JAS - News and Prospects

LC Simulation Meeting

Norman Graf and Tony Johnson

Contents

- Quick Overview of JAS
- Interoperability
  - JAS and Linear Collider Studies
  - JAS and WIRED
  - JAS and AIDA
  - JAS and GEANT4
  - JAS and Grid
  - JAS and Root
- Future Plans

Introduction to JAS

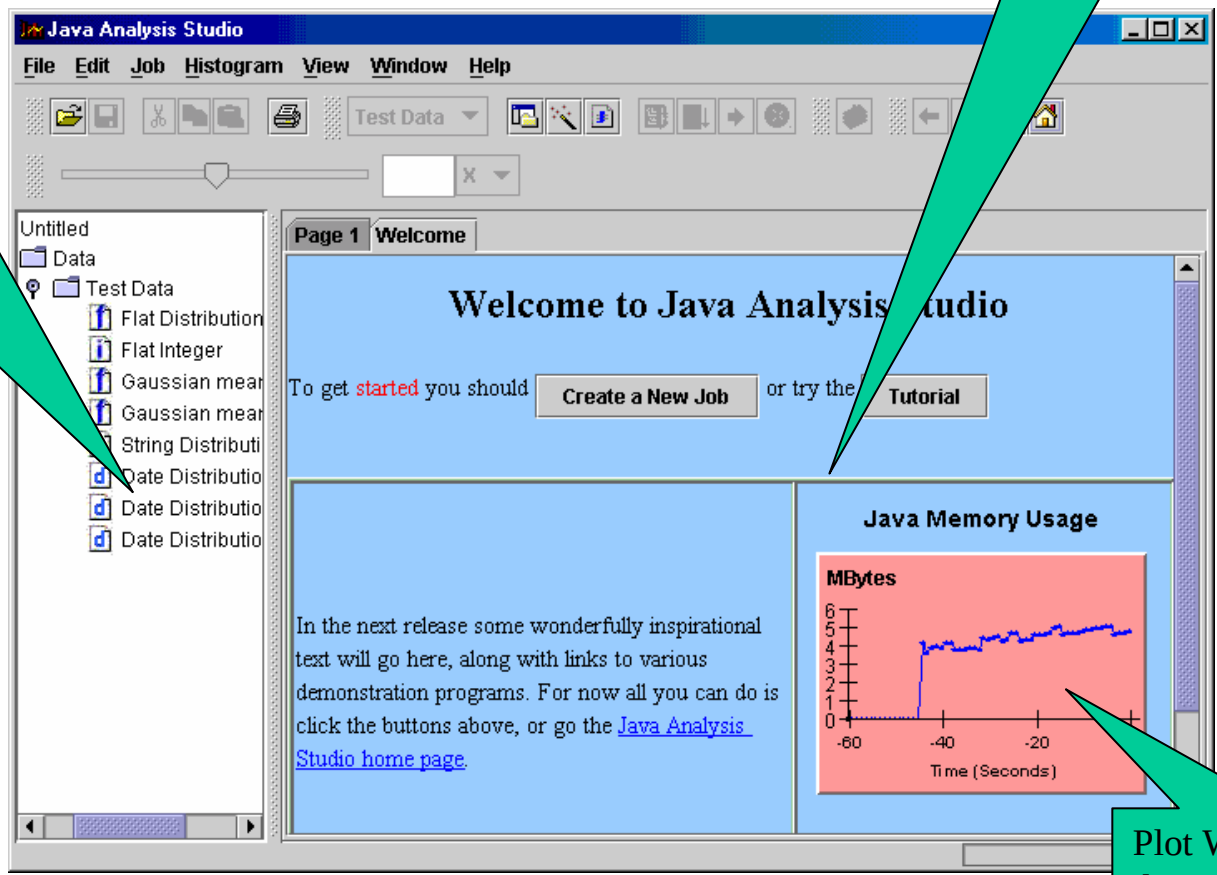
- Pure Java Analysis Environment
  - Data Format Independent
  - Extensible via Plugins/Data Interface Modules
  - Rich Easy-to-use GUI
  - Built in editor/compiler for analysis code
  - Quick and easy to install
    - Snowmass CD – 0 to Physics Analysis in 15 minutes
  - Local and Client-Server Operation
  - Modular – individual components can be taken out and used separately
- Current production release 2.2.4

JAS GUI

Tree provides access to analysis objects:
- Histograms
- Plots
- Data Sets
- Analysis Routines

In principle any object. Each item has popup menus and double click action.

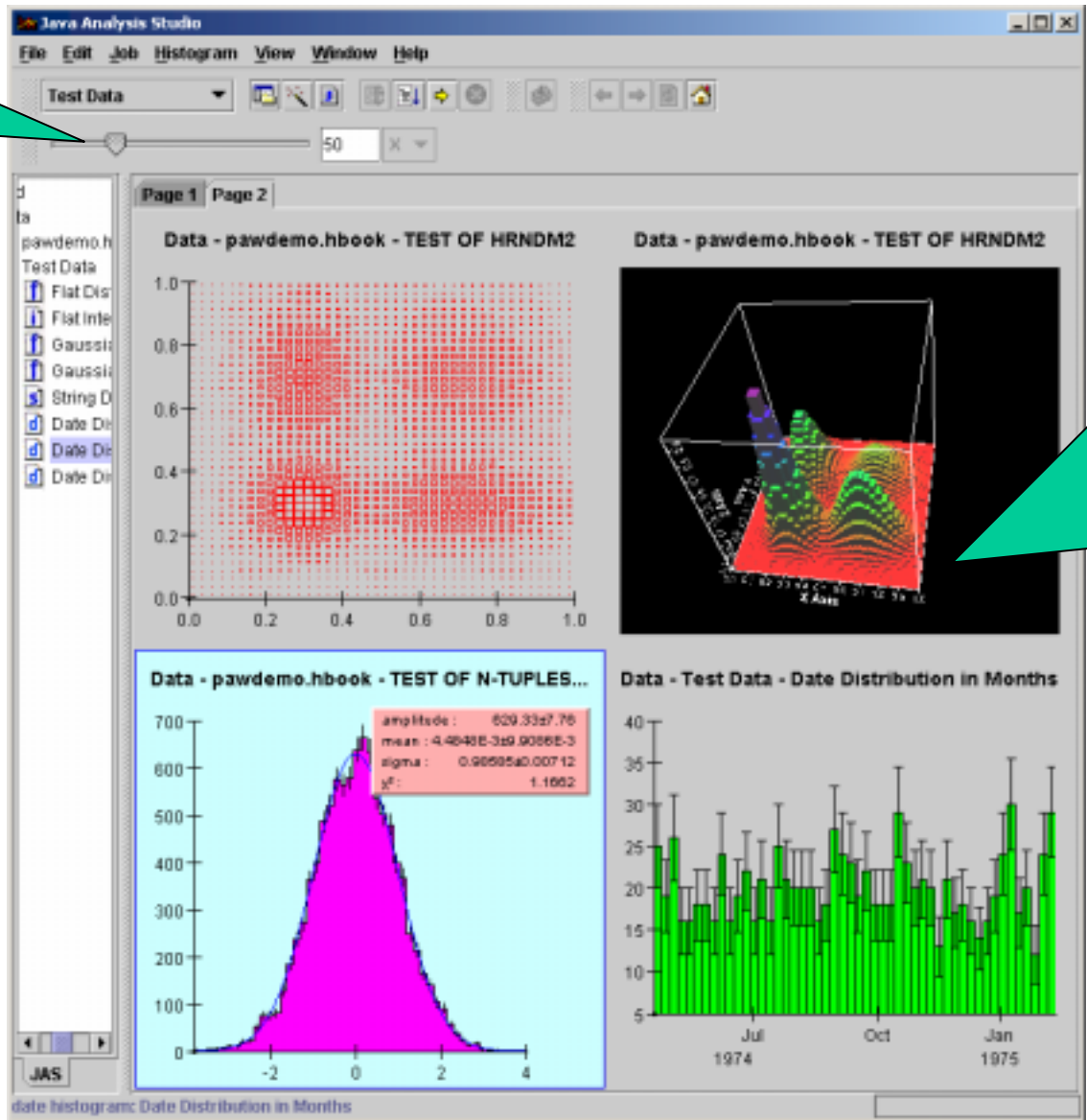
Built in HTML viewer with embeddable "objects" (buttons, plots, etc).



