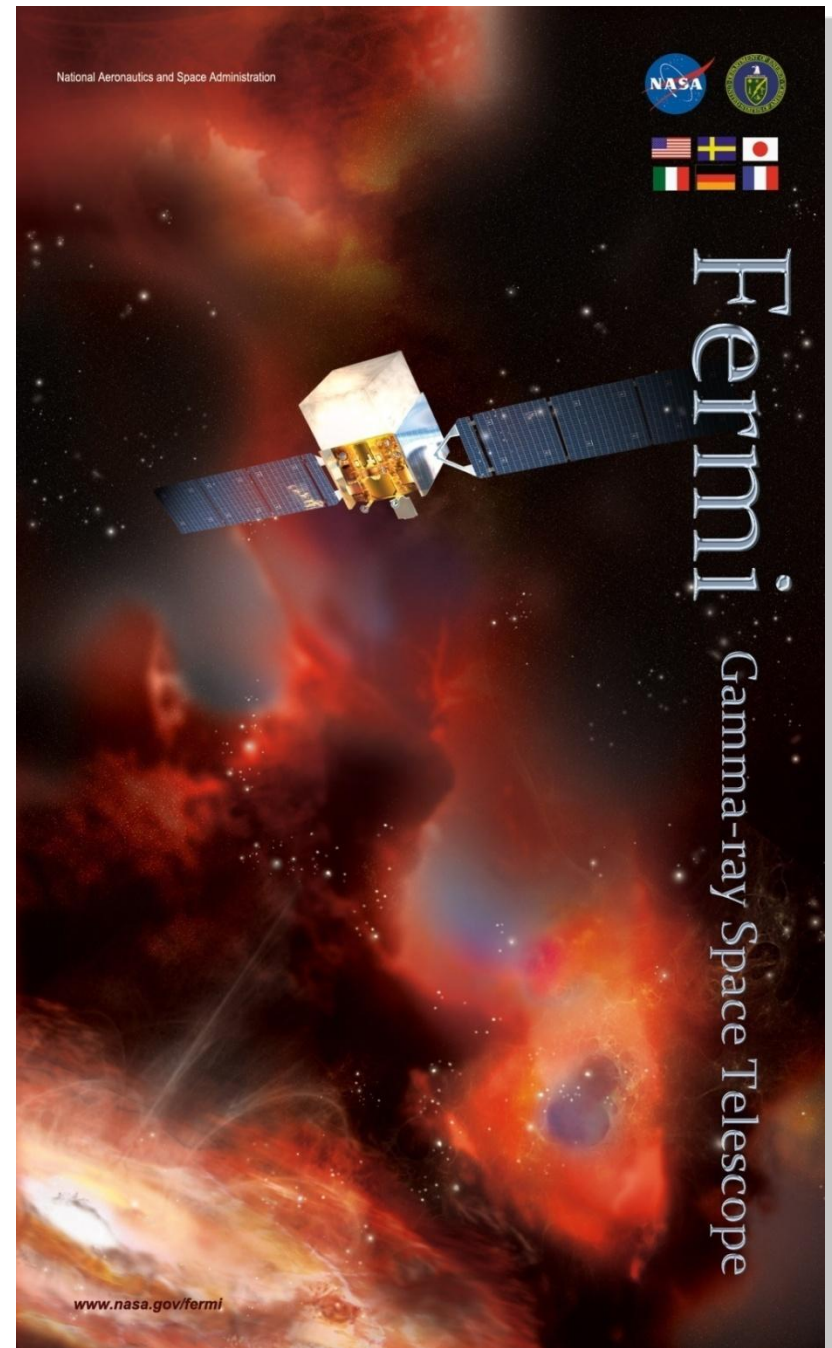


Fermi Gamma-Ray Space Telescope Processing Pipeline and Data Catalog and Online Monitoring

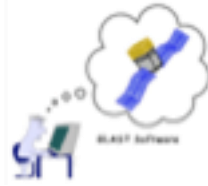
Tony Johnson



tonyj@slac.stanford.edu



Overview

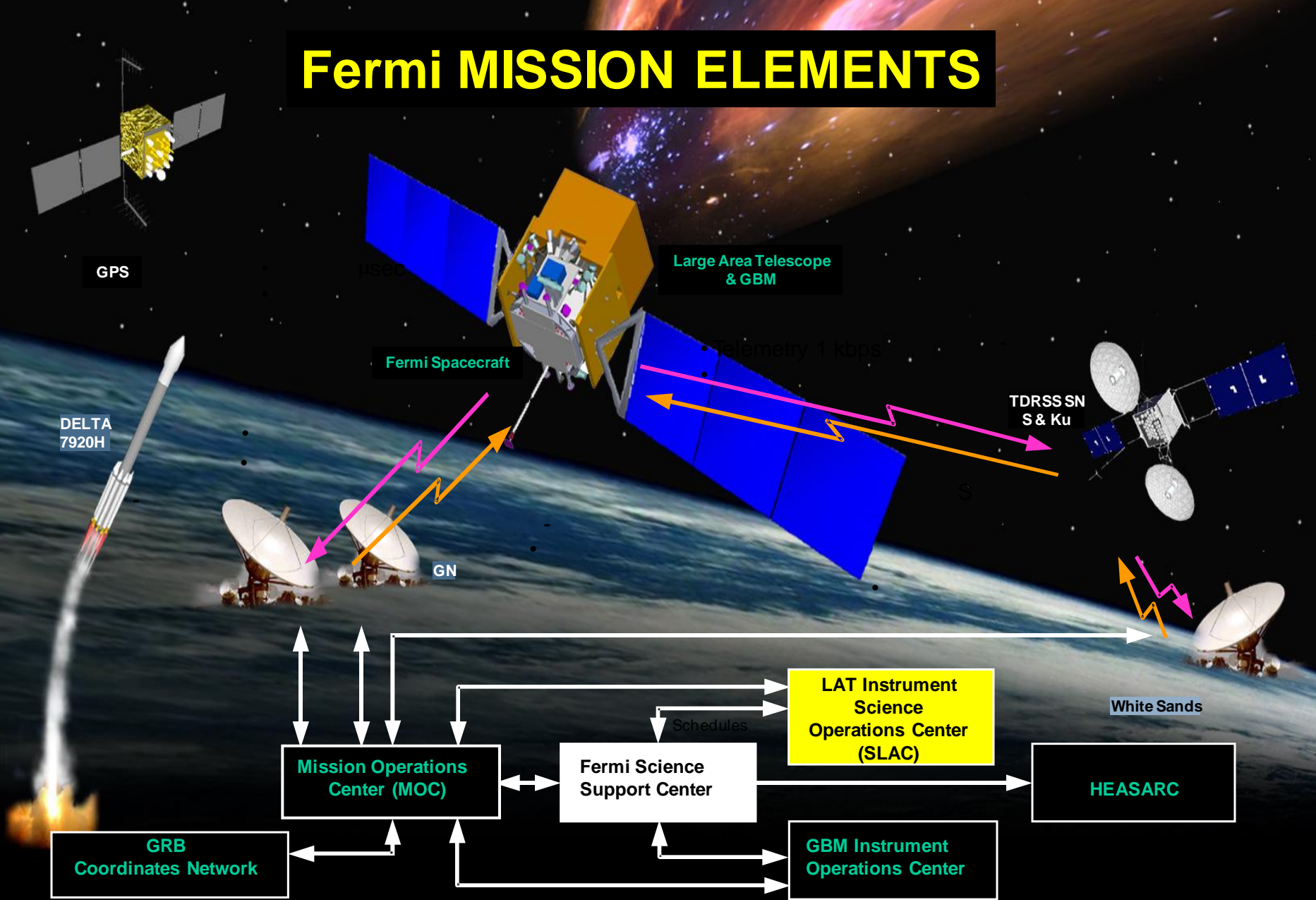


- **Fermi infrastructure**
 - **Automated data processing pipeline**
 - **Also use for MC simulation**
 - **Data quality monitoring**
 - **Data access and data selection tools**
 - **Future development**
- **Explore potential for future use by CTA**
 - **Reuse of any existing Fermi tools?**
 - **Reuse of experience and lessons learned from Fermi?**
 - **Development of future CTA tools?**

