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# SAMGrid

Monte Carlo Production and  
Reprocessing at DZero

# Overview

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- DZero Production Software
- SAM and SAMGrid, the Fermilab Grid
- Monte Carlo Production with SAMGrid
- Reprocessing with SamGrid
- SAMGrid on OSG and LHCG

# DZero Software

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- **Analysis Software**

- All analyze packages (topanalyze, bana, cafe, ...)
- Takes data from any stage of processing (raw, tmb or root).
- Run on different resources from laptops to dedicated farms.
- Customized by the end user.

- **Production Software**

- Common use by the collaboration.
- Heavy work; must run on computer farms or grids.
- Real Data processing.
- Simulated Data processing.

# DZero Production Software

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- **Real Data:**

- **Online Data Acquisition System**
  - Select and store the events of interest.
  - Triggers L1, L2, L3 and filters.
  - Builds the Raw data - collection of hits and ADC counts.
  - Software independent.
- **Data Reconstruction.**
  - Identify physical objects and its kinematical properties.
  - Transforms the Raw data into Thumbnail format.
  - Software dependent.
- **Data Skimming:**
  - Select the events based on its physical characteristics.
  - Transform the raw data into Root format for the analysis.
  - Software dependent.

- **Simulated Data:**

- **Event generation:**
  - Generates physical events of interest.
  - Pythia, Alpgen, Herwig, Isajet, Comphep, etc.
  - External software.
- **Experiment Simulation:**
  - Software dependent.
  - Full simulation of DZero RunII detector
    - D0GSTAR -- DØ GEANT Simulation of the Total Apparatus Response
    - How much energy is deposited in the active areas of the detector by the particle produced by the generator.
  - Raw data simulation:
    - D0SIM - Electronics Simulation.
    - Adds noise and inefficiencies to the events from D0GSTAR.
    - Merges hard scatter and minimum bias events.
    - Adds calorimeter pileup from previous crossings.
- **Data Reconstruction.**
  - Same functionality as for real data.

# DZero Production Activities

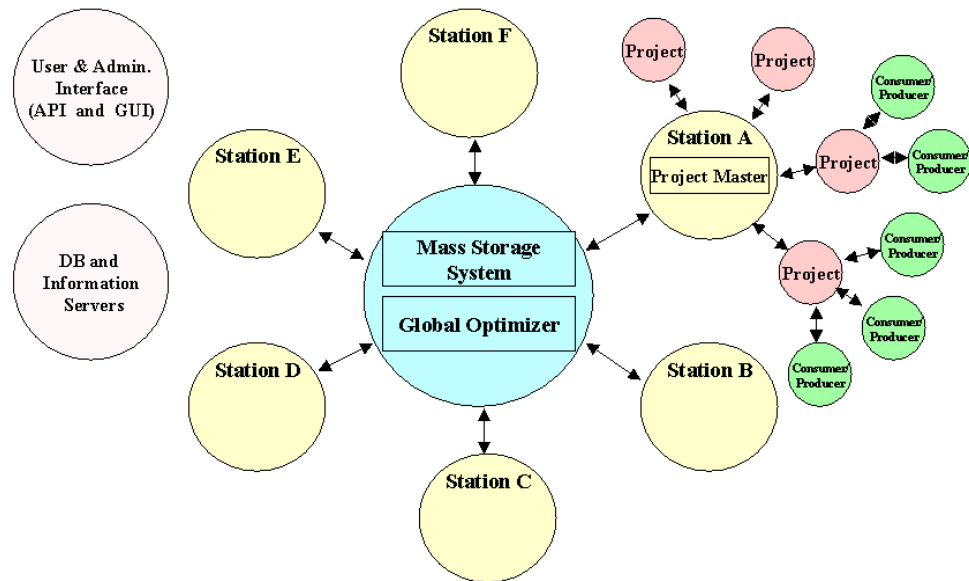
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- **Production of simulated data:**
  - Production chain managed by MC\_Runjob.
  - Data catalog, storage and retrieval managed by SAM.
  - Produced mostly by offsite farms on SAMGrid, the Fermilab Grid.
    - More then 12 sites in 8 countries
    - LU, LTU, OU, UTA, MSU, UW, Sprace, WestGrid, Nikhef, ccin2p3, Gridka, FZU and Tata to list some.
    - Submission and monitoring by SAMGrid, the DZero production Grid.
    - Based on JIM (Job Information Management) suite.
  - Use of LCG and OSG as SAMGrid resources has just begun.
- **Reprocessing of real data.**
  - Reconstruct the raw data according to latest software.
  - All raw data collect to date must be reprocessed.
  - First reprocessing (p14) made at Fermilab facility.
  - Second reprocessing (p17) made mostly off site using SAMGrid.
- **Refixing of produced thumbnails.**
  - Both simulated and real data.
  - Last refixing used LCG and OSG as SAMGrid resources.
- **Data Skimming.**
  - Uses Fermilab computing resources.
- **Real Data Reconstruction:**
  - Increasing luminosity increases the load for online reconstruction.
  - On the move into SAMGrid.
  - First time online data is shipped off site processing.