Plot Widget, shows data in real time, optimized for fast refresh performance

JAS Plotter

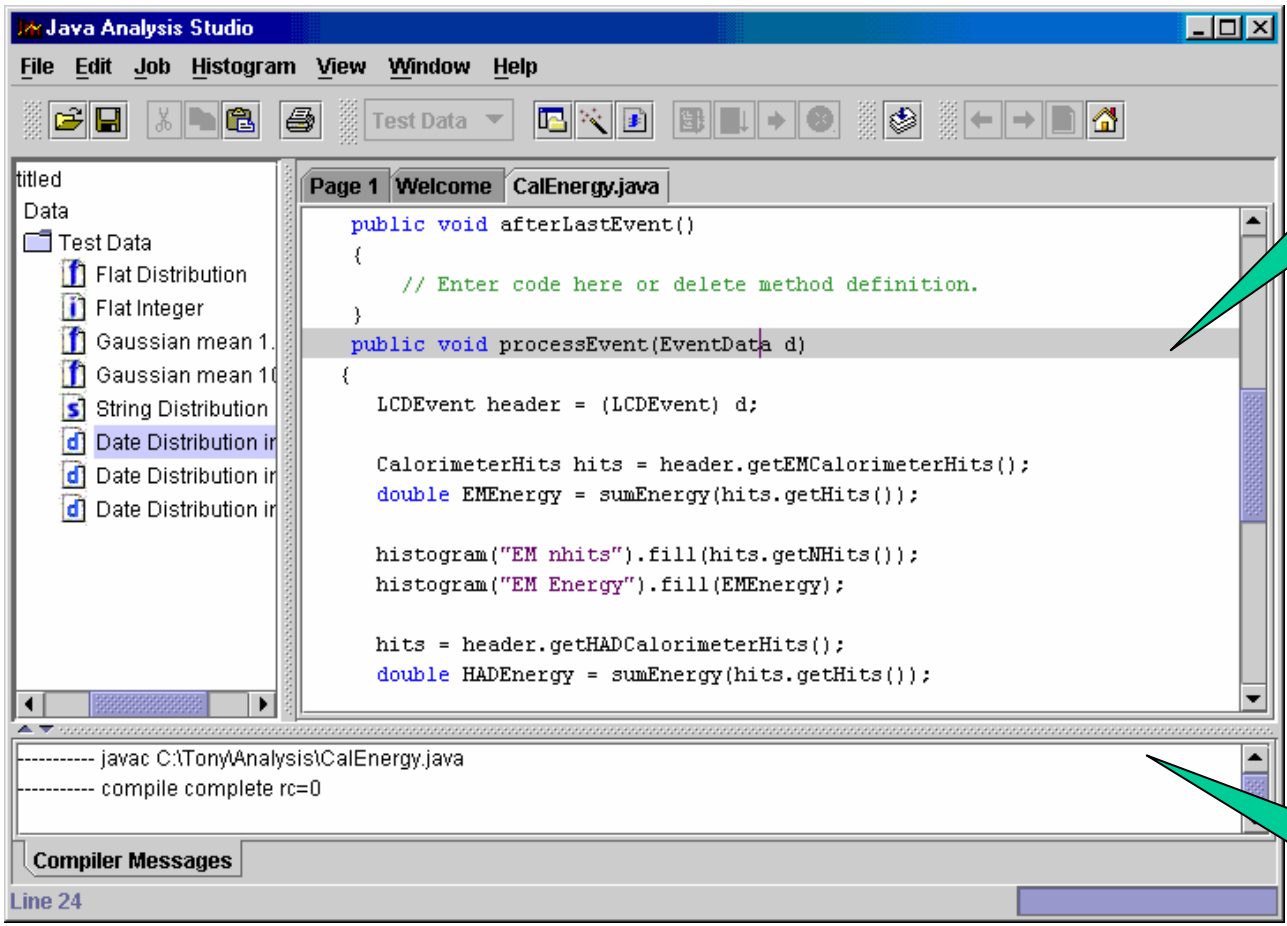
Rebin slider can be used to dynamically change # of bins.



Pages can display histograms. User can control layout, add remove plots, etc.

Plots are highly interactive, can be manipulated by the user by dragging on the axis, or bounding box. Labels (title, legend, axis labels) can be updated by clicking and typing.

JAS Editor/Compiler



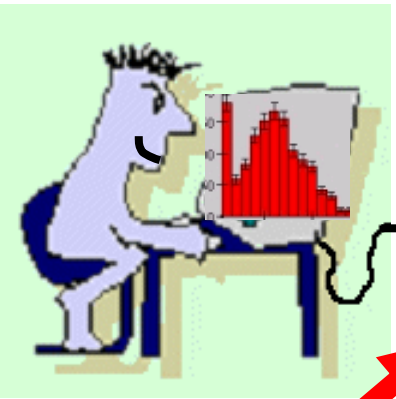
Built in code editor with syntax highlighting (based on open-source Jedit editor)

Built-in Java compiler. Can dynamically load (and unload) analysis code.

Data Format Independent

- JAS uses a simple interface (DIM) to isolate it from any particular data format. There are many DIM implementations which make different data formats accessible to the JAS client.
- Flexible design works with many different types of data, from N-Tuples, Database tables (via JDBC) to arbitrary trees of objects.

