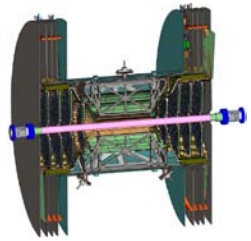
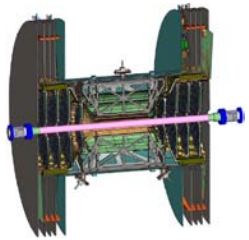


FVTX Detector Assembly

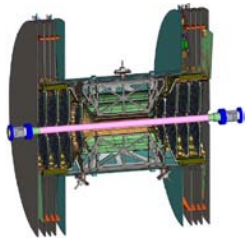
Stephen Pate
New Mexico State University
(FVTX Assembly Management
WBS 1.7)

Talk Outline



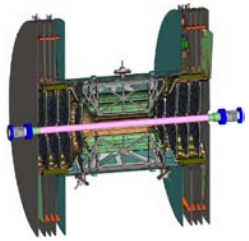
- Scope
- Assembly Labs at BNL – status and outlook
- Support Structures and Assembly Fixtures
- Optical Metrology of Sensors on Wedges
- Assembly Schedule
- Summary

Scope



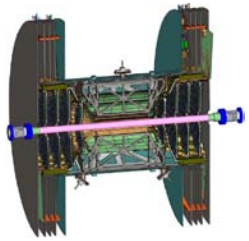
- Prepare assembly labs at BNL
- Receive wedges, ROCs, and support structures
- Build up half-disks and half-cages
- Metrology and Survey of sensors
  - Sensors located to 10 microns in *x* and *y* in each plane
- System testing including sensors and ROCs
  - Functioning and noise levels in all components
- Coordination of Installation in PHENIX

Assembly Labs



- Some minimum requirements for labs:
  - Just “clean” enough; sticky pad at door to minimize dust, proper handling procedures for wedges, dry box to store wedges
  - Basic electronic equipment
  - Four people should be able to work there
  - Sufficient room for surveying
  - Space for “mini-DAQ” and cooling system

Assembly Labs



Two rooms to be used in Physics Building:

(1) Room 1-116

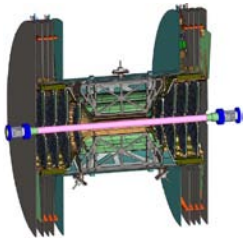
- ~ 250 sq ft; will be used largely for storage of items before and after assembly
- Can do survey of finished half-cages there
- Needs: Dry box for storage

(2) Room 2-91

- ~ 400 sq ft; active assembly and testing area
- Needs: Clean entry; dry box; air filter; electronics

