DO Run IIb Project

- Overview of project
- Organization
- Guide through documentation
- Risk analysis
- Schedule management
- Contingency estimation
- Project cost
- Manpower profiles
- Conclusions

Jon Kotcher

Director's Review of the Run IIb Projects

August 12-15, 2002

Run IIb Design Guidelines

- Run IIb: increase in instantaneous, integrated luminosity relative to guidelines that drove Run IIa detector design

	Integrated Luminosity (fb^{-1})	Instantaneous Luminosity ($X10^{32} cm^{-2} sec^{-1}$)
Run IIa	2	2
Run IIb	10-15	2-5
Requirements for Run 2b	Silicon replacement, more rad-hard version	Trigger upgrades (dominated by Level 1)

- Silicon:
  - Current detector designed for ~ 2 fb^{-1}, evidence that it will survive to 4-5 fb^{-1}
    - The most appropriate rad-hard technology used at that time
  - After study of various options, have chosen to pursue full silicon replacement
    - Partial replacement not viable: unacceptable level of technical risk, more down-time for removal/installation, limited SVX2 chip availability, etc.
- Trigger:
  - Increase in luminosity results in unacceptable increase in rates - occupancies, pileup, combinatorial effects
  - Move rejection upstream in readout stream (contain dead time), maintain both downstream rejection, event selectivity
  - Address need for higher-bandwidth data logging

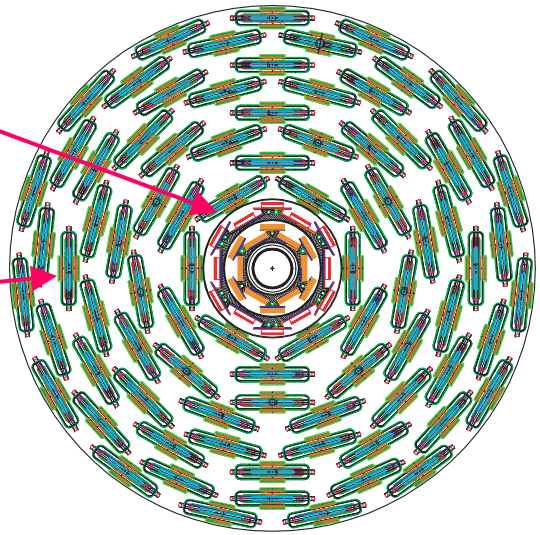
Subproject Overviews

- WBS 1.1: Silicon Detector
  - Replace with more radiation-hard version
- WBS 1.2: Trigger Systems
  - Level 1: Shift some trigger functionality upstream to hardware level trigger
    - WBS 1.2.1, L1 Calorimeter Trigger
    - WBS 1.2.2, L1 Calorimeter/Track Match
    - WBS 1.2.3, L1 Central Track Trigger
  - Level 2: Incremental upgrades to Run IIa systems
    - WBS 1.2.4, L2 Beta System
    - WBS 1.2.5, L2 Silicon Track Trigger
- WBS 1.3: DAQ/Online System
  - Address aging, obsolescence of computing hardware, need for higher bandwidth data logging, filtering capability
- WBS 1.4: Project Administration
  - Project personnel, travel, miscellaneous supplies
- WBS 1.5: Installation
  - Integration of silicon, trigger installation & pre-beam commissioning

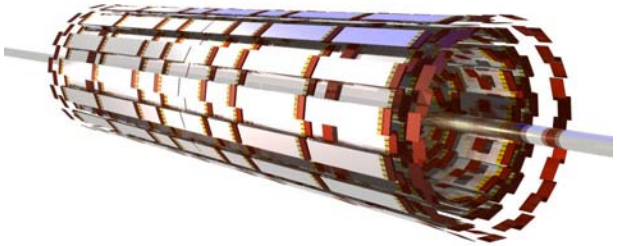
WBS 1.1: Basic Silicon Design Choices

See talks by Marcel Demarteau & Alice Bean

- Six layer silicon tracker, divided into two radial regions
  - Inner layers: Layers 0 and 1
    - Axial readout only
    - Mounted on integrated support
    - Assembled into one unit
    - Designed for V_{bias} up to 700 V
  - Outer layers: Layers 2-5
    - Axial and stereo readout
    - Stave support structure
    - Designed for V_{bias} up to 300 V

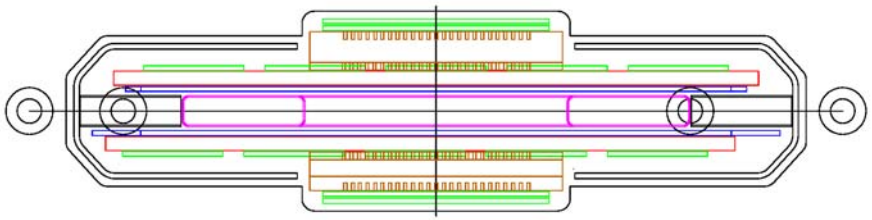


- Employ single sided silicon only, 3 sensor types
  - 2-chip wide for Layer 0
  - 3-chip wide for Layer 1
  - 5-chip wide for Layers 2-5
- No element supported from beampipe

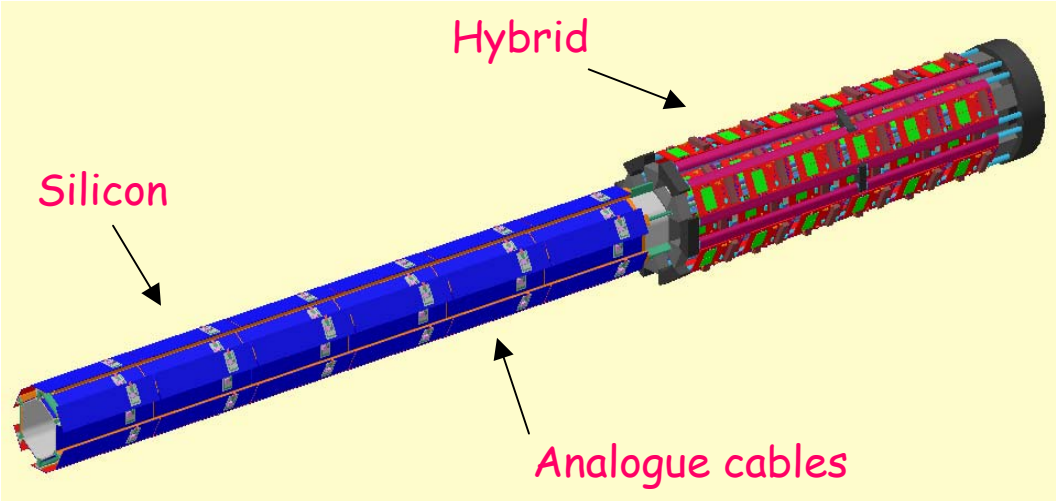


Silicon Detector Elements

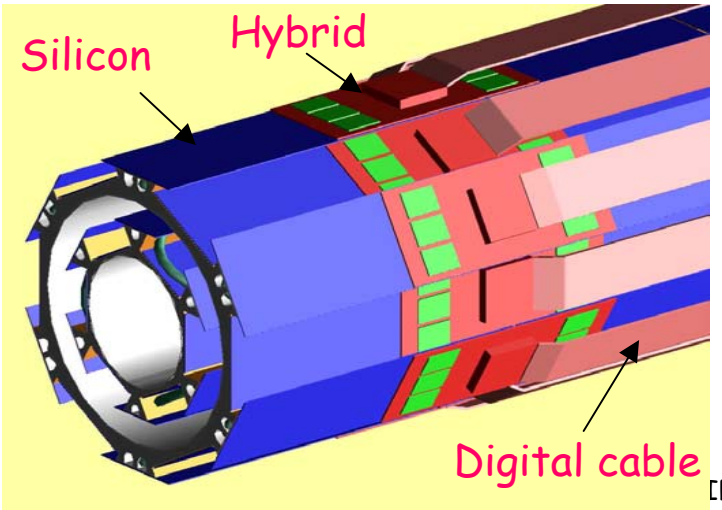
- 168 silicon staves: basic building block of outer layers
- Supported in positioning bulkheads at z=0, z=605 mm



