

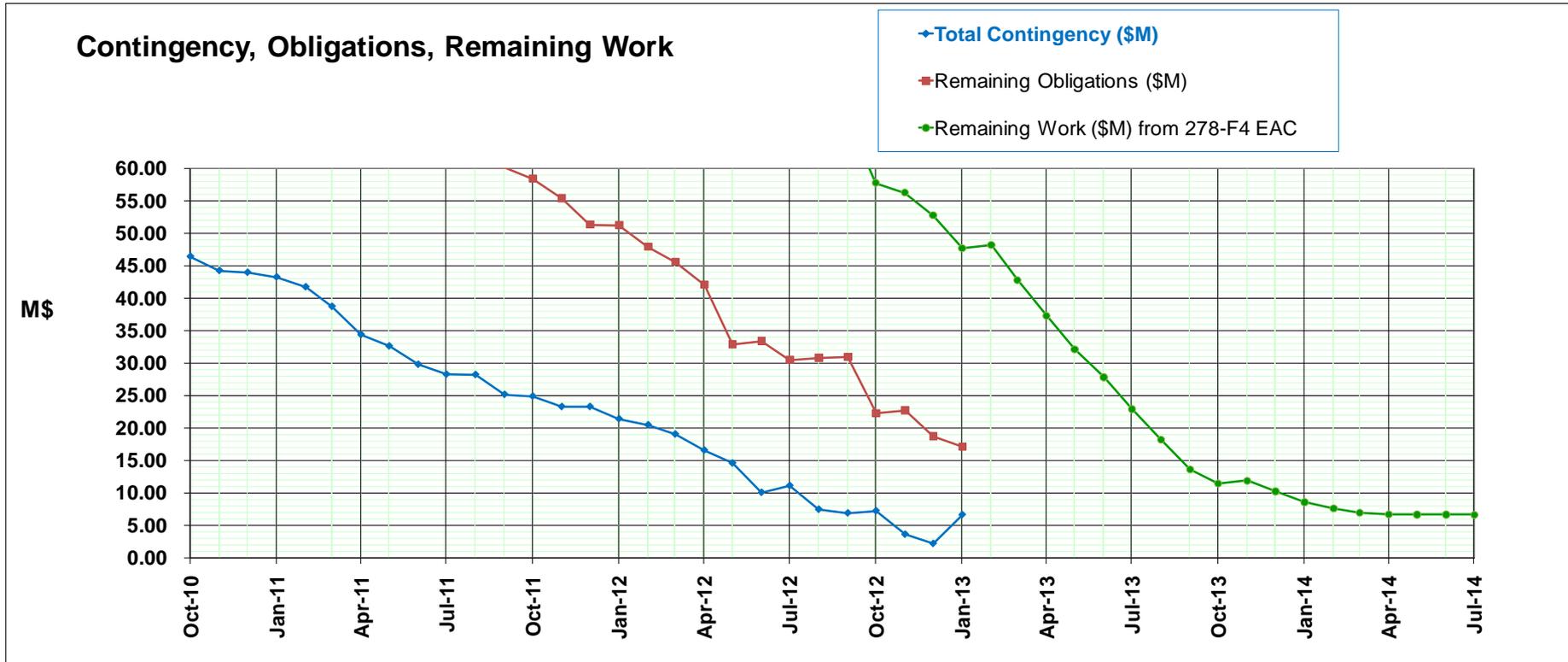
Project Financial and Schedule Status and Summary

Greg Bock
NOvA Mini-Review
February 27, 2013

NOvA Progress since November

- Technical Progress is very good (previous talks)
- Project management and contingency
 - Contingency situation much improved—13% on remaining work (up from 4% last month) and 35% on remaining obligations. Involved significant efforts by the project, collaboration, and Laboratory.
 - Directorate Review in December
 - Full bottoms up estimate on remaining work. Updated monthly along with risks.
 - Tracking schedule and taking corrective action when needed. Still on track for completion late Spring 2014
- Project is in very good technical shape (Cosmic rays in March with 1KT active detector and Fermilab neutrinos in June with 3KT, risks retiring as outfitting progresses), and improving financial shape

Contingency History



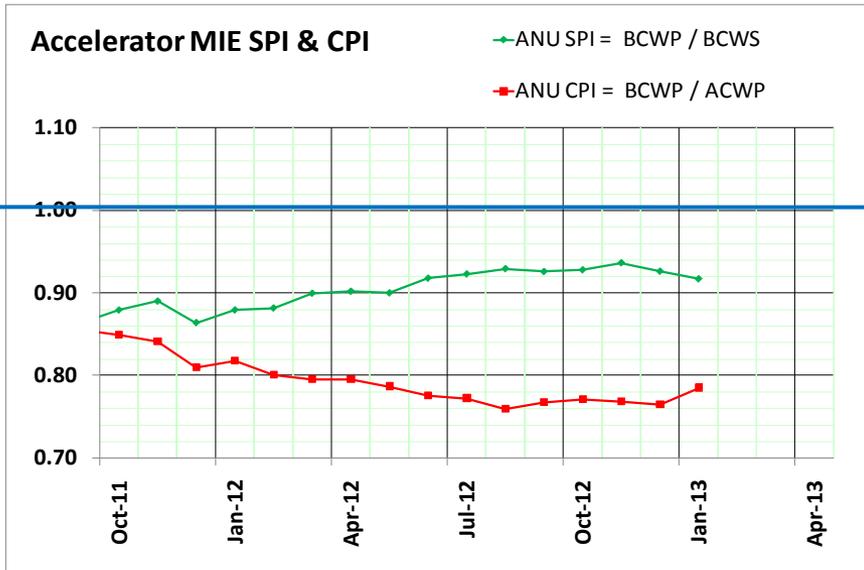
- This illustrates the difference between Remaining Obligations and Remaining Work.
- Incorporated changes from bottoms up ETC (NOvA planned changes, changes suggested by both the McCluskey Committee, and from the monthly ETC Team)
- In FY13: \$6.2M cost increases and \$5.3M cost decreases, all incorporated in a few dozen CR's

EVMS Reporting Overview

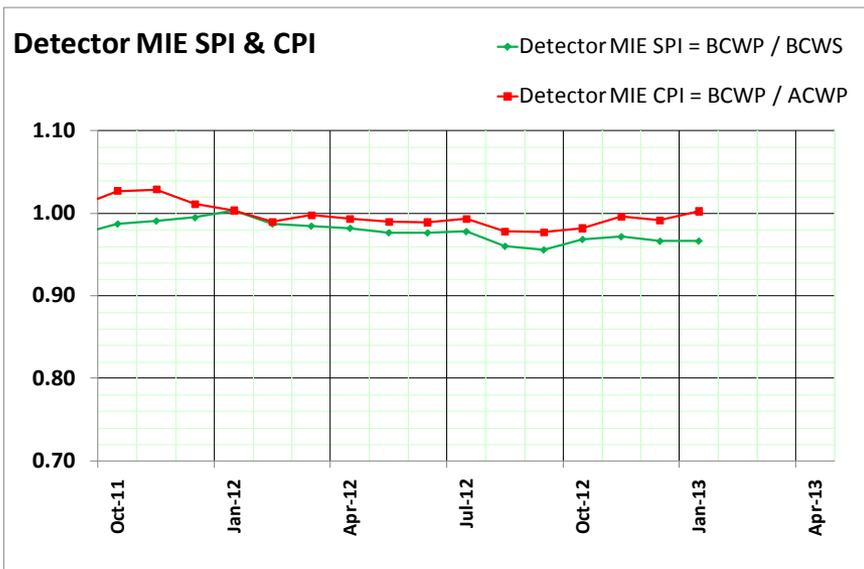
- Data now available through **January** 2013
 - SPI = **0.968**, compare to 0.970 in Dec, 0.975 in Nov, 0.972 in Oct, 0.966 in Sep
 - CPI = **0.949**, compare to 0.937 in Dec, 0.940 in Nov, 0.934 in Oct, 0.931 in Sep



SPI & CPI for Active Work



- ANU CPI has a long slide down to 0.76, then ~ flat in Sep – Dec 13
 - Increases in Jan to 0.79 due to transfer of RF Cavity #3 off-project
 - **January work went as planned!**
- Meanwhile the SPI approximately flat since August around 0.91 – 0.94.



