



Accelerator & NuMI Upgrades Update

Paul Derwent

27 February 2013

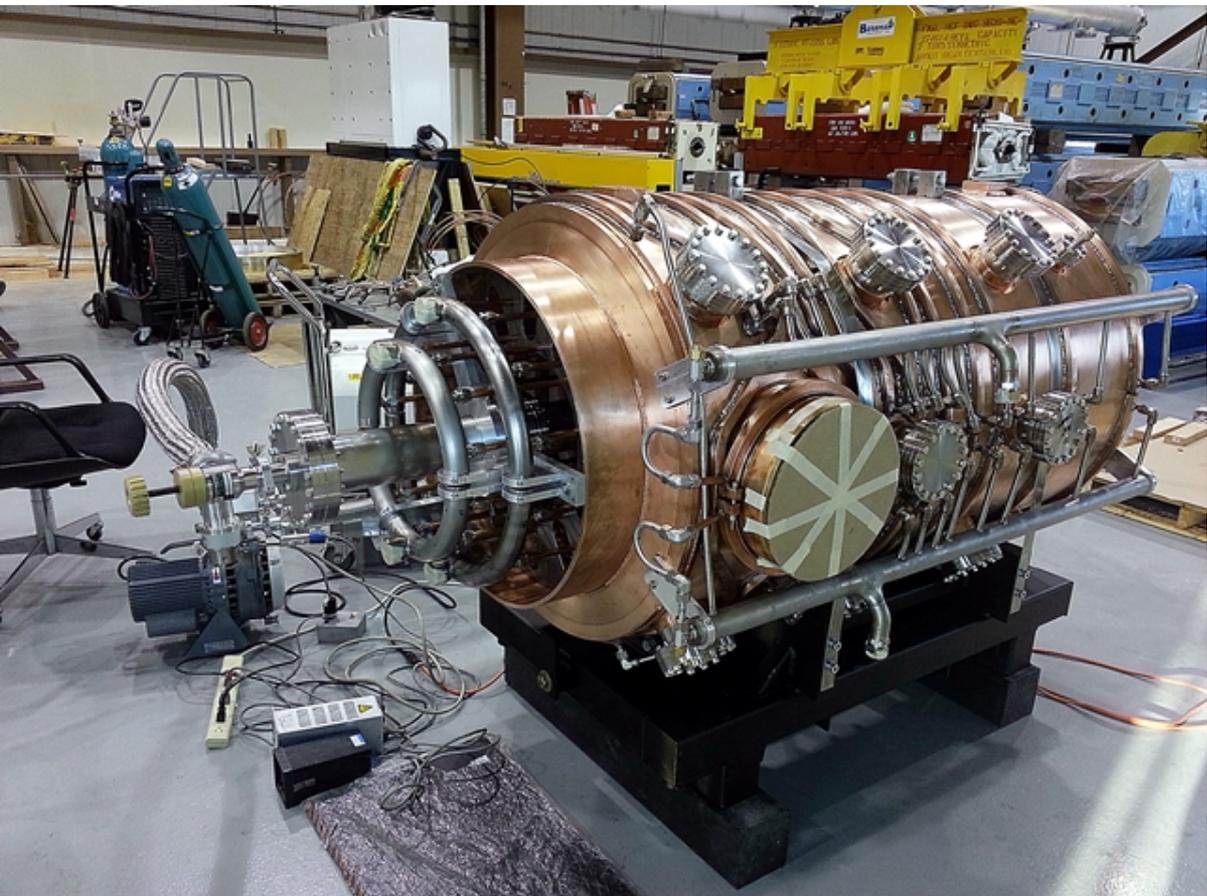


Remaining ANU Critical Path Hardware

- Remaining kickers are in fabrication
 - Long full turn RKB magnets in progress – fabrication complete February
 - Building 6, 4 required for beamline
 - 3 through HV testing, 4 through LV testing
- RF cavities:
 - First cavity ready for installation
 - 2nd cavity (Rising Son)
 - Into test cave for power tests: Low Voltage complete, High Voltage in progress
 - 3rd cavity (Phoenix) had major vacuum welds in June
 - Vacuum ports complete in December
 - Finishing on operations funds (hot spare)
- Beam Pipe & Vacuum components:
 - Injection line installation moving along
 - “Looking like a beamline”



