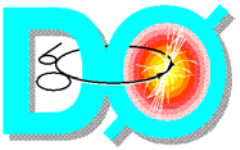


Run II Computing

Amber Boehnlein
FNAL/CD

For CDF and DO collaborations

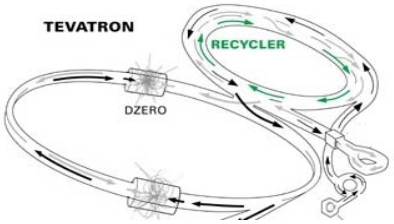
September 27, 2004

Computing Model

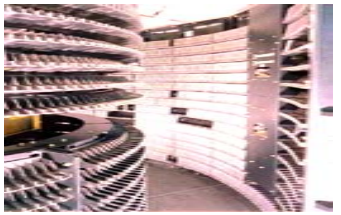
Remote Farms

Central Farms

Raw Data
RECO Data
RECO MC
User Data



Data Handling System

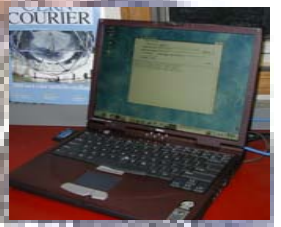


Central
Robotic Storage

Remote Analysis
Systems

Central Analysis
Systems

User
Desktops



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Vital Statistics

Vital Statistics	CDF	DO
Raw Data Size (kbytes/event)	205	250-300
Reconstructed Data Size (kbytes/event)	180	200
Primary User data (kbytes/event)	N/A	30 (60)
User Skims	DST	TMB
User Skims(kbytes/event)	25-180	20-40
Reconstruction Time (Gh-sec/event)	10	50
Monte Carlo Chain	fast	full Geant
Peak Data Rate(Hz)	75(+)	50(+)
Persistent format	RootIO	DOom/dspack

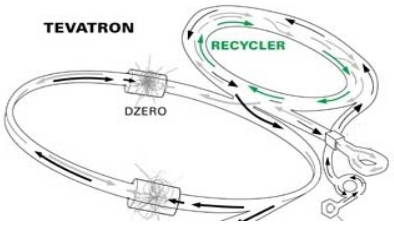
Both collaborations continue to evaluate and evolve data formats in response to analysis needs and computing constraints

Computing Model

Remote Farms

Central Farms

Raw Data
RECO Data
RECO MC
User Data



Data Handling System

Central
Robotic Storage

Remote Analysis Systems

Central Analysis Systems

User Desktops

Amber Boehnlein, FNAL

SAM data handling

- Flagship CD-Tevatron Joint project—initial design work ~7 years ago.
- Provides global access to DO and CDF data
  - Comprehensive meta-data to describe collider and Monte Carlo data.
  - Consistent user interface via command line and web
  - Local and wide area data transport
  - Caching layer
  - Batch adapter support (PBS, Condor, FBS, lsf…)
  - Optimization knobs in place-designed for 2 fb^{-1} by 2003
- Stable SAM operations allows for global support and additional development
  - Schema and DBserver updated in 2004
  - Introduction of SRM interface/dCache
  - Monitoring and Information Server prototype

