Potential use of JAS/JAIDA *etc.* *SAS J2EE Review*

Mark Donszelmann
(standing in for Max Turri)

SLAC Java Tools Group

Outline

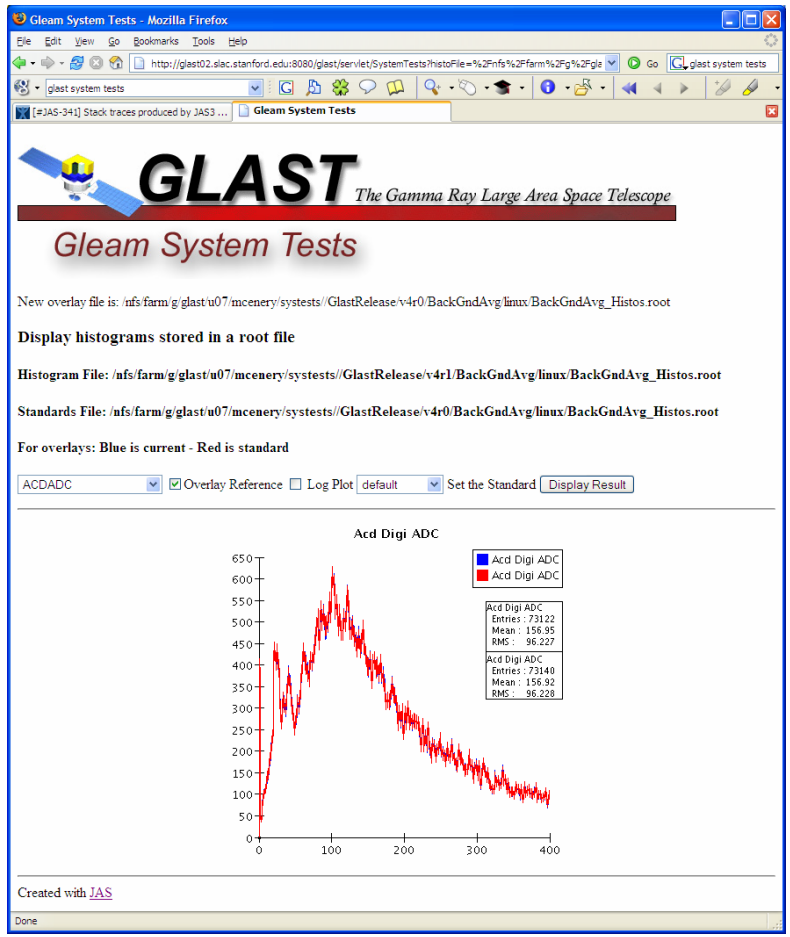
- Review of existing tools developed for GLAST
  - GLAST System Tests Interface
  - Enhanced System Tests
  - JAS3 System Test plugin
- Technologies used
  - AIDA/JAIDA/Java Root IO
  - AIDATLD
  - Statistical Testing
  - JAS3
- Other potential areas for collaboration
  - WIRED4

System Tests goals

- Compare the quality of new software releases
  - Check quality of software by comparing produced data against known distributions
  - Easily assess which distributions fail
  - Easy access of results to collaboration
- Evaluate performance of new hardware modules during production

Glast System Tests (Version 1)

- First version of System Tests to incorporate some of our code developed two years ago
  - still works and in use, although not actively maintained since we expected it to be rapidly replaced by something better.
- Uses combination of
  - .ASP scripts (developed by Richard and Karen)
  - Oracle database
  - Java Root IO for reading root files
  - Java servlet for plot display.

