



ACCELERATOR DIVISION

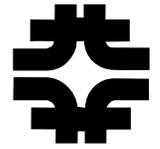
Roger Dixon

Fermilab

March 16, 2004

www-ad.fnal.gov

The Accelerator Division



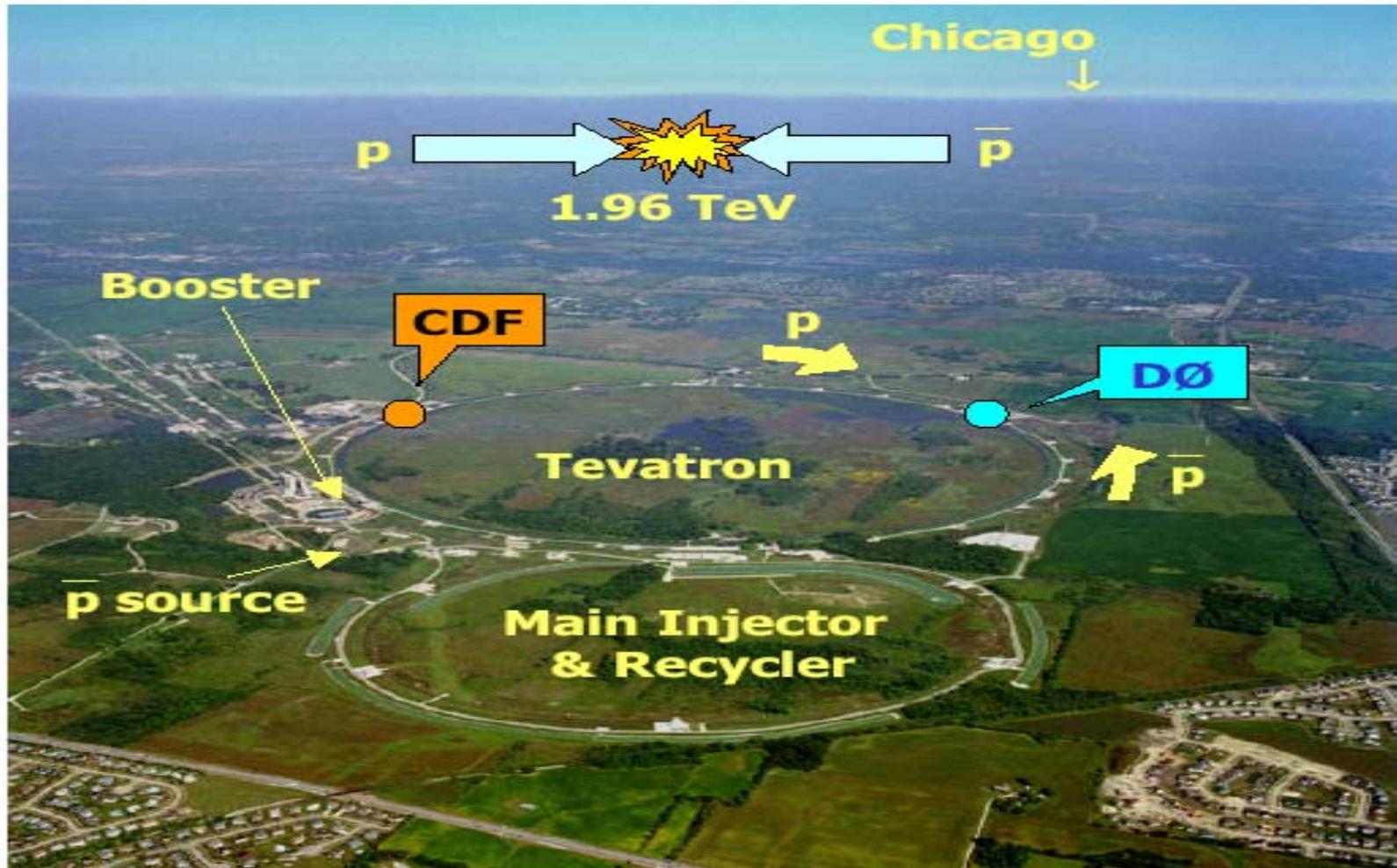
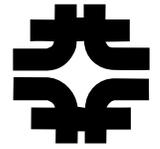
- provides the expertise to reliably and cost-effectively deliver particle beams to qualified researchers conducting basic research at the frontiers of high-energy physics and related disciplines;
- operates, maintains, and improves the existing Fermilab accelerator complex and beam lines;
- conducts particle beam physics research; and
- develops, designs, and builds the accelerators and subsystems required to advance the field.

AD – current programs

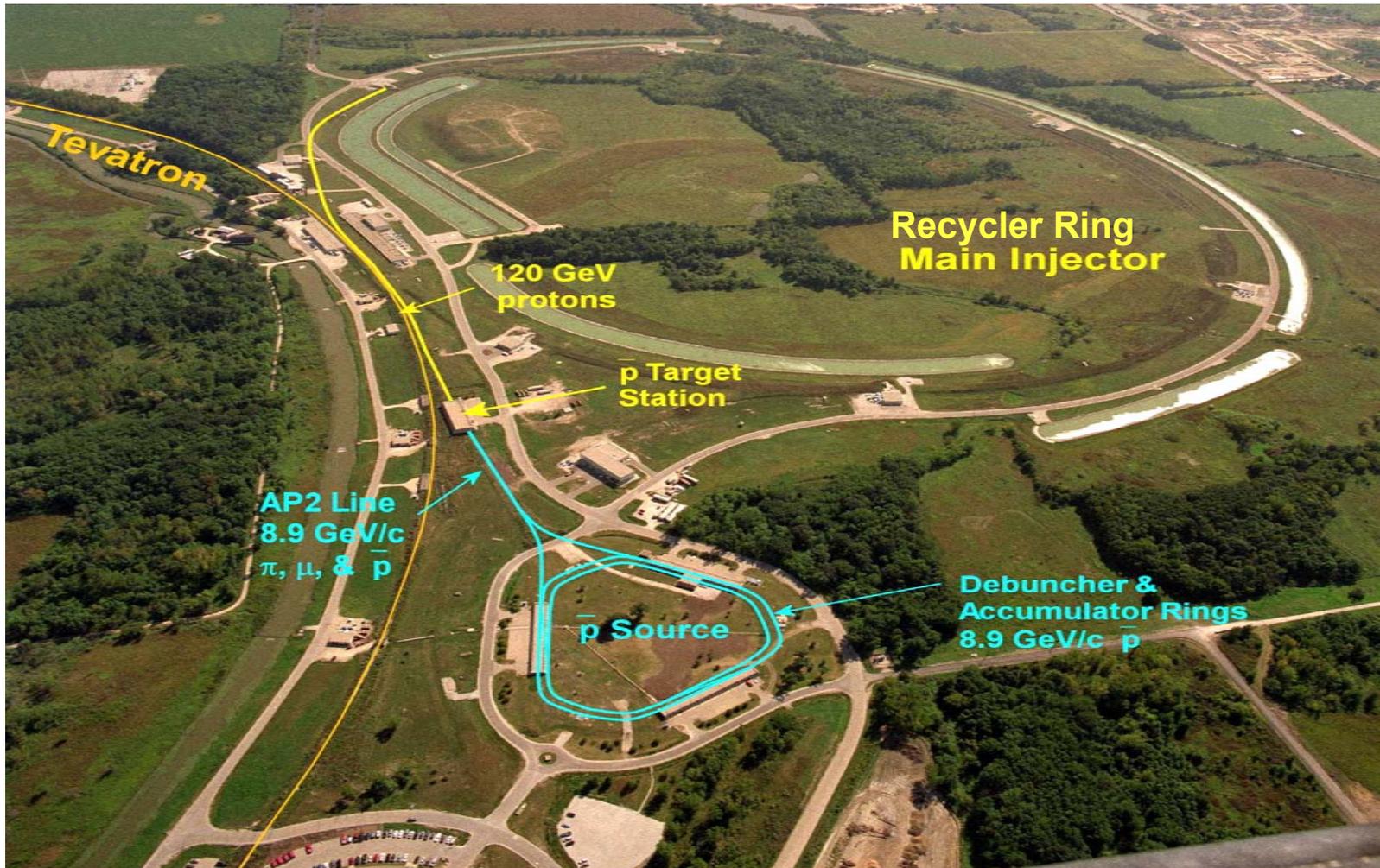
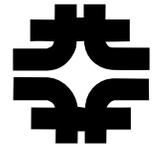


