

# The PHENIX NCC Management, Budget Schedule

Richard Seto

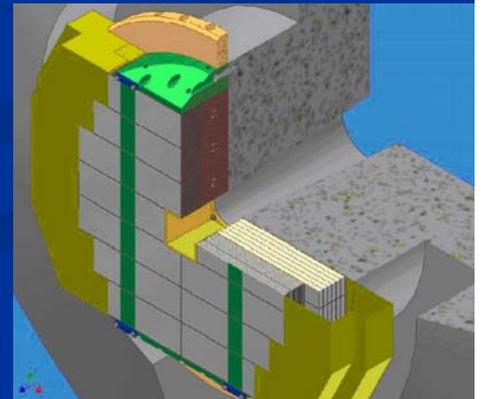
UCR

BNL Review

March 14-16, 2006



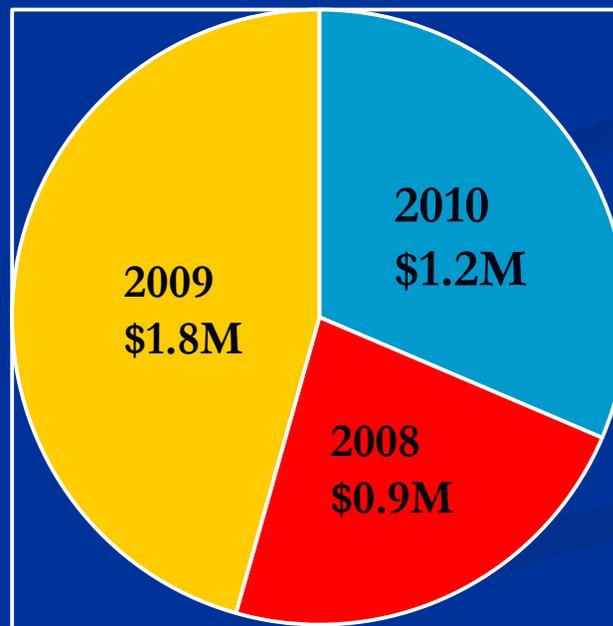
R. Seto



# The Request



- \$3.94M starting in 2008
- Construction complete in 2010



# Collaboration

- US Institutions
    - BNL: Physics, Chemistry, Instrumentation
    - FNAL, Nevis Labs/Columbia
    - UCR, Colorado, UIUC, ISU, SUNYSB
  - Strong Involvement of International Collaborators
    - Russia (JINR/Dubna, Moscow State)
    - Czech Republic (Charles U, Academy of Sciences, Czech Tech)
    - Japan (Tsukuba, RIKEN)
    - Korea (Yonsei, Ewha, KoreaU)
- Total : 74 people 20 institutions

