Ash River Detector Outfitting Status and Plans

R.J. Tesarek
NOvA Deputy Project Manager
Lehman Review
5/08/12

Scope

Status of far detector outfitting planning

- Detector Outfitting Infrastructure (this talk)
- Detector Assembly (See P.Lukens' talk)
- Detector Outfitting (this talk)
- Detector Commissioning (outline in this talk)
- Commissioning the Ash River detector is part of the project

Boundary Conditions:

- All installation/outfitting done by technicians under expert guidance
- Outfitting keeps up with block assembly
- DAQ ready **BEFORE** first block installed
- Commissioning done remotely (centered at FNAL)

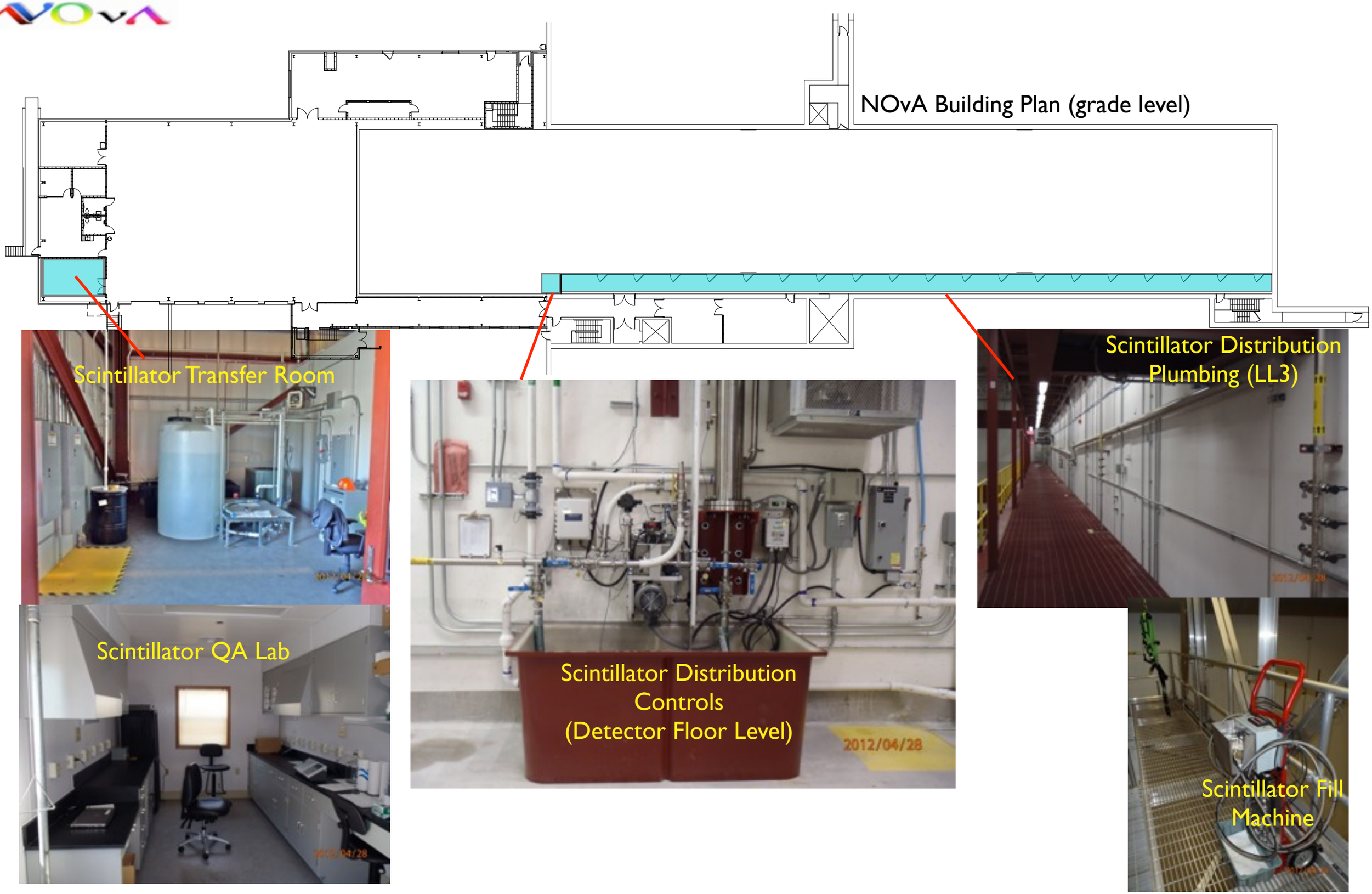
Experience and plans collected and developed workshops held ~monthly

- Resource loaded outfitting schedule for Ash River
- Last workshop held 4/24 - 4/26

