

org.lcsim
Reconstruction and Analysis
Framework for ILC

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SLAC

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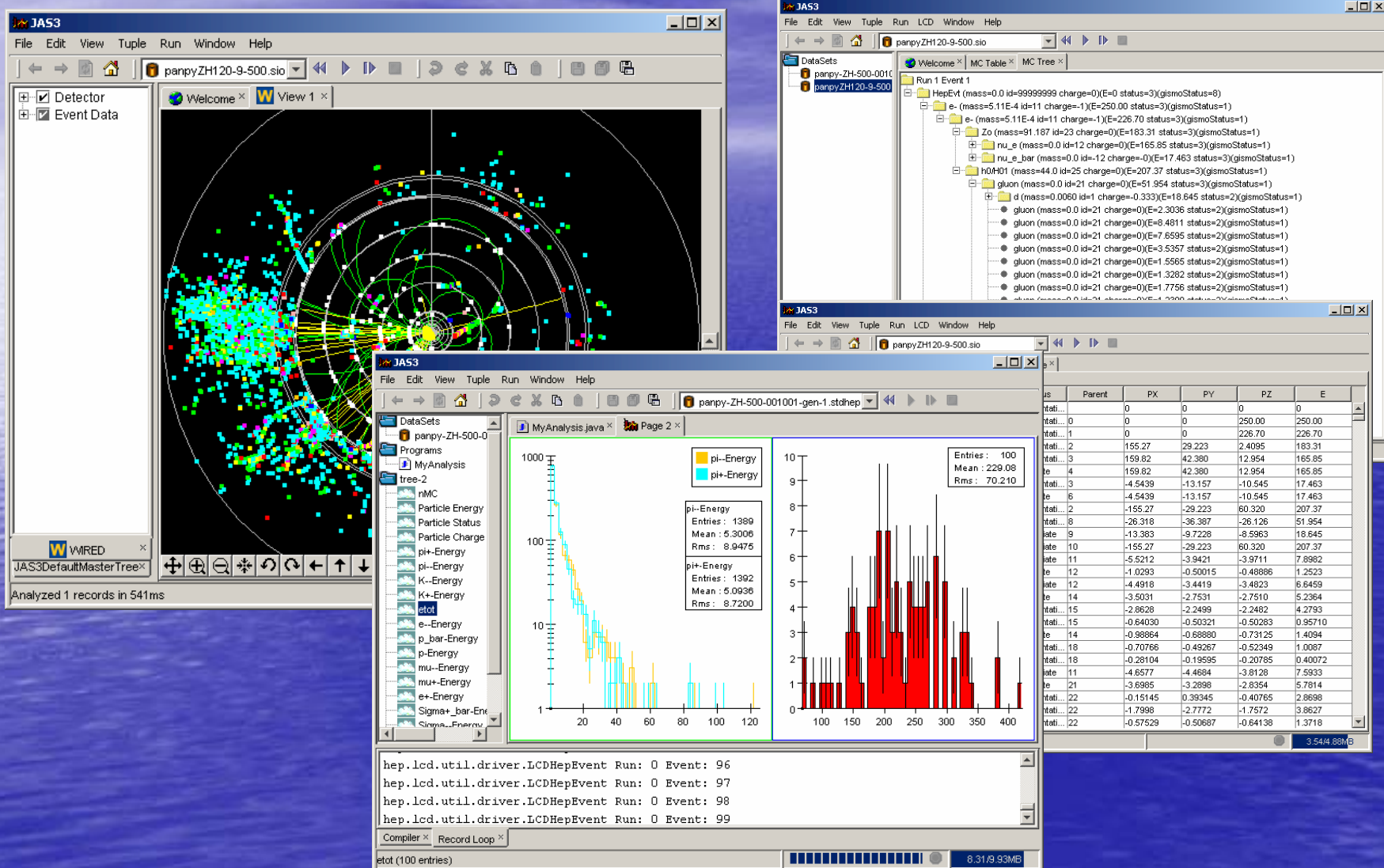
Contents

- History
- Goals
- Key Features
- Status
- Plans
- How to get started
 - This is a very compressed version of talks given at the LC simulation workshop preceding this meeting
 - <http://www-conf.slac.stanford.edu/lcsim05/>

