Schedule & Cost

Mike Tuts

DOE Review

November 4, 1999

- Schedule Milestones
- Manpower
- Cost
- Contingency
- Conclusions

Schedule

- Subsystem status and schedules presented by Harry Weerts
  - Action item to produce realistic schedule with tracking milestones
  - shows significant variances from 6/99 schedule
- Schedules (MS Project 98) produced by subsystem managers and maintained by Bill Freeman
- Project tracks major milestones
  - M1 - held by DOE
  - M2 - held by FNAL Directorate
  - M3 - held by Project Managers
  - Others held by Subsystem Managers

D0 Schedule Overview

	Lehman 99	Current schedule
Description	Completion date	Completion date
Solenoid @ FNAL	May-12-1997	May-12-1997
Solenoid +CPS installed	Sept-30-1998	Sept-30-1998
Fiber tracker		
mechanically complete	Jan-24-2000	May-4-2000
Installed & aligned	Mar-16-2000**	May-18-2000
Finish hookup tracker	May-11-2000	July-17-2000
First electronics crate availab	Mar-1-2000	May-17-2000
50% VLPC installed	Feb-25-2000 ^^	June-1-2000
All VLPC's installed	May-25-2000	Sept-13-2000
Silicon		
Start ladder production	Sept-1-1997	Sept-1-1997
6 chip ladders (DSDM)	Jan-13-2000	April-27-2000
3 chip ladders (single side)	July-12-1999	Nov-16-1999
9 chip ladders (DS 2 degr.)	Jan-1-2000	June-21-2000
F disks complete	Jan-27-2000	July-26-2000
H disks complete	Feb-10-2000	June-19-2000
Complete first barrel	June-11-1999	Jan-19-1999
Complete first barrel & testec	July-24-1999	Feb-2-2000
Barrels/disks complete	Feb-3-2000	Aug-25-2000
Silicon completed	Feb-17-2000	Sept-18-2000
Silicon installed & hooked up	June-16-2000	Oct-30-2000

D0 Schedule Overview

	Lehman 99	Current schedule
Description	Completion date	Completion date
Calorimeter		
Electr. Fab. Complete	Oct-25-1999 *	Aug-7-2000
ECS on platform	Mar-21-00	Nov-2-2000
Electr. installed & tested	May-31-00	Jan-9-2001
Muon		
Central	***	***
Trigger pixel planes installed	May-10-2000	Aug-25-2000
MDT planes installed	Apr-26-2000	Aug-4-2000
Electronics complete	May-8-2000	July-19-2000
EF's on platform	Apr-3-2000	Nov-15-2000
C-layers in hall & surveyed	June-22-2000	Jan-8-2001

Trigger not on critical path for roll-in,
available for commissioning in collision hall
L2 commissioned 9/20/00

D0 Installation & Commissioning Overview

	Lehman 99	Current
Description	Completion date	Completion date
Commissioning		
Fiber tracker start	none	June-2-2000
Calorimeter CC start	none	August-29-2000
Central Muon	continous	continous
Installation		
Silicon installed	Mar-16-2000**	Sept-25-2000
Si hookup & checkout comple	June-16-2000	Oct-30-2000
ECS on platform	Mar-21-2000	Nov-2-2000
EF's picked up	Apr-3-2000	Nov-10-2000
platform moves back		
Shield wall down	May-17-2000	Nov-28-2000
EMC layers in the hall	Jun-22-2000	Dec-28-2000
Detector rolled in	June-21-2000	Jan-12-2001
Shielding wall back up	July-14-2000	Feb-2-2001
Rolled in and hooked up	July-14-2000	Feb-2-2001
** coupled D0SMT & CFT		

Schedule Comments

- Silicon is critical path item
  - Possible sources of schedule contingency
    - Existing production capacity
    - Extra shifts (cost/manpower risks)
    - Move ECS to platform sooner (loss of checkout flexibility)
    - Collider schedule start (4 weeks beyond our end date)

Reportable Milestones

- Based on action item from last review
  - Identified ~90 tracking milestones ("reportable") in consultation with DOE & Lab
    - Includes M1, M2, some M3 and others to track progress
  - Working baseline established end Sept 99
  - Update schedule every 2 weeks, and report at bi-weekly PMG
  - Track at weekly subsystem manager's meetings
    - Reason for delays, mitigation of delays

