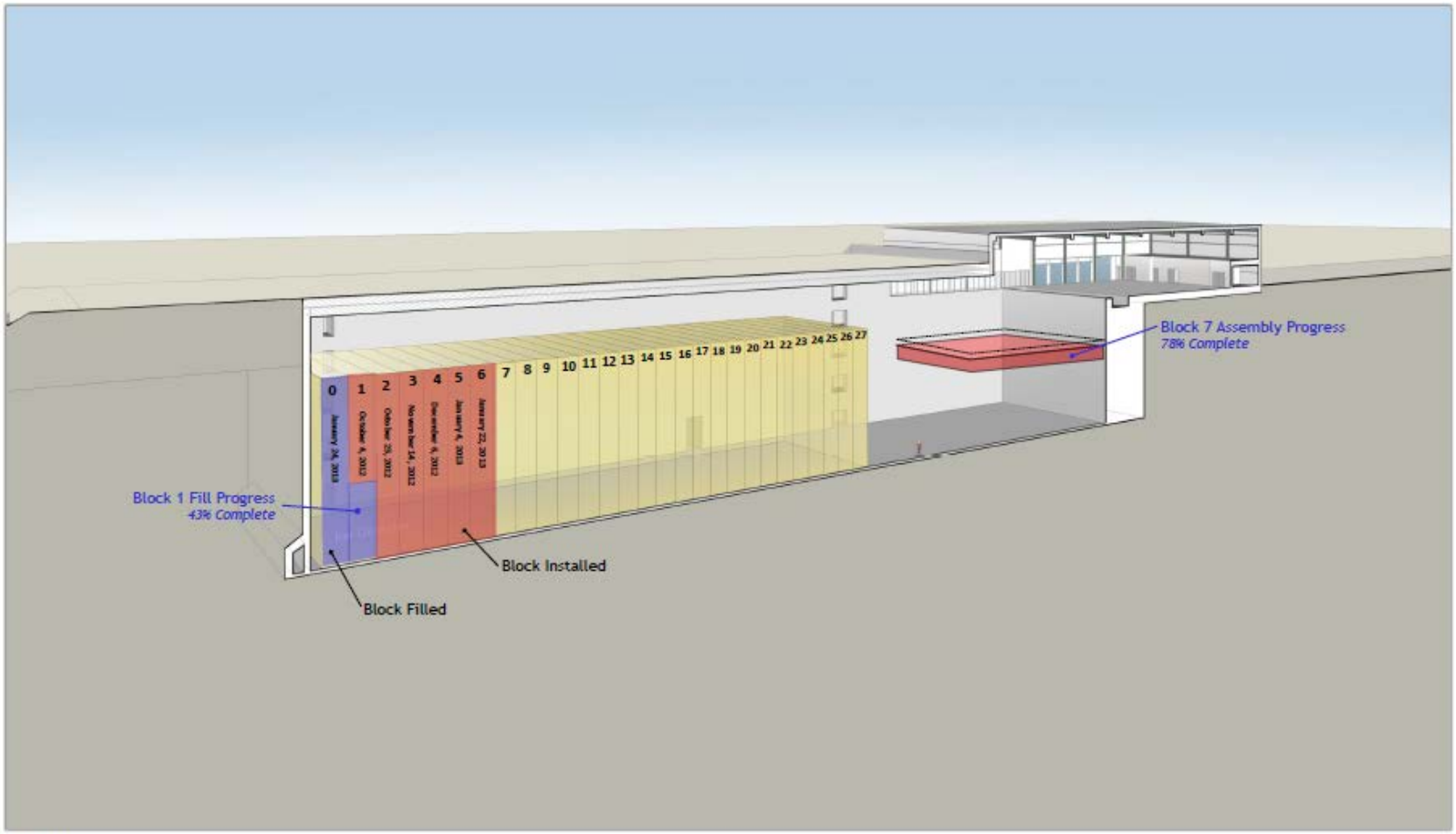
NOvA Weekly Update

John Cooper

The Intensity Frontier

NOvA Far Detector Assembly Progress



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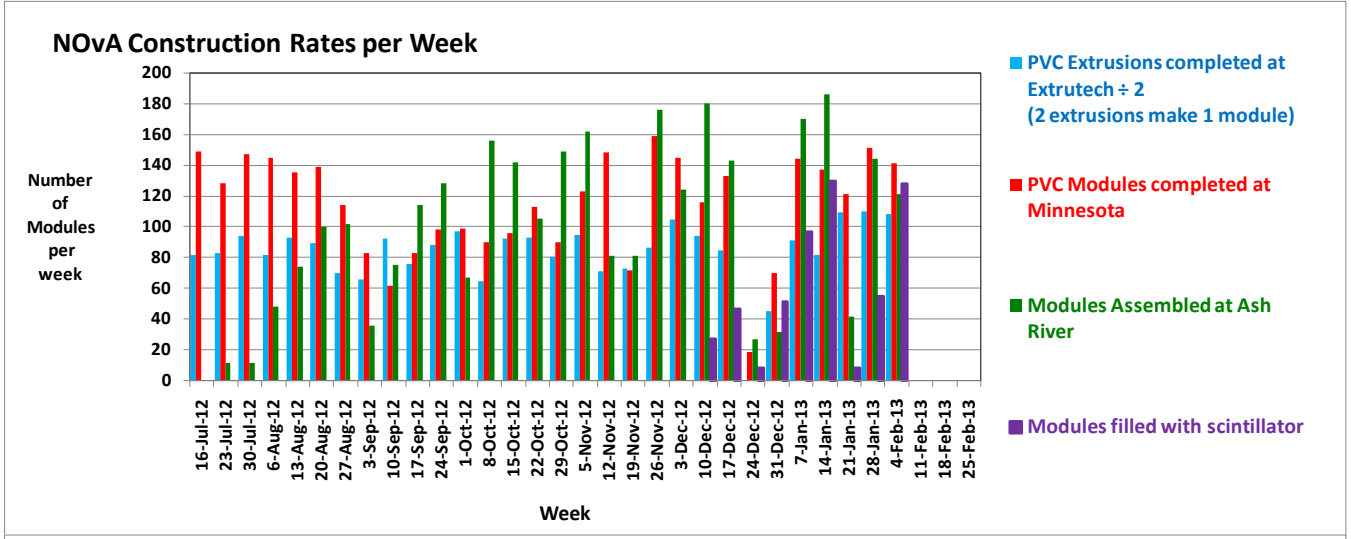
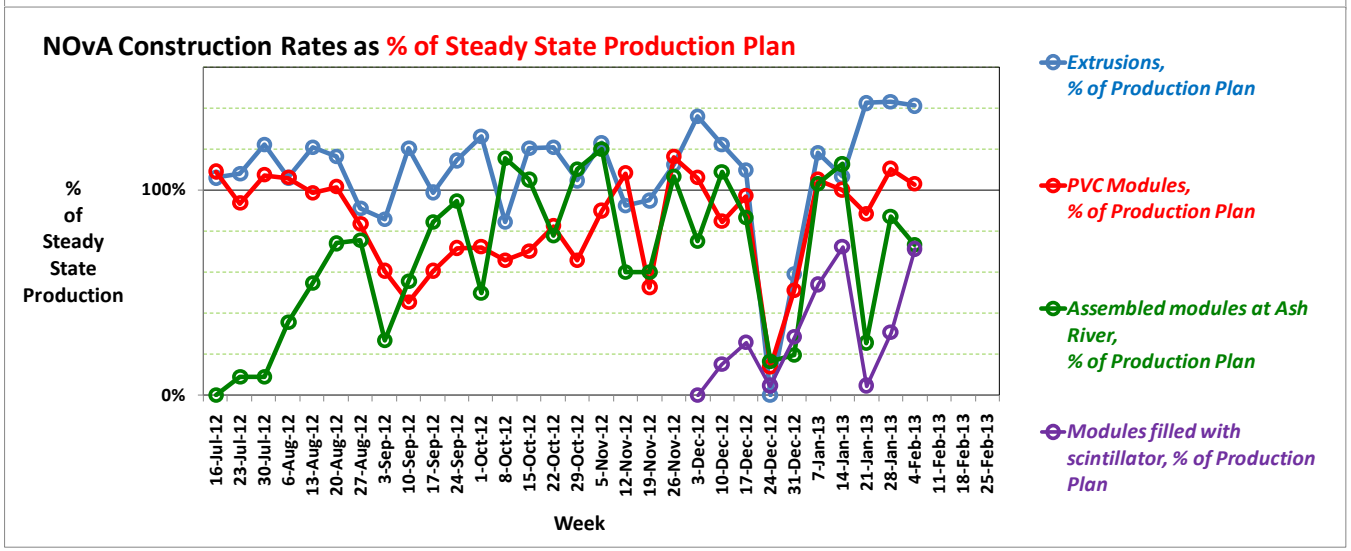
