GLAST Large Area Telescope:

Exploring the γ-ray Sky

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http://www-glast.slac.stanford.edu/software

Über Outline

- Introduction to GLAST & C++ world
- Reconstruction events in a pair conversion telescope
- Astronomy analysis with GLAST
- Data Handling

Outline

- Introduction to GLAST
- The Instrument
  - Pair conversion telescope
- Code Development Environment
- Users: code installation, documentation
- Overview of C++ World: Gaudi, GEANT4 etc

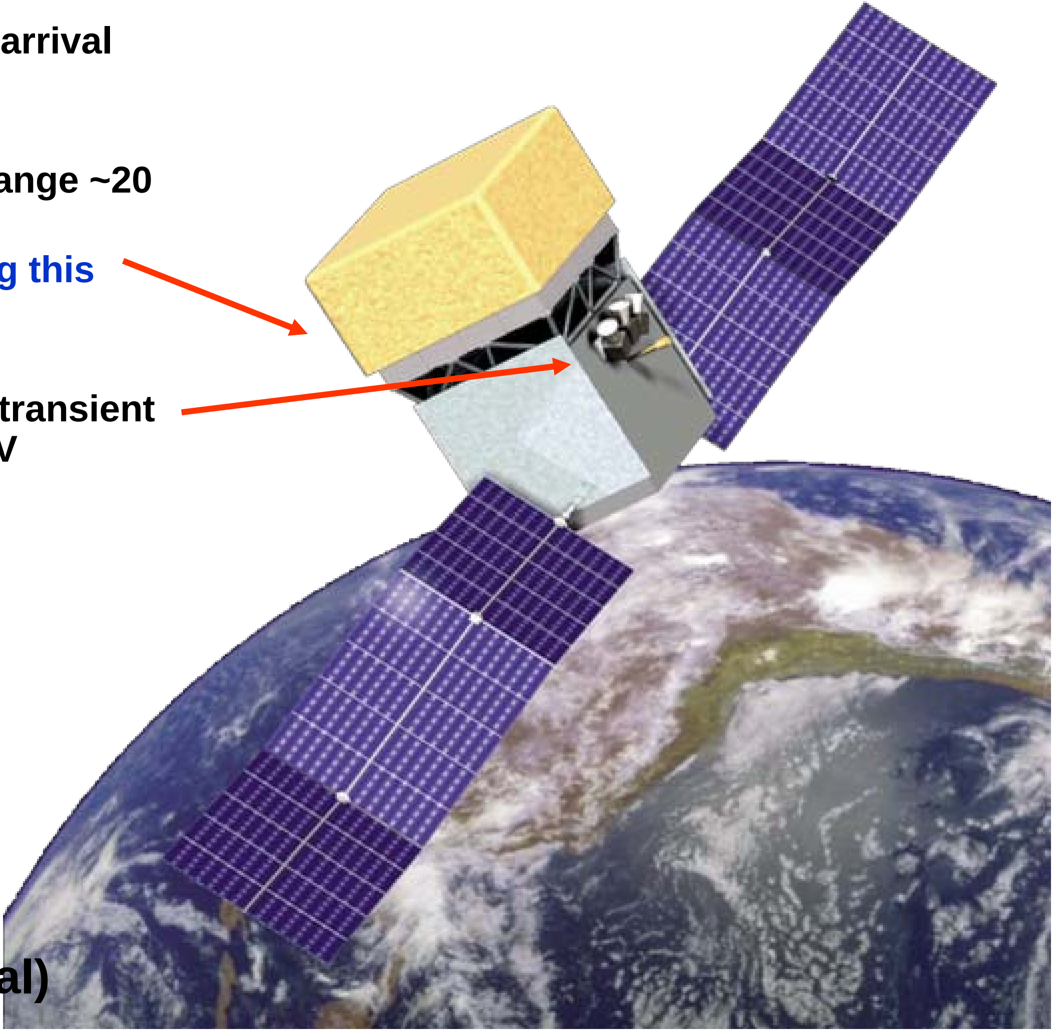
GLAST Mission

GLAST measures the direction, energy and arrival time of celestial gamma rays

-LAT measures gamma-rays in the energy range ~20 MeV - >300 GeV

- There is no telescope now covering this range!!

- GBM provides correlative observations of transient events in the energy range ~20 keV – 20 MeV



Launch:	August 2007 Florida
Orbit:	565 km, 28.5º inclination
Lifetime:	5 years (minimum; 10 yrs goal)

GLAST Participation

NASA - DoE Partnership on LAT

LAT is being built by an international team

- Stanford University (SLAC & HEPL, Physics)
- Goddard Space Flight Center
- Naval Research Laboratory
- University of California, Santa Cruz
- University of Washington
- Ohio State University
- CEA/Saclay & IN2P3 (France)
- INFN & ASI (Italy)
- Hiroshima University, ISAS, RIKEN (Japan)
- Royal Inst. of Technology & Stockholm Univ. (Sweden)

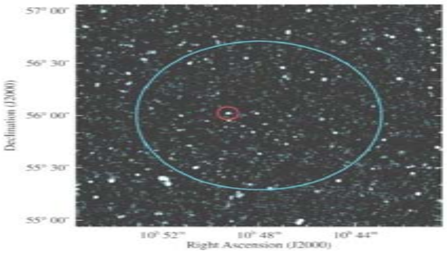
LAT managed by SLAC
PI – Peter Michelson

GBM is being built by US and Germany

- MPE, Garching (Germany)
- Marshall Space Flight Center

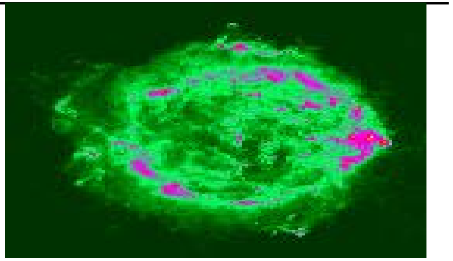
Spacecraft and integration - Spectrum Astro

GLAST science - the sky above 20 MeV

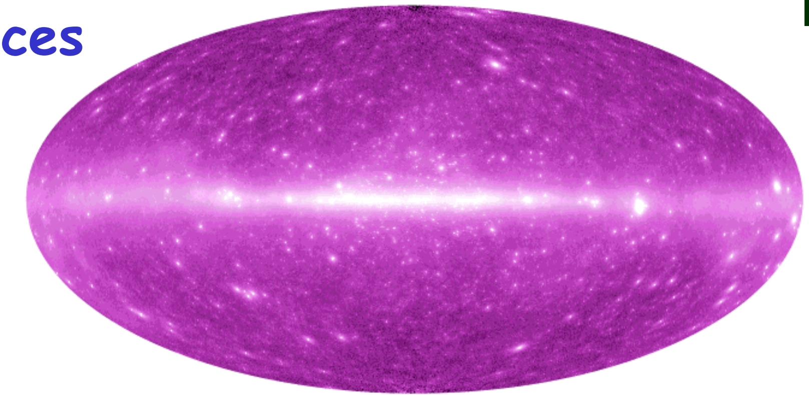


Unidentified sources

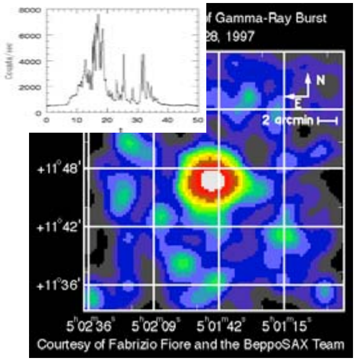
Active Galactic Nuclei



Cosmic ray acceleration

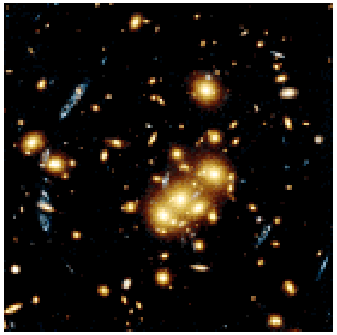


Pulsars

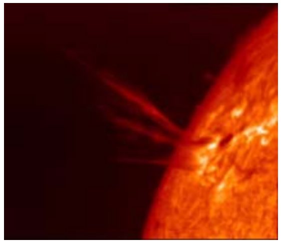


Courtesy of Fabrizio Fiore and the BeppoSAX Team

Gamma Ray Bursts



Dark matter



Solar flares

0.01 GeV 0.1 GeV 1 GeV 10 GeV 100 GeV 1 TeV

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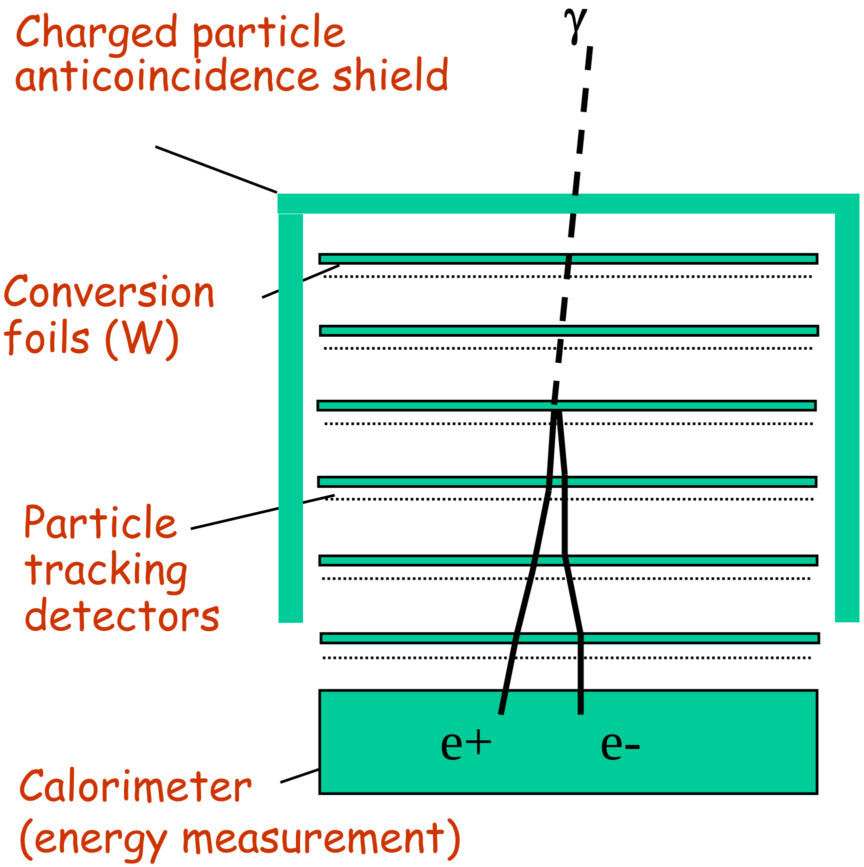
γ detection – pair conversion telescope

Pair production is the dominant photon interaction in our energy range



Charged particle anticoincidence shield

Conversion foils (W)

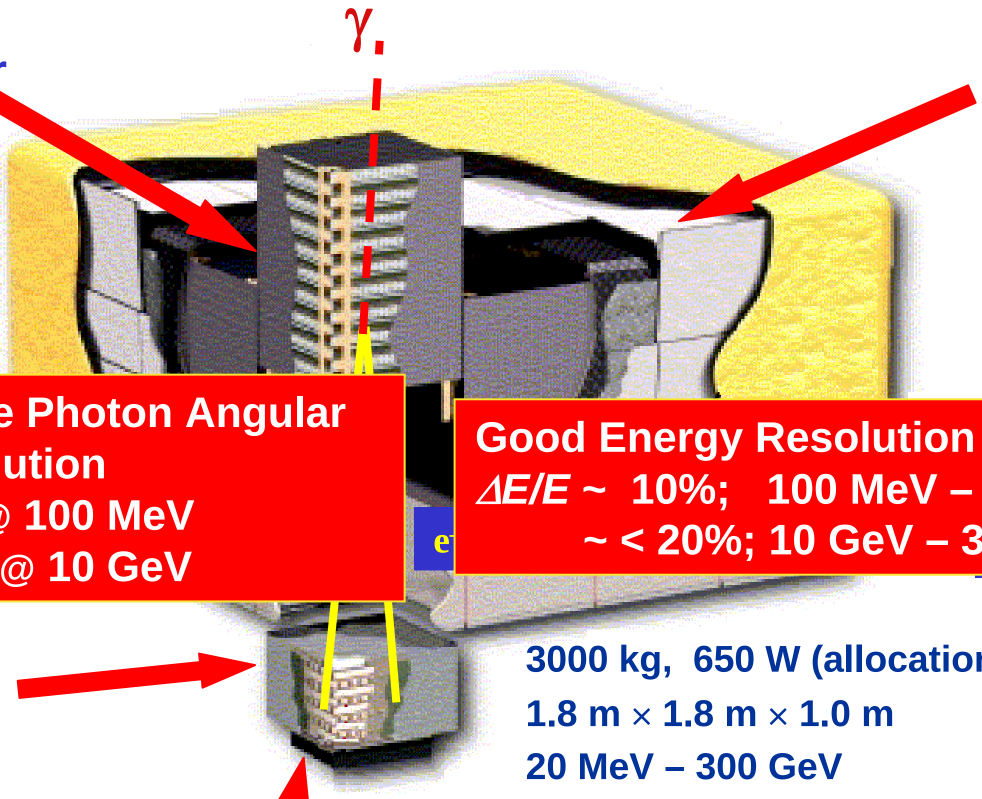
Particle tracking detectors

Calorimeter (energy measurement)

GLAST Concept

- Low profile for wide f.o.v.
- Segmented anti-detector to minimize self-veto at high E.
- Finely segmented calorimeter for enhanced background rejection and shower leakage correction.
- High-efficiency, precise track detectors located close to the conversions foils to minimize multiple-scattering errors.
- Modular, redundant design.
- No consumables.
- Low power consumption (650 W)

GLAST Large Area Telescope (LAT)



Si Tracker Tower

pitch = 228 µm

5.52 10^4 channels

12 layers × 3% X_0

+ 4 layers × 18% X_0

+ 2 layers

ACD

Segmented scintillator tiles

0.9997 efficiency

⇒ minimize self-veto

Single Photon Angular Resolution

3.5° @ 100 MeV

0.15° @ 10 GeV

Good Energy Resolution

$\Delta E/E$ ~ 10%; 100 MeV – 10 GeV

~ < 20%; 10 GeV – 300 GeV

Thermal

Radiators)

CsI Calorimeter

Hodoscopic array

8.4 X_0 8 × 12 bars

2.0 × 2.7 × 33.6 cm

⇒ cosmic-ray rejection

⇒ shower leakage correction

3000 kg, 650 W (allocation)

1.8 m × 1.8 m × 1.0 m

20 MeV – 300 GeV

Data acquisition

16 identical towers

300 Hz average downlink

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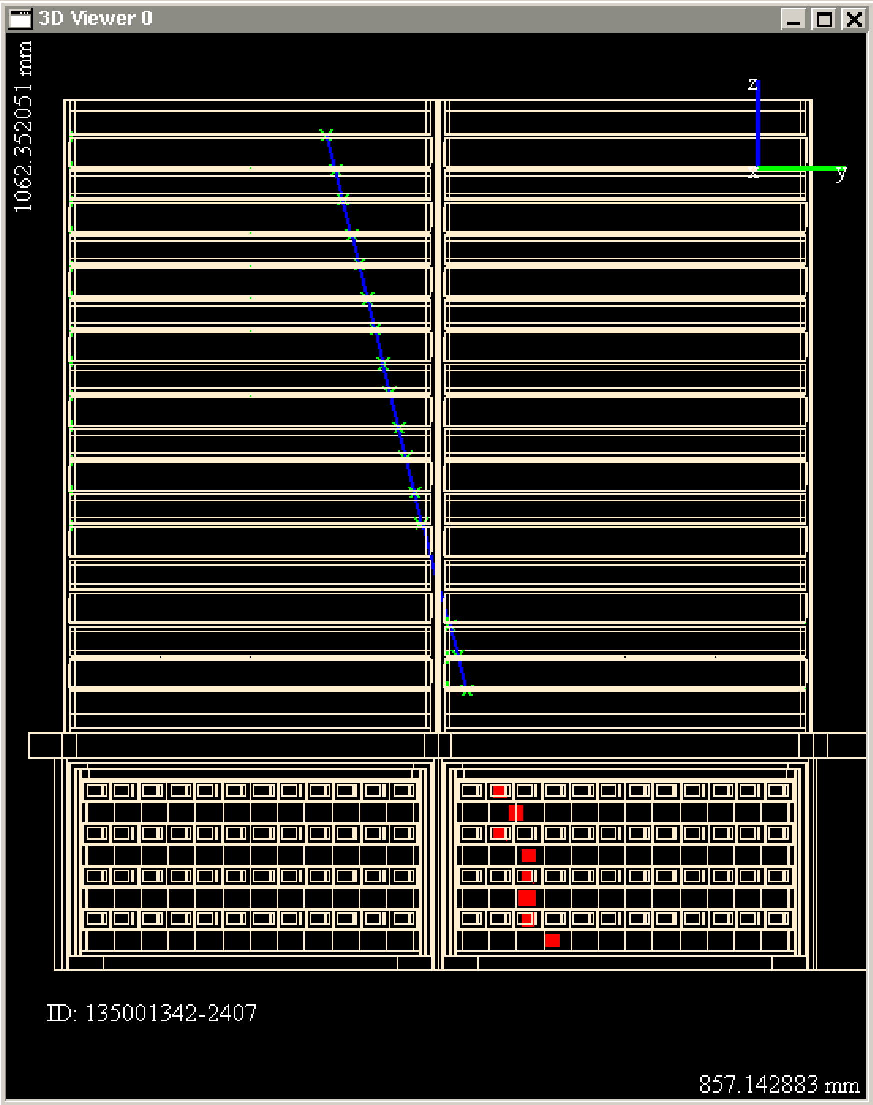
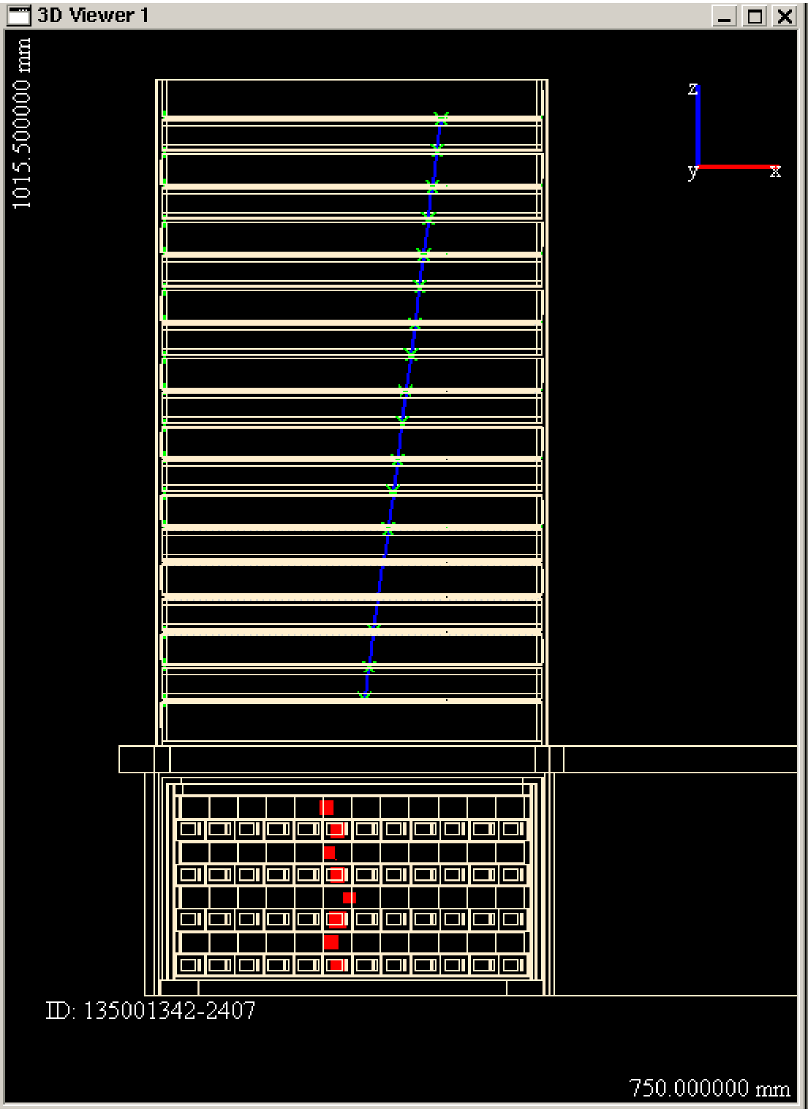
Cosmic Ray Muon for Two-Towers



ID: 135001342-2407

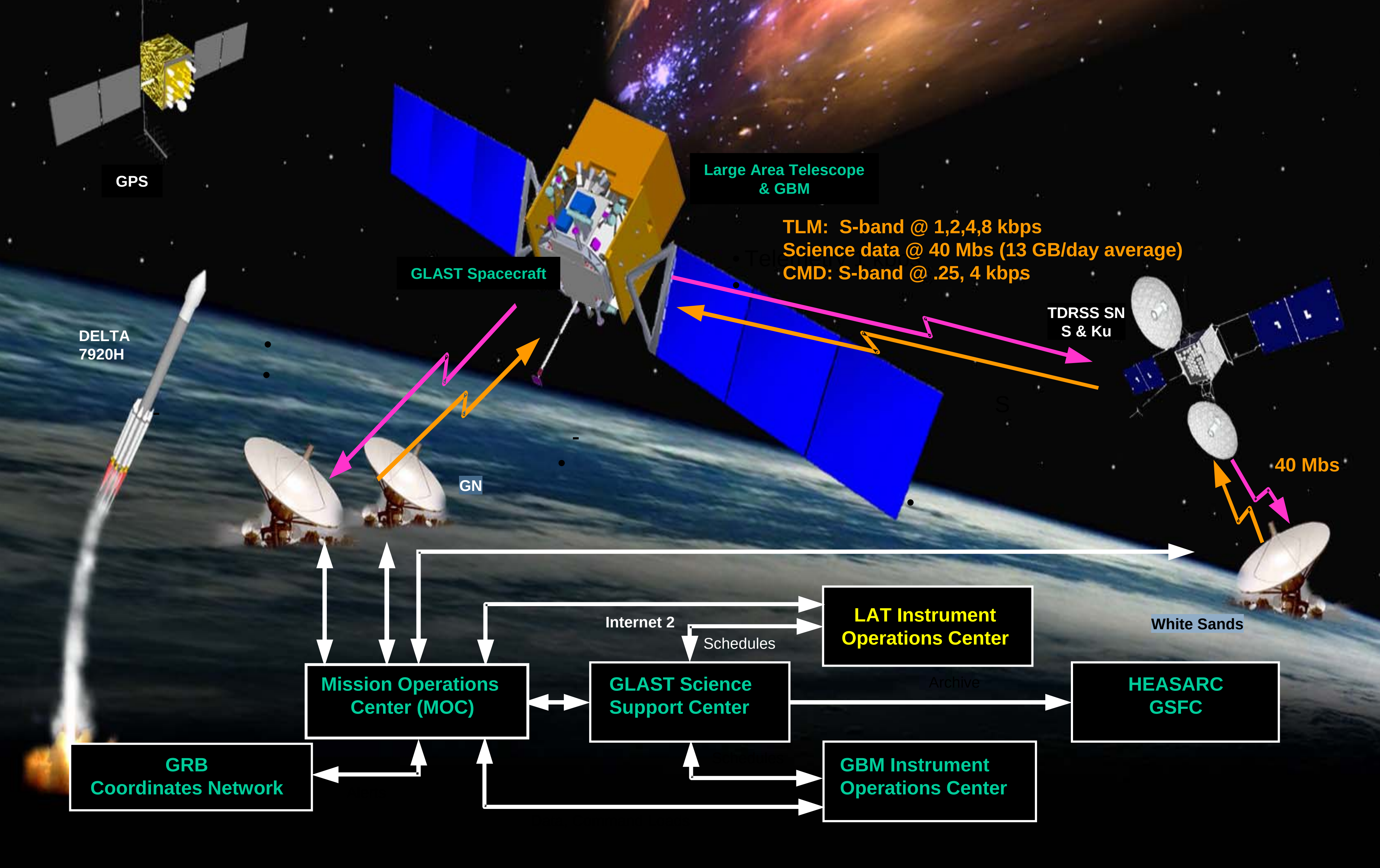
857.142883 mm



ID: 135001342-2407

750.000000 mm

GLAST MISSION ELEMENTS



GPS

DELTA
7920H

GLAST Spacecraft

Large Area Telescope
& GBM

TLM: S-band @ 1,2,4,8 kbps
Science data @ 40 Mbs (13 GB/day average)
CMD: S-band @ .25, 4 kbps

TDRSS SN
S & Ku

GN

40 Mbs

White Sands

Internet 2

Schedules

LAT Instrument Operations Center

Mission Operations Center (MOC)

GLAST Science Support Center

Archive

HEASARC GSFC

GRB Coordinates Network

GBM Instrument Operations Center

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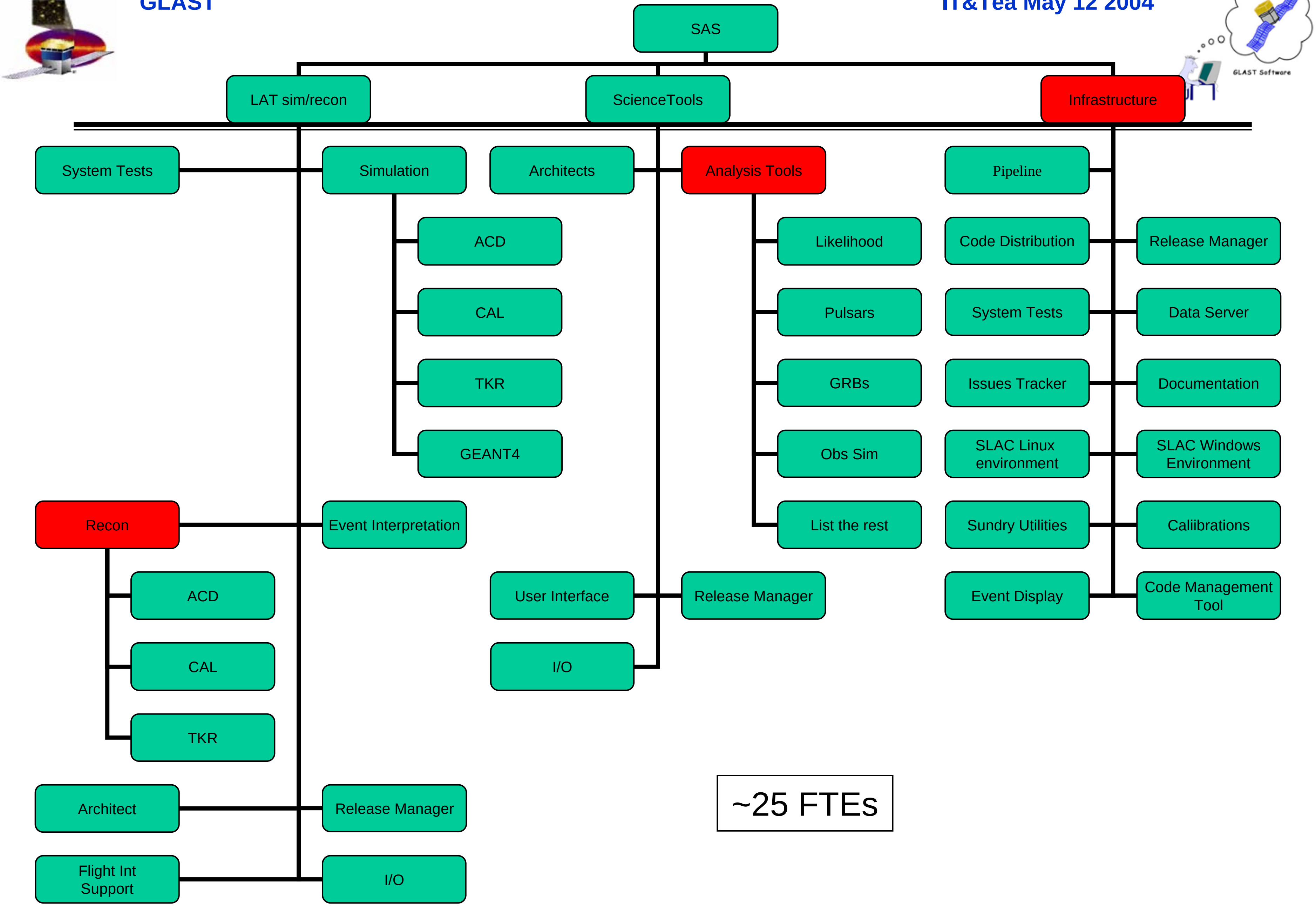


SAS

LAT sim/recon
- System Tests
- Simulation
  - ACD
  - CAL
  - TKR
  - GEANT4
- Recon
  - ACD
  - CAL
  - TKR
- Event Interpretation
- Architect
- Release Manager
- Flight Int Support
- I/O

ScienceTools
- Architects
- Analysis Tools
  - Likelihood
  - Pulsars
  - GRBs
  - Obs Sim
  - List the rest
- User Interface
- Release Manager
- I/O

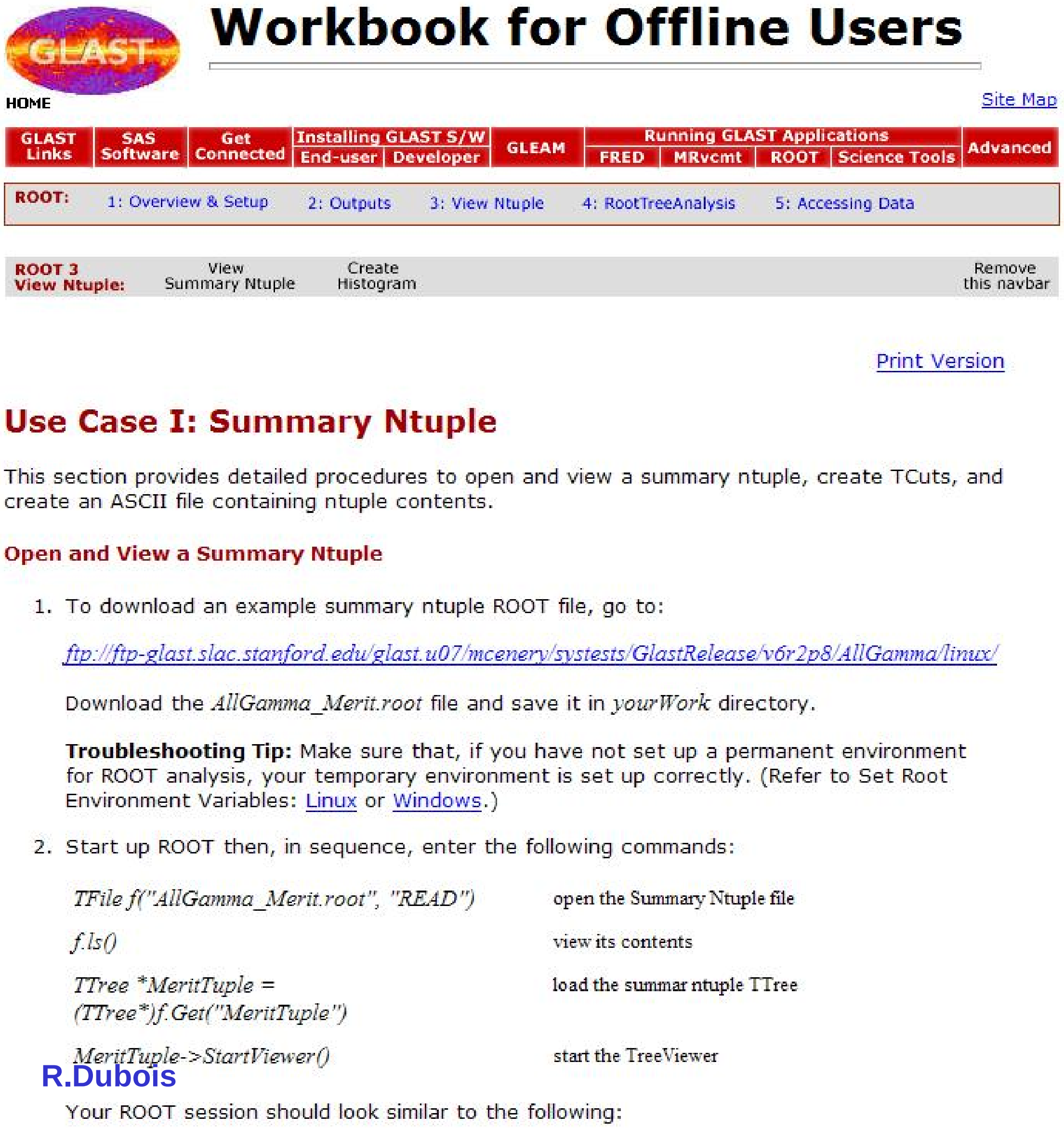
Infrastructure
- Pipeline
- Code Distribution
- Release Manager
- System Tests
- Data Server
- Issues Tracker
- Documentation
- SLAC Linux environment
- SLAC Windows Environment
- Sundry Utilities
- Caliibrations
- Event Display
- Code Management Tool

~25 FTEs

Software Development Approach

- Enable distributed development via cvs repository @ SLAC
- Extensive use of electronic communications
  - Web conferencing (VRVS), Instant Messaging (icq)
- CMT tool permits equal development on Windows and Linux
  - ‘requirements’ file generates MS Project or gnu Makefiles from single source
  - Superior development environment on Windows; compute cycles on linux
- documentation and coding reviews enforce coding rules
- “Continuous integration”
  - Eliminate surprises for incoming code releases
  - Build code when packages are tagged; alert owners to failures in build or running of unit tests. Results tracked in database.
  - Developing comprehensive system tests in multiple source configurations. Track results in database; web viewable.

