



# Project Status

John Cooper  
Project Manager



# Overview of Project & Risks remaining

- Accelerator & NuMI upgrades have used more labor than estimated
  - The estimate was off for Shutdown work, but the effort is less from now on.
  - And, we have doubled the labor estimates for remaining work based on experience from the 1<sup>st</sup> half of the shutdown.
- The Near Detector cavern (7.5 M\$) is ahead of schedule and on cost.
  - The excavation is complete.
- The Far Detector Assembly is really underway
  - 4<sup>th</sup> block will be up soon
- All the parts required for the Detectors are flowing north
  - Scintillator
    - We own 30% of the mineral oil so risk due to oil prices is reduced -- have an 8 month buffer.
    - The scintillator transportation P.O. in place and the 1<sup>st</sup> two tankers moved scintillator to Ash River at 6 PM on November 5. 3<sup>rd</sup> tanker qualified Nov 6. 3 more planned for the week of Nov 12.
  - Fiber
    - We have all of the original 12,000 km order from Kuraray
    - We have an additional 387 km coming -- all that Kuraray had on hand, half price to us at 200 K\$, enough for 28 blocks
  - Extrusions
    - We have 58% of the PVC extrusions. Storing them in Minneapolis and Manitowoc, WI
    - Waste rate is 8% vs. base plan of 6%



# Overview of Risks remaining, slide 2

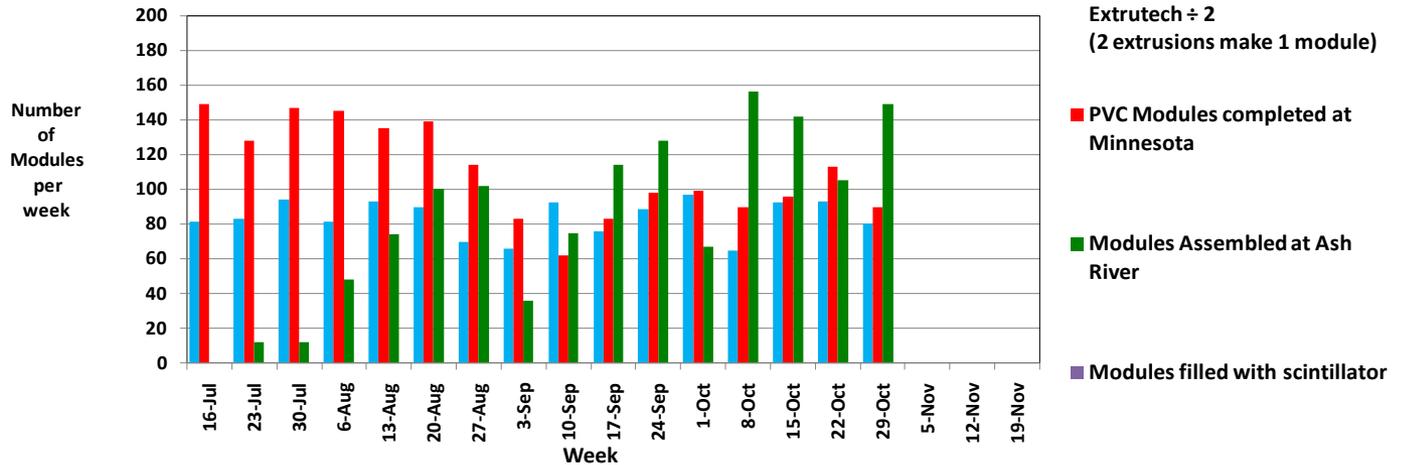
- All the parts required for the Detectors are flowing north . . .
  - **PVC Modules**
    - 2, 748 good modules completed. 25% of 28 blocks.
    - Another ~ 300 have possible fiber damage in only one cell of 32 cells and could be used.
    - Failure rates are now ~ 4% vs. our base plan of 2%.
      - Failure rate still coming down as the new students this Fall Semester gain experience.
      - Failed modules will have their PVC recycled into the Near Detector
      - Failure rates may pressure our fiber stockpile. But we have enough fiber for a 4.5% fiber waste rate.
  - **Electronics**
    - The first APDs in the production order of 12,000 have arrived from Hamamatsu
    - 12,000 allows for 11% spares
    - We have 60% of the Front End Boards in hand and tested
    - We have 100% of the Thermo-electric Cooler Controller boards in hand and tested.
  - **Data Acquisition Electronics**
    - We have 70% of the final version Data Concentrator Modules in hand and tested.
    - We have 100% of the Timing Distribution Units in hand and tested.
  - **Ash River Assembly**
    - The block assembly rate is at 3 weeks/block, still pushing to get it down to 2.5 weeks/block
      - Block assembly labor is right on our estimate, using 1 shift per week overtime to accelerate
    - Scintillator filling begun / starting soon
    - Outfitting has begun: cables, power supplies, some electronics in place on 1<sup>st</sup> diblock
      - Most of our labor estimates here appear to be dead on target