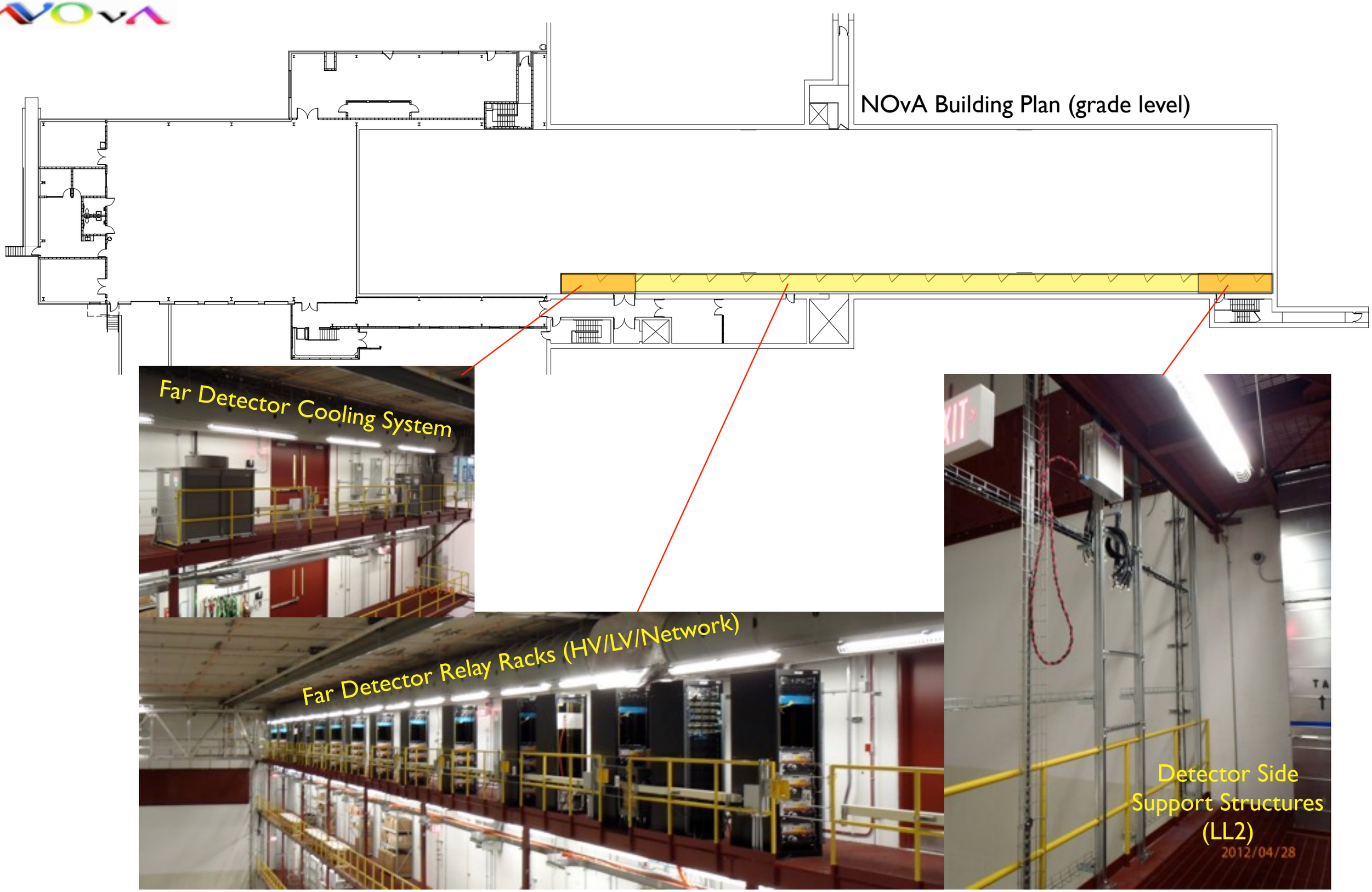
This summary is based on the work of many people

Infrastructure installation (outfitting the detector hall) is underway

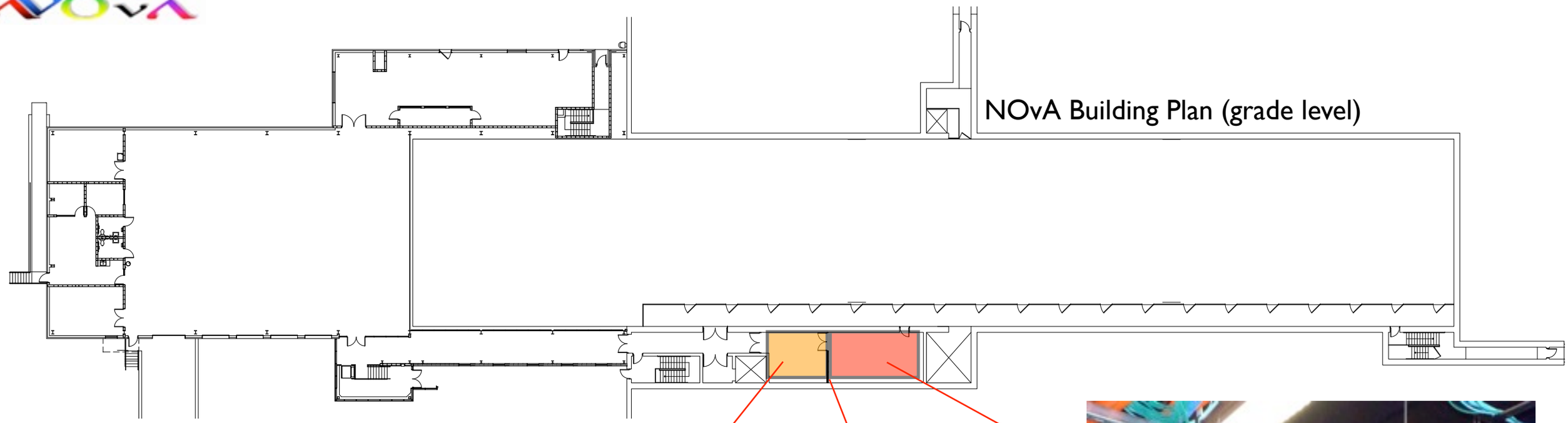
Infrastructure: Scintillator Distribution

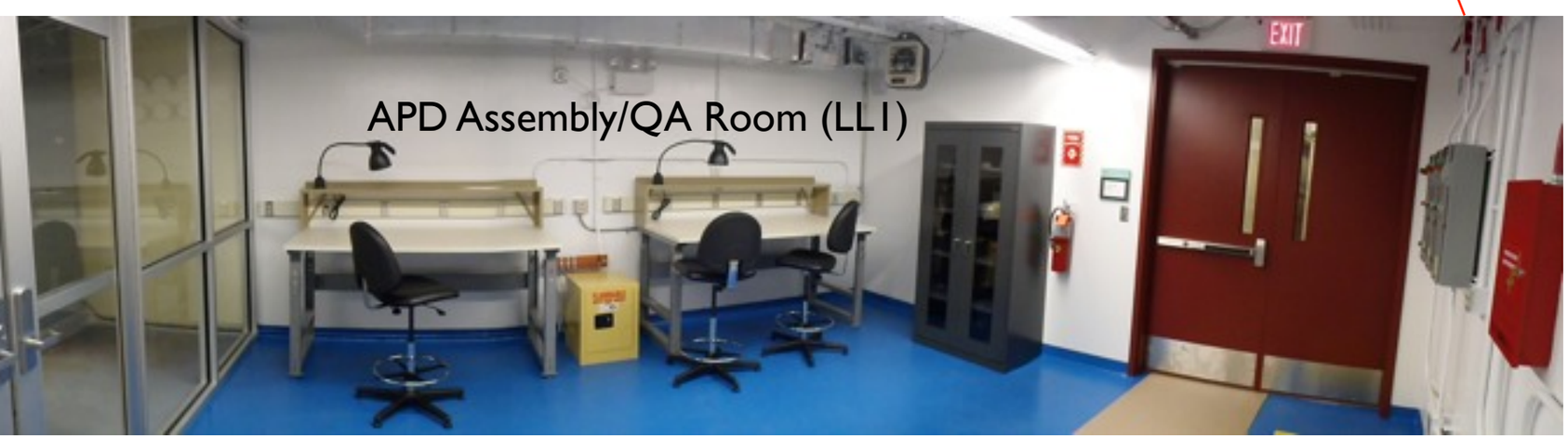


Infrastructure: Detector



Infrastructure: Control Room, Computing





Detector Rack Status

Detector Racks Include the following infrastructure:

- Network connections
- Power supplies for on-detector electronics/sensor bias
- Timing for the readout
- Rack monitoring (temperature, air flow)
- Detector structural monitors (strain gages, etc)

Status:

- 15 LV racks 70% complete
- 2 HV racks 43% complete
- 2 Network racks 77% complete

HV Racks

Equipment	Equipment Serial Number by Rack (Rack Front)	
	LL0DHRR04N	LL0DHRR13N
Rack Protection Monitor	RPII-17	RPII-18
Blank panel (4U)		
HV Patch Panel #6	UVA HVP-001	UVA HVP-007
HV Patch Panel #5	UVA HVP-002	UVA HVP-008
HV Patch Panel #4	UVA HVP-003	UVA HVP-009
HV Patch Panel #3	UVA HVP-004	UVA HVP-010
HV Patch Panel #2	UVA HVP-005	UVA HVP-011
HV Patch Panel #1	UVA HVP-006	UVA HVP-012
Blank Panel (1U)		
DCS Sensor Crate #3		
Blank Panel (1U)		
DCS Sensor Crate #2		
Blank Panel (1U)		
DCS Sensor Crate #1		
Blank Panel (1U)		
Block Structure Crate #2		
Blank Panel (1U)		
Block Structure Crate #1		
Blank Panel (1U)		
120V Power Interrupt	120 PDC17	120 PDC18
Wiener MPOD HV Mainframe	2789048	2789046

Detector Network Racks

Equipment	Equipment Serial Number by Rack (Rack Front)	
	LL0DHRR05N	LL0DHRR13N
Rack Protection Monitor	RPII-19	RPII-20
120V Power Interrupt	120PDC-20	120PDC-19
Cable Management	Installed	Installed
DCS2960 Switch	119398	119392
Cable Management	Installed	Installed
DCS2960 Switch	119396	119393
Cable Management	Installed	Installed
DCS2960 Switch	119397	119394
Cable Management	Installed	Installed
DAQ 4948 Switch	119405	119401
Cable Management	Installed	Installed
DAQ 4948 Switch	119407	119404
Cable Management	Installed	Installed
PoE Camera Switch	ET1124S800311	ET1124S800315
Patch Panel 9		
Cable Management	Installed	Installed
Patch Panel 8		
Cable Management	Installed	Installed
Patch Panel 7		
Cable Management	Installed	Installed
Patch Panel 6		
Cable Management	Installed	Installed
Patch Panel 5		
Cable Management	Installed	Installed
Patch Panel 4		
Cable Management	Installed	Installed
Patch Panel 3		
Cable Management	Installed	Installed
Patch Panel 2	Installed	
Cable Management	Installed	Installed
Patch Panel 1	Installed	-
Cable Management	Installed	-
Cable Management	Installed	-

LV Racks

Equipment	Equipment Serial Number by Rack (Rack Front)														
	LL0DHRR02S	LL0DHRR03S	LL0DHRR04S	LL0DHRR05S	LL0DHRR06S	LL0DHRR07S	LL0DHRR08S	LL0DHRR09S	LL0DHRR10S	LL0DHRR11S	LL0DHRR12S	LL0DHRR13S	LL0DHRR14S	LL0DHRR15S	LL0DHRR16S
Rack Protection Monitor	RPII-2	RPII-3	RPII-4	RPII-5	RPII-6	RPII-7	RPII-8	RPII-9	RPII-10	RPII-11	RPII-12	RPII-13	RPII-14	RPII-15	RPII-16
Patch Panel	Installed	Installed													
Cable Management	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed
Patch Panel	Installed	Installed													
TDU	557347(02)	557348(03)	557349(04)	557350(05)	557351(06)	557352(07)	557353(08)	557354(09)	557355(10)	557356(11)	557357(12)	557358(13)	557359(14)	557360(15)	557361(16)
TDU	557362(17)	557363(18)													
Blank															
Block Structure crate #2															
Blank															
Block Structure crate #1															
Blank															
fan tray	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed
Wiener PL506 #4	2389022	3089031	2389010	3089010	2389013	2389019	3089034	2389003	3089042	3089028	3089033	3089045	3089041	3089038	
240V Power Interrupt #4	240 PDC-02	240 PDC-06	240 PDC-10	240 PDC-14	240 PDC-18	240 PDC-22	240 PDC-26	240 PDC-30	240 PDC-34	240 PDC-38	240 PDC-42	240 PDC-46	240 PDC-50	240 PDC-54	240 PDC-58
fan tray	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed
Wiener PL506 #3	2389011	3089016	2389008	3089037	3089088	2389004	3089039	3089036	3089021	3089022	3089030	3089048	3089044	3089032	
240V Power Interrupt #3	240 PDC-03	240 PDC-07	240 PDC-11	240 PDC-15	240 PDC-19	240 PDC-23	240 PDC-27	240 PDC-31	240 PDC-35	240 PDC-39	240 PDC-43	240 PDC-47	240 PDC-51	240 PDC-55	240 PDC-59
fan tray	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed
Wiener PL506 #2	3089013	2389007	2389021	3089011	2389006	2389005	2389025	3089024	3089019	2389009	3089046	2389024	3089026	3089015	
240V Power Interrupt #2	240 PDC-04	240 PDC-08	240 PDC-12	240 PDC-16	240 PDC-20	240 PDC-24	240 PDC-28	240 PDC-32	240 PDC-36	240 PDC-40	240 PDC-44	240 PDC-48	240 PDC-52	240 PDC-56	240 PDC-60
fan tray	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed
Wiener PL506 #1	3089012	2389017	2389016	3089035	3089047	2389015	2389012	3089025	3089043	3089018	3089014	3089029	3089027	3089020	
240V Power Interrupt #1	240 PDC-05	240 PDC-09	240 PDC-13	240 PDC-17	240 PDC-21	240 PDC-25	240 PDC-29	240 PDC-33	240 PDC-37	240 PDC-41	240 PDC-45	240 PDC-49	240 PDC-53	240 PDC-57	240 PDC-01
fan tray	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed	Installed

