



Computing Division

URA Visiting Committee Review

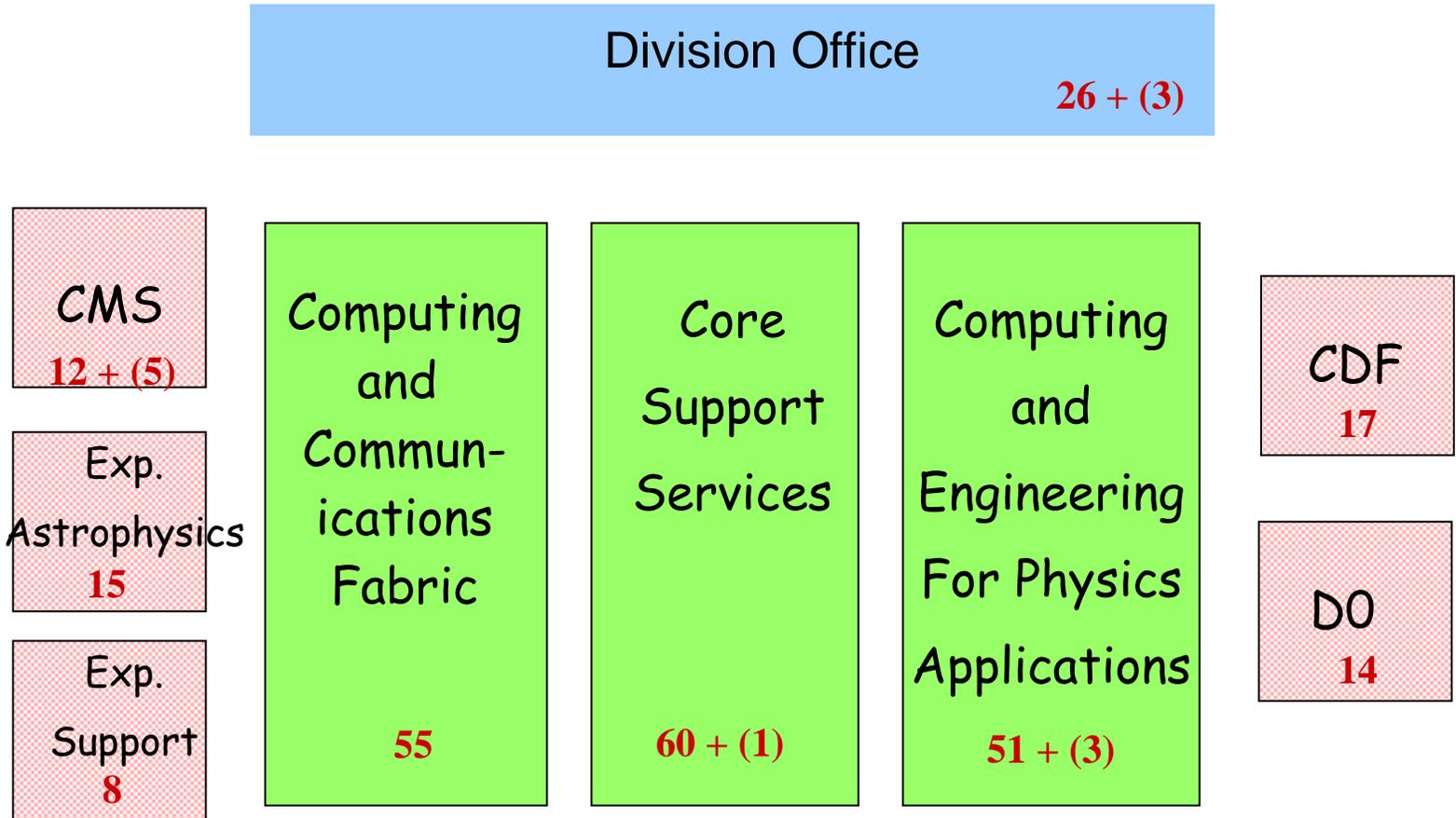
March 12, 2004

Vicky White

Head, Computing Division



Computing Division Organization

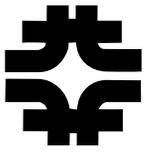


Scientists of all sorts, Engineers, Technical, Computing, Admin = 258 + (12) = 270

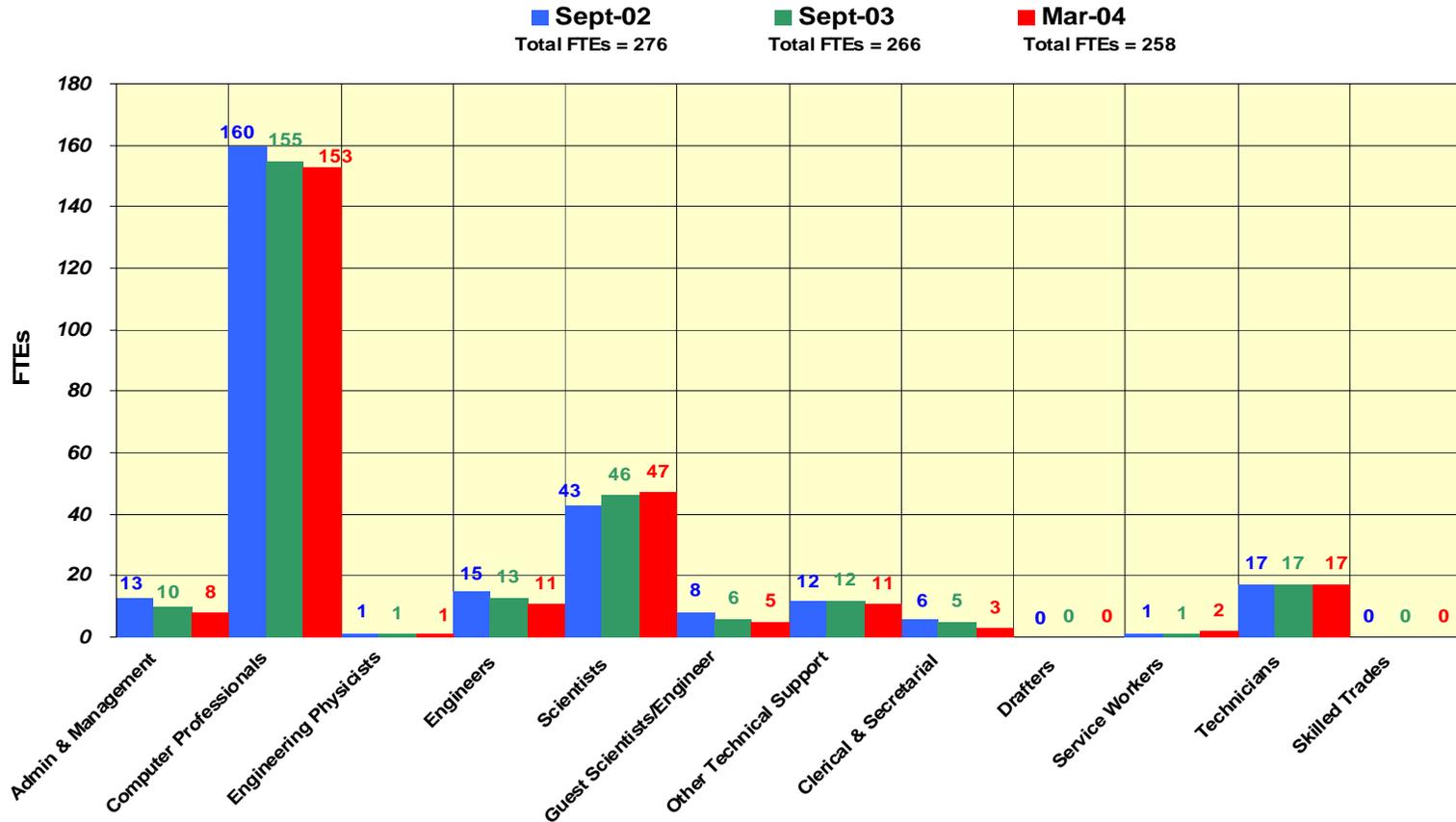


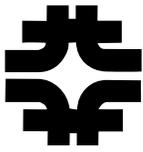
Five Activity Areas

- 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



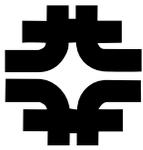
Some Common Services

Common Service	Customer/Stakeholder	Comments
Storage and Data movement and caching	CDF, DO, CMS, MINOS, Theory, SDSS, KTeV, all	Enstore - 1.5 Petabytes data ! dCache, SRM
Databases	CDF, DO, 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, DO, MINOS	Aligning with LHC
Simulation, MC and Analysis Tools	CDF, DO, CMS, MINOS, Fixed Target, Accel. Div.	Growing needs
Farms	All experiments	Moving to GRID
Engineering Support and R&D	CDF, DO, BTeV, JDEM, Accel. Div. Projects	Q outside our door

