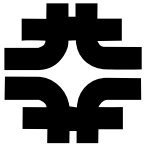


Computing Division

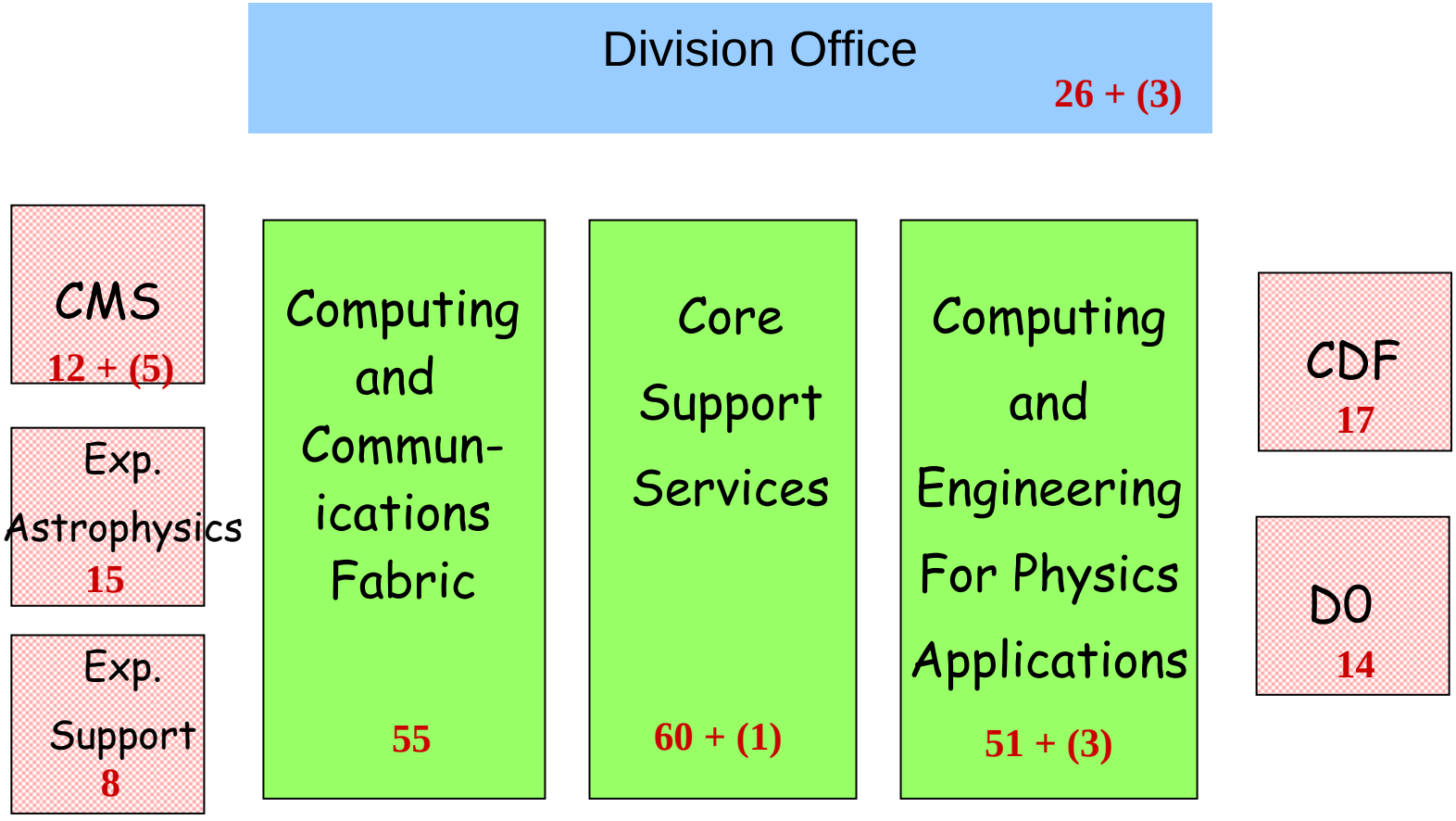
URA Visiting Committee Review

March 12, 2004

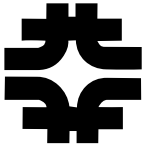
Vicky White

Head, Computing Division

Computing Division Organization



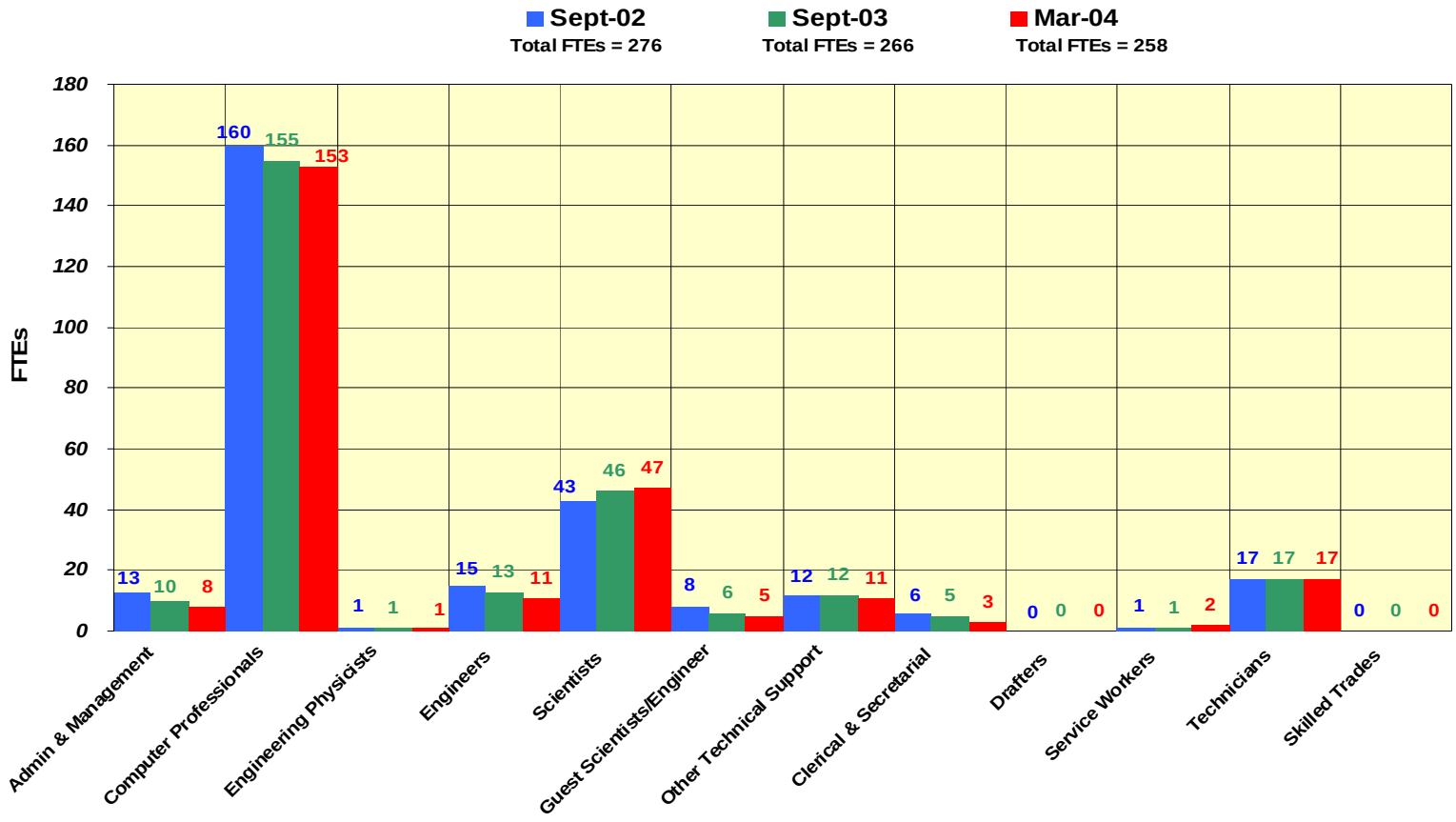
Scientists of all sorts, Engineers, Technical, Computing, Admin = 258 + (12) = 270

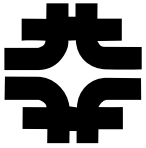


Five Activity Areas

- Provide services, tools, and components, and operate computing facilities that serve the lab and the scientific program broadly.
- Provide dedicated help, leadership and active participation in running and approved experiments,US-CMS, and other lab scientific programs (including support and expert help to the Beams Division).
- Work on projects funded competitively outside the base budget – e.g. SciDAC & GRID projects.
- Participate in planning and R&D for future experiments/lab activities.
- Run a computing organization and computer center.