- Detector still relatively constant near 1.0 for both indices
- SPI=0.966, CPI=1.003 in Jan 13

CPR1 Jan 2013 continued

| COST PERFORMANCE REPORT FORMAT 1 - WORK BREAKDOWN STRUCTURE | | | | | | | | | | | | | |
|--|----------------|----------------|----------------|--------------|--------------|--------------------|----------------|----------------|----------------------|-----------------|----------------|------------------------------------|----------------|
| CONTRACTOR | | | | | | CONTRACT | | | PROGRAM | | | REPORT PERIOD | |
| NAME Fermi National Accelerator Laboratory | | | | | | NAME | | | NAME NOvA project | | | FROM 01-Jan-2013 TO 31-Jan-2013 | |
| PERFORMANCE DATA | | | | | | | | | | | | | |
| CTC-FndSrc CTC[2] Results... ITEM | 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 | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| DO DOE- OPS | | | | | | | | | | | | | |
| 1.0 ANU R&D | | | | | | | | | | | | | |
| Fully burdened AY\$k | 0 | 16 | 12 | 16 | 4 | 1,818 | 1,708 | 1,375 | (110) | 333 | 1,818 | 1,487 | 331 |
| 2.7 DAQ | | | | | | | | | | | | | |
| Fully burdened AY\$k | 21 | 21 | 0 | 0 | 21 | 21 | 21 | 0 | 0 | 21 | 192 | 171 | 21 |
| CTC-FndSrcTotals: | 21 | 37 | 12 | 16 | 25 | 1,839 | 1,729 | 1,375 | (110) | 354 | 2,010 | 1,657 | 352 |
| DR DOE-POST CD-1 DET R&D | | | | | | | | | | | | | |
| 1.1 Site and Building R&D | | | | | | | | | | | | | |
| Fully burdened AY\$k | (1,356) | (1,356) | (1,541) | 0 | 186 | 2,275 | 2,275 | 1,627 | 0 | 647 | 2,275 | 1,627 | 647 |
| 1.2 Liquid Scintillator R&D | | | | | | | | | | | | | |
| Fully burdened AY\$k | 0 | 0 | | | | | | | | | | 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: | (1,356) | (1,356) | (1,541) | 0 | 186 | 13,711 | 13,711 | 17,806 | 0 | (4,095) | 13,711 | 17,806 | (4,095) |
| 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 | 3,698 | 3,225 | 698 | (473) | 2,528 | 219,108 | 212,125 | 223,639 | (6,983) | (11,515) | 261,817 | 271,356 | (9,539) |
| Management Resrv. | | | | | | | | | | | 16,183 | | |
| Total | 3,698 | 3,225 | 698 | (473) | 2,528 | 219,108 | 212,125 | 223,639 | (6,983) | (11,515) | 278,000 | | |

Current month reflects moving prototype Near Detector building off-project

| COST PERFORMANCE REPORT FORMAT 1 - WORK BREAKDOWN STRUCTURE | | | | | | | | | | | | | |
|--|----------------|----------------|----------------|----------|-------|--------------------|----------------|----------------------|----------|---------|---------------|------------------------------------|----------|
| CONTRACTOR | | | | CONTRACT | | | | PROGRAM | | | | REPORT PERIOD | |
| NAME Fermi National Accelerator Laboratory | | | | NAME | | | | NAME NOvA project | | | | FROM 01-Jan-2013 TO 31-Jan-2013 | |
| 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 | | 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) | |
| DA DOE-ACEL MIE | | | | | | | | | | | | | |
| 2.0 ANU Construction Fully burdened AY\$k | 429 | 79 | (973) | (350) | 1,052 | 34,518 | 31,645 | 40,313 | (2,873) | (8,668) | 35,197 | 42,099 | (6,902) |
| CTC-FndSrcTotals: | 429 | 79 | (973) | (350) | 1,052 | 34,518 | 31,645 | 40,313 | (2,873) | (8,668) | 35,197 | 42,099 | (6,902) |
| DC DOE-CA | | | | | | | | | | | | | |
| 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 |
| DD DOE-ACEL R&D | | | | | | | | | | | | | |
| 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 |
| DE DOE-DET MIE | | | | | | | | | | | | | |
| 2.1 Site and Building Fully burdened AY\$k | 0 | 0 | (3) | 0 | 3 | 7,131 | 7,131 | 6,164 | 0 | 967 | 7,131 | 6,164 | 967 |
| 2.10 NOvA Project Management Fully burdened AY\$k | 188 | 188 | 161 | 0 | 27 | 9,584 | 9,584 | 8,476 | 0 | 1,108 | 11,331 | 10,223 | 1,108 |
| 2.2 Liquid Scintillator Fully burdened AY\$k | 180 | 162 | 76 | (17) | 86 | 10,672 | 10,262 | 10,312 | (411) | (50) | 21,120 | 20,983 | 138 |
| 2.3 WLS Fiber Fully burdened AY\$k | 217 | 0 | 12 | (217) | (12) | 13,036 | 13,028 | 13,289 | (8) | (260) | 13,039 | 13,300 | (260) |
| 2.4 PVC Extrusions Fully burdened AY\$k | 1,212 | 958 | 883 | (254) | 74 | 25,441 | 23,846 | 24,319 | (1,595) | (473) | 33,193 | 33,677 | (484) |
| 2.5 PVC Modules Fully burdened AY\$k | 675 | 683 | 495 | 8 | 188 | 15,446 | 15,471 | 13,088 | 25 | 2,383 | 23,286 | 20,881 | 2,405 |
| 2.6 Electronics Fully burdened AY\$k | 314 | 678 | 486 | 365 | 193 | 8,257 | 7,431 | 7,469 | (827) | (38) | 11,767 | 11,817 | (51) |
| 2.7 DAQ Fully burdened AY\$k | 22 | 34 | 53 | 12 | (19) | 4,199 | 3,527 | 4,306 | (672) | (779) | 4,490 | 5,172 | (683) |
| 2.8 Near Detector Assembly Fully burdened AY\$k | 1,153 | 819 | 509 | (334) | 309 | 9,449 | 9,908 | 10,521 | 459 | (613) | 12,139 | 12,777 | (638) |
| 2.9 Far Detector Assembly Fully burdened AY\$k | 643 | 943 | 527 | 300 | 416 | 14,939 | 13,968 | 15,915 | (971) | (1,947) | 22,518 | 24,513 | (1,994) |
| CTC-FndSrcTotals: | 4,603 | 4,465 | 3,200 | (138) | 1,265 | 118,155 | 114,155 | 113,858 | (4,000) | 297 | 160,014 | 159,506 | 508 |

Current month reflects moving RF cavity #3 off-project

Still checking this one

103 K\$ undercosted by Harvard

Current month reflects Near Cavern updated actual billing from Kiewit

560 K\$ undercosted pending P.O. addition to U of Minn

Above 2 red items imply we may be overstating our contingency by 663 K\$
NOvA Mini-Review 27Feb2013

AY\$ by Level 2 with MIE/OPC split

| | WBS | Items | NOVA Costs to Date (\$M) | NOVA's Cost Estimate AY \$M (for February 1, 2013 to project end) | | | | | | | | | |
|-----|------|--------------------------------|--------------------------|---|--------------------|------------------|-----------------------|--------------------|-----------------|---------------|--------------------|------------|-------------------|
| | | | as of 31-Jan-2013 | Estimated Cost (with indirects) | | | Mgmt Reserve Estimate | | | Contingency % | | | Total Cost |
| | | | | M&S | Labor ¹ | Total | M&S | Labor ¹ | Total | M&S | Labor ¹ | Total | |
| TEC | 2.0 | Accelerator & NuMI Upgrades | \$ 40.3 | \$ (1.2) | \$ 3.0 | \$ 1.8 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 42.1 |
| | 2.1 | Far Detector Site and Building | \$ 6.2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 6.2 |
| | 2.2 | Liquid Scintillator | \$ 10.3 | \$ 10.5 | \$ 0.2 | \$ 10.7 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 21.0 |
| | 2.3 | Wave-Length-Shifting Fiber | \$ 13.3 | \$ 0.0 | \$ 0.0 | \$ 0.0 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 13.3 |
| | 2.4 | PVC Extrusions | \$ 24.3 | \$ 9.0 | \$ 0.4 | \$ 9.4 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 33.7 |
| | 2.5 | PVC Modules | \$ 13.1 | \$ 2.7 | \$ 5.1 | \$ 7.8 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 20.9 |
| | 2.6 | Electronics Production | \$ 7.5 | \$ 3.3 | \$ 1.0 | \$ 4.3 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 11.8 |
| | 2.7 | Data Acquisition System | \$ 4.3 | \$ 0.5 | \$ 0.4 | \$ 0.9 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 5.2 |
| | 2.8 | Near Detector Assembly | \$ 10.5 | \$ 1.5 | \$ 0.7 | \$ 2.3 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 12.8 |
| | 2.9 | Far Detector Assembly | \$ 15.9 | \$ 3.1 | \$ 5.5 | \$ 8.6 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 24.5 |
| | 2.10 | Project Management | \$ 8.5 | \$ 0.1 | \$ 1.6 | \$ 1.7 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 10.2 |
| | | | | | | | | | | | | | |
| | | Subtotal Construction | \$ 154.2 | \$ 29.4 | \$ 18.1 | \$ 47.4 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 201.6 |
| OPC | | R&D - Accelerator | \$ 6.6 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 6.6 |
| | | R&D - Detector | \$ 26.6 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 26.6 |
| | | Cooperative Agreement | \$ 34.9 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 34.9 |
| | | Operating - Accelerator | \$ 1.4 | \$ 0.0 | \$ 0.1 | \$ 0.1 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 1.5 |
| | | Operating - Detector | \$ - | \$ - | \$ 0.2 | \$ 0.2 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 0.2 |
| | | Total OPC: | \$ 69.5 | \$ 0.0 | \$ 0.3 | \$ 0.3 | \$ - | \$ - | \$ - | 0% | 0% | 0% | \$ 69.8 |
| | | Contingency | | | | | | | | | | | \$ 6.6 |
| | | TPC: | \$ 223.639 | \$ 29.4 | \$ 18.3 | \$ 47.716 | \$ - | \$ - | \$ 6.644 | 0% | 0% | 14% | \$ 278.000 |

