org.lcsim
Reconstruction and Analysis framework for ILC Detectors

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org.lcsim: Contents

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- Geometry/Conditions/Detector system
- Reconstruction overview/status
- Using org.lcsim with JAS3
- Using org.lcsim with WIRED4
- Becoming an org.lcsim Developer
- Where next?

org.lcsim Goals

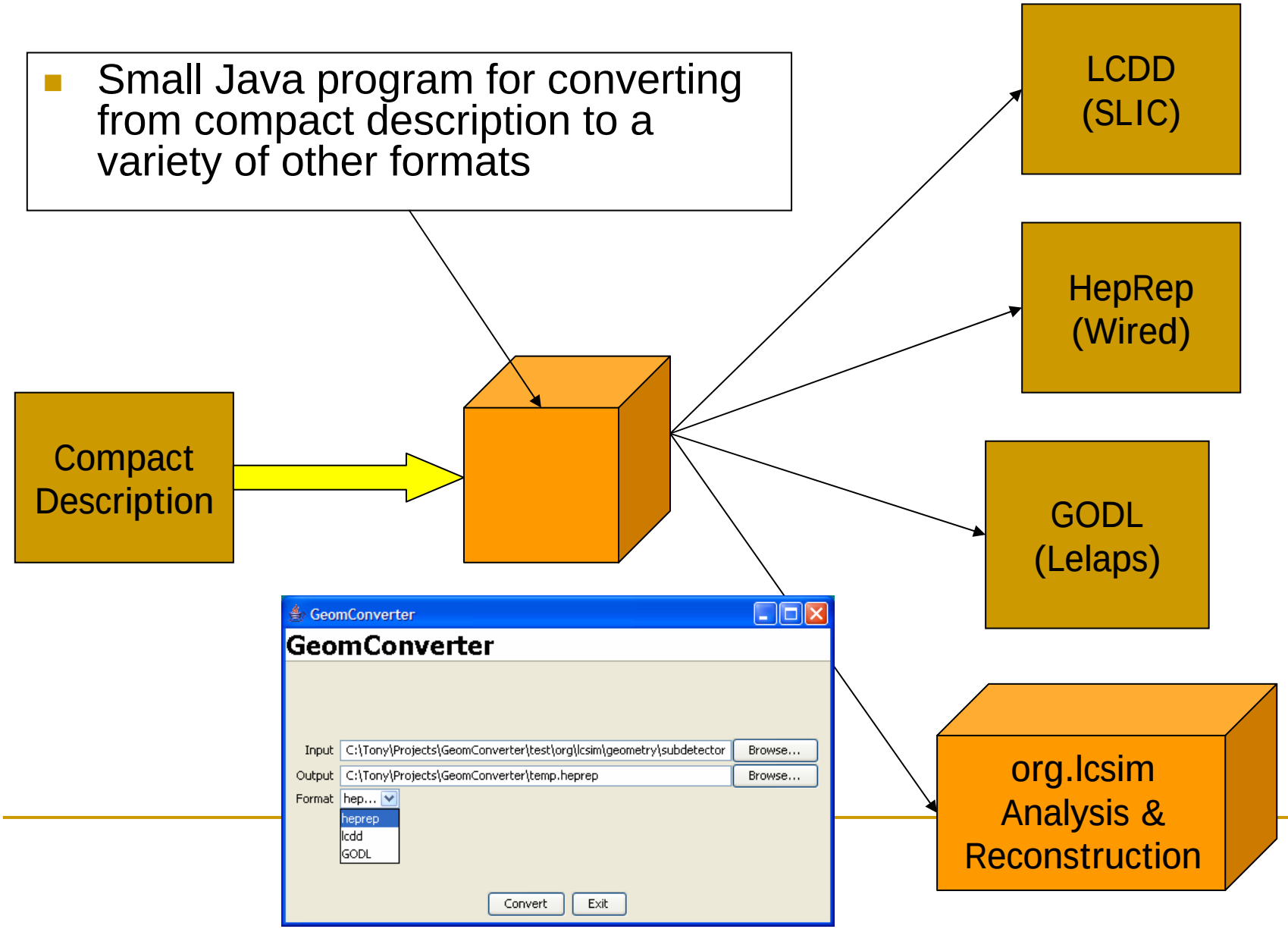
- “Second generation” ILC reconstruction/analysis framework
  - Builds on hep.lcd framework used since 1999
  - Full suite of reconstruction and analysis tools
- Uses LCIO for IO and as basis for simulation, raw data and reconstruction event formats
  - Isolate users from raw LCIO structures
  - Maintain full interoperability with other LCIO based packages
- Detector Independence
  - Make package independent of detector, geometry assumptions so can work with any detector
  - Read properties of detectors at runtime
- Written using Java (1.5)
  - High-performance but simple, easy to learn, OO language
  - Enables us last 10 years of software developments in the “real world”
- Ability to run standalone (command line or batch) or in JAS3 or IDE such as Netbeans, Eclipse