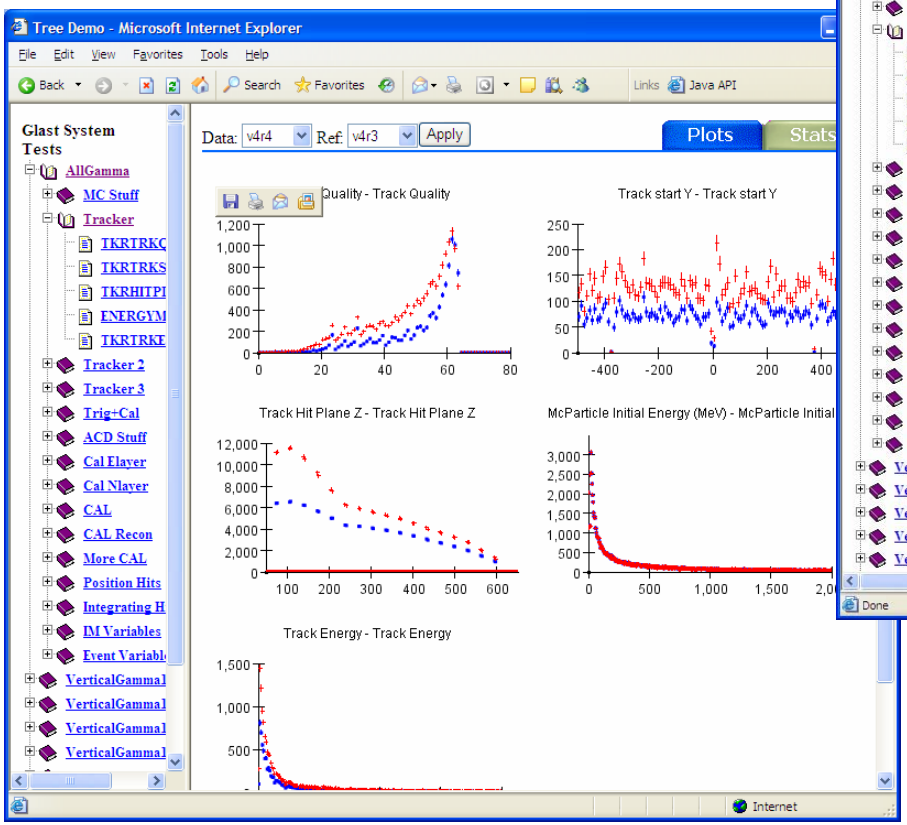


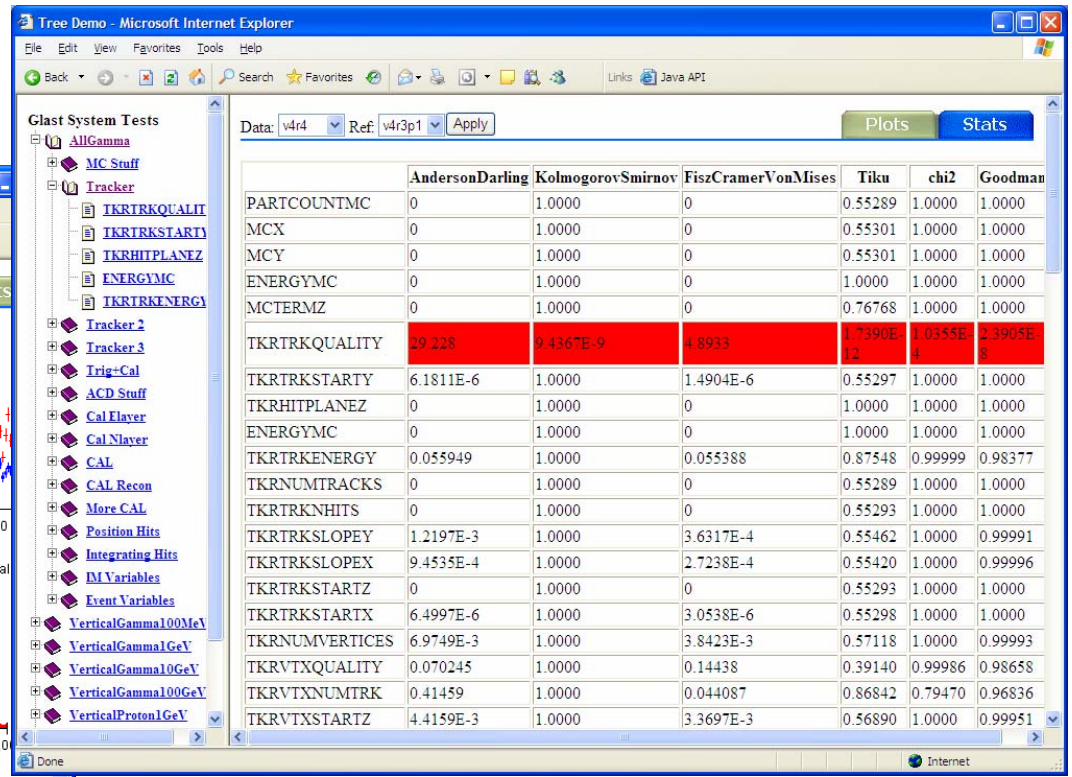
- http://www-glast.slac.stanford.edu/software/SysTests/TestInfo.asp

