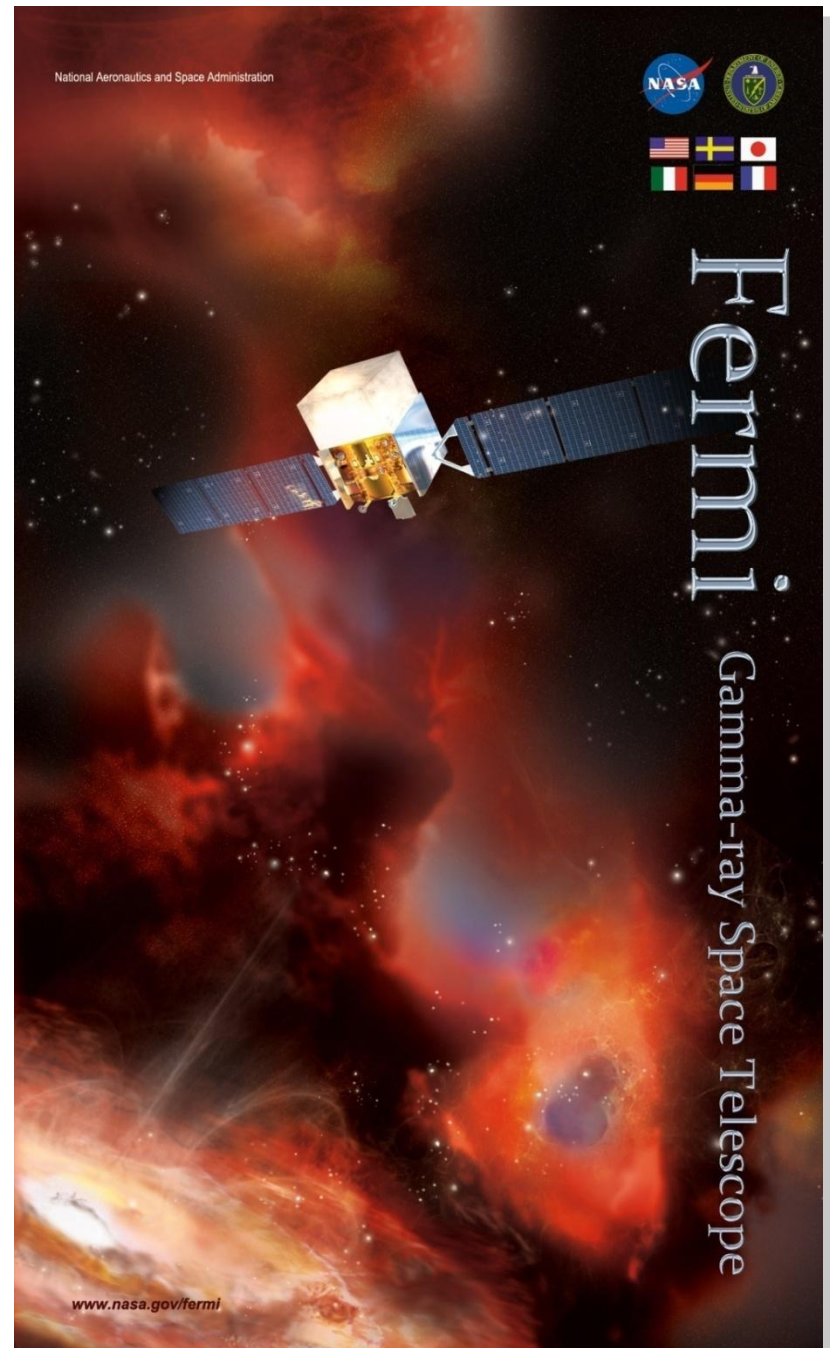


Fermi Data Management (10 minute version)