- **2 TeV** pbar-p Collider Program
- Run II Luminosity and Reliability Upgrades
- Neutrino Program – MiniBooNE and NUMI
- Proton Improvement Plan (for more neutrinos)
- Slow-spill extracted beams, C0 IR for BTeV
- Future Accelerator R&D
 - Fermilab NICADD PhotoInjector Laboratory,
Neutrino Facilities (Muon Storage Ring),
Linear Collider, New Proton Driver
- **operating, maintaining, improving facilities**

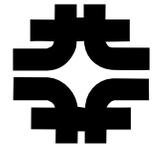
Overview of Accelerator Complex



anti-protons

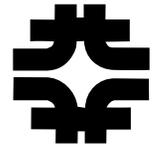


How *big* is the Accelerator Div.?



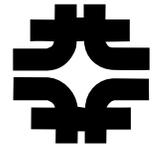
- ~580 people and \$ 95 M in FY04
- Accelerators – a 6-ring circus, and then some
 - Proton Source: Cockcroft-Walton, LINAC, **Booster**
 - **Main Injector**
 - AntiProton Source: **Debuncher & Accumulator**
 - **Recycler Ring** (permanent magnets)
 - **Tevatron**: 1 TeV protons x 1 TeV anti-protons
- **External Beam Lines from Booster and MI**
 - MiniBooNE, NuMI, SW120, E-907 MIPP, Test Beams