Reportable Milestones

- **Milestones through Dec 99**

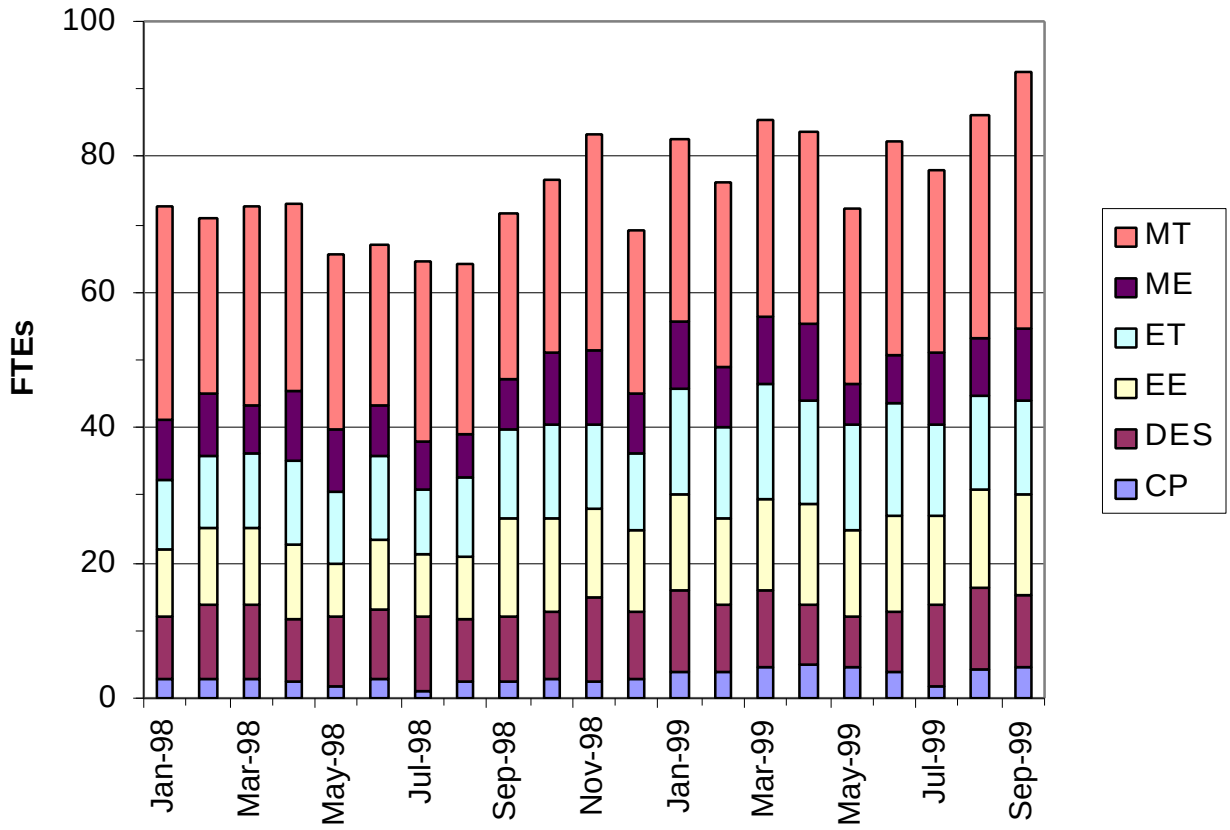
Milestone	Baseline	New	Variance	Slack	Comments
M2-First cylinder complete	9/2	9/2	0w		
H half wedge fab 20% complete	10/15	10/15	0w		
3 chip ladder fab 80% done	10/20	10/26	0.6w		
9 chip ladder fab 20% complete	11/3	11/3	0w		
C-Layer MDT modules at FNAL	10/22	11/3	2w	5w	Shipping delay
SLIC's received	11/10	11/10	0w	4w	
M3-Fiber Tracker ribbon fab 50% compl.	11/12	11/12	0w	0/5w	Tracker/rolled in
First track electr. readout crate installed & working	12/2	12/2	0w	6w	For 10% test
MDT ADB fab complete	12/2	12/2	0w	16w	Some in hand
MDC fab. complete	12/13	12/13	0w	4w	
M2 – Muon electr. Preprod installation	12/13	12/13	0w	4w	
SCA testing complete	12/15	12/15	0w	26w	80% in hand

