Quarterly Report FY09Q1

Project Name: PHENIX-VTX Date: January 28, 2009
Contract Project Manager: Yasuyuki Akiba

Narrative of project highlights:

Pixel:
- First articles of pixel buses are produced.
- First articles of SPIRO production boards have been produced and tested.
- Pixel FEE production review (December 10th).
- New 15 sensor modules from CERN/VTT delivered

Strip:
- Internal Review of strip detector performance (October 1st)
- Bench tests of ROC3-prime module
- Radiation damage test of ROC3 module
- FNAL beam test analysis (finite angle)
- Q/A test of stripixel sensors
- Strip module assembly fixtures designed
- ppROC fabrication is in progress
- RCC board, LDTB, and bus fabrication is in progress

Mechanics:
- First articles of pixel staves have been produced at LBNL.
- New Be Beam pipe (40mm ID) was placed on December 1st.
- Contract to fabricate Space Frame and the Barrel mounts
- Task Order #4 for HYTEC was signed.

Software
- VTX material budget
- More simulation (DCA, $D \rightarrow K \pi$)

Summary of milestones covered during review period:
- The following 13 out of 42 control milestones are covered or delayed in this quarter.
- The project complete date remains 09/2010 consistent with the baseline project complete date.
- There are 17 weeks of schedule contingency included on the critical path of the project. The project is scheduled to complete in 89 weeks.

1) WBS 1.1.1.4 (delayed)
   A pre-production ROC/RCC performs to the specifications.

Baseline completion date: FY08 2nd Quarter
New completion date: FY09 3rd Quarter
This milestone is on the critical path.

This is a chain test of the first prototype of strip ladder. The prototype ladder consists of 6 strip silicon sensors based on pre-production ROCs (ppROC), 6 RCC boards, and a strip bus that connects them together, and it is read-out by a Ladder Data Transfer Board (LDTB). Fabrication of ppROCs, RCC boards, and strip buses was started in December, and fabrication of LDTB will start in January. We expect that the first prototype strip ladder will be assembled in FY09 Q2 and the chain test will be completed in early FY09Q3.

2) WBS 1.5.2.14 (delayed)
   Prototype strip stave delivered

Baseline completion date: FY08 2nd Quarter
New completion date: FY09 3rd Quarter
Float to critical path 3 days

Design of the strip stave has waited the final specification of ppROC. Now the stave design is being finalized. This milestone is now expected to be completed in FY09 Q3.

3) WBS1.1.3.4 (delayed)
   A pre-production strip ladder performs to the specification. This is a system chain test of the strip ladder.

Baseline completion date: FY08 4th Quarter
New completion date: FY09 4th Quarter
Float to critical path 3 days

After the chain test of ROC+RCC (WBS 1.1.1.4) and fabrication of a prototype stave, a pre-production strip ladder is assembled and tested. This is the final test of the strip ladder. This milestone is now expected to be completed in FY09 Q4.

4) WBS1.1.2.5 (delayed)
   246 + spare strip sensors are Q/A'd. They are sufficient for building the entire strip detector subsystem.

Baseline completion date: FY08 1st Quarter
New completion date: FY09 3rd Quarter
Float to critical path 20 days

The sensors were Q/A'd by the manufacturer (Hamamatsu Co.), and only good sensors that passed the Q/A were delivered with the Q/A data. We will test a subset of the delivered sensor at BNL. Four hundred of the production sensors are now at BNL, and we performed basic IV/CV tests of all of these sensors. We found a good agreement between our measurements and HPK's measurements. In addition, we plan to do a full test (IV/CV tests of all strips) of 1/3 of sensors. This milestone is now expected to be complete in FY09 Q3.

5) WBS1.2.9.4 (delayed)
   The first prototype pixel ladder performs to the thermal specification. This is the responsibility of RIKEN.

Baseline completion date: FY08 1st Quarter
New completion date: FY09 2nd Quarter
Float to critical path: 89 days

Thermal cycle tests of the bus and glue was done. The final thermal cycle test waits for Ladder D, a fully assembled ladder, which is expected to be produced at the end of January. This milestone is expected to complete in February 2009.

6) WBS1.5.2.15 (delayed)
30 + spare pixel staves are delivered. They are sufficient for building the entire pixel
Baseline completion date: FY08 4th Quarter
New completion date: FY09 3rd Quarter
Float to critical path 207 days

First articles of pixel staves were produced at LBNL in December, and they met the mechanical specifications. Full production will start at the beginning of January. It will take about 8 weeks to produce 40 staves at a rate of 10 staves per 2 weeks. This milestone is now expected to complete in early FY09 Q3.

7) WBS1.2.4.6 (delayed)
60 pixel bus extenders + spares are fabricated. This is the responsibility of RIKEN.
Baseline completion date: FY08 3rd Quarter
New completion date: FY09 2nd Quarter
Float to critical path 272 days

Production of the 60 pixel bus extenders has started, and first articles will be delivered in January 2009. It will takes about 2months to complete the production of 60+spare extenders.

8) WBS 1.2.4.5 (delayed)
60 pixel buses + spares fabricated. This is the responsibility of RIKEN
Baseline completion date: FY08 1st Quarter
New completion date: FY09 3rd Quarter
Float to critical path 89 days

After a technical problem in through holes was fixed, production of the 60 pixel bus was resumed and the first articles of the production buses have been delivered in November. Both of the left and the right version of buses, 5 pieces of each, were produced. They will be used to make the first production pixel ladder, which we call Ladder D. After Ladder D is produced and tested, full production of both types of buses will resume. This mile stone is now expected to complete in FY09 Q3.

9) WBS 1.2.5.5 (delayed)
60 pixel SPIRO modules + spare perform to spec. This is the responsibility of Ecole Polytech and RIKEN
Baseline completion date: FY08 2nd Quarter

New completion date: FY09 3rd Quarter
Float to critical path 213 days

First 4 boards of production version of SPIRO were produced in December. Testing of one of the SPIRO boards with prototype pixel ladders is in progress. No problem was found so far. Full production of the rest of the boards will start after the test is completed in January. This milestone is now expected to be completed in FY09 Q3.

10) WBS1.2.6.4

30 pixel FEMs + spares perform to the specification. This is the responsibility of RIKEN/French group.

Baseline completion date: FY09 1st Quarter
New completion date: FY09 3rd Quarter
Float to critical path 344 days

Final review of pixel FEE was held in December 10th and the review panel recommended the start of the full production of the board. The production will start in January. This mile stone is now expected to complete in FY09 Q3.

11) WBS1.2.3.4

120 + spare pixel sensor modules are tested and they performs to the specification. They are sufficient for building the entire pixel subsystem, including spares. This is the responsibility of RIKEN.

Baseline completion date: FY07 4th Quarter
New completion date: FY09 4th Quarter
Float to critical path 81 days

We received 15 new sensor modules from VTT in December, and Q/A tests of them is in progress at RIKEN. We have received total of 150 sensor modules so far, and 141 of them has been tested as of the end of December. Out of those 141 modules, we have 71 Class-I (good) modules, 8 Class-II (usable) modules, and 46 Class-III (bad) modules available for assembly at RIKEN. 1 module is to be re-tested. The balance of 15 modules, most of them were Class-III, had been used for prototypes.