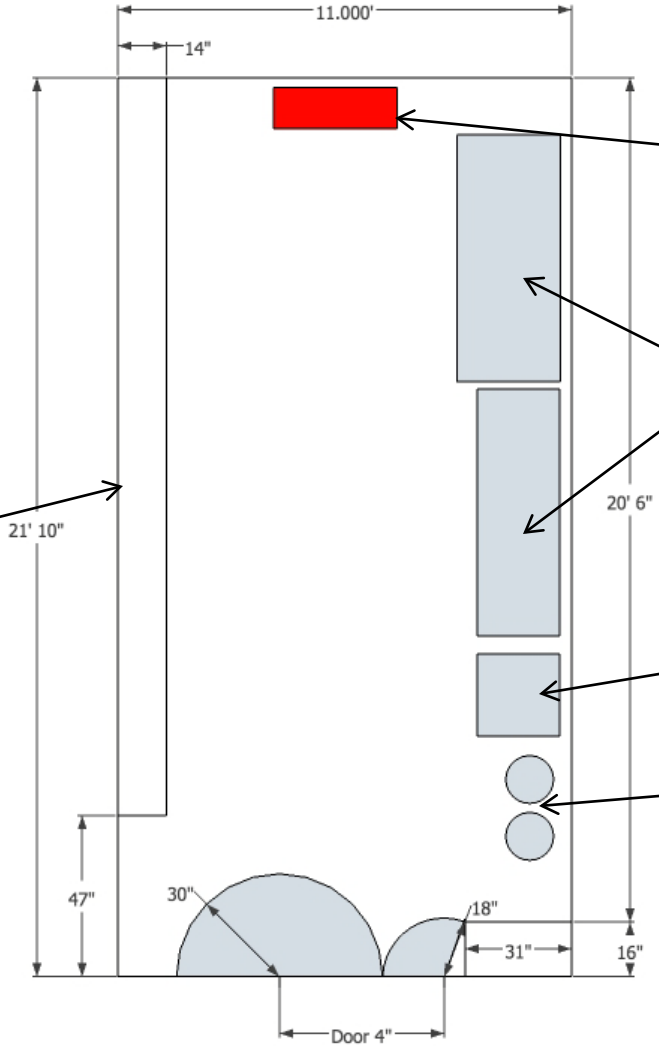
Assembly Labs

Plan for Room 1-116



Main task for this room is storage of “raw” materials (wedges, ROCs) and finished items (half-cages).

Existing shelves



Storage bins

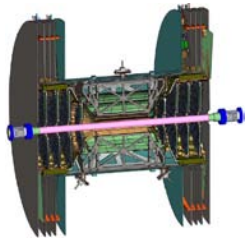
Two 35” high work benches

Dry box

Dry air bottles

Assembly Labs

Plan for Room 2-91



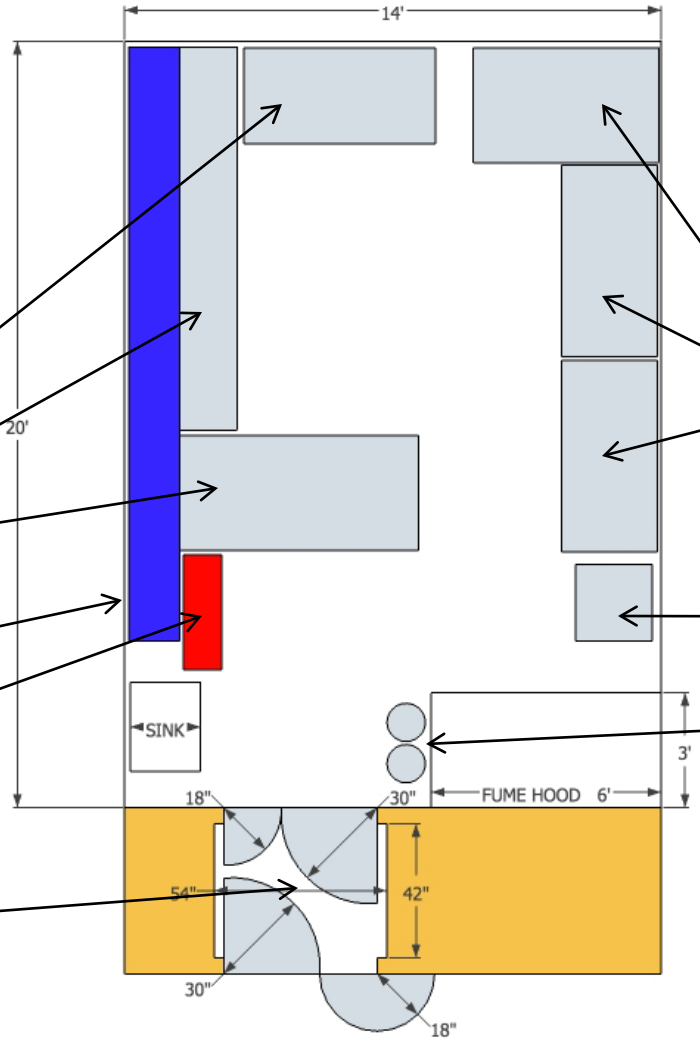
Main task for this room is active assembly and testing of half-disks and half-cages.

