Project Status

John Cooper
Project Manager

NOvA CD-4 Deliverables

- Upgrade the Fermilab accelerator complex proton source from pre-NOvA 320 kW to a source capable of 700 kW
  - Paul Derwent is covering this in the next talk
- Build a new Far Detector Hall
  - At Ash River, Minnesota near the US-Canada border
  - The building is sized to hold an 18 kiloton detector
  - **We have beneficial occupancy of the building (as of 13Apr2011)**
- Build a 14 kiloton Far Detector at Ash River
  - This is a "Threshold Key Performance Parameter (KPP)".
  - **18 kt is now authorized as an "Objective KPP" (as of 10Dec2010).**
- Build a 222 ton Near Detector
  - Which will be underground at Fermilab in the MINOS tunnel
- R&D goal: Integration Prototype Near Detector
  - **Now taking data on the surface near the MINOS Service building**

Progress on the Ash River building

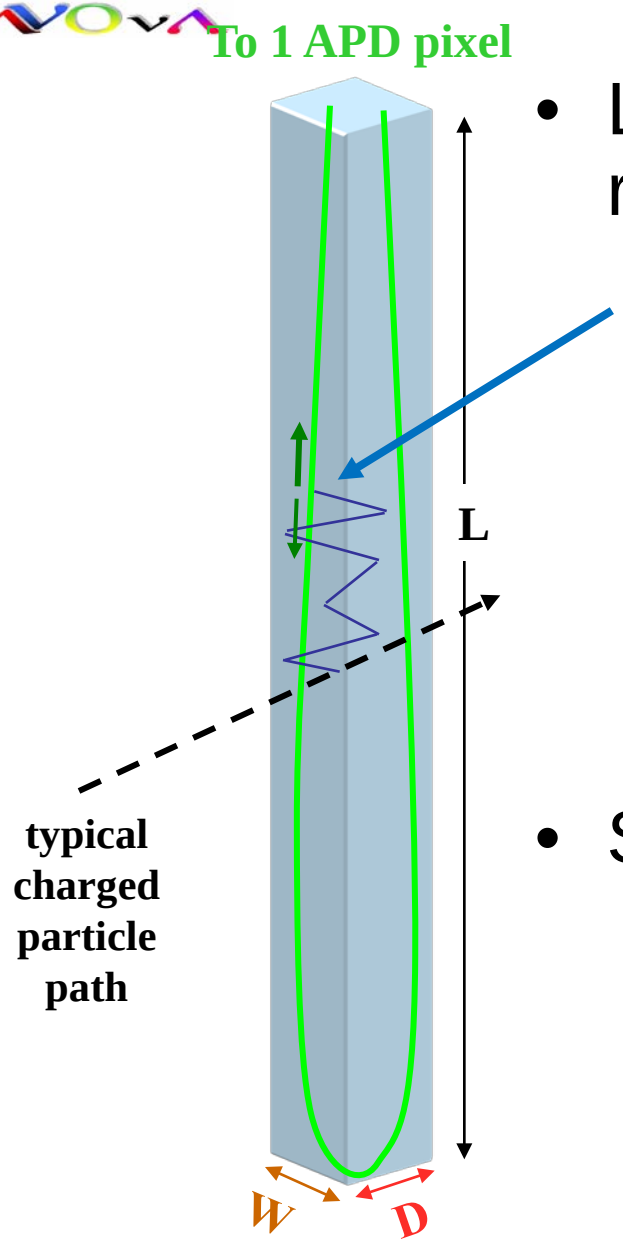
- **Now complete, beneficial occupancy April 13, 2011.**
  - **Granite berm and Barite (6” Barium Sulfate) overburden in place**
  - **Well water is last major item still in progress (September completion)**
  - Total cost ~ 34 M$ (claims settled), compare to estimate of 45 M$
    + 10M$ contingency at CD-2 in 2007 (ARRA funds came at the right moment)

More Progress on Ash River Building

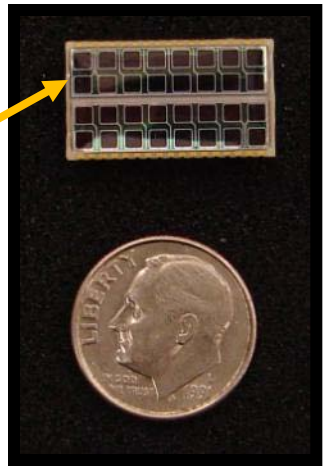
August 2010:
Some concrete

- **August 2011 – Interior complete, Outfitting nearly complete**
  - **Movable access platforms at ceiling**
  - **South wall flat**
  - **Pivoter rails on floor**
  - **Movable platforms in Assembly area, ventilation for adhesive**
  - **4 levels of catwalks with lights, detector power, cable trays**

Reminder: NOvA Basic Detector Element



- Liquid scintillator in a highly reflective PVC plastic cell
  - Passage of charged particle through scintillator creates light
  - Light bounces off reflective PVC walls until captured in a thin wavelength-shifting fiber
    - Typically light hits fiber within ~ 50 cm of particle path, ~ 8 reflections
  - The fiber is U-shaped and both ends terminate in one pixel of a pixel avalanche photodiode (APD)



- Simple construction, just repeat 357,120 times
  - Cells are 15 m long (they just fit in a 53 ft semi-trailer truck)
  - For vertical cells, pressure from liquid scintillator is 19 psi at bottom

Detector Progress: prototype Near Detector

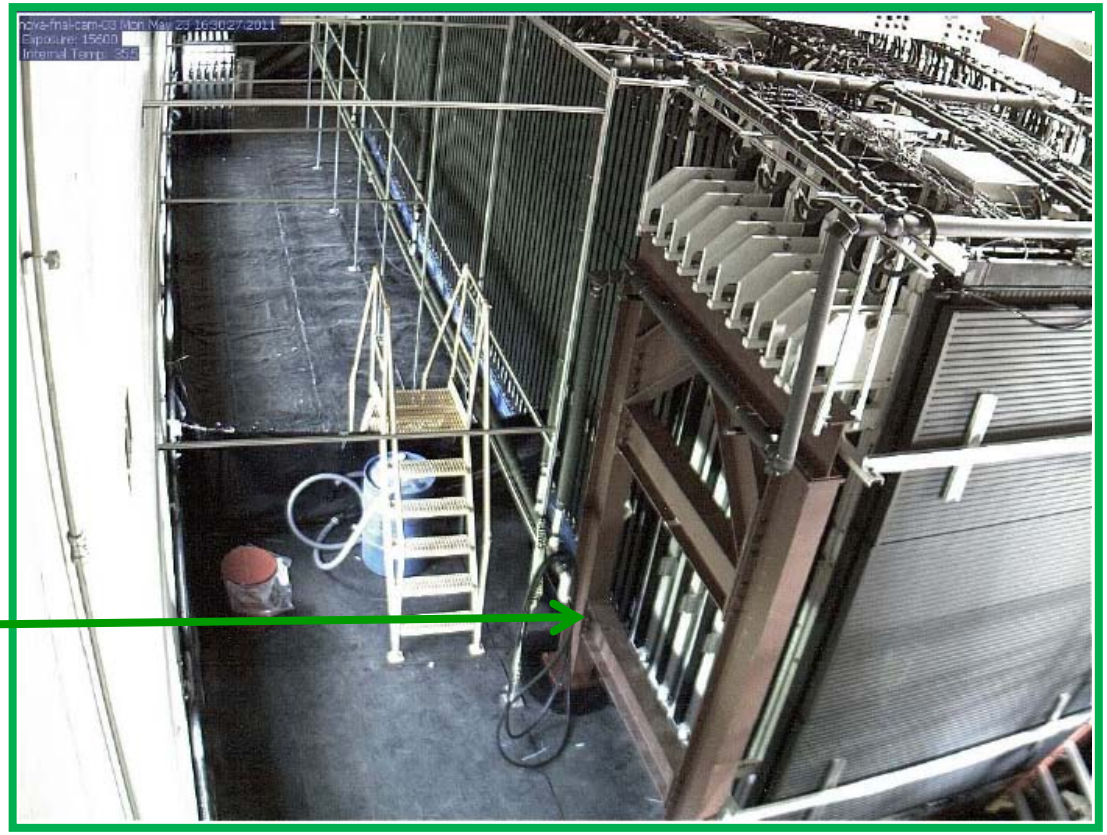
- New Near Detector Building at Fermilab
  - 124 planes in place at last August's IPR, **all 199 in place today**
  - **30,000 gallons of scintillator in place, all PVC modules filled.**
  - **Front-end and Data Acquisition Electronics in place**
    - **Water cooling in place and on for extended periods**
  - **Shortage of APDs**

    (see next slide)

    - 85% of fiducial volume (1st 124 planes) was instrumented,

      20% of shower containment (62 planes),

      100% of μ catcher



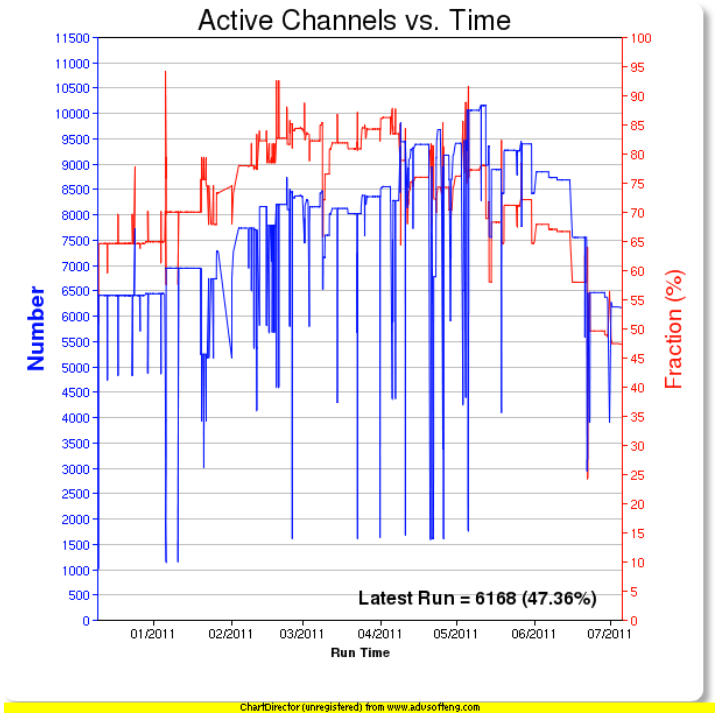
Detector Progress: prototype Near Detector

- We learned a tremendous amount while assembling this prototype – this will make Ash River assembly smoother.
  - Tested access issues (rolling platform prototype), tested fill machines
    - Found mechanical interferences – modified Ash River plans
  - Found problems with PVC module manifolds
    - cracks reported in last year's IPR, **but all now repaired in place**

  - Water system redesigned after installation & tests with original
  - **Learned APDs must be installed with care**
    - **Cleanliness counts !**
    - **Added 3 mil shim to keep fibers away from APD surface**
    - **Modified procedures for additional cleaning**
    - **Now working to add protective coating from Hamamatsu**
      - See WBS 2.6 slide
  - Noise from thermoelectric cooler circuit
    - cap board fix in place
  - Data Acquisition software was a huge effort
    - Now performs with headroom

Detector Progress: prototype Near Detector

- STILL learning
  - Turned on APD cooling (-15 deg C) for extended periods
    - Continue to lose APDs
    - Inspection of APD installation shows many more errors than previously detected, particularly on the O-rings that keep building air away from the uncoated APD surface
    - BUT, even on 40 “golden” installations, about one APD lost per day
  - Also still finding some noise from thermoelectric cooler circuit
    - cap board fix may not be sufficient

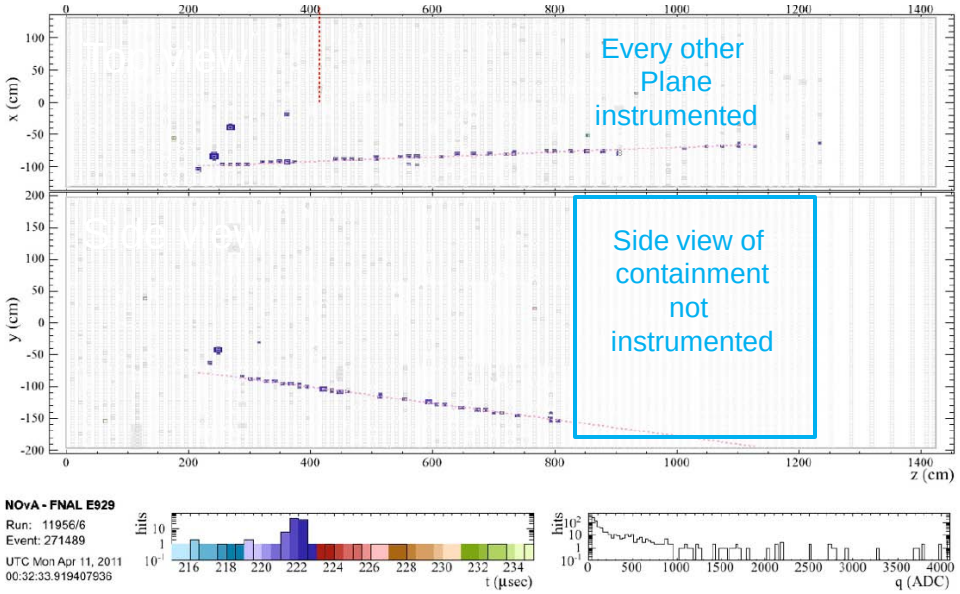


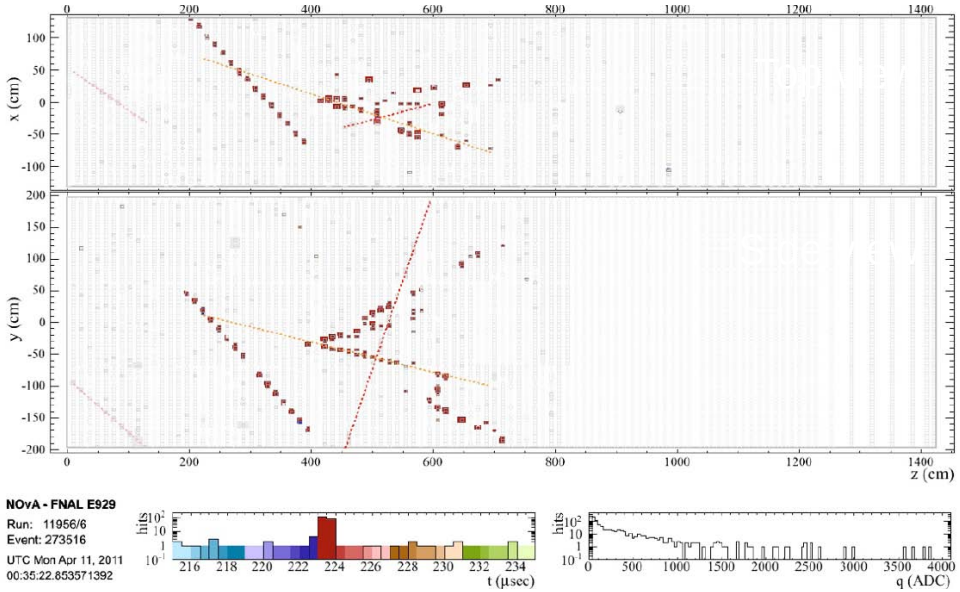
- Task Force assigned to look at all the issues in an integrated way
  - Met during week of July 25-29, recommendation on next slide