History

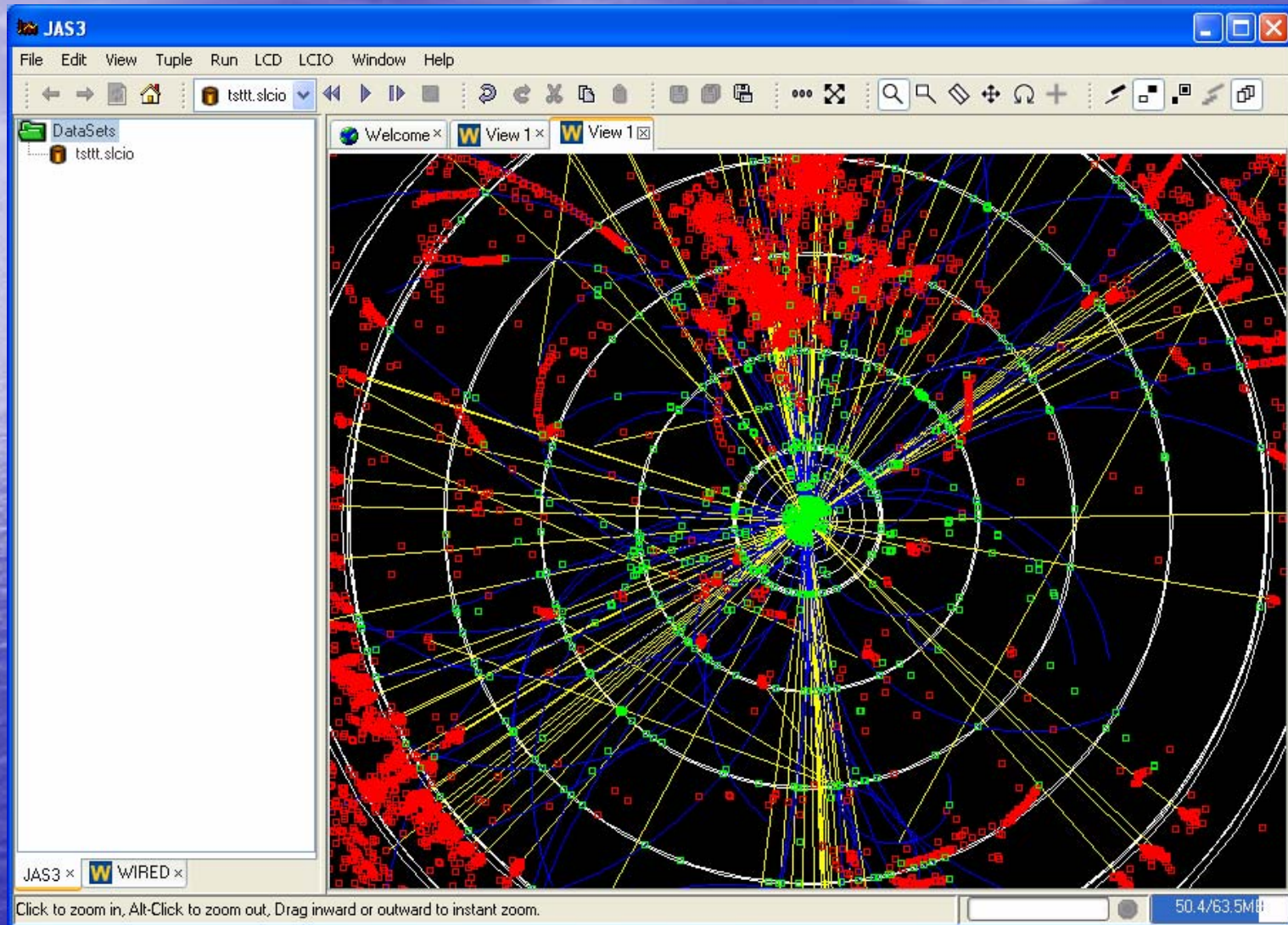
- hep.lcd framework used for 5+ years
 - Includes FastMC, Tracking, Clustering, Vertex Finding, Analysis Tools, Event Display, Beam-background Overlay
 - Still working and in use but does not comply with recently developed international standards, particularly LCIO
- LCIOPlugin for JAS3 provides used for >1 year
 - LCIO compatibility, Event Display, Event browser, limited analysis capabilities.

hep.lcd analysis tools



- Tutorial: <http://jas.freehep.org/jas3/Tutorial/index.html>

LCIOPlugin with WIRED4



LCIOPlugin with WIRED4

JAS3

File Edit View Tuple Run LCIO Window GridClientPlugin Help

simdet.slcio

Selection

Actions

Zoom into region

Picked objects (1): Options...

| Type | Points | Code |
|---------|--------|---------|
| Neutral | 2 | 3965704 |