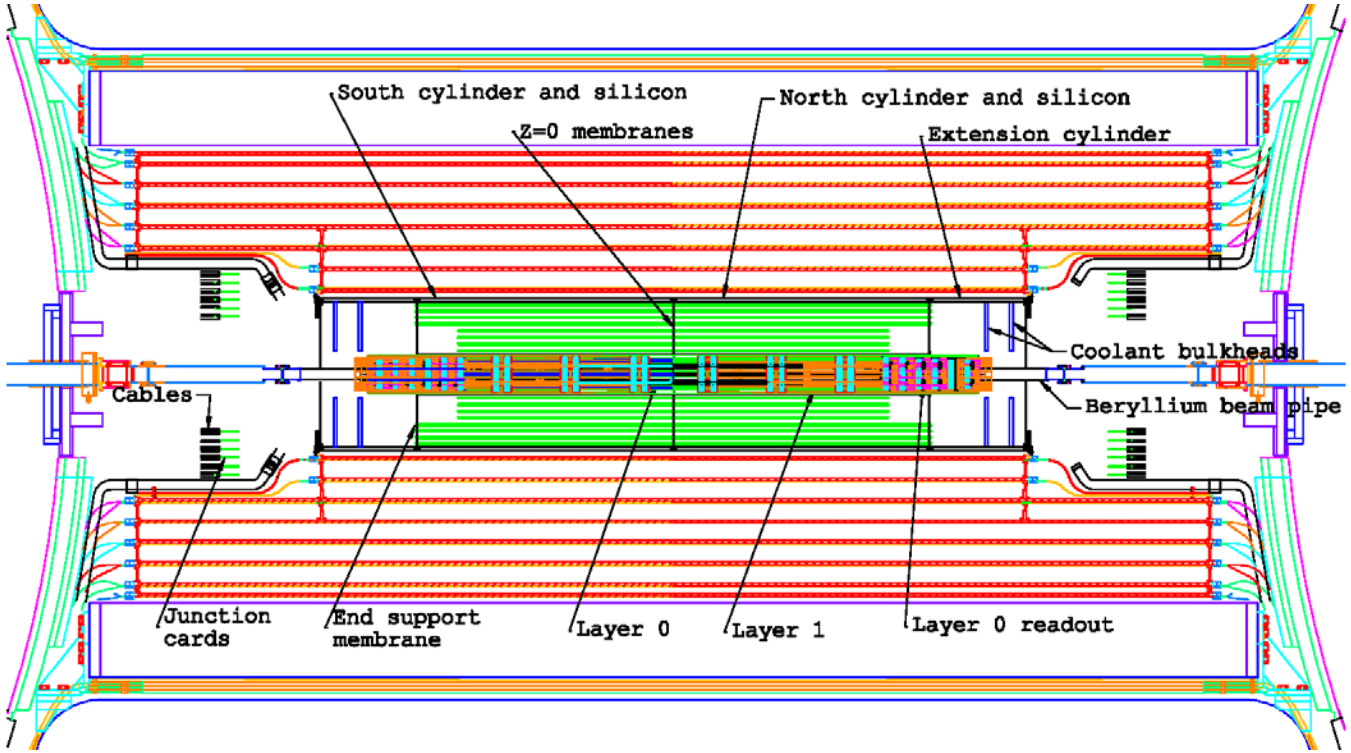
- Layer 0 support structure: University of Washington



- Layer 0/Layer 1 mated



Plan View of Run IIb Barrel Region



- 18.542 mm IR beam tube
- L0 and L1: 12 sensors long
- L2 and L3: 10 sensors long
- L4 and L5: 12 sensors long
- 1220 mm long barrel region
- Support from "bulkheads" at z = 0 and z = ±610 mm

WBS 1.5: Installation

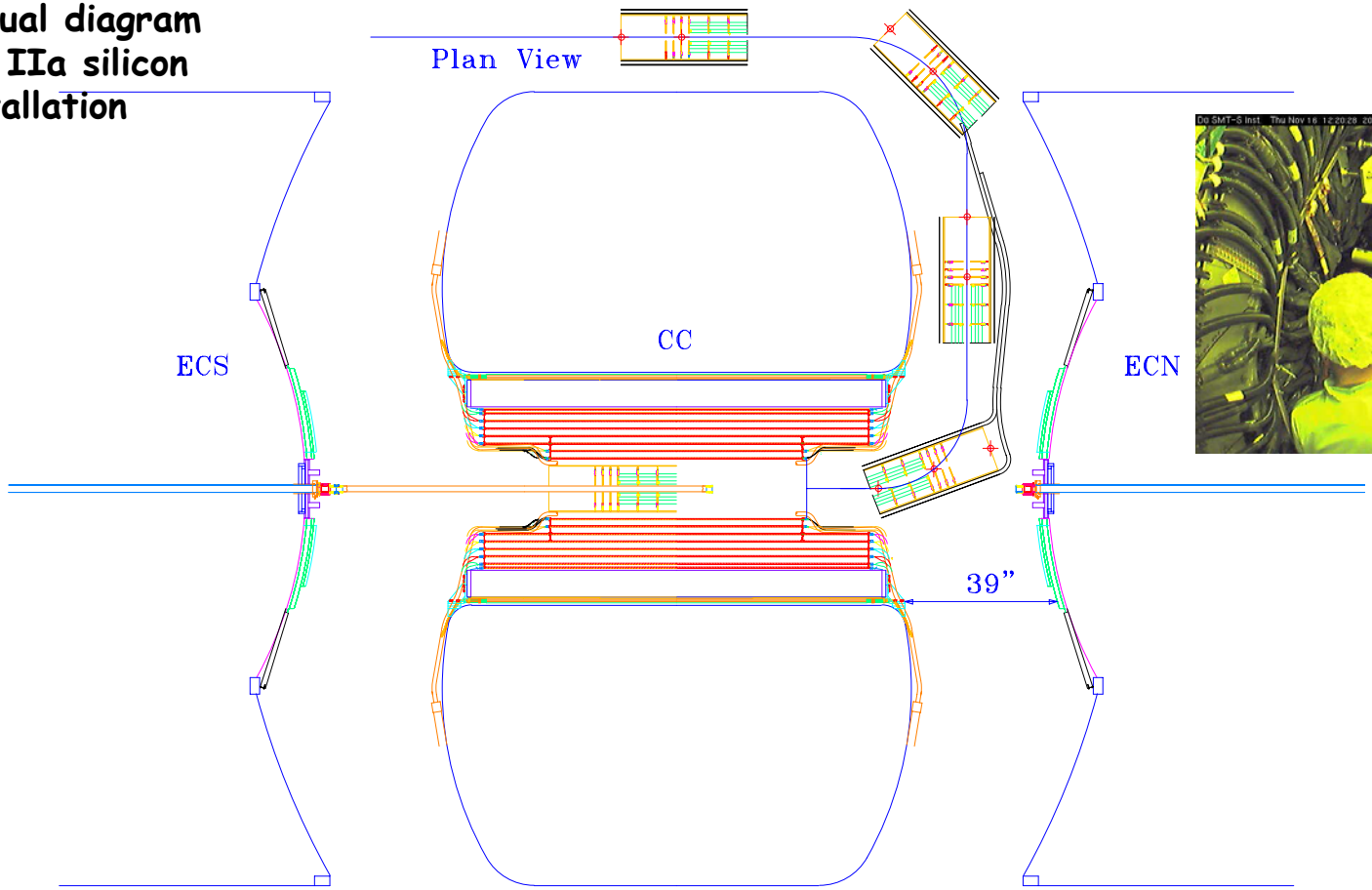
See talk by Rich Smith

Split-silicon design allows installation in Collision Hall

Platform not rolled out - much reduces time, effort, risk

Allows shutdown time to be dedicated to installation, hookup, commissioning

Conceptual diagram of Run IIa silicon installation



WBS 1.2: Run IIb Trigger Upgrade

See talk by Darien Wood

Level 1 systems

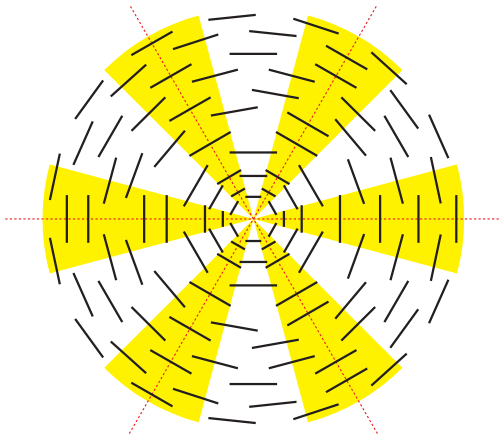
System	Problems	Solutions
Cal	1) Trigger on $\Delta\eta\times\Delta\phi$=0.2×0.2 TTs ⇒ slow turn-on curve 2) Slow signal rise ⇒ trigger on wrong crossing	• Clustering • Digital Filter
Track	1) Rates sensitive to occupancy 2) Limited match to calorimeter	• Narrower Track Roads • Improve Cal-Track Match
Muon	No Additional Changes Needed!	• Requires Track Trigger