Manpower

- Track actual manpower by effort reporting at WBS level 2 (data available from 1/98)
  - by type, eg MT, ME, ET, EE
  - by subsystem
- Extract manpower profiles from MS Project
  - Completing update, not available now
  - Have observed that effort reported manpower larger than from schedule
- Use effort reported manpower to estimate Operating SWF costs

Labor

- **Effort reported Fermilab FTE by type**



- **Converted to then yr k$ using average salaries (Op SWF)**

Labor (thousands)	*FY97*	*FY98*	*FY99*	*FY00*	*FY01*	*Total*
Reported	$4,227	$3,968	$4,598	$5,640	$654	$19,087
	⬆	($2,976)				
Allocated	$4,227	$4,295	$2,955	$1,064	--	$12,541

Cost Estimate

- Performed new bottoms-up cost estimate in Oct-Nov 1999
  - Input from subsystem managers
  - Maintained by Sherie Landrud
- Change control executed for all significant changes
  - >$100k at WBS level 2 reviewed and approved by PMG
  - Smaller changes reviewed and approved by project managers
    - Increasing flexibility for subsystem managers at WBS levels 4 to 6 to re-adjust costs (signature authority to $2,500)
    - Project managers sign for all reqs >$2,500
  - Change control forms filed electronically and on paper
  - All changes recorded in Excel cost spreadsheet in dated notes field

M&S Cost Estimate

- Bottoms-up cost estimate through FY99
  - provided by Level 3 managers
  - M&S only, then year k$, no contingency
  - EAC= estimate at completion, ETC = estimate to complete, OTD = obligations to date through Sept

WBS	System	EAC	ETC	OTD
1.1.1	Silicon Tracker	7,533	1,491	6,042
1.1.2	Fiber Tracker	7,140	404	6,736
1.1.3	Central Preshower	238	0	238
1.1.4	Forward Preshower	511	11	500
1.1.5	Tracking Electronics	3, 529	618	2,911
1.2.1	Cal Electronics	4,316	223	4,093
1.2.2	Intercryostat Detector	302	54	248
1.3.1	Cosmic Ray Scintillator	1,223	0	1,223
1.3.2	Central Moun	909	83	826
1.3.3	Forward Muon Trigger	2,034	200	1,834
1.3.4	Forward Muon Tracking	1,213	260	953
1.3.5	Muon Electronics	3,979	444	3,535
1.4.1	Framework	1,866	0	1,866
1.4.2	Lum Monitor	137	13	124
1.4.3	L1 Trigger	1,428	308	1,120
1.4.4	L2 Trigger	2,080	343	1,737
1.4.5	L3 Trigger	1,084	244	840
1.5.1	Online	722	429	293
3.1.1	Solenoid	4,975	0	4,975
	TOTAL	45,219	5,125	40,094

Cost Variance

- Variances from Jun99 DOE review (then yr k$)

WBS	6/99	11/99	Diff	Reason
1.1	17,319	18,951	1,632	
1.2	4,549	4,618	69	Additional preamps, SCA's
1.3	8,176	8,135	-41	Electronics
1.4	6,544	6,595	51	Manpower
1.5	722	722	0	
3.1	4,936	4,975	39	Miscellaneous
TOT	43,469	45,219	1,749	

WBS	6/99	11/99	Diff	Reason
1.1.1	6,480	7,533	1,053	Low mass cables, interface board, spares
1.1.2	6,882	7,140	258	Flex circuits, connectors, fiber
1.1.3	238	238	0	
1.1.4	554	511	-43	Waveguide fab
1.1.5	3,165	3,529	364	Save on Si electr, over on fiber boards & chips
TOT	17,319	18,951	1,749	

M&S Cost and Funding

- Costs (no cont., then yr k$)

Cost Type	k$
M&S	40,244
Solenoid	4,975
TOTAL	45,219

- Funding (then yr $)

Funding Source	k$
DOE M&S	38,851
Solenoid – Plant	5,168
Non-DOE	1,835
TOTAL	45,854