Tony Johnson



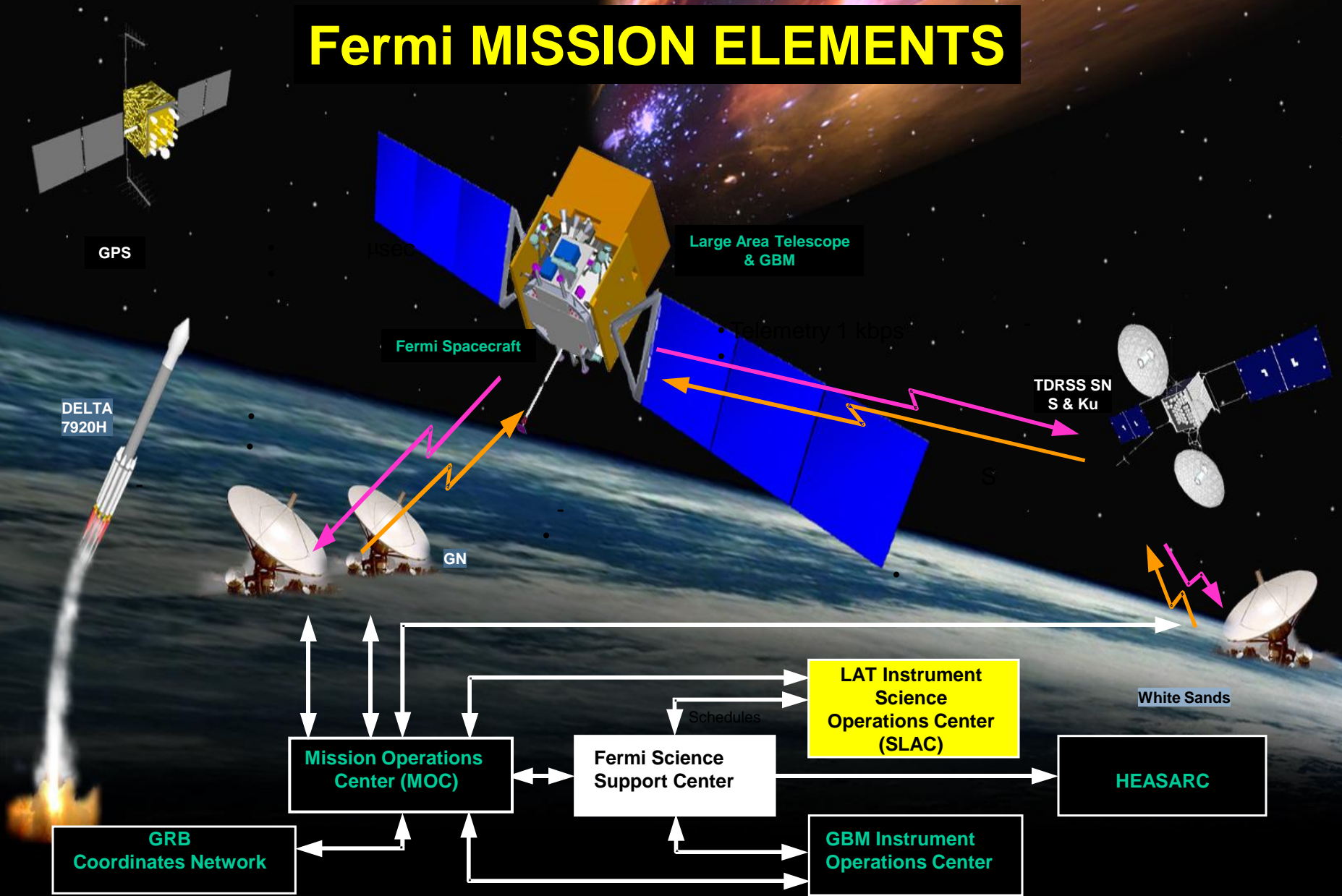
tonyj@slac.stanford.edu



Launched 11 June 2008 – LAT activated 25 June



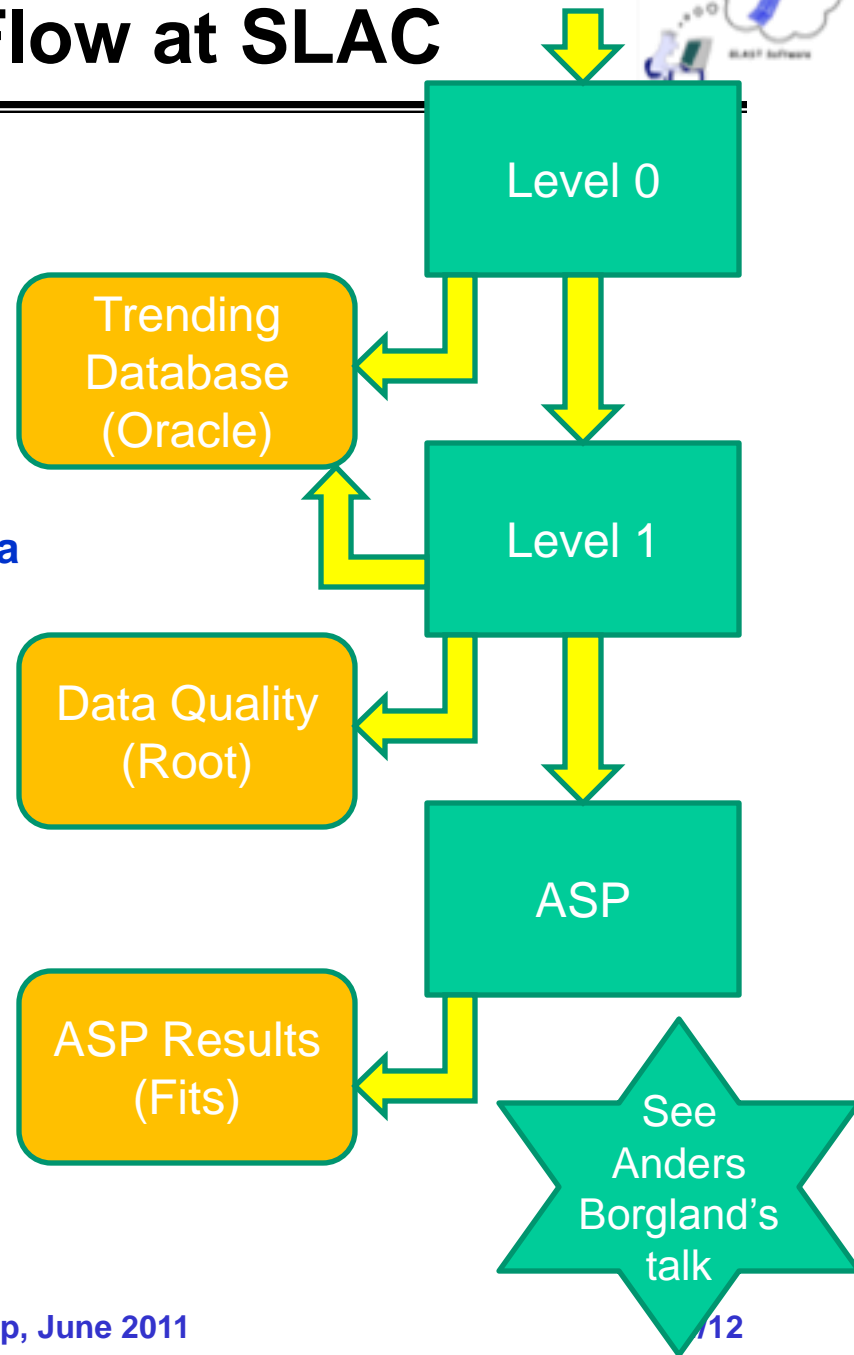
Fermi MISSION ELEMENTS



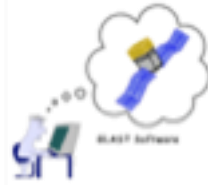
Data Processing Flow at SLAC



- **Downlink from Goddard Space Flight Center**
 - ~8 downloads per day
 - 15 GB total daily
- **Level 0 Processing**
 - Automatically launched as data arrives
 - Decode & repackage incoming data
 - Split science data from telemetry data
- **Level 1 Processing**
 - Full event reconstruction: 750 GB/day
 - Data Quality Monitoring
 - Transfer science summary files to Fermi Science Support Center - 200 MB/day
 - Immediately available to the public
- **ASP (Automated Science Processing)**
 - GRB and Flare detection
 - Spectral analysis
- **120,000 quantities continuously monitored**