- We are conservatively claiming \$6.0 of contingency
- 6.0 M\$ is 13% of remaining work (6.0 / 47.716)
- 6.0 M\$ is 35% of remaining Obligations
 - 271.356 (EAC) - 254.218 obligated = 17.138 M\$ yet to obligate

NOvA – ETC Team

(P. Mantsch, T.J. Sarlina, H. Brown, H. Ferguson)

Objectives:

- Update the BOEs for each of the level 2 tasks.
- Follow up findings and recommendations of the *Internal Nova Assessment Committee* of DEC 2012.
- Examine remaining risks with L2 managers and update the risk register as needed.
- Update the projected ETC monthly

Status:

- Second round of BOE and Risk meetings with L2s (L3s as needed) completed 15 February.
- Most BOE's have been updated and CRs completed and included in the January report.
- Risks have been reevaluated and updated including those from the McCluskey report.
- A new projected ETC has been prepared.

BOE Update Process

Status 16 January 2013

| Count of Status- 1/16/13 | | |
|--------------------------|---|------------|
| Cnt % | Row Labels | Total |
| 67% | a) Tasks are complete, no change necessary | 304 |
| 10% | b) Not changed, tasks will complete by end of CY13, and ETC forecast keeps track of anticipated contingency use | 44 |
| 18% | c) Reviewed, no changes required | 81 |
| 3% | d) Updated, CR completed | 14 |
| 0% | d) Updated, Needs CR | 1 |
| 2% | e) New activity, new BOE, CR completed | 9 |
| Grand Total | | 453 |

Monthly updates for each L2 system ongoing

Status 13 February 2013

| Count of Status- 2/13/13 | | |
|--------------------------|--|------------|
| Cnt % | Row Labels | Total |
| 76% | a) Tasks are complete, no change necessary | 350 |
| 2% | b) Not changed, tasks will complete by end of shutdown | 11 |
| 11% | c) Reviewed, no changes required | 49 |
| 6% | d) Updated, CR completed | 26 |
| 1% | d) Updated, CR needed, in Dec ETC update | 5 |
| 2% | e) New activity, new BOE, CR completed | 10 |
| 1% | k) New activity, BOE completed and CR in progress | 3 |
| 1% | l) Reviewed, need more info, check status next month | 4 |
| Grand Total | | 458 |

Number of newly discovered activities and corresponding cost increase seem to be decreasing as one would expect

Estimate to Complete

- **M&S**

- ~3M\$ per month until Oct this year, then drops quickly
- Negative in Nov 2013 due to spares → special process spares

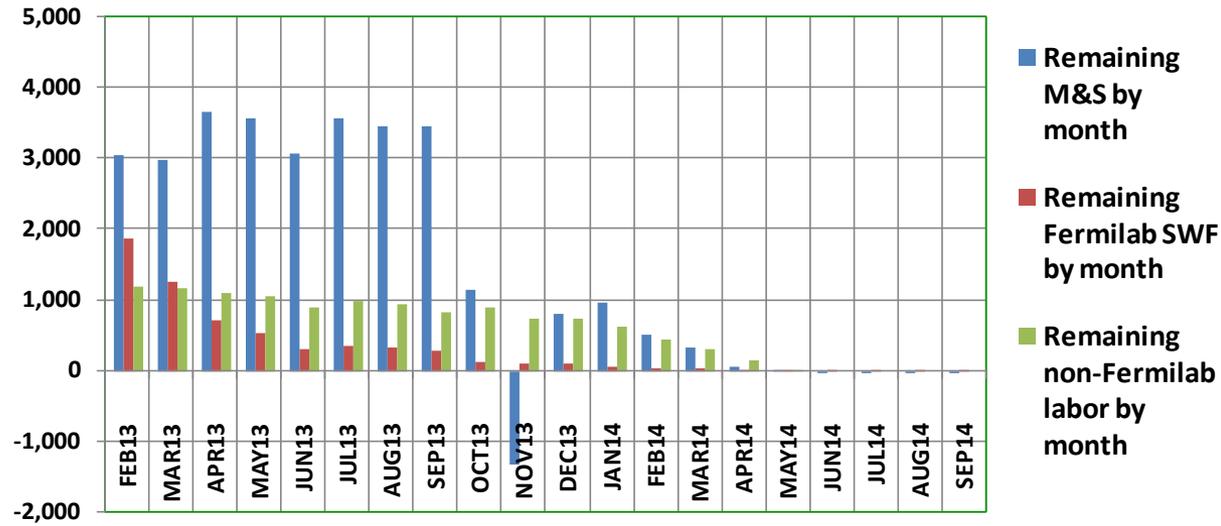
- **Fermilab SWF**

- **Diving from 1.9 M\$ in Feb 2013 to ~ 300 K\$ per month in June 2013 when the Accelerator shutdown ends**
- **Rest is Project Controls**

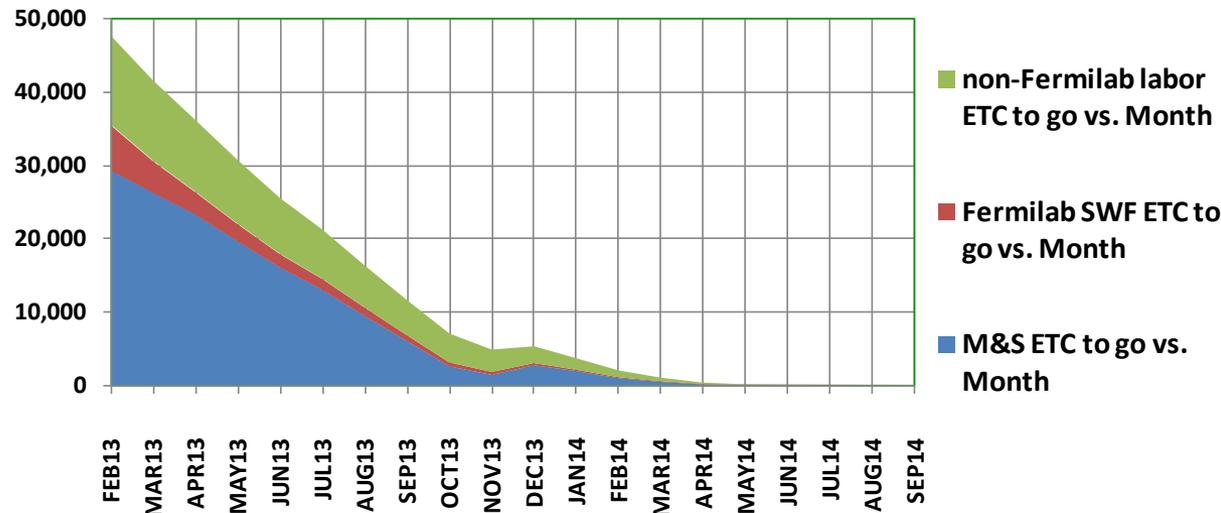
- **Non-Fermilab labor**

- Minneapolis Factory until December 2013
- Ash River Assembly until mid-Feb 2014
- Ash River scintillator filling & outfitting until May 2014

ETC Remaining Work, month by month (K\$, including indirects)



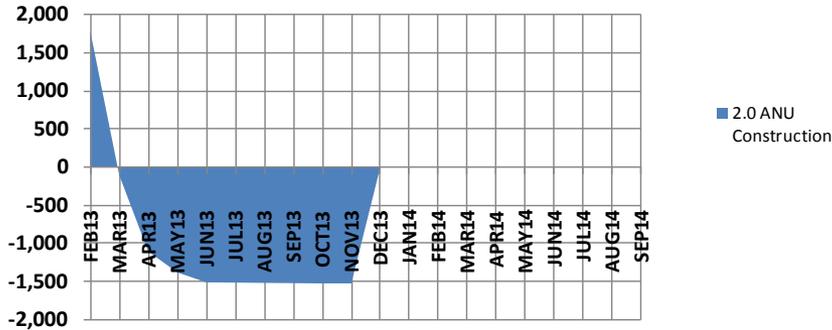
Remaining Work vs. Time (K\$, including indirects)