Documentation: User Workbook



Workbook for Offline Users

Use Case I: Summary Ntuple

This section provides detailed procedures to open and view a summary ntuple, create TCuts, and create an ASCII file containing ntuple contents.

Open and View a Summary Ntuple

1. To download an example summary ntuple ROOT file, go to:

   ftp://ftp-glast.slac.stanford.edu/glast.u07/mcenery/systests/GlastRelease/v6r2p8/AllGamma/linux/

   Download the *AllGamma_Merit.root* file and save it in *yourWork* directory.

   Troubleshooting Tip: Make sure that, if you have not set up a permanent environment for ROOT analysis, your temporary environment is set up correctly. (Refer to Set Root Environment Variables: Linux or Windows.)

2. Start up ROOT then, in sequence, enter the following commands:

TFile f("AllGamma_Merit.root", "READ")	open the Summary Ntuple file
f.ls()	view its contents
*TTree *MeritTuple = (TTree*)f.Get("MeritTuple")*	load the summar ntuple TTree
MeritTuple->StartViewer()	start the TreeViewer

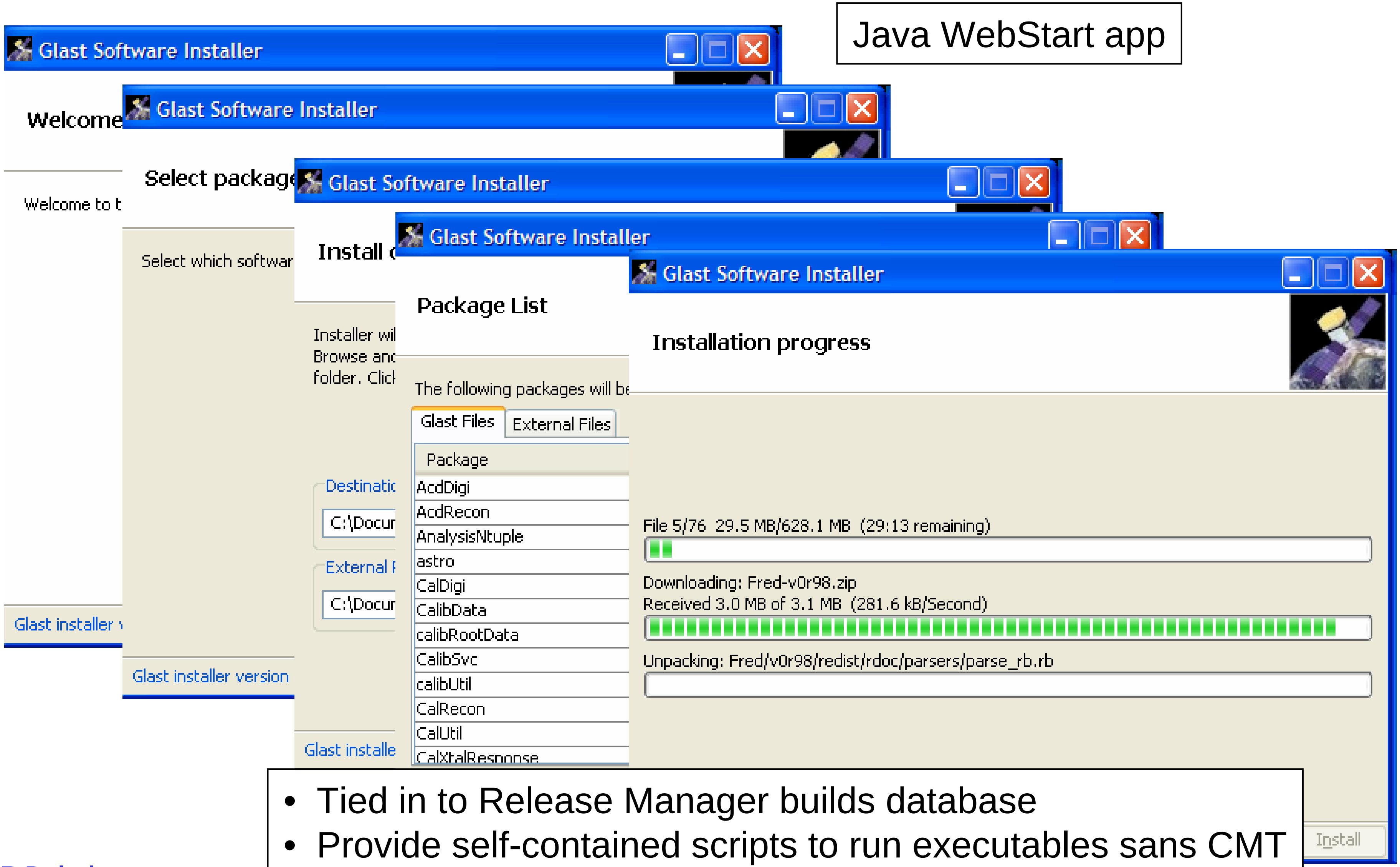
Your ROOT session should look similar to the following:

Follow on lead from SLD, BABAR, but …

- work with Tech Writer
  - skilled at extracting information from us wackos
  - worries about layout, organization
  - can write good
- we're struggling with apparent conflict of web navigation vs "printed book". Pursuing the former.

Code Distribution

Java WebStart app



Glast Software Installer

Welcome

Welcome to t

Glast installer v

Glast Software Installer

Select package

Select which softwar

Glast installer version

Glast Software Installer

Install

Installer wil
Browse and
folder. Click

Destinatio
C:\Docur

External F
C:\Docur

Glast installe

Glast Software Installer

Package List

The following packages will be

Package
AcdDigi
AcdRecon
AnalysisNtuple
astro
CalDigi
CalibData
calibRootData
CalibSvc
calibUtil
CalRecon
CalUtil
CalXtalResponse

Glast Software Installer

Installation progress

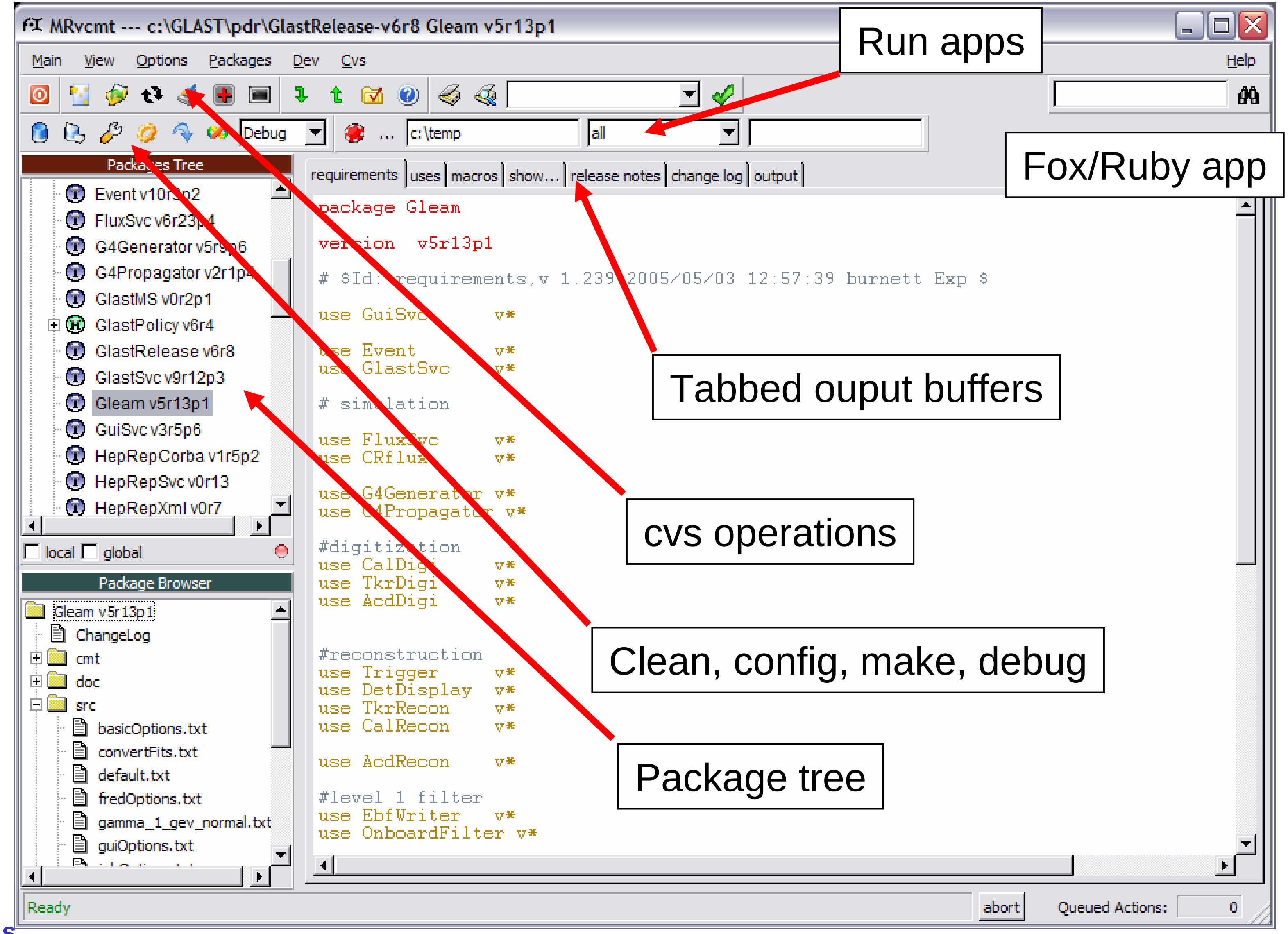
File 5/76 29.5 MB/628.1 MB (29:13 remaining)

Downloading: Fred-v0r98.zip
Received 3.0 MB of 3.1 MB (281.6 kB/Second)

Unpacking: Fred/v0r98/redist/rdoc/parsers/parse_rb.rb

- Tied in to Release Manager builds database
- Provide self-contained scripts to run executables sans CMT

MRvcmt – gui for code development



```
package Gleam

version  v5r13p1

# $Id: requirements,v 1.239 2005/05/03 12:57:39 burnett Exp $

use GuiSvc       v*

use Event        v*
use GlastSvc     v*

# simulation

use FluxSvc      v*
use CRflux       v*

use G4Generator v*
use G4Propagator v*

#digitization
use CalDigi      v*
use TkrDigi      v*
use AcdDigi      v*


#reconstruction
use Trigger      v*
use DetDisplay   v*
use TkrRecon     v*
use CalRecon     v*

use AcdRecon     v*

#level 1 filter
use EbfWriter    v*
use OnboardFilter v*
```

Run apps

Fox/Ruby app

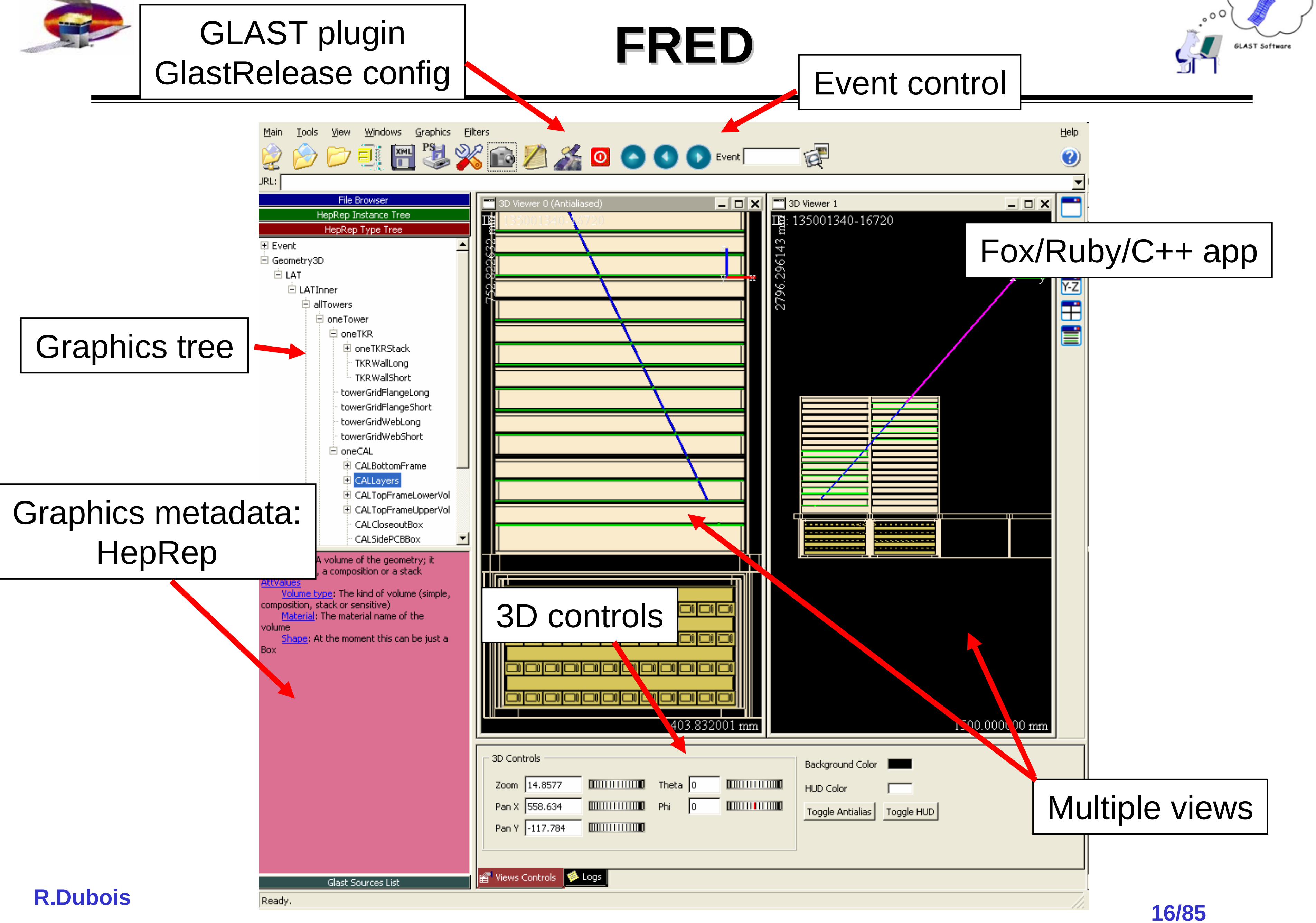
Tabbed ouput buffers

cvs operations

Clean, config, make, debug

Package tree

FRED



GLAST plugin
GlastRelease config

Event control

Fox/Ruby/C++ app

Graphics tree

Graphics metadata:
HepRep

3D controls

Multiple views

```
⊞ Event
⊟ Geometry3D
  ⊟ LAT
    ⊟ LATInner
      ⊟ allTowers
        ⊟ oneTower
          ⊟ oneTKR
            ⊞ oneTKRStack
              TKRWallLong
              TKRWallShort
            towerGridFlangeLong
            towerGridFlangeShort
            towerGridWebLong
            towerGridWebShort
          ⊟ oneCAL
            ⊞ CALBottomFrame
            ⊞ CALLayers
            ⊞ CALTopFrameLowerVol
            ⊞ CALTopFrameUpperVol
              CALCloseoutBox
              CALSidePCBBox
```

A volume of the geometry; it
, a composition or a stack

AttValues

Volume type: The kind of volume (simple, composition, stack or sensitive)

Material: The material name of the volume

Shape: At the moment this can be just a Box

3D Controls

Zoom 14.8577
Pan X 558.634
Pan Y -117.784
Theta 0
Phi 0

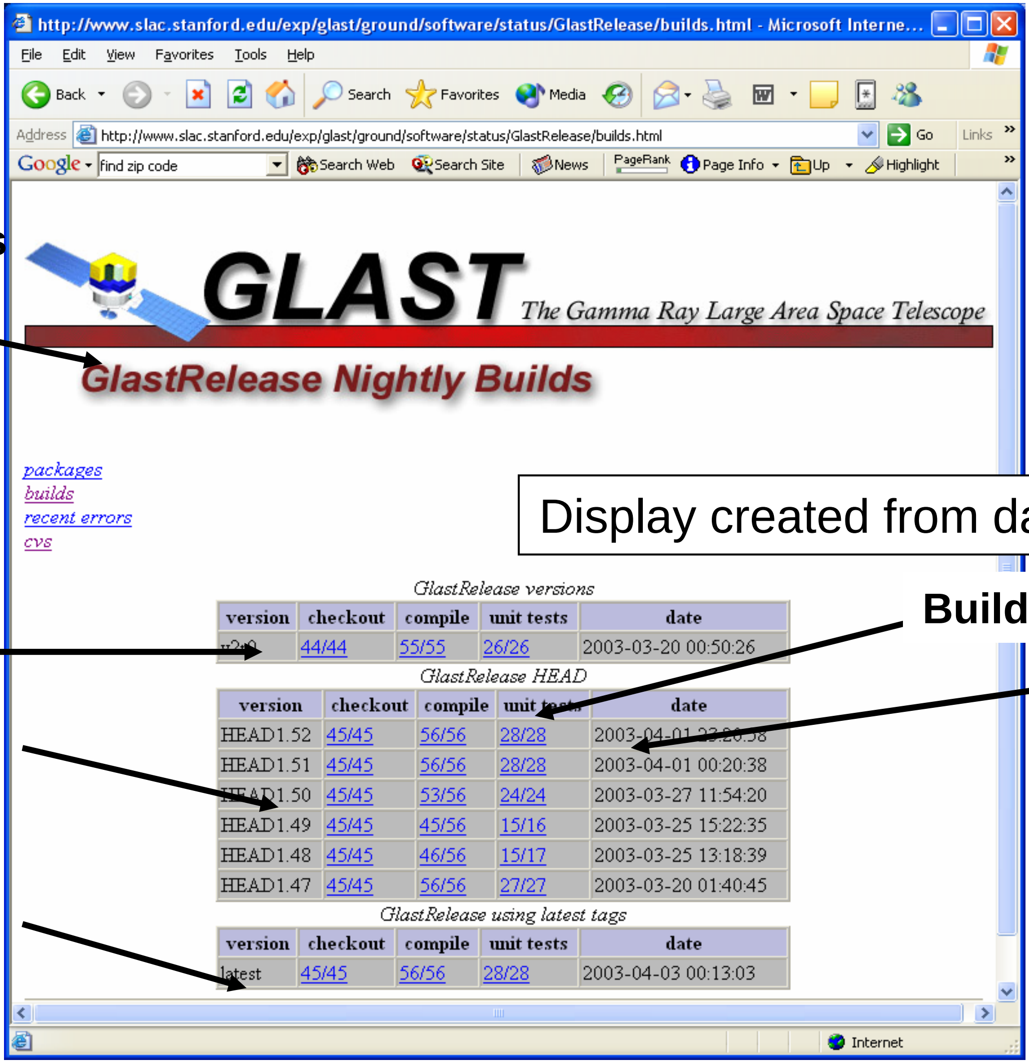
Background Color
HUD Color

Toggle Antialias
Toggle HUD

Issues Tracker; CCB; wiki

- User JIRA web issues tracker
  - Commercial product but affordable
  - Handles bugs, features, improvements
  - Full user/group management
  - “roadmaps” for version evolution/project management
- Change Control Board
  - Code used in pipeline – sim/recon; executive scripts; pipeline itself
  - Require documentation of all changes – preferably backed up by JIRA issues
  - Demonstration that fixes work; system tests on sim/recon
  - Using wiki tool to record actions
  - 4-person board – adjudicated by email so far
- Wiki
  - Commercial product (Atlassian – same parent as JIRA)
  - Simple web editing independent of user OS
  - Space management; same groups and users as JIRA

Code Builds



http://www.slac.stanford.edu/exp/glast/ground/software/status/GlastRelease/builds.html - Microsoft Interne...
File Edit View Favorites Tools Help
Back
Search
Favorites
Media
Address
http://www.slac.stanford.edu/exp/glast/ground/software/status/GlastRelease/builds.html
Go
Links
Google
find zip code
Search Web
Search Site
News
PageRank
Page Info
Up
Highlight
Internet

GLAST The Gamma Ray Large Area Space Telescope

GlastRelease Nightly Builds

packages
builds
recent errors
cvs

GlastRelease versions

version	checkout	compile	unit tests	date
v2r0	44/44	55/55	26/26	2003-03-20 00:50:26

GlastRelease HEAD

version	checkout	compile	unit tests	date
HEAD1.52	45/45	56/56	28/28	2003-04-01 23:20:38
HEAD1.51	45/45	56/56	28/28	2003-04-01 00:20:38
HEAD1.50	45/45	53/56	24/24	2003-03-27 11:54:20
HEAD1.49	45/45	45/56	15/16	2003-03-25 15:22:35
HEAD1.48	45/45	46/56	15/17	2003-03-25 13:18:39
HEAD1.47	45/45	56/56	27/27	2003-03-20 01:40:45

GlastRelease using latest tags

version	checkout	compile	unit tests	date
latest	45/45	56/56	28/28	2003-04-03 00:13:03

Performing builds for Science Tools also

Display created from database query

Build status

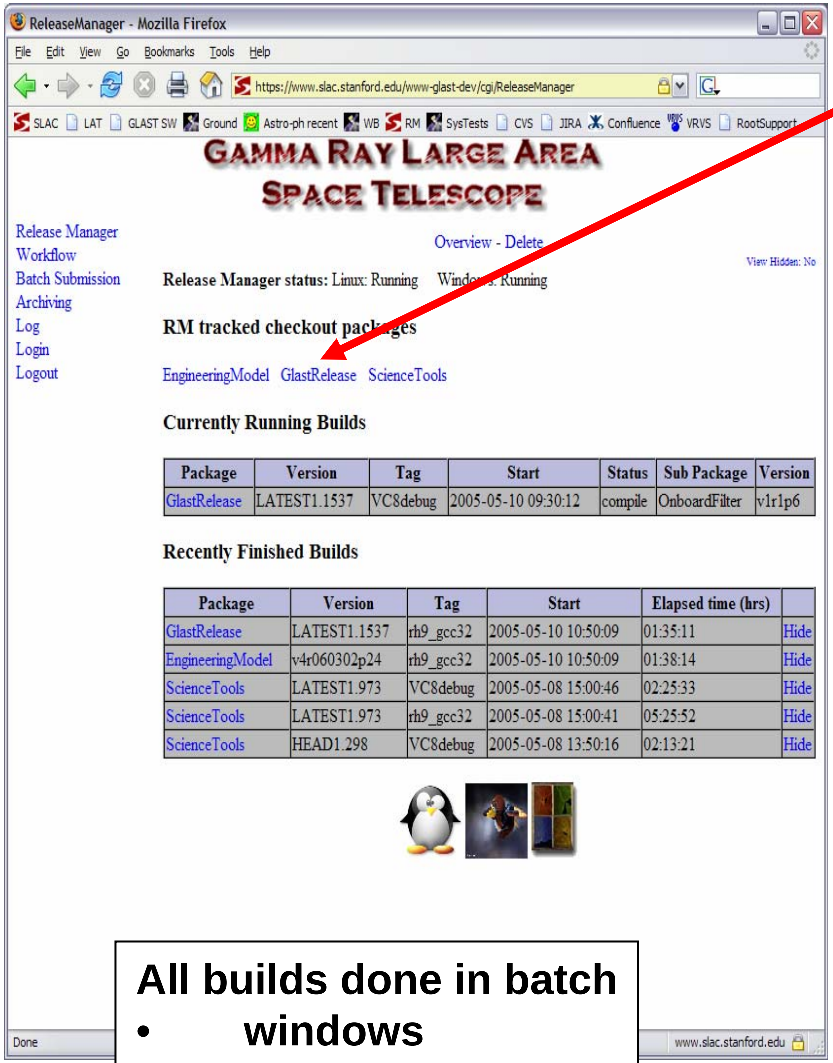
Unit test status

Past release

Release in progress

Future release

More Code Builds


ReleaseManager - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
https://www.slac.stanford.edu/www-glast-dev/cgi/ReleaseManager
SLAC LAT GLAST SW Ground Astro-ph recent WB RM SysTests CVS JIRA Confluence VRVS RootSupport
Done
www.slac.stanford.edu

GAMMA RAY LARGE AREA
SPACE TELESCOPE

Release Manager
Workflow
Batch Submission
Archiving
Log
Login
Logout

Overview - Delete

View Hidden: No

Release Manager status: Linux: Running Windows: Running

RM tracked checkout packages

EngineeringModel GlastRelease ScienceTools

Currently Running Builds

Package	Version	Tag	Start	Status	Sub Package	Version
GlastRelease	LATEST1.1537	VC8debug	2005-05-10 09:30:12	compile	OnboardFilter	v1r1p6

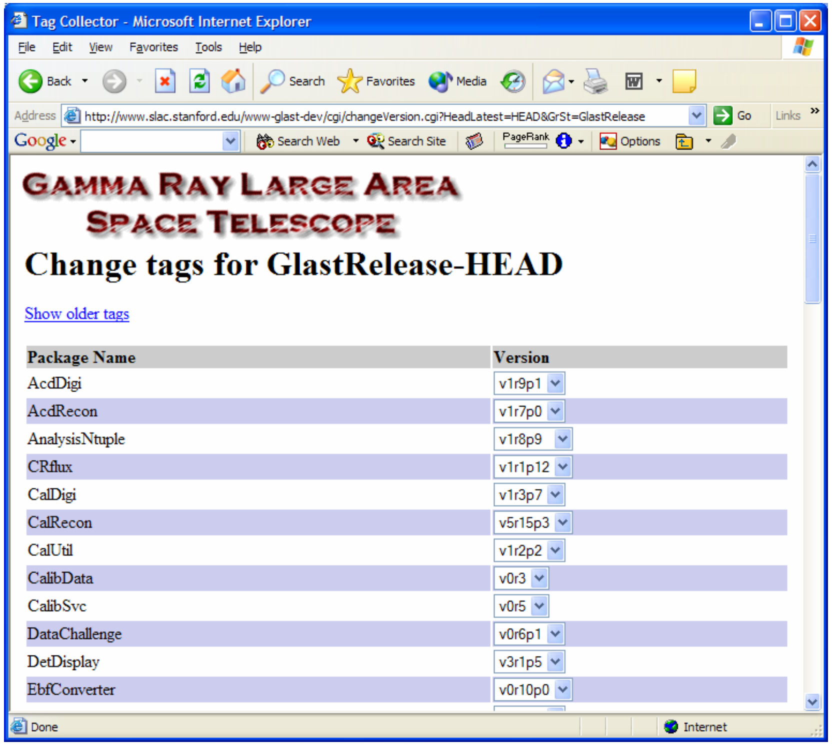
Recently Finished Builds

Package	Version	Tag	Start	Elapsed time (hrs)	
GlastRelease	LATEST1.1537	rh9_gcc32	2005-05-10 10:50:09	01:35:11	Hide
EngineeringModel	v4r060302p24	rh9_gcc32	2005-05-10 10:50:09	01:38:14	Hide
ScienceTools	LATEST1.973	VC8debug	2005-05-08 15:00:46	02:25:33	Hide
ScienceTools	LATEST1.973	rh9_gcc32	2005-05-08 15:00:41	05:25:52	Hide
ScienceTools	HEAD1.298	VC8debug	2005-05-08 13:50:16	02:13:21	Hide

Multiple packages being tracked

All builds done in batch
- windows
- linux

Web tag collector


Tag Collector - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.slac.stanford.edu/www-glast-dev/cgi/changeVersion.cgi?HeadLatest=HEAD&GrSt=GlastRelease
Go Links
Google Search Web Search Site PageRank Options
Done
Internet

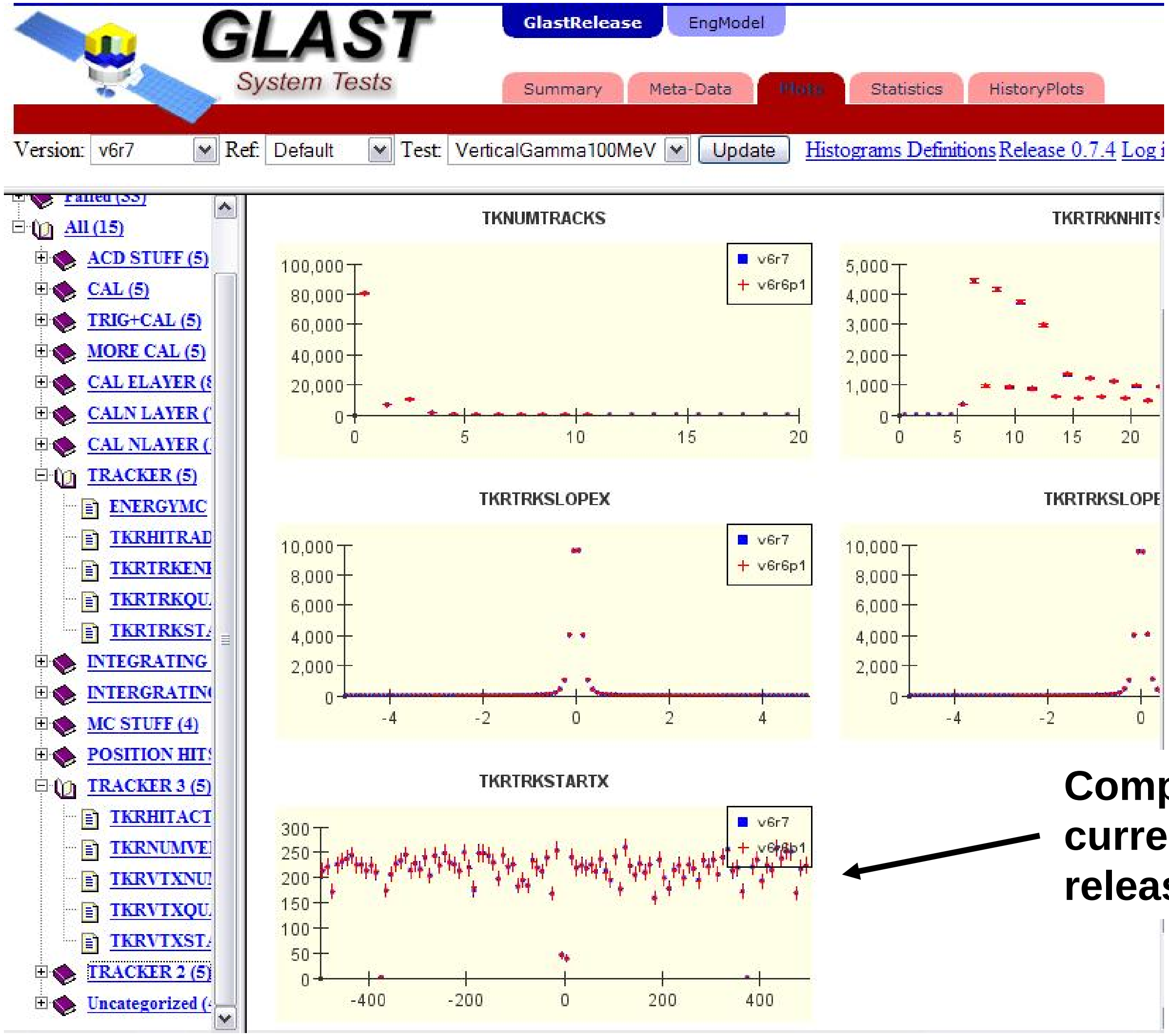
GAMMA RAY LARGE AREA
SPACE TELESCOPE

Change tags for GlastRelease-HEAD

Show older tags

Package Name	Version
AcdDigi	v1r9p1
AcdRecon	v1r7p0
AnalysisNtuple	v1r8p9
CRflux	v1r1p12
CalDigi	v1r3p7
CalRecon	v5r15p3
CalUtil	v1r2p2
CalibData	v0r3
CalibSvc	v0r5
DataChallenge	v0r6p1
DetDisplay	v3r1p5
EbfConverter	v0r10p0

System Tests



Version: v6r7 Ref: Default Test: VerticalGamma100MeV

Comparison of current to previous release.

