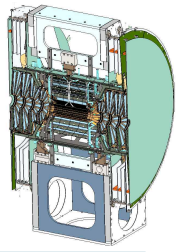
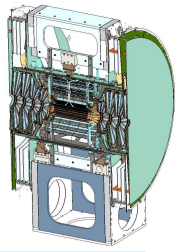


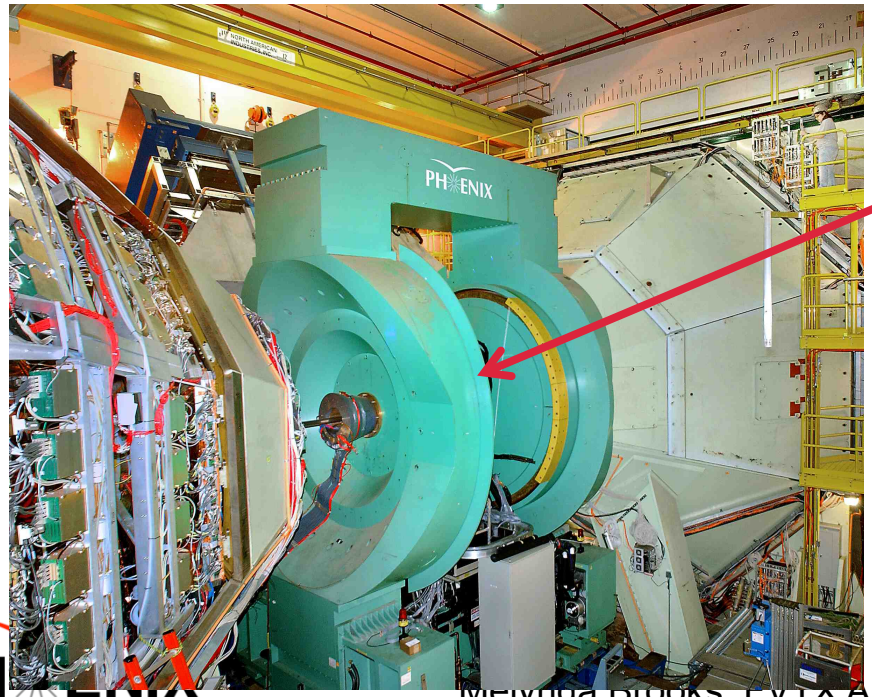
FVTX Project Overview
Cost & Schedule

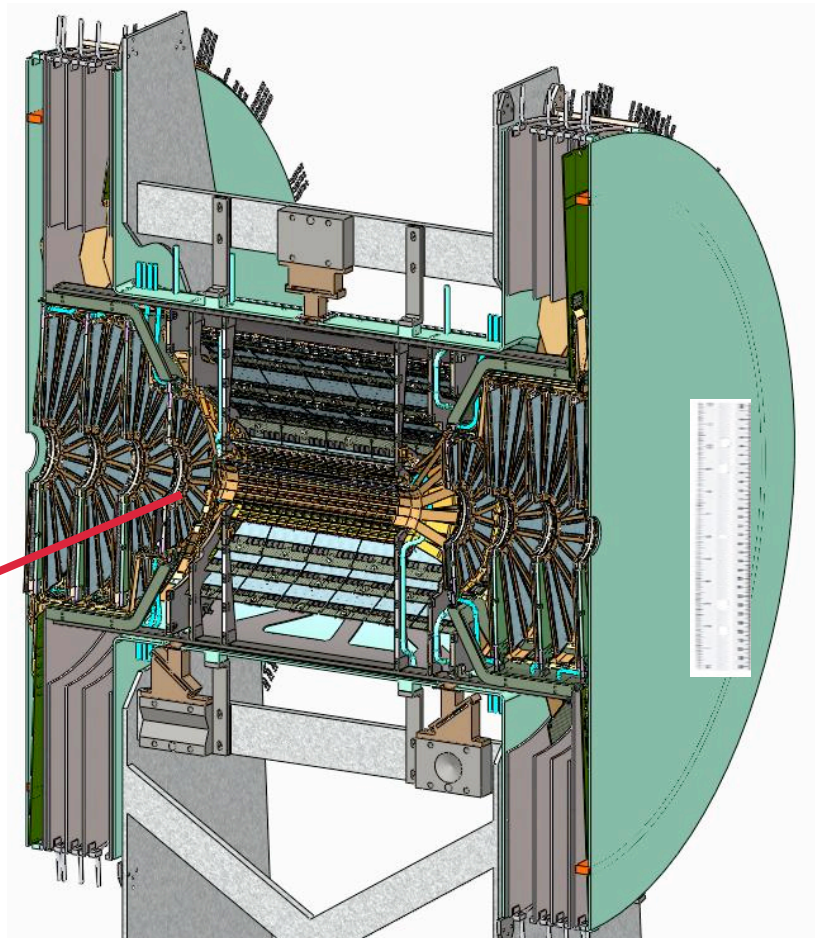
Melynda Brooks
Los Alamos National Laboratory
FVTX Project Manager

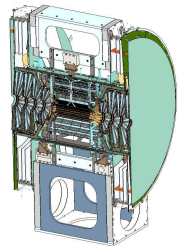


Talk Outline

- Project Overview
- Addressing past Review Questions
- Construction Progress
- FY11 Technical Plans
- Budget and Schedule Summary
- Day's agenda



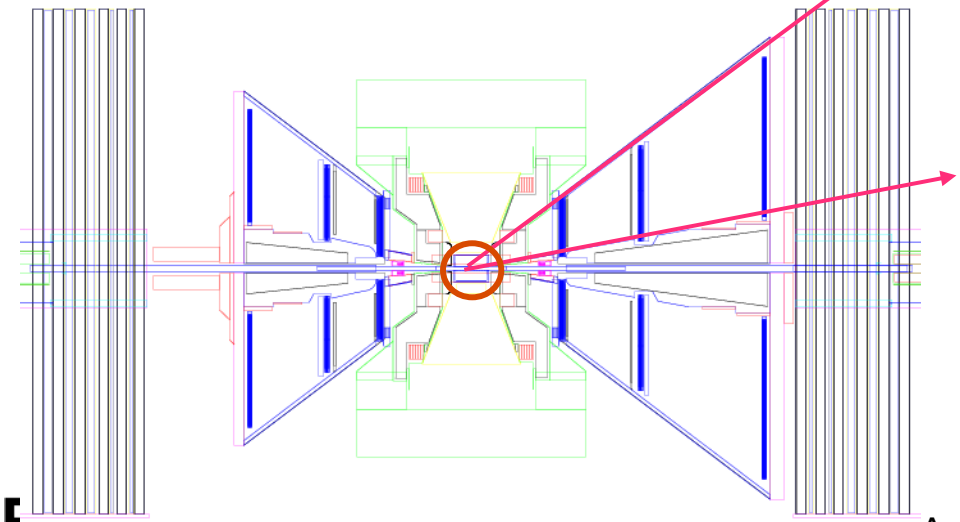


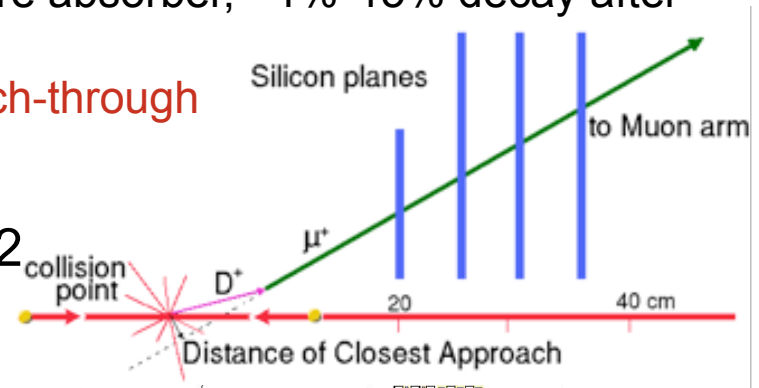


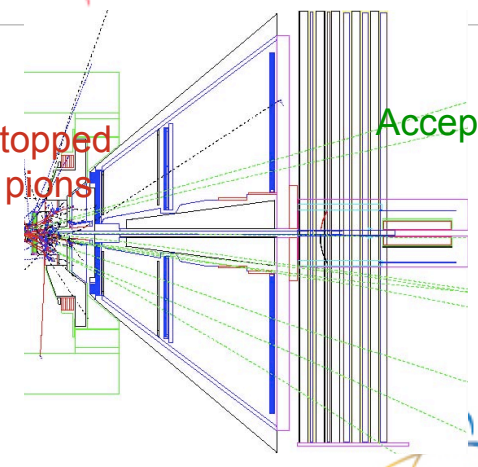
Why an FVTX Detector for Muons?

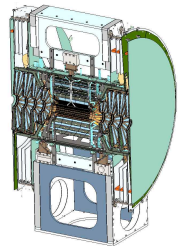
Enhance Muon performance to allow precision heavy flavor measurements

- Initial absorber to reduce hadrons that reach the active detectors
- Muon Tracking stations inside magnet to find tracks and measure momentum
- Muon Identifier for μ/π separation, Lvl-1 trigger
- ~1% "punch through", ~1% decay into muon before absorber, ~1%*15% decay after the absorber
- No way to discriminate $\pi/K \rightarrow \mu$, $D/B \rightarrow \mu$, π/K punch-through
- Mass resolution limited by absorber
- Track isolation information lost by absorber









Physics Programs Accessible With FVTX

Single Muons:

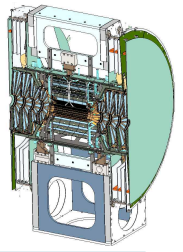
- Precision heavy flavor and hadron measurements at forward rapidity
- Separation of charm and beauty
- W background rejection improved

Dimuons:

- First direct bottom measurement via $B \rightarrow J/\psi$
- Separation of J/ψ from ψ' with improved resolution and S:B
- First Drell-Yan measurements from RHIC
- Direct measurement of c-cbar events via $\mu^+\mu^-$ becomes possible

Physics:

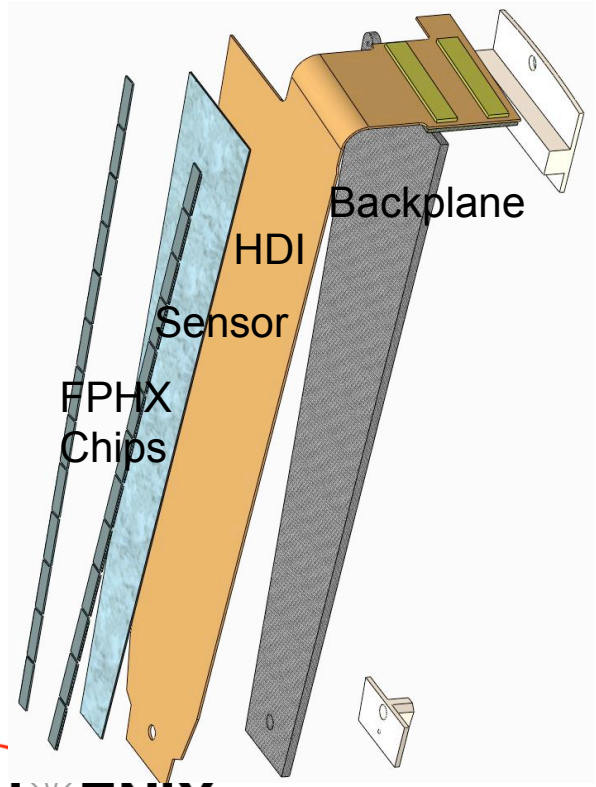
- Advance understanding of energy loss, by adding precise heavy flavor measurements of R_{AA} and flow.
- First detection of ψ' plus heavy quark allow detailed understanding of vector meson production and modification
- Separation/Understanding of Cold Nuclear Matter and QGP effects with rapidity coverage
- Precise gluon polarization and sea quark measurements over large x range, fundamental tests of Sivers functions possible