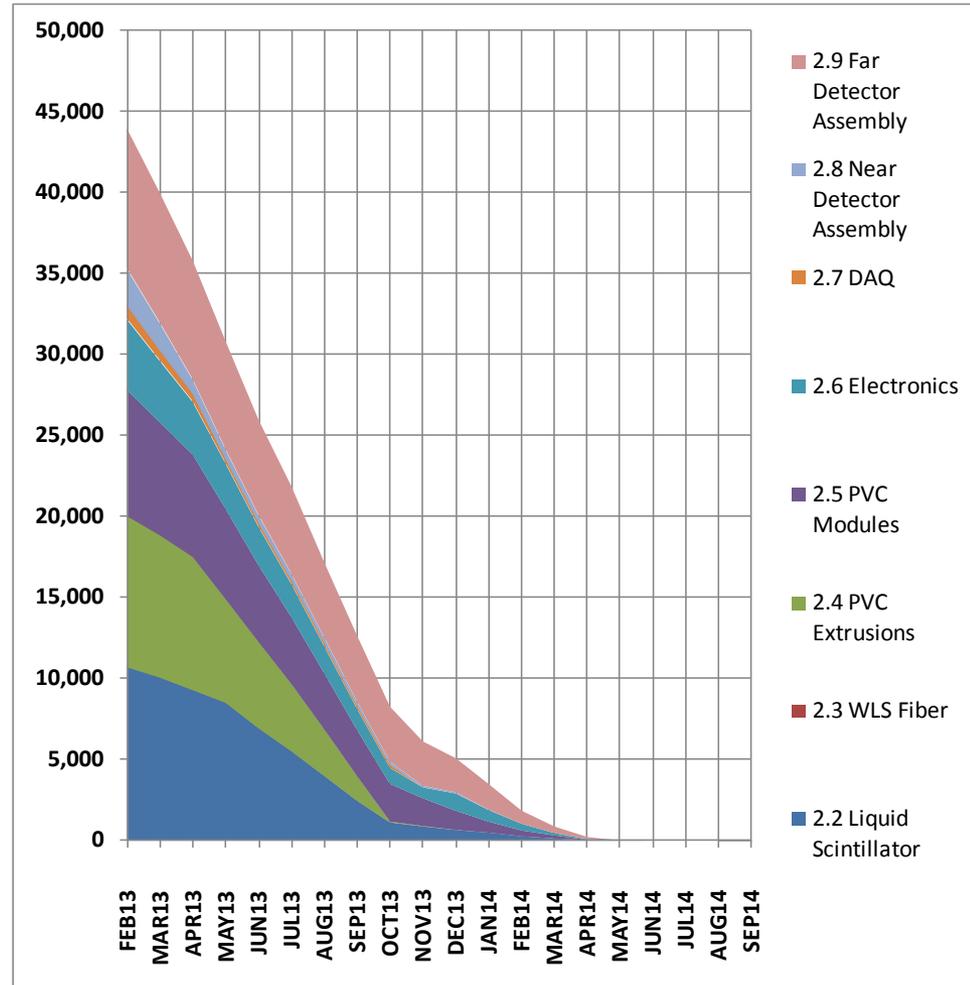
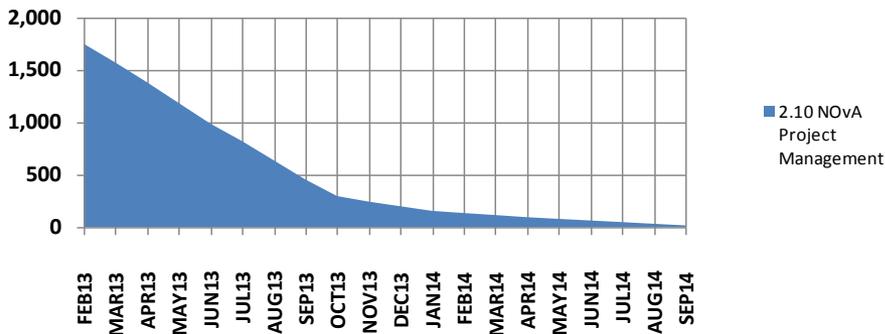
Estimate to Complete

- By Level 2

2.0 ANU Construction



2.10 NOvA Project Management



Estimate to Complete

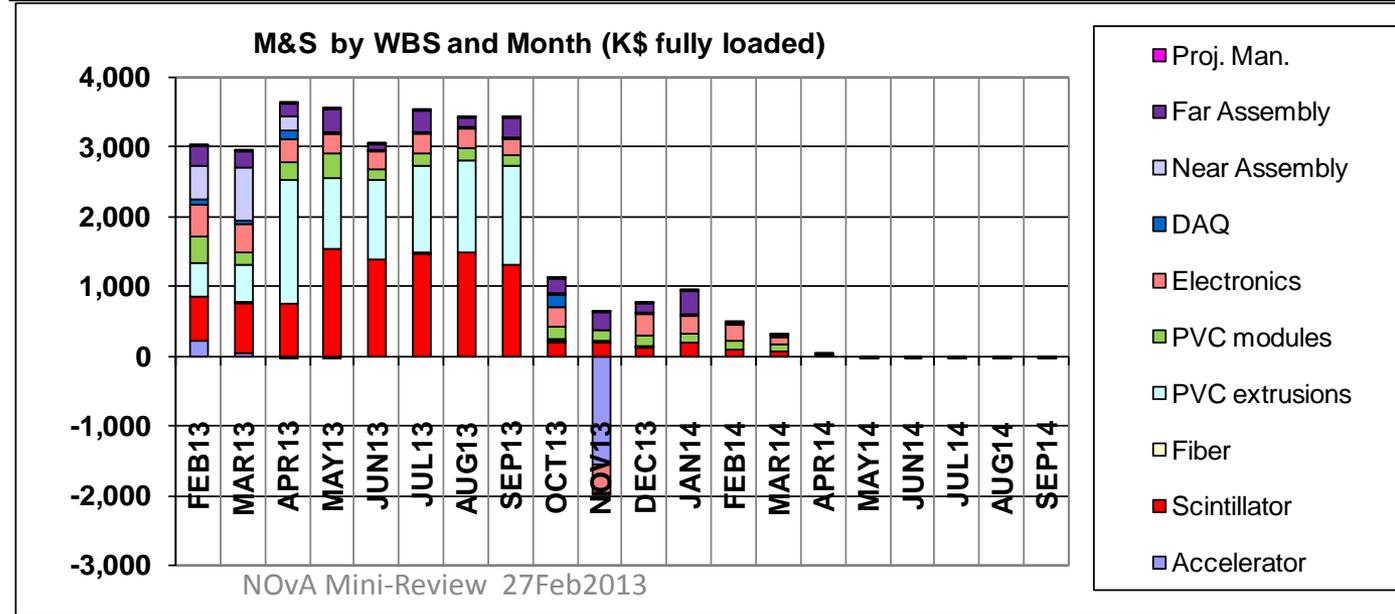
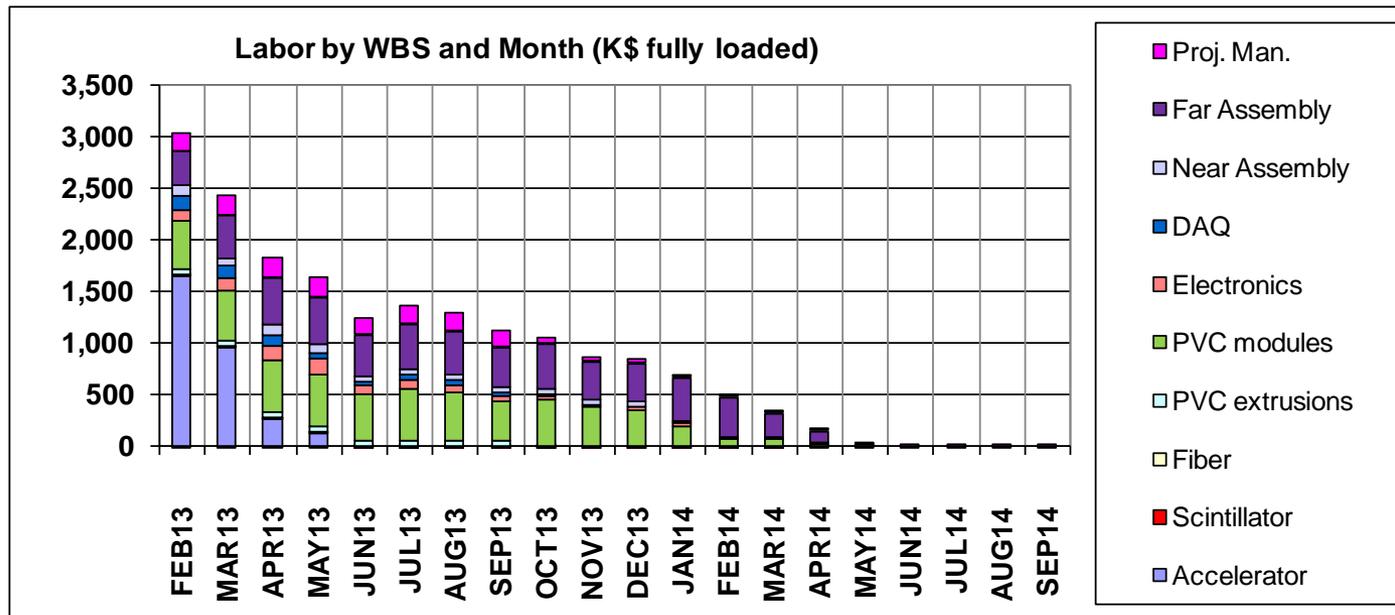
Month by Month for each Level 2