JAS Remote Data Access



GUI

TCP/IP Network

Data Analysis Engine

Experiment Extensions (Event Display)

Java Compiler + Debugger

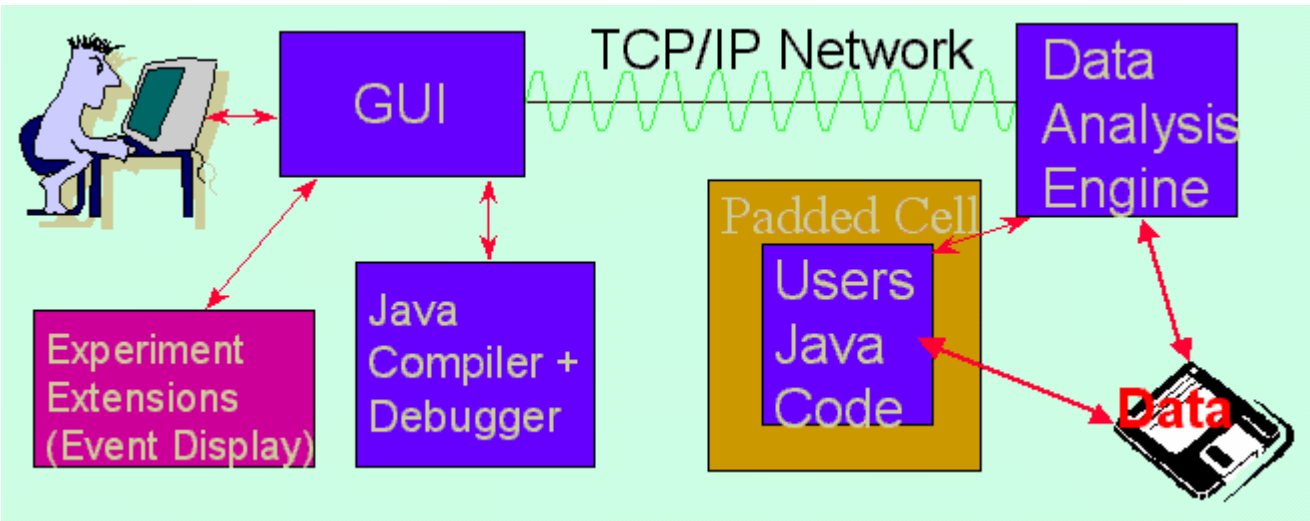
User's Java Code

Padded Cell

DATA

Remote Data Access

- Rather than transporting peta-bytes of data to the physicist
  - Transport the physics analysis code to the data
  - Transparently - so that it feels just like local data access
  - Just ship histogram contents back to the physicists desktop (on demand)
- Allows remote analysis with modest network bandwidth
- Allows user to “feel” as if using local machine even when accessing remote data.



Extensible via Plugins

- Plugins can:
  - Define experiment specific utilities (event display, analysis utilities, specialized tables).
  - Define data interfaces to handle new types of data.
  - Define new plotting routines (e.g. to display special display).
  - Add menus, create control areas, consoles, and output pages.
  - Plugins will be even more flexible in JAS 3.0
    - Entire application will become a set of cooperating plugins in the “FreeHEP application framework”

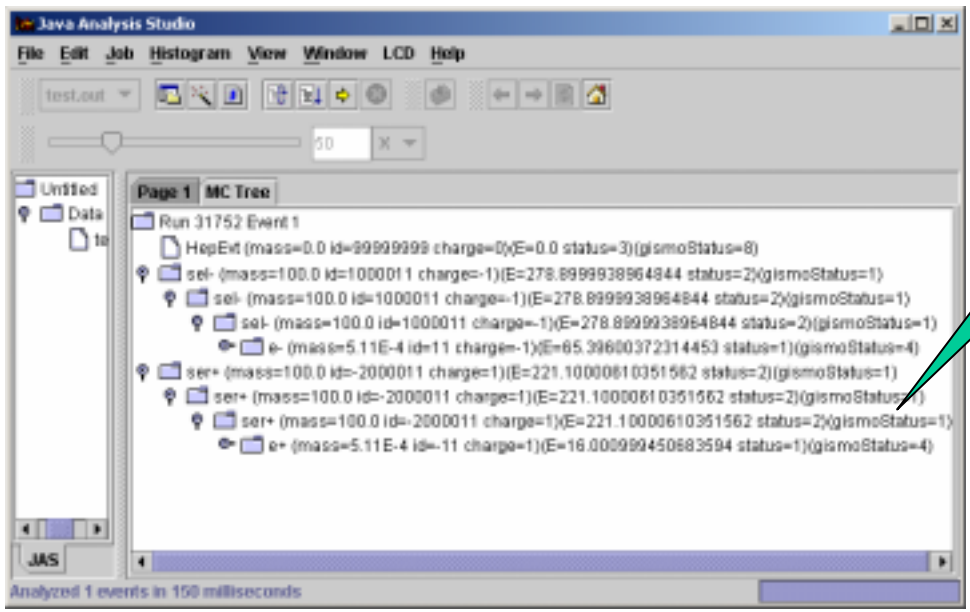
JAS and Linear Collider

- History
  - JAS has been used for Linear Collider Physics studies in US for 3+ years
- Usage
  - Reconstruction
    - Entire LCD reconstruction program written in Java
      - Track finding+fitting
      - Cluster finding
      - Vertex finding (ZVTop)
      - Fast (parameterized Monte-Carlo)
    - Can be run standalone – or inside JAS
      - No explicit dependence on JAS

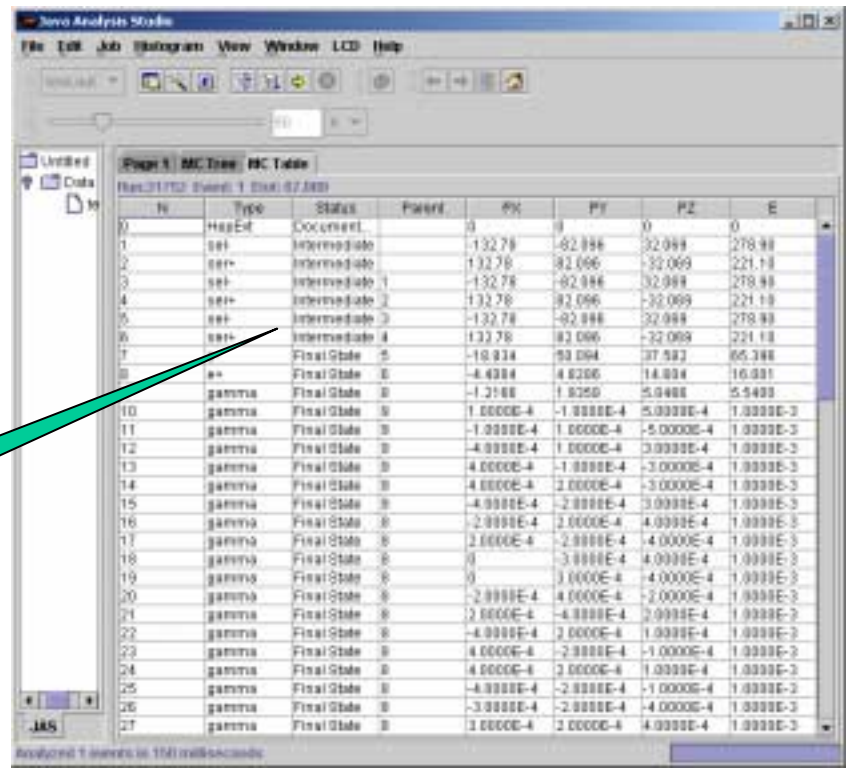
JAS + Linear Collider

- Usage cont.
  - IO Formats
    - DIM's created for 2 different data formats
      - SIO – Serial IO – simple XDR based format ideal for interchange with other programs (Geant4, Gismo, Root etc)
      - LCD – random access format optimized for high-performance data analysis
    - Analysis/Reconstruction works equally well with either format (it doesn't see any difference)
  - Remote Data Access
    - Used to allow remote access to large volumes of MC data stored at SLAC and elsewhere.
  - Tools
    - MC particle viewer, event display, …

