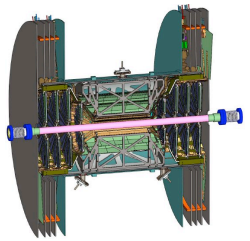
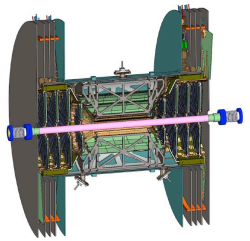


FVTX Detector Assembly Plan

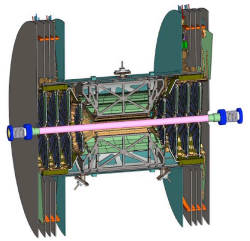
Stephen Pate
New Mexico State University
(FVTX Assembly Management
WBS 1.7)

Talk Outline



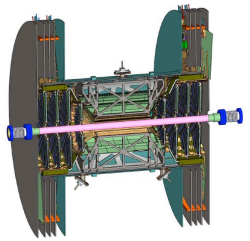
- Scope
- Assembly Schedule
- Support Structures and Assembly Fixtures
- Assembly Lab Area at BNL
- Assembly Procedure --- from wedges to cages
- Installation in PHENIX IR
- WBS Summary

Scope



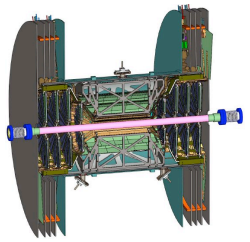
- Prepare assembly lab at BNL
- Receive wedges, ROCs, and support structures
- Build up half-disks and half-cages
- Metrology and Survey of sensors
  - Sensors located to 10 microns in *x* and *y* in each plane
- Testing of sensors and ROCs
  - Functioning and noise levels in all components
- Coordination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

Assembly Schedule



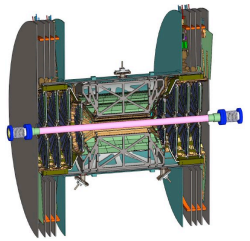
- Assembly fixtures manufactured by 6/17/09
- Support structures manufactured by 7/29/09
- Testing of wedge assemblies 3/23/10 – 10/18/10
- Vendor Q/A of ROCs 1/7/10 – 3/15/10
- Start date for detector assembly is 4/20/10
- Cages completed and surveyed by 1/13/11
- Install in PHENIX IR during 11/11/10 – 2/10/11
- Commission during 11/18/10 – 5/12/11

Support Structures & Assembly Fixtures



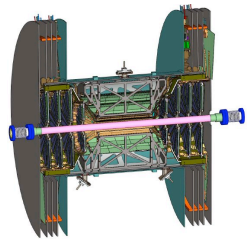
- HYTEC is designing the Support Structures (WBS 1.6.2-1.6.4) and the Assembly Fixtures (WBS 1.6.5);
- After delivery of support structures, we will test them using “dummy wedges”
- See Walt Sondheim’s talk for more details

Assembly Lab Area



- Some minimum requirements for this lab:
  - 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 Lab Area



Two rooms to be used in Physics Building:

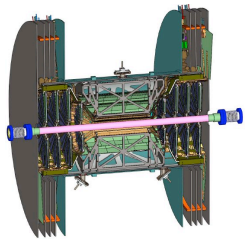
(1) Room 1-116

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

(2) Room 2-91

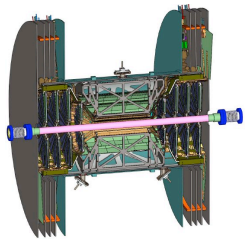
- ~ 400 sq ft; active assembly and testing area
- Needs: Clean entry; dry box; air filter; electronics