Three 33” high work benches (for assembly work)

Existing cabinets

Storage bins

Floor sticky pad will go here

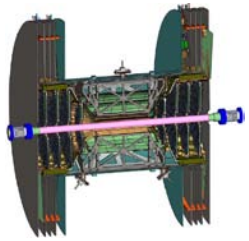


Three 29” high work desks (for electronics testing)

Dry box

Dry air bottles

Assembly Labs



Requests for clean-up and preparation of Room 2-91

•Cleaning of all surfaces, including inside and outside of cabinets (janitorial)

•Cleaning and sealing the floor (janitorial)

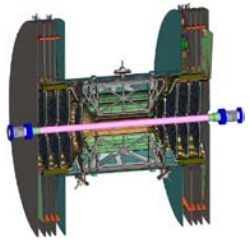
•Filter box built over air inlet, with replaceable filter (Mike Lenz)

•Dry air system for dry-boxes (Rob Pisani)

•Grounding points for dry-boxes and anti-static mats (request to Sal)

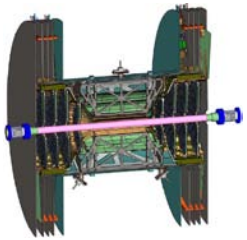
Experimental Safety Review (ESR) is needed before this room can be used.

Support Structures & Assembly Fixtures

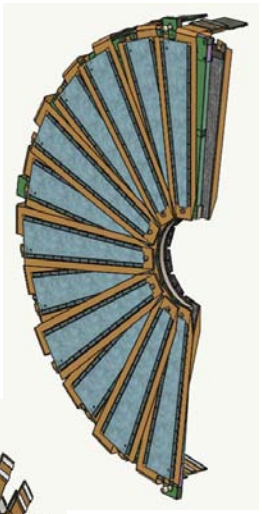


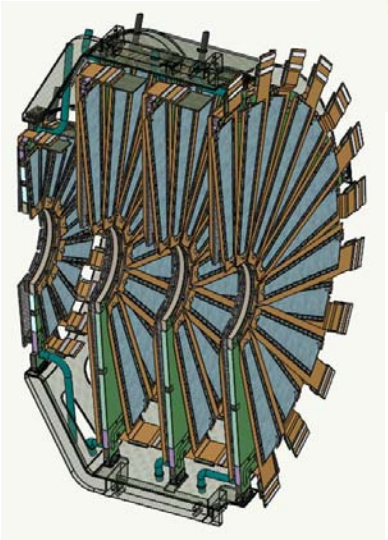
- HYTEC is designing the Support Structures (WBS 1.6.2-1.6.4) and the Assembly Fixtures (WBS 1.6.5);
- The support structures are far advanced in design; see Walt Sondheim's talk for more details
- The assembly fixtures (i.e. items used in the assembly process, but not part of the final detector) are still in the conceptual phase; attention needed.

Assembly Procedure

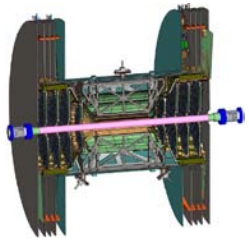


1. Power-up tests of wedges delivered from SiDet, and of manufactured ROCs
2. Build up a half-disk as wedges become available; mechanical testing
3. Electronic testing of half-disk
4. Metrology of sensors on half-disk
5. Install half-disks into half-cages
6. Survey of half-disks in half-cages
7. Electronic testing of half-cage
8. Installation of half-cages into VTX enclosure
9. Installation of FVTX in PHENIX IR