LCD Plugins

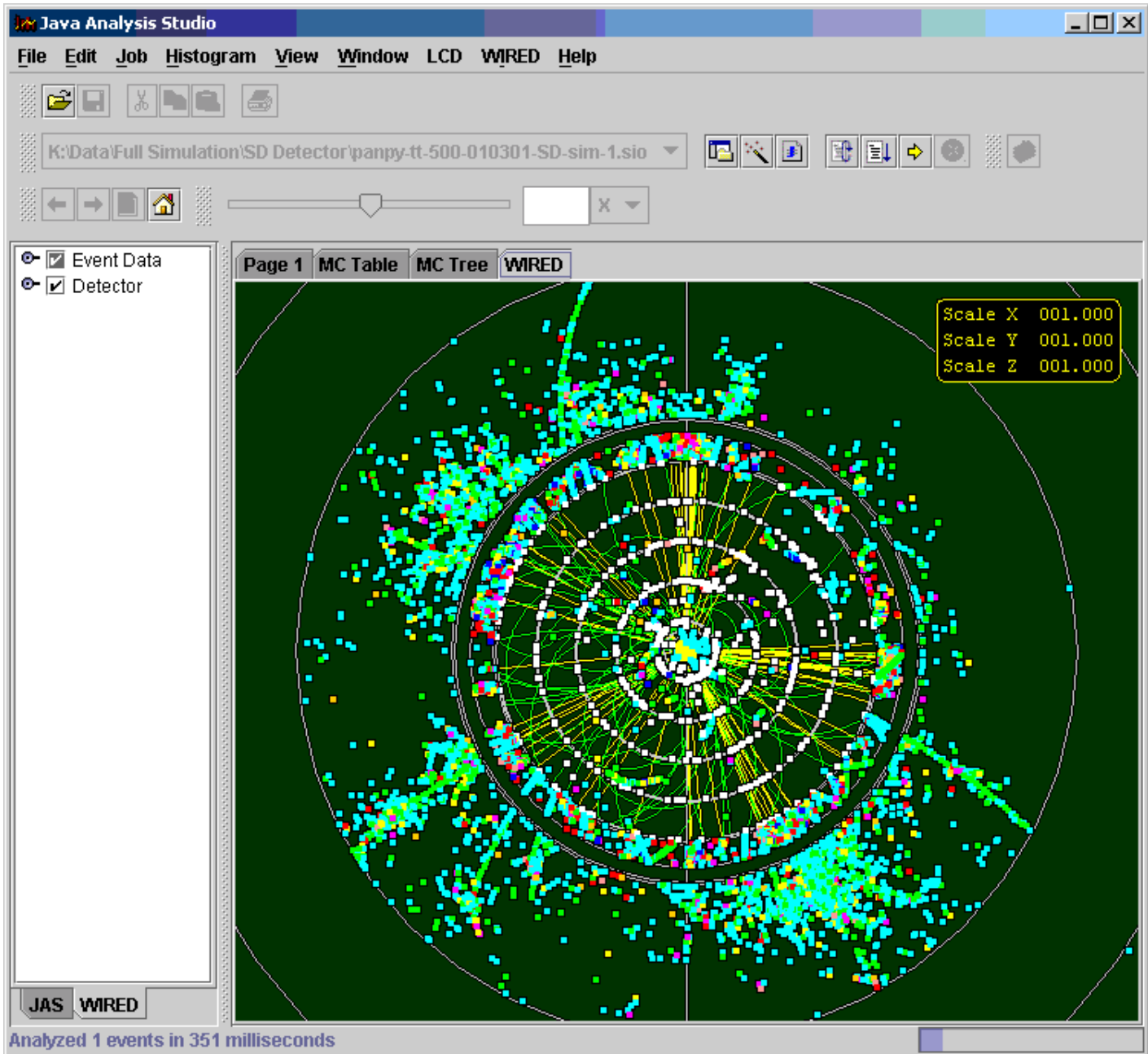


Particle decay tree



Particle tabulation

Wired Plugin for LCD



JAS + Wired

- WIRED
  - Excellent toolkit for developing very flexible event displays
  - WIRED used as LCD event display
    - took only a few days work
  - WIRED can now run as a JAS plugin
- Work is well along to merge JAS+WIRED base functionality into FreeHEP Java Library
- JAS (analysis, plotting) + WIRED (event display) will become plugins for “FreeHEP Analysis Studio”.

JAS + AIDA

- AIDA = Abstract Interface for Data Analysis
  - Joint effort between devlopers of Lizard/Anapne, Open Scientist, JAS, FreeHEP, and others.
  - Aims to provide common set of abstract interfaces for:
    - Histograming
    - N-Tuples
    - Fitting
    - Plotting
  - Will allow analysis code to run unaltered with different analysis tools
  - Will allow interchange of analysis objects (eg histograms) between tools
  - JAS 3 (future) aims to be completely “AIDA compliant”
  - JAS 2 (present) is phasing in AIDA support
    - Import/export of AIDA Histograms, Ntuples via XML
    - N-Tuple tools based on AIDA interfaces