# Silicon Expertise

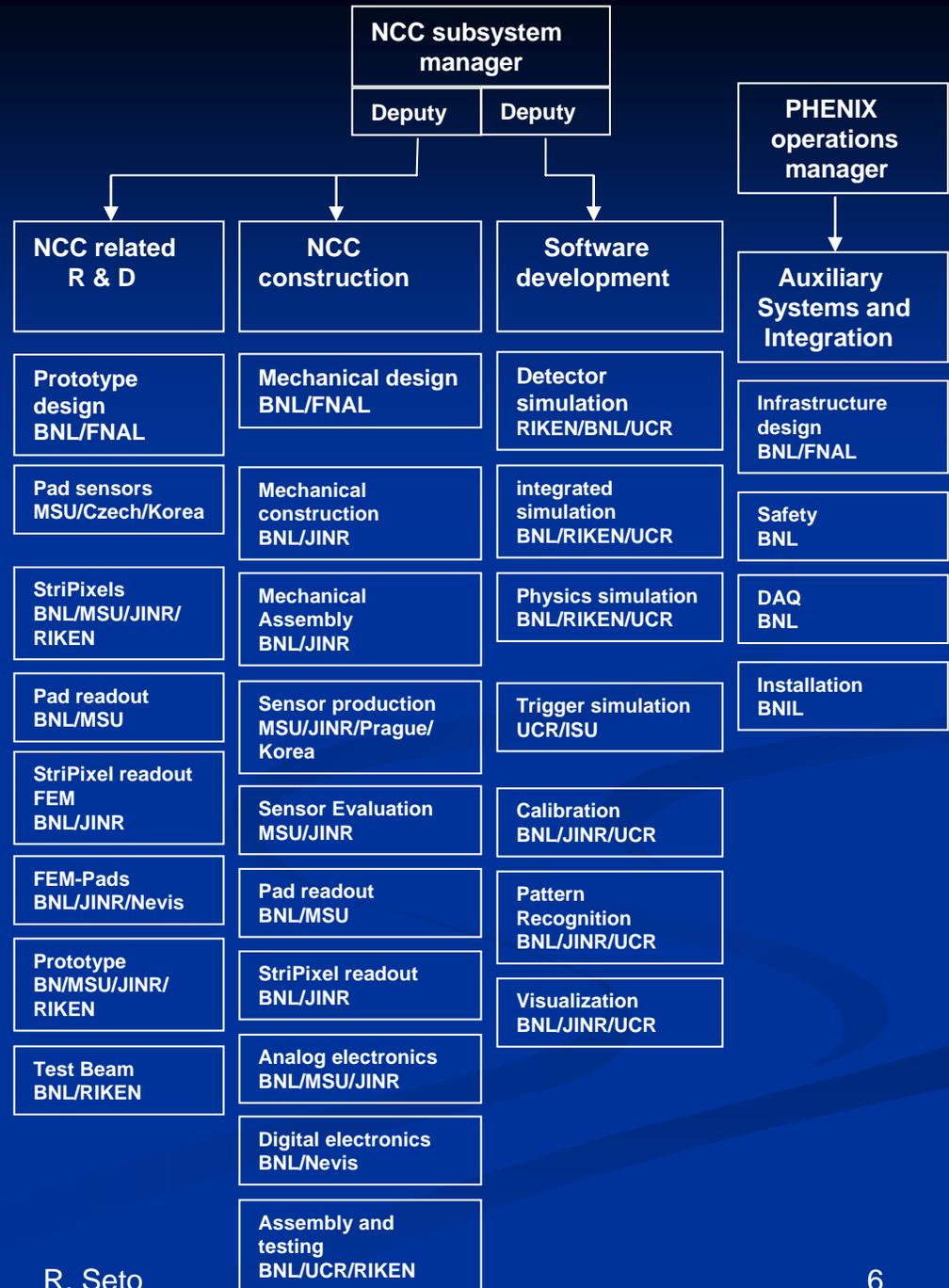
- MSU – M. Merkin, D. Kharmanov (D0)
- BNL Chemistry – A. Sukhanov (PHOBOS)
- BNL Instrumentation
- FNAL- W.E Cooper, Y. Orlov (D0)
- Ewha – I. Park (Cream Balloon experiment)
- Czech Czech Academy of Sciences - V. Vrba, M Tomasek, L Tomasek ( Calice)

# Collaboration Responsibilities

- Si pad sensors ♦ Moscow State U (MSU), Czech, Korea
- Si Strip Sensors ♦ BNL Instrumentation, BNL Chemistry, MSU, JINR/Dubna
- Pad structure ladders, Readout for Pads ♦ MSU
- StriPixel ladder, Readout for StriPixels ♦ BNL, JINR/Dubna
- Analog Data processing for pad ♦ BNL
- Digital data processing ♦ BNL, Nevis
- Trigger ♦ ISU/Ames
- Support Structure and Absorber Plates ♦ BNL, UCR
- Mechanical ♦ Design – FNAL
- Mechanical ♦ Manufacture – JINR/Dubna
- Assembly and testing of Bricks/Calorimeter ♦ BNL, UCR, RIKEN
- Software and Simulations ♦ RIKEN, UCR

# Management Structure

- Under leadership of PHENIX management
- Subsystem Manager- R. Seto UCR
- Deputy/Construction DOE contract Project Manager – E. Kistenev (BNL)
- Deputy/Software-Physics Itaru Nakagawa (RIKEN)



# Plans

- R and D phase:
  - Assemble a full “brick” –  
PS+SM+EM1+EM2+HAD
- Construction Phase – NCC-1
  - \$3.94M to start in FY08
  - Funding and detector to be completed in 2010