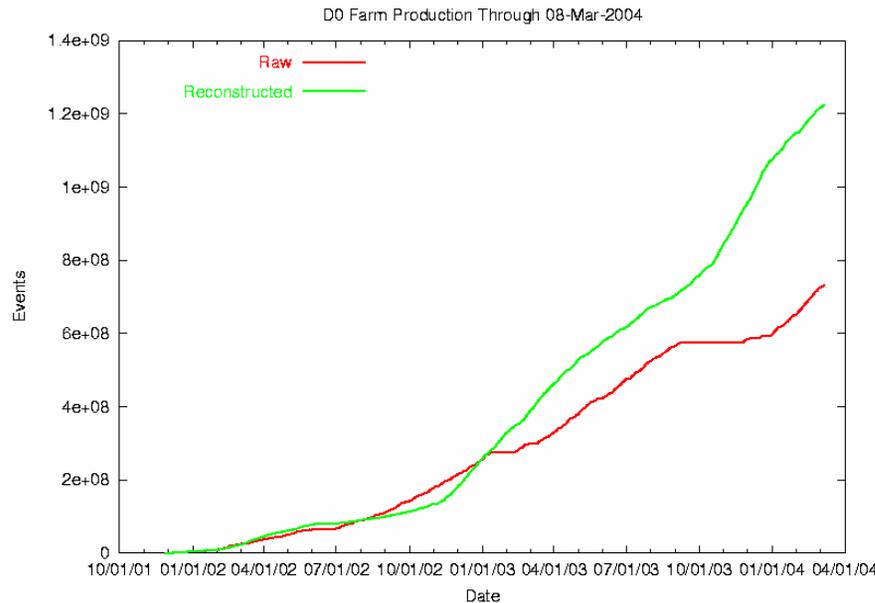


Run II Computing

- 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
 - ESNNet working with us on Metropolitan Area Network between ANL, Fermilab and Starlight



DO 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

DZero



SFU campus on Sansby Mountain, Vancouver



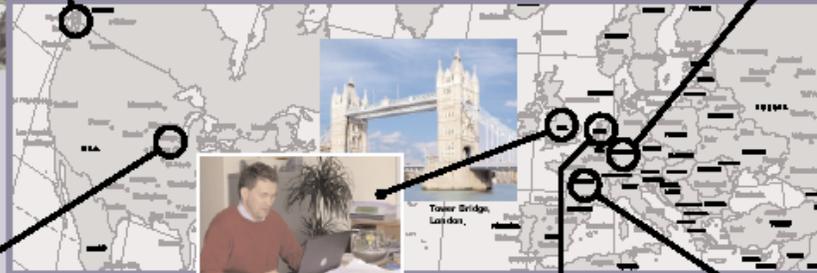
"You can't make the Grid work without motivation. It's one thing to have a vision, and it is another thing to stay up to three in the morning to make things work because they need to get done. DZero is a real application. We need to get the physics results out."
— Dugan O'Neil, Simon Fraser University, Canada



Wuppertal's landmark, the suspension railway



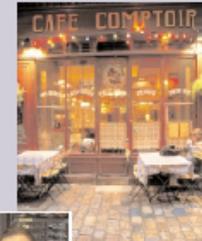
"In the past, particle physics collaborations have used remote computing sites to carry out Monte Carlo simulations. We are now one of the first experiments to process real data at remote sites. The effort has opened up many new computing resources. The evaluation of our experience will provide valuable input to the Grid development."
— Daniel Wicke, University of Wuppertal, Germany



Tower Bridge, London



"The machines at Imperial College, for example, are shared across the whole college, so it takes grid software to keep it all running smoothly."
— Gavin Davies, Imperial College London, UK



Street scene in Lyon



"With the SAM software developed by the Fermilab Computing Division and DZero, a user doesn't know whether the data is stored on tape or on disk, whether it is located at Fermilab or at Karlsruhe."
— Wyatt Stewart (left), with Mike Daburg and Amber Boehnlein, Fermilab, U.S.A.



Chicago skyline



"We've participated in large-scale Monte Carlo production in the past, but data reprocessing involves large volumes of data to be transferred in both directions on a scale that was simply unthinkable a few years ago. It will open new possibilities that we are only beginning to explore."
— Patrice Lebun (right), with Tibor Kurca, CCIN2P3, Lyon, France



Amsterdam, famous for its canals



"The re-processing was a major milestone for DZero. For us it is also important that we have been able to show that we can really use the LHC Computing Grid for DZero processing. We saw jobs submitted from Wuppertal being executed on our CPUs, and we executed jobs in Karlsruhe, at Rutherford Appleton Laboratory and a few more places."
— Kees Bos (front row, second from left) and the Scientific Computing team at NIKHEF, Amsterdam, Netherlands



D0 Computing

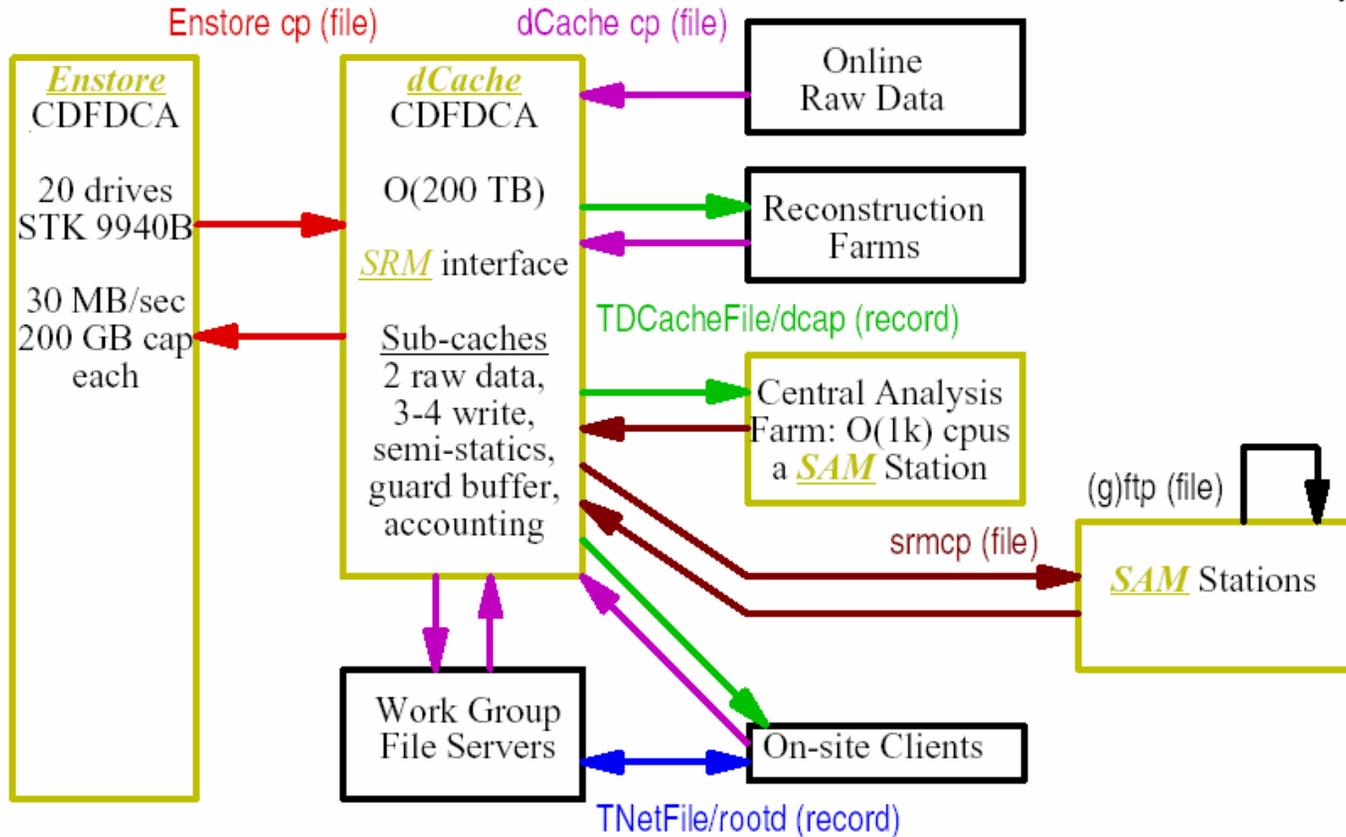
- Central SGI processor being phased out
 - Successful linux farm analysis processing on CAB
- In a typical week analyze 50 TB of data on the analysis systems, corresponding to 1.2 Billion events
 - Wait times for delivery to caches from central Enstore storage system typically small compared to the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