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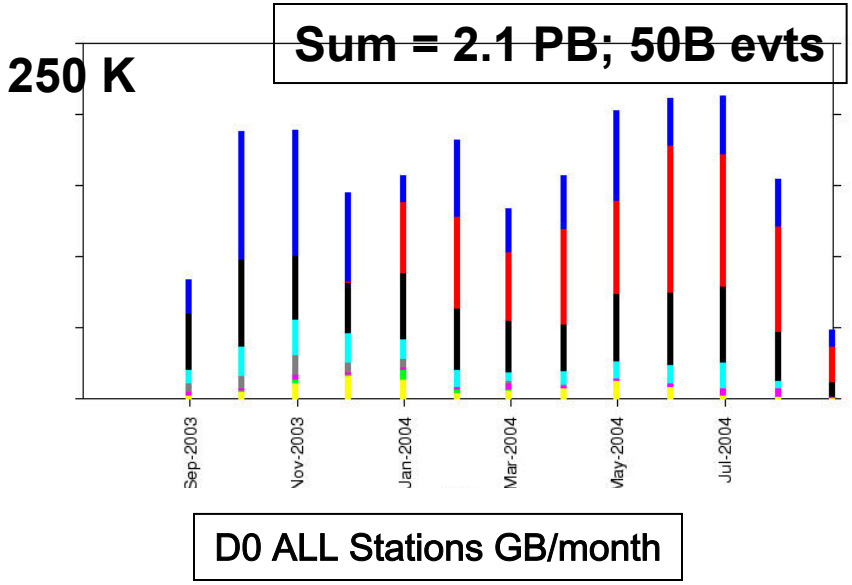
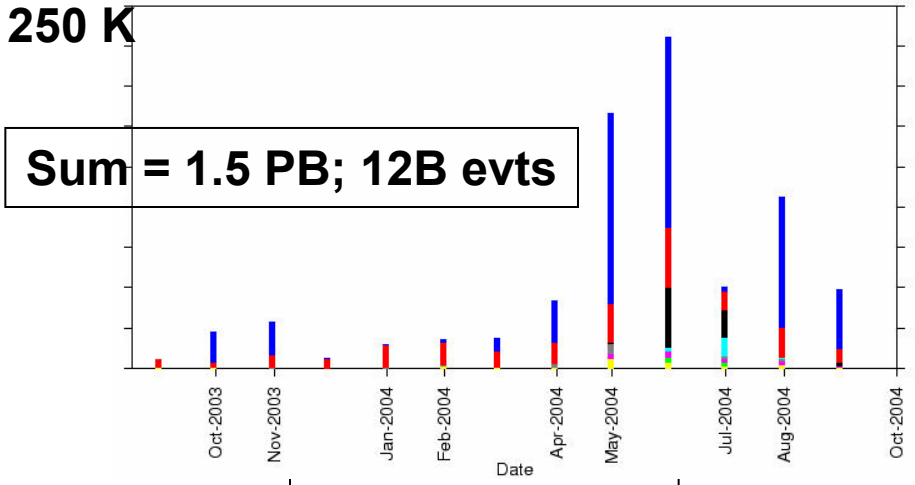
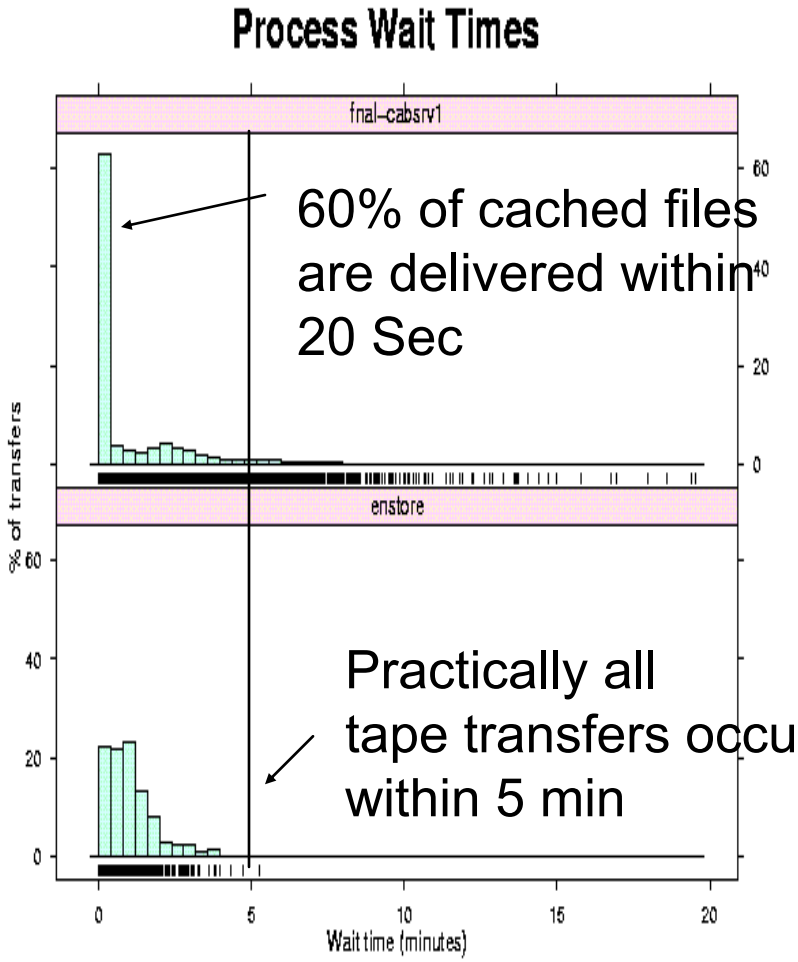
SAM Performance