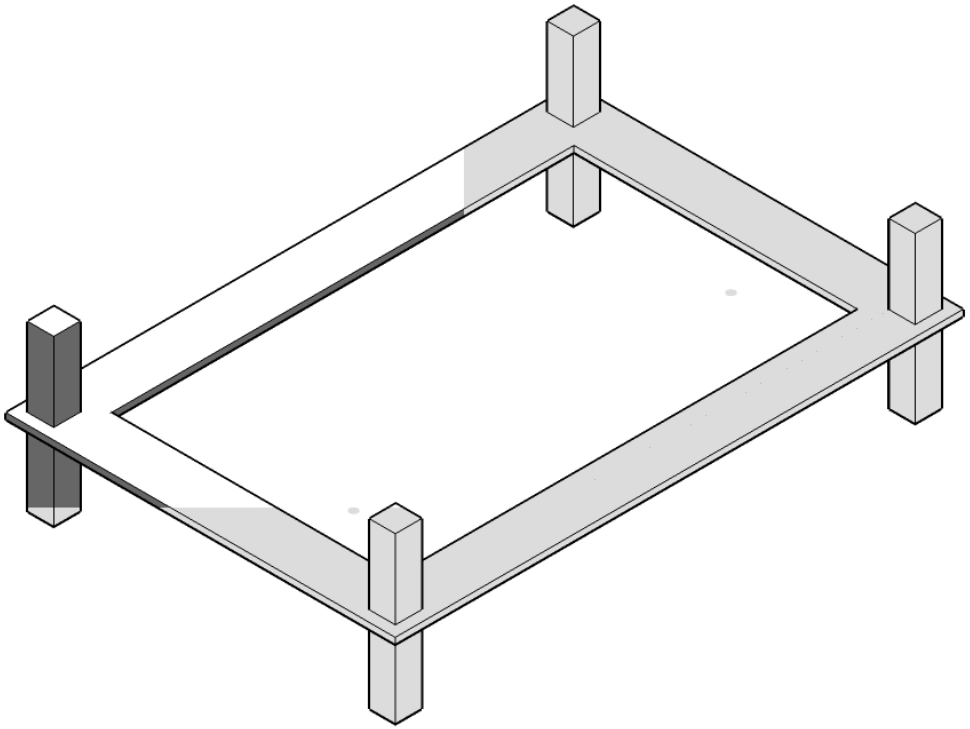


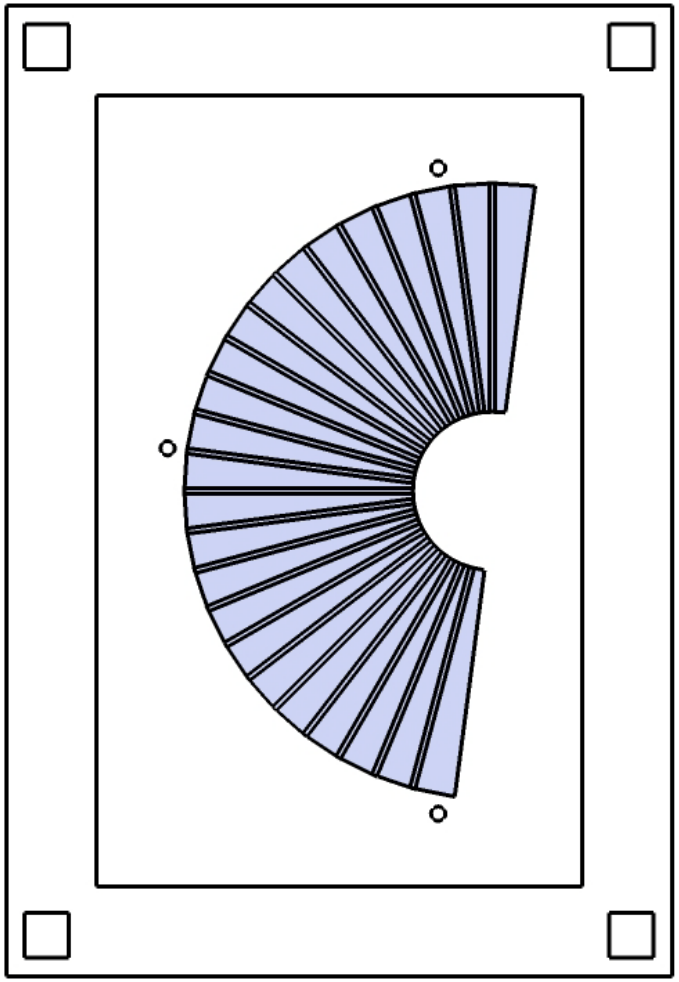


Support Structures & Assembly Fixtures

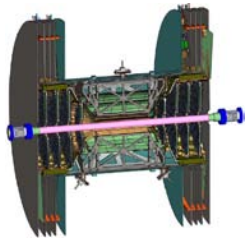


Prototype design for a half-disk assembly and storage mount





Support Structures & Assembly Fixtures



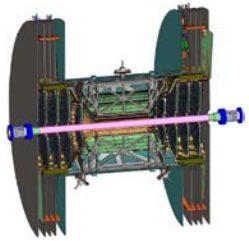
Need a support and dark enclosure for half-cages:

Enclosure Idea – build a combination dry-box and dark-box for storing a half-cage while testing it; must take into account the size and shape of the big wheel

Build four boxes of this type?

The support should also be the transport fixture from 510 to 1008, and should be used to insert the half-cage into the VTX/FVTX enclosure.

Metrology and Survey

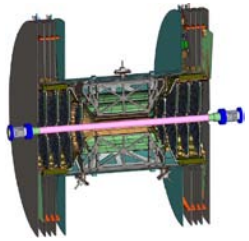


- Goal is to locate the sensors in a plane to within ~10 microns in *x* and *y*
- The strip-to-strip spacing within a wedge will be much better than that. So the issues reduces to the metrology of the sensors in a half-disk, the survey of the half-disks into a half-cage, and the survey of the half-cages in the IR.
- Optical metrology of individual half-disks can reach the ~5 micron level
- Normal surveying of disks in cages can get you to ~50-100 microns
- Analysis of track data needed to reach ~10 microns

A preliminary document has been written describing a procedure for this process – in development…

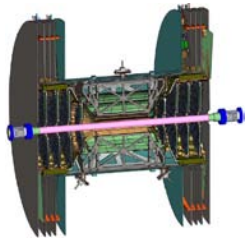
https://www.phenix.bnl.gov/WWW/publish/pate/FVTX/strip_coords.pdf