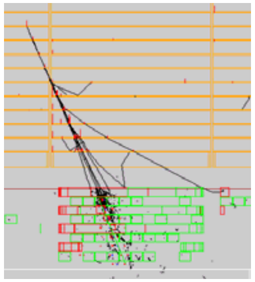
Matt

Sim/Recon Toolkit

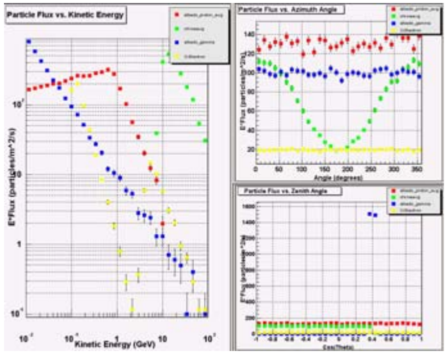
Package	Description	Provider	Status
ACD, CAL, TKR Recon	Data reconstruction	LAT	90% done In use
ACD, CAL, TKR Sim	Instrument sim	LAT	95% done In use
GEANT4	Particle transport sim	G4 worldwide collaboration	In use
xml	Parameters	World standard	In use
Root 4.02.00	C++ object I/O	HEP standard	In use
Gaudi	Code skeleton	CERN standard	In use
doxygen	Code doc tool	World standard	In use
Visual C++/gnu	Development envs	World standards	In use
CMT	Code mgmt tool	HEP standard	In use
ViewCvs	cvs web viewer	World standard	In use
cvs	File version mgmt	World standard	In use

Instrument Simulation and Reconstruction

3 GeV gamma interaction



Source Fluxes

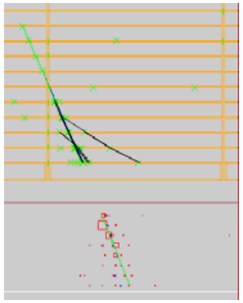


Particle Transport

Instrument data

"Raw" Data

Recon

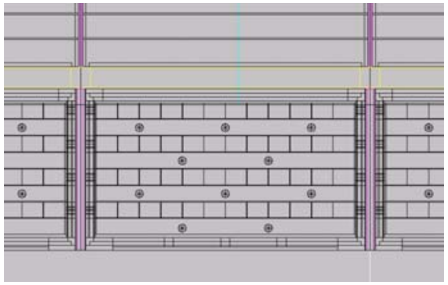


3 GeV gamma recon

Geometry

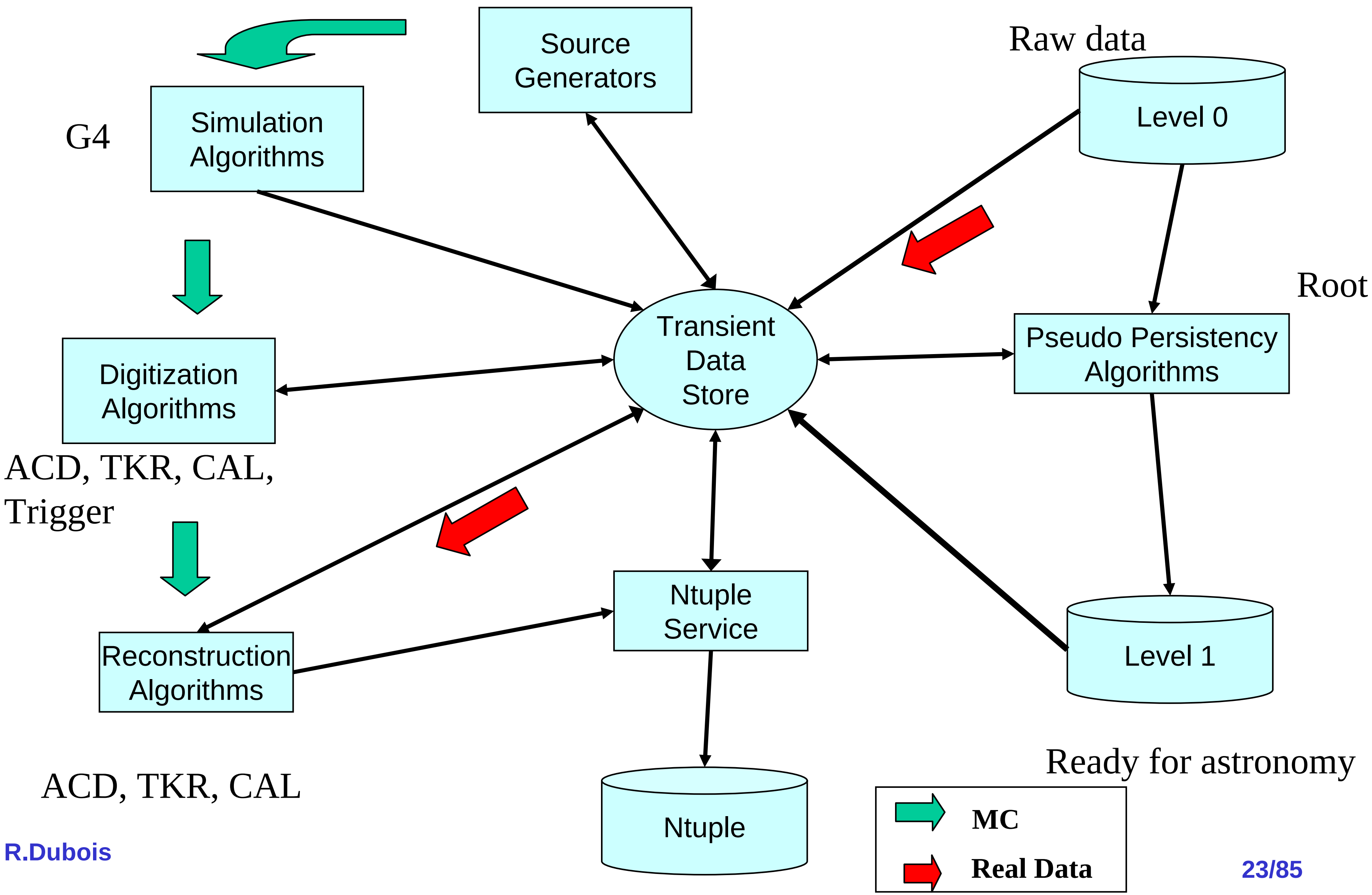
Background Rejection - Particle ID

Full geometry in xml with C++ interface
G4 discovers instrument from the xml



CAL Detail

Data flow in the Gaudi framework



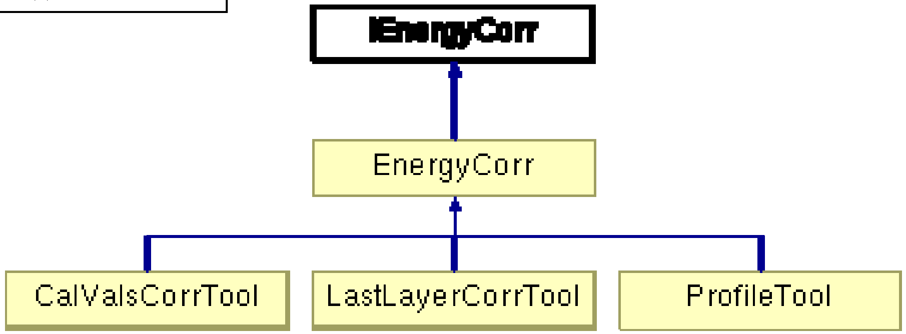
Example of Using Gaudi Tools

```
 IEnergyCorr* m_lastLayerTool;
 sc = toolSvc()->retrieveTool(m_lastLayerToolName, m_lastLayerTool);

m_lastLayerTool->setTrackSlope(slope);
m_lastLayerTool->doEnergyCorr((*it)->getEnergySum(),(*it));
```

Retrieve tool by name via base class

Refer to base class functions. Does not know which concrete tool it is.



IEnergyCorr

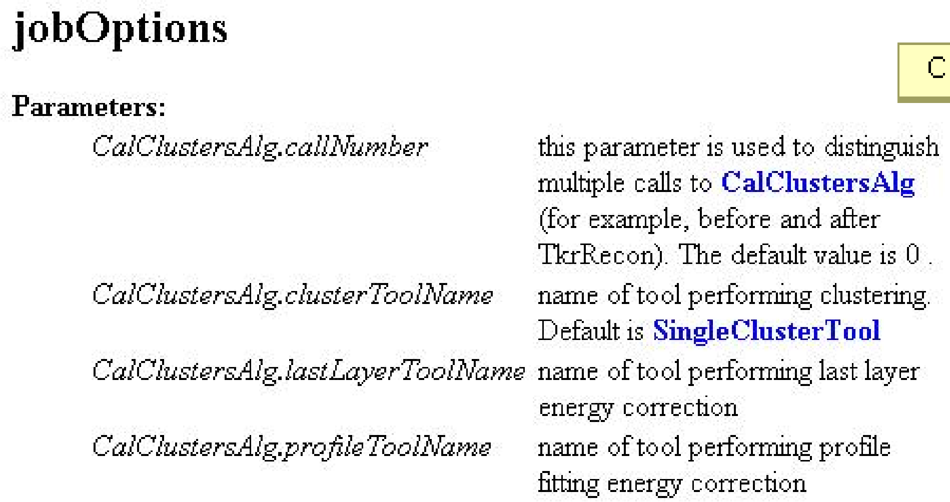
EnergyCorr

CalValsCorrTool

LastLayerCorrTool

ProfileTool

Concrete classes that customize behaviour



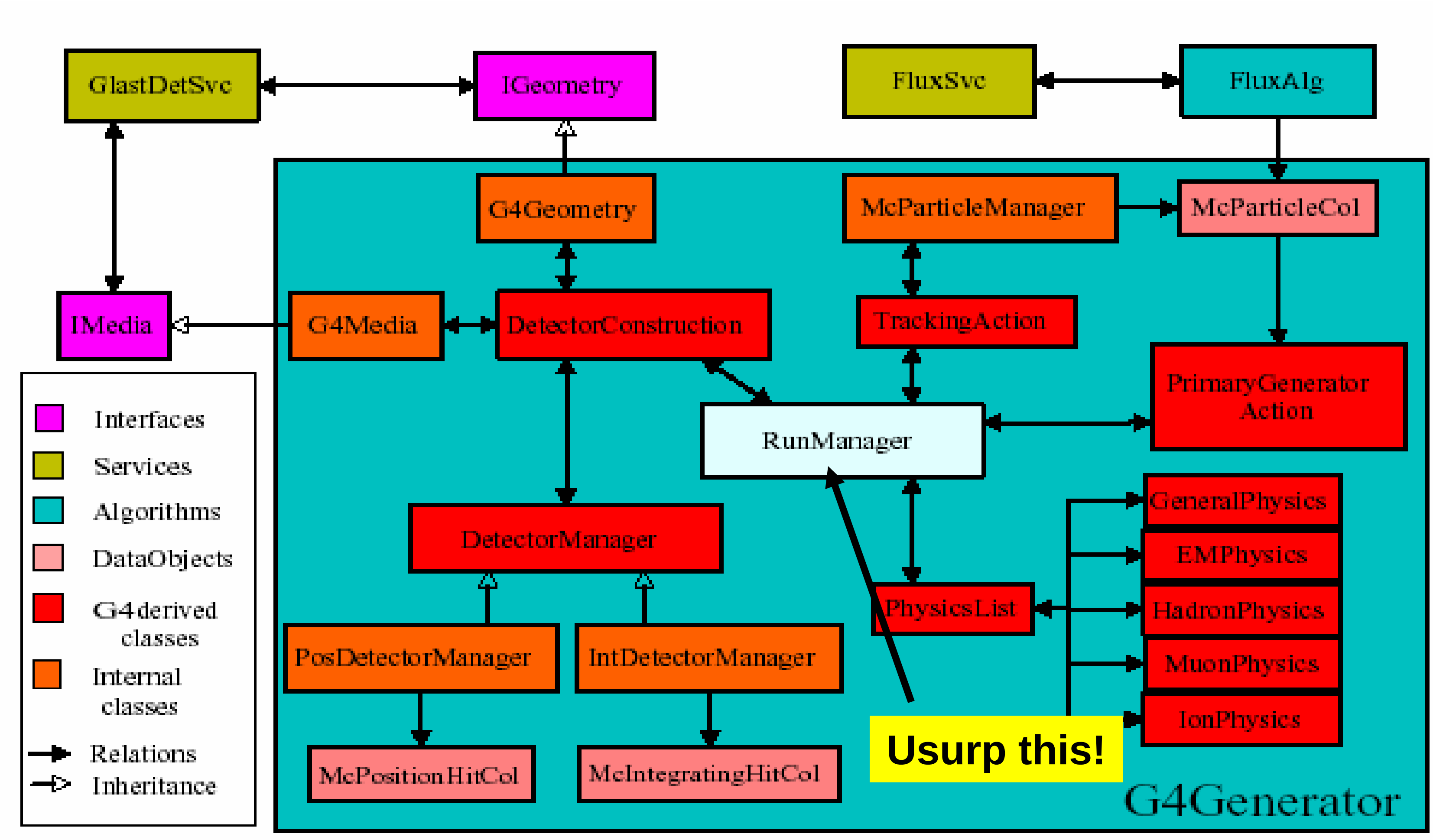
jobOptions

Parameters:

CalClustersAlg.callNumber	this parameter is used to distinguish multiple calls to **CalClustersAlg** (for example, before and after TkrRecon). The default value is 0 .
CalClustersAlg.clusterToolName	name of tool performing clustering. Default is **SingleClusterTool**
CalClustersAlg.lastLayerToolName	name of tool performing last layer energy correction
CalClustersAlg.profileToolName	name of tool performing profile fitting energy correction

Tools id'ed by name in ascii config file ("jobOptions")

Gaudi Interface to Geant4



http://www-glast.slac.stanford.edu/software/core/documentation/reviews/G4Generator/g4greview.pdf

Data Challenges

- Ground software is amalgam of HEP instrument software and Astro FTOOLS
- Adopt HEP's "Data Challenges" to create a series of end-to-end studies: create a progression of ever more demanding studies
- DC1. Modest goals. Contains most essential features of a data challenge.
  - 1 simulated day all-sky survey simulation
  - find GRBs
  - recognize simple hardware problem(s)
  - a few physics surprises
  - Exercise all the components
- DC2, start beginning of CY06. More ambitious goals. Encourage further development, based on lessons from DC1. One simulated month.
- DC3, in CY07. Support for flight science production.

DC Components

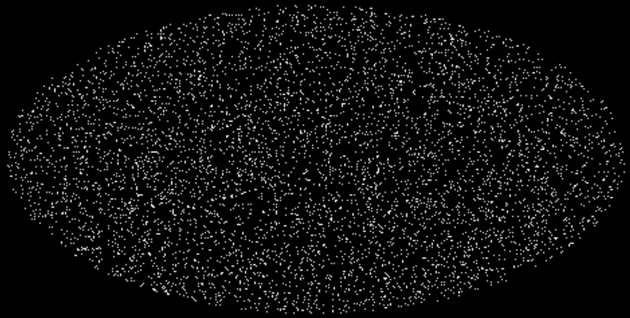
- Focal point for many threads
  - Orbit, rocking, celestial coordinates, pointing history
  - Plausible model of the sky
  - Background rejection and event selection
  - Instrument Response Functions
  - Data formats for input to high level tools
  - First look at major science tools – Likelihood, Observation Simulator
  - Generation of datasets
  - Populate and exercise data servers at SSC & LAT
  - Code distribution on windows and linux

- Involve new users from across the collaboration

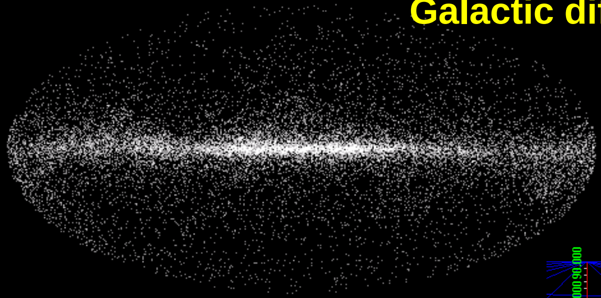
- Teamwork!

The Simulated DC1 Sky

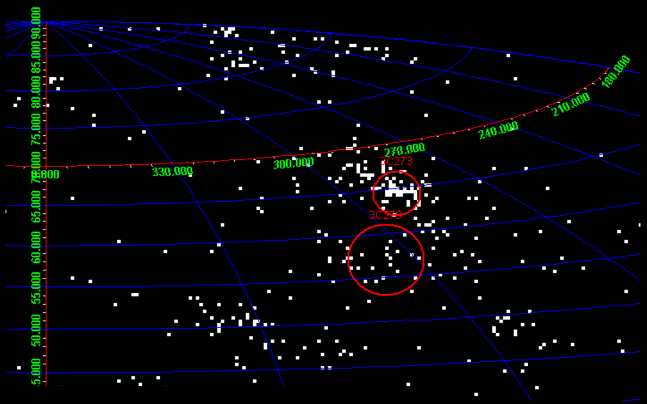
Extragalactic diffuse

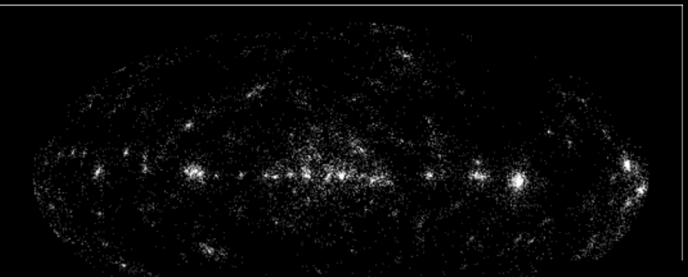


Galactic diffuse



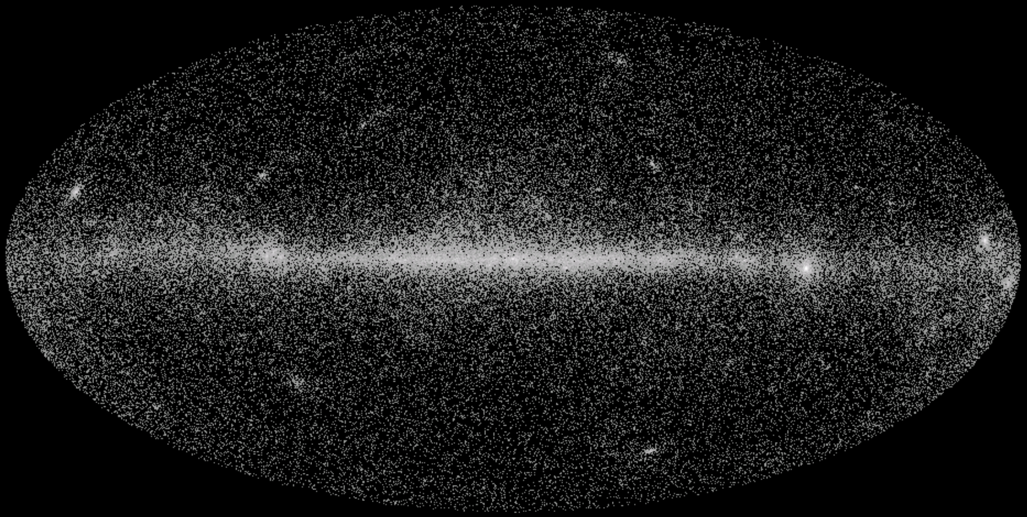
Fiddling 3C273/279





EGRET 3EG

Our Sky



GLAST Large Area Telescope:

Reconstruction

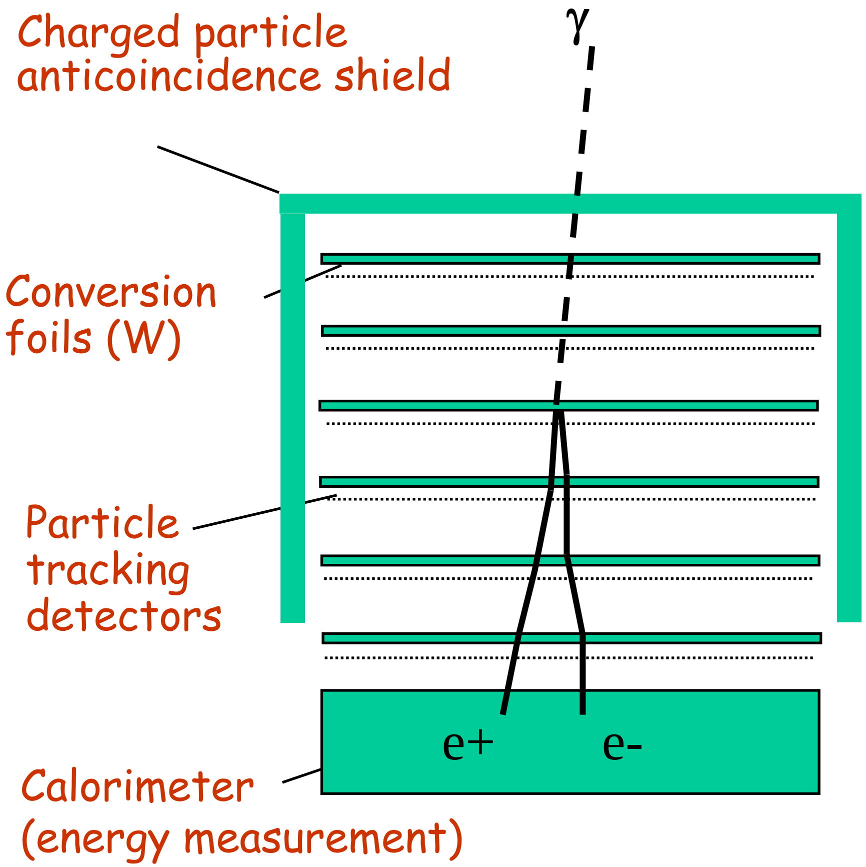
Tracy Usher
Stanford Linear Accelerator Center
usher@slac.stanford.edu

http://www-glast.slac.stanford.edu/software

GLAST Reconstruction

Anatomy of a "Typical" Event

Pair production is the dominant photon interaction in our energy range


Charged particle anticoincidence shield
γ
Conversion foils (W)
Particle tracking detectors
Calorimeter (energy measurement)
e+
e-

- Reconstruction Goals:
  - Incident Gamma Direction and Energy
  - Reject Backgrounds
- Incident Gamma converts in the tracker
  - In particular, conversion occurs in one of the converter foils – ie at a well defined location
- Resulting electron-positron pair range out of tracker (TKR)…
  - No magnetic field, tracks are "straight lines"
  - Resulting two tracks "point" back to incident Gamma
- And into the CsI Calorimeter (CAL)
  - Measures total energy of electron-positron pair
  - = Gamma energy
- Surrounding Anti-Coincidence Detector (ACD) vetoes any wayward charged particles

GLAST Reconstruction

What makes it challenging…

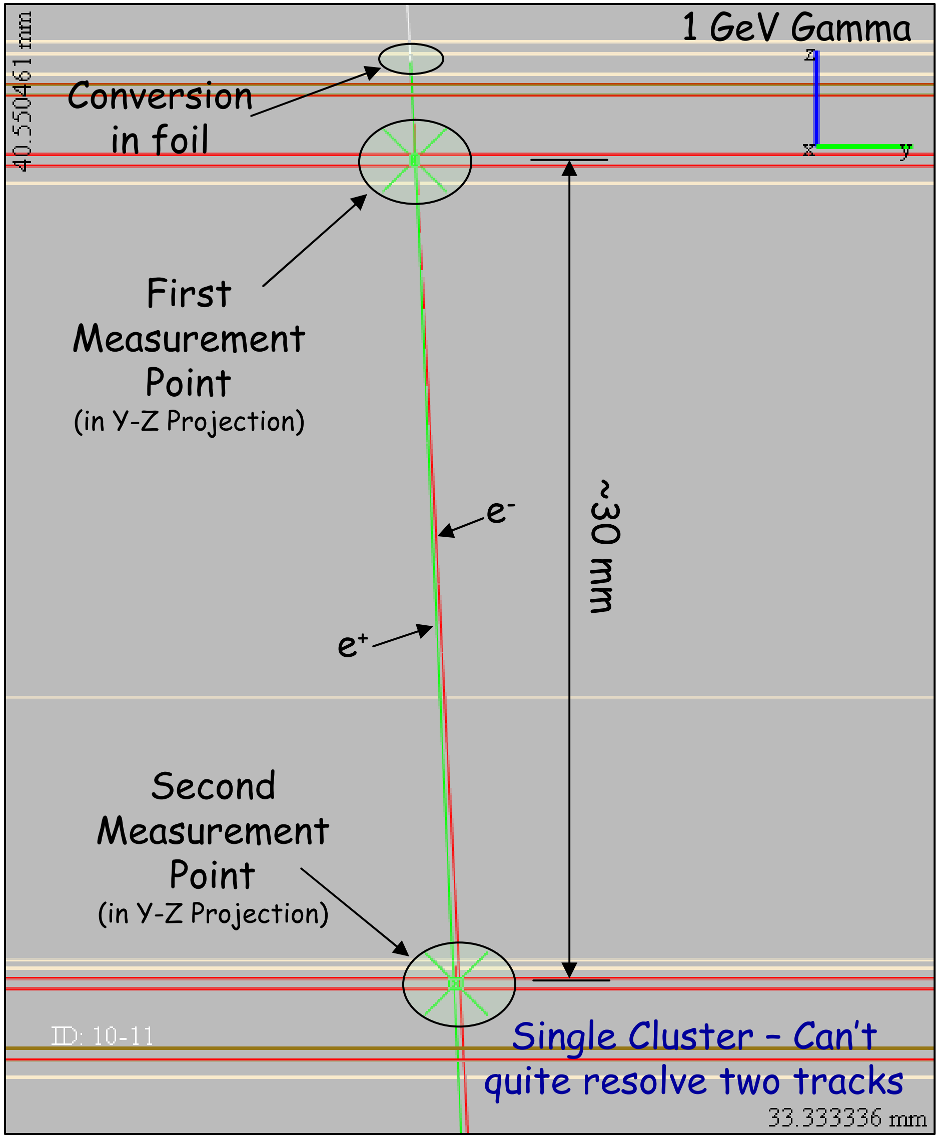
- Track Opening Angle ~0
  - Resolve
    ~ 2 * 228 um / 30 mm = ~15 mr

    Strip Pitch

    ~ Tray Spacing

    < ~50 MeV photons to resolve tracks without "help"

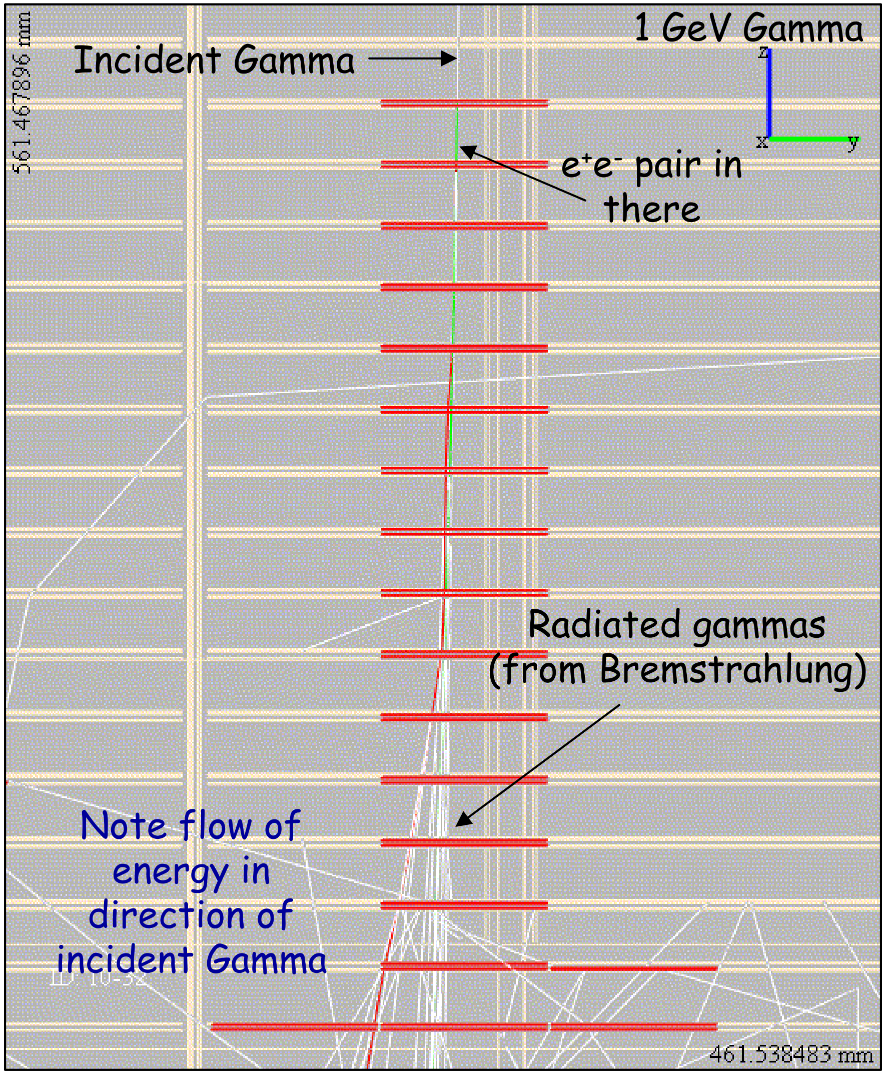
- Looking for "v"s may not be the correct strategy for gamma direction reconstruction
  - Well… see next slides…



GLAST Reconstruction

What makes it challenging…

- Tracker has a lot of material
  - Actual tracker is ~ .3 rl
    - Could live with this…
  - Converter foils are ~ 1.1 rl
    - Love them: convert gamma
    - Hate them: tracking electrons
  - Total ~ 1.4 rl
    - For particles traversing active area of tracker
    - Does not include walls between towers, etc.
- Issues to deal with
  - Gammas can (and do) convert outside the foils
  - e^+e^- pair interact with tracker
    - Multiple scatter
    - Primary e^+ or e^- can stop in the tracker
    - e^+ and e^- radiate energy
    - etc.