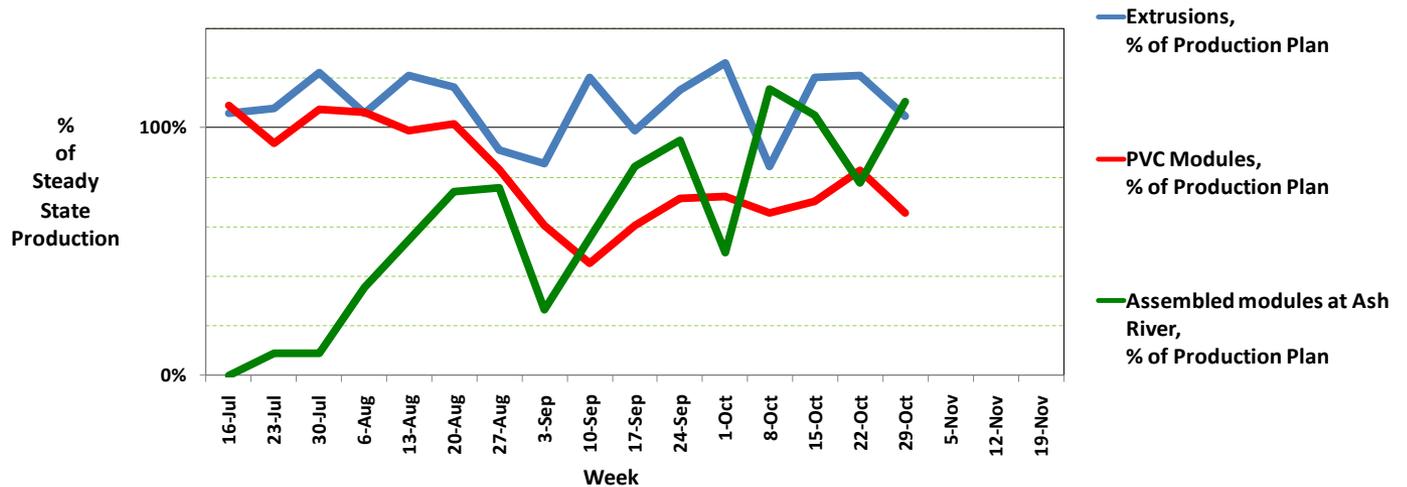
# NOvA Weekly Progress

These graphs satisfy a recommendation from the 14 Aug IPR

### NOvA Construction Rates per Week



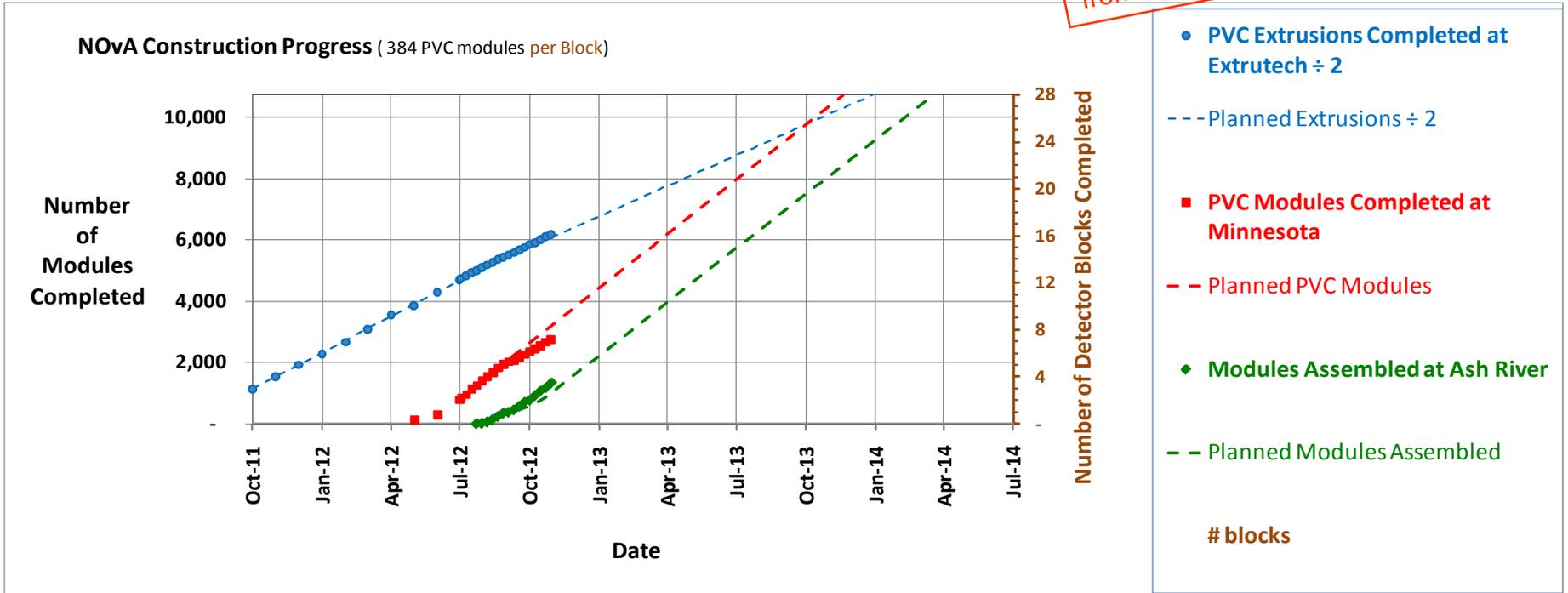
### NOvA Construction Rates as % of Steady State Production Plan



- Week of 29 October
  - 161 PVC extrusions = 105% of desired rate
  - 90 PVC modules = 66% of desired rate, Sept conversion to part-time students difficult
  - 149 Ash River modules assembled = 110% of desired rate

# NOvA longer view of Progress

Another graph to satisfy a recommendation from the 14 Aug IPR

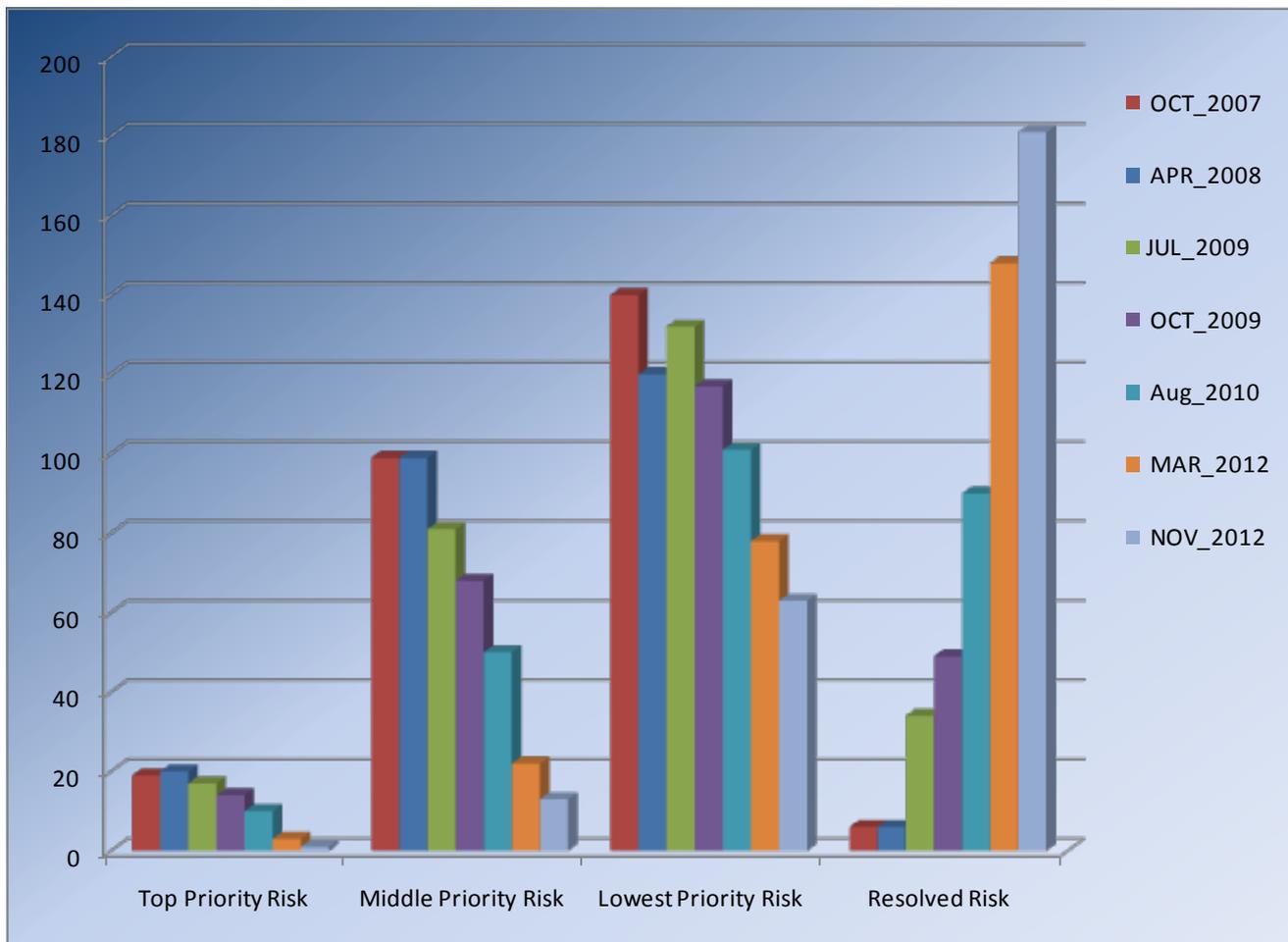


- PVC extrusions on the plan (note change in slope in July)
  - Deliberate slow-down since we ran out of storage space
- Modules lagging behind while new student workers are trained
  - Also moved sanding operation from Ash River to Minneapolis
- Assembly running ahead of plan
  - Due to a fast start. Slope is closer to the plan.