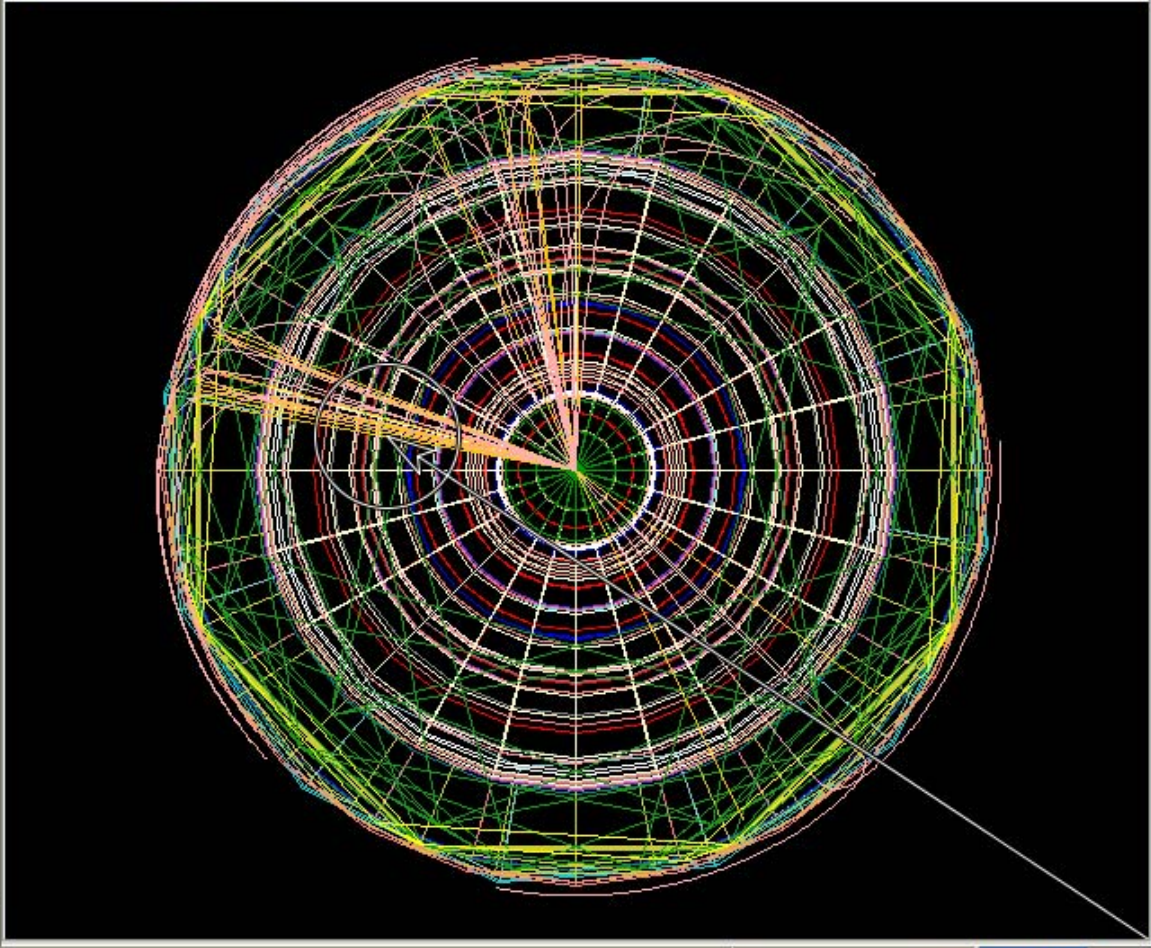
Attributes of picked object (5): Options...

| Name | Value | Unit | Node |
|--------|-----------|------|-------------------------------------|
| color | | | <input type="checkbox"/> |
| drawAs | Line | | <input type="checkbox"/> |
| energy | 0.67116 | | <input checked="" type="checkbox"/> |
| layer | Particles | | <input type="checkbox"/> |
| type | 2 | | <input checked="" type="checkbox"/> |

JAS3 x WIRED x

Hover over or near object to show information.

27.4/43.1MB



org.lcsim Goals

- org.lcsim is designed to combine best of hep.lcd and LCIOPlugin
 - Designed to interoperate with both US developed tools (e.g. SLIC, LCG4) and other international LC tools, Mokka, Jupiter, Marlin, etc.
- Retain core functionality from hep.lcd package
 - Full suite of reconstruction and analysis tools available to all LCIO users
- Update to use LCIO for IO and as basis for simulation, raw data and reconstruction event formats
 - Provide some user friendly features on top of LCIO structures
- Update/simplify framework using experience from hep.lcd
 - Provide good tutorial documentation
- Internationalization
 - Try to make package independent of detector, geometry assumptions so can work with any detector
 - Read properties of detectors at runtime
- Update to Java 1.5
- Ability to run standalone or in JAS3