APD Task Force Recommendations

Detector Progress: prototype Near Detector

- **Yet, we still see neutrino events !**
- In NuMI neutrino mode
  - 110 mrad off-axis
  - First event seen on April 10, 2011
  - Now have about 150 in-time events
    - ν_μ CC
    - NC candidate with two π^0s
- In NuMI anti-neutrino mode
  - First event seen on Dec 15, 2010
  - Now have about 900 in-time events
- Booster anti-neutrino mode
  - 375 mrad off-axis
  - Events seen in March 2011
  - Now have > 200 in-time events





Detector progress: WBS 2.2 Scintillator

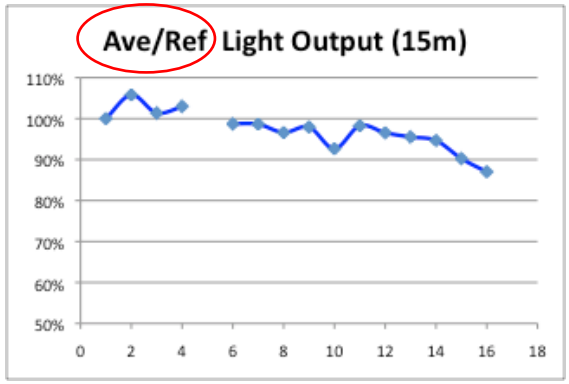
- Mineral Oil, 3.0 million gallons, ~ 120 railcars
  - Mineral Oil contract with Renkert Oil (Riverdale, IL)
  - Fixed price if crude oil (West Texas Intermediate) is $ 60 -110/barrel
    - Outside this range we pay a price indexed to Conoco-Phillips Lube oil.
    - e.g. at $111/bbl would pay 22% more, have 30% contingency set aside
  - **We have a 600,000 gallon storage tank rented at Riverdale**
    - Buffer volume for mineral oil glitches in delivery
- Pseudocumene, 5% of mixture, need 155,000 gallons = 22 ISO tanks
  - **Also Renkert Oil contract -** they are a broker with a Chinese firm.
    - Indexed price relative to Asian naptha (which follows crude oil), ~ $8 / gallon
  - **1st ISO delivered, in storage yard**
- Wave-shifting chemicals in hand (had these last year)
- Toll blending
  - 30,000 gallons from 5 test blends used in prototype Near Detector last fall
  - **P.O. placed with Renkert Oil (but at Wolf Lake, IN)**
    - $0.67 / gallon to blend + 600 K$ of infrastructure. This is a fixed price
    - Infrastructure includes TWO 120,000 gallon tanks for scintillator (mix & buffer space)
  - Expect first 120,000 gallon blend in Oct/Nov this year.

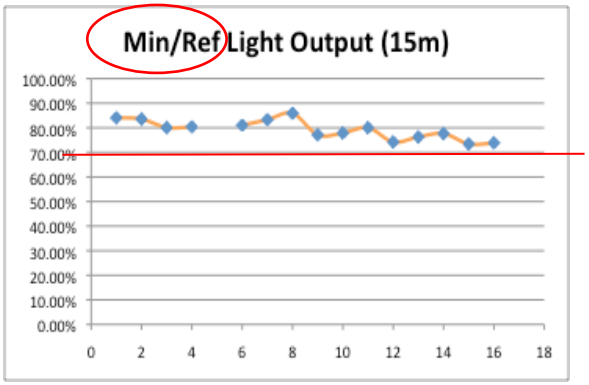
More on Mineral Oil prices

- Our "fixed" price is $3.92 / gallon
- 600,000 gallon storage tank was ready May 17
  - 1st 89,000 gallons in on May 17 – 24
    - Vendor charged $4.79/gallon since WTI > $110 & dropped below for 15th day on 5/25
    - The higher price cost us 77 K$
  - Next 123,000 gallons
    - Vendor can only charge $3.92/gallon
    - Vendor loses about $100K since his Lube Oil base product is now at $4.67/gallon
  - Another 50,000 gallons on the way
    - $3.92/gallon, Vendor to lose another $40K
- **Neither party is happy**
  - Vendor suggests different crude index (Brent or Louisiana Light Sweet), since both are still above $110
  - We think the root cause is the base Lube Oil is out of whack relative to crude
    - See next slide
  - Agreed to stop deliveries for up to 6 months, expecting Lube Oil prices to stabilize
    - No schedule impact for NOvA, we just don't fill the buffer tank as full as we had hoped

Detector progress: WBS 2.3 Fiber

- 12,183 kilometers of fiber required
  - Fiber from Kuraray in Japan, still delivering after earthquake.
    - Actually 1.5 months ahead of schedule
  - **6,100 kilometers already delivered**
    - **50% complete vs. 14% last August**
- Recent issue with 10% drop in light output
  - QA is alert !
  - Carl Bromberg (L2 Manager) is working the issue with Kuraray





Detector progress: WBS 2.4 PVC

- 23,000 extrusions required, 13.8 million pounds of PVC
  - PVC resin from PolyOne in Pasadena, Texas, fixed price $ 1.00 / lb
    - Almost fixed: our PVC has 15% TiO_2 and the TiO_2 price is up 28% (to $1.62/lb) over the last year due to a world-wide shortage
      - Several manufacturers went out of business during the economic crash.
    - We have agreed to pay the difference based on a quarterly adjustment.
  - Extruding by Extrutech in Manitowoc, Wisconsin, fixed price $ 0.96 / lb
  - **Final die tuned, production started in January 2010**
  - **Have 1219 extrusions in hand (5%) which meet our specifications**
    - **QA of specs on 6-inch long parts cut between each 51 ft extrusion:**
      - Part size profile is checked optically
      - Part tensile strength is tested
      - Part performance is checked in a 200 psi hydraulic test
      - Part reflectivity vs. wavelength checked
    - **Part performance under 1 atmosphere pressure in every other cell checked on every 51 ft extrusion**

PVC: Problems after Start of Production

- **Inconsistent performance of N-27 PVC resin**
  - Variations in extruding parameters (screw torque) ➔ profile out of geometrical tolerance
- Sources of problems have been identified by PolyOne
  - Contamination of 500,000 pound lot due to material from an unclosed valve
    - Shipment was returned for credit
  - Errors in production ➔ overheating of material
- PolyOne changed production process: **problem solved**

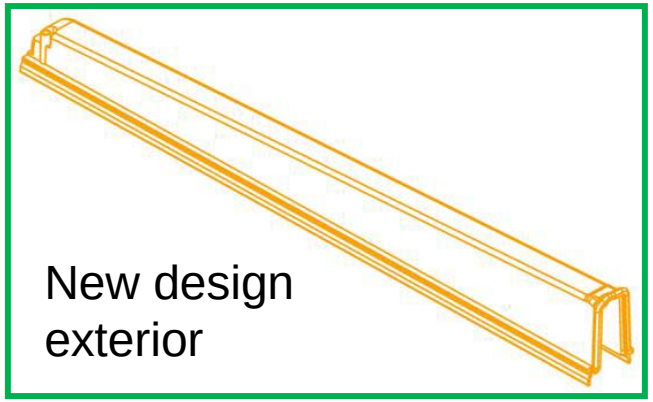
- **Extrusion reflectivity below acceptability**
  - Contamination of anataseTiO_2 with rutile TiO_2 by manufacturer Kronos (March & April)
  - New development. This was never an issue before, including R&D phase.
- Problem has been identified by PolyOne and Kronos
  - PolyOne requested a limit on contamination suitable for NOvA
  - Kronos has rejected their request
- PolyOne has contacted Millenium, another TiO_2 manufacturer
  - Millenium will supply anatase in accordance with NOvA contamination limit
  - **Problem is about to be solved**

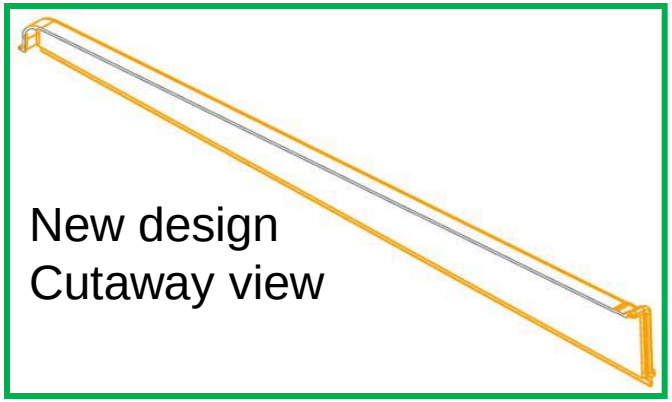
More PVC Problems after Start of Production

- **Possible Problem with Extrusion Strength**
  - PVC melt flows around metal supports in the die and then recombines ("knits")
  - Examination of these regions in extrusions indicated a possible weakness may eventually develop in some regions under stress
- **Production Extrusions are strong at time of production**
  - Extrusions already pass rigorous PVC strength tests
  - But it is difficult (if not impossible) to predict the time development of strength for extrusions under stress
  - Gun-shy after our experience with the cracked PVC module manifolds last year: therefore, try to ensure all recombination "welds" are strong, **no need to predict**
- **Solution: Process Improvements and Die Modification**
  - Better mixing and more uniform (and higher) PVC melt temperatures for better knitting in the die
    - New screws in extruder put in more mixing & mechanical work
      - Screws tested in July and are now being chromed before putting them into production
  - Modified the die to allow more time in the die for knitting
- **Expecting to be in full production in mid-August**

Detector Progress: PVC Module Production

- Module factory is at the University of Minnesota
- Major effort over the last year to understand the cracked manifold issue, then to redesign the part to avoid cracks
  - Simpler part, removed all stress points
  - Learned how to check new parts for hidden cracks using acoustic micro imaging (Sonolab Midwest), so can check samples for quality





- **New manifolds are due in July (last Friday?)**
- Other parts come in later, so production to start in November 2011
  - Meanwhile have split out the task that glues 2 extrusions together to form a module and are almost ready to start that work

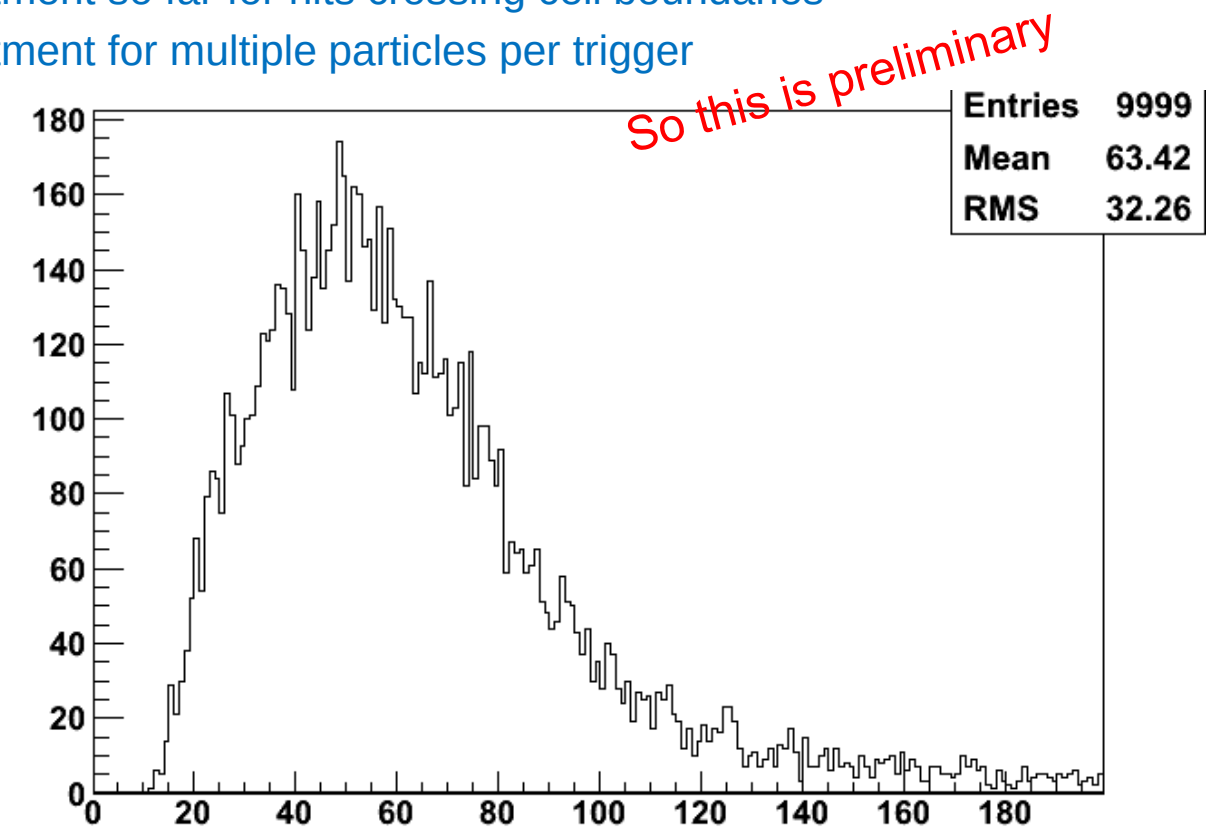
- Might put a slide here with details and pictures of the 2-to-1 extrusion-to-module operation