**The R and D phase in which we produce a full Brick is critical**

**It will:**

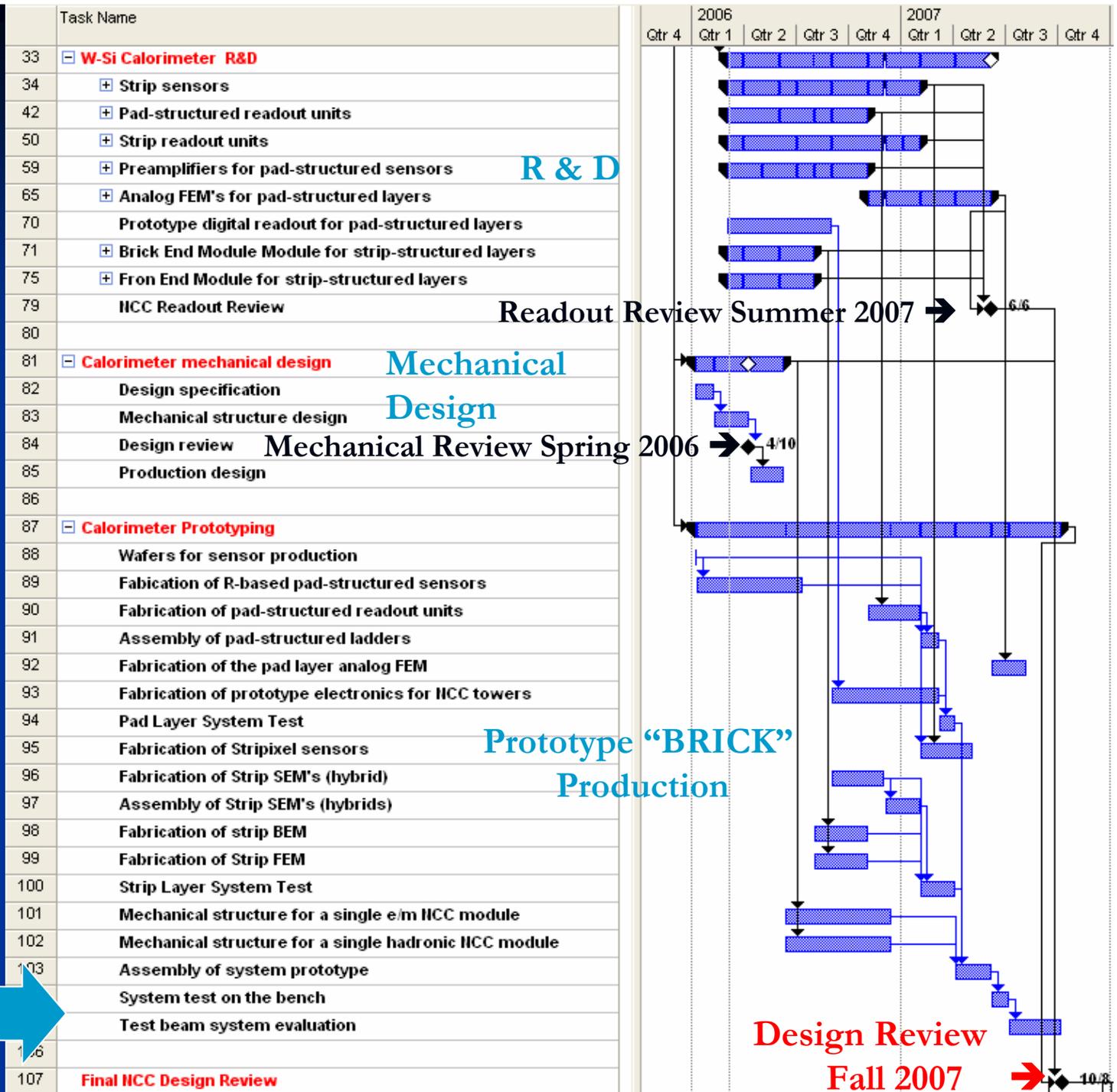
**Provide critical calibrations for energy resolution,  $\pi^0$  reconstruction,  
photon identification/hadron rejection**