Contingency Analysis

- Remaining Contingency
  - $635k (=$45,854k-45,219k)
- Fractional Contingency on
  - Unobligated $ to go: 635/5,125 =12 %
- Comments
  - Significant contingency usage since last Lehman (we had $2M then)
  - No known large contingency needs in the pipeline
  - We would be more comfortable with larger contingency

Conclusions

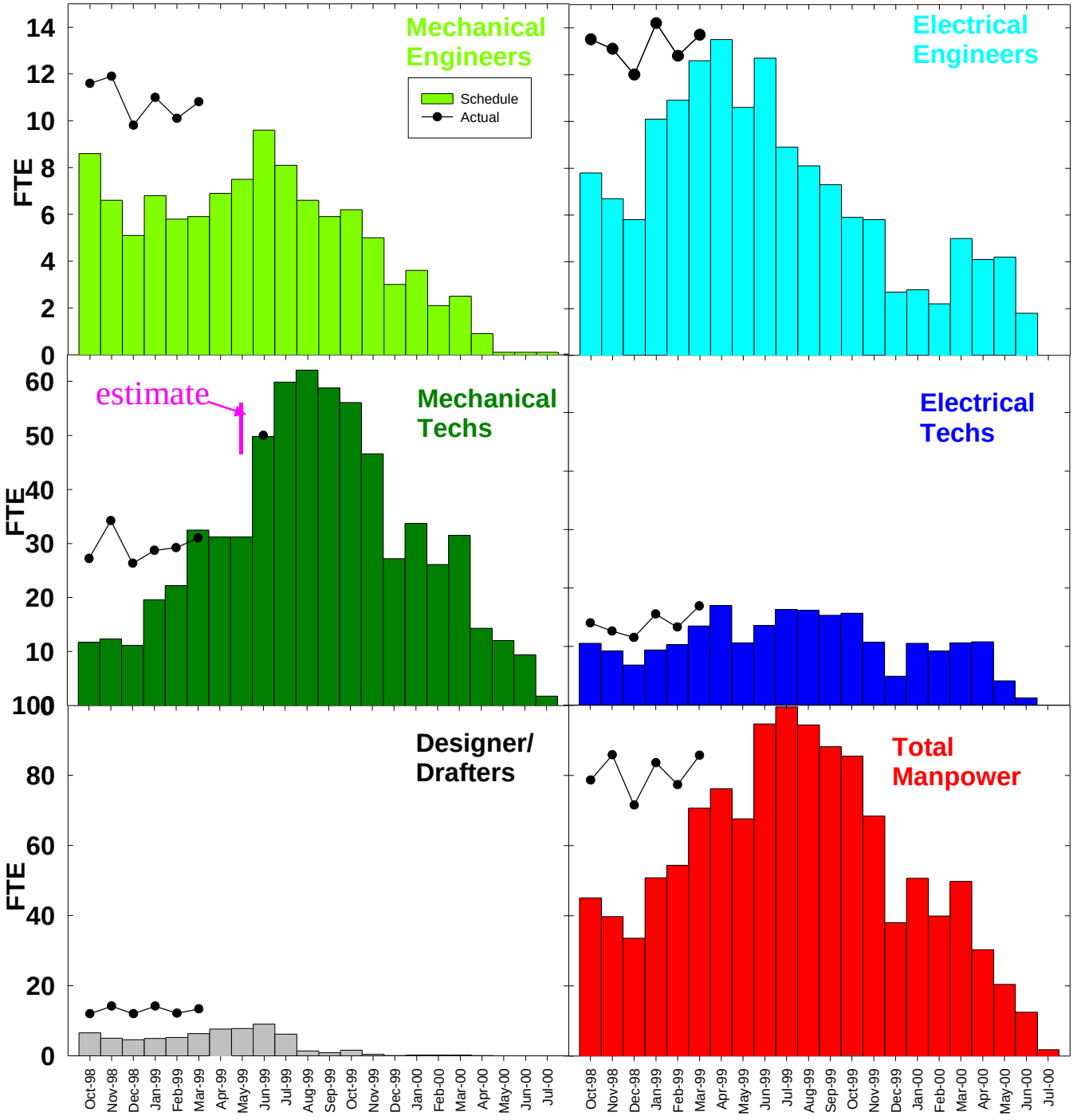
- Schedules and Costs re-evaluated since June 1999
  - Rolled-in 2/2/01
  - Present EAC within budget
- Ongoing Issues:
  - Need to baseline schedule, identify possible schedule risks & develop workarounds
  - Continuing to track/update schedule bi-weekly & reporting to DOE
  - Contingency (12%) is uncomfortably low
- Performance:
  - So far, ~keeping to schedule milestones (some met early, some late)
  - Significant use of contingency ($1.4M since 6/99), in part to maintain schedule