One sensor module has 4 chips and most of the Class-III modules have only one bad chip. VTT can replace those bad chips with new chips, with success rate of ~80%. We will send 35 Class-III modules to VTT for rework in January 2009.

This milestone is now expected to complete in FY09 Q4. The new completion date is not on the critical path for the pixel part of the project since we have sufficient pixel sensor modules to begin pixel ladder assembly.

12) WBS1.3.2 (delayed)

Design completion of DCMs. The new DCM used for the VTX is developed by PHENIX as part of DAQ upgrade.

Baseline completion date: FY08 4th Quarter

New completion date: FY09 2nd Quarter
Float to critical path 246 days

Off/project. Not a critical path

13) WBS1.4.1.14 (delayed)
Grounding plan is finalized.
Baseline completion date: FY08 4th Quarter
New completion date: FY09 2nd Quarter
Float to critical path 434 days
(This milestone was completed in January 2009.)

Critical Path of the Project:

The Figure 1 shows the summary of Project Critical Path. Project Critical Path is formed by the following steps:

- System test of the pre-production ROC modules (with sensors)
- Design and production of the production ROC
- Production of the ROC modules (with sensors)
- Assembly of the strip ladders
- Installation of the ladders in the VTX

There are total of 17 weeks of schedule contingency (unchanged from last quarter) included on the Project Critical Path. Schedule contingency is 17 wks/89 wks ~ 20%. The items without WBS number in Figure 1 are schedule contingency on the critical path.

ID	WBS	Task Name	Start	Finish	Duration
51	1.1.1.2.14.1	board ppROC Fab	12/22/08	1/19/09	10 days
53	1.1.1.2.14.3	assemble ppROC Fab	1/20/09	1/29/09	8 days
92	1.1.1.9.1.2	layout design Production ROC	4/20/09	5/15/09	20 days
94	1.1.1.9.2.1	prepare documents production ROC Design Review	4/27/09	5/15/09	15 days
96	1.1.1.9.3.1	Fab board Production ROC	5/18/09	6/15/09	20 days
98	1.1.1.9.3.3	assemble fab Production ROC	6/16/09	7/29/09	30 days
101	1.1.1.9.4.2	Test Production ROC	7/16/09	9/10/09	40 days
196	1.1.1.4	Milestone: pre-production ROC perform to spec	4/17/09	4/17/09	0 days
261	1.1.3.3.8	glue pre-production rocs + sensor	1/30/09	2/5/09	1 wk
262	1.1.3.3.9	wire-bonding pre-production module at FNAL/encaps	2/6/09	2/12/09	1 wk
263	1.1.3.3.5	assemble modules + non_ROC components into partial c	2/13/09	2/26/09	2 wks
264	1.1.3.3.6	strip system test BNL: test of pre-production partial chain	2/27/09	3/26/09	20 days
265		contingency	3/27/09	4/17/09	3 wks
274	1.1.3.5	Milestone: pre-production detector module perform to elec	4/17/09	4/17/09	0 days
275	1.1.3.8	Milestone: Pre-production strip partial chain ladder (modules+bus) pe	4/17/09	4/17/09	0 days
308	1.1.4.4.1	Glue ROC on sensor	7/30/09	3/25/10	8 mons
309	1.1.4.4.2	wire bond ROC+Sensor=>sensor module	8/6/09	4/1/10	8 mons
310	1.1.4.4.3	test assembled sensor modules	8/13/09	4/1/10	7.75 mons
311	1.1.4.4.4	Mount sensor modules on stave and wire bonds between	8/27/09	4/15/10	7.75 mons
312	1.1.4.4.5	test assembled strip ladders	8/27/09	4/15/10	7.75 mons
313		contingency	4/16/10	6/17/10	9 wks
315	1.1.4.6	Milestone: 44 strip ladders + spare performs to spec	6/17/10	6/17/10	0 days
528	1.4.4.1	Testing of fully assembled barrel detector	8/30/10	9/20/10	3 wks
529		contingency	9/20/10	9/27/10	1 wk
675	1.5.3.2.1	align + fix strip ladders onto barrel mounts	6/18/10	7/12/10	0.83 mons
676	1.5.3.2.2	test strip ladders on barrel	7/12/10	7/26/10	2 wks
677		contingency	7/26/10	8/16/10	3 wks
678	1.5.3.3	Complete assembly of barrel+space-frame	8/16/10	8/23/10	1 wk
679		contingency	8/23/10	8/30/10	1 wk
680	1.5.3.4	Milestone - all ladders on VTX	8/30/10	8/30/10	0 days
714	1.6.5	Milestone: project complete	9/27/10	9/27/10	0 days

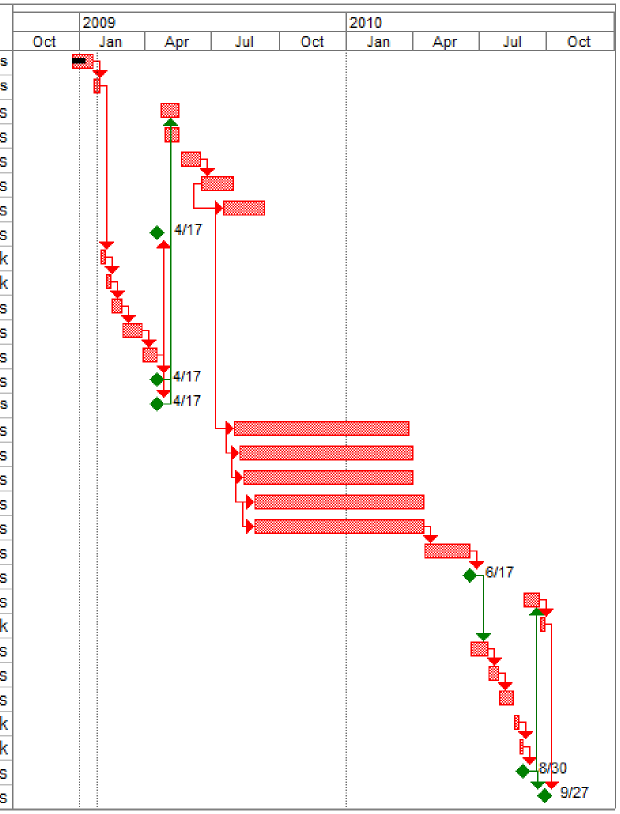

Figure 1 Critical path of the project.