Launched 11 June 2008 – LAT activated 25 June



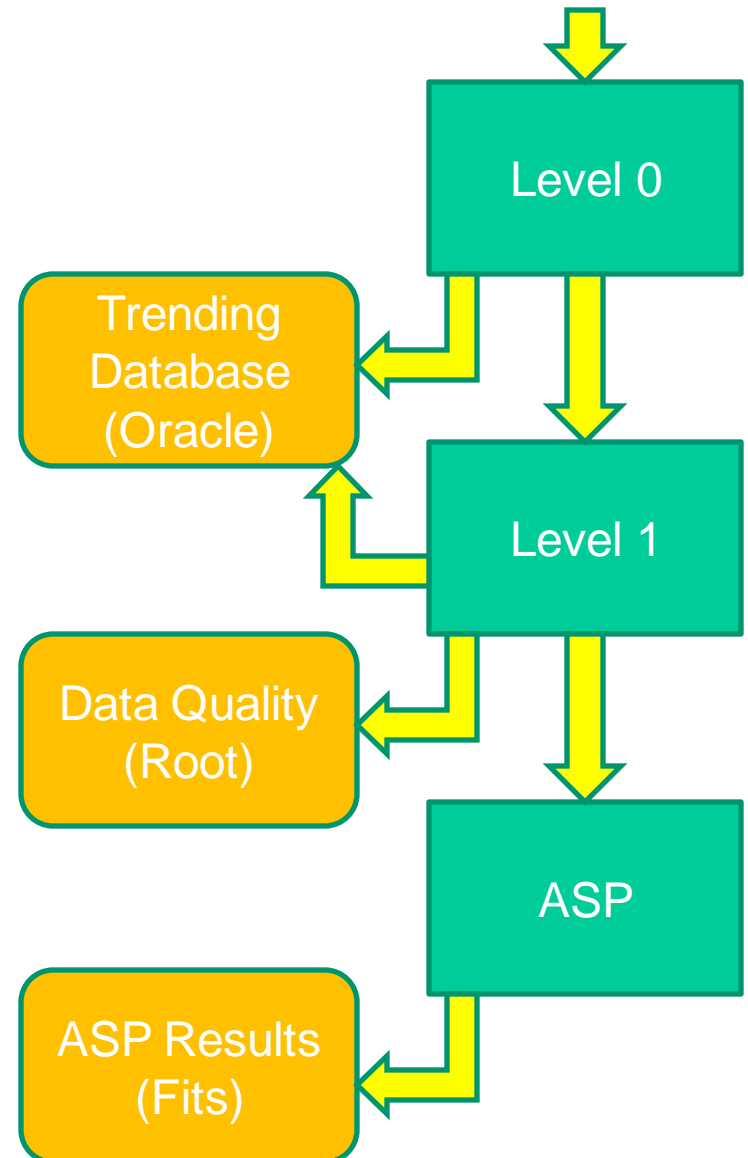
Fermi MISSION ELEMENTS



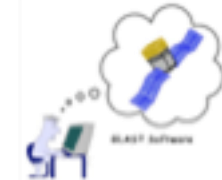
Data Processing Flow at SLAC



- **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

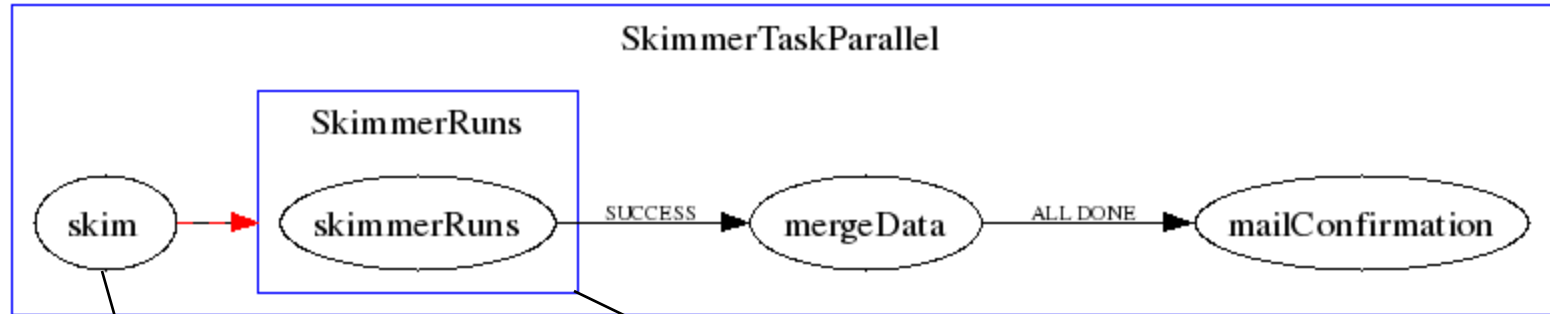


Data Processing Pipeline



- **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**

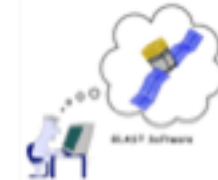
Tasks, Subtasks, Processes, Streams, specified in user written XML



```
<process name="skim">
  <script>
    <![CDATA[
from java.util import HashMap
start = 0
chunk_size = DP_FILE_LINES/DP_SUBTASKS + 1
for i in range(DP_SUBTASKS):
  vars = HashMap()
  vars.put("DP_START", start)
  end = min( start + chunk_size, DP_FILE_LINES )
  vars.put("DP_END", end)
  if end>start:
    pipeline.createSubstream("SkimmerRuns",i,vars)
  start = end
]]>
  </script>
  <createsubtasks>
    <subtask>SkimmerRuns</subtask>
  </createsubtasks>
</process>
```

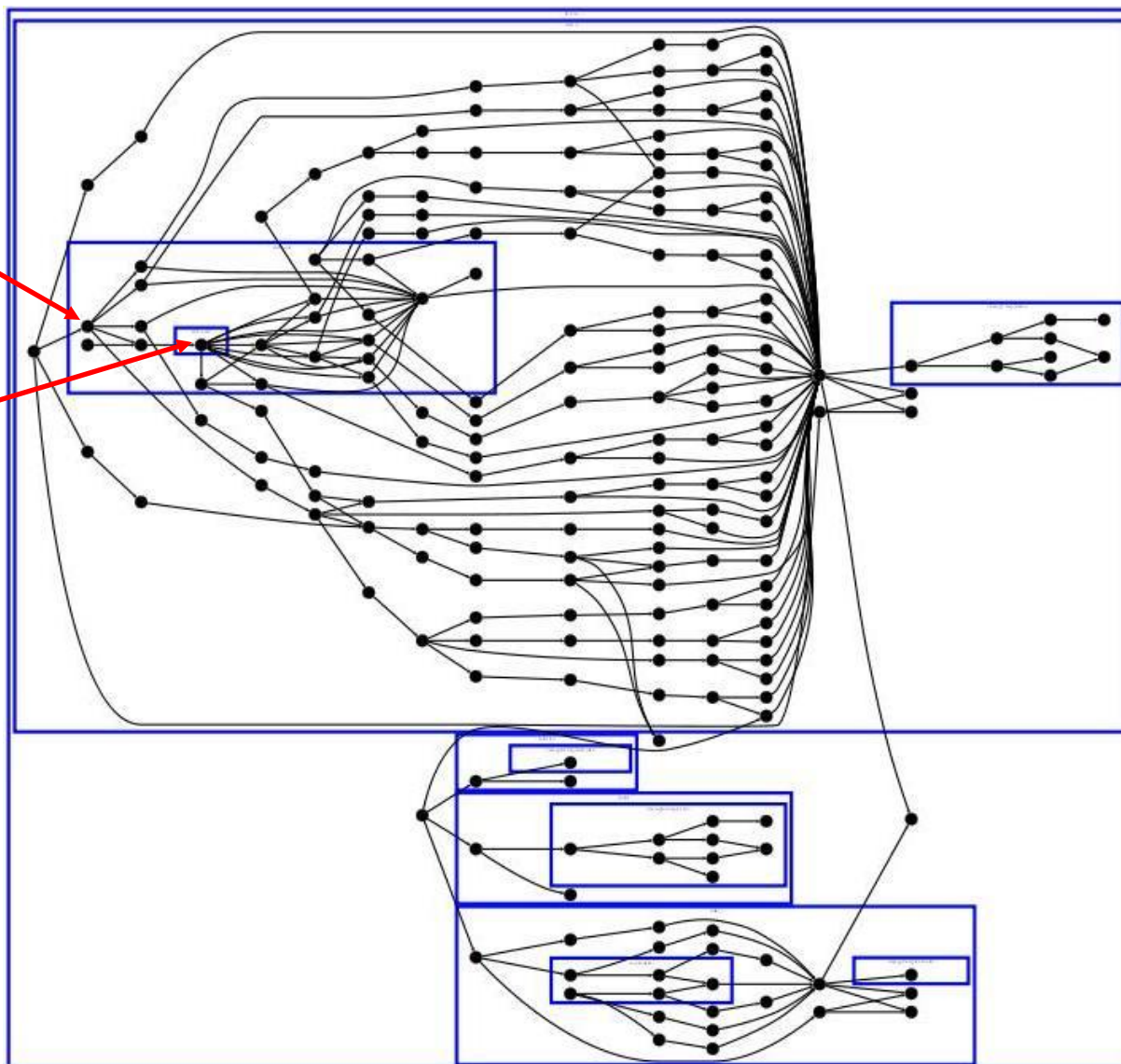
```
<task name="SkimmerRuns" type="Data" version="1.0">
  <process name="skimmerRuns">
    <variables>
      <var name="streamID">${format(pipeline.stream,"%04d")}</var>
    </variables>
    <job maxCPU="${DP_SKIMMER_MAXCPU}">
      cat ${DP_FILE_LIST} | head -${DP_END} | tail -${(DP_END-DP_START)} > partlist
      export SK_FILE_LIST_FILE=partlist
      export SK_OUT_DIR=${DP_OUT_DIR}/${streamID}
      export SK_ENFORCE_OUTPUT_FILES=false
      export SK_MAX_FILE_SIZE=0
      export SK_OUT_FILE_BODY=${DP_JOBNAME}-${streamID}
      mkdir -p ${SK_OUT_DIR}
      $SK_DIR/bin/skimmer
    </job>
  </process>
</task>
```

Level 1 Processing Task Example

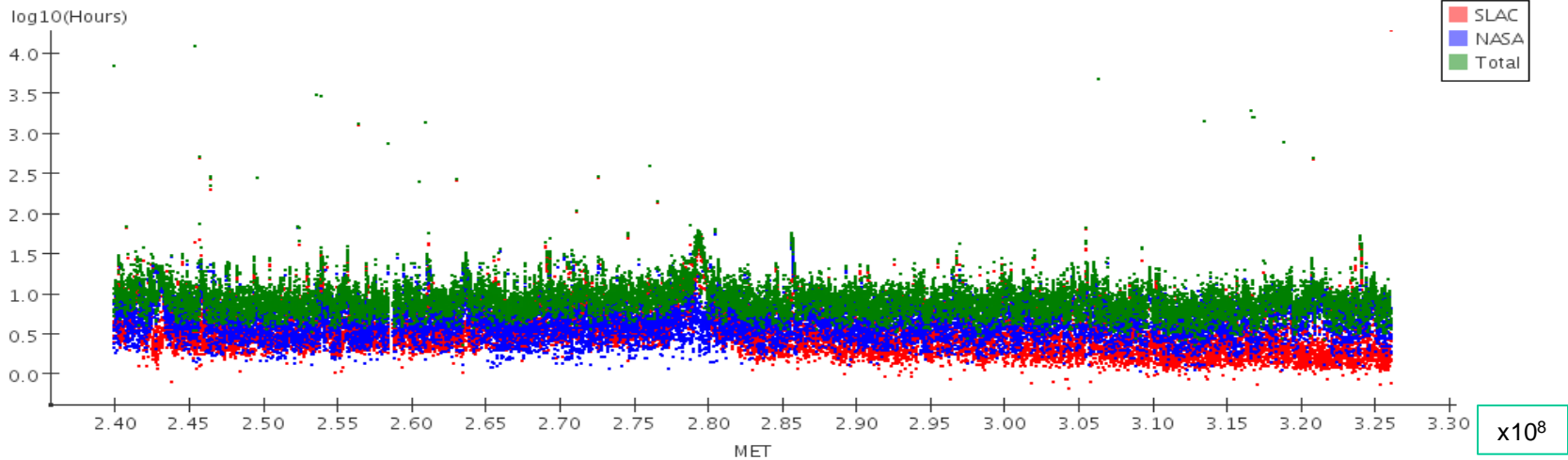


Digitization

Reconstruction

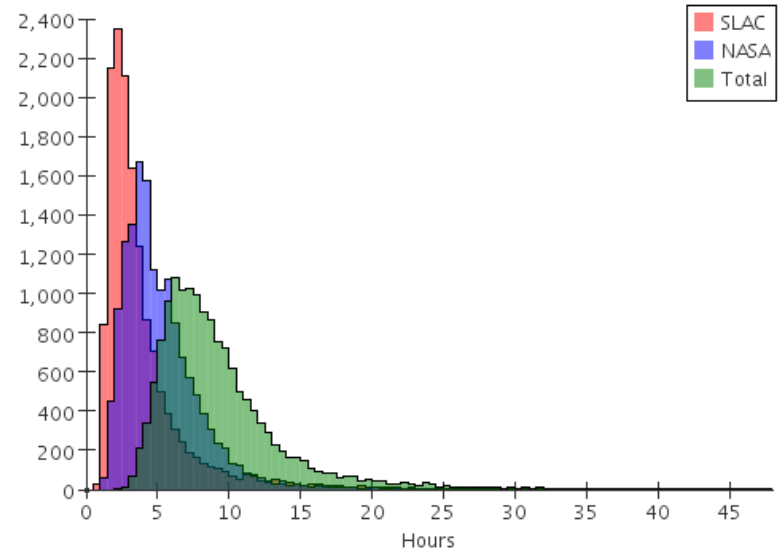


Data processing elapsed time per run vs MET

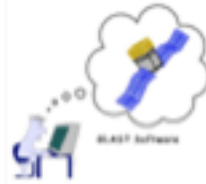


Elapsed time between data being recorded on satellite and arriving at SLAC (blue), and between arriving at SLAC and being totally processed (red), and total elapsed time (green). Almost all data is fully processed <24 hours after being recorded.