Backup Slides

DoE Review
Nov 4 1999

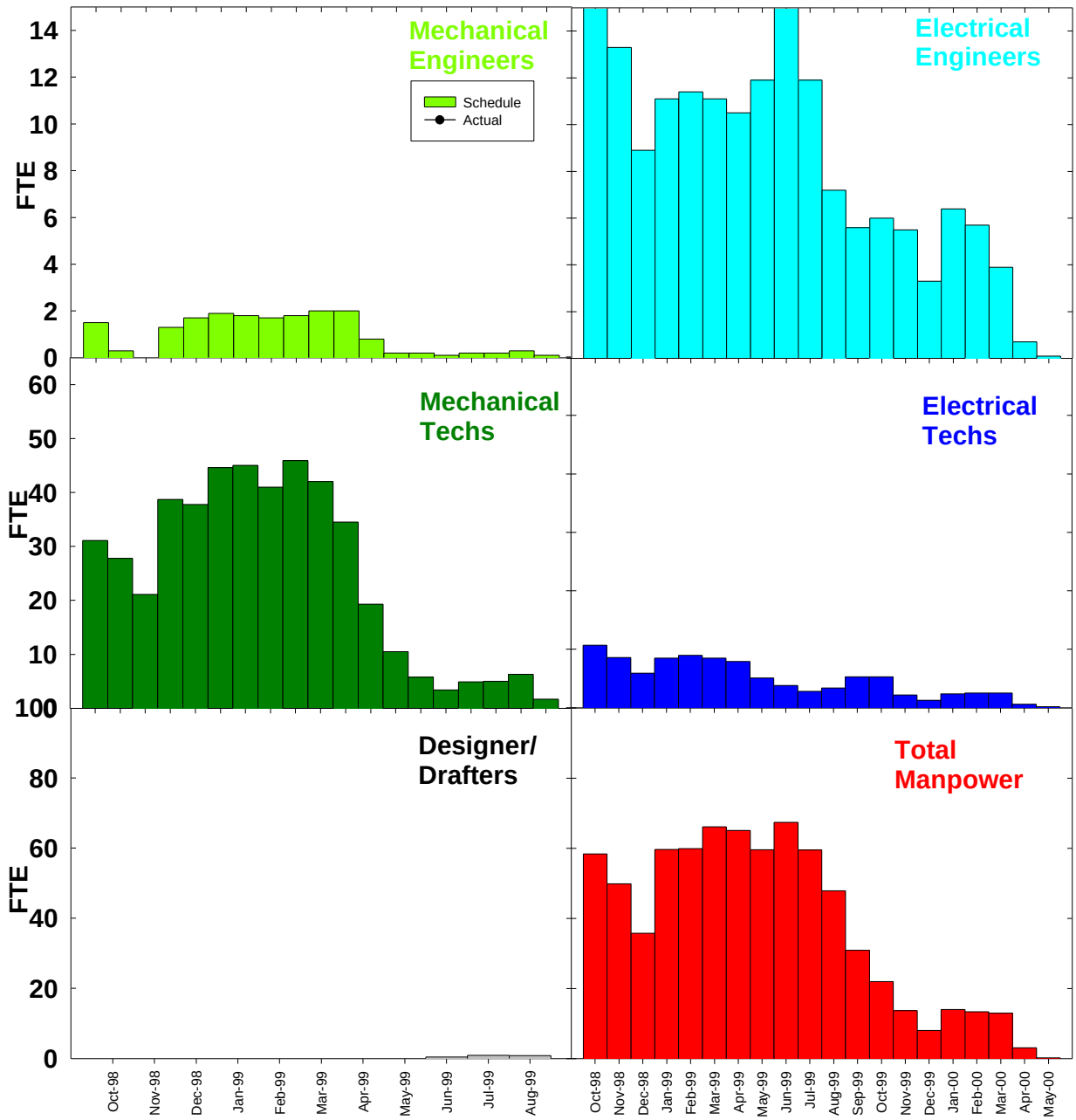
FNAL Technical Manpower Profiles

- **FTE by type, add contract labor & overtime**



"University" Technical Manpower Profiles

- FTE's by type



Foreign Funding

- FY95
  - Tata $260K
- FY97
  - Tata = $145K
  - IHEP = $260K
  - Moscow = $35K
- FY98
  - NSF / MRI = $502K
- FY99
  - Saclay = $100K
  - IN2P3 = $210K
- $1512 Total

Lab Profile

D0 Then Year $K	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY2001	Total	Total 99-01
Equipment M&S	286	1,676	3,057	4,056	5,828	5,510	7,193	8,088	3,104	--	**38,798**	**11,192**
Equipment SWF	392	1,234	2,002	507	925	901	1,774	898	43	--	**8,676**	**941**
G&A	--	--	--	254	847	1,011	2,020	2,214	1,652	--	**7,997**	**3,866**
Equipment Total	678	2,910	5,059	4,817	7,600	7,422	10,987	11,200	**4,799**	--	**55,471**	**15,999**
Operating SWF	--	--	--	--	--	4,227	4,295	2,955	1,064	--	**12,541**	**4,019**
Operating G&A		--	--	--	--	1,691	1,718	1,182	426		**5,016**	**1,608**
Plant Funds (incl. G&A)	--	--	5,168	--	--	--	--	--	--	--	**5,168**	--
Total U.S.	**678**	**2,910**	**10,227**	**4,817**	**7,600**	**13,339**	**17,000**	**15,337**	**6,289**	--	**78,197**	**21,625**
Other Funding Identified	--	--	--	260	--	440	502	310	--	--	1,512	310
Other Funding Total	--	--	--	260	--	440	502	310	--	--	**1,512**	**310**