# SAM: A Grid-like Data Handling System

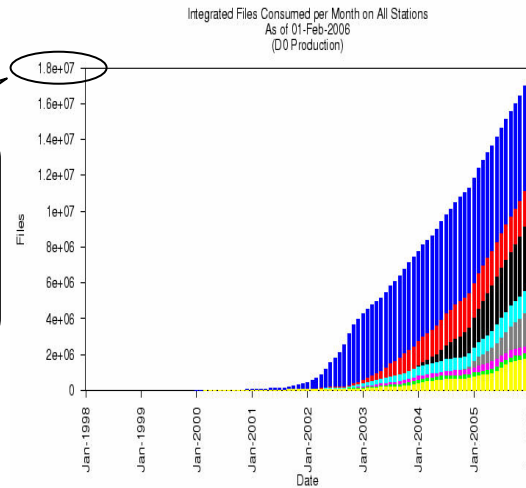
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- **Organized system of distributed servers.**
  - Store and retrieve files and associated metadata.
    - Track locations and metadata for each file in the system.
    - Interface to a mass storage system on a robotic tape store.
    - Cache files on local disk and make them available for other stations.
    - GridFTP enabled for file transfers using globus (preferred method).
  - Provide methods of job submission for local or grid-aware systems.
  - Adaptable to grid submission systems using Condor and Globus grid tools.
- **Used by DZero and CDF Experiments**
- **More than 50 SAM stations worldwide**

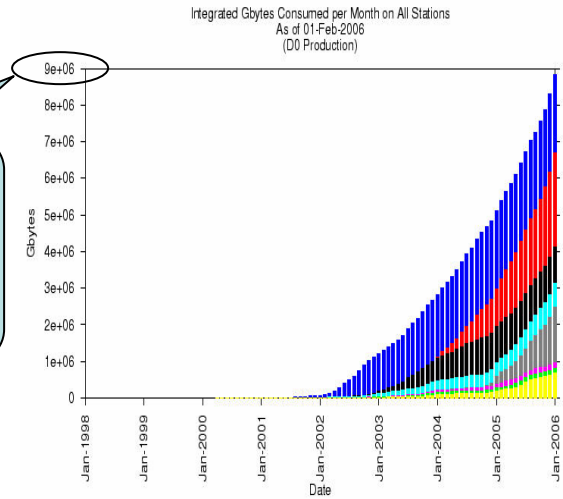


# SAM in Numbers: The Petabyte Era

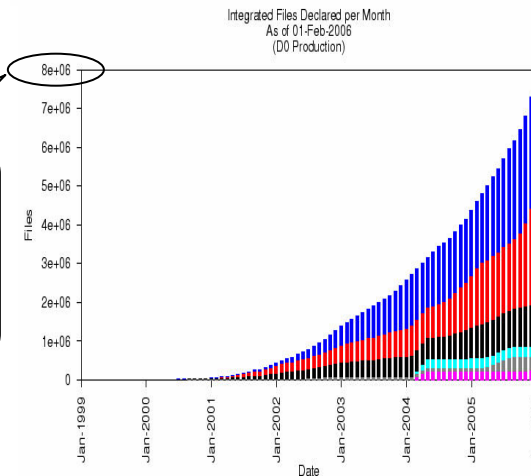
18 Million  
Files  
Delivered by  
the Stations