org.lcsim Key Features: Conditions

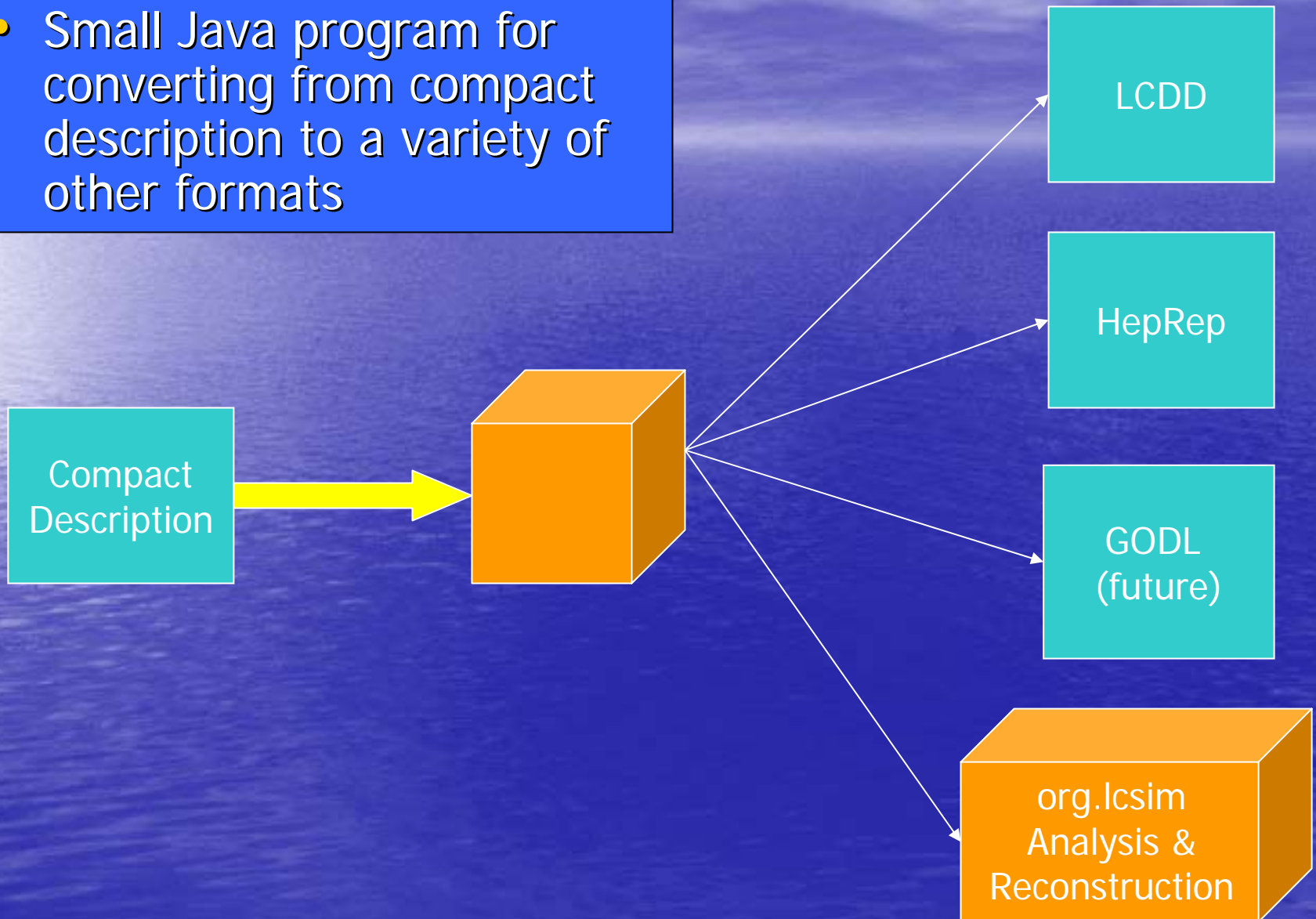
- Using “detector name” in LCIO file
 - Provides access to a extensible set of conditions:
 - Detector Geometry
 - Algorithm Specific Constants
 - E.g. FastMC smearing parameters
 - Doesn’t make assumptions about format of data
 - Doesn’t rely on internet access, or database
- Detector Constants stored in .zip file
 - Can be on users machine
 - Can be downloaded (and cached) from web
 - Easy to create and share new detector definitions

org.lcsim Geometry Access

- Uses “compact detector description” (xml)
 - Accessed from .zip file along with other conditions
 - Supports an extensible set of shapes, segmentation schemes
 - Scales from idealized detectors to more complex geometries
- org.lcsim provides
 - simple API for access to required geometry from reconstruction program
 - Ability to decode hit ID's stored in LCIO files

GeomConverter

- Small Java program for converting from compact description to a variety of other formats



org.lcsim Drivers, Event Access

- Reconstruction and Analysis Code is written by extending Driver class.
 - Most code extends only a single method
 - process(EventHeader event)
 - which passes in EventHeader through which all event data, conditions, and geometry is accessed.
- EventHeader maintains features which users liked from old hep.lcd framework, but adds compatibility with LCIO events
 - All LCIO data is accessible.
 - Arbitrary user data, either collections or single objects can be added to event.
 - Event can be written out
 - Currently only objects understood by LCIO are written out
 - MCParticles, Hits, Clusters, Tracks, Reconstructed Particles (can include Jets, Vertices)
 - Maybe be able to use LCIO "GenericObjects" to write out more in future.