# Formal status of documented Risks

- Risks vs. time
- 180 of ~ 250 now retired





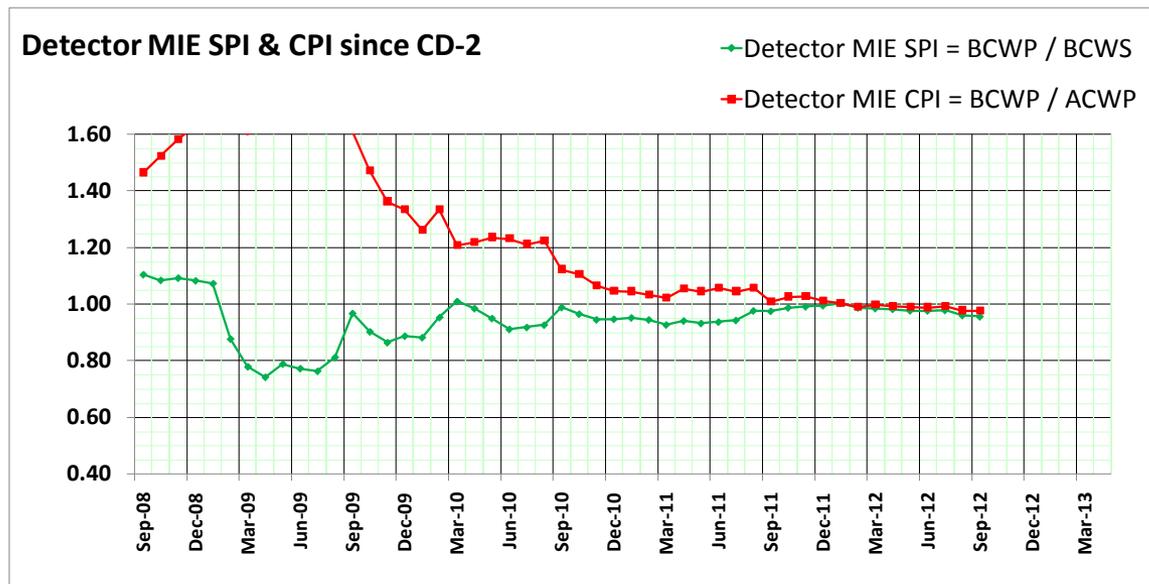
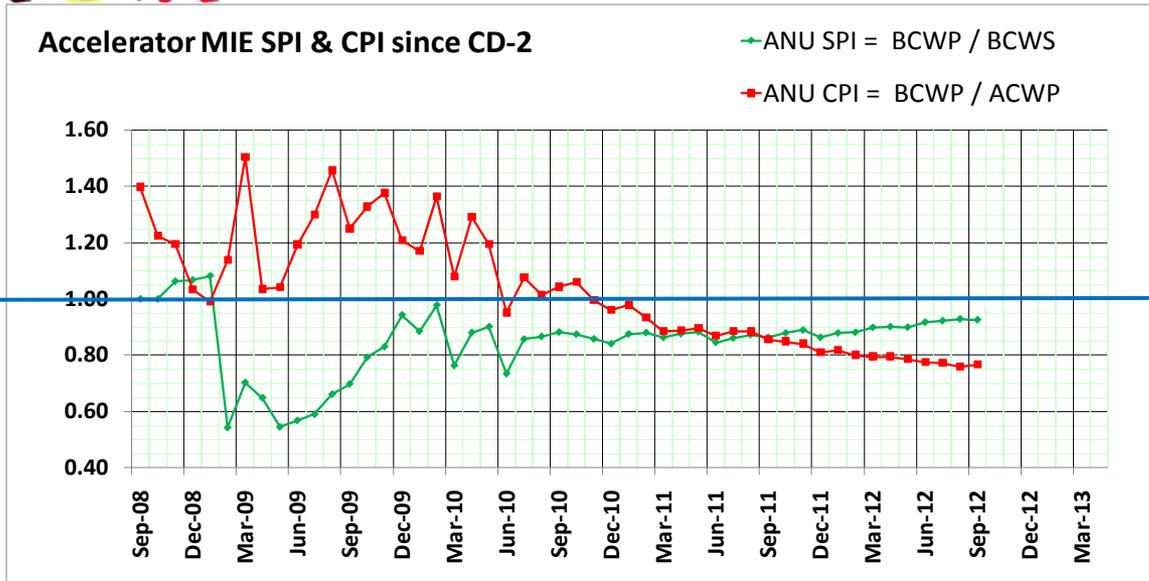
# EVMS Reporting Overview

- Data now available through **September 2012**
  - SPI = **0.966**, compare to 0.970 in August, 0.980 in July, 0.978 in June
  - CPI = **0.931**, compare to 0.931 in August, 0.941 in July, 0.940 in June
- Installed a CR in September with double ANU labor for remaining unstarted shutdown tasks(except 30 section and RF installs)
  - 1.3 M\$ This held us flat in the CPI in August and September.





# SPI & CPI for Active Work



- ANU long slide down to 0.76 reversed to 0.77 in September
  - Installed Change Request doubling the labor estimate on unstarted tasks
- Meanwhile the SPI trends up, ~0.925.

- Detector still relatively constant near 1.0
  - SPI=0.955, CPI=0.977

**COST PERFORMANCE REPORT  
FORMAT 1 - WORK BREAKDOWN STRUCTURE**

**CPR1 Sep 2012**

CONTRACTOR						CONTRACT			PROGRAM			PERIOD		
NAME						NAME			NAME			FROM 01-Sep-2012		
Fermi National Accelerator Laboratory									NOvA project			TO 30-Sep-2012		
PERFORMANCE DATA														
CTC-FndSrc CTC[2] Results... ITEM (1)	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION			
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE			LATEST REVISED		
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	ESTIMATE	VARIANCE	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
<b>DA DOE-ACEL MIE</b>														
2.0 ANU Construction														
Fully burdened AY\$k	2,298	2,028	2,284	(270)	(256)	30,903	28,606	37,276	(2,297)	(8,671)	36,086	43,135	(7,048)	
CTC-FndSrcTotals:	2,298	2,028	2,284	(270)	(256)	30,903	28,606	37,276	(2,297)	(8,671)	36,086	43,135	(7,048)	
<b>DC DOE-CA</b>														
2.1 Site and Building														
Fully burdened AY\$k	0	0	0	0	0	35,060	35,060	34,872	0	188	35,060	34,872	188	
CTC-FndSrcTotals:	0	0	0	0	0	35,060	35,060	34,872	0	188	35,060	34,872	188	
<b>DD DOE-ACEL R&amp;D</b>														
1.0 ANU R&D														
Fully burdened AY\$k	0	0	(0)	0	0	7,025	7,025	6,615	0	410	7,025	6,615	410	
CTC-FndSrcTotals:	0	0	(0)	0	0	7,025	7,025	6,615	0	410	7,025	6,615	410	
<b>DE DOE-DET MIE</b>														
2.1 Site and Building														
Fully burdened AY\$k	3	10	94	7	(84)	7,131	7,131	6,148	0	983	7,131	6,148	983	
2.10 NOvA Project Management														
Fully burdened AY\$k	182	182	142	0	40	8,849	8,849	7,690	0	1,159	11,699	10,540	1,159	
2.2 Liquid Scintillator														
Fully burdened AY\$k	115	110	144	(6)	(34)	10,053	9,948	10,127	(105)	(179)	22,187	22,375	(188)	
2.3 WLS Fiber														
Fully burdened AY\$k	400	38	93	(362)	(54)	11,648	12,045	12,389	397	(344)	12,838	13,184	(346)	
2.4 PVC Extrusions														
Fully burdened AY\$k	1,012	697	803	(316)	(106)	20,656	20,172	20,536	(484)	(364)	30,141	30,579	(438)	
2.5 PVC Modules														
Fully burdened AY\$k	430	519	498	90	22	12,850	12,891	12,098	41	793	21,715	20,942	773	
2.6 Electronics														
Fully burdened AY\$k	26	113	195	87	(82)	7,389	5,982	6,099	(1,406)	(117)	12,515	12,685	(170)	
2.7 DAQ														
Fully burdened AY\$k	51	71	90	20	(19)	4,117	3,116	4,009	(1,002)	(893)	4,488	5,371	(883)	
2.8 Near Detector Assembly														
Fully burdened AY\$k	694	851	545	158	306	5,807	5,363	5,703	(444)	(340)	12,344	12,724	(380)	
2.9 Far Detector Assembly														
Fully burdened AY\$k	1,016	733	845	(283)	(112)	12,189	10,696	13,628	(1,493)	(2,932)	22,348	25,528	(3,180)	
CTC-FndSrcTotals:	3,929	3,325	3,448	(604)	(123)	100,688	96,192	98,427	(4,496)	(2,235)	157,406	160,075	(2,669)	

Down dramatically from negative 1M\$ in Aug

J. Cooper Also down dramatically from negative 1.5 M\$ in Aug

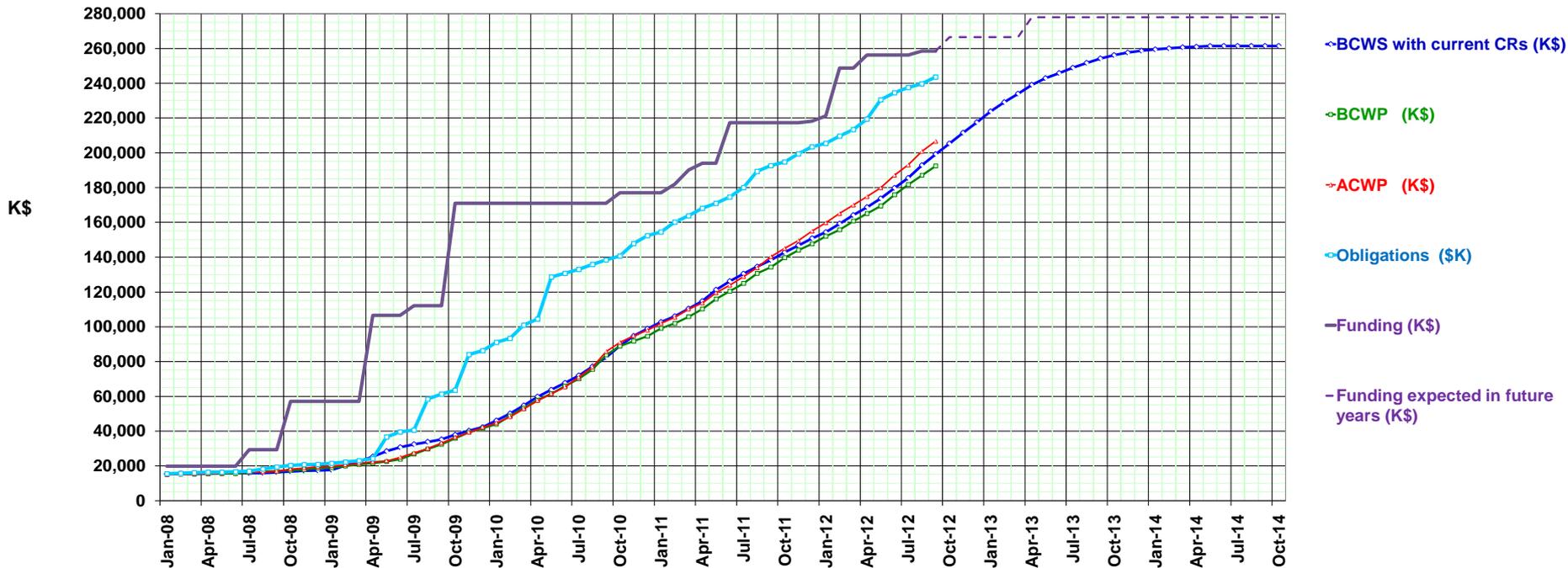
CONTRACTOR NAME	CONTRACT NAME
Fermi National Accelerator Laboratory	