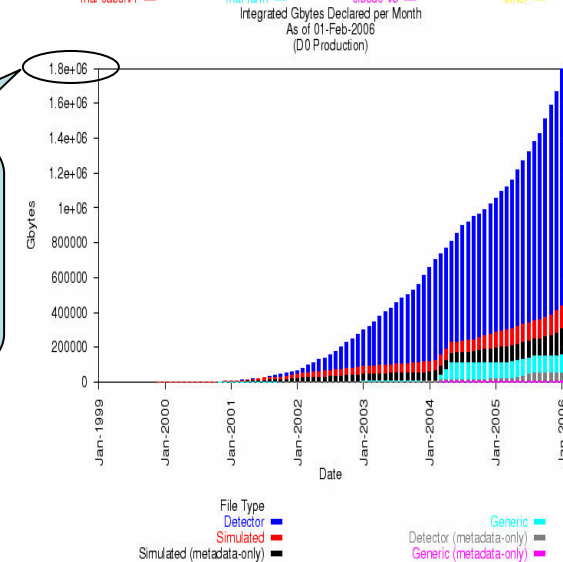
9 PetaBytes of  
Data  
Delivered by  
the Stations



8 Million Files  
Stored on  
Tape



1.8 PetaBytes  
of Data Stored  
on Tape





# SAMGrid



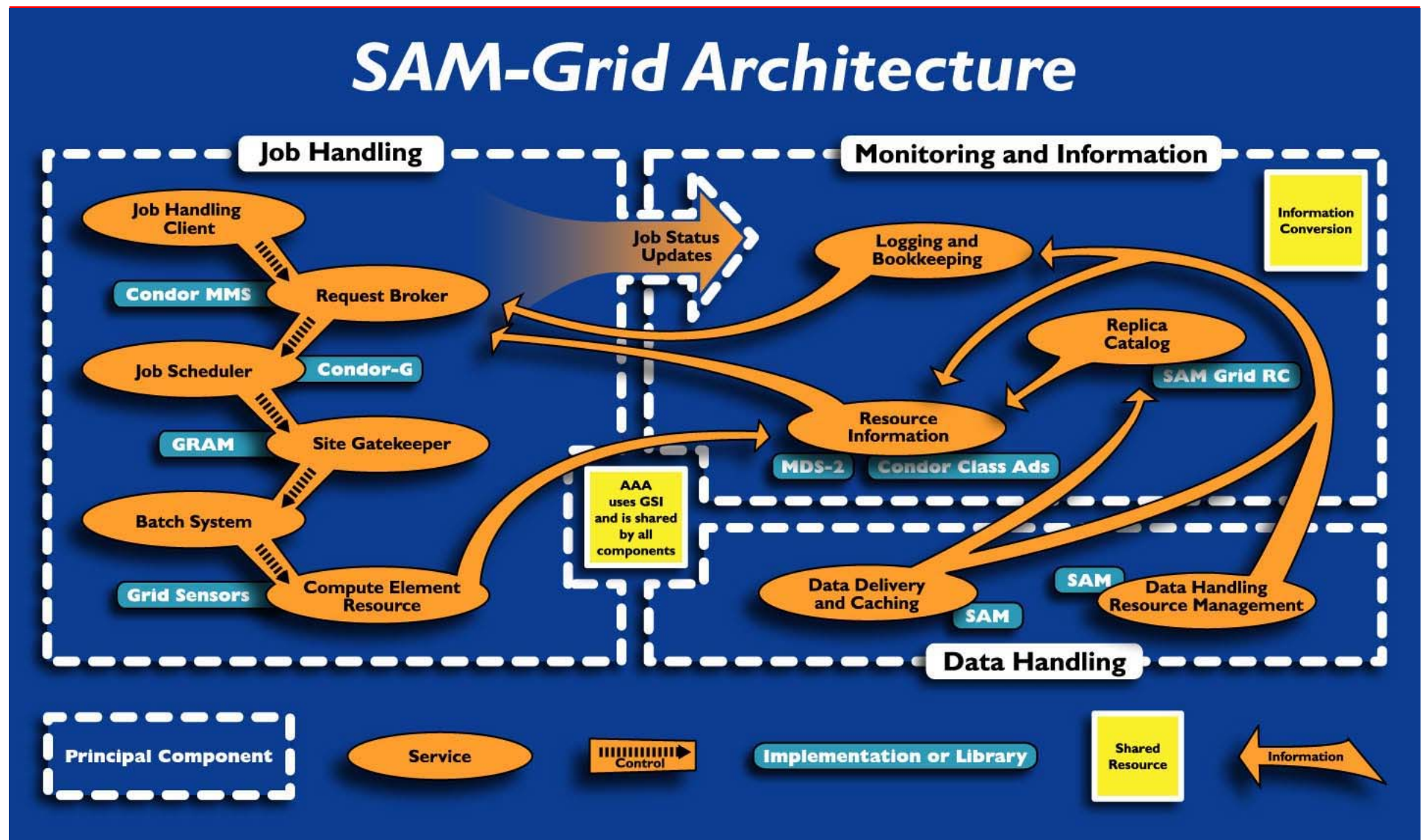
Eduardo Gregores

VII DOSAR Workshop

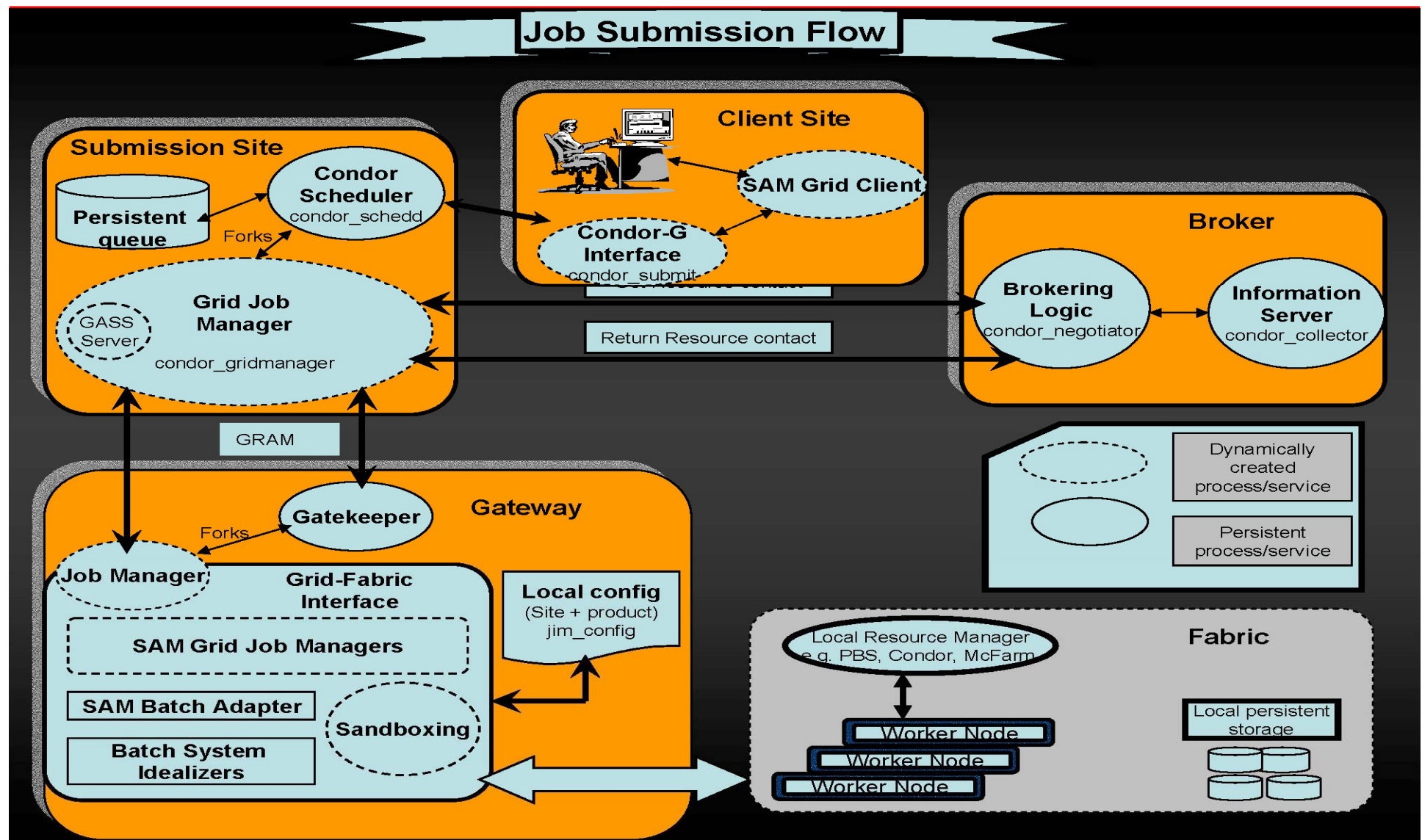
March 2006



# SAMGrid Architecture



# SAMGrid Job Flow



# SAMGrid Execution Sites

Station Name	Type	Site	Universe	Experiment
<a href="#"><u>alicenext</u></a>	SAMGRID	<a href="#"><u>Wuppertal</u></a>	prd	d0
<a href="#"><u>ccin2p3-grid1</u></a>	SAMGRID	<a href="#"><u>Wuppertal2LCG</u></a>	prd	d0
<a href="#"><u>ccin2p3-grid1</u></a>	SAMGRID	<a href="#"><u>Wuppertal2LCG Devel</u></a>	test_prd	d0
<a href="#"><u>cms-grid</u></a>	SAMGRID	<a href="#"><u>CMS-FNAL-WC1</u></a>	prd	d0
<a href="#"><u>d0_fzu_prague</u></a>	SAMGRID	<a href="#"><u>FZU GRID</u></a>	prd	d0
<a href="#"><u>d0karlsruhe</u></a>	SAMGRID	<a href="#"><u>GridKa</u></a>	prd	d0