D0 ALL Stations GB/month



CDF-SAM GB/month



D0 Cabsrv1 process wait times

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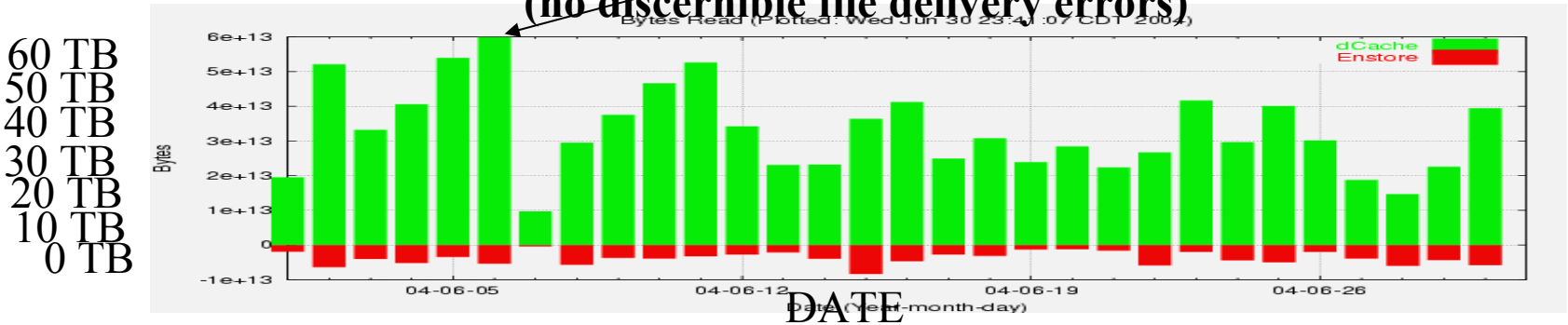
CDF Data Handling

Direct dCache access

- 60 TB/day movement at peak

- Access via SAM in "open beta" mode
  - Remote CAF systems use SAM (10 TB/week consumed)
  - Phasing out old legacy data catalog

60 TB read by CDF clients on 06 June 2004
(no discernible file delivery errors)



CDF dCache – June 2004
nBytes Read Per Day

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SAM-Grid

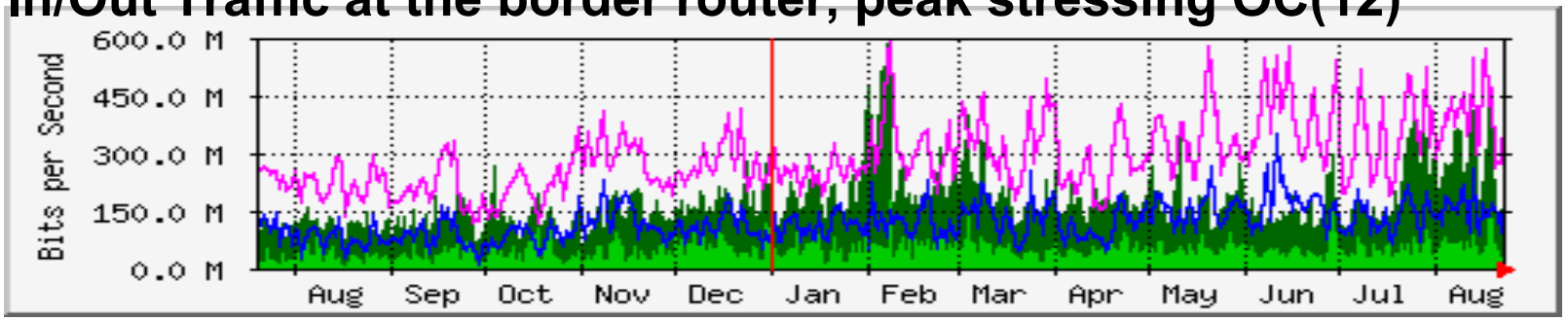
- SAM-Grid project includes Job and Information Monitoring (JIM), grid job submission and execution package
  - JIM is in production for execution at most DO MC sites
  - Migration to VDT completed
  - Integrated with runjob, discussion with respect to CAF.
  - Collaboration/discussions within the experiments on the interplay of LCG and OSG with SAMGrid efforts
    - Demonstration of use of sam_client on LCG site
    - University of Oklahoma runs Grid3 and JIM on a single gatekeeper
- Tevatron experiments working towards grid-like environments
  - DO defining interfaces, isolate experiment specific exes, deployed OS compatibility product