Glast System Tests (Version 2)

- Developed during this year
- Java solution
  - Mostly reusable technologies, very little Glast specific code
    - Java IO + xrootd for accessing root files
    - AIDA for plotting, data manipulation
    - Tag Libraries for inserting plots into web pages (AIDATLD)
    - Driven by XML configuration file
      - Currently hand maintained
      - Designed to be dynamically generated from Glast database via JSP page.
- Not yet in production
  - Waiting decision on how to integrate with Matt's stuff
  - Advanced features (user customization etc.) likewise require tighter integration with Glast infrastructure
- http://sldrh2.slac.stanford.edu:8080/GlastSystemTests/

Glast System Tests (Version 2)



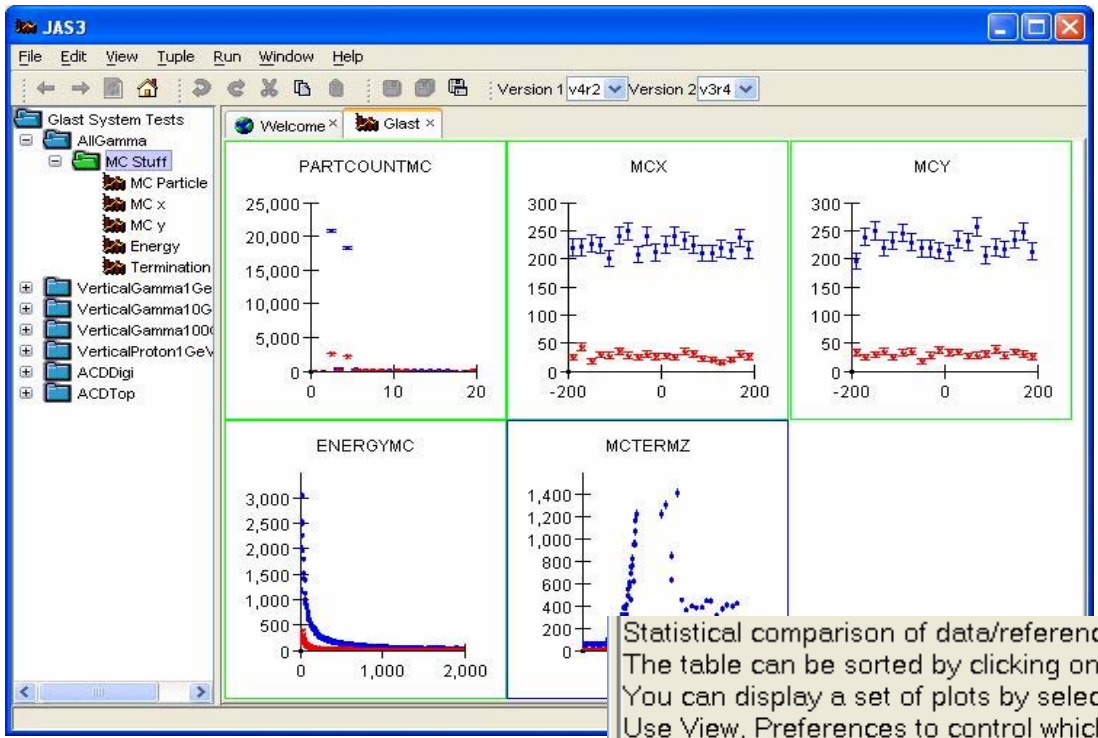


	AndersonDarling	KolmogorovSmirnov	FiszCramerVonMises	Tiku	chi2	Goodman
PARTCOUNTMC	0	1.0000	0	0.55289	1.0000	1.0000
MCX	0	1.0000	0	0.55301	1.0000	1.0000
MCY	0	1.0000	0	0.55301	1.0000	1.0000
ENERGYMC	0	1.0000	0	1.0000	1.0000	1.0000
MCTERMZ	0	1.0000	0	0.76768	1.0000	1.0000
TKRTRKQUALITY	29.228	9.4367E-9	4.8933	1.7390E-12	1.0355E-4	2.3905E-8
TKRTRKSTARTY	6.1811E-6	1.0000	1.4904E-6	0.55297	1.0000	1.0000
TKRHITPLANEZ	0	1.0000	0	1.0000	1.0000	1.0000
ENERGYMC	0	1.0000	0	1.0000	1.0000	1.0000
TKRTRKENERGY	0.055949	1.0000	0.055388	0.87548	0.99999	0.98377
TKRNUMTRACKS	0	1.0000	0	0.55289	1.0000	1.0000
TKRTRKNHITS	0	1.0000	0	0.55293	1.0000	1.0000
TKRTRKSLOPEY	1.2197E-3	1.0000	3.6317E-4	0.55462	1.0000	0.99991
TKRTRKSLOPEX	9.4535E-4	1.0000	2.7238E-4	0.55420	1.0000	0.99996
TKRTRKSTARTZ	0	1.0000	0	0.55293	1.0000	1.0000
TKRTRKSTARTX	6.4997E-6	1.0000	3.0538E-6	0.55298	1.0000	1.0000
TKRNUMVERTICES	6.9749E-3	1.0000	3.8423E-3	0.57118	1.0000	0.99993
TKRVTXQUALITY	0.070245	1.0000	0.14438	0.39140	0.99986	0.98658