CTC-FndSrc CTC[2] Results... ITEM (1)	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST			
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
<b>DO DOE- OPS</b>													
1.0 ANU R&D													
Fully burdened AY\$k	129	8	59	(121)	(51)	1,689	1,646	1,282	(43)	365	1,816	1,430	385
2.7 DAQ													
Fully burdened AY\$k	0	0	0	0	0	0	0	0	0	0	192	192	0
CTC-FndSrcTotals:	129	8	59	(121)	(51)	1,689	1,646	1,282	(43)	365	2,007	1,622	385
<b>DR DOE-POST CD-1 DET R&amp;D</b>													
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	0	0	0	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	2,028	2,600	0	(572)	2,028	2,600	(572)
1.7 DAQ R&D													
Fully burdened AY\$k	0	0	0	0	0	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	4,931	0	(1,808)	3,123	4,931	(1,808)
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	0	0	0	0	15,067	15,067	19,347	0	(4,281)	15,067	19,347	(4,281)
<b>DY DOE CD-0 TO CD-1 R&amp;D</b>													
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	6,356	5,360	5,790	(995)	(429)	199,232	192,396	206,620	(6,836)	(14,224)	261,451	274,466	(13,015)
Management Resrv.											16,549		
Total	6,356	5,360	5,790	(995)	(429)	199,232	192,396	206,620	(6,836)	(14,224)	278,000		

ANU OPS \$ also only slightly negative this month

# EVMS Reporting Overview

- Basic data in BCWS, BCWP, ACWP, **Funding & Obligations** through **Sept 2012**
  - BCWS = Budgeted cost of work Scheduled
  - BCWP = Budgeted cost of work Performed
  - ACWP = Actual cost of work Performed
- Project is 73.6 % complete ( $BCWP/BAC = 192.4 \text{ M\$} / 261.5 \text{ M\$}$ )
  - BAC = Budget at Completion (using EAC, get 70%)
- Project is 93.1 % obligated ( $Obligations/BAC = 243.5 / 261.5$ )
  - EAC = Estimate at Completion (using EAC, get 88%)





# AY\$ by Level 2 with MIE/OPC split

WBS	Items	NOvA Costs to Date (\$M) as of 30-Sep-2012	NOvA 's Cost Estimate AY \$M (for October 1, 2012 to project end)									
			Estimated Cost (with indirects)			Mgmt Reserve Estimate			Contingency %			Total
			M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total	Cost
2.0	Accelerator & NuMI Upgrades	\$ 37.3	\$ (0.6)	\$ 6.4	\$ 5.9	\$ 0.2	\$ 0.7	\$ 0.9	-37%	11%	16%	\$ 44.1
2.1	Far Detector Site and Building	\$ 6.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 6.1
2.2	Liquid Scintillator	\$ 10.1	\$ 12.0	\$ 0.2	\$ 12.2	\$ 1.5	\$ 0.1	\$ 1.6	13%	42%	13%	\$ 24.0
2.3	Wave-Length-Shifting Fiber	\$ 12.4	\$ 0.7	\$ 0.1	\$ 0.8	\$ 0.0	\$ 0.0	\$ 0.0	0%	10%	1%	\$ 13.2
2.4	PVC Extrusions	\$ 20.5	\$ 9.5	\$ 0.6	\$ 10.0	\$ 0.4	\$ 0.1	\$ 0.5	4%	18%	5%	\$ 31.0
2.5	PVC Modules	\$ 12.1	\$ 3.4	\$ 5.4	\$ 8.8	\$ 0.0	\$ 0.2	\$ 0.3	1%	5%	3%	\$ 21.2
2.6	Electronics Production	\$ 6.1	\$ 5.8	\$ 0.8	\$ 6.6	\$ 0.4	\$ 0.2	\$ 0.6	6%	29%	9%	\$ 13.3
2.7	Data Acquisition System	\$ 4.0	\$ 0.7	\$ 0.7	\$ 1.4	\$ 0.2	\$ 0.2	\$ 0.4	25%	28%	27%	\$ 5.7
2.8	Near Detector Assembly	\$ 5.7	\$ 6.0	\$ 1.0	\$ 7.0	\$ 0.0	\$ 0.1	\$ 0.1	0%	5%	1%	\$ 12.8
2.9	Far Detector Assembly	\$ 13.6	\$ 5.3	\$ 6.6	\$ 11.9	\$ 1.1	\$ 2.3	\$ 3.4	21%	35%	29%	\$ 28.9
2.10	Project Management	\$ 7.7	\$ 0.1	\$ 2.7	\$ 2.9	\$ 0.0	\$ 0.0	\$ 0.0	10%	0%	1%	\$ 10.6
<b>Subtotal Construction</b>		<b>\$ 135.7</b>	<b>\$ 42.9</b>	<b>\$ 24.6</b>	<b>\$ 67.5</b>	<b>\$ 3.8</b>	<b>\$ 4.0</b>	<b>\$ 7.8</b>	<b>9%</b>	<b>16%</b>	<b>12%</b>	<b>\$ 211.0</b>
O P C	R&D - Accelerator	\$ 6.6	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 6.6
	R&D - Detector	\$ 28.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 28.1
	Cooperative Agreement	\$ 34.9	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 34.9
	Operating	\$ 1.3	\$ 0.0	\$ 0.1	\$ 0.1	\$ 0.0	\$ 0.0	\$ 0.0	38%	8%	14%	\$ 1.5
	<b>Total OPC:</b>	<b>\$ 70.9</b>	<b>\$ 0.0</b>	<b>\$ 0.1</b>	<b>\$ 0.1</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>38%</b>	<b>8%</b>	<b>14%</b>
<b>Available Contingency</b>								<b>\$ (4.078)</b>				<b>\$ (4.1)</b>
<b>TPC:</b>		<b>\$ 206.6</b>	<b>\$ 43.0</b>	<b>\$ 24.7</b>	<b>\$ 67.7</b>	<b>\$ 3.8</b>	<b>\$ 4.0</b>	<b>\$ 3.73</b>	<b>9%</b>	<b>16%</b>	<b>6%</b>	<b>\$ 278.000</b>

- 3.73 M\$ Contingency
  - 5.5% of remaining work
  - 12.0 % of remaining Obligations