Data processing elapsed time per run




ISOC Control Room



- “Duty Scientists” monitoring data quality daily
- All of the data processing and data quality monitoring can be done from the web

Monitoring Data Processing





Fermi LAT Data Processing

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

User: tonyj . ([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									
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: yellow;"></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: yellow;"></div>				
					277997612	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></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: yellow;"></div>	Complete	4231	FM Di Re Me Cal
					277967692	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></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: yellow;"></div>	Running	25 4206	FM Re Me Cal
					277961622	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></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: yellow;"></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: yellow;"></div>	Complete	1 4230	FM Di Re Me Cal
					277945852	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></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: yellow;"></div>	Complete	333 1 3897	
					277940123	R	Complete	nomSciOps_diagEna	<div style="width: 100%; height: 10px; background-color: yellow;"></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

[Quick Links](#) [Data Processing](#) [Data Access](#) [Data Monitoring](#) [Science](#) [Shifts](#) [Mission Planning](#) [Contact Info](#) [Change Control](#)
[Software Tools](#) [Developer](#)

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Login Mode: [**Prod** | Dev | Test]

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Task Summary

Task Filter: Regular Expression (?) Active in Last 30 days Latest Task Versions

Last Active	Task Name	Type	0	1	2	3	4	5	6	7	8	9	10	Total
2010-10-18 16:20	L1Proc	Data	0	0	1	404	2	0	0	0	0	0	0	407
2010-10-18 16:19	RspAGN_src	Data	0	0	3	11165	253	0	1	0	0	0	0	11422
2010-10-18 16:16	Level0Xroot	Data	0	0	0	630	6	0	0	0	0	0	0	636
2010-10-18 16:15	SkimmerTaskParallel	SKIM	0	0	2	861	86	0	2	0	0	0	0	951
2010-10-18 15:58	P116-FT1	Data	0	0	218	11625	1	0	0	0	0	0	0	11844
2010-10-18 15:14	rspmq7day	DATA	0	0	0	21	0	0	0	0	0	0	0	21
2010-10-18 14:40	GRB_refinement_launcher	Data	0	0	0	583	5	0	0	0	0	0	0	588
2010-10-18 14:38	AspInsertIntervals	Data	0	0	0	273	44	0	0	0	0	0	0	317
2010-10-18 14:34	AstroServerSkimmerTask	SKIM	0	0	0	957	128	0	0	0	0	0	0	1085
2010-10-18 13:55	DRP_monitoring	Data	0	0	0	165	0	0	0	0	0	0	0	165
2010-10-18 13:25	PGWave	Data	0	0	0	165	0	0	0	0	0	0	0	165
2010-10-18 13:20	AspLauncher	Data	0	0	0	295	3	0	0	0	0	0	0	298
2010-10-18 12:55	HalfPipe	Data	0	0	0	6784	2	0	0	0	0	0	0	6786
2010-10-18 12:16	nonEventReporting	Data	0	0	0	34844	3315	0	4	0	0	0	0	38163
2010-10-18 09:25	launchReport	Data	0	0	0	941	0	0	0	0	0	0	0	941
2010-10-18 04:01	obssim_v9r16p1	MC	0	0	0	86	109	0	0	0	0	0	0	195
2010-10-17 20:40	GRB_afterglow	Data	0	0	0	37	0	0	0	0	0	0	0	37
2010-10-17 20:34	GRB_afterglow_launcher	Data	0	0	0	91	488	0	0	0	0	0	0	579
2010-10-17 11:12	GRB_refinement	Data	0	0	0	42	0	0	0	0	0	0	0	42
2010-10-15 14:37	SkimmerTask	SKIM	0	0	0	634	97	0	0	0	0	0	0	731
2010-10-15 10:56	P105-FT2	Data	0	0	0	5575	0	0	0	0	0	0	0	5575
2010-10-15 03:16	intOnlineAnalysis	Data	0	4	0	20	6	0	0	0	0	0	0	30
2010-10-14 14:13	GRBSimulator-GR-v17r35p8	MC	0	0	0	7701	0	0	0	0	0	0	0	7701
2010-10-13 13:45	RePipe	Data	0	0	0	53	6	0	0	0	0	0	0	59

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Task L1Proc Stream 100917001

Stream 100917001
 Execution 1
 Is Latest 1
 Status Failed
 Submitted 16-Sep-2010 17:49:20.335
 Started 16-Sep-2010 17:49:34.071
 Ended 16-Sep-2010 21:46:21.016

Variables

Name	Type	Value
DOWNLINK_ID	Integer	100917001
DOWNLINK_RAWDIR	String	/afs/slac/g/glast/ground/PipelineStaging6/halfPipe/100917001

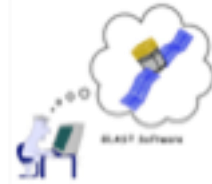
Stream Processes

Show only latest execution

Process	Status	Type	Created	Submitted	Started	Ended	Job Id	CPU	Host	Links
findRunDirs	Success	Batch	16-Sep-2010 17:49:20	16-Sep-2010 17:49:23	16-Sep-2010 17:49:29	16-Sep-2010 17:49:38	961916	0	hequ0019	Messages : Log : Files
cleanupDI	Skipped	Batch	16-Sep-2010 17:49:20			16-Sep-2010 18:36:32				Messages
kludgeAsp	Success	Batch	16-Sep-2010 17:49:20	16-Sep-2010 19:32:08	16-Sep-2010 19:32:12	16-Sep-2010 19:33:58	976707	5	fell0182	Messages : Log : Files

- Pipeline web interface allows
 - Many views of data processing, down to log files of individual jobs
 - Job submission (but normally done from command line)
 - If jobs do fail they can be “rolled back” directly from the web interface

Front End: Activity Plots



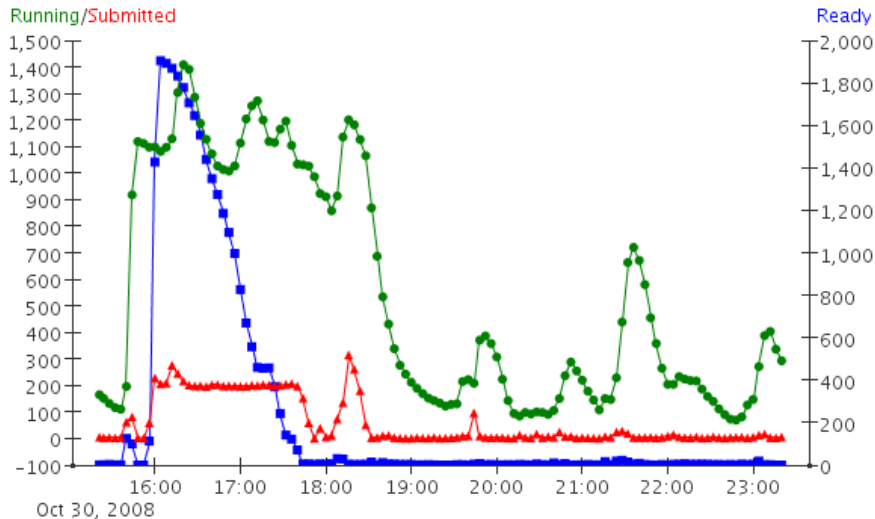
Select Task: All Tasks

Start: None End: None or last 8

Submit

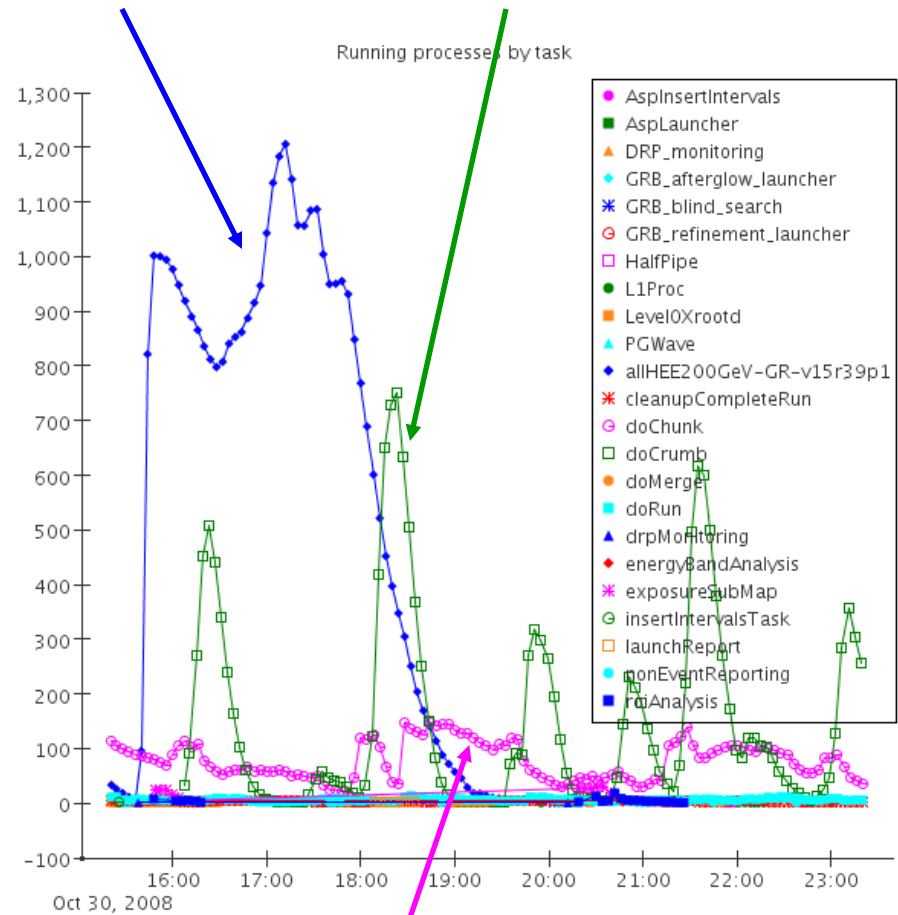
Starting Date: Thu Oct 30 15:20:00 PDT 2008 - Ending Date: Thu Oct 30 23:20:00 PDT 2008
 121 records found from table Minutes with group by 4

Task: ALL



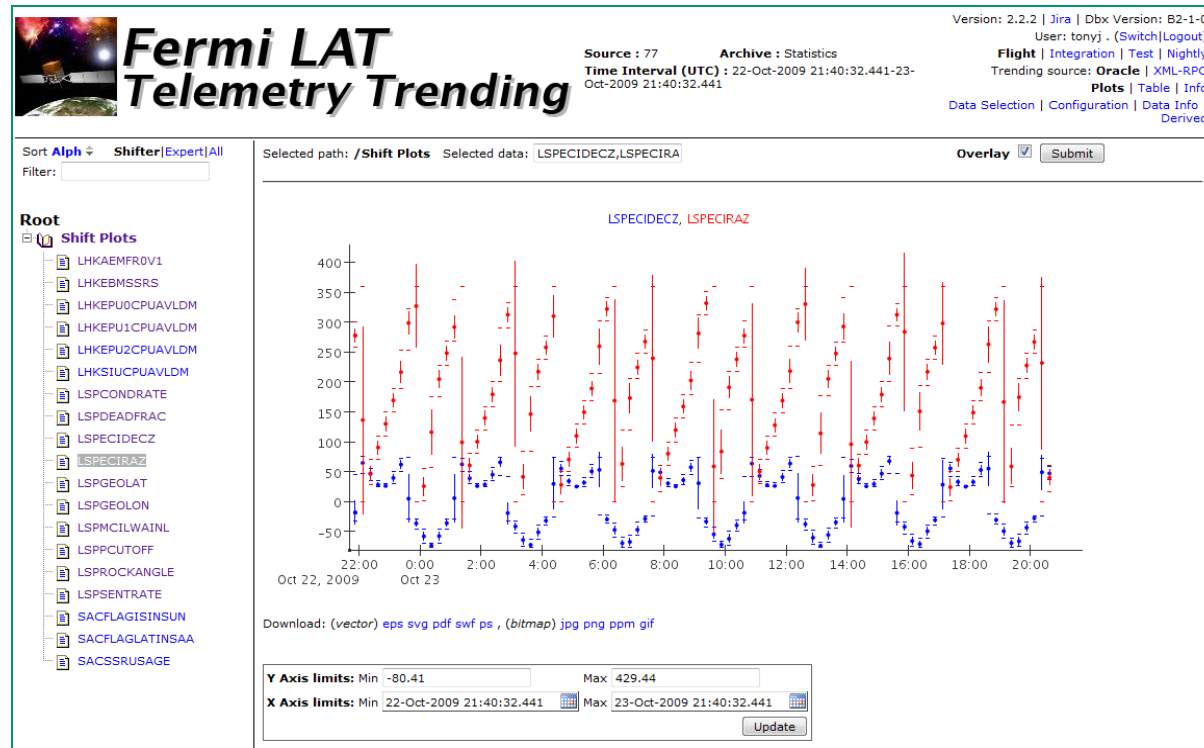
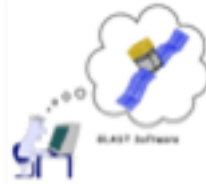
Simulation