Metrology and Survey



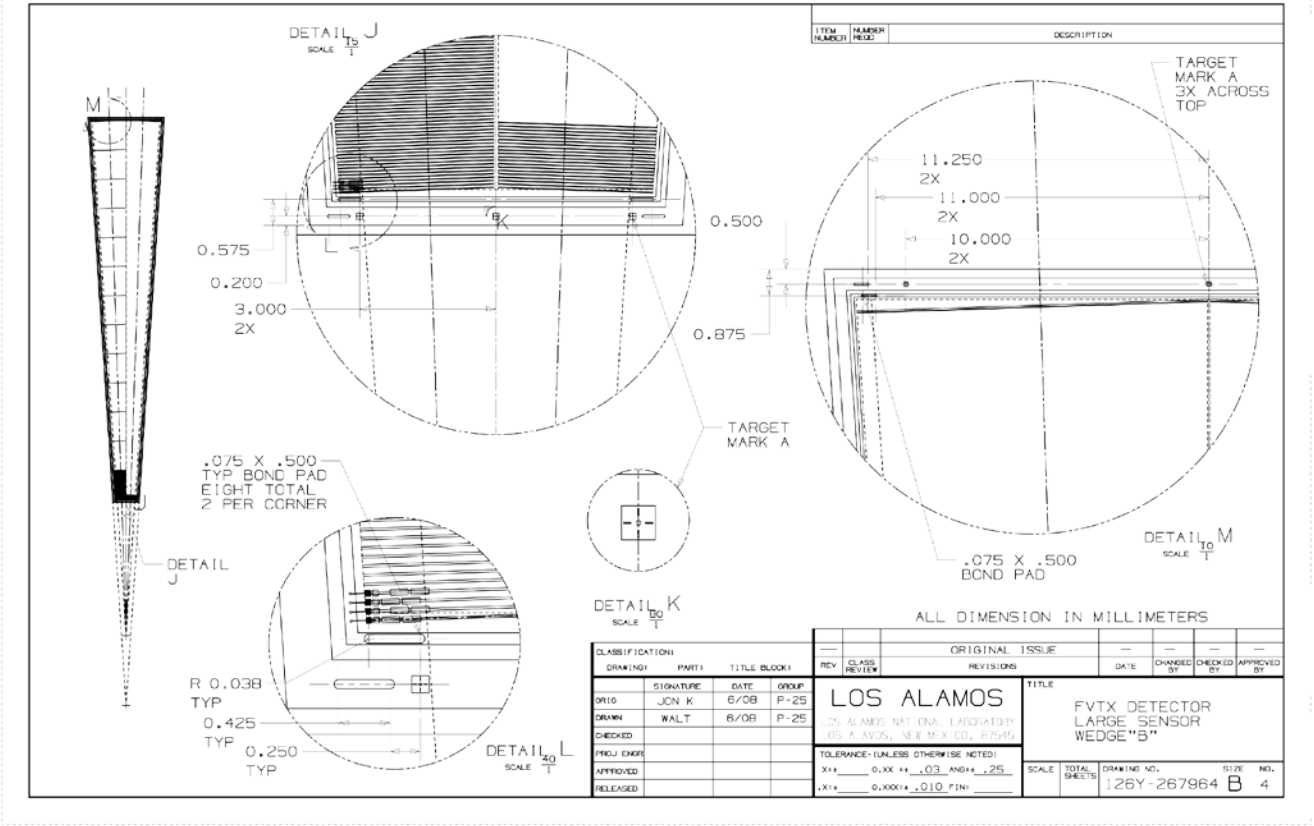
- Procedure:
  - There are 6 target marks on each wedge
  - Wedges are mounted on a half-disk; the half-disk fixtures will include survey targets
  - Target marks and survey targets will be located using a camera mounted on an optical CMM
  - Survey half-disks within a half-cage after assembly
  - Survey the half-disks into the IR during installation

Metrology and Survey

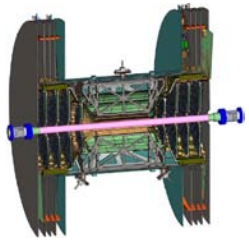


Each sensor has 6 alignment marks placed with high precision by sensor vendor; are visible to the un-aided eye.

These marks will be optically located by a camera mounted on a CMM.



Metrology and Survey

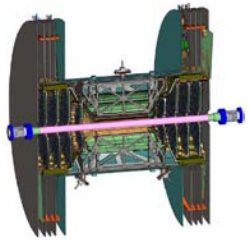


Three Options:

1. Nikon optical scanner in the Physics building, which was previously used by STAR many years ago. Control system needs replacing, cost about $17k.
2. CMM in the BNL Main Shops; in constant use and carries hefty hourly price tag.
3. VTX has an appropriate machine but we have a big schedule overlap with them; shared use unlikely.

Most likely we will replace the control system on the Nikon machine and use that one.

Assembly Schedule



Currently we're considering a plan in which we install one or two half-cages into the PHENIX IR before Run 11 starts, in Fall 2010. The purpose would be to gain some advanced knowledge of operating the detector in the IR.

Pursuit of this plan would need to be done in coordination with the VTX.