# Details: AY\$ by Level 2 with MIE/OPC split

WBS	Items	NOvA Costs to Date (\$M) as of 30-Sep-2012	NOvA's Cost Estimate AY \$M (for October 1, 2012 to project end)									
			Estimated Cost (with indirects)			Mgmt Reserve Estimate			Contingency %			Total
			M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total	Cost
2.0	Accelerator & NuMI Upgrades	\$ 37.3	\$ (0.6)	\$ 6.4	\$ 5.9	\$ 0.2	\$ 0.7	\$ 0.9	-37%	11%	16%	\$ 44.1
2.1	Far Detector Site and Building	\$ 6.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 6.1
2.2	Liquid Scintillator	\$ 10.1	\$ 12.0	\$ 0.2	\$ 12.2	\$ 1.5	\$ 0.1	\$ 1.6	13%	42%	13%	\$ 24.0
2.3	Wave-Length-Shifting Fiber	\$ 12.4	\$ 0.7	\$ 0.1	\$ 0.8	\$ 0.0	\$ 0.0	\$ 0.0	0%	10%	1%	\$ 13.2
2.4	PVC Extrusions	\$ 20.5	\$ 9.5	\$ 0.6	\$ 10.0	\$ 0.4	\$ 0.7	\$ 0.5	4%	18%	5%	\$ 31.0
2.5	PVC Modules	\$ 12.1	\$ 3.4	\$ 5.4	\$ 8.8	\$ 0.0	\$ 0.2	\$ 0.3	1%	5%	3%	\$ 21.2
2.6	Electronics Production	\$ 6.1	\$ 5.8	\$ 0.8	\$ 6.6	\$ 0.4	\$ 0.2	\$ 0.6	6%	29%	9%	\$ 13.3
2.7	Data Acquisition System	\$ 4.0	\$ 0.7	\$ 0.7	\$ 1.4	\$ 0.2	\$ 0.2	\$ 0.4	25%	28%	27%	\$ 5.7
2.8	Near Detector Assembly	\$ 5.7	\$ 6.0	\$ 1.0	\$ 7.0	\$ 0.0	\$ 0.1	\$ 0.1	0%	5%	1%	\$ 12.8
2.9	Far Detector Assembly	\$ 13.6	\$ 5.3	\$ 6.6	\$ 11.9	\$ 1.1	\$ 2.3	\$ 3.4	21%	35%	29%	\$ 28.9
2.10	Project Management	\$ 7.7	\$ 0.1	\$ 2.7	\$ 2.9	\$ 0.0	\$ 0.0	\$ 0.0	10%	0%	1%	\$ 10.6
<b>Subtotal Construction</b>		<b>\$ 135.7</b>	<b>\$ 42.9</b>	<b>\$ 24.6</b>	<b>\$ 67.5</b>	<b>\$ 3.8</b>	<b>\$ 4.0</b>	<b>\$ 7.8</b>	<b>9%</b>	<b>16%</b>	<b>12%</b>	<b>\$ 211.0</b>
O P C	R&D - Accelerator	\$ 6.6	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 6.6
	R&D - Detector	\$ 28.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 28.1
	Cooperative Agreement	\$ 34.9	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 34.9
	Operating	\$ 1.3	\$ 0.0	\$ 0.1	\$ 0.1	\$ 0.0	\$ 0.0	\$ 0.0	38%	8%	14%	\$ 1.5
	<b>Total OPC:</b>	<b>\$ 70.9</b>	<b>\$ 0.0</b>	<b>\$ 0.1</b>	<b>\$ 0.1</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>\$ 0.0</b>	<b>38%</b>	<b>8%</b>	<b>14%</b>
<b>Available Contingency</b>								<b>\$ (4.078)</b>				<b>\$ (4.1)</b>
<b>TPC:</b>		<b>\$ 206.6</b>	<b>\$ 43.0</b>	<b>\$ 24.7</b>	<b>\$ 67.7</b>	<b>\$ 3.8</b>	<b>\$ 4.0</b>	<b>\$ 3.73</b>	<b>9%</b>	<b>16%</b>	<b>6%</b>	<b>\$ 278.000</b>

Counting on 1.53 M\$ reimbursement to project via buy into Special Process Spares.  
M&S to go is less than 1.53 M\$ now

Should be zero, action taken to eliminate labor overrun

All electronics (except APDs) in hand with no problems

Ash River labor estimates are close to reality.  
Using 1 OT shift in assembly = 19% for that part.  
No OT for Outfitting.



# Project Manager View of Contingency

WBS	Items	NOvA Costs to Date (\$M)	NOvA 's Cost Estimate AY \$M (for October 1, 2012 to project end)										
		as of 30-Sep-2012	Estimated Cost (with indirects)			Mgmt Reserve Estimate			Contingency %			Total Cost	
			M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total	M&S	Labor <sup>1</sup>	Total		
T E C	2.0	Accelerator & NuMI Upgrades	\$ 37.3	\$ (0.6)	\$ 6.4	\$ 5.9	\$ -	\$ -	\$ -	0%	0%	0%	\$ 43.1
	2.1	Far Detector Site and Building	\$ 6.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	0%	0%	0%	\$ 6.1
	2.2	Liquid Scintillator	\$ 10.1	\$ 12.0	\$ 0.2	\$ 12.2	\$ -	\$ -	\$ -	0%	0%	0%	\$ 22.4
	2.3	Wave-Length-Shifting Fiber	\$ 12.4	\$ 0.7	\$ 0.1	\$ 0.8	\$ -	\$ -	\$ -	0%	0%	0%	\$ 13.2
	2.4	PVC Extrusions	\$ 20.5	\$ 9.5	\$ 0.6	\$ 10.0	\$ -	\$ -	\$ -	0%	0%	0%	\$ 30.6
	2.5	PVC Modules	\$ 12.1	\$ 3.4	\$ 5.4	\$ 8.8	\$ -	\$ -	\$ -	0%	0%	0%	\$ 20.9
	2.6	Electronics Production	\$ 6.1	\$ 5.8	\$ 0.8	\$ 6.6	\$ -	\$ -	\$ -	0%	0%	0%	\$ 12.7
	2.7	Data Acquisition System	\$ 4.0	\$ 0.7	\$ 0.7	\$ 1.4	\$ -	\$ -	\$ -	0%	0%	0%	\$ 5.4
	2.8	Near Detector Assembly	\$ 5.7	\$ 6.0	\$ 1.0	\$ 7.0	\$ -	\$ -	\$ -	0%	0%	0%	\$ 12.7
	2.9	Far Detector Assembly	\$ 13.6	\$ 5.3	\$ 6.6	\$ 11.9	\$ -	\$ -	\$ -	0%	0%	0%	\$ 25.5
	2.10	Project Management	\$ 7.7	\$ 0.1	\$ 2.7	\$ 2.9	\$ -	\$ -	\$ -	0%	0%	0%	\$ 10.5
		<b>Subtotal Construction</b>	<b>\$ 135.7</b>	<b>\$ 42.9</b>	<b>\$ 24.6</b>	<b>\$ 67.5</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 203.2</b>
O P C		<b>R&amp;D - Accelerator</b>	<b>\$ 6.6</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 6.6</b>
		<b>R&amp;D - Detector</b>	<b>\$ 28.1</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 28.1</b>
		<b>Cooperative Agreement</b>	<b>\$ 34.9</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 34.9</b>
		<b>Operating</b>	<b>\$ 1.3</b>	<b>\$ 0.0</b>	<b>\$ 0.1</b>	<b>\$ 0.1</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 1.4</b>
		<b>Total OPC:</b>	<b>\$ 70.9</b>	<b>\$ 0.0</b>	<b>\$ 0.1</b>	<b>\$ 0.1</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>\$ 71.1</b>
		<b>Available Contingency</b>						<b>\$ 3.725</b>				<b>\$ 3.7</b>	
		<b>TPC:</b>	<b>\$ 206.6</b>	<b>\$ 43.0</b>	<b>\$ 24.7</b>	<b>\$ 67.7</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 3.73</b>	<b>0%</b>	<b>0%</b>	<b>6%</b>	<b>\$ 278.000</b>

- Just to emphasize that the Project Manager holds all the contingency.
- I am of course fully aware of the line by line risk analyses, but also more able to judge how many of these independent assessments are likely to occur together.
  - And able to judge how many are currently overstated, see previous slide.
- And, I am the one who can adjust priorities to accommodate risks as they occur.
  - I implement any contingency savings plan action that spans across L2 WBSs
    - E.g., a reduction in the number of blocks, like we did with block #29 after the 14 August IPR.
    - E.g., buying additional fiber based on my estimate of the waste rate in module assembly



# Current list of top ten risks

- All these risks have been reduced in score
- Added one risk for Project Manager's judgment