L1 Reconstruction



L1 Digitization

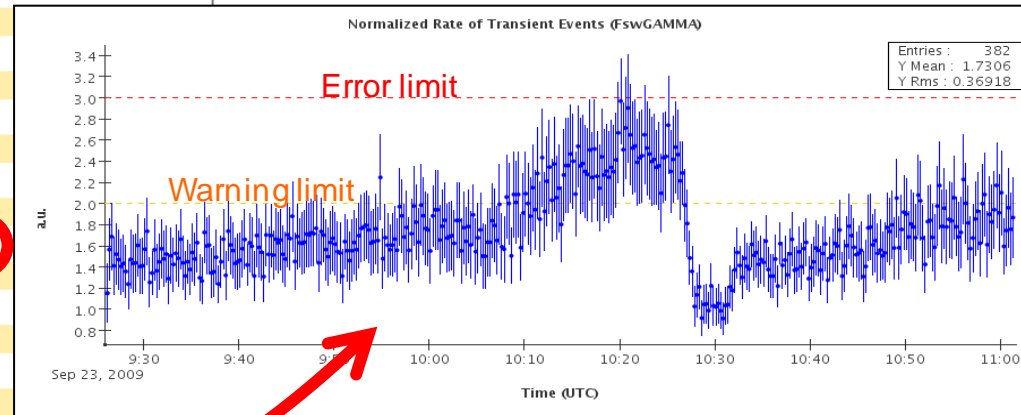
Telemetry Trending



- **Web interface allows**
 - **Dynamic selection of time period**
 - **Dynamic overlay of quantities**
 - **Customized tree to draw attention to important plots**
 - **Can be customized for individuals or groups**
- **Cross trending of housekeeping and level 1 data**

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	0	0
Digi	Hist	0	0	0	0
Digi	Trend	0	0	0	0
FastMon	Hist	0	0	0	0
FastMon	Trend	0	0	0	0
fastMonError	Trend	0	0	0	0
Merit	Hist	0	0	0	0
Merit	Trend	0	1	0	0
Recon	Hist	0	0	0	0
Recon	Trend	0	0	0	0
TkrMon	Trend	0	0	0	0
verifyFt2Error	Trend	0	0	0	0
verifyLog	Trend	0	0	0	0



WARNING Status

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

- Automated alarms are used to alert duty scientists to anomalies
- Use fixed limits and reference histograms
- Many quantities are highly orbit dependent, so particle fluxes, geomagnetic variables must be taken into account
 - 20 different alarm algorithms

- **Fermi data is immediately available to the public**
 - **Via Fermi Science Support Center**
- **ISOC supports collaboration data servers which provide**
 - **Full access to data via web based “data catalog”**
 - **Access to public files plus extended event formats**
 - **Search based on arbitrary “meta-data” associated with datasets**
 - **Web based event display for looking at detailed reconstruction of individual events**
 - **Web based data selection tools**
 - **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.

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/fermi/u20/FT1-2copies/fermi/Data/Flight/Level1/LPA/prod/1.79/ft1/gll_ph_r0277967692_v000.fit
SLAC_XROOT	OK	23-Oct-2009 15:29:44	root://fermi-rdr.slac.stanford.edu/fermi/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]

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

Navigation: Welcome | Catalog | Merit Skimmer | Fits Skimmer | Astro Server | Wired | History

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

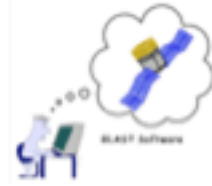
File Name	File Size	Status
r0236084237_ft1.fit	3.8 MB	Done
r0236090205_ft1.fit	2.9 MB	Downloading
r0236096298_ft1.fit	613.1 kB	Queued
r0236102471_ft1.fit	478.1 kB	Queued
r0236108455_ft1.fit	689.1 kB	Queued
r0236121367_ft1.fit	191.2 kB	Queued
r0236126697_ft1.fit	174.4 kB	Queued
r0236135175_ft1.fit	12.4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

"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 08:53	arodrig_ana_2	arodrig	AstroServer	Success	View dir	
21-Oct-2009 08:12	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	uchiyama-1713-13mon	uchiyama	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	guillemo-AstroServer-00003	guillemo	AstroServer	Success	View dir	
20-Oct-2009 08:13	guillemo-AstroServer-00002	guillemo	AstroServer	Success	View dir	

[Up to higher level directory](#)

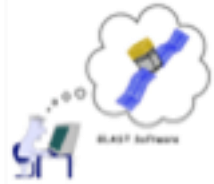
Name

- tonyj-AstroServer-00040-README.html
- tonyj-AstroServer-00040-ft1.fits
- tonyj-AstroServer-00040-ft2-30s.fits