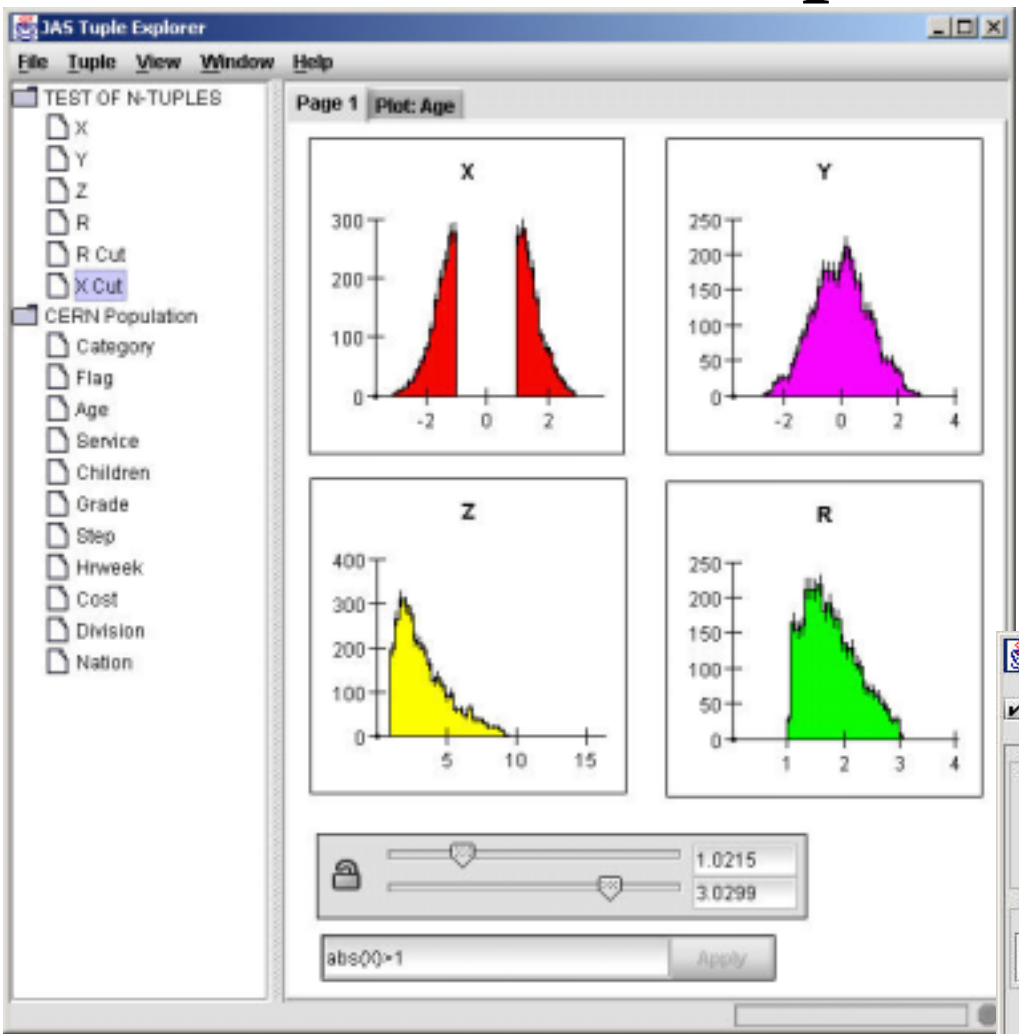
JAS Tuple Explorer

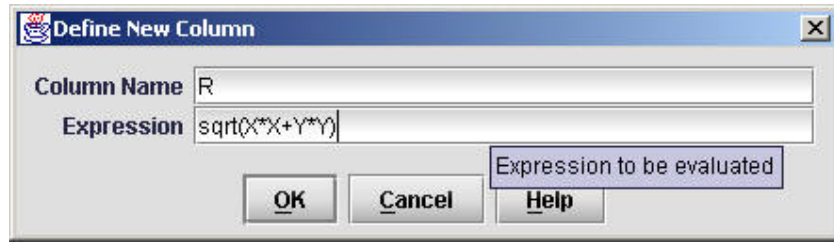
- AIDA compliant
  - Based on AIDA N-tuple
  - Will be able to exchange data/plots with other AIDA applications
- Simpler tool for first time users
  - No remote data access
  - Only support N-Tuple access
- Runs now as standalone application
  - Will also run as plugin in full JAS 3.0
  - Based on JAS 3.0/FreeHEP application framework

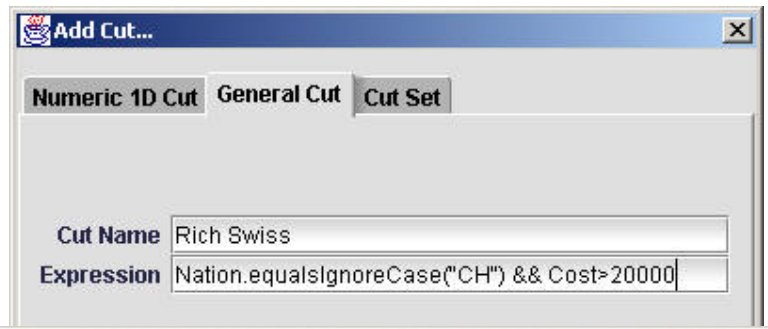
JAS Tuple Explorer - Features

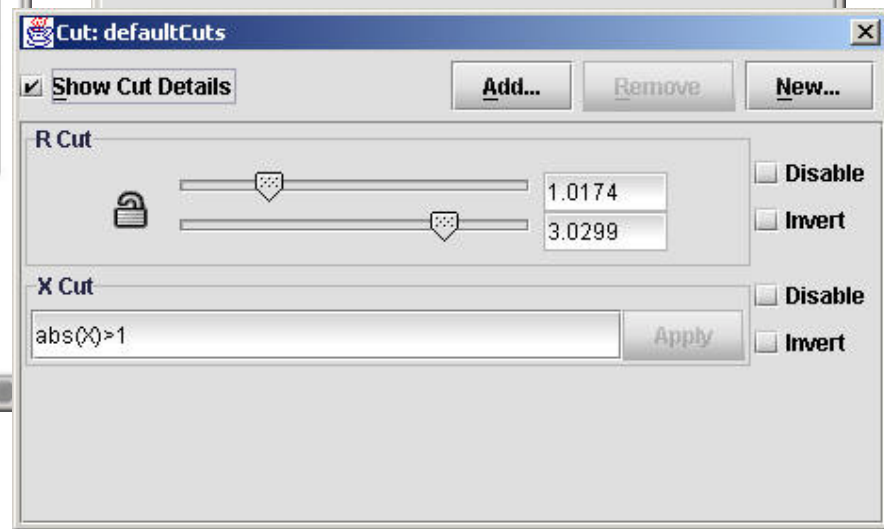
- Many data formats supported
  - PAW files, Root files, SQL Database, ASCII text files
  - Uses JAS DIM interface – so easy to add new formats
  - Supports very large (too big for memory) Ntuples
  - Columns may be int, float, double, boolean, String, Date, Object…
- Built-in expression compiler/evaluator
  - Allows new columns to be defined on the fly
- 1D, 2D histograms, profile plots, scatter plots
  - Multiple overlays on same plot
- Dynamic Cuts – based on expression or sliders
- N-tuple Tabulation – supports large N-tuples
- Plots and Cuts can be arranged on page
  - Drag and drop for easy page building
- Highly extensible – easy to add new cuts/plot types/etc