NOVA Top Ten Risk List					
List is sorted by Tolerance - Top Priority to Lowest Priority and then by Score High to Low					
Activity	Risk #	Score	Tolerance	Event	Owner
2.0.3 - NuMI Upgrades	39	0.35	Top Priority	Insufficient manpower, takes longer	Derwent, Paul
2.0 - ANU Construction	92	0.28	Middle Priority	Work can not be accomplished as planned	Derwent, Paul
2.10 - Project Management - Construction	516	0.25	Middle Priority	Allocation of Contingency across WBS items	Cooper, John
2.9.4 - Block Assembly and Installation	185	0.21	Middle Priority	Adhesive failure causes structural failure	Lukens, Patrick (Pat)
2.0.1.1.1.14 - Installation	8	0.20	Middle Priority	Installation Takes longer than expected	Derwent, Paul
2.0 - ANU Construction	99	0.20	Middle Priority	Construction takes longer than expected	Derwent, Paul
2.6.1.2 - APD Arrays	193	0.20	Middle Priority	ADP Delivery lags schedule	Mualem, Leon
2.10 - Project Management - Construction	254	0.17	Middle Priority	CD-4 Float inadequate	Carolan, Pepin
2.0.1.2.3.3.9 - RKB Magnets - HV testing in transfer gallery	75	0.11	Middle Priority	electrocution	Derwent, Paul
2.0.1.2.3.3.10 - RKB Magnets - Life testing	76	0.11	Middle Priority	electrocution	Derwent, Paul



# Recall where we were

## at the time of the 14Aug2012 IPR

- **14.6 M\$** of contingency remained as of June 1 financial processing.
- **10.5 – 16.7 M\$** of items were identified which could **use** contingency.
- **2.9 – 6.0 M\$** of items were identified which would **increase** contingency.
- Since June 1 we have processed **12.7 M\$** of Change Requests that **used** contingency:
  - Only one major item was not on our 14Aug list:
    - An accrual from the Univ of Minn to true up their reporting of costs, used 1.5 M\$ of contingency
    - They will stay current from now on so that we do not get a surprise like this at the project end.
  - Three other items on our 14Aug list cost more than planned.
    - Our estimates of 3.11 M\$ turned into 6.0 M\$
      - Accelerator labor in the shutdown went from 1.80 M\$ estimate to 3.89 M\$ actual + a 1.30 M\$ CR to double this labor for the rest of the shutdown
      - Minneapolis factory space rental went from 0.76 to 1.12 M\$
      - Estimated effort to build the Near Detector went from 0.55 to 0.98 M\$, adding needed details.
- Since June 1 we have processed **2.5 M\$** of Change Requests that **increased** contingency:
  - Removed the 29<sup>th</sup> Far Detector block for a savings of 1.8 M\$
  - Removed Accelerator scope (2<sup>nd</sup> target, 2<sup>nd</sup> hadron monitor) for a savings of 0.54 M\$
  - The laboratory reversed overhead increases of 0.06 M\$ for FY12



# Contingency overview today:

- **3.7 M\$** of contingency remains as of Oct 1 financial processing.

- **The future contingency use identified by the Project is now much smaller, since most of the items presented at the 14 Aug IPR have been done.**
- One major item has been removed since the 14 Aug IPR:
  - The Laboratory now assures the Project that the estimated 1.53 M\$ of spare accelerator components will be put into Special Process Spares in FY14, reimbursing the project for these items. The Project counts on this reimbursement.

- **0.6 – 3.6 M\$** of items are now identified which could **use** contingency.

- The initial FY13 Fringe and Overhead rates just announced by the Laboratory will cost the Project an additional 0.50 M\$ beyond our assumption of FY12 initial rates.
- About 2.24 M\$ remains for additional PVC resin needed for 28 blocks.
- About 0.30 M\$ remains for sanding, about 0.34 M\$ for Near modules.
- About 0.13 M\$ remains for sufficient spare APDs.

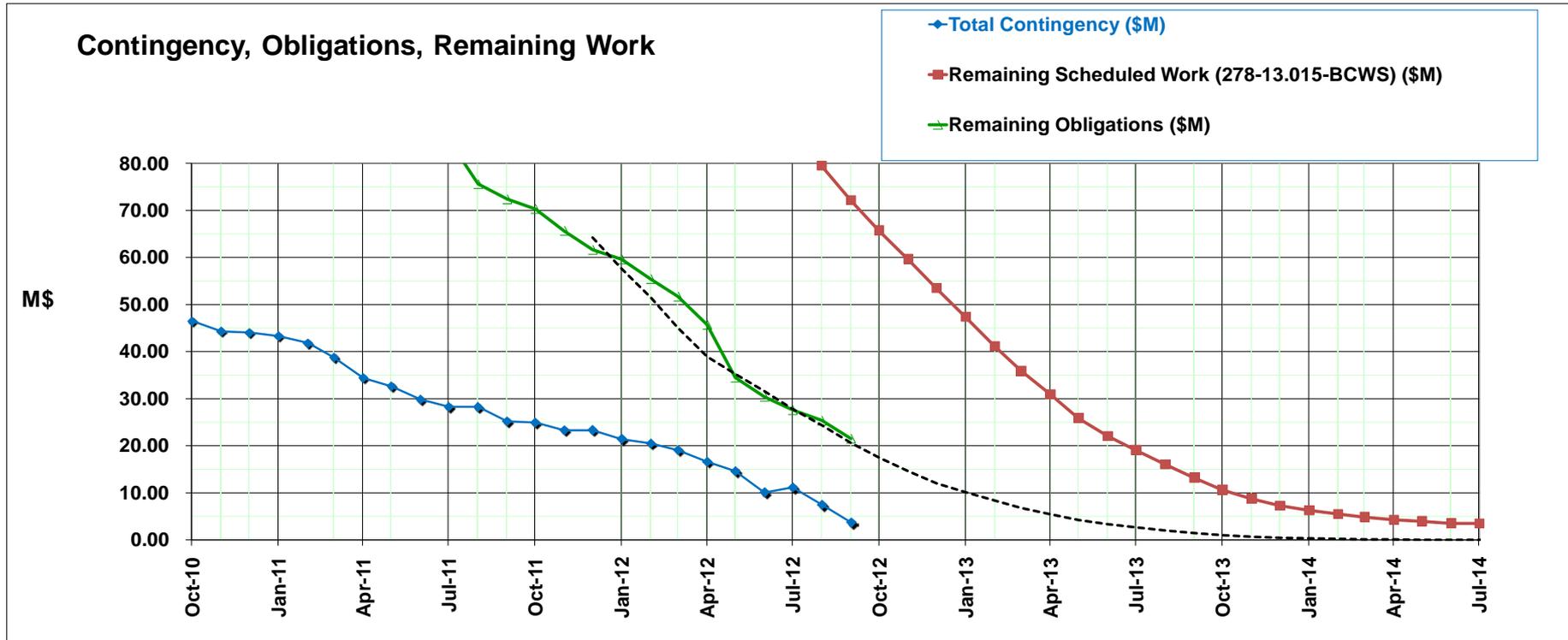
- **0.1 – 3.0 M\$** of items are now identified which would **increase** contingency

- Move Accelerator as-built drawings off project to offset accelerator labor overrun in the shutdown = 0.080 M\$
- Move Accelerator Pump Vault Nine work off-project since this is a general infrastructure item for Accelerator cooling ponds and is not NOvA specific = 0.189 M\$
- Use all PVC modules with “visual fiber damage” (NOT broken fibers) in ONE cell. Now estimate we could have 900 such modules along with (10,752 – 900) “perfect” ones. This would amount to a 2.6 M\$ increase in contingency by cost avoidance.