<a href="#"><u>d0ppdg-wisconsin-2</u></a>	SAMGRID	<a href="#"><u>Wisconsin</u></a>	prd	d0
<a href="#"><u>fnal-farm</u></a>	SAMGRID	<a href="#"><u>FNAL</u></a>	prd	d0
<a href="#"><u>imperial-prd</u></a>	SAMGRID	<a href="#"><u>Imperial College London</u></a>	station_prd	d0
<a href="#"><u>ltu-cct</u></a>	SAMGRID	<a href="#"><u>LTU-CCT</u></a>	prd	d0
<a href="#"><u>luhep</u></a>	SAMGRID	<a href="#"><u>LUHEP</u></a>	prd	d0
<a href="#"><u>mcgill</u></a>	SAMGRID	<a href="#"><u>Zephir-McGill</u></a>	prd	d0
<a href="#"><u>msu2</u></a>	SAMGRID	<a href="#"><u>MSU</u></a>	prd	d0
<a href="#"><u>oscer</u></a>	SAMGRID	<a href="#"><u>OSCER</u></a>	prd	d0
<a href="#"><u>osg-ouhep</u></a>	SAMGRID	<a href="#"><u>Samgrid-OSG</u></a>	prd	d0
<a href="#"><u>ouhep</u></a>	SAMGRID	<a href="#"><u>OUHEP</u></a>	prd	d0
<a href="#"><u>sprace</u></a>	SAMGRID	<a href="#"><u>SPRACE</u></a>	prd	d0
<a href="#"><u>tata-d0-mcfarm</u></a>	SAMGRID	<a href="#"><u>Tata</u></a>	prd	d0