JAS Tuple Explorer





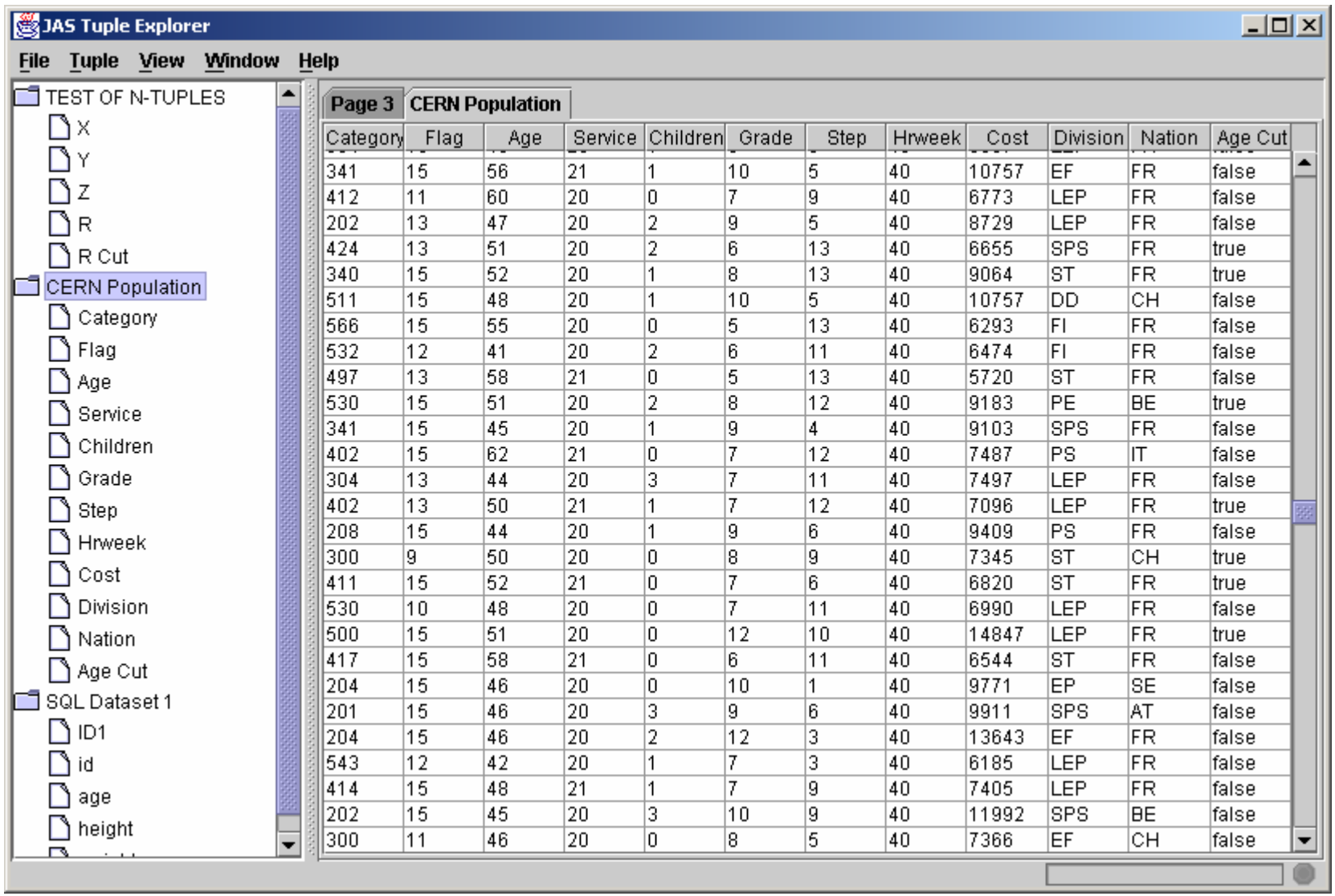




More Info:

- http://jas.freehep.org/documentation/TupleExplorer/

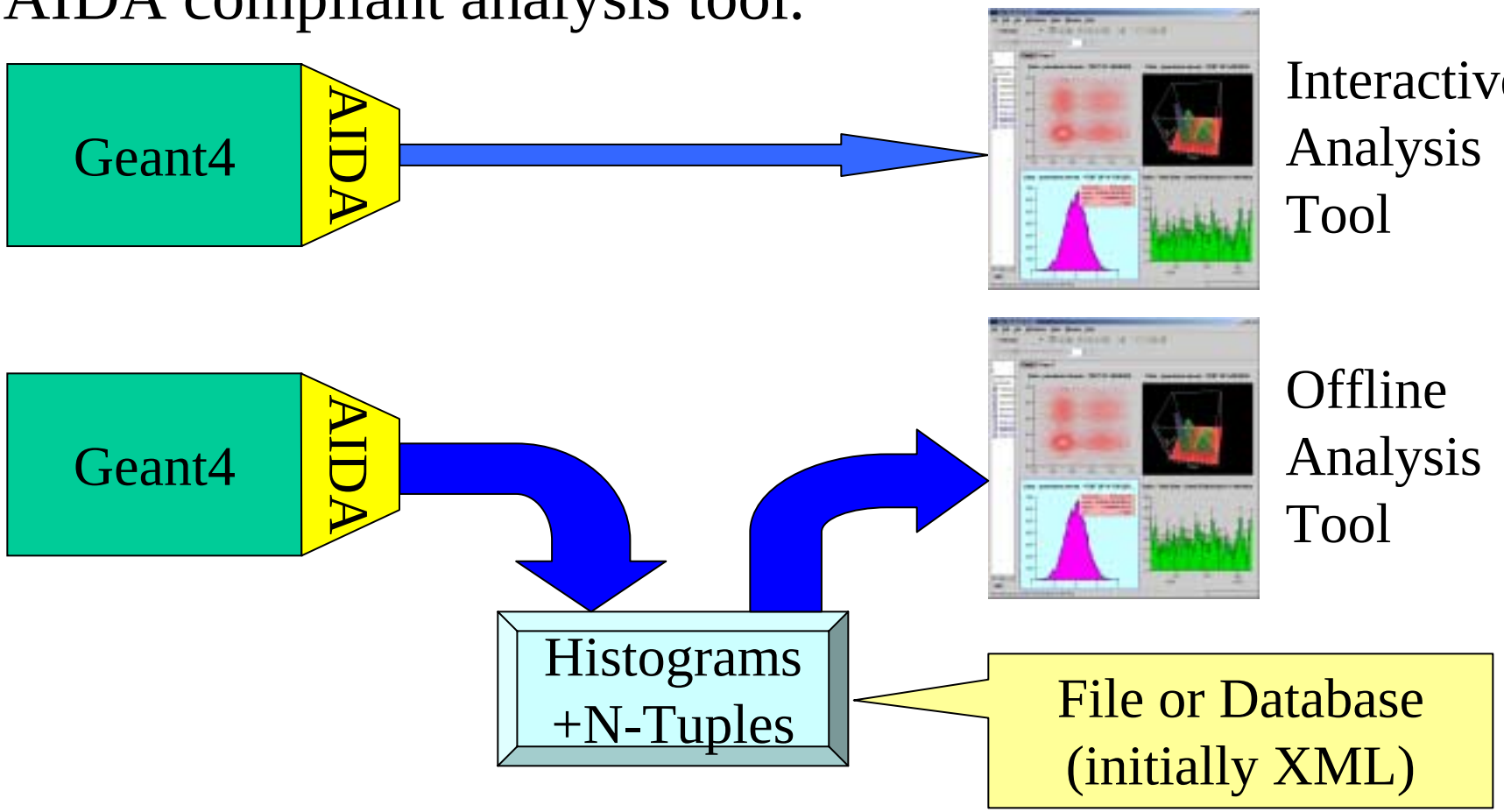
JAS Tuple Explorer



Category	Flag	Age	Service	Children	Grade	Step	Hrweek	Cost	Division	Nation	Age Cut
341	15	56	21	1	10	5	40	10757	EF	FR	false
412	11	60	20	0	7	9	40	6773	LEP	FR	false
202	13	47	20	2	9	5	40	8729	LEP	FR	false
424	13	51	20	2	6	13	40	6655	SPS	FR	true
340	15	52	20	1	8	13	40	9064	ST	FR	true
511	15	48	20	1	10	5	40	10757	DD	CH	false
566	15	55	20	0	5	13	40	6293	FI	FR	false
532	12	41	20	2	6	11	40	6474	FI	FR	false
497	13	58	21	0	5	13	40	5720	ST	FR	false
530	15	51	20	2	8	12	40	9183	PE	BE	true
341	15	45	20	1	9	4	40	9103	SPS	FR	false
402	15	62	21	0	7	12	40	7487	PS	IT	false
304	13	44	20	3	7	11	40	7497	LEP	FR	false
402	13	50	21	1	7	12	40	7096	LEP	FR	true
208	15	44	20	1	9	6	40	9409	PS	FR	false
300	9	50	20	0	8	9	40	7345	ST	CH	true
411	15	52	21	0	7	6	40	6820	ST	FR	true
530	10	48	20	0	7	11	40	6990	LEP	FR	false
500	15	51	20	0	12	10	40	14847	LEP	FR	true
417	15	58	21	0	6	11	40	6544	ST	FR	false
204	15	46	20	0	10	1	40	9771	EP	SE	false
201	15	46	20	3	9	6	40	9911	SPS	AT	false
204	15	46	20	2	12	3	40	13643	EF	FR	false
543	12	42	20	1	7	3	40	6185	LEP	FR	false
414	15	48	21	1	7	9	40	7405	LEP	FR	false
202	15	45	20	3	10	9	40	11992	SPS	BE	false
300	11	46	20	0	8	5	40	7366	EF	CH	false

JAS+AIDA+Geant 4

- Geant 4 will use AIDA to allow it to interoperate with any AIDA compliant analysis tool.