- **It is conceivable that 3.7 M\$ is enough contingency.**



# Graphic of Contingency history



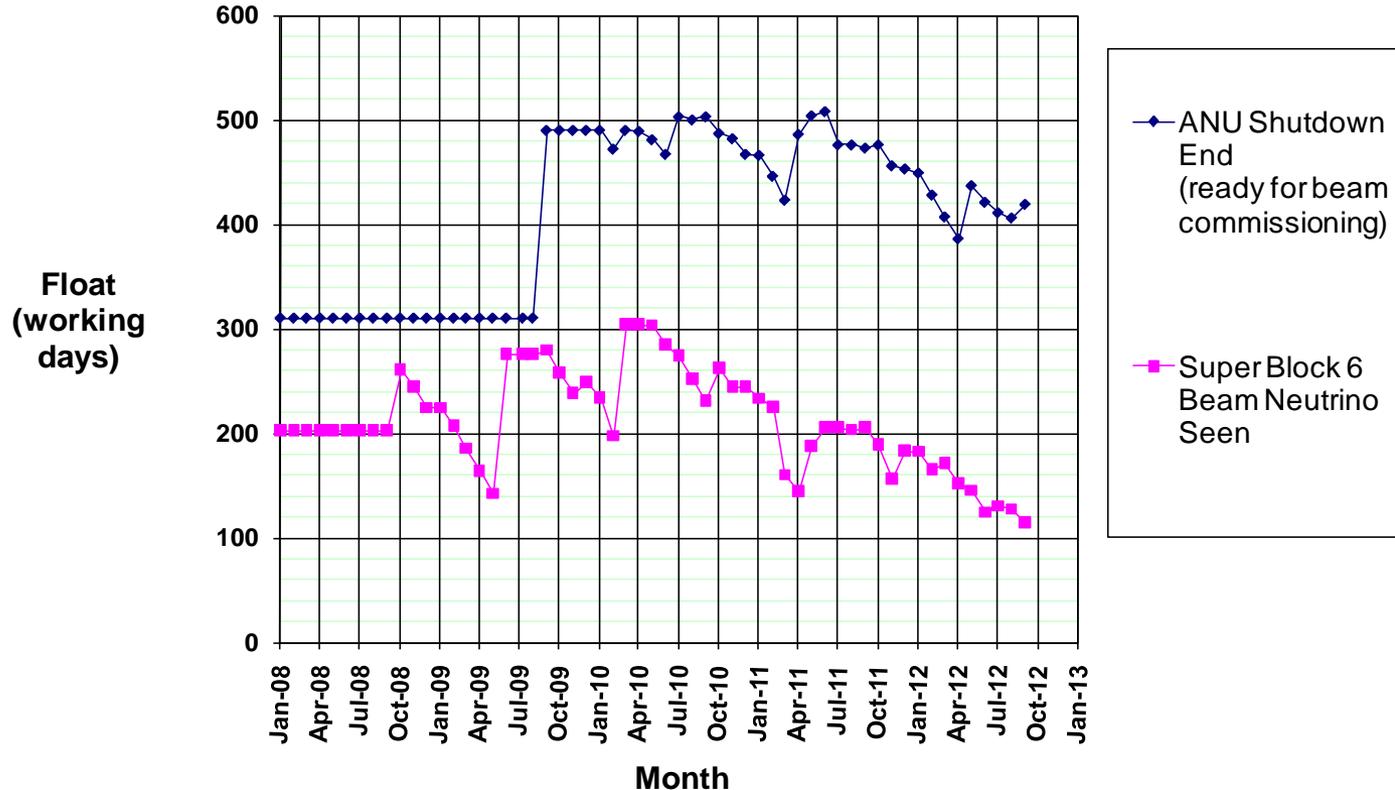
- Contingency is 3.7 M\$
- This contingency is 5.5% of the remaining scheduled work
- This contingency is 12.0% of the remaining obligations
  - Dotted line is an extrapolation based on history.
  - We are working to put in actual Obligations remaining vs. time by the Nov 20 Review. Open Plan does not give us this information naturally.



# Schedule Contingency: Float to CD-4

- **ANU gained 13 days of float in September -- Now at 419 days**
  - Kicker and RF schedules are still the real drivers.
- **The Detector lost 13 days of float in September -- Now at 114 days**
  - This is driven by APD installation lagging Ash River block assembly of the 28<sup>th</sup> block by about one month.

Tracking Float to CD-4





# Schedule Contingency Summary

- As of October 1, we have 114 days float to CD-4
- There are 14 months to CD-4 = 426 days
  - CD-4 is end of November, 2014
- Schedule Contingency is  $114 / 426 \text{ days} = 27\%$ .



# Summary

- Risks are reduced
  - **All parts are now flowing north to Ash River**
  - **3 detector blocks are up at Ash River, 4<sup>th</sup> soon**
  - Scintillator filling and some Outfitting tasks remain to hit production stride
  - APDs are better understood, but 1,000's at Ash River will be the test.
- Contingency is tight
  - 5.5% of Remaining Work or 12% remaining Obligations
  - 3.73 M\$ is not much to spare for unforeseen problems.
  - Contingency \$ NEEDS of ~ 3.6 M\$ identified (details next slides)
  - Possible Contingency increases of ~ 3.0 M\$ identified (details next slides)
- Contingency float is reasonable
  - 114 out of 426 days remaining to CD-4 or 27%



# Contingency history since 14 Aug IPR and known future needs

(continued on next slide)

Identified Contingency Needs		CR in June			
		CR in July			
		CR in August			
		CR in September			
		CR in October			
		\$M	\$M	WHEN	
		Well Understood	Additional Estimates (some unknown, some where cost is unknown)		
Whole Project	Increase of Fermilab fringe and G&A retroactive Oct-May FY12	0.369		done	
	Increase of Fermilab fringe and G&A for June - Sept FY12	0.304		done	
	An extension of these rates into FY13 would cost even more	-	-	2013	now real on line below.
	<b>The Laboratory has posted initial Fringe &amp; overhead rates for FY13. They are NOT like the initial rates for FY12. Instead, they are more like the retroactive end of FY12 and will cost the Project ANOTHER 0.495 M\$</b>	0.495			
ANU	Anticipate using all remaining contingency (2.6 M\$) during shutdown. <b>Actual now is 3.9 M\$</b>	-			
	CR for MLAW and Pump Vault 9 upgrades	0.339		done	
	Retroactive change in Cobra to T&M rates, correcting an error	0.439		done	
	Cost overrun in June	0.941		done	
	Cost overrun in July	0.321		done	
	Cost overrun in August	0.999		done	
	Cost overrun in September	0.307		done	
	Change request to double unstarted labor tasks (except 30-Straight and RF)	1.320		done	
	Above ANU contingency need assumes Project recovers cost from spares built on-project. Accel Div now says they cannot do this in FY13, suggest FY14. Some risk that the Project may never get reimbursed for these items. Actual # of spares will depend on performance of non-spares. <b>The amount of reimbursement planned is 1.53 M\$.</b>	-	The Laboratory now assures us that the Project will be reimbursed. Still some risk that the Project may not deliver working spares.	2014	
Scintillator	For transportation from Wolf Lake IN to Ash River MN. Bidder chosen, cost was 0.20 M\$ more than in Open Plan. Some are within our estimate, some are not. We are still evaluating the bids and asking the bidders questions about their proposals.	0.201		done	
Fiber	Increased cost (\$/Yen) for final part of Kuraray order	0.232	-	done	
	See PVC Modules below. May need as much as 10% additional fiber to cover training, start-up and continuing waste at Module Factory. <b>The estimate at the 14Aug2012 IPR was 2.0 M\$.</b>	0.201		done	
PVC Extrusions	Need additional PVC resin to cover waste during final R&D in 1st 9 months of 2011.	-	-	Apr-13	
	Original P.O. was on Recovery Act funds and did not cover the full detector. Need additional PVC resin to complete detector, depends on detector size. This estimate is for 28 blocks	-	2.240	Apr-13	
	Need additional PVC extruding of the resin to complete detector, depends on detector size and on the waste rate in extruding and waste in Minneapolis. (the original P.O. was also on Recovery Act funds and did not cover the full detector)	-	-	Apr-13	already in Open Plan
	Need to pay storage costs in Manitowoc, WI since the Minnesota Module Factory is full (June CR covers through Apr 2013)	0.112	0.030		now likely through July 2013
	Need additional labor for QA at extruding vendor for work now occurring in FY13	0.122		done	



# Contingency history since 14 Aug IPR and known future needs

(continued from previous slide)