Job Categories (FTEs) – March 2004





Common Services and Tools

- Much of our work in this area is used by the whole lab and all of the experiments and scientific program stakeholders
- This year we have worked hard to improve our efficiency and to develop metrics to monitor all of our systems, services and performance. Also to formalize all of our project work
- Digest of some of our metrics
- Our projects and their statuses

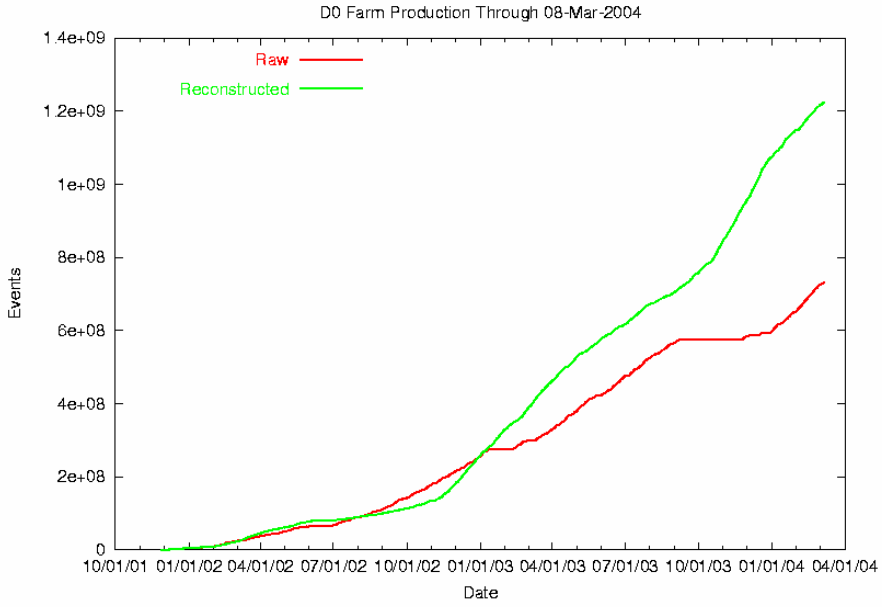
Some Common Services

Common Service	Customer/Stakeholder	Comments
Storage and Data movement and caching	CDF, D0, CMS, MINOS, Theory, SDSS, KTeV, all	Enstore – 1.5 Petabytes data ! dCache, SRM
Databases	CDF, D0, MINOS, CMS, Accelerator, ourselves	Oracle 24x7 mySQL,Postgres
Networks, Mail, Print Servers, Helpdesk, Windows, Linux, etc.	Everyone !	First class, many 24X7, services + lead Cyb.Security
SAM-GRID	CDF, D0, MINOS	Aligning with LHC
Simulation, MC and Analysis Tools	CDF, D0, CMS, MINOS, Fixed Target, Accel. Div.	Growing needs
Farms	All experiments	Moving to GRID
Engineering Support and R&D	CDF, D0, BTeV, JDEM, Accel. Div. Projects	Q outside our door

Run II Computing

- Working very well in general
- Reconstruction raw data keeping up, except for few glitches
  - Luminosity increases and/or detector degradations and/or increased data rates present risks
- Large Analysis capability at Fermilab for CDF, smaller Farms
- Large Farm resources at Fermilab for D0, smaller Analysis
- Virtual Computing center model
  - core computing is provided by Fermilab, according to reviewed Run II plans, with global computing contributions
- Adequate Network bandwidth is clearly essential
  - After 1 year we finally have a contract for a dark fiber to Starlight and will commission this link soon
  - ESNet working with us on Metropolitan Area Network between ANL, Fermilab and Starlight

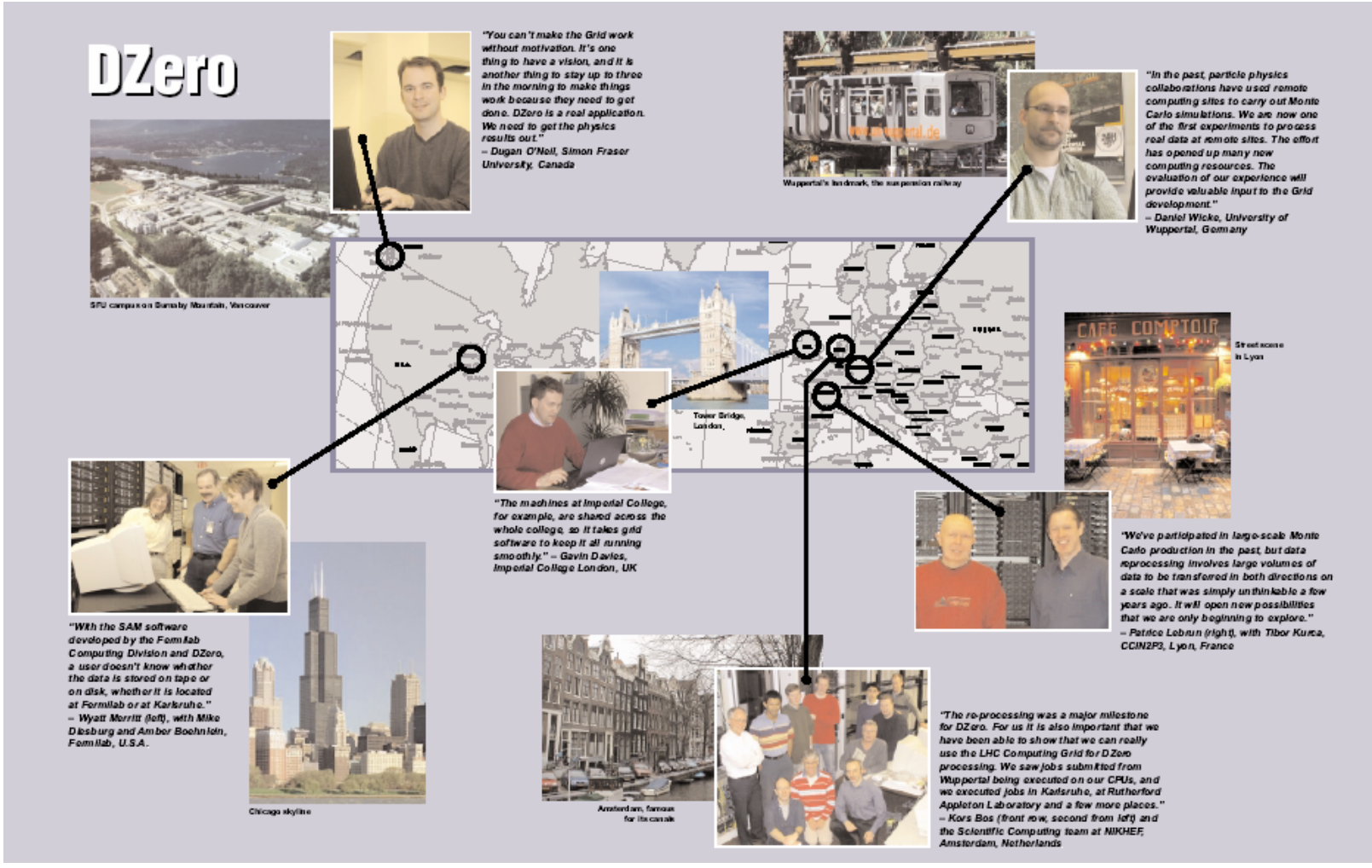
D0 Reconstruction Processing

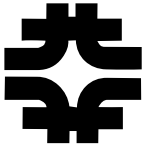


- Keeping up with the raw data
- ~800 processors in the Farm at Fermilab

- Highly successful distributed reprocessing of data recently completed at 6 sites worldwide
  - article in FermiNews **DZero Breaks New Ground in Global Computing Efforts.** First steps toward Grid application with 'real data'