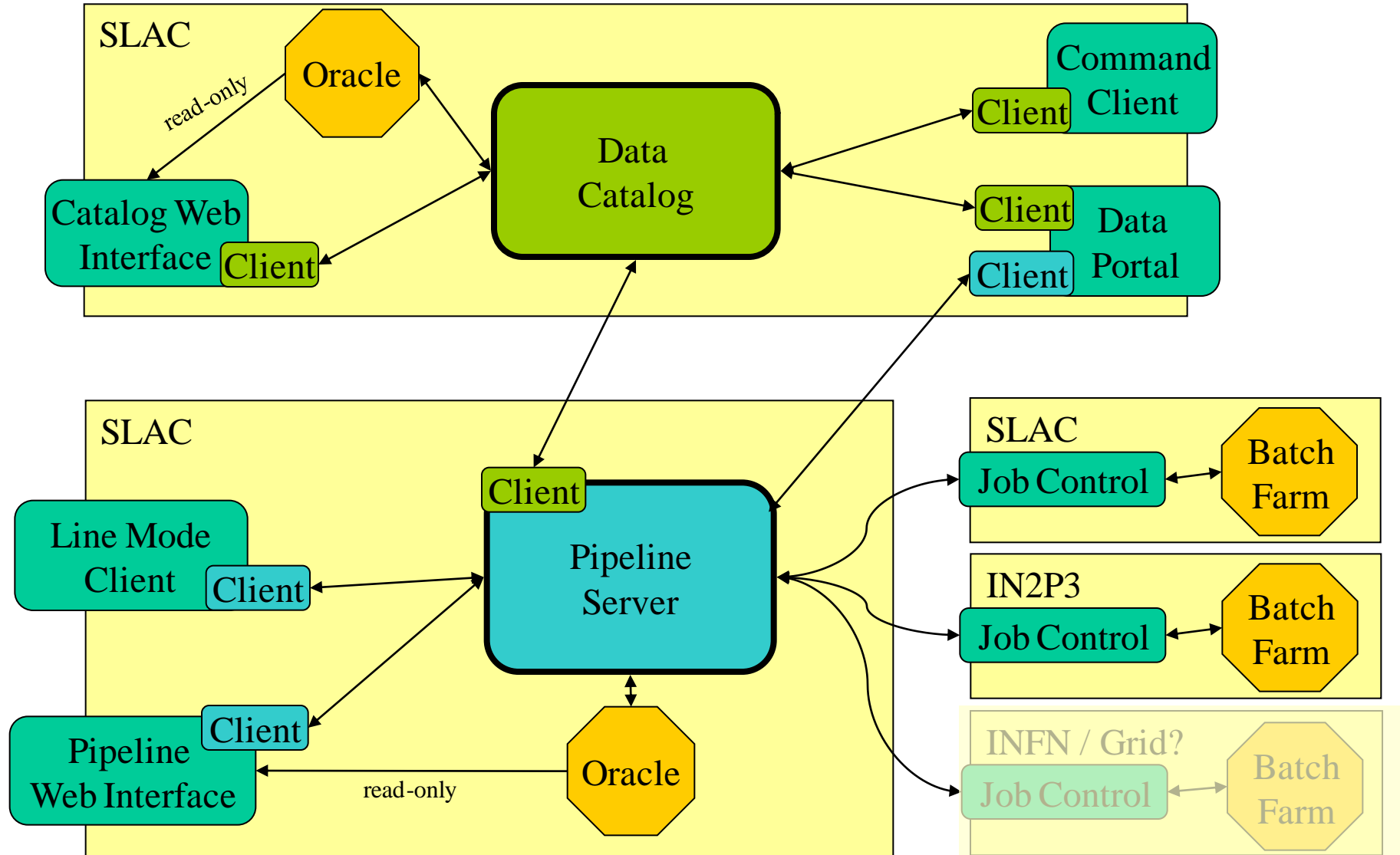
Size Last Modified

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

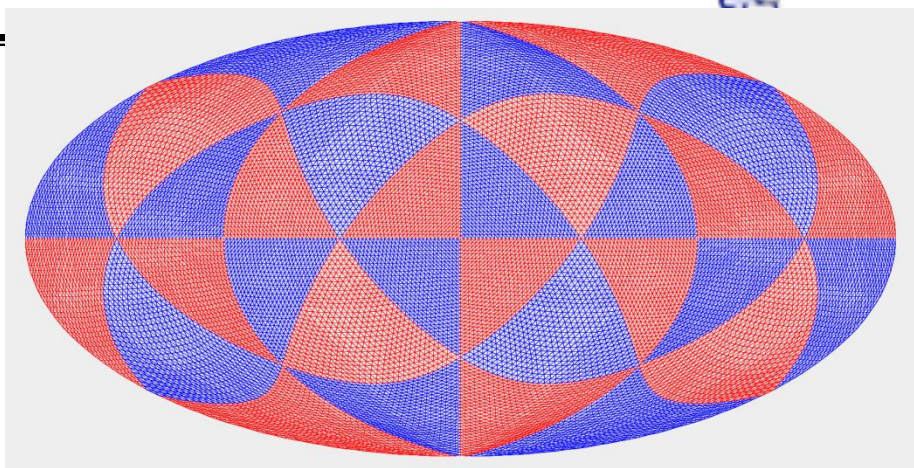
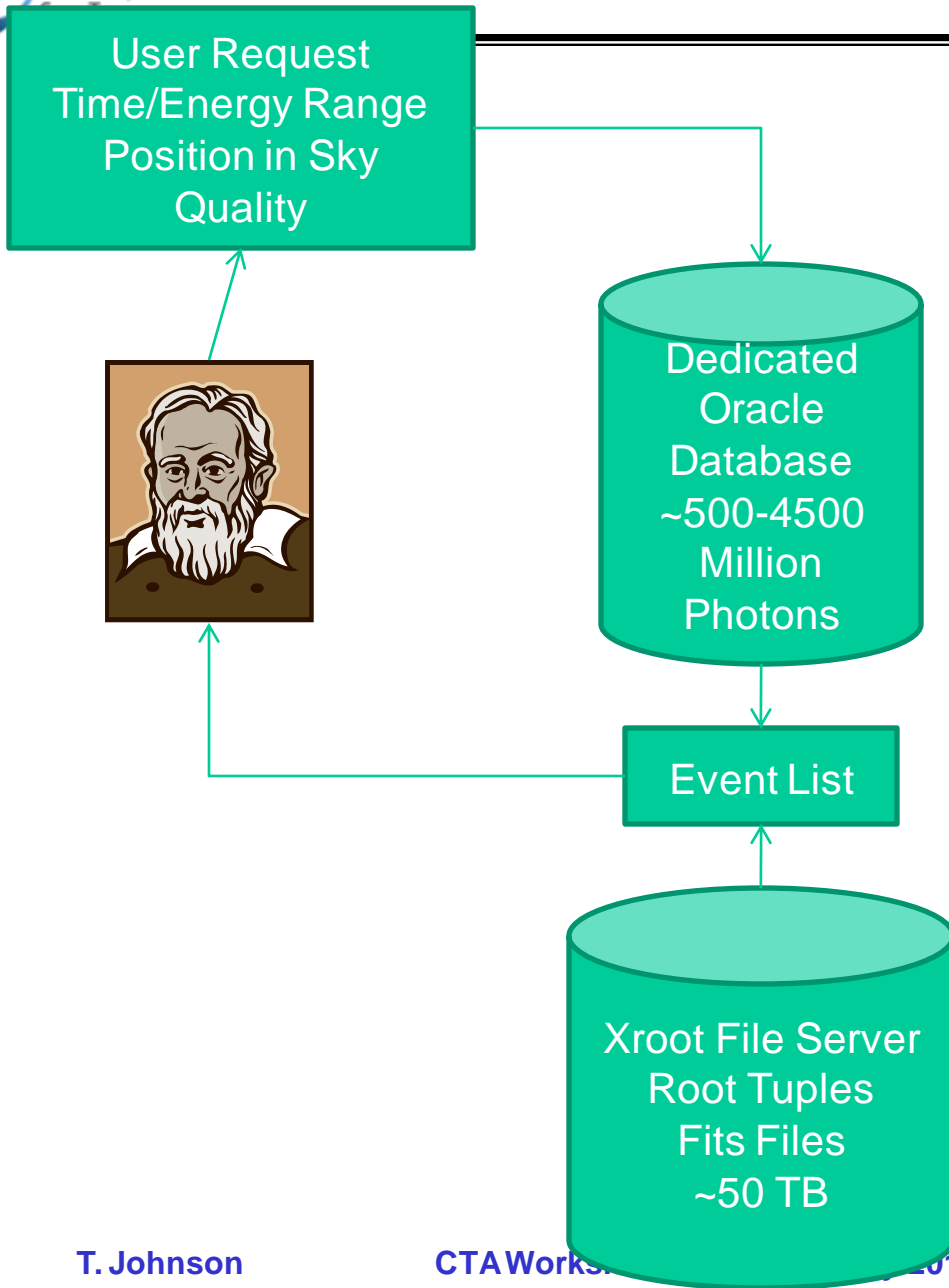
Implementation



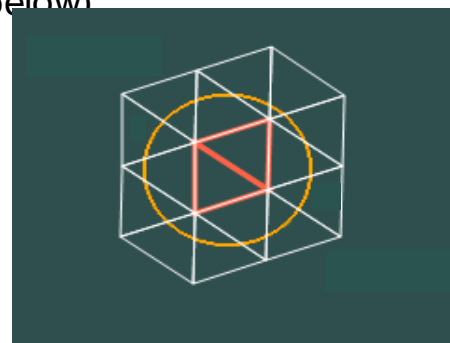
- **Pipeline, Web Servers implemented in Java**
 - **Apache tomcat web server**
 - **Redundant servers for reliability, scalability**
 - **Java Server Pages (JSP) for web pages**
 - **Extensive use of 3rd party and custom tag libraries**
 - **DisplayTag for tabular data**
 - **AIDA tld for dynamic plot generation**
 - **JMX for monitoring, control**
 - **JaSIG CAS single-signon for user authentication**
- **Extensive use of database for storing state, history**
 - **Oracle (10g, 11)**
 - **Java Stored Procedures for performance**
 - **GridControl for performance, tuning, monitoring**



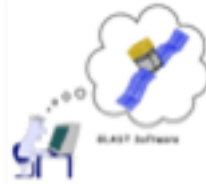
“Astro” Server Implementation



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)

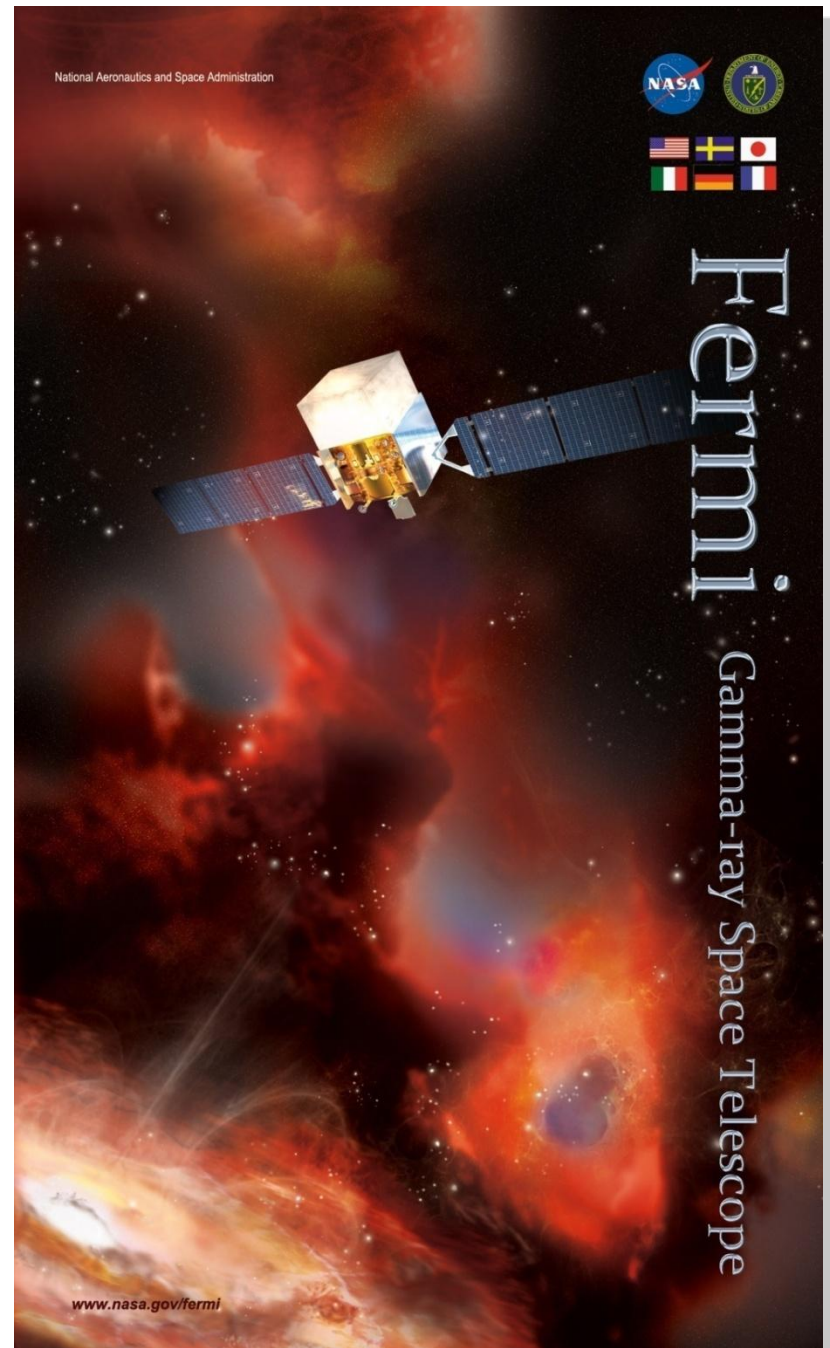


Conclusions

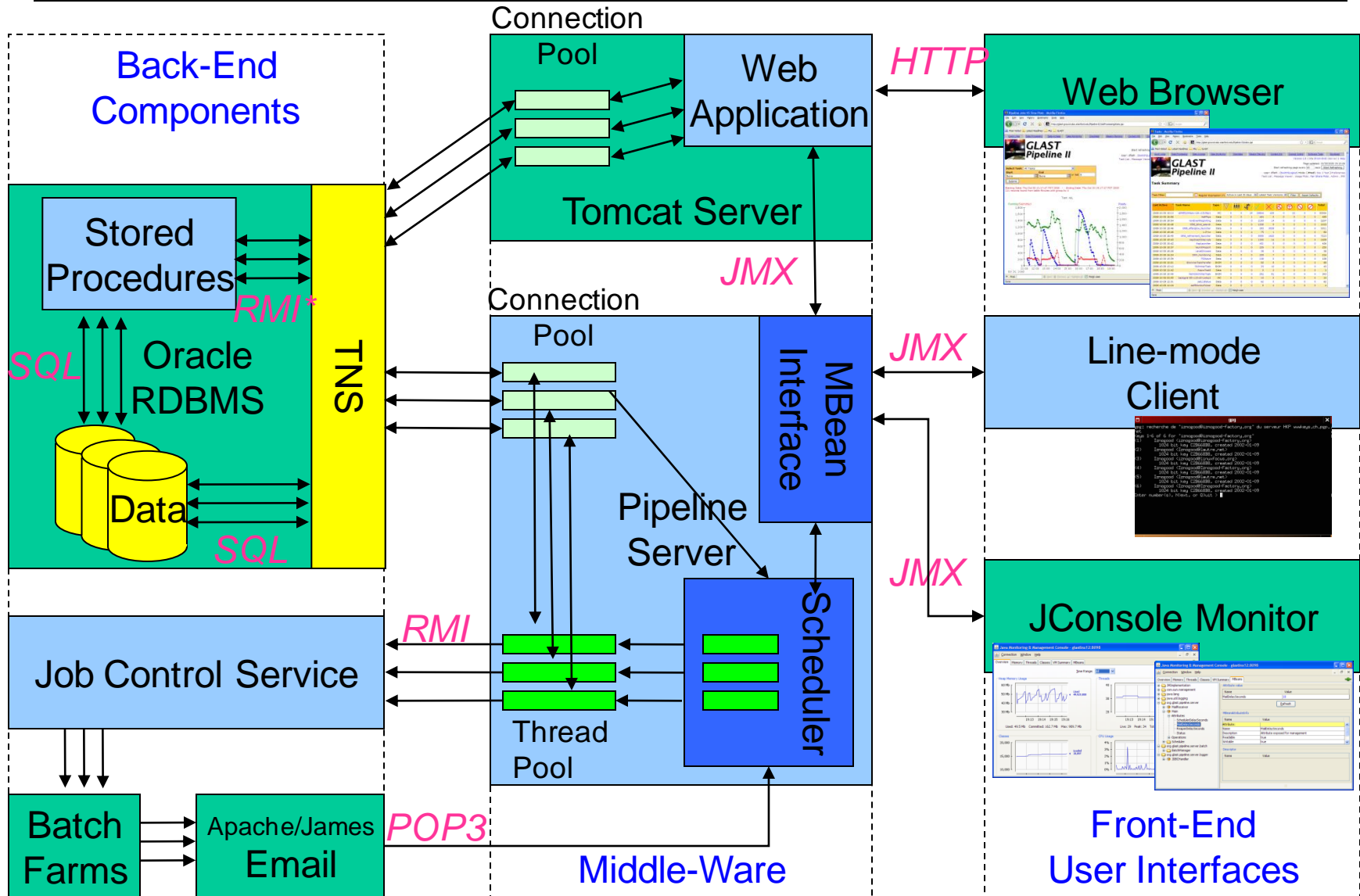
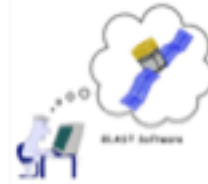