 - Mixture of Oracle, Root, Fits data

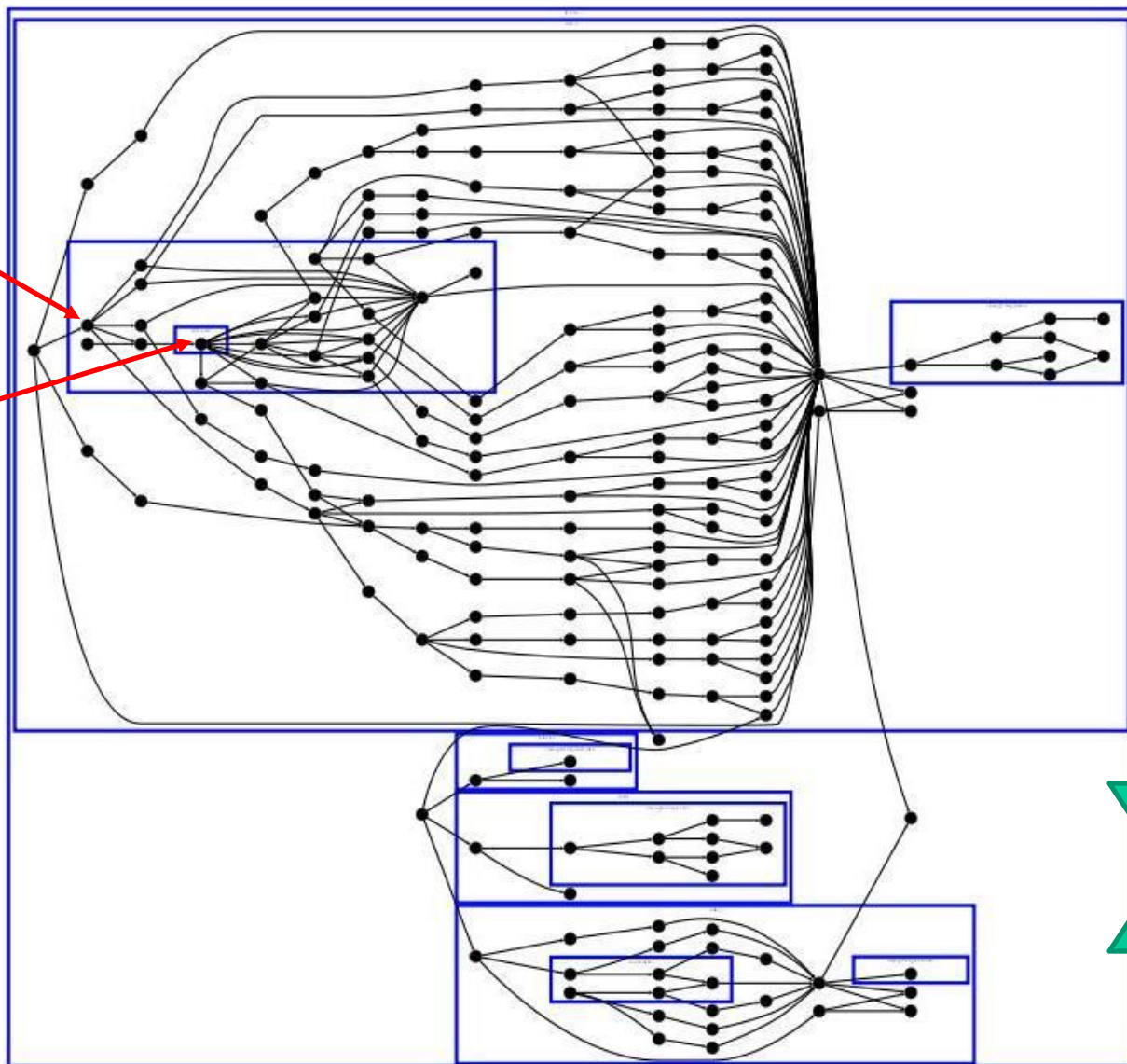


Data Processing Pipeline



- **Allow completely automatic processing of Fermi data**
 - **Reconstruction and initial analysis of incoming data**
 - **Aim to completely process incoming data in 3 hours**
 - Requires massive parallelization (2000 jobs, 800 cores)
 - Less than .01% of batch jobs require manual intervention
 - **Re-processing of data**
 - **Monte-Carlo simulation of data**
 - **Sufficient capacity to do MC simulations and reprocessing without impacting data processing**
- **Full bookkeeping for maintaining provenance of data products**
- **Ability to roll back failed (or successful) jobs**
 - **Including automatic resubmission of all downstream jobs**
- **Web interface to allow data processing to be monitored or controlled from anywhere**