**Optimize design and manufacturing processes**

# R and D Schedule

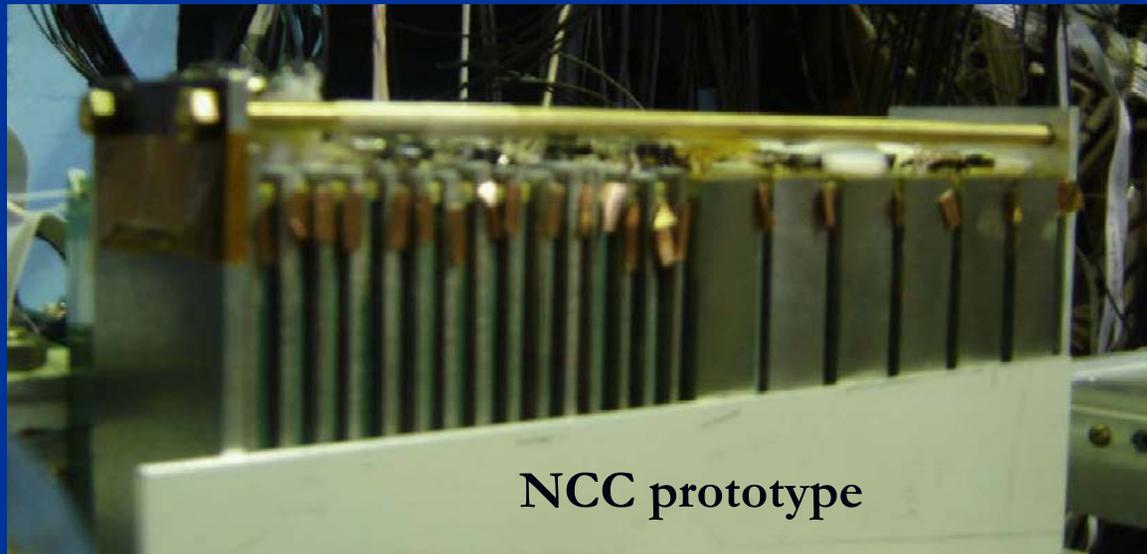
Test beam  
Mid 2007

3/13/2006



# External Sources of Past R and D funds

- RIKEN \$100K
- UCR: \$30K
- Contributions from MSU - \$10K
  - Test Beam operations, Travel
- Contributions for JINR - \$15K
  - Design, Construction, Tungsten for Prototype



# R and D Costs

<b>R&amp;D 2006-2007: Development</b>	<b>2006</b>	<b>2007</b>	<b>Total</b>
Pxilated strip sensors (StriPixels)	\$26,300		\$26,300
Pad-structured readout units	\$18,565		\$18,565
Strip-structured readout units	\$8,000	\$12,000	\$20,000
Pad readout analog electronics		\$15,200	\$15,200
Pad readout digital electronics	\$3,000	\$5,813	\$8,813
StriPixel readout electronics	\$4,000	\$8,250	\$12,250
<b>R&amp;D 2006-2007: Design and Prototyping</b>			
Si wafers		\$39,950	\$39,950
Pad-structured sensors	\$70,000	\$22,531	\$92,531
Pad-structured ROU's	\$5,000	\$19,323	\$24,323
Electronics for pad-structured layers	\$16,563	\$27,500	\$44,063
Pxilated strip sensors (StriPixels)		\$10,540	\$10,540
StriPixel ROU's and electronics	\$2,936	\$18,185	\$21,121
Mechanical Structure	\$7,013	\$8,850	\$15,863
Testing (bench and Test beam)		\$17,038	\$17,038
<b>2006-2007 R&amp;D Funding</b>	<b>\$161,377</b>	<b>\$205,178</b>	<b>\$366,554</b>