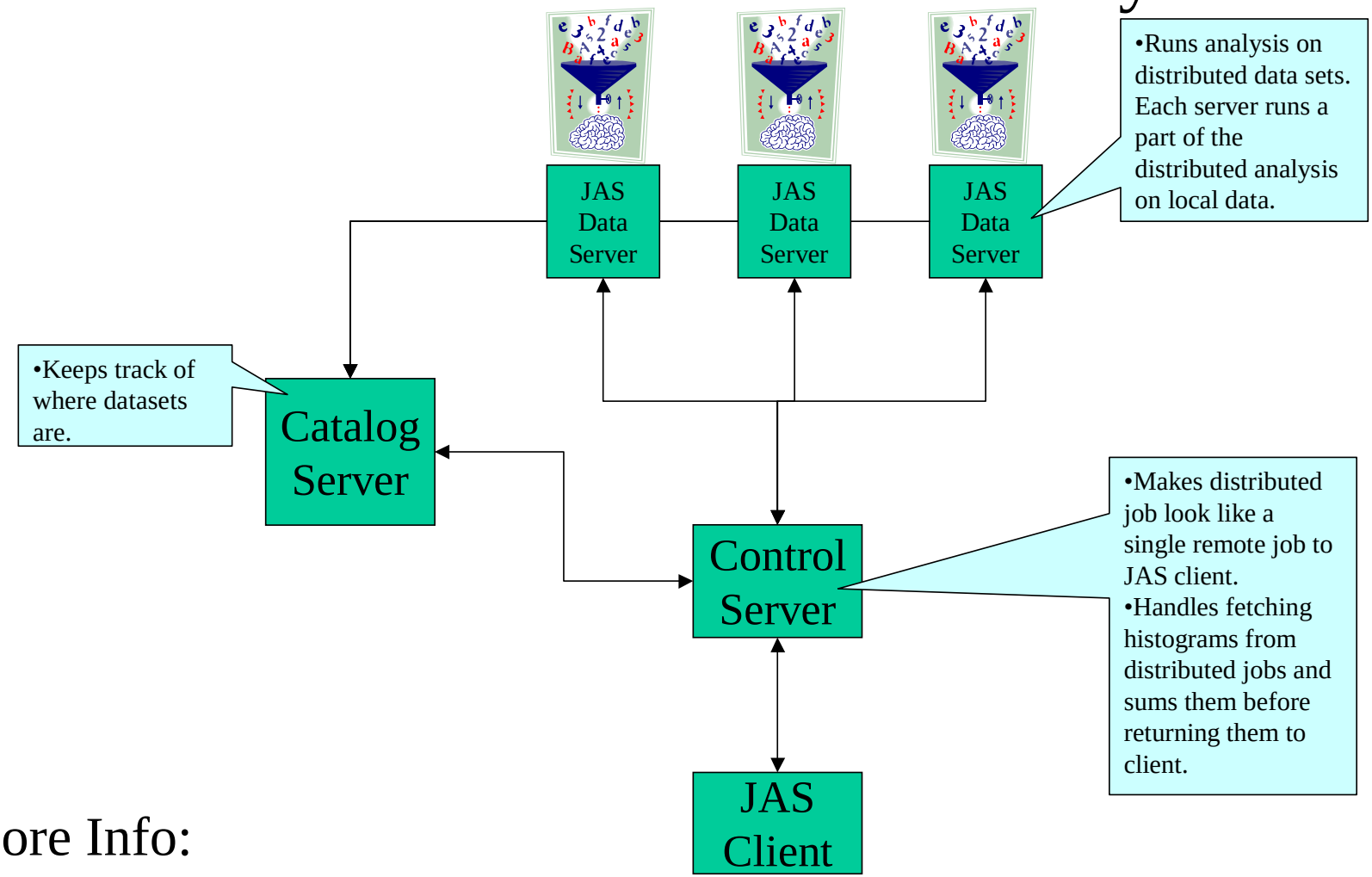
- Similar model could work for any simulation or reconstruction program

JAS + GRID

- Prototype system for distributing analysis on a farm of machines is now available
  - Increase throughput by distributing data across many machines
  - Increase processing power by exploiting many CPU's
- Future Plans
  - Integrate with GRID services including
    - Distributed authentification services
    - Data catalog services
    - Resource locator services
  - Working with others working on similar projects
    - For example "BlueOx" from Jeremiah Mans

Distributed Analysis

- Current prototype allows interactive analysis to be performed on ~50 nodes simultaneously.