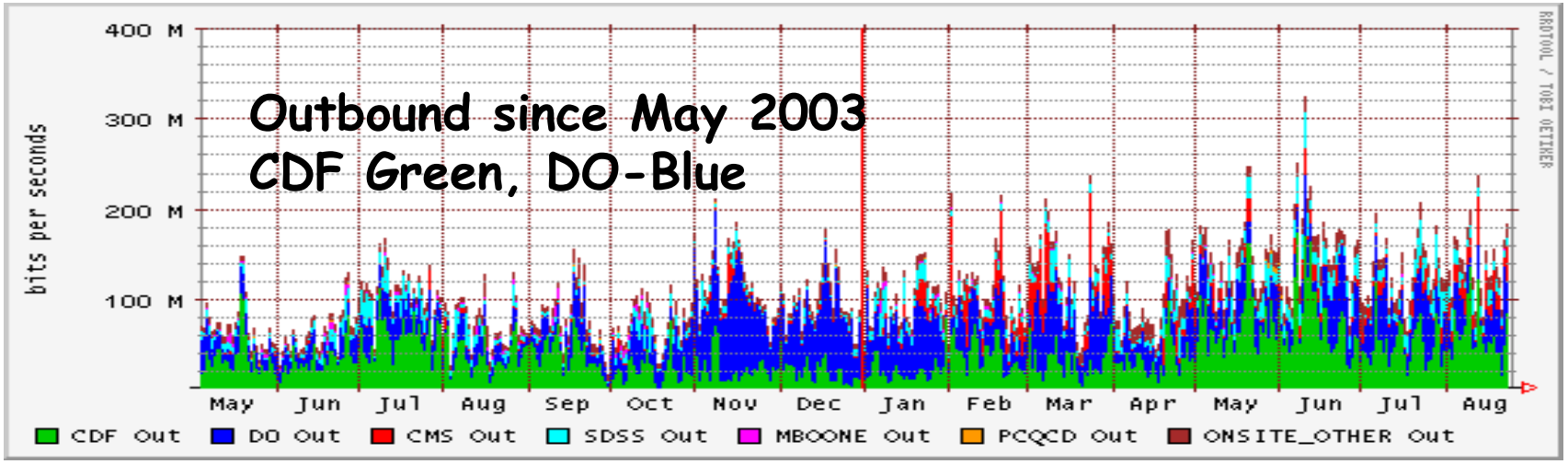
Graphic from Gabriele pending

Wide Area Networking

OC(12) to ESNET, OC(48) to Starlight carrying production traffic
Reference parallel talks

In/Out Traffic at the border router, peak stressing OC(12)