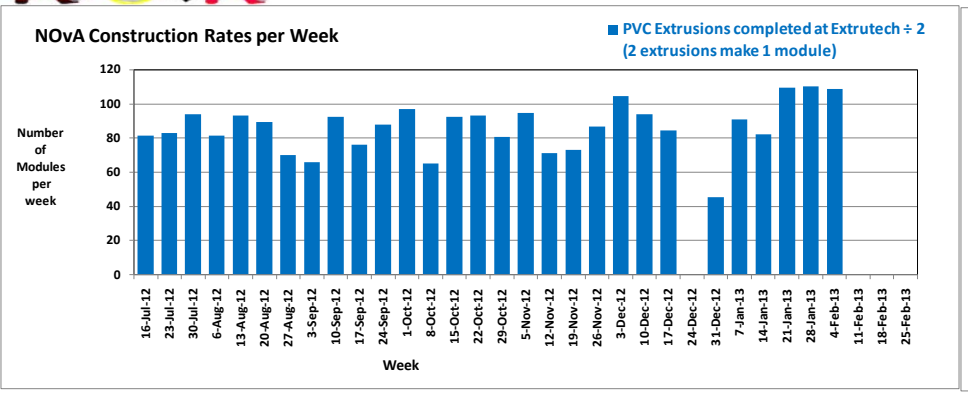
NOvA Weekly Progress

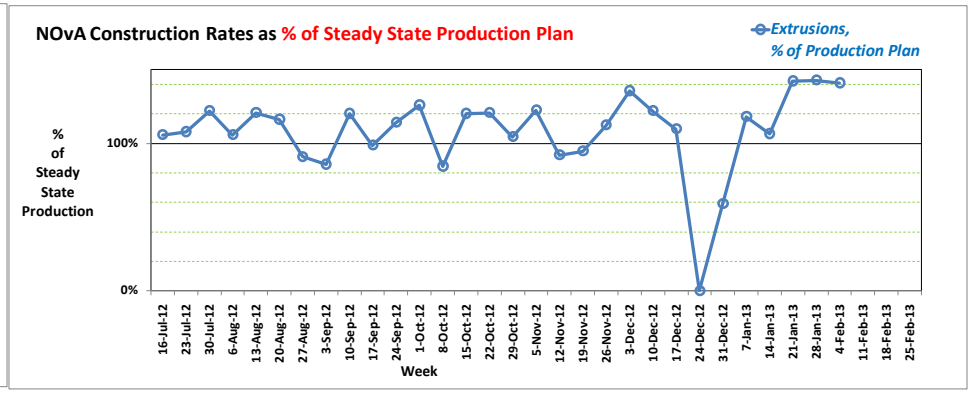




- PVC extrusions: **217** (141% of planned rate)
- PVC modules: **141** (103%)
- Ash River modules: **121**(73%)
- Ash River scintillator: **128** (71%)