Level 1 Processing Task Example



See
Warren
Focke's
talk

Monitoring Data Processing





Start refreshing page every secs [Start Refreshing](#)

User: tonj . ([Switch](#)|[Logout](#)) | Version 0.2.3 | Jira
[Prod](#) | [Dev](#)
[Summary](#) | [Delivery](#) | [Run](#) | [Selection](#)

Time Interval (UTC) : Oct/22/2009 09:34:53-Oct/23/2009 21:34:53

[Hide Deliveries/Runs processing status](#)

Deliveries/Runs processing status

Delivery		FASTCopy		HalfPipe	Runs			L1Proc				GRB Search
Id	Time (UTC)	Proc	Logs	Proc	Id - Start MET	Status	Intent	Proc	Status	Logs	Data Mon	Proc
91023011	Oct/23/2009 20:55:08	<div style="width: 100%; height: 10px; background-color: green;"></div>	5	<div style="width: 100%; height: 10px; background-color: green;"></div>								
91023010	Oct/23/2009 18:50:52	<div style="width: 100%; height: 10px; background-color: green;"></div>	13	<div style="width: 100%; height: 10px; background-color: green;"></div>	278008869	InProgress	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>				
					278003229	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>				
91023009	Oct/23/2009 17:59:19	<div style="width: 100%; height: 10px; background-color: green;"></div>	19	<div style="width: 100%; height: 10px; background-color: green;"></div>	278003229	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>				
					277997612	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>				
					277991657	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running		
91023008	Oct/23/2009 14:08:42	<div style="width: 100%; height: 10px; background-color: green;"></div>	15	<div style="width: 100%; height: 10px; background-color: green;"></div>	277991657	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running	316	Di
					277985681	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running		
91023007	Oct/23/2009 12:59:36	<div style="width: 100%; height: 10px; background-color: green;"></div>	15	<div style="width: 100%; height: 10px; background-color: green;"></div>	277985681	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running	4231	FM Di Re Me Cal
					277979700	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running		
91023006	Oct/23/2009 12:12:48	<div style="width: 100%; height: 10px; background-color: green;"></div>	19	<div style="width: 100%; height: 10px; background-color: green;"></div>	277979700	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running	744	FM Di Me Cal
					277973710	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Complete	4231	FM Di Re Me Cal
					277967692	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Running	300	Di
91023005	Oct/23/2009 08:37:23	<div style="width: 100%; height: 10px; background-color: green;"></div>	15	<div style="width: 100%; height: 10px; background-color: green;"></div>	277967692	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Running	25 4206	FM Re Me Cal
					277961622	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Running	4231	FM Di Re Me Cal
91023004	Oct/23/2009 07:14:45	<div style="width: 100%; height: 10px; background-color: green;"></div>	15	<div style="width: 100%; height: 10px; background-color: green;"></div>	277961622	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running		
					277955445	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Running	2 4229	FM Di Re Me Cal
91023003	Oct/23/2009 06:13:35	<div style="width: 100%; height: 10px; background-color: green;"></div>	21	<div style="width: 100%; height: 10px; background-color: green;"></div>	277955445	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></div>	Running	369 1 3861	
					277951581	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Complete	1 4230	FM Di Re Me Cal
					277945852	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Complete	4 4227	FM Di Re Me Cal
91023002	Oct/23/2009 02:41:57	<div style="width: 100%; height: 10px; background-color: green;"></div>	13	<div style="width: 100%; height: 10px; background-color: green;"></div>	277945852	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Complete	333 1 3897	
					277940123	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: green;"></div>	Complete	4231	

GRB Alerts

Trigger Time		GRB		Processing		Data
UTC	MET	Name	Notice	Prompt	Afterglow	Data
Oct/23/2009 00:29:45	277950585	GRB091023021	FERMI	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	277945852
Oct/22/2009 18:03:28	277927408	GRB091022752	FERMI	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	277922632

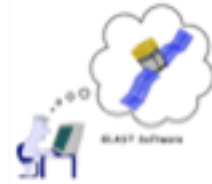
ASP Sky Monitor Process

Processing (UTC)	PGWave	DRP	Data	Data Start (UTC)	Frequency
Oct/23/2009 00:18:30	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/22/2009 18:00:00	six_hours
Oct/22/2009 22:36:08	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/22/2009 00:00:00	daily
Oct/22/2009 19:00:01	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/22/2009 12:00:00	six_hours
Oct/22/2009 13:12:11	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/22/2009 06:00:00	six_hours
Oct/22/2009 13:12:06	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/22/2009 00:00:00	six_hours
Oct/22/2009 04:00:58	<div style="width: 100%; height: 10px; background-color: green;"></div>	<div style="width: 100%; height: 10px; background-color: green;"></div>	Pgwave Drp	Oct/21/2009 18:00:00	six_hours



- **Web interface allows**
 - Quick overview of data processing
 - Flags runs requiring further attention
 - Allows “drill-down” to isolate/identify problems

Monitoring Data Quality



Fermi LAT Telemetry Trending

Version: 2.2.2 | Jira | Dbx Version: B2-1-0
 User: tonyj (Switch/Logout)
 Flight | Integration | Test | Nightly
 Trending source: Oracle | XML-RPC
 Plots | Table | Info
 Data Selection | Configuration | Data Info | Derived

Source : 77 Archive : Statistics
 Time Interval (UTC) : 22-Oct-2009 21:40:32.441-23-Oct-2009 21:40:32.441

Selected path: /Shift Plots Selected data: LSPECIDECZ,LSPECIRAZ Overlay Submit

Filter:

Root

- Shift Plots
 - LHKAEMFRDVI
 - LHKEBMSSRS
 - LHKEPU0CPUAVLDM
 - LHKEPU1CPUAVLDM
 - LHKEPU2CPUAVLDM
 - LHKSUCPUAVLDM
 - LSPCONDRATE
 - LSPDEAFRAC
 - LSPECIDECZ
 - LSPECIRAZ
 - LSPGEOLAT
 - LSPGEOLON
 - LSPMCLWAINL
 - LSPFCUTOFF
 - LSPROCKANGLE
 - LSPENTRATE
 - SACFLAGISINSUN
 - SACFLAGLATINSAA
 - SACSSRUSAGE

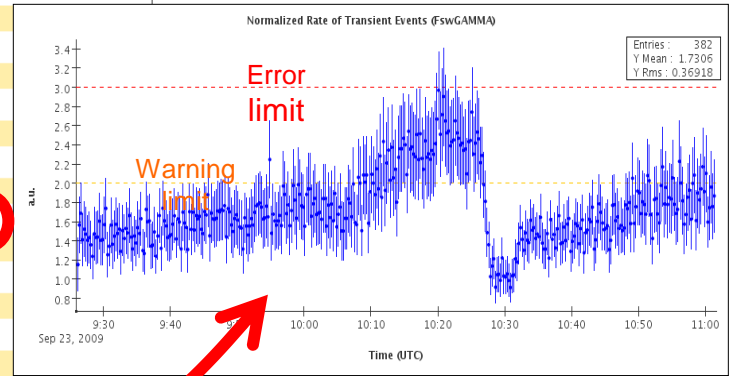
Download: (vector) eps svg pdf swf ps (, bitmap) jpg png ppm gif

Y Axis limits: Min -80.41 Max 429.44
 X Axis limits: Min 22-Oct-2009 21:40:32.441 Max 23-Oct-2009 21:40:32.441 Update

See Maria Elena Monzani's talk

Alarms for run 275390766

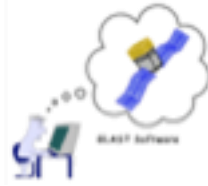
Mode	Type	Error	Warning	Undefined	Clean
acdPedsAnalyzer	Hist	0	0	0	14
calGainsAnalyzer	Hist	0	0	0	18
CalPed	Hist	0	0	0	2
calPedsAnalyzer	Hist	0	0		
Digi	Hist	0	0		
Digi	Trend	0	0		
FastMon	Hist	0	0		
FastMon	Trend	0	0		
fastMonError	Trend	0	0		
Merit	Hist	0	0		
Merit	Trend	0	1		
Recon	Hist	0	0		
Recon	Trend	0	0		
TkrMon	Trend	0	0		
verifyFt2Error	Trend	0	0		
verifyLog	Trend	0	0		



WARNING Status

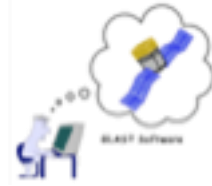
Severity	Mode	Type	Variable Name	Algorithm	Value	Limits	Details
5	Merit	Trend	Out_NormRateTransientEvs	values	2.97 +- 0.81	[-1.0E10 -1.0E10 --- 2.0 3.0]	View

Data Management/Access



- **Fermi data is immediately available to the public**
 - **Via Fermi Science Support Center**
- **SLAC supports collaboration data servers which provide**
 - **Storage of all Fermi data products (data and MC)**
 - **Currently all products on disk (and tape)**
 - **Full access to data via “data catalog”**
 - **Access to public files plus extended event formats**
 - **Search based on arbitrary “meta-data” associated with datasets**
 - **Web based event display (WIRED) for looking at detailed reconstruction of individual events**
 - **Web based data selection tools (Skimmer, Astro Server)**
 - **With support for producing Root and Fits files**

Data Catalog Web Interface



Run Min: Max: Status: ALL

MET Start: Stop:

Filter: Clear

Folder /Data/Flight/Level1/LPA Group FT1

7,310 items found, displaying 1 to 500.

[First/Prev] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

Name	Type	Format	Run Min	Run Max	MET Start	MET Stop	Events	Size	Status	Created (UTC)
r0277985681	FT1	fit	277985681	277985681	277985683.905165	277990271.085179	30,504	2.7 MB	OK	23-Oct-2009 19:56:21
r0277979700	FT1	fit	277979700	277979700	277979702.903274	277984145.085137	23,534	2.1 MB	OK	23-Oct-2009 19:19:55
r0277973710	FT1	fit	277973710	277973710	277973712.90496	277977906.089333	30,101	2.7 MB	OK	23-Oct-2009 18:26:11
r0277967692	FT1	fit	277967692	277967692	277967694.903479	277971873.08714	15,808	1.4 MB	OK	23-Oct-2009 15:28:46
r0277961622	FT1	fit	277961622	277961622	277961624.903399	277965984.086222	28,896	2.6 MB	OK	23-Oct-2009 15:31:20
r0277955445	FT1	fit	277955445	277955445	277955447.910756	277960098.085405	41,667	3.7 MB	OK	23-Oct-2009 17:47:14
r0277951581	FT1	fit	277951581	277951581	277951583.905027	277954232.085327	23,772	2.1 MB	OK	23-Oct-2009 10:54:16
r0277945852	FT1	fit	277945852	277945852	277945854.903315	277951571.085071	64,889	5.7 MB	OK	23-Oct-2009 14:09:05
r0277940123	FT1	fit	277940123	277940123	277940125.911704	277945842.086144	48,907	4.3 MB	OK	23-Oct-2009 13:54:41
r0277934394	FT1	fit	277934394	277934394	277934396.906468	277940113.085254	60,327	5.3 MB	OK	23-Oct-2009 06:33:40
r0277928665	FT1	fit	277928665	277928665	277928667.906523	277934384.085057	47,486	4.2 MB	OK	23-Oct-2009 09:02:42
r0277922632	FT1	fit	277922632	277922632	277922634.903501	277928655.098038	53,059	4.7 MB	OK	23-Oct-2009 05:28:14
r0277917385	FT1	fit	277917385	277917385	277917387.905128	277922501.086144	39,463	3.5 MB	OK	23-Oct-2009 00:00:00
r0277911633	FT1	fit	277911633	277911633	277911635.907134	277916406.085176	37,431	3.3 MB	OK	23-Oct-2009 00:00:00