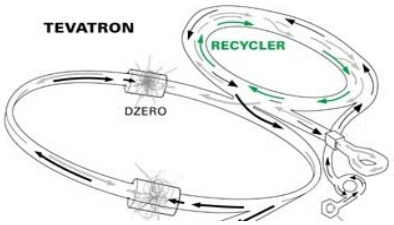




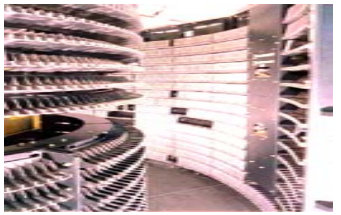
Amber Boehnlein, FNAL

Computing Model

Raw Data
RECO Data
RECO MC
User Data



Data Handling System



Central Robotic Storage

Remote Analysis Systems

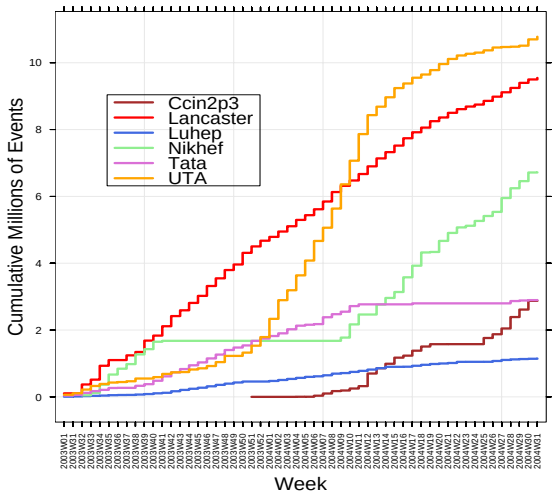
Central Analysis Systems

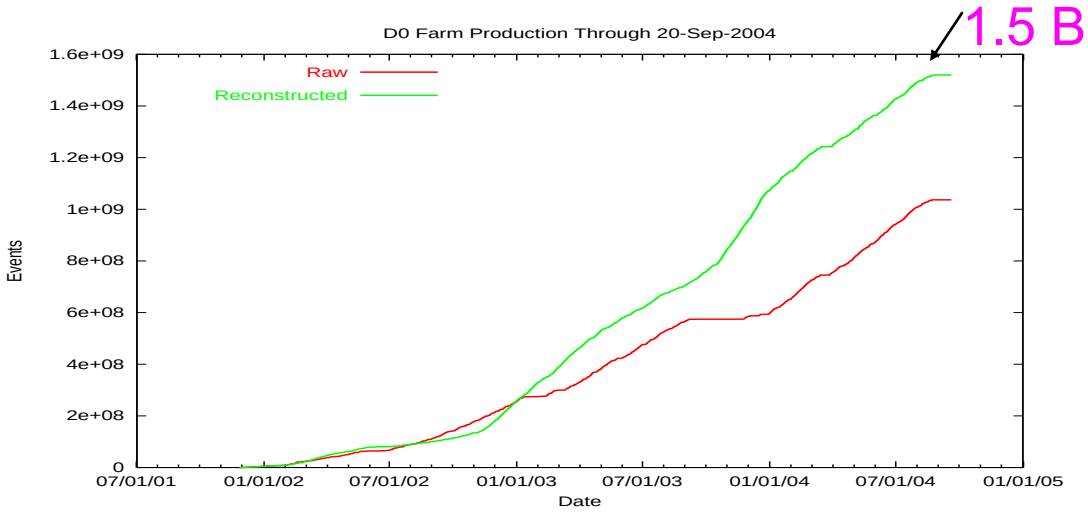
User Desktops

Amber Boehnlein, FNAL

DO Farm Production

- DØ Reconstruction Farm—18-20 M event/week capacity- operates at 80% efficiency—events processed within days of collection. 1.5 B events processed in Run II (1B events collected)
  - Successful remote re-reconstruction effort-100M events processed at IN2P3, NIKHEF, gridka, UK, and WestGrid (Canada)
- DØ Monte Carlo Farms—1 M event/week capacity-globally distributed resources. Running Full Geant, reconstruction and trigger simulation





P14 Reprocessing Status as of 26-Apr-2004 (Remote sites only)

Processed Events	97619114	
Sites	fnal ccin2p3 gridka nikhef uk westgrid	

in, FNAL

CDF Farm Production

- CDF Reconstruction Farm sized to keep up with data collection
  - Plan to integrate resources with CAF, move to using SAM for data handling by Dec 2004. Provides reprocessing buffer while maximizing availability of resources for CDF central analysis

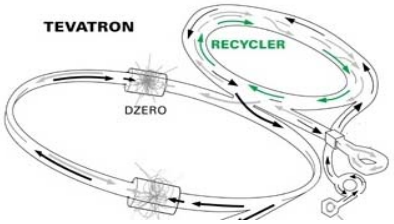
- CDF MC produced remotely at Toronto (60%), UK (30%), San Diego, Italy

Computing Model

Remote Farms

Central Farms

Raw Data
RECO Data
RECO MC
User Data



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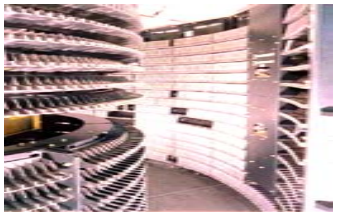
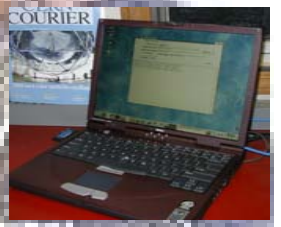