RF Cavity status



Recycler RF #2

Recycler RF #1 Status

- **Ready for installation**

2nd Cavity (Rising Son) in Test Cave

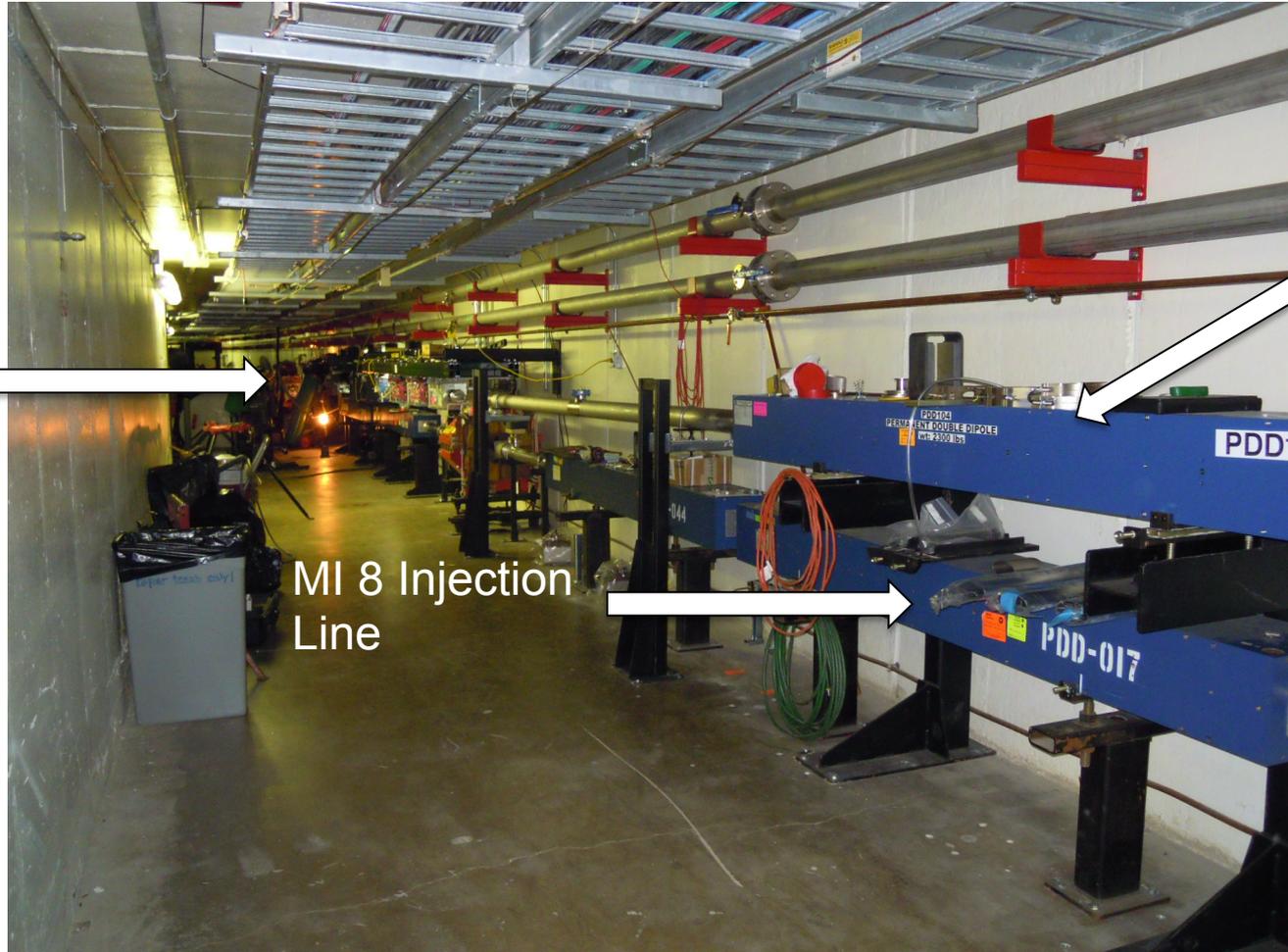
**Conditioned with 500 W
High Power tests underway**

**mounted on installation
cradle**

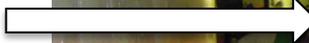


Injection line vacuum installation

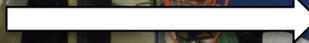
- Looking back towards the Booster, vertical switch magnet



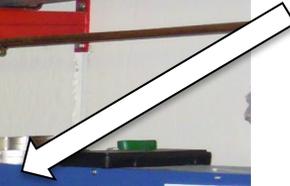
Vertical
Switch
Magnet



MI 8 Injection
Line



New
Recycler
Injection
Line





Preparing for RR30 installation

RR-30 straight:

Staged stands and other hardware in the tunnel in preparation for installation

Riggers started work February 18
2 Crews: Stand installation complete
Girder installation underway



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

Girders installed on the stands





RR 30 Installation



- Girders staged in tunnel
- First girder ready for installation

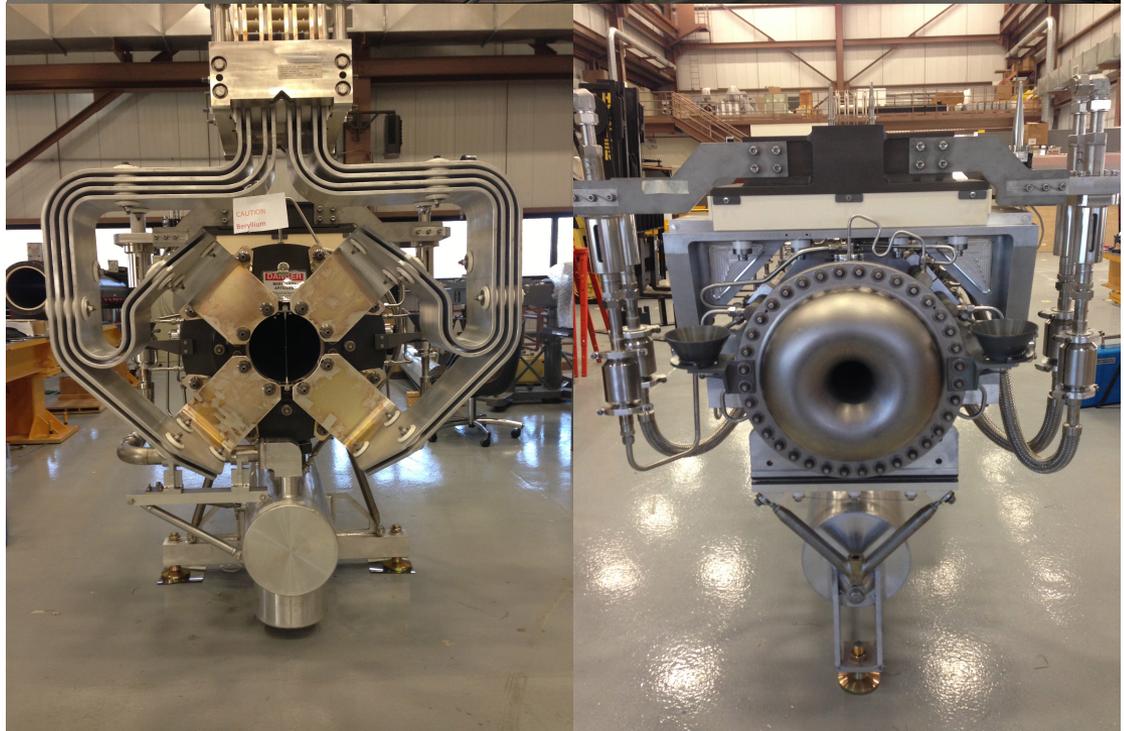
Alignment fixturing to speed installation