Folder /Data/Flight/Level1/LPA Group FT1

Dataset r0277967692 version 0

Standard Data

Name	Value
Created (UTC)	23-Oct-2009 15:28:46
Run Min:	277967692
Run Max:	277967692
Events:	15,808
Size:	1.4 MB
Format:	fit
Type:	FT1
Source:	PIPELINE
Tasks:	doRun
Links	Download History

Meta-data

Name	Value	Type
L1_P6_public_v1	true	STRING
nDownlink	91023005	NUMBER
nMetStart	277967694.903479	NUMBER
nMetStop	277971873.08714	NUMBER
nMootKey	2557	NUMBER
nRun	277967692	NUMBER
sCreator	L1Proc-1.79	STRING
sDataSource	LPA	STRING
sIntent	nomSciOps_diagEna	STRING

Edit meta-data

Location

Site	Status	Checked (UTC)	Location
SLAC	OK	23-Oct-2009 16:01:39	/nfs/farm/g/glast/u20/FT1-2copies/glast/Data/Flight/Level1/LPA/prod/1.79/ft1/gll_ph_r0277967692_v000.fit
SLAC_XROOT	OK	23-Oct-2009 15:29:44	root://glast-rdr.slac.stanford.edu/glast/Data/Flight/Level1/LPA/prod/1.79/ft1/gll_ph_r0277967692_v000.fit

Drill down to get more details

Fermi LAT Data Portal Catalog

Catalog version 1.9 | Jira | Portal Version 3.1 | Jira

User: tony | (Switch/Logout) | Config: OnOrbit | Mode: [Prod | Dev | Test] | [Messages - Admin - Problems]

View: [Tree | Data Types | File Formats | Messages - Admin - Problems]

Folder /Data/Flight/Level1/LPA Group FT1

FT1 files from level 1 processing of on-orbit data. Edit description

Created (UTC): 25-Jun-2008 16:27:11

Run Min: 236084237
Run Max: 277985681
Files: 7310 (Errors 38)
Events: 227,334,343
Size: 16.9 GB
Data Type: FT1

List Files | Download Files | Dump file list (SLAC) | Dump file list (SLAC_XROOT)

Meta-data

Name	Value	Type
astroDB-LEOScience	true	STRING
astroDB-Level1	true	STRING
FT1Skim Level 1 LPA data	STRING	STRING
L1_P6_public_v1	true	STRING
nKeyData	20	NUMBER

Edit meta-data

GLAST Download Manager

File Edit Help

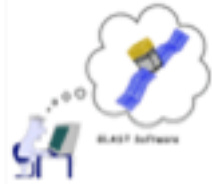
Buttons: Add... Remove Details Clean Up Start downloading Pause downloading

File Name	File Size	Status
r0236084237_ft1.fit	3.8 MB	Done
r0236090205_ft1.fit	2.9 MB	Downloading
r0236096298_ft1.fit	613.1 kB	Queued
r0236102471_ft1.fit	478.1 kB	Queued
r0236108455_ft1.fit	689.1 kB	Queued
r0236121367_ft1.fit	191.2 kB	Queued
r0236126697_ft1.fit	174.4 kB	Queued
r0236135175_ft1.fit	12.4 MB	Queued


Progress

Total Download Size: 16.9 GB Downloaded So Far: 5.5 MB
Download Rate: 270.2 kB/sec Time Remaining: 18:11:49

Download manager, reliable download of multiple files

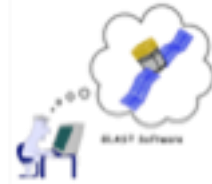


- **Data catalog currently contains**
 - 15 million datasets, 1.1 PetaBytes (data+mc)
- **Features**
 - Supports arbitrary file locations
 - nfs, afs, xrootd, ...
 - Supports multiple locations/sites for the same file
 - Allows arbitrary meta-data to be associated with files or directories
 - Command line interface (in addition to web interface)
 - Registration, list, search, ...
 - Includes “Data crawler” which verifies integrity of data catalog
 - Automatic extraction of meta-data from files
- **Implementation**
 - Data mostly stored in xrootd
 - Automatic volume management
 - Automatic tape archival (and in principle retrieval)
 - Scalability (many simultaneous jobs)
 - Uses oracle database (so does pipeline, monitoring etc)



See Andy
Hanushevs
ky's talk

"Astro" Server Web Interface



The P6_public_v1 event sample currently contains 190,185,596 events covering the time period 2008-08-04 15:43:36 UTC (239,557,418 MET) to 2009-10-22 11:23:53 UTC (277,903,436 MET) .