Trigger	Physics Channel	Rate (no upgrade)	Rate (w/upgrade)	Upgrade components
EM Trigger (1 EM tower > 10 GeV)	$W \to e\nu$	9 kHz	0.5 kHz	Trk, Cal, Trkmtch
Jet Trigger (2 trigger towers > 4 GeV)	$ZH \to \bar{\nu}\nu\ \bar{b}b$	2 kHz	0.5 kHz	Cal
Track Trigger (2 trk > 10,5 GeV, iso,EM)	$H \to \tau\tau$	60 kHz	0.7 kHz	Trk, Cal, Trkmtch
Muon Trigger (muon > 10 GeV)	$W \to \mu\nu$	6 kHz	2 kHz	Trk
SUM		≤ 77 kHz	≤ 3.7 kHz	

Upgraded L1 trigger accommodates 5 kHz bandwidth budget

Run IIb Level 2 Trigger Upgrade

- Modest upgrades to two components:
  - Silicon Track Trigger
    - Vital for triggering on b-quarks
      - $ZH \rightarrow \nu\nu bb$
      - $Z \rightarrow bb$ (top mass jet energy scale)
    - Improves track trigger
      - Sharper p_T turn-on
      - Reduced fake rate
    - Upgrade needed to accommodate design of new silicon detector
      - Instrumenting 5 of 6 Run IIb silicon layers
        - See report submitted to June PAC
  - Level 2β processors
    - More processing power required to retain same Level 2 rejection
    - Add 12 additional processors



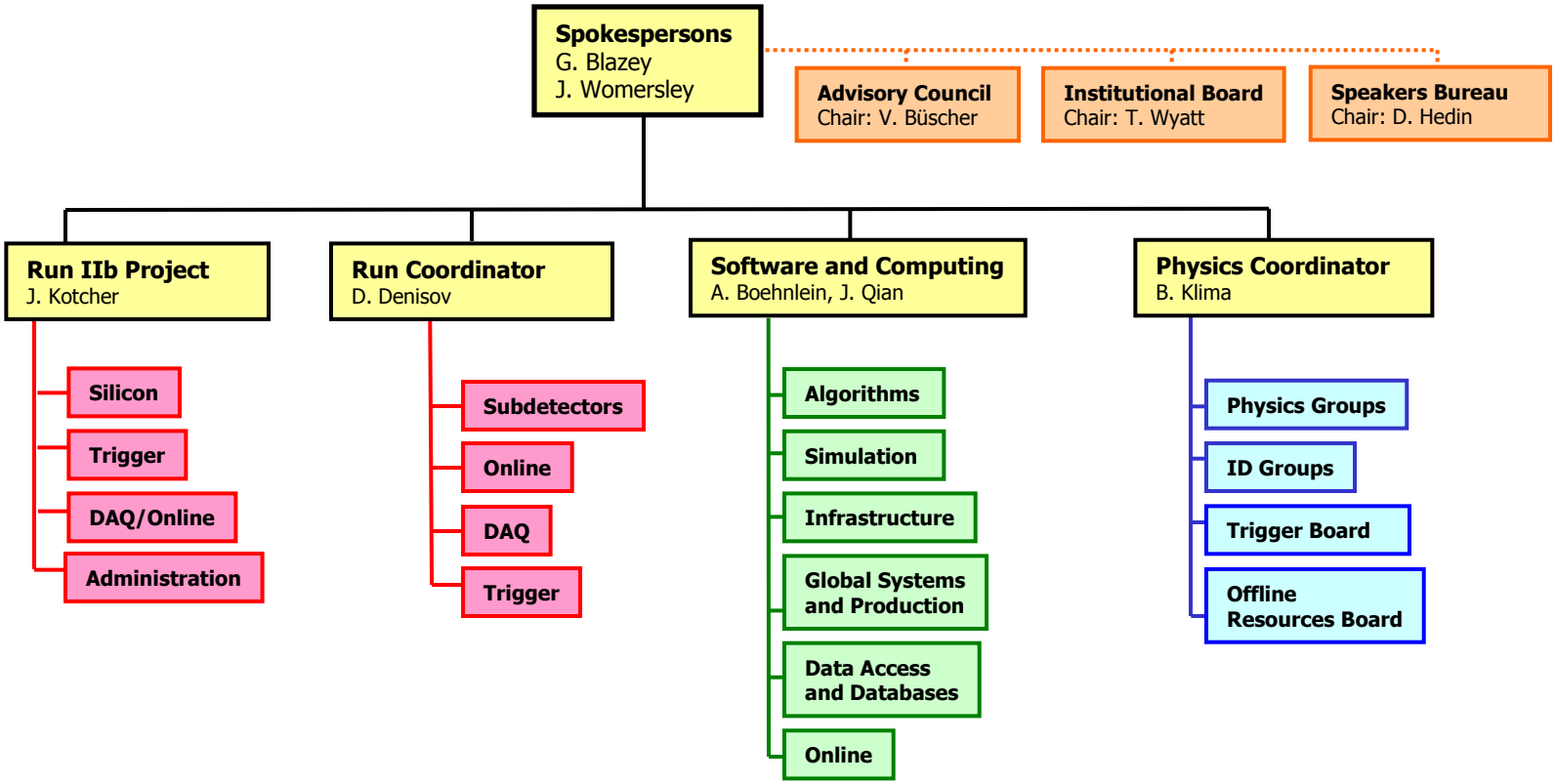
See talk by Stu Fuess

WBS 1.3: DAQ/Online

System	Items	Need
Level 3 filter nodes	~100 more L3 Farm nodes	Match to rates and processing requirements
DAQ HOST system	Linux data logging nodes and buffer disk arrays	Replace aging systems with higher performance nodes
ORACLE systems	Database nodes, disk arrays, and backup systems	Adopt lab standard ORACLE platform
File Server systems	Linux server nodes, disk arrays, and backup systems	Replace aging systems

Upgrades to DAQ/Online systems required for long-term, high rate running during Run IIb

D0 Experiment Organization



Run IIb Project Organization

DO Run IIb Project
J. Kotcher, Project Manager
R. Partridge, Deputy; V. O'Dell, Associate; W. Freeman, Assistant
M. Johnson, Technical Coordinator
C. Yoshikawa, Budget Officer; T. Erickson, Administration

WBS 1.1 Silicon
M. Demarteau
A. Bean, Deputy

- 1.1.1 Sensors — R. Demina, F. Lehner
- 1.1.2 Readout System — A. Nomerotski, N.W. Reay
- 1.1.3, 1.1.5 Mechanics & Assembly — W. Cooper, K. Krempetz
- 1.1.4 Production — J. Fast, H. Haggerty
- 1.1.4 QA, Testing, & Burn-in — C. Gerber
- 1.1.6 Monitoring — M. Corcoran, S. de Jong
- 1.1.7 Software & Simulation — F. Rizatdinova, L Shabalina
- 1.1.8 Administration — (M. Demarteau)

WBS 1.2 Trigger
H. Evans
D. Wood

- 1.2.1 L1 Cal Upgrade — M. Abolins, (H. Evans), P. LeDu
- 1.2.2 L1 Cal/Track Match — K. Johns
- 1.2.3 L1 Track Trigger — M. Narain
- 1.2.4 L2β Upgrade — R. Hirosky
- 1.2.5 Silicon Track Trigger — U. Heintz
- 1.2.6 Simulation — M. Hildreth, E. Perez
- 1.2.7 Administration — (D. Wood)

WBS 1.3 DAQ/Online
S. Fuess
P. Slattery

- 1.3.1 Level 3 Systems — D. Chapin, G. Watts
- 1.3.2 Network & Host Systems — J. Fitzmaurice, (S.Fuess), S. Krzywdzinski
- 1.3.3 Control Systems — F. Bartlett, G. Savage, V. Sirotenko
- 1.3.4 DAQ/Online Management — (P. Slattery)