org.lcsim: JAS Plugin

The screenshot shows the JAS3 application window. The top menu bar includes File, Edit, View, Tuple, Loop, LCIO, Window, and Help. The toolbar contains navigation icons and a file icon. The left sidebar shows a tree view of DataSets, Programs, and aida31133aida. The main window displays the 'Run:0 Event: 0' information. The 'LCIO Event Header' section shows the following details:

| Field | Value |
|---------------|------------------------------|
| Run | 0 |
| Event | 0 |
| Time Stamp | Fri Mar 11 14:25:13 PST 2005 |
| Detector Name | sdjan03 |

The 'Blocks' section shows a list of blocks with their names and types:

| Name | Type |
|--------------------------|---|
| HcalEndcapHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| HcalBarrHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| EcalEndcapHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| EcalBarrHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| MuonEndcapHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| TkrBarrHits | org.lcsim.util.lcio |
| EcalBarrHits | org.lcsim.util.lcio |
| MuonBarrHits | org.lcsim.util.lcio |
| LumEndcapHits | org.lcsim.util.lcio |
| EcalEndcapHits | org.lcsim.util.lcio |
| HcalEndcapHits | org.lcsim.util.lcio |
| HcalBarrHits | org.lcsim.util.lcio |
| EcalBarrHits | org.lcsim.util.lcio |
| MuonEndcapHits | org.lcsim.util.lcio |
| MuonBarrHits | org.lcsim.util.lcio |
| LumEndcapHits | org.lcsim.util.lcio |
| MCParticle | org.lcsim.event |

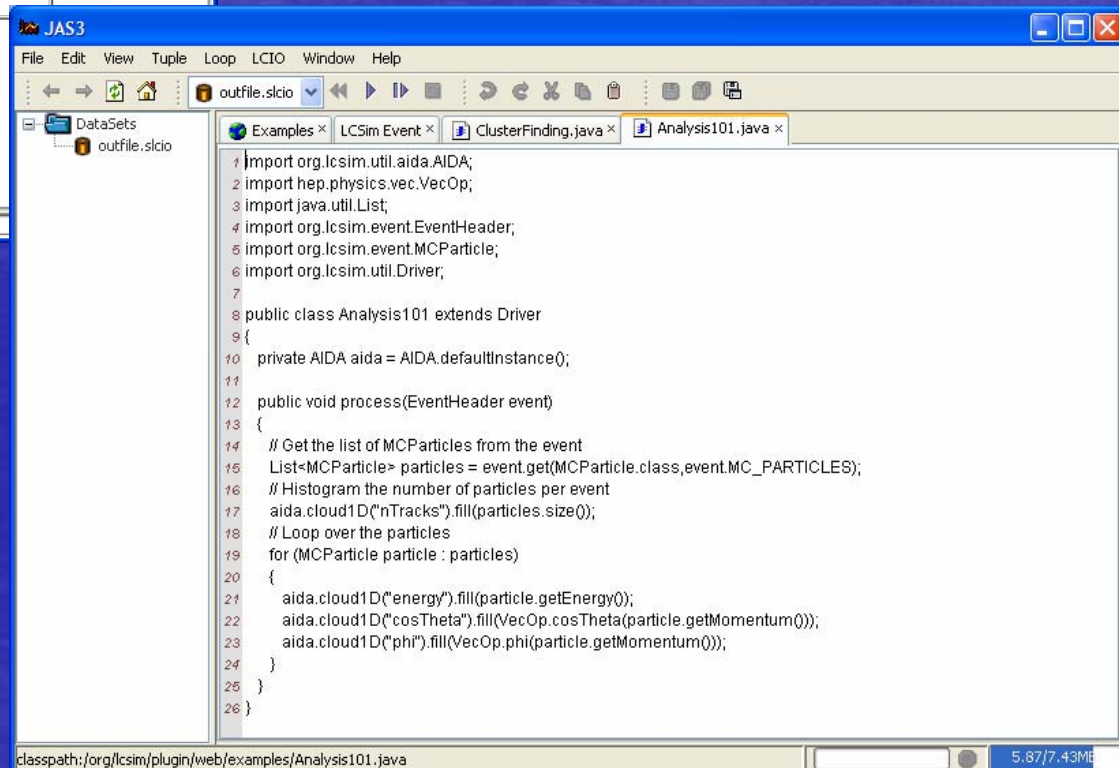
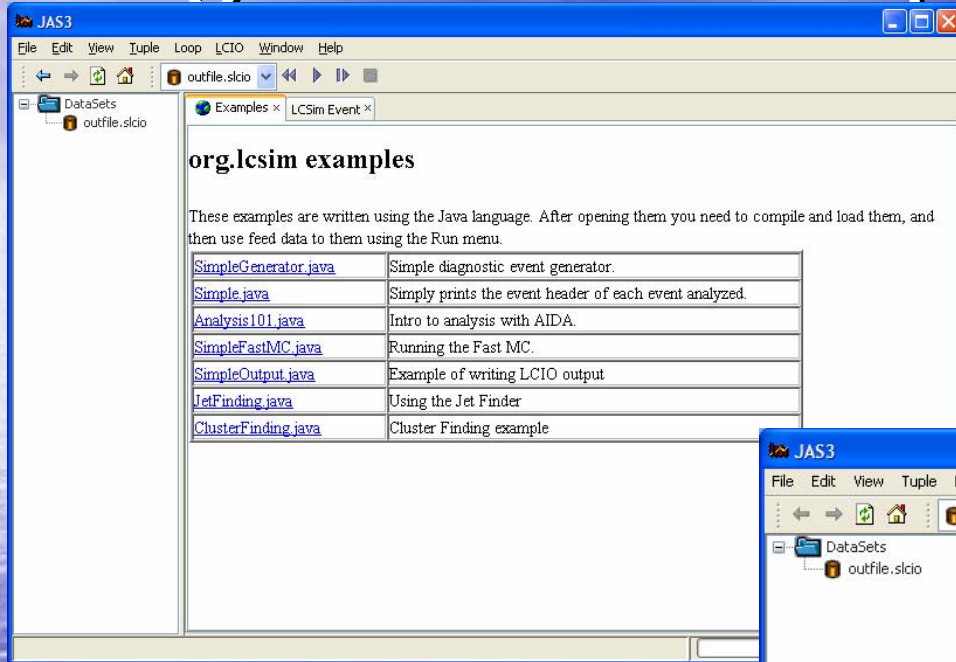
The status bar at the bottom indicates 'Analyzed 1 records in 406ms'.