- Labor dominated by

- PVC modules @ ~ 400 K\$ per month throughout calendar 2013
 - Ash River assembly @ ~ 400 K\$ per month through Feb-Mar 2014

- Materials & Services dominated by

- Scintillator @ > 1 M\$/ month until October 2013
 - PVC extrusions @ > 1 M\$ per month until October 2013



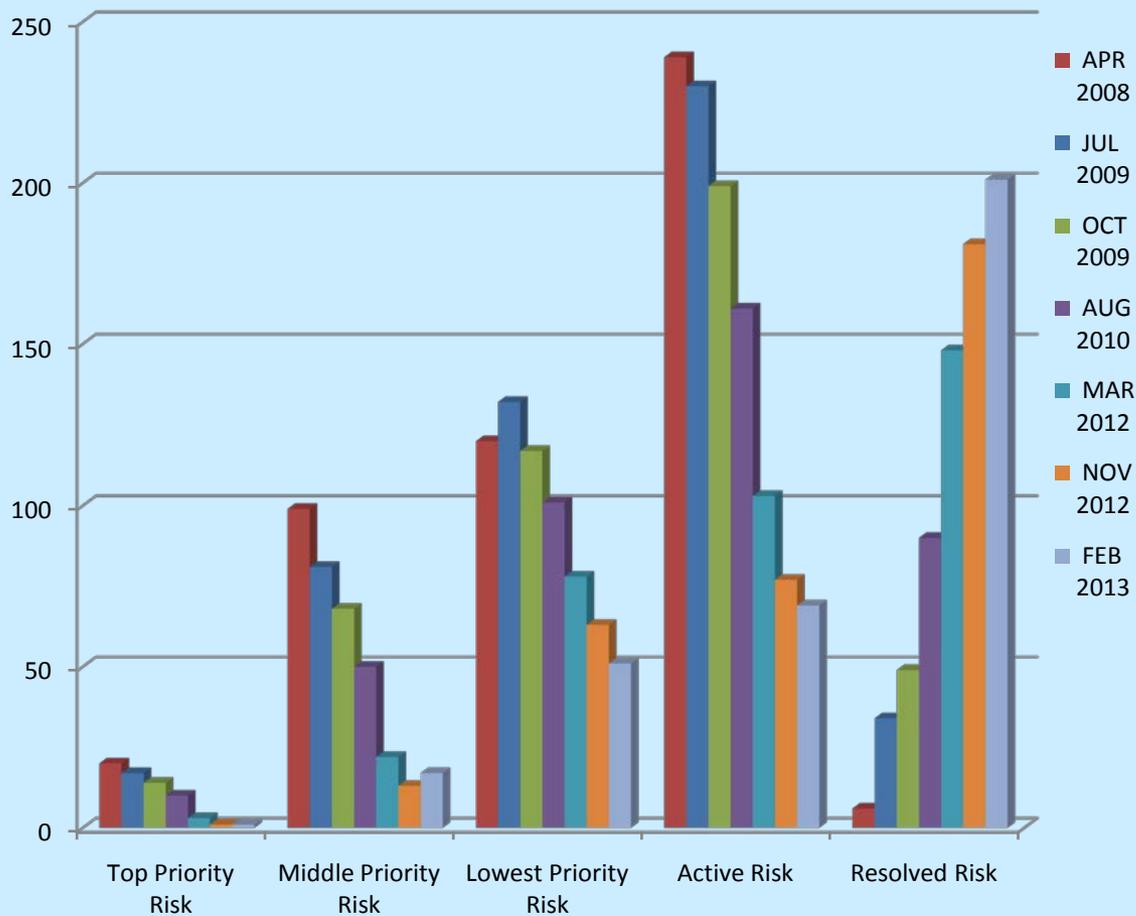
List of NOvA risks by priority over time

The 270 NOvA Risks have a “score” assigned to each risk by WelcomRisk

All risks identified by McCluskey Committee and added by ETC Committee work are rolled into this. Assessments underway.

NOvA Risk Overview

| Risk Level | November 2012 | February 2013 |
|--|---------------|---------------|
| Top Priority | 1 | 1 |
| Middle Priority | 13 | 17 |
| Low Priority | 63 | 51 |
| Active Risk (sum of top, middle, low) | 77 | 69 |
| Resolved / Retired | 181 | 201 |
| Total | 258 | 270 |



Risk Correlated to Assessment Report (1st page of 3)

| WBS Section | Risk | K\$ from Dec Directors Review | K\$ NOvA Project Assessment | NOvA Risk Number | Risk RANK Among The 69 Active Risks | Project Assessment in February 2013 |
|-------------------------------------|--|-------------------------------|-----------------------------|------------------|-------------------------------------|---|
| 2.0 ANU | Recycler RF cavities failure | 600 | 200 | 528 | 13 | Have 1 cavity tested, and one half way thru testing. Note Change Request CR618 moves RF Cavity 3 scope and budget off project. 1/3 of the risk as assessed in December. |
| | Recycler extraction kickers failure | 300 | 30 | 527 | 21 | Have 2 tested, 2 to go, experience in testing is that failure probability is quite low and cost would be small, e.g. 30 K\$ |
| 2.1 Far Building | | | | | | Complete |
| 2.2 Liquid Scintillator Mineral Oil | Mineral Oil costs rise more than planned by 15% | 1,800 | 980 | 506 | 1 | The 15% is reasonable, but 15% of the total mineral oil required (2.57 M gal) at \$3.92 per gallon is only 1,511 K\$, not 1,800 K\$. In addition we now have 900,000 gallons of 2,570,000 in hand in our buffer tank or already mixed as scintillator. 15% as a point estimate is therefore reduced to 980 K\$ as of this review. Note this risk decreases with every gallon we purchase. |
| | Mineral oil costs rise due to middle east politics by 15% more | 1,800 | 350 | | 1 | For the political risk, 15% is also reasonable (See J. Cooper talk at this review). However, our strategy is to keep the buffer tank full until the end of the project. This lets us ride out a political price increase for about 6 months, during which we would use the buffer tank mineral oil and not buy at a high price. This avoids most of the additional political cost risk as of this review. Therefore a more reasonable \$ estimate of the risk is about 350 K\$. |
| 2.3 WLS Fiber | | | | | | Complete |
| 2.4 PVC Extrusions | TiO2 costs rise, increasing cost of resin | 210 | 150 | 517 | 12 | ICIS Chemical Business (28 Jan 2013 issue) says the outlook is for stable TiO2 prices through early summer. Our purchases end about then. Chemical Data Inc. forecasts a possible \$0.05 per pound increase in PVC resin prices through early summer, equal to a possible 150 K\$ increase to NOvA |