Target Hall installation

- Target & Horn 1
 - Horn 1 Installation almost complete
 - Horn 1 power testing, beam pipe window installation, dehumidification work in March
 - Target installation
 - 1 – 12 April
 - Target hall buttoned up and ready for beam by 26 April





Horn 1 Installation

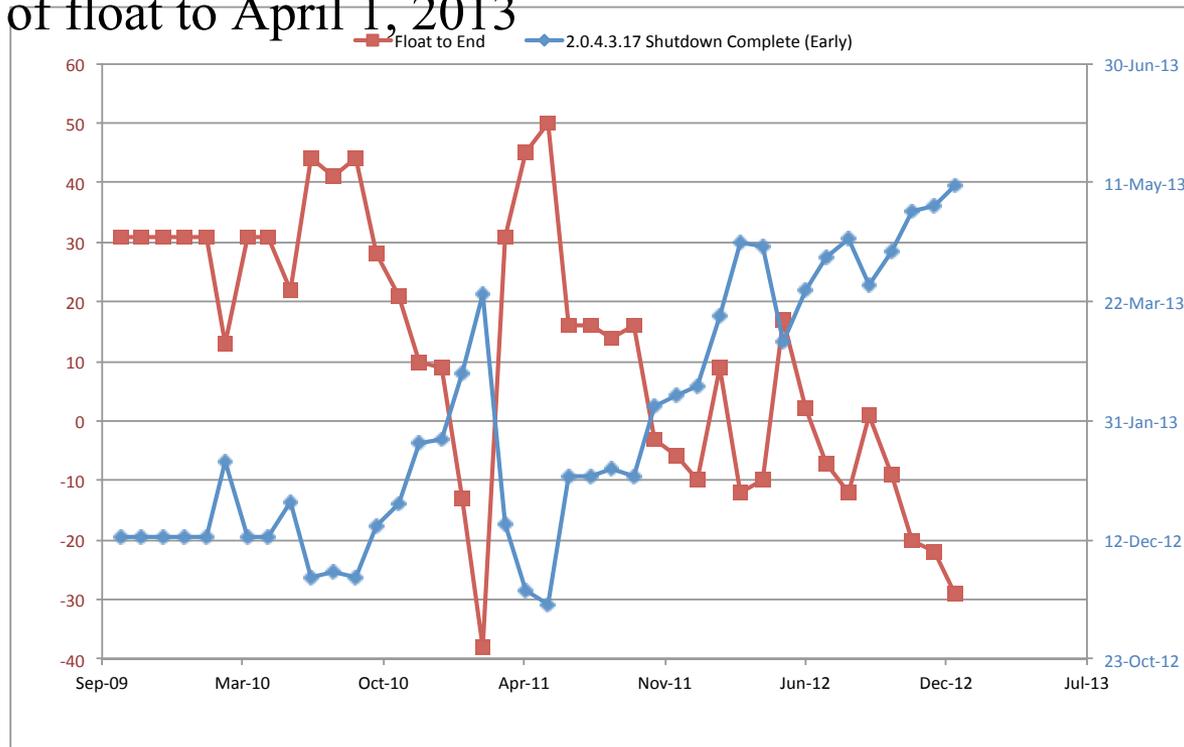
- Horn 1 and Module moving from work cell to installation position
- Shielding T blocks now in place, alignment underway





Shutdown float

- OpenPlan end of shutdown: May 10th (January Status)
 - Kicker Power Supply work in Service Building -> underway now
 - RR30 installation -> underway, alignment work may pick up a week or more here
 - RF Cavity -> Preparation work started last week
 - -29 days of float to April 1, 2013





January EVMS Performance

- CPR5: ACWP (\$961,133) BCWP \$94,612
 - CV: \$1,055,745
- 3rd RF Cavity work: moved off project, assigned to AD Equipment
 - (\$1.466M) in ACWP, (\$602,527) to BCWS and BCWP
- Correcting for 3rd RF Cavity:
- ACWP \$504,687, BCWP \$697,139
 - Positive CV for ANU: \$192,272
 - Best month in last year



Summary

- Shutdown work progressing
 - RR30 work underway in February
 - Horn 1 installation in February
 - Target in April – after beam pipe work in March
- No longer on schedule for 1 April 2013 completion
 - May 1 is current estimate
- Doing regular ETC
 - February estimate: minimal CV in next 3 months
 - looking for ways to recover costs