<a href="#"><u>westgrid-ubc</u></a>	SAMGRID	<a href="#"><u>WestGrid</u></a>	prd	d0

# SAMGrid Submission Sites

Scheduler Name	Machine Name	Platform	Users	Max Jobs
<a href="http://d0farm.hecr.tifr.res.in">d0farm.hecr.tifr.res.in</a>	d0farm.hecr.tifr.res.in	I386-LINUX-RH72	1	200
<a href="http://hep.westgrid.ca">hep.westgrid.ca</a>	hep.westgrid.ca	I386-LINUX-RH9	4	200
<a href="http://luhep03.lunet.edu">luhep03.lunet.edu</a>	luhep03.lunet.edu	I386-LINUX-RH72	14	200
<a href="http://sam.farm.particle.cz">sam.farm.particle.cz</a>	sam.farm.particle.cz	I386-LINUX-RH72	1	200
<a href="http://samgrid.fnal.gov">samgrid.fnal.gov</a>	samgrid.fnal.gov	I386-LINUX-RH72	50	200

# MC Production on SAMGrid

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## DZero Software Latest Cut

Package	Version	Tarball in SAM
D0 Release	p17.09.01	d0_MC_p17.09.01_v9.tar.gz
MC_Runjob	v06-05-19	mc_runjob_v06-05-19_v2.tar.gz
Magnetic Field	v00-01-00	MagField_v00-01-00.tar.gz