Risk Correlated to Assessment Report (2nd page of 3)

| WBS Section | Risk | K\$ from Dec Directors Review | K\$ NOVA Project Assessment | NOVA Risk Number | Risk RANK Among The 69 Active Risks | Project Assessment in February 2013 |
|----------------------------|--|-------------------------------|-----------------------------|------------------|-------------------------------------|--|
| 2.5 PVC Modules | Cost of one month delay beyond March 2014 to operate factory | 83 | 0 | 518 | 69 | <p>This is the cost of warehouse rental and operations for one additional month. Lease ends in April 2014. Current projected end date for the factory is Feb 2014.</p> <p>It is not clear from the McCluskey report if they understood that there were another 260 modules already built with only 1 cell of fiber "damage". It is the clear intent of the Project to use these modules at the back of the detector. This saves ~60% of one block's worth of module construction = 25 days = another month of float.</p> |
| 2.6 Electronics Production | 5% contingency on APD procurement to go | 242 | 0 | 193 | 19 | <p>This is a fixed price contract with experience to date that the delivery schedule is being met, now have 18% of the APDs in hand. The risk is lower than it was when assessed by the Director's Committee in December.</p> |
| | 15% contingency on non-APD procurements to go | 127 | 0 | * | * | <p>All the other procurements are in hand. All required FEBs for the Fart Detector are complete. This risk is zero.</p> |
| | 25% contingency on remainder | 19 | 19 | * | * | <p>No change.</p> |
| 2.7 DAQ | 15% contingency on remaining materials procurement to go | 15 | 15 | 525 | 67 | <p>No change</p> |
| | 25% contingency on non-materials to go | 226 | 115 | * | * | <p>Still 25%, but now less to work to go.</p> |

* Newly identified risk and will be in the list next month

Risk Correlated to Assessment Report (3rd page of 3)

| WBS Section | Risk | K\$ from Dec Directors Review | K\$ NOvA Project Assessment | NOvA Risk Number | Risk RANK Among The 69 Active Risks | Project Assessment in February 2013 |
|-------------------------|---|-------------------------------|-----------------------------|------------------|-------------------------------------|--|
| 2.8 Near Assembly | Near Detector installation labor underestimated | 73 | 0 | * | * | CR621 and CR623 fixed this. Free labor from the NOvA Collaboration |
| | Need FNAL techs to oversee collaboration installation | 60 | 0 | 522 | 21 | CR623 fixed this. Free oversight labor from Fermilab as a way to train the Fermilab tech force which will maintain the Near Detector. |
| 2.9 Far Assembly | Weather-related delays at Ash River | 165 | 68 | 171, 520 | 13, 15 | McCluskey review suggested 165 K\$ which represents ~ 1 week standing army per winter. Our experience to date is less than 8 hours per ½ of winter so if we say 2 days per winter at current rate the value is 68 K\$. |
| | Key people leave before project is complete | 50 | 50 | 257 | 10 | McCluskey review suggested hiring key foremen into the operations part of the experiment as one way out of this. The other suggestion was a bonus system so that people stay. Still investigating. |
| | Need more Operations costs at Ash River | 200 | 420 | 130 | 8 | Risk here is calculated as OT \$ to compensate for slower than 21 assembly shifts per block. OT estimate to add one shift per week is 30 K\$ per month. Assuming we can sustain this OT during the remaining 14 months of assembly amounts to 420 K\$. |
| 2.10 Project Management | Projected CD-4 date moves by one month | 80 | 50 | 254 | 12 | See BOE for Project Management, NOVA-doc-6337. The Project Controls staff is quantified by estimated BCWS per month. The risk is that we need an additional month at the start of FY14 before the staff ramps down. The estimate is 50 K\$. |
| | TOTAL | 6,050 | 2,447 | | | Not ALL of these Risks should materialize |

* Newly identified risk and will be in the list next month

NOvA January 2013 Budget Status

- TPC \$ 278.0 M
- ETC \$ 47.8 M
- Contingency \$ 6.0 M

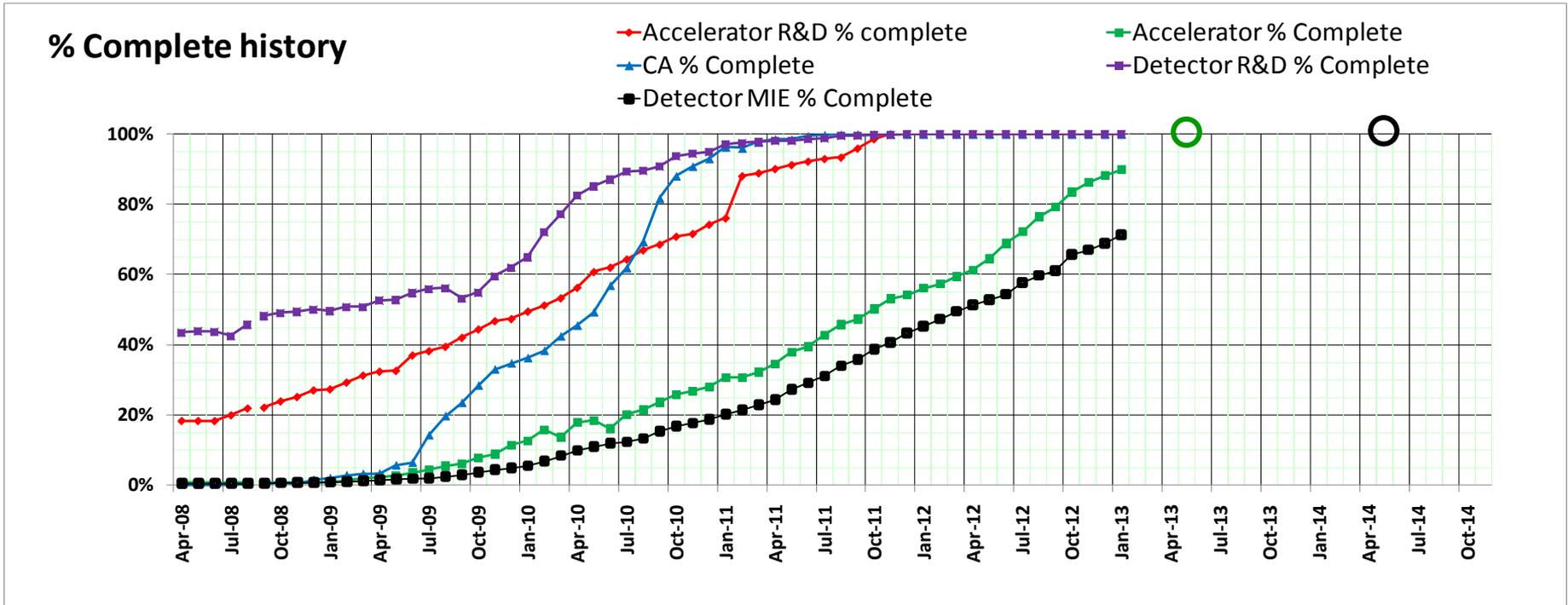
Milestones held by DOE - OHEP

|  Nova_Project Milestone Gantt Chart Nova_Milestones_L1_L2 = [BOOL.T] and ESDATE >= {10/1/08} January 2013 Status TimeNow: 01Feb13 | | | | Baseline Date  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---------------|------------------------|-------------------|---|---|----|----|--|----|----|----|---|---|---|---|------|----|----|----|---|---|---|---|---|---|----|----|--|--|--|--|--|--|
| | | | | Completed Milestone  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | Current Forecast Date  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Activity Desc. | Baseline Date | Forecast / Actual Date | Baseline Variance | FY09 | | | | FY10 | | | | FY11 | | | | FY12 | | | | FY13 | | | | FY14 | | | | | | | | | |
| | | | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | | | | |
| L.1 -- DOE - OHEP Associate Director Milestone | | | | Time Now - 01Feb13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CD-3a | 02Feb09 | 24Oct08 | 63d |  |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CD-3b | 01Oct09 | 29Oct09 | -21d | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | |
| IPND ready to take data | 11Oct10 | 30Nov10 | -35d | | | | | | | | |  |  | | | | | | | | | | | | | | | | | | | | |
| Beneficial occupancy (Substantial completion) - far detector building construction | 30Jun11 | 13Apr11 | 54d | | | | | | | | | | |  |  | | | | | | | | | | | | | | | | | | |
| Beneficial occupancy of near detector cavern | 14Jun13 | 29Mar13 | 53d | | | | | | | | | | | | | | | | |  |  | | | | | | | | | | | | |
| NuMI neutrino event observed in Superblock 1 | 01Oct13 | 26Jul13 | 45d | | | | | | | | | | | | | | | | | | |  |  | | | | | | | | | | |
| Near detector completed and ready to operate | 02Jan14 | 22Jan14 | -14d | | | | | | | | | | | | | | | | | | | | |  |  | | | | | | | | |
| 14 kt installation completed | 16Jan14 | 25Apr14 | -70d | | | | | | | | | | | | | | | | | | | | |  |  | | | | | | | | |

In a long two year gap with no L1 milestones, next is June 2013

Current forecast for Near Cavern Beneficial Occupancy is April 2013.