- Summary of schedule: (based on sub sys. Manager report)

Table 1 Summary of percentage complete of the tasks

WBS	Baseline Start Date mo/year	Actual/ Forecast Start Date mo/year	Baseline Complete Date mo/year	Actual/ Forecast Completion Date mo/year	% Complete Baseline	% Complete Actual
1.1 Strip	10/2006	07/2007	05/2010	06/2010	73%	56%
1.2 Pixel	04/2005	07/2007	03/2009	11/2009	98%	83%
1.3 DAQ	10/2006	07/2008	04/2009	08/2009	62%	0%
1.4 Electronic Integration	10/2006	07/2007	09/2010	09/2010	72%	52%
1.5 Auxiliary system & integration	10/2006	07/2007	07/2010	08/2010	70%	52%
1.6 Management	10/2006	07/2007	09/2010	09/2010	60%	44%
1.7 Installation	07/2010	07/2010	09/2010	09/2010	0%	0%

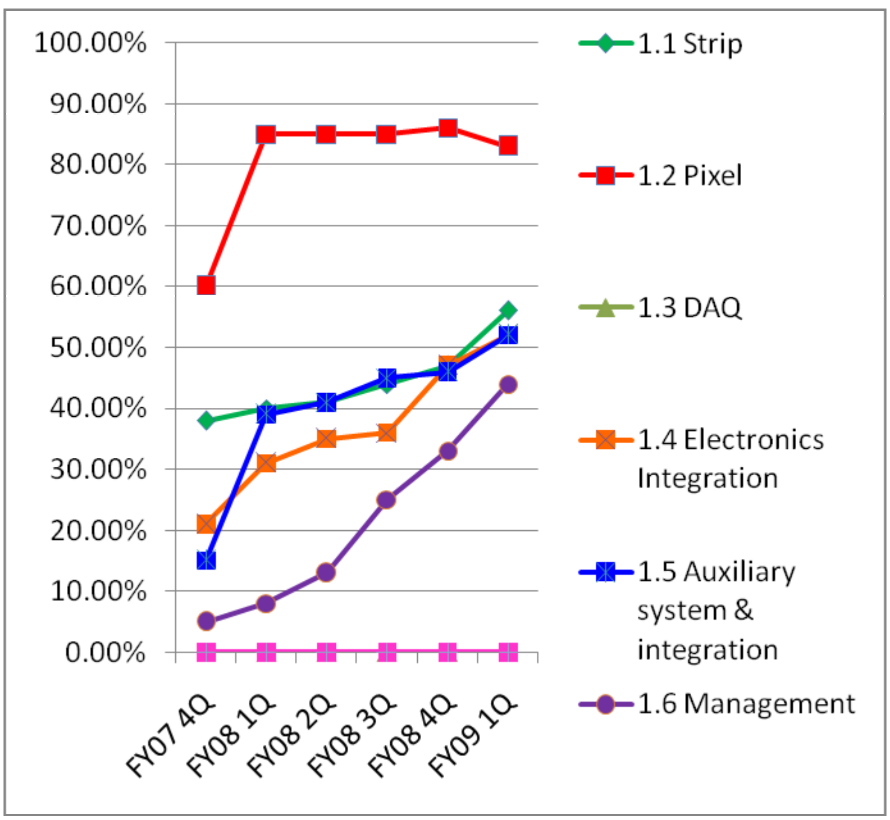

Figure 2 Historical tracking of percentage complete of tasks

Table 1 summarizes percentage complete of the major tasks of the project and compare them the baseline project. Figure 2 shows the historical tracking of percentage complete of the tasks (the last column of Table 1). Table 2 compares the completion date of the major milestones in the baseline schedule at the start of the project and the current schedule.

For the pixels system, the slow Q/A of the sensor modules and a technical problem in the production of pixel bus causes major delay. The latter problem has been solved and production of the buses resumed. Meantime, final production of read-out electronics (SPIRO, FEE) and pixel stave has started. Since pixel system have been well ahead of the over-all proejct, it is still far from the over-all critical path.

For the strip system, the major cause of the delay had been the noise issue of the stripixel ROC. We have solved the noise problem by design change of ROC and related changes in the read-out scheme. The beam test at FNAL in August 2008 confirmed a satisfactory signal-to-noise perfornamce of the strip detector. We have de-serialized tasks to absorb the delay to minimize the impact to the completion date of the project. After the design change of the ROC and the read-out scheme the project is proceeding on schedule.

The delay in the DCM development is reflected in a 0% progress in the DAQ 1.3, which is DCM II production. The DCM II production is 246 days from the critical path and is not a concern.

Table 2 Comparison of the completion date of the major milestones in the baseline and the current schedule

milestone	Name	baseline	Current	Complete	Delay (days)	Start slack (days)
Pixel						
1.2.3.4	120 + spare pixel sensor modules performs to spec	9/17/2007	6/18/2009	0%	640	81
1.2.4.5	60 pixel buses + spares fabricated	11/1/2007	5/1/2009	0%	547	89
1.2.9.3	1st prototype pixel ladder performs to electrical spec	8/2/2007	9/30/2007	100%	58	0
1.5.2.15	30 + spare pixel staves delivered	8/28/2008	3/2/2009	0%	186	207
1.2.9.5	30 pixel ladders assembled + spare	1/29/2009	12/11/2009	0%	316	81
Strip						
1.1.3.5	pre-production detector module perform to spec		4/17/2009			0
1.1.3.4	Pre-production strip ladder performs to spec	8/22/2008	7/24/2009	0%	336	3
1.1.1.6	123 ROCs performs to spec, sufficient ROCs for half-VTX	1/7/2009	8/12/2009	0%	217	90
1.5.2.16	44 + spare strip staves delivered	7/20/2009	9/21/2009	0%	63	3
1.1.4.5	22 strip ladders performs to spec, sufficient for half-VTX	11/9/2009	1/28/2010	0%	80	10
1.1.4.6	44 strip ladders + spare performs to spec	5/14/2010	6/17/2010	0%	34	0
Mech						
1.5.2.17	12 barrel mounts delivered	4/24/2009	10/12/2009	0%	171	210
1.5.2.18	space frame delivered	7/20/2009	12/23/2009	0%	156	161
1.5.4.3	infrastructure ready for installation	8/19/2009	10/30/2009	0%	72	226
1.5.3.4	all ladders on VTX	7/8/2010	8/30/2010	0%	53	0
Project						
1.6.5	Milestone: project complete	9/9/2010	9/27/2010	0%	18	0

- Summary of over-all schedule of the pixel and strip layers.