D0 worldwide reprocessing

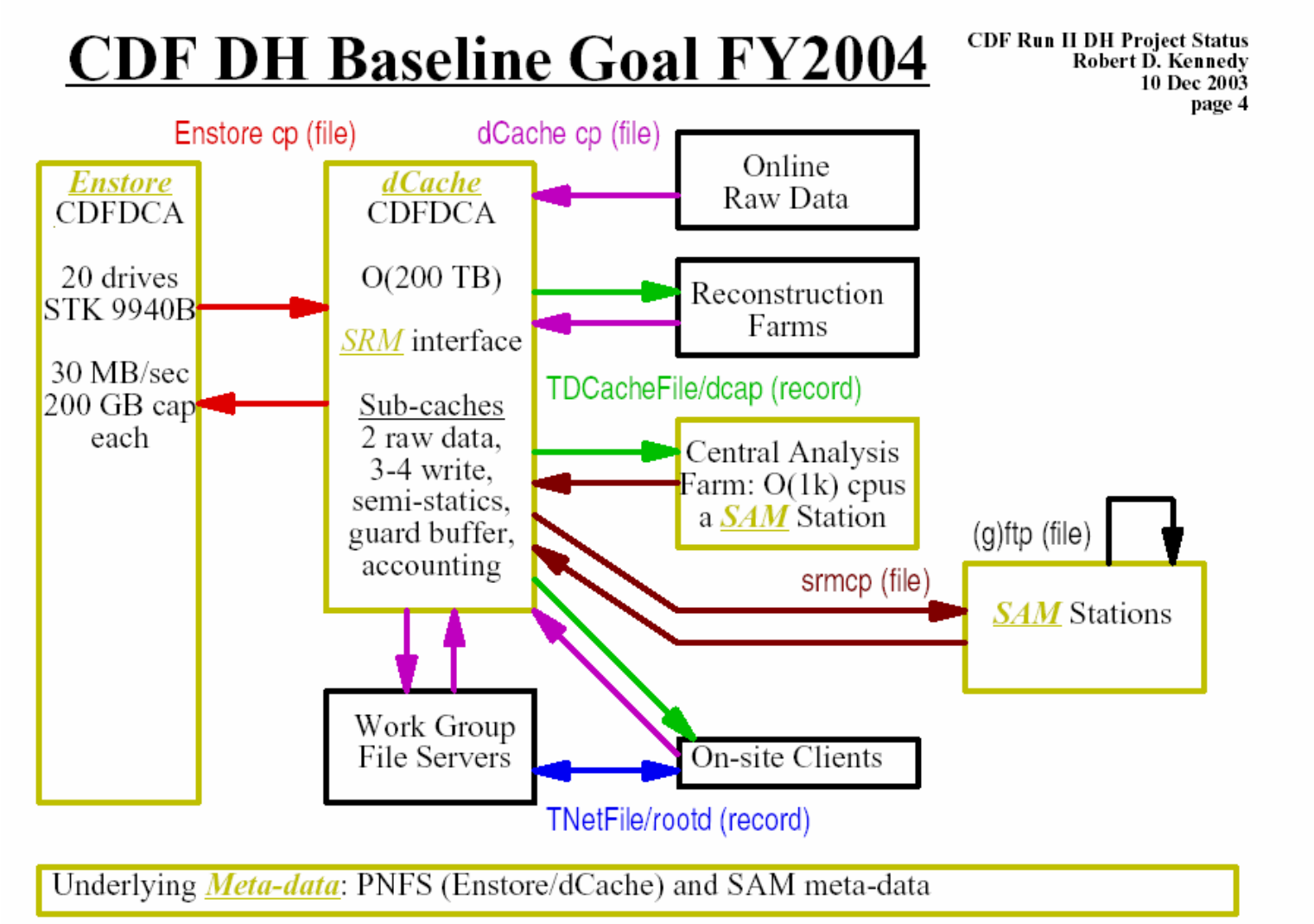




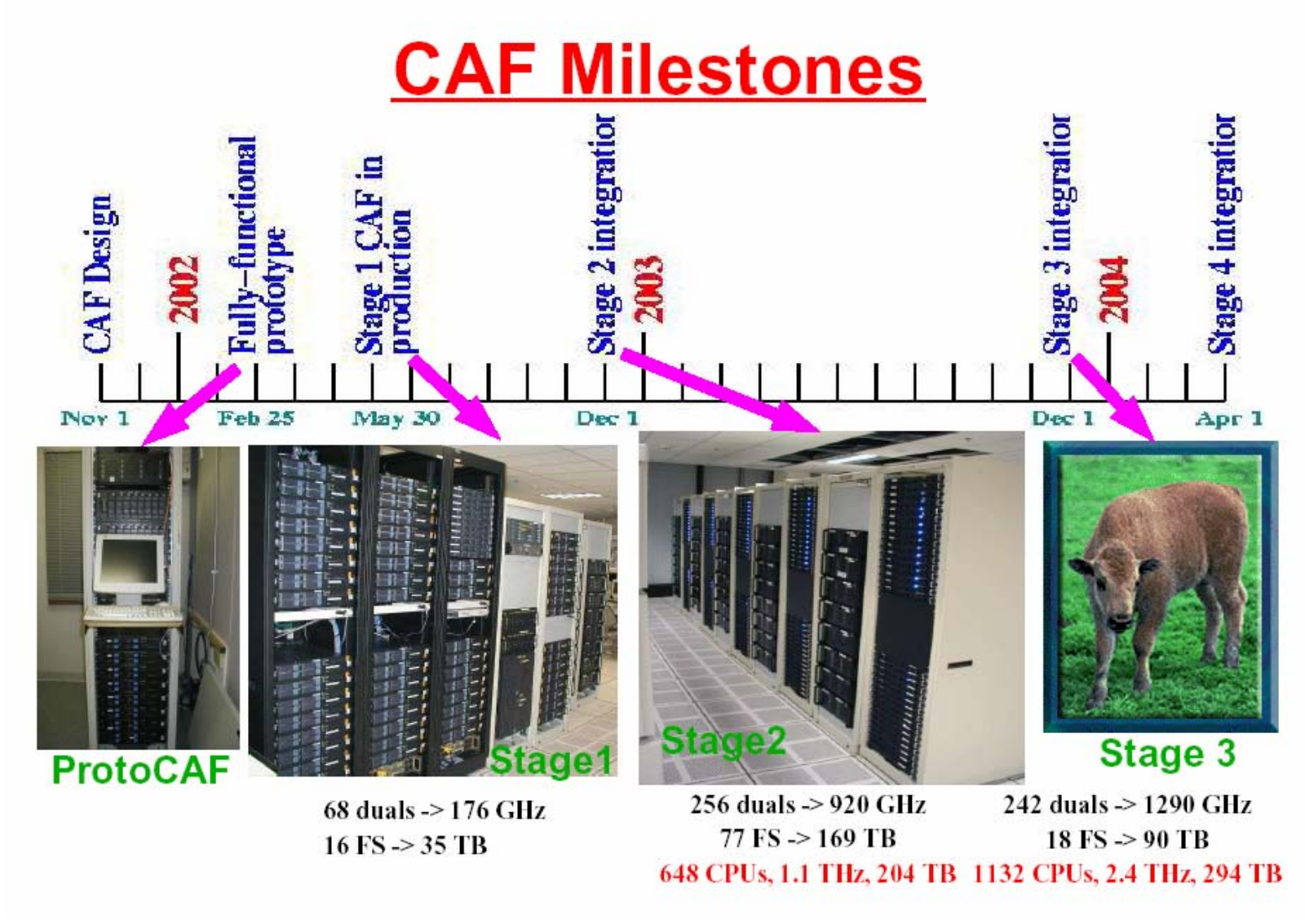
D0 Computing

- Central SGI processor being phased out
  - Successful linux farm analysis processing on CAB
- In a typical week analyze 50 TB of data on the analysis systems, corresponding to 1.2 Billion events
  - Wait times for delivery to caches from central Enstore storage system typically small compared to the cpu time used for analysis
- SAM-GRID data handling system used for all data delivery, tracking, metadata