Assembly Lab Area



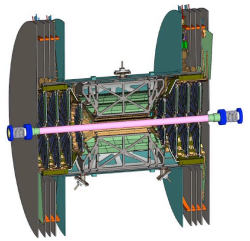
Room 1-116

Assembly Lab Area



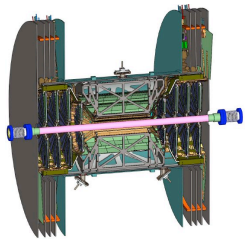
Room 1-116

Assembly Lab Area



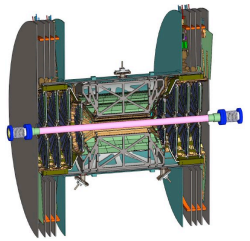
Room 2-91

Assembly Lab Area

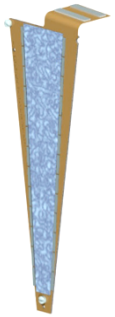


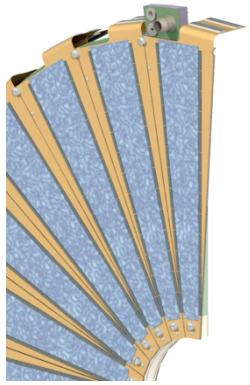
Room 2-91

Assembly Procedure

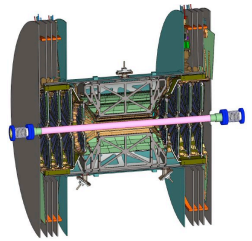


1. Re-testing of wedges delivered from SiDet; re-testing of manufactured ROCs
2. Build up a half-disk as wedges and ROCs become available; mechanical testing
3. Electronic testing of half-disk; do all wedges and ROCs still function?
4. Metrology of sensors on half-disk
5. When sufficient half-disks are available, then move on to a half-cage
6. Survey of half-disks in half-cages
7. Electronic testing of half-cage with mini-DAQ



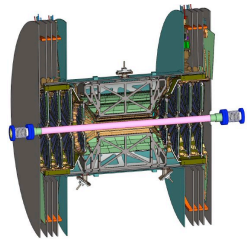


Alignment and Survey



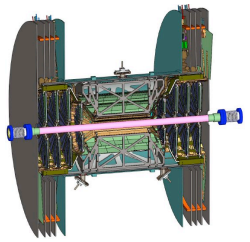
- Goal is to locate the sensors in a plane to within ~10 microns in *x* and *y*
- The strip-to-strip spacing within a wedge will be much better than that. So the issues reduces to the metrology of the sensors in a half-disk, the survey of the half-disks into a half-cage, and the survey of the half-cages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