Central Robotic Storage

Remote Analysis Systems

Central Analysis Systems

User Desktops



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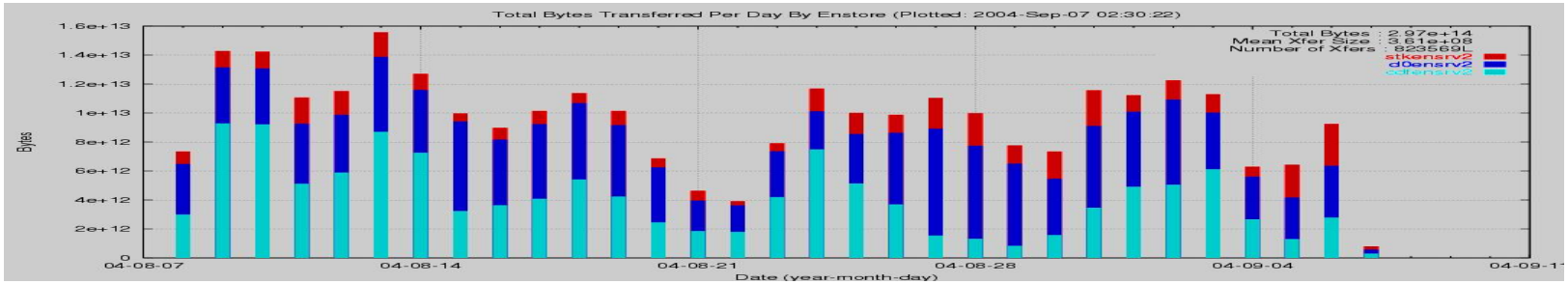
Central Robotics

20TB
At peak

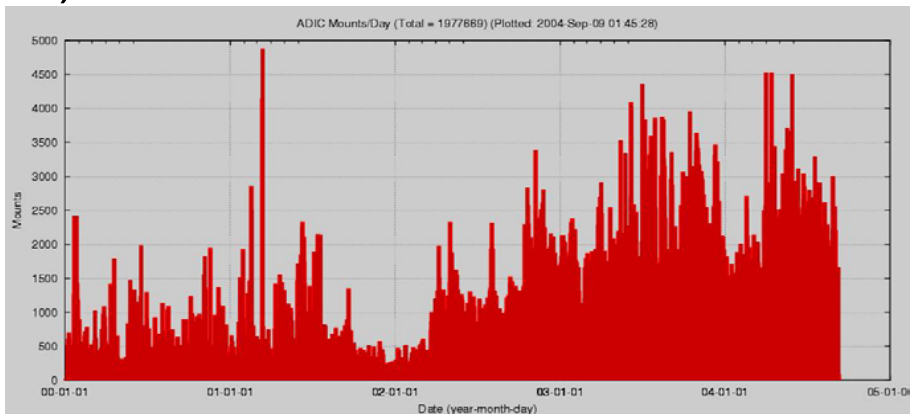


Daily Enstore traffic for CDF, DO, and other users

Data to tape, Sept 20, 2004
CDF 9940b 1000 TB (look up number)

DO 9940a	205 TB
DO 9940b	360 TB
DO LTOI	175 TB
DO LTOII	70 TB
	750 TB Total

Mounts/day on ADIC



Known data loss due to Robotics/Enstore for DO >10 GB
Somewhat larger for CDF due to a hardware problem

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Computing Model

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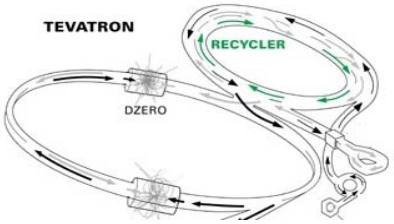

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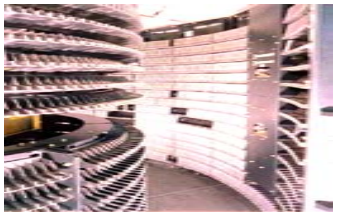

Central
Robotic Storage

Remote Analysis Systems

Central Analysis Systems

User Desktops

Amber Boehnlein, FNAL

Central Analysis

- Both experiments support peaks of 200 users
- Ntuple based analysis, some user MC generation
- DO supports TMB based "fixing" as a common activity (moving to production platform)
- B physics tends to be most cpu and event intensive—uses full framework/event size for CDF
- CDF CAF—Linux based system
  - Number of processors
  - 150 TB Cache and 150 TB of group managed space
- DO—legacy SGI and two linux compute clusters
  - Phasing out SGI as a central SAM cache
  - Past year, we have been short of cache, see as much as 2/3 file deliveries from tape.
  - Deployed n TB as SAM Cache on CABSRV1– working extremely well

