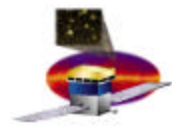


GLAST Large Area Telescope: Release System for GLAST Offline Software

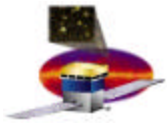
Karl Young, Richard Dubois, Alex Schlessinger
Stanford Linear Accelerator Center
kyoung@slac.stanford.edu

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



Outline

- **Introduction to GLAST and GLAST Offline Software**
- **Description of Offline Software Release Management System:**
 - **Nightly Build System**
 - **System Tests**
- **Summary**



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

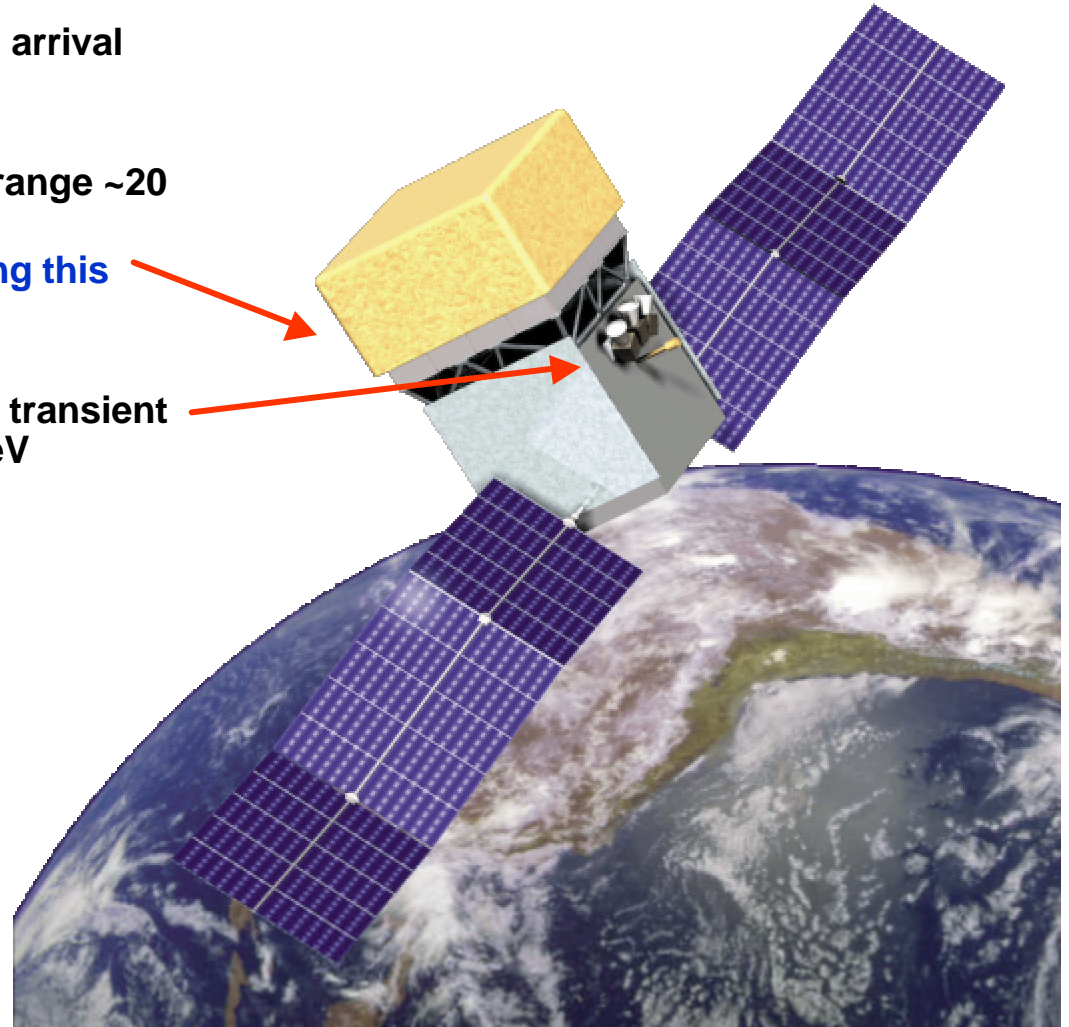
- There is no telescope now covering this range!!