WBS 1.4 Project Administration

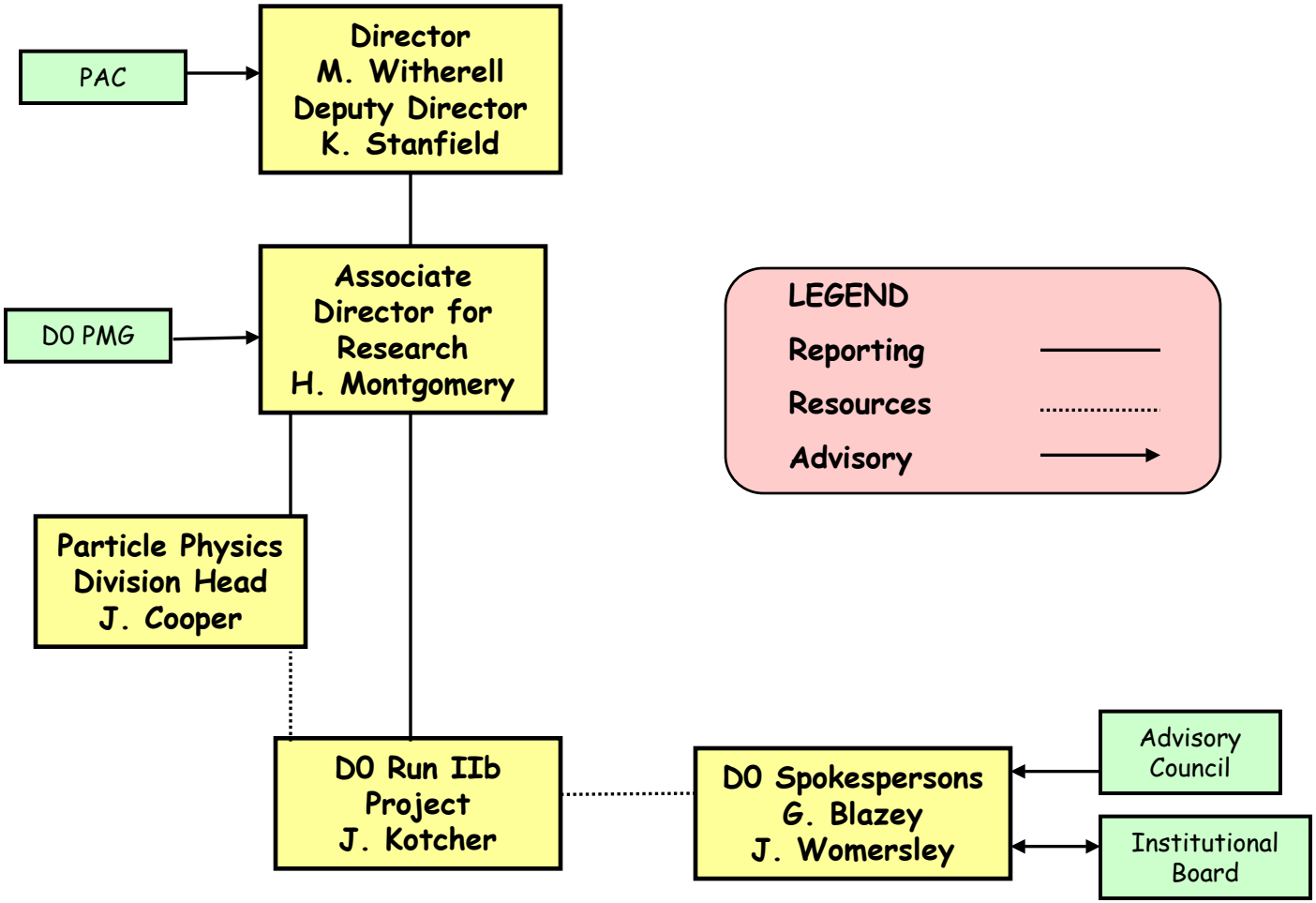
WBS 1.5 Installation
R. Smith

- 1.5.1 Silicon Installation — Mechanical: H. Lubatti; Electronics: L. Bagby, R. Sidwell
- 1.5.2 Trigger Installation — D. Edmunds

Installation is part of project plan, but funded out of operating

Experienced group, key positions in place for more than 1 year. All managers in place through WBS Level 3.

Project Reporting Structure



Past Run IIb Milestones, Reviews

- April/Nov 00: Initial presentations of Run IIb plans to PAC
- June 01: D0 Trigger Task Force put in place to clarify Run IIb trigger needs
  - Co-chairs: M. Hildreth, R. Partridge
- Nov 01: Silicon TDR and Trigger/Online CDR presented to PAC
- Dec 01: Director's Technical Review of CDF and D0 Run IIb Upgrades
  - Chair: J. Pilcher
- April 02: Director's Review of Run IIb Upgrade Projects
  - Chair: E. Temple
- June 02: Aspen PAC recommends Stage I approval
- Aug 12-15 '02: Director's Review of Run IIb Upgrade Projects
- Sep 23 '02: DOE (Lehman) Baselining Review

Cost, Schedule Tools

- Work from resource-loaded schedule in MS Project 2000. To set scale:
  - Silicon (1.1) – 1100 lines
  - Trigger (1.2) – 340 lines
  - Online (1.3) – 150 lines
  - Project Administration (1.4) – 30 lines
  - Installation (1.5) – 160 lines

Total: 1780 lines

- MS Project schedule is primary project tool used for cost, schedule development
  - All M&S, labor, contingency estimates, & risk factors loaded directly into schedule
- Project costs reflect technical manpower only
  - Physicists are not costed, but are fully loaded & used for project planning
- Burdening (indirects, escalation) done external to schedule for this review
  - COBRA, primary project cost tracking tool, will introduce these factors once fully integrated – will calculate earned value
  - Have recently uploaded silicon and trigger schedules into COBRA

COBRA Output from Trigger Schedule

Program:		Description:				Approval:			
D0_2		D0_1.2 TRIGGER					Program Manager		
Run Date:		Status Date:					Functional Manager		
8/8/2002		9/30/2002					Cost Account Manager		

Funding Source	Organization		FY 01	FY 02	FY03	FY 04	FY 05	FY 06	Cumulative
EQU									
	AZ University of Arizona	BCWS	0	0	309,853	58,885	0	0	368,738
	BU Boston University	BCWS	0	110,682	177,431	249,026	7,782	0	544,921
	CU Columbia University-Nevis	BCWS	0	65,458	44,751	229,547	45,498	0	385,253
	FNAL Fermilab	BCWS	0	35,146	57,941	28,517	0	0	121,604
	MSU Michigan State University	BCWS	0	279,546	0	168,913	229,263	0	677,721
	SUNYSB SUNY-Stony Brook	BCWS	0	0	65,978	26,373	6,261	0	98,612
	UVA University of Virginia	BCWS	0	0	0	16,153	81,068	0	97,221
Funding Source Totals:		BCWS	0	490,831	655,953	777,414	369,871	0	2,294,070
INK-FOREIGN									
	MAN Manchester University	BCWS	0	0	0	0	0	0	0
	ORS Orsay	BCWS	0	0	0	2,870	0	0	2,870
	SAC Saclay	BCWS	0	3,086	118,314	1,039	0	0	122,439
Funding Source Totals:		BCWS	0	3,086	118,314	3,909	0	0	125,309
INK-MRI2									
	BU Boston University	BCWS	0	80,182	535,889	482,214	0	0	1,098,285
Funding Source Totals:		BCWS	0	80,182	535,889	482,214	0	0	1,098,285
INK-OTHER									
	AZ University of Arizona	BCWS	0	0	0	0	0	0	0
	BRN Brown University	BCWS	0	0	0	0	0	0	0
	BU Boston University	BCWS	0	17,028	0	0	0	0	17,028
	CU Columbia University-Nevis	BCWS	0	260,732	202,959	25,607	0	0	489,298
	FNAL Fermilab	BCWS	0	0	0	0	0	0	0
	FSU Florida State University	BCWS	0	0	0	0	0	0	0
	KU University of Kansas	BCWS	0	0	0	0	0	0	0
	MSU Michigan State University	BCWS	0	0	190,972	10,153	0	0	201,125
	ND Notre Dame	BCWS	0	0	0	0	0	0	0
	NEU Northeastern University	BCWS	0	0	0	0	0	0	0
	SAC Saclay	BCWS	0	0	0	0	0	0	0
	SUNYSB SUNY-Stony Brook	BCWS	0	0	0	0	0	0	0
	UVA University of Virginia	BCWS	0	0	0	0	0	0	0
Funding Source Totals:		BCWS	0	277,760	393,931	35,760	0	0	707,451
Grand Totals:									
		BCWS	0	851,859	1,704,087	1,299,297	369,871	0	4,225,115

Funding sources

Total burdened subproject cost

Documentation Provided to Committee

- Technical Design Report
  - Detailed technical descriptions of systems for which we will be requesting baselining: Silicon (WBS 1.1), Trigger (WBS 1.2), Online (WBS 1.3)
- Black book:
  - Plenary talks
  - GANTT charts of project schedule
  - responses to June PAC
- Blue book:
  - Selected 15' presentations prepared for breakouts by Level 3 Subproject Managers
- Red book:
  - Preliminary project planning documents:
    - Acquisition Execution Plan
    - Project Execution Plan
    - Project Management Plan
  - Multi-Year Run IIb Memorandum of Understanding, Statement of Work
  - Run II General Collaboration MoU
  - D0/CDF Silicon Comparison Document

Documentation Provided to Committee

- Purple book:
  - WBS Dictionary, Basis of Estimate for all subsystems
- Four green cost books:
  - Book 1: Silicon Sensors (1.1.1), Readout (1.1.2)
  - Book 2: Remainder of silicon (1.1.3-1.1.8)
  - Book 3: Trigger (1.2)
  - Book 4: DAQ/Online (1.3)
  - Contain supporting BoE documentation: past POs/reqs, vendor quotes, labor estimates, etc.
- Project charts (posted on walls):
  - Flow chart of silicon module production
  - GANTT chart of full project schedule
- Links to previous review web pages
  - April '02 PAC, Temple Committee, responses to past reports, etc.