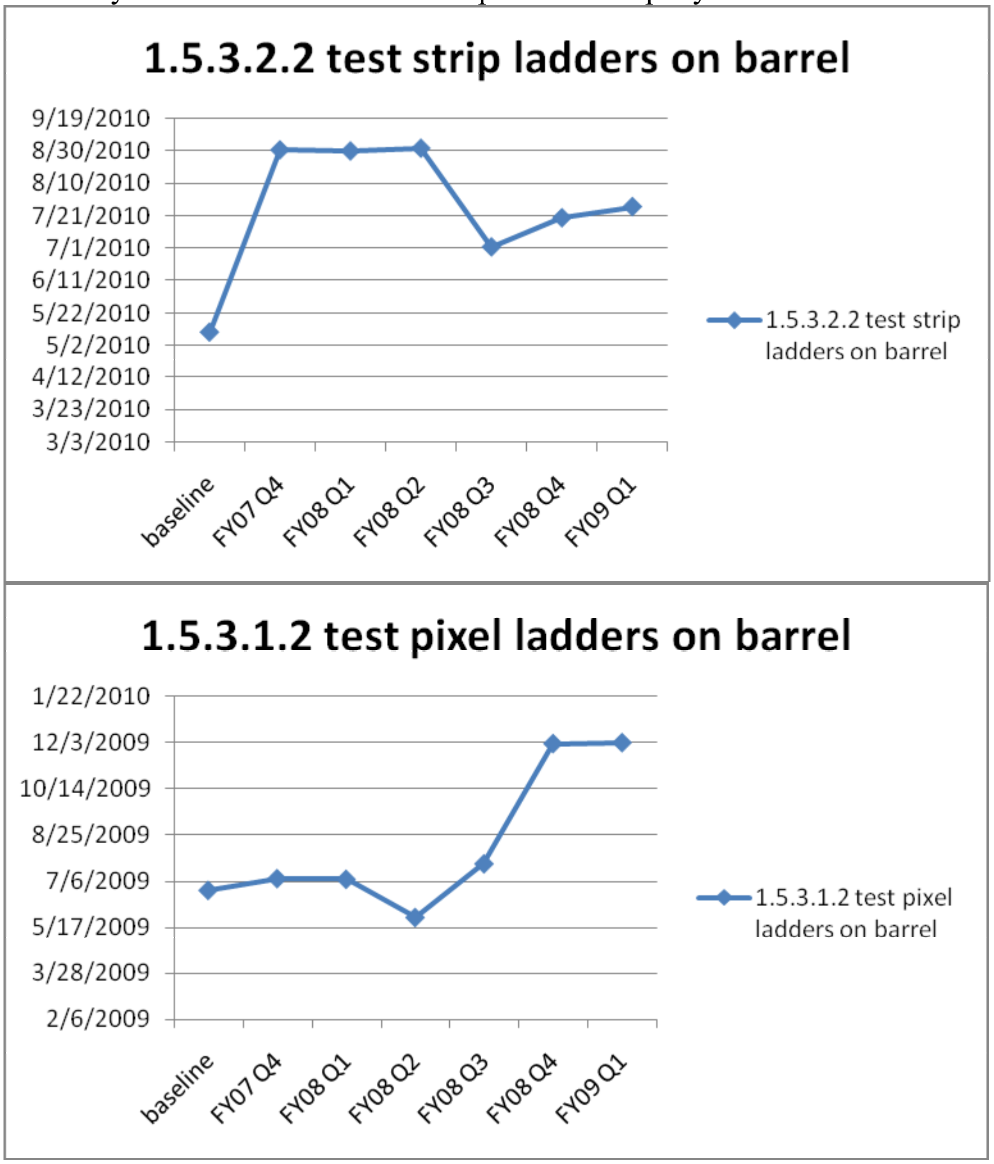

Figure 3 Historical Changes of the milestones (test in the barrel) in the Pixel and Strip system in the project file.

The two plots in Figure 3 show the historical changes of the dates of two major milestones in the project file. The top panel shows the projected date when all of the pixel ladders are tested on the barrel, i.e. the pixel system is ready to be installed. The second plot shows the date when all strip ladders are tested on the barrel. The plot shows that overall schedule of the project is not slipped since the first quarter report (FY07Q4).

Summary of expenditures:

Table 3 is the baseline project budget before the start. The baseline cost is $4.7M in actual year dollars including contingency.

Table 3 Baseline project budget

WBS	Item	Baseline Total Cost (AY$)	Costed & Committed	Estimate To Complete (AY$)	Estimated Total Cost (AY$)	Available Contingency (AY$)	Available Contingency (% of Est to Comp)
1.1	Strip	1,676	0	1345	1345	331	25
1.3	DAQ	200	0	160	160	40	25
1.4	Electronics System Integration	705	0	582	582	124	21
1.5	Auxiliary Systems & Integration	1940	0	1524	1524	416	27
1.6	Management	111	0	100	100	11	11
1.7	Installation	68	0	68	68		
Totals:		4700	0	3778	3778	922	24

Table 4 shows the status of the project at the end of FY09Q1

Table 4 Current project budget

WBS	Item	Baseline	Cost Accrued to date	Committed contract	To Complete	Estimated cost	Contingency	
		(AY k$)	(AY k$)	(AY k$)	(AY k$)	(AY k$)	(AY k$)	(% of Est to Comp)
1	VTX	4700	1270	355	2562	4187	513	20.0
1.1	Strip	1676	487	0	860	1347		
1.3	DAQ	200	0	0	199	199		
1.4	Electronics System Integration	705	99	119	257	475		
1.5	Auxiliary Systems & Integration	1940	651	203	1179	2032		
1.6	Management	111	33	33	38	104		
1.7	Installation	68	0	0	30	30		

The total estimated cost of Mechanical system has increased. The new cost reflects the quote of mechanical system fabrication at LBNL and also the cost increase of the engineering at HYTEC. The cost increase of DAQ reflects the increased number of DCMs required for pixel system readout (from 30 DCMs to 60 DCMs). The cost of the strip system reflects the updated estimate for strip FEE.

Table 5 shows cumulative amounts from the inception of the project. The commitment less accrued column shows that the remaining funds of the amount that was transferred to ORNL, LANL and LBNL plus the open commitment (i.e. the current ceiling of the amount of the contract less that has been spent to date) in the contracts with HYTEC, ISU and Nevis, including the estimated amount of BNL overhead.

Table 5 Cumulative amount of expenditure to the end of FY09Q1

	FY 2007	FY 2008	FY 2009
A) Funds allocated:	1,599	3,599	4,378
B) Costs accrued:	347	1,124	1,270
C) Open commitments	496	869	942
D) Remaining contingency:	922	561	513
E) Uncommitted funds (e=a-b-c)	756	1,606	2,166

Figures are Year to date

Brief summary of project issues, concerns, successes

Pixel subsystem

Successes:

- First articles of pixel buses are produced
  First articles of production pixel buses, both of the "left" and "right" versions, have been produced. They are ready to produce the first production ladder, which we call Ladder D. Ladder D will be assembled at the end of January.
- First articles of SPIRO production boards have been produced and tested.
  First 4 boards of production SPIRO were produced at Ecole Polytech. One of those boards was sent to RIKEN for tests with pre-production pixel ladders (Figure 4). No problem found so far. After the test is completed, the full production of the rest of the SPIRO will start at the end of January.
- Pixel FEE production review
  Pre-production Pixel FEE was fabricated and tested at Stony Brook (Figure 5). We had a final internal review of Pixel FEE on December 10th at BNL. The review panel recommended start of the production of Pixel FEE.
- 15 new sensor modules from CERN/VTT delivered
  After a long bureaucratic delay, 15 new pixel sensor modules were delivered from CERN/VTT to RIKEN (Figure 6). The Q/A tests of the new modules are in progress. As of the end of 6 of 15 sensor modules were Q/A tested, and we found 5 of them to be Class-I (good). The other one is to be re-tested. This brings up the total number of sensor modules that had been tested to 141. 15 of them had been consumed to make prototypes. The breakdown of the 126 tested modules that are available at RIKEN is shown in Figure 7. We now have 71 good (Class-I) and 8 usable (Class-II) modules. We will send 35 class-III modules to CERN/VTT for rework. The paperwork for shipment is complete and the modules will be shipped in January 2009. We need 120 sensor modules to complete the pixel system.