The screenshot shows the JAS3 application window with the 'Collection: EcalBarrHits size:424 flags:a0000000' displayed. The table below shows the hit data for the selected event.

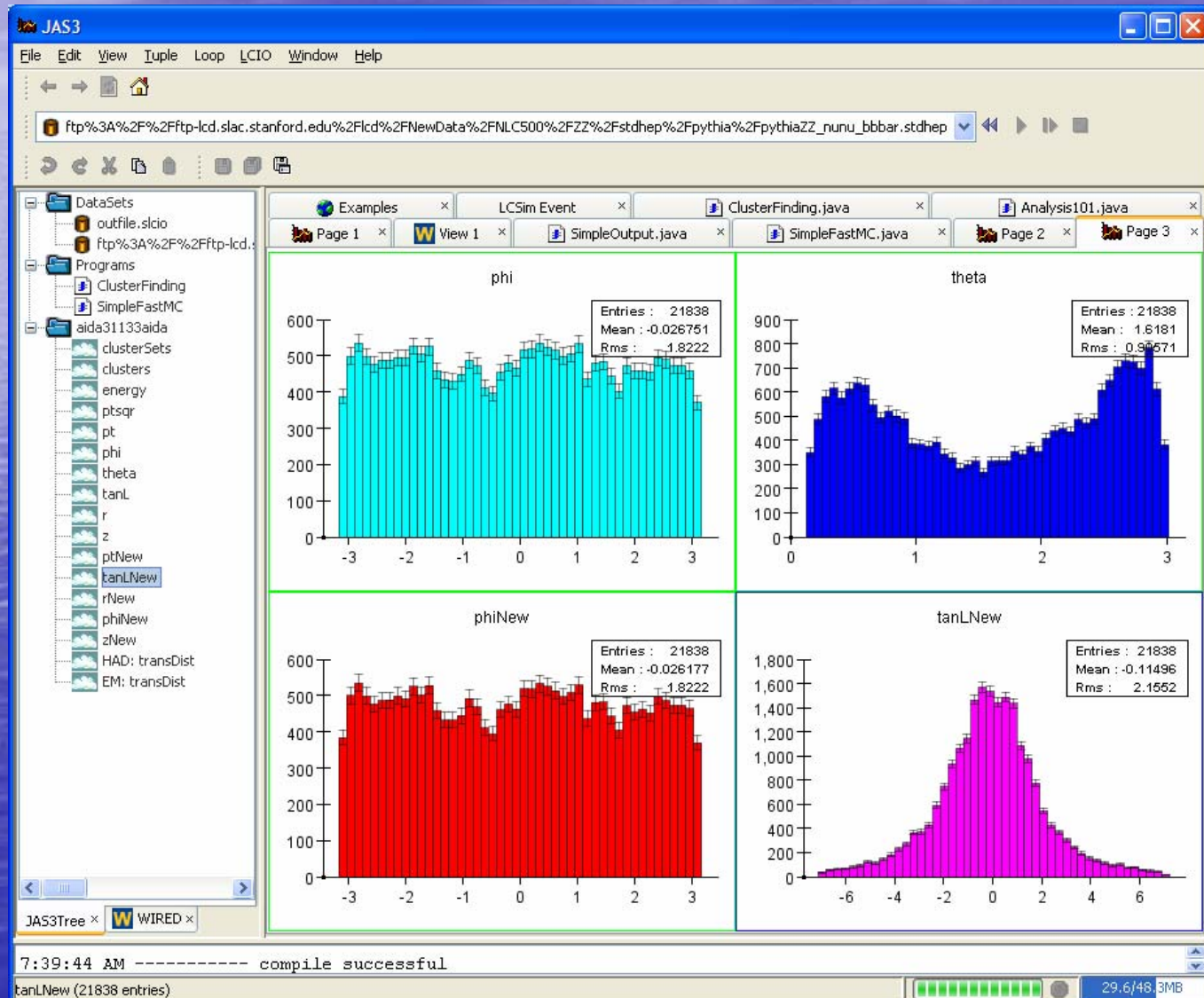
| layer | system | barrel | theta | phi | energy | x | y | z |
|-------|--------|--------|-------|------|-----------|---------|---------|--------|
| 0 | 2 | 0 | 333 | 1595 | 4.0386E-4 | 1210.1 | -395.70 | 426.89 |
| 1 | 2 | 0 | 333 | 1594 | 1.1317E-4 | 1213.4 | -401.80 | 428.57 |
| 9 | 2 | 0 | 341 | 1593 | 6.0089E-5 | 1249.8 | -419.05 | 398.53 |
| 1 | 2 | 0 | 333 | 1595 | .0025117 | 1214.9 | -397.26 | 428.57 |
| 2 | 2 | 0 | 333 | 1595 | 3.3759E-4 | 1219.7 | -398.81 | 430.24 |
| 0 | 2 | 0 | 416 | 881 | 1.1273E-4 | -1257.9 | -196.82 | 16.667 |
| 1 | 2 | 0 | 416 | 880 | 3.5485E-4 | -1263.6 | -192.87 | 16.733 |
| 2 | 2 | 0 | 416 | 880 | 1.1914E-4 | -1268.5 | -193.62 | 16.798 |
| 3 | 2 | 0 | 416 | 880 | 1.0678E-4 | -1273.5 | -194.38 | 16.863 |
| 4 | 2 | 0 | 416 | 880 | 1.3202E-4 | -1278.4 | -195.13 | 16.929 |