% Complete history for the 5 Main parts of the Project

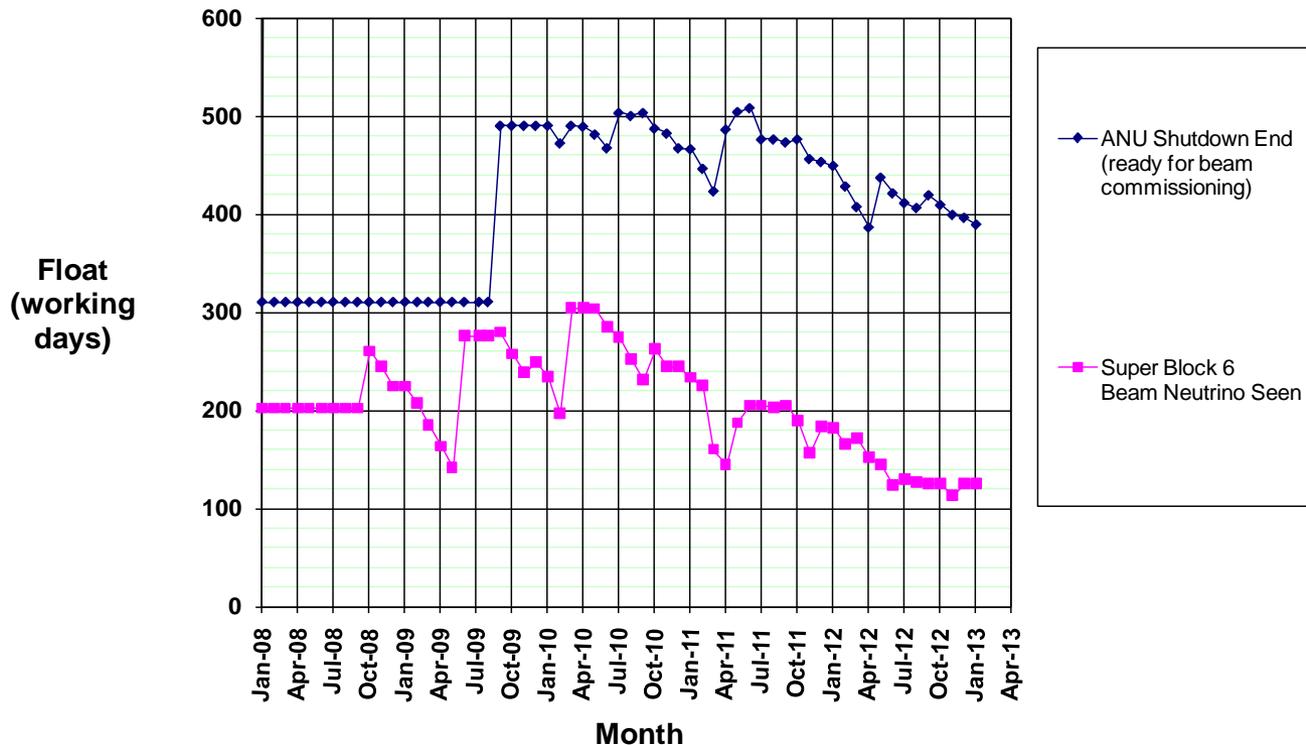


- ANU at 90%, to be complete by ~ May 2013
- Detector at 71%, to be complete by ~ May 2014
- Building & Detector R&D & ANU R&D are all done

Schedule Contingency: **Float to CD-4**

- **ANU lost 7 days of float in **January** -- Now at 389 days**
 - Kicker and RF schedules are still the real drivers for the end of the shutdown
 - Now forecasting the NOvA shutdown work to extend until May 10, 2013
- **The Detector had no loss or gain to days of float in **January** -- Still at 125 days**
 - This is driven by installation of APDs for the 28th block.

Tracking Float to CD-4



Schedule Contingency Summary

- As of **January 31**, we have **125** working days float to CD-4
- As of **January 31**, we have **22** months to CD-4 = **458** working days
 - CD-4 is end of November, 2014
- Schedule Contingency is $125 / (458 - 125)$ days = **38%**.

Schedule contingency is holding, but we are watching closely and taking proactive steps when needed:

- Far detector block assembly previously reached desired rate, but has not quite held. Instituting some extra shifts and monitoring progress
- Early indications on outfitting (oil filling, electronics installations, etc) indicate that those steps could progress faster than plan
- Reevaluation of the 'fitness for duty' of some previously 'failed' components

ES&H Summary

- At Ash River: **2 new accidents since 20 Nov mini-Review**
 - First record was 391 days and accumulated 61,669 employee hours since beneficial occupancy of the Ash River building in April 2011. Average of ~ 20 employees/day
 - First lost time accident on 01 Nov 2012. Worker hit his knee, lost one day, topical medication prescribed
 - Second record was 67 days, now at 46 employees
 - Incident on 31 Jan 2013, employee lost time due to apparent hernia caused by manually pushing vacuum lifter suspended from overhead crane. Employee has been away from work since 06 Feb.
 - Third record was 6 days
 - Incident on 06 Feb, employee lifted a cardboard box of cable tray supports weighing 97 pounds, muscle strain. Lifting restriction for a week. No lost time. Training on all shifts in proper lifting techniques.
- Transportation of Materials to Ash River: **One since 20 Nov mini-Review**
 - A truck with PVC modules from Minneapolis was involved in a low speed accident on 27Nov2012. No damage to the modules, but Ash River lost 6 hours of construction time.
- At the U of Minnesota Factory: **Nothing new**
 - **No reportable accidents** since module assembly started in April 2011.
 - About **159,000** student hours worked during this time
- At Fermilab during the Accelerator Shutdown for NOvA: **Nothing new**
 - Of order 70 - 120 FTEs working per month on shutdown items.
 - Accelerator tunnel incident on 19Nov2012.
 - Employee did mandated stretch exercise after installing a shim on a permanent magnet end in the tunnel, hit his hand on something nearby, needed a butterfly closure.
- At Fermilab by Kiewit, construction of the Near Detector Cavern: **Nothing new**
 - **26,624** hours of work as of Feb 14, 2013. **No accidents.**

Is the ETC credible?

- Since November
 - Bottoms up estimate on all remaining work
 - Director's review team in December and responses
 - Added management
 - Increased Lab oversight
 - Enhanced some practices and processes
- Uncovered a few additional cost changes since November (both increases and decreases)
- Established ETC Team:
 - Monthly reassessments with L2 managers
 - BOE updates
 - New risks identified and assessed. We have the resources to meet the risks should they materialize
 - Process is in place Since December and continues

What have we done to reduce risks?

- Repurposed building housing ND prototype. Advanced planned purchase of RF cavity for accelerator operations
- Increased collaboration involvement in ND outfitting
- Planning for extra effort ('5th day') on any lagging production line if needed
- Gaining experience and confidence in production lines and initiating the final production stages
 - APD's arriving at an acceptable rate
 - Filling started and fast approaching nominal rate
 - APD installation at Ash River about to start
- Prototype NOVA detector performance clearly demonstrates the detector will perform as needed. Recent Experiment Operations Readiness review affirms this.
- Monthly assessments, evaluation of all risks including those identified by McCluskey committee.
- Increasing Lab management attention on NOvA (and all projects)
- We assess we have about \$2.5M in potential risks and \$6M to cover those risks.

Has the risk analysis been updated to reflect the real risks...?

- Continue to update the risks as we enter the final stages
 - McCluskey Review identified several new ones
 - ETC Team working with L2's keep this current, including identification of new risks
 - Project Management assesses all of these monthly
 - Biggest risks (commodity costs, mostly oil; assembly schedule at Minnesota, extra shifts) are more than covered by available contingency
- Remaining risks total ~\$2.5M (\$6M available; these are risks for unexpected occurrences. Not in the EAC and do not belong in the EAC)
- Project risks have been retiring rapidly over the last year
- We believe the answer is Yes

Management Attention

- Here is what we (FRA, NOvA) are doing:
 - Continue vigilance—weekly updates, monthly reporting
 - Continue developing future cost reduction opportunities and schedule advancement opportunities
 - Lab maintaining its increased focus on project management—Project Management Practices Review, March 25-27 (Wunderlich, Byon, Knutson, Reichenadter)

Summary comments

- Project is in very good technical shape (Cosmic rays in late March and Fermilab neutrinos in June, risks retiring), and considerably improved financial shape. We have an approved adjustment to the ND cavern beneficial occupancy milestone
- Contingency situation much improved—13% (up from 4% last month) on remaining work and 35% on remaining obligations
- Recommendations from reviews are completed and new processes in place. We have a bottoms up ETC incorporated into the plan and are updating it monthly. This includes a monthly risk assessment update.
- Beam Upgrade (ANU) work going well and finishing up in May. January work went just as planned!
- Work at Ash River continues to go well, 8 blocks up, 2 completely full, early results from outfitting indicate we can make some schedule up. Block assembly has reached, but not held, desired rate and we are adding effort.
- Attention also turning to commissioning in support of CD4 KPP: Cosmic rays in late March starting with ~1KT. Fermilab Neutrinos in June ~3KT.