- **Fermi data pipeline, data catalog and monitoring tools have been in production use for 4 years**
 - **Have proved very reliable for data processing**
 - **Web based tools allows monitoring load to be distributed world wide**
- **Important design decision to avoid tight coupling to specific experiment**
 - **Fermi tools already being used by other experiments**
 - **EXO, CDMS**
 - **Being evaluated for use by James Webb Space Telescope**
- **Future work planned to**
 - **Support submission of pipeline jobs to more systems**
 - **Currently support LSF (SLAC), BQS (Lyon), Condor**
 - **Adding support for Grid Engine, EGE Grid**
 - **Increase interactivity of web applications (AJAX, Web 2.0, GWT)**
- **Interested in exploring reuse of tools and/or experience for CTA**
 - **Good area to start may be use of pipeline for some CTA simulations**

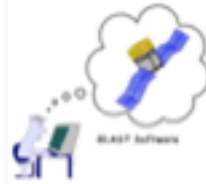
Extra Slides



Pipeline Implementation

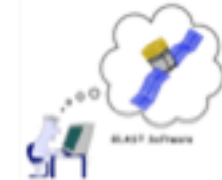


Technologies Used



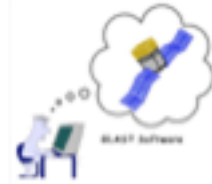
- **Database**
 - **Oracle**
 - **Java Stored Procedures** for performance
 - **Scheduled Server-side Jobs** for monitoring, stats-gathering
 - **Hierarchical queries**
- **Servers and Client Libraries (Pipeline, Data Catalog)**
 - **Java**
 - **Extensive use of threads, concurrency utilities** for performance
 - **Jython** interpreter for user scripts
 - **JMX MxBean Interfaces** for monitoring, communication
 - **XML** used for processing-task definitions
 - **Batch jobs** use e-mail for status notification
 - **Apache/James Email server**
- **Web:**
 - **Apache/Tomcat servers**
 - **JSP** for web pages
 - **DisplayTag** for tabular data
 - **AIDA tag libraries** for plotting
 - **Custom tag libraries** expose Pipeline client methods
 - **Java Servlets**
 - **Serve GraphViz State diagrams**
 - **JMX Interfaces**

Data Catalog design goals



- Support multiple storage formats
 - AFS, NFS, xrootd, dCache, Grid etc
- Support multiple file locations for same datasets
 - SLAC, IN2P2, ...
- Allow arbitrary meta-data to be stored with datasets
 - As much meta-data as possible should be extracted from the file itself to ensure integrity
- Dataset access from web, command line, API
 - Including search based on meta-data
- Avoid tight coupling to specific experiment to allow for reuse
 - Avoid tight coupling with pipeline

Processing Pipeline Web Interface



Version 2.8.3 | Jira (Front-End) (Server) | Help

Page updated: 10/18/2010 16:23:09
Start refreshing page every 60 secs

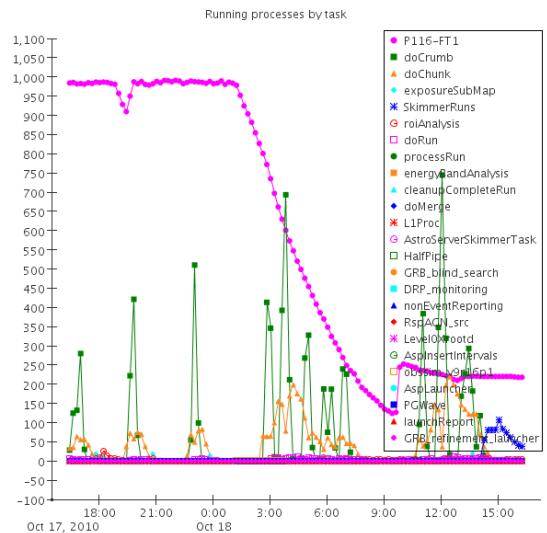
Login Mode: [**Prod** | Dev | Test]

Task List · Message Viewer · Usage Plots · Fair Share Plot · Admin · JMX

Task Summary

Task Filter: Regular Expression (?) Active in Last 30 days Latest Task Versions

Last Active	Task Name	Type	0	1	2	3	4	5	6	7	8	9	10	Total
2010-10-18 16:20	L1Proc	Data	0	0	1	404	2	0	0	0	0	0	0	407
2010-10-18 16:19	RspAGN_src	Data	0	0	3	11165	253	0	1	0	0	0	0	11422
2010-10-18 16:16	Level0Xroot	Data	0	0	0	630	6	0	0	0	0	0	0	636
2010-10-18 16:15	SkimmerTaskParallel	SKIM	0	0	2	861	86	0	2	0	0	0	0	951
2010-10-18 15:58	P116-FT1	Data	0	0	218	11625	1	0	0	0	0	0	0	11844
2010-10-18 15:14	rspm7day	DATA	0	0	0	21	0	0	0	0	0	0	0	21
2010-10-18 14:40	GRB_blind_search	Data	0	0	0	316	0	0	0	0	0	0	0	316
2010-10-18 14:40	GRB_refinement_launcher	Data	0	0	0	583	5	0	0	0	0	0	0	588
2010-10-18 14:38	AspInsertIntervals	Data	0	0	0	273	44	0	0	0	0	0	0	317
2010-10-18 14:34	AstroServerSkimmerTask	SKIM	0	0	0	957	128	0	0	0	0	0	0	1085
2010-10-18 13:55	DRP_monitoring	Data	0	0	0	165	0	0	0	0	0	0	0	165
2010-10-18 13:25	PGWave	Data	0	0	0	165	0	0	0	0	0	0	0	165
2010-10-18 13:20	AspLauncher	Data	0	0	0	295	3	0	0	0	0	0	0	298
2010-10-18 12:55	HalfPipe	Data	0	0	0	6784	2	0	0	0	0	0	0	6786
2010-10-18 12:16	nonEventReporting	Data	0	0	0	34844	3315	0	4	0	0	0	0	38163
2010-10-18 09:25	launchReport	Data	0	0	0	941	0	0	0	0	0	0	0	941
2010-10-18 04:01	obssim_v9r16p1	MC	0	0	0	86	109	0	0	0	0	0	0	195
2010-10-17 20:44	GRB_refinement_launcher	Data	0	0	0	37	0	0	0	0	0	0	0	37



Version 2.8.3 | Jira (Front-End) (Server) | Help

Page updated: 10/18/2010 16:31:42
Start refreshing page every 60 secs

User: tonyj · (Switch|Logout) Mode: [**Prod** | Dev | Test] Preferences

Task List · Message Viewer · Usage Plots · Fair Share Plot · Admin · JMX

Task L1Proc Stream 100917001

Stream 100917001
Execution 1
Is Latest 1
Status Failed
Submitted 16-Sep-2010 17:49:20.335
Started 16-Sep-2010 17:49:34.071
Ended 16-Sep-2010 21:46:21.016

Variables

Name	Type	Value
DOWNLINK_ID	Integer	100917001
DOWNLINK_RAWDIR	String	/afs/slac/g/glast/ground/PipelineStaging6/halfPipe/100917001

Stream Processes

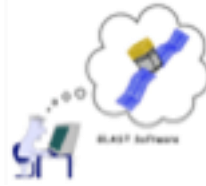
Show only latest execution

Process	Status	Type	Created	Submitted	Started	Ended	Job Id	CPU	Host	Links
findRunDirs	Success	Batch	16-Sep-2010 17:49:20	16-Sep-2010 17:49:23	16-Sep-2010 17:49:29	16-Sep-2010 17:49:38	961916	0	hequ0019	Messages : Log : Files
cleanupDI	Skipped	Batch	16-Sep-2010 17:49:20			16-Sep-2010 18:36:32				Messages
kludgeAsp	Success	Batch	16-Sep-2010 17:49:20	16-Sep-2010 19:32:08	16-Sep-2010 19:32:12	16-Sep-2010 19:33:58	976707	5	fell0182	Messages : Log : Files


Select all · Deselect all · Toggle selection

- Pipeline web interface allows
 - Many views of data processing, down to log files of individual jobs
 - If jobs do fail they can be “rolled back” directly from the web interface

Data Quality Monitoring



[Quick Links](#) | [Data Processing](#) | [Data Access](#) | [Data Monitoring](#) | [Science](#) | [Shifts](#) | [Mission Planning](#) | [Contact Info](#) | [Change Control](#) | [Software Tools](#) | [Developer](#)



Fermi LAT Data Quality Monitoring

Time Interval (UTC) : Oct/15/2010 17:33:46.651-Oct/18/2010
14:56:04.009

RunId : 309090776,309096826,309077924,30908465

For the selected runs: **Intent**: nomSciOps_diagEna | **Moot Key**: 2643

[Refresh Data](#)

Version 1.0.7[Jira]

User: tonyj . ([Switch](#) | [Logout](#)) | Mode: **[Prod | Dev]**

[Table](#) | [Plots](#) | [Alarms](#) | [Errors](#) | [Images](#)

[Selection](#) | [Data Info](#)

Filter on/off Sort **Alph** Expert

Show Selection Form | Parameters Selection: **Complete** [Hide Data Description](#)

Root

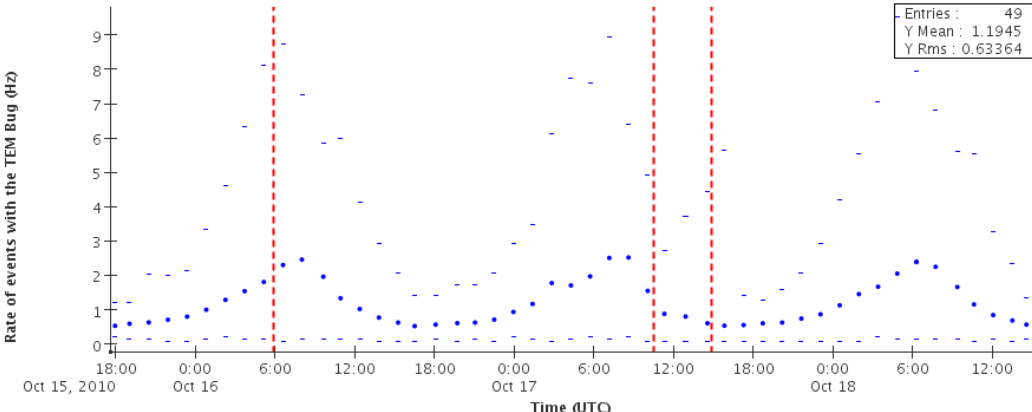
- Shift Plots
- Arrival Times
 - CAL_HI
 - CAL_LO
 - CNO
 - ROI
 - TKR
- Detector Means-Rates
- Event Rates to SSR
- FastMonErrors
 - Any_Error_But_TEM
 - TEM bug rate
- GEM-Filter Rates
- GPS
- Hardware Trigger
- Navigation
 - Distance to SAA
 - Earth Limb in FOV
 - Geomagnetic McIlwain L
 - Geomagnetic cutoff
 - Spacecraft Rock angle
 - Spacecraft Z-Dec
 - Spacecraft Z-Ra