### Job description file for Monte Carlo production

```
+notify_user = gregores@fnal.gov
check_consistency = true
d0_release_version = p17.09.01
group = mcc99
instances = 1
job_type = dzero_monte_carlo
jobfiles_dataset = sprace_mcp17_v00-09-20_e
minbias_dataset =
Zerobias_p17MC_avelumi_1_rename2
runjob_numevts = 200000
runjob_requestid = 31118
sam_experiment = d0
sam_universe = prd
station_name = sprace
```

### Job Submission

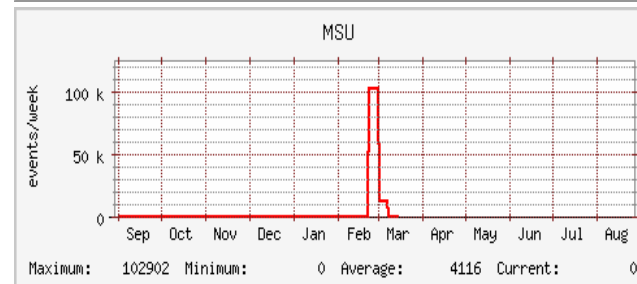
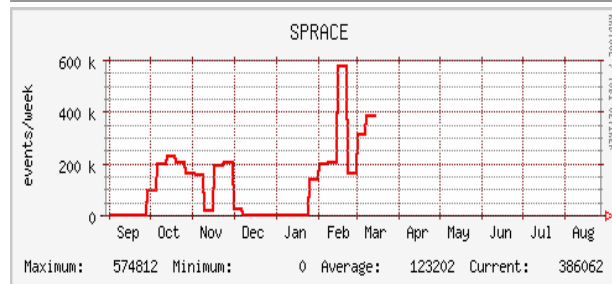
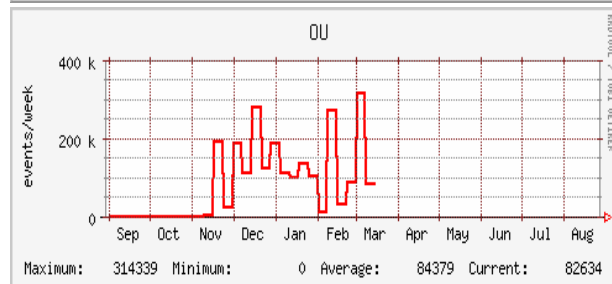
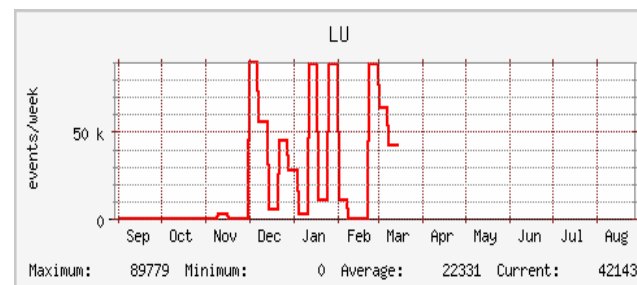
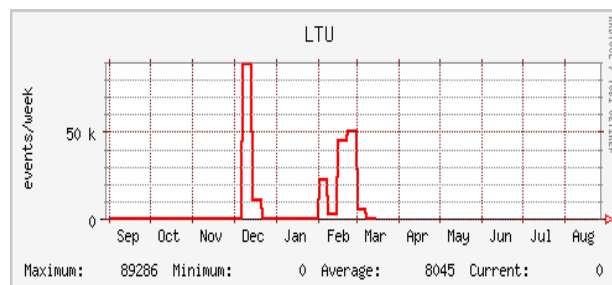
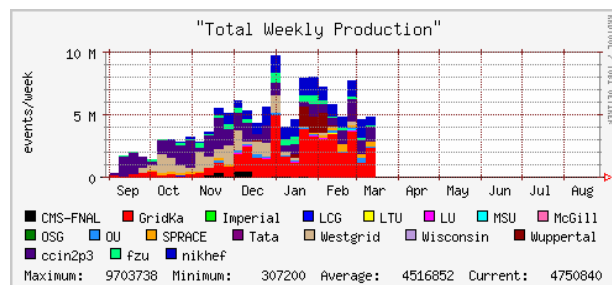
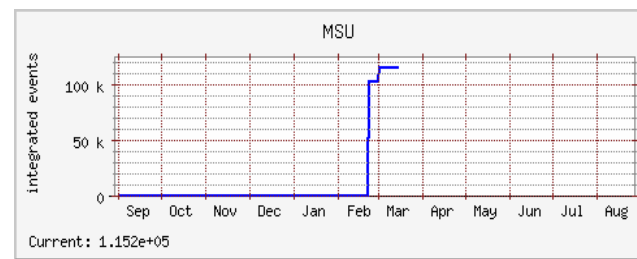
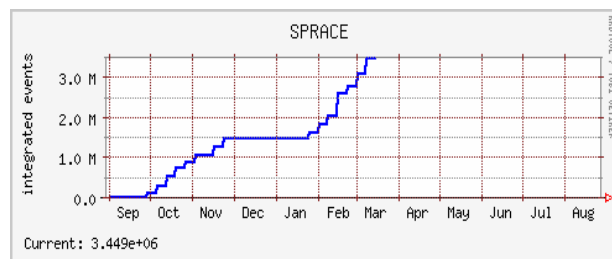
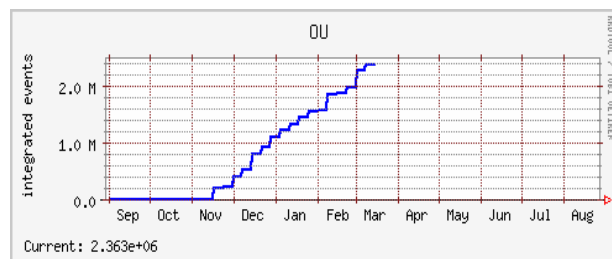
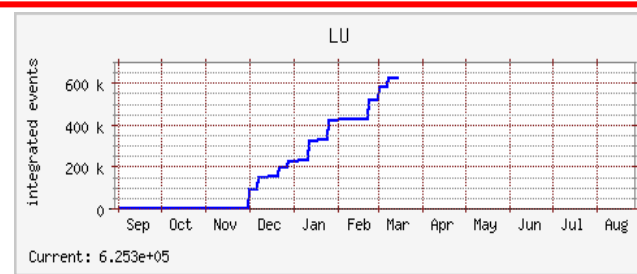
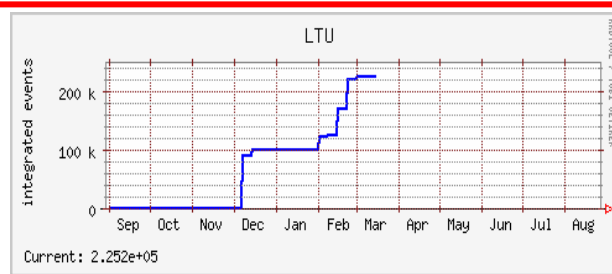
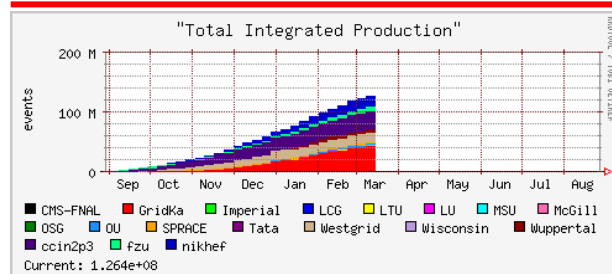
```
> Samg submit file.jdf
```