Additional information if necessary to discussion

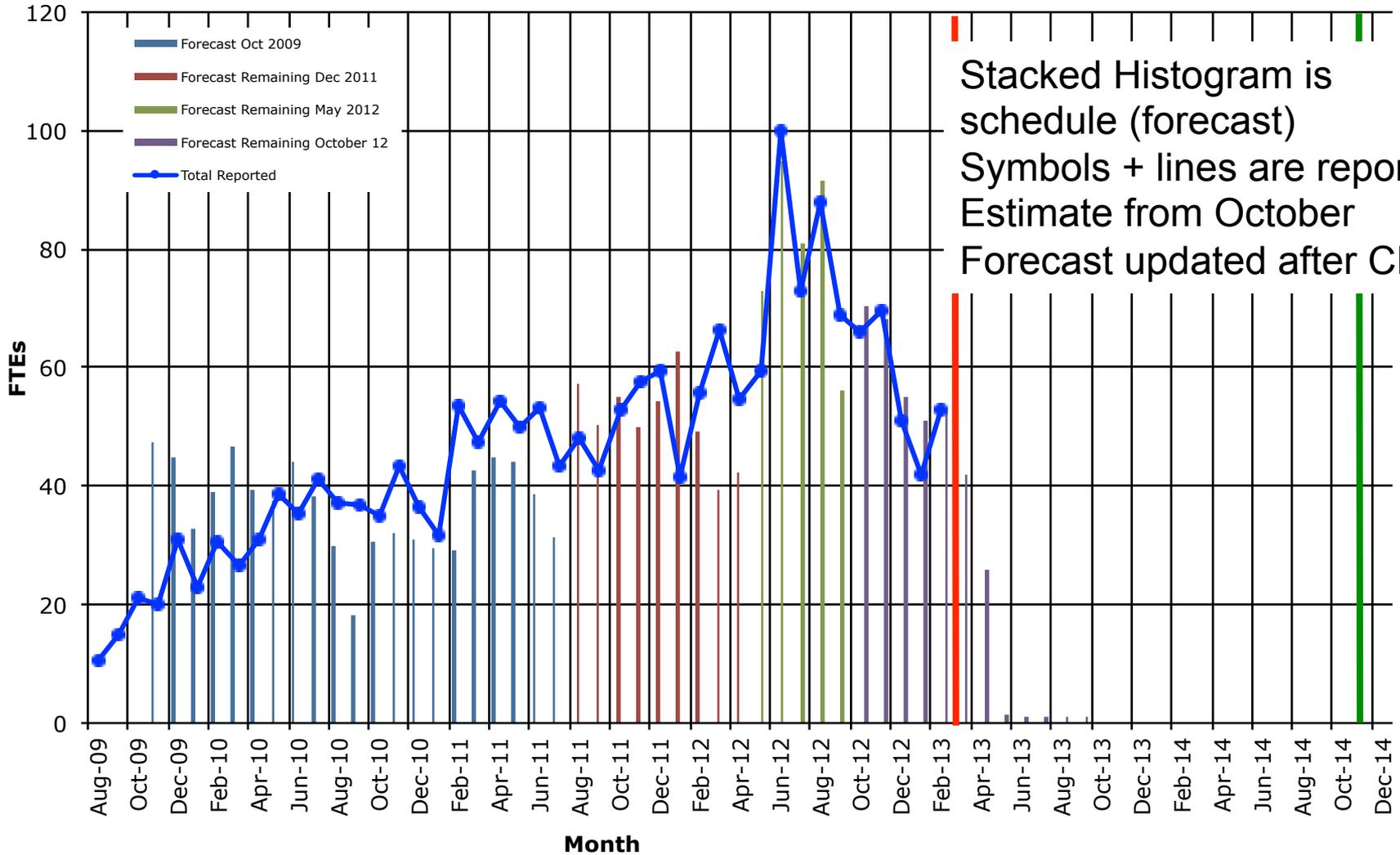
Aka Backups!



ANU Resource Requirements

Time Now

CD-4



FTE := 147.3 hours/month



Estimates to Complete

- November 14: started polling the L3/L4s in ANU on remaining budget vs remaining work
 - Showed them the budget and asked if it was enough
 - Results went into the McCluskey ETC assessment in December
- January 3: started another round with L3/L4s
 - Asked a different question: how much effort is required to complete the work?
 - Broke it down into 27 pieces and went to speak with responsible parties
 - Labor in major categories (techs, engineers, drafting, machining, welding, electricians, riggers)
 - Making a comparison between budget and estimate
 - A bottoms up estimate, with top down multipliers from me (in 10 of the 27 sections, 50-100%)
- February 4: another go-round with L3/L4s
 - Updating the January data

NB: week before
Lehman review!



Budget – Estimate Result

| | Tech Days | Welder Days | Electrician Days (or maybe pipefitters!) | Rigger Days | Engineering Days | |
|------------------------------------|-----------|-------------|--|-------------|------------------|-----------|
| total | 358 | (213) | (22) | (196) | 188 | |
| II Beam Pipe & Vacuum Installation | 5 | (15) | 0 | 0 | 0 | |
| MI 60 Staging Crew | 24 | 0 | 0 | 0 | 0 | |
| MI 60 Girder Work | (60) | (7) | 0 | 0 | 0 | |
| RR 30 Straight Installation | (33) | 0 | 0 | (212) | 5 | |
| EL Installation | 44 | 0 | 0 | (75) | 5 | |
| Multiwire/DCCT/Toroid fabrication | (28) | 7 | 0 | 0 | (2) | |
| DCCT Installation | 25 | 0 | 0 | 0 | 3 | |
| MI 614 Reconstruction | (8) | 0 | 0 | 0 | 0 | |
| RR 40 Vacuum | (33) | (2) | 0 | 0 | 0 | |
| RR RF Installation | 125 | (3) | 0 | 39 | 14 | |
| Damper Installation | 32 | (2) | 12 | 32 | 3 | |
| BPM Hardware Installation | (39) | 0 | 0 | 0 | (9) | |
| Vacuum Hardware & Prep | (107) | (204) | 0 | 0 | 3 | |
| RR RF cavity 1 Retrofit | (7) | 0 | 0 | 0 | 3 | |
| RR RF mid & hi level | (90) | 0 | 0 | 0 | (5) | |
| RR RF low level | 4 | 0 | 0 | 0 | 6 | |
| RR Water | 42 | (2) | 7 | 0 | 6 | |
| NuMI Water | 32 | 0 | 39 | 0 | 2 | |
| Recycler Shims | 66 | 0 | 0 | 0 | 0 | |
| Cable Pulls | 0 | 0 | (80) | 0 | 0 | |
| RKB Fabrication | 53 | 13 | 0 | 0 | 36 | |
| Kicker Power Supplies & Testing | 203 | (8) | 0 | 0 | 74 | |
| Installation Planning | (14) | 9 | 0 | 0 | (59) | |
| Target & Horn 1 Installation | 73 | 0 | 0 | 0 | 14 | |
| Target Hall Infrastructure | 19 | 0 | 0 | 20 | 14 | |
| Timing & Controls | (13) | 0 | 0 | 0 | 1 | |
| RBEX and Ramped Supplies | 56 | 0 | 0 | 0 | 71 | |
| Ramped Correctors | (13) | 0 | 0 | 0 | 3 | |
| Dollars? | \$264,554 | (\$231,432) | (\$21,302) | (\$239,281) | \$223,169 | (\$4,292) |
| value of a single day | \$740 | \$1,085 | \$980 | \$1,223 | \$1,185 | |