Level LAT

Variable:
FastMon_Trend_Rate_FastMon_TemBug_Event

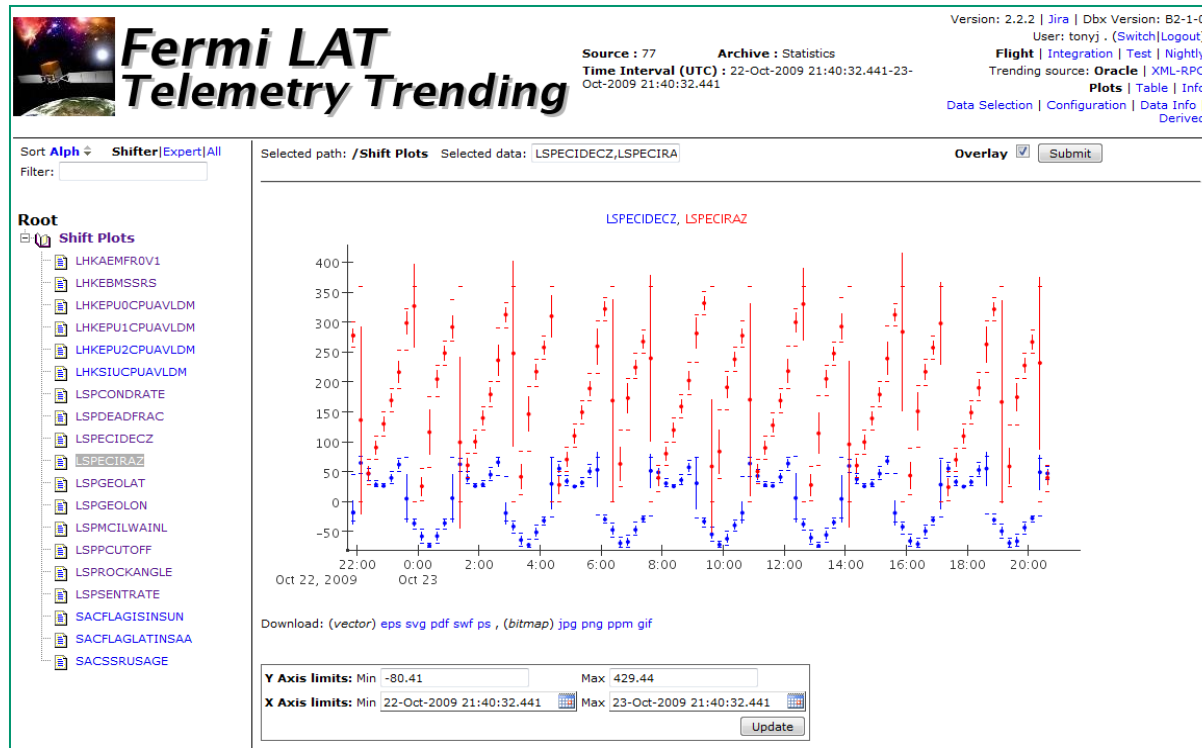
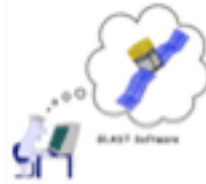
Rate of events suffering the TEM bug.
The rate of error is expected to follow the total event rate, so one can compare with the GEM rate (LAT) in the GEM-Filter Rates group.
The rate of TEM bugs is expected to be comprised between 0 and 10Hz.
A smooth trend is expected, one can look for short spikes or drops in the rate.

Rate of events with the TEM Bug

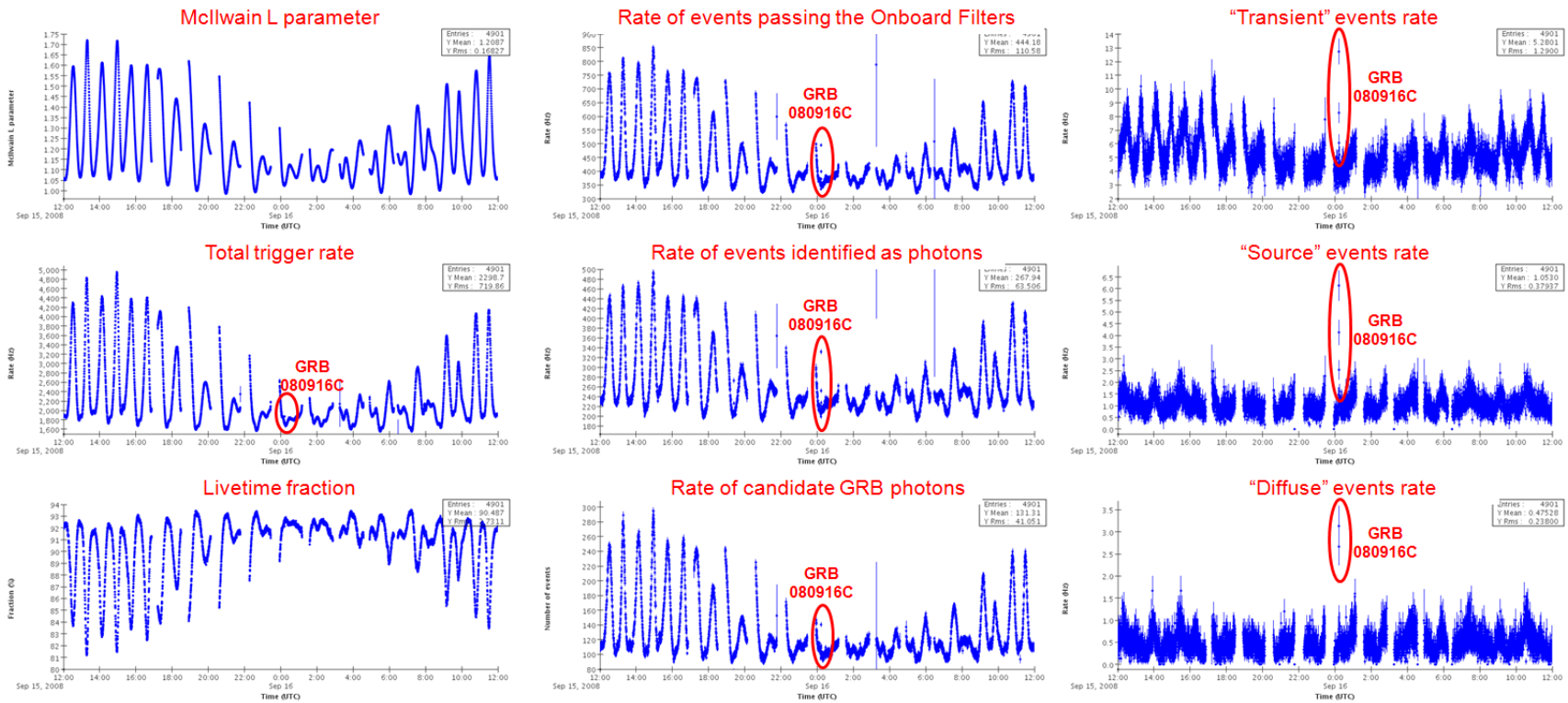


- **Web interface allows**
 - Show data from single run or aggregate set of runs
 - View description of each plot
 - View/Print multiple plots
 - Customized tree to draw attention to important plots
 - Can be customized for individuals or groups

Telemetry Trending

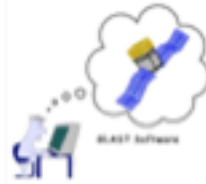



- **Web interface allows**
 - Dynamic selection of time period
 - Dynamic overlay of quantities
 - Customized tree to draw attention to important plots
 - Can be customized for individuals or groups
- **Cross trending of housekeeping and level 1 data**



- The trending graphs below show some rate summary plots for the 24 hours around GRB.
- Strong correlation with orbital period (~ 90 minutes) can clearly be seen
- This burst was so bright that it can be seen even in the global rate plots.

Automated Science Processing





Fermi LAT ASP Data Viewer

Time Interval (UTC) : 23-Sep-2009 21:57:49-23-Oct-2009 21:57:49

Version: 0.3.4 | Jira
 User: tonyj . (Switch/Logout) | Mode: [Prod | Dev] | Prefs
[Public Source Plots](#) | [GRB](#) | [Processes](#)
[Configuration](#) | [Point Sources](#) | [Source Grouping](#) | [XML Source Model](#)
[Data Info](#) | [Advanced Config](#)

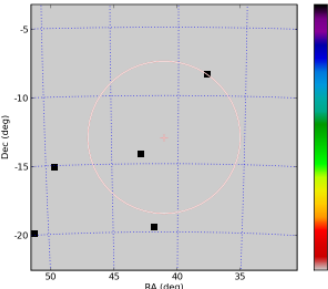
Filtering: on/off Alpha: Ra off Show: View Coordinates: type|group|latcatalog

Selected data: GRB:276193572 Show Table Overlay OFF

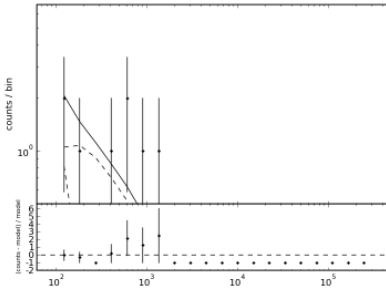
Parameters Selection: Complete Products Selection: Complete

Time	GRB Id	GCN	Run Id	Ra	Dec	Radius	Fluence (> 30 MeV, ph/cm ²)	Fluence (> 100 MeV, ph/cm ²)	Photon spectral index	Peak Flux	Peak Flux Time	Advocate
02-Oct-2009 16:26:11	276193572	GRB091002685	276191756	41.050	-13.050	5.590	2.2593E-06 +/- 2.4761E-06	60.687E-09 +/- 66.51E-09	-5.00 +/- 0.02	0.00 +/- 0.00	0.0	0.0

Prompt




Counts Map



Counts Spectra

- Used to rapidly detect Gamma Ray Bursts or other flaring events
- Enabled timely notification of interesting events to external astrophysical community



Fermi LAT Data Portal Catalog

Catalog version 1.9 | [Jira](#) | Portal Version 3.1 | [Jira](#)

User: tonyj . ([Switch](#)|[Logout](#)) | Config: **OnOrbit**

Mode: [[Prod](#) | [Dev](#) | [Test](#)]

View: [[Tree](#) . [Data Types](#) . [File Formats](#) . [Messages](#) . [Admin](#) . [Problems](#)]

Welcome

Catalog

Merit Skimmer

Fits Skimmer

Astro Server

Wired

History

Folders

- ASP
- Data
 - Flight
 - LEOScience
 - Level1
 - LCI
 - LPA
 - ACDPEDSALARM
 - ACDPEDSANALYZER
 - ACDPLOTS
 - CAL
 - CALGAINSALARM
 - CALGAINSANALYZER
 - CALHIST
 - CALHISTALARM
 - CALPEDSALARM
 - CALPEDSANALYZER
 - CALTREND
 - COMPAREDFM
 - DIGI
 - DIGIGAP
 - DIGIHIST
 - DIGIHISTALARM
 - DIGITREND
 - DIGITRENDALARM

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
L1_P6_public_v1	true	STRING
nKeyData	20	NUMBER

[Edit meta-data](#)

Logical tree allows browsing for files Folders and Groups

Summary of all files in a group

Meta-data associated with folders, groups and files

Crawler runs in background and validates all files and extracts size, #events, etc

Acknowledgments

Software Development Team:

Daniel Flath

Charlotte Hee

Karen Heidenreich

Claudia Lavalley

Tony Johnson

Max Turri

Beta Testers:

Warren Focke

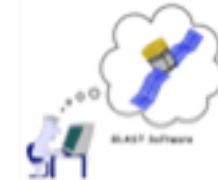
Tom Glanzman

- **Command line tools for direct or scripted interaction with middle-ware**
 - **Control Server**
 - **Ping**
 - **Restart**
 - **Shutdown**
 - **Upload Task Definitions**
 - **Manage processing streams**
 - **Create**
 - **Delete**
 - **Cancel**
 - **Retry from failure point**
 - **Query processing history**
 - **Plus Interaction with Data Catalog**

Front End: Web Interfaces

- Provides all administrative functions available in a user-friendly interactive GUI
- Interactive displays show active (and historical) processing
 - Filtering by Task, Process, Status(es), Stream-range, Date-range
- Processing Statistics Plots
 - Provided by AIDA tag library
 - System throughput plots
 - Filterable by Task, Date-Range
 - Individual process statistics plots
 - CPU time (vs Wallclock)
 - Pending time
 - By Batch Host-type
- Task diagrams generated by GraphViz and image-mapped to provide links to task element (Sub-tasks, processes) displays

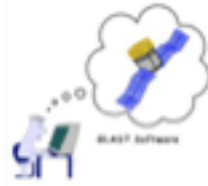
Front End: Task Summary Display



Task Filter: Regular Expression (?) Active in Last 30 days

Last Active	Task Name	Type										Total
2008-10-30 23:12	L1Proc	Data	0	0	5	78	1	0	0	0	0	84
2008-10-30 22:47	HalfPipe	Data	0	0	0	488	0	0	0	0	0	488
2008-10-30 22:39	nonEventReporting	Data	0	0	0	2207	14	0	0	0	0	2221
2008-10-30 22:13	GRB_blind_search	Data	0	0	0	1008	9	0	0	0	0	1017
2008-10-30 22:13	GRB_afterglow_launcher	Data	0	0	0	283	3034	0	0	0	0	3317
2008-10-30 22:12	GRB_refinement_launcher	Data	0	0	0	5596	1620	0	0	0	0	7216
2008-10-30 22:10	AspInsertIntervals	Data	0	0	0	1397	14	0	0	0	0	1411
2008-10-30 22:10	AspLauncher	Data	0	0	0	408	5	0	0	0	0	413
2008-10-30 21:31	DRP_monitoring	Data	0	0	0	211	7	0	0	0	0	218
2008-10-30 20:23	PGWave	Data	0	0	0	110	0	0	0	0	0	110
2008-10-30 19:47	allHEE200GeV-GR-v15r39p1	MC	0	0	0	29861	427	0	16	0	0	30304
2008-10-30 18:37	launchReport	Data	0	0	0	255	0	0	0	0	0	255
2008-10-30 16:28	Level0Xrootd	Data	0	0	0	38	0	0	0	0	0	38
2008-10-30 15:01	SkimmerTaskParallel	SKIM	0	0	0	80	8	0	0	0	0	88
2008-10-30 13:12	SkimmerTask	SKIM	0	0	0	33	10	0	0	0	0	43
2008-10-30 12:42	ReproTest8	Data	0	0	0	0	2	0	0	0	0	2
2008-10-30 10:40	AstroSkimmerTask	SKIM	0	0	0	262	81	0	0	0	0	343
2008-10-30 03:55	backgnd-GR-v15r40-Limbo2	MC	0	0	0	10	0	0	0	0	0	10
2008-10-29 12:31	setL1Status	Data	0	0	0	62	0	0	0	0	0	62
2008-10-29 12:16	aeffMonitorPulsar	Data	0	0	0	0	4	0	0	0	0	4
2008-10-29 08:12	GRB_afterglow	Data	0	0	0	137	3	0	0	0	0	140
2008-10-29 08:07	backgnd-GR-v15r40-Limbo	MC	0	0	0	3610	0	0	0	0	0	3610
2008-10-29 07:55	backgnd-GR-v15r39p1-FullDay	MC	0	0	0	70000	0	0	0	0	0	70000
2008-10-29 02:44	GRB_refinement	Data	0	0	0	107	11	0	0	0	0	118

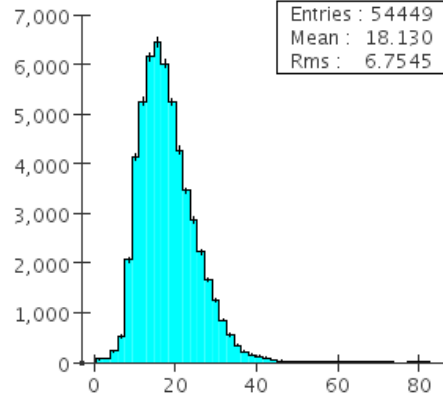
Front End: Process Detail Plots



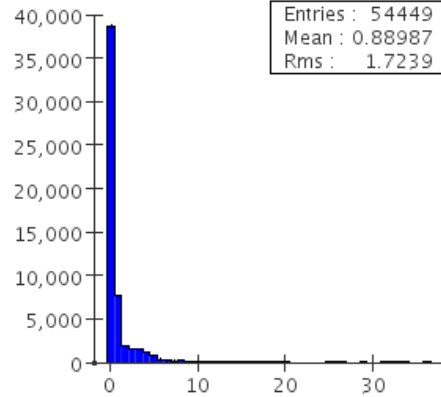
Summary

recon

Wall Clock time (mins)

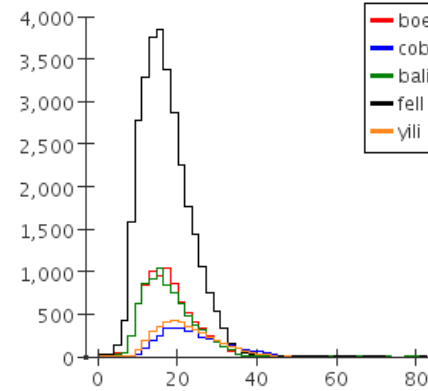


Pending time (mins)

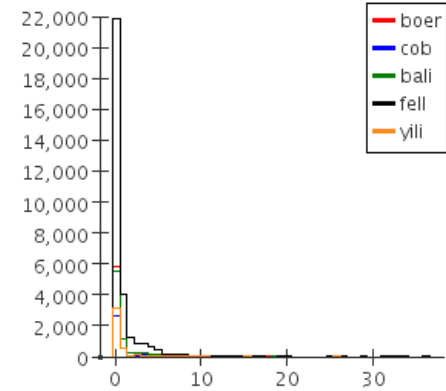


PLOTS by BATCH NODES

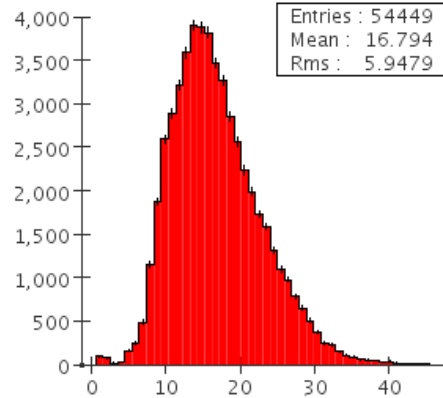
Wall Clock time (mins)



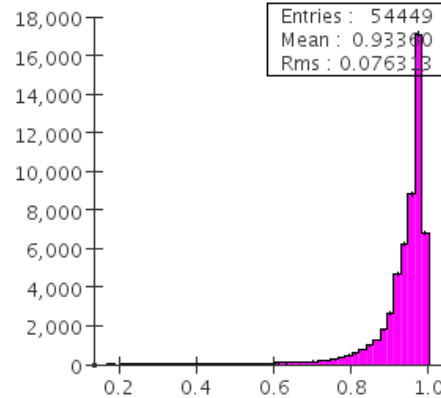
Pending time (mins)



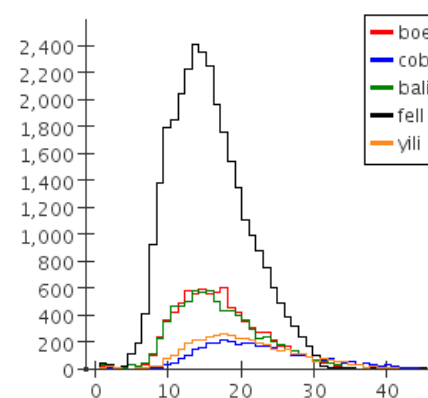
CPU time (mins)



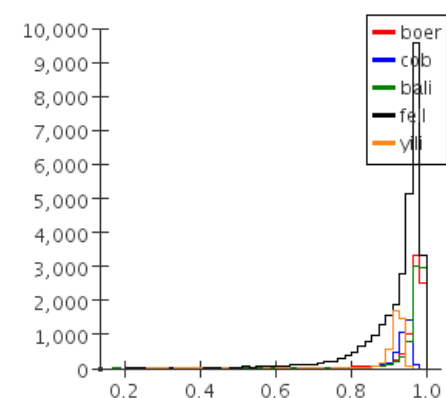
CPU time/Wall Clock



CPU time (mins)



CPU time/Wall Clock



Front End: Job Detail Display



Task doChunk Process fastMonHist Stream 81031004.247117860.15155

Type Batch
 Status Running
 Stream [81031004.247117860.15155](#)
 CreateDate 30-Oct-2008 22:46:16.000
 SubmitDate 30-Oct-2008 23:14:54.482
 StartDate 30-Oct-2008 23:14:59.000
 EndDate
 CPU Used
 Memory Used
 Swap Used
 Execution Host boer0105
 Exit Code
 Working Dir [/nfs/farm/g/glast/u15/pipeline-II/prod/log/L1Proc/1.68/doRun/doChunk/fastMonHist/081xxxxxx/031xxx/004/247xxxxxx/117xxx/860/015xxx/155](#)
 Log File [/nfs/farm/g/glast/u15/pipeline-II/prod/log/L1Proc/1.68/doRun/doChunk/fastMonHist/081xxxxxx/031xxx/004/247xxxxxx/117xxx/860/015xxx/155/logFile.txt](#)
 Execution Number **1**
 Retry Number **0**
 Is Latest 1
 Batch Job ID [423937](#)

Links: [View Messages](#)

Variables

Nothing found to display.

- Show UpStream Process Instances
- Show Downstream Process Instances
- Show Created SubStreams

Upstream Process Instances

Wait Condition	Process	Status	Type	Created	Submitted	Started	Ended	Job Id	CPU	Host	Links
Success	fastMonTuple	Success	Batch	30-Oct-2008 22:46:16	30-Oct-2008 22:46:26	30-Oct-2008 22:46:33	30-Oct-2008 23:14:31	421514	1646	bali0244	Messages : Log : Files

Downstream Process Instances

Wait Condition	Process	Status	Type	Created	Submitted	Started	Ended	Job Id	CPU	Host	Links
Success	checkChunk	Waiting	Batch	30-Oct-2008 22:46:17							Messages
DONE	mergeFastMonHist	Waiting	Batch	30-Oct-2008 22:45:22							Messages

Middle Tier: Threading

- **Makes extensive use of Java Concurrency library (java.util.concurrent)**
- **Scheduler Threads**
 - **Look for work and delegate to Execution pool**
 - **Ready Jobs (Script and Batch)**
 - **Submits work to execution threads**
 - **Handle Email status-messages**
 - **Checks for email**
 - **Submits status transition calculations to execution threads**
 - **Receives confirmation from workers, deletes email**
 - **Reaper**
 - **Searches for 'lost' jobs in Batch, updates processing history accordingly**
- **Execution Threads**
 - **Decode email status messages and update process records**
 - **Execute Jython script processes directly**
 - **Submit Batch jobs to Farms**