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

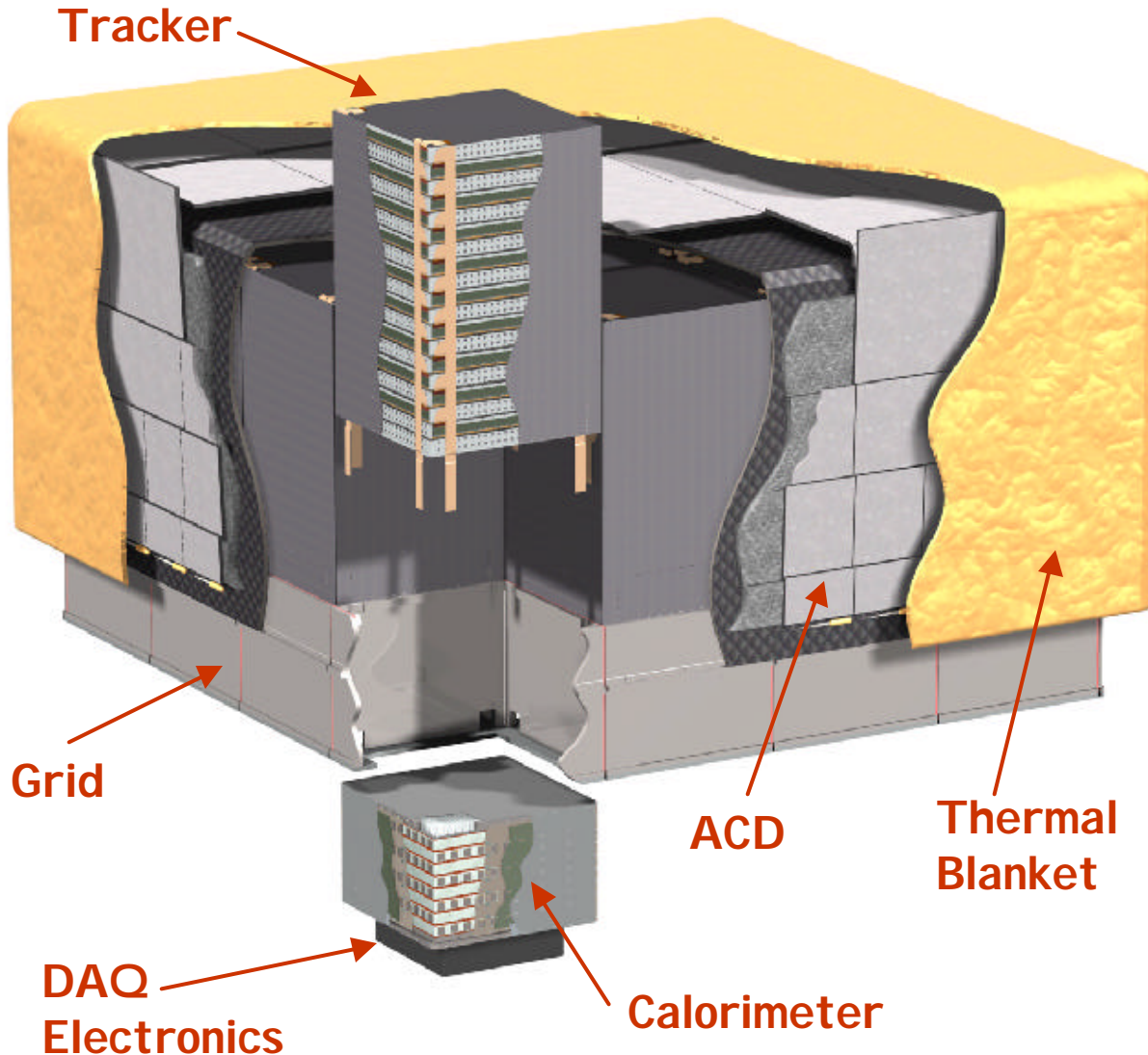
Launch: September 2006
Florida

Orbit: 550 km,
28.5° inclination

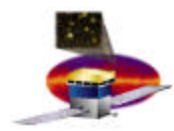
Lifetime: 5 years
(minimum)