TKRVTXNUMTRK	0.41459	1.0000	0.044087	0.86842	0.79470	0.96836
TKRVTXSTARTZ	4.4159E-3	1.0000	3.3697E-3	0.56890	1.0000	0.99951

Glast System Tests JAS Plugin

- Designed to be complementary to web based system tests
  - Web based system =
    - zero install
    - limited interactive capabilities
  - JAS Plugin =
    - Prior installation required (but easy to do)
    - Much easier to add interactive features, and allow users to perform one-off exploratory analysis.
  - Both systems share common infrastructure
    - Configuration from same XML file
    - Read data files from same location and same (xrootd technology)
    - Both use AIDA for plotting and data analysis
    - Large amount of shared code

Glast System Tests JAS Plugin



Statistical comparison of data/reference histogram using various algorithms
The table can be sorted by clicking on the column headers.
You can display a set of plots by selecting rows of the table and using the popup menu.
Use View, Preferences to control which tests are displayed.
Comparison from Tracker, recursive = false

Histogram Name	AndersonDarling	KolmogorovSmi...	FiszCramerVon...	Tiku	chi2	Goodman
TKRTRKQUALI...	3.9984	0.058847	0.92983	3.4813E-3	0.99919	0.070262
TKRTRKSTAR...	0.33921	0.91318	0.064515	0.77564	1.0000	0.74075
TKRHITPLANEZ	4.7526	8.6503E-3	157.43	0	0.99947	0.012355
ENERGYMC	0	1.0000	0	0	1.0000	1.0000
TKRTRKENER...	0.36227	0.99202	0.39761	0.075701	1.0000	0.86158

Technologies used

AIDA
Abstract Interfaces for Data Analysis

- A standard set of interfaces for data analysis
  - Histograms, Tuples, Functions, Fitter, Plotter, etc.
- CERN-LAL-SLAC collaboration
  - Each lab providing an implementation
    - 2 in C++, 1 in Java and 1 in Python
- http://aida.freehep.org