Detector Progress: WBS 2.6 Electronics

- Front End Board (FEB-4)
  - **400 assembled for Near Detector**
- Components for FEBs at Ash River:
  - Avalanche Photo diodes (APDs)
    - **Received 500 from Hamamatsu for Near Detector**
    - **Hamamatsu's production yield was good enough for them to quote a cost of $350 each**
    - About 20% were lost on installation
      - Oil incident, fibers hitting APD surface, general dust and whiskers
      - Unable to clean any & restore functionality for longer than a few days
    - A second pass installation with more care only lost 5%
    - But even more were lost when APDs were cooled to -15°C
  - **Pursuing thin (20 - 100 micron) protective coating**
    - **June 2 quote from Hamamatsu is $372 per APD for 12,000 parts vs. uncoated $350.**
    - **Pursuing early delivery of 500 coated APDs to rescue prototype Near and test coatings**
  - **Have ordered the low noise ASIC amplifiers, due in July**
  - **Have in hand all the ADCs**
  - Starting to procure other parts (1 regulator unavailable implies version 4.1 FEB)

Vertical Slice test

- One 51 ft extrusion with standard scintillator & APD readout at Caltech
- See ~30 photoelectrons **from far end**, consistent with our requirements.
  - Peak at ~50 ADC counts (44 electrons/ACD) = 2200, ÷ gain of 70 = 31 photoelectrons
  - 1 hit per trigger
  - No adjustment so far for hits crossing cell boundaries
  - No adjustment for multiple particles per trigger



Detector Progress: WBS 2.7 Data Acquisition

- General Overview of progress during the last year:
  - **System installed for Near Detector works**
    - Software / Firmware took a long time to shakedown (Oct-Feb)
    - **Have now sustained the rate expected at Ash River all the way through the data logger**
- Data Concentrator Modules (DCMs) (Each read out 64 FEBs)
  - 11 installed on Near Detector
  - Ash River version will have a faster version of PPC processor (25%), increased processor RAM to 2 GB, and a Larger FPGA
- Time Distribution Units (TDUs)
    - 3 are installed on Near Detector, no major changes for Ash River.
- Data Acquisition / Networking / Computers
  - All commercial items
- Power Distribution, Cables
  - Buying parts for Ash River now, testing at Univ of Virginia

Detector Progress: WBS 2.9 Assembly

- Pat Lukens will cover Assembly after the break
  - FHEP
  - Pivoter
  - Ash River Assembly
  - Near Detector
- Rick Tesarek will cover Outfitting after the break
  - Scintillator
  - Electronics
  - Cables and Power supplies
  - Near Detector
- So I won't say much here
  - Will cover a PVC issue crossing several L2 WBS (next 2 slides)
  - Will explain our plan for the Near Detector (3rd slide coming)

We made a major change in the PVC structure at Ash River last spring

- **Last fall, Pat Lukens (Assembly L2 Manager) noted that the Ash River assembly would be MUCH simpler if we only had one kind of PVC module instead of two kinds with different PVC thicknesses**
  - Horizontal were ~ 3 mm baseline design→ 4.5 mm thick in the new design
  - Verticals continue to be ~ 4.5 mm thick
  - So we would add about 25% more PVC mass (average 50% with 0%)
- **Pat Lukens and Rick Tesarek (Deputy Project Manager) also noted that the Ash River Assembly would be more straightforward with 32 plane structures instead of 31 planes per block**
  - All blocks are then the same instead of two types due to the odd number.
  - It was also noted that the structure avoids large gaps if all the blocks lean to the South.
    - The nominal tilt will be 1.0” ± 0.25”

- **To our surprise in January we found in FEA work that the Ash River PVC structure would be more stable with this new structure**
  - The safety factor against buckling for a filled, top guided block was found to increase from 1.3 to 3.1 compared with the baseline design
  - The safety factor when leaning is 2.5 for filled blocks after 20 years.
  - Asymmetric loading with 32 planes was found to be insignificant

More on PVC structure

- **The drawback is that 25% more PVC costs 25% more**
  - The base cost of PVC was 22 M$, so 25% more is ~ 5.5 M$.
  - This consumed a major chuck of our available contingency, so at the same time we scaled back the # of blocks in the detector from 30 to 29 (but now 32 layers/block, not 31).
    - This leaves us at 14.25 kt, still above our Threshold KPP (14kt)
- **There are other advantages:**
  - The PVC WBS 2.4 WBS needs to make only one kind of extrusion & needs only one die
    - We did build & test a thin-wall PVC die, but have not qualified it for production
    - We may investigate if it can be converted to a spare thick PVC die at modest cost.
  - The PVC Module 2.5 WBS needs to match only one kind of extrusion with its manifold and endplate parts
    - At the time we were facing the re-design of two sets of parts with limited personnel, but trimmed that to one set
  - Assembly WBS 2.9 would have required 2 types of steel pallets for two types of blocks
    - now only one type needed
  - Experience with the Near Detector has now shown that the juxtaposition of super-blocks as originally planned with two adjacent "A" type blocks (vertical outsides) is a problem without an extrusion sized gap for the base pallet – now avoided
  - A single block of the structure is now stable even when filled with scintillator. So we can start filling block 1 when #2 is in place (vs original plan at #6). **Accelerates schedule.**
- The detector's live fraction declines from ~ 70% to 65% but this is a small effect

Near Detector plans

- The existing prototype Near Detector has
  - Thin and thick PVC walls & Two types of 31 plane blocks
- **We want to make the Near-to-Far comparison as transparent as possible, so we will rebuild the Near Detector.**
- In addition, there is a proposal from our Spokesperson to increase the size of the Near Detector
  - from 2 wide by 3 high PVC modules to 3 by 3
  - For increased acceptance of neutrino events & reduced systematic effects in the experiment
    - Simulations of this are in progress
- A wider Near Detector requires a wider Near Detector Cavern
  - A re-design of the cavern will cost ~ 300 K$ & a wider cavern costs an extra ~ 500 K$
    - No decision on either step as yet
- A new Near Detector requires additional PVC modules
  - WBS 2.5 Module Assembly strives to achieve only 2% rejections (2% of 11,136 = 222)
    - Just barely reached that goal with the prototype Near Detector modules, rejections at start were ~20%
  - Assembly errors are at the module ends, so we can only cut them too short for Ash River. BUT we can get 3 new Near modules out of every reject Far module.
    - 666 expected raw materials, need 600 for a 3 x 3 Near Detector, may build a few Near Modules first as test

Bottoms up Cost Estimate

- We have gone back through our Basis of Estimate documents and reviewed each
  - The status is shown in the table below
  - This LAST YEAR's TABLE, Halley Brown and Alan Wehmann are working on an update

Cnt %		Status of BOE	Count
18%		a) Tasks are complete, no change necessary	80
35%		b) Not changed, tasks will complete by end of CY10, and ETC forecast keeps track of anticipated contingency use	74
83%		c) Reviewed, no changes required	209
93%		d) Updated, CR completed	44
94%		e) New activity, new BOE, CR completed	4
97%		f) Reviewed, BOE updated but has a small cost change, no CR done	11
100%		h) Reviewed and updated BOE, no CR completed yet	13
		Grand Total	**435**

AY$ by Level 2 with MIE/OPC split

- Just about 50% done: 123.9 M$ costed, 124.3 M$ estimate to go.
- Contingency of 29.8 M$ or 24%
  - 27.1 M$ is assigned, line by line in the schedule, according to risk
  - 2.67 M$ is "available"

	WBS	Items	NOvA Costs to Date ($M) as of 30-June-2011	NOvA 's Cost Estimate AY $M (for July 1, 2011 to project end)									
				Estimated Cost (with indirects)			Mgmt Reserve Estimate			Contingency %			Total
				M&S	Labor[1]	Total	M&S	Labor[1]	Total	M&S	Labor[1]	Total	Cost
TEC	2.0	Accelerator & NuMI Upgrades	$ 15.0	$ 7.0	$ 13.2	$ 20.2	$ 2.3	$ 4.1	$ 6.4	32%	32%	32%	$ 41.5
	2.1	Far Detector Site and Building	$ 3.2	$ 0.8	$ 0.1	$ 0.9	$ 0.1	$ 0.0	$ 0.1	16%	4%	15%	$ 4.2
	2.2	Liquid Scintillator	$ 5.0	$ 16.3	$ 0.5	$ 16.7	$ 4.5	$ 0.2	$ 4.7	28%	42%	28%	$ 26.5
	2.3	Wave-Length-Shifting Fiber	$ 6.4	$ 5.4	$ 0.4	$ 5.8	$ 0.2	$ 0.0	$ 0.3	5%	11%	5%	$ 12.5
	2.4	PVC Extrusions	$ 6.2	$ 21.9	$ 1.1	$ 23.0	$ 1.4	$ 0.3	$ 1.7	6%	29%	7%	$ 30.8
	2.5	PVC Modules	$ 5.2	$ 5.3	$ 7.8	$ 13.1	$ 0.8	$ 1.3	$ 2.1	15%	17%	16%	$ 20.5
	2.6	Electronics Production	$ 1.3	$ 9.7	$ 1.1	$ 10.8	$ 1.3	$ 0.3	$ 1.6	13%	28%	15%	$ 13.7
	2.7	Data Acquisition System	$ 1.1	$ 2.0	$ 1.0	$ 3.0	$ 0.4	$ 0.3	$ 0.8	22%	32%	25%	$ 4.9
	2.8	Near Detector Assembly	$ 2.0	$ 4.8	$ 0.3	$ 5.1	$ 1.6	$ 0.2	$ 1.7	33%	52%	34%	$ 8.8
	2.9	Far Detector Assembly	$ 4.5	$ 8.1	$ 10.2	$ 18.3	$ 1.9	$ 5.4	$ 7.2	23%	53%	40%	$ 30.0
	2.10	Project Management	$ 4.7	$ 0.2	$ 5.7	$ 5.9	$ 0.1	$ -	$ 0.1	24%	0%	1%	$ 10.6
		Subtotal Construction	**$ 54.6**	**$ 81.4**	**$ 41.3**	**$ 122.7**	**$ 14.6**	**$ 12.2**	**$ 26.8**	**18%**	**30%**	**22%**	**$ 204.1**
OPC		**R&D - Accelerator**	$ 6.5	$ 0.0	$ 0.5	$ 0.5	$ 0.0	$ 0.2	$ 0.2	18%	31%	31%	$ 7.2
		R&D - Detector	$ 28.1	$ 0.0	$ 0.2	$ 0.2	$ 0.0	$ 0.0	$ 0.0	55%	5%	7%	$ 28.4
		Cooperative Agreement	$ 34.2	$ 0.2	$ -	$ 0.2	$ -	$ -	$ -	0%	0%	0%	$ 34.3
		Operating	$ 0.5	$ 0.1	$ 0.5	$ 0.6	$ 0.0	$ 0.2	$ 0.2	42%	35%	36%	$ 1.3
		Total OPC:	**$ 69.3**	**$ 0.3**	**$ 1.3**	**$ 1.6**	**$ 0.0**	**$ 0.4**	**$ 0.4**	**13%**	**28%**	**25%**	**$ 71.2**
		Available Contingency							**$ 2.670**				**$ 2.7**
		TPC:	**$ 123.9**	**$ 81.7**	**$ 42.5**	**$ 124.3**	**$ 14.6**	**$ 12.6**	**$ 29.8**	**18%**	**30%**	**24%**	**$ 278.000**

Notes: [1] Labor costs presented here include all project labor from Fermilab, other DOE facilities and Universities.