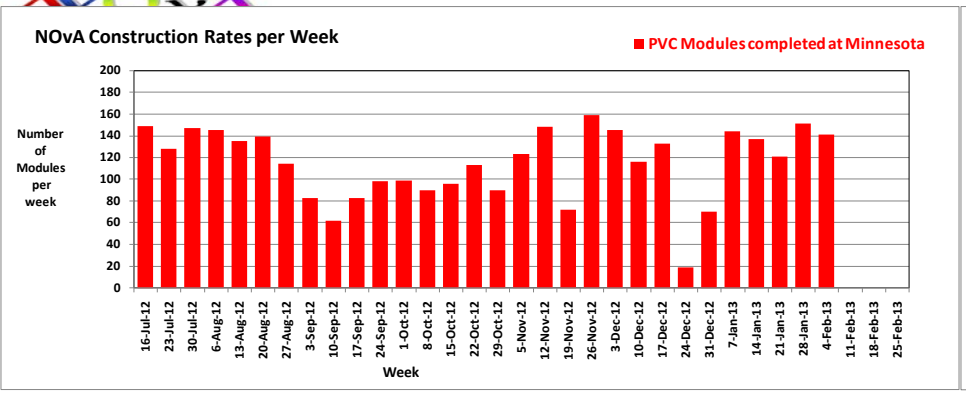
NOvA Weekly Progress: Extrusions

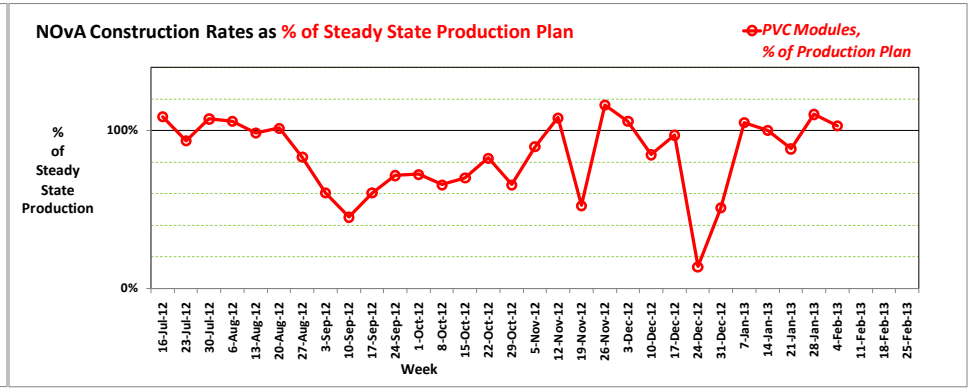




- Overall: Extrusions generally > the planned rate
  - 217 extrusions last week, 141% of planned rate
    - 11 better than last week.
    - Recall 14 in last week's total were reclassified from earlier production
  - Extrutech continues 6 day by 24 operations