JAIDA – AIDA in Java

- Full implementation of the AIDA interfaces
- Distributed as Part of FreeHEP Java library:
  - http://java.freehep.org
- Easy to extend and customize using Service Architecture
  - New factories, plotter, fitters, functions etc. can be added easily

- Histograms, Tuples, …
- Functions
  - Runtime compilation of expressions using JEL (Java Expression Library)
- Fitting
  - Support for multiple fitting engines: UNCMIN, MINUIT, JMinuit
  - Support for multiple fitting methods:
    - Binned (LeastSquares, Chi2,BinnedMaximumLikelihood)
    - Unbinned

- Stores
  - Read/Write support for AIDA XML format
  - Read support for ASCII, HBOOK, Root files
- Plotter
  - For batch and interactive data analysis
  - Plots update in real time as they are filled
  - Easy to embed in any Java GUI or Web application
  - High quality graphics export formats: PDF, EPS, SVG, SWF, PNG, GIF, JPG, …

Java Root IO and JAIDA Plugin

- Java Root IO
  - Pure Java Package for reading Root files
    - Will be extended to writing later
  - Access to Root Data, not to C++ code
  - Java proxies are dynamically generated for each Root object read
    - Built as Java bytecode using BCEL (http://jakarta.apache.org/bcel)
    - Converted at runtime to machine code by HotSpot VM
    - Robust against changes
    - Backwards compatible with older root versions
  - High performance
    - Standard java.nio package for binary IO
  - Network Root IO
    - Compatible with either rootd or xrootd servers
- JAIDA Root IO Plugin
  - Read Root files via the AIDA interfaces
  - Root objects are available as AIDA objects