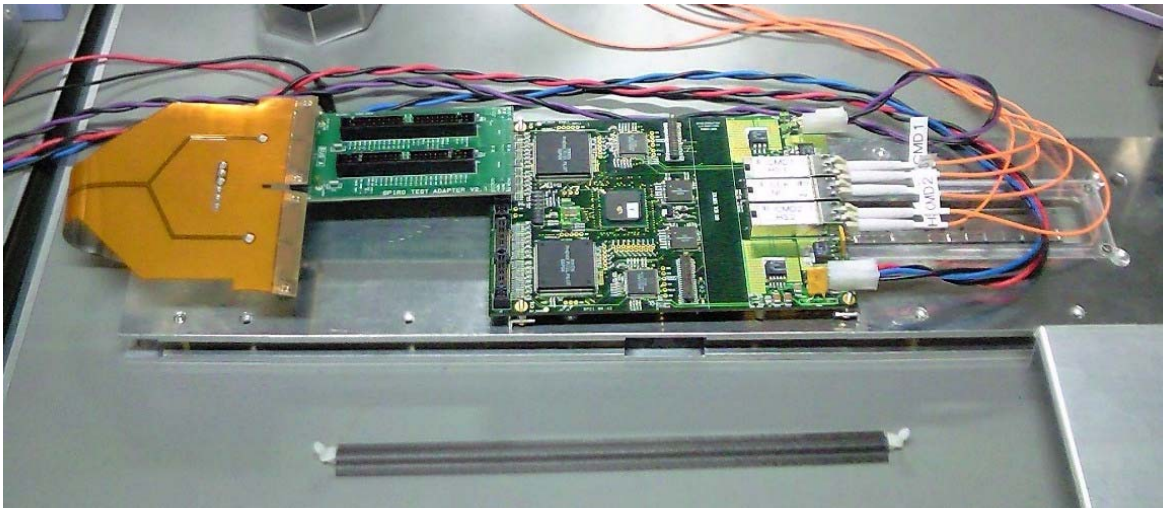

Figure 4 A first SPIRO production board being tested at RIKEN with a prototype ladder.

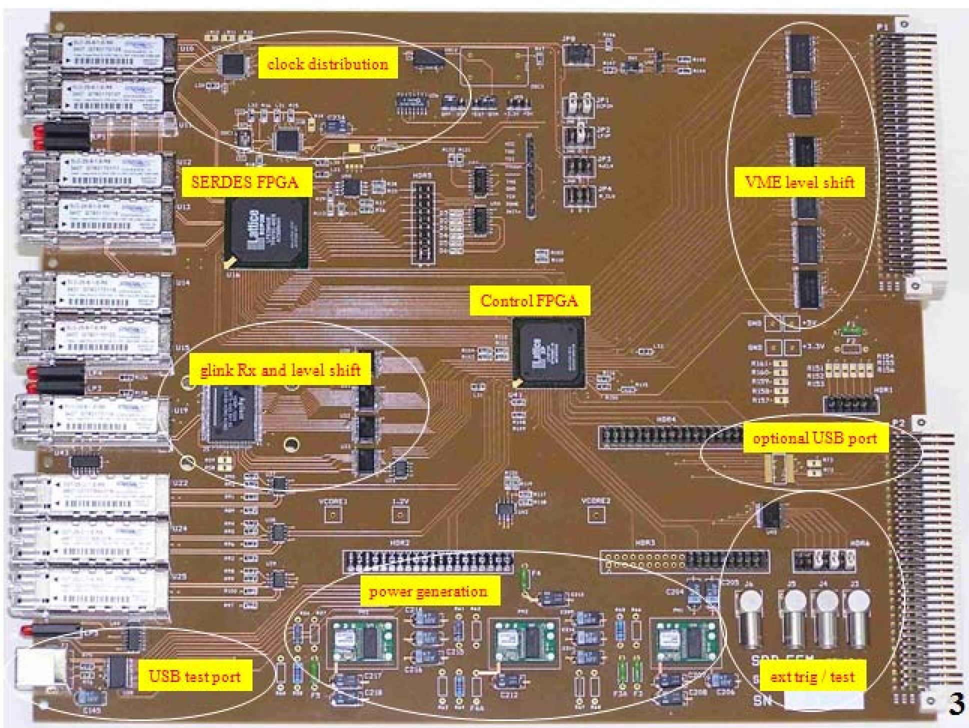

Figure 5 A pre-production pixel FEE

Figure 6 New pixel sensor modules delivered to RIKEN from CERN/VTT. One of the 15 modules is being tested and is now shown in the picture.

Total **141 Ladder** probed

Available at RIKEN for assembly

Class I	71 ladders
Class II	8 ladders
Class III	46 ladders
To Be Retested	1 ladder

Figure 7 Summary of the Q/A test results of pixel sensor modules at RIKEN.

Issues and concerns

- A new batch of sensor modules had arrived from VTT and this finally ended the long pause of the Q/A tests. The initial Q/A test results show a good yield (~80%) of the new batch. However, the long pause had caused a considerable delay in the completion of the milestone WBS 1.2.3.4. We still need more than 40 good sensor modules. We will send 35 class sensor modules to VTT for rework and will purchase sensors to make more sensor modules.
- Although the pixel detector has a large margin to be a critical path of the project, the schedule is slipping due to several unforeseen issues. We need to maintain the schedule of the subsystem.

Strip subsystem:

Successes:

- Internal Review of strip detector (October 1st)
  An internal review of the strip detector was held on October 1st, 2008. This is a follow up of the first annual review of VTX in June 2008. The review panel members are Chen-Y Chi (Columbia), Tom Hemmick (Stony Brook), Dave Lynn (BNL), and Steve Pate. The main focus of the review was the noise performance of the ROC3 modules. Bench test results of ROC3 modules and the results of a beam test at FNAL in August 2009 were presented. The panel delivered the review report on October 20th. The review panel found that ROC3 tests had demonstrated a 10X signal to noise ratio in the bench tests as well as in the FNAL beam test and concluded that the ROC-3 performance is suitable for PHENIX. The review panel recommended that the option of using a conventional sensor should not be pursued further.
- Bench tests of ROC3-prime module
  We produced a new prototype of ROC, ROC3-prime. This ROC has less material and is easier for fabrication than ROC3, which was not intended for production. The experience of ROC3 fabrication is feed back to the design of pre-production ROC to further improve the ease in fabrication. Sensor modules based on ROC3 prime were assembled and tested at BNL. They show good noise performance (Figure 8).
- Radiation damage test of ROC3 module
  One of the ROC3 modules was exposed to a neutron beam at LANL. Increase of the leakage current is as expected (Figure 9). The S/B ratio for the MIP of the exposed module was then measured at BNL by a source test. No significant decrease of S/B was observed.
- FNAL beam test analysis (finite angle)
  Data of the FNAL beam test with finite incident angle were analyzed. The S/B ratio of MIP signal was 10, and detection efficiency of ~99% is achieved (Figure 10).
- Design of the strip ladder is finalized
  Configuration and the geometry of a strip ladder is finalized. A strip ladder is made of 5 or 6 sensor modules on a mechanical stave. Each of the modules is read-out by a RCC board on the opposite side of the stave. The RCC boards are connected by a strip bus, and Ladder Data Transfer Board (LDTB) at the end of the bus reads out the entire ladder. The schematic drawing of a ladder is shown in Figure 11.
- Design of the assembly fixtures of strip sensor modules is in progress.
- ppROC fabrication is in progress
  Design and layout of pre-production ROC (ppROC) has been completed and it was submitted to Hughes, a board manufacturer. The layout of the ppROC is shown in Figure 12. The board is expected to be delivered at the end of January.
- RCC board, LDTB, and the strip bus.
  RCC is a read-out board that reads out one strip module (sensor+ppROC). Five or six of them on a strip ladder are connected by a strip bus and the entire ladder is read out by LDTB board at the end of the bus. Design and layout of a RCC

prototype and the bus prototype is complete. The layout of LDTB is near completion. We expect that they are all produced at the end of January or at the beginning of February.