CDF Computing

CDF DH Baseline Goal FY2004

CDF Run II DH Project Status
Robert D. Kennedy
10 Dec 2003
page 4

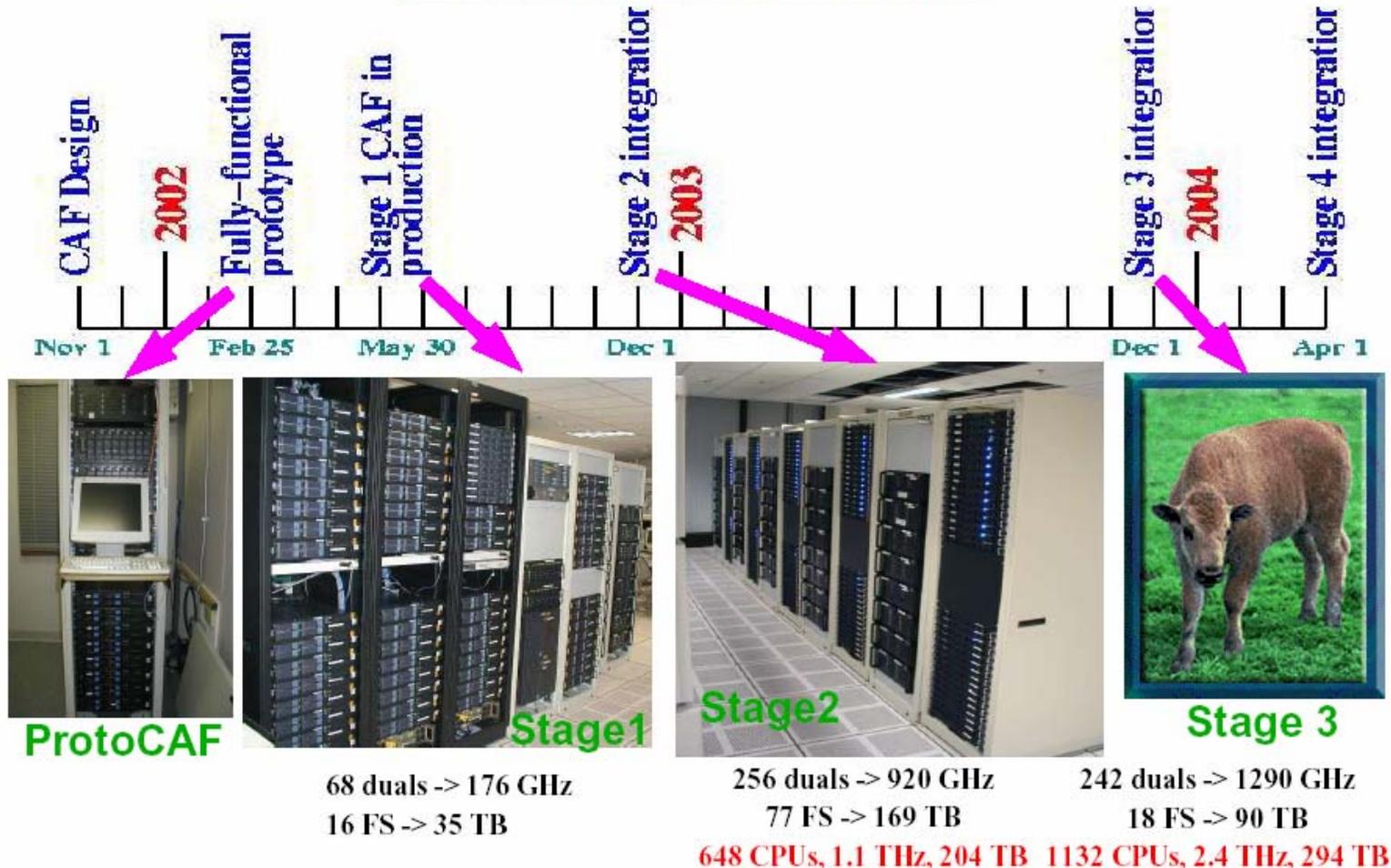


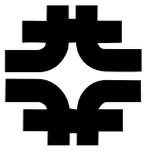
Underlying Meta-data: PNFS (Enstore/dCache) and SAM meta-data



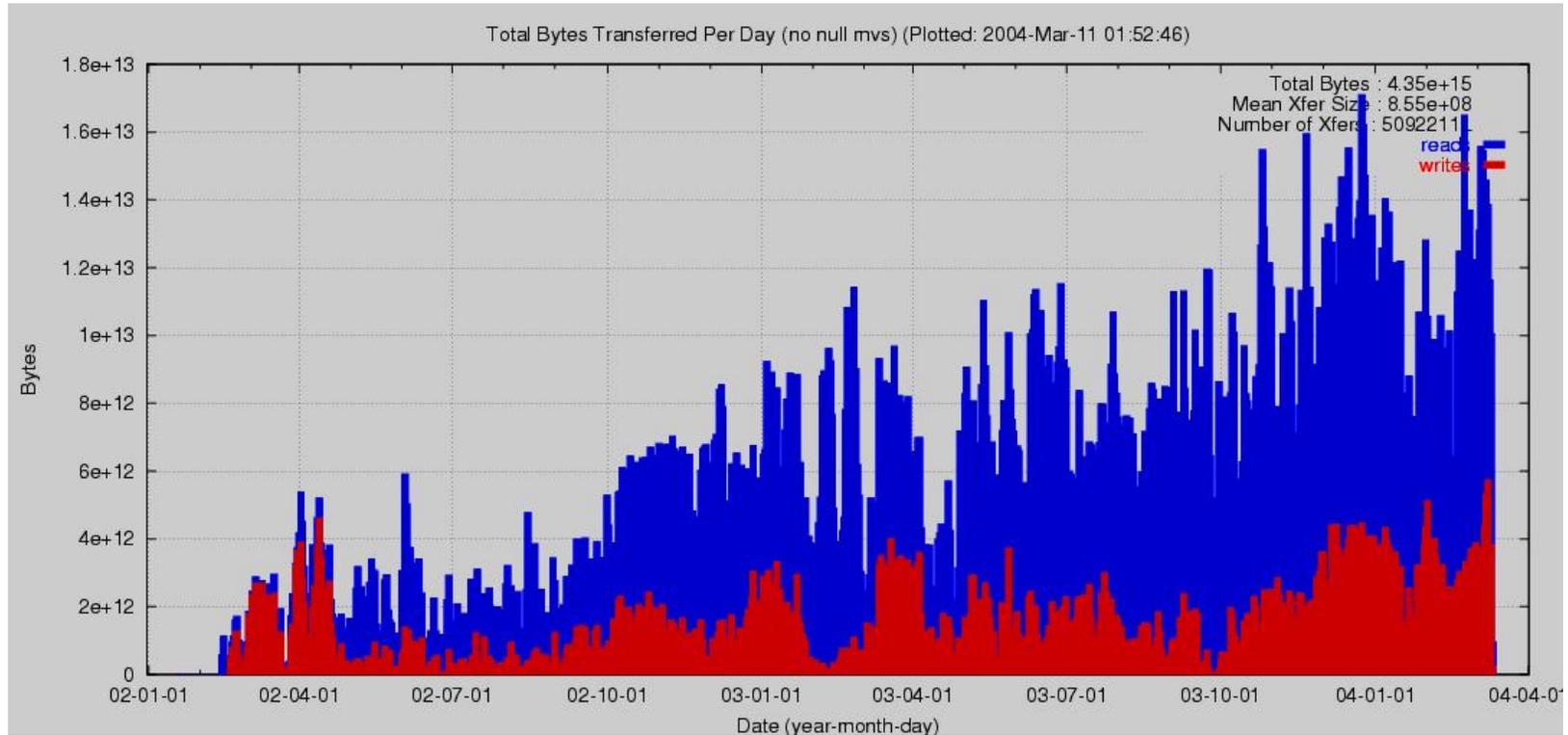
Building a CDF analysis facility (CAF)