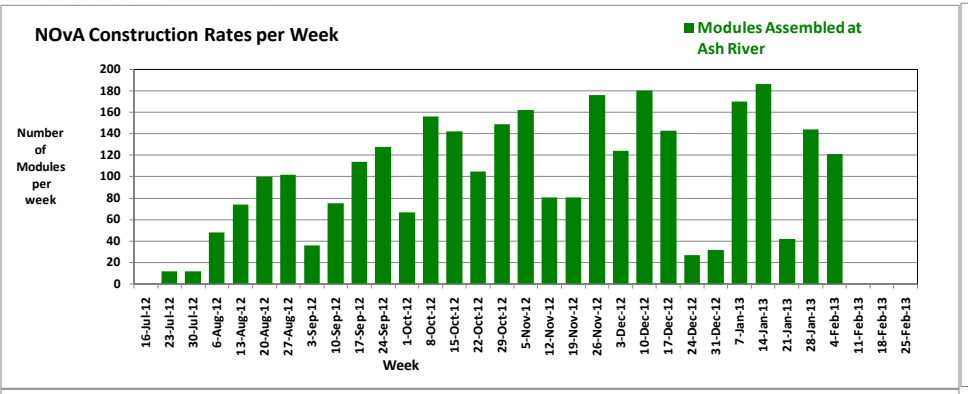
NOvA Weekly Progress: Modules

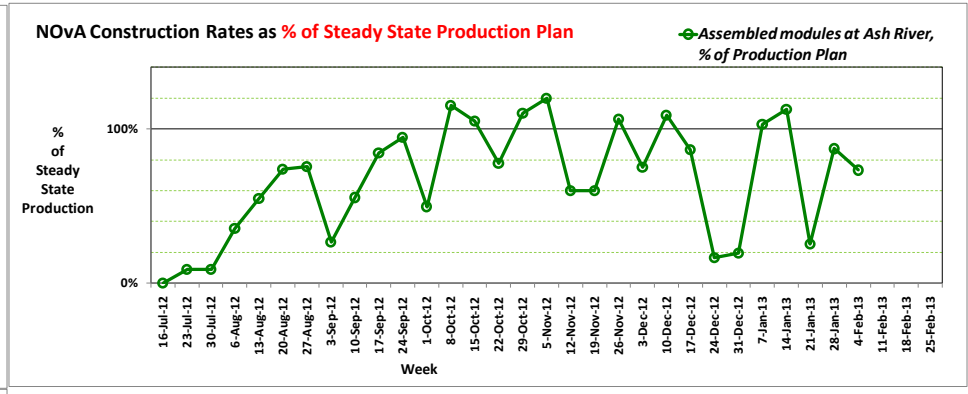


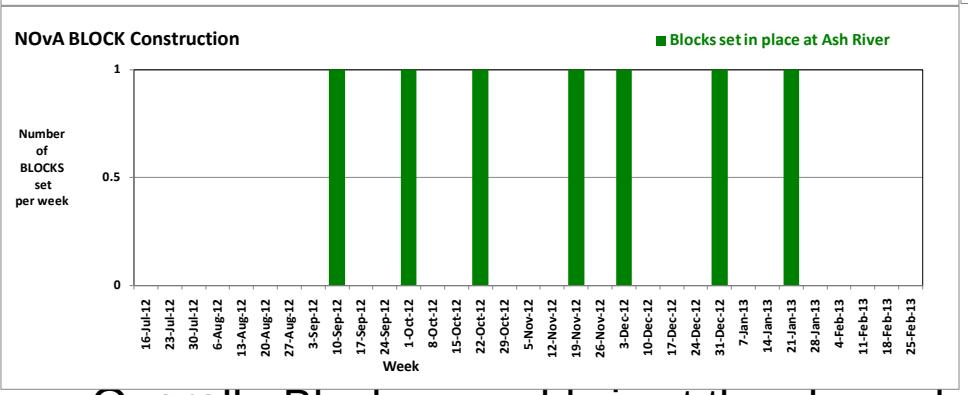


- Overall: Module production back to the planned rate after Fall Semester startup with part-time vs. summer full-time students
  - 141 modules produced last week, 103% of planned rate
- Module production failure rate is now **1.1%** integrated over production since October 15, 2012. (goal is < 2%)

Weekly Progress: Modules at Ash River



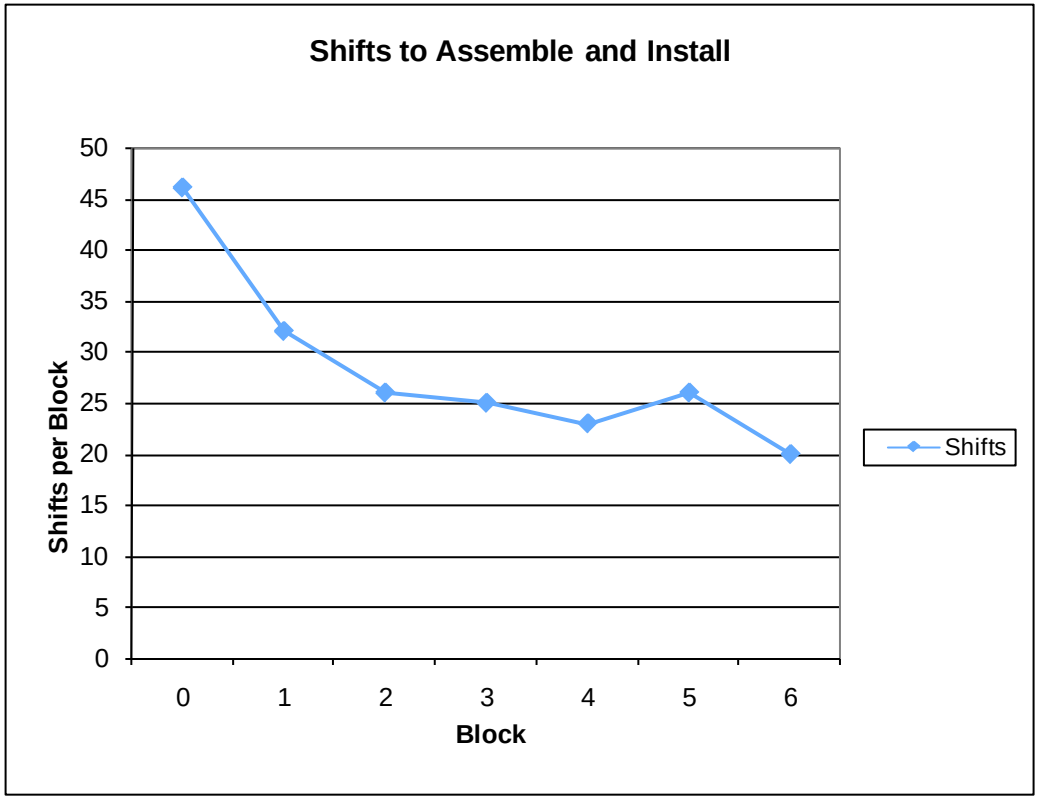




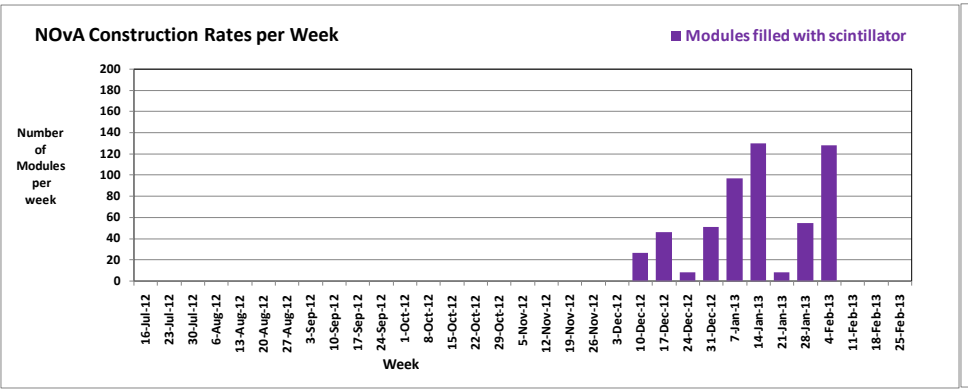
- Overall: Block assembly is at the planned rate, except when setting a completed block
  - 121 modules set in place last week, 73% of planned rate
  - Continued trouble-shooting with the adhesive machine from problems the previous week.
    - Changed procedure: More frequent replacement of O-rings on the "Follow plate" in the 55 gal. barrels. Removed a work-around. Back to normal rate after 1 lost shift.
    - Pressure gauge instrumentation led to the conclusion that one of the barrel pump assemblies needs to be rebuilt. We have the parts in hand and will do this work while the next block (#8) is being set by the Pivoter. This should be next Wed, Feb 13.
  - Down 50% of another shift due to a scissor lift problem
  - See next slide for Block assembly rate vs. time