For comparison, here is the same table as the previous slide as shown at the last IPR in Aug/Sept 2010

	WBS	Items	NOvA Costs to Date ($M) as of 31-JULY-2010	NOvA 's Cost Estimate AY $M (for August 1, 2010 to project end)									
				Estimated Cost (with indirects)			Mgmt Reserve Estimate			Contingency %			Total
				M&S	Labor[1]	Total	M&S	Labor[1]	Total	M&S	Labor[1]	Total	Cost
TEC	2.0	Accelerator & NuMI Upgrades	$ 5.8	$ 9.0	$ 16.1	$ 25.0	$ 3.3	$ 5.3	$ 8.5	36%	33%	34%	$ 39.4
	2.1	Far Detector Site and Building	$ 0.4	$ 4.0	$ 0.5	$ 4.5	$ 0.9	$ 0.0	$ 0.9	22%	10%	21%	$ 5.9
	2.2	Liquid Scintillator	$ 3.3	$ 17.1	$ 0.5	$ 17.6	$ 4.9	$ 0.2	$ 5.1	29%	44%	29%	$ 26.0
	2.3	Wave-Length-Shifting Fiber	$ 2.0	$ 9.5	$ 0.7	$ 10.2	$ 0.5	$ 0.1	$ 0.6	5%	11%	6%	$ 12.8
	2.4	PVC Extrusions	$ 1.8	$ 21.2	$ 1.3	$ 22.5	$ 2.8	$ 0.5	$ 3.3	13%	35%	14%	$ 27.5
	2.5	PVC Modules	$ 1.5	$ 6.9	$ 6.6	$ 13.5	$ 1.1	$ 1.5	$ 2.6	16%	22%	19%	$ 17.6
	2.6	Electronics Production	$ 0.1	$ 11.3	$ 1.1	$ 12.4	$ 3.7	$ 0.4	$ 4.1	33%	34%	33%	$ 16.6
	2.7	Data Acquisition System	$ 0.2	$ 1.7	$ 1.3	$ 3.1	$ 0.5	$ 0.4	$ 0.9	28%	30%	29%	$ 4.1
	2.8	Near Detector Assembly	$ 0.4	$ 3.6	$ 0.5	$ 4.1	$ 1.9	$ 0.3	$ 2.2	54%	56%	54%	$ 6.8
	2.9	Far Detector Assembly	$ 0.7	$ 4.6	$ 7.2	$ 11.9	$ 3.0	$ 4.2	$ 7.2	65%	58%	61%	$ 19.7
	2.10	Project Management	$ 2.5	$ 0.3	$ 10.1	$ 10.4	$ 0.1	$ 0.2	$ 0.3	25%	2%	3%	$ 13.2
		Subtotal Construction	**$ 18.6**	**$ 89.2**	**$ 46.0**	**$ 135.3**	**$ 22.6**	**$ 13.0**	**$ 35.6**	**25%**	**28%**	**26%**	**$ 189.5**
OPC		**R&D - Accelerator**	$ 5.6	$ 0.5	$ 2.4	$ 2.9	$ 0.1	$ 0.8	$ 0.9	29%	32%	31%	$ 9.3
		R&D - Detector	$ 26.3	$ 0.6	$ 1.1	$ 1.7	$ 0.1	$ 0.1	$ 0.1	9%	7%	8%	$ 28.1
		Cooperative Agreement	$ 20.0	$ 12.6	$ 0.0	$ 12.6	$ 2.6	$ -	$ 2.6	13%	0%	20%	$ 35.2
		Operating	$ 0.5	$ 0.1	$ 0.9	$ 1.0	$ 0.0	$ 0.3	$ 0.3	36%	33%	33%	$ 1.8
		Total OPC:	**$ 52.4**	**$ 13.7**	**$ 4.5**	**$ 18.1**	**$ 2.8**	**$ 1.1**	**$ 3.9**	**20%**	**26%**	**22%**	**$ 74.4**
		Available Contingency							**$ 14.065**				**$ 14.1**
		TPC:	**$ 71.0**	**$ 102.9**	**$ 50.5**	**$ 153.4**	**$ 25.4**	**$ 14.1**	**$ 53.6**	**25%**	**28%**	**35%**	**$ 278.000**

CPR1 June 2011

COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

CONTRACTOR	CONTRACT	PROGRAM	REPORT PERIOD
NAME	NAME	NAME	FROM 01-June-2011
Fermi National Accelerator Laboratory		NOvA Project	TO 30-June-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 ESTIMATE	
ITEM	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED		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$k	1,261	530	1,061	(731)	(531)	15,363	12,993	14,955	(2,370)	(1,962)	32,947	35,130	(2,183)
CTC-FndSrcTotals:	1,261	530	1,061	(731)	(531)	15,363	12,993	14,955	(2,370)	(1,962)	32,947	35,130	(2,183)
DC DOE-CA													
2.1 Site and Building													
Fully Burdened AY$k	232	375	356	144	19	34,870	34,887	34,150	18	737	35,060	34,341	719
CTC-FndSrcTotals:	232	375	356	144	19	34,870	34,887	34,150	18	737	35,060	34,341	719
DD DOE-ACEL R&D													
1.0 ANU R&D													
Fully Burdened AY$k	69	70	35	1	34	7,024	6,565	6,455	(459)	110	7,119	7,000	119
CTC-FndSrcTotals:	69	70	35	1	34	7,024	6,565	6,455	(459)	110	7,119	7,000	119
DE DOE-DET MIE													
2.1 Site and Building													
Fully Burdened AY$k	332	575	206	243	369	5,828	5,558	3,175	(271)	2,383	6,408	4,061	2,347
2.10 Project Management - Nova Project - Construction													
Fully Burdened AY$k	292	292	233	0	59	5,631	5,631	4,672	0	959	11,523	10,574	949
2.2 Liquid Scintillator													
Fully Burdened AY$k	494	278	808	(216)	(529)	5,062	4,852	5,010	(210)	(158)	21,507	21,743	(236)
2.3 WLS Fiber													
Fully Burdened AY$k	352	760	310	408	450	5,821	6,576	6,427	755	148	12,403	12,222	181
2.4 PVC Extrusions													
Fully Burdened AY$k	428	522	366	94	156	6,560	6,353	6,192	(207)	161	29,526	29,169	357
2.5 PVC Modules													
Fully Burdened AY$k	367	381	219	15	163	7,181	6,482	5,239	(699)	1,243	19,547	18,349	1,198
2.6 Electronics													
Fully Burdened AY$k	609	181	185	(428)	(3)	2,509	1,630	1,324	(879)	306	12,428	12,133	295
2.7 DAQ													
Fully Burdened AY$k	71	78	136	7	(58)	1,124	851	1,080	(273)	(229)	3,841	4,090	(250)
2.8 Near Detector Assembly													
Fully Burdened AY$k	6	2	31	(4)	(29)	918	849	2,019	(69)	(1,170)	5,863	7,090	(1,227)
2.9 Far Detector Assembly													
Fully Burdened AY$k	421	358	388	(63)	(30)	4,162	3,171	4,507	(991)	(1,335)	21,172	22,765	(1,592)
CTC-FndSrcTotals:	3,373	3,428	2,880	55	548	44,796	41,953	39,646	(2,844)	2,306	144,218	142,195	2,023
DO DOE-ACEL OPS													
1.0 ANU R&D													
Fully Burdened AY$k	0	0	3	0	(3)	312	312	532	0	(220)	894	1,114	(220)
CTC-FndSrcTotals:	0	0	3	0	(3)	312	312	532	0	(220)	894	1,114	(220)

SPI: Several deliveries for June came in early July

CPI: labor over 236K$ (peg points), M&S over 263K$ (kickers, RF)

Outfitting work progress

Got 89,000 gallons BCWS in May, then only 50K of 75K acrrued in June

Extra shipment from Kuraray

CPR1 June 2011 continued

COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

CONTRACTOR	CONTRACT	PROGRAM	REPORT PERIOD
NAME	NAME	NAME	FROM 01-June-2011
Fermi National Accelerator Laboratory		NOvA Project	TO 30-June-2011

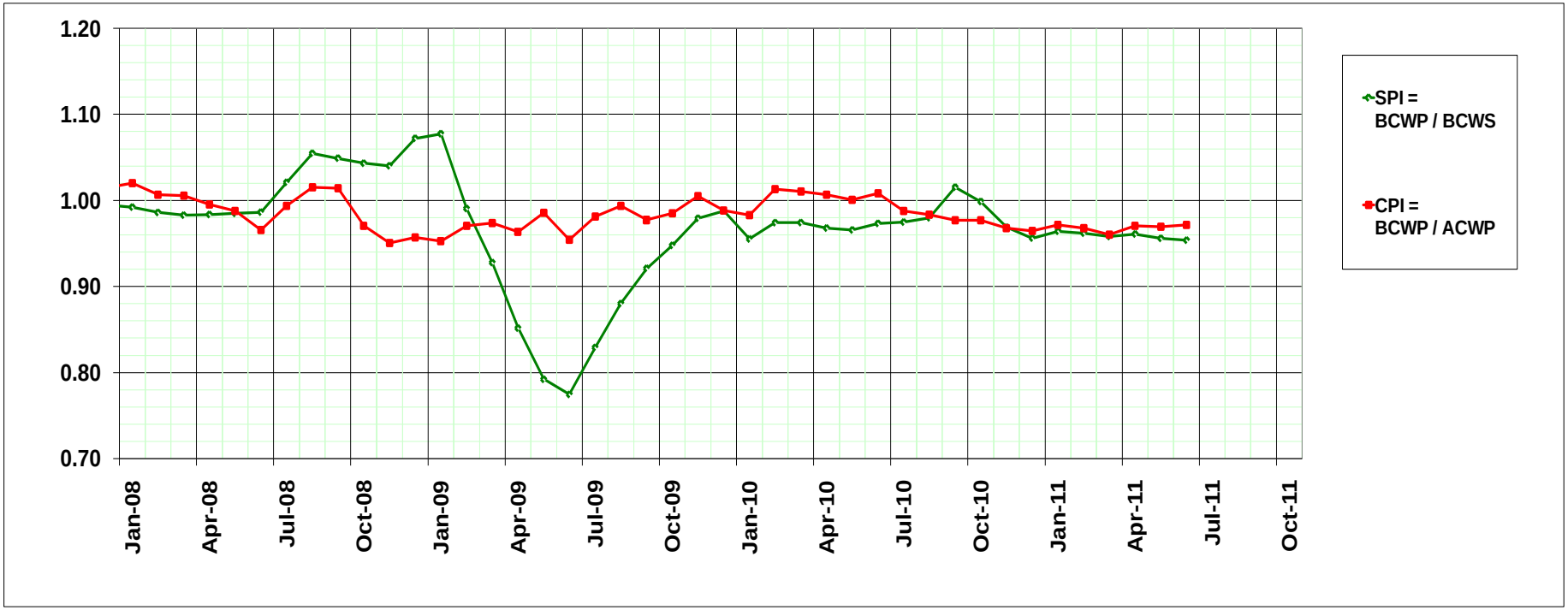
PERFORMANCE DATA

CTC-FndSrc	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
WBS[2] Results...	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE			LATEST	
ITEM	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	REVISED ESTIMATE	VARIANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
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	4	0	(4)	1,369	1,369	2,087	0	(718)	1,369	2,087	(718)
1.5 PVC Module R&D													
Fully Burdened AY$k	0	0	0	0	0	2,260	2,260	2,414	0	(154)	2,260	2,414	(154)
1.6 Electronics R&D													
Fully Burdened AY$k	19	57	7	38	50	2,022	1,996	2,580	(27)	(585)	2,028	2,621	(594)
1.7 DAQ R&D													
Fully Burdened AY$k	13	15	10	2	5	1,608	1,561	2,824	(47)	(1,263)	1,635	2,899	(1,264)
1.8 Detector Assembly R&D													
Fully Burdened AY$k	0	0	6	0	(6)	3,123	3,020	4,938	(103)	(1,918)	3,123	5,059	(1,936)
1.9 Project Management R&D													
Fully Burdened AY$k	0	0	0	0	0	383	383	559	0	(176)	383	559	(176)
CTC-FndSrcTotals:	32	72	27	40	45	15,033	14,857	19,335	(176)	(4,478)	15,067	19,572	(4,506)
DY DOE CD-0 TO CD-1 R&D													
1.9 Project Management R&D													
Fully Burdened AY$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	4,967	4,475	4,362	(492)	113	126,198	120,368	123,875	(5,830)	(3,507)	244,106	248,153	(4,047)
Management Resrv.											33,894		
Total	4,967	4,475	4,362	(492)	113	126,198	120,368	123,875	(5,830)	(3,507)	278,000		

Schedule variance due to Accel and Det MIE
Cost variance due to Det R&D

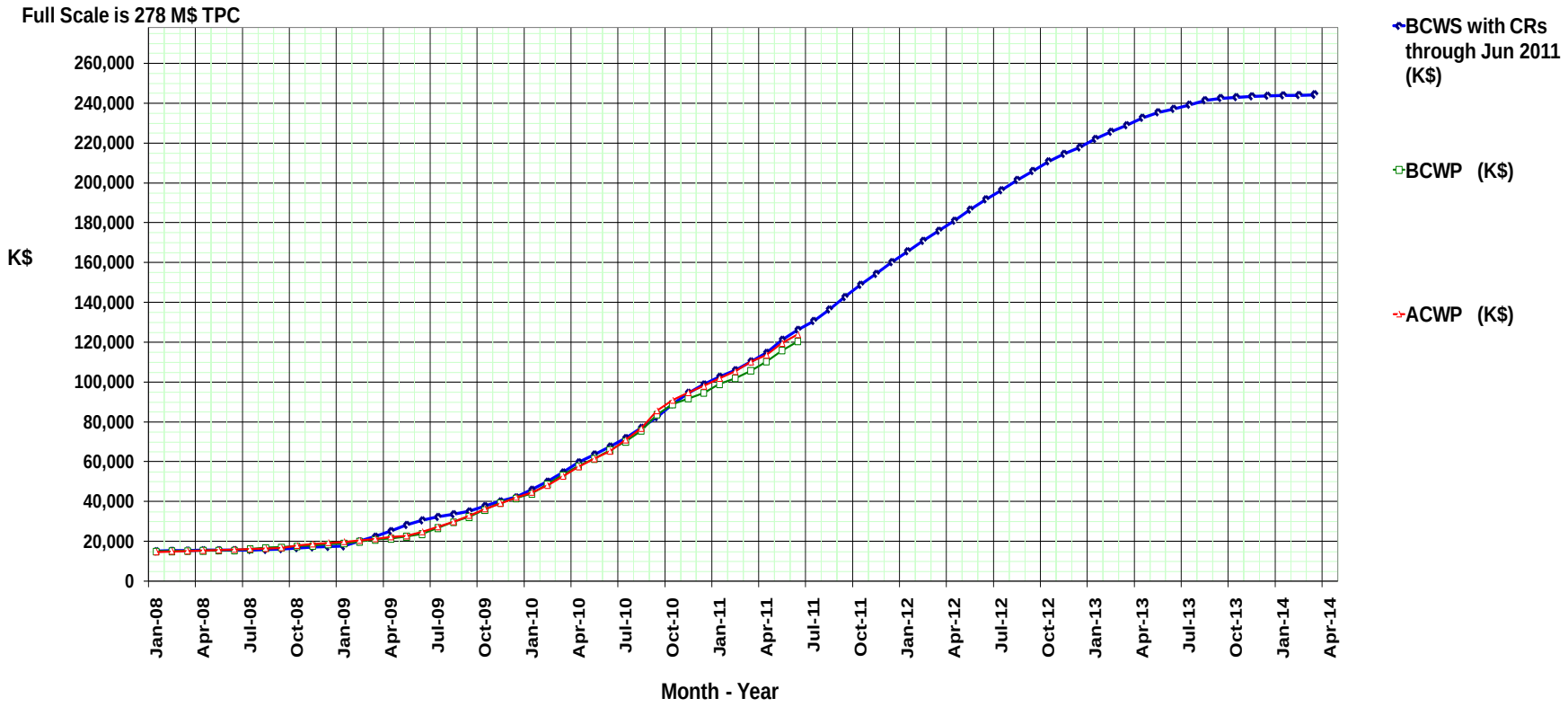
EVMS Reporting Overview

- Data now available through June 2011
  - SPI = **0.954**, compare to 0.956 in May, 0.961 in Apr
  - CPI = **0.972,** compare to 0.970 in May, 0.971 in Apr
- We are still "Green"



