**
  - **The review will include a full noise analysis.**
  - **The review will include information available from the prototype detector on the failure rate of TECs.**

- **7)** Revise the installation schedule to accommodate the delays that will occur if these recommendations are followed.
  - **Agreed, working on this now**
  - **Unknowns:**
    - **New date from Hamamatsu if we don't give a green light to production until the end of April 2012**
    - **Impact of the vacuum testing on the schedule**
    - **Can we increase the installation rate later to make up lost time?**

DAQ Hardware

- Purchasing of DCM and TDU parts was completed in October and parts are now arriving.
- A pilot run of 5 DCM boards is expected in November
- A pilot run of TDU hardware is already completed and testing is underway.
- Nothing in production yet, no change in graph from last month



Near Detector

- PPD review of NOvA construction impacts held on Nov 7
  - NOvA provided estimates of vibrations expected from Roadheader
  - No final recommendations yet

- Near Detector cavern requisition approved

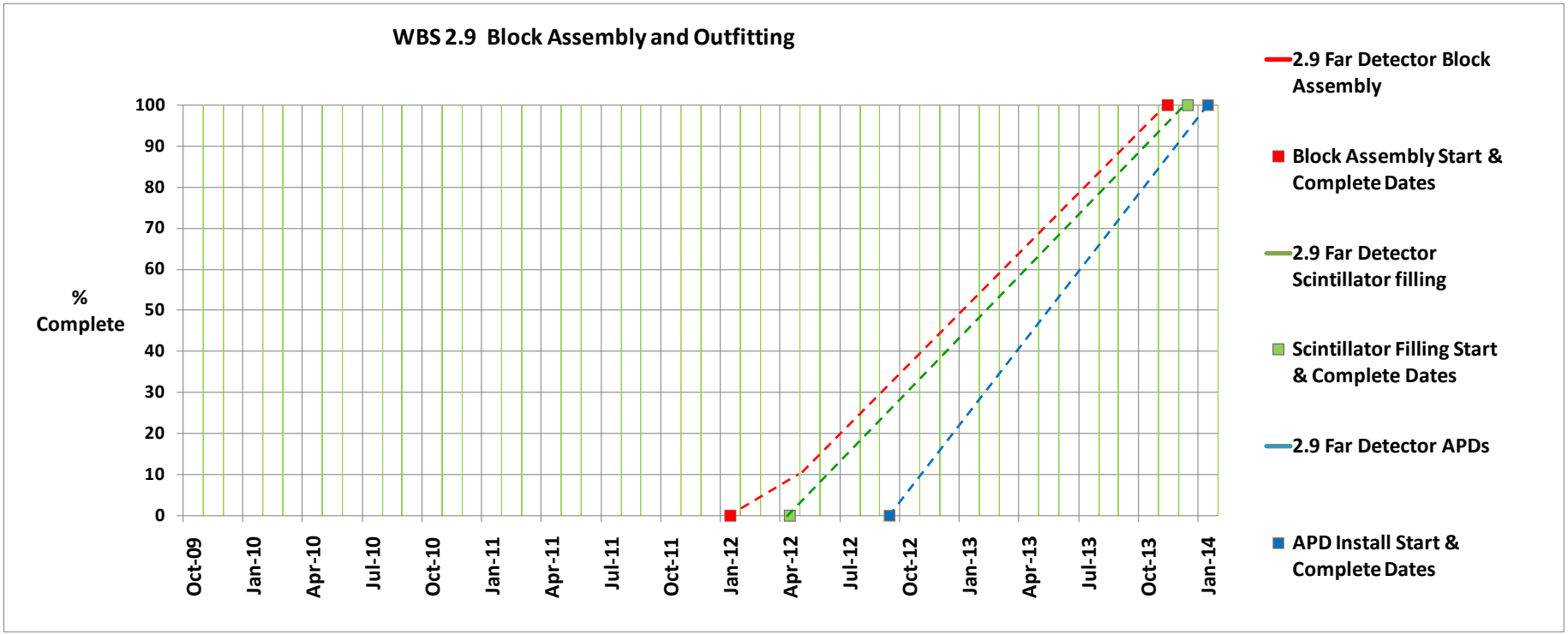
Preliminary Construction Schedule

Dec. 1, 2011 → Issue for Proposals
Feb. 16, 2012 → Receive Proposals
Mar. 14, 2012 → Issue Purchase Order
Apr. 18, 2012 → NTP to Start **Site Prep Package**
May 1, 2012* → START Shutdown
Aug. 29, 2012 → Start Excavation **Tunnels & Hall Package**
Jan. 1, 2013 → Start **Outfitting Package**
Feb. 1, 2013* → END Shutdown
Jun. 1, 2013 → Project Complete