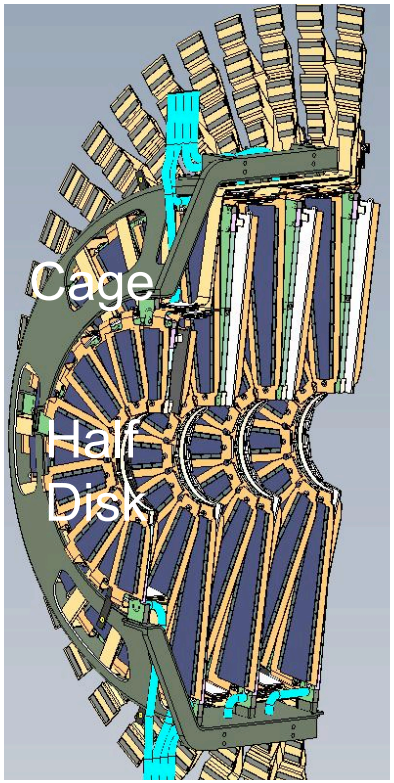


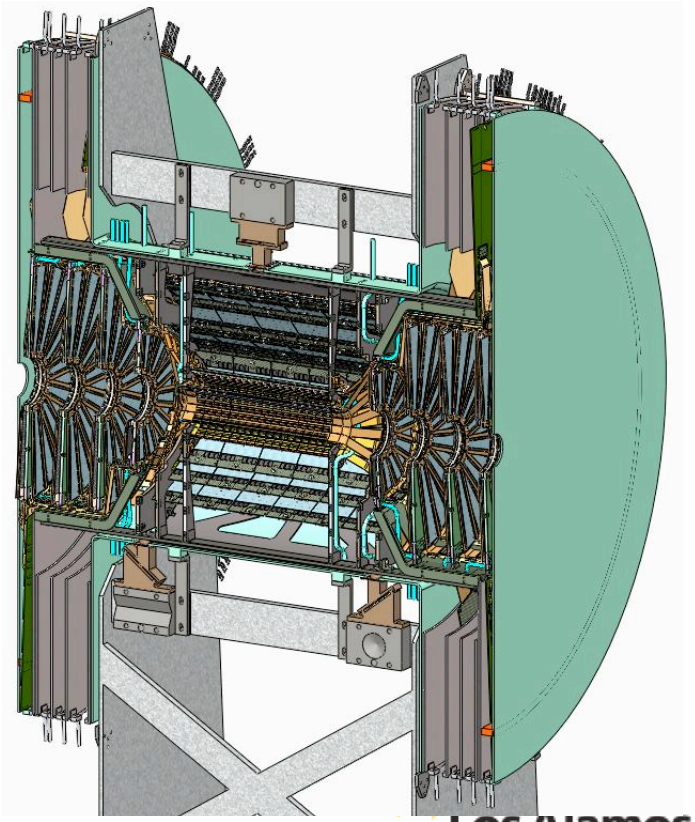
FVTX Geometrical Design

Four tracking stations with full azimuthal coverage

- 75 μm pitch strips in radial direction, 3.75° staggered phi strips
- Radiation length < 2.4%/wedge to minimize multiple scattering
- Outer Support and Cooling outside active area
- Kapton cable plant primarily outside active area

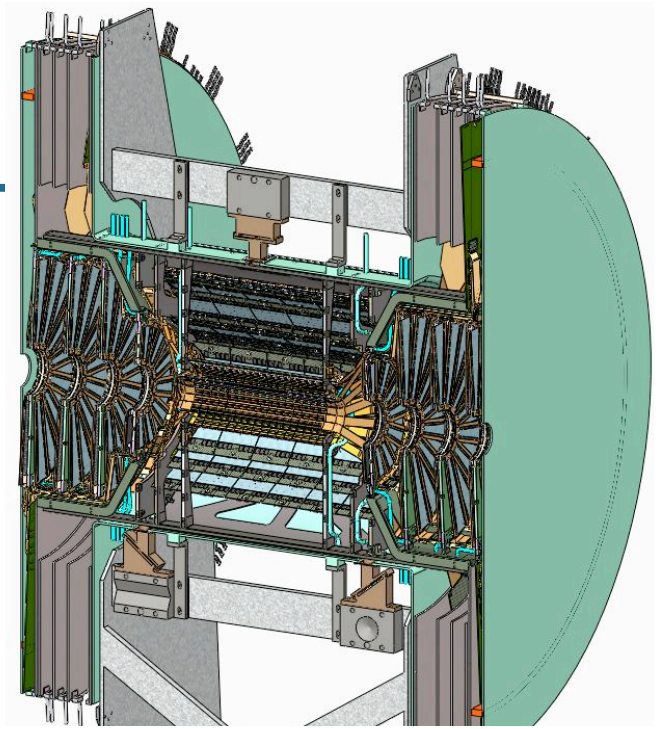


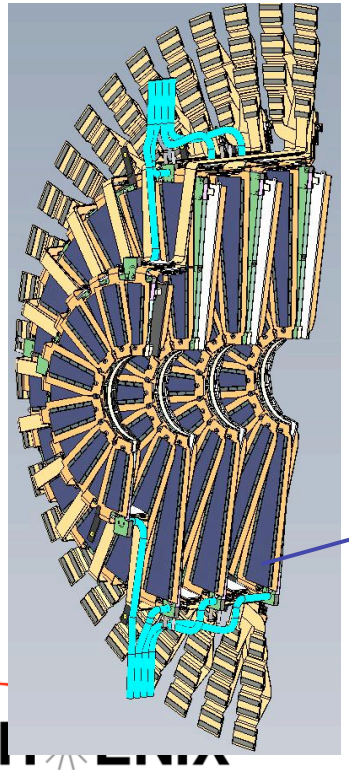


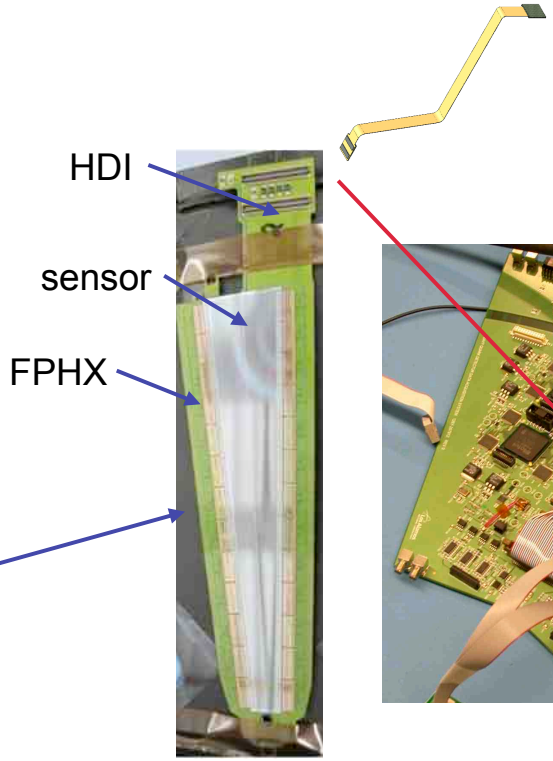


FVTX Electrical Design

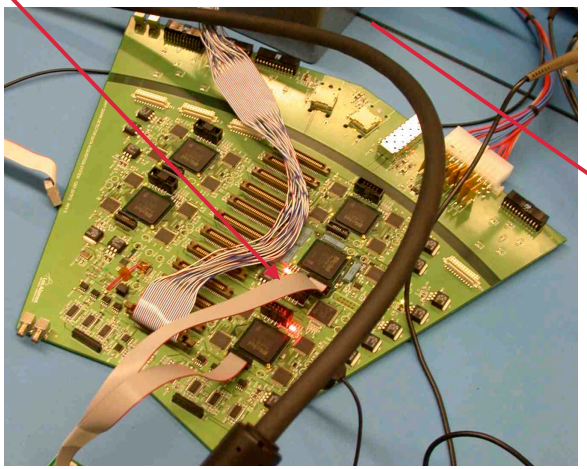
- p on n ministrip sensor, 75 μm x 3.75° →
- Data push FPHX readout chip →
- High density interconnect cable →
- ROC (big wheel area in IR) →
- FEM (VME crate in counting house) →
- PHENIX DCMs



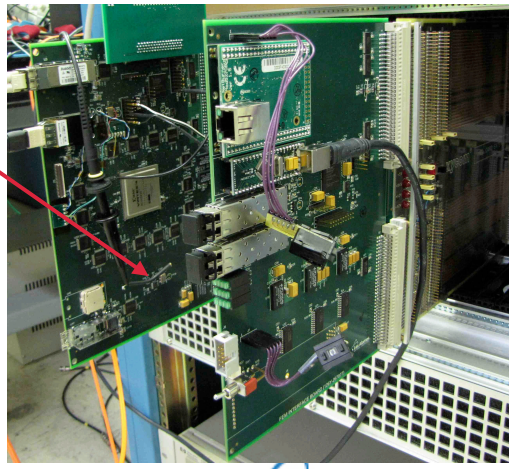




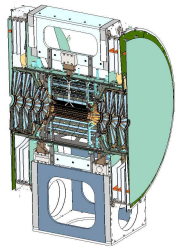
ROC, IR



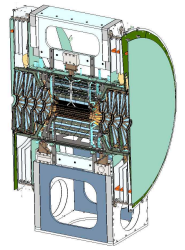
FEM, IB, Counting House



Los Alamos NATIONAL LABORATORY



FY09 Recommendations



2009 Annual Review Recommendations

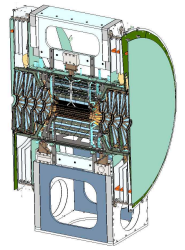
"*A technical line of communication regarding the HDI manufacture should be established with Dyconex immediately. This communication would best be initiated in person at their facility.*"

Reminder of November 2009 Status (last year's review):

- All prototype HDIs tested good, but poor communication from manufacturer to FVTX group about handling of bubbling during processing (holes were introduced into the design)
- HDI driving wedge assembly which was on the critical path so delivery of working HDIs very important to the Project's schedule

Response:

- Jon Kapustinsky, Eric Mannel traveled to Dyconex (Switzerland), MSE (Germany) shortly after review
- Met with management and technical personnel, gave presentation on project, took tour of facilities
- Maintained close communication with Dyconex/MSE staff as well as technical representative that we used previously throughout HDI production



2009 Annual Review Recommendations

"The FVTX team should actively plan for the production cycle of the Wedges by identifying risks and implementing mitigating strategies that could increase the probability of having the Wedges produced on schedule. "

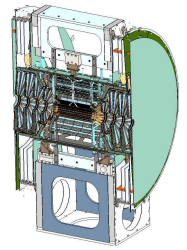
Reminder of November 2009 Status (last year's review):

- Wedge assembly on the critical path

Response:

- Submitted HDI PR with hand-carry (fastest) schedule. Unfortunately, time lost in lawyer's negotiations, but got hand-carry process once started.
- Active participation with SiDet to optimize wedge assembly (See Dave Winter's talk)
- Prompt testing of all components made all but HDIs available in advance of beginning of wedge assembly.
- Result – wedge assembly met project schedule until delay of last HDI delivery (see later). May still be completed on time.