Elements of AD Management

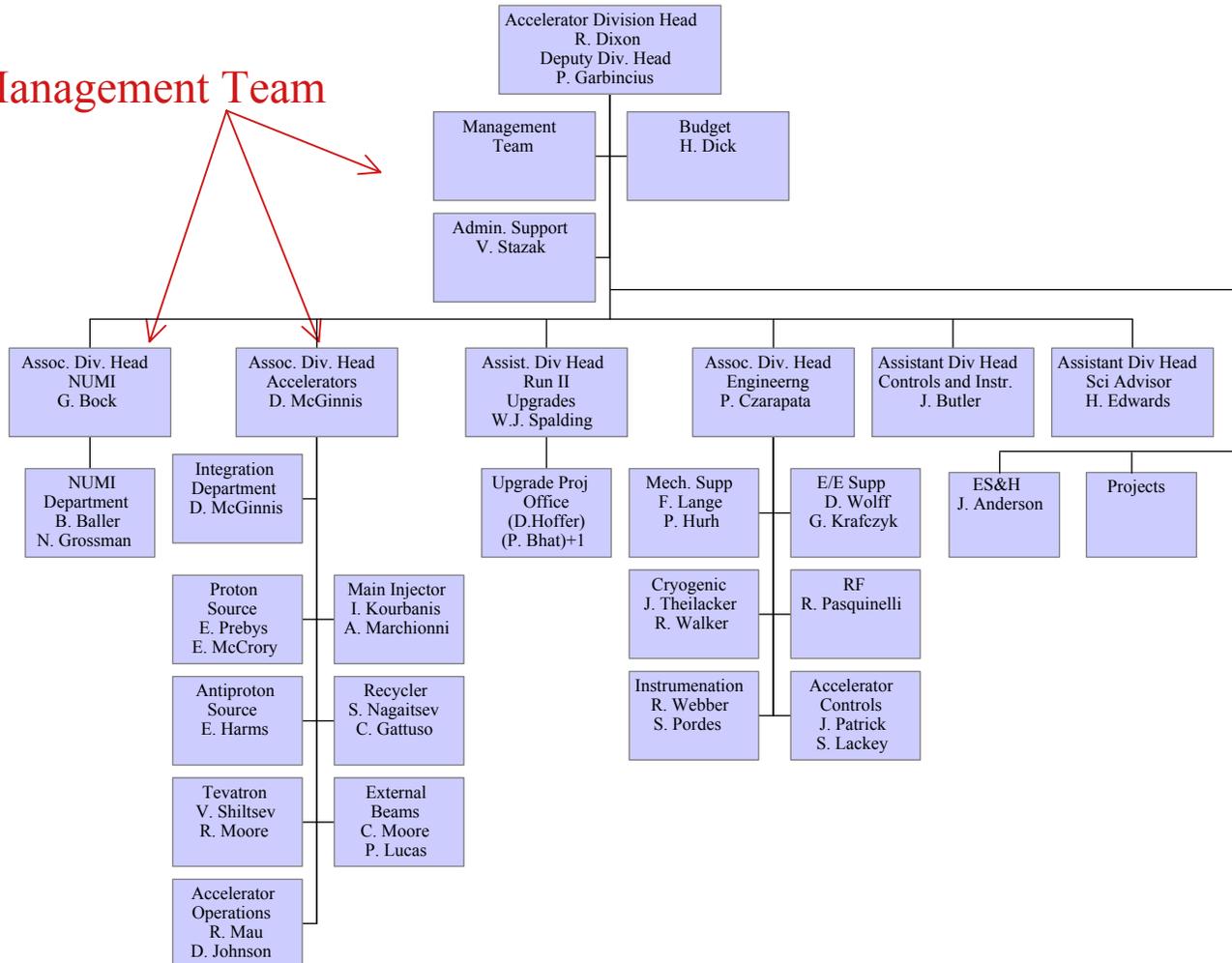


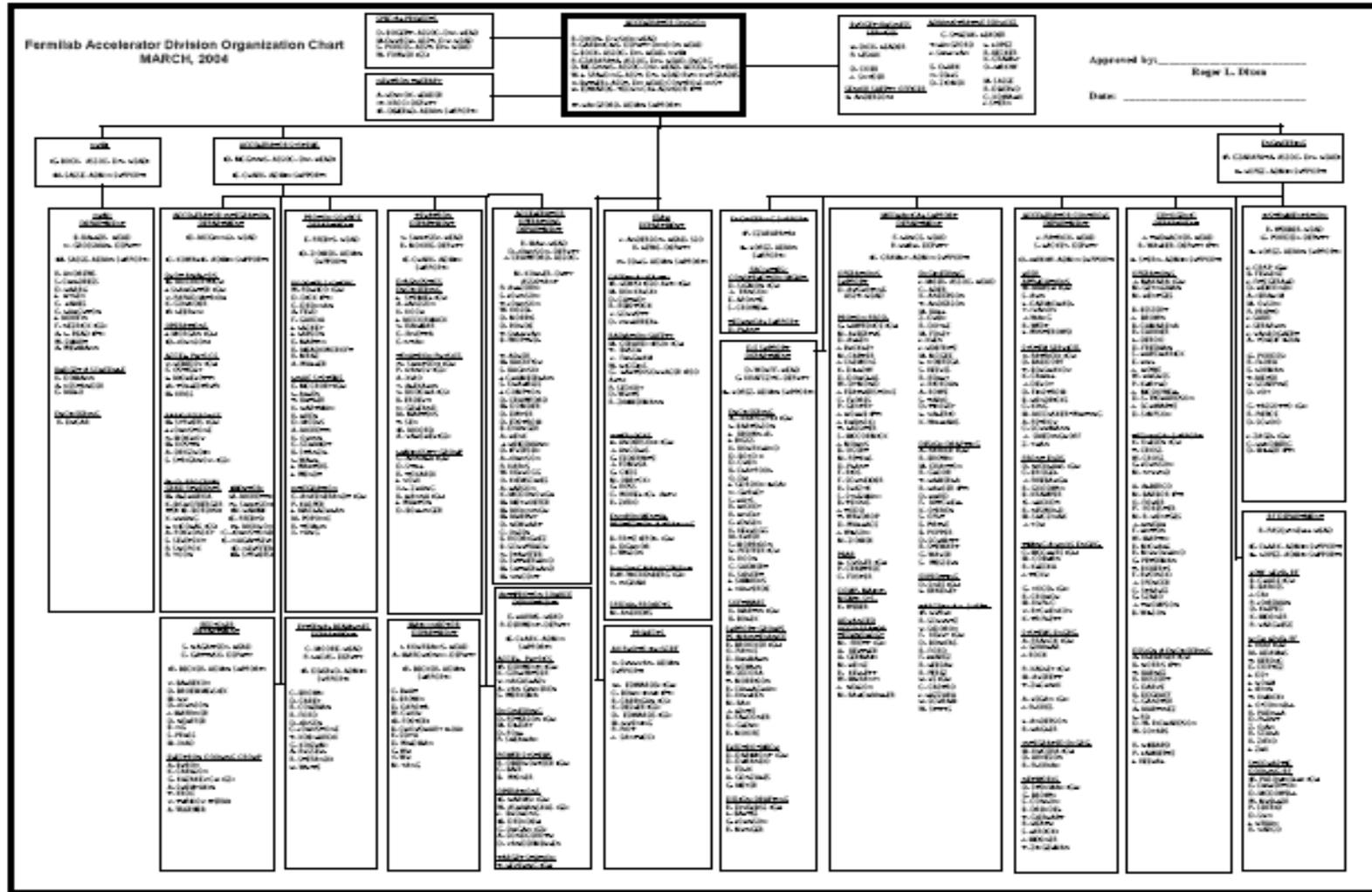
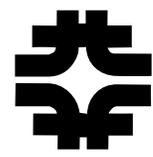
- Program and Budget – annual budget review
- Identifying and Resolving Problems
- Optimizations – often lead to re-organization
- Interactions with our Stakeholders
- Performance Metrics (a few examples)
 - Project Milestones – *e.g.* NUMI, Run II Upgrade
 - almost *every* weekday at AD/Integration meeting
 - Review accelerator performance vs. expectation & recent history
 - Shot Data Analysis - Run II Luminosity Upgrade Plan – correlations
 - Proven to be a vital component of our current successes
 - Monthly AD statistics, accident analysis, ES&H training status
- ES&H + Self-Assessment are important elements

AD Organization - since July 2003

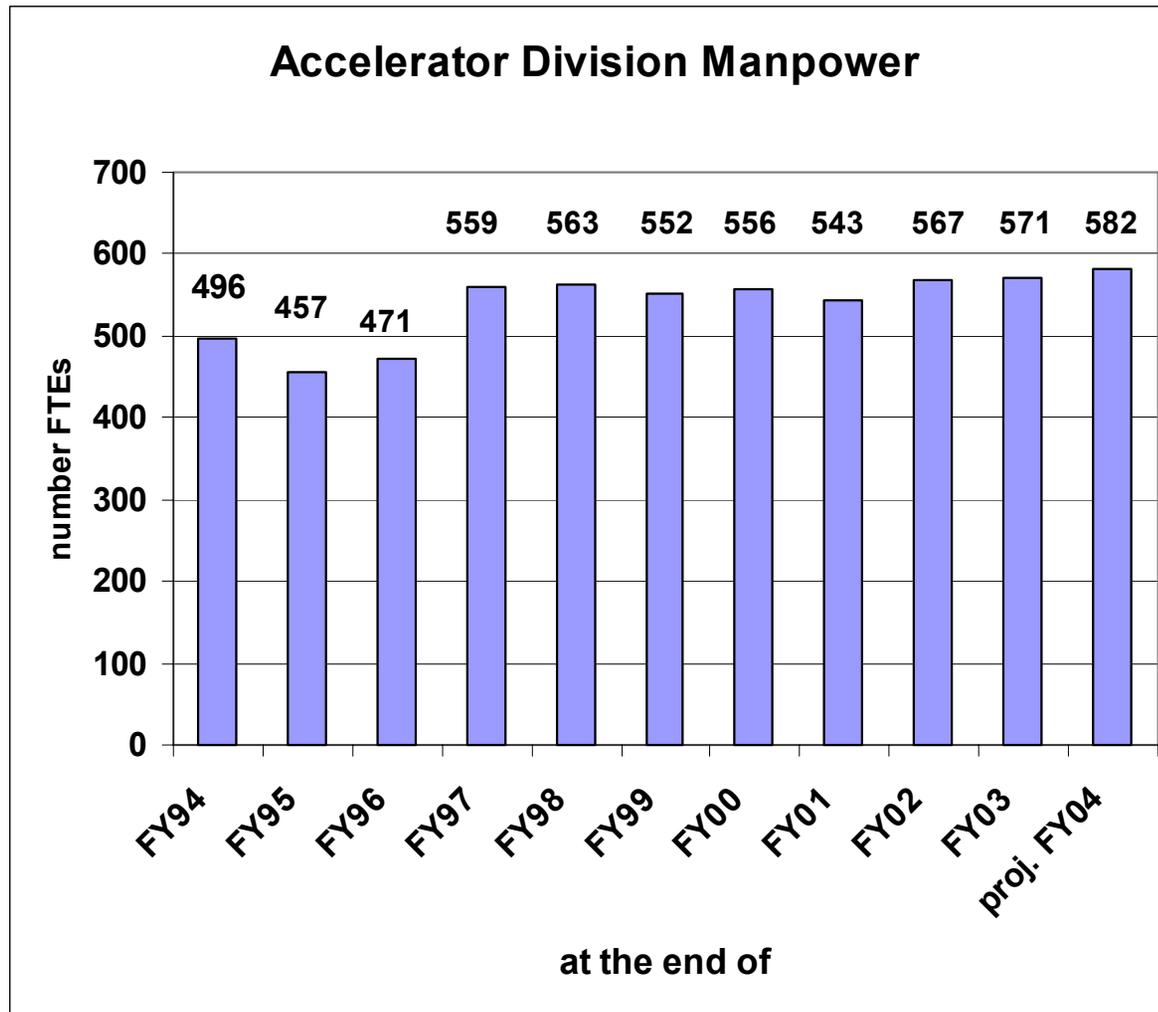
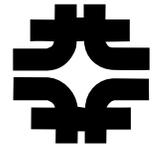