- If additional cavern option selected (~ Oct, 2012?), then add 4 month to the above schedule (4 more months of excavation)

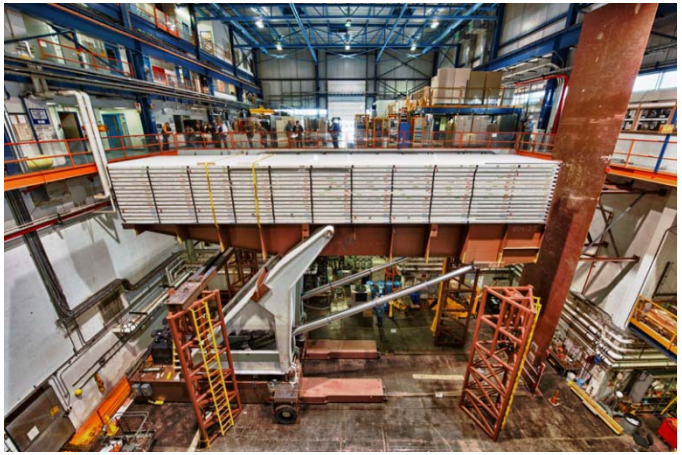
Block Assembly & Outfitting

- Nothing in production yet, so no change in the graph from last month
  - The Pivoter is the critical path, supposed to be ready in January
  - Pivoter assembly has started on the first 10 truckloads of Pivoter parts (8-10 more to go)
  - Outfitting infrastructure also started, racks are at Ash River…



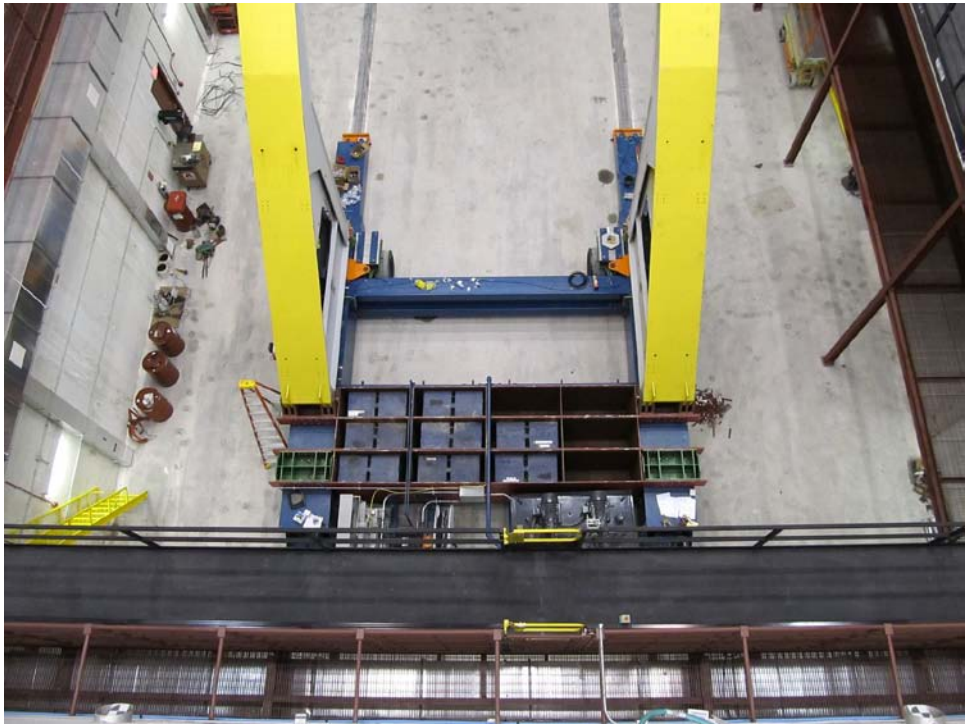
Assembly & Outfitting Progress

- FHEP installed and rotated at CDF building
  - Movie at
    - http://www.symmetrymagazine.org/breaking/2011/11/17/novapivotertest/
    - http://www.fnal.gov/
  - Will fill with water



Assembly & Outfitting Progress

- Pivoter under construction at Ash River
  - Moved along rails (some grout obstructions to remove)
  - Blue block counterweights installed
  - Table section arrived from vendor and sent back due to missing welds



Assembly & Outfitting Progress

- Racks and scintillator piping being installed
- Scintillator piping being installed.
- Scintillator QA trailer installed and used to qualify 5 totes of mineral oil for testing the scintillator piping.
- 13.5 Techs in place at Ash River, 5 more will start Jan 3
- Webcams installed, see http://home.fnal.gov/~tesarek/nova/