WBS Number	Control Milestone Name	Baseline Date
WBS 1.1	DOE construction funds received	Q3 FY08
Accounts open	Accounts open	Q3 FY08
WBS 1.6.2.2.2	Review and Approve wedge, disk, cage design	Q3 FY08
WBS 1.4.3.2.5	HDI tested	Q3 FY08
WBS 1.4.1.2.3	Sensor prototype tested	Q1 FY09
WBS 1.4.1.2.5	First prototype wedge assembly	Q1 FY09
WBS 1.5.2.2.6	PHENIX system test complete	Q1 FY09
WBS 1.5.2.2.8	Review and Approve FEM and ROC	Q2 FY09
WBS 1.4.3.3.1	**1st Production HDIs Received**	**Q2 FY10**
WBS 1.4.1.3.1	Sensor Procurement complete	Q3 FY09
WBS 1.4.1.2.6	Wedge assembly test complete	Q4 FY09
WBS 1.4.2.5.1	FPHX engineering run complete	Q1 FY10
WBS 1. 5.3	ROC and FEM production Complete	Q2 FY10
WBS 1.7.1.1	**Disk Assembly begins**	**Q3 FY10**
WBS 1.7.2.1	**First Two ½ Cages Assembled**	**Q1 FY11**
WBS 1.7.2.1	**Functional Requirements Tests on Bench Begins**	**Q1 FY11**
WBS 1.5.5.6	Install ancillary Equipment	Q4 FY10
WBS 1.7.1.1	**Disk Assembly complete**	**Q1 FY11**
WBS 1.7.2.1	½ Cage Assembly finished	Q2 FY11
	All FVTX Component Deliverables Completed	**Q2 FY11**
WBS 1.7.5	**Verify Functional Requirements on Bench Completed**	**Q3 FY11**
WBS 1.7.3	**Install into VTX enclosure**	**Q4 FY11**
WBS 1.7.3	**Project Complete**	**Q4 FY11**



2009 Annual Review Recommendations

"The FVTX team should present a detailed commissioning plan, including necessary scientific and technical personnel, at the next (2010) annual review. "

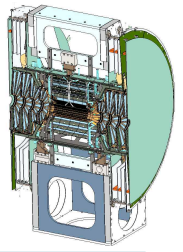
Response:

- Commissioning topics covered throughout the day and in the Commissioning Talk

"PHENIX and the FVTX team should develop and present, at the next annual review, a plan to experimentally estimate the DCA background distributions and to tune their simulations accordingly. The necessary personnel to carry out these studies with the Run 12 data should also be identified. "

Response:

- We can select/enhance contribution from real data prompt particles, punch-through hadrons, decay hadrons by cutting on J/psi events, Muon Identifier momentum for stopped particles in the Muon Identifier, and compare DCA distributions from these selected events to Monte Carlo distributions.
- See Software Talk

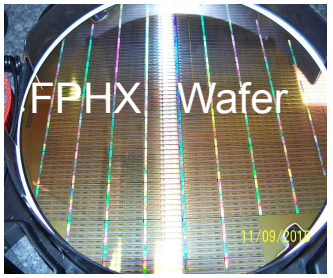


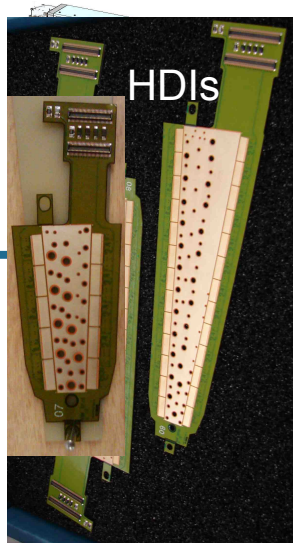
Technical Progress

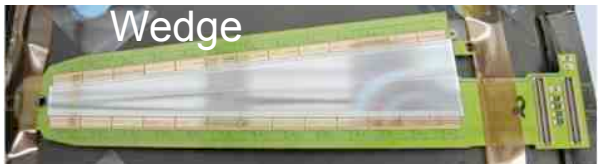
FY10 Progress - Technical

Wedge Components

- All sensors procured and tested. ~100% yield
- 24 FPHX wafers procured and 17 tested, >95% yield
- All small HDIs received (125), 25 large HDIs received, rest in progress, ~100% yield
- All backplanes received and within specifications



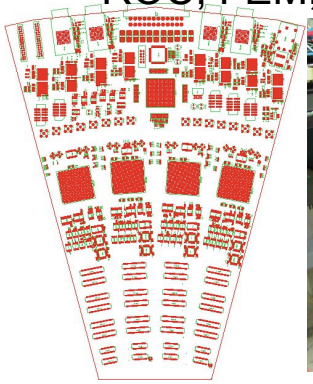


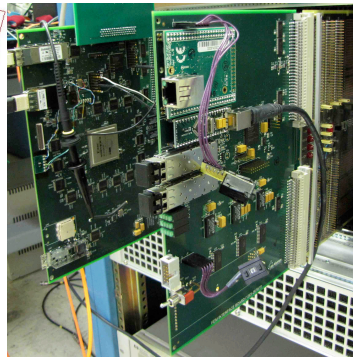


Detector Assembly

- 120(118) small production wedges with chips (chips+sensors) and 23 large production wedges assembled at SiDet
- Disk assembly at BNL underway, cage assembly plan in place

ROC, FEM, FEM Interface



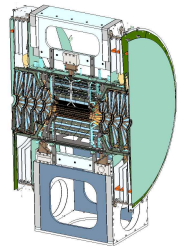


DAQ

- FEM Interface 1st article tested good, rest in assembly
- FEM production board 1st article received and tests good
- Full ROC prototype underway.

Mechanics

- Disk, cage fabrication in progress
- Assembly fixtures for disk, cage completed



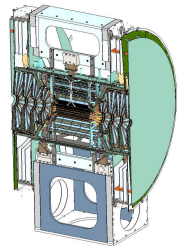
FY10 Project Hurdles

Schedule Issues and Mitigation Strategies

- ~3 month delay in Initial HDI Delivery: HDI PR submitted in November 2009 with anticipated delivery by January/February. Lawyer negotiations did not accept terms of PR until ~March 2010, delivery of HDIs in May 2010.
- Active work with SiDet to optimize wedge assembly plus project contingency → assembly rate was making up most of the 3 month delay (until delay of last HDI delivery)

- Delay of last batch of HDIs → 150 HDIs delivered and working well, then last large HDI batch failed in manufacturing process. Rapid succession of technical discussions to determine best path forward, Follow-up with in-person visit to Dyconex. Large HDIs that were to have been delivered in October will be delivered in December and January. SiDet can ~double manpower for wedge assembly. Large disk assemblies will have to be compressed, full cage assembly delayed.

- Mechanical Disk Delay – Engineering company dissolved by new parent company unexpectedly in Dec. 2009 → had to bring on designers/engineer as contractors. Iteration on design to reduce price, Slow PR process→ October delivery of first disk.



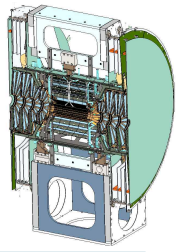
FY10 Project Hurdles

Schedule Issues (cont'd)

- ROC delay – Layout has taken much longer than anticipated (designer availability + design work more complicated than anticipated). LANL management negotiated with designer groups to have all resources applied to layout work. Some cost coverage by LANL. Assembly will use already available boards for testing until final round ROC boards become available. (more details in schedule discussion)

Technical

- Prototyping/production on many fronts at once this past year – sensors, FPHX chips, backplanes, HDIs, FEM cards, FEM Interface cards ROC cards, disk, cage, assembly fixtures.
- Employed multiple checks on electrical and mechanical designs.
- Overall, no major technical flaws found in production designs.



FY11 Technical Work

Wedge, Disk and Cage Assembly

- Wedge assembly at SiDet
- Disk Assembly at BNL
- Cage Assembly at BNL

DAQ

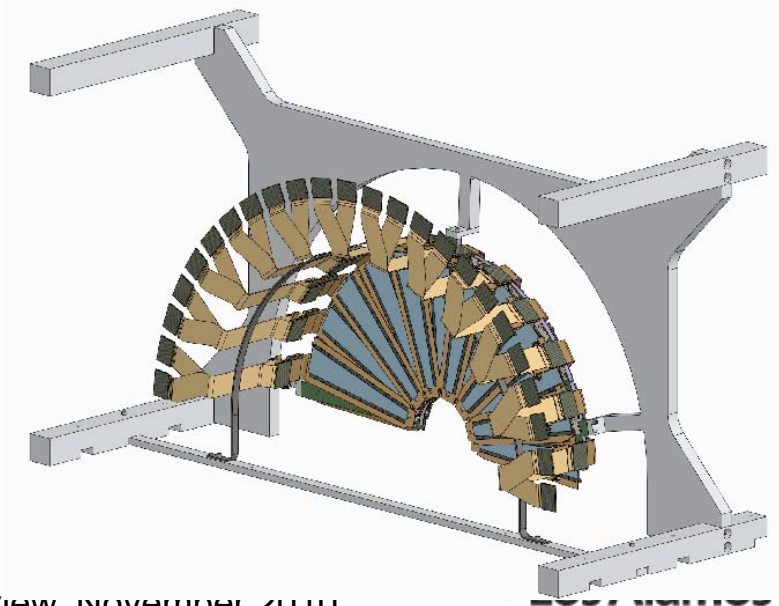
- Production FEM Interface and FEM boards in hand or in assembly line
- ROC prototype board should be received November/December 2010
- Full ROC production January 2011 (?)

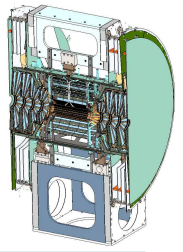
Bench Testing and Commissioning

- Disk Testing during assembly
- Individual Cage Testing during assembly
- Multiple Cages with FVTX on Bench
- FVTX and VTX installed into IR
- Functional Testing in IR

IR Preparation

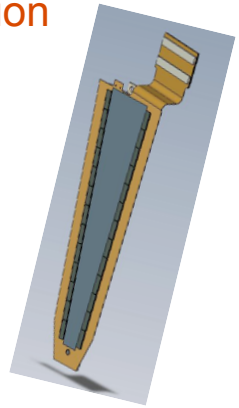
- Installation of power, cabling, etc.