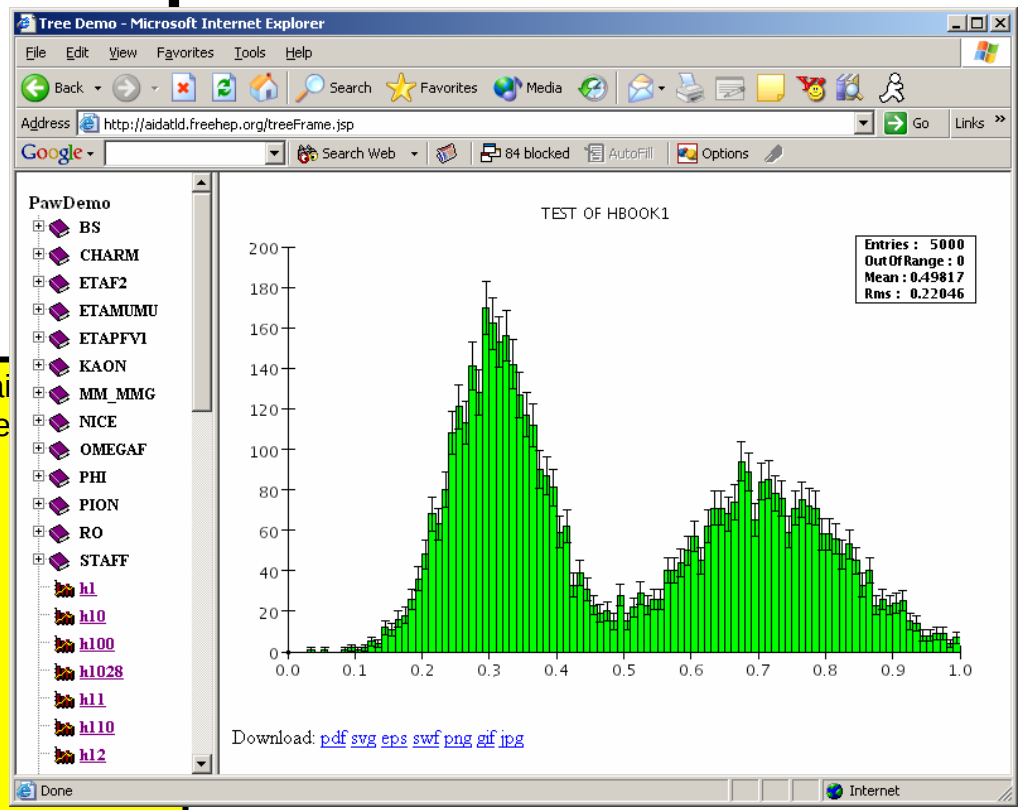
AIDATLD – AIDA Tag Library

- Sets of HTML-like tags to embed AIDA functionality in Java Server Pages
  - <aida:tree>, <aida:plotter>, <aida:style> etc.
- Allows web developers to insert “live” plots into web pages with no knowledge of Java etc.
- Plots and data can be made easily accessible to a collaboration quickly
- Works with Java Server Pages 2.0
- http://aidatld.freehep.org

AIDATLD - Example

```
<%@taglib prefix="aida" uri="http://java.freehep.org/jsp/ai
<%@taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core

<html>
    <head><title>Single plot of a histogram accessed via
      rootd</title></head>
      <body>
          <c:set var="rootDataURI"
      value="root://rh92.slac.stanford.edu/demo.root" />
          <c:set var="histoPath" value="/h110" />
          <aida:plotter>
                <aida:region>
                    <aida:plot dataSourceURI="${rootDataURI}"
                                plotObjectPath="${histoPath}" />
                </aida:region>
          </aida:plotter>
      </body>
</html>
```