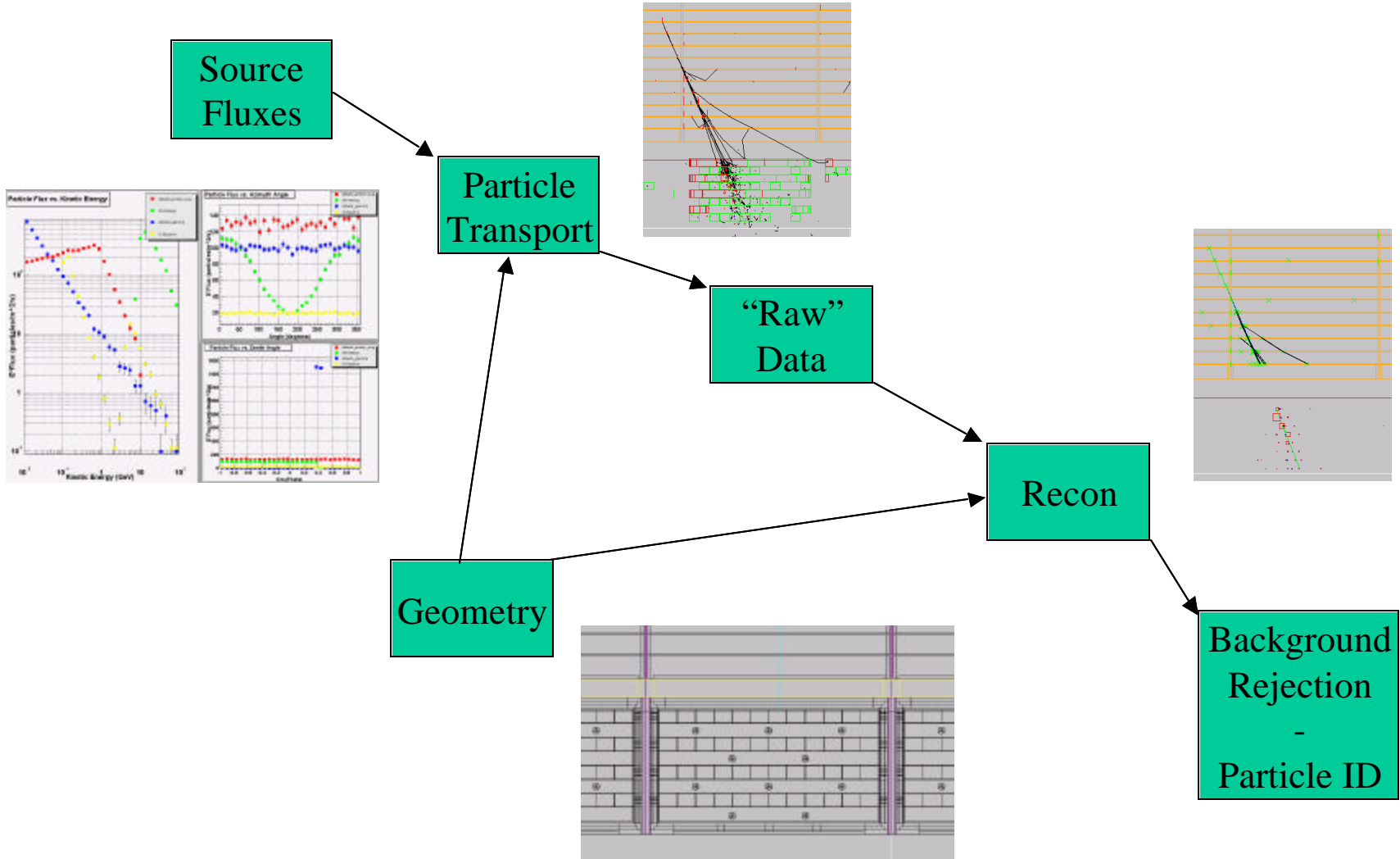
GLAST Instrument: Large Area Telescope (LAT)

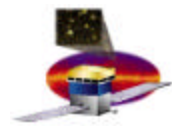


- Array of 16 identical “Tower” Modules, each with a **tracker** (Si strips) and a **calorimeter** (CsI with PIN diode readout) and DAQ module.
- Surrounded by finely **segmented ACD** (plastic scintillator with PMT readout).



GLAST Offline Software





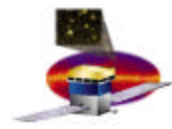
GLAST Offline Software (continued)

Simulation software in C++; uses standard HEP software tools:

CMT, Geant4, Gaudi, Root, CLHEP

Uses xml for representation of sources and geometry

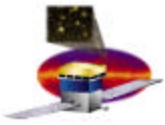
Linux and Windows are supported operating systems



Motivation for Nightly Builds

Want to encourage developers to commit changes early and often while avoiding a train wreck at release time

Need to keep track of which versions of a large number of interdependent packages work (i.e. build and pass unit tests) and work together



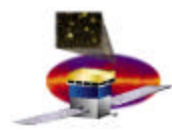
Nightly Build Strategy

- **Specify all packages associated with a software release via a “container” package – GlastRelease (cmt package with list of packages in the cmt requirements file) –**
 - **a tag of GlastRelease is a release**
 - **the HEAD of GlastRelease is a release in progress**
 - **LATEST (latest version of packages contained in GlastRelease) is a potential future release**
- **Require package maintainers to provide a unit test with their package (so far about 60 % compliance)**
- **Package maintainers specify which version of their package should be specified in current version of GlastRelease (not necessarily latest version of package)**