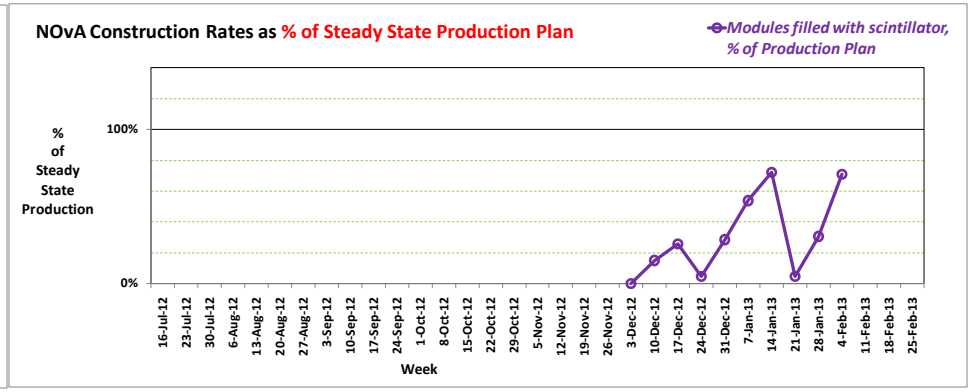
Block Assembly Rate history

- Shifts to assemble and install vs. Block #
  - **Baseline is 21 shifts per block**, including time to take it down the hall and set it.
  - Block #5 slow due to winch cable re-design
  - **Block #6 done on January 22 in 20 Shifts, better than Baseline**
  - But Block #7 will be late due to adhesive dispenser problem



Weekly Progress: Scintillator Filling





- Overall: Filling started the week of Dec 10, still working up to the steady state plan
  - Gallons filled equivalent to 128 modules this week (31,000 gallons), 71% of plan.
  - This week was spent filling the horizontals on the 2nd block.
    - Filling faster than before
    - This week was with 4 fill machines and did as many gallons in one shift as was done a few weeks ago with 6 fill machines. So going 50% faster.
- **NO LEAKS !**
  - 70 gallons in vent line overflow container due to overfilling
- 3rd 100,000 gallon blend complete and QA'd at Wolf Lake, ready for shipment

Scintillator Filling

- Filling scheme
  - We fill all horizontals not quite full (orange),
  - then all verticals really full (green),
  - then go back to topping off horizontals (spotty green part)
- The reason for topping off is to let air bubbles percolate through the horizontals before filling right to the top.

Block 01

Vertical Modules

Position	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
0																
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																

Horizontal Modules

Position	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
11																
10	249	241	238	236	240	248	250	203	244	250	248	225	248	245	250	167
9	247	247	243	235	242	243	246	247	242	247	248	239	249	249	243	249
8	243	243	241	238	245	248	245	247	246	247	235	243	252	242	249	249
7	244	249	249	246	250	247	251	246	244	246	247	242	249	249	239	249
6	243	250	241	240	248	249	247	247	245	246	244	253	251	251	245	251
5	250	242	237	248	241	247	246	247	246	247	244	**122**	251	252	249	251
4	246	245	246	245	251	250	249	246	244	245	242	245	252	251	250	250
3	247	**246**	242	245	246	**246**	247	248	247	**246**	232	247	**246**	**246**	241	249
2	246	245	239	246	248	250	247	249	247	227	228	250	250	250	247	252
1	248	239	244	248	242	246	247	249	246	234	226	245	250	247	246	250
0	247	240	238	241	238	249	245	240	249	227	241	195	249	250	245	250

Block 00

Vertical Modules

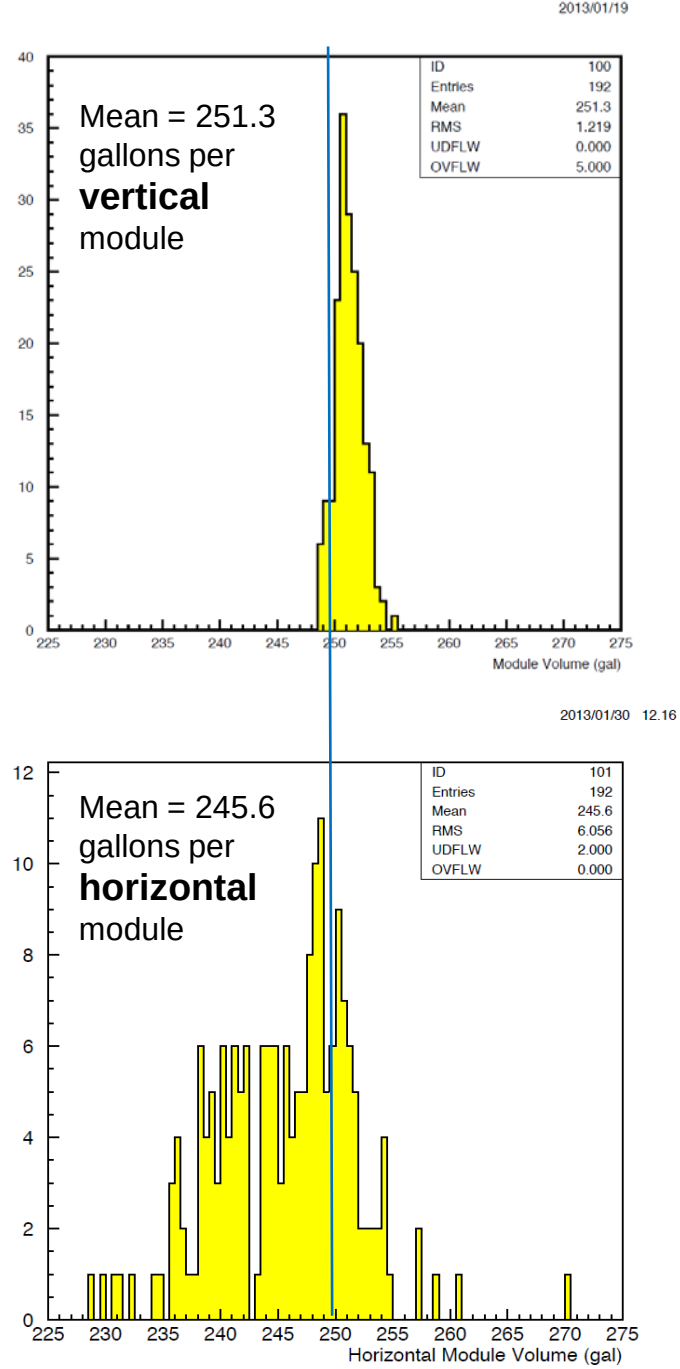
Position	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
0	252	252	252	252	252	252	252	252	252	252	252	252	311	252	252	252
1	252	252	252	252	252	252	252	252	252	252	252	252	366	252	252	252
2	252	252	252	252	252	252	252	252	252	252	252	252	252	288	252	252
3	252	252	252	252	252	252	255	252	252	252	252	252	252	252	252	252
4	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
5	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
6	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
7	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
8	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
9	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
10	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252	252
11	252	252	252	252	252	252	343	252	252	252	252	252	252	382	252	252