Getting To Detector Outfitting I

Fermilab network at Ash River

• Main network switches	√ Main switches installed	12/19/11
• Detector network switches	√ Installed & tested	12/19/11
• Wireless access	√ Installed & tested	4/05/12
• Configuration (DAQ/slow controls/QA)	DAQ done	date

Detector HV/LV/network

• Racks	√ Installed & configured	1/28/12
• Rack monitoring/protection	√ Installed & tested	4/30/12
• HV/LV power supplies	Installed not tested	4/26/12

Support infrastructure

• Unistrut & cable tray support (detector side)	√ All materials in hand	4/20/12
• 1st di-block cable tray & support structure	Installed, tweaking holes	4/27/12
• PDB/DCM tables & cable tray support (top)	All materials in hand	June

Cooling system

• Chillers, reservoir, pumps	Chillers installed	4/02/12
• Electrical services for cooling system	Done this week?	
• Main supply/return lines	Installation	May/June
• System tests	Loop tests (sans detector)	June

Getting To Detector Outfitting II

Scintillator distribution system

• Plumbing/pumps/controls	√ Plumbing completed	4/17/12
• Scintillator plumbing leak tight	√ Pass leak checks	4/20/12
• Filling machines	First filling machine on site	4/17/12
• Plumbing qualified	Train techs to qualify plumbing	5/07/12

DAQ

• Control room computers	√ Counting Room operational	date
• DAQ computers	√ Buffer computers operational	date
• GPS	√ GPS installed	6/08/11
• DAQ test stand (TDU/DCM)	√ Installed, tests underway	4/26/12
• Control room video conferencing	System spec'd	2/03/12
• Detector timing system	1 of 2 timing chains installed	4/26/12

Special facilities

• Scintillator QA trailer	√ Trailer outfitted	11/10/11
• Outfitting parts storage	√ 5577 ft^2 storage available	2/21/12
• APD storage, assembly/testing area	Room prepared, stocked with tools	3/15/12

Getting To Detector Outfitting III

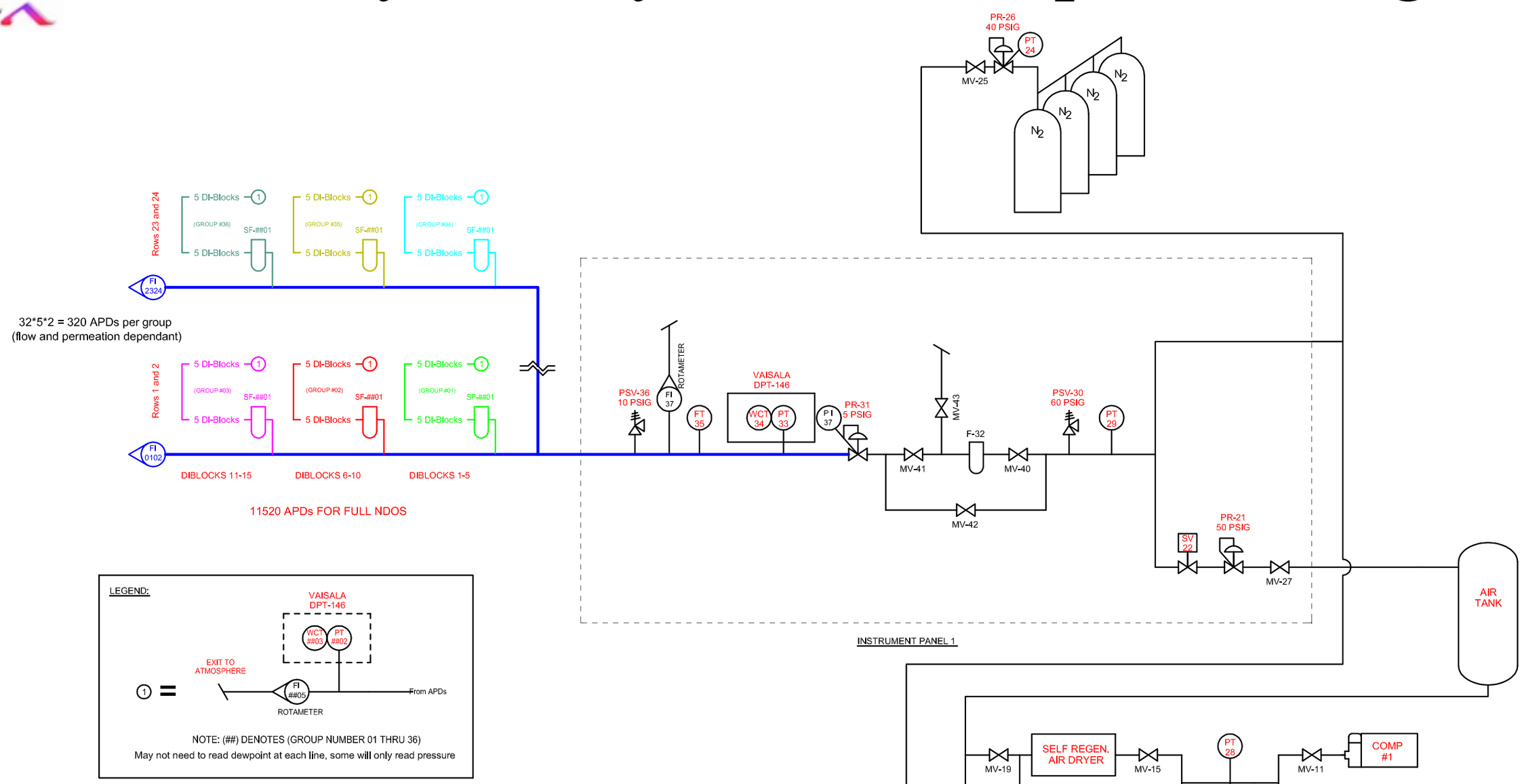
Cables

• Timing (fiber, master-to-slave)	√ Installed & tested	4/26/12
• Timing (rack-to-rack)	1 of 2 sets installed	4/25/12
• FEB-DCM power	1st di-block prototypes tested	4/25/12
• Timing (DCM-to-DCM)	Lengths known	date
• FEB-DCM communication	Lengths known	date
• DCM-network	Lengths known	date
• DCM-timing	Lengths known	date
• Network patch cables	Misc lengths in racks	
• HV network	??	
• Slow controls/monitoring	??	