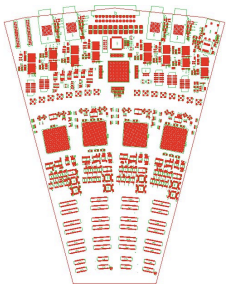


Project Reviews

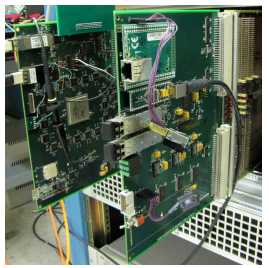
Feb-April 2008	FPHX Design Reviews before prototype submission
August 2008	Overall Electronics Design Review
August 2008	Informal Mechanics Review of Components
May 2009	FPHX review prior to FPHX-2 prototype
June 2009	1st RHIC Safety Review
Sep 2009	FPHX review prior to production
Oct 2009	HDI review prior to 2nd prototype
Dec 2009	Final HDI and Interconnect Cable review
June 2010	Go-Ahead for FEM/FEM Interface Production
Dec 2010	ROC final review
Late 2011	PHENIX Readiness Review



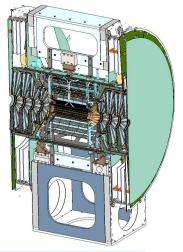
Note: each FPHX review was presented as a "system" review already



ROC



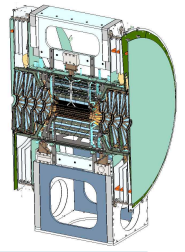
FEM



FVTX Project Deliverables

Item	Number	Working Spares
Wedge assemblies		
Large Sensors	288	25 in spare wedges
Small Sensors	96	8 in spare wedges
Large Wedges	288	25
Small Wedges	96	8
ROC boards	24	4
FEM boards	48	6
Mechanical		
Large ½ Disks	12	2
Small ½ Disks	4	1
Suspension system	1 (VTX funded)	0
Dry gas enclosure	1 (VTX funded)	0
Cooling system	1 (VTX funded)	0
Power supply system	1	Spare components available
DCM channels	48	4

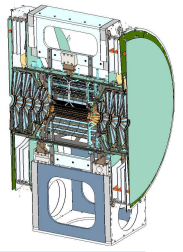
KEY:
Done
In Progress



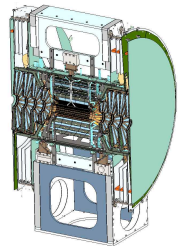
FVTX Functional Requirements

Mini strips active	>80%	(expect ~99%)
Hit efficiency	>85%	(expect ~99%)
Radiation length per wedge	< 2.4 %	
Detector hit resolution	< 25 μm	(can achieve without analog information)
Random noise hits/chip	<0.1%	(threshold:noise ~5:1)
Level-1 latency	4 μs	
Level-1 Multi-Event buffer depth	4 events	
Read-out time	< 40 μs	
Read-out rate	> 10 kHz	

*Primary bench test requirements. Others are met by design



Cost & Schedule

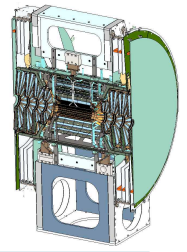


FY10 Project Hurdles

Costs – significant increase in few project costs have reduced contingency

- $172k more for mechanical components (backplane, disk, cage)
- $506k more for HDI + extension cables ("fast" HDI delivery + significant extension cable NRE * 16 types)
- ~$100k more for Ancillary Systems (power distribution, DCMs)

- Mitigation – had to take above increased costs, but worked to keep other costs from increasing:
  - Negotiated somewhat lower price for extension cables
  - Redesign work with LBNL to bring initial disk estimate down to 2.5* lower than initial quote
  - Negotiations at LANL resulted in LANL covering part of extra ROC design costs
  - Did not accept ~$50k over-charge from contracted institution that carried out work beyond scope
  - Continue to look for cost reductions wherever we can.



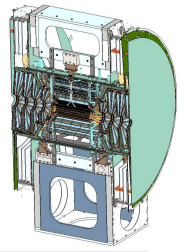
Cost Summary

FVTX Cost Roll-Up:

- Management Plan Cost = $4880k, Contingency = $927k (23%)
- $4276k costs and commitments to date
- Remaining Cost to Complete = $523k with Contingency = $101k (19%)

Primary Remaining Costs

ROC production board (but many parts already procured) - ~$275k remaining
Remaining FEM production boards – PR in place, just need to give go-ahead - $99k
Engineering Support - $55k
Power Distribution boards - ~$40k
Endcap assembly - $30k



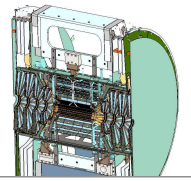
Schedule Summary

Current Schedule: Project Deliverables June 30 2011, Sept. 30 2011

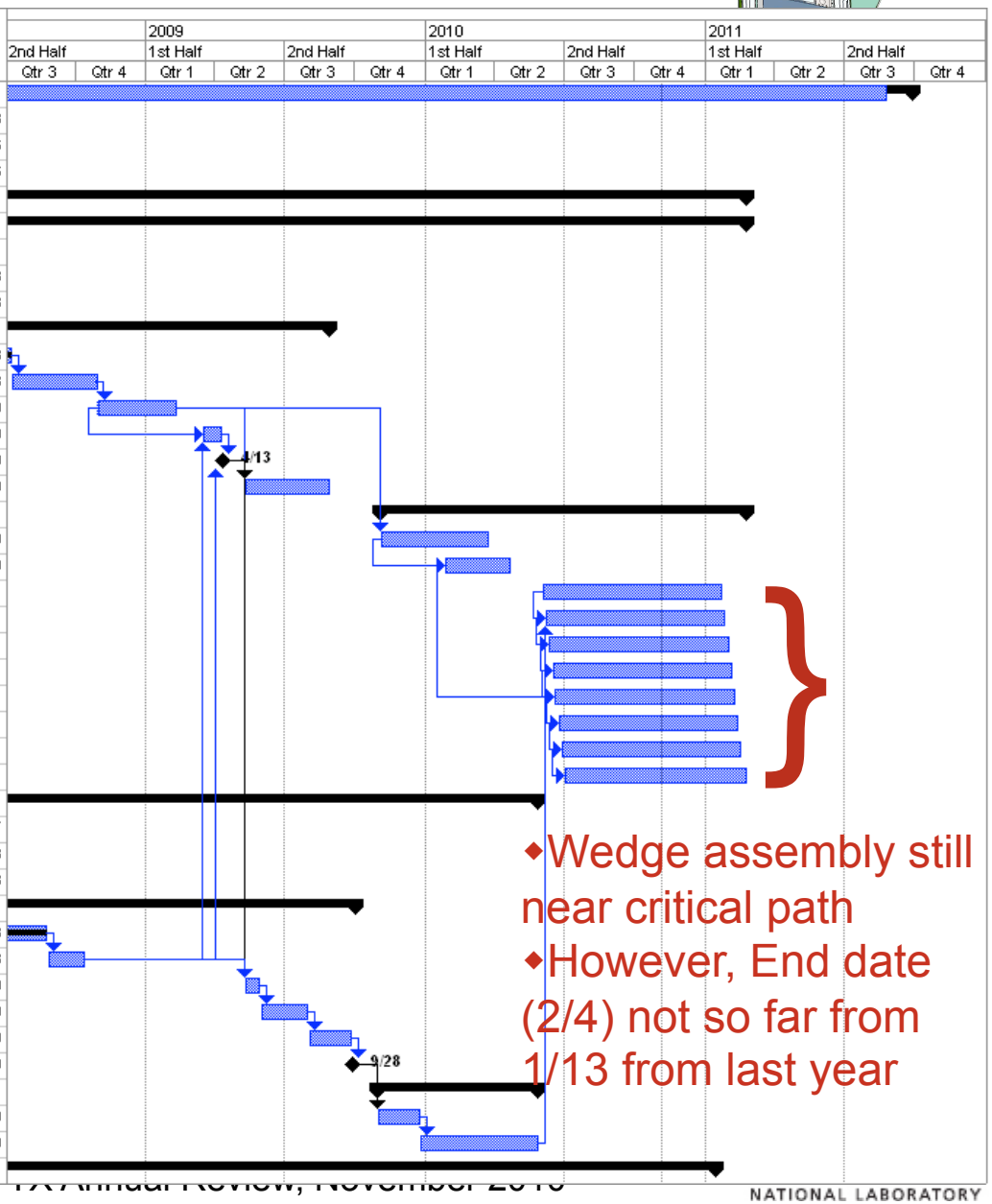
• Wedge Assembly	Jun 2010 – Feb 2011
• Disk Assembly	Nov 2010 – May 2011
• Disks into Cages	Feb 2011 – Jun 2011
• **Test Functional Requirements**	**Mar 2010 – Jun 2011**
• Schedule Float	6/7/11 – 6/30/11
• Install and Test in IR	Jul 2011 – Sept 2011
• **Project Complete**	**September 30, 2011**

- Options to increase schedule float:
  - Parallel assembly of disks (done serially now): wedge preparations finished in March, last disk does not get assembled until May so 1-2 months could be gained here if infrastructure is in place
  - Earlier delivery of 1st large wedges: Steve assumes large wedges not available until 1/31, but could be ready sooner

FVTX Project File

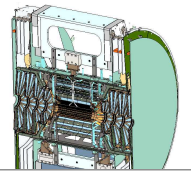


ID	WBS	Task Name	Start	Finish
1	**1**	**FVTX Project**	**Fri 10/21/05**	**Tue 9/27/11**
2	1.1	**Start Construction**	Tue 4/1/08	Tue 4/1/08
3	1.2	**Start R&D BNL**	Mon 1/2/06	Mon 1/2/06
4	1.3	**Start R&D LANL**	Mon 1/2/06	Mon 1/2/06
5	**1.4**	**Wedge Components**	**Thu 3/15/07**	**Tue 2/22/11**
6	**1.4.1**	**Wedge sensors**	**Fri 2/15/08**	**Tue 2/22/11**
7	**1.4.1.1**	**Vendor selection**	**Fri 2/15/08**	**Thu 4/10/08**
8	1.4.1.1.1	develop criteria	Fri 2/15/08	Thu 2/28/08
9	1.4.1.1.2	Vendor quotes	Fri 2/29/08	Thu 4/10/08
10	**1.4.1.2**	**procure prototype sensor**	**Wed 6/11/08**	**Fri 8/28/09**
11	1.4.1.2.1	mask set	Wed 6/11/08	Tue 7/8/08
12	1.4.1.2.2	sensor manufacture	Wed 7/9/08	Tue 10/28/08
13	1.4.1.2.3	test prototype sensor	Wed 10/29/08	Tue 2/10/09
14	1.4.1.2.4	wire bond FPHX	Mon 3/16/09	Fri 4/10/09
15	1.4.1.2.5	1st prototype wedge assembly	Mon 4/13/09	Fri 5/8/09
16	1.4.1.2.6	test wedge assembly(system test)	Mon 5/11/09	Fri 8/28/09
17	**1.4.1.3**	**procure sensors**	**Wed 11/4/09**	**Tue 2/22/11**
18	1.4.1.3.1	procure sensor(fully tested)	Wed 11/4/09	Tue 3/23/10
19	1.4.1.3.2	Sensor Q/A	Wed 1/27/10	Tue 4/20/10
20	1.4.1.3.3	Attach HDI to Backplane	Wed 6/2/10	Fri 1/21/11
21	1.4.1.3.7	Glue chips to HDI	Mon 6/7/10	Wed 1/26/11
22	1.4.1.3.12	Wire bond chips to HDI	Thu 6/10/10	Mon 1/31/11
23	1.4.1.3.8	Test chips and HDI	Tue 6/15/10	Thu 2/3/11
24	1.4.1.3.4	Attach sensor	Fri 6/18/10	Tue 2/8/11
25	1.4.1.3.5	Wire bond sensor to chips + HDI	Wed 6/23/10	Fri 2/11/11
26	1.4.1.3.6	Test chip,sensor + cable assemblies	Mon 6/28/10	Wed 2/16/11
27	1.4.1.3.9	Wire bond encapsulation	Thu 7/1/10	Tue 2/22/11
28	**1.4.2**	**FPHX Chip**	**Thu 3/15/07**	**Thu 5/27/10**
29	1.4.2.1	design(FNAL)	Thu 3/15/07	Wed 6/20/07
30	1.4.2.3	layout	Fri 10/26/07	Thu 4/10/08
31	1.4.2.6	Review design	Mon 4/14/08	Mon 4/14/08
32	**1.4.2.4**	**procure prototype chip**	**Mon 6/2/08**	**Thu 10/1/09**
33	1.4.2.4.1	First MOSIS run	Mon 6/2/08	Fri 8/22/08
34	1.4.2.4.2	test prototype(FNAL)	Mon 8/25/08	Fri 10/10/08
35	1.4.2.4.3	redesign	Mon 5/11/09	Fri 5/29/09
36	1.4.2.4.4	submit 2nd MOSIS run	Mon 6/1/09	Fri 7/31/09
37	1.4.2.4.5	test 2nd proto	Mon 8/3/09	Fri 9/25/09
38	1.4.2.4.9	review and approve	Mon 9/28/09	Thu 10/1/09
39	**1.4.2.5**	**procure production chips**	**Fri 10/30/09**	**Thu 5/27/10**
40	1.4.2.5.1	engineering run	Fri 10/30/09	Thu 12/24/09
41	1.4.2.5.2	test chips(FNAL)	Fri 12/25/09	Thu 5/27/10
42	**1.4.3**	**Kapton flex cables HDI**	**Wed 6/4/08**	**Thu 1/13/11**