Balance to
\$4,292!!!
1 rigging
crew day



Budget for remaining tasks

| through January Status | Tech Days | Welder Days | Electrician Days | Rigger Days | Engineering Days | | M&S (loaded \$) | M&S (unloaded \$) |
|---|-------------|-------------|------------------|-------------|------------------|-------------|-----------------|-------------------|
| | | | | | | | | 1.16 |
| total | 2319.64375 | 29.6675 | 78.25625 | 299.375 | 580.335 | | \$284,751 | \$245,474.97 |
| II Beam Pipe & Vacuum Installation | 92.5 | | | | | | \$2,923 | \$2,519.61 |
| MI 60 Staging Crew | 204.375 | | | | 30 | | | |
| MI 60 Girder Work | 0 | | | | | | | |
| RR 30 Straight Installation | 183.125 | | | 58.125 | 5 | | \$11,833 | \$10,200.86 |
| EL Installation | 148.75 | | | 60 | 5 | | \$17,811 | \$15,354.31 |
| Multiwire/DCCT/Toroid fabrication | 1.5625 | 7.5 | | | 0.75 | | \$0 | |
| DCCT Installation | 63 | | | | 3.2 | | \$0 | |
| MI 614 Reconstruction | 0 | | | | | | \$0 | |
| RR 40 Vacuum | | | | | | | | |
| RR RF Installation | 292.5 | | | 129 | 14.25 | | \$30,204 | \$26,038.22 |
| Damper Installation | 92.25 | | 12 | 32.25 | 3 | | \$52,061 | \$44,880.17 |
| BPM Hardware Installation | 42 | | | | | | \$0 | |
| Vacuum Hardware & Prep | 2.64 | | | | 2.64 | | \$33,243 | \$28,657.67 |
| RR RF cavity 1 Retrofit (includes testi | 23.24 | 0 | | | 23.24 | | \$0 | \$0.00 |
| RR RF mid & hi level | 0 | | | | | | \$0 | |
| RR RF low level | 4.35 | | | | 41.1 | | \$0 | |
| RR Water | 69.91875 | | 7.41875 | | 15.58125 | | \$5,423 | \$4,675.00 |
| NuMI Water | 72.41875 | | 38.8375 | | 17.30625 | | \$30,003 | \$25,864.61 |
| Recycler Shims | 146.0625 | | | | | | \$0 | |
| Cable Pulls | | | 20 | | | | \$0 | |
| RKB Fabrication | 52.67 | 12.78 | | | 36.21125 | | \$19,211 | \$16,561.59 |
| Kicker Power Supplies & Testing | 345.5375 | | | | 186.03125 | | \$25,671 | \$22,130.17 |
| Installation Planning | 43.375 | 9.3875 | | | 23.85 | | \$0 | |
| Target & Horn 1 Installation | 172.99375 | | | | 37.96875 | | \$27,043 | \$23,312.97 |
| Target Hall Infrastructure | 94.1 | | | 20 | 15.3 | | \$5,028 | \$4,334.48 |
| Timing & Controls | 11.525 | | | | 16.00625 | | \$7,341 | \$6,328.71 |
| RBEX and Ramped Supplies | 136.25 | | | | 101.4 | | \$7,468 | \$6,438.15 |
| Ramped Correctors | 24.5 | | | | 2.5 | | \$9,487 | \$8,178.45 |
| Dollars? | \$1,715,875 | \$32,185 | \$76,667 | \$366,184 | \$687,672 | \$2,878,584 | | |
| value of a single day | \$740 | \$1,085 | \$980 | \$1,223 | \$1,185 | | | |