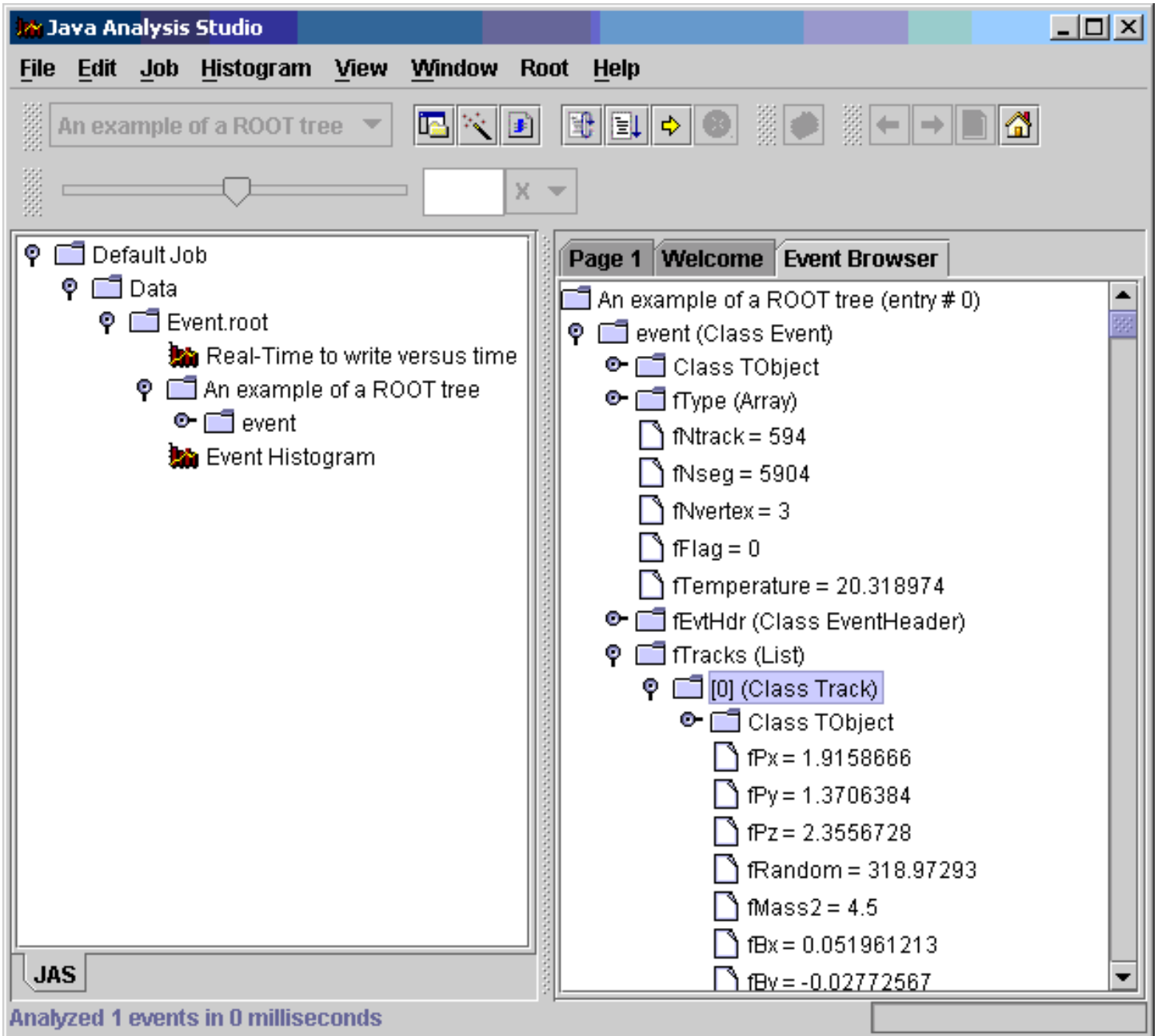
More Info:

•http://jas.freehep.org/documentation/DistributedComputing/

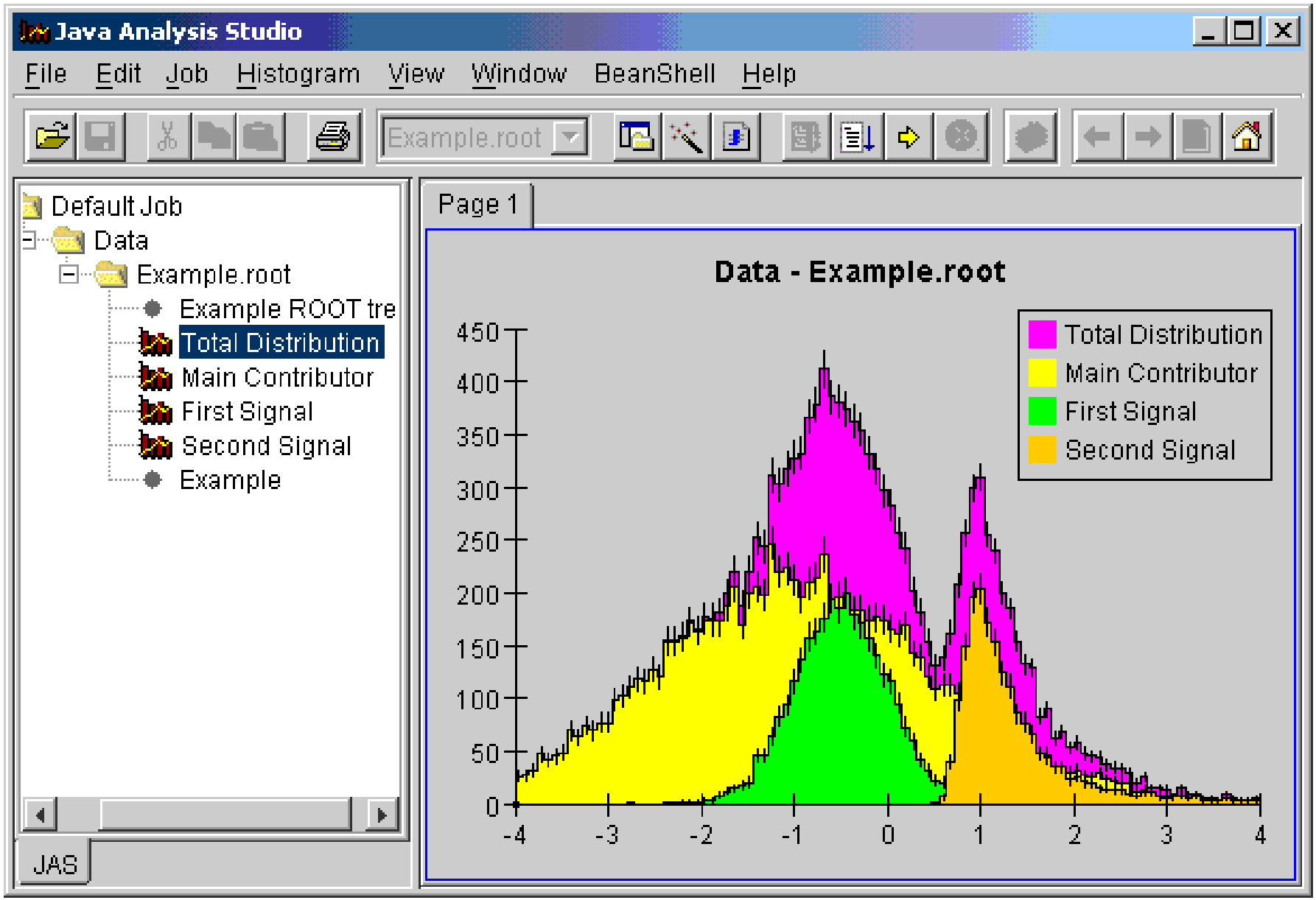
JAS+Root

- Root Data Interface Module (DIM) exists
  - Allows Root Data to be read and analyzed in JAS
    - Files must be written with Root 3.0 or later
    - Full support for user-defined objects
    - Based on Java implementation of Root IO from FreeHEP Java library
      - Current implementation is slow, *much* faster version will be available by the end of 2001

Root Object Browser (JAS Plugin)



Root Histogram Viewer



JAS Future

- JAS 3.0
  - Will use FreeHEP/plugin architecture
  - Will introduce:
    - Fully AIDA compliant analysis environment
    - Scripting – probably using Jython
    - Tuple Explorer integrated into JAS
  - Improvements to JAS 2.2.x will continue in parallel to JAS 3 development
- Manpower
  - Max Turri (SLAC computing services) has now joined JAS team (approximately full-time)
    - Anticipate further increases in manpower in near future
  - Modular design enables us to take advantage of contributions from FreeHEP project, Babar, LCD and others.

Conclusions

- JAS 2.2.x is a stable release
  - Used extensively for US linear collider physics studies
  - JAS + Java makes excellent rapid design tool for studies of analysis and reconstruction strategies
- Many new features coming in JAS 3.0
  - Will combine FreeHEP + JAS + WIRED
  - Continue to emphasize inter-operability with other programs
- More Info:
  - http://jas.freehep.org