Alignment and Survey



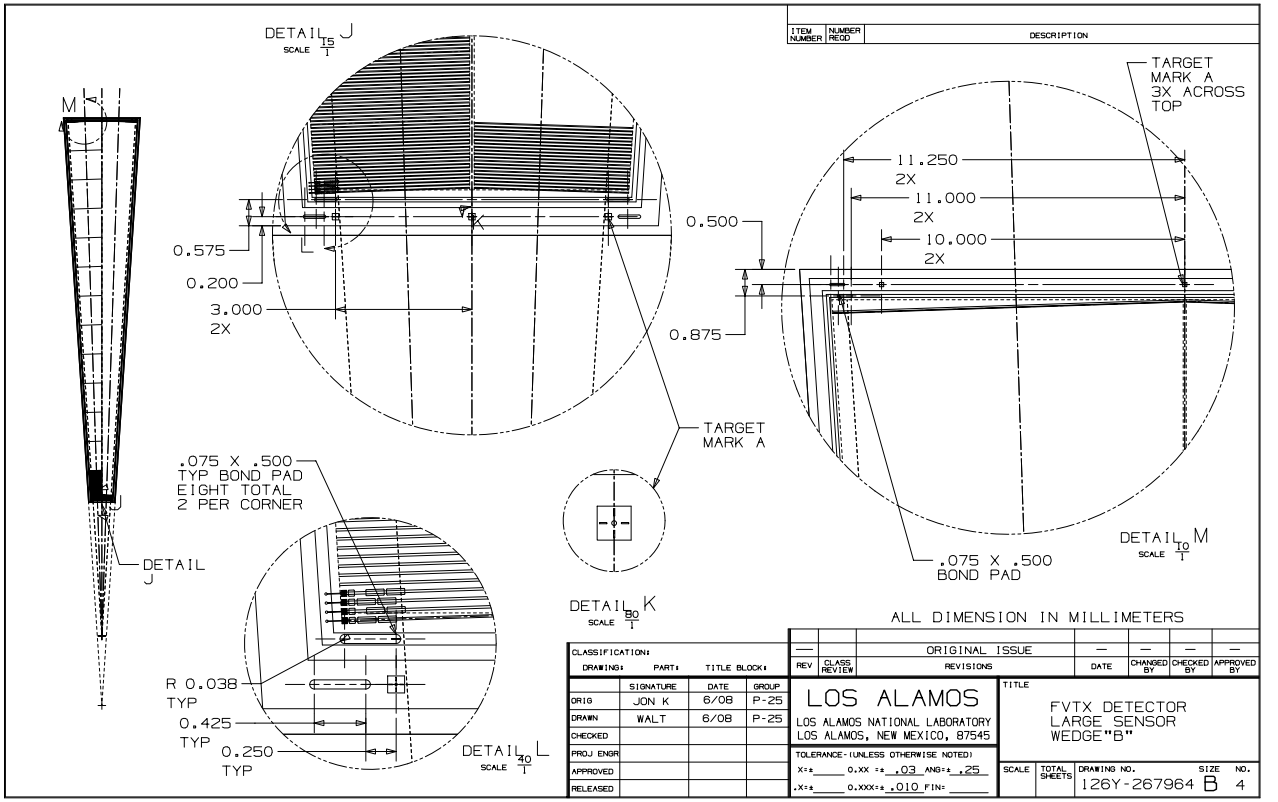
- Procedure:
  - There are 6 target marks on each wedge
  - Wedges are mounted on a half-disk; the half-disk fixtures will include survey targets (details remain to be finalized)
  - Target marks and survey targets will be located using a camera mounted on a CMM machine in the main BNL shop
  - Survey half-disks within a half-cage after assembly
  - Survey the half-disks into the IR during installation

Alignment and Survey

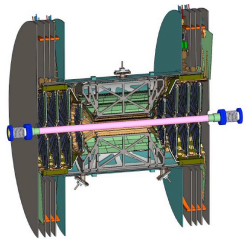


Each sensor has 6 alignment marks placed with high precision by sensor vendor.

These marks will be optically located by a camera mounted above an *xy*-table in the BNL shop.



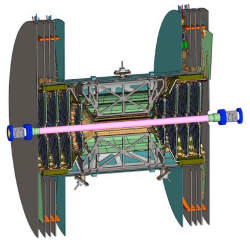
Alignment and Survey



xy-table in main BNL shop
(camera would replace drill bit…)

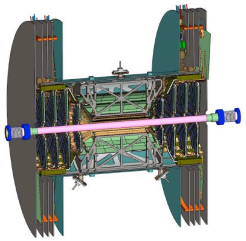
5 μm positioning in *x* and *y;*
everything on a half-disk will be internally located to this accuracy

Installation in PHENIX IR

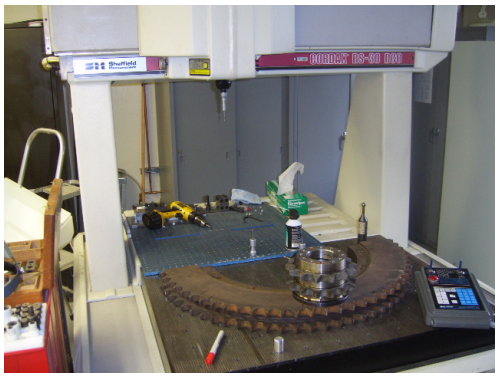


- Major integration activity, planned in close cooperation with BNL/PHENIX scientists and technicians
- PHENIX tech crew responsible for installation; BNL will survey location in IR; PHENIX scientists (see later slide) will connect cables, test detector functions, commission, etc…
- Lots of experience in LANL/NMSU/UNM team

Near-term Activities



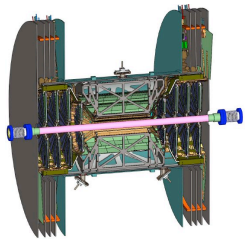
- Work with BNL shop to verify functionality of *xy*-table camera and positioning accuracy