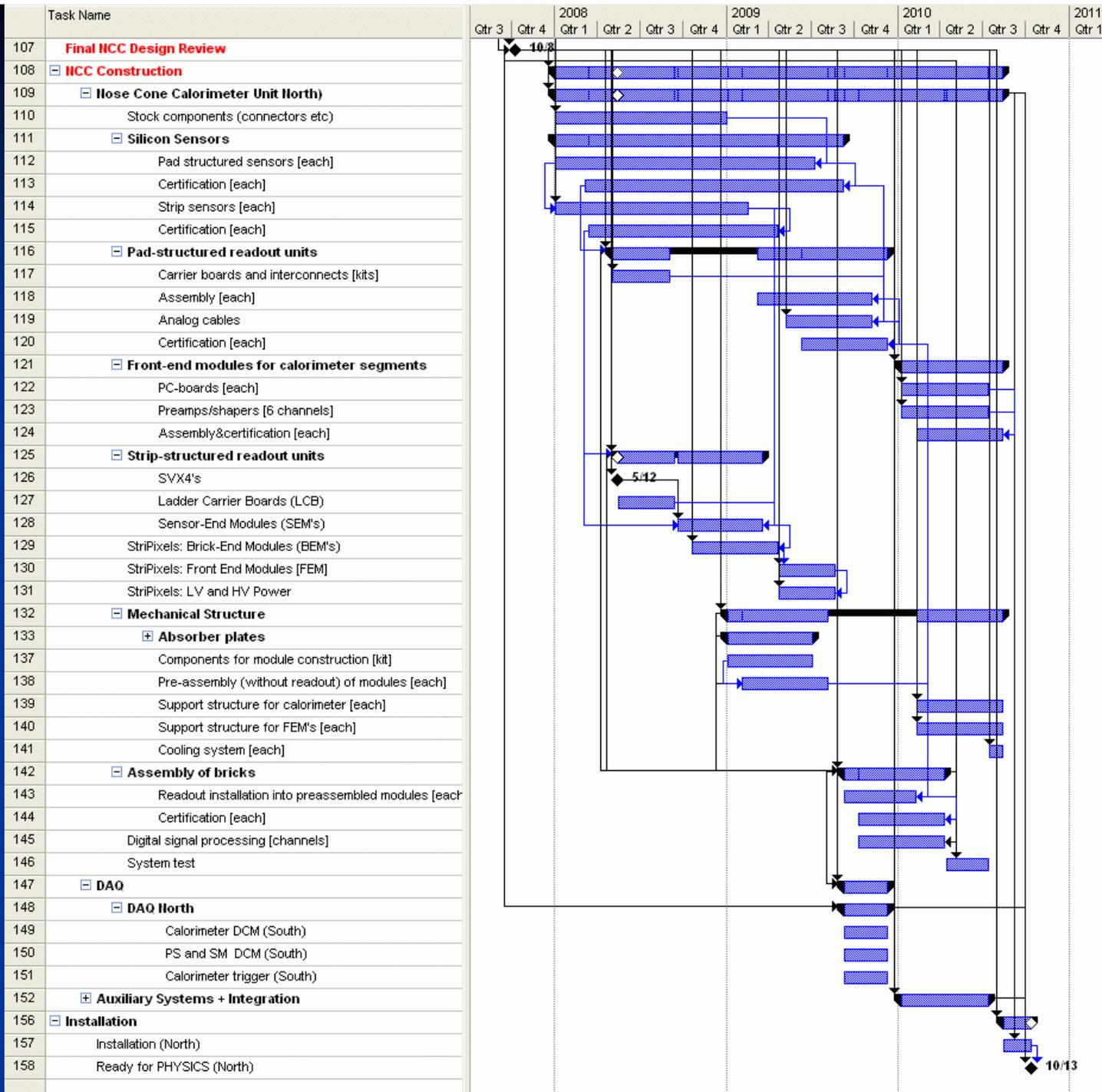
note: this table  
is corrected  
from the CDR