Total	**678**	**2,910**	**10,227**	**5,077**	**7,600**	**13,779**	**17,502**	**15,647**	**6,289**	--	**79,709**	**21,935**
M&S plus Other		0.00000									38,798	11,192
Escalation Factor	1.082	1.054	1.028	1.000	0.972	0.944	0.916	0.889	0.855	0.830		

D0 Constant FY95 $K	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY2001	Total	Total 99-01
Equipment M&S	310	1,767	3,143	4,056	5,665	5,201	6,589	7,190	2,654	--	**36,574**	**9,844**
Equipment SWF	424	1,301	2,058	507	899	850	1,625	798	37	--	**8,499**	**835**
G&A	--	--	--	254	823	954	1,850	1,968	1,413	--	**7,262**	**3,380**
Equipment Total	734	3,067	5,201	4,817	7,387	7,006	10,064	9,956	4,103	--	**52,335**	**14,060**
Operating SWF	--	--	--	--	--	3,990	3,934	2,627	910	--	**11,461**	**3,537**
Operating G&A	--	--	--	--	--	1,596	1,574	1,051	364	--	**4,584**	**1,415**
Plant Funds (incl. G&A)	--	--	5,313	--	--	--	--	--	--	--	**5,313**	--
Total U.S.	**734**	**3,067**	**10,513**	**4,817**	**7,387**	**12,592**	**15,572**	**13,634**	**5,377**	--	**73,694**	**19,011**
Other Funding Identified	--	--	--	260	--	415	460	276	--	--	1,411	276
Other Funding Total	--	--	--	260	--	415	460	276	--	--	**1,411**	**276**
Total	**734**	**3,067**	**10,513**	**5,077**	**7,387**	**13,008**	**16,032**	**13,910**	**5,377**	--	**75,104**	**19,287**