EVMS Reporting Overview

- Basic data in BCWS, BCWP, ACWP, **Funding** through June 2011
  - BCWS = Budgeted cost of work Scheduled
  - BCWP = Budgeted cost of work Performed
  - ACWP = Actual cost of work Performed
- **Project is 49.3 % complete (BCWP/BAC = 120.4 M$ / 244.1 M$)**
  - BAC = Budget at Completion (using EAC, get 48.5%)
  - We were at 31% complete at the Aug/Sept 2010 IPR



EVMS analysis

- Now divide the project into 4 parts and look at Schedule and Cost variations

- The four parts:
  - Accelerator work, R&D + Construction
    - R&D and Const are mixed until very near the end
    - ~ ends with the end of the 2012 long shutdown for installation
  - Cooperative Agreement work, building
    - Concludes ~ now
  - Detector R&D
    - Concludes ~ now
  - Detector Construction
    - This is the bulk of the project (59% of BAC)

4 part data

- June:

	Accelerator Upgrades	Ash River Building	Detector R&D	Detector Construction
BAC	$ 41.0 M	$ 35.1 M	$ 15.0 M	$ 144.2 M
EAC	$ 43.2 M	$ 34.3 M	$ 19.6 M	$ 142.2 M
BCWS	$ 22.7 M	$ 34.9 M	$ 15.0 M	$ 44.8 M
BCWP	$ 19.9 M	$ 34.9 M	$ 14.9 M	$ 42.0 M
ACWP	$ 21.9 M	$ 34.2 M	$ 19.3 M	$ 39.6 M
% Complete (BCWP/BAC)	48.5%	99.5%	98.6%	31.1%
SPI = BCWP/BCWS	0.88	1.00	0.99	0.94
CPI = BCWP/ACWP	0.91	1.02	0.77	1.06

3.6 M$

- May

	Accelerator Upgrades	Ash River Building	Detector R&D	Detector Construction
BAC	$ 40.9 M	$ 35.1 M	$ 15.1 M	$ 141.5 M
EAC	$ 42.7 M	$ 34.3 M	$ 19.6 M	$ 139.9 M
BCWS	$ 21.4 M	$ 34.8 M	$ 15.0 M	$ 41.3 M
BCWP	$ 19.3 M	$ 34.6 M	$ 14.8 M	$ 38.4 M
ACWP	$ 20.8 M	$ 33.8 M	$ 19.3 M	$ 36.8 M
% Complete (BCWP/BAC)	47%	99%	98%	29%
SPI = BCWP/BCWS	0.90	0.99	0.99	0.93
CPI = BCWP/ACWP	0.92	1.02	0.77	1.05

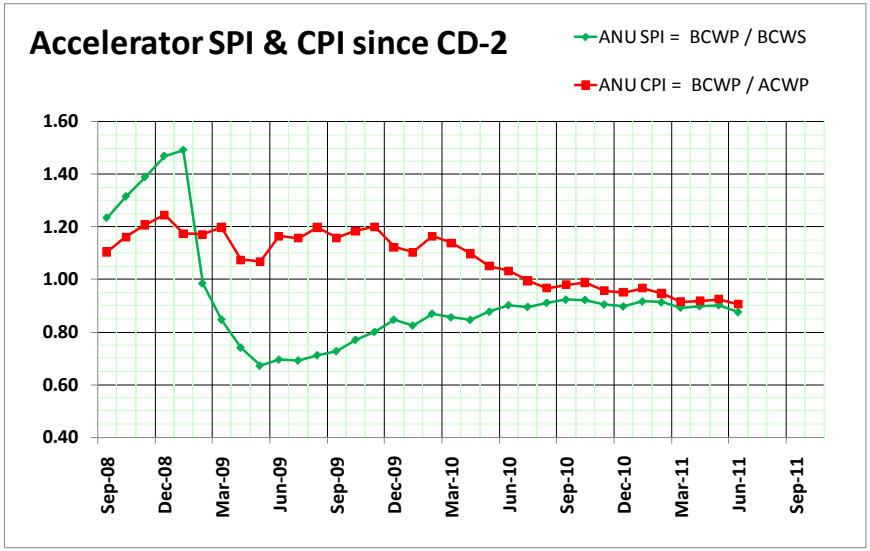
4.2 M$

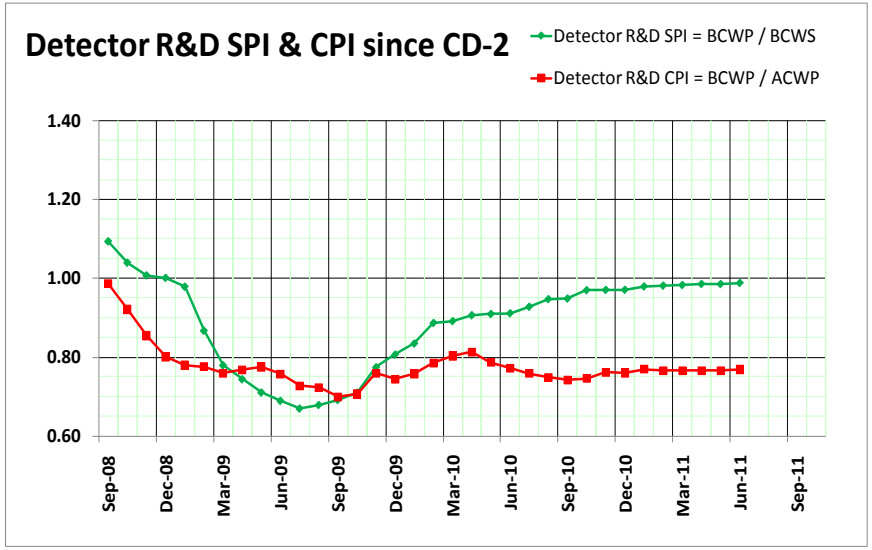
- April

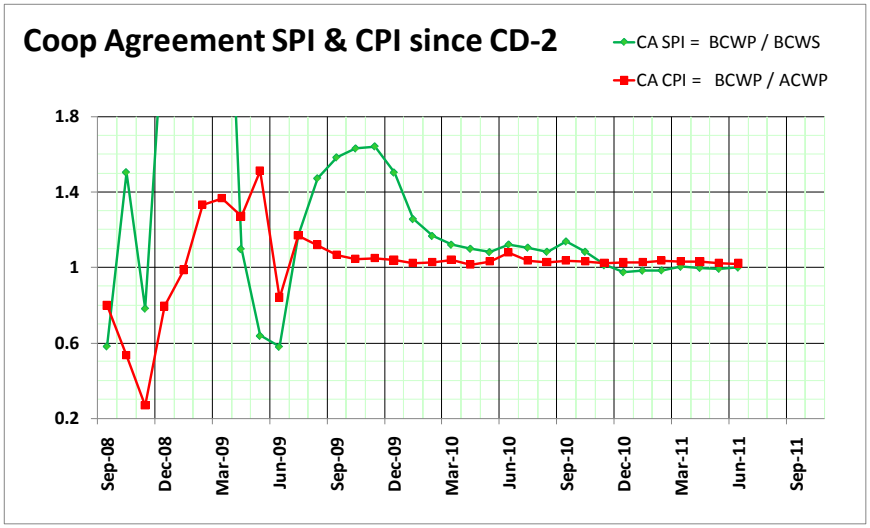
	Accelerator Upgrades	Ash River Building	Detector R&D	Detector Construction
BAC	$ 40.9 M	$ 34.9 M [a]	$ 15.1 M	$ 140.5 M
EAC	$ 42.5 M	$ 33.7 M [a]	$ 19.6 M	$ 139.0 M
BCWS	$ 20.1 M	$ 34.4 M	$ 15.0 M	$ 36.4 M
BCWP	$ 18.1 M	$ 34.4 M	$ 14.8 M	$ 34.2 M
ACWP	$ 19.7 M	$ 33.4 M	$ 19.3 M	$ 32.4 M
% Complete (BCWP/BAC)	44%	99%	98%	26%
SPI = BCWP/BCWS	0.89	1.00	0.99	0.94
CPI = BCWP/ACWP	0.92	1.03	0.77	1.06

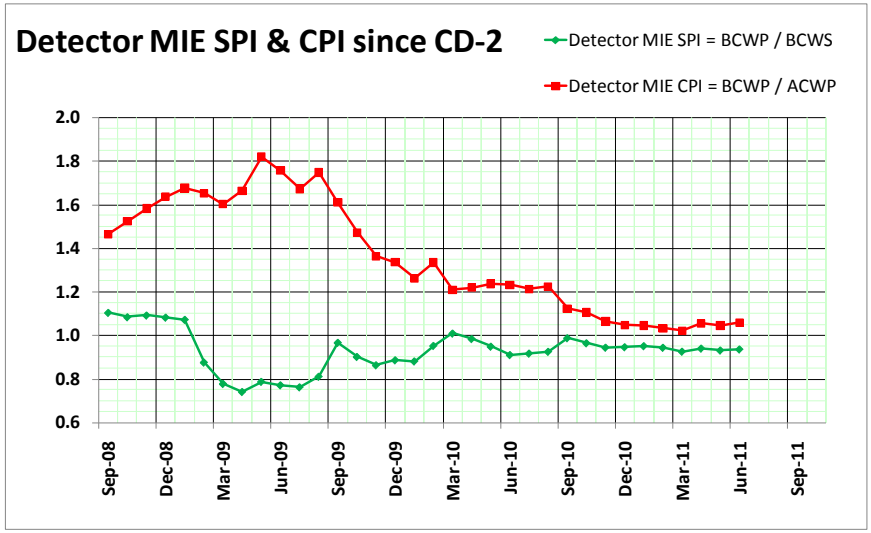
a – This includes the full rock claim. No further claims are expected.