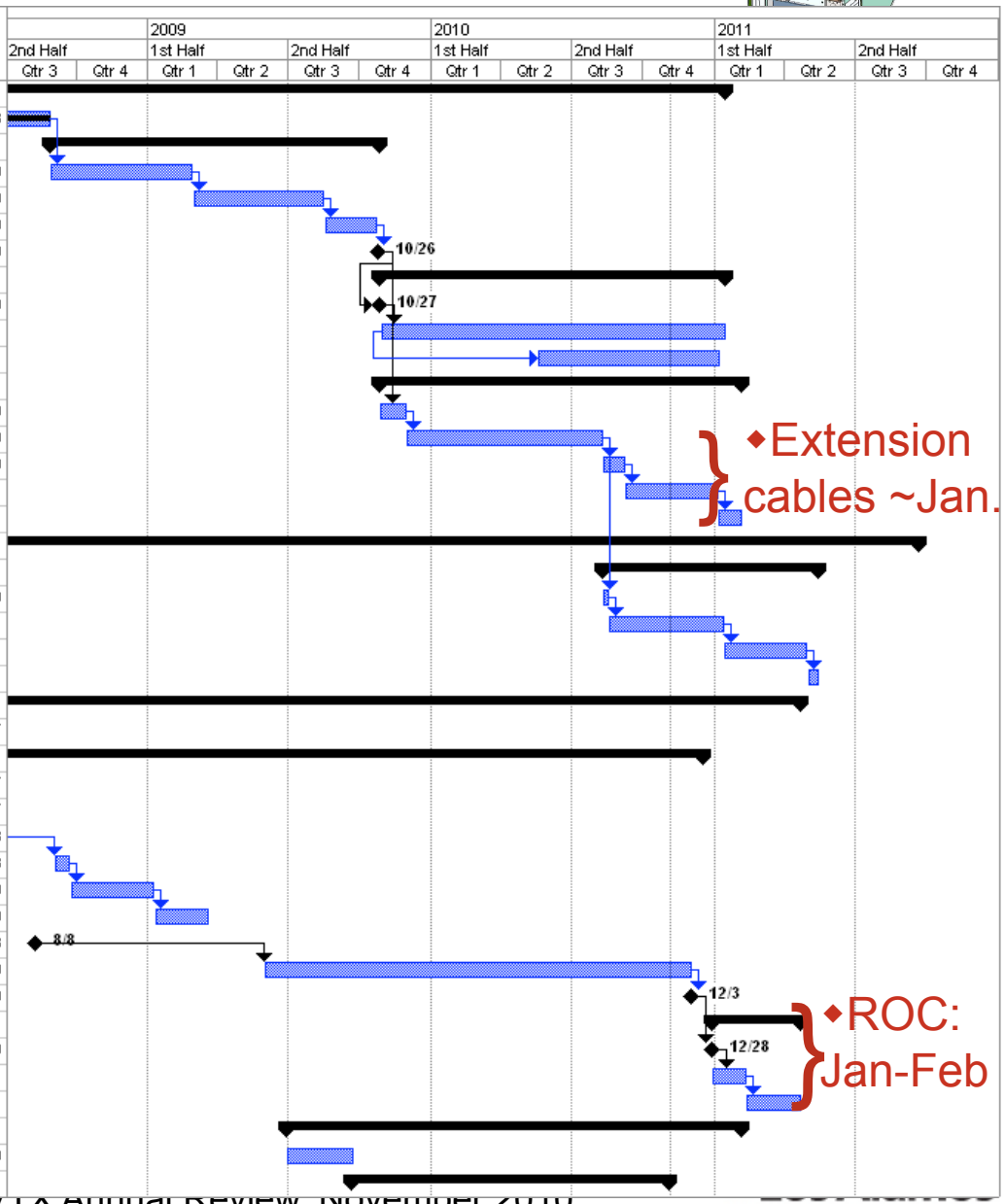


- Wedge assembly still near critical path
- However, End date (2/4) not so far from 1/13 from last year

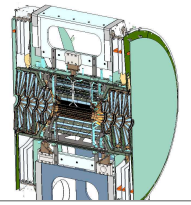
FVTX Project File



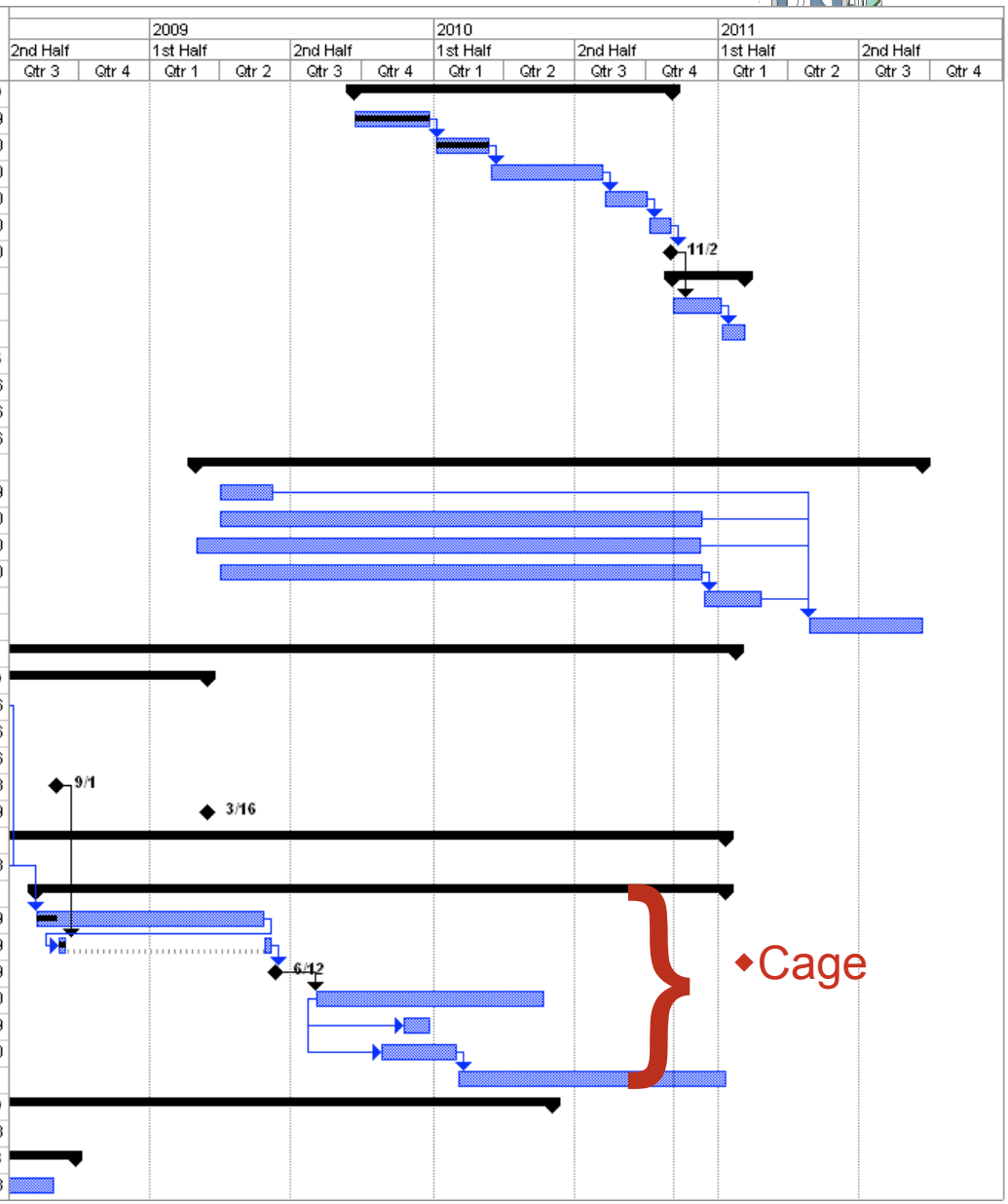
ID	WBS	Task Name	Start	Finish
42	**1.4.3**	**Kapton flex cables HDI**	**Wed 6/4/08**	**Thu 1/13/11**
43	1.4.3.1	design	Wed 6/4/08	Tue 8/26/08
44	**1.4.3.2**	**procure prototype HDI**	**Wed 8/27/08**	**Mon 10/26/09**
45	1.4.3.2.1	prototype	Wed 8/27/08	Fri 2/27/09
46	1.4.3.2.2	test	Mon 3/2/09	Fri 8/14/09
47	1.4.3.2.3	redesign	Mon 8/17/09	Fri 10/23/09
48	1.4.3.2.6	review and approve HDI prototype	Mon 10/26/09	Mon 10/26/09
49	**1.4.3.3**	**procure production HDI**	**Tue 10/27/09**	**Thu 1/13/11**
50	1.4.3.3.3	final design review	Tue 10/27/09	Tue 10/27/09
51	1.4.3.3.1	procure	Wed 10/28/09	Thu 1/13/11
52	1.4.3.3.2	test cable	Wed 5/19/10	Thu 1/6/11
53	**1.4.4**	**Kapton HDI to ROC interconnect**	**Tue 10/27/09**	**Thu 2/3/11**
54	1.4.4.1	design	Tue 10/27/09	Mon 11/30/09
55	1.4.4.2	prototype	Tue 12/1/09	Mon 8/9/10
56	1.4.4.3	test prototype	Tue 8/10/10	Mon 9/6/10
57	1.4.4.4	procure	Tue 9/7/10	Wed 1/5/11
58	1.4.4.5	test cable	Thu 1/6/11	Thu 2/3/11
59	**1.5**	**DAQ**	**Mon 10/23/06**	**Mon 9/19/11**
60	**1.5.1**	**Fiber output ROC-FEM**	**Tue 8/10/10**	**Fri 5/13/11**
61	1.5.1.1	design	Tue 8/10/10	Mon 8/16/10
62	1.5.1.2	prototype	Tue 8/17/10	Wed 1/12/11
63	1.5.1.3	procure	Thu 1/13/11	Fri 4/29/11
64	1.5.1.4	test cable	Mon 5/2/11	Fri 5/13/11
65	**1.5.2**	**ROC Electronics**	**Tue 1/30/07**	**Wed 4/20/11**
66	1.5.2.1	design	Tue 1/30/07	Mon 3/19/07
67	**1.5.2.2**	**procure prototype**	**Tue 3/20/07**	**Thu 12/16/10**
68	1.5.2.2.1	prototype	Tue 3/20/07	Mon 5/21/07
69	1.5.2.2.2	test prototype	Tue 5/22/07	Mon 7/30/07
70	1.5.2.2.3	redesign	Tue 7/31/07	Mon 2/25/08
71	1.5.2.2.4	2nd prototype ldrd version	Mon 9/1/08	Fri 9/19/08
72	1.5.2.2.5	test second proto	Mon 9/22/08	Fri 1/9/09
73	1.5.2.2.6	PHENIX system test	Mon 1/12/09	Fri 3/20/09
74	1.5.2.2.9	internal design review	Fri 8/8/08	Fri 8/8/08
75	1.5.2.2.7	preproduction prototype FVTX version	Mon 6/1/09	Thu 12/2/10
76	1.5.2.2.8	test ROC	Fri 12/3/10	Thu 12/16/10
77	**1.5.2.3**	**procure production ROC**	**Tue 12/28/10**	**Wed 4/20/11**
78	1.5.2.3.3	final design review	Tue 12/28/10	Tue 12/28/10
79	1.5.2.3.1	production	Wed 12/29/10	Thu 2/10/11
80	1.5.2.3.2	Q/A - 28 units	Fri 2/11/11	Wed 4/20/11
81	**1.5.3**	**FEM Electronics**	**Tue 6/30/09**	**Thu 2/3/11**
82	1.5.3.1	design	Tue 6/30/09	Mon 9/21/09
83	**1.5.3.2**	**procure prototype FEM**	**Mon 9/21/09**	**Tue 11/2/10**