Project Risk Assessment

Evaluating Impact of a Risk on Major Project Objectives

Project Objective	Very Low Impact .05	Low Impact .1	Moderate Impact .2	High Impact .4	Very High Impact .8	Comments
Cost	Insignificant cost increase	<5% cost increase	5-10% cost increase	10-20% cost increase	>20% cost increase	
Schedule	Insignificant schedule slippage	Schedule slippage <5%	Overall project slippage 5-10%	Overall project slippage 10-20%	Overall project schedule slips>20%	20% slippage ~ 8 months
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Project scope reduction unacceptable for physics objectives	Scope of project effectively useless for physics objectives	
Technical	Technical degradation of project barely noticeable	Technical performance of final product minimally affected	Technical performance of final product moderately affected	Degradation of technical performance of final product unacceptable for physics objectives	Technical performance of project end item effectively useless for physics objectives	

Project Risk Assessment

Risk Matrix:
Product of risk impact and probability
green, yellow, red = low, moderate, high risk

Probability	Risk Score = Probability x Impact				
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Impact on Objectives				

- Select high risk score elements, discuss means of mitigation
  - Mitigation procedure in notes field in BoE
- Risk score used to aid assigning cost, labor, and schedule contingency

Partial Risk Summary

Silicon Sensors (1.1.1) & Readout (1.1.2)

ID	WBS	Name	Cost Risk Score	Schedule Risk Score	Scope Risk Score	Technical Risk Score
1	1.1	Run IIb Silicon				
2	1.1.1	Sensors				
3	1.1.1.1	Probing Equipment Setup	Green	Green	Green	Green
16	1.1.1.2	L0 Sensors	Green	Green	Yellow	Yellow
43	1.1.1.3	L1 Sensors	Green	Green	Yellow	Yellow
73	1.1.1.4	L2-L5 Sensors	Yellow	Yellow	Green	Green
105	1.1.2	Readout System				
106	1.1.2.1	SVX4 Chips	Red	Red	Yellow	Yellow
139	1.1.2.2	L0 Hybrids	Green	Green	Yellow	Yellow
164	1.1.2.3	L1 Hybrids	Green	Green	Yellow	Yellow
196	1.1.2.4	L2-L5 Hybrids	Yellow	Yellow	Yellow	Yellow
227	1.1.2.5	L0 Analog Flex Cables	Yellow	Green	Red	Red
239	1.1.2.6	L0-L1 Digital Jumper Cables (KSU)	Green	Green	Green	Green
252	1.1.2.7	L2-L5 Digital Jumper Cables (KSU)	Green	Green	Green	Green
265	1.1.2.9	Testing of cables (LA Tech)	Green	Green	Green	Green
273	1.1.2.10	L0-L1 Junction Cards	Green	Green	Green	Green
283	1.1.2.11	L2-5 Junction Cards	Green	Green	Green	Green
293	1.1.2.12	Twisted-Pair Cables	Yellow	Green	Yellow	Yellow
311	1.1.2.13	Adapter Cards	Yellow	Green	Yellow	Yellow
326	1.1.2.14	SASEQ Test Stands	Green	Green	Green	Green
357	1.1.2.16	Interface Boards and backplanes	Green	Green	Green	Green
371	1.1.2.17	Low Voltage System	Green	Green	Green	Green
390	1.1.2.18	High-mass Cables	Green	Green	Green	Green
394	1.1.2.19	High Voltage System	Green	Green	Green	Green
410	1.1.2.21	Support of Downstream electronics at Fermilab	Green	Green	Green	Green

Risk assessed at WBS Level 4

(Green, Yellow, Red) = (Low, Medium, High) Risk Score

Performed for all subprojects

Schedule Management

- April '02 Director's Review of Run IIb Projects:
  - "…we do encourage the collaborations to manage aggressively to an optimistic schedule."
  - "…suggest a significant float be added to project completion, perhaps as much as a year beyond the Silicon ready to install date."
- Schedule being managed to contains no explicit slack
  - Task durations reflect nominal need for completion
- Three tiers of project milestones, with time offsets between them, will be used for project oversight:
  - Project Manager Milestones, extracted directly from schedule. These contain no explicit contingency.
  - Director's Milestones - modest amount of schedule contingency introduced, aided by integrating risk assessments.
  - DOE Level 1 Milestones, in which additional contingency has been added, based on above guidance.
- Project being managed to nominal dates represented by Project Manager Milestones. These reflect the schedule we intend to meet.

DOE Level 1 Milestones, CD-4

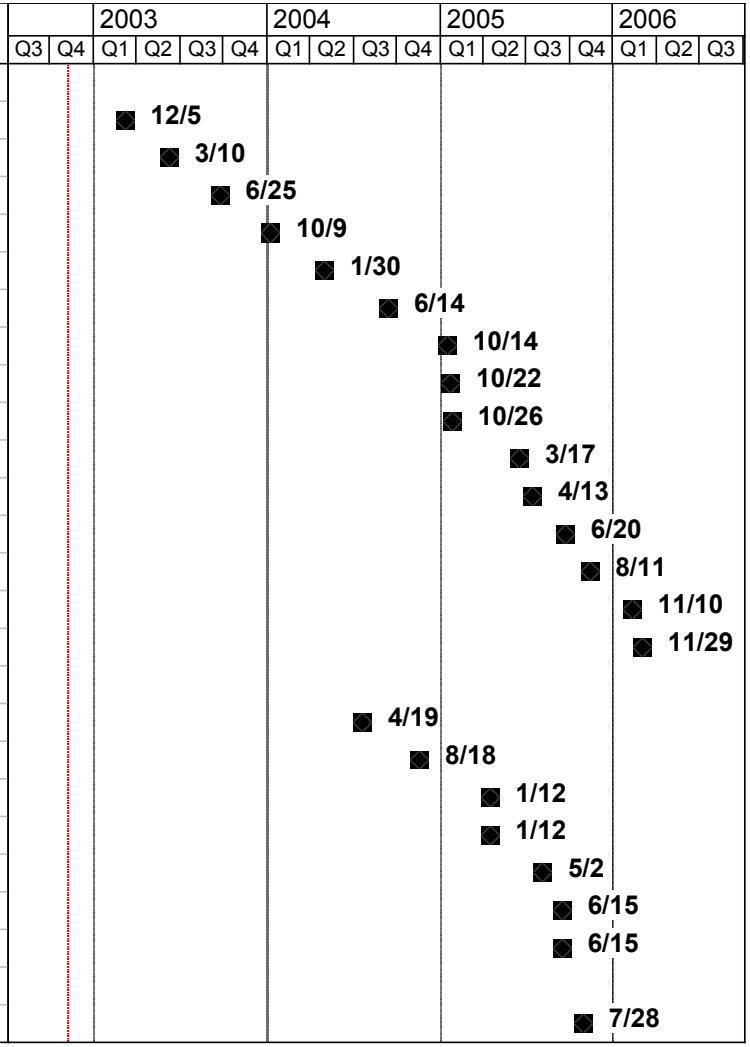
Milestone	Project Manager	Director	DOE Level 1	Comments
All silicon sensors delivered and tested	08/10/04	10/26/04	7/05	
Level 2 Trigger Production and Testing Complete	10/15/04	01/12/05	4/06	
Level 1 Trigger Production and Testing Complete	03/09/05	06/15/05	6/06	
Silicon stave production complete	03/14/05	06/20/05	4/06	
Silicon ready to move to D0 Assembly Building	07/22/05	11/29/05	11/06	CD-4: Approve Project Closeout

Project being managed to Project Manager's Milestones

DOE Level 1 milestone dates guided by recommendations from April '02 Director's Review of Run IIb Projects