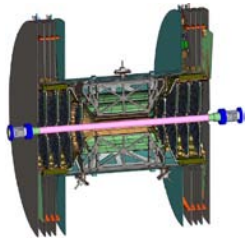
This "early commissioning" plan would have a big influence on the order of tasks in the detector assembly at BNL.

I have put together two task/workforce schedules; one that reflects the "baseline" plan (install 4 half-cages before Run 12) and one that reflects this "early commissioning" plan (install up to 2 half-cages before Run 11).

Both plans are viable at this point in time. If we decide that having a half-cage in the IR for Run 11 is a priority, then we will need to focus our efforts on that; need to make that decision sometime in Spring 2010.

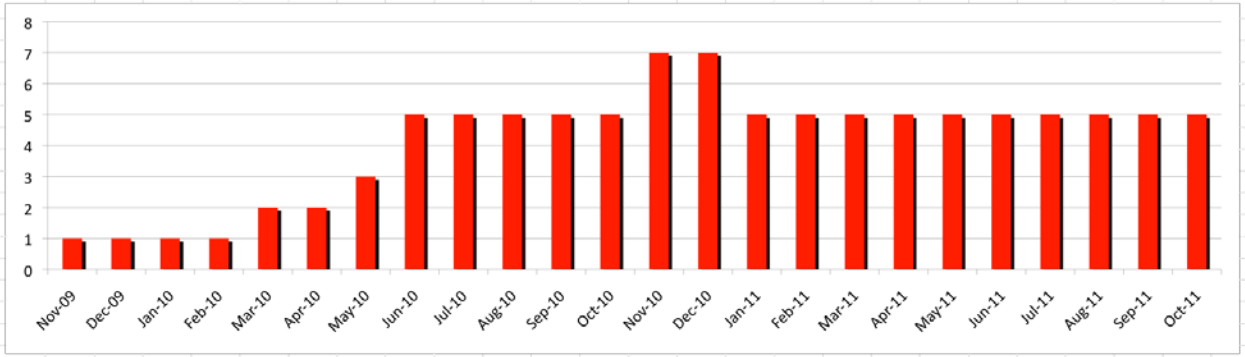
Assembly Schedule

Baseline plan



	Month-Year	N-09	D-09	J-10	F-10	M-10	A-10	M-10	J-10	J-10	A-10	S-10	O-10	N-10	D-10	J-11	F-11	M-11	A-11	M-11	J-11	J-11	A-11	S-11	O-11
	Task Description																								
	Assembly Lab & CMM Preparation	1	1	1	1	1	1																		
	Q/A on Support Structs. and Fixtures					1	1																		
	Receive/test wedges from SiDet							1	1	1	1	1	1												
FOUR CAGES	Place wedges on cooling plates							2	2	2	1	1	1	1	1		float								
	Optical survey of cooling plates								2	2	1	1	1	1	1										
	Place cooling plates in cages										2	2	2	2	2	2	2	2							
	Survey plates in cages																								
	Electronic Test of cages													3	3	3	3	3							
	Install Cages in VTX enclosure in IR																		5	5	5				
	Test Functionality in IR																					2	2	2	2
	Install/Test Final Two Cages in IR																					3	3	3	3
	Workforce Sums	1	1	1	1	2	2	3	5	5	5	5	5	7	7	5	5	5	5	5	5	5	5	5	5

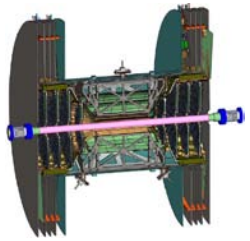
Workforce Timeline



Contains explicit float of 3 months.