Safety clearance to operate

• Rack protection system	√ Approval granted	2/02/12
• Time Distribution Units (TDU)	√ Approval granted	2/24/12
• Data concentrator Modules (DCM)	√ Approval granted	2/24/12
• Power distribution box/system (PDB)	√ Approval granted	4/19/12
• Safety clearance to operate	Safety walkthrough complete	4/25/12
• Detector structure (prior to filling)	documentation under review	4/10/12
• Front end board (FEB)	Safety walkthrough	May/June
• Equipment racks (scintillator in detector)	Safety walkthrough	June

APD Dry Gas System Conceptual Design



Dry Gas System Status:

- Design based on prototype near detector (pending experience)
- Detailed design for far detector started
- Compiling initial cost and schedule estimates
- Estimate design review in July 2012

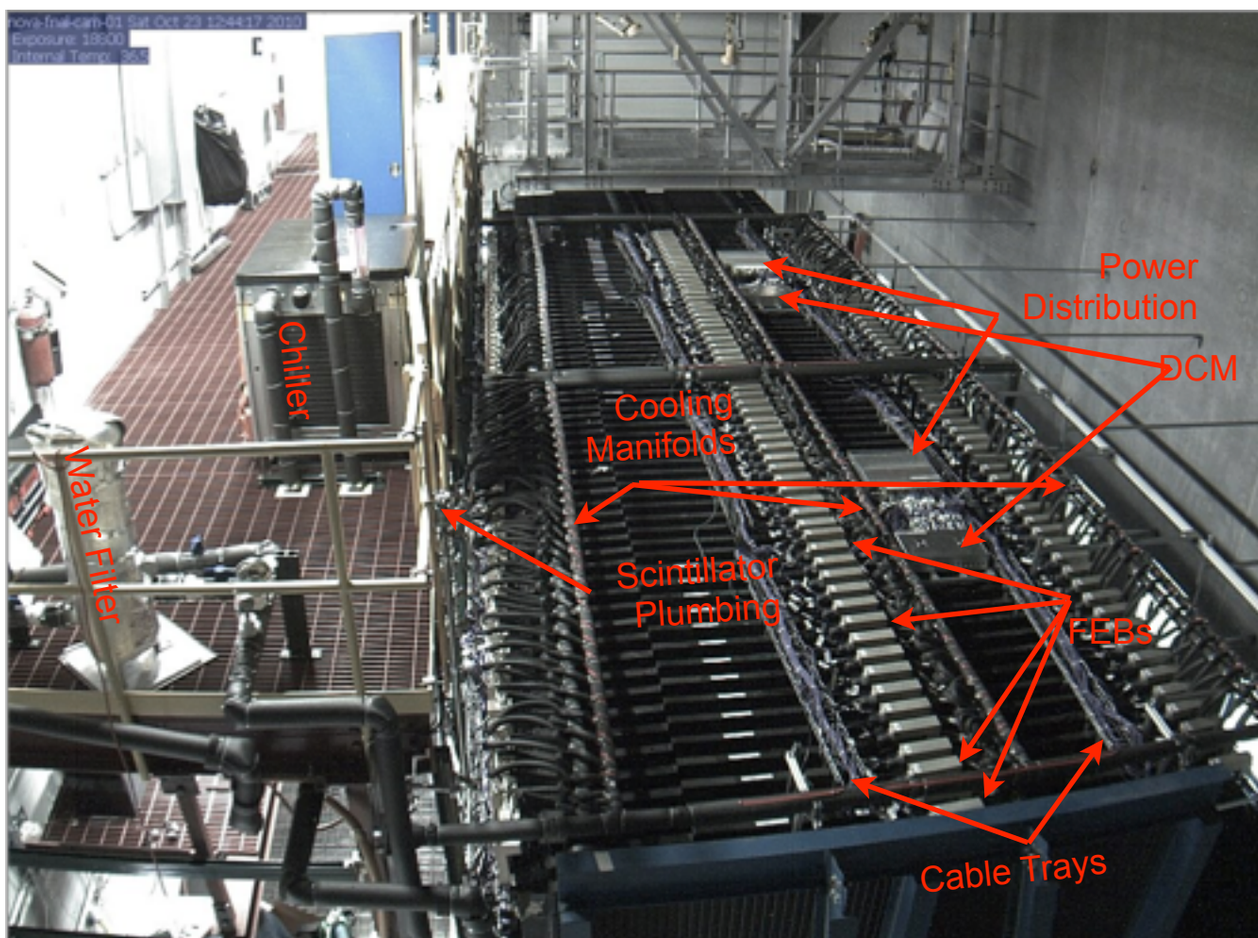
Detector Outfitting

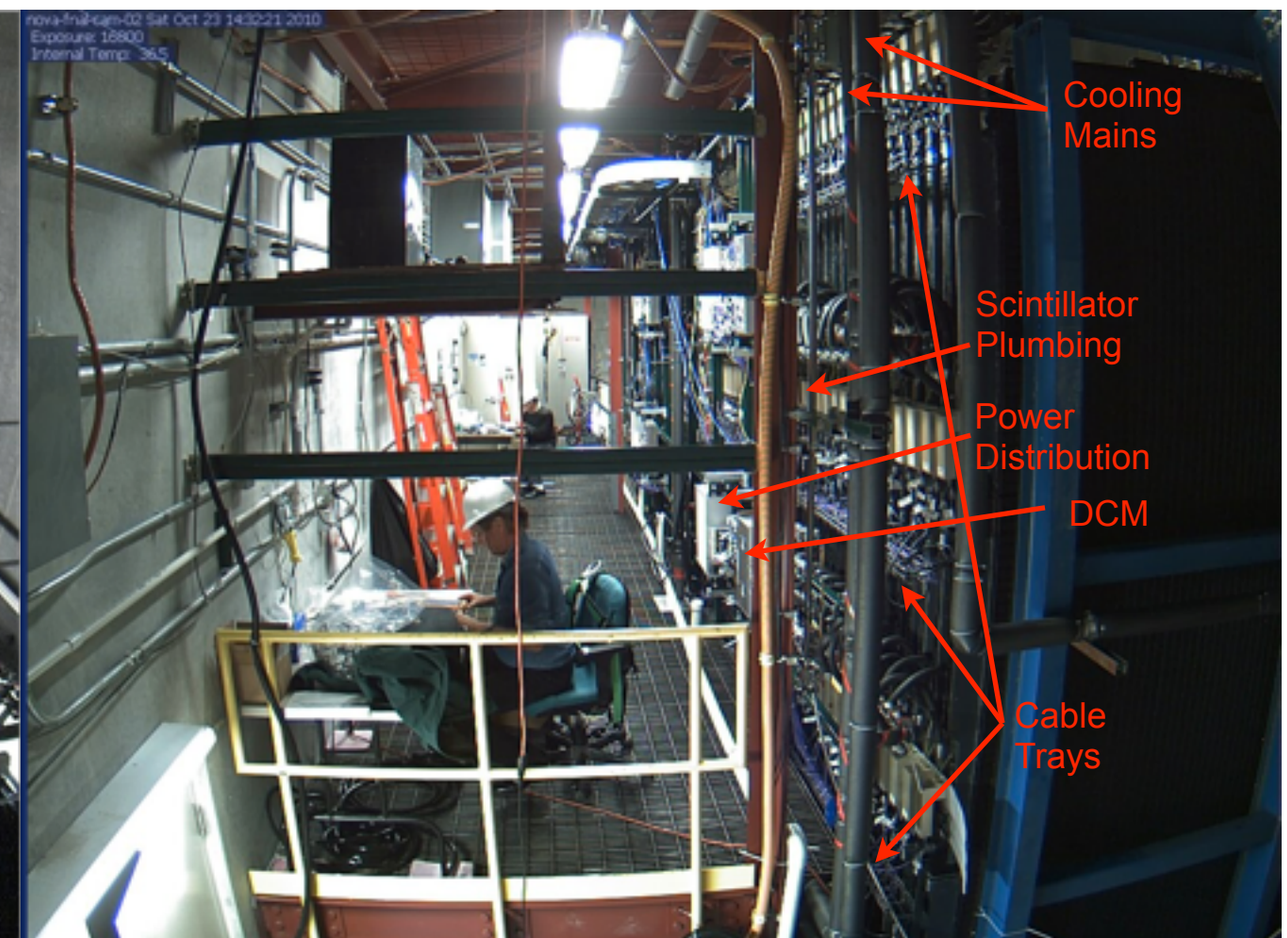
Far detector outfittting based on prototype near detector experience

- Far detector top mostly the same as prototype near detector
- Far detector side some details differ

Significant differences:

- Simpler cooling system likely faster installation
- Side support structures adjustable to facilitate filling





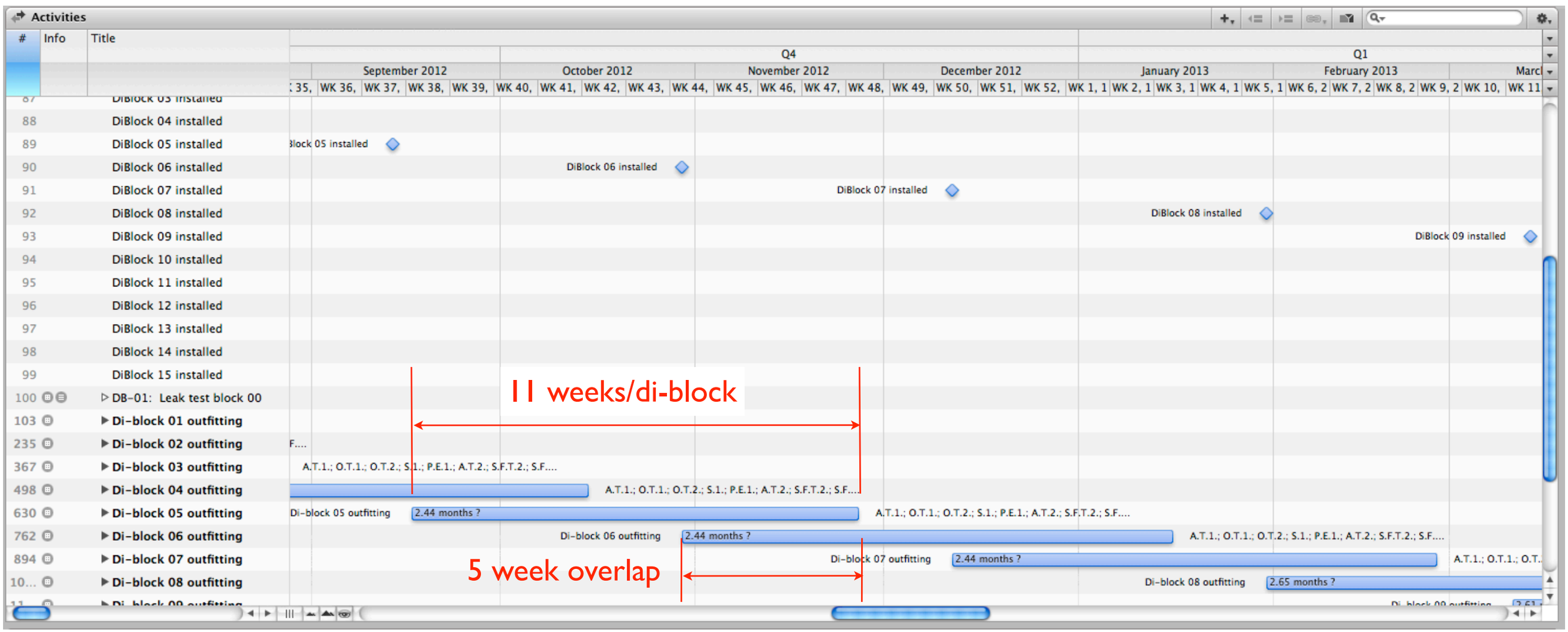
Di-Block Outfitting Overview

Assumptions:

- Steady state outfitting
- Realistic task times from workshops (when available)
- 2 10 hour shifts working 4 days per week
- Outfitting keeps up with block production (3 weeks/block)

Includes commissioning (5% failures, will need revision based on recent experience.)