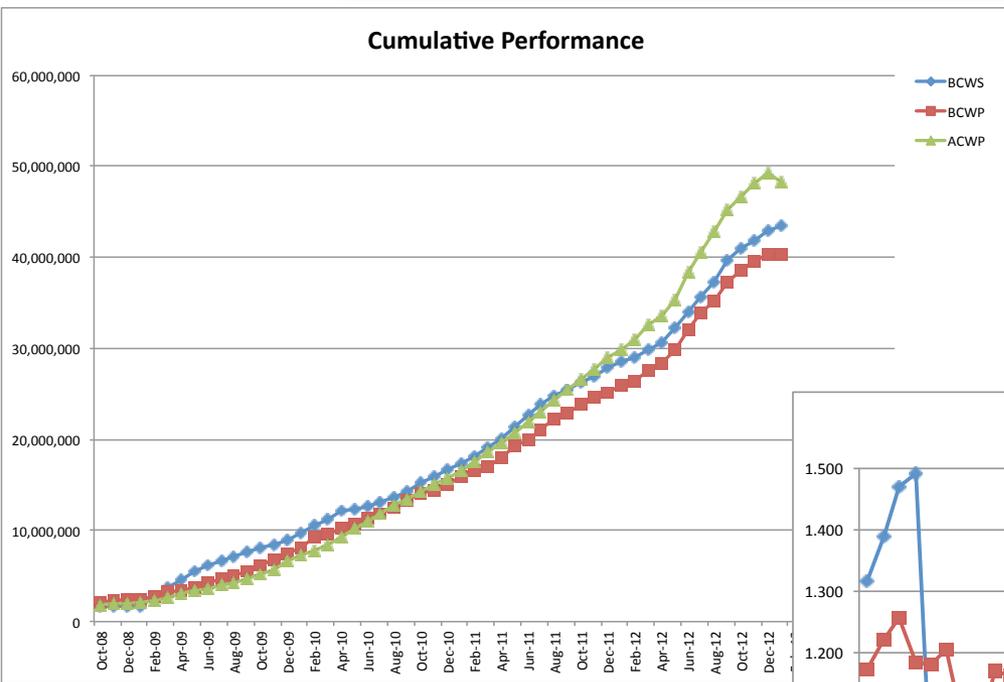
Estimates for remaining tasks

| | Tech Days | Welder Days | Electrician Days | Rigger Days | Engineering Days | | January comment | scale factor | February Comment |
|------------------------------------|-------------|-------------|------------------|-------------|------------------|-------------|-------------------------------|--------------|--|
| total | 1962 | 243 | 100 | 495 | 392 | | | | |
| II Beam Pipe & Vacuum Installation | 88 | 15 | | | | | | | had 24 welder days in my notes but only 15 in the column? Leave it for now. Did maybe 1.5 weeks of the 5 estimated, still have to leave the electrical and water connections |
| MI 60 Staging Crew | 180 | | | | 30 | | | | remove 3 techs*20days |
| MI 60 Girder Work | 60 | 7 | | | | | | | remove 2 techs*20 days |
| RR 30 Straight Installation | 216 | | | 270 | | | 50% more | 1.5 | no change, riggers in February! |
| EL Installation | 105 | | | 135 | | | 50% more | 1.5 | no change, riggers in February! |
| Multiwire/DCCT/Toroid fabrication | 30 | 0.5 | | | 3 | | using Sep-Nov and extrapolate | | using Nov-Jan, multiply by 0.5 as things are supposed to be done! and extrapolating Feb-April (probably still an overestimate) |
| DCCT Installation | 38 | | | | | | | | no change, even though we did a little work |
| MI 614 Reconstruction | 8 | | | | | | | | magnet in place, still have to finish hookups |
| RR40 Vacuum | 33 | 2 | | | | | | | missed this last month! Check with Chris on work done with loads and fluorinert |
| RR RF Installation | 168 | 3 | | 90 | | | 50% more | 1.5 | no change, prep work started 1st week of February |
| Damper Installation | 60 | 2 | | | | | | | no change |
| BPM Hardware Installation | 81 | | | | 9 | | double | 1.5 | did the first house first week of February - 3 techs, 3 days + 1 eng day/house. Was 11 tech + 1 eng day/house and doubled, so now use 11+1 and factor of 1.5! |
| Vacuum Hardware & Prep | 110 | 204 | | | | | double | 2 | Linda estimates 50 days tech time left, welding still the same. Not much reduction in the machinist time...maybe 5 days |
| RR RF cavity 1 Retrofit | 30 | 0 | | | 20 | | | | finished cavity 1 work, got cavity 2 in cave, still have installation setup/checkout |
| RR RF mid & hi level | 90 | | | | 5 | | | | upstairs work: 11 days charged, so take off 10 |
| RR RF low level | | | | | 35 | | | | charged 30 days so far, take off 20 |
| RR Water | 28 | 2 | | | 10 | | | | no change |
| NuMI Water | 40 | | | | 15 | | | | no change, most work starting in February |
| Recycler Shims | 80 | | | | | | | | no change, will be taking place in February |
| Cable Pulls | | | 100 | | | | | | no change to previous work, some added (10 days for the fiber optic pull and M18 acnet pull) |
| RKB Fabrication | 0 | | | | 0 | | | | no change |
| Kicker Power Supplies & Testing | 142.5 | 7.5 | | | 112.5 | | 50% more | 1.5 | Chris updates: lots of details in an email, note that remaining work still has 1.5 factor applied |
| Installation Planning | 57 | | | | 82.5 | | 50% more dr | 1.5 | charged 25 days of drafting, 18 days of engineering. Linda estimates 38 days of drafting (22) and 55 (15) of engineering left. Still going to leave the 1.5 piece there |
| Target & Horn 1 Installation | 100 | | | | 24 | | guess hadron monitor at s | | no change |
| Target Hall Infrastructure | 75 | | | | 1 | | double this | 2 | charged 2.5 days engineering, 0.5 day machinist, 5 days of technician. Subtract tech and 2 days of engineer |
| Timing & Controls | 25 | | | | 15 | | double this | 2 | performed about 1/2 of the remaining work (from end of December), so take 1/2 |
| RBEX and Ramped Supplies | 80 | | | | 30 | | | | was 2 techs and 1 engineer full time for 10 weeks, chop 4 weeks off that (charged 5 weeks EE and tech in last 5) |
| Ramped Correctors | 37.5 | | | | | | extrapolate D Kihlken from | | take 3/4 of previous estimate |
| Dollars? | \$1,451,321 | \$263,617 | \$97,970 | \$605,466 | \$464,503 | \$2,882,876 | | | |
| value of a single day | \$740 | \$1,085 | \$980 | \$1,223 | \$1,185 | | | | |