| 5 | 2 | 0 | 416 | 880 | 1.0821E-4 | -1283.3 | -195.89 | 16.994 |
| 6 | 2 | 0 | 416 | 880 | 1.4717E-4 | -1288.3 | -196.64 | 17.060 |
| 7 | 2 | 0 | 416 | 880 | 1.1575E-4 | -1293.2 | -197.40 | 17.125 |
| 8 | 2 | 0 | 416 | 880 | 1.2397E-4 | -1298.2 | -198.15 | 17.191 |
| 9 | 2 | 0 | 416 | 880 | 1.3174E-4 | -1303.1 | -198.90 | 17.256 |
| 10 | 2 | 0 | 416 | 879 | 1.1775E-4 | -1308.8 | -194.77 | 17.322 |
| 11 | 2 | 0 | 416 | 879 | 1.3348E-4 | -1313.7 | -195.50 | 17.387 |
| 12 | 2 | 0 | 416 | 879 | 3.6082E-4 | -1318.7 | -196.24 | 17.453 |
| 13 | 2 | 0 | 416 | 879 | 1.1621E-4 | -1323.6 | -196.97 | 17.518 |
| 14 | 2 | 0 | 416 | 879 | 1.0455E-4 | -1328.6 | -197.71 | 17.583 |
| 15 | 2 | 0 | 416 | 879 | 1.0607E-4 | -1333.5 | -198.45 | 17.649 |
| 16 | 2 | 0 | 416 | 879 | 1.2895E-4 | -1338.5 | -199.18 | 17.714 |
| 17 | 2 | 0 | 416 | 879 | 1.2762E-4 | -1343.4 | -199.92 | 17.780 |
| 18 | 2 | 0 | 416 | 879 | 1.0028E-4 | -1348.4 | -200.65 | 17.845 |

The status bar at the bottom indicates 'Analyzed 1 records in 406ms' and '7.22/7.43MB'.