Nightly Build Strategy (continued)

- **Nightly build scripts try to build and run tests for:**
 - **packages in current version of GlastRelease (if it has changed since previous night)**
 - **HEAD, i.e. head version of GlastRelease (which contains tagged versions of contained packages)**
 - **LATEST, i.e. the latest versions of all packages specified in GlastRelease (to try and anticipate looming build, run, and compatibility problems)**
- **Before a release is officially declared the system tests are run on the current version of GlastRelease, provided it successfully built and unit tests ran successfully, and the results of the system tests are evaluated.**



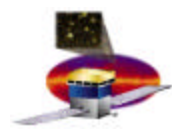
Nightly Build Strategy (continued)

package list
[Auto](#)
[current errors](#)
[css](#)

GlastRelease package list (new packages shaded)

package	released in v2r0	current (head)	latest tags
AccDigi	v1r7p1	v1r7p1	v1r7p1
AccRecon	v1r6p0	v1r6p0	v1r6p0
AnalysisNtuple	v1r2p4	v1r2p4	v1r2p4
CalDigi	v1r0p2	v1r0p2	v1r0p2
CalRecon	v5r11p5	v5r11p5	v5r11p5
CalUtil	v1r2p1	v1r2p1	v1r2p1
CalbData	v0r2p1	v0r2p1	v0r2p1
CalbSvc	v0r2p1	v0r2p1	v0r2p1
Event	v8r8	v8r8	v8r8
FluxDisplay	v2r7p2	v2r7p2	v2r7p2
FluxSvc	v6r0p2	v6r0p2	v6r0p2
G4Generator	v5r2p1	v5r2p1	v5r2p1
G4Propagator	v1r1	v1r1	v1r1
GRB	v2r0p2	v2r0p2	v2r0p2
GlastPolicy	v5r0p2	v5r0p2	v5r1
GlastSvc	v8r7p2	v8r7p2	v8r7p2
Glcsm	v5r1p1	v5r1p1	v5r1p1
GsaSvc	v3r4p3	v3r4p3	v3r4p3
IExternal	v2r0	v2r0	v2r0
Recon	v2r7p2	v2r7p2	v2r7p2
RootIo	v6r0p0	v6r0p0	v6r0p0
RootPolicy	v2r1p1	v2r1p1	v2r1p1
TierDigi	v1r11	v1r11	v1r11
TierRecon	v8r9p0	v8r9p0	v8r9p0
TierUtil	v1r6	v1r6	v1r6
Trigger	v2r5p1	v2r5p1	v2r5p1

Web page showing list of packages specified by GlastRelease, versions of those packages specified in the current version of GlastRelease, versions specified in the head of GlastRelease, and the latest tags for the packages in the cvs repository



Nightly Build Strategy (continued)

package list
builds
recent errors
css

GlastRelease tags

version	checkout	compile	tests	date
v2r0	ok	ok	26/26	2003-03-14 12:00:50
v1r1	ok	ok	26/26	2003-03-06 00:42:00
v1r0	ok	ok	23/24	2003-02-20 00:58:18
v0r3	ok	ok	14/18	2003-02-12 13:44:30

GlastRelease HEAD

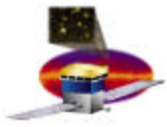
version	checkout	compile	tests	date
HEAD1.47	fail	-	27/27	2003-03-16 00:50:50
HEAD1.46	ok	ok	26/26	2003-03-13 16:40:46
HEAD1.45	ok	ok	0/0	2003-03-13 15:32:06
HEAD1.44	ok	ok	26/26	2003-03-13 00:18:50
HEAD1.43	ok	ok	25/26	2003-03-12 00:58:29
HEAD1.41	ok	ok	26/26	2003-03-11 00:51:27
HEAD1.40	ok	ok	25/26	2003-03-04 00:33:29
HEAD1.39	ok	ok	26/26	2003-03-03 15:13:36
HEAD1.38	ok	ok	25/26	2003-01-09 13:51:51
HEAD1.36	ok	ok	24/26	2003-02-25 00:00:13