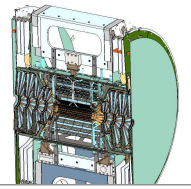
FVTX Project File



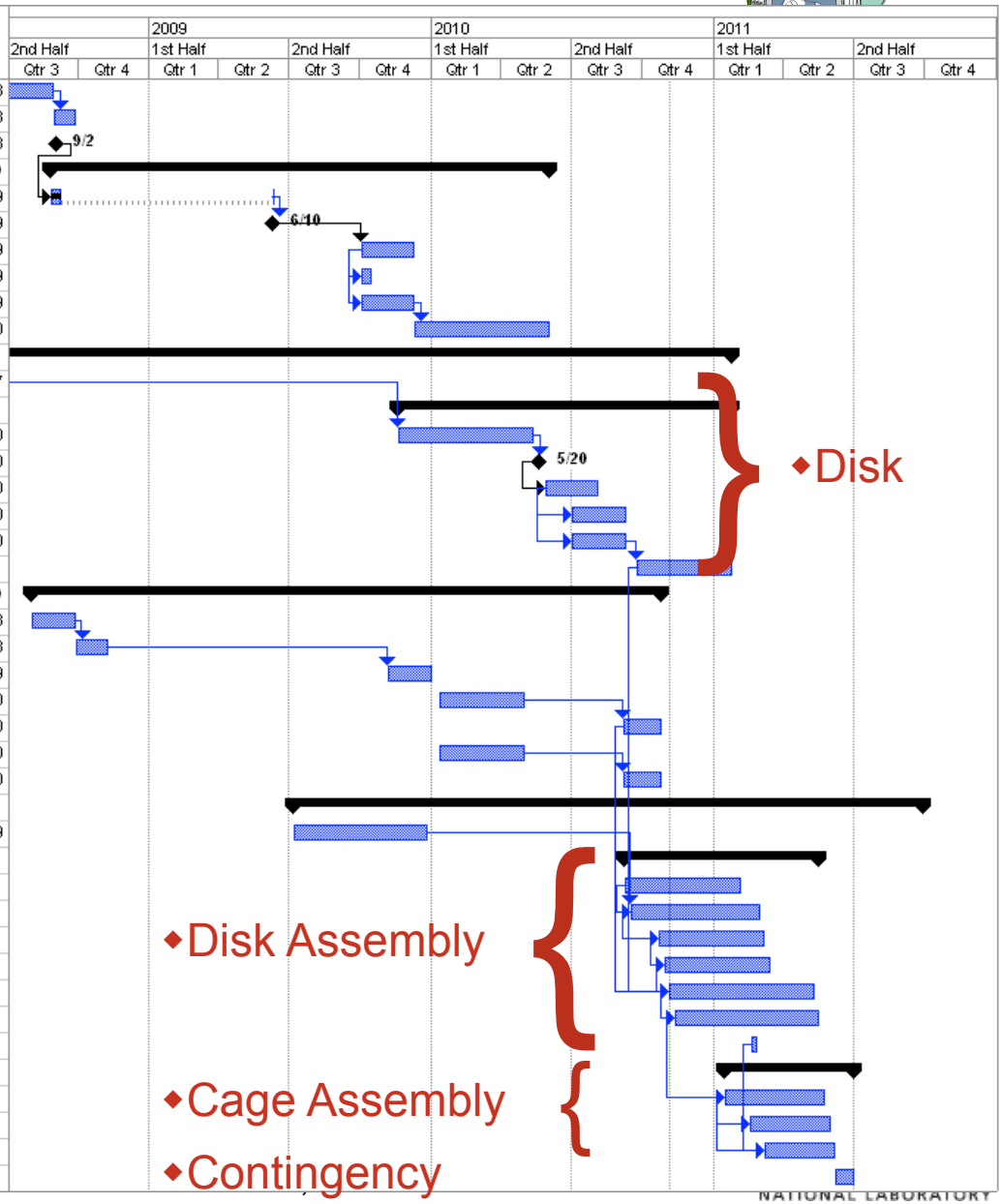
ID	WBS	Task Name	Start	Finish
83	**1.5.3.2**	**procure prototype FEM**	**Mon 9/21/09**	**Tue 11/2/10**
84	1.5.3.2.1	prototype	Mon 9/21/09	Fri 12/25/09
85	1.5.3.2.2	test prototype	Mon 1/4/10	Fri 3/12/10
86	1.5.3.2.11	redesign + review	Mon 3/15/10	Fri 8/6/10
87	1.5.3.2.7	preproduction prototype FVTX version	Mon 8/9/10	Fri 10/1/10
88	1.5.3.2.10	Test FEM	Mon 10/4/10	Mon 11/1/10
89	1.5.3.2.8	review and approve FEM	Tue 11/2/10	Tue 11/2/10
90	**1.5.3.3**	**procure production FEM**	**Wed 11/3/10**	**Thu 2/3/11**
91	1.5.3.3.1	production	Wed 11/3/10	Wed 1/5/11
92	1.5.3.3.2	Q/A - 28	Thu 1/6/11	Thu 2/3/11
93	**1.5.4**	**Calibration**	**Mon 10/23/06**	**Fri 12/29/06**
94	1.5.4.1	Design Pulse injection	Mon 10/23/06	Fri 11/17/06
95	1.5.4.2	prototype	Mon 11/20/06	Fri 12/15/06
96	1.5.4.3	test prototype	Mon 12/18/06	Fri 12/29/06
97	**1.5.5**	**Ancillary**	**Mon 3/2/09**	**Mon 9/19/11**
98	1.5.5.1	Racks	Tue 3/31/09	Mon 6/8/09
99	1.5.5.2	LV,HV,crates,etc	Tue 3/31/09	Fri 12/10/10
100	1.5.5.3	DCM-24	Mon 3/2/09	Thu 12/9/10
101	1.5.5.4	Slow controls	Tue 3/31/09	Fri 12/10/10
102	1.5.5.5	Misc lab equip	Mon 12/13/10	Fri 2/25/11
103	1.5.5.6	install	Thu 4/28/11	Mon 9/19/11
104	**1.6**	**Mechanics**	**Fri 10/21/05**	**Mon 1/24/11**
105	**1.6.1**	**specifications**	**Fri 10/21/05**	**Mon 3/16/09**
106	1.6.1.1	endcaps - specify heat load	Tue 11/15/05	Mon 2/6/06
107	1.6.1.2	specify mechanical tolerances/distortions	Fri 10/21/05	Thu 2/9/06
108	1.6.1.3	specify disassembly/configuration options	Fri 10/21/05	Thu 2/9/06
109	1.6.1.4	Internall review	Mon 9/1/08	Mon 9/1/08
110	1.6.1.5	final design review	Mon 3/16/09	Mon 3/16/09
111	**1.6.2**	**Support structure cage**	**Tue 4/1/08**	**Tue 1/11/11**
112	1.6.2.1	design	Tue 4/1/08	Mon 6/23/08
113	**1.6.2.3**	**procure**	**Wed 8/6/08**	**Tue 1/11/11**
114	1.6.2.3.1	final design	Wed 8/6/08	Tue 5/26/09
115	1.6.2.3.2	detail drawings	Wed 9/3/08	Fri 6/5/09
116	1.6.2.3.7	Cage Final design review	Fri 6/12/09	Mon 6/15/09
117	1.6.2.3.3	Cage Laison	Mon 8/3/09	Fri 5/21/10
118	1.6.2.3.4	Cage Tooling	Mon 11/23/09	Fri 12/25/09
119	1.6.2.3.5	Cage Material	Mon 10/26/09	Fri 1/29/10
120	1.6.2.3.6	Cage Fabrication	Mon 2/1/10	Tue 1/11/11
121	**1.6.3**	**wedge backplane**	**Fri 4/11/08**	**Thu 6/3/10**
122	1.6.3.1	design	Fri 4/11/08	Thu 6/5/08
123	**1.6.3.2**	**procure prototype wedge backplane**	**Fri 6/6/08**	**Thu 9/25/08**
124	1.6.3.2.1	prototype	Fri 6/6/08	Thu 8/28/08