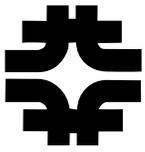
CAF Milestones



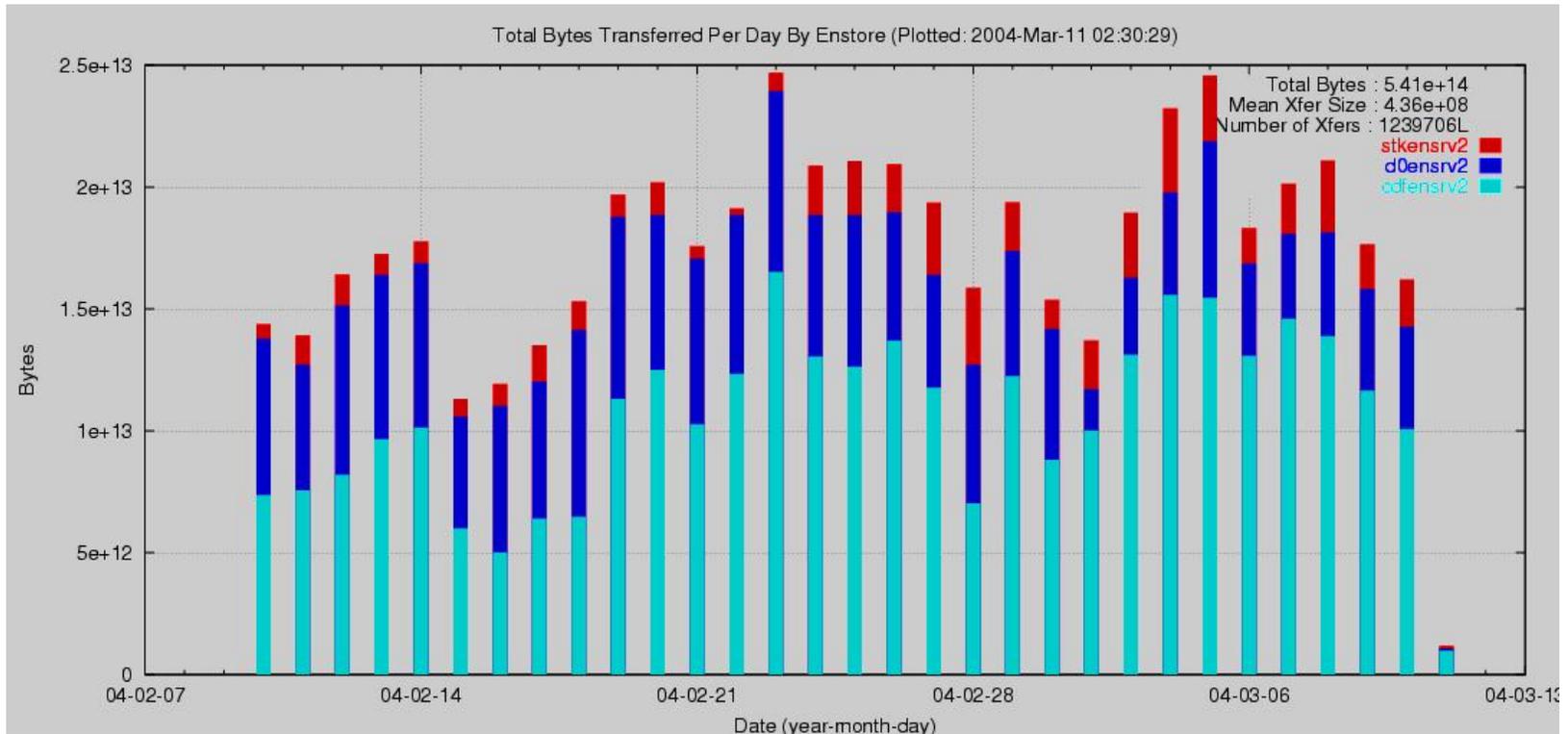


CDF Enstore Bytes/day transferred





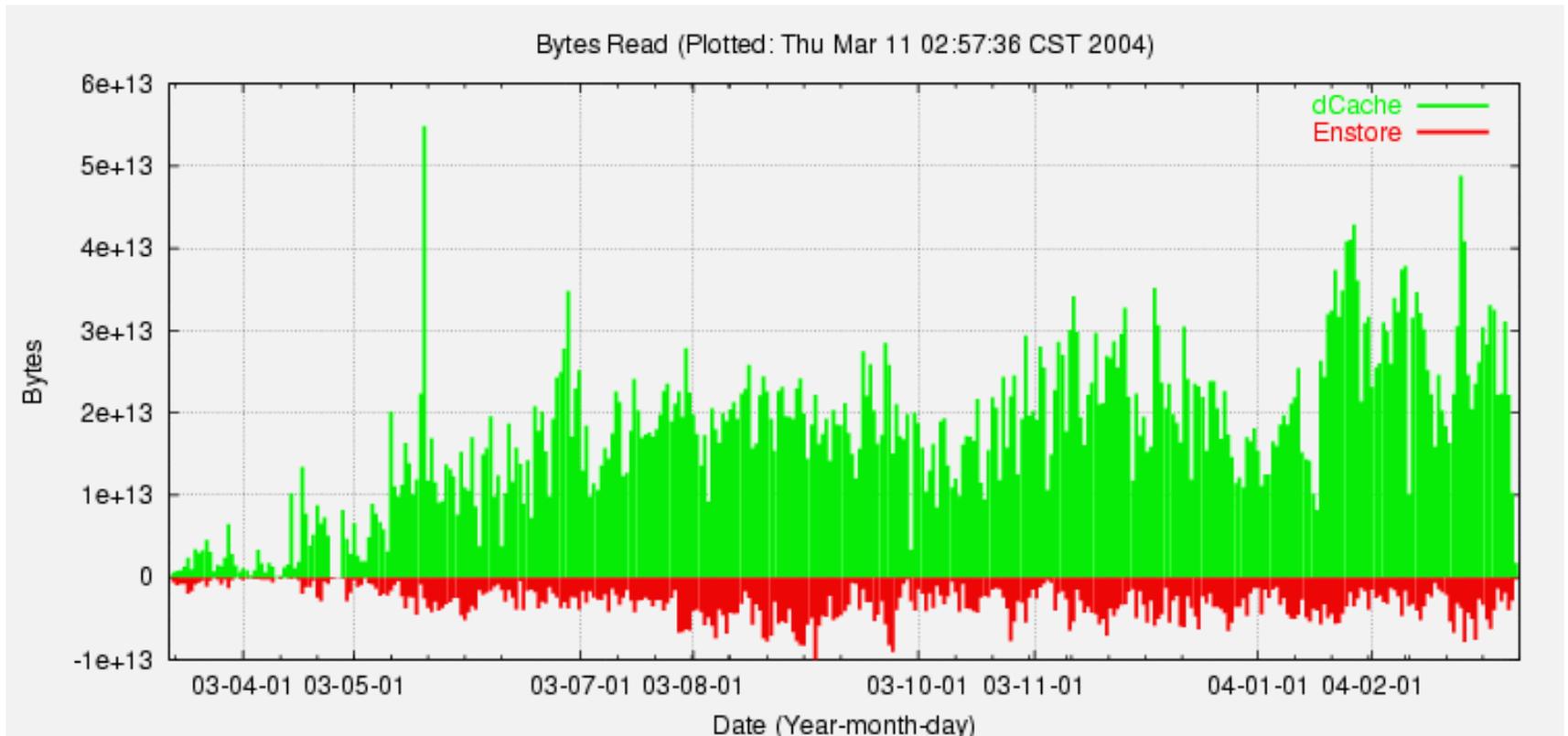
Total Lab bytes/day - Enstore

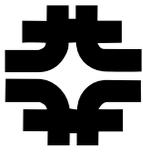


25 Terabytes
per day!



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



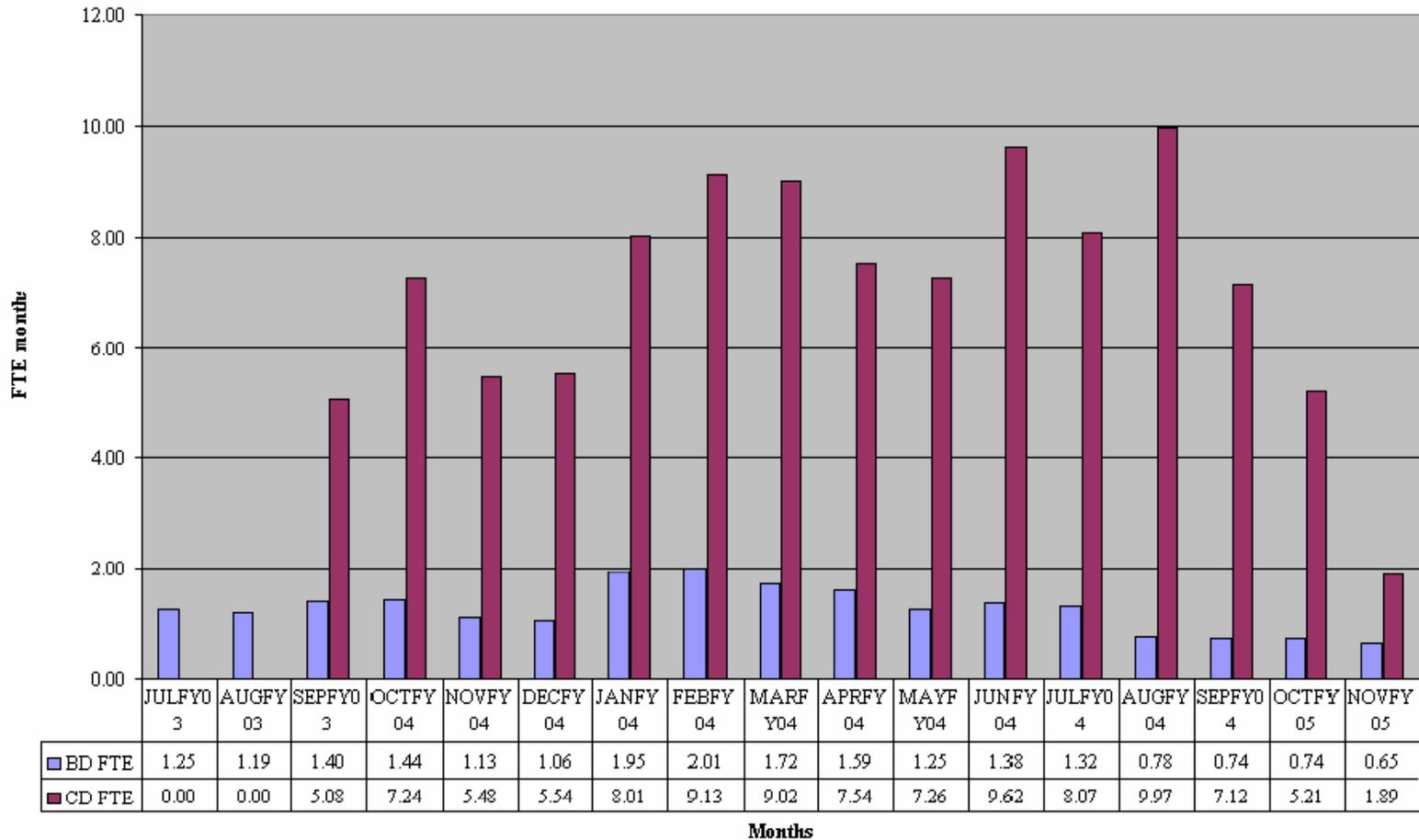
Tev BPM Project will deliver

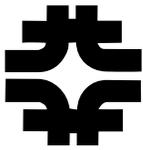
- All new electronics.
- Front-end software.
- Data to the online/controls system.