**2006: \$162K (RIKEN, UCR, BNL Generic R and D )**  
**2007 \$205K**  
**Total \$367K**

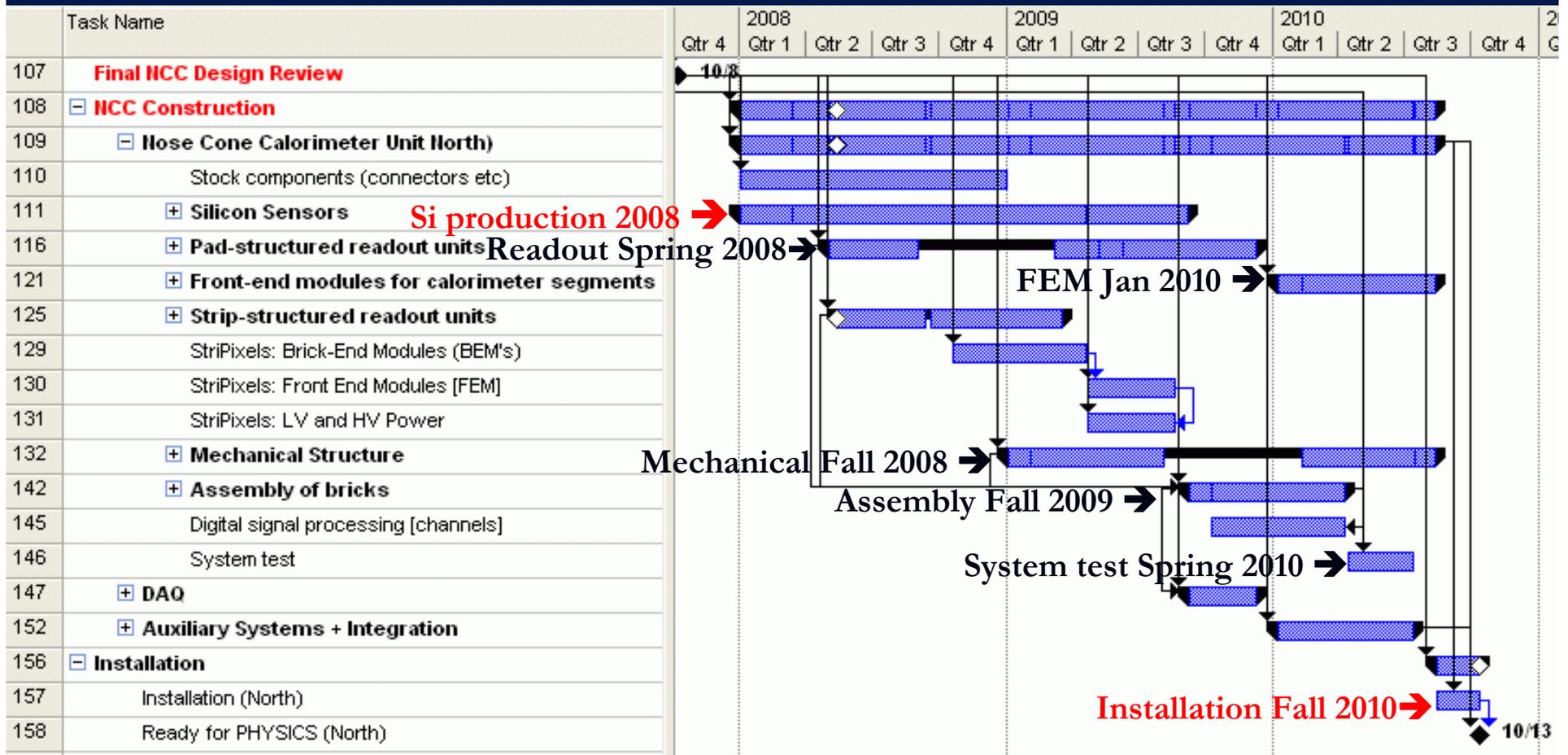
3/13/2006

# THE NCC Production Schedule

3/13/2006



# Rolled up



**Critical Path Item: Silicon Production must begin in early 2008**

We are working with multiple vendors to produce the Si detectors: Performance is confirmed for ELMA(Russia), and evaluations are ongoing with prototypes from ON Semiconductor(Czech Republic) and SENS(Korea) :

# NCC Construction Project



- Funding (\$3.94M) will cover
  - Construction of a single NCC
  - Upgrade to PHENIX infrastructure (DAQ etc)
  - Installation and commissioning
- Cost Basis – Major items
  - Si Sensors – based on quotes from ELMA
  - Mechanical – FNAL/JINR Dubna
  - Tungsten – Quote from STARK International
  - Electronics – Engineering estimate based on construction of similar detector systems

# The Budget – Contingency Calculation

## ■ Contingency

- For all testing, assembly, and installation tasks, we assume that the contingency is 50% of the costs.
- For purchases based on vendor information, 20% of the cost is included as contingency.
- For all other purchases, the contingency is 30% of the costs.
- For all tasks that require the production of prototypes, contingency is taken to 100% of the cost of one extra design plus prototype cycle.
- General Labor 20%: Labor costs for much of the electronics is in M&S (e.g. Digital electronics, hence the contingency is applied there)
- These contingencies are done on components. Average contingencies are shown as summaries

## ■ Spares and overhead

- 10% spares on all electronics, pad and strip sensors.
- 18% overhead assumed on all costs (Present BNL rate)

# Cost estimate – detail

Total = \$3.94M

- Cost to project includes spares, contingency and overhead
- missing on this section of the spreadsheet are DAQ, ancillary systems, and installation costs of about \$200K
- contingency and spares in %