Number of events selected: 369311

Parameter	Value
Job Name	<input type="text" value="Arbitrary name: %u=%user name, %t=%job type, %n=unique id"/>
Event Sample	<input type="text" value="P6_public_v1"/> Event selection help
Energy Range	Min: <input type="text"/> Max: <input type="text"/> MeV (Leave blank for no limit)
Time Range	Min: <input type="text"/> Max: <input type="text"/> Mission elapsed time (MET) (Leave blank for no limit)
Position	RA: <input type="text" value="40.1"/> DEC: <input type="text" value="61.225"/> degrees (Leave blank for full sky) or astronomical object: <input type="text"/> using <input type="text" value="NED"/> overrides ra, dec above help
Radius	<input type="text" value="10.0"/> degrees
Event Class	<input type="text" value="Diffuse"/>
Output (FT2 Files)	<input checked="" type="checkbox"/> 30 second (fits) <input type="checkbox"/> 1 second (fits)
Output (Event Data)	<input checked="" type="checkbox"/> FT1 (fits) <input type="checkbox"/> LS1 (fits) <input type="checkbox"/> Merit (root) <input type="checkbox"/> Event-List (text)
Debug Mode	<input type="text" value="False"/>
User Comment	<input type="text" value="LS I 61+303"/>
Expert Options	<input type="text"/>

[help](#)

Parameter	Value
Job Name	%u-%t-%n
Event Source	P6_public_v1
Minimum energy	
Maximum energy	
Minimum MET	
Maximum MET	
RA	40.1
DEC	61.225
Galactic Object	
Radius	10.0
Event Class	Diffuse
Output (FT2 Files)	30-second
Output (Event Data)	FT1
Debug	false
User Comment	LS I 61+303
Expert Options	

Astro job submitted

Your job tonyj-AstroServer-00040 has been submitted.

Your data will be available for download from <ftp://ftp-glast.slac.stanford.edu/glast.u27/DataServer/1256243366055>

You will be sent an e-mail at tonyj@slac.stanford.edu when your job has completed.

You can monitor your job's progress using the [Pipeline](#)

Note: Clicking on the Status column will take you to the pipeline task that ran the job. Clicking on the Job column will allow you to rerun this task, or a similar one. Clicking on the Output Directory column will take you to the output.

Submit Time	Job	User	Task Type	Status	Output Directory	User Comment
22-Oct-2009 13:21	tonyj-AstroServer-00040	tonyj	AstroServer	Success	View dir	LS I 61+303
22-Oct-2009 08:01	arodrig_ana_4	arodrig	AstroServer	Success	View dir	
22-Oct-2009 07:30	arodrig_ana_3	arodrig	AstroServer	Success	View dir	
22-Oct-2009 07:29	arodrig_ana_3	arodrig	AstroServer	Success	View dir	
22-Oct-2009 00:36	Aug08_Oct08_2008_10953p0755	bijant	AstroServer	Success	View dir	
21-Oct-2009 13:46	Abdo-FT2-Oct21	abdo	AstroServer	Success	View dir	
21-Oct-2009 13:44	Abdo-AllSky-5	abdo	PitsSkimmer	Failed	View dir	
21-Oct-2009 09:53	arodrig_ana_2	arodrig	AstroServer	Success	View dir	
21-Oct-2009 09:12	arodrig_ana_1	arodrig	AstroServer	Success	View dir	
21-Oct-2009 03:01	parent-AstroServer-00004	parent	AstroServer	Success	View dir	
20-Oct-2009 14:52	borgland-SimpleSkimmer-00052	borgland	SimpleSkimmer	Success	View dir	Pass7.2 Diffuse - Aug-Sept
20-Oct-2009 14:15	uchiama-1713-13mon	uchiama	Astro	Failed	View dir	
20-Oct-2009 14:02	borgland-SimpleSkimmer-00051	borgland	SimpleSkimmer	Success	View dir	Pass6 Diffuse - Aug-Sept - For Pass7.2 validation
20-Oct-2009 08:17	guillermo-AstroServer-00003	guillermo	AstroServer	Success	View dir	
20-Oct-2009 08:13	guillermo-AstroServer-00002	guillermo	AstroServer	Success	View dir	

[Up to higher level directory](#)