History of SPI & CPI for the 4 parts

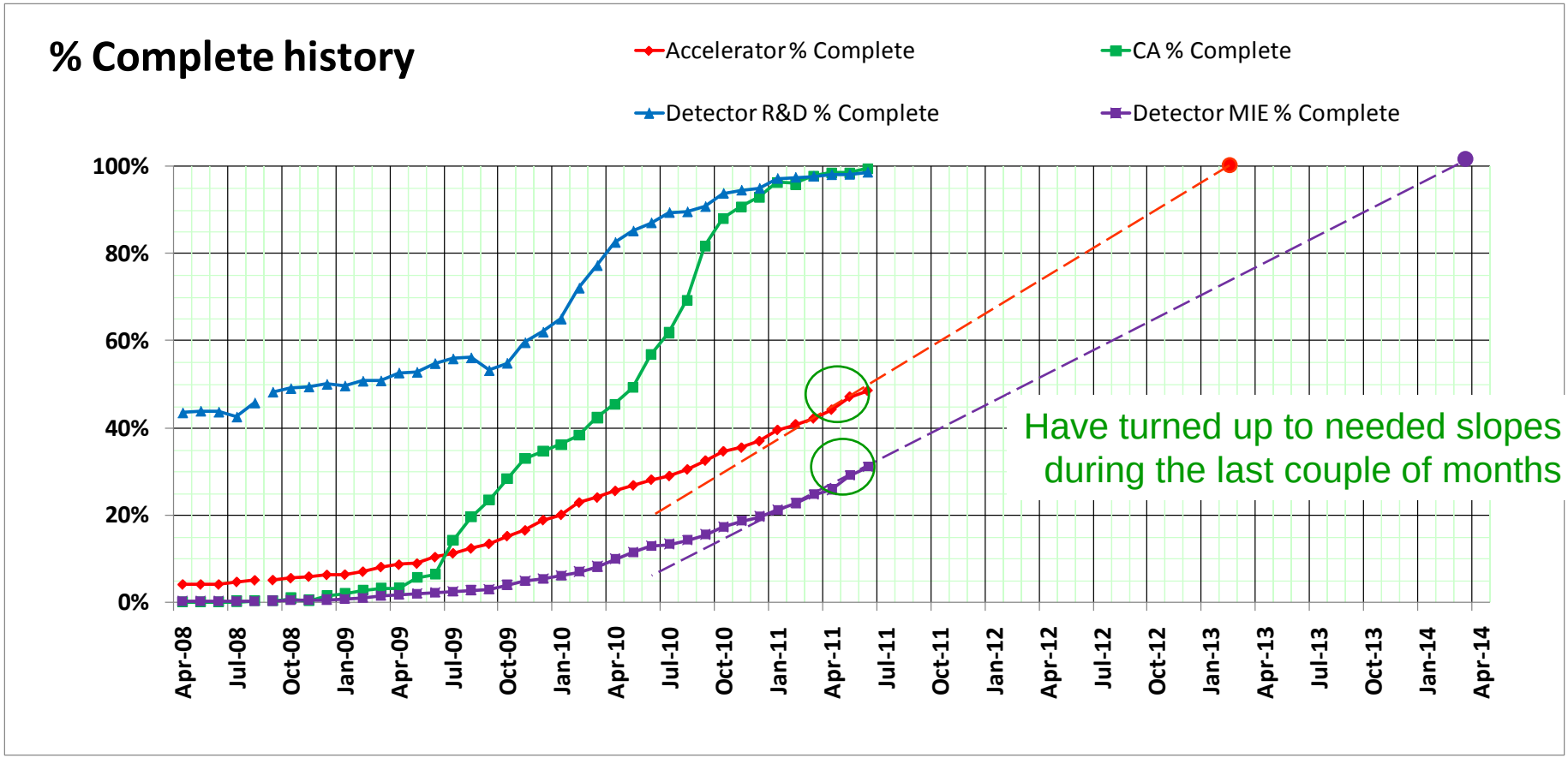






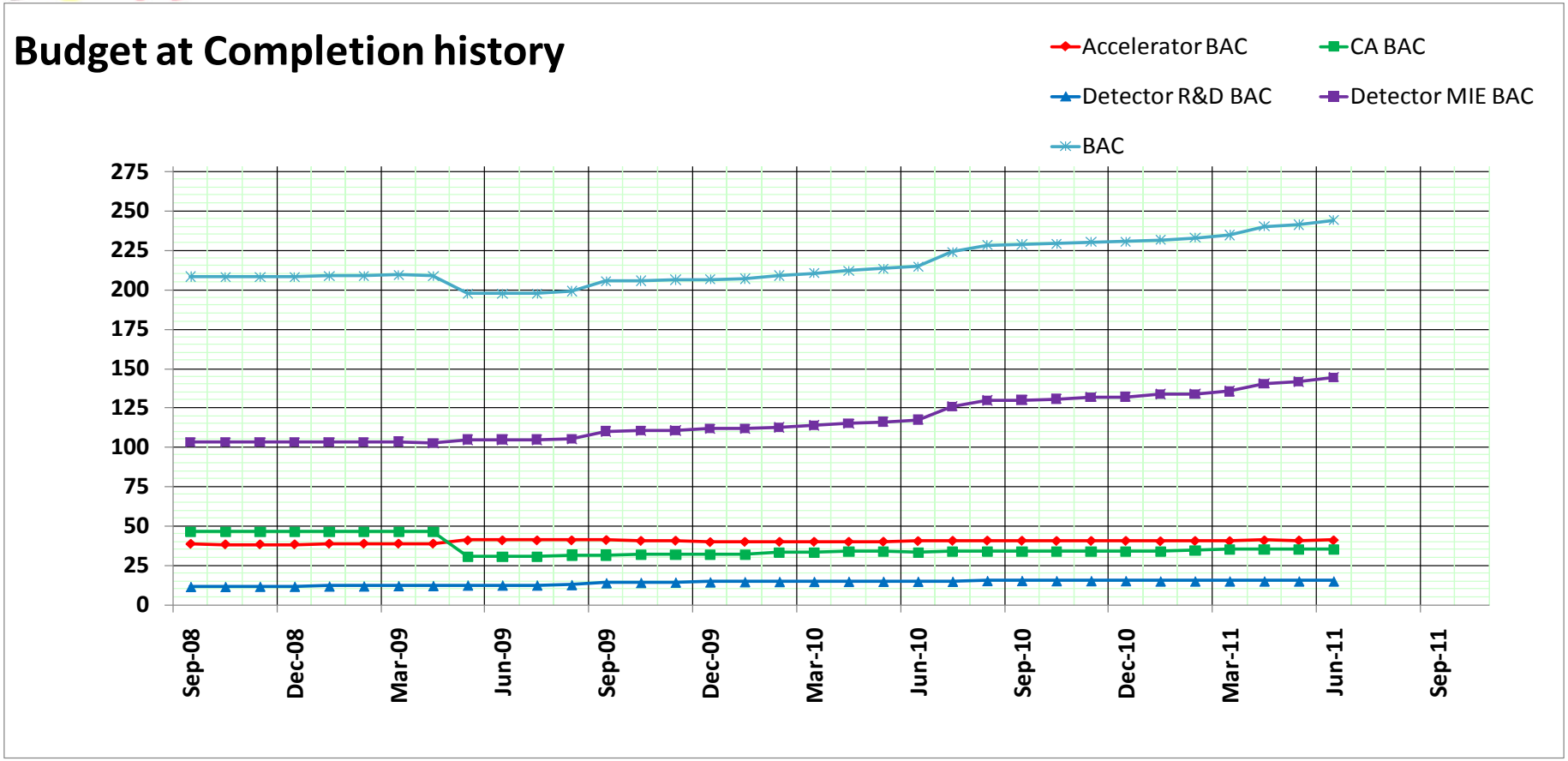


% Complete history for the 4 parts



- Building & Detector R&D near the end
- ANU to be complete by ~ Feb 2013
  - ANU R&D is 92% complete, construction is 39% complete
- Detector complete by ~ Feb - March 2014

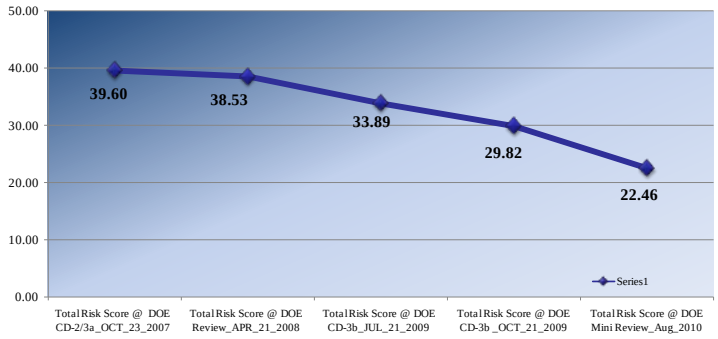
BAC history for the 4 parts

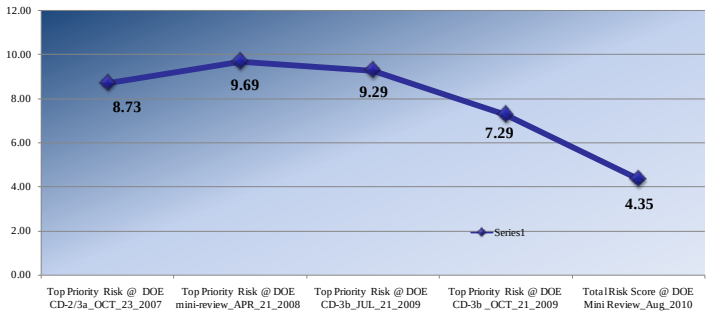


- Cheaper building in April 09
- Detector MIE increases at IPR Reviews in 2009, 2010, and now 2011
  - Bottoms up cost estimate each year (PVC early in April 2011, rest in June 2011)
- Note full scale is TPC = $ 278 M

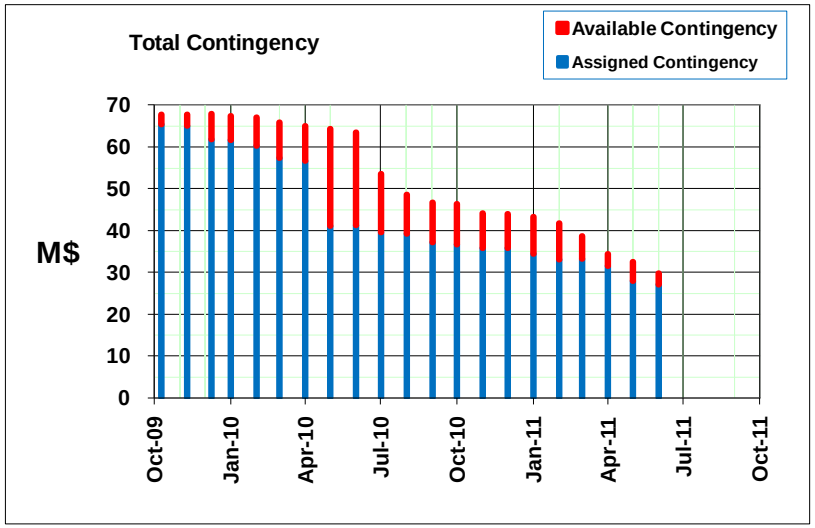
Risk Status

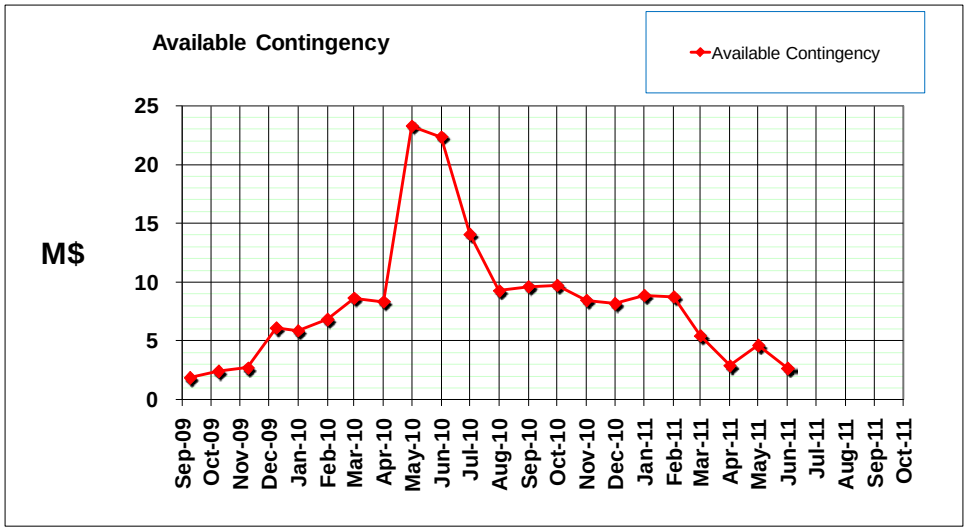
- Harry Ferguson is updating this after consulting with all L2 managers and the Change Request list for the last year.
- We use WelcomeRisk
  - Left graph shows the Sum of scores for all risks vs. time
  - Right graph shows the Sum of scores for “top” risks vs. time
  - Object is to show that risks are declining as the assigned contingency declines.





Contingency History & Status

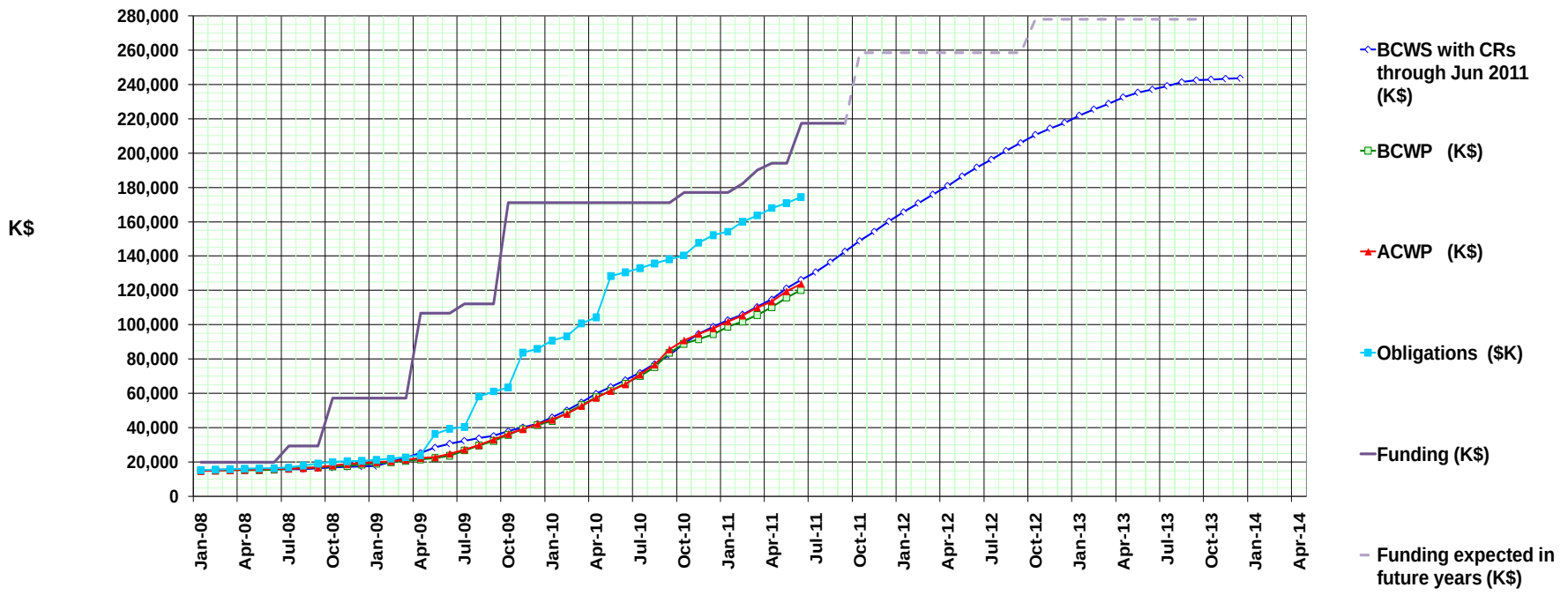




- Total contingency = 29.8 M$
  - Note drops as we prepare for IPR in July 2010 and Apr-June 2011
- Available Contingency = 2.67 M$ in June (May = 4.63 M$, Apr = 2.89 M$)
  - This is small but should increase as we get PVC into production
- 26% Contingency on remaining work
  - Is that sufficient? YES, see next slides

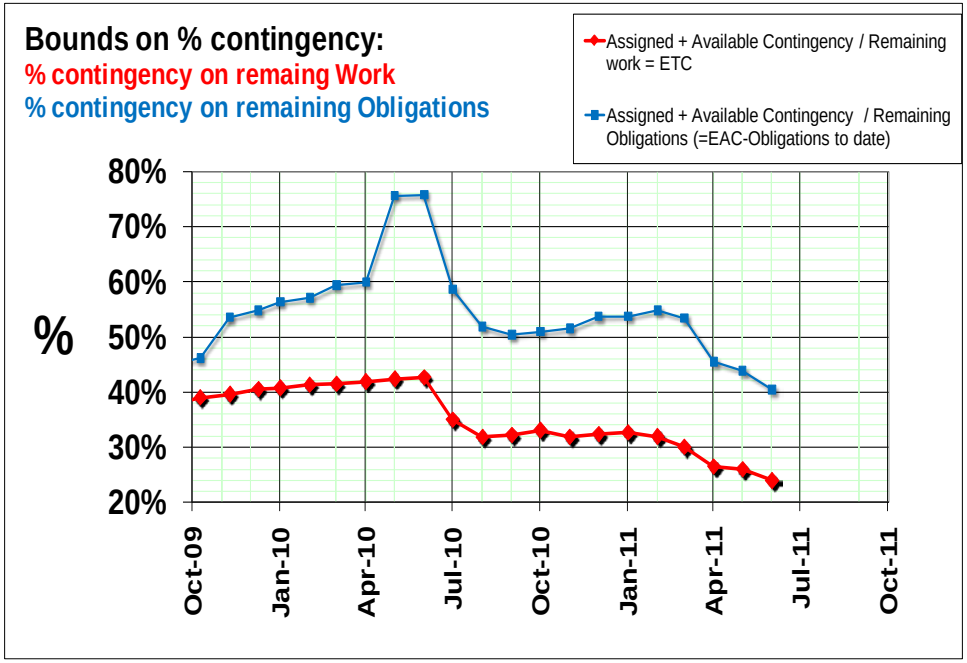
Obligations Overview

- Basic data in BCWS, BCWP, ACWP, **Funding** through June 2011,
  but now add OBLIGATIONS
- Project is 49.3 % complete (BCWP/BAC = 120.4 M$ / 244.1 M$)
  - BAC = Budget at Completion (using EAC, get 47.2%)
- **Project is 71.5 % obligated** (Obligations/BAC = 174.5 M$ / 244.1)
  - EAC = Estimate at Completion (using EAC, get 70.3%)
  - **We have 54.1 M$ of obligations out there that will turn into costs over the next 2 years and the price is already known.**