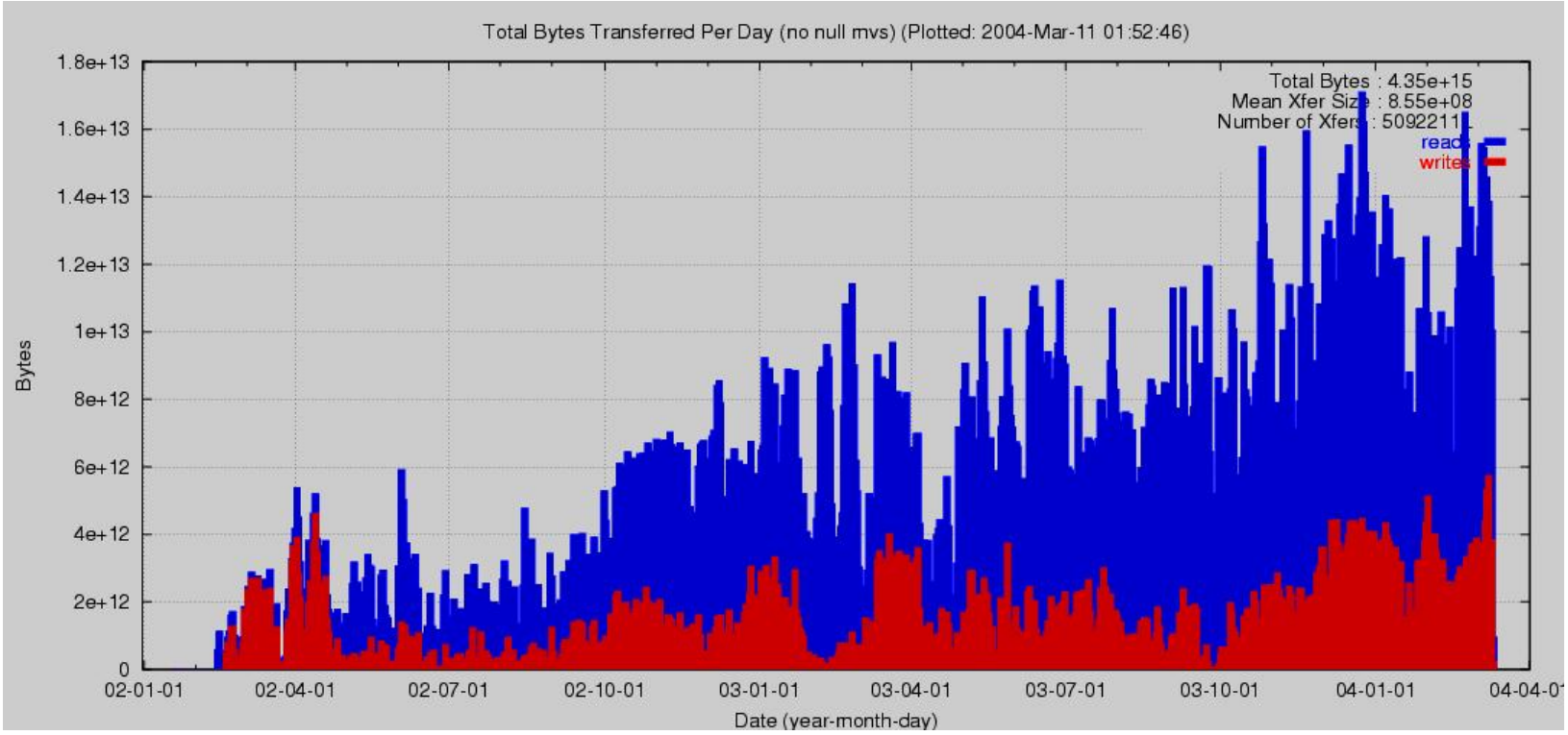
CDF Computing



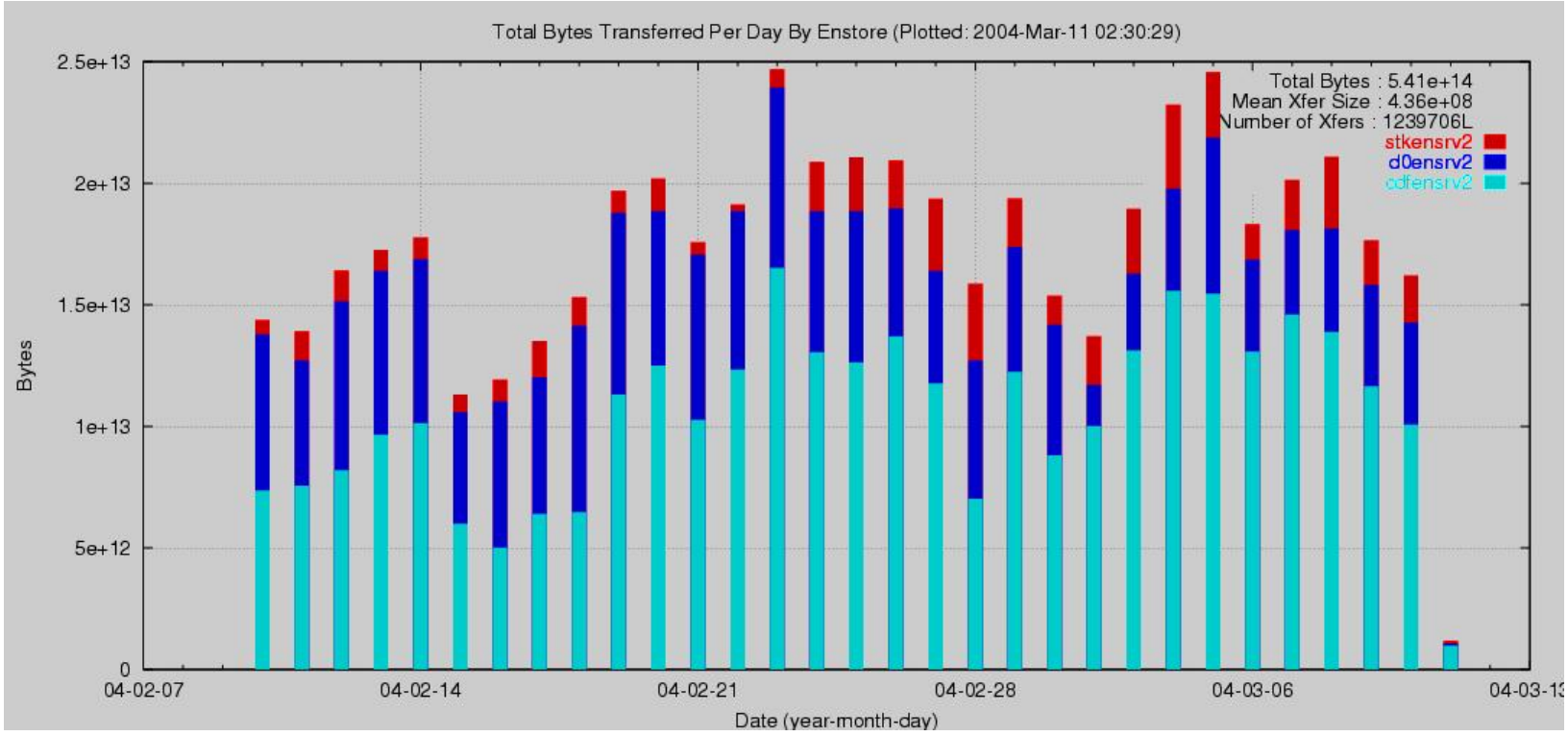
Building a CDF analysis facility (CAF)