1 GeV Gamma

Incident Gamma

e^+e^- pair in there

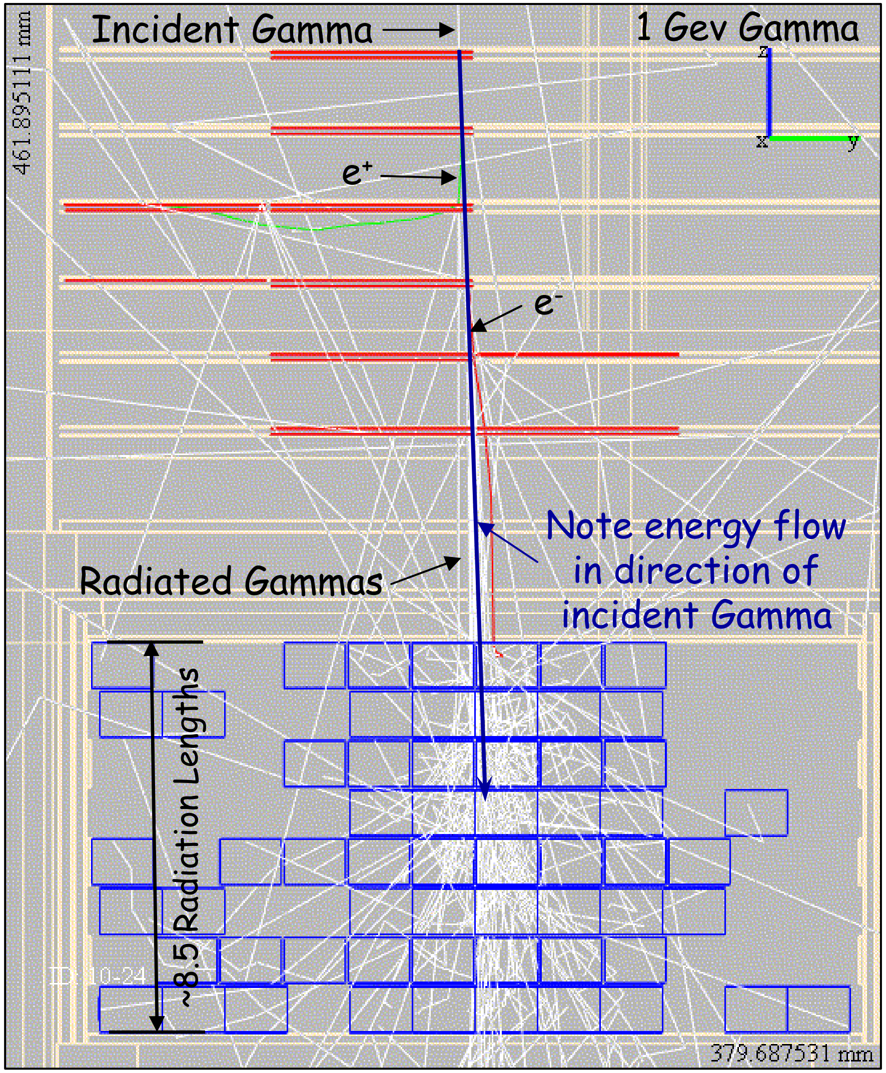
Radiated gammas (from Bremstrahlung)

Note flow of energy in direction of incident Gamma

GLAST Reconstruction

What makes it challenging…

- **Calorimeter Issues**
  - Measure Event Energy – Not Track Energy(ies)
    - Don’t have resolution to separate
    - Large fraction of measured energy from Brems
    - Implications for determining gamma direction when you do have two track events…
  - Measure Fraction of Event Energy
    - Energy “loss”
      - in tracker
      - Leaking out of Calorimeter
    - Significant contribution at
      - lower energies (e.g. < 1 GeV)
      - for conversions starting higher in the tracker
    - Must augment total energy determination with contribution from tracker



GLAST Reconstruction

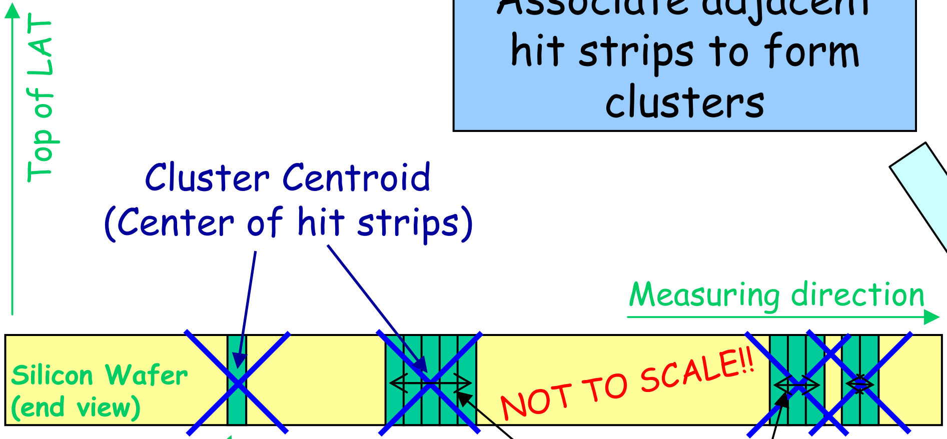
- Summary: Slightly more complicated than first thought
- But still follow the “Standard” HEP Approach
  - Tracking
    - Change Goal slightly
      - Still look for two tracks
        - Multiple Scattering separates them
      - But emphasize the “longest, straightest” (highest energy) track
    - Algorithms to assign energy to tracks in final fits
    - Provide enough information to reject “bad” events
  - Calorimetry
    - Look for total event energy
    - Algorithms to correct for
      - Losses in the tracker
      - Leakage
      - Etc.
  - Both: Algorithms to help reject background

Tracking Overview

“Standard” HEP Approach

Raw Data
1) Hit Strips
2) “ToT”

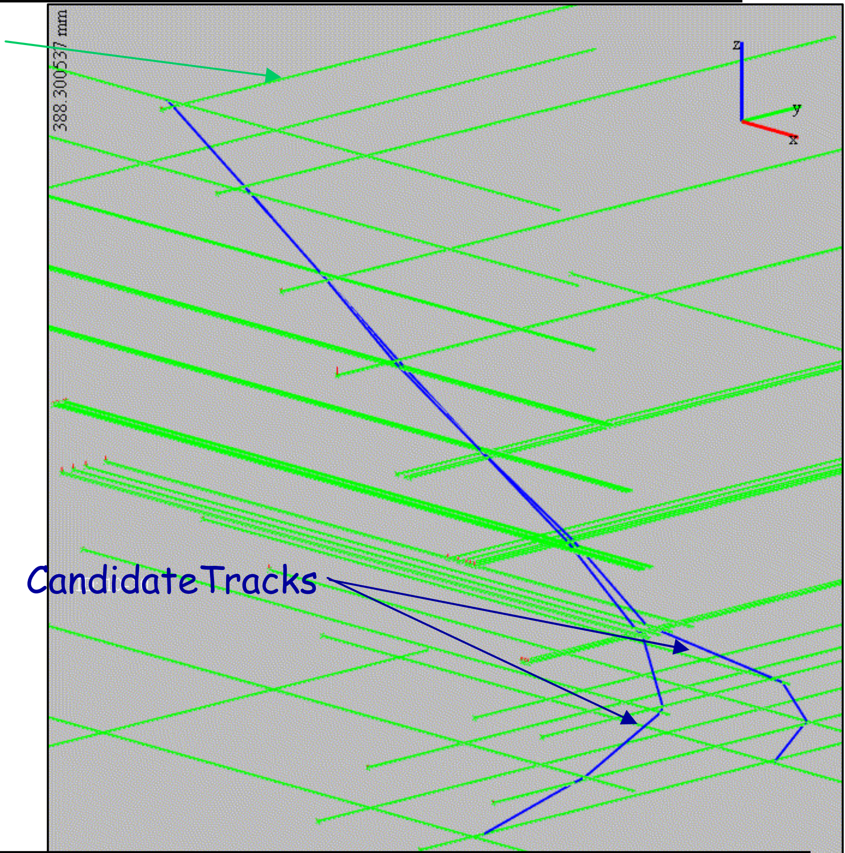
1) Clustering:
Associate adjacent hit strips to form clusters



Cluster Centroid
(Center of hit strips)

Hit strip
(strip pitch: 228 µm)

Cluster Width
(Number of hit strips)



2) Track Finding:
Assume start point, direction and energy
Follow track and attach clusters allowing for deviations due to multiple scattering, etc.

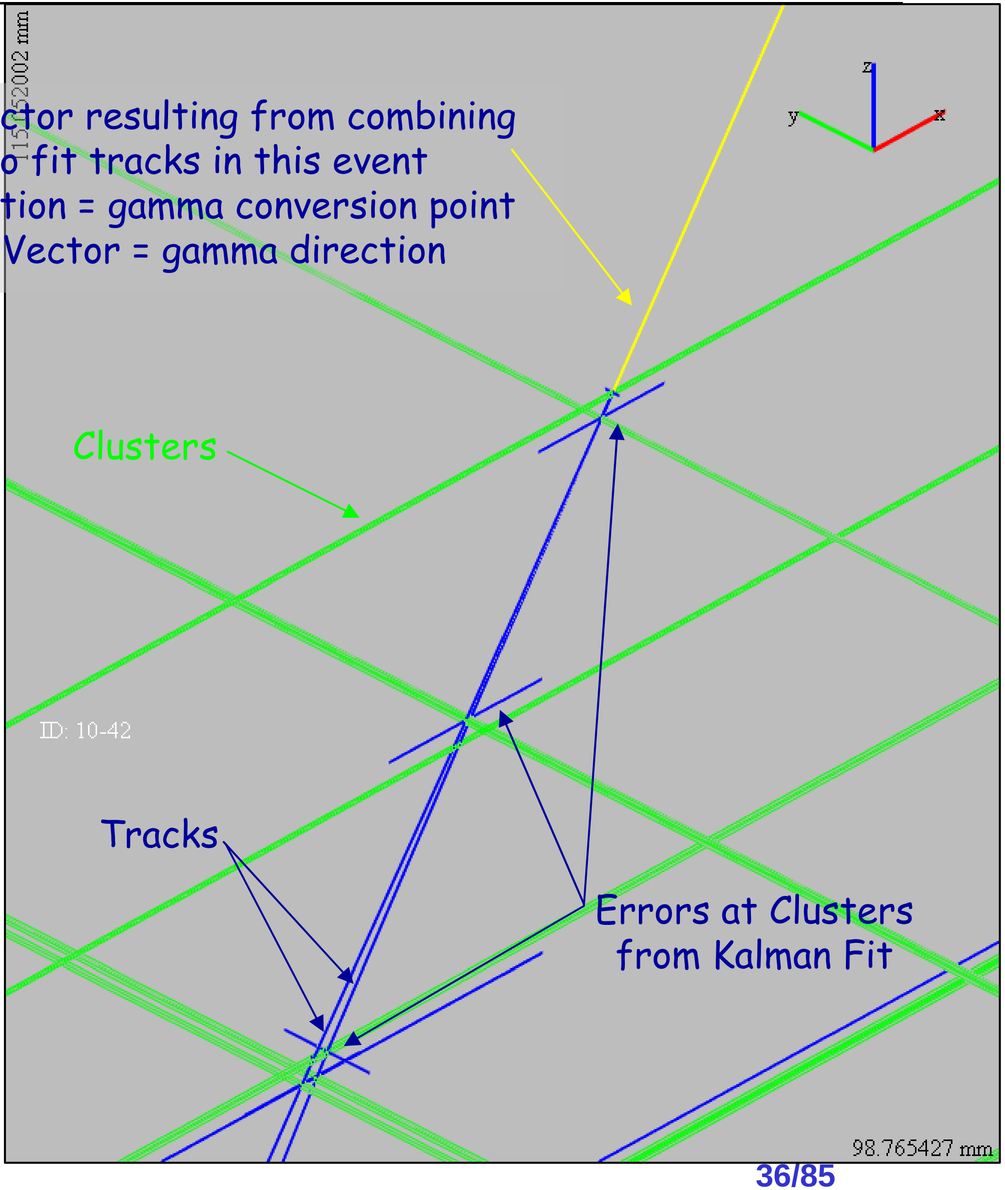
Tracking Overview

"Standard" HEP Approach

Track Finding
(see previous page)

3) Track Fit:
Kalman Filter Fit to get final Track Parameters

4) "Vertexing":
Combine Tracks to determine conversion point and direction of the incident Gamma
Note: a "vertex" can consist of only one track



"Vertex" vector resulting from combining the two fit tracks in this event
Vertex Position = gamma conversion point
Vertex Vector = gamma direction

Clusters

Tracks

Errors at Clusters from Kalman Fit

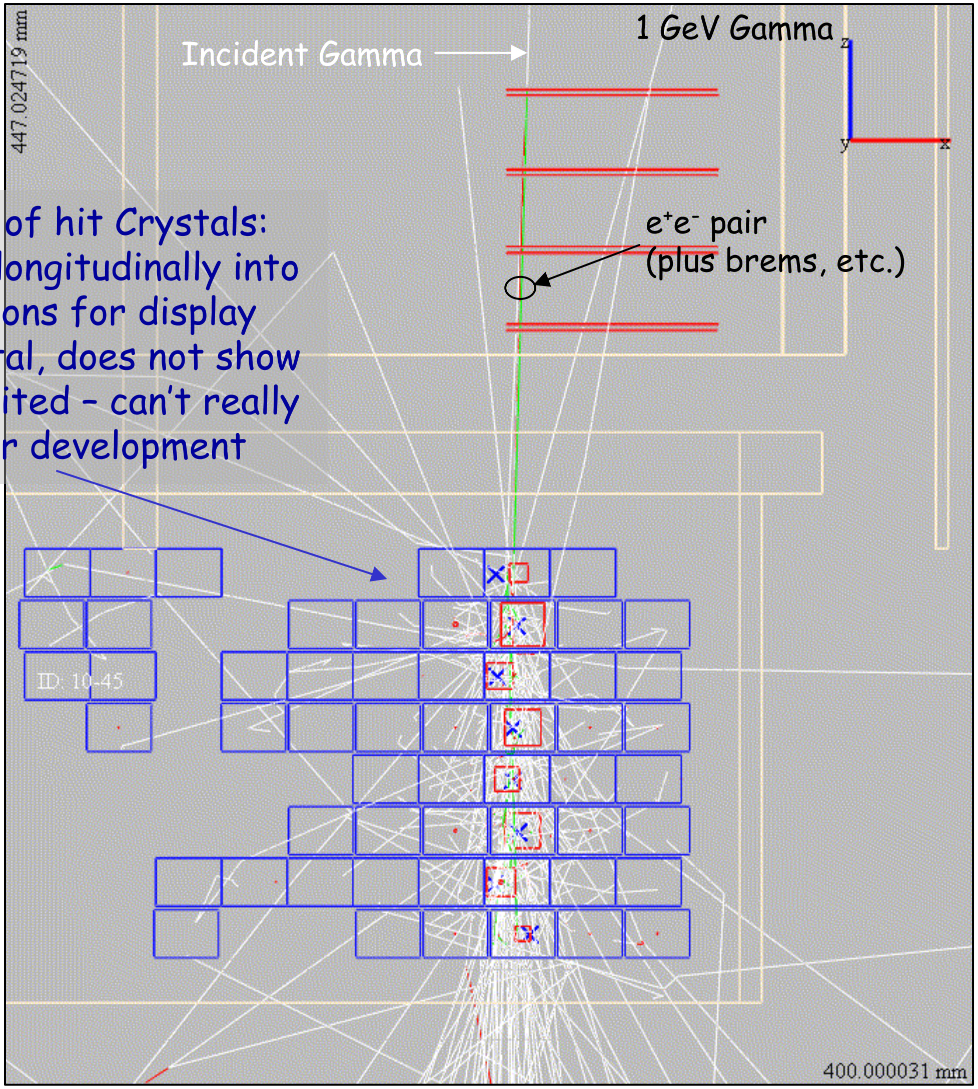
Calorimetry Overview

“Raw” Data

Corrected Energy, “Position” per Crystal (Xtal)

Corrections/Calibrations applied before this step!

MC Display of hit Crystals: Divides Xtal longitudinally into eight sections for display
Shows Hit Xtal, does not show energy deposited – can’t really see shower development



Clustering:

Associate hit Xtals together to form clusters

Gamma Energy: All hit Xtals are from incident Gamma – Energy is sum over all hit Xtals

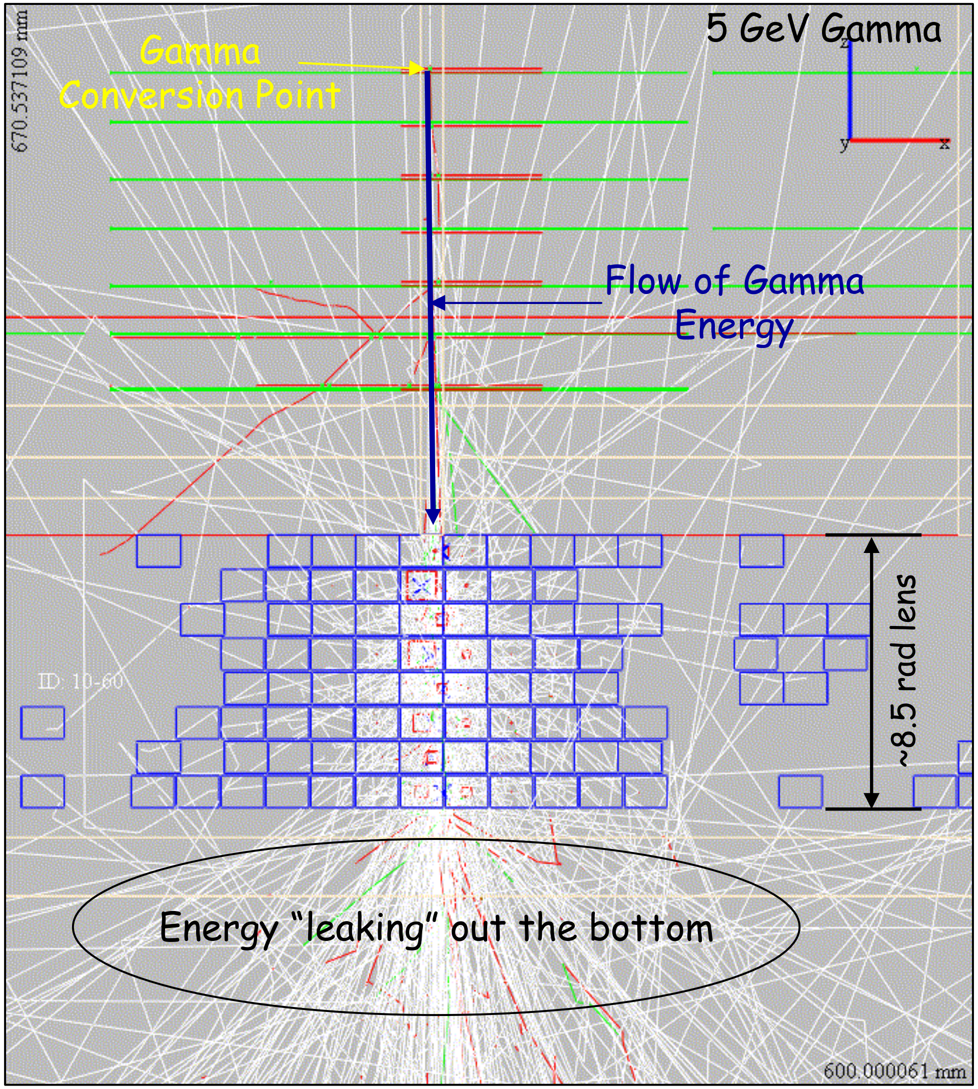
Backgrounds: Isolated sets of hit Xtals from own “cluster”

Calorimetry Overview

Energy Correction Algorithms:

1) Shower Profile
2) Inefficiencies due to Geometry
3) Leakage
4) etc.

(see next slides)



5 GeV Gamma

Gamma Conversion Point

Flow of Gamma Energy

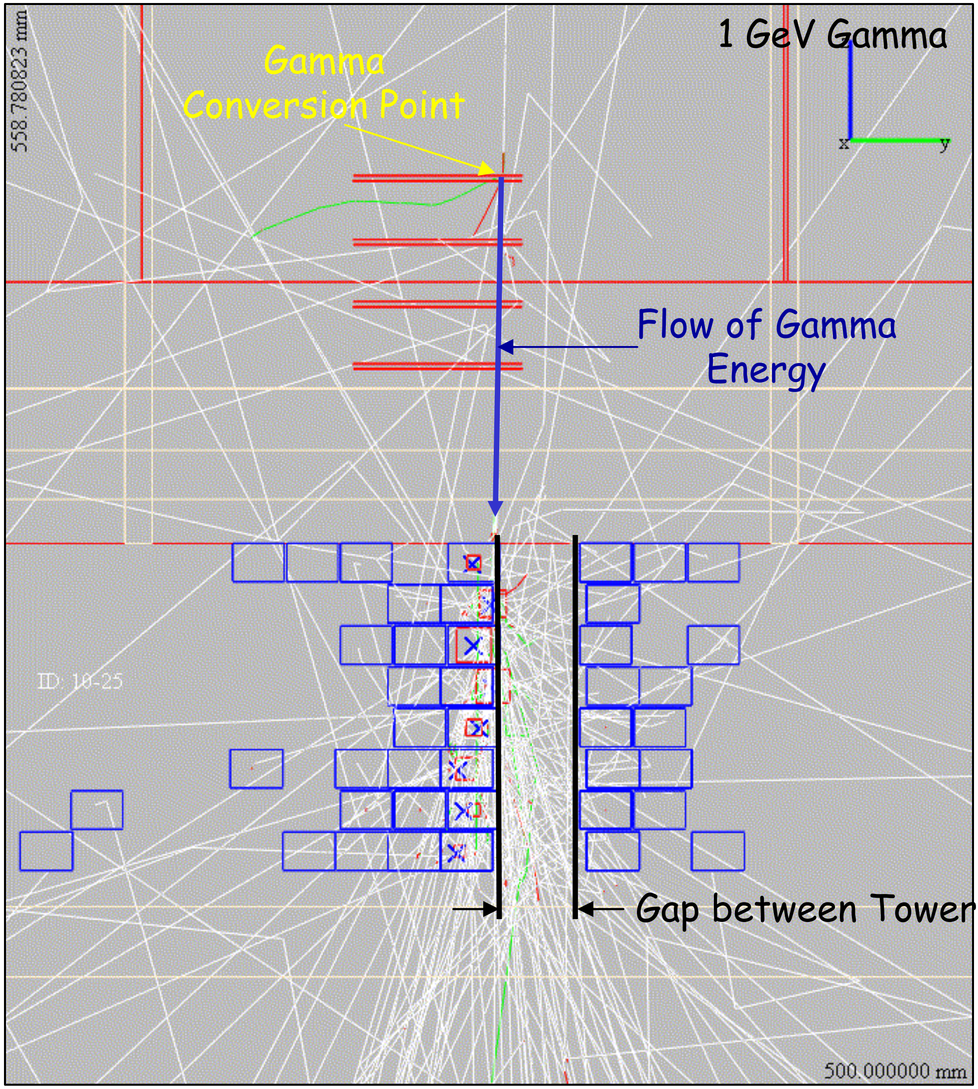
~8.5 rad lens

Energy “leaking” out the bottom

Calorimetry Overview

Energy Correction Algorithms:
Inefficiencies due to Geometry

Given the direction of energy flow (from the reconstructed Gamma direction), can apply geometric corrections to account for energy "lost", e.g. between towers



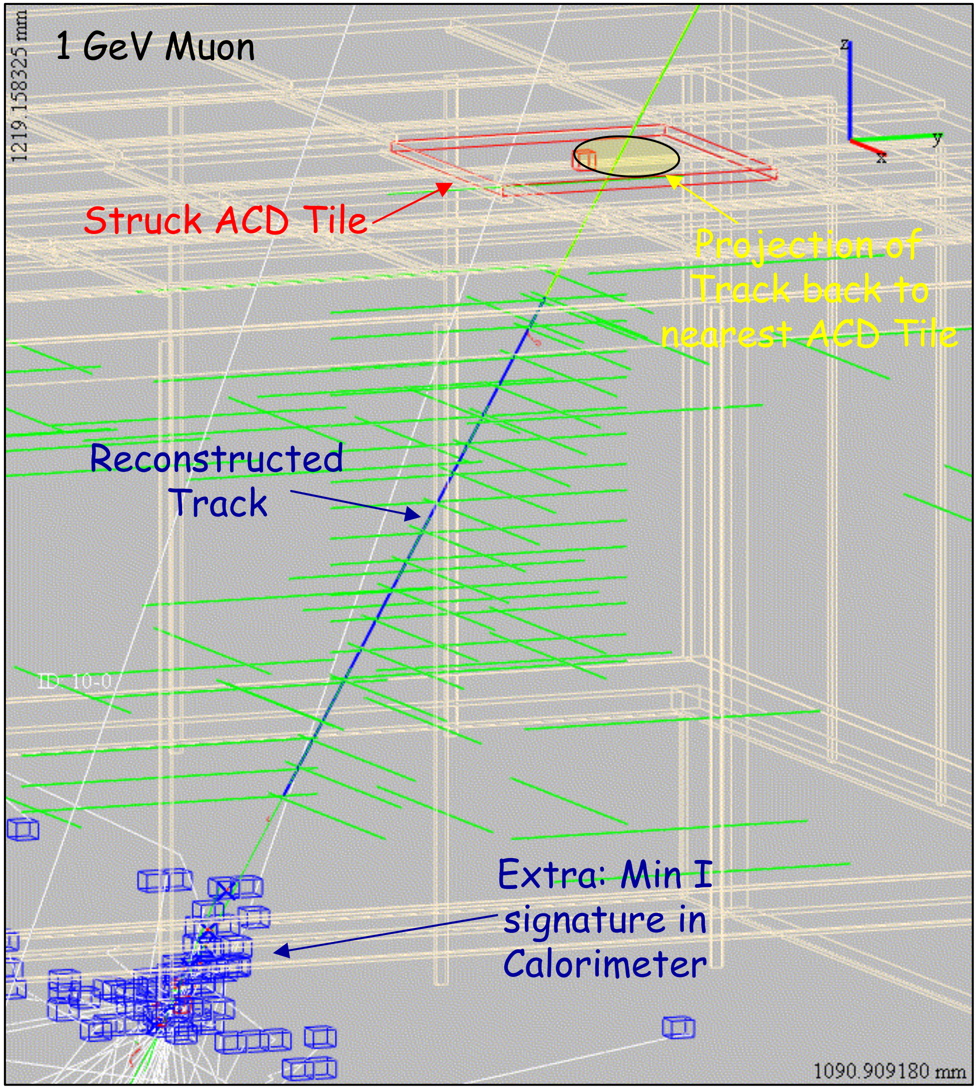
Putting It All Together

- Chicken…
  - Track Finding/following needs starting values:
    - Initial Position
    - Initial Direction
    - Initial Energy
  - This from the Calorimeter…
- Or Egg?
  - Energy Correction algorithms need gamma direction
  - This from the tracking…

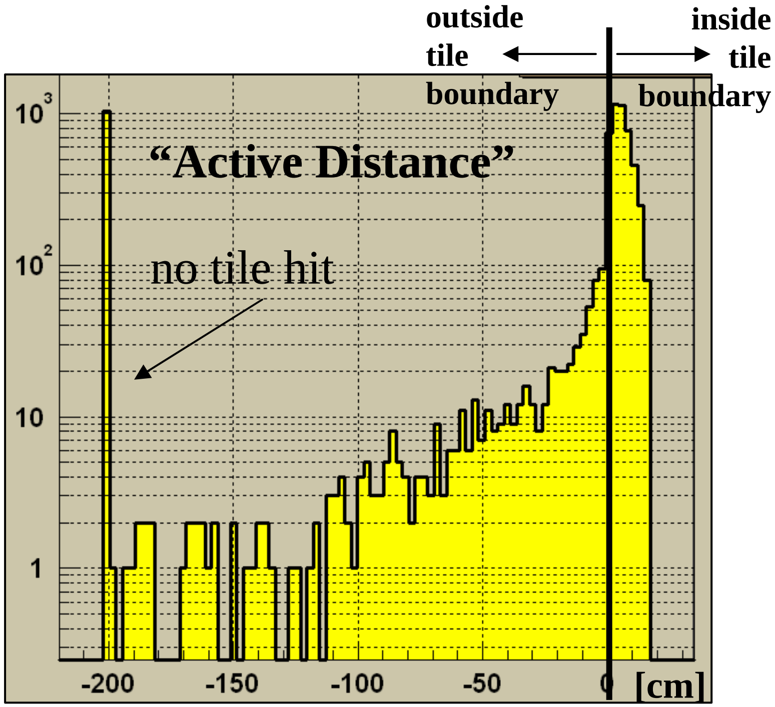
- Solution: Iterative Reconstruction
  - First Pass
    - Calorimeter Reconstruction
      - Through Clustering
        - » Total Energy
        - » Cluster Centroid
        - » Cluster Axis
    - Tracker Reconstruction
      - Track Finding/Following
      - Track Fit and Vertexing
        - » Good enough for 2nd pass
  - Second Pass
    - Calorimeter Reconstruction
      - Energy Correction Algorithms
    - Tracker Reconstruction
      - Track Fit and Vertexing
        - » Use “improved” energy

Background Rejection

Example: Charged Particles in Tracker



- Project Track to plane of struck tile
- Calculate distance to nearest edge
- Sign
  Positive if track projection inside the tile
  Negative if track projection outside the tile
- Reject if inside the tile



End of Reconstruction

- Two Levels of Output at end of Reconstruction:
  - Root Trees
    - Basically, all the output of all steps of reconstruction
    - Enough information to read back in and continue reconstruction from that point
    - Detailed offline analysis for reconstruction algorithm improvements
    - Main component of System Tests
  - Output Ntuple with two branches
    - A detailed branch which contains enough information for checking of reconstruction performance
    - The analysis branch which is passed on to the next stage…

LAT Science Tools for Gamma-Ray Astronomy

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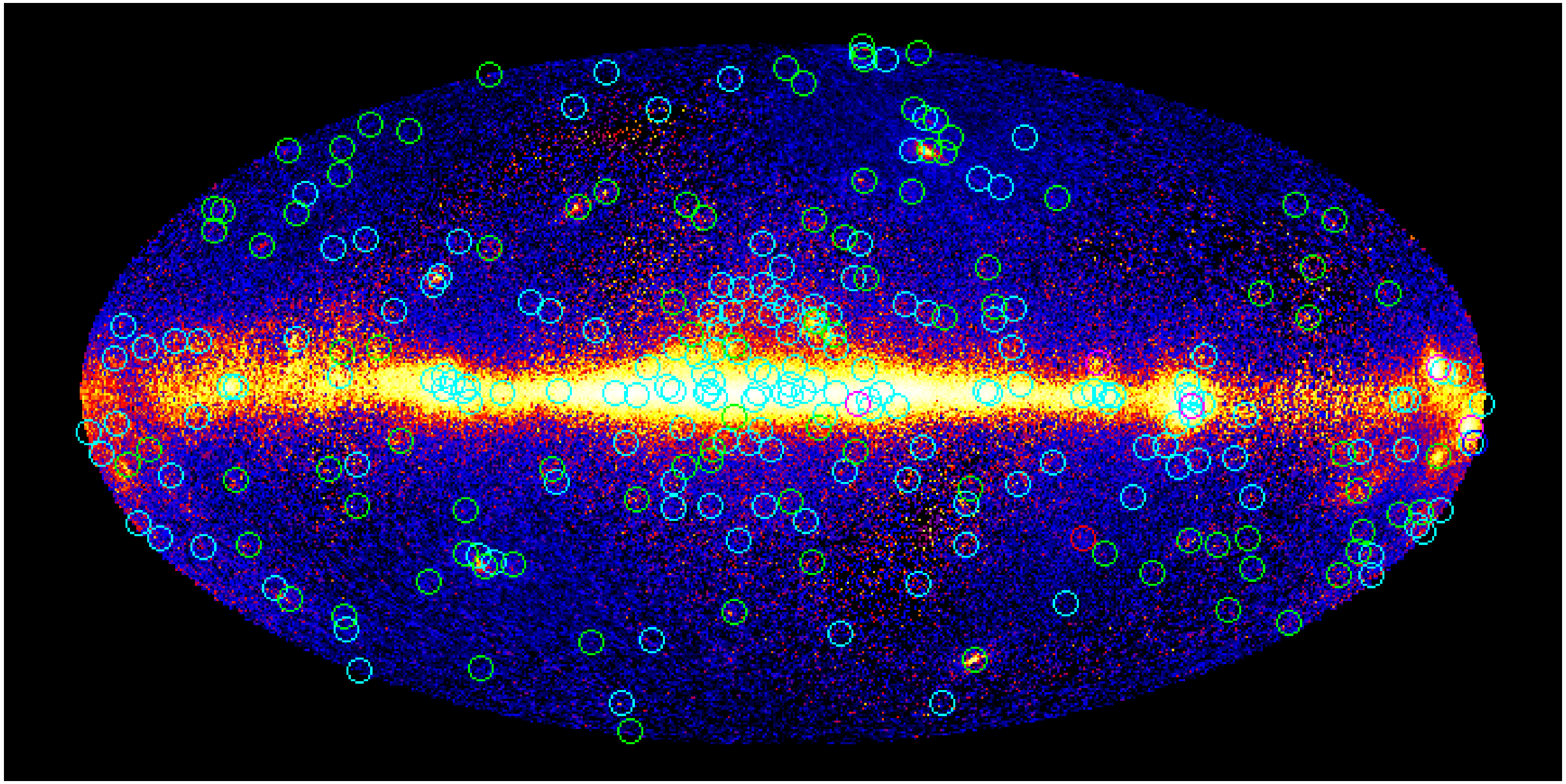
The Gamma-Ray Sky

- EGRET All-Sky Map and 3rd EGRET Catalog:

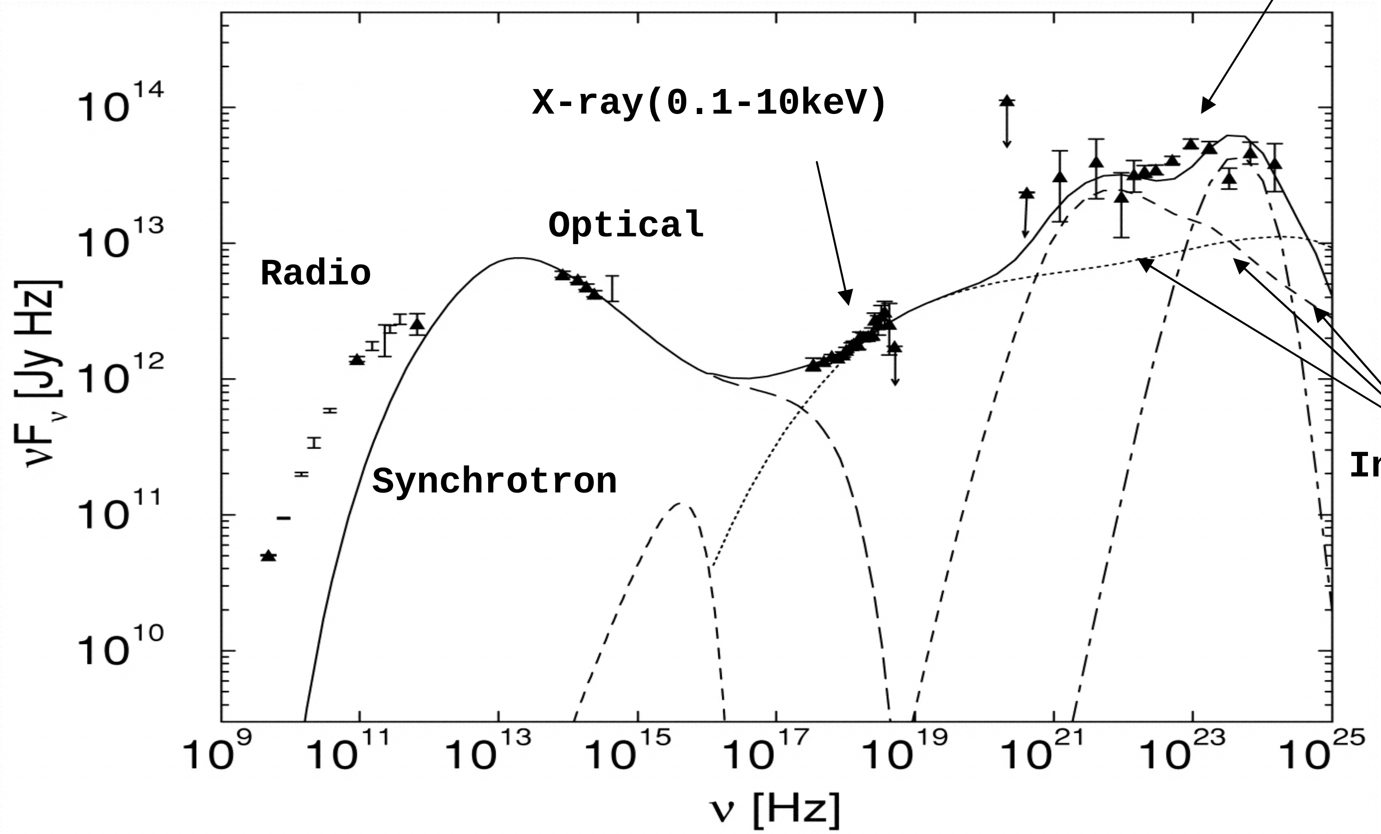


	3EG	GLAST		3EG	GLAST
AGNs	94(67)	~3000	Unids	170	O(10^3)?
Pulsars	5	~ 10s	Sol. Flare	1	?
galaxies	1(LMC)	>1?			