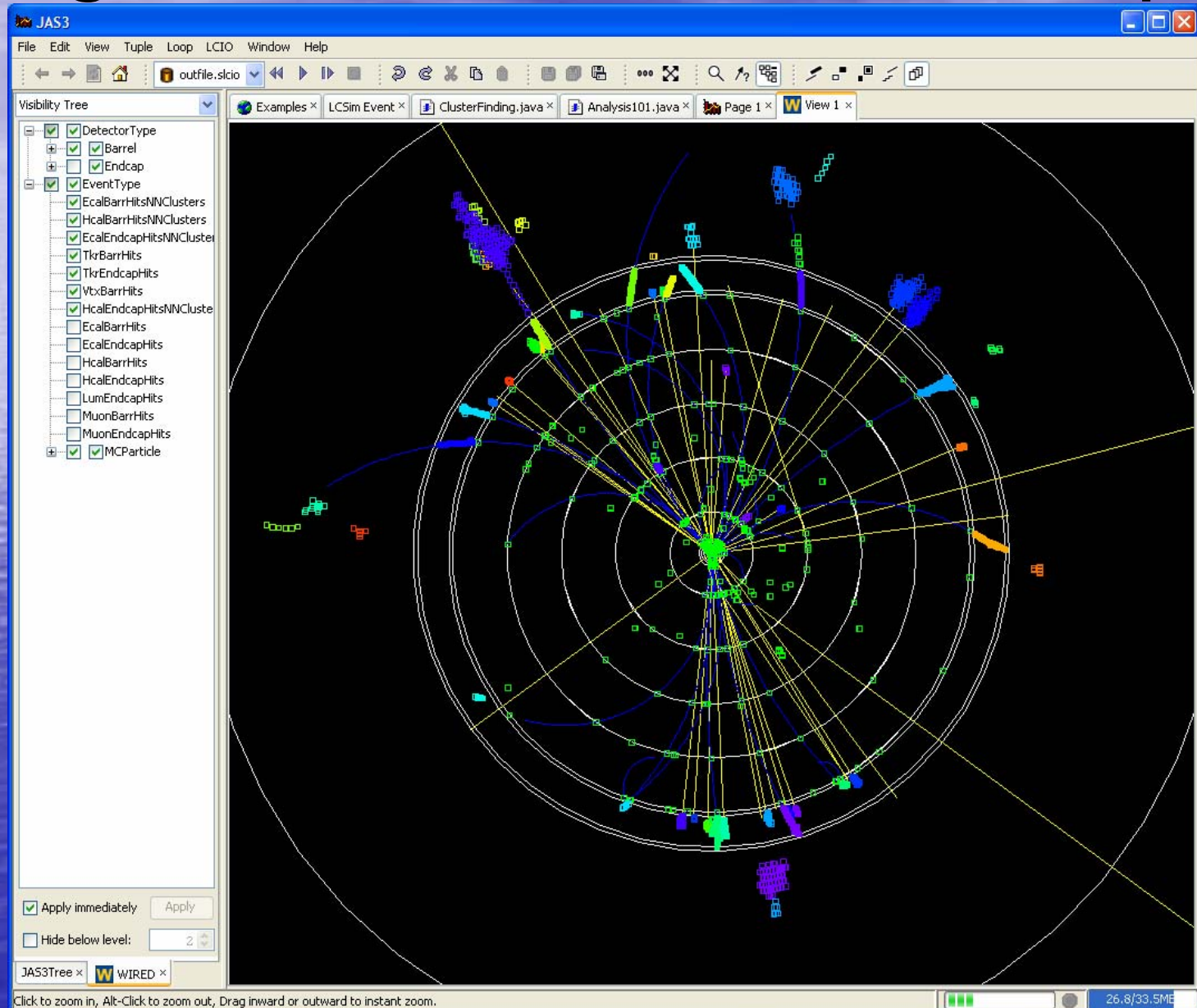
org.lcsim: Examples



org.lcsim: Plot Viewing



org.lcsim: WIRED event display



org.lcsim Status

- Physics Utilities - done
 - stdhep reader
 - 3, 4-vector utilities
 - diagnostic generator
 - Jet finder, event shape utilities
- Conditions framework – done
 - Ability to read detector constants from “zip” file
 - To define new detector just create new zip file and place on web
 - File is read and cached locally
 - Ability to read compact geometry file
- Driver framework – done
- Fast MC – done
- IO Framework – done
- Event Access – working, still being improved
- Event Display interface – mostly done
- Reconstruction
 - Clustering – done
 - Tracking – TRF - in progress, very nearly done
 - Vertex finding – needs port from hep.lcd
 - Hit digitization – needs port from hep.lcd
 - Swimmer, cluster analysis tools, pfa, etc. – needs port from hep.lcd

org.lcsim: To Do List

- Improve Documentation/Tutorials
- Continue to (work with others to) migrate reconstruction algorithms from hep.lcd
 - Strongly encourage people to work in CVS:
 - If we make changes to event access *etc.* we can update all code in CVS using refactoring tools
- Remove divergences from LCIO standard
 - 100% compatible with LCIO file format, philosophy
 - Attempts to make event access easier should be merged back into LCIO standard interfaces?
 - LCIOPlugin and org.lcsim plugin should be merged
 - Look at possibility of shared geometry API with Marlin
- Test ability to interoperate with other software, e.g. slic, marlin, mokka, jupiter, brahms, lelaps, etc.
- Produce new CD, hopefully well before Snowmass meeting.

More Information

- org.lcsim Home Page
 - <http://www.lcsim.org/software/lcsim/>
- To use you can just download JAS3, and then use the JAS3 Plugin Manager to install the org.lcsim Plugin
 - <http://confluence.slac.stanford.edu/display/ilc/Installing+JAS3>
- To add new software to the framework check out the software from CVS and build using “maven”
 - <http://confluence.slac.stanford.edu/display/ilc/Building+org.lcsim+software>