GANTT Chart of Director's Milestones for All Subprojects

ID	Task Name	Milestone
1	**Silicon**	
2	Silicon Prototype Mechanical Stave Built	12/5
3	Silicon L2-L5 Sensors Released For Production	3/10
4	SVX4 Released For Production	6/25
5	Successful Readout of Full Silicon Stave	10/9
6	Silicon Module Production Begun	1/30
7	All SVX4 Chips Produced And Tested	6/14
8	All Silicon Hybrids Produced and Tested	10/14
9	Silicon Stave Production Begun	10/22
10	All Silicon Sensors Delivered and Tested	10/26
11	Silicon Module Production Complete	3/17
12	Downstream Silicon Readout Ready for Installation on Platform	4/13
13	Silicon Stave Production Complete	6/20
14	South Silicon Complete	8/11
15	North Silicon Complete	11/10
16	Silicon Ready To Move To DAB	11/29
17	**Trigger**	
18	Level 2 Beta Trigger Production and Testing Complete	4/19
19	L1 Trigger Cal-Trk Match Production and Testing Completed	8/18
20	L2 Silicon Track Trigger Production and Testing Complete	1/12
21	L2 Trigger Upgrade Production and Testing Complete	1/12
22	L1 Calorimeter Trigger Production And Testing Complete	5/2
23	L1 Central Track Trigger Production And Testing Complete	6/15
24	L1 Trigger Upgrade Production and Testing Complete	6/15
25	**Online**	
26	Online System Production and Testing Complete	7/28



Cost, Labor Contingency Evaluation

- Base estimates for both labor and equipment contain no contingency
- Contingency for both estimated on task-by-task basis by Level 2 Subproject Managers
- Contingency guidelines provided by Project Manager in Project Management Plan
- Can be overridden by Subproject Managers if justified by risk factors
  - Example: 94% on silicon analog flex cables (WBS 1.1.2.5)
  - Moderate cost risk, high scope/technical
  - Large contingency helps mitigate potential risk
  - Same principle applies to labor contingency estimates
- Contingency estimates by Subproject Managers thought to be adequate, and have been used in cost estimates

Project Contingency Guidelines

- Guidelines for M&S contingency from Project Management Plan:

7.1.2 Contingency Estimation

The contingency is estimated by the WBS level 3 Sub-project Managers at the lowest available level. It is based on detailed estimates of designs where available, and on the experience of the Sub-project Managers and the engineering staff directly involved with the subsystem where a conceptual design exists. Guidelines for the estimation of the contingency have been provided, but may be overridden by the Sub-project Managers in exceptional cases. The general guidelines for the contingency estimation are:

- 0% on items that have been completed.
- about 10-15% on items that have been ordered, but not delivered (this accommodates change orders, delivery costs, etc.)
- about 30-50% on items that can be readily estimated based on quotes for a detailed design
- about 50-70% on items for which a detailed conceptual design exists
- about 70-100% on items for which there does not yet exist a detailed conceptual design, but which is an item required for the Project

- For Labor, general guidance is 50% - exceptions can be made during life cycle of project (i.e., multiple shifts, overtime during production)

US National Science Foundation MRIs for Run IIb

- Silicon MRI submitted Feb '01, awarded July '01
  - Brown, California State (Fresno), U Illinois (Chicago), Kansas, Kansas State, Michigan State, Northwestern, Stony Brook, Washington, (Moscow State, CINVESTAV)
    - Principal Investigator: A. Bean
    - Co-PIs: R. Demina, C. Gerber, R. Partridge, G. Watts
  - $1.7M + $0.7M matching = $2.4M total
- Level 1 Trigger MRI submitted Jan '02, partial award granted July '02
  - Arizona, Boston, Columbia, Florida State, Langston, Michigan State, Northeastern, Notre Dame, (Saclay)
    - Principal Investigator: M. Narain
    - Co-PIs: H. Evans, U. Heintz, M. Hildreth, D. Wood
  - $446k + $113k matching = $559k total
  - Funds will go toward Central Track Trigger upgrade
  - Level 1 Calorimeter, Track Match proposal will be re-submitted at end of year
- D0 universities playing major role throughout Run IIb Project

Total Project Cost in FY02 k$

Includes G&A, contingency

FY02 k$	Base	Cont %	Cont	Total
Silicon	14016	58.7	8225	22241
Trigger	3075	44.6	1370	4444
Online	901	48.9	441	1342
Administrative	962	47.8	460	1422
TOTAL PROJECT COST	18953	55.4	10495	29448

Cost by subsystem

FY02 k$	M&S + R&D Cost	G&A	Cont %	Cont	Cost+ Cont Total	Total M&S + R&D	Labor FNAL	G&A	Cont %	Cont	Cost+ Cont Total	Total Labor	Total
Silicon	7984	981	60.5	5427	13411	14393	3931	1120	55.4	2797	6728	7848	22241
Trigger	2764	219	45.0	1343	4107	4327	71	20	29.0	26	97	118	4444
Online	605	107	51.0	363	968	1075	147	42	41.0	77	224	266	1342
Administrative	89	15.8	30.0	31	120	136	667	190	50.0	429	1096	1286	1422
TOTAL PROJECT COST	11442	1323	56.1	7165	18607	19931	4816	1372	53.8	3330	8145	9518	29448

Cost broken out into M&S + R&D, FNAL labor

Fermilab G&A rates applied

	EQUIPMENT	LABOR
G&A	17.7%	28.5%

TPC in AY k$

AY k$	Base	Cont %	Cont	Total
Silicon	14387	59	8495	22882
Trigger	3173	45	1420	4593
Online	955	49	467	1422
Administrative	1008	48	482	1490
TOTAL PROJECT COST	19523	56	10864	30387

Includes G&A, contingency, & escalation

Cost by subsystem

AY k$	M&S + R&D Cost	G&A	Cont %	Cont	Cost+ Cont Total	Total M&S + R&D	Labor FNAL	G&A	Cont %	Cont	Cost+ Cont Total	Total Labor	Total
Silicon	8168	1008	60.9	5593	13761	14769	4055	1156	55.7	2902	6957	8113	22882
Trigger	2850	228	45.2	1392	4242	4469	75	21	29.0	28	103	124	4593
Online	641	113	51.0	385	1026	1140	156	44	41.0	82	238	282	1422
Administrative	93	16.5	30.0	33	126	143	699	199	50.0	449	1148	1347	1490
TOTAL PROJECT COST	11752	1366	56.4	7403	19155	20521	4984	1421	54.0	3461	8446	9866	30387

Cost broken out into M&S + R&D, FNAL labor

	FY01	FY02	FY03	FY04	FY05	FY06
DOE ESCALATION RATES	-2.1%	N/A	2.1%	2.5%	2.9%	2.8%
CUMULATIVE	0.979	1	1.021	1.046	1.076	1.106

Total Project Cost = $30,387k
Includes 56% contingency ($10,864k)
Contingency consistent with April '02 Dir Rev guidance (57%)

Cost Profiles in AY k$

Cost Profile AY k$ (by subsystem)	FY01	FY02	FY03	FY04	FY05	FY06	TOTAL
Silicon (incl. G&A and FNAL labor)	17	1279	6061	4184	709	0	12248
Trigger (incl. G&A and FNAL labor)	0	400	1052	1546	109	0	3107
Online (incl. G&A and FNAL labor)	0	0	61	393	500	0	955
Administration (incl. G&A and FNAL labor)	0	0	329	335	344	0	1008
Sub Total	17	1679	7503	6459	1661	0	17318
R&D (incl. G&A and FNAL labor)	0	1499	706	0	0	0	2205
Contingency	0	0	5734	4178	952	0	10864
Total Project Cost	17	3178	13943	10637	2613	0	30387
Percentage by FY	0	10	46	35	9	0	

Cost by subsystem w/R&D and contingency broken out

Cost Profile AY k$ (by funding type)	FY01	FY02	FY03	FY04	FY05	FY06	TOTAL
M&S (incl. cont and In-Kind contr.)	17	1679	8915	6443	1011	0	18065
R&D (incl.cont. on R&D)	0	604	486	0	0	0	1090
FNAL Labor (M&S and R&D, incl. Cont)	0	613	3351	3195	1286	0	8446
G&A (on M&S and R&D)	0	282	1190	998	316	0	2786
TOTAL	17	3178	13943	10637	2613	0	30387