- Applications to use the new data.
- The pickups in the accelerator will not be modified!





Joint CD/AD project





US-CMS Fermilab Tier-1 Activities

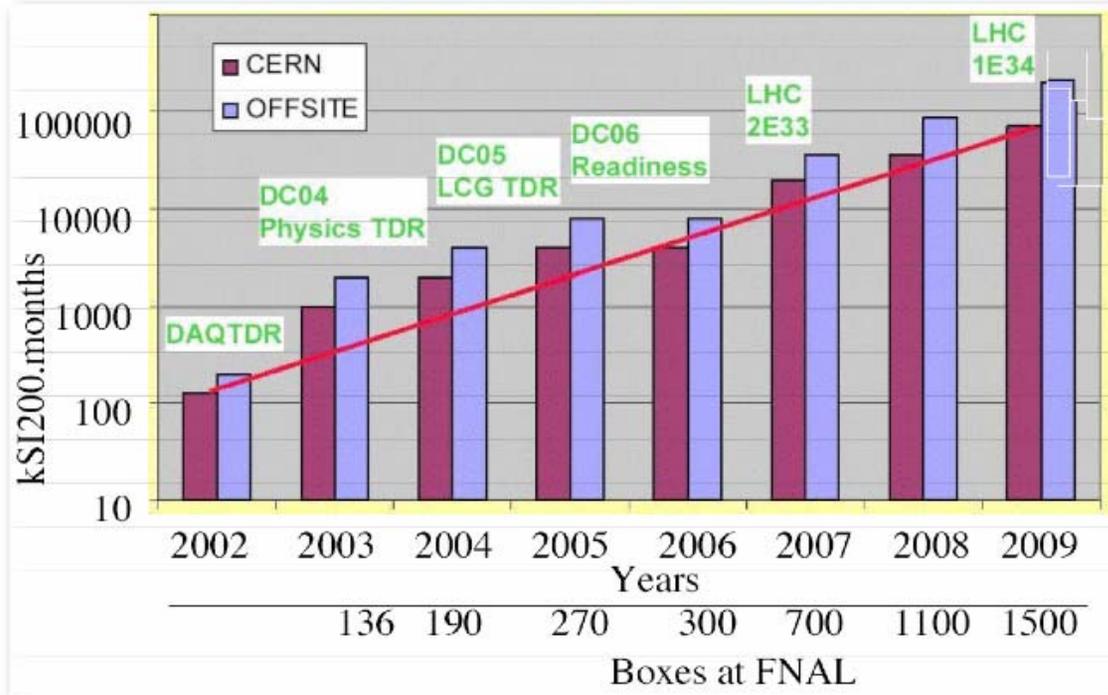
- Preparations for major milestones
 - DC04 Data Challenge and preparation for computing TDR
 - preparation for the Physics TDR
 - roll out of the LCG Grid service and federating it with the U.S. Grid facilities (Grid3)
- Develop the required Grid and Facilities infrastructure
 - increase the facility 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