Backup Materials

Status of Recommendations from the McCluskey Committee

| | <u>Recommendation (drawn from December Report)</u> | <u>Planned Action</u> | <u>Status</u> | <u>Responsibility</u> | <u>Estimated Completion</u> |
|---|--|--|--|------------------------------|--|
| 1 | Perform a bottoms-up re-estimate of all work to go. This should be complete by January for use in conjunction with December monthly reporting. | L2 Managers will review and update as needed the BOE's for work to go. | Second round completed Feb 15, ongoing monthly now. | Cooper/Mantsch/Brown/Sarlina | 2/15/2013 round 2 completed, ongoing monthly |
| 2 | The project incorporate the 'identified contingency draws' that come out of the re-estimate into the base budget. | Following above re-estimates incorporate into the base EAC | Planned for completion in February | Cooper | 2/15/2013 round 2 completed, ongoing monthly |
| 3 | The project should maintain the ETC with a transparent assessment each month by L2 managers of any work that is not in their budget and to communicate this to the Project Office for inclusion in the monthly reports. This should start with December monthly report, expected out in January. | Discuss with each L2 Manager monthly any needs in the ETC beyond the budget, and prepare the documentation for review and approval. | In progress, | Cooper/Mantsch | monthly until end of project |
| 4 | Discontinue managing contingency activity by activity on a percentage basis. Confirm with managers that they need to manage to their base budget. | This change has been implemented and is being reemphasized to the staff. | Complete. Done verbally in December and by email to all L2s. | Cooper | 16-Jan-13 |
| 5 | The project, with stakeholders as appropriate, validate the list of risks and their cost values identified in this review, update as necessary. Maintain this list by reviewing it monthly with the project team. Use it to manage contingency to go on the project. | Project management staff together with an outside senior manager from the Laboratory will interview L2 managers monthly | First cycle completed. Continuing process underway . | Mantsch | Reviews started January and continue monthly |
| 6 | The project and Fermilab management assess the list of opportunities to see if work should be recategorized, scope reduced, or performed by the NOvA science collaboration. | Assess the feasibility of items in the list and include time triggers for all items that might be implemented. | In progress, monthly reports to POG underway. First major actions completed. | Cooper/Lindgren/Bock | 18-Feb-13 |
| 7 | The project work with the Federal Project Director, OPA, and Fermilab PSS to see how variance thresholds can be utilized to be more reflective of current performance and not driven by past performance either for a short term or for the rest of the project duration. | Work with the project controls staff, the Fermilab Office of Project Management, and DOE to see whether changes in the reporting process could improve information flow. | Appears to be unhelpful due to the amount of work by project controls | Hoffer/Carolan/Webster | 18-Jan-13 |
| 8 | Fermilab management consider providing outside senior management support to the Project Manager to review the monthly ETC and risk updating prior to inclusion in the monthly report. | Provide outside oversight to work with project team to review ETC and risks on a monthly basis. A second senior manager will continue to assess technical risks. | Complete: Added Mantsch and ALD Bock | Directorate | 9-Jan-13 |
| 9 | Fermilab management assess in February (after January monthly reporting) if these actions are improving timely communication of cost status as well as understanding of contingency on remaining work. | Provide an assessment of the effectiveness of these corrective actions and the state of the project. | Report to Fermilab POG and DC Mini review team | Bock | 28-Feb-13 |

Notable NOvA Facts

- Largest self supporting plastic structure ever built
- Over 200 UM students building modules in university factory
- Extensive collaboration with Industry
 - PVC manufacturer worked on especially light reflective formulations to increase the efficiency of light collection
 - Devcon developed special glues to work on the reflective PVC
 - Extrusion industry worked with NOvA on ultralarge extrusions with the specially formulated PVC
 - 12000 Hamamatsu APD's used – 32 channel detectors with 85% QE
 - 12000 km of WLS fiber produced – enough to stretch across US twice
 - 3M gallons of mineral oil and scintillator blend
 - Delivering underground cavern safely and on schedule
- Will double the already highest beam power neutrino beam in the world

Electron neutrinos in NOvA prototype

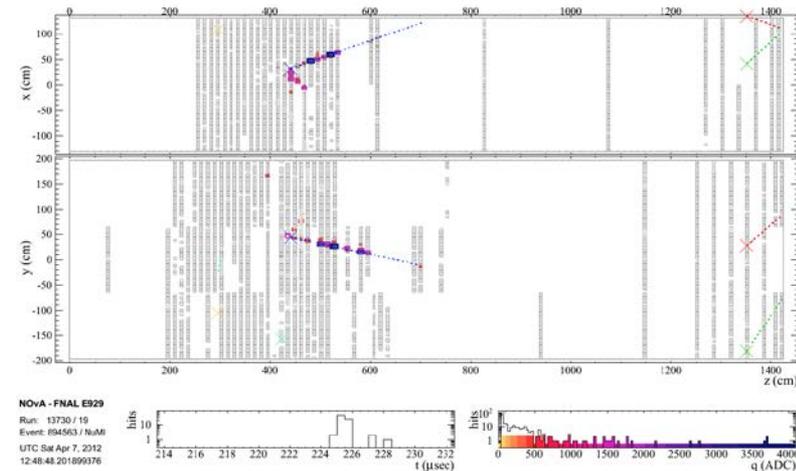
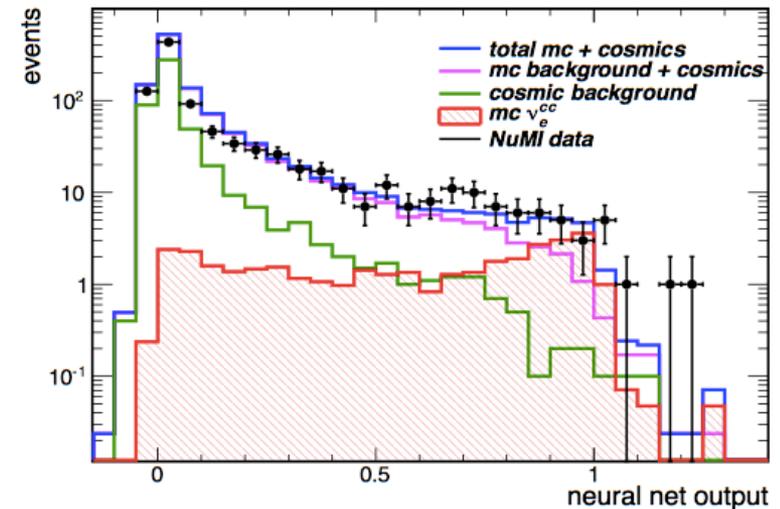
Ran it “as is”. Situation at NDOS is much harder than far detector will be

- Sparsely instrumented
- No overburden
- Large surface area / volume ratio
- Lower energy neutrino spectrum

Measured the electron neutrino component of the beam (data pulls away from magenta histogram)

Successful Operational Readiness Review (Feb. 8)

NOvA will work as planned !



Analysis of all milestones

L3 and lower are intentionally aggressive—it is not expected that a project will meet all these

Cumulative Tally as of 01Feb13
For Milestone Dates >= 12Apr07

| Count of Milestone Description | | |
|--------------------------------|-----------------|-------|
| Computed Status | Milestone Level | Total |
| Complete | L.0 | 2 |
| | L.1 | 7 |
| | L.2 | 27 |
| | L.3 | 23 |
| | L.4 | 46 |
| | L.5 | 324 |
| Complete Total | | 429 |
| Planned | L.0 | 1 |
| | L.1 | 4 |
| | L.2 | 7 |
| | L.3 | 5 |
| | L.4 | 36 |
| | L.5 | 224 |
| Planned Total | | 277 |
| Grand Total | | 706 |

| Level | Held By |
|-------|---|
| L.0 | DOE Acquisition Executive |
| L.1 | DOE OHEP Associate Director |
| L.2 | DOE Federal Project Director (Carolan) |
| L.3 | Fermilab Associate Director for Research (Bock) |
| L.4 | Nova Project Manager (Cooper) |
| L.5 | Other |

- **429 of 706 now complete**
 - 13 completed in January
- **Behind on 94**

Milestones since Jan 2008



Slipping/Missed Milestones as of 01Feb13

| Count of Milestone Description | | |
|--------------------------------|-----------------|-------|
| Computed Status | Milestone Level | Total |
| Planned | L.3 | 2 |
| | L.4 | 13 |
| | L.5 | 79 |
| Planned Total | | 94 |

Milestones Completed in January 2013

| Count of Milestone Description | | |
|--------------------------------|-----------------|-------|
| Computed Status | Milestone Level | Total |
| Complete | L.2 | 2 |
| | L.4 | 1 |
| | L.5 | 10 |
| Complete Total | | 13 |