Cost broken out by funding type

Tables includes G&A, contingency, & escalation

Funding Profile in AY k$

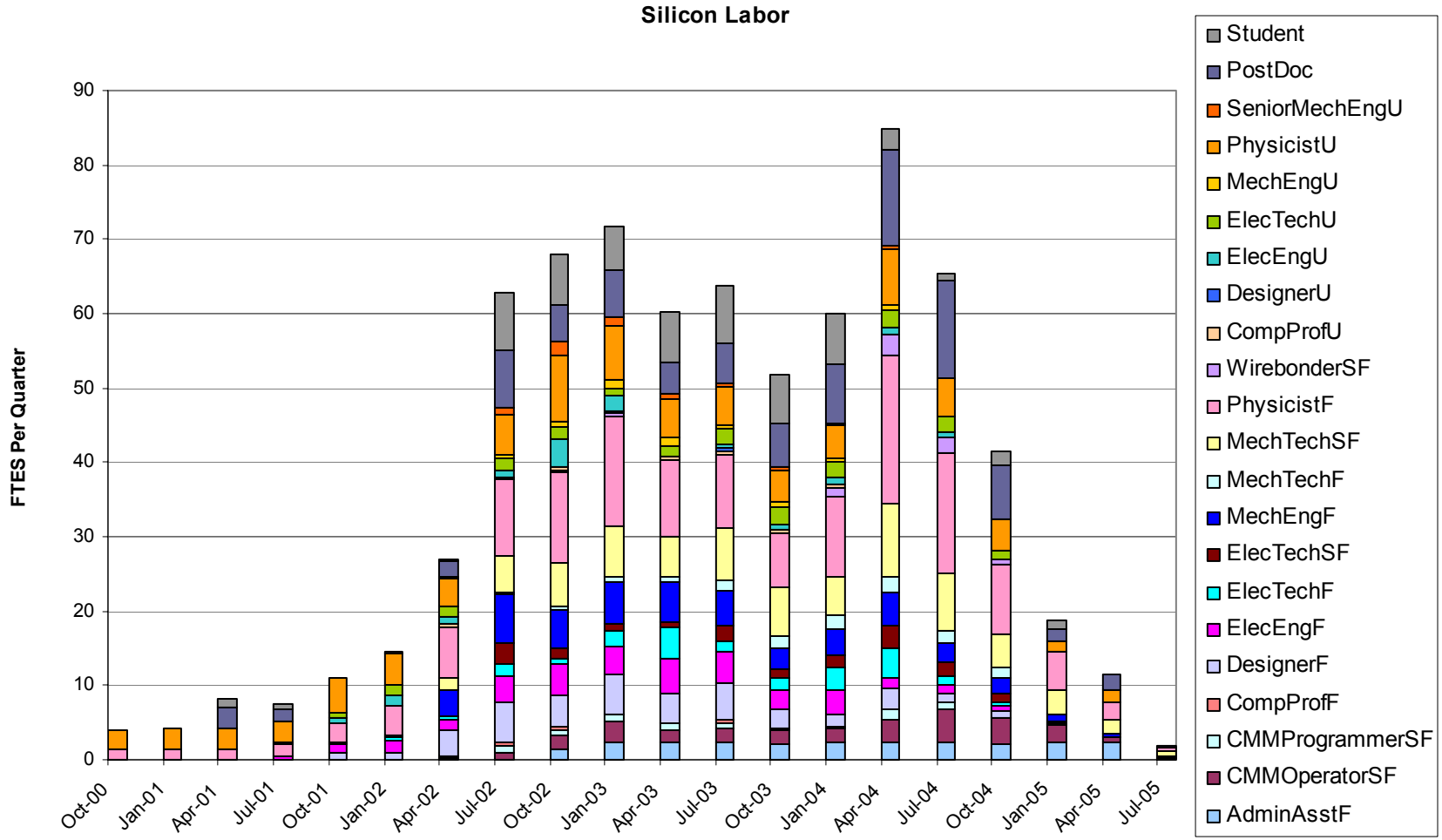
Includes G&A, contingency, & escalation

Cost Profile In AY k$	FY01	FY02	FY03	FY04	FY05	FY06	TOTAL
Silicon (incl. Cont + G&A)	17	1279	10581	7215	1203	0	20294
Trigger (incl. Cont + G&A)	0	400	1596	2340	157	0	4493
Online (incl. Cont + G&A)	0	0	91	586	745	0	1422
Administration (incl. Cont + G&A)	0	0	485	496	508	0	1490
Total Project	17	1679	12753	10637	2613	0	27698
R&D (incl. Cont + G&A)	0	1499	1190	0	0	0	2689
Total Project Cost	17	3178	13943	10637	2613	0	30387
DOE M&S	0	0	7491	5538	1001	0	14030
DOE SWF	0	0	2782	3195	1286	0	7263
DOE G&A	0	0	1055	998	316	0	2370
TOTAL DOE EQ	0	0	11328	9731	2604	0	23663
DOE M&S R&D	0	604	486	0	0	0	1090
DOE SWF R&D	0	613	569	0	0	0	1183
DOE G&A R&D	0	282	135	0	0	0	416
TOTAL DOE R&D	0	1499	1190	0	0	0	2689
In Kind - Foreign	0	208	231	46	0	0	485
In Kind - MRI silicon	17	1279	858	304	0	0	2458
In Kind - MRI trigger	0	0	114	471	0	0	585
In Kind - US base	0	192	222	85	10	0	508
Total In-Kind contributions	17	1679	1424	906	10	0	4035
Total Project Cost	17	3178	13943	10637	2613	0	30387

Funding need broken out by source

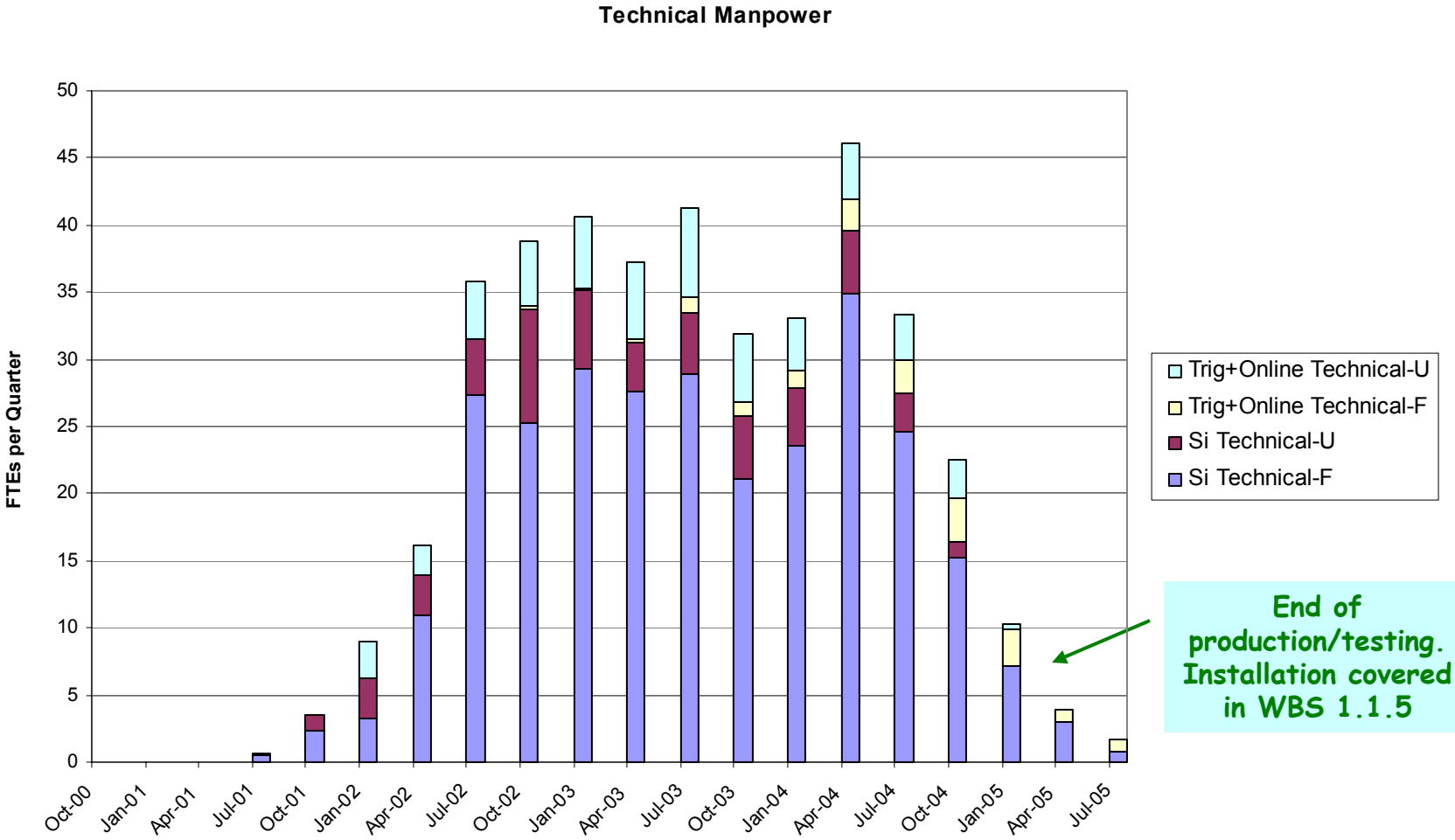
Profile will be relieved by:
Moving ~ $2M from FY03 to out years via forward funding
Moving left over non-R&D equipment funds from FY02 to FY03