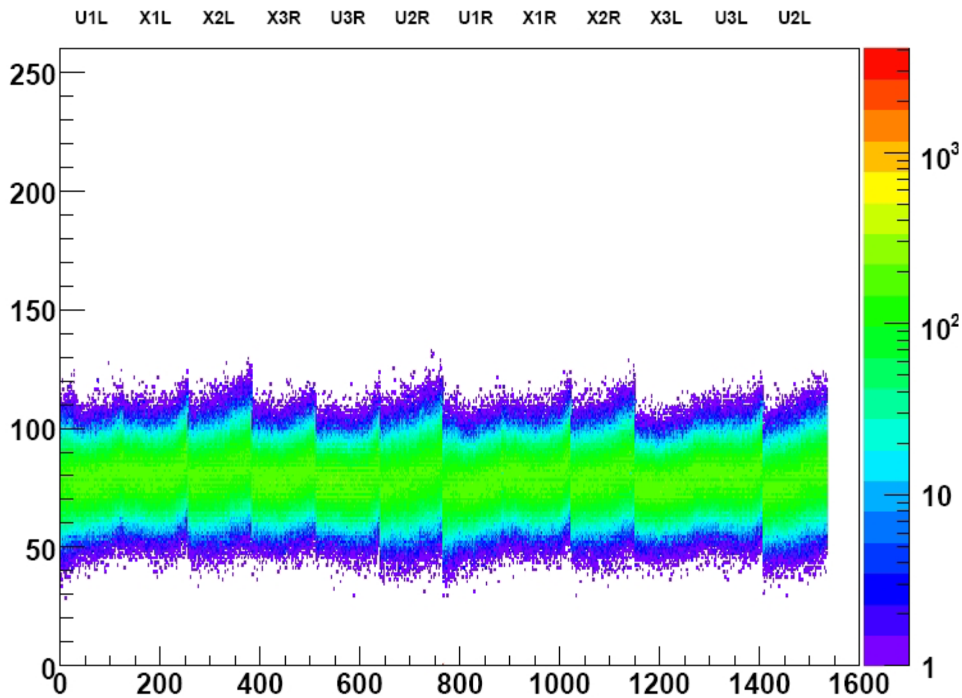

Figure 8 Pedestal vs channel of a ROC3-prime based sensor module. All of 12 SVX4 chips are working and pedestal distribution is nearly flat. This is as good as the best ROC3 based module.

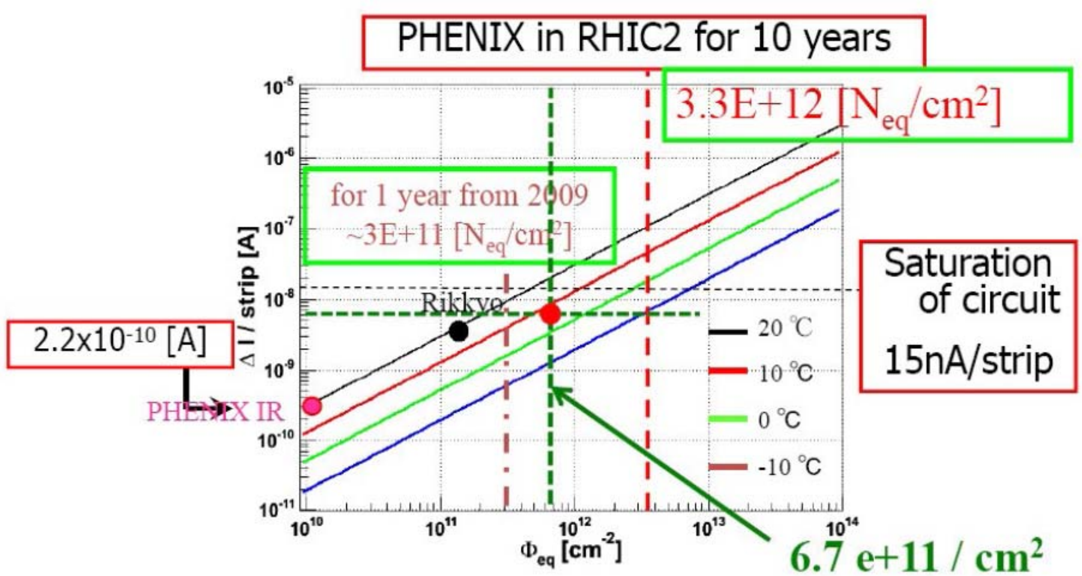

Figure 9 Increase of the leakage current of the strip silicon sensor as a function of radiation dose. The red point shows the result of the test at LANL. The two other points are from earlier measurements.

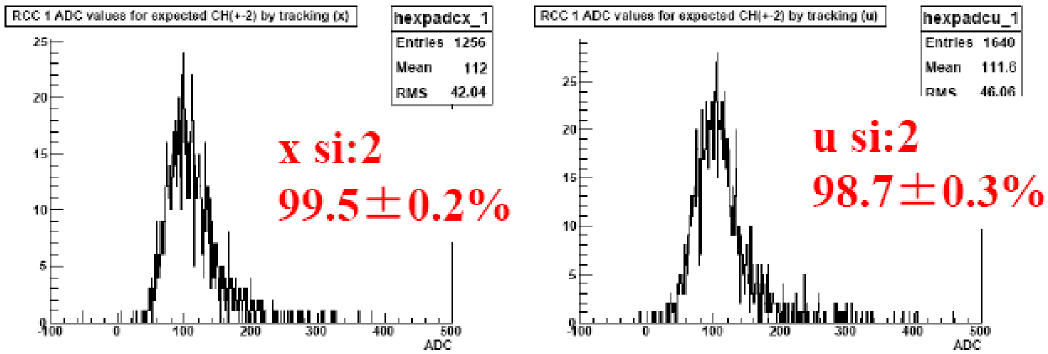

Figure 10 ADC distributions in the titled angle data from the FNAL beam test. Left panel shows the cluster ADC distributions for the X plan and the right panel is for the U plane. Here cluster ADC is the sum of ADCs within +/-2 strips of the expected hit position of the beam. The incident angle of the beam is 0.112 radians.