Official schedule (OpenPlan)



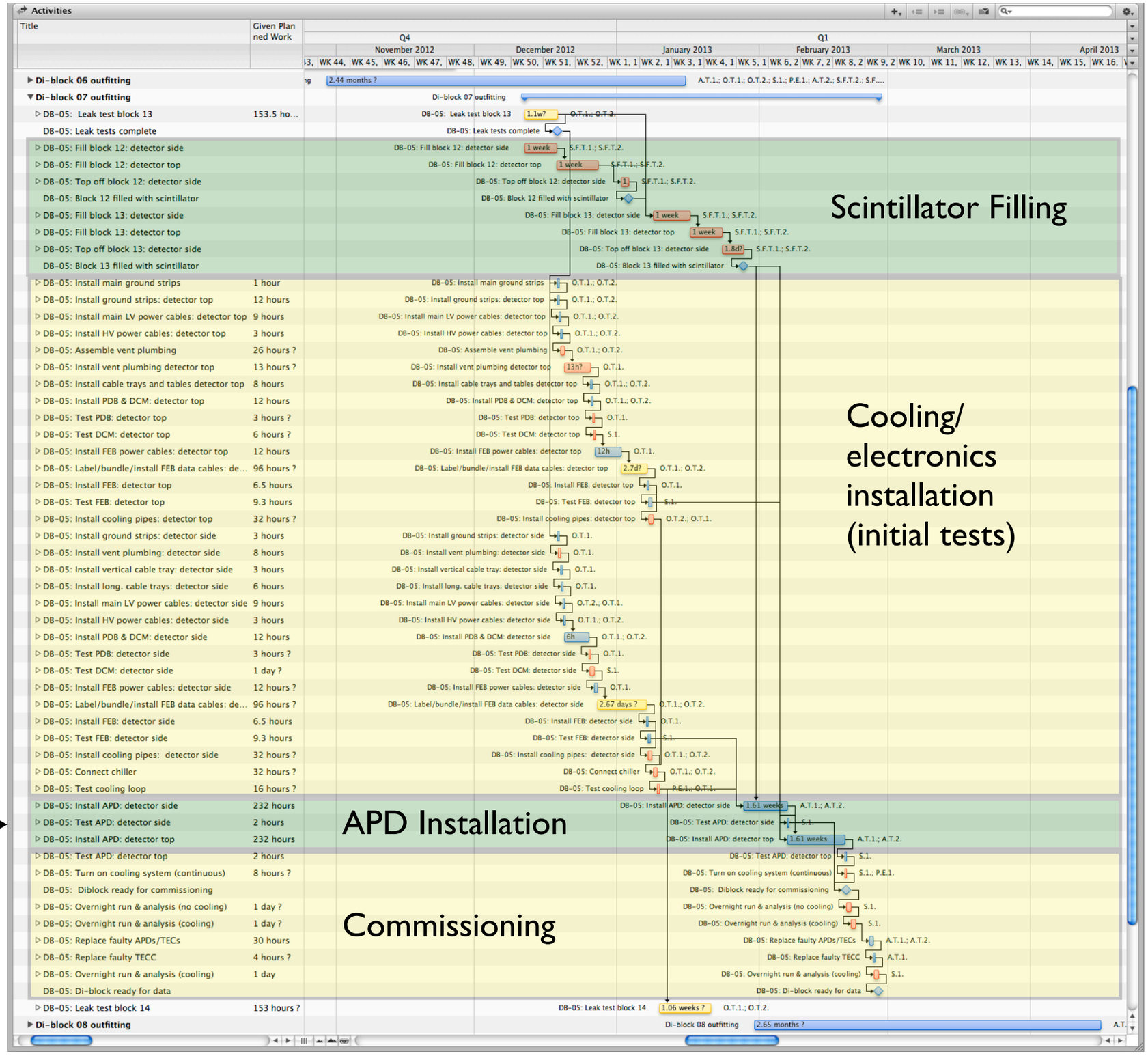
Di-Block Outfitting Detail

Task Color Code:

- (Blue)Documented task durations
- (yellow)Documented task durations, but opportunity to advance schedule using external effort
- (Red)Semi-documented task durations and guesses based on near detector outfitting

NOTE: New resource information becoming available based on preliminary work at Ash River. These data will be fed back into the OpenPlan schedule.

Will need revision



Outfitting Personnel

Personnel Needs/shift:

- 2 scintillator filling techs
- 2 outfitting techs
- 2 APD tech
- < 1 scientist (Ash River)
- ? scientist (Collab.)