Dark Matter, SNRs, etc.

Example Source Class: Blazars

- Spectral Energy Distribution (SED)



EGRET(0.03-20GeV)

X-ray(0.1-10keV)

Optical

Radio

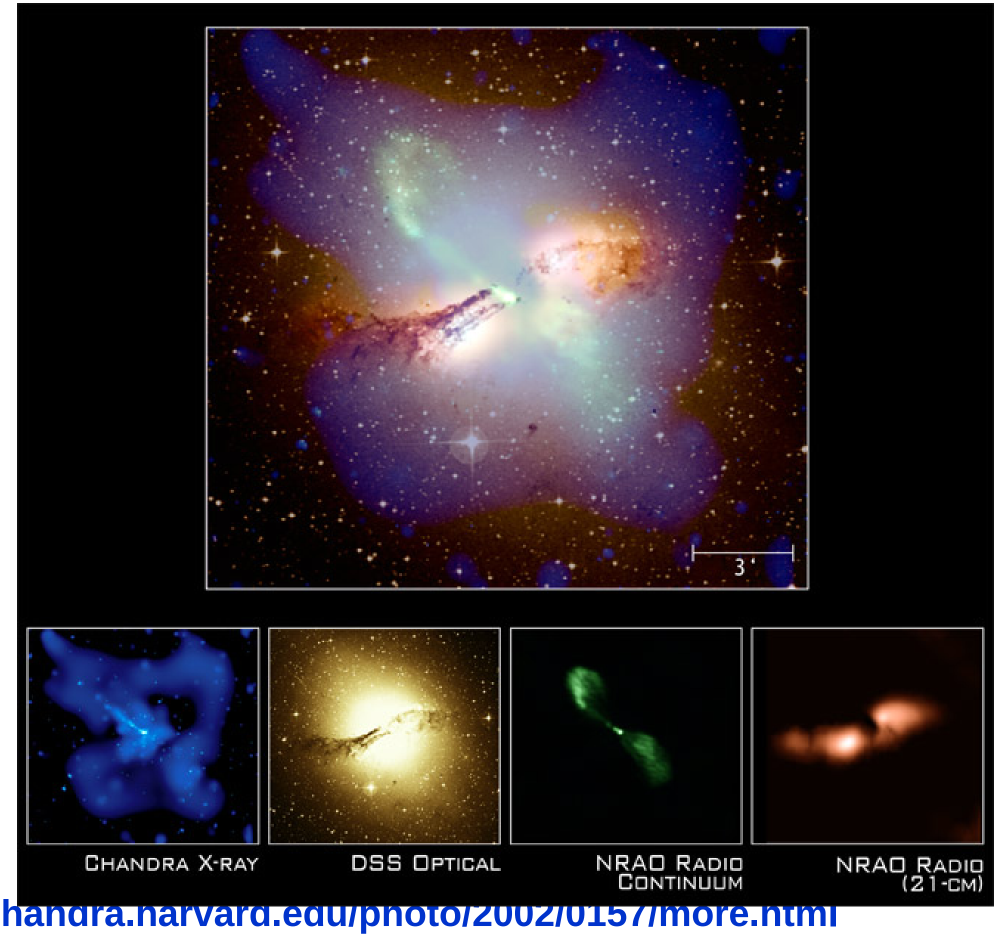
Synchrotron

Inverse Compton

3C 279 (Hartman et al., 2001, ApJ, 553, 683)

Blazars (cont.)

- Radio morphology and its evolution implies a relativistic outflow (jet):

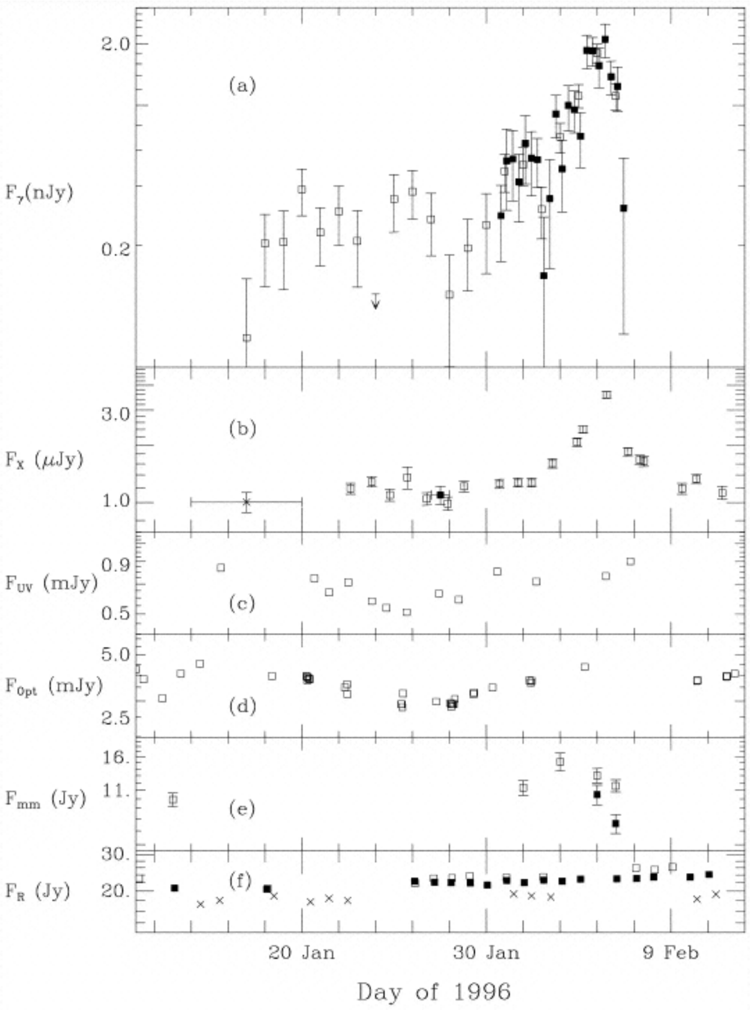


- http://chandra.harvard.edu/photo/2002/0157/more.html

Multi-wavelength Observations

- Light curves and rapid variability across wavebands, e.g., 3C279 in 1996 (Wehrle et al 1998) require coordinated monitoring efforts with other missions and ground-based teams
- After 1st year, all data becomes public immediately

∴ It must be straight-forward to analyze LAT data by investigators outside of the collaboration.

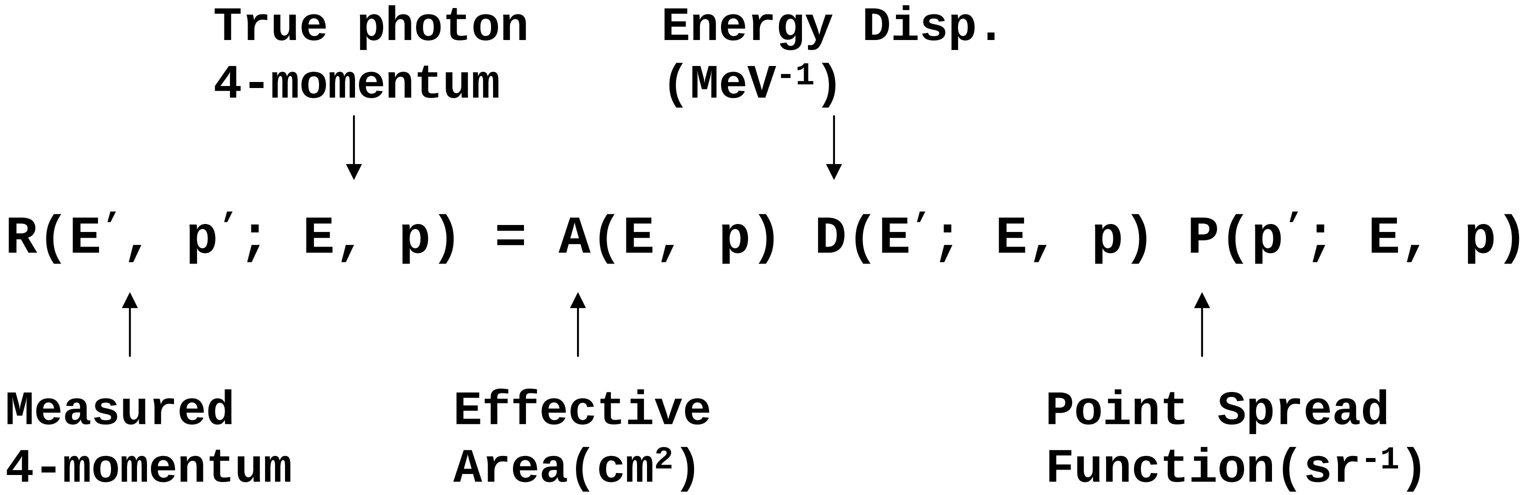


Data Analysis for High Energy Astronomy

- Framework driven by
  - Desire for uniformity between missions
  - Guest observer support (HEASARC)
  - Aggregate nature of the data: events are (almost) never analyzed individually
- Standardized software and data formats
  - FITS files for images and tabular data
  - FTOOLs for examining and manipulating contents
    - Can be mission-specific
    - User interfaces – “parameter interface layer”, ballistic operation
    - Often scripted (Tcl, Perl), some GUI use
  - High level analysis applications: `Xspec` (from `Xanadu` suite), `Sherpa`, `ISIS` (from `CIAO`), etc.
  - Unix-based tradition; GLAST pushing for Windows support

Instrument Response Functions (IRFs)

- The *linchpin* between the event reconstruction and Science Tools
- The IRFs are a statistical description of the performance of the LAT for measuring photon properties, e.g., a transition matrix.
- They are derived from real calibration runs using a photon source (e.g., real data + recon) and/or from Monte Carlo simulations using GlastRelease (GEANT 4 + recon).
- The total response, R, is usually factored into three components:



True photon 4-momentum

Energy Disp. (MeV^{-1})

$$R(E', p'; E, p) = A(E, p)\, D(E'; E, p)\, P(p'; E, p)$$

Measured 4-momentum

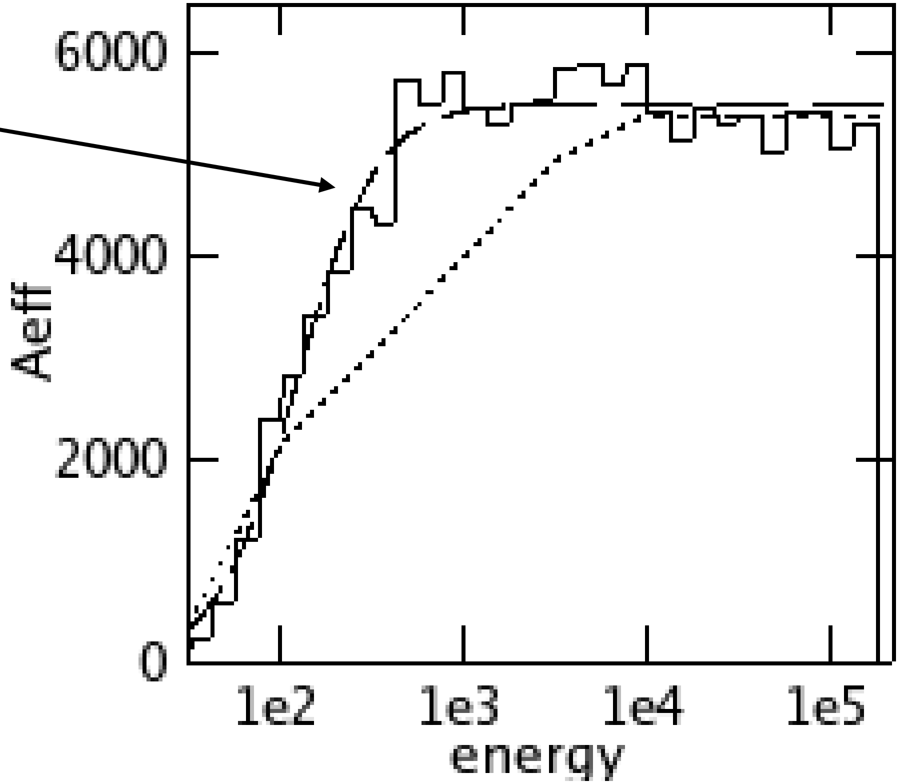
Effective Area(cm^2)

Point Spread Function(sr^{-1})

Example IRF Generation: DC1

- ~5 M “AllGamma” events are generated covering 2π sr and spanning energies 20 MeV to 200 GeV.
- Effective Area -- detector “cross-section” as a function of energy:

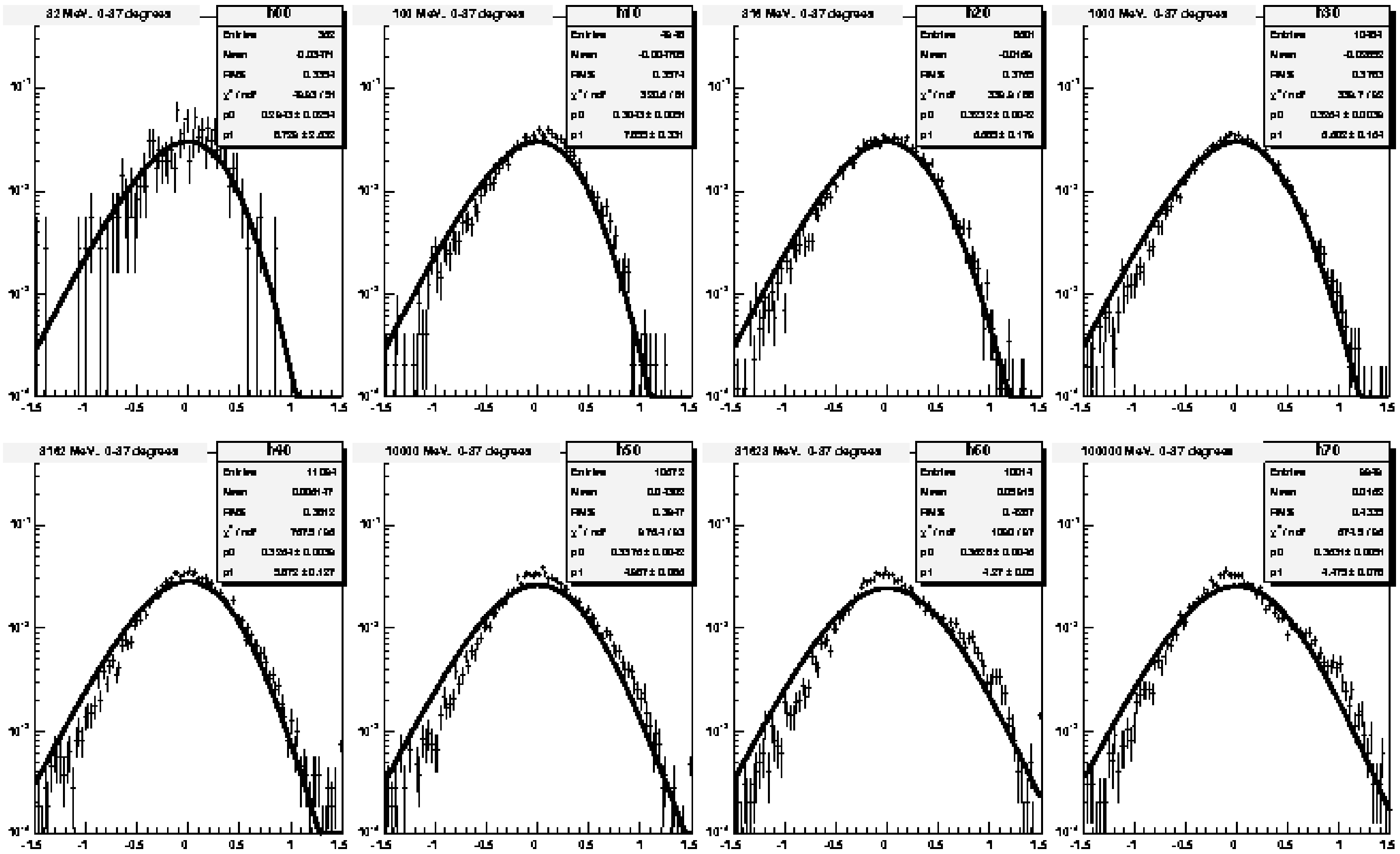
LAT performance is strongly impacted by cuts on particle background



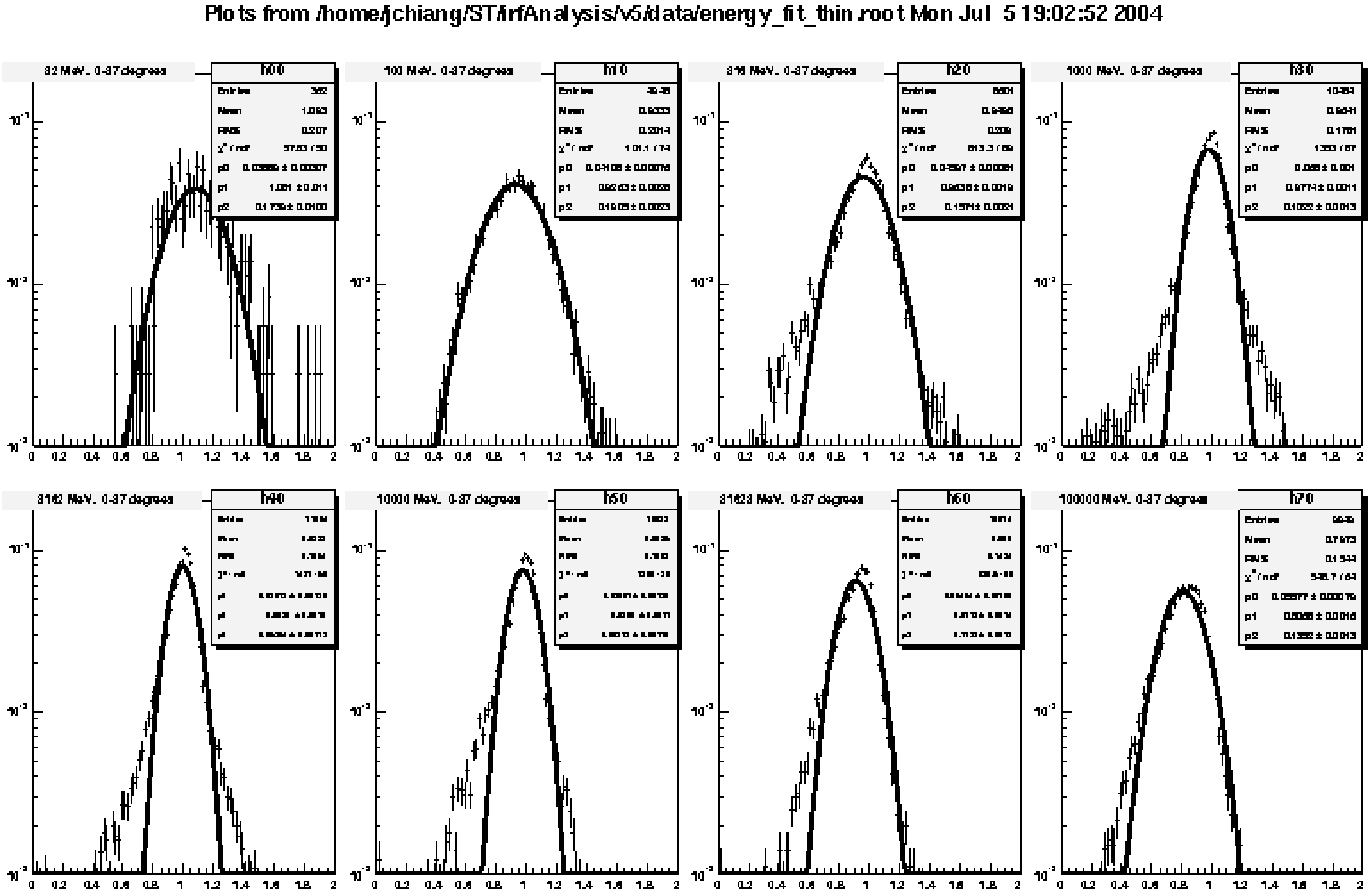
Point Spread Functions (PSFs)

- Data are partitioned into broad energy and inclination bins
- Angular deviations are scaled by ~E^{-1} to account for multiple scattering

Plots from /home/jchiang/ST/irfs/irfAnalysis/v6/data/psf_new_thin.root Wed Jan 12 22:08:16 2005



Energy Dispersion

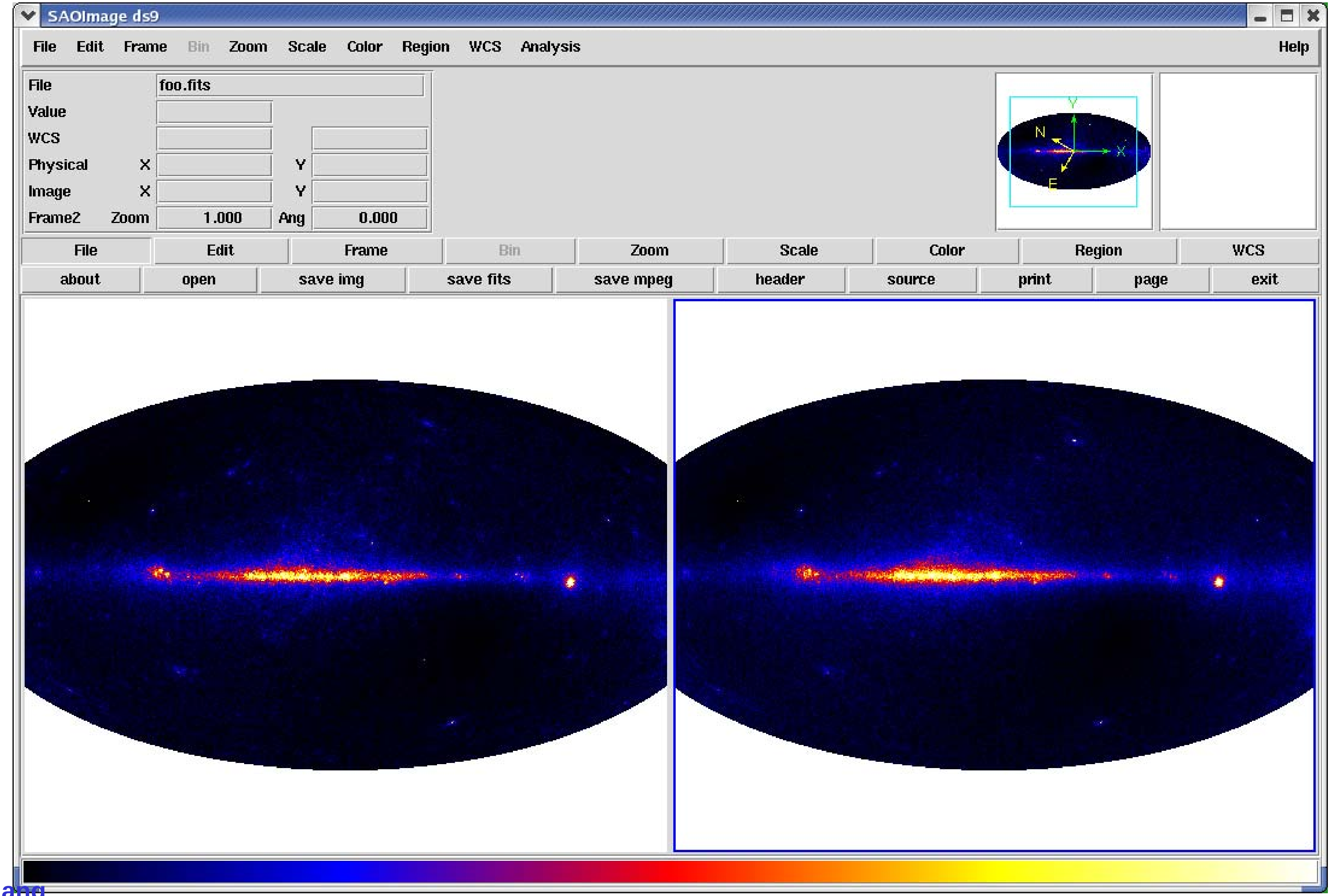


Plots from /home/jchiang/ST/irfAnalysis/v5/data/energy_fit_thin.root Mon Jul 5 19:02:52 2004

Using the IRFs for Simulation

- Assuming perfect knowledge of incident photons, the distributions of measured quantities should (ideally) be identical for all three ways of obtaining them:
  - Real observations + Gleam reconstruction
  - Gleam simulation + recon
  - IRFs
- For Science Tools development and testing, we have developed a high level observation simulator that reads in the same sky model as Gleam, but uses the IRFs to produce simulated events:
  - Source flux (photons cm^{-2}s^{-1}) x **A** (cm^2) = rate of detected events
  - True photon 4-momentum & **P** & **D** $\Rightarrow$ Apparent photon 4-momentum, i.e., smeared by instrument response

IRF Simulation vs Gleam



SAOImage ds9
File Edit Frame Bin Zoom Scale Color Region WCS Analysis Help
File Edit Frame Bin Zoom Scale Color Region WCS
about open save img save fits save mpeg header source print page exit
Y
N
X
E

File foo.fits
Value
WCS
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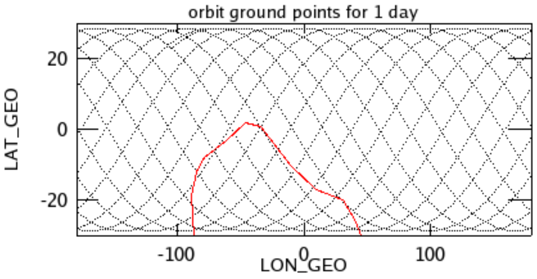
Image X Y
Frame2 Zoom 1.000 Ang 0.000

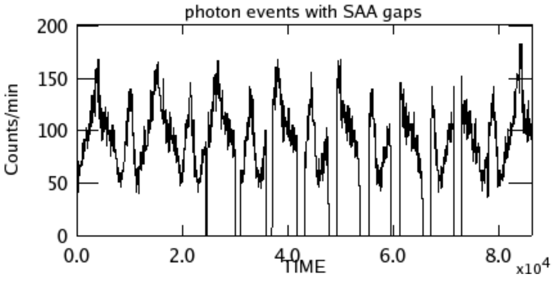
Typical Steps in a LAT Analysis

- Acquire data
  - download from GSSC server
- Preliminary visualization
  - counts and exposure maps
- Analysis-specific data selections
  - GTIs, ROI, event type
- Source identification
  - Source detection and identification: image processing techniques, wavelet analyses, etc.. (should be fast).
- Source characterization
  - Maximum Likelihood estimate (MLE) of source properties—flux, spectrum, position (computationally expensive).
  - Multi-wavelength spectral fitting (using Xspec).