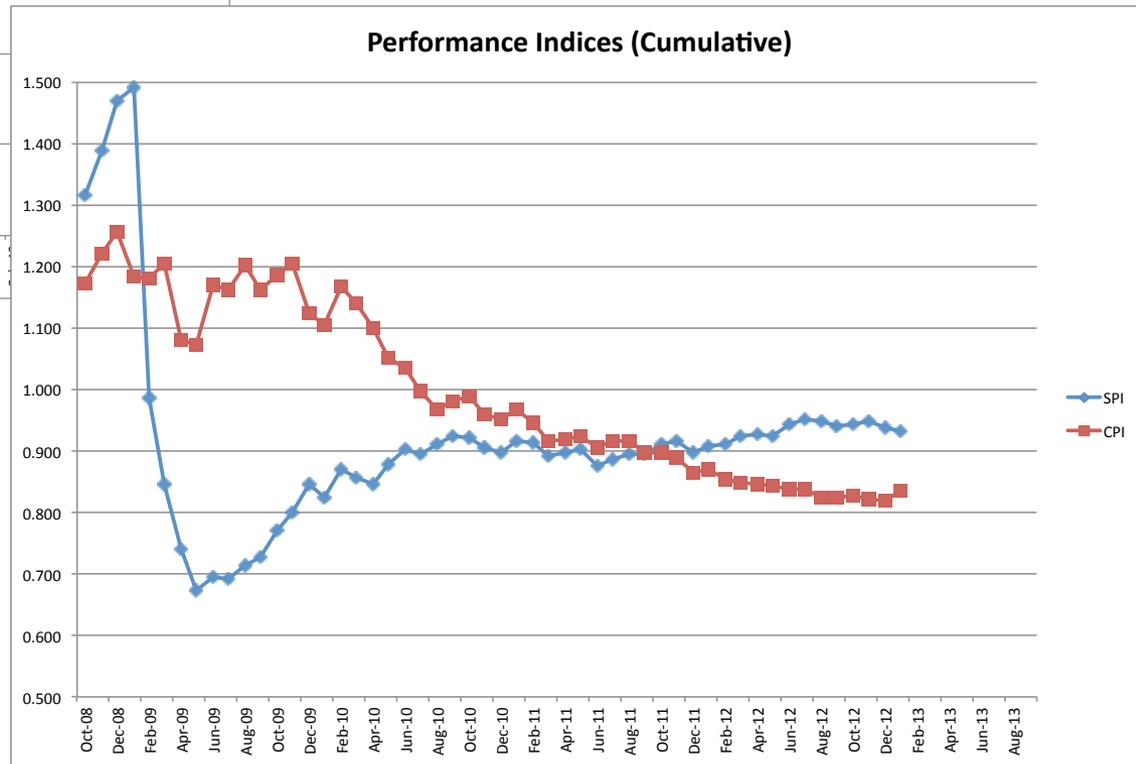


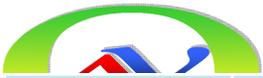
EVMS Performance

Cumulative Performance



Performance Indices (Cumulative)