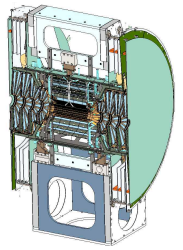


FVTX Project File



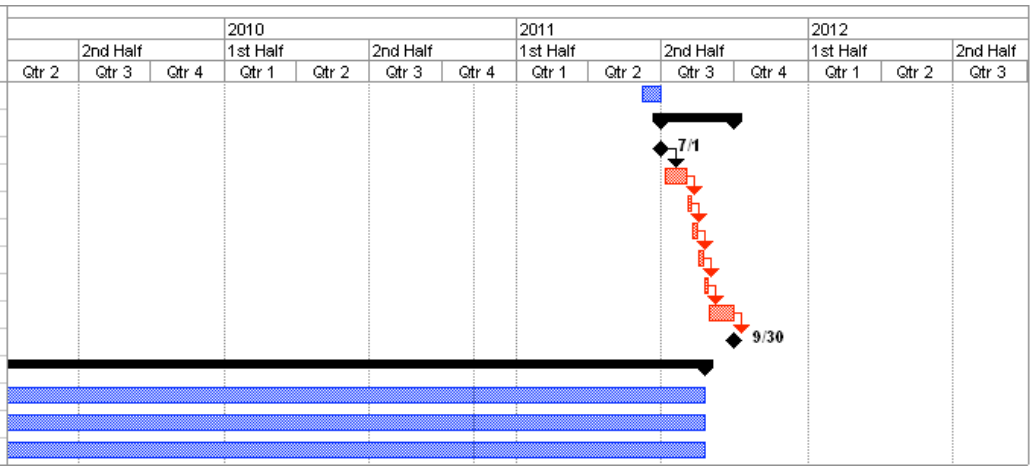
ID	WBS	Task Name	Start	Finish
124	1.6.3.2.1	prototype	Fri 6/6/08	Thu 8/28/08
125	1.6.3.2.2	test	Fri 8/29/08	Thu 9/25/08
126	1.6.3.2.4	internal review	Tue 9/2/08	Tue 9/2/08
127	**1.6.3.3**	**procure**	**Tue 8/26/08**	**Thu 6/3/10**
128	1.6.3.3.1	final design	Tue 8/26/08	Wed 6/10/09
129	1.6.3.3.7	Backplane Final design review	Wed 6/10/09	Thu 6/11/09
130	1.6.3.3.3	Backplane Liason	Thu 10/1/09	Thu 12/10/09
131	1.6.3.3.4	Backplane Tooling	Thu 10/1/09	Thu 10/15/09
132	1.6.3.3.5	Backplane Material	Thu 10/1/09	Thu 12/10/09
133	1.6.3.3.6	Backplane Fabrication	Thu 12/10/09	Thu 6/3/10
134	**1.6.4**	**support disk**	**Thu 1/4/07**	**Mon 1/24/11**
135	1.6.4.1	R&D design	Thu 1/4/07	Wed 5/23/07
136	**1.6.4.3**	**Procure**	**Thu 11/19/09**	**Mon 1/24/11**
137	1.6.4.3.10	final design	Thu 11/19/09	Wed 5/12/10
138	1.6.4.3.9	Disk Final design review	Thu 5/20/10	Thu 5/20/10
139	1.6.4.3.4	Disk Liason	Thu 5/27/10	Wed 8/4/10
140	1.6.4.3.5	Disk Tooling	Thu 7/1/10	Wed 9/8/10
141	1.6.4.3.6	Disk Material	Thu 7/1/10	Wed 9/8/10
142	1.6.4.3.7	Disk Fabrication	Thu 9/23/10	Mon 1/24/11
143	**1.6.5**	**Alignment and assembly jigs**	**Fri 8/1/08**	**Mon 10/25/10**
144	1.6.5.1	design wedge jig	Fri 8/1/08	Thu 9/25/08
145	1.6.5.2	procure prototype wedge jig	Fri 9/26/08	Thu 11/6/08
146		procure production jigs	Fri 11/6/09	Thu 12/31/09
147	1.6.5.3	design disk assembly jig	Mon 1/11/10	Fri 4/30/10
148	1.6.5.4	procure disk assembly jig	Mon 9/6/10	Mon 10/25/10
149	1.6.5.5	design cage assembly jig	Mon 1/11/10	Fri 4/30/10
150	1.6.5.6	procure cage assembly jig	Mon 9/6/10	Mon 10/25/10
151	**1.7**	**Endcap Assembly**	**Mon 7/6/09**	**Tue 9/27/11**
152	1.7.8	assembly lab setup	Mon 7/6/09	Fri 12/25/09
153	**1.7.1**	**Assemble ladders onto cooling plate**	**Wed 9/8/10**	**Mon 5/16/11**
154	1.7.1.8	Wedges shipped from SiDet to BNL	Wed 9/8/10	Fri 2/4/11
155	1.7.1.4	Test Assembled Wedges	Wed 9/15/10	Mon 2/28/11
156	1.7.1.5	Bend HDIs of wedges	Thu 10/21/10	Mon 3/7/11
157	1.7.1.6	Attach Thermal Mounts	Thu 10/28/10	Mon 3/14/11
158	1.7.1.7	Place wedges on disks	Thu 11/4/10	Mon 5/9/11
159	1.7.1.2	optically survey wedges	Fri 11/12/10	Mon 5/16/11
160	1.7.1.3	Assemble ROC Big Wheel	Fri 2/18/11	Fri 2/25/11
161	**1.7.2**	**Install into cage enclosure**	**Fri 1/14/11**	**Thu 6/30/11**
162	1.7.2.1	Place Disks in Cage	Fri 1/14/11	Mon 5/23/11
163	1.7.2.2	Test Functional Requirements on Bench	Wed 2/16/11	Tue 5/31/11
164	1.7.2.3	Optically Survey Cage	Mon 3/7/11	Mon 6/6/11
165	1.7.2.4	Schedule Contingency	Tue 6/7/11	Thu 6/30/11



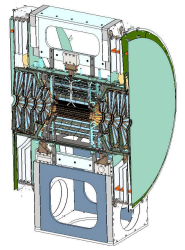


FVTX Project File

ID	WBS	Task Name	Start	Finish
165	1.7.2.4	Schedule Contingency	Mon 6/6/11	Thu 6/30/11
166	**1.7.10**	**Install cages into VTX enclosure**	**Fri 7/1/11**	**Fri 9/30/11**
167	1.7.10.10	RHIC Shutdown begins	Fri 7/1/11	Fri 7/1/11
168	1.7.10.6	Prepare Enclosure for FVTX Installation	Tue 7/5/11	Mon 8/1/11
169	1.7.10.1	Install 2 half cages into enclosure	Tue 8/2/11	Mon 8/8/11
170	1.7.10.7	Survey half cages in enclosure	Tue 8/9/11	Mon 8/15/11
171	1.7.10.8	Reinstall enclosure in IR	Tue 8/16/11	Mon 8/22/11
172	1.7.10.9	Survey VTX and FVTX in IR	Tue 8/23/11	Mon 8/29/11
173	1.7.10.2	Connect to infrastructure and test	Tue 8/30/11	Fri 9/30/11
174	1.7.10.11	Project Complete	Fri 9/30/11	Fri 9/30/11
175	**1.8**	**System Integration**	**Wed 4/2/08**	**Wed 8/24/11**
176	1.8.1	Mechanical egineer	Wed 4/2/08	Wed 8/24/11
177	1.8.2	Electrical Engineer	Wed 4/2/08	Wed 8/24/11
178	1.11	**FVTX Management**	Wed 4/2/08	Wed 8/24/11



- Installation into IR



ARRA FVTX Funds, Milestones

$2M in ARRA funds received in summer 2009. Milestones:

	Plan	Actual
Initiate Backplane procurement process	6/2009	6/2009
Initiate Cage procurement process	6/2009	6/2009
Start Recovery Act FVTX Management and Integration by LANL	7/2009	7/2009
Initiate Ancillary System procurement process	11/2009	11/2009
Review and approve ROC/FEM design	12/2009	12/2010
Initiate ROC/FEM production procurement process	1/2010	3/2010
Begin testing ROC/FEM board	2/2010	9/2010
Begin attaching HDIs to Backplane	3/2010	5/2010
Begin testing production version of FPHX chips	4/2010	4/2010
Begin attaching chips to HDIs	6/2010	6/2010
Begin attaching sensors to HDIs	7/2010	6/2010
Begin testing wedge assemblies	8/2010	6/2010
Begin assembling wedges into disks	9/2010	11/2010

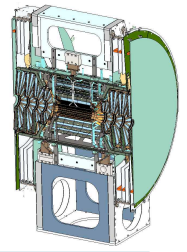
WBS Number	Control Milestone Name	Baseline Date	Actual/ Forecast Date
WBS 1.1	DOE construction funds received	Q3 FY08	Q3 FY08
Accounts open	Accounts open	Q3 FY08	Q3 FY08
WBS 1.6.2.2.2	Review and Approve wedge, disk, cage design	Q3 FY08	Q3 FY08
WBS 1.4.3.2.5	HDI tested	Q3 FY08	Q2 FY09
WBS 1.4.1.2.3	Sensor prototype tested	Q1 FY09	Q1 FY09
WBS 1.4.1.2.5	First prototype wedge assembly	Q1 FY09	Q2 FY09
WBS 1.5.2.2.6	PHENIX system test complete	Q1 FY09	Q3 FY09
WBS 1.5.2.2.8	Review and Approve FEM and ROC	Q2 FY09	Q1 FY11
WBS 1.4.3.3.1	1st Production HDIs Received	Q2 FY10	Q3 FY10
WBS 1.4.1.3.1	Sensor Procurement complete	Q3 FY09	Q3 FY10
WBS 1.4.1.2.6	Wedge assembly test complete	Q4 FY09	Q4 FY09
WBS 1.4.2.5.1	FPHX engineering run complete	Q1 FY10	Q1 FY10
WBS 1. 5.3	ROC and FEM production Complete	Q2 FY10	Q2 FY11
WBS 1.7.1.1	Disk Assembly begins	Q3 FY10	Q1 FY11
WBS 1.7.2.1	First Two ½ Cages Assembled	Q1 FY11	Q2 FY11
WBS 1.7.2.1	Functional Requirements Tests on Bench Begins	Q1 FY11	Q1 FY11
WBS 1.5.5.6	Install ancillary Equipment	Q4 FY10	Q2 FY11
WBS 1.7.1.1	Disk Assembly complete	Q1 FY11	Q2 FY11
WBS 1.7.2.1	½ Cage Assembly finished	Q2 FY11	Q3 FY11
	All FVTX Component Deliverables Completed	Q2 FY11	Q3 FY11
WBS 1.7.5	Verify Functional Requirements on Bench Completed	Q3 FY11	Q3 FY11
WBS 1.7.3	Install into VTX enclosure	Q2 FY11	Q4 FY11
WBS 1.7.3	Project Complete	Q3 FY11	Q4 FY11

FVTX Cost Estimate

2 endcaps	WBS	TPC 2007	Baseline Cost with contingency AY	Baseline contingency	Remaining contingency	Cost AY$
Mechanics	**1.6**					
Cage	1.6.2	352	174	35	-108	282
Backplane	1.6.3		188	38	24	164
Disk	1.6.4		114	23	-95	208
Alignment and Assembly jigs	1.6.5.2	60	80	15	18	62
1.6	**totals**	**412**	**555**	**110**	**-161**	**716**
Sensor						
Silicon Sensor	1.4.1					
prototype sensor and test	1.4.1.2	85	107	19	-33	140
purchase	1.4.1.3	410	553	107	128	425
sensor Q/A and testing	1.4.1.3.2	50	62	8	55	7
attach HDI to backplane	1.4.1.3.3	30	39	7	30	9
attach sensor	1.4.1.3.4	30	39	7	30	9
wire bond assembly	1.4.1.3.5	188	263	49	55	208
test wedge assembly	1.4.1.3.6	40	54	9	10	45
Sidet prototype assembly	1.4.1.1		0		-19	19
1.4.1	**totals**	**833**	**1118**	**206**	**256**	**863**
FPHX	1.4.2					
1 st Prototype	1.4.2.4.1	0	0	0	-45	45
2 nd + 3rd Mosis run and test	1.4.2.4.4	175	242	51	92	150
FNAL coding	1.4.2.4.9	0	0	0	-37	37
FPHX test stands	1.4.2.4.9		0		0	0
engineering run	1.4.2.5.1	240	385	115	128	258
testing	1.4.2.5.2	50	64	8	13	52
1.4.2	totals	**465**	**692**	**174**	**150**	**542**