Management Team

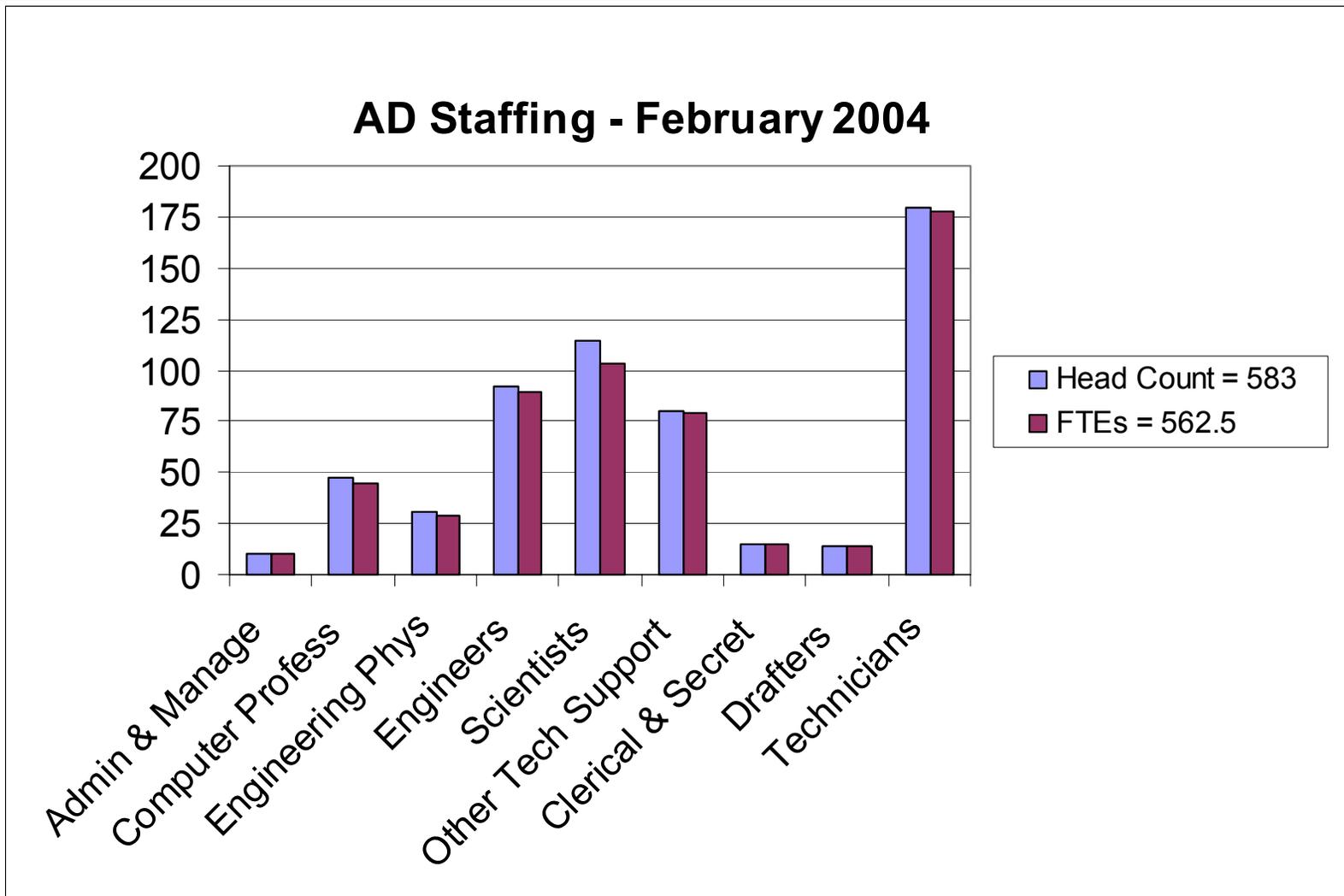




AD Staffing Levels

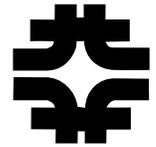


AD Manpower – by classification



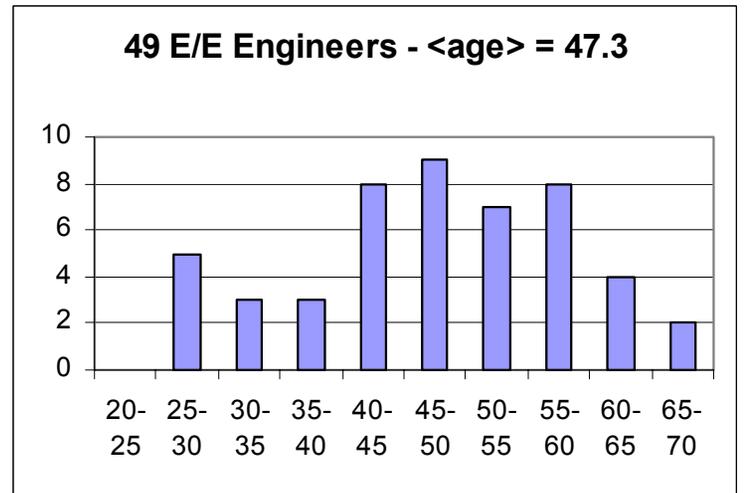
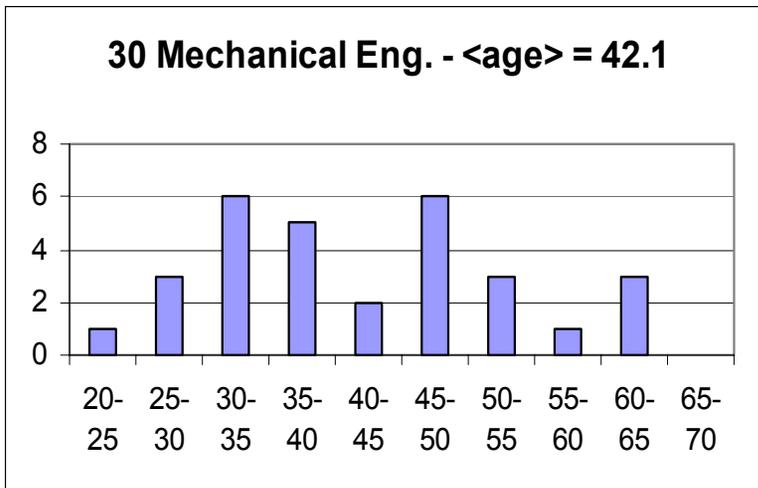
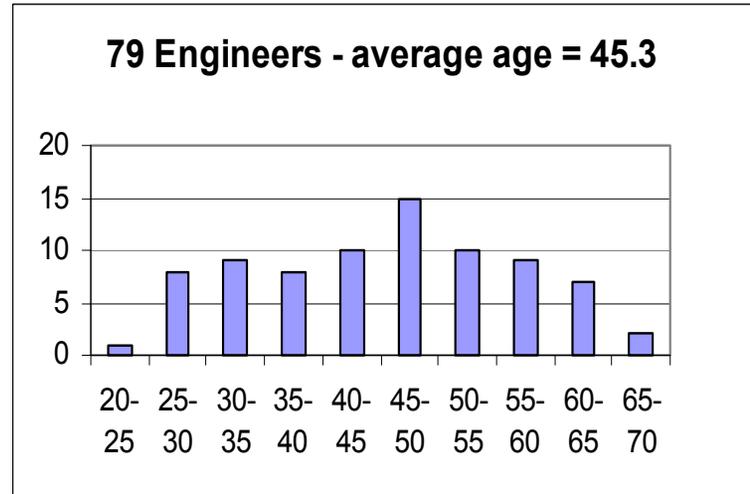
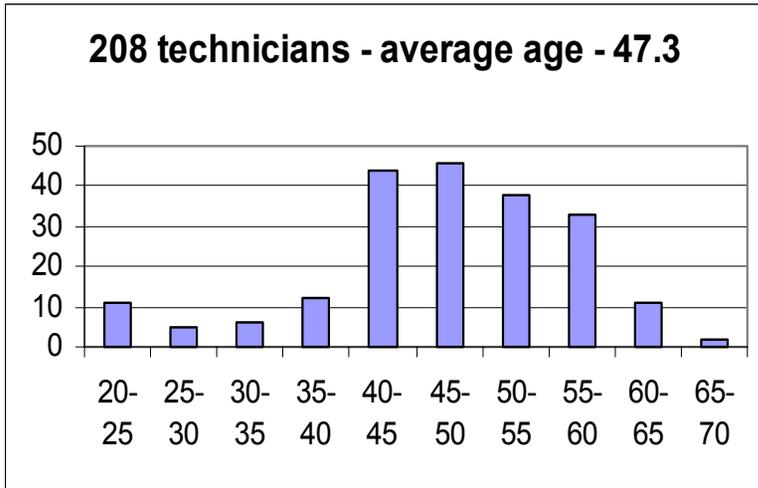
AD FTE Distribution