CDF Central Analysis Facility

- **CAF is two farms—FBS and Condor—with single submission mechanism**

83% of jobs
Average
1Ghz*sec/event

17% have mean
Of 3Ghz*sec/event

Doesn't include
Condor CAF

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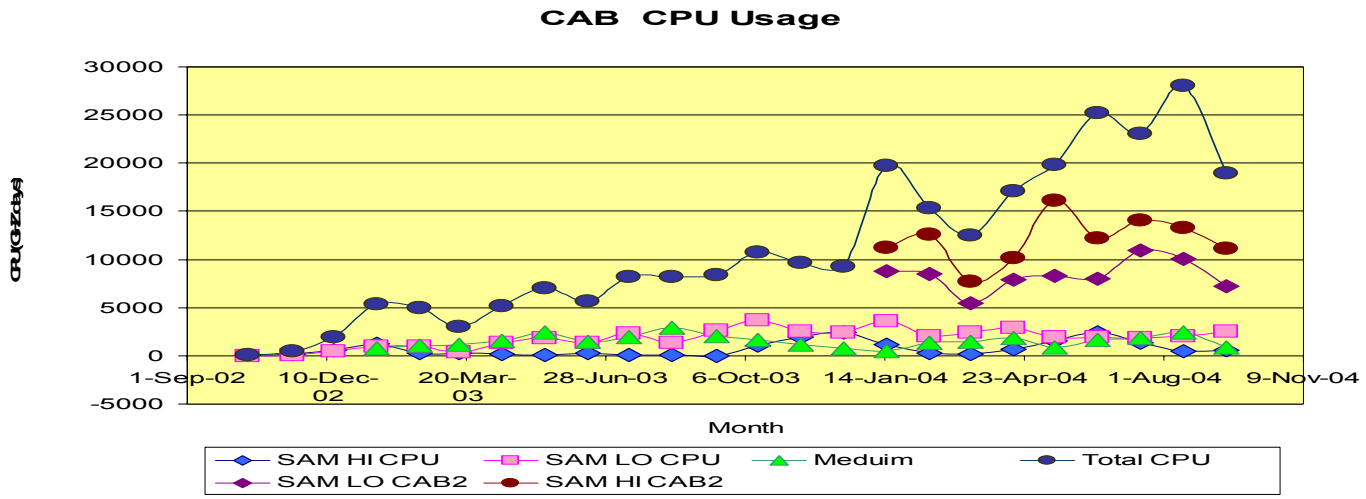
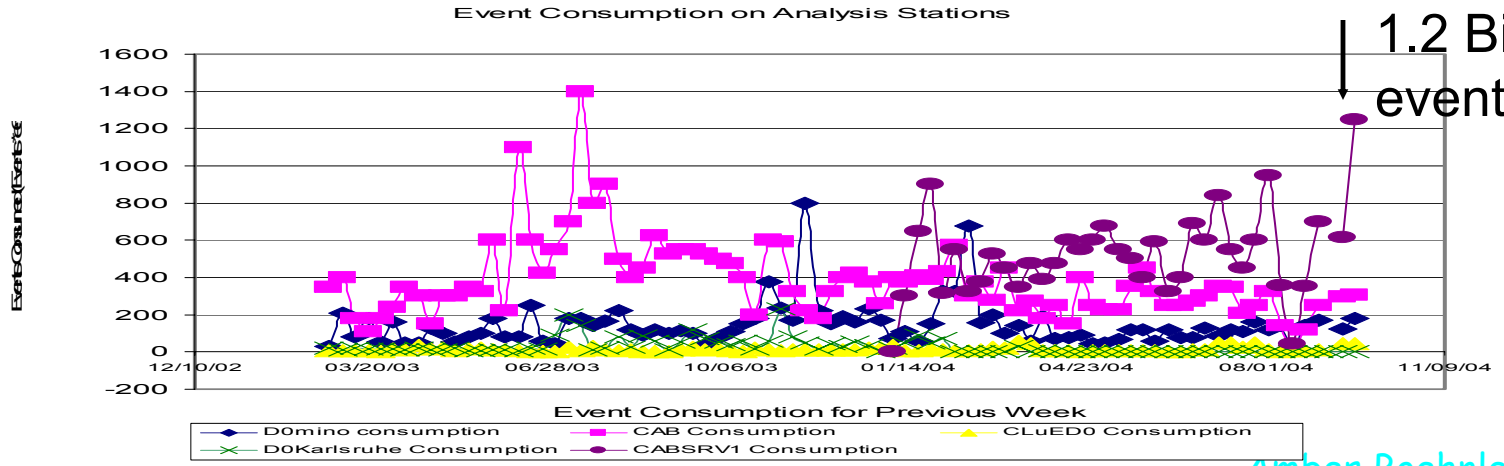
DO Central Analysis Systems