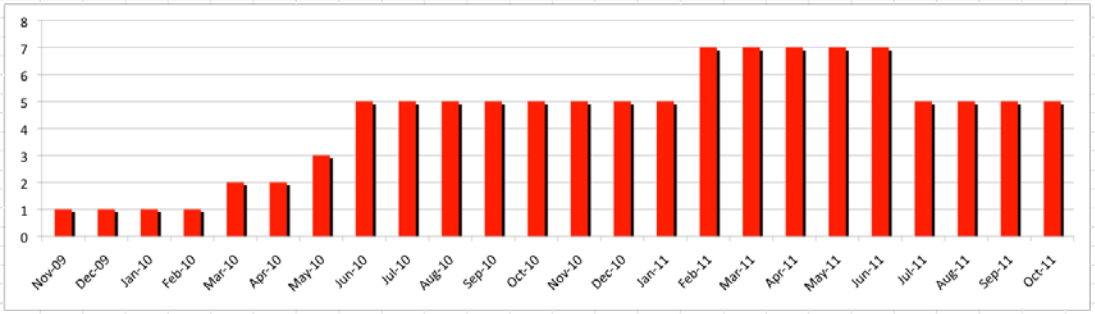
Assembly Schedule

Early Commissioning Plan



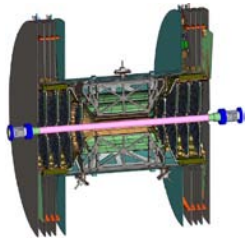
	Task Description	Month-Year N-09	D-09	J-10	F-10	M-10	A-10	M-10	J-10	J-10	A-10	S-10	O-10	N-10	D-10	J-11	F-11	M-11	A-11	M-11	J-11	J-11	A-11	S-11	O-11
	Assembly Lab & CMM Preparation	1	1	1	1	1	1																		
	Q/A on Support Structs. and Fixtures					1	1																		
	Receive/test wedges from SiDet							1	1	1	1	1													
	Place wedges on cooling plates							2	2	2	1	1													
FIRST TWO CAGES	Optical survey of cooling plates								2	2	1	1													
	Place cooling plates in cages										2	2	2												
	Survey plates in cages																								
	Electronic Test of cages												3	3											
	Install First 2 Cages in IR													2	5										
	Test Functionality in IR															3	3	3	3						
	Place wedges on cooling plates															2	2	2	1	1					
LAST TWO CAGES	Optical survey of cooling plates																2	2	1	1					
	Place cooling plates in cages																		2	2	2				
	Survey plates in cages																								
	Electronic Test of cages																			3	3				
	Install Last 2 Cages in IR																				2	5			
	Test Functionality in IR																						5	5	5
	Workforce Sums	1	1	1	1	2	2	3	5	5	5	5	5	5	5	5	7	7	7	7	7	5	5	5	5

Workforce Timeline



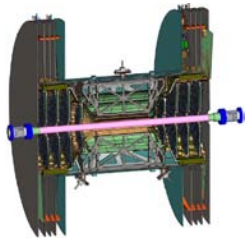
No explicit float, and bigger workforce integral.

Assembly Schedule Overview(s)



- Baseline Plan
  - Start building half-disks from wedges – May 2010
  - Start placing half-disks in half-cages – August 2010
  - Start testing half-cages – November 2010
  - Start placing half-cages in VTX enclosure in IR – April 2011
  - Start install and test 2 half-cages in IR – June 2011 [project complete!]
  - Start install and test remaining half-cages in IR – July 2011
- Early Commissioning Plan
  - Start building half-disks from wedges – May 2010
  - Start placing half-disks in half-cages – August 2010
  - Start testing first 2 half-cages – October 2010 [first diversion from baseline plan]
  - Start placing first 2 half-cages in IR – November 2010 – followed by testing!
  - Resume building half-disks – January 2011
  - Start building final 2 half-cages – April 2011
  - Start testing final 2 half-cages – May 2011
  - Start placing final 2 half-cages in IR – June 2011 [project complete!]

Summary



- Assembly labs at BNL are in a good shape with some work still remaining to be done to prepare them
- Support structure designs are advanced; assembly fixtures need attention
- Funds will likely be expended to repair CMM.
- Workforce needs and schedule have been anticipated; we have good schedule contingency at this point