Snapshot – Feb 8-14, 2004

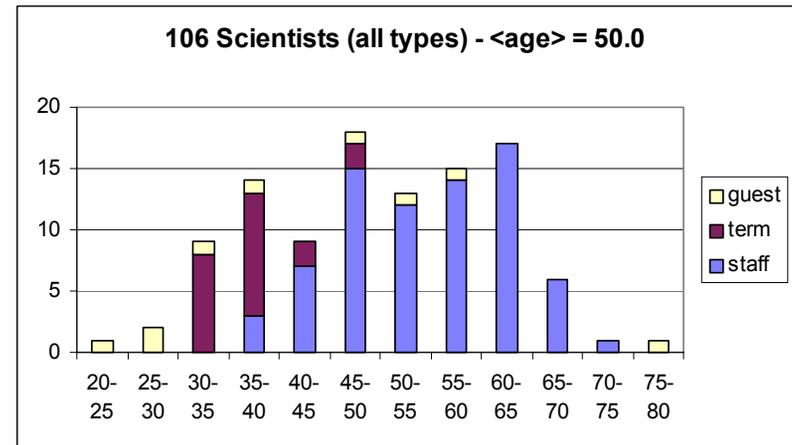
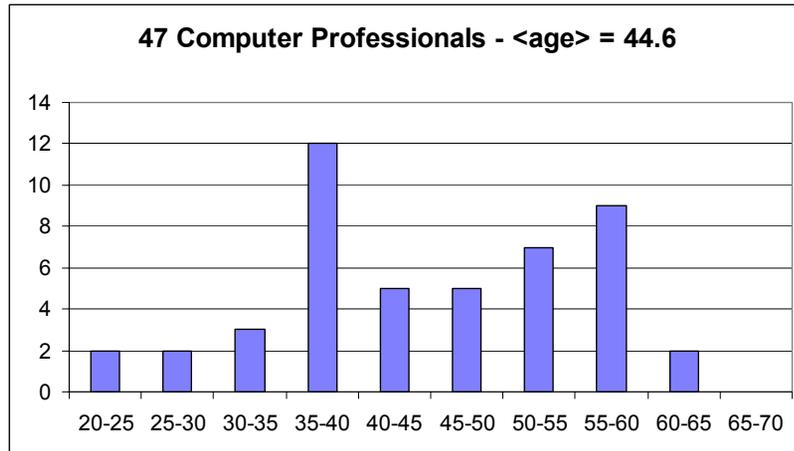
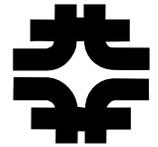


Accelerator Division Staff levels (FTE's)													
FY04		Monthly						Weekly / Hourly					TOTAL
		Admin & Management	Computer Professionals	Engineering Physicists	Engineers	Scientists	Other Technical Support	Clerical & Secretarial	Drafters	Service Workers	Skilled Trades	Technicians	
TOTAL		10.0	45.0	29.0	89.6	103.1	79.4	15.0	14.0	0.0	0.0	177.4	562.5
Experimental		0.0	2.3	2.4	5.7	11.7	4.5	0.0	1.1	0.0	0.0	3.4	31.1
	CDF												0.0
	DO												0.0
	MINOS												0.0
	MiniBooNE												0.0
	CMS												0.0
	BTeV			0.6	2.4	3.2			1.1				7.3
	Future Kaons					1.8							1.8
	SDSS												0.0
	CDMS												0.0
	Auger												0.0
	Fix target exp		2.3	1.8	3.3	6.2	4.5					3.4	21.5
	New Initiatives					0.5							0.5
Theory						0.2							0.2
LHC Accelerator													0.0
Accelerator operation		3.8	34.7	25.2	68.3	83.0	56.3	2.0	11.4	0.0	0.0	146.7	431.4
	Run 2	1.5	34.2	22.0	53.4	70.0	47.3	1.0	9.8			124.1	363.3
	MiniBooNE		0.1	0.5	0.5	0.7	0.3					0.3	2.2
	NuMI	2.3	0.4	2.7	14.4	12.4	8.8	1.0	1.6			22.3	65.9
Accelerator R&D		0.2	0.0	1.5	6.0	4.8	1.1	0.0	1.5	0.0	0.0	11.9	26.9
	NLC				0.1								0.1
	TESLA					0.1							0.1
	FNPL	0.2		1.1	2.4	3.7	1.1		0.8			7.6	16.9
	Muon Facilities			0.1	3.3	1.0			0.7			4.3	9.4
	New Proton Source			0.3	0.2								0.5
	VLHC												0.0
	Generic R&D												0.0
Other Direct		6.0	8.0	0.0	9.7	3.4	17.5	13.0	0.0			15.4	73.0
Indirect													0.0