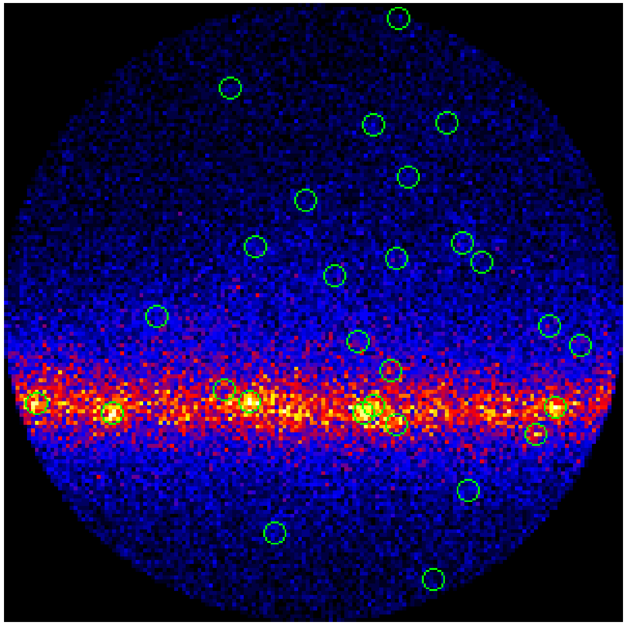
Data Selection

South Atlantic Anomaly (SAA) passages handled by "good time intervals" (GTIs)…

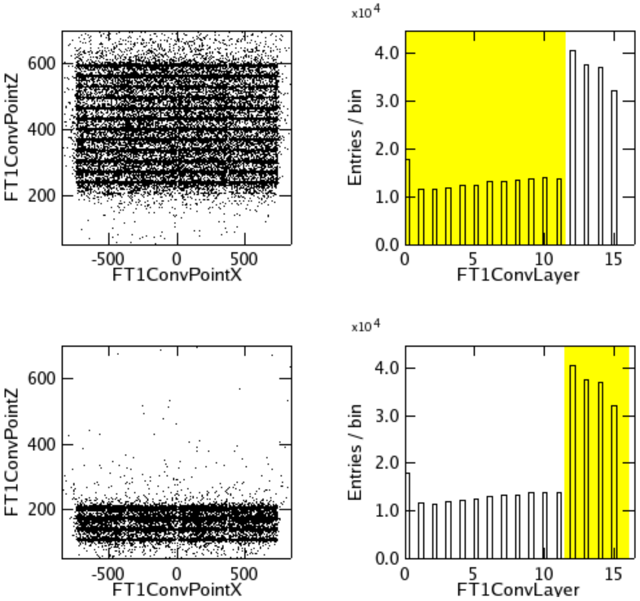




event data are partitioned into "regions-of-interest" (ROIs)…

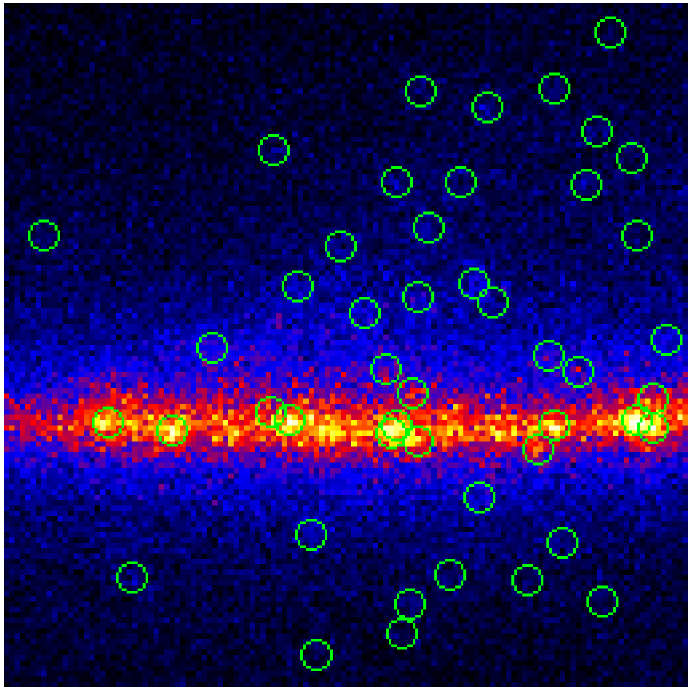


and by event type, eg. "front" vs "back" (depends on IRF granularity)

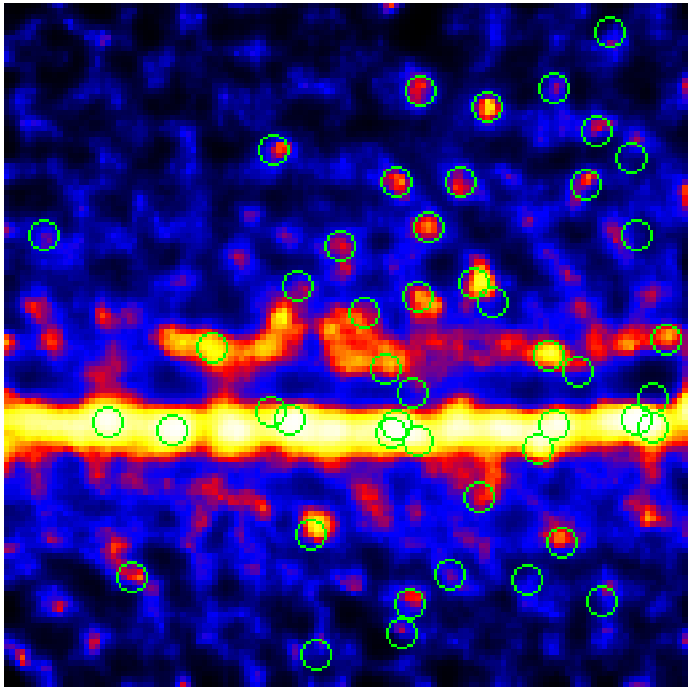


Source Identification

- De-noising and deconvolution (wavelets, etc.)
- Source finder (preferably automated)



Input counts map
1 week simulation time



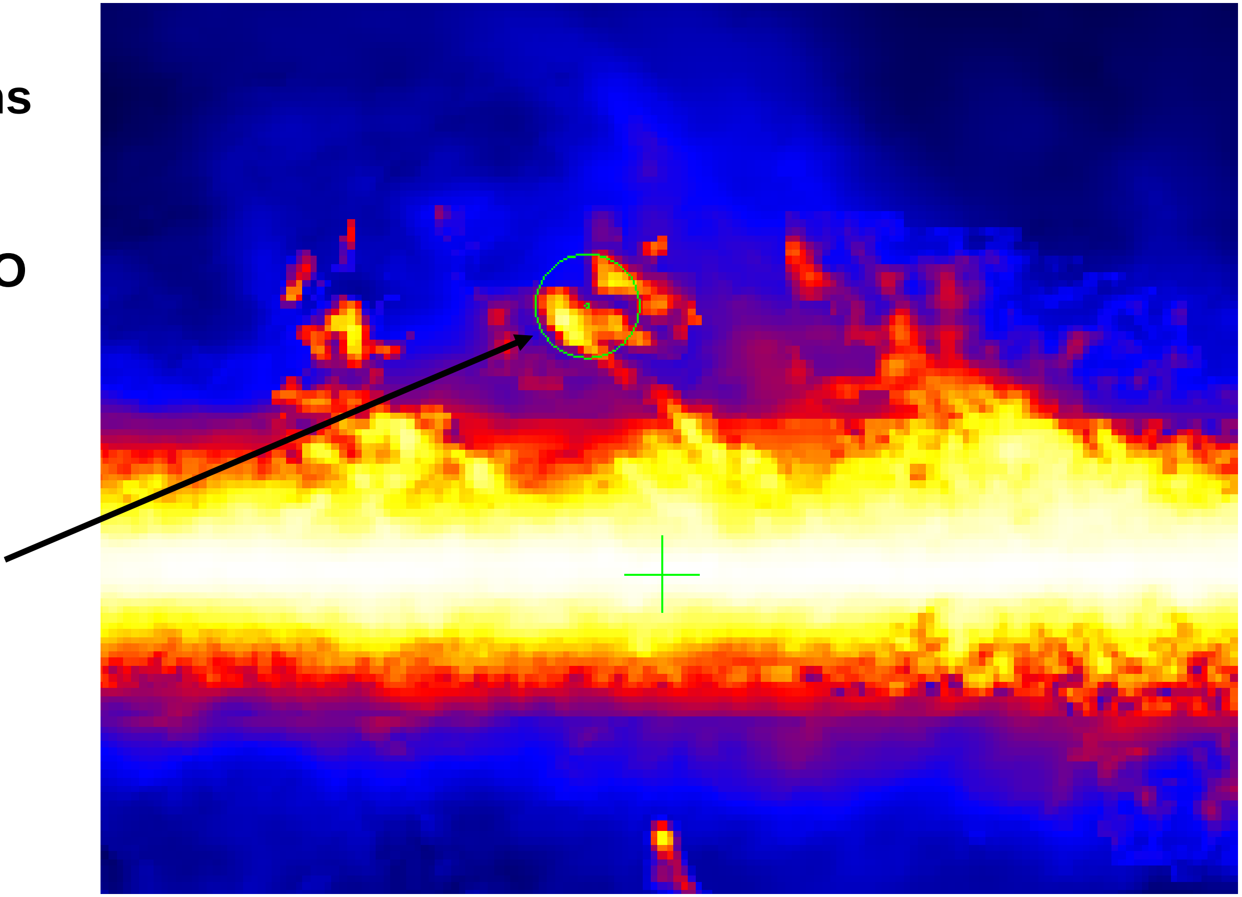
Deconvolved map using
EM algorithm ⇒ MLE

Galactic Diffuse and Source Confusion

Emission results from cosmic ray interactions with interstellar gas.

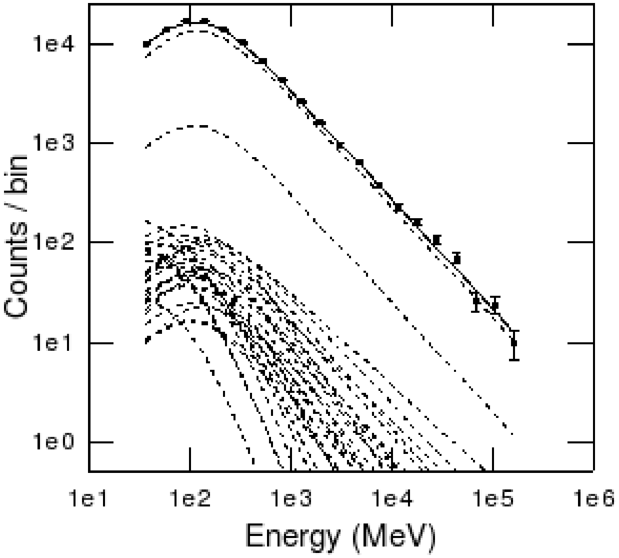
Models rely on HI & CO observations for the gas distribution.

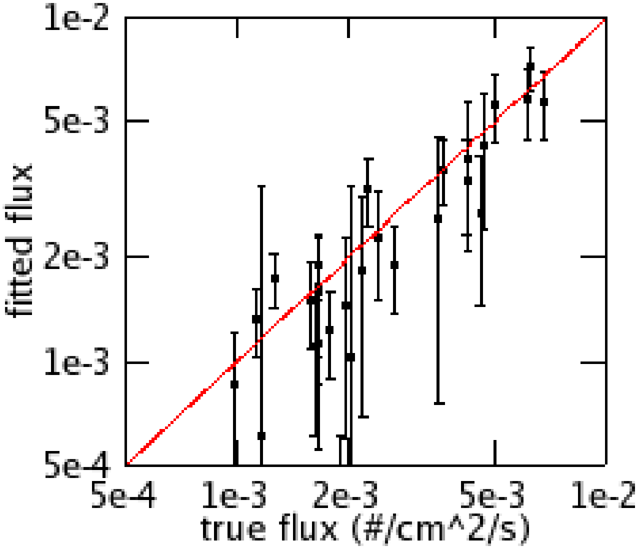
These observations reveal structures on angular scales similar to the PSF:
~3.5^o @ 100 MeV
~0.1^o @ 10 GeV

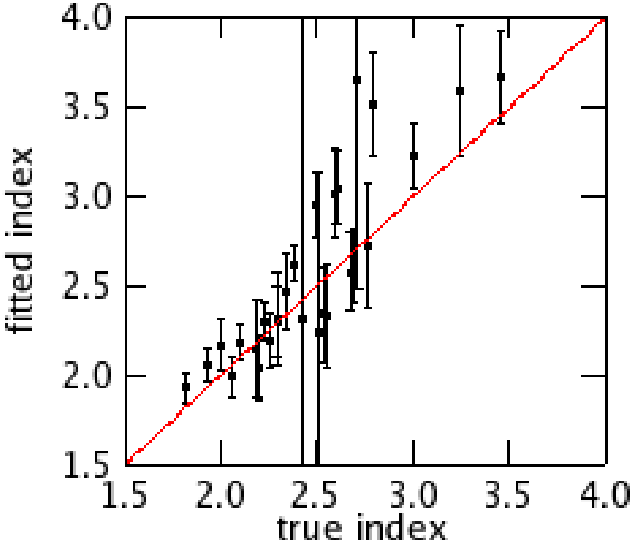


Source Characterization

- Maximum likelihood for ascertaining source parameters
  - flux, spectral index, source position
  - > 50 parameter fits for a single ROI are common



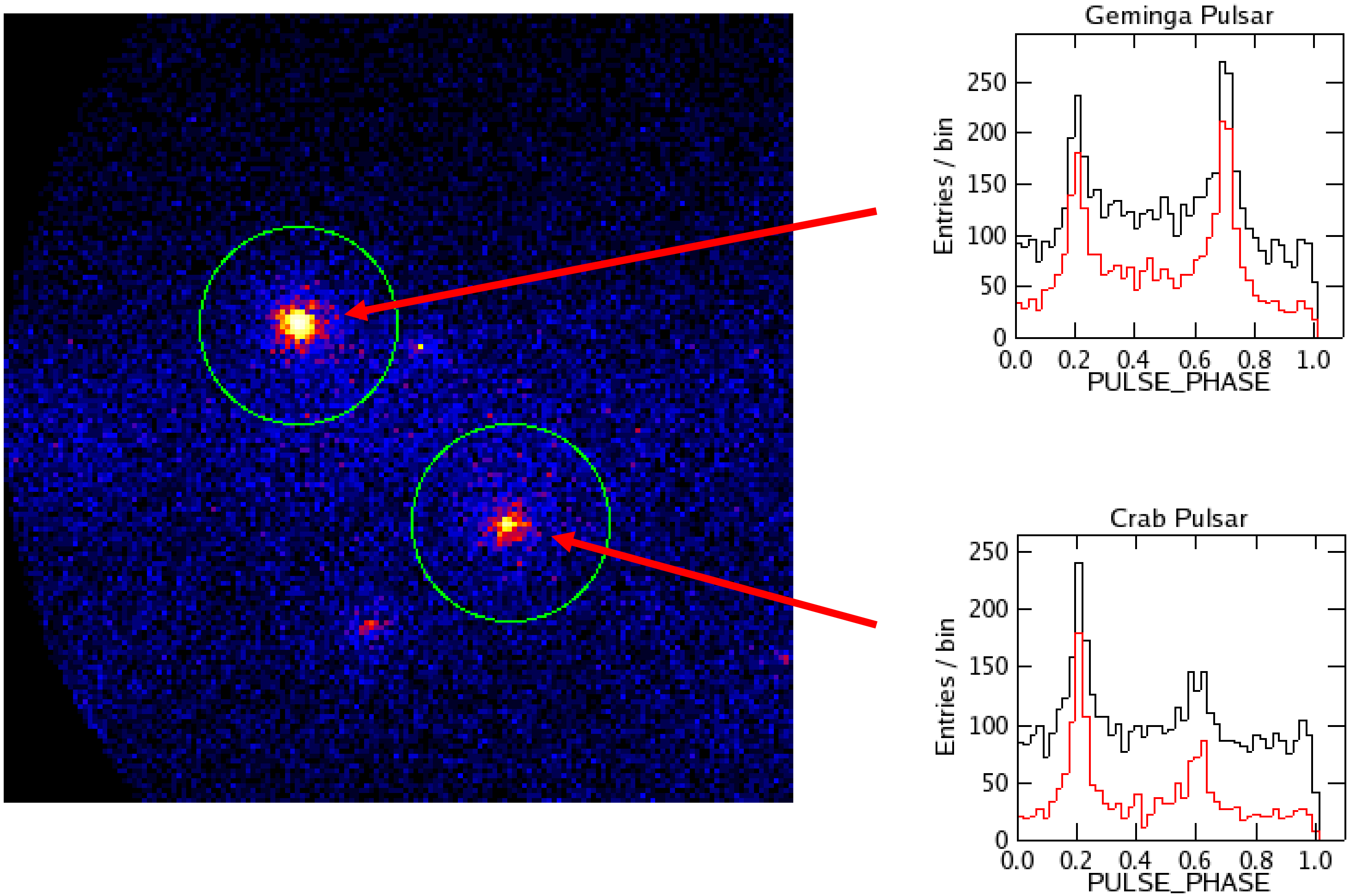




Types of Gamma-Ray Sources

- Pulsars
  - Rapidly rotating neutron stars (P~10^{-3}-10s, $(dP/dt)_{Crab}$ ~10^{-13} s/s) with B~10^{9}-10^{12} G
  - Ephemerides from radio observations
- Blazars
  - Variability over a wide range of time scales (hours to months)
  - Multi-wavelength monitoring is crucial
- Gamma-ray Bursts
  - Very short time scales, < 10s of seconds
- Diffuse/extended emission
  - Milkyway galaxy, LMC, supernova remnants
  - Extragalactic diffuse may comprise unresolved discrete sources such as blazars
- New physics:
  - Dark Matter sources

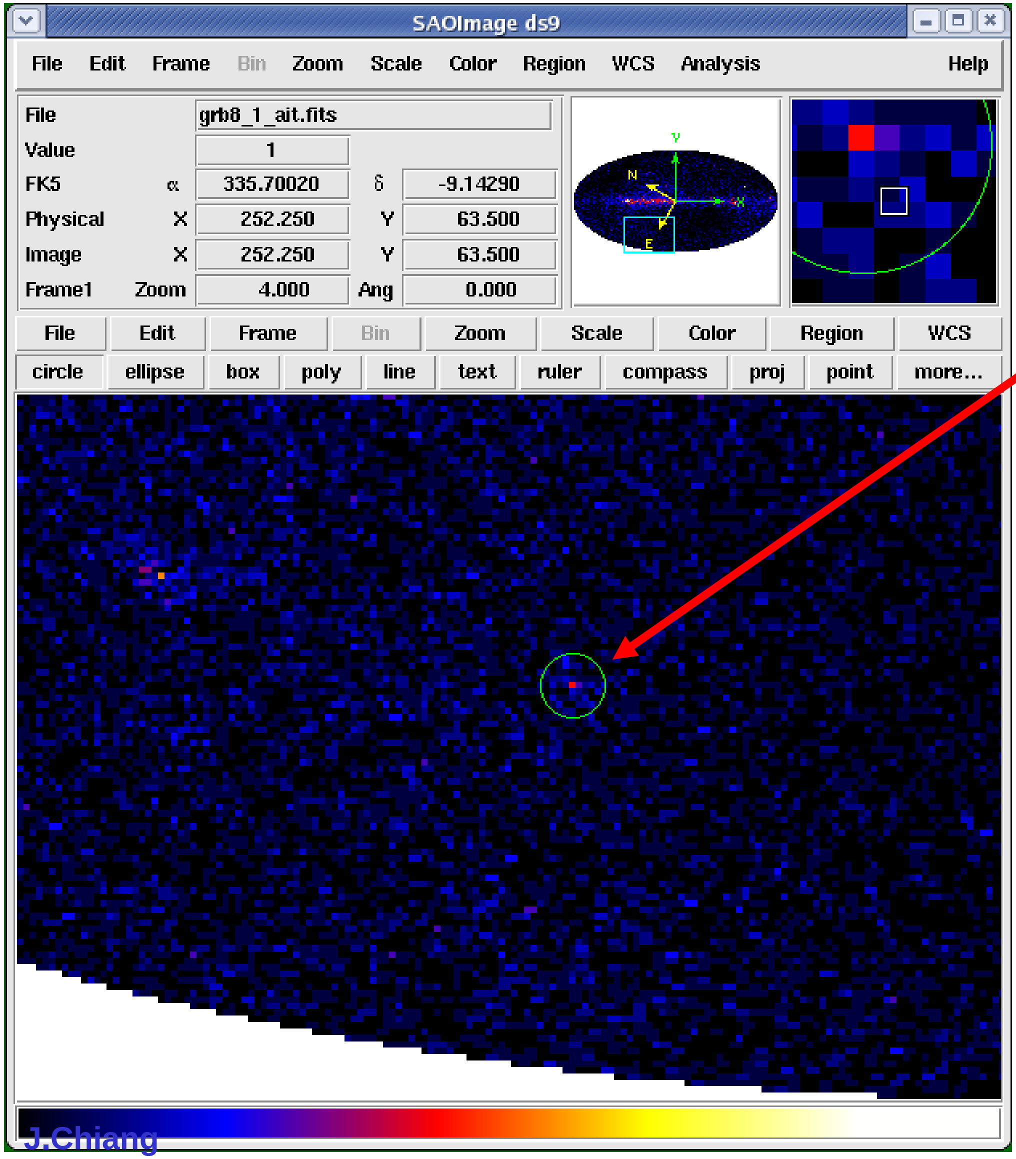
Pulsars



P=237ms

P=33ms

Gamma-Ray Bursts



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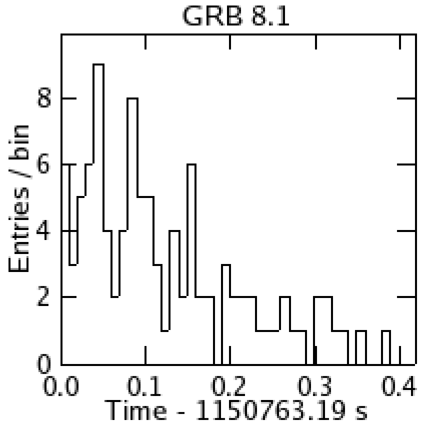
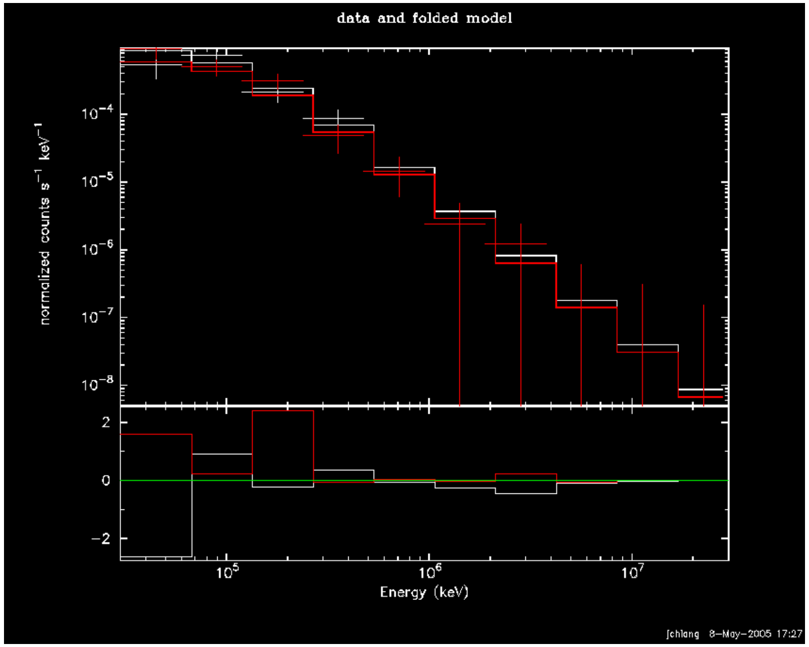
Physical X 252.250 Y 63.500
Image X 252.250 Y 63.500
Frame1 Zoom 4.000 Ang 0.000





J.Chiang

For more on ScienceTools…

http://www-glast.slac.stanford.edu/ScienceTools/

http://www.slac.stanford.edu/exp/glast/ground/software/status/documentation/ScienceTools/latest/Likelihood/latest/tutorial.html

http://glast.gsfc.nasa.gov/cgi-bin/ssc/LAT/STCDataQuery.cgi

GLAST Large Area Telescope:

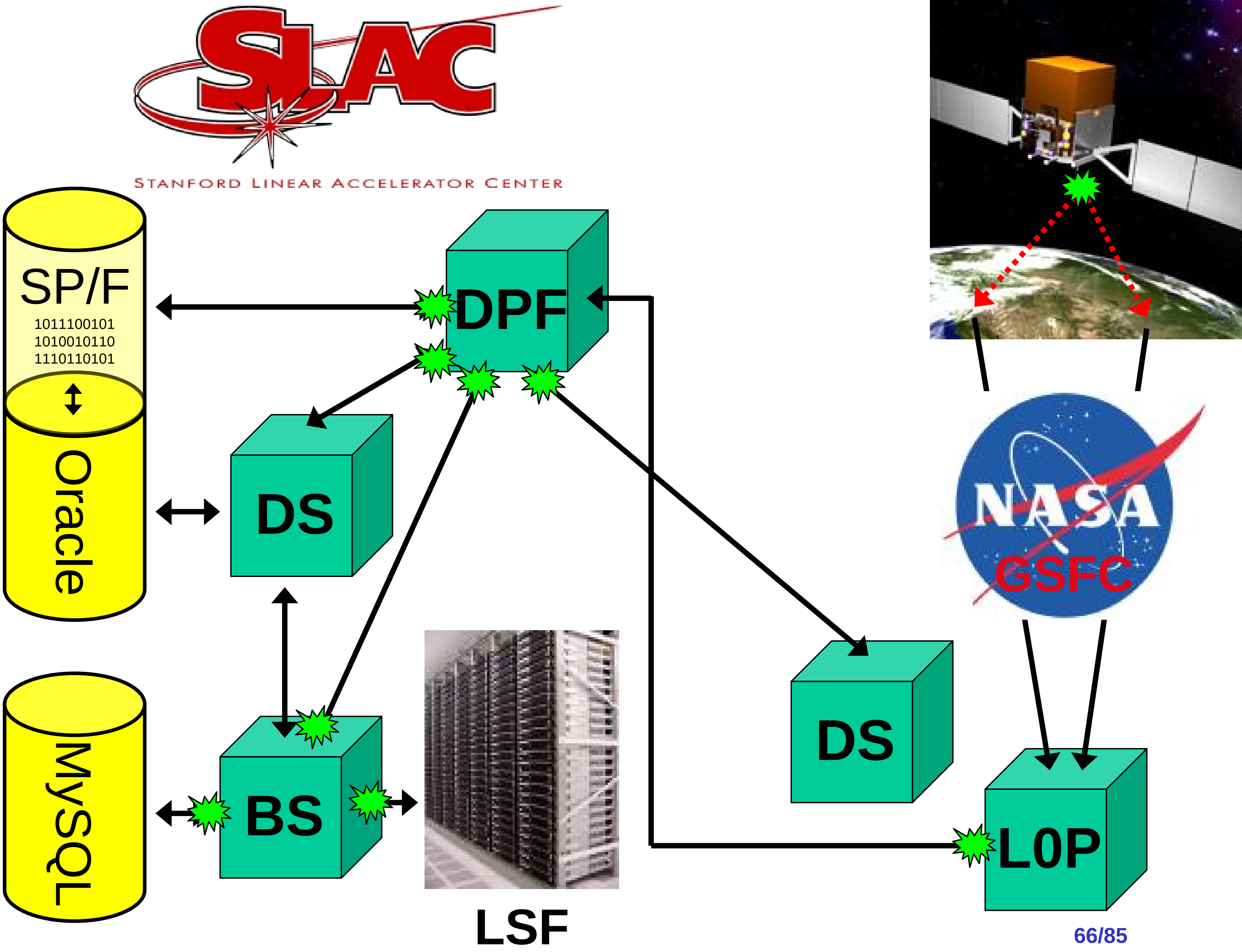
Exploring the γ-ray Sky

Daniel Flath
Stanford Linear Accelerator Center
dflath@slac.stanford.edu

http://www-glast.slac.stanford.edu/software

Data Handling: Outline

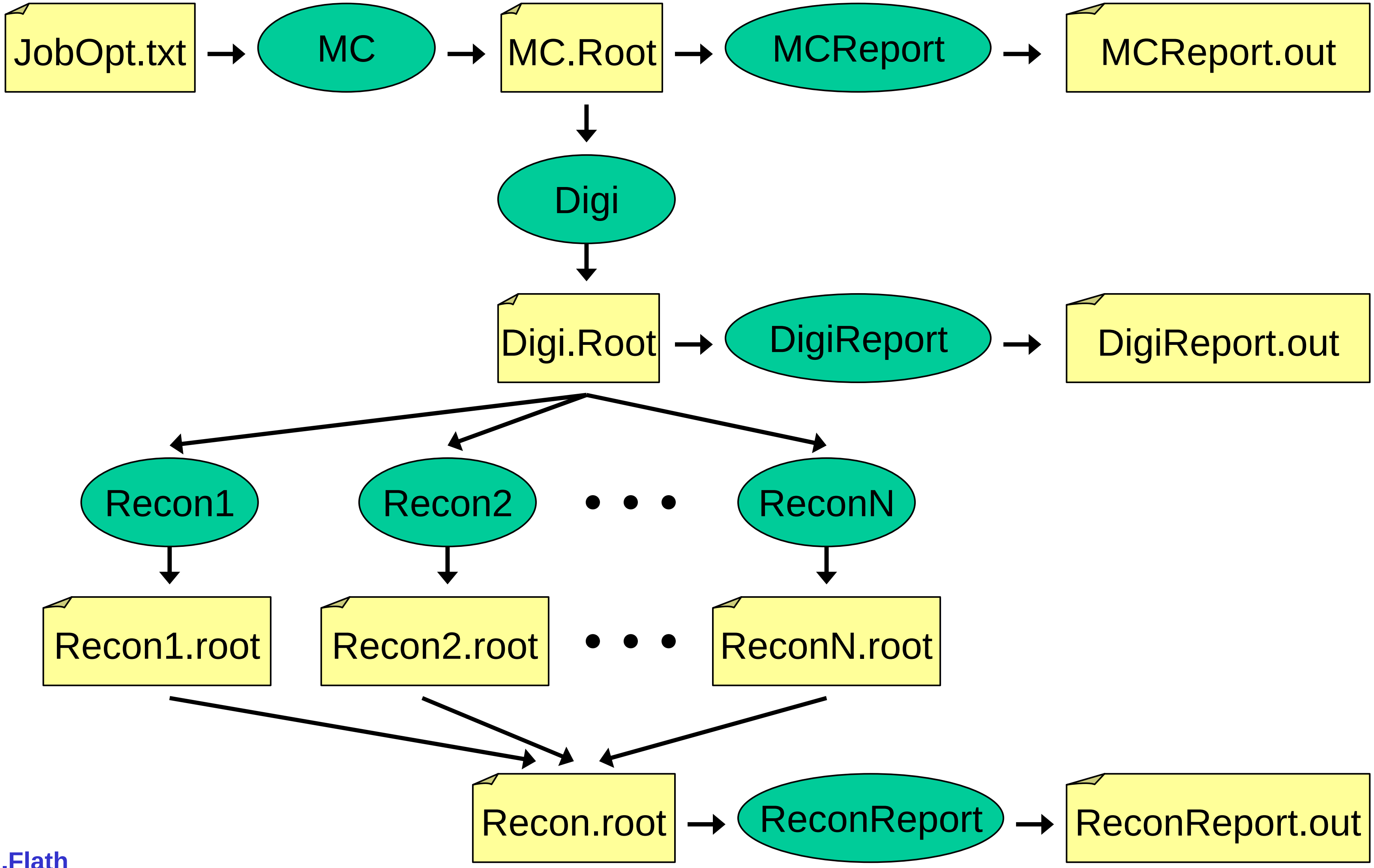
- Automation: Pipeline
  - Guaranteed 1 hour turnaround
  - 24x7x365x10
  - Parallel processing of data – Workflow
  - Web based monitoring
- System Tests
  - Monitoring data and software
  - Web based
- Data Server
  - Public data server, for public
  - Glast data server, for collaboration
    - Why? (pull region of sky from many orbits)
    - Users don’t (want to know) much about recon/simulation
- Technologies (to be) used
  - 3rd Generation Web Application Containers
    - Web applications that work like desktop applications
  - Mix of commercial products and Open Source projects
    - JIRA
      - Bug tracker
      - Project management tool
    - Confluence
      - Documentation repository
      - “Super WIKI”
  - Commercial tools
    - Themselves based on Open Source projects
    - Examples of 3rd Generation web applications


SLAC
STANFORD LINEAR ACCELERATOR CENTER
SP/F
1011100101
1010010110
1110110101
Oracle
MySQL
DPF
DS
BS
LSF
DS
NASA
GSFC
L0P

Pipeline Intro

- What is the pipeline?
  - Envisaged as tool to provide a tree of processing on a given input dataset
  - Full bookkeeping to track what happened
  - Archive all files touched
- Used by whom?
  - Online
    - for sweeping integration data out of the clean room and to tape
    - populate eLogbook
  - SVAC (Science Verification and Calibrations)
    - for doing digi, recon
    - creating reports
    - Preparing for calibrations
  - Generic MC
    - DC2, background runs etc etc
  - ISOC (Instrument Science Operations Center)
    - Flight operations
    - What about environmental testing, at Spectrum Astro, KSC?