CDF Enstore Bytes/day transferred

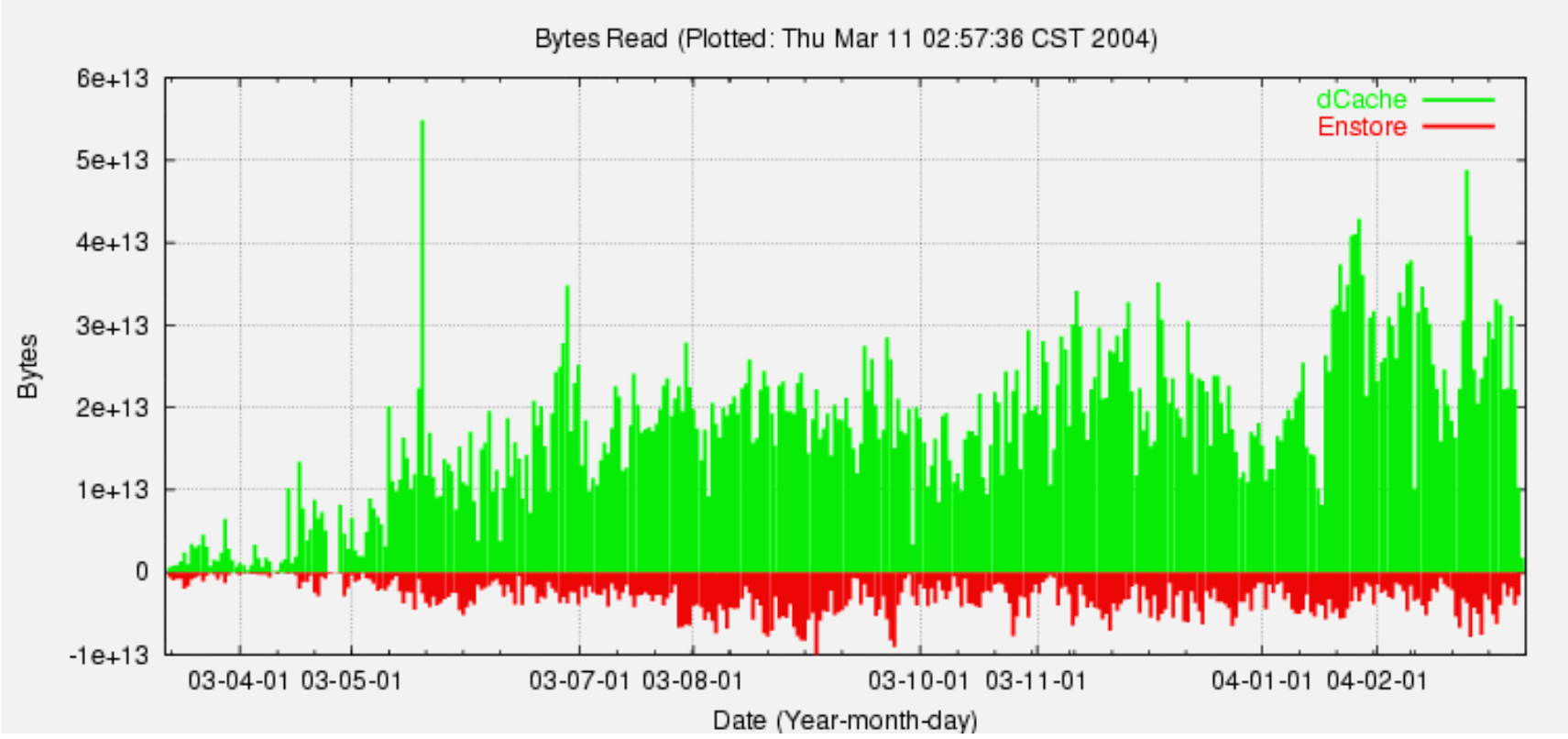


Total Lab bytes/day - Enstore



25 Terabytes
per day!

CDF dCache data read



Accelerator Division Projects

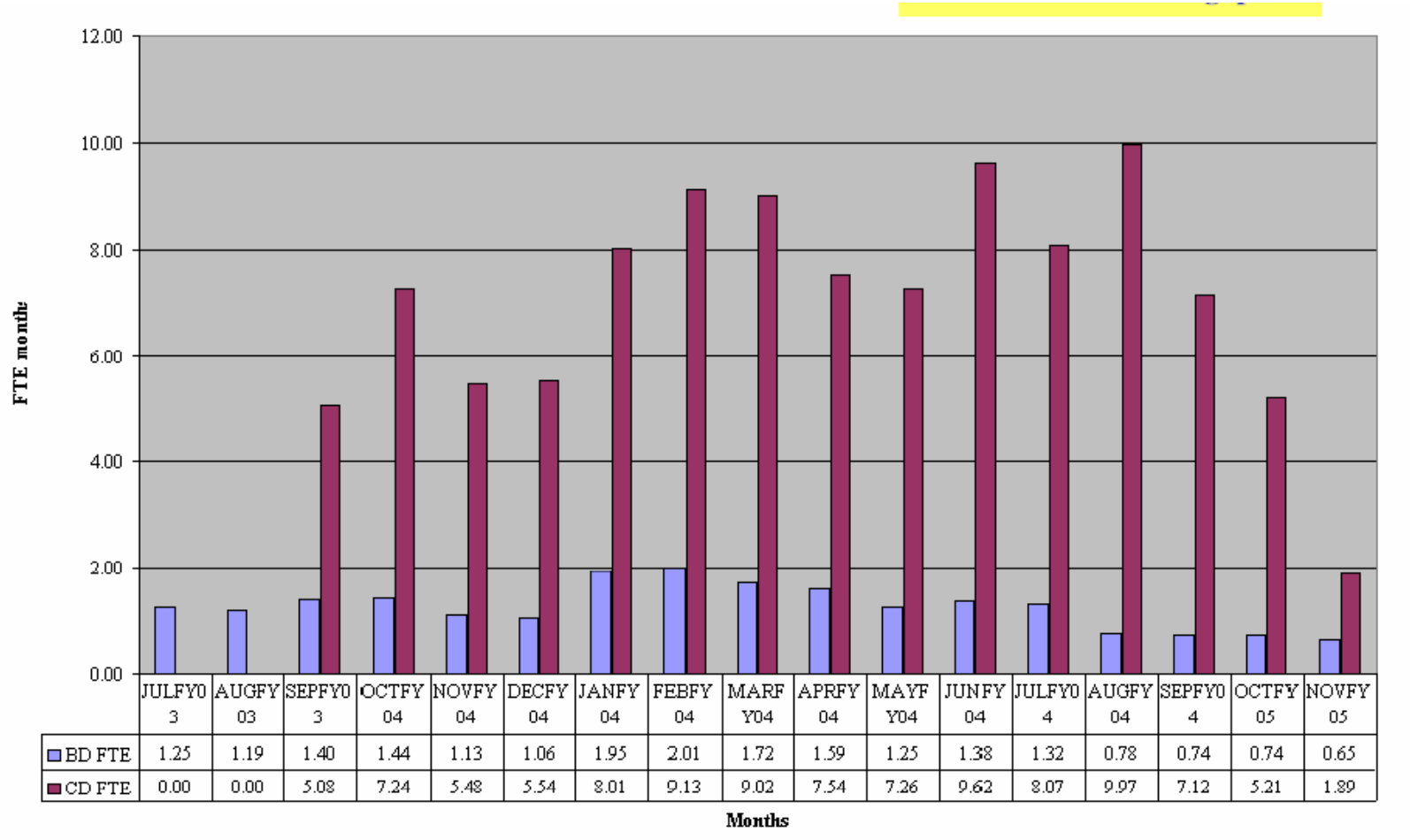
- 15 FTEs of help on projects from throughout the division. 5+ scientists strongly involved.
- Tevatron BPM project led by Steve Wolbers the largest effort
- Various ongoing analysis, controls, database and tools efforts

20 people involved – limited by nature of tasks available

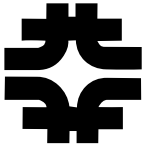
Tev BPM Project will deliver

- All new electronics.
- Front-end software.
- Data to the online/controls system.
- Applications to use the new data.
- The pickups in the accelerator will not be modified!

Joint CD/AD project



	JULFY03	AUGFY03	SEPFY03	OCTFY04	NOVFY04	DECFY04	JANFY04	FEBFY04	MARFY04	APRFY04	MAYFY04	JUNFY04	JULFY04	AUGFY04	SEPFY04	OCTFY05	NOVFY05
BD FTE	1.25	1.19	1.40	1.44	1.13	1.06	1.95	2.01	1.72	1.59	1.25	1.38	1.32	0.78	0.74	0.74	0.65
CD FTE	0.00	0.00	5.08	7.24	5.48	5.54	8.01	9.13	9.02	7.54	7.26	9.62	8.07	9.97	7.12	5.21	1.89



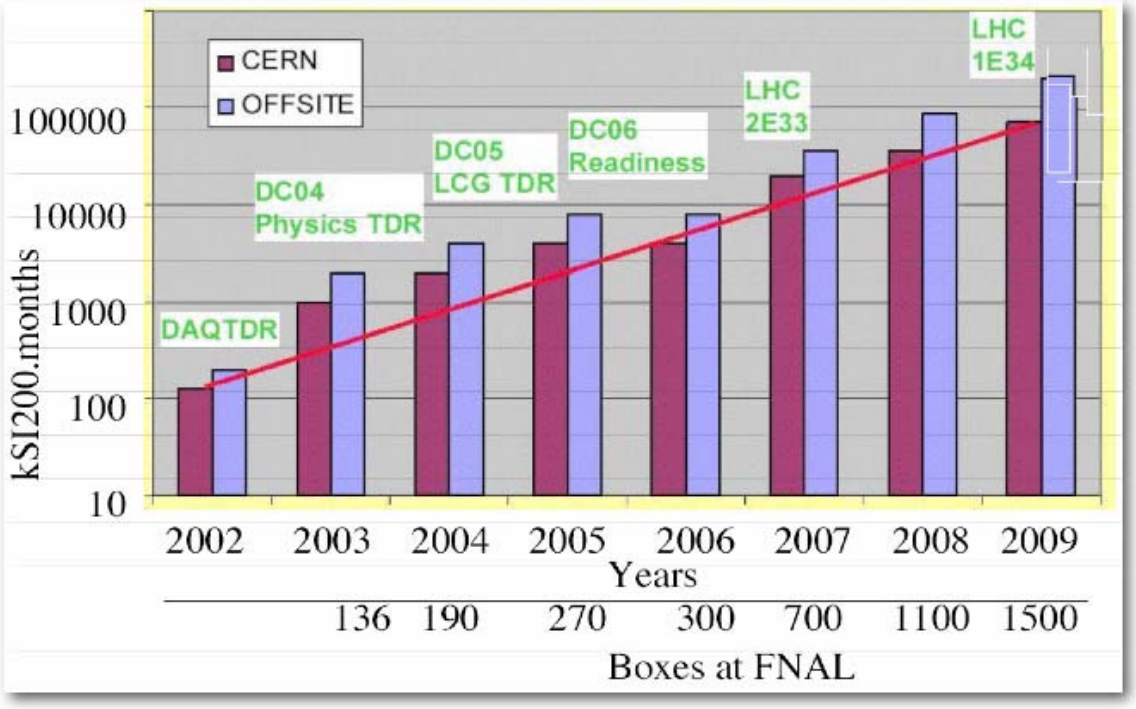
US-CMS Fermilab Tier-1 Activities

- Preparations for major milestones
  - DC04 Data Challenge and preparation for computing TDR
  - preparation for the Physics TDR
  - roll out of the LCG Grid service and federating it with the U.S. Grid facilities (Grid3)
- Develop the required Grid and Facilities infrastructure
  - increase the facility capacity through equipment upgrades, following the baseline plan
  - commission Grid capabilities through Grid3 and LCG-1 efforts
  - develop and integrate required functionalities and services
- Increase the capability of User Analysis Facility
  - improve how a physicists would use facilities and software
  - facilities and environment improvements
  - software releases, documentation, web presence etc