AD – ages of technical staff



Comp Prof & Scientist Ages

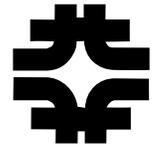


age distribution for scientists:

staff: Scientists, Applied Scientists, &
Applications Physicists

term: Research Associates & Associate Scientists

AD FY04 budget by major activities



	Labor	M&S	Total	
• DS - ACCELERATOR DIVISION				
• Run 2				
– Accelerator Operation	35,562	11,847	47,409	
– Accelerator Improvement	6,542	14,039	20,581	Run 2 Upgrades
– Detector Operation	0	0	0	
– Detector Improvement	0	0	0	
• Non-Run 2				
– Accelerator Operation	3,515	2,049	5,564	External Beams
– Accelerator Improvement	0	0	0	+ NUMI OPC
– Detector Operation	0	0	0	
– Detector Improvement	0	0	0	
• Others (not subject of this review)				
– LHC	0	0	0	
– Non-accelerator physics	0	0	0	
– Theory	0	0	0	
– Physics Research	0	0	0	
– NuMI Line Item	1,484	9,880	11,364	
– <i>Future</i> Accelerator R&D	462	1,010	1,472	
– <i>Future</i> Detector R&D	0	15	15	C0 IR design
• Direct Support (manage, admin, ESH, etc)	6,313	2,558	8,871	infrastructure
• Indirect	0	0	0	
• Total	53,878	41,398	95,276	

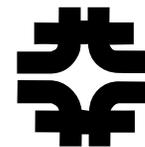
AD Simplified WBS – direct only more details, FY05 & 06 at breakout



<u>Laboratory WBS Structure Total</u>		CT 2/27/04(HJD)		
<u>Division/Section:</u>		DS - ACCELERATOR DIVISION		
<u>Control Level:</u>		(All)		
		<u>Total</u>	<u>SWF</u>	<u>M & S</u>
		<u>FY04 BASE</u>	<u>FY04 BASE</u>	<u>FY04 BASE</u>
1.1	<u>Accelerators</u>	67,990	42,104	25,886
1.1.1	Accelerator Maintenance and Operations	47,409	35,562	11,847
1.1.2	Accelerator Upgrades	20,581	6,542	14,039
1.1.2.1	Proton Plan	0	0	0
1.1.2.3	Run II Luminosity Upgrades	18,768	6,199	12,569
1.1.2.4	Run II Plan Reliability Upgrades	1,813	343	1,470
1.2	<u>Collider Experimental Program</u>	0	0	0
1.3	<u>LHC</u>	0	0	0
1.4	<u>BTeV</u> CZero Interaction Region	15	0	15
1.5	<u>Experimental Initiatives</u>	3,340	2,589	751
1.5.1	Future Kaons	0	0	0
1.5.2	External Beamlines & Fixed Target Exps	3,340	2,589	751
1.6	<u>Neutrino Experiments</u>	13,588	2,410	11,178
1.6.1	NuMI / MINOS	13,588	2,410	11,178
1.6.1.1	Beamline	12,450	2,410	10,040
1.6.1.7	NuMI Beam Line Spares	1,138	0	1,138
1.6.4	MiniBooNE	0	0	0
1.7	<u>Future Accel. & Advanced Accel. R&D</u>	1,472	462	1,010

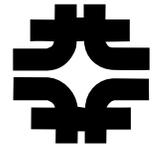
AD Simplified WBS - direct only

more details, FY05 & 06 at breakout



<u>Laboratory WBS Structure Total</u>		CT 2/27/04(HJD)		
<u>Division/Section:</u>	DS - ACCELERATOR Division			
<u>Control Level:</u>	(All)			
		Total	SWF	M & S
		FY04 BASE	FY04 BASE	FY04 BASE
1.8	<u>Theory</u>	0	0	0
1.9	<u>Experimental Particle Astrophysics</u>	0	0	0
1.10	<u>Programmatic Support (Direct)</u>	249	0	249
1.10.6.2	Computer Aided Systems	193	0	193
1.10.11	Travel for Conferences	56	0	56
1.11	<u>Other Projects (Neutron Therapy)</u>	0	0	0
1.12	<u>Other Support (Direct)</u>	4,071	2,865	1,206
1.12.1	Buildings/Facilities	907	423	484
1.12.2	ES&H	3,164	2,442	722
1.13	<u>Division Management and Support (Direct)</u>	4,551	3,448	1,103
1.13.1.1	Division Management and Operations	3,757	3,448	309
1.13.2.2	Professional Development	399	0	399
1.13.3.1	PC's and Desktop Computing	395	0	395
1.0	TOTAL	95,276	53,878	41,398

AD Challenges and Risks



- How do we face hard choices and issues?
- Luminosity of pbar-p Collider Program
 - Run II Luminosity Upgrade plan
- Proton Economics for neutrino program
 - Proton Committee (Finley) Report, Oct03
 - Eric Prebys formulating Proton Improvement Plan
- Reliability & obsolescent tech infrastructure
 - Vulnerabilities (Sept02), Run II Support (Dec02)
 - Remedies are Part of Run II Luminosity Upgrade plan
- Proton Driver Design Reports – 2000 & 2002
- R&D for Future Accelerators - *balance*

when a substantive issue arises,



- **Commission a study**
 - Vulnerabilities Report, Run II Support White Paper, Proton Report (Finley), *etc.*
- **Develop leadership team - formulate plan of action**
 - Run II Luminosity Upgrade Plan, Proton Driver CDRs, Proton Improvement Plan
- **Review & Assess plan – participation by AD, other Div/Sec, Exps, other Labs, and often DoE**
 - *e.g.* many Technical Reviews for NuMI and Run II Upgrade sub-projects

mitigation or solution



- Reconfigure the support matrix, if need be
 - AD/Management Team (Spring 03)
 - Accelerator Dynamics Dept (end of CY 03)
morphs into
 - Accelerator Integration Dept – including Operations Coordination, Shot Data Analysis, and Rapid Response Team
 - Re-distribute some Accelerator Dynamics members directly into Accelerator Systems Departments

mitigation...



- Ask for manpower help when needed
 - Spikes during accelerator shutdowns:
 - TD (15), PPD (50), SLAC Alignment
 - Computing Div = 22 FTEs on Run II Upgrades
 - Technical Div ~ 50 FTEs on various AD projects
 - PPD transferred ~ 15 people to AD over last year
 - plus ~ 18 FTEs working on AD project
 - support from universities and other Laboratories
 - UTA foil SEMs for NuMI, CDF/D0 alignment
 - Cornell, BNL, CERN, LBNL, SLAC, ANL, IHEP, BINP

mitigation...



- (often) monitor and assess progress
by an inter-organizational
Project Management Group

AD Communications

with our stakeholders



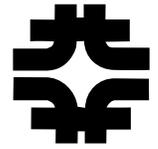
- Regularly meet within the AD and with the Directorate, other Div/Sec, Expts, DOE, *etc.*
- often working meetings to solve problems and resolve issues, not just to transfer info
 - AD/Integration (weekdays),
 - AD/Ops (weekly), AD/Heads (bi-weekly),
 - AD/Management Group (monthly),
 - AD Scientific Staffing (weekly),
 - Experimenters Meeting (monthly),
 - Scientific Advisory Group (monthly),
 - AD meets with Directorate (monthly)

communications...