## SAMGrid Software Latest Cuts

Product	2 Sep 2005	22 Nov 2005
jim_advertise	v1_4_7	v1_4_7
jim_client	v2_1_27	v2_1_37
jim_config	v1_2_16	v1_2_17
jim_job_managers	v2_2_70	v2_2_79
jim_merge	v1_18	v1_18
jim_sandbox	v2_4_10	v2_4_10
samgrid_util	v2_0_12	v2_0_13
sam_batch_adapter	v1_0_1_18	v1_0_1_21
sam_client	v1_0_60	v1_0_66
sam_fcp	v1_0_19	v1_0_20
sam_gsi_config	v2_2_19 -q vdt	v2_2_22 -q vdt
tomcat	v4_3_3_9	v4_3_3_9
vdt	v1_1_14_13	v1_1_14_13
xmladb_client	v2_0_11	v2_0_11
xmladb_server	v1_0_3	v1_0_3



# MC Production on SAMGrid



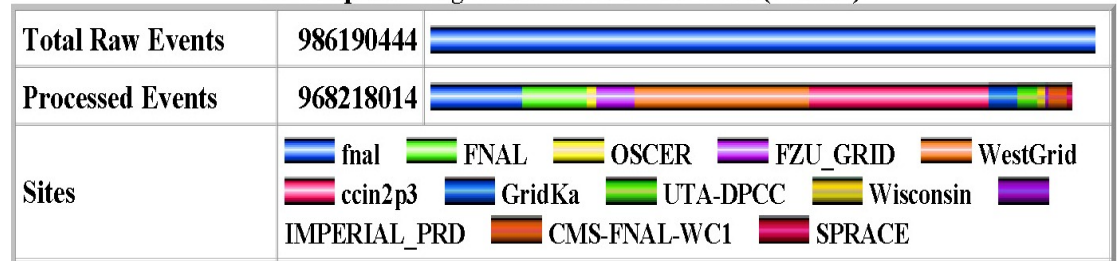


# Reprocessing and Refixing on SAMGrid

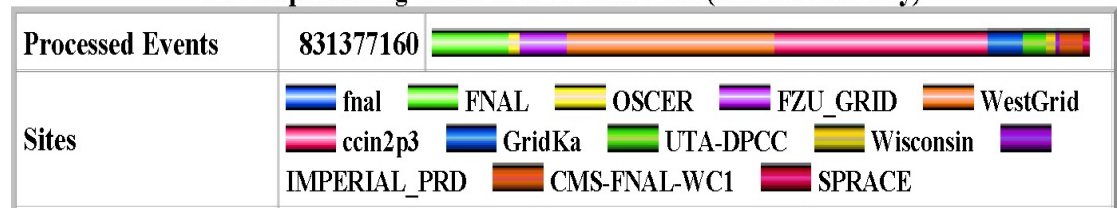
- **Raw Data Reprocessing**

- About 1 Billion events.
  - 500 fb<sup>-1</sup> of RunII data.
  - 250 TB of raw data.
  - All data taken up to 2005.
- Reprocessed on 12 locations distributed over 6 countries on 3 continents during 6 months.
- Gathered 3500 GHz equivalent of computer power.
- Completely run on SAMGrid infrastructure.
- First use of Grid architecture to process real data on large scale.

P17 Reprocessing Status as of 23-Mar-2006 (all sites)



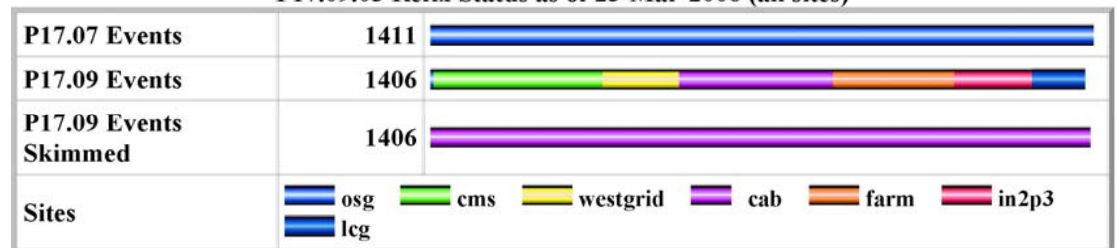
P17 Reprocessing Status as of 23-Mar-2006 (Remote sites only)



- **Data Refixing**

- All data up to 09/2005.
- 1.5 Billion events refixed.
- Use of OSG and LHCG infrastructure by SAMGrid.
- First real world use case of large scale interoperability.

P17.09.03 Refix Status as of 23-Mar-2006 (all sites)



# SAMGrid - LCG - OSG

- **Expanding SAMGrid .**

- Increase SAMGrid resources using LCG and OSG
- Keep SAMGrid data handling.

- **Use of Forwarding Nodes**

- The FW node is a usual gateway for SamGrid.
- Grid-to-Grid as evolution of Grid-to-Fabric interface.
- Job Management is implemented via an Grid specific “scheduler” handler.
- Uses some regional SAM station for data retrieval and storage.
  - LCG uses station at CCIN2P3.
  - US OSG sites uses OSG\_OUHEP station.

- **Status:**

- DZero data has been refixed on LCG and OSG resources.
- MC is being produced on LCG.
- Joel may have some good news for MC production on OSG.
- Still lots of open questions concerning operation on external resources.