US-CMS Tier-1 Facility

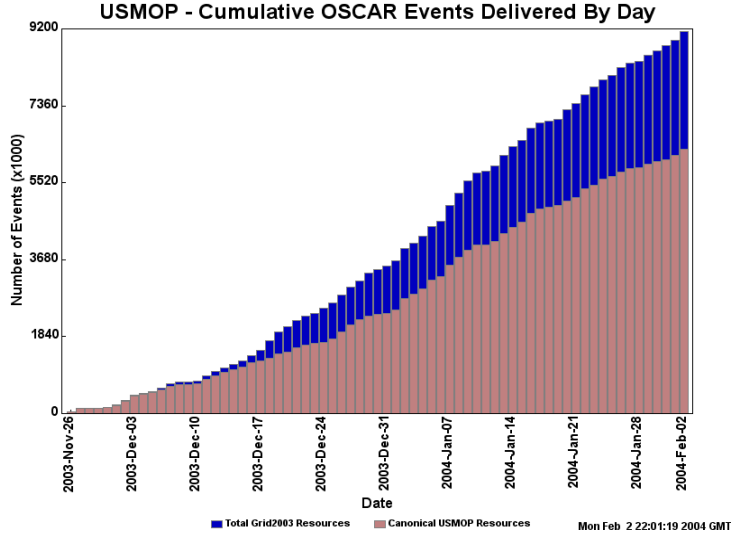
- Scaling up the Tier-1 equipment
  - On track for the baseline plan
  - preparation for DC04: U.S. share to CMS CPU, storage, data access
  - Planned procurement for next upgrades

	2002	2003
CPU	75	200
Storage	10 TB	34 TB
Throughput	200 MB/s	700 MB/s



Towards US Grid Infrastructure- Open Science Grid

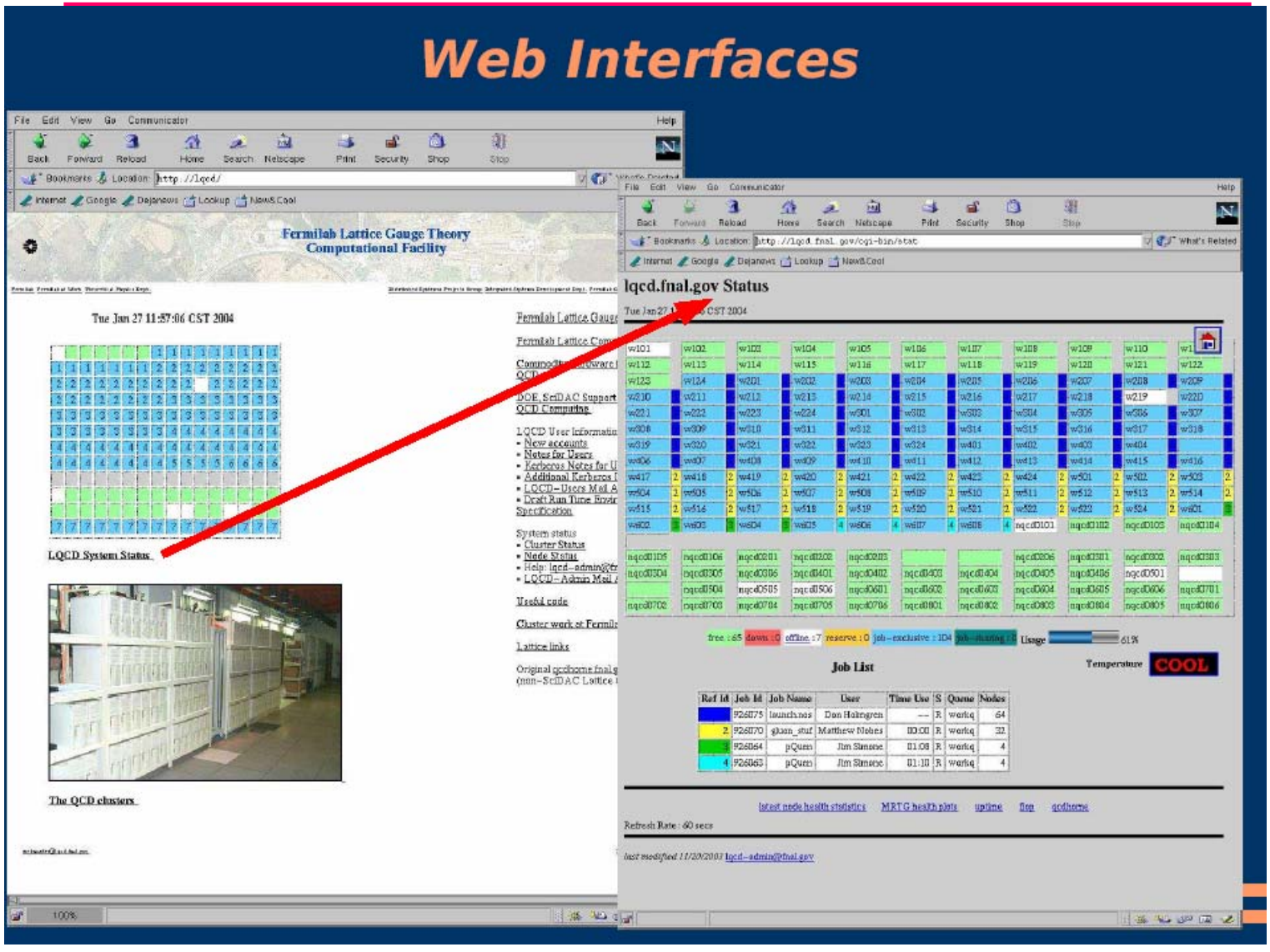
- Grid3 demonstrator for multi-organizational Grid environment
  - together with US Atlas, iVDGL, GriPhyN, PPDG, SDSS, LIGO
  - Fermilab and US LHC facilities available through shared Grid
  - Massive CMS production of simulated events and data movements
  - Hugely increase CPU resources available to CMS through opportunistic use, running on Grid3!



LHC Production Grids

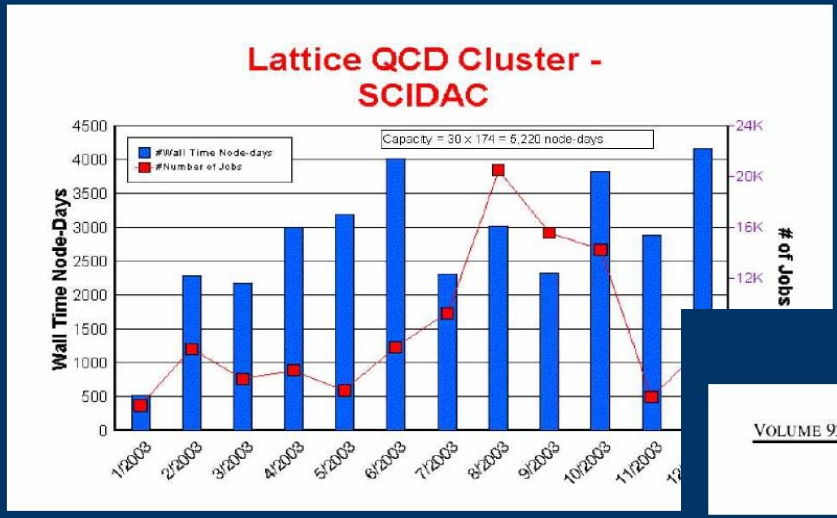
- Federating U.S. Grid resources with the LHC Grid through Grid3

Lattice QCD SciDAC Clusters



Lattice QCD – using clusters for physics results

Utilization



Physics Results


VOLUME 92, NUMBER 2 PHYSICAL REVIEW LETTERS week ending 16 JANUARY 2004

High-Precision Lattice QCD Confronts Experiment

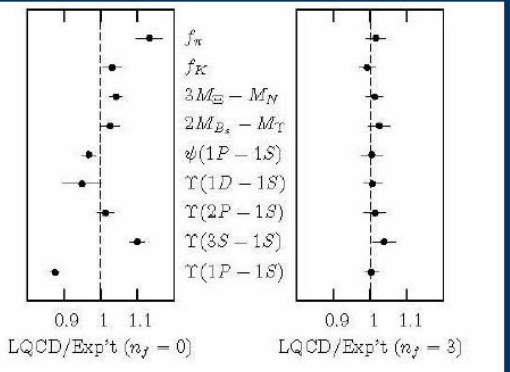
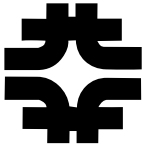


FIG. 1: LQCD results divided by experimental results for nine different quantities, without and with quark vacuum polarization (left and right panels, respectively). The top three results are from our $a = 1/11$ and $1/8$ fm simulations; all others are from $a = 1/8$ fm simulations.