CAB usage in CPU days



Typically spin through 1 billion events per week at 1 GHz*sec/event

Events weekly consumed on central analysis platform



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Computing Model

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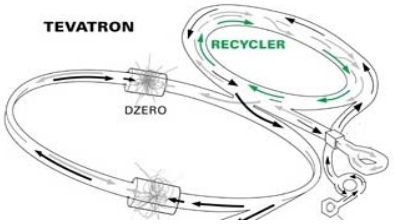

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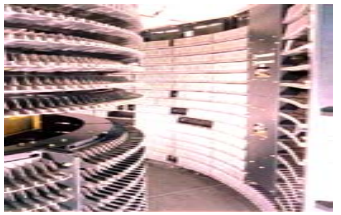
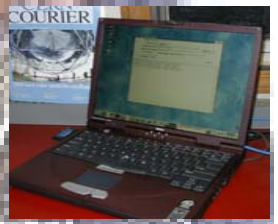


Central
Robotic Storage

Remote Analysis Systems

Central Analysis Systems

User Desktops



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Remote Analysis

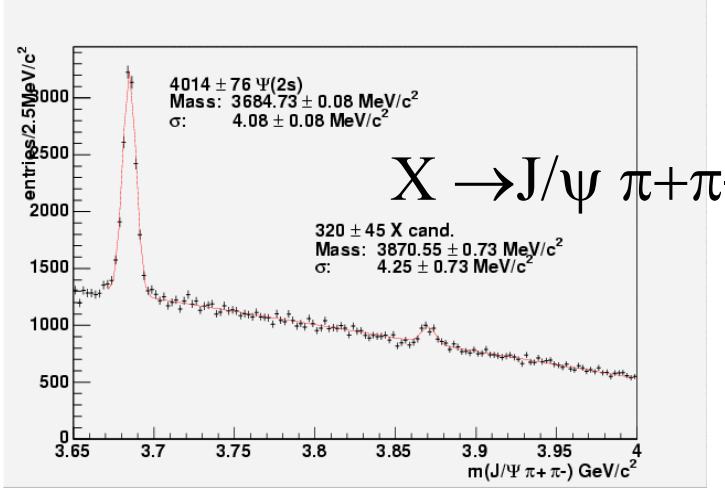
- Active SAM stations: 40 DØ (9 @ FNAL)
  26 CDF (2 @ FNAL)

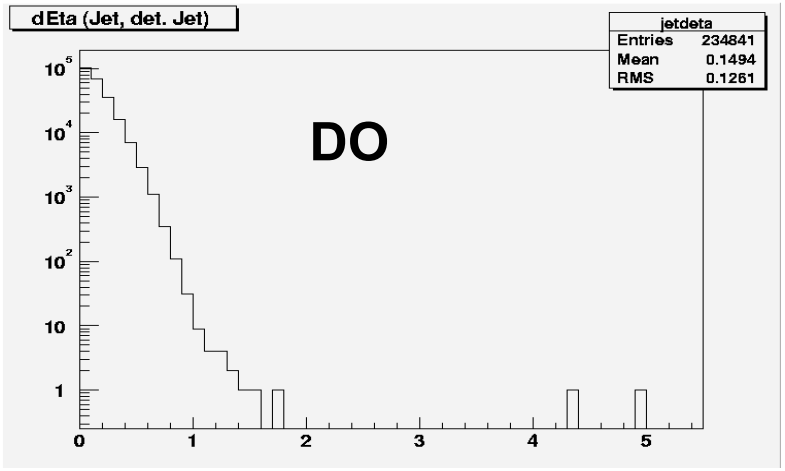
35% of CDF analysis resources are available outside of FNAL

Wyatt to get ratio of remote/central projects

Run II Analysis Plots from GridKa

CDF





60 processes/3000 files: jpmm0c

Verification plot from reprocess

Amber Boehnlein, FNAL

Summary and Outlook

- Both experiments have a complete and operationally stable computing model
  - CDF pioneered commodity fileserver usage
  - DO pioneered grid-style data handling
- Both experiments refining computing systems and evaluating scaling issues
  - Planning process to estimate needs
  - DO costing out a virtual center to meet all needs
- CDF has joined the SAM project
- DO has deployed linux fileservers as SAM cache
- Both experiments are finding common computing ground and moving towards global and grid computing

Databases

- Both experiments use Oracle on SUN systems
- Databases used for SAM, calibration, run and trigger table tracking, luminosity accounting
- Both experiments use Client-Server model
  - DO uses corba based servers, long production service
  - CDF deploying web services based servers for calibration data