Total Silicon Labor



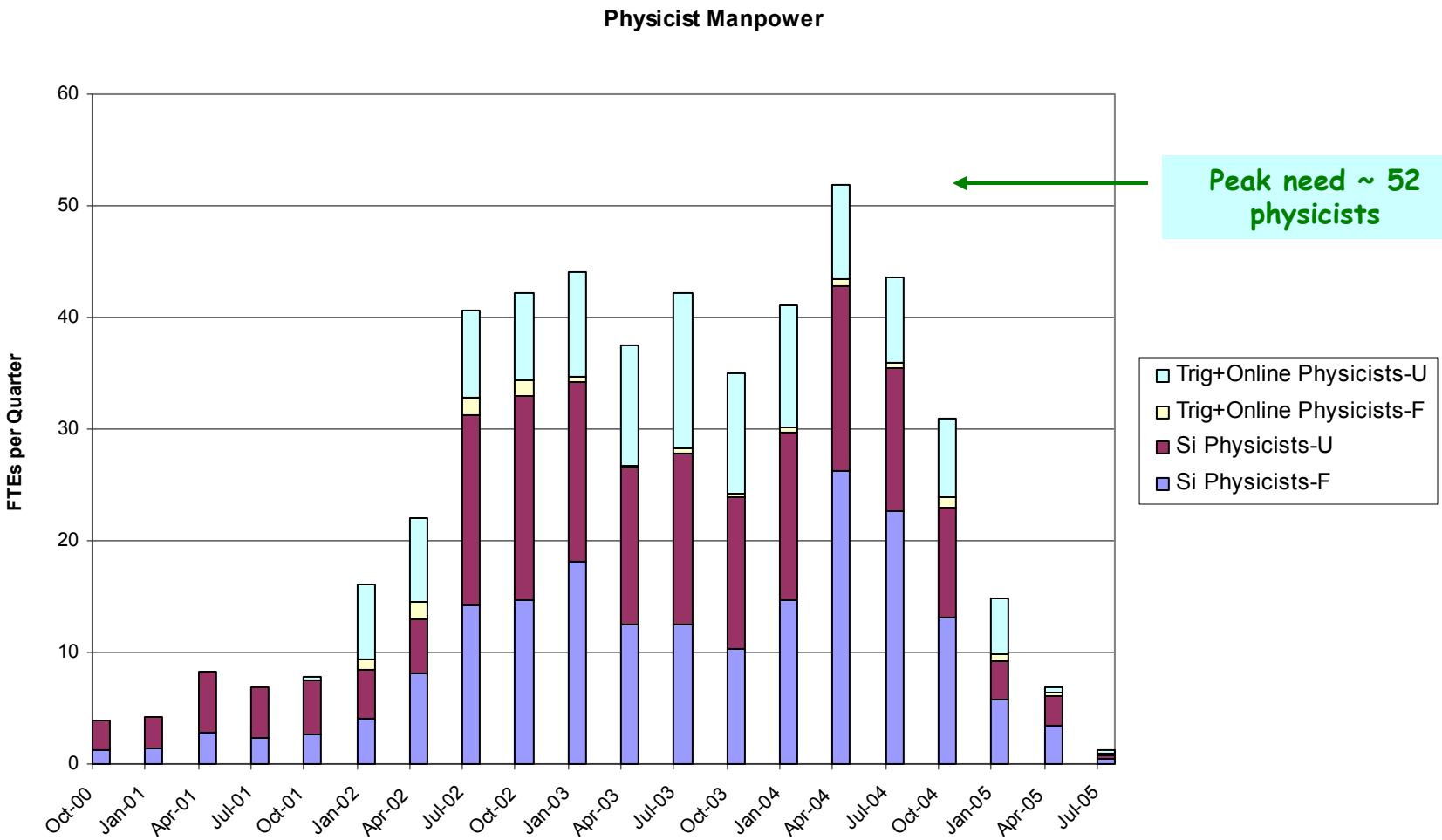
Includes all personnel, all categories - physicists, technical, and administrative – required to deliver silicon detector

Total Technical Labor



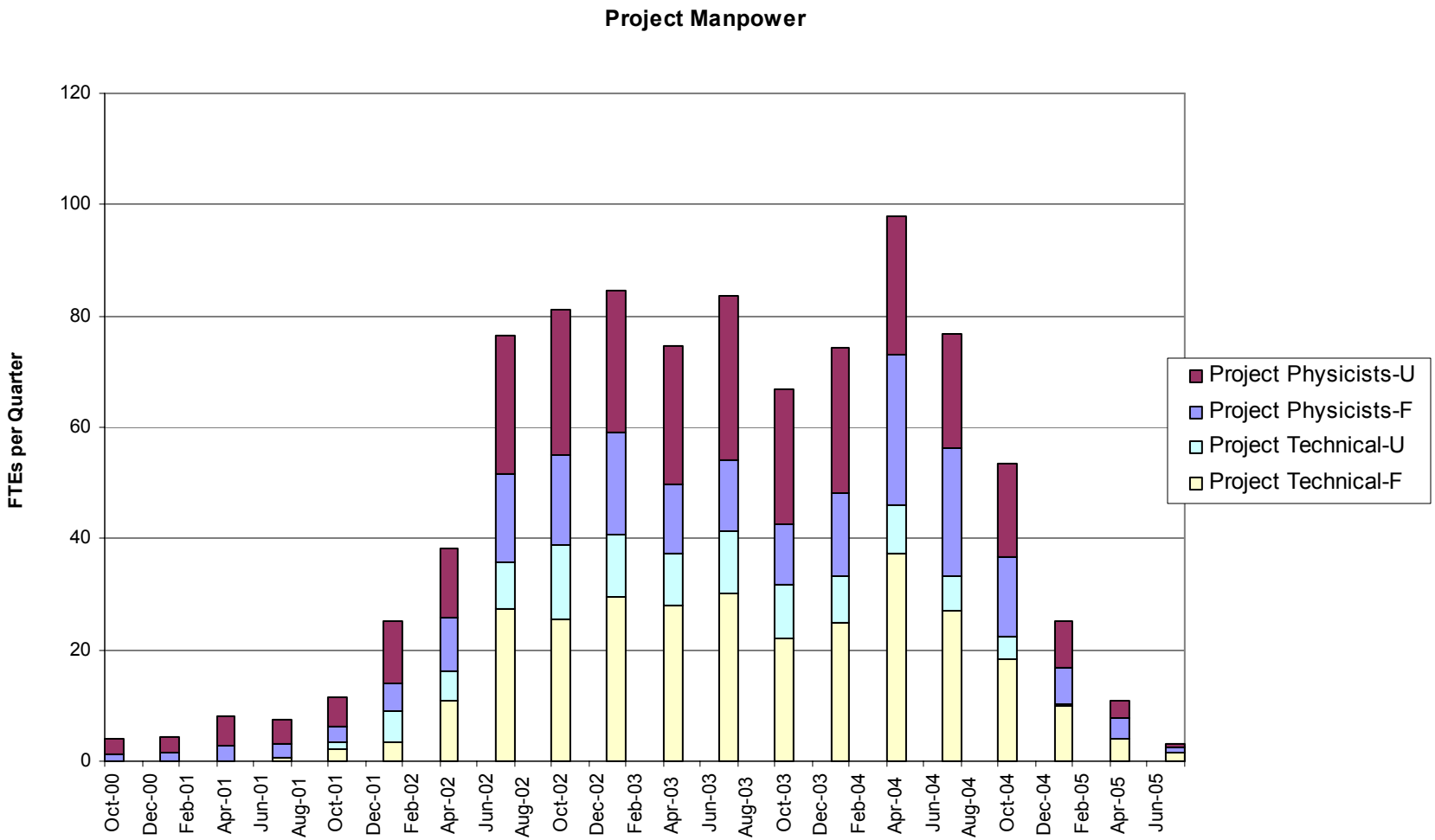
Technical labor required to deliver silicon and trigger+online projects, divided into Fermilab and university components

Total Physicist Labor



Physicists required to deliver silicon and trigger+online projects, divided into Fermilab and university components

Total Project Labor



Total required to deliver silicon and trigger+online projects, divided into Fermilab and university components

Conclusions

- Run IIb has matured into a solid, well-defined project
- Project plan in place, based on detailed technical designs and fully resource loaded schedule
- In order to remain on track, must place SVX4 pre-production order in November '02
- Will be seeking approval to begin construction on all subsystems – silicon, trigger, and DAQ/online - at DOE Baselining Review in September