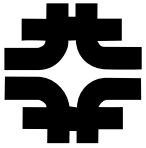
- Papers with data generated partially on FNAL clusters:
  - PRL Article: "High-Precision Lattice QCD Confronts Experiment"
    - 31 Citations according to SPIRES
    - Anticipate *Nature* article on this paper in early February
    - Discussed in *Science*, "Calculating the Incalcuable" 16 May 2003, 300, 1076.
  - Physics Today, Feb 2004, "Lattice Chromodynamics Comes of Age"



MINOS Computing contributions in

- Offline Software infrastructure
- Data handling (using SAM, dCache, Enstore)
- Databases development
- Control Room Logbook usage
- Near detector LAN installation
- System Support and installs

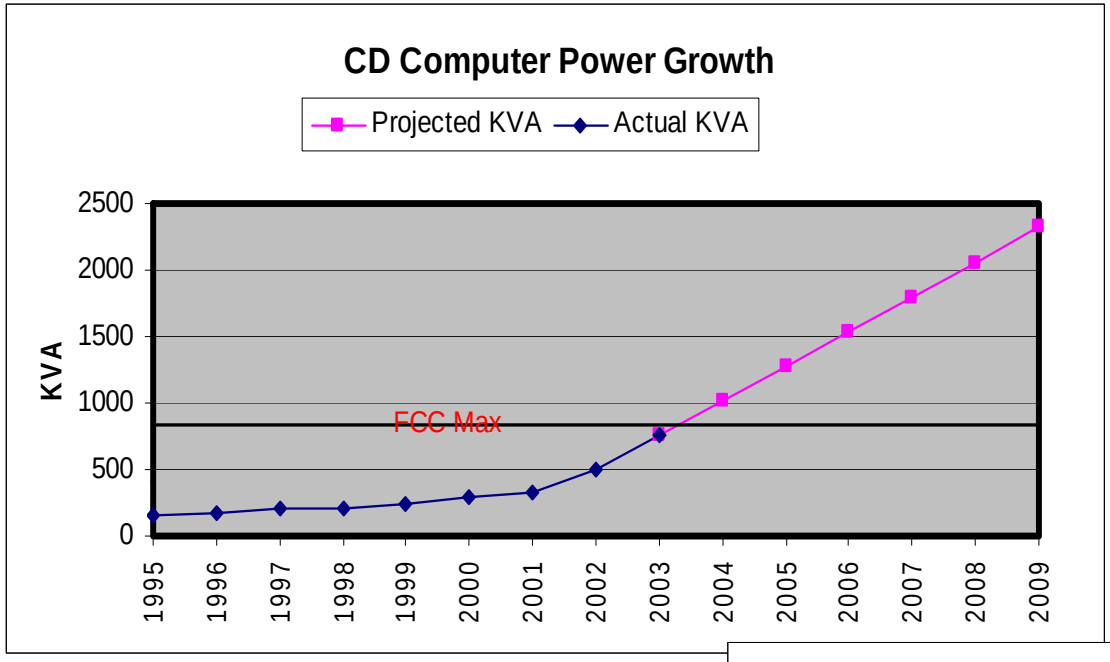
- (Use General Purpose Farms, FNALU, Common Storage System and services)

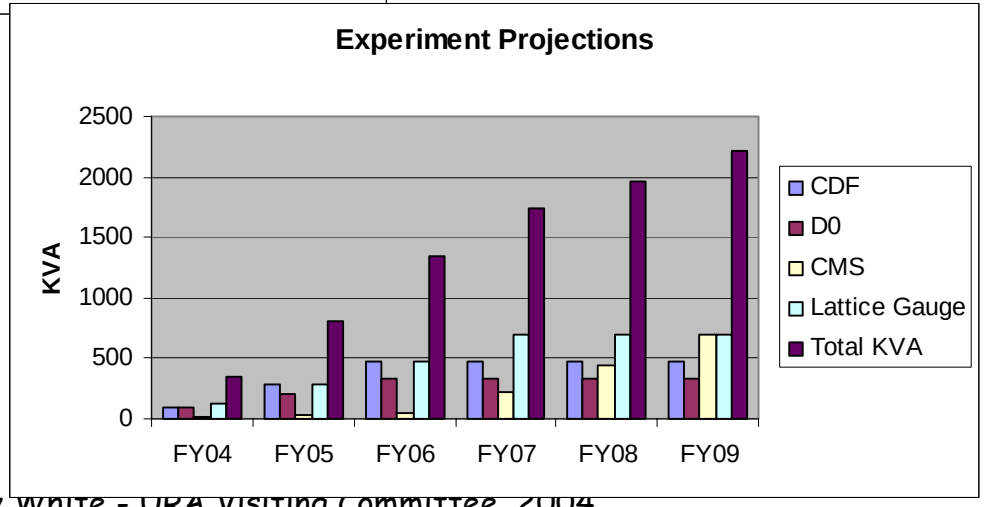


Computer Center(s)

- Feynman Center is out of power, cooling and space
  - Facility with Uninterruptible Power (UPS + Generator)
- Satellite facility for Lattice Gauge clusters
  - And soon CDF CAF Stage 4
  - Pre-fall Farms – part of Grid accessible Farm facilities for CMS, D0, CDF
- Heroic work by FESS, Directorate, CD staff to plan for and execute a project for re-use of experimental facility (formerly Wide Band).
  - Stage 1 of a High Density Computing Facility
  - Demolition and Construction starts April 5
- Massive power and cooling needs for Run II experiments and CMS. Even accounting for Grid computing and contributions to data processing worldwide for Run II

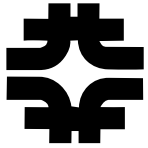
Historical Power Growth + Projected Total





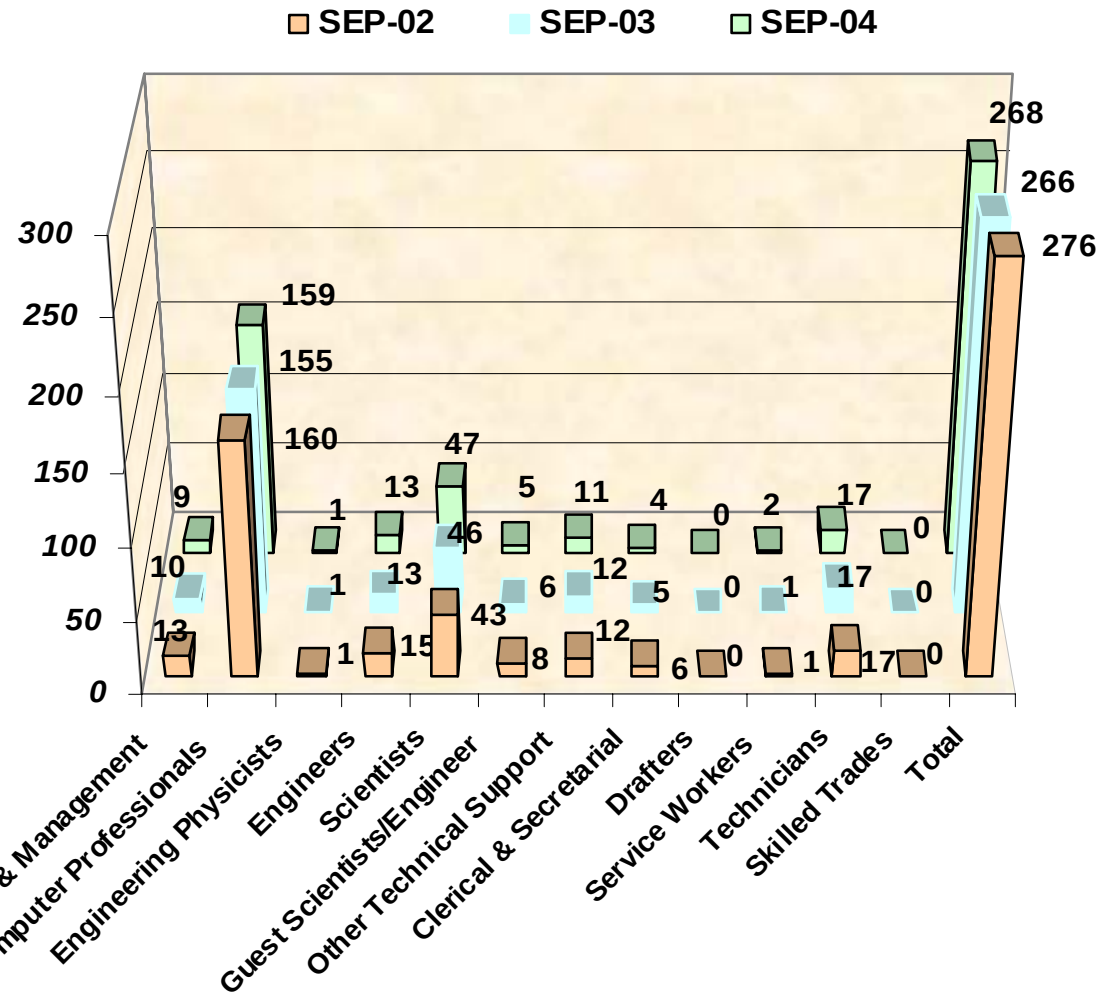
Conclusions

- CD is running flat out on all cylinders – with improved efficiency in operations
  - Taken on more tasks (e.g. Accelerator Support and modeling), SNAP R&D
  - US-CMS ramp up of Tier 1 facility and user support
  - To the point of being stretched very thin and hiring in targeted areas
- We worked safely – and received a trophy for 1Million hours worked without a lost time injury
- We continue to evolve and plan for transition
  - RunII era -> CMS era -> BTeV era
  - GRID computing, the Open Science Grid and our partnership in worlwide LHC Grid are important components of our strategy