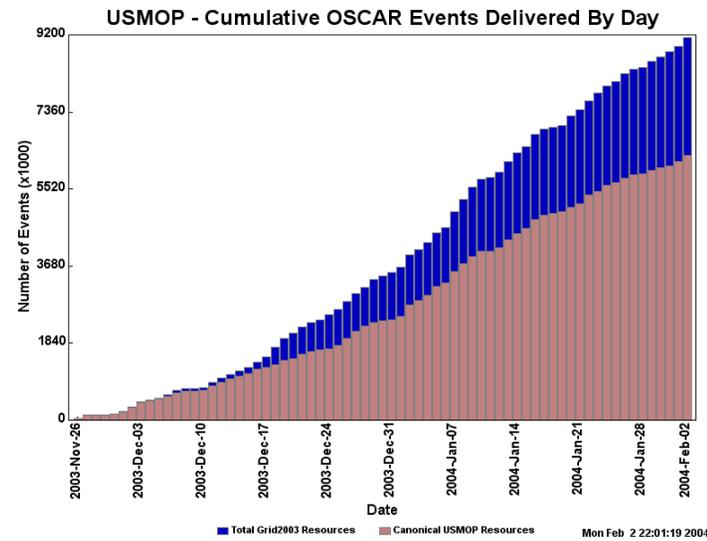
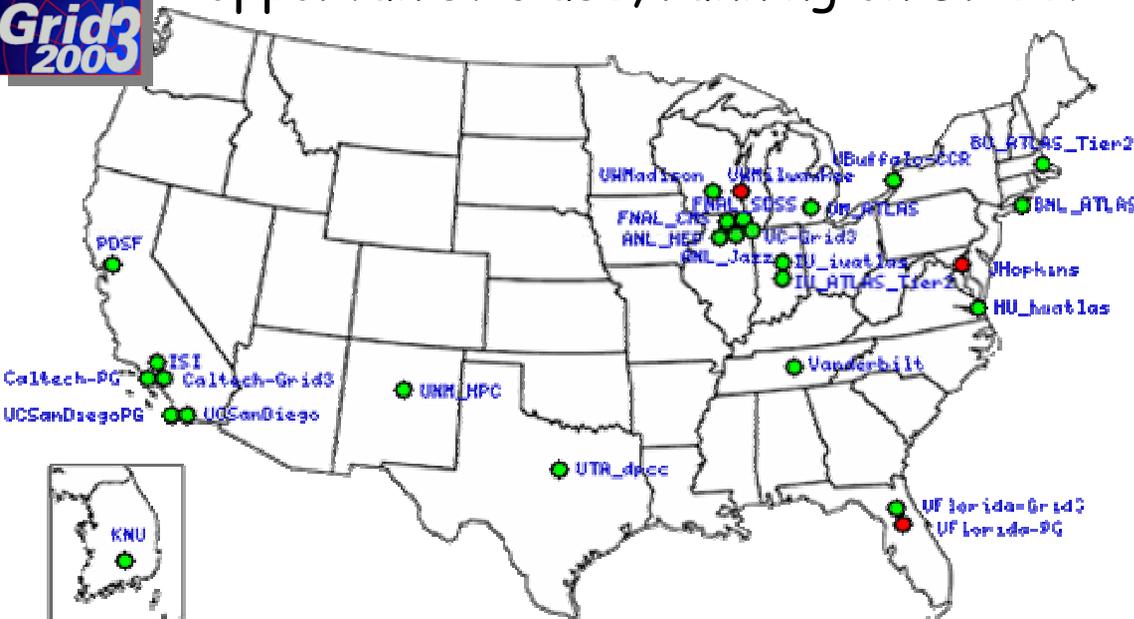
	2002	2003
CPU	75	200
Storage	10 TB	34 TB
Throughput	200 MB/s	700 MB/s

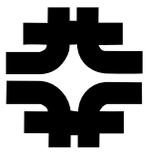




Towards US Grid Infrastructure- Open Science Grid

- 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

Web Interfaces

The screenshot shows a web browser window displaying the Fermilab Lattice Gauge Theory Computational Facility website. The page is titled "Fermilab Lattice Gauge Theory Computational Facility" and shows a grid of server status indicators. A red arrow points from the "LQCD System Status" link to the "lqcd.fnal.gov Status" page. The "lqcd.fnal.gov Status" page displays a detailed grid of server status indicators, including a "Job List" table.

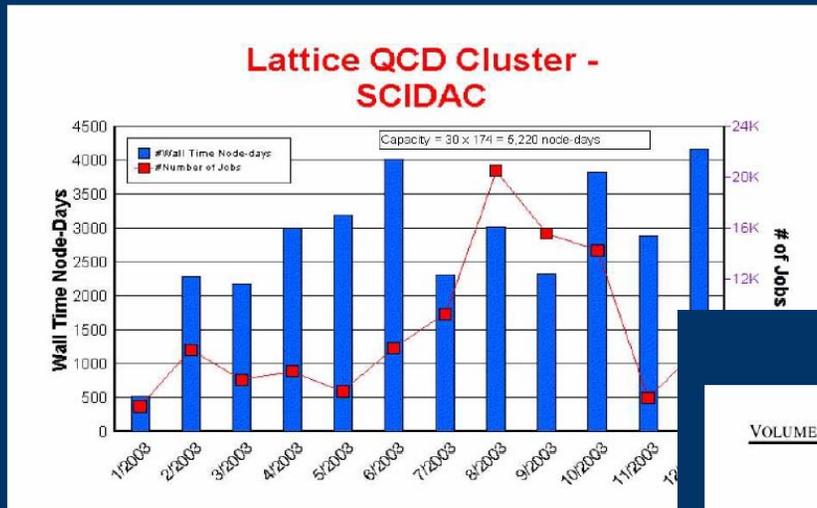
Job List

Ref Id	Job Id	Job Name	User	Time Use	S	Queue	Nodes
926075	launch_noz	Don Hoisingren	---	R	workq	64	
926070	gkaan_staf	Matthews Nobles	DD:00	R	workq	32	
926064	pQueen	Jim Stamer	01:08	R	workq	4	
926063	pQueen	Jim Stamer	01:10	R	workq	4	



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

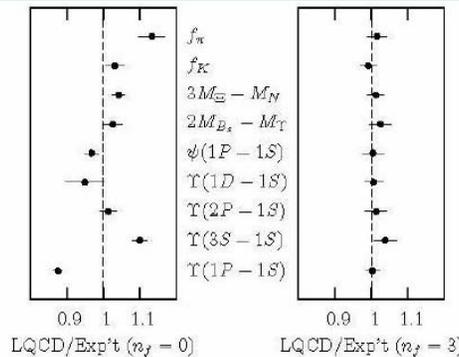


FIG. 1: LQCD results divided by experimental results for nine different quantities, without and with quark vacuum polarization (left and right panels, respectively). The top three results are from our $a = 1/11$ and $1/8$ fm simulations; all others are from $a = 1/8$ fm simulations.

- 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 Incalculable" 16 May 2003, 300, 1076.
 - Physics Today, Feb 2004, "Lattice Chromodynamics Comes of Age"



MINOS Computing contributions in

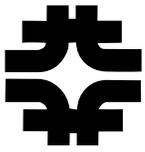
- Offline Software infrastructure
- Data handling (using SAM, dCache, Enstore)
- Databases development
- Control Room Logbook usage
- Near detector LAN installation
- System Support and installs