org.lcsim: Compact Geometry Description

- org.lcsim uses “Comact Geometry Description” to define detector
  - Simple XML format for describing ILC detectors
  - Handles typical ILC detector geometries
    - Range of detectors handled is extensible (by writing Java modules)
- Allows rapid prototyping of new detector geometries
- Does not require network access or installation of database software to run
- Automatic generation of full Geant4 LCDD geometry for full compatibility with SLIC

org.lcsim: Geometry Converter

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

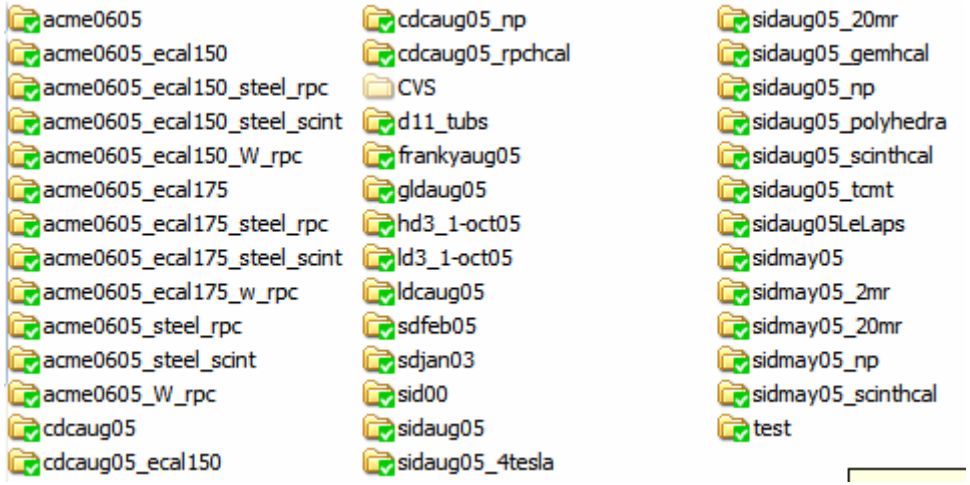


org.lcsim Conditions Data

- Provide access to a extensible set of conditions for each detector including:
  - 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 local database installation
- Detector Constants stored in .zip file
  - Typically contains:
    - Compact geometry file
    - Set of (ascii) constants for standard algorithms
  - Can additionally contain:
    - Arbitrary files (xml, ascii, binary) needed by other algorithms
    - Other geometry formats (HepRep, LCDD)
    - Full fieldmap
- To define a new detector just create a new .zip file.

Available Detector Descriptions

- Although detector descriptions can live anywhere we maintain a CVS repository of detector descriptions
  - Exported to org.lcsim web site for automatic download
- 40 detector variants as of July 2006
- Many SiD variants, but also some gld, ldc