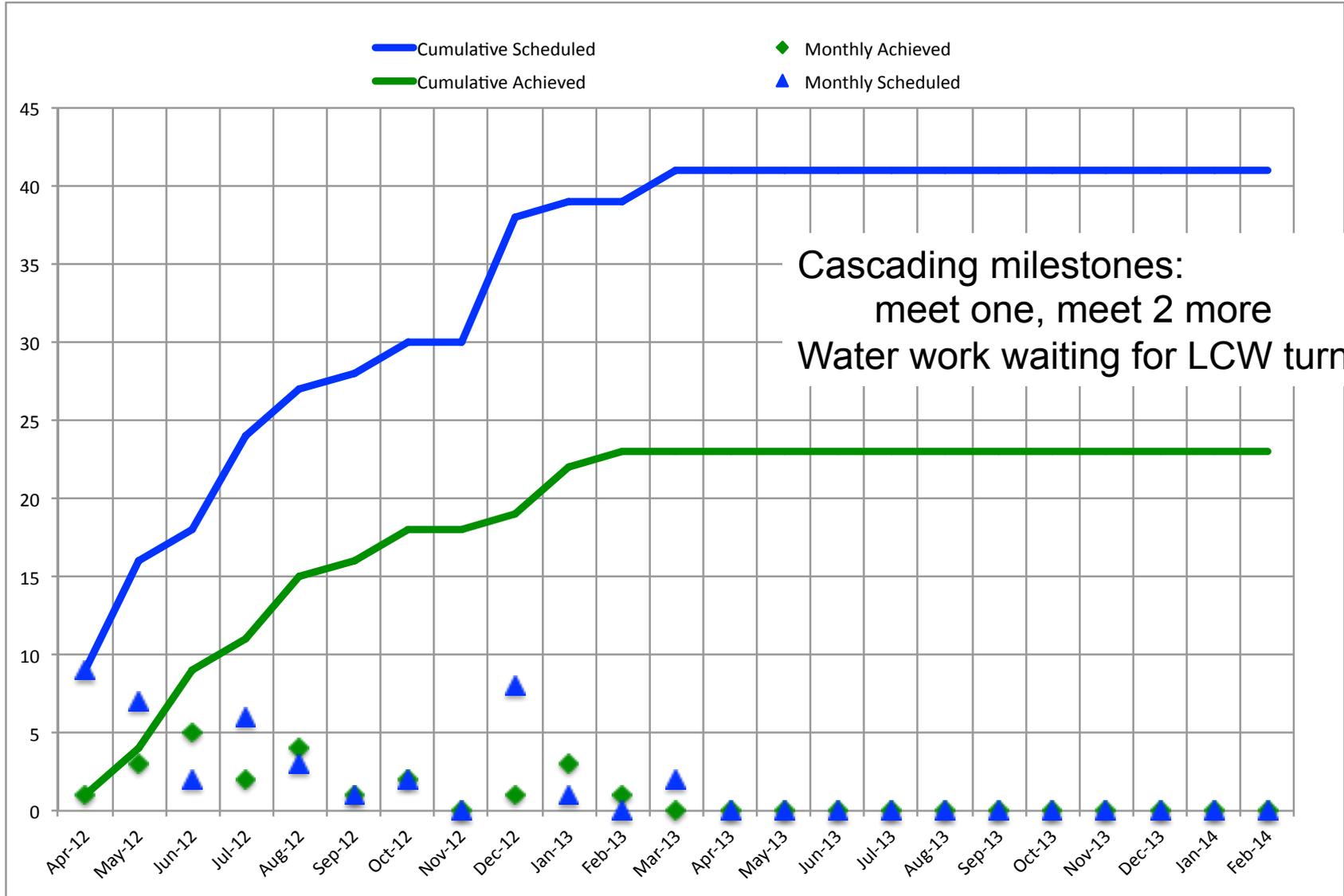


EVMS Performance

| Month | BCWS | BCWP | ACWP | SPI | SV (\$) | CPI | CV (\$) |
|---------------------|--------------|--------------|--------------|--------|-----------|--------|-------------|
| Oct-11 | \$452,944 | \$616,798 | \$716,328 | 1.36 | 347,719 | 0.86 | (118,116) |
| Nov-11 | \$732,319 | \$834,344 | \$1,178,574 | 1.14 | 102,025 | 0.71 | (344,231) |
| Dec-11 | \$1,017,305 | \$369,795 | \$1,274,208 | 0.36 | (647,510) | 0.29 | (904,412) |
| Jan 12 | \$581,113 | \$860,305 | \$805,092 | 1.48 | 279,192 | 1.069 | 56,587 |
| Feb-12 | \$561,330 | \$544,809 | \$1,180,131 | 0.97 | (16,521) | 0.46 | (635,322) |
| Mar-12 | \$759,409 | \$1,128,324 | \$1,541,540 | 1.49 | 368,914 | 0.73 | (413,216) |
| Apr-12 | \$845,830 | \$820,307 | \$1,041,863 | 0.97 | (25,523) | 0.79 | (221,555) |
| May-12 | \$1,561,287 | \$1,372,793 | \$1,757,983 | 0.88 | (188,494) | 0.78 | (385,190) |
| Jun-12 | \$1,785,348 | \$2,327,656 | \$3,027,918 | 1.30 | 542,308 | 0.77 | (700,263) |
| Jul-12 | \$1,624,540 | \$1,762,817 | \$2,084,021 | 1.09 | 138,277 | 0.85 | (321,203) |
| Aug-12 | \$1,534,787 | \$1,361,180 | \$2,360,712 | 0.89 | (173,607) | 0.58 | (999,532) |
| Sep-12 | \$2,426,730 | \$2,035,864 | \$2,341,862 | 0.84 | (390,866) | 0.87 | (305,998) |
| FY12 | \$14,097,119 | \$14,433,033 | \$19,725,484 | 1.02 | 335,914 | 0.73 | (5,292,451) |
| Oct-12 | \$1,353,600 | \$1,320,683 | \$1,552,026 | 0.98 | (32,917) | 0.85 | (231,343) |
| Nov-12 | \$834,116 | \$996,748 | \$1,412,398 | 1.195 | 162,632 | 0.71 | (415,650) |
| Dec-12 | \$1,126,838 | \$688,935 | \$1,127,111 | 0.611 | (437,903) | 0.611 | (438,176) |
| Jan-13 | \$429,442 | \$94,612 | (\$961,133) | 0.220 | (334,830) | -0.098 | 1,055,745 |
| Jan-13 Corrected | \$1,031,527 | \$697,139 | \$504,867 | .0.676 | (334,830) | 1.381 | 192,272 |



Remaining milestones



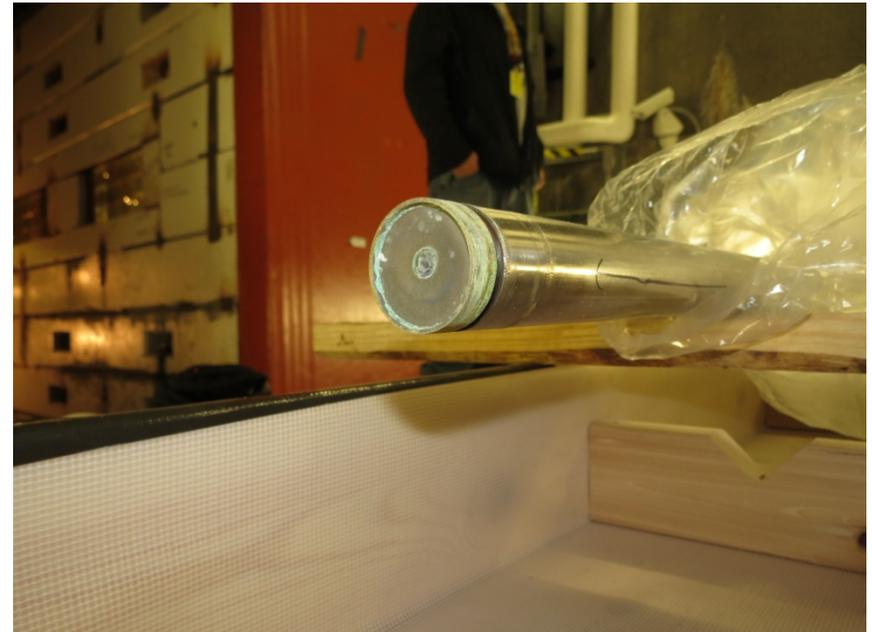
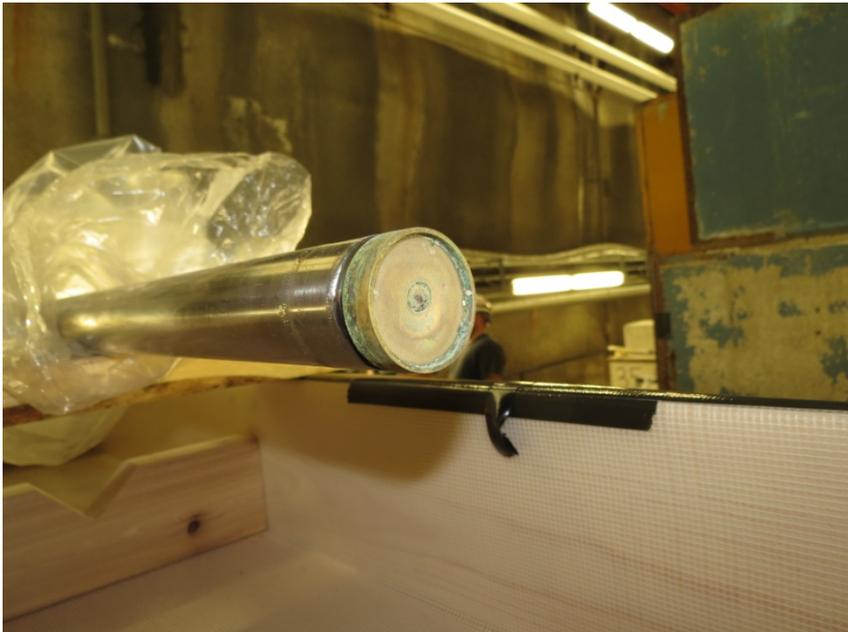
Cascading milestones:
meet one, meet 2 more
Water work waiting for LCW turn on



Target Beryllium Window Vacuum Leak

Corrosion and radiation damage?

Leak was on the weld between Be and Steel



Rework of the spare window/beam pipe piece before reinstallation
Not a project job, supported by AD maintenance but necessary to complete
before we can run beam to the target