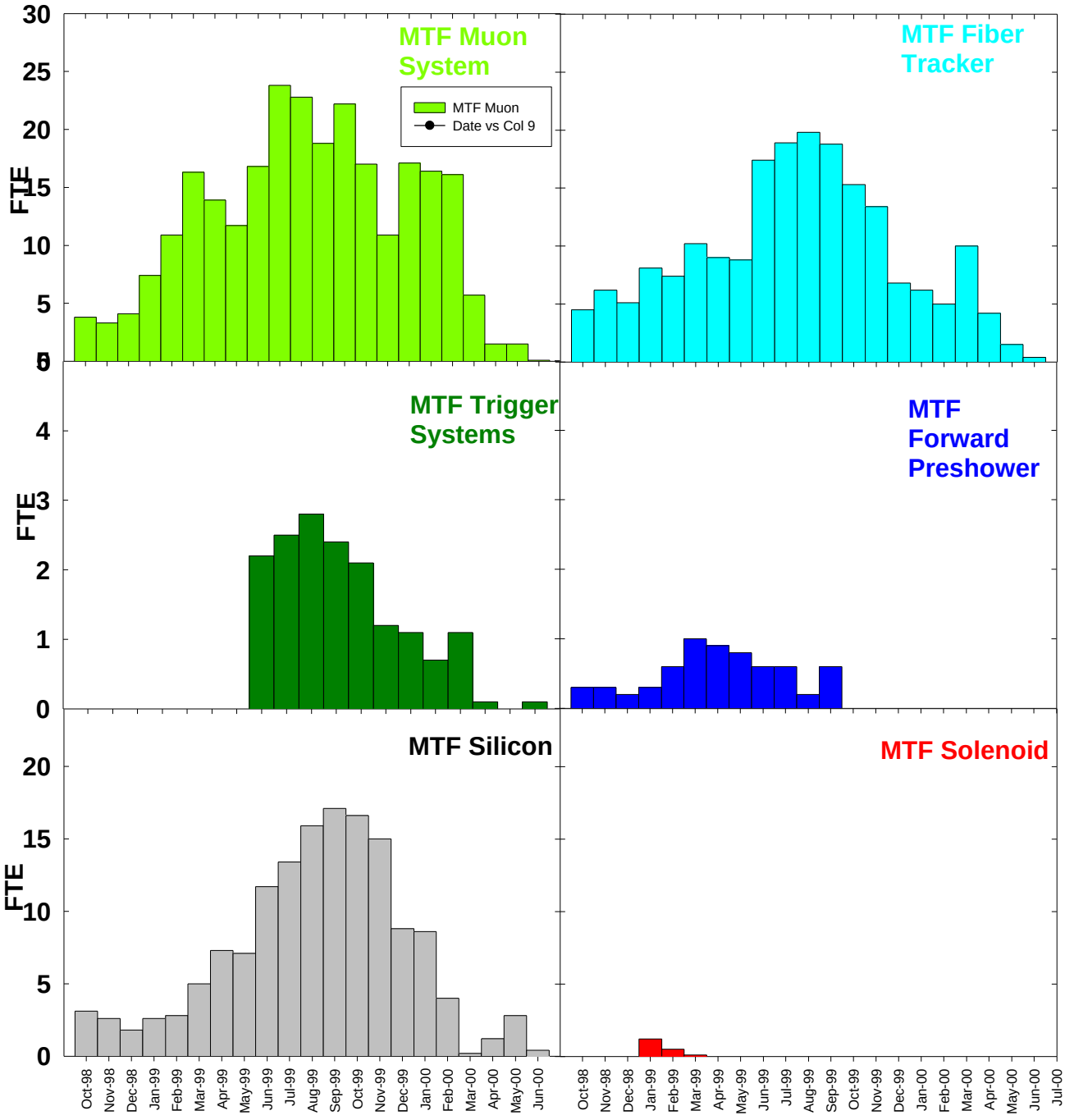
Lab Guidance vs. D0 Estimate (Then YR $)