PVC Modules	extension of rental on 24,000 sq ft extra Factory space in 2012 (2013)	0.033	-		2013 now very unlikely
	Rental of main 125,000 sq ft Module Factory space in April 2013- March 2014. Current final task would be in mid-March 2014, so this extension has no float. Original estimate was 0.760 M\$.	0.815		done	
	Operate Module Factory during April 2013 - March 2014. Original estimate was 0.170	0.183		done	
	Rental of Module Factory space April 2014 - Aug 2014?	-	-	Oct-13	Now very unlikely, U Minn trying to modify the lease to allow month to month after April 2014.
	Operate Module Factory during April 2014 - Aug 2014?	-	-	Oct-13	now very unlikely
	<b>New item, accrual of Module Assembly Labor in August. One time catch-up, U Minn to keep up in the future.</b>	1.476		done	
	<b>New item, addition required to fund sanding operation in Minneapolis</b>		0.300	soon	
	<b>New item, addition required to fund building 600 Near Detector modules</b>		0.339	Jan-13	
Electronics	October 2012: APD success rate for installation and cooling to -15C is currently 85%. 15% more APDs may be required, but $0.15 * 10752 = 1600$ additional APDs now that we downsized to 28 blocks. Our existing P.O. with Hamamatsu is for 12,000 APDs, so we would only need $10,752 + 1,600 - 12,000 = 352$ more @ \$372 each = 130 K\$ August 2012: APD success rate for installation and cooling to -15C is currently 88%. 12% more APDs may be required, cost would be 536 K\$.	-	0.130	Jan-14	depends on initial installation test and Ash River experience
Far Detector	Standing army charge in FY12. Work on Pivoter, practice assembly	0.623		done	
	Additional effort from ANL during assembly startup	0.169		done	
Near Detector	Add concrete floor and drip ceiling to the Excavation task	0.322	-	done	
	Add the Outfitting and Demobilization tasks to the schedule	1.602	-	done	
	Need Eng & Drafting to design Fermilab Factory & underground install. fixtures (estimate 0.50)		-	done	original estimate was 0.50, actual CRs total 0.30
	Initial engineering and design	0.066		done	
	Complete designs of assembly tooling and muon catcher	0.232		done	
	Need Fermilab technicians to build new 3x3 Near Detector (estimate 0.55)		-	done	original estimate was 0.55, actual CRs total 0.98
	Initial setup of Block Assembly facility & muon catcher steel purchase	0.290		done	
	Block Assembly	0.512		done	
	Underground Installation	0.180		done	
	<b>New item, need to cover labor for scintillator filling and detector outfitting of Near Detector. Equivalent to 1.5 Ash River blocks.</b>	0.077			
	<b>Sum:</b>	<b>13.282</b>	<b>3.039</b>	<b>M\$</b>	
	<b>Contingency Need Range</b>	<b>13.282</b>	<b>to</b>	<b>16.321</b>	<b>M\$</b>
					<b>RANGE at 14Aug2012 IPR 10.5 - 16.71</b>
	June Sum:	5.013			
	July Sum:	0.793			
	August Sum:	3.185			
	September Sum:	3.518			
	October Sum:	0.201			
	<b>TOTAL SUM to date:</b>	<b>12.710</b>			
	<b>UPDATED Contingency Need Range as of November 6</b>	<b>0.572</b>	<b>to</b>	<b>3.611</b>	<b>M\$</b>
	<b>As of Oct 17, have 3.73 M\$</b>				



# Possible Contingency Actions to limit need

(continued on next slide)

Identified possible Contingency savings		June CRs		
		July CRs		
		Aug CRs		
		Sept CRs		
		CR in October		
		\$M	\$M	WHEN?
		Well Understood	Additional Possibilities & Estimates	
Whole Project	Ask Laboratory to freeze NOVA fringe and overhead rates in FY13 and FY14: Basis would be that no Project in the final stages can contend with varying rates, particularly if the rates are applied retroactively. <b>Lab did lower FY12 rates in final FY12 accounting, saved NOVA 58 K\$.</b>	(0.058)	-	done
ANU	Move 2nd target off-project (AD is buying one from RAL on Ops \$ for delivery late next Spring)	(0.222)	-	done
	Move Hadron Monitors off-project (existing one still works, AD planning to buy one on operations)	(0.318)	-	done
	<b>NEW ITEM: move As-Built drawings off-project</b>		(0.080)	
	<b>Move Pump Vault 9 work off project</b>		(0.189)	
Scintillator	Less scintillator if drop Block #29	(0.389)	-	done
Fiber	Buy only 5% additional fiber instead of 10%. This assumes the rate of waste will not grow from recent performance. Original estimated savings was (0.63). <b>In fact on this line all the savings came in NOT buying more fiber in the "Contingency Needs" spreadsheet. We only paid 200K\$ more and now will watch the waste rate to see if this commodity is the driver to put water into some blocks simply because we can't put fiber in and so water will be fine.</b>	-	-	done
PVC Extrusions	Need additional PVC resin to complete 29 blocks, BUT 28 blocks may satisfy the 14 kt KPP. Serendipitously, a block 1/2 filled with water ADDs 24,400 kg of mass and would help us reach 14 kt with 28 blocks. <b>28 blocks does satisfy the KPP.</b>	(0.462)		done
	Need additional PVC extruding to complete 29 blocks: Now reduced to just 28	(0.404)		done
PVC Modules	Use ~ 300 existing modules with "visual fiber damage" on a single fiber in the detector. Use any more with this defect that we build in the future (estimate ~600 more will occur). <b>Total is 900 modules.</b> 384 modules = one block. Put these at the back of the detector.		(2.600)	?
	Savings in module assembly from dropping the 29th block.	(0.226)		done
Electronics	Dropped Block #29, but not technically a savings because we let the order for 12,000 stand until we know the APD installation rate. Even then, we likely will need enough of these custom devices to keep the detector going for ten years. The question: Is 12,000 enough? It does include 12% spares for 28 blocks.	-	-	?



# Possible Contingency Actions to limit need

(continued from  
previous slide)

<b>Far Detector</b>	Save assembly costs if drop Block 29	(0.400)		done	
<b>Near Detector</b>	Re-use prototype Near Detector <b>NO, pursuing full new Near Detector as most important to science in era of large theta13</b>	-	-	done	
	Would still have needed design/drafting to install + installation labor	-	-		
	<b>Collaboration labor will be used to Outfit the Near Detector (scintillator, cables, electronics)</b>	(0.102)		May-13	
	<b>Sum:</b>	(2.581)	(2.869)	M\$	
	<b>Contingency Savings Range</b>	(2.581)	-	(5.450)	M\$
					<b>RANGE at 14Aug2012 IPR (2.52) - (6.00)</b>
	<b>June Sum:</b>	(0.318)			
	<b>July Sum:</b>	(1.881)			
	<b>August Sum:</b>	(0.222)			
	<b>September Sum:</b>	(0.058)			
	<b>October Sum:</b>				
	<b>TOTAL SUM to date:</b>	(2.479)			
	<b>UPDATED future Contingency Savings Range as of Nov 6</b>	(0.10)	-	(2.97)	M\$



# Other options

- Recall at the 14 August IPR, our list of possible items to increase contingency included the possibility to put water in every other layer of 2 – 4 blocks at the back of the detector.
  - 4 blocks with 50% water would generate ~ 1 M\$ of additional contingency.
- Other options are under discussion and are listed on the next slide.



# Other possible contingency savings discussed

(most require that the laboratory have additional cash)

(some require that collaborating Univ get additional DOE help)

Possible additional Contingency savings				
		\$M	\$M	WHEN?
		Well Understood \$, but not agreed to	Additional Possibilities & Estimates	
	<b>Laboratory PPD buys MINOS crane parts into Special Process Spares.</b> The Project bought long lead time parts (300 ft rope, hoist brake, inverter) to make sure the crane would not impact cavern construction and Near Detector installation.	(0.028)		
	<b>Laboratory PPD buys Project's spare electronics into Special Process Spares to ensure smooth operations for 6 - 10 years.</b> 2,500 FEBs @ \$125 each = 312.5 K\$ 1672 TECCs @ \$12 each = 20.0 K\$ 18 PDBs @ \$1,500 each = 27.0 K\$ 70 DCMs @ \$2,200 each = 154.0 K\$ 6 master TDUs @ \$2,500 each = 15 K\$ 14 slave TDUs @ \$1,000 each = 14 K\$	(0.543)		
	<b>Collaboration provides the labor to build the Near Detector modules at Minneapolis.</b> This would offset 190K\$ by providing approximately 9,500 hours of labor. This labor would take about 10 people over a period of 5.6 months, Feb-July 2013.		(0.190)	by Feb 2013
	<b>Collaboration provides the labor to build Ash River modules at Minneapolis Factory so we can vacate warehouse rental by April 1, 2014.</b> Not well defined, but the idea is that collaborators could replace students in the Fall of 2013 to provide a solid core to finish Ash River modules on time. For the moment assume this is another offset of 200K\$ by providing approximately 10,000 hours of labor. This labor would take about 10 people over a period of 6 months, September 2013-March 2014.		(0.190)	by Sep 2013
	<b>Laboratory does not charge Scientists to Project in FY14</b>		(0.481)	
	<b>Laboratory does not charge Scientists to Project in FY13</b>		(0.992)	
	<b>Laboratory buys the prototype Near Detector building from the Project.</b> Shell cost was 841 K\$ Outfitting cost was 343 K\$ 223 K\$ of the building shell were NOVA specific. 120 K\$ of Outfitting was NOVA specific. Net is 841 K\$		(0.841)	
		<b>SUM:</b>	(0.571)	(2.694)
		<b>Contingency Savings Range</b>	(0.571) -	(3.265) M\$