Contingency Status

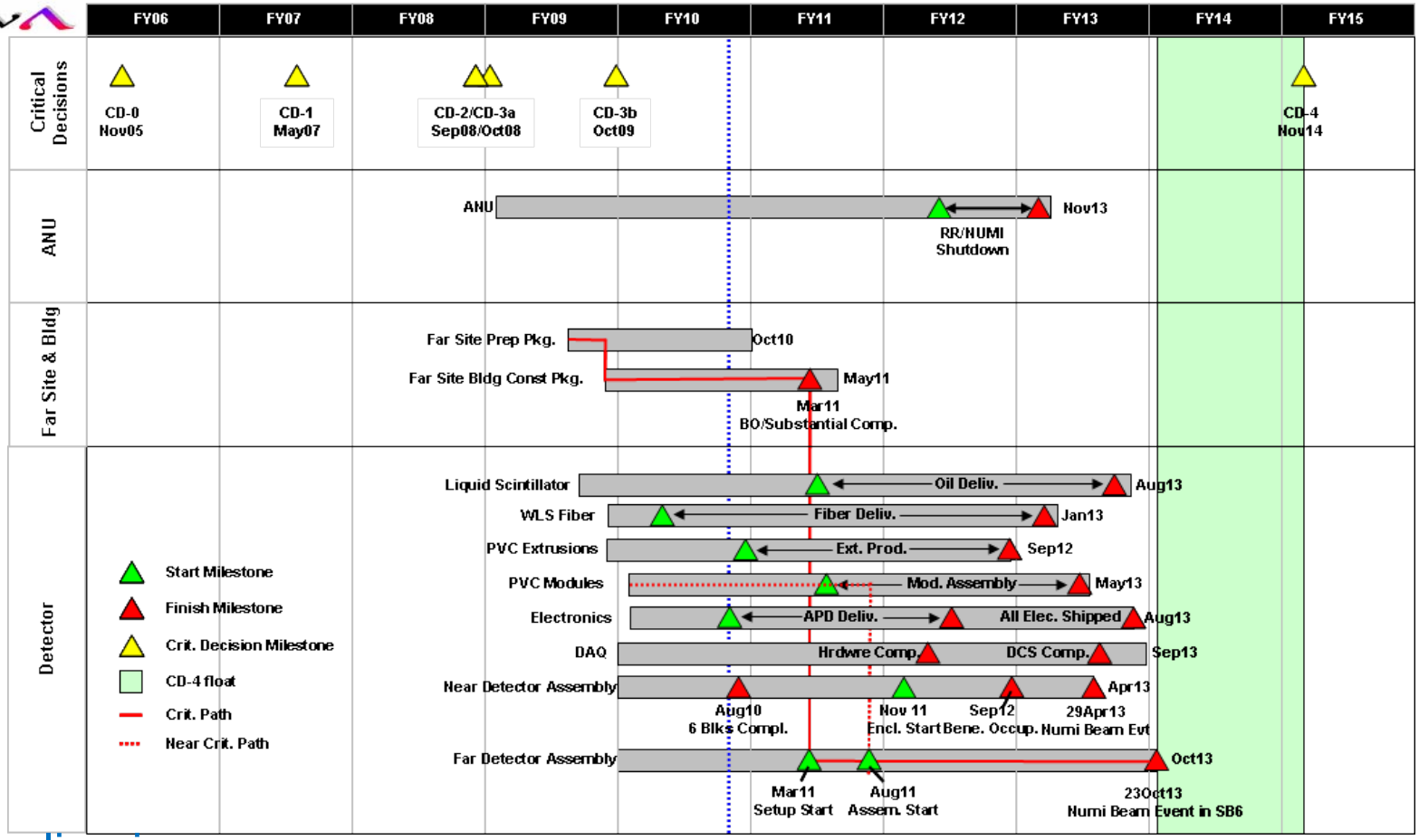
- 24% Contingency on remaining work
- **40% on remaining Obligations**
  - We have obligated many large procurements at fixed price
  - The contingency required on such items is therefore smaller
  - We watch contingency use for $/Yen, for TiO_2, for mineral oil, and update the base cost as needed, typically looking only 6 months into the future for such actions
  - We still hold substantial assigned contingency on items that haven't started yet (e.g. Minnesota factory labor, Ash River assembly and outfitting labor).



Contingency Use Plan update

- **<u>First</u> we use Available contingency to reduce project risk, to hold the project schedule, or to advance the project schedule**
  - **We have done this many times during the last year. (thicker PVC example)**
- But we still dream of using some of it for other things
  - Now authorized to build > 14 kilotons, up to 18 kt (~9 M$/ kt incl. contingency)
  - Also thinking about Near Detector items to address systematic issues
    - Larger Near Detector, 3 PVC modules wide instead of 2
      - Better event containment
    - Another Near Detector, perhaps mobile in another larger hall to look for LSND / MiniBooNE effects at fixed L, variable E
      - Current Near Detector is at L/E = 0.4, but short baseline oscillation signals are above 0.4. Those events occur downstream of our Near Detector.
    - SciNOvA in front of our Near Detector.
      - Solid scintillator device (SciBooNE already took data) with half the cell size of NOvA to check our event pattern recognition & identification.
    - Testbeam NOvA module in an electron beam at Fermilab
- No actions will be taken without substantial “available” contingency in hand, but I want to keep all options open as we go towards CD-4.

Schedule on a page from last IPR

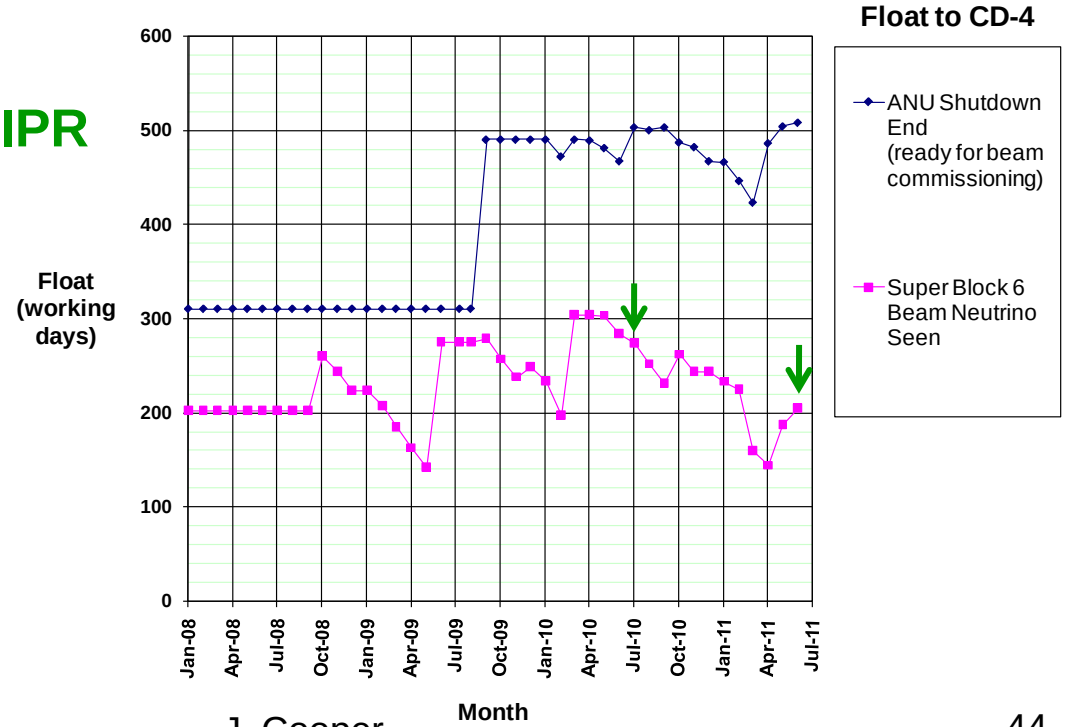


- Blue line is now
- Critical path is still Ash River Building, then Assembly (red line)
  - Next to critical path (dotted red line) happens if Module assembly slides 4 months
- Schedule slipped about 3 months since last IPR
  - Due to Manifold redesign, Pivoter slow design, PVC early production problems

Float to CD-4

- **ANU gained 4 days of float in June** **-- Now at 508 days**
  - Kickers are the driver
- **The Detector gained 18 days of float in June** **-- Now at 205 days**
  - Reworking the schedule over the last few months:
    - Modified PVC extruding from 22 days to 17 days per block
      - 24 x 7 operation, shutdown only to clean die vs. old plan to run 24 x 4.5 days/week
    - Modified PVC Module assembly from16 days to 14 days per block
      - add Saturdays with supervisor = $
    - Block Assembly at Ash River still takes 13 days per block after the first one
    - Outfitting of blocks at Ash River still takes 13 days per block
- **Have recovered**
  3 of the 6 months lost
  Since the August 2010 IPR
  - PVC assembled modules are the driver for CD-4.
    - We want every part of the project to finish in a close pack:

    - But that is not the whole story



Float to **start** of Ash River Assembly for each Detector WBS

- Some parts of the project are hard to get started
- Bill to add data when he returns in August, float for each component

Float to STEADY STATE Ash River Assembly for each Detector WBS

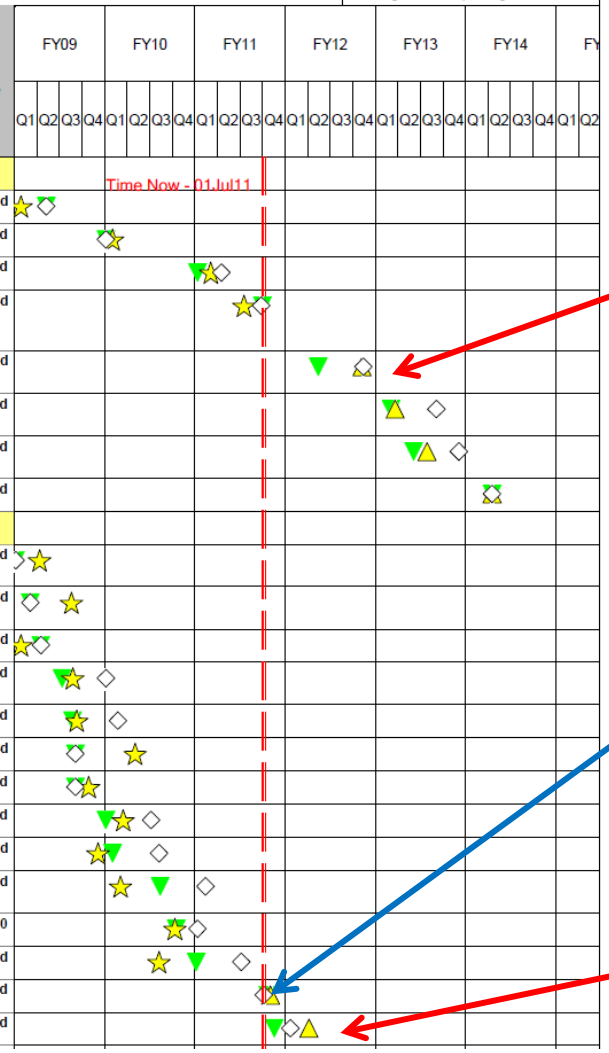
- Some parts of the Project will need help early in the race
  - This is typically for block #3 of 29 blocks
  - 1st block takes longer for everyone
  - 2nd block is faster
  - 3rd block is at the final rate and we need to know this final rate to predict the end
    - Expect STEADY STATE in mid-summer 2012.
- Bill to add data when he returns in August
  - Float for each component

Milestones held by DOE remove?

Nova_Project
Milestone Gantt Chart
Nova_Milestones_L1_L2 = [BOOL.T] and ESDATE >= {10/1/08}
June 2011 Status
TimeNow: 01Jul11

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	03Aug12	10Aug12	4d	-123d
NuMI neutrino event observed in Superblock 1	03Dec12	17Dec12	03Jun13	113d	-10d
Near detector completed and ready to operate	01Mar13	22Apr13	03Sep13	92d	-36d
14 kt installation completed	16Jan14	15Jan14	16Jan14	0	1d
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	02Aug11	01Jul11	-21d	-11d
Block pivoter completed	18Aug11	03Jan12	20Oct11	-48d	-91d



Will need to move this one once the final Shutdown date is known.

CR moved milestone from to July 2011, should still make it.