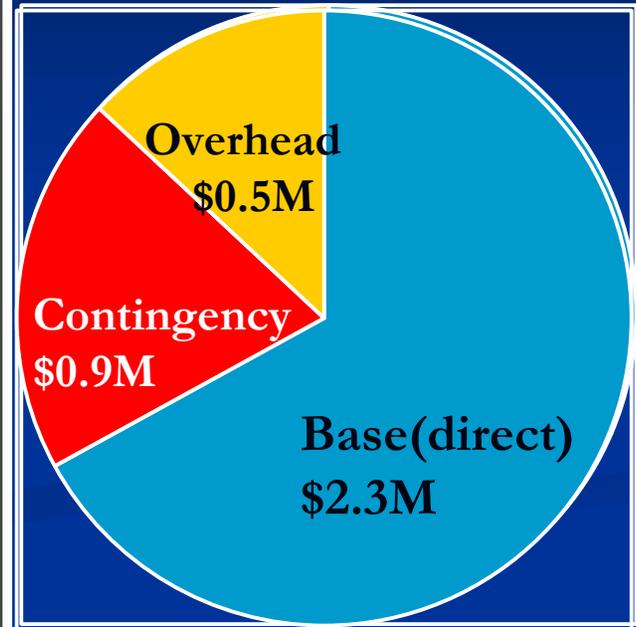
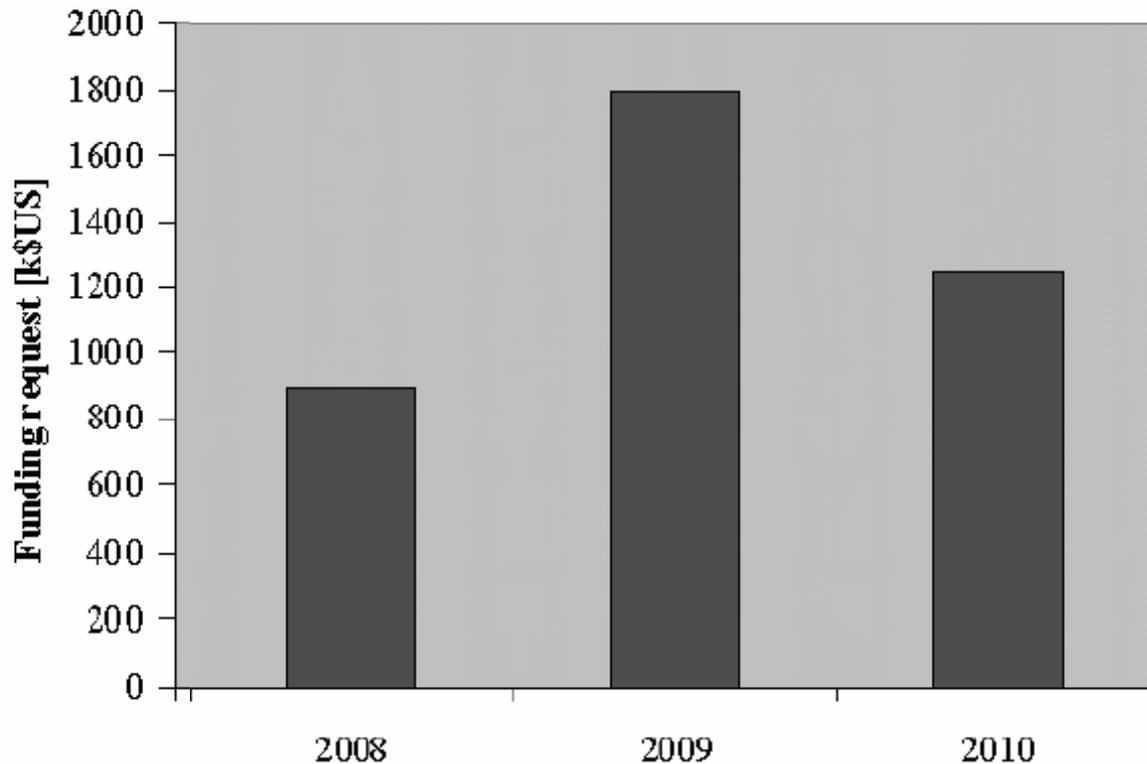
	Units	Spares	Base cost	Contingency	Cost to Project
2					
5	NCC North	0	\$2,331,070	35	\$3,707,475
6	Stock components (connectors etc)		\$100,000	88	\$220,313
7	Silicon Sensors	0	\$916,440	34	\$1,439,658
8	Pad structured sensors [each]	3192	\$798,000	32	\$1,237,698
9	Certification [each]	3192	\$15,960	56	\$29,255
20	Strip sensors [each]	336	\$100,800	43	\$169,369
21	Certification [each]	336	\$1,680	69	\$3,336
22	Pad-structured readout units	0	\$139,810	35	\$222,121
23	Carrier boards and interconnects [kits]	504	\$75,802	32	\$117,568
24	Assembly [each]	504	\$45,360	32	\$70,353
25	Flexible cables	504	\$13,608	65	\$26,383
26	Certification [each]	504	\$5,040	32	\$7,817
27	Front-end modules for calorimeter segme	0	\$119,980	64	\$230,983
28	PC-boards [each]	84	\$3,780	65	\$7,328
29	Preamps/shapers [6 channels]	1400	\$112,000	65	\$217,140
30	Assembly&certification [each]	84	\$4,200	32	\$6,514
31	Strip-structured readout units	0	\$122,840	37	\$197,039
32	SVX4's	722	\$14,440	32	\$22,396
33	Ladder Carrier Boards (LCB)	28	\$4,200	32	\$6,514
34	Sensor-End Modules (SEM's)	168	\$50,400	32	\$78,170
35	StriPixels: Brick-End Modules (BEM's)	28	\$28,000	32	\$43,428
36	StriPixels: Front End Modules [FEM]	84	\$16,800	65	\$32,571
37	StriPixels: LV and HV Power	0	\$9,000	32	\$13,959
38	Mechanical Structure	0	\$339,520	31	\$523,044
39	Absorber plates	0	\$319,000	30	\$487,273
40	W plates for Converter and EM segment	325	\$65,000	30	\$99,288
41	W plates for Hadronic segment [kg]	1270	\$254,000	30	\$387,985
43	Components for module construction [ki	56	\$8,400	50	\$14,805
44	Pre-assembly (without readout) of modul	56	\$1,120	20	\$1,579
45	Support structure for calorimeter [each]	1	\$5,000	50	\$8,813
46	Support structure for FEM's [each]	2	\$4,000	50	\$7,050
47	Cooling system [each]	1	\$2,000	50	\$3,525
48	Assembly of bricks	0	\$39,200	20	\$55,272
49	Readout installation into preassembled n	56	\$11,200	20	\$15,792
50	Certification [each]	56	\$28,000	20	\$39,480
51	Digital signal processing [channels]	8512	\$553,280	27	\$822,382
53					