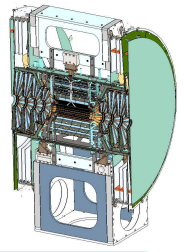
FVTX Cost Estimate

2 endcaps	WBS	TPC 2007	Baseline Cost with contingency	Baseline contingency	Remaining contingency	Cost AY$
HDI bus	1.4.3	143	194	39	-235	429
flex cables, sensor to ROC	1.4.4	56	70	9	-329	398
	totals	**1497**	**2074**	**428**	**-158**	**2232**
Readout Electronics						
ROC electronics	1.5.2					
preproduction proto	1.5.5.2	71	100	26	-168	268
Clock and Interface		0	0	0	-41	41
production	1.5.5.3.1	337	497	111	123	374
Q/A	1.5.5.3.2	14	18	2	18	0
	totals	**422**	**615**	**139**	**-68**	**683**
FEM electronics	1.5.3					
preproduction	1.5.3.2	80	116	29	-39	155
production	1.5.3.3.1	301	444	99	239	205
Q/A	1.5.3.3.2	14	18	2	18	0
fibercables, ROC-FEM	1.5.1	17	21	3	2	19
lab equipment	1.5.5.5	100	117	10	91	26
	totals	**512**	**716**	**143**	**312**	**405**
Ancillary Systems	1.5.5					
Racks,LV,HV,DCM,crates,install	1.5.5.1-1.5.5.6	99	123	12	-99	222
slow controls	1.5.5.4	5	7	1	7	0
calibration system	1.5.4					0
	totals	**104**	**130**	**13**	**-92**	**222**



FVTX Cost Estimate

Assembly						
Assemble endcap	1.7	**30**	**42**	**8**	**19**	**23**
Integration						
Electronics Integration	1.8.2	165	189	23	92	97
Mechanical Integration	1.8.1	250	311	35	80	231
	totals	**415**	**500**	**58**	**172**	**327**
Management						
Management	1.9	**200**	**249**	**28**	**77**	**172**
total		3593	4881	927	101	4780



Issues/Concerns

Maintaining cost & schedule through remainder of project

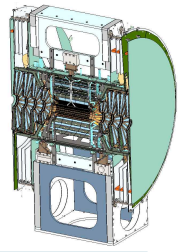
- Major components are committed/quoted, but still need to watch for unexpected additional costs
- Continual assembly effort required for several months to reach project complete

Maintaining performance through full system tests

- Careful system testing at each stage important for optimizing power + grounding, maintaining performance

Time to install detector into IR for final project deliverable

- Time between IR access and project complete is expected to be short
- Very careful planning required to meet schedule.
- VTX installation this year means much of the infrastructure will already be in place, and PHENIX will already have significant experience in preparing and installing enclosure into the IR



Summary

Production of almost all major detector components during last year:

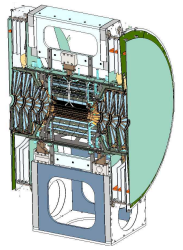
- No major technical issues uncovered in performance tests, high yields

Project Schedule took a few hits:

- Some delays already absorbed by efficient testing of components, high yields, and faster wedge assembly than FY09 Project File
- 8 months to assemble disks and cages still looks like sufficient time to complete project
- IR assembly will still be challenging

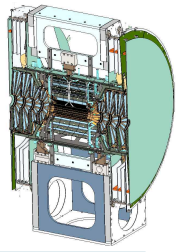
Project Cost Contingency Reduced:

- Careful management of remaining funds needed

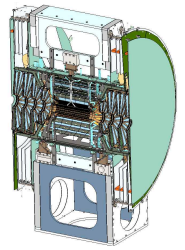


Day's Agenda

10:00 - 10:20	Sensors/FPHX Readout Chip (WBS 1.4.1, 1.4.2)	Jon Kapustinsky
10:20 - 10:40	Break	
10:40 - 11:10	High Density Interconnect and Extension (WBS 1.4.3, 1.4.4)	Doug Fields
11:10 - 11:40	Wedge Assembly (WBS 1.4.1.3.3 – 1.4.1.3.9)	Dave Winter
12:00 - 1:00	Lunch	
1:00 - 1:15	Mechanics (WBS 1.6)	Walt Sondheim
1:15 - 1:55	Detector Assembly (WBS 1.7)	Steve Pate
1:55 - 2:10	Mechanical Integration (WBS 1.6)	Robert Pak
2:10 - 2:50	DAQ Overview (WBS 1.5.2, 1.5.3)	Sergey Butsyk
2:50 - 3:10	Break	
3:10 - 3:40	Electrical Integration (1.8.2)	Eric Mannel
3:40 - 4:10	Physics Simulation Results	Zhengyun You
4:10 - 4:40	Commissioning (ppt)	Jon Kapustinsky



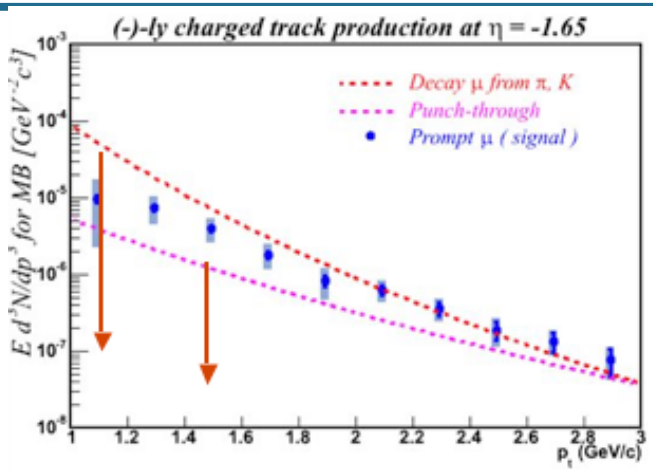
Backups

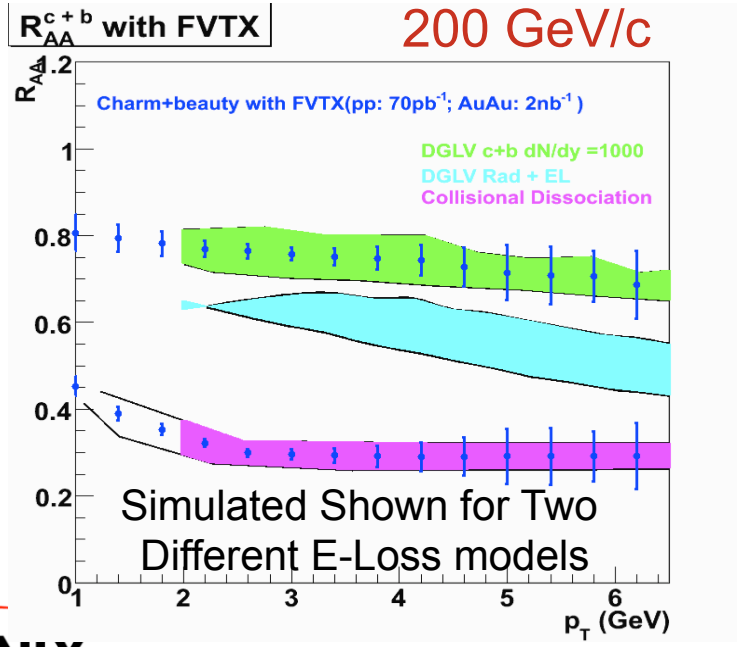


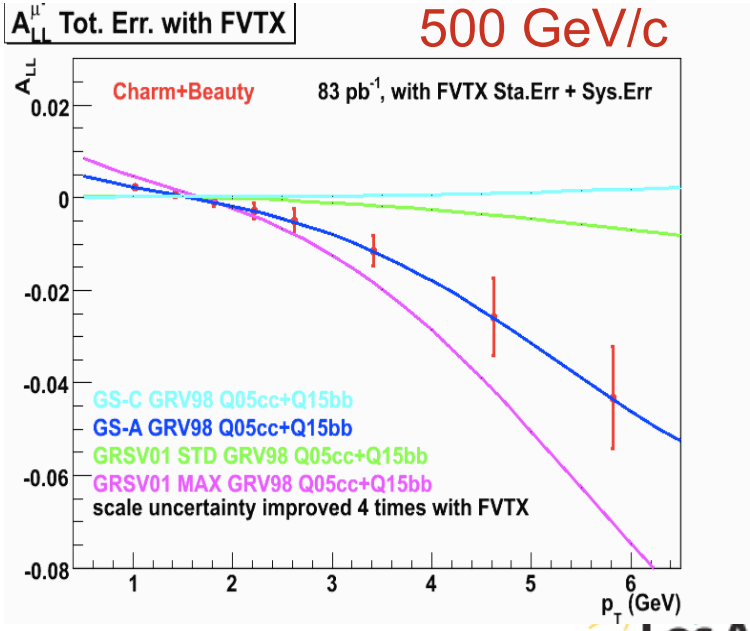
Reminder of Simulated Performance

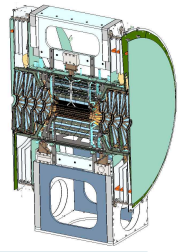
Improved S:B in heavy flavor via single muons allows precision heavy flavor R_{AA}, A_{LL} measurements

(Updated Information in Simulation Talk)









Cost Updates Since Last Year

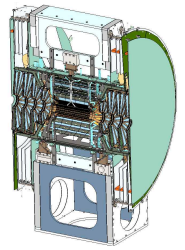
Included In Current Costs:

FEM Production	$ 95k savings
ROC Prototype + Production	$109k additional cost
Increased Mechanical Costs	$172k additional cost
Ancillary systems (Power Dist, DCMs)	$106k additional cost
Extension Cable	$336k additional cost
Production HDI	$170k additional cost

Management Plan Cost = $4880k, Contingency = $927k
$4276k costs and commitments to date and remaining Contingency = $101k (19%)

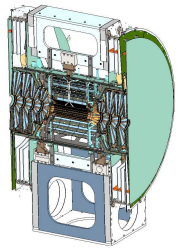
Primary Remaining Costs

ROC production board (but many parts already procured) - ~$200k remaining
Power Distribution boards - ~$40k
Endcap assembly - $30k



Management Plan Milestones

WBS 1.1 DOE construction funds received	Q3 FY08
WBS 1.6.2.2.2 Review and approve wedge, disk, cage design	Q3 FY08
WBS 1.4.3.2.5 HDI tested	Q3 FY08
WBS 1.4.1.2.3 Sensor prototype tested	Q1 FY09
WBS 1.4.1.2.5 First prototype wedge assembly complete	Q1 FY09
WBS 1.5.2.2.6 PHENIX system test complete	Q1 FY09
WBS 1.5.2.2.8 Review and approve FEM and ROC	Q3 FY09
WBS 1.4.1.3.1 Sensor Procurement complete	Q3 FY09
WBS 1.4.1.2.6 Wedge assembly test complete	Q4 FY09
WBS 1.4.2.5.1 FPHX engineering run complete	Q1 FY10
WBS 1. 5.3 ROC and FEM production complete	Q2 FY10
WBS 1.7.1 Start endcap assembly	Q3 FY10
WBS 1.5.5.6 Ancillary electronics installed	Q4 FY10
WBS 1.7.2 Start installation into cage enclosure	Q4 FY10
WBS 1.7.1.1 Place wedges on cooling plate complete	Q1 FY11
WBS 1.7.2.1 ½ Cage assembly complete	Q2 FY11
WBS 1.7.3 Install cages into VTX enclosure complete	Q2 FY11
WBS 1.7.5 Verify functional requirements and Project Complete	Q3 FY11



Organizational Chart