Horizontal Modules

Position	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
11	249	245	249	236	229	231	248	242	229	236	245	235	245	244	246	243
10	248	251	241	237	249	242	244	250	217	231	241	244	241	239	250	249
9	252	251	248	270	246	239	238	244	238	234	244	261	247	242	254	259
8	247	248	249	215	245	240	248	244	239	235	239	244	251	243	254	251
7	248	248	246	241	246	241	242	245	242	239	249	249	254	250	253	252
6	248	236	249	239	242	239	247	250	238	242	247	241	239	242	246	251
5	248	238	247	237	245	254	236	244	221	248	250	248	240	248	250	253
4	251	240	249	232	240	249	245	249	240	240	249	250	247	246	250	252
3	238	241	250	244	250	240	244	249	244	249	247	242	244	249	246	251
2	238	249	251	252	250	240	248	251	255	239	236	238	240	251	251	250
1	248	248	246	251	248	245	251	253	247	236	249	251	247	251	253	254
0	247	246	248	244	252	241	244	246	243	237	249	248	245	250	257	254

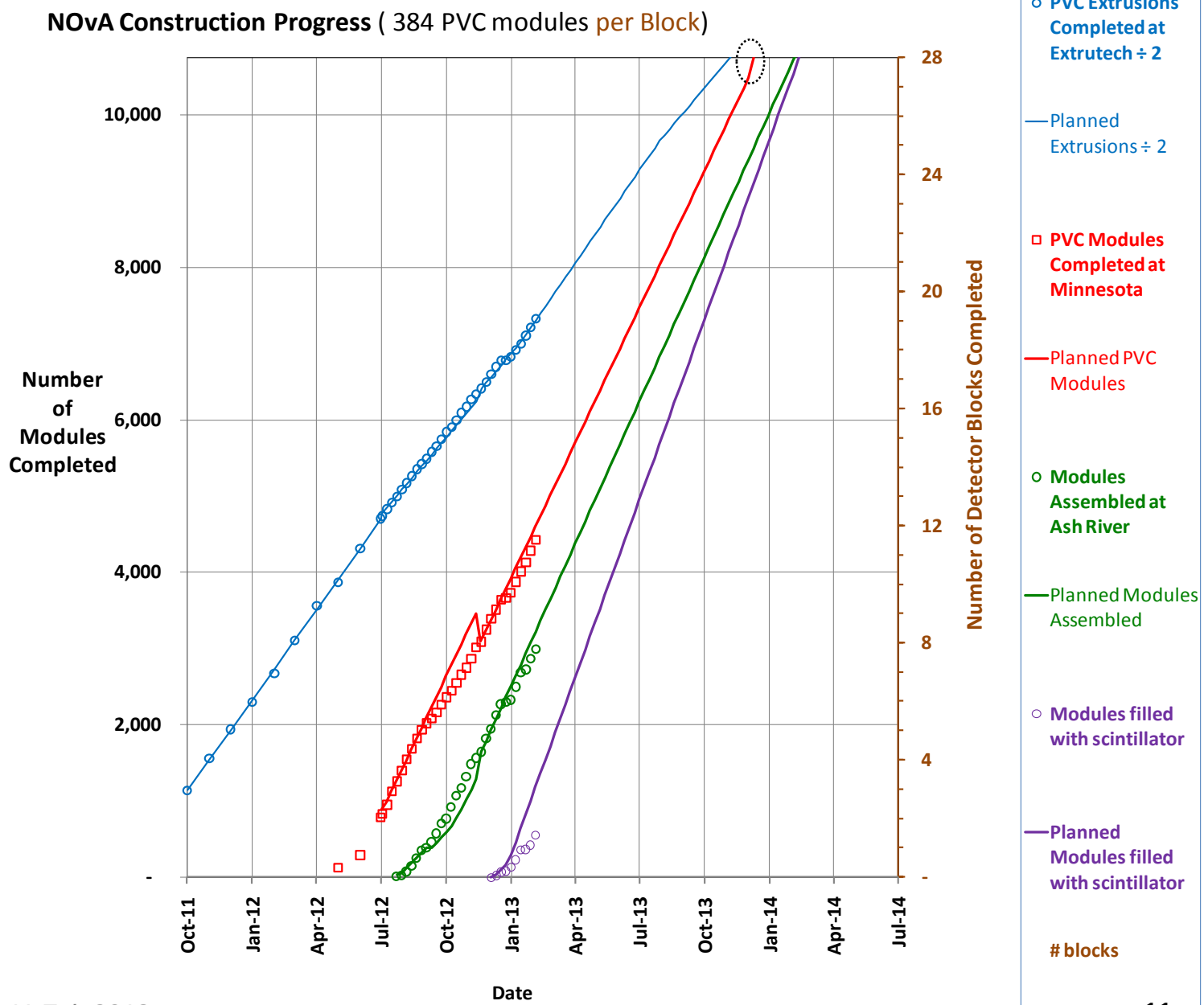
Scintillator Filling

- Still differences between Vertical gallons per module and Horizontal gallons per module.
- Pushing ahead while considering this data
  - Precision dip stick measurements of fill level being done daily this week
    - Fill level known to be above the top of the top horizontal cell in all modules
  - From a 2004 study we suspect we have bubbles on the PVC surfaces in ALL cells
    - If so, will not impact data quality since the bubbles are small, typically 3mm or less thick vertically, variable lengths.
    - Missing 5 – 6 gallons equivalent to 75% of one horizontal cell or 2.2% of all horizontal cells (0.9 mm per cell)
  - Expect tracking of cosmic rays to further illuminate this effect once we start operating the detector