GlastRelease using latest tags

version	checkout	compile	tests	date
latest	ok	ok	27/27	2003-03-17 00:27:54

last updated: Mon Mar 17 01:09:27 PST 2003

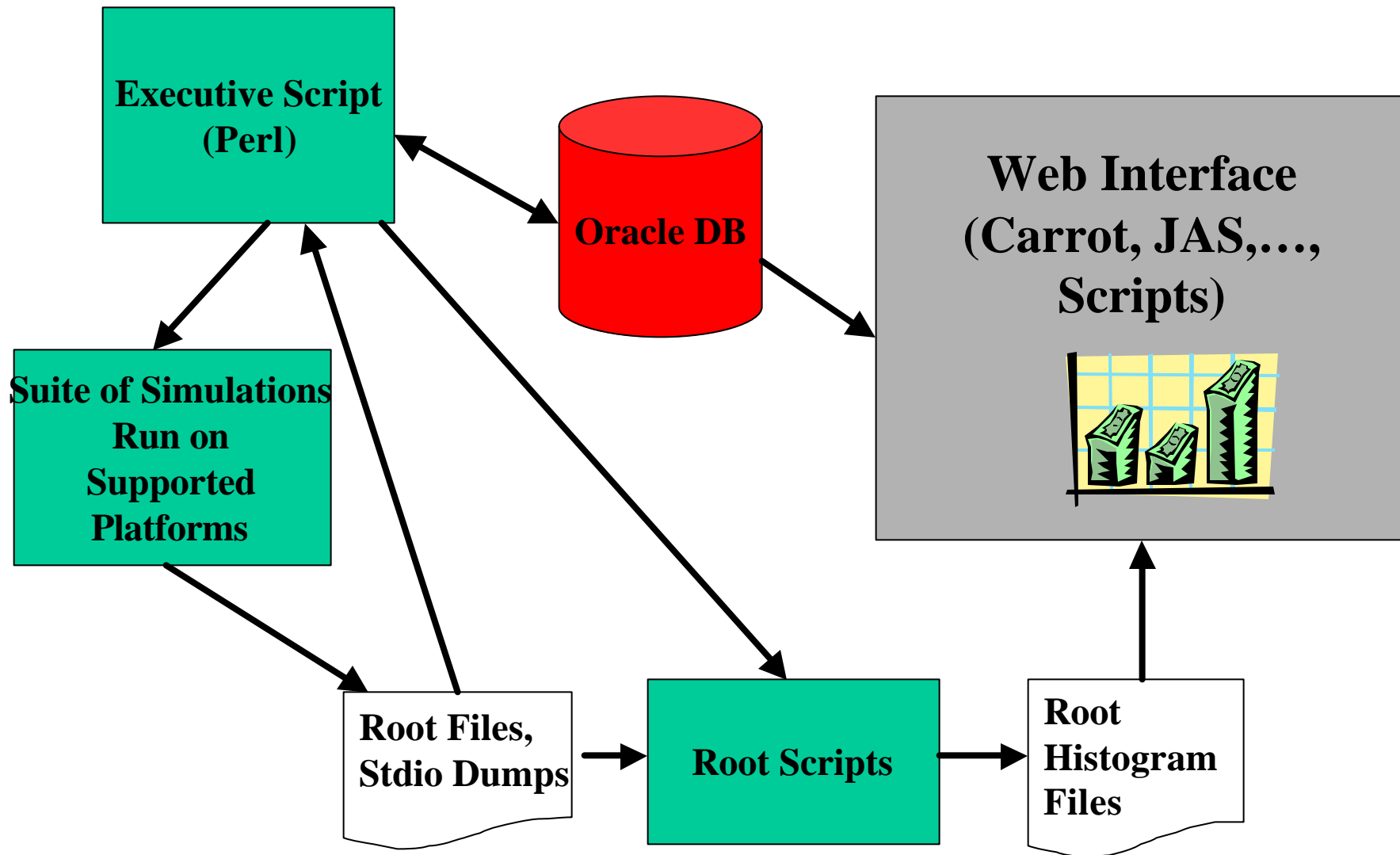
Web page showing status of builds and tests for different versions of GlastRelease as well as status for builds of the head of GlastRelease, and the “latest” build (builds and tests using latest versions of packages specified in GlastRelease)

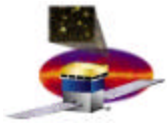


System Tests

- **Provide end to end test of system under different conditions (after verifying that the last nightly build was successful)**
- **Track performance of offline software, release by release, via a broad range of diagnostics**
- **Allow for use of diagnostics, via comparison to a standard set of diagnostic results, to determine when GlastRelease is actually ready for release**