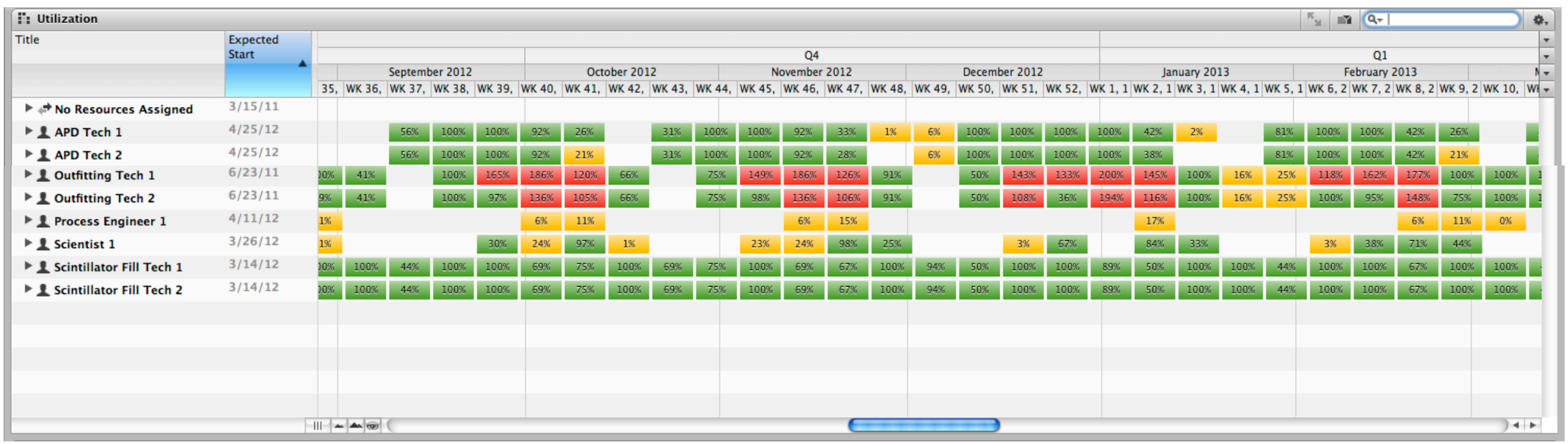
Commissioning personnel partially included in resources (Ash River).

Collab. help with comm. (later slides)

Note: Filling, outfitting and APD installation/commissioning use independent crews and are only loosely coupled in the schedule.

Color Code

- Green 25-100%
- Yellow < 25%
- Red > 100%



Installation Sequence

Di-block outfitting sequence:

1. Install supports & cooling mains & dry gas mains
2. Install PDB, trunk power cables
   - ✓ Test PDB
   - • Replace problem PDB/cards
3. Install DCM
   - ✓ Test (DCM/TDU)
   - • Replace problem electronics
4. Install FEB
   - ✓ Test (FEB/DCM/TDU)
   - • Replace problem electronics
5. Install APD
   - ✓ Test (APD/FEB/DCM/TDU)
   - • Replace problem electronics
6. Overnight run with cosmics
   - ➡ Analyze cosmic ray data (detector problems)
   - • Identify/replace problem electronics
   - ✓ Test new electronics
7. Cool APD
   - ✓ Test (Cooling APD/FEB/DCM/TDU)
8. Overnight run with cosmics
   - ➡ Analyze cosmic ray data (detector problems)
   - • Identify/replace problem electronics
   - ✓ Test new electronics

Collaboration help analyzing data and developing software to analyze cosmic ray data, measure/monitor detector performance

Software needs for AshRiver

Commissioning Analysis Software:

- Charge injection --> obtain ADC to charge scale factors (channel-by-channel)
- DSO scan analysis --> obtain channel-to-channel noise (in electrons)
- Threshold calculation --> set threshold channel-to-channel
- Temperature Control/display (detector controls)

Database Analysis/Display Software:

- Hardware inventory at Ash River (list)
- Hardware installed at Ash River (list/location display) (TDU/DCM/FEB/PDB/APD, etc)
- Cumulative installation plot (# installed of each item by date)
- Calib. Constants display (histogram/location display) (ADC-to-Q, APD QE, etc)

Cosmic Ray Analysis (overnight runs)

- Event Display (tracks)
- Hot/dead channels (hit rates)
- Average "E" per channel per event
- Normalized channel response
- Personnel to analyze overnight runs (shift/collaboration member??)
- Cosmic ray rates vs time

Procedures Needed at Ash River

Procedure	Author	DocDB	Comments
PDS Installation	R.Ehrlich	5675	
PDS Checkout	R.Ehrlich	5601	Updated 4/15/11
PDS Operating Manual	R.Ehrlich	5347	
Fill Machine Test	J.Musser	5276	
Scint. Light Transmission (tintometer)	S.Mufson, B.Baugh	5828	Updated 5/24/11
Scint. Light Transmission (photospec.)	S.Mufson,	5828	Added 1/24/12
Manifold Cover Repair	M.Muether	5139	Addendum to cover filled modules
Module Leak Testing (FNAL)	E.Voirin	5109	
ND prototype Water System Repair	M.Zuckerbrot	5465	
ND prototype Water System Testing	M.Zuckerbrot	5465	
Draining Scint. from ND prototype	M.Zuckerbrot	5891	
FEB data cable bundling	T.Coan, C.Rosenfeld	6101	
Scintillator spill procedures	M.Gebhard	6535	
Far detector scint. system commissioning	J.Musser	6533	
Far detector scint. filling	J.Musser	7263	
Module Leak Testing (ND prototype)	E.Voirin	5109	
Far detector LV rack turn on	R.Tesarek	7399	Draft version
Far detector HV rack turn on	R.Tesarek		
FEB/APD Installation	L.Mualem, M.Muether	4775	Needs updating
FEB data cable tests	M.Muether	5926	Basic info here
APD/FEB/DCM installation, checkout	S.Kasahara, D.Perevalov	5657	Needs written installation procedure
Scint. Light Yield	C.Bower	4030	Talk, not formalized

Procedures Needed for Ash River

Topic	Who	Status
Scintillator top off (ND prototype)	K.Kephart	
Scintillator top off (Ash River)	K.Kephart	
Cooling system testing (Ash River)	E.Voirin	Writing docs
Module leak test (Argonne apparatus)	S.Magill	Writing docs
Optical fiber test procedure	C.Bromberg	
Operating manual for optical fiber testing apparatus	C.Bromberg	Writing docs
Power Distribution System cable bundling	R.Ehrlich	
TDU installation & checkout	R.Kwarciany	Writing docs
Heat sink/Spacer frame leak check	L.Mualem, M.Muether	

Summary

Making progress at Ash River

- Control room, computing, and network operational
- DAQ test stand operational (begin remote DAQ debugging)
- Detector racks ~ 70% complete
- Starting to check off significant infrastructure tasks

Some infrastructure outfitting has tight restrictions

- Delivery of large items problematic after modules begin arriving
- Light crew dedicated to block assembly (infrastructure done before this?)

Outfitting & commissioning software help

- Analyze cosmic ray data from overnight runs
- Measure detector performance part of commissioning

Outfitting workshops

- Software component to outfitting workshops (focus on commissioning/monitoring)
- Last workshop at Ash River
- Switch to regular meetings

Busy and exciting time in front of us