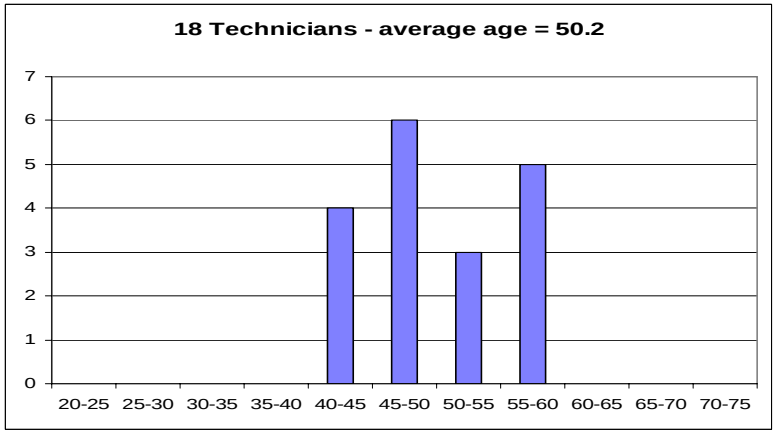


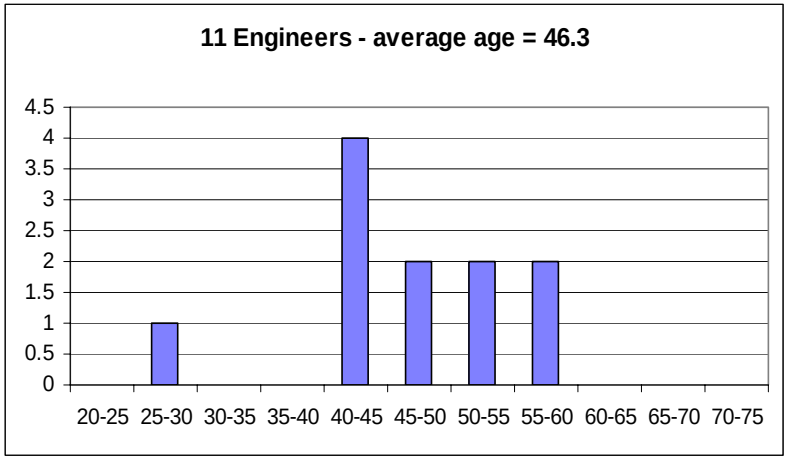
Extra Slides

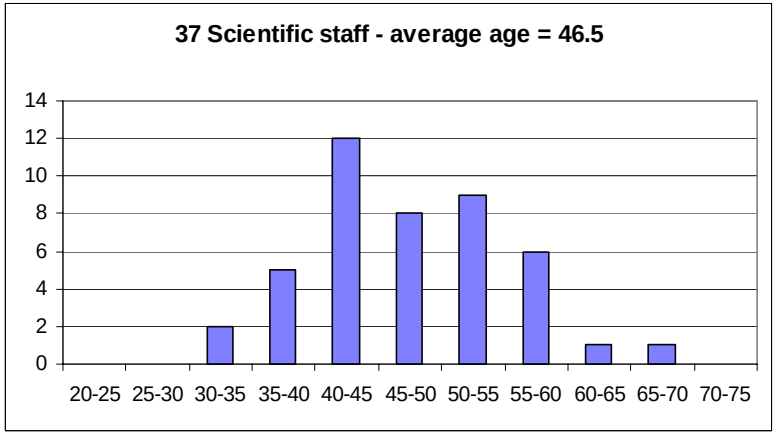
Job Categories – March 2004

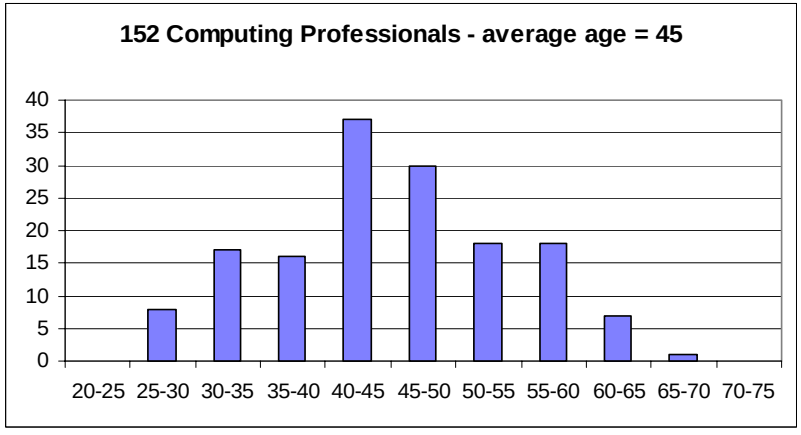


CD – ages of technical staff

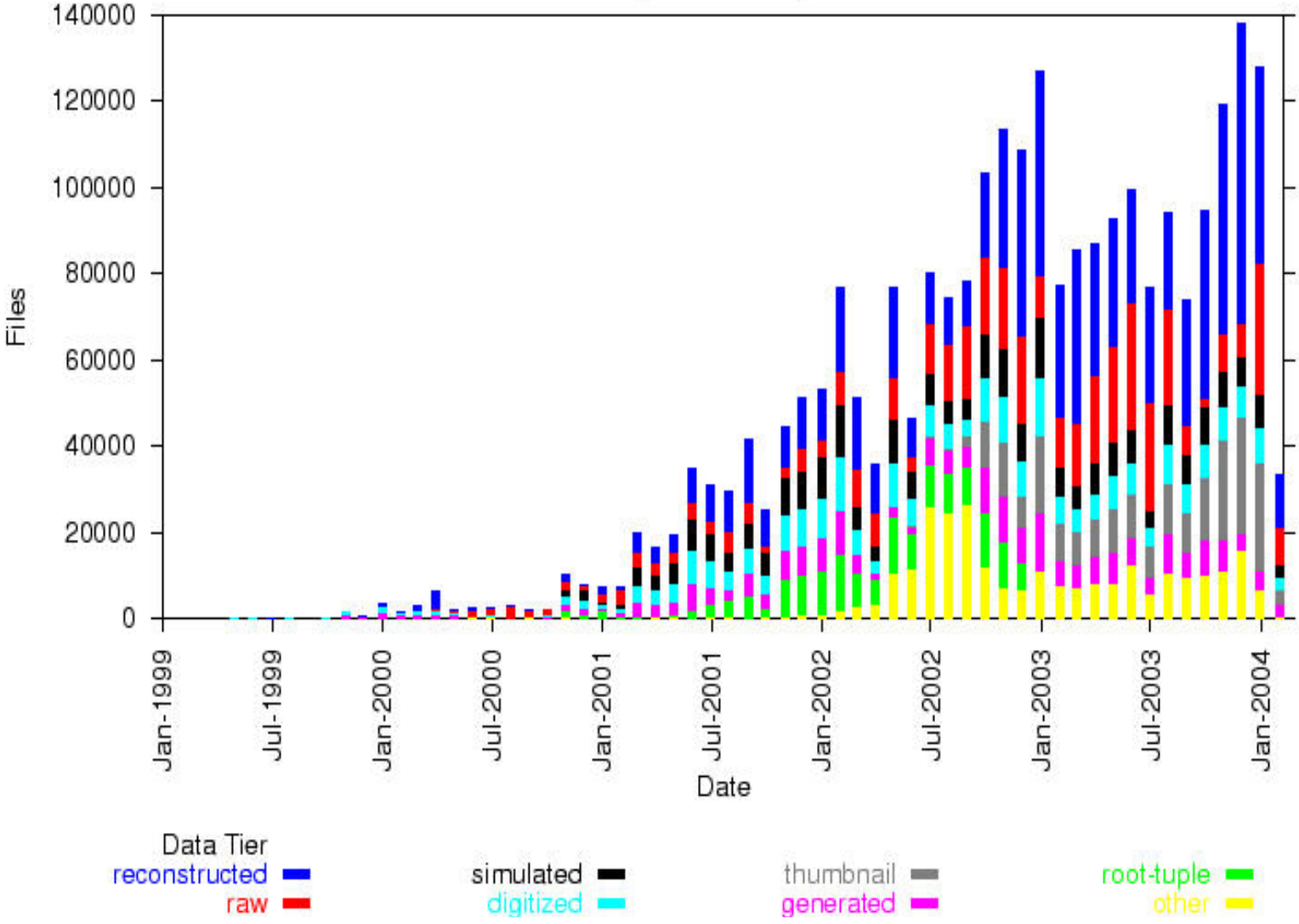








D0 SAM Files delivered



Experimental Astrophysics

- Sloan Digital Sky Survey (SDSS)
  - Started 5th year of operations
  - 2nd official data release in March
  - We operate the SDSS data processing systems, process imaging, spectroscopic data and design plug plates. Monitor DAQ. Survey strategy.
  - SDSS archive became a major component of a National Virtual Observatory
  - Grid Computing used for SDSS science analysis.
  - Terabyte Analysis Machine joined Grid3
  - EAG members active in many science discoveries
- JDEM/SNAP
  - Joined the SNAP collaboration
- Much more about all EAG activities in Kent's talk