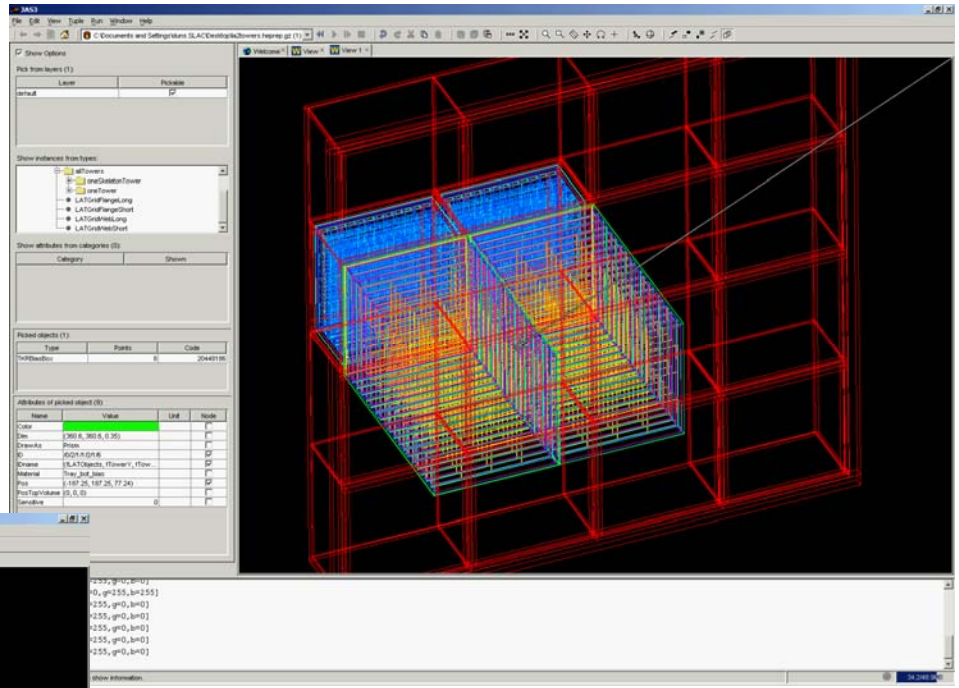
Statistical Testing

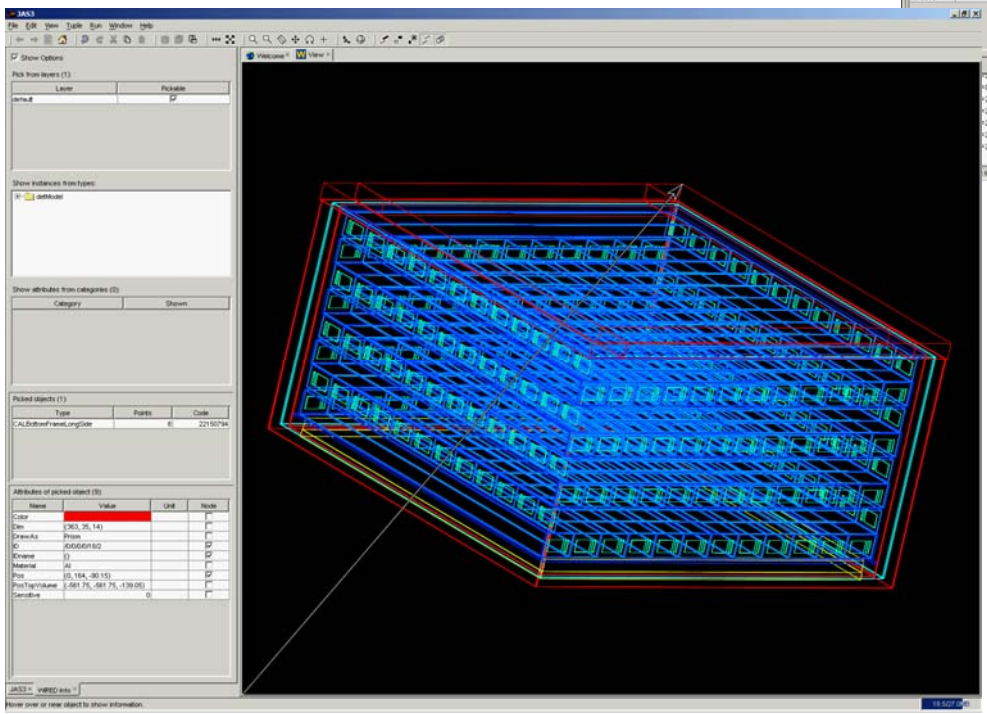
- JAIDA extension to AIDA:
  - Tests statistical significance of datasets
  - Used to statistically compare the shape of data distributions
  - Extensible set of algorithms:
    - Anderson-Darling, Kolmogorov-Smirnov, Fisz-Cramer-Von Mises, Goodman, Kuiper, Tiku, Chi2

JAS3 – Java Analysis Tool

- Data Analysis System
- Modular, Extensible, Data Format Independent
- Based on FreeHEP Application shell
- Analysis based on JAIDA
- Powerful GUI
- Editor for (Java) code
- Support scripting (Python, Pnuts, …)

WIRED 4





Experiment independent HepRep Event Display

Future Collaboration with GLAST

- Our group has:
  - Large amount of Java experience (including some J2EE)
  - Is charged with supporting experiments such as GLAST
- Particularly interested in projects where we can develop experiment independent tools which can be used by GLAST and others, *e.g.*
  - Complete Systems tests interface
    - with clean integration into GLAST J2EE infrastructures
  - Data Analysis and Data Visualization (AIDA, JAS3, WIRED4)
  - Distributed Data Analysis
  - Generic Distributed task scheduler

References

- GLAST System Tests
  - http://sldrh2.slac.stanford.edu:8080/GlastSystemTests/
  - http://confluence.slac.stanford.edu/display/JAS3/Glast+System+Tests+plugin+for+JAS3
- AIDA
  - http://aida.freehep.org
- JAIDA
  - http://java.freehep.org/jaida/index.html
- Java Root IO
  - http://java.freehep.org/lib/freehep/doc/root/
- AIDATLD
  - http://aidatld.freehep.org/
- Statistical Testing
  - http://java.freehep.org/jaida/v3.2.4/StatisticalComparison.html
- JAS3
  - http://jas.freehep.org/jas3
- WIRED4
  - http://wired.freehep.org
- Freehep Java Library
  - http://java.freehep.org/