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

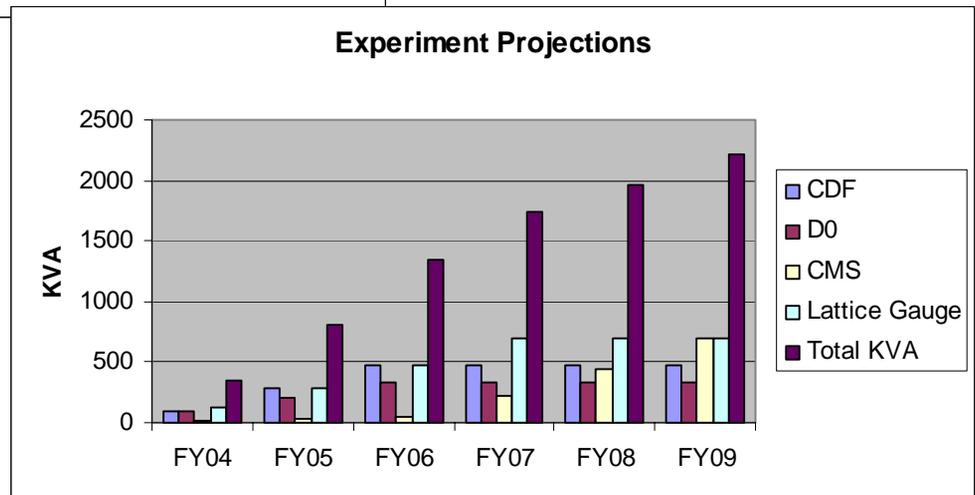
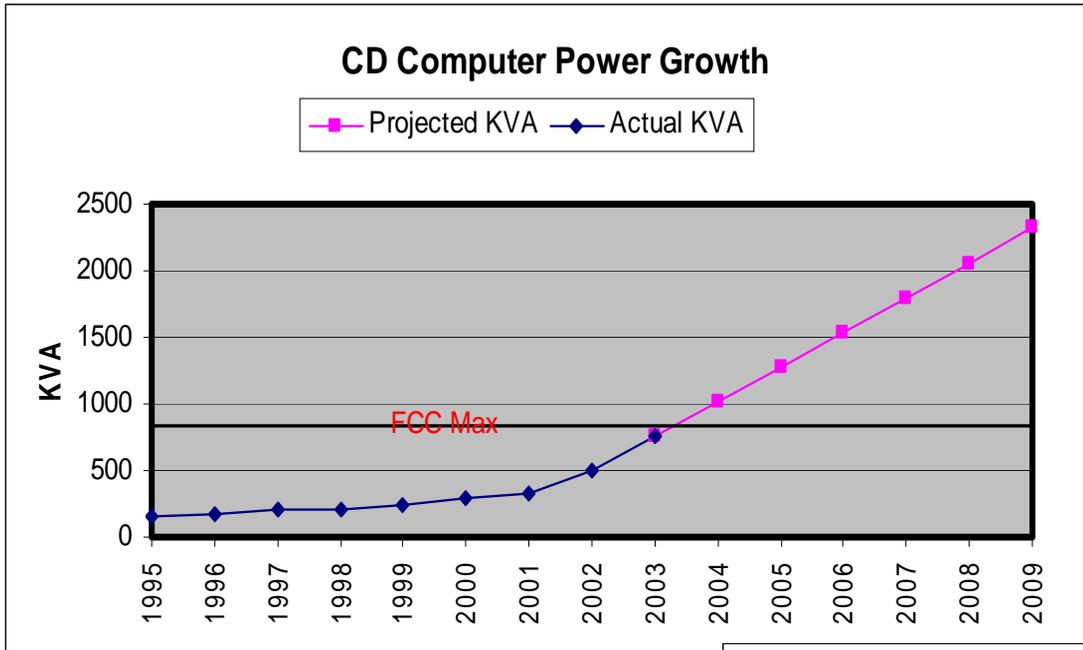


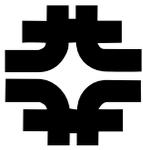
Computer Center(s)

- 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



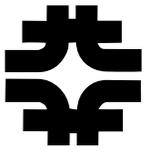
Historical Power Growth + Projected Total



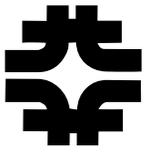


Conclusions

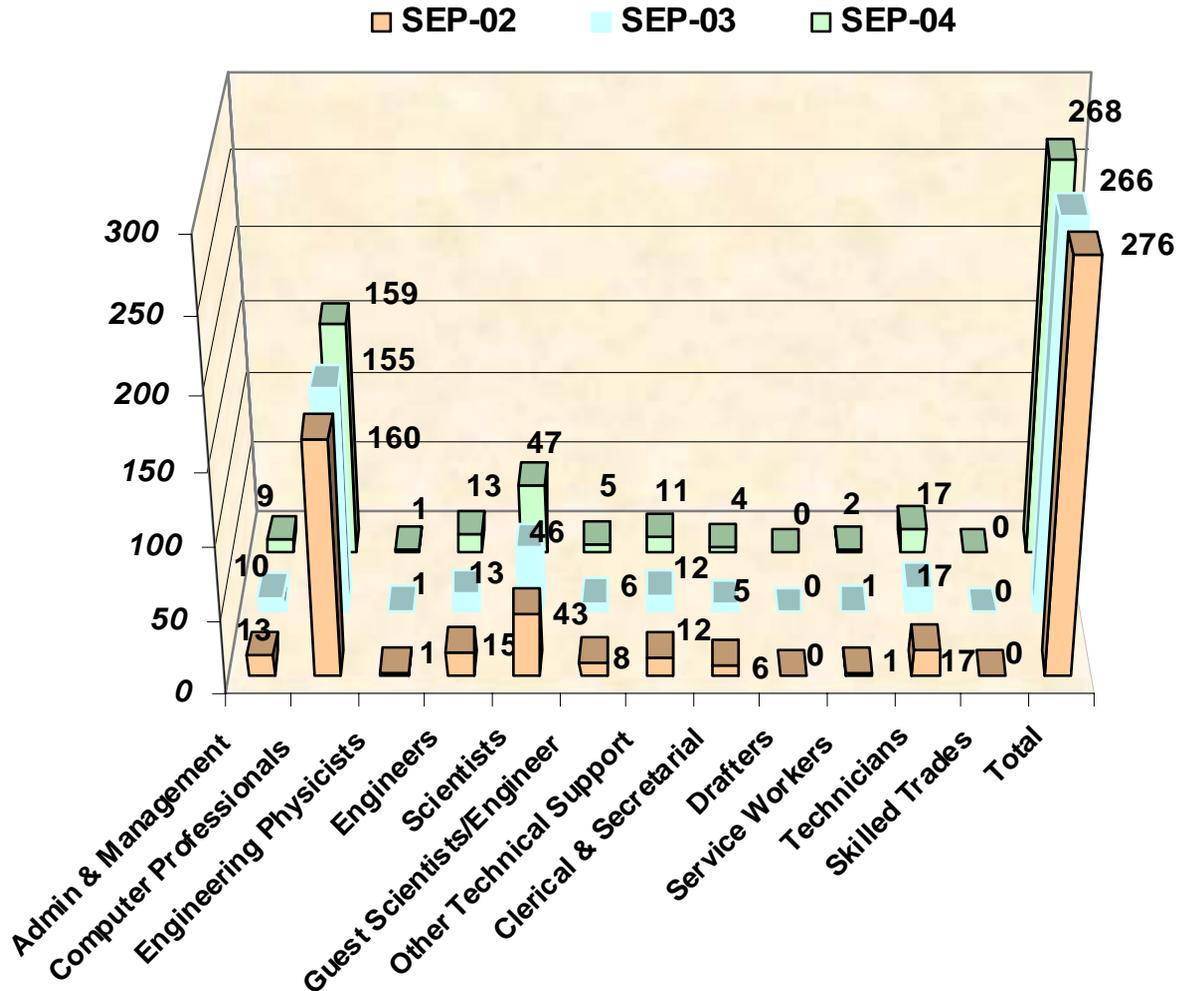
- CD is running flat out on all cylinders - with improved efficiency in operations
 - Taken on more tasks (e.g. Accelerator Support and modeling), SNAP R&D
 - US-CMS ramp up of Tier 1 facility and user support
 - To the point of being stretched very thin and hiring in targeted areas
- We worked safely - 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 worldwide LHC Grid are important components of our strategy