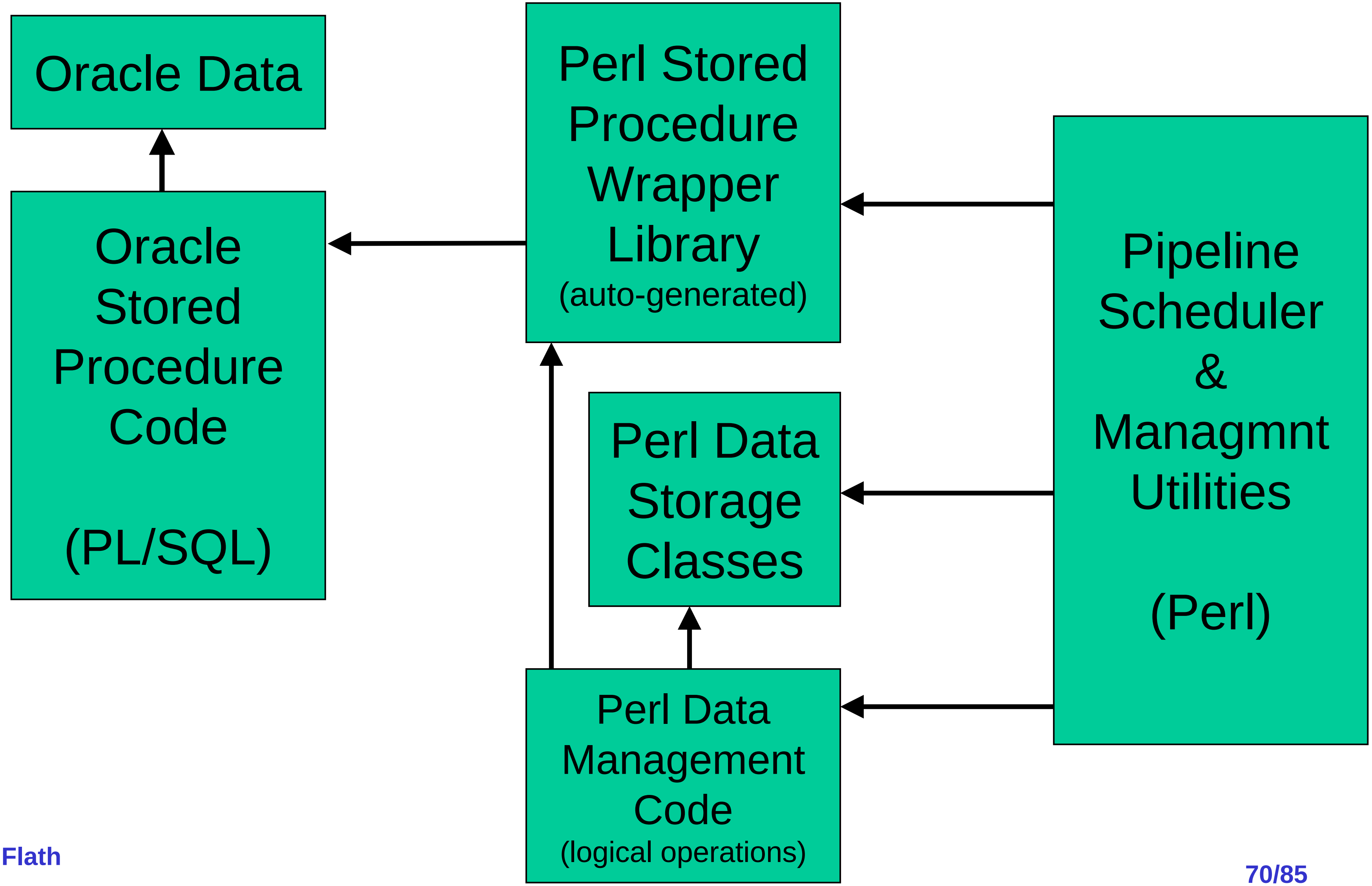
Sample Processing Chain



Current Pipeline: Major Components & Tech Used

- RDBMS (relational database management system)
  - Oracle
  - Contains all processing and data product history and relationships
- Data Exchange Layer
  - Oracle PL/SQL
  - Compiled SQL queries provide read/write access to tables
- DB Access Layer
  - Perl::DBI
  - Auto-Generated subroutines wrapping every public stored function and procedure
  - Provides simple, seamless DB interface to Perl Utilities
  - Also Perl classes representing each record type
- Scheduler, utilities
  - Perl
  - Higher level code to manage data and processing
  - Little dependency on actual table structure gives developer freedom to write maintainable, extensible code

Pipeline Component Dependencies



Oracle Data

Oracle Stored Procedure Code

(PL/SQL)

Perl Stored Procedure Wrapper Library

(auto-generated)

Perl Data Storage Classes

Perl Data Management Code

(logical operations)

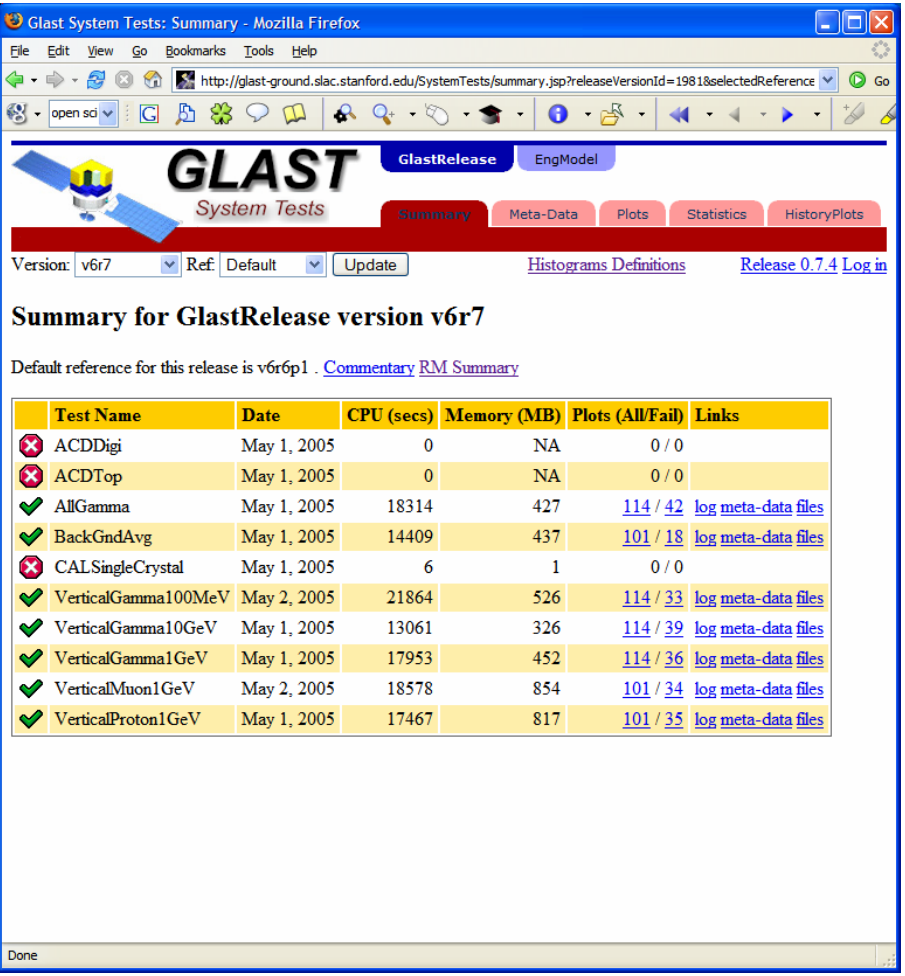
Pipeline Scheduler & Managmnt Utilities

(Perl)

System Tests

- Goals
  - Provides mechanism for validating:
    - Software releases (now)
    - Data quality (after launch)
  - Run (automatically) after each software release
    - Compares plots to references and flags problems
- Web based access to system tests results from any platform
  - No software install needed
  - Accesses data from combination of
    - Oracle database tables
    - Root files
  - Implemented using JAIDA, xrootd, JSP, Tomcat

System Tests



Glast System Tests: Summary - Mozilla Firefox

File Edit View Go Bookmarks Tools Help
http://glast-ground.slac.stanford.edu/SystemTests/summary.jsp?releaseVersionId=1981&selectedReference
Go
open sci
GLAST
System Tests
GlastRelease
EngModel
Summary
Meta-Data
Plots
Statistics
HistoryPlots

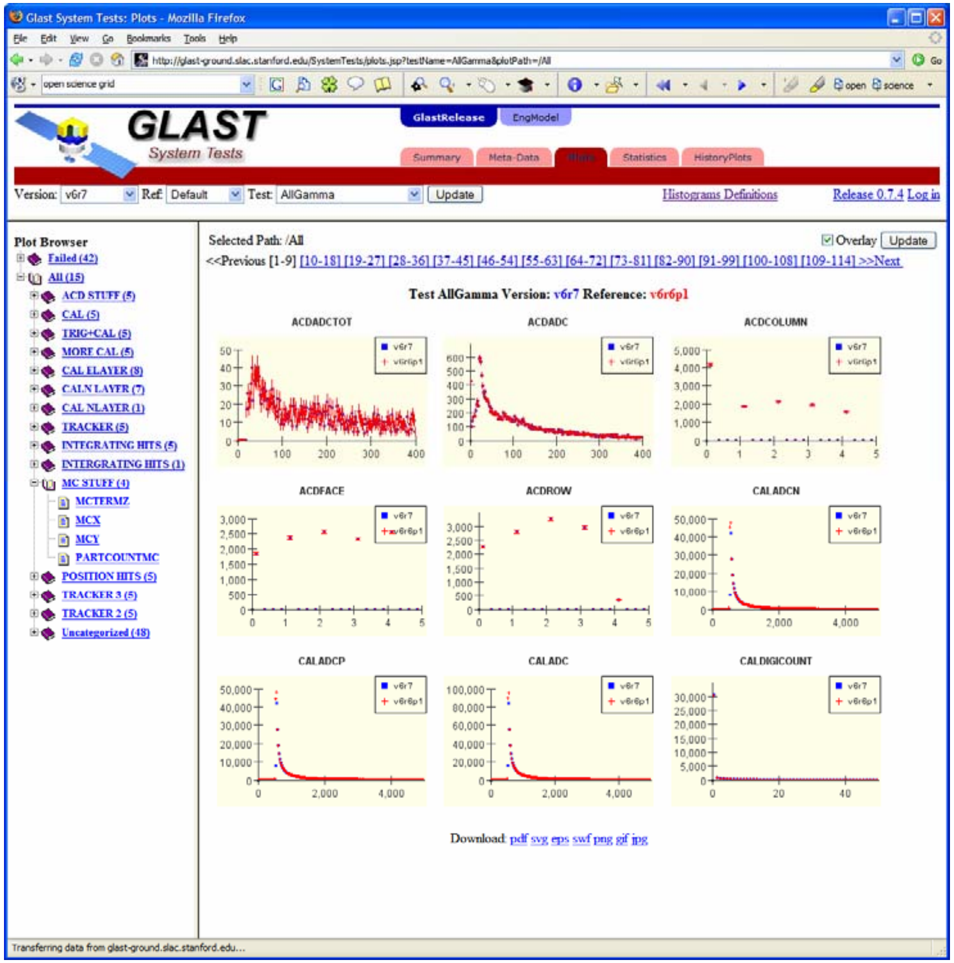
Version: v6r7 Ref: Default Update Histograms Definitions Release 0.7.4 Log in

Summary for GlastRelease version v6r7

Default reference for this release is v6r6p1 . Commentary RM Summary

	Test Name	Date	CPU (secs)	Memory (MB)	Plots (All/Fail)	Links
☒	ACDDigi	May 1, 2005	0	NA	0 / 0	
☒	ACDTop	May 1, 2005	0	NA	0 / 0	
✓	AllGamma	May 1, 2005	18314	427	114 / 42	log meta-data files
✓	BackGndAvg	May 1, 2005	14409	437	101 / 18	log meta-data files
☒	CALSingleCrystal	May 1, 2005	6	1	0 / 0	
✓	VerticalGamma100MeV	May 2, 2005	21864	526	114 / 33	log meta-data files
✓	VerticalGamma10GeV	May 1, 2005	13061	326	114 / 39	log meta-data files
✓	VerticalGamma1GeV	May 1, 2005	17953	452	114 / 36	log meta-data files
✓	VerticalMuon1GeV	May 2, 2005	18578	854	101 / 34	log meta-data files
✓	VerticalProton1GeV	May 1, 2005	17467	817	101 / 35	log meta-data files

Done



Glast System Tests: Plots - Mozilla Firefox

File Edit View Go Bookmarks Tools Help
http://glast-ground.slac.stanford.edu/SystemTests/plots.jsp?testName=AllGamma&plotPath=/All
Go
open science grid
open science
GLAST
System Tests
GlastRelease
EngModel
Summary
Meta-Data
Plots
Statistics
HistoryPlots

Version: v6r7 Ref: Default Test: AllGamma Update Histograms Definitions Release 0.7.4 Log in

Plot Browser

- Failed (42)
- All (15)
  - ACD STUFF (5)
  - CAL (5)
  - TRIG+CAL (5)
  - MORE CAL (5)
  - CAL ELAYER (8)
  - CALN LAYER (7)
  - CAL NLAYER (1)
  - TRACKER (5)
  - INTEGRATING HITS (5)
  - INTERGRATING HITS (1)
  - MC STUFF (4)
    - MCTERMZ
    - MCX
    - MCY
    - PARTCOUNTMC
  - POSITION HITS (5)
  - TRACKER 3 (5)
  - TRACKER 2 (5)
  - Uncategorized (48)

Selected Path: /All ☑ Overlay Update

<<Previous [1-9] [10-18] [19-27] [28-36] [37-45] [46-54] [55-63] [64-72] [73-81] [82-90] [91-99] [100-108] [109-114] >>Next

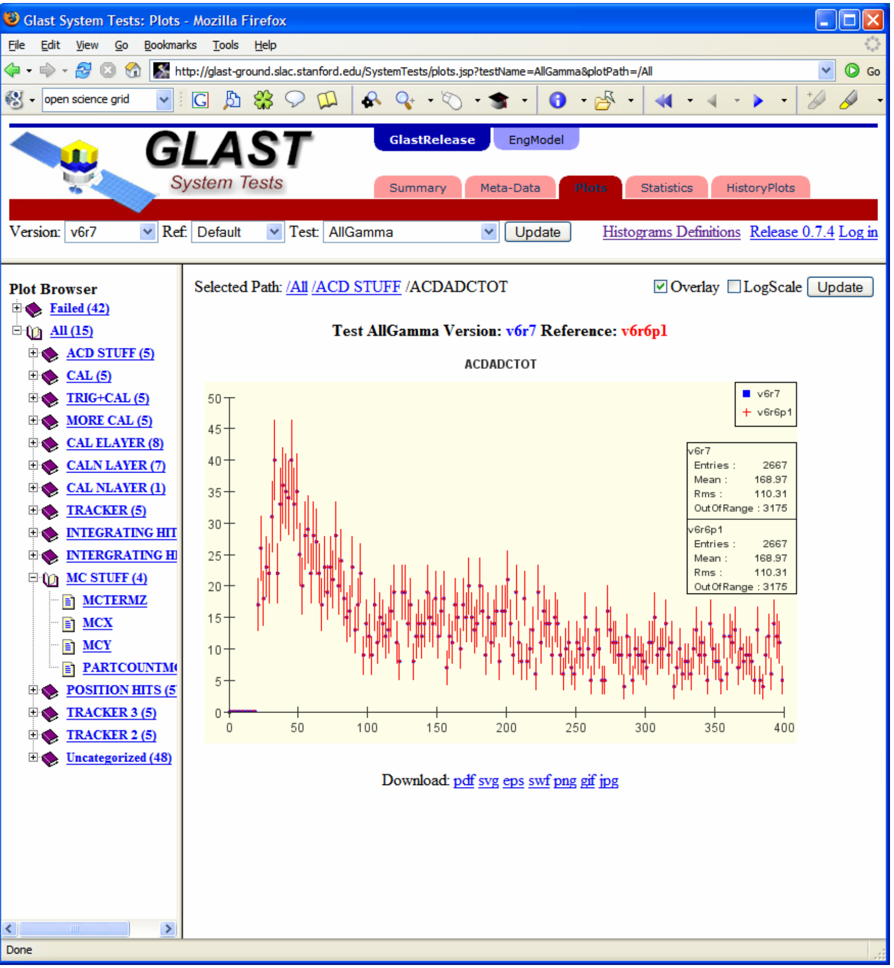
Test AllGamma Version: v6r7 Reference: v6r6p1

Download: pdf svg eps swf png gif jpg

Transferring data from glast-ground.slac.stanford.edu...

D.Flath

System Tests



Glast System Tests: Plots - Mozilla Firefox

http://glast-ground.slac.stanford.edu/SystemTests/plots.jsp?testName=AllGamma&plotPath=/All

Version: v6r7 Ref: Default Test: AllGamma Update

Histograms Definitions Release 0.7.4 Log in

Plot Browser

- Failed (42)
- All (15)
  - ACD STUFF (5)
  - CAL (5)
  - TRIG+CAL (5)
  - MORE CAL (5)
  - CAL ELAYER (8)
  - CALN LAYER (7)
  - CAL NLAYER (1)
  - TRACKER (5)
  - INTEGRATING HIT
  - INTERGRATING HI
  - MC STUFF (4)
    - MCTERMZ
    - MCX
    - MCY
    - PARTCOUNTM
  - POSITION HITS (5
  - TRACKER 3 (5)
  - TRACKER 2 (5)
  - Uncategorized (48)

Selected Path: /All /ACD STUFF /ACDADCTOT ☑ Overlay □ LogScale Update

Test AllGamma Version: v6r7 Reference: v6r6p1

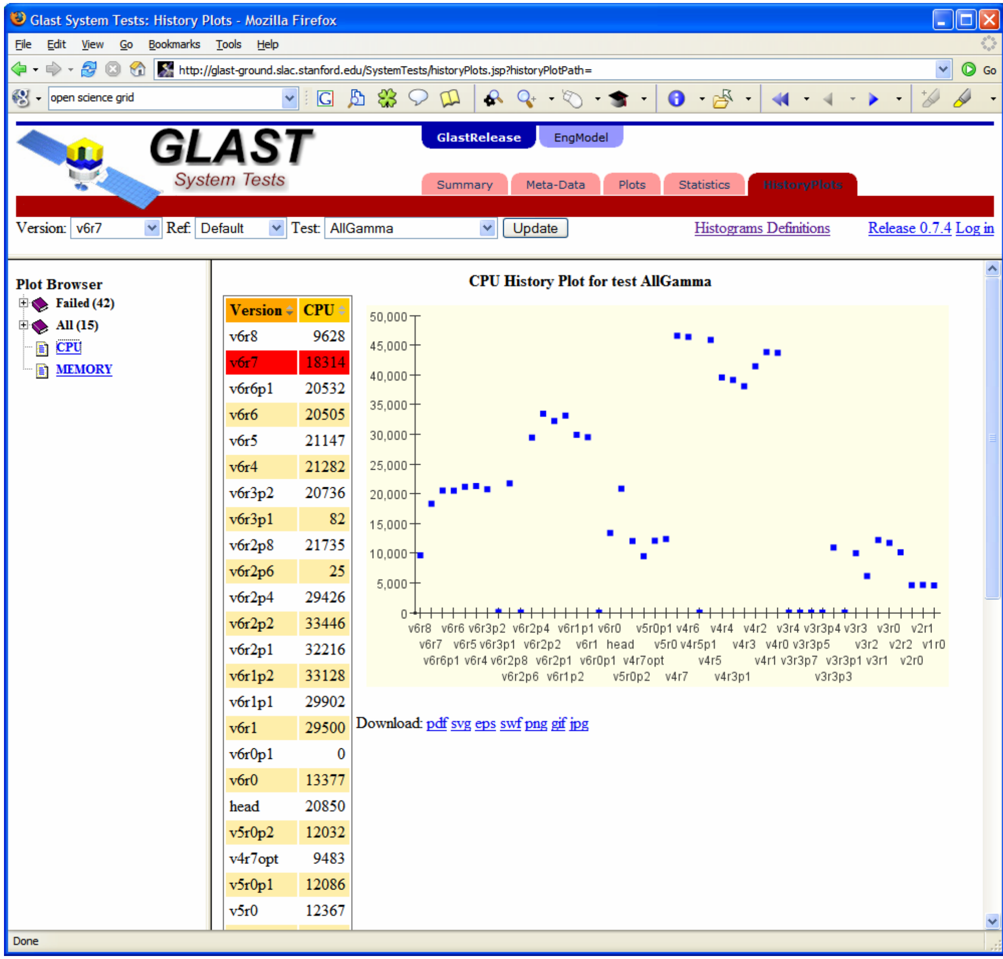
ACDADCTOT

v6r7
Entries : 2667
Mean : 168.97
Rms : 110.31
OutOfRange : 3175

v6r6p1
Entries : 2667
Mean : 168.97
Rms : 110.31
OutOfRange : 3175

Download: pdf svg eps swf png gif jpg

Done



Glast System Tests: History Plots - Mozilla Firefox

http://glast-ground.slac.stanford.edu/SystemTests/historyPlots.jsp?historyPlotPath=

Version: v6r7 Ref: Default Test: AllGamma Update

Histograms Definitions Release 0.7.4 Log in

Plot Browser

- Failed (42)
- All (15)
- CPU
- MEMORY

CPU History Plot for test AllGamma

Version	CPU
v6r8	9628
v6r7	18314
v6r6p1	20532
v6r6	20505
v6r5	21147
v6r4	21282
v6r3p2	20736
v6r3p1	82
v6r2p8	21735
v6r2p6	25
v6r2p4	29426
v6r2p2	33446
v6r2p1	32216
v6r1p2	33128
v6r1p1	29902
v6r1	29500
v6r0p1	0
v6r0	13377
head	20850
v5r0p2	12032
v4r7opt	9483
v5r0p1	12086
v5r0	12367

50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
v6r8 v6r6 v6r3p2 v6r2p4 v6r1p1 v6r0 v5r0p1 v4r6 v4r4 v4r2 v3r4 v3r3p4 v3r3 v3r0 v2r1
v6r7 v6r5 v6r3p1 v6r2p2 v6r1 head v5r0 v4r5p1 v4r3 v4r0 v3r3p5 v3r2 v2r2 v1r0
v6r6p1 v6r4 v6r2p8 v6r2p1 v6r0p1 v4r7opt v4r5 v4r1 v3r3p7 v3r3p1 v3r1 v2r0
v6r2p6 v6r1p2 v5r0p2 v4r7 v4r3p1 v3r3p3

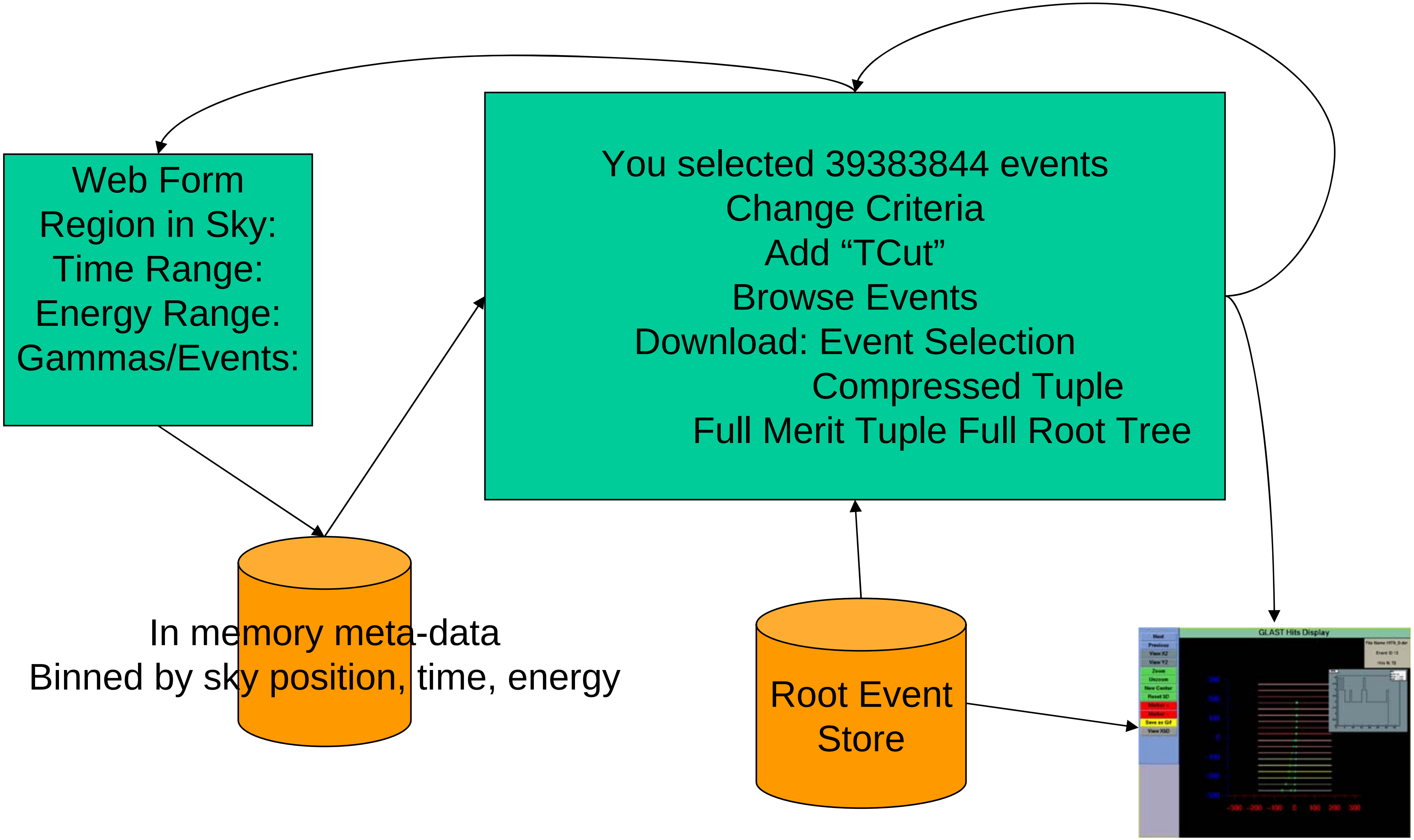
Download: pdf svg eps swf png gif jpg

Done

Data Server

- Glast will run two data servers
  - One for the public at Goddard Space Flight Center
  - One at SLAC for Glast collaborators
- Glast Physicists will access data via Data Server
  - Pulls events associated with
    - Particular region of the sky
      - Satellite doesn’t stay still so this is spread throughout data.
    - Energy range
    - Time Period
  - Removes need for users to know how/where data is stored
    - For most astrophysics measurements physicists only need to know about photon direction and efficiency, details of reconstruction/simulation are largely irrelevant
  - Should be able to download data in various formats
    - List of run/events
    - Tuples (FITS, root, possibly with choice of number of columns)
    - Full root trees
  - Should be able to browse events
    - with web based event display (WIRED)
  - Should be able to store personal favorite searches
    - Should be able to download incremental updates to data
- Expect to get 100M events/year for 10 years
  - Small compared to Babar, but we want fast turnaround

Data Server



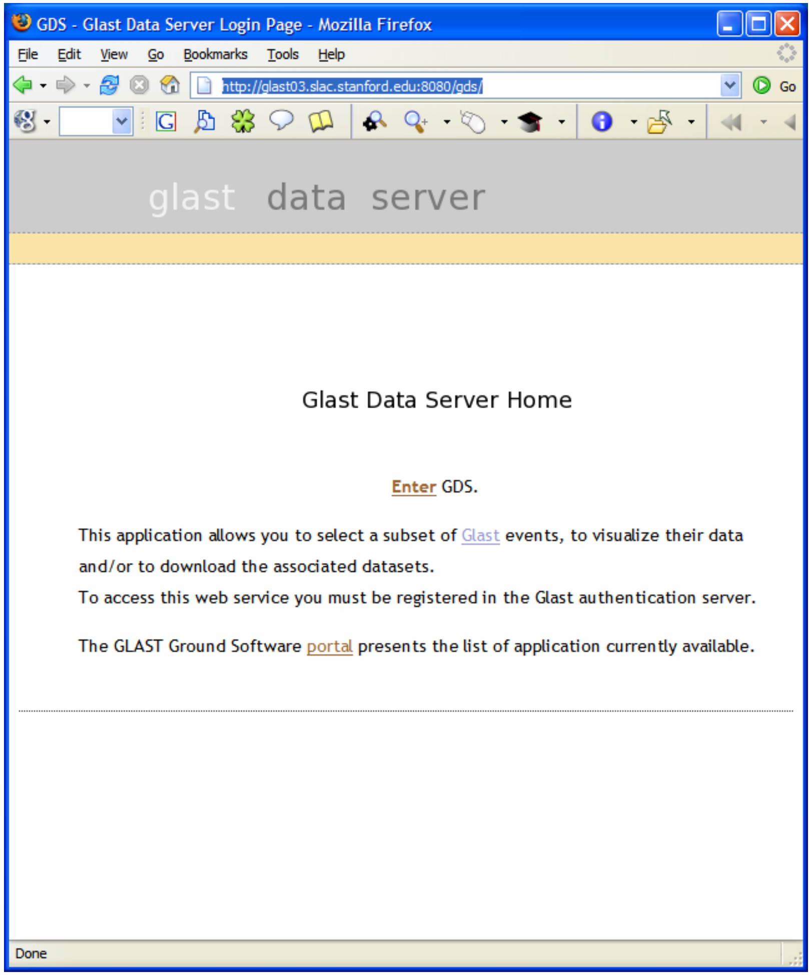
Web Form
Region in Sky:
Time Range:
Energy Range:
Gammas/Events:

You selected 39383844 events
Change Criteria
Add “TCut”
Browse Events
Download: Event Selection
Compressed Tuple
Full Merit Tuple Full Root Tree

In memory meta-data
Binned by sky position, time, energy

Root Event
Store

Data Server


GDS - Glast Data Server Login Page - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
Go
Done

http://glast03.slac.stanford.edu:8080/gds/

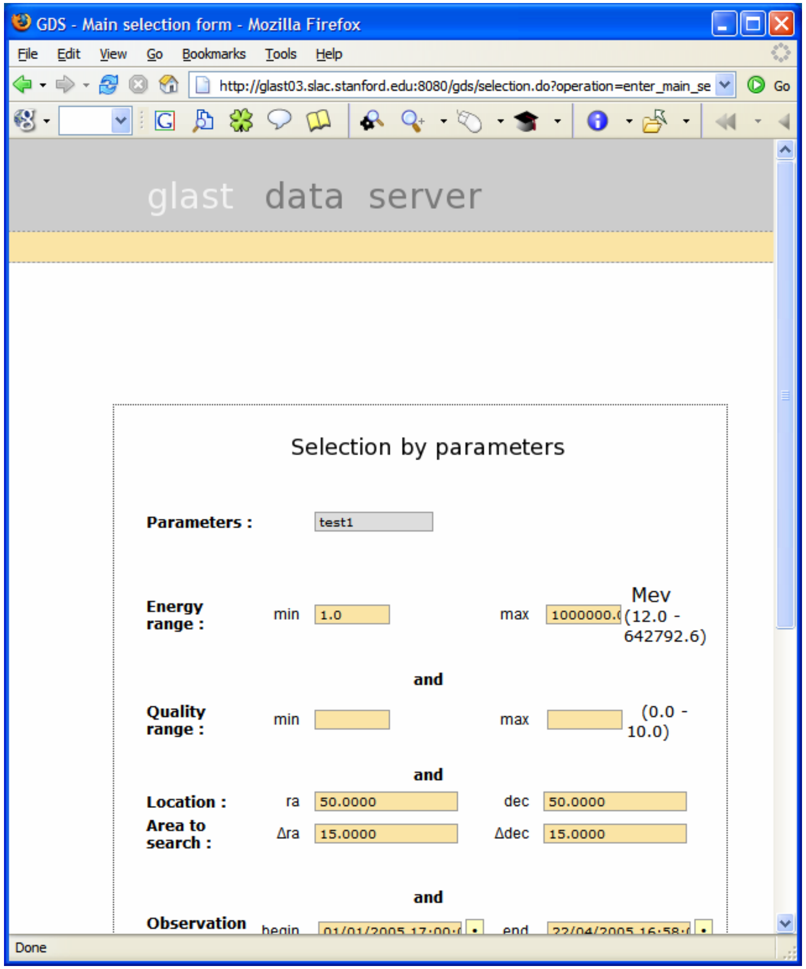
glast data server

Glast Data Server Home

Enter GDS.