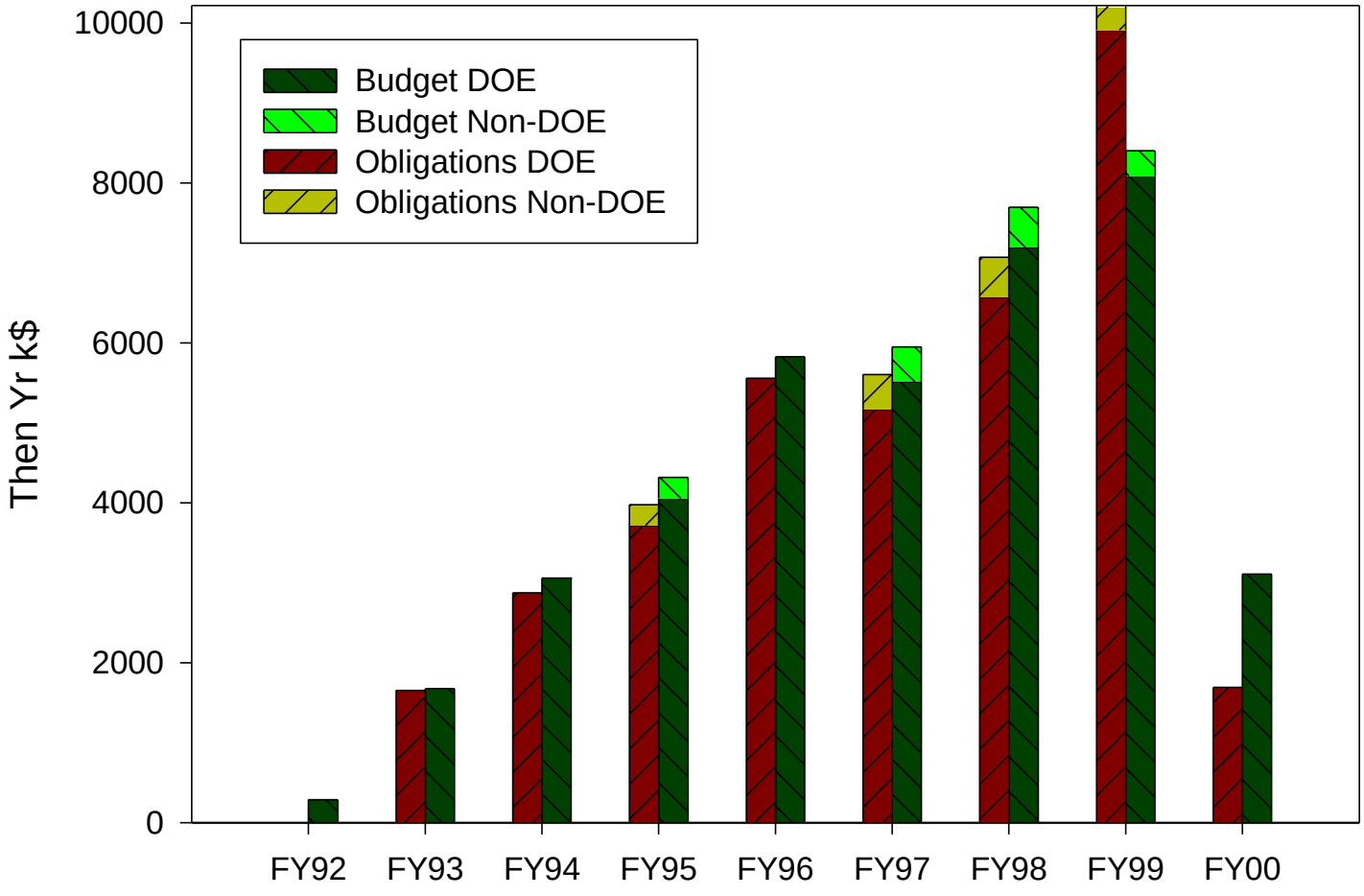
	Lab Guidance	D0 Estimate
Equip M&S	38,851	40,244
Equip SWF	8,676	8,676
G&A	7,997	7,997
Op SWF	12,541	19,087
Op G&A	5,016	7,787
Solenoid	5,168	4,936

- Increase in Operating SWF
  - ~$5M for FY99 + FY00
  - Scale scheduled OpSWF by correction factor from effort reporting data for 10/98-3/99
- Note we do have the FTE's from Lab, so not an issue

Fermilab Mechanical Techs

- **Breakdown of FTE for some Mechanical Techs (MT) by subsystem**



D0 Profile

- Then-yr k$; no solenoid (FY94 plant funds)
- Legend
  - left - D0 obligations for DOE and non-DOE
  - right - Budget authority for DOE (Lab) and non-DOE (foreign funding)