Longer Cumulative View:

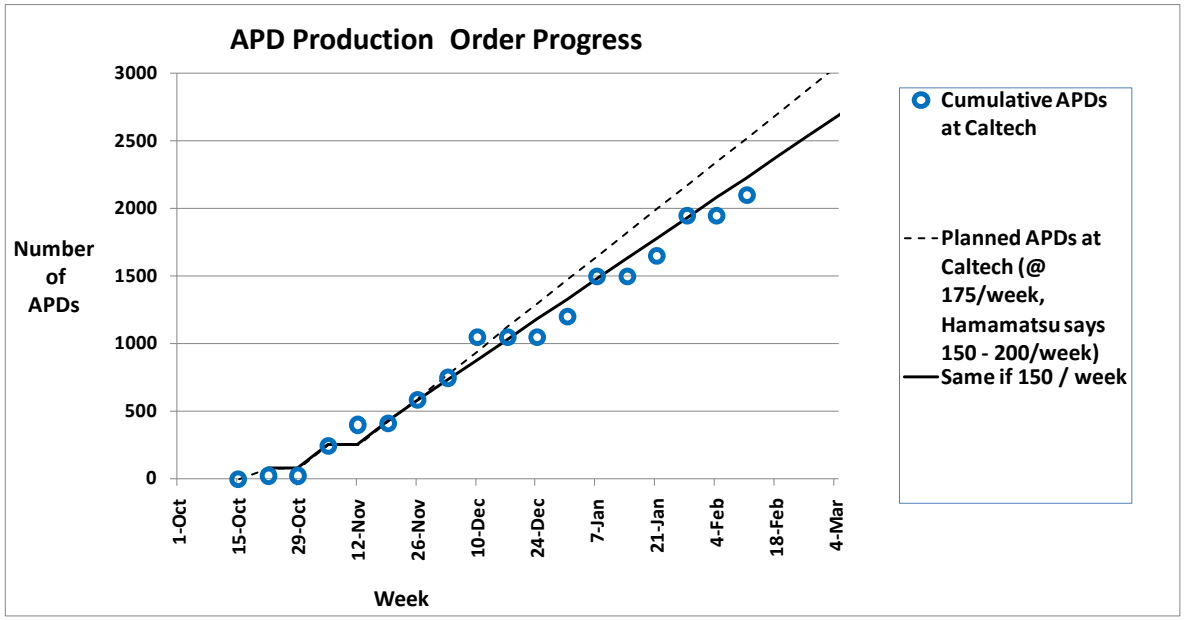
- Projections for all four assuming planned rate is sustained after Nov 26, 2012
- PVC modules does not include 0.68 blocks of modules with 1 cell not passing the fiber test(s)
  - Since we want to use those at the END of the detector (see circle)
- Watching slopes & end points of the various parts
  - PVC modules will slow down as we build 660 Near Detector modules (= 1.7 blocks) this spring & summer



APDs

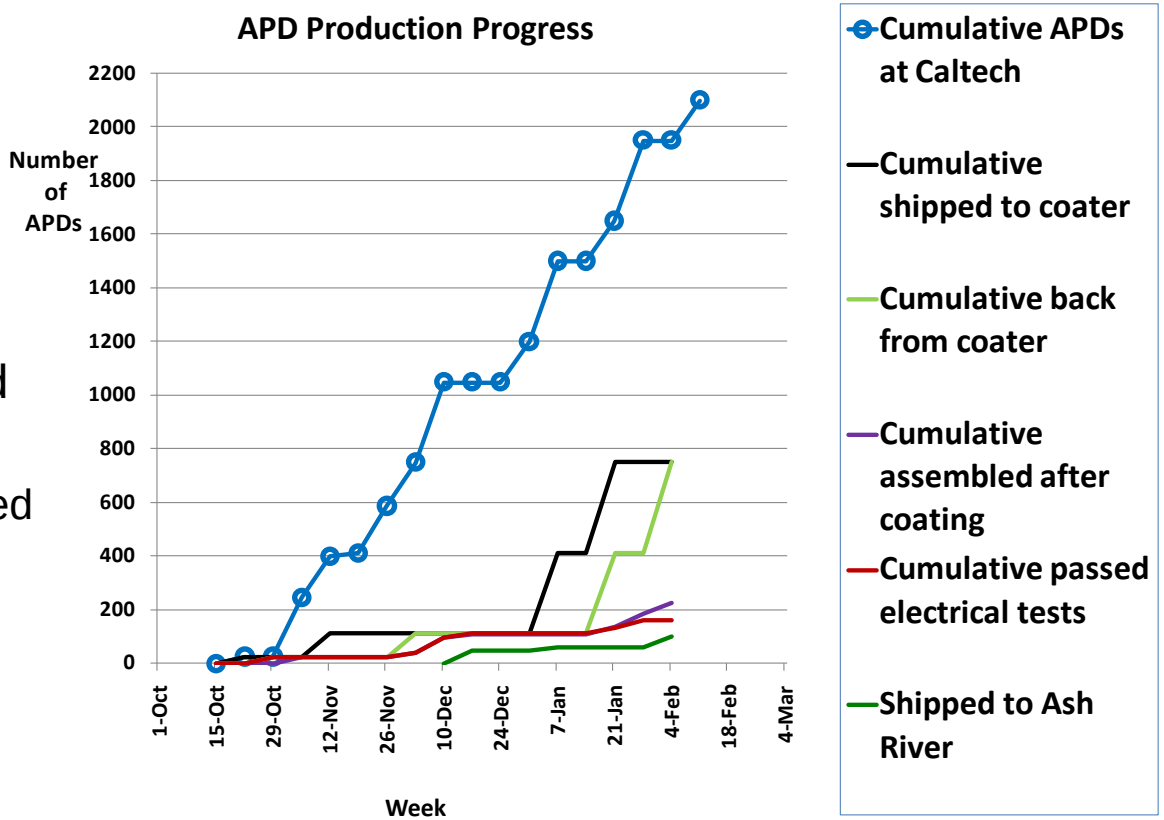
- **Reminder:** Status of Installation test at Fermilab
  - 85 production Parylene coated APDs installed during Nov-Dec on a set of 30 production optical connectors.
  - All were cooled to -15C.
  - Of the 85, 2 were noisy after installation.
    - Viewing "noisy" an installation failure, the failure rate is 2/85 = 2.4%.
    - This is much better than the 15% installation failure rate reported at the 20 Nov Mini-review.