This application allows you to select a subset of Glast events, to visualize their data and/or to download the associated datasets.
To access this web service you must be registered in the Glast authentication server.

The GLAST Ground Software portal presents the list of application currently available.


GDS - Main selection form - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
Go
Done

http://glast03.slac.stanford.edu:8080/gds/selection.do?operation=enter_main_se

glast data server

Selection by parameters

Parameters : test1

Energy range : min 1.0 max 1000000.(Mev (12.0 - 642792.6)

and

Quality range : min max (0.0 - 10.0)

and

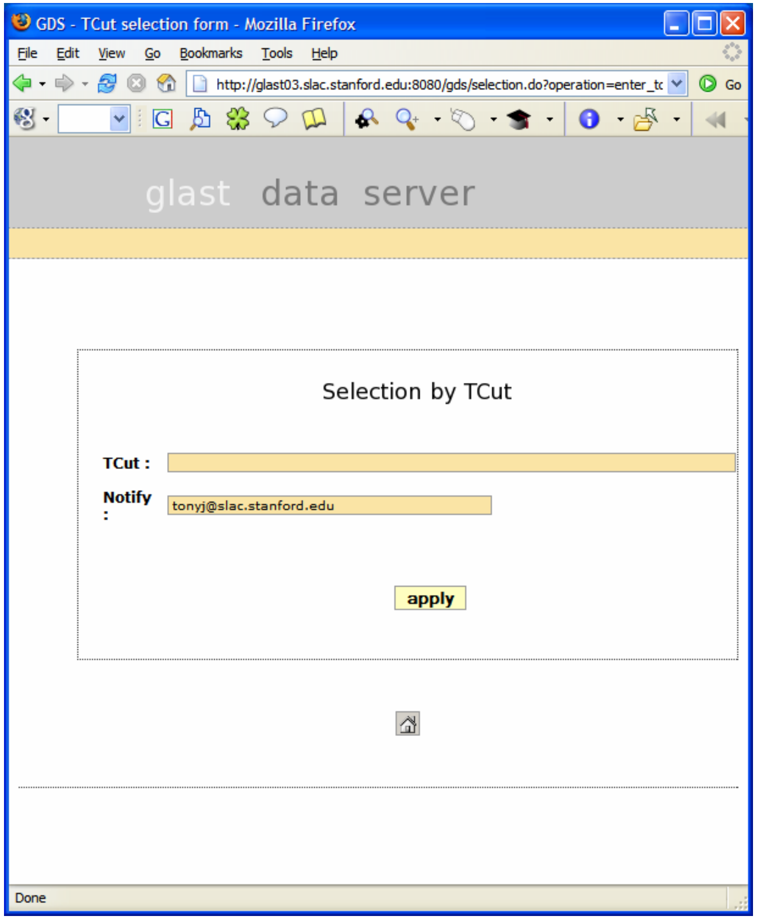
Location : ra 50.0000 dec 50.0000

Area to search : Δra 15.0000 Δdec 15.0000

and

Observation begin 01/01/2005 17:00:(end 22/04/2005 16:58:(

Data Server


GDS - TCut selection form - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
Go
Done

http://glast03.slac.stanford.edu:8080/gds/selection.do?operation=enter_tc

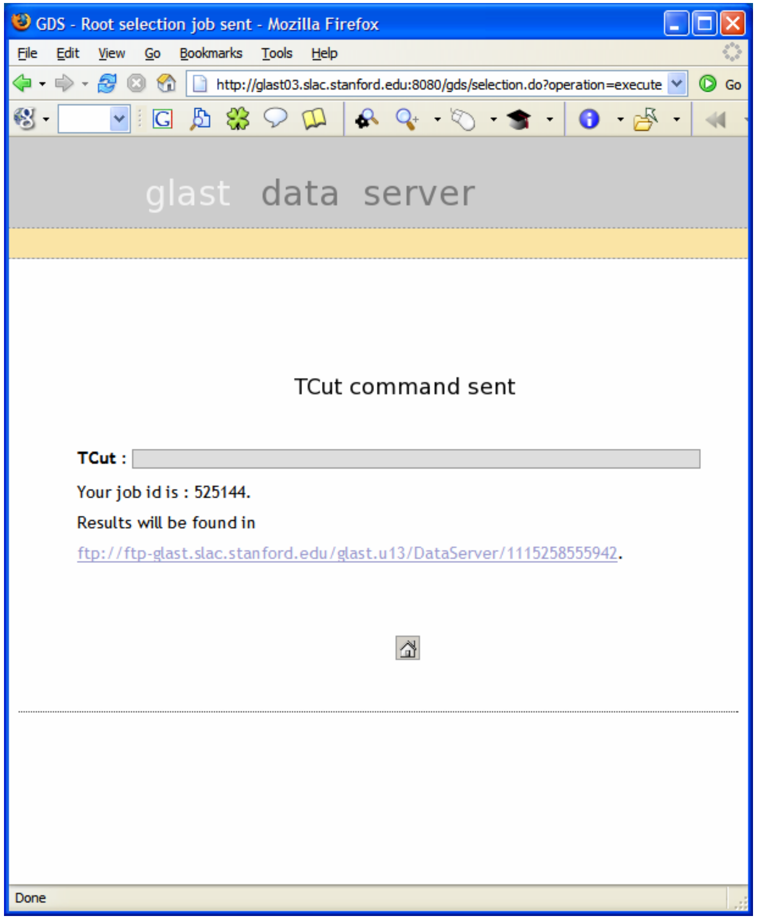
glast data server

Selection by TCut

TCut :

Notify : tonyj@slac.stanford.edu

apply


GDS - Root selection job sent - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
Go
Done

http://glast03.slac.stanford.edu:8080/gds/selection.do?operation=execute

glast data server

TCut command sent

TCut :

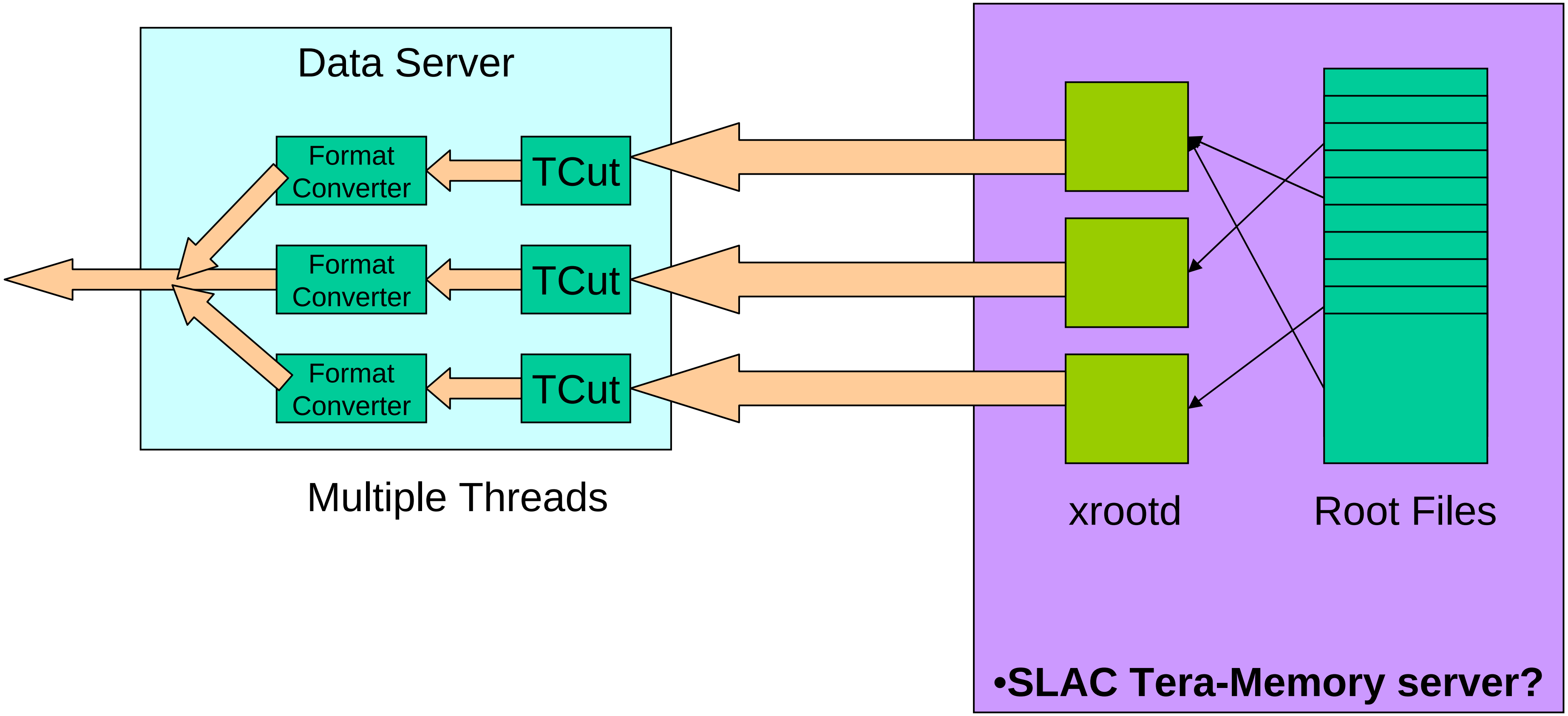
Your job id is : 525144.

Results will be found in

ftp://ftp-glast.slac.stanford.edu/glast.u13/DataServer/1115258555942.

Future Data Server

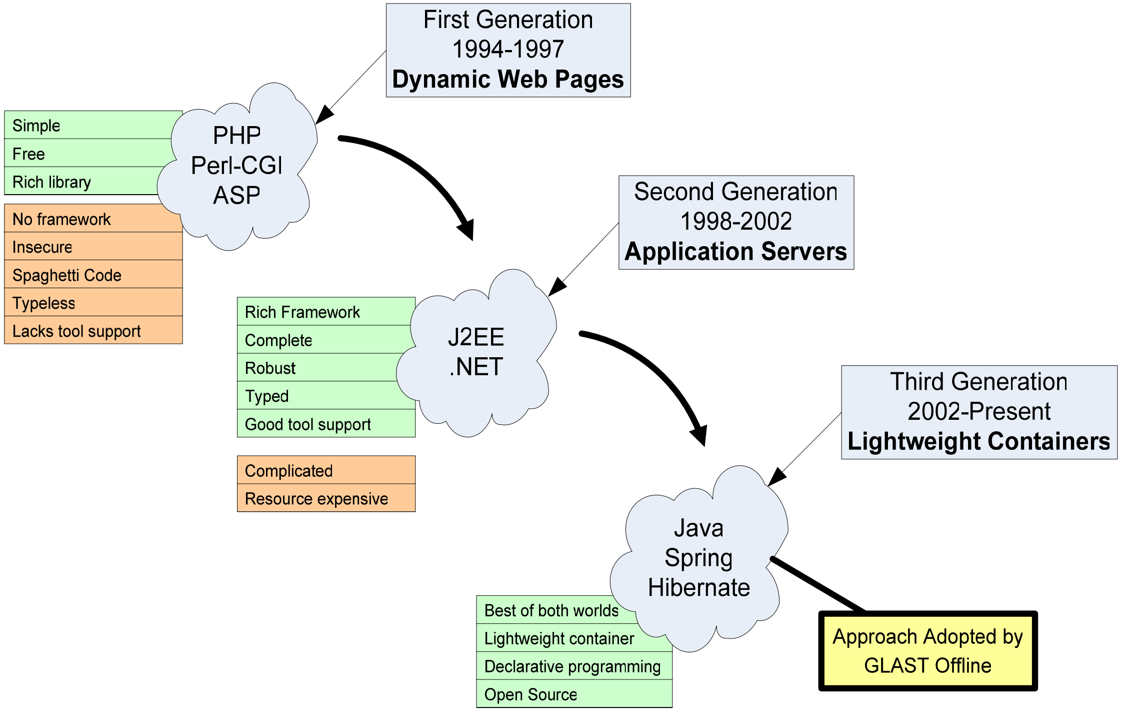
- **Future plans for Data Server:**
  - **Instead of delivering data via FTP, use real-time streaming**



Back to the Future: Adopt 3rd Generation Web Applications

- **Program as little as possible, declare as much as possible**
  - **State your requirements and intentions in configuration files**
  - **Write code only for your specific problem domain, leave the rest to the** container

Brief History of Web Application Platforms



First Generation
1994-1997
Dynamic Web Pages

PHP
Perl-CGI
ASP

- Simple
- Free
- Rich library

- No framework
- Insecure
- Spaghetti Code
- Typeless
- Lacks tool support

Second Generation
1998-2002
Application Servers

J2EE
.NET

- Rich Framework
- Complete
- Robust
- Typed
- Good tool support

- Complicated
- Resource expensive

Third Generation
2002-Present
Lightweight Containers

Java
Spring
Hibernate

- Best of both worlds
- Lightweight container
- Declarative programming
- Open Source

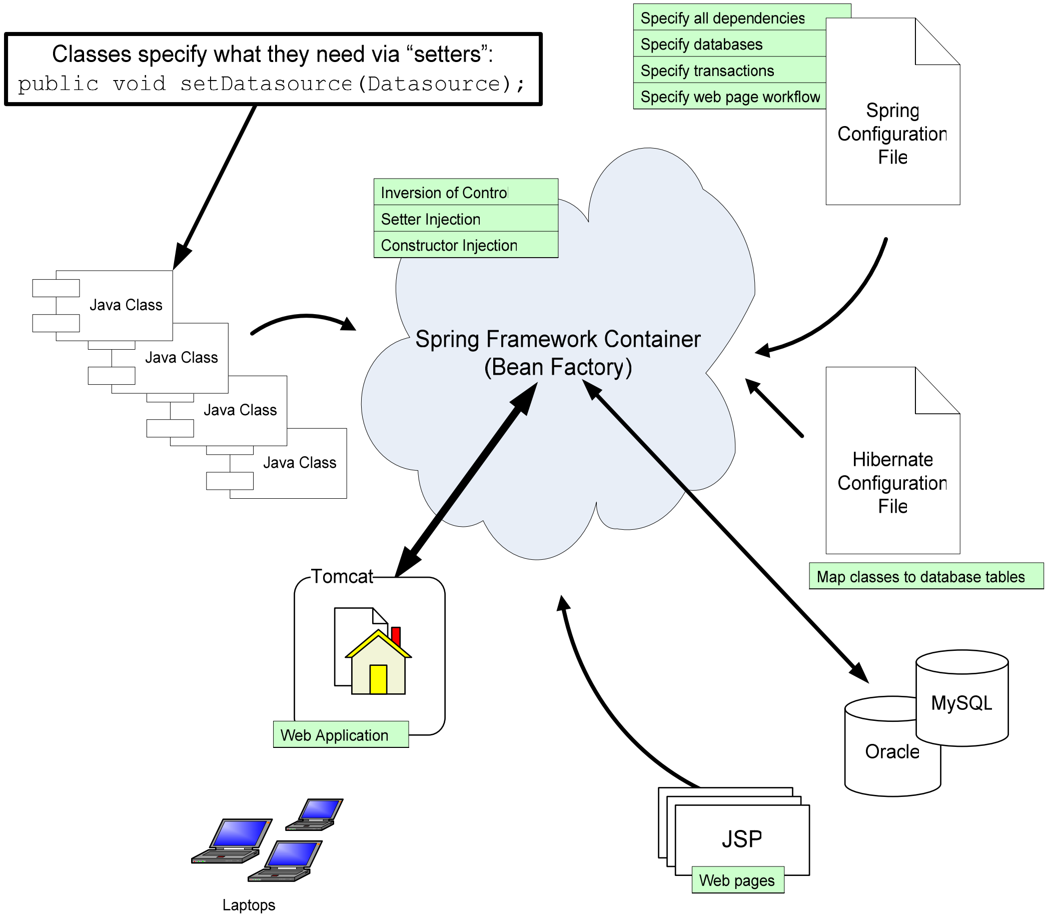
Approach Adopted by
GLAST Offline

References

http://www.springframework.org
http://www-106.ibm.com/developerworks/webservices/library/co-tmline/notes
http://www-106.ibm.com/developerworks/java/library/j-what-are-ejbs/part1/
http://perl.apache.org/about/history.html

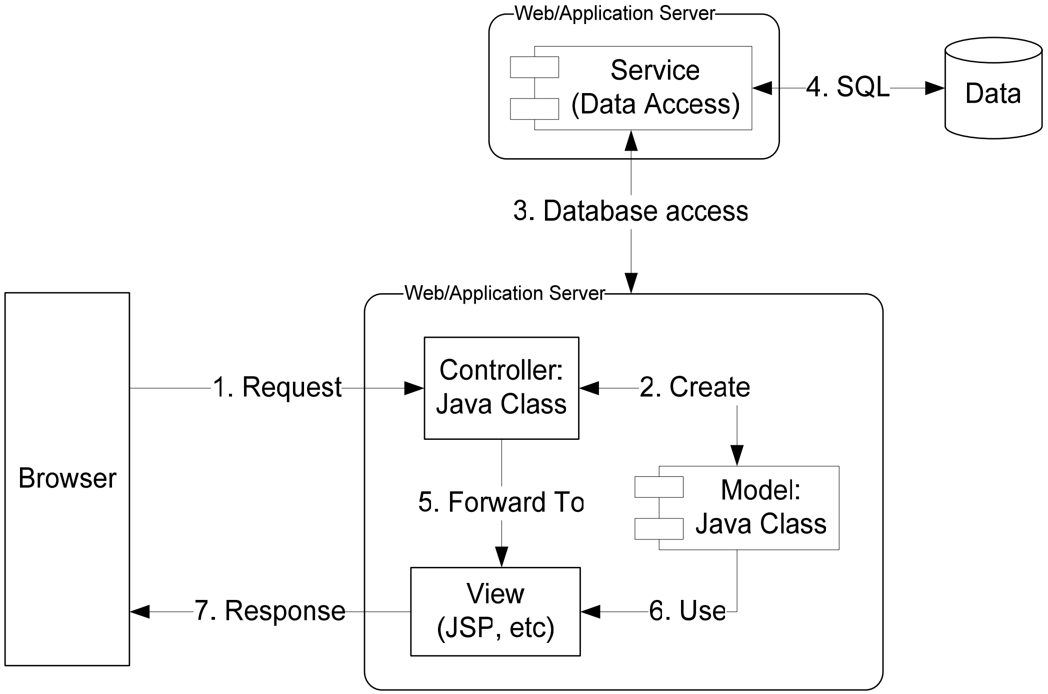
Lightweight Container

Classes specify what they need via "setters":
`public void setDatasource(Datasource);`



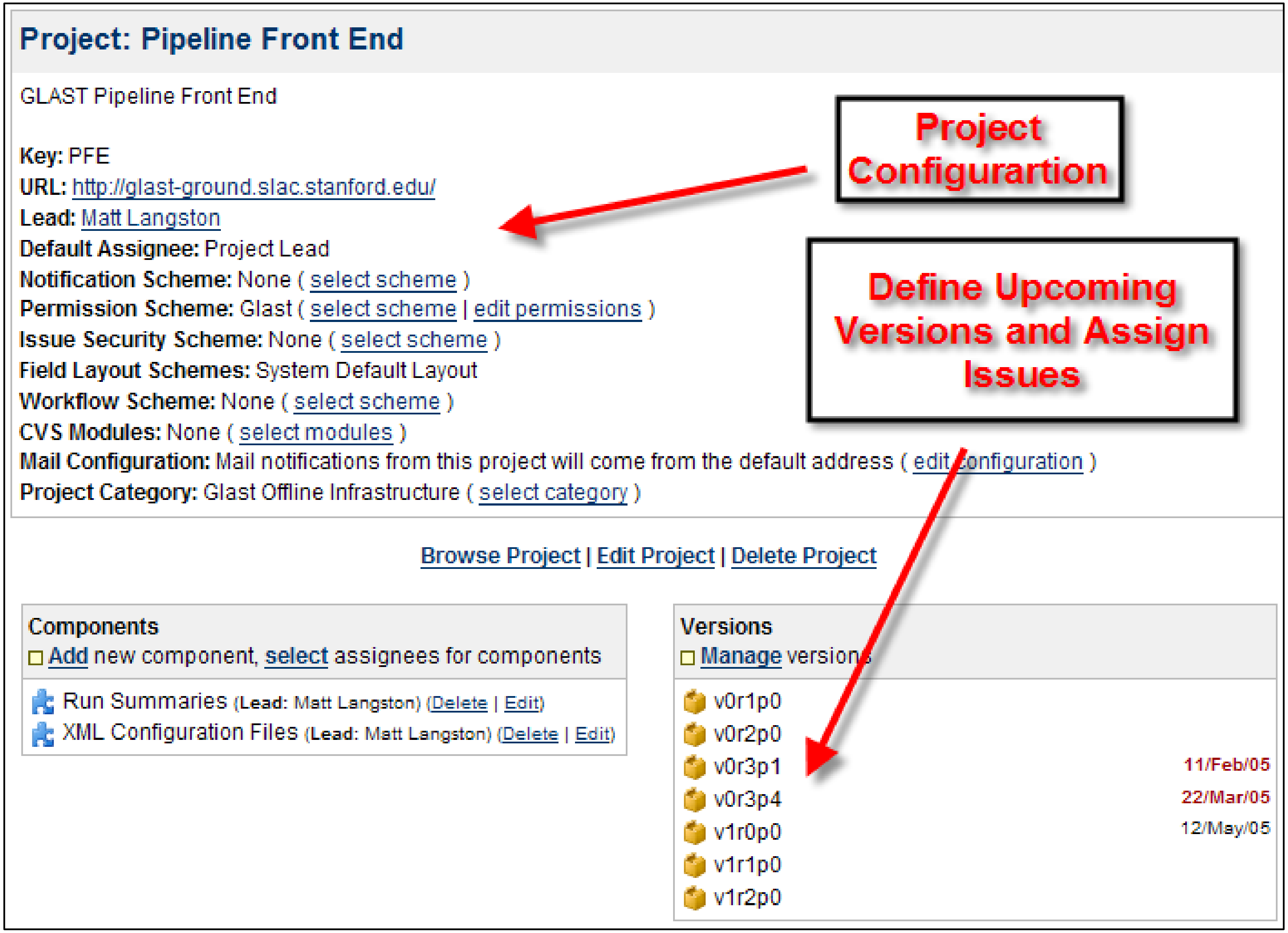
MVC type 2

Model **V**iew **C**ontroller



Guaranteed workflow (page order)
Guaranteed security (force login, HTTPS, Role membership, etc.)
Coarse-grained security (directory, page, page fragment
Fine-grained security (member functions, arguments, element in returned array)
Auto-populate web forms
Data validation (date ranges, run ranges, etc.)

JIRA Web Application



Project: Pipeline Front End

GLAST Pipeline Front End

Key: PFE
URL: http://glast-ground.slac.stanford.edu/
Lead: Matt Langston
Default Assignee: Project Lead
Notification Scheme: None (select scheme)
Permission Scheme: Glast (select scheme | edit permissions)
Issue Security Scheme: None (select scheme)
Field Layout Schemes: System Default Layout
Workflow Scheme: None (select scheme)
CVS Modules: None (select modules)
Mail Configuration: Mail notifications from this project will come from the default address (edit configuration)
Project Category: Glast Offline Infrastructure (select category)

Browse Project | Edit Project | Delete Project

Components
□ Add new component, select assignees for components

Run Summaries (Lead: Matt Langston) (Delete | Edit)
XML Configuration Files (Lead: Matt Langston) (Delete | Edit)

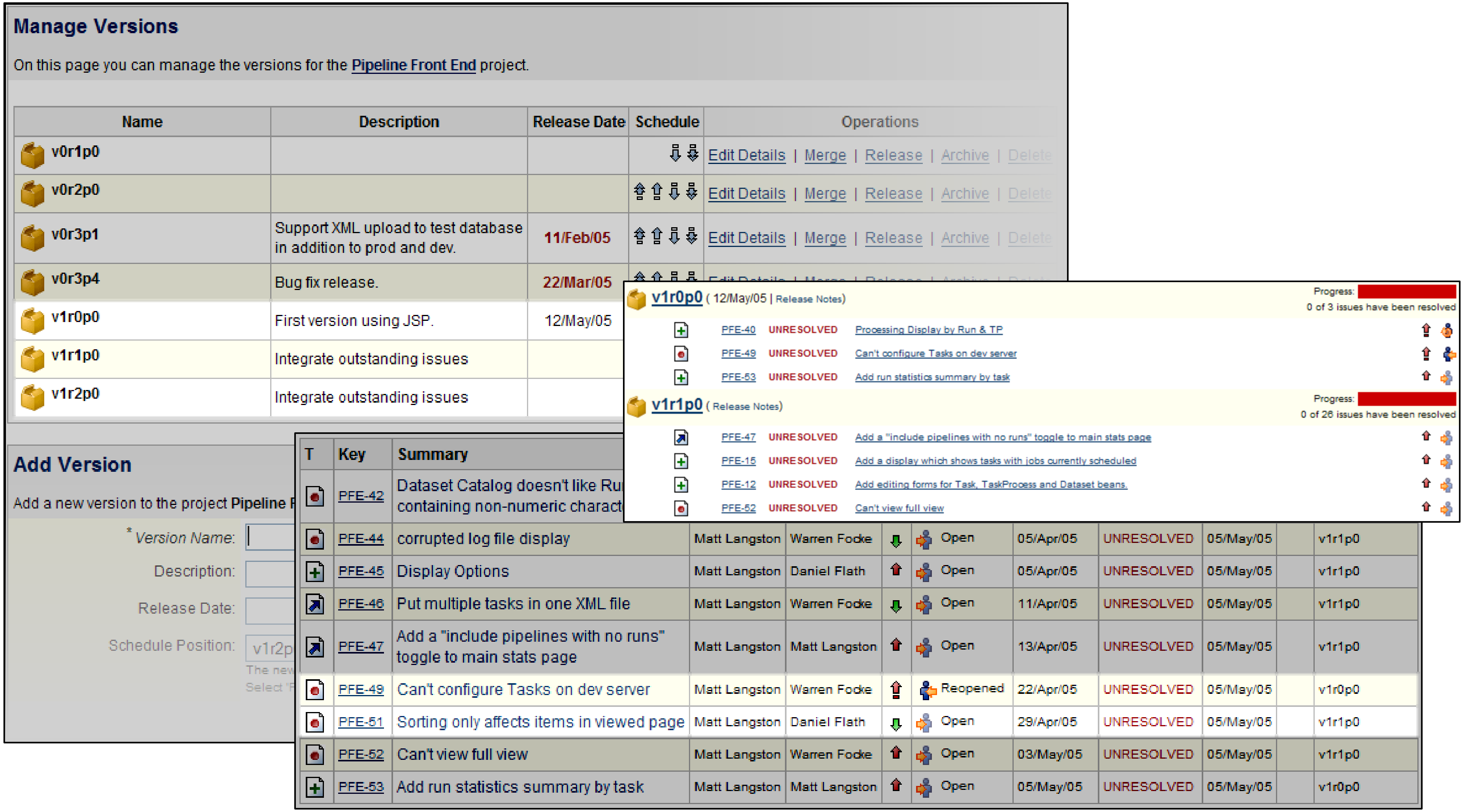
Versions
□ Manage versions

v0r1p0
v0r2p0
v0r3p1 11/Feb/05
v0r3p4 22/Mar/05
v1r0p0 12/May/05
v1r1p0
v1r2p0

Project Configurartion

Define Upcoming Versions and Assign Issues

JIRA as a Project Management Tool



Manage Versions

On this page you can manage the versions for the Pipeline Front End project.

Name	Description	Release Date	Schedule	Operations
v0r1p0			⇩ ⇩	Edit Details | Merge | Release | Archive | Delete
v0r2p0			⇧ ⇧ ⇩ ⇩	Edit Details | Merge | Release | Archive | Delete
v0r3p1	Support XML upload to test database in addition to prod and dev.	11/Feb/05	⇧ ⇧ ⇩ ⇩	Edit Details | Merge | Release | Archive | Delete
v0r3p4	Bug fix release.	22/Mar/05	⇧ ⇧ ⇩ ⇩	Edit Details | Merge | Release | Archive | Delete
v1r0p0	First version using JSP.	12/May/05		
v1r1p0	Integrate outstanding issues			
v1r2p0	Integrate outstanding issues			

Add Version

Add a new version to the project Pipeline F

* Version Name:	
Description:	
Release Date:	
Schedule Position:	v1r2p The new Select 'F

v1r0p0 (12/May/05 | Release Notes)

Progress: 🟥
0 of 3 issues have been resolved

⊞	PFE-40	UNRESOLVED	Processing Display by Run & TP
●	PFE-49	UNRESOLVED	Can't configure Tasks on dev server
⊞	PFE-53	UNRESOLVED	Add run statistics summary by task

v1r1p0 (Release Notes)

Progress: 🟥
0 of 26 issues have been resolved

↗	PFE-47	UNRESOLVED	Add a "include pipelines with no runs" toggle to main stats page
⊞	PFE-15	UNRESOLVED	Add a display which shows tasks with jobs currently scheduled
⊞	PFE-12	UNRESOLVED	Add editing forms for Task, TaskProcess and Dataset beans.
●	PFE-52	UNRESOLVED	Can't view full view

T	Key	Summary									
●	PFE-42	Dataset Catalog doesn't like Ru containing non-numeric charact									
●	PFE-44	corrupted log file display	Matt Langston	Warren Focke	⇩	Open	05/Apr/05	UNRESOLVED	05/May/05		v1r1p0
⊞	PFE-45	Display Options	Matt Langston	Daniel Flath	⇧	Open	05/Apr/05	UNRESOLVED	05/May/05		v1r1p0
↗	PFE-46	Put multiple tasks in one XML file	Matt Langston	Warren Focke	⇩	Open	11/Apr/05	UNRESOLVED	05/May/05		v1r1p0
↗	PFE-47	Add a "include pipelines with no runs" toggle to main stats page	Matt Langston	Matt Langston	⇧	Open	13/Apr/05	UNRESOLVED	05/May/05		v1r1p0
●	PFE-49	Can't configure Tasks on dev server	Matt Langston	Warren Focke	⇧	Reopened	22/Apr/05	UNRESOLVED	05/May/05		v1r0p0
●	PFE-51	Sorting only affects items in viewed page	Matt Langston	Daniel Flath	⇩	Open	29/Apr/05	UNRESOLVED	05/May/05		v1r1p0
●	PFE-52	Can't view full view	Matt Langston	Warren Focke	⇧	Open	03/May/05	UNRESOLVED	05/May/05		v1r1p0
⊞	PFE-53	Add run statistics summary by task	Matt Langston	Matt Langston	⇧	Open	05/May/05	UNRESOLVED	05/May/05		v1r0p0

Overall Summary

- GLAST offline software represents a confluence of HEP and Astro communities
  - Looks like HEP for instrument simulation
    - C++; Gaudi; Geant4; Root; Kalman filter tracking etc
  - Looks like a telescope for analysis of the sky
    - FTOOLS, FITS etc
  - We have a small group
    - Trying to automate as much as we can
    - Trying for good gui tools; good user doc
    - Release Manager, System Tests
    - processing pipeline
      - Backbone of Science Ops Center
  - Modest data volumes
    - Keep it all on disk
    - Provide smart data servers for the collaboration