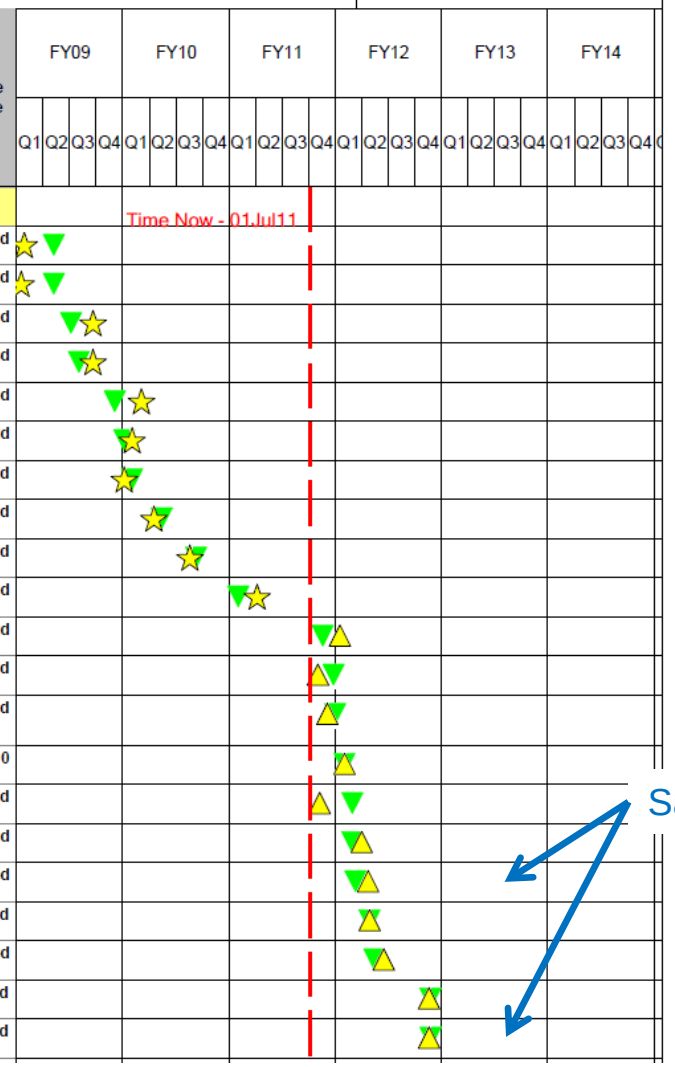
CR to move later

Milestones held by Directorate Remove?

Nova_Project
Milestone Gantt Chart
Nova_Milestone_L3_L4 = [BOOL.T] and (ESDATE >= {10/01/08} or BSDATE >= {10/01/08})
June 2011 Status
TimeNow: 01Jul11

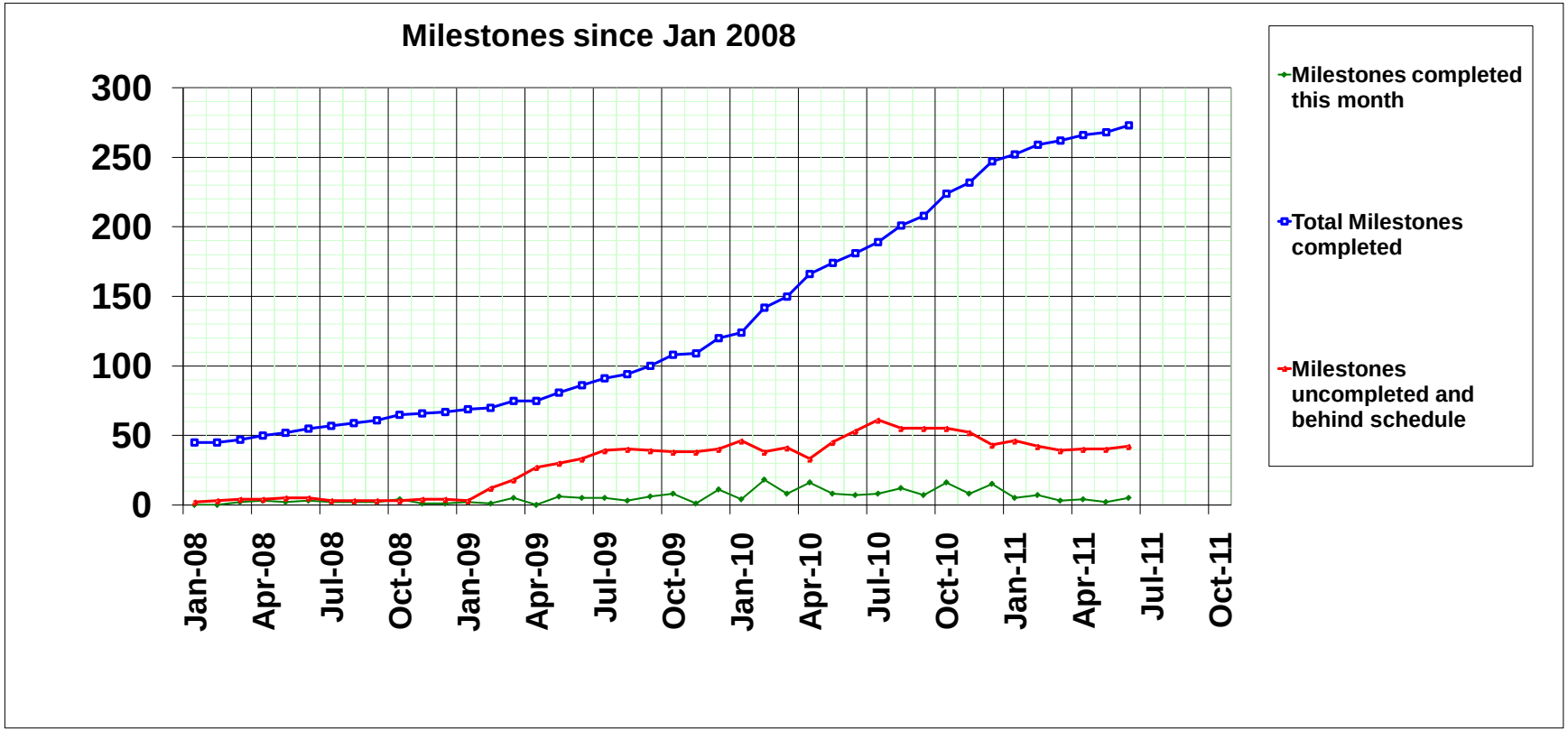
Baseline Date
Completed Milestone
Current Forecast Date

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
2.0.3.3.4.3	NuMI Stripline Assembly Complete	17Aug11	13Oct11	-40d
2.0.4.3.13	ANU Shielding Assessment Updates Complete	20Sep11	01Aug11	34d
2.1.2.5.23	Final acceptance/project completion - far detector building construction	30Sep11	29Aug11	22d
2.10.9.10	FY12 Funds Available	01Nov11	01Nov11	0
2.0.3.3.4.1	NuMI Shielding Blocks & Carriage Complete	28Nov11	02Aug11	80d
2.5.3.3.2.45.44	Far detector module assembly started	28Nov11	29Dec11	-21d
2.10.10.5	Accelerator Shutdown Begun	06Dec11	18Jan12	-26d
2.7.2.1.2.8	Production data concentrators received	25Jan12	27Jan12	-2d
2.0.2.2.5.4	MI RF Cavities (2) Installation & Testing Complete	07Feb12	14Mar12	-26d
2.0.3.2.4.3	NuMI ME Target/Carrier/Baffle Assembly Complete	20Aug12	15Aug12	3d
2.10.10.7	NuMI Upgrades Shutdown Begun	21Aug12	16Aug12	3d



Same shutdown

Analysis of all 500 milestones



- Of the 42 missed milestones <u>as of June</u> (there were 40 in May, 40 in Mar)
  - 2 are Detector R&D (there were 3 in May, 3 in Apr)
  - 6 are ANU (there were 8 in May, 8 in Apr)
  - 34 are Detector Construction (there were 28 in May, 29 in Apr)
- **50 additional milestones added during our schedule update**

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
1	**Accelerator and Beamlines:** Formulate an alternative plan (by 12/31/10) to mitigate the potential impact of further delays to the kicker ceramic vessel procurement and target production.	**Closed.** Kicker ceramic beam tubes have been ordered. New plan in place for both short and long tubes. IHEP is building additional NuMI targets now and this bumps NOvA lower in the queue. RAL (UK) has been contracted to build a target using the IHEP design.
2	**Sites & Bldgs:** Assign the Outfitting design portion of the Near Detector Cavern by October 2010.	**Closed.** A requisition for the Outfitting final design was approved by the Project Manager on Oct 28.
3	**Sites & Bldgs:** Implement recommendation of the Independent Schedule Review and reconcile contractor's schedule, then proceed with plans to move the DOE Level 1 Milestone by October 2010.	**Closed.** Change Request #215, NOvA-doc-5242 was processed to move the DOE L1 "beneficial occupancy" milestone from December 2010 to June 30, 2011. This CR has been signed by all parties at Fermilab and by Dennis Kovar.
4	**Commodities:** Identify storage facilities for mineral oil and blended liquid scintillator by Dec 15, 2010. Provide a document that describes tests and measurements of oil storage in containers with epoxy coatings.	**Closed**. Refer to NOvA-doc-5453 for details. We have a 600,000 gallon storage tank for mineral oil at Riverdale, IL and we have two 120,000 blend tanks for scintillator being cleaned and painted at Wolf Lake, IN. Epoxy coating was tested.

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
5	**Commodities:** Complete the vertical slice test by December 15, 2010 to ensure that there are no surprises in light production and collection.	**In progress:** The readout is installed and data is being taken slowly due to unexpected noise issues. Faster trigger mode hasn't been implemented due to personnel availability. Faster trigger implemented in July 2011 and data presented in this talk.
6	**PVC Modules:** Accelerate the design, production, and testing of the new extruded and injection-molded parts.	**Closed**. Added engineering (Rick Fischer ANL engineer with injection molded plastics experience) to this task in addition to the UMN engineer Tom Chase. Bought out Prof. Chase from teaching in the first semester of 2011. All designs are complete, all RFPs are done, all bids are received, now awaiting first delivered parts.
7	**PVC Modules:** Develop a contingency plan to repair the cracked modules.	**Closed**. A crack repair procedure was developed. See NOvA-doc-5139. All cracked ND modules have been repaired and splinted to prevent any additional cracks from forming. All modules (repaired cracks or no cracks) have been pressure tested *in-situ* at Fermilab.

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
8	**PVC Modules**: Produce a block assembly or accelerate a test block assembly as soon as final production parts are available in order to determine whether the crack issues are resolved.	**Closed.** As stated in the review, we believe we will build at least one additional Near Detector block out of final production parts. A crucial step was filling of the existing blocks, and four blocks are now filled. A "test block" is NOT part of our plan - just one or more real Near Detector blocks will be constructed. As stated in this talk, our plan now is to build a new Near Detector to match the thicker plastic in the Far Detector. Some modules for this may be built this year at Minnesota as a test.
9	**Detector Assembly:** Conduct a final design review of the block pivoter as soon as the FHEP has been constructed, in spite of the tight pivoter schedule. Include an evaluation of worker safety during block assembly. Fall protection issues need very careful consideration.	**Closed.** The pivoter kneeling cylinders were satisfactorily tested in Sept 2010. The drive functioned properly in Oct 2010. The pivoting table was installed in Nov 2010. The pivoting hydraulic cylinders have been tested. The final design review was held on 24 March 2011. Worker safety issues were part of the scope. Details in Pat Luken's talk after the break.

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
10	**Detector Assembly:** Develop contingency plans and work-arounds for critical assembly processes during the planning process.	**Closed.** This is one purpose of the Full Height Assembly Prototype (FHEP). Detailed planning has begun for the FHEP PVC assembly and testing. FHEP requirements are being written down that will translate to Ash River. Pivoter component procurement has begun. FHEP and Pivoter construction now both underway.
11	**Cost Estimate:** Complete hiring for open staff positions by December 2010.	**Closed**. The Project Manager I position was filled and the candidate began work on 1 Nov 2010. The Budget Analyst (term) was filled and the candidate began work on 20 Dec 2010. The PM Associate (term) and the Cost & Schedule Manager (term) were combined into a single opening. This has been filled internally. (half-time until Oct 1, 2011)

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
12	**Schedule and Funding:** Provide block pivoter early occupancy schedule plan by November 2010.	**Closed**. The FHEP work is a prerequisite to a final plan. We're procuring commercial parts of the pivoter (hydraulic pumps & cylinders). Procurement of weldments will occur as changes to the original drawings are incorporated into new bid sets. We have new, additional help from PPD to update the drawings. We met with the Ash River contractor (A&P) on 14 Oct 2010 to discuss early occupancy. A Change Request was submitted and approved to reflect early occupancy dates and move the appropriate resources into the proper WBS. The Pivoter was not ready in time to require early occupancy.
13	**Schedule and Funding:** Add CD-4 Review milestone and activity for CD-4 DOE approval/Project closeout by December 2010.	**Closed.** Added to the Open Plan schedule. Refer to NOvA DocDB CR 281 for additional information. Used input on dates from Pepin Carolan.

2010 DOE Review Recommendations

#	Committee Recommendation	NOvA Response
14	**Management:** Address shortage on project management support by December 2010.	**Closed.** See Recommendation #11 above.
15	**Management:** Formulate a decision making process which includes appropriate stake holders (DOE, collaboration, lab management) for the remaining major items in the contingency use plan in a timely manner.	**Closed**. The PEP and PMP together do sufficiently indicate a decision making process. Ultimately, a Change Request for use of contingency gets signatures from most of the stakeholders. It is easy to modify this form to include a wider set of signatures as is being done for the beneficial occupancy milestone date change right now. Change Request thresholds for such signatures are already in the PMP and PEP.
16	**ES&H:** Ensure that requirements for event/incident notification are clearly delineated and incorporated into existing project ES&H plans.	**Closed**. The DRAFT Safety Plan for after Beneficial Occupancy has been updated to reflect a draft/ initial call list structure. The Ash River Safety Plan includes a detailed call list structure.

SUMMARY

- The NOvA Project continues to make good progress.
- The project has sufficient funding and contingency to match the risks.
- The project schedule has slipped about 3 months since the last IPR in September 2010.
  - We still have substantial float to CD-4 and funds to pursue work-arounds.
  - The next step is to START assembly at Ash River
    - Expect in January
  - The critical step after that is to get the production lines and assembly at Ash River into a STEADY STATE
    - Expect next summer.
  - Paul Derwent will show you that we expect to be ready for the March 2012 Accelerator Shutdown on schedule.