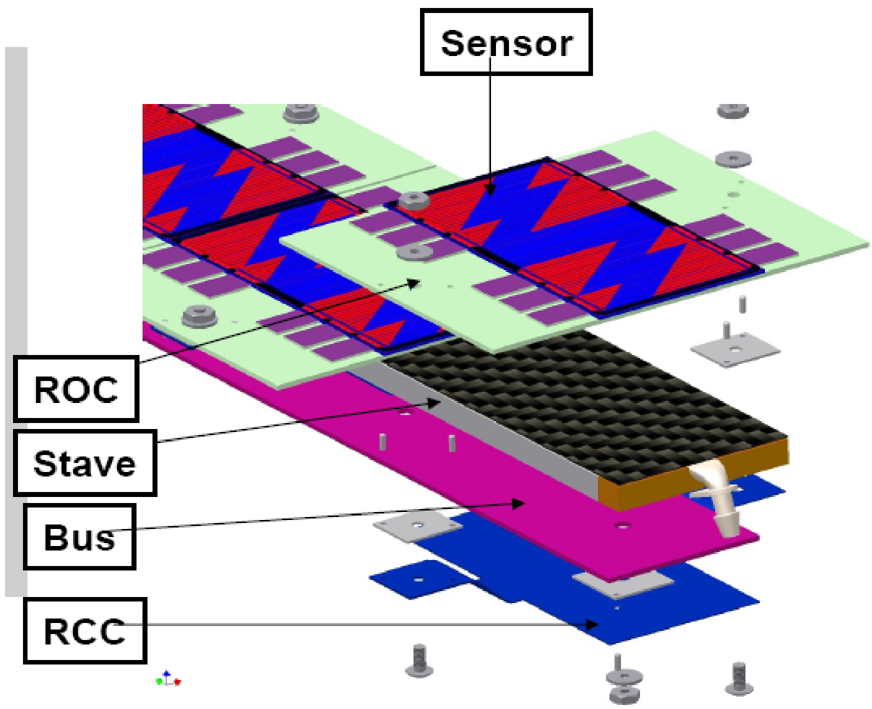

Figure 11 A strip ladder. Various components of the ladder (ROC, stave, bus, RCC) are shown. A ladder is read-out by a LDTB board at the end of the bus.

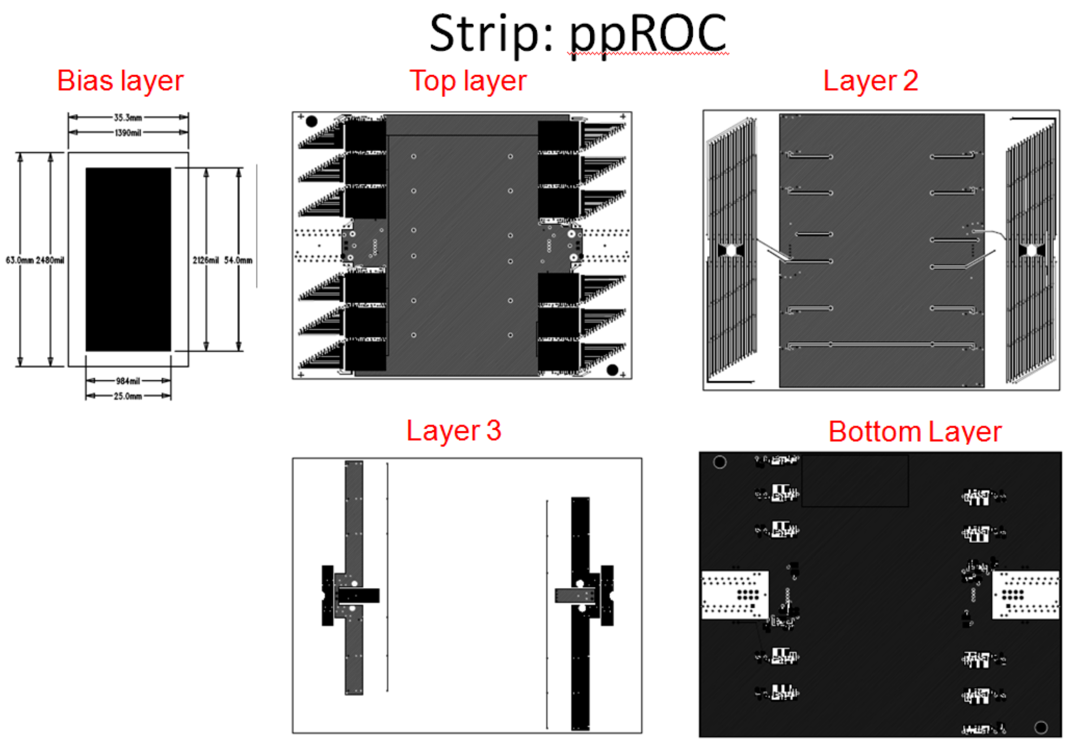

Figure 12 Layout of ppROC board.

Issues and concerns:

- The strip system is on the critical path of the project. Although the current schedule shows that the project will be completed at the end of the FY10 with explicit schedule contingency of 17 weeks, the schedule is tight.

Mechanics:

Successes:

- First articles of pixel staves have been produced at LBNL.
  Pixel mechanical staves made of carbon composite are produced at LBNL. The first articles of the staves were produced in December 2008 and they met the mechanical specification (Figure 13). VTX project members visited LBNL on December 13th and received the pixel staves (Figure 14). They will be used to produce the first pixel ladder at RIKEN in January 2009.
- Purchase order of new Be Beam pipe (40mm ID) was placed on December 1st.
  The beam pipe will be produced by Brush Wellman in 9 months.
- Paper works to fabricate Space Frame and the Barrel mounts at LBNL was completed in December. .
- Task Order #4 for HYTEC was signed.

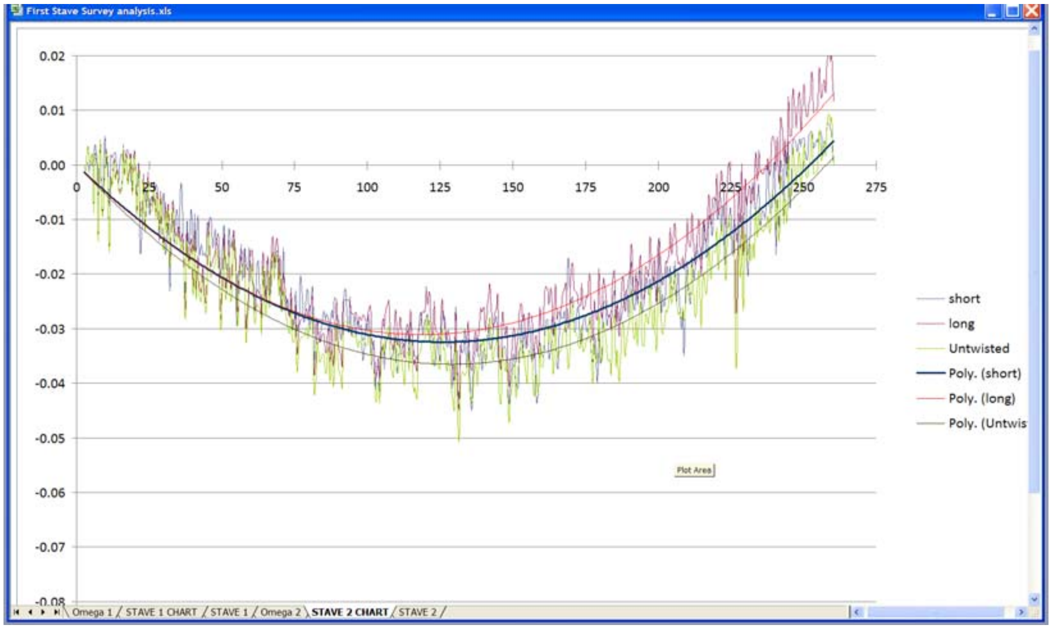

Figure 13 Measurements of non-flatness of a pixel stave prototype produced at LBNL. The maximum deviation from a straight line is 30-40 micron, well within the mechanical requirement.

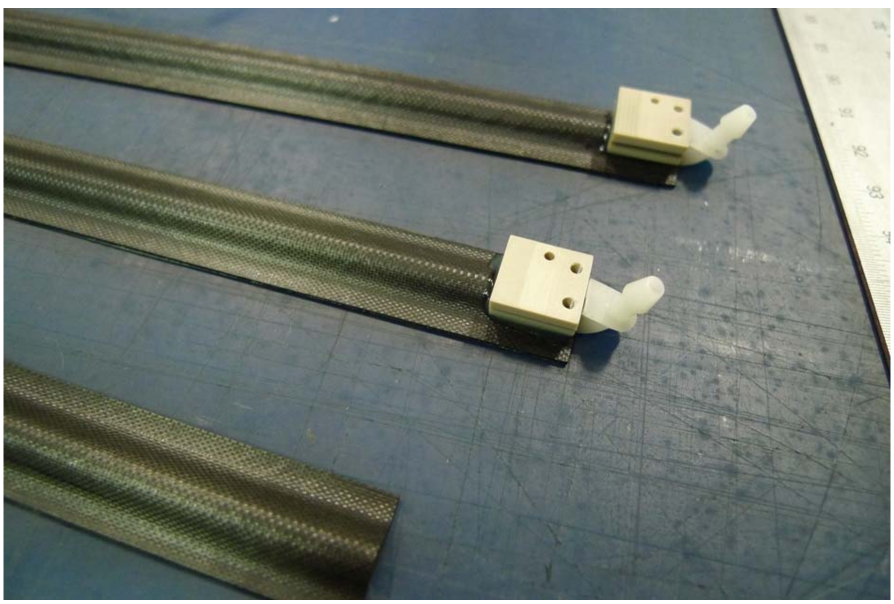

Figure 14 A photograph of pixel staves produced at LBNL.

Issues and concerns:

- Cost of the fabrication of mechanical components at LBNL is higher than we originally budgeted. Additional costs are reflected in the revised CTC.
- Progress on the VTX mechanical design at HYTEC is slower than planned. There have been cost increases due to the stretch-out in the mechanical design effort. These additional costs are reflected in the revised CTC. Solutions to keep the design effort on schedule include moving some mechanical design tasks to BNL.

Software:

Successes:

- VTX material budget and its impact on physics

  In the internal review of the strip system on October 1st, the material budget of the VTX and its impact on J/Psi mass resolution and DCA resolution was presented. The review panel found that the VTX group has performed detailed and realistic simulation. They found that the amount of the material in the current VTX design is acceptable and fits the PHENIX detector performance goals.
- More progress in the simulation effort.

  Figure 15 shows DCA resolutions as function momentum from a full GEANT simulation. A good DCA resolution of 50-60 micron is achieved for high pT. The results depend on the parameters of Kalman fit algorithm used for the analysis. At this point the parameters are not fully optimized. A simpler algorithm using a straight line fit of the pixel layers gives a better DCA resolution by about 20%. Figure 16 shows the simulation results on D^0 measurement by VTX. The simulation shows that with a DCA cut at 300 micron, the S/B ratio fo the D^0 signal is improved by a factor of 30.

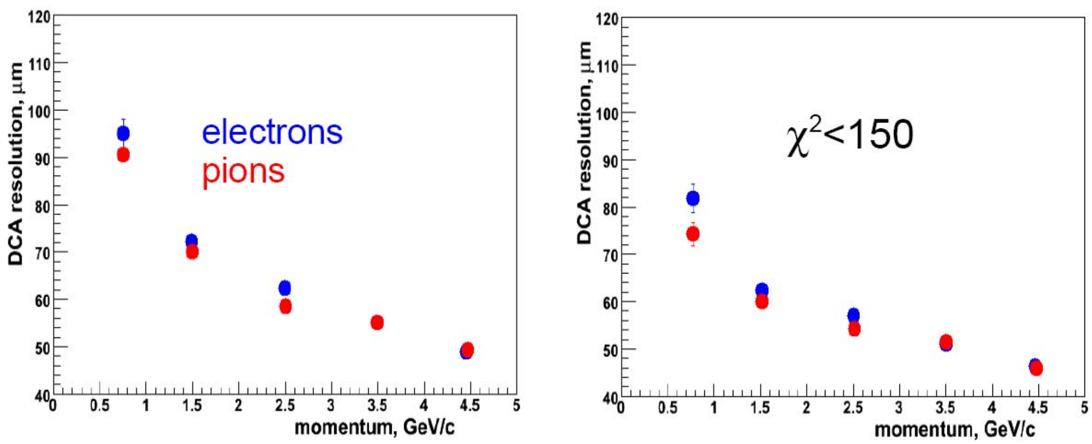

Figure 15 DCA resolutions for electrons and pions as a function of momentum, obtained from a full PISA (GEANT) simulation and using a Kalman Filter fit. The left panel shows the results with no chi2 cut, while the right panel shows the result with chi**2<150.**

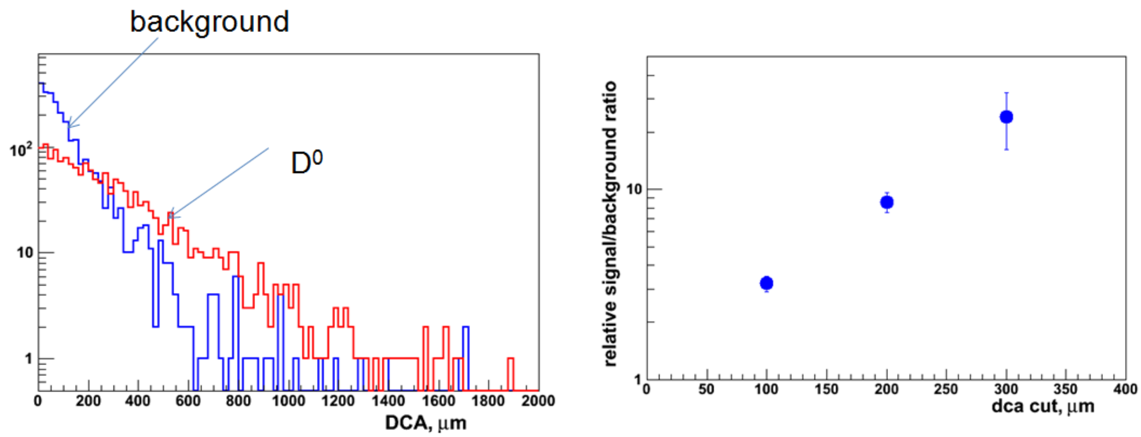

Figure 16 Simulation results of $D^0 \rightarrow K\pi$ measured by VTX. In the left panel, reconstructed DCA distribution for D^0 and light hadron background are shown in red and in blue respectively. The right panel shows the relative S/B improvement factor as function of DCA cuts.

Issues and concerns:

- Manpower working on the VTX software effort has increased over the last 6 months, but the project would still benefit from additional people. Efforts to improve the situation art ongoing.