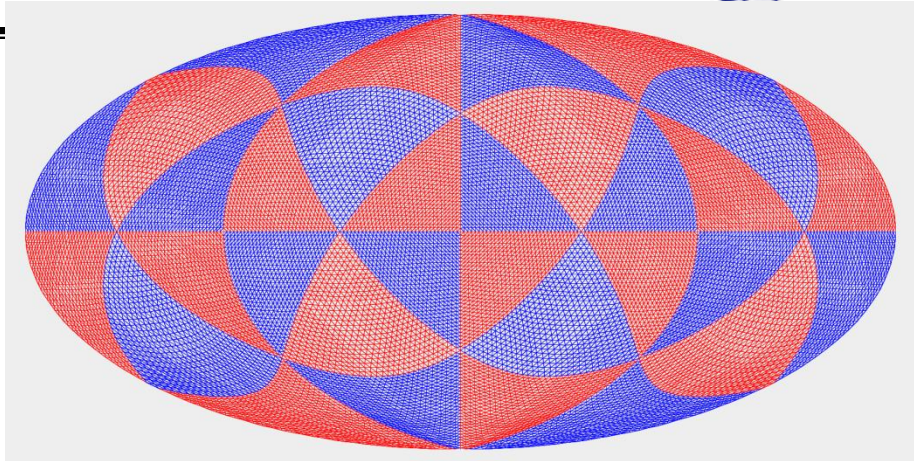
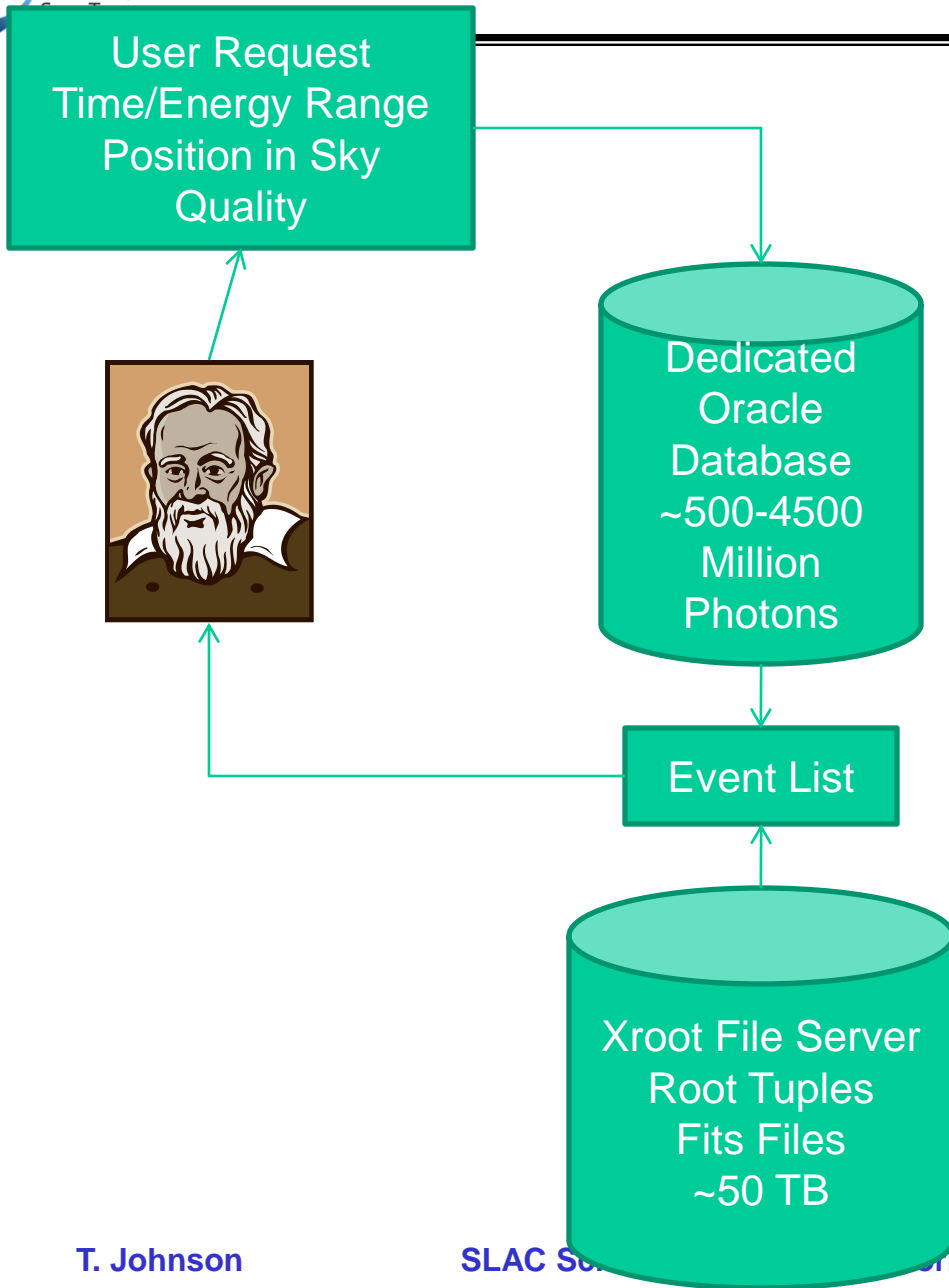
Name

- [tonyj-AstroServer-00040-README.html](#)
- [tonyj-AstroServer-00040-ft1.fits](#)
- [tonyj-AstroServer-00040-ft2-30s.fits](#)

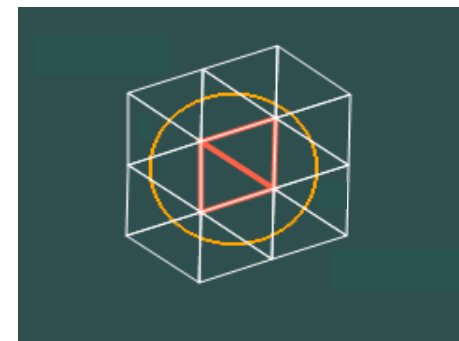
Size Last Modified

4 KB	10/22/2009 8:31:00 PM
33351 KB	10/22/2009 8:39:00 PM
144206 KB	10/22/2009 8:46:00 PM

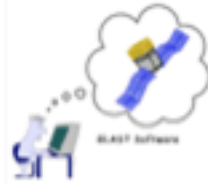
"Astro" Server Implementation




Within the database events are indexed by time, energy and position using a hierarchical triangular mesh (HTM). Database partitions are used to split the data into 1 week time bins and 32 position bins within each time bin, each containing 1024 HTM regions (shown above). The use of HTM triangles makes it easy to identify which regions are entirely contained in the user request, and which are partially contained and require finer selection (below).



Conclusions



- **Fermi data pipeline, data catalog and monitoring tools have been in production use for 4 years**
 - **Have proved very reliable for data processing**
 - **Web based tools allows monitoring load to be distributed world wide**
- **Important design decision to avoid tight coupling to specific experiment**
 - **Fermi tools already being used by other experiments**
 - **EXO, CDMS, CTA**
 - **Being evaluated for use by James Webb Space Telescope**
 - **Supported by PPA Scientific Computing Application group**
- **Future work planned to**
 - **Extend pipeline + data catalog to support**
 - **Additional batch systems**
 - **Currently support LSF (SLAC), BQS (Lyon), Condor**
 - **Adding support for Grid Engine, EEEG Grid**
 - **Additional data storage locations**
 - **Grid**
 - **Increase interactivity of web applications including data catalog**
 - **(AJAX, Web 2.0, GWT)**



See Brian
Van
Klaveren's
talk