- Joint AD – TD meeting with S. Holmes (weekly)
- AD/TD Magnet Work Coordination (bi-weekly)
- Lab Scheduling Meeting (weekly),
- Lab Administrative Meeting (monthly)
- Program Management Groups
 - Run II Luminosity and Strategy (monthly),
NUMI (monthly), BTeV (bi-weekly)
- AAC (2 per year), URA BoOs (3 per year),
- Directorate (Temple) Reviews
- DOE (Lehman) Reviews,
- *bi-weekly* Teleconference w/DOE-HEP

Integrated Safety Management

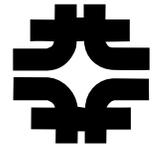


- AD – Division Level Implementation
- see www.bdnew.fnal.gov/esh

Satisfy 7 ES&H Principles (#) with 25 Processes (a)

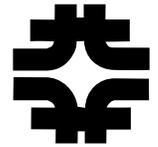
1. Management Responsibilities
2. Clear Roles and Responsibilities
3. Competencies commensurate with Responsibilities
4. Balanced Priorities
5. Identify Standards and Requirements
6. Specifically Tailored Hazard Controls
7. Authorization for Operations
 - Leads to a Matrix (#,a)

Integrated Safety Management



- Documents, Procedures, Processes:
 - a. ADAP-01-0001 AD Procedure Requirements
 - b. AD Admin Procedures ADAPs
 - c. AD Safety Procedures ADSPs
 - d. Safety Assessment Documents
 - e. Shielding Assessment Documents
 - f. Shielding Review Committee
 - g. ADAP-11-0001 Beam Permits, Run Conditions, and Startup
 - h. Cryogenic Review Panels
 - i. Small Project Review Panels

Integrated Safety Management



- j. Radiation Safety System Interlock Review & Test
- k. Oxygen Deficiency Hazard (ODH) Analysis
- l. Industrial Hygiene Assessments
- m. Highly Protected Risk Assessments
- n. Workstation Ergonomic Assessments
- o. Self-Assessment Program Department Head
Inspection Reports
- p. Task Manager List
- q. T&M Electrical Coordinators
- r. Building/Area Manager List and Program
- s. Crane and Forklift Evaluators

Integrated Safety Management



- t. ESHTRK report
- u. Division Head Safety Talks, e-mails, memos
- v. Department Head Meetings
- w. Training Tickler Report
- x. Monthly Training Report
- y. DuPont Training Report

Documents, Procedures, Processes

ES&H	a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
Topic																									
1	•	•	•				•																•	•	•
2	•	•	•				•									•	•	•	•				•		
3			•													•	•	•	•				•		
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5			•	•	•	•		•	•		•	•	•							•					
6			•	•	•	•		•	•		•			•											
7				•	•	•	•	•	•	•	•														

Are AD ES&H programs effective?



Safety Goals for FY04

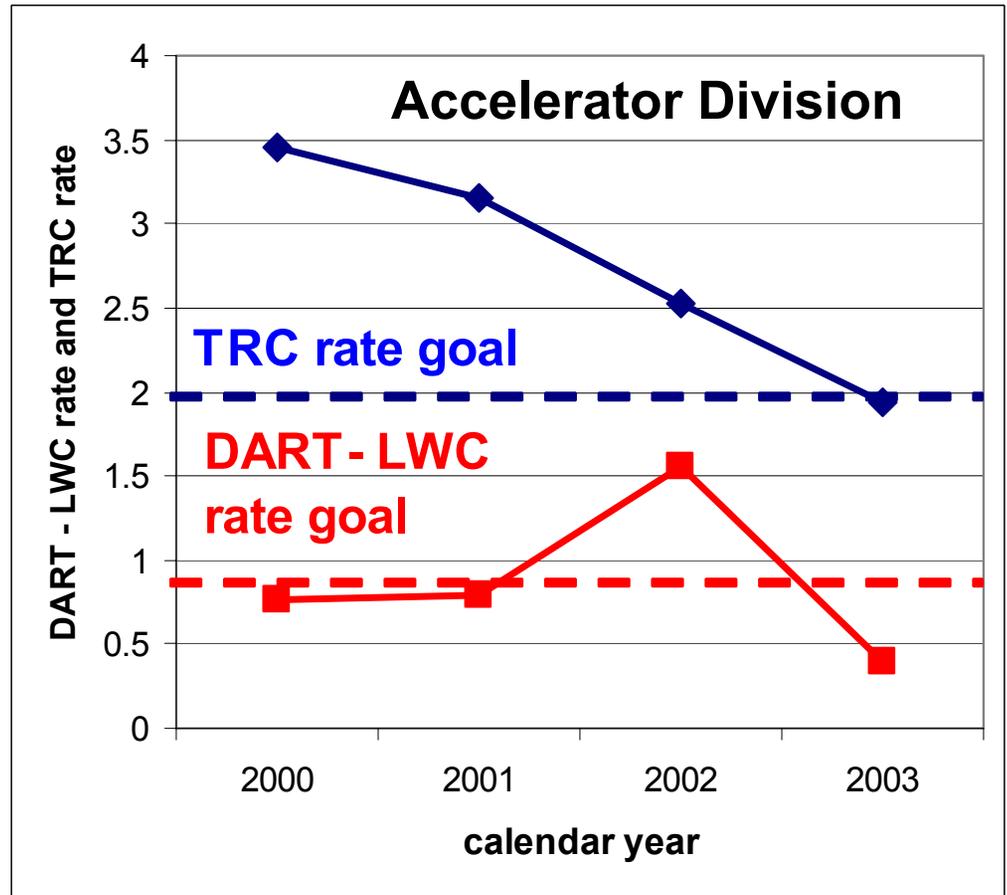
URA - DOE contract:

“outstanding” would be

TRC rate < 2.0

DART - LWC rate < 0.9

1.0 and 0.5 may even
be within reach!

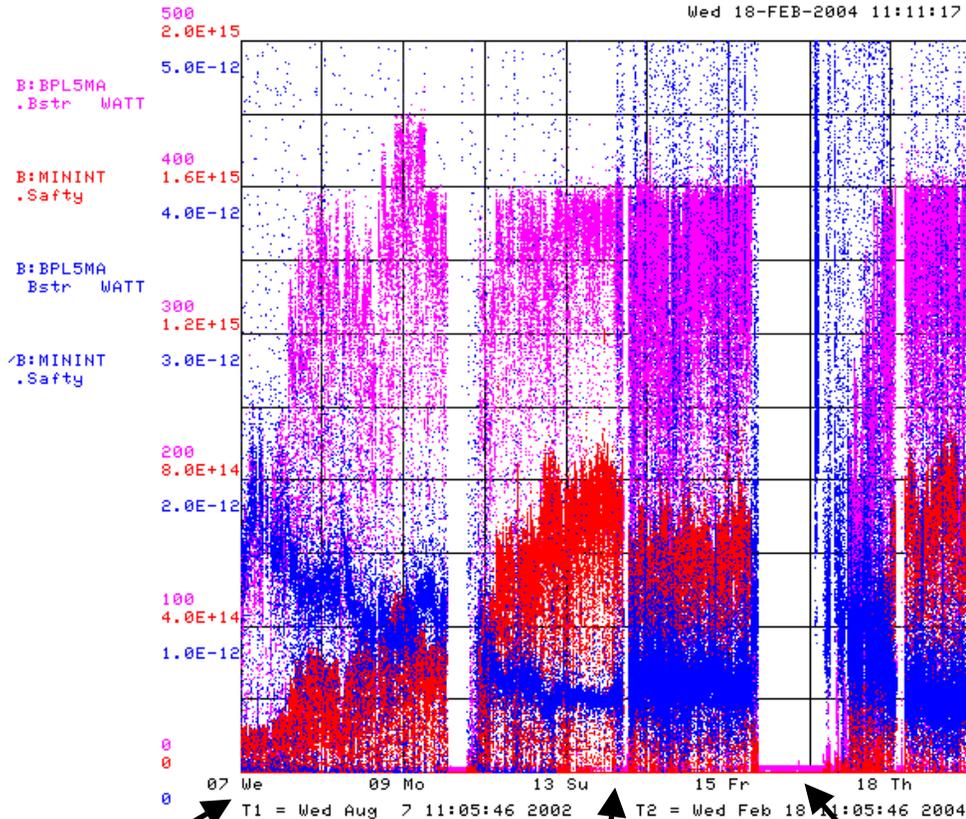
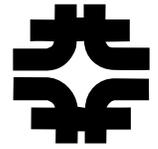