- Establish assembly labs (1-116 and 2-91) as useful workspaces

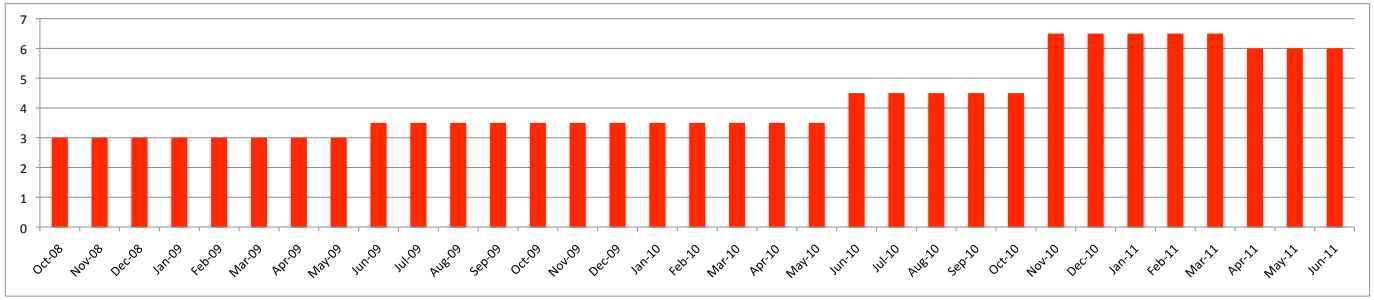
- Begin work on positioning and alignment software and data-basing

Workforce Summary

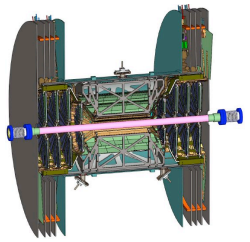


Phase	Task Description	Month-Year	O-08	N-08	D-08	J-09	F-09	M-09	A-09	M-09	J-09	J-09	A-09	S-09	O-09	N-09	D-09	J-10	F-10	M-10	A-10	M-10	J-10	J-10	A-10	S-10	O-10	N-10	D-10	J-11	F-11	M-11	A-11	M-11	J-11
Phase Ia	Assembly Lab Preparation		3	3	3	3	3	3	3	3																									
Phase Ib	Q/A on Support Structs. and Jigs										3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5													
Phase IIa	Receive/test wedges from SiDet																						2.5	2.5	2.5	2.5	2.5	2.5	2.5						
Phase IIb	Place wedges on cooling plates																						2	2	2	2	2	2	2	2					
Phase IIc	Survey wedges on cooling plates																							2	2	2	2	2	2	2					
Phase IId	Place cooling plates in cages																													2.5	4.5	4.5			
Phase IIe	Survey plates in cages																														2	2	2	2	2
Phase III	Install Cages in VTX enclosure																																		
Phase IV	Install Two Cages in IR																																6	6	
Phase V	Test Functionality in IR																																		6
Phase VI	Install/Test Final Two Cages in IR																																		
	Workforce Sums		3	3	3	3	3	3	3	3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5	6.5	6	6	6

Workforce Timeline

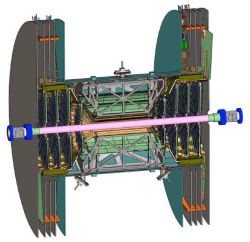


Summary: Cost and Schedule WBS 1.7 Endcap Assembly



• Cost with Contingency	$38k
• R&D needed	none
• Cost Basis	engineering estimate
• Cost Contingency	26%
• Schedule Start and Complete	3/6/09 – 10/25/11
• Schedule Contingency	2 month float
• Risk	low

Summary: Technical
WBS 1.7 Endcap Assembly



• Specification Document	TDR
• Manpower (on-project)	BNL tech crew
• Institutions Involved	LANL, NMSU, UNM, Columbia, BNL
• Infrastructure Defined	Assembly lab at BNL
• QA procedures in place	TDR specs