Architecture of System Tests

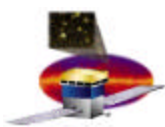




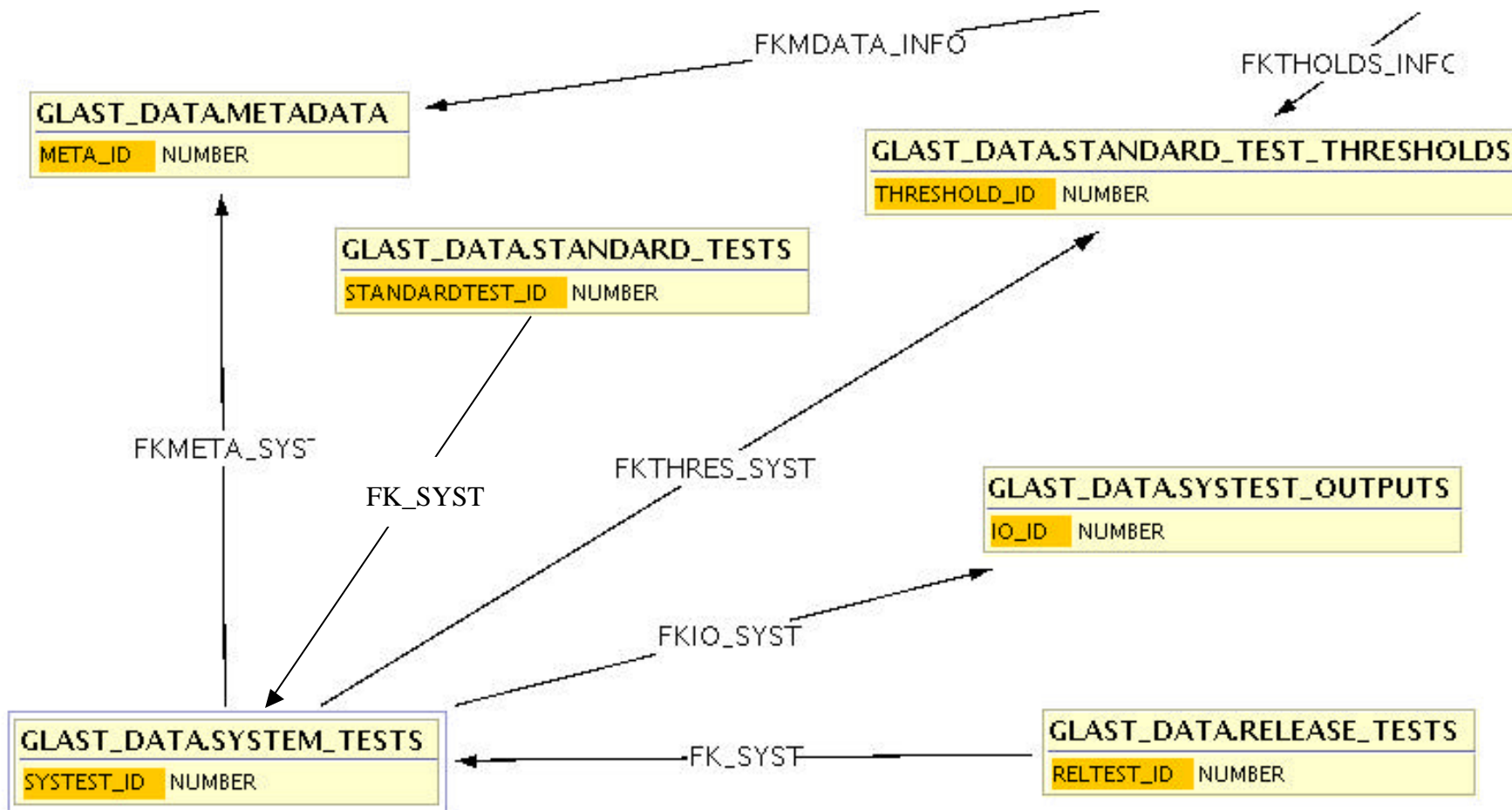
System Test Database

System test relational tables (as a part of larger data tracking and release system database) designed to maximize flexibility and extensibility – allows for tracking, across software releases, of both:

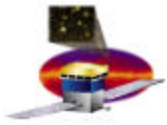
- instrumental quantities (track multiplicity, energy deposited in subsystems,...)**
- operational quantities (cpu and memory usage,...)**



System Test Database (continued)

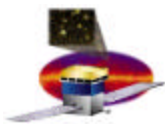


Entity diagram for system test tables in DB



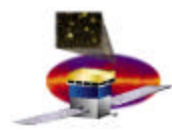
Web Interface

- **Intended to provide easy access to and analysis of system test results**
- **Based on scripts (currently experimenting with both Carrot and JAS) that display histograms and metadata from system test database**
- **Prior to programs like Carrot and JAS, displaying such extensive information via the web was difficult**
- **Histogram display allows for overlaying of test and standard histograms for quick visual impression (scripts also calculate the Kolmogorov-Smirnov statistic as a diagnostic measure of the difference between test and standard histograms)**