- You are welcome to contribute more

Org.lcsim Reconstruction

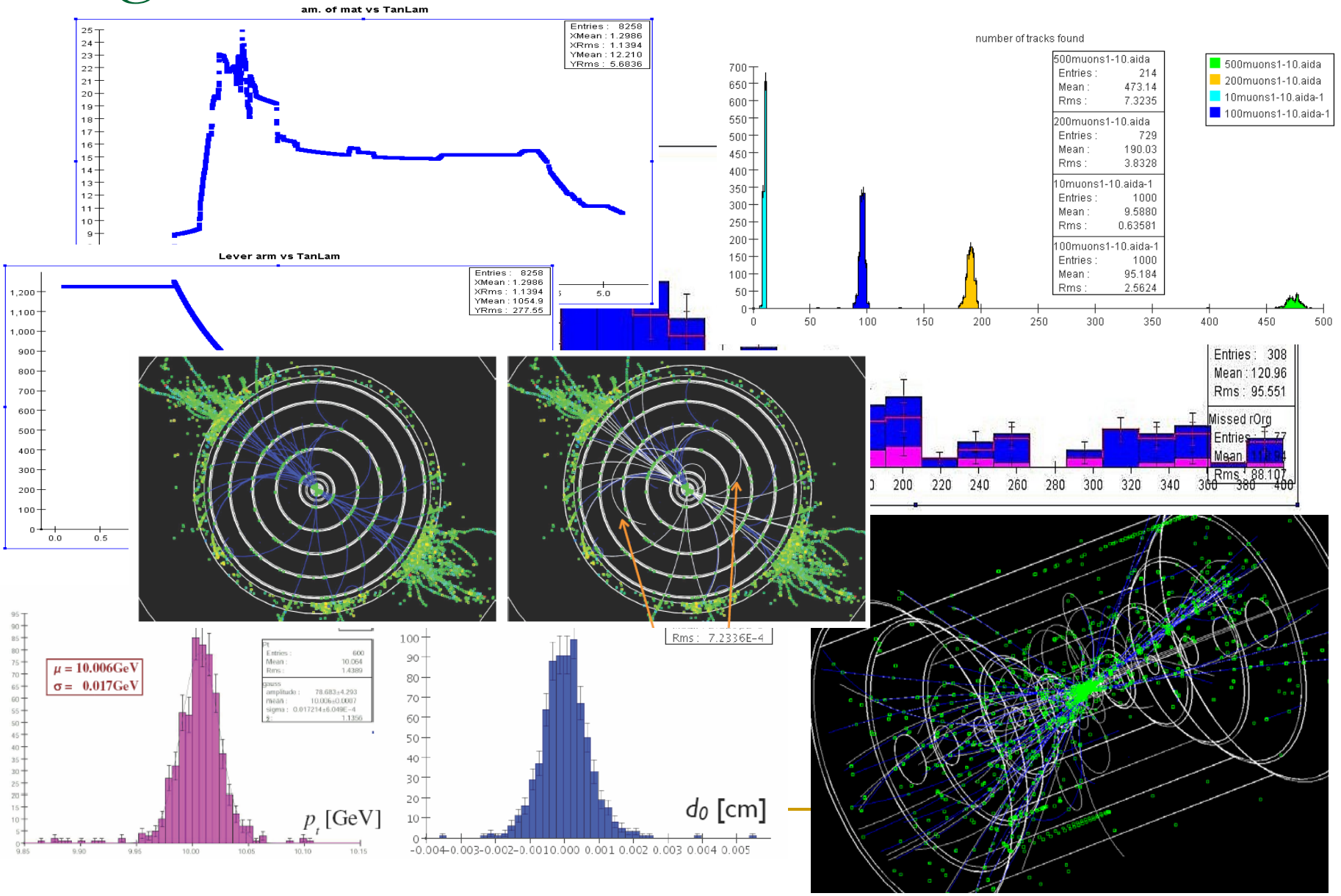
- Reconstruction package includes:
  - Physics utilities:
    - Jet finders, event shape routines
    - Diagnostic event generator, stdhep reader/translator
    - Histogramming/Fitting/Plotting (AIDA based)
    - Event Display
    - Processor/Driver infrastructure
  - Fast MC
    - Track/Cluster smearing
  - Reconstruction
    - Cheaters (perfect reconstruction)
    - Detector Response
      - CCDSim, Digisim
    - Clustering Algorithms
      - Cheater, DirectedTree, NearestNeighbour, Cone
    - Tracking Finding/Fitting Algorithms
      - TRF,
    - Muon Finding, Swiming
    - Vertex Finding (ZvTop)

org.lcsim: Contrib Area

- Goal of org.lcsim is not to provide “A single reconstruction package” but rather a framework into which reconstruction algorithms can be plugged.
- We encourage users to contribute code to the “contrib” area as soon as possible.
  - Important to encourage collaboration, reuse, and as learning tool.
- Many contributions added in last year:
  - HMatrix cluster analysis
  - VertexFitter
  - PFA algorithms/template
  - SODTracker
  - Garfield Tracker
  - Calorimeter Cell Ganging
  - FastMC improvements
  - Tracking finding/fitting
  - MIP Finder
  - Minimum Spanning Tree Clustering

org.lcsim results