e.g. – Booster Ops vs. ALARA



- MiniBoone Experiment needs many protons
- Beam Losses in Booster limit beam to MiniBooNE
 - Radiation damage of components
 - Radiation dose rates to workers who repair and maintain Booster systems
- Long term solution:
 - improved apertures, collimation, alignment, optics
 - Rapid Response Team commissioning new collimators
 - part of Run II Luminosity & Reliability Upgrades
 - will be addressed in Proton Improvement Plan

Booster Beam to MiniBooNE



← 400 Watts
Power loss (W)

Protons (p/min)

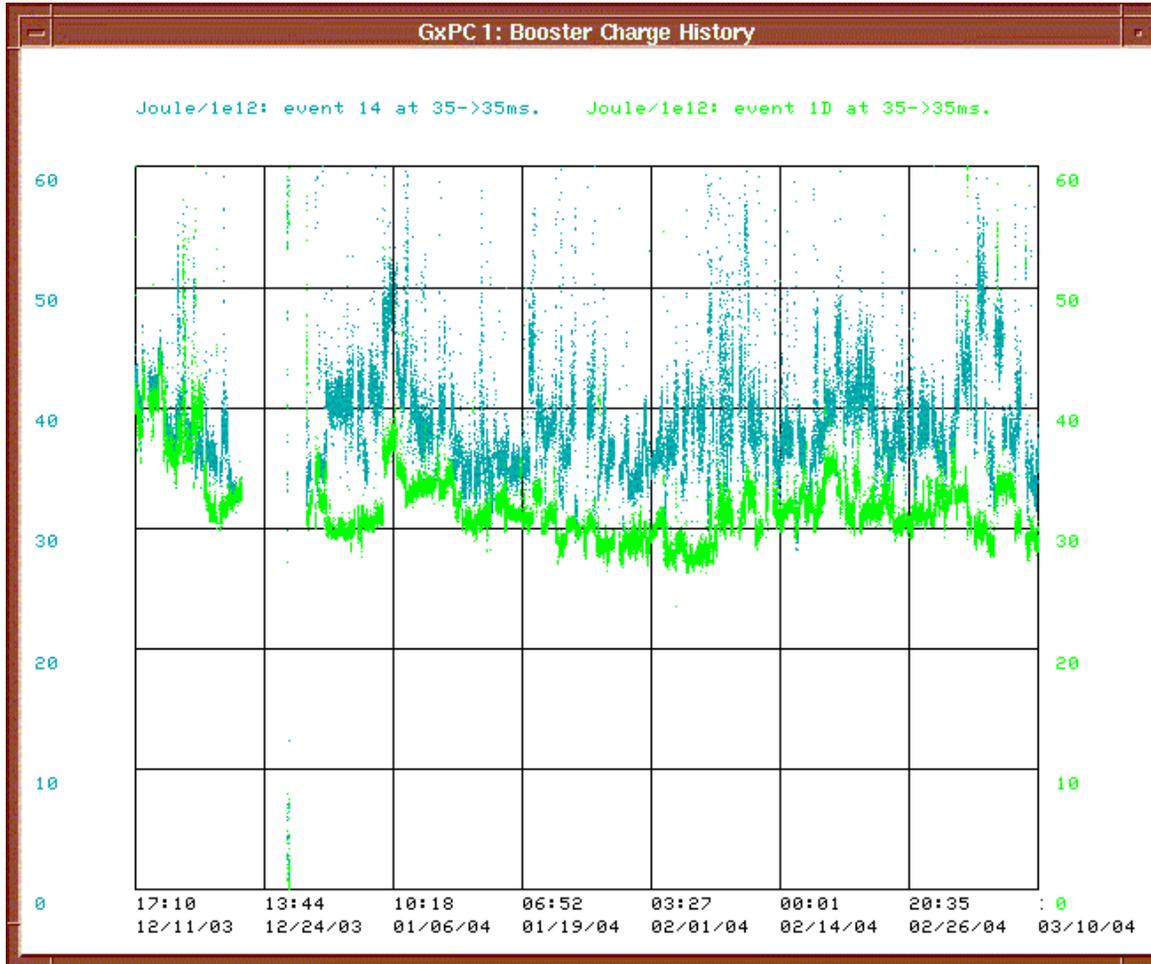
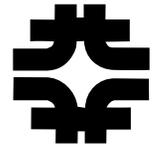
Energy Lost (W-min/p)

MiniBooNE turn-on
(Sept. 2002)

"Mysterious"
Performance Problems

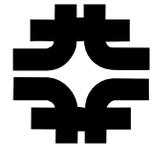
Big Shutdown (Fall 2003)

The Last 3 Months @ Booster



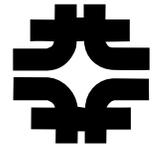
← Beam for pbar production
← Beam to MiniBooNE

In the meantime,



- to deliver useful beam to MiniBooNE
 - Limit Booster beam loss power to < 400 Watts
 - Tried various limits to find optimization between MiniBooNE intensity and radiation dose
 - AD Rad Physics evaluation and approval of all jobs
 - substantial cool-downs,
 - spread the dose among many workers
 - mid-night call-ins of Rad Techs as escorts as needed
 - other than 400 W limit, this is
Standard Procedure for working in radiation areas

AD Self-Assessment Activities



- pre-2002 – the dark ages – different format
- small assessment teams, led by P. Czarapata
- 2002 - concentrated on AD Operations
 - Accelerator Operations, Run Coordination, Emergency Response, Record Keeping, Operational Readiness, Accelerator Improvements
- 2003 – how does AD meet the mission goal?
 - Administrative, Security, ES&H, Engineering, and Accelerator Complex
- Reports from 2002 and 2003 are available

AD final words (until tomorrow):



- We are operating and upgrading the capabilities of the world's highest energy accelerator complex, safely, economically, effectively
- There *is* always room for improvement, reviews like this can help us focus
- We are planning and working toward the future:
 - current: Run II Luminosity Upgrades, NuMI
 - near term: Proton Improvement Plan
 - intermediate term: C0 IR for BTeV, Proton Driver
 - long term, new technologies: Linear Collider, μ -facilities