Comparison of Carrot and JAS

- **Carrot**
 - Web development reasonably easy modulo subtleties re. Carrot “write” statements
 - Carrot threads are fragile - require bullet proof scripts
 - Oracle connections require initial Root configuration setup
 - Root functionality native
 - Plotting faster than JAS (but on faster dedicated machine and with no optimization of JAS)
 - Last release winter '02
 - Broke with Root 3.04.02
 - Remote support
 - Possible security problems
- **JAS**
 - Web development easy via, e.g. FrontPage
 - Oracle connections, i.e. ODBC connections via IIS, straightforward
 - Fetching DB results with vbscript straightforward
 - Lacks some of Root's functionality
 - Possibility of using netbeans (gui tool) for building Root access pages
 - Local support available



Web Interface (continued)

The screenshot shows a Netscape browser window with the address bar set to <http://www-glast.slac.stanford.edu/software/systems/>. The page content includes the GLAST logo and the title "Gleam System Tests". A navigation menu contains links for Home, Intro, Usage, Caveats, Reference Manual, and Wish list. The "Introduction" section welcomes users and explains the system's purpose. The "Usage" section lists features like CPU time tracking and histogram viewing. The "Caveats" section is dated March 18, 2003.

GLAST *The Gamma Ray Large Area Space Telescope*

Gleam System Tests

[[Home](#) | [Intro](#) | [Usage](#) | [Caveats](#) | [Reference Manual](#) | [Wish list](#)]

Introduction

Welcome! This system allows us to track the performance of our workhorse [Gleam](#) application as it evolves through its code releases. It allows us to run several configurations of Gleam (eg. AllGamma, several energies of vertical gammas and muons, etc) and compare the output histograms to previous standard versions.

The portal to the system is at

<http://www-glast.slac.stanford.edu/software/systems/TestInfoRD.asp>

[JAS](#) is used as the web plot display tool, with asp and visual basic providing the connection to the underlying database.

Usage

Having selected a version of GlastRelease (which sets the Gleam version), you will be presented with a table of tests for that version. It has the following features:

- lists the CPU time and memory used in the process generating the test output
- a link to view the histograms
- a button showing all the metadata associated with the test (currently, mean, sigma, # entries and KS test value for each histogram)
- buttons showing the KS test results above and below threshold, and a summary count of those two conditions.

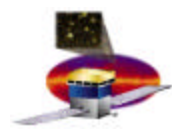
If you are not familiar with KS testing for comparisons of distributions, see [this link](#).

Once you select a particular test's histograms to browse, you'll see a pull-down menu of histogram titles available in the Root file and a button to enable overlays.