- Production APDs continue to arrive at Caltech
  - A total of **2,100** received to date. (**18 %** of the order).
  - Rate consistent with 150/week but 175/week still possible
    - End dates for delivery are 11 weeks different, late Feb 2014 (for 175/wk) or early May 2014 (for 150/wk)
    - Watching the rate



APD production downstream of delivery

- **Status of production chain**
- **2,100** received to date.
- **749** shipped to Parylene coater
- **749** now coated and returned to Caltech
  - One returned with a damaged thermistor. This is the only flaw found so far.
  - Coating slope > delivery slope
- **226** of those now assembled at Caltech
- **153** passed tests at Caltech,
  - NO failures so far, testing just lags assembly
  - Ramping up the rate
- **99** shipped to Ash River



FEBs (Front End boards)

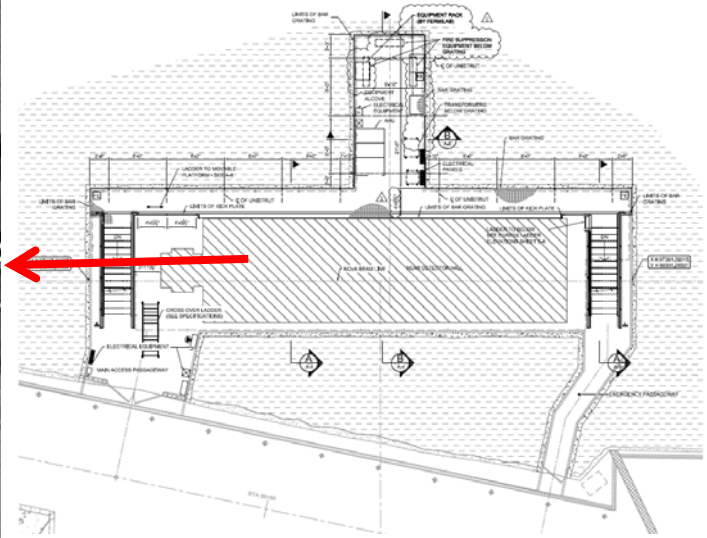
- Tested production FEBs now total 11,392, enough for the 28 blocks.
- **The first 70 FEBs were installed at Ash River last week.**
  - Gold boxes in the picture below
  - Rate was 5 min / box, looks like plan of 3 min / box is achievable
- The first APDs will be installed at Ash River during the week of 25 Feb.

Progress towards reading out detector

- DCMs checked out on 3 ½ di-blocks
- Picture below shows middle di-block with PS on (red at right edge) and lights on DCMs as they are exercised with patterns from Fermilab.
- Commissioning shifts by the Collaboration begin on March 11

Near Detector Cavern status

- Drip ceiling near completion, **complete today, Feb 11**
- Most steel work completed, deck, stairs, walkways, **expect complete on Feb 11**
- Electrical installation continues. See lights, conduit,… in picture below.
  - Final electrical tie-in **scheduled for Feb 20** to tie cavern to existing underground system.
- HVAC installation continues.
- Spill containment material is on site and stored inside for installation at the end of Feb.
- Kiewit now estimates project complete in mid-March
  - but this depends on arrival of the Movable Access Platform which goes up against the ceiling.
  - Keiwit contractually has until June 14. OHEP milestone is being moved to June 14 to match.



ANU Progress

- 2nd RF cavity completed low power tests
- Vacuum installation continuing through the MI and Recycler injection lines
- Girder fabrication continues, anticipate riggers next Monday. There will be 4-5 weeks of rigger work.
- Horn 1 installation starting this week (10 working days to complete)
- Hadron Monitor was removed last week, new Hadron Monitor installation this week
- Completed installation of BPM electronics in 1st service building, 5 more to go

RKB magnet testing

- RKB003 and RKB004 passed the HV testing (100% gradient for 10 days)
- RKB003 failed at 110%
  - Ticking noise
  - Sparking resistor – fully open

- Same resistors in Gap Clearing (RKA 8 magnets), RR Injection (RKAA 9 magnets), Abort (RKD 6 magnets)
  - 4 in each magnet
  - No other failures in testing – infant mortality? (1 of 100)
  - None known in operation (1.5 years with GCK)
  - Swapped in spare RKA because of vacuum leak during this shutdown, will inspect at earliest opportunity

ES&H Summary

- At Ash River: New accidents
  - First record was 391 days and accumulated 61,669 employee hours since beneficial occupancy of the Ash River building in April 2011.
    - First lost time accident on 01 Nov 2012. Worker hit his knee, lost one day, topical medication prescribed
  - Second record was 67 days
    - 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: Nothing new
  - 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
  - **25,990** hours of work as of Jan 24, 2013**. No accidents**.

Ash River building wins Illinois award

- 50 entries, 10 won “honor” awards and go on to a national competition