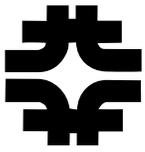


Extra Slides

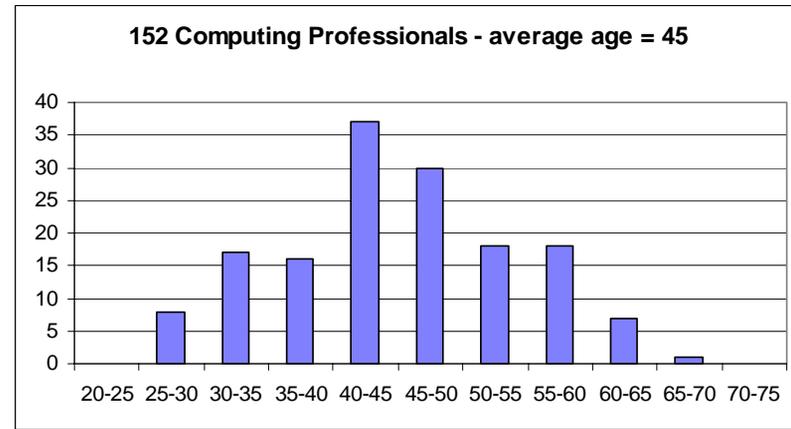
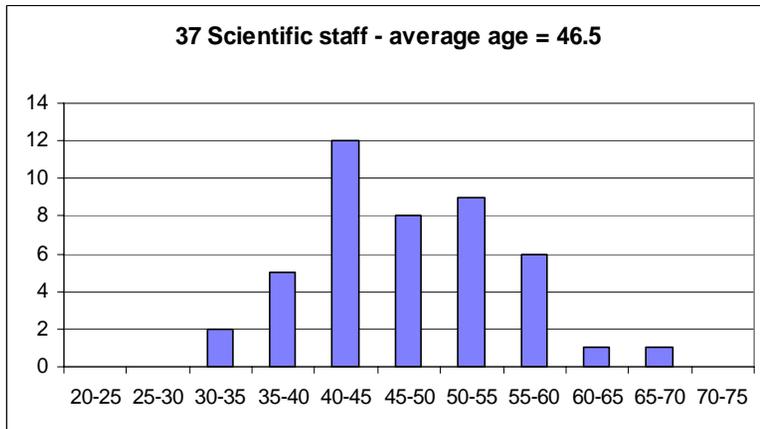
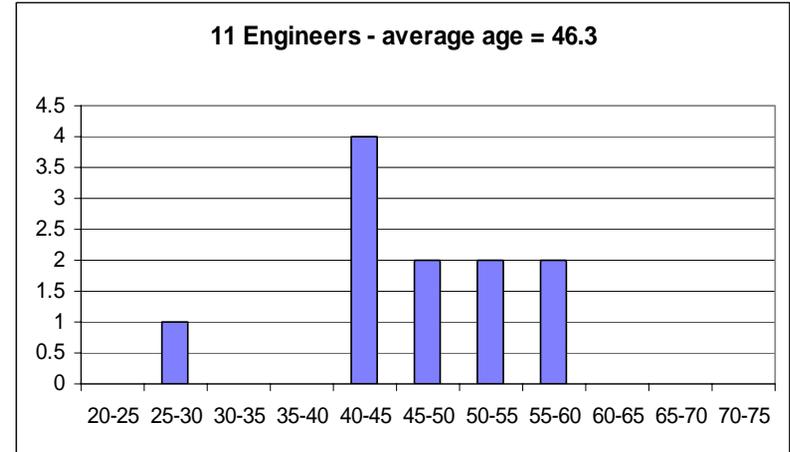
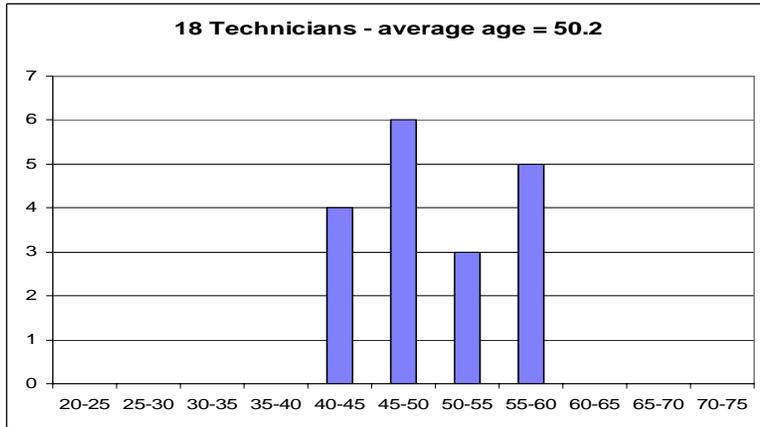


Job Categories - March 2004



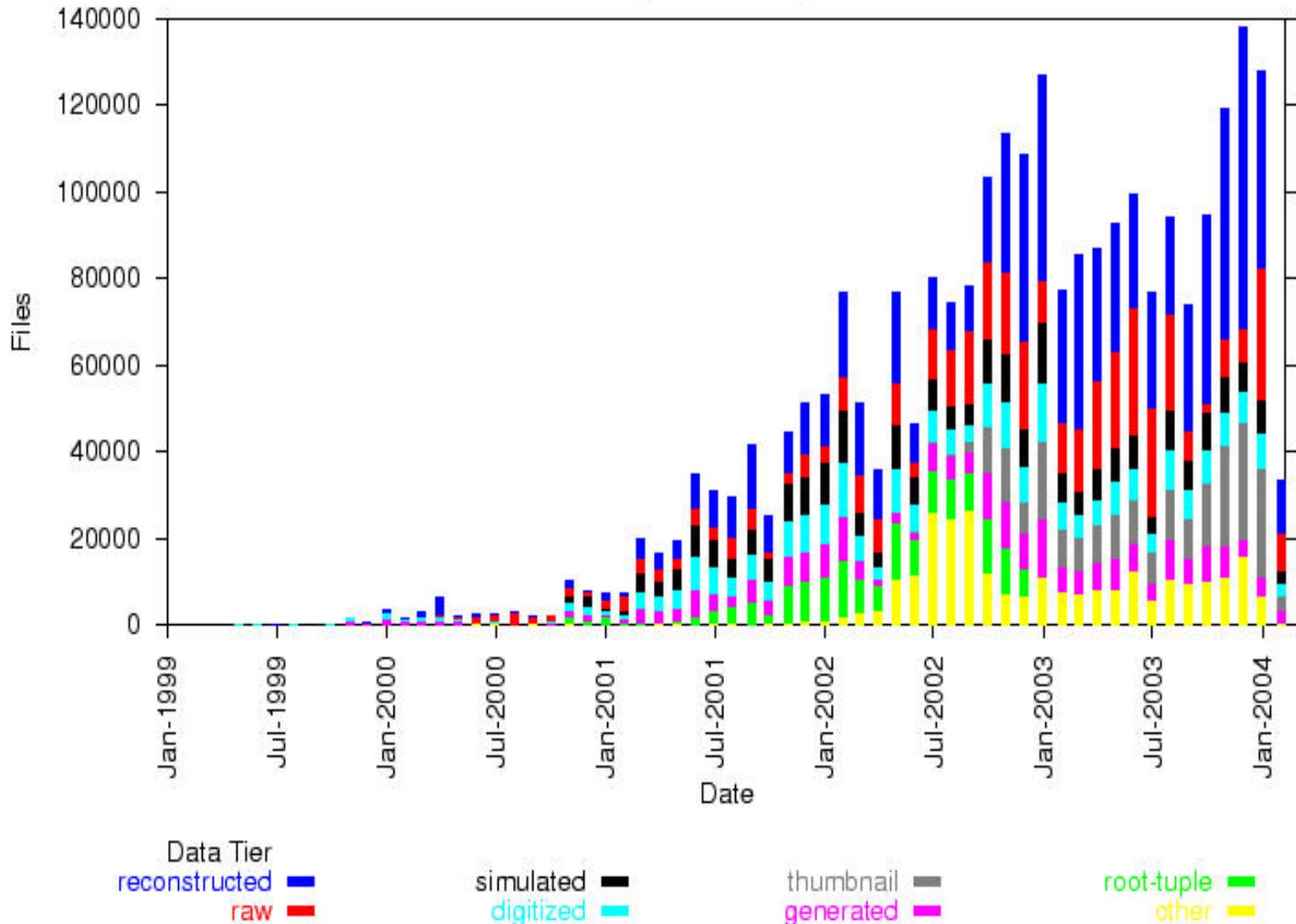


CD - ages of technical staff





DO 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