Caveats

March 18, 2003

Web portal (JAS) to system test information



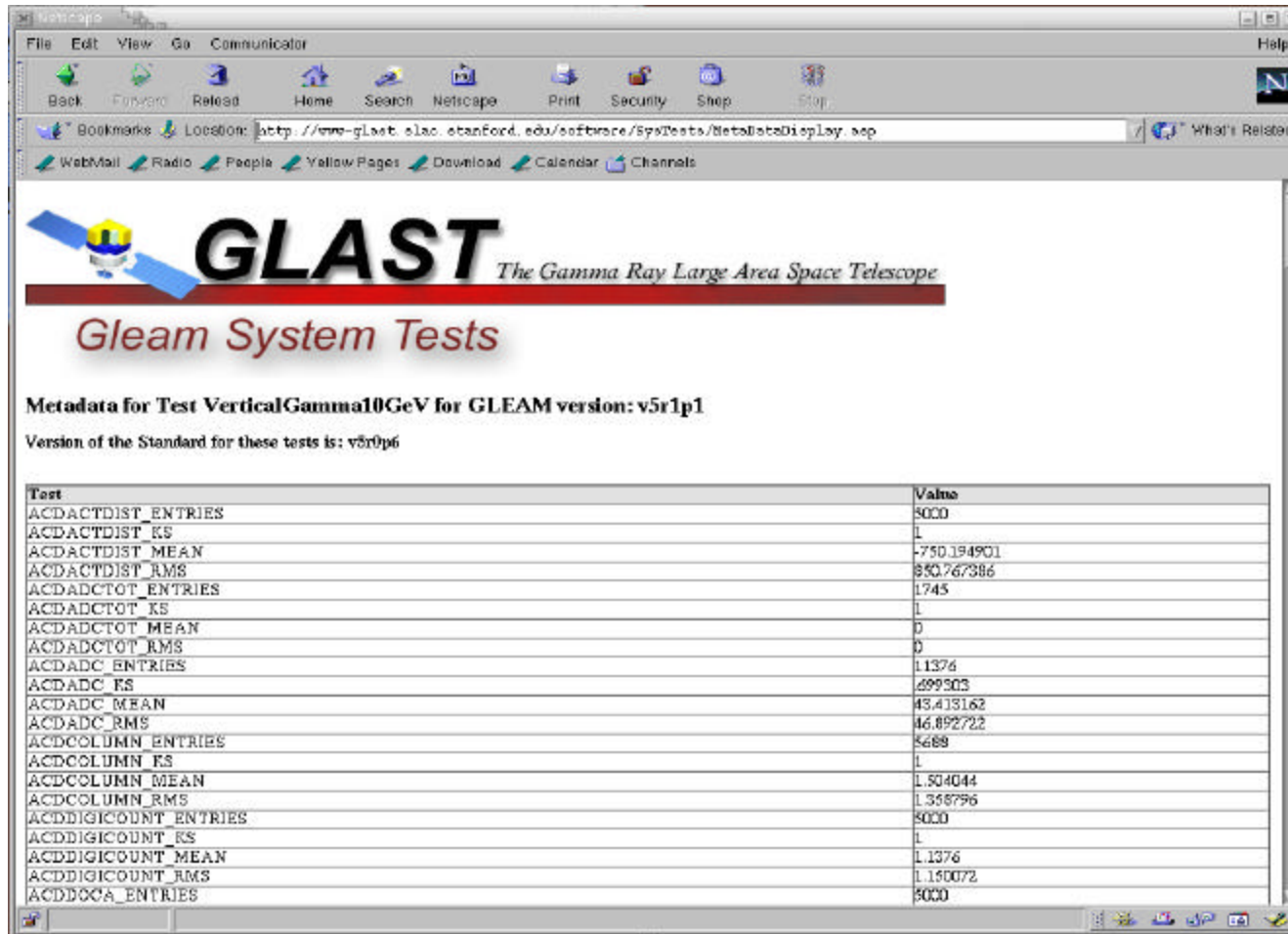
Web Interface (continued)


Tests for package GLEAM version: v5r1p1
Standard for these tests is: v5r0p6

System Test Name	CPU secs	Memory MB	Histogram File	Metadata Values	Threshold Check	Threshold Summary
VerticalGamma10GeV	352.82	157	Histogram	<input type="text" value="Metadata"/>	<input type="text" value="Above"/> <input type="text" value="Below"/>	Above: 80 Below: 4
ACDDlg	0	NA	Histogram	<input type="text" value="Metadata"/>	<input type="text" value="Above"/> <input type="text" value="Below"/>	Above: 0 Below: 0
VerticalProtan1GeV	2556	101	Histogram	<input type="text" value="Metadata"/>	<input type="text" value="Above"/> <input type="text" value="Below"/>	Above: 79 Below: 5

Web page containing diagnostic info. and access to histograms for specific system tests

Web Interface (continued)




GLAST *The Gamma Ray Large Area Space Telescope*

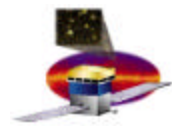
Gleam System Tests

Metadata for Test VerticalGamma10GeV for GLEAM version: v5r1p1

Version of the Standard for these tests is: v5r0p6

Test	Value
ACDACTDIST_ENTRIES	8000
ACDACTDIST_KS	L
ACDACTDIST_MEAN	-750.194901
ACDACTDIST_RMS	850.767386
ACDADCTOT_ENTRIES	1745
ACDADCTOT_KS	L
ACDADCTOT_MEAN	0
ACDADCTOT_RMS	0
ACDADC_ENTRIES	11376
ACDADC_KS	699903
ACDADC_MEAN	45.419162
ACDADC_RMS	46.892722
ACDCOLUMN_ENTRIES	5689
ACDCOLUMN_KS	L
ACDCOLUMN_MEAN	L.504044
ACDCOLUMN_RMS	L.558796
ACDDIGICOUNT_ENTRIES	8000
ACDDIGICOUNT_KS	L
ACDDIGICOUNT_MEAN	L.1376
ACDDIGICOUNT_RMS	L.150072
ACDDOXA_ENTRIES	8000

Web page containing metadata for specific system tests



Summary

- **A reasonably robust Release Management System for GLAST Offline Software has been designed and mostly implemented**
- **Nightly build system allows for rapid development and continuous testing of complex, multi developer, multi institution software, and thus greatly reduces problems encountered at release time**
- **System tests allow for easy viewing and analysis of extensive diagnostic information prior to release**
- **Focus now shifting to content of system tests rather than infrastructure design**