# Cost Estimate – major categories

■ Major Items	average contingency	Total cost
■ Si Sensors Pads:	32%	\$1,237K
■ StriPixels:	43%	\$169K
■ Pad structure readout units :	35%	\$222K
■ Strip structure readout units :	37%	\$197K
■ FEM Analog electronics: Pads	64%	\$231K
■ FEM Digital electronics: Pads	27%	\$822K
■ Mechanical structure (including W)	31%	\$523K
■ Assembly of Bricks	20%	\$55K
■ DAQ, Ancillary systems, Installation	30%	\$235K
■ Stock components	88%	\$220K
■ Total	35%	\$3.94M

■ Total cost includes spares, contingency and overhead

# Funding Profile



<b>Costs (k\$) / Year:</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Base Cost</b>	<b>Contingency</b>	<b>Overhead</b>	<b>Total</b>
NCC Construction (k\$)	900	1800	1007	2331	827	549	3707
Ancillary Systems (k\$)			236	160	48	28	236
<b>Total DOE Construction (k\$)</b>	<b>900</b>	<b>1800</b>	<b>1243</b>	<b>2491</b>	<b>875</b>	<b>577</b>	<b>3943</b>

# Funding 2<sup>nd</sup> NCC

- Actively seeking funds from International Collaborators
  - Commitments already from RIKEN
  - Have found possible sources of funds
    - Japan
    - Korea
    - Russia (In kind)
    - Czech Republic (in kind)
  - Ongoing discussions with European groups

# Summary

- Technologies chosen are
  - Well established and robust
  - Often shared with other areas
    - In PHENIX (SVX4, Stripixels)
    - At BNL (hybrid amplifiers)
- Potential Vendors identified
- R and D well underway
- Goal: Construction complete in 2010
  - Schedule for physics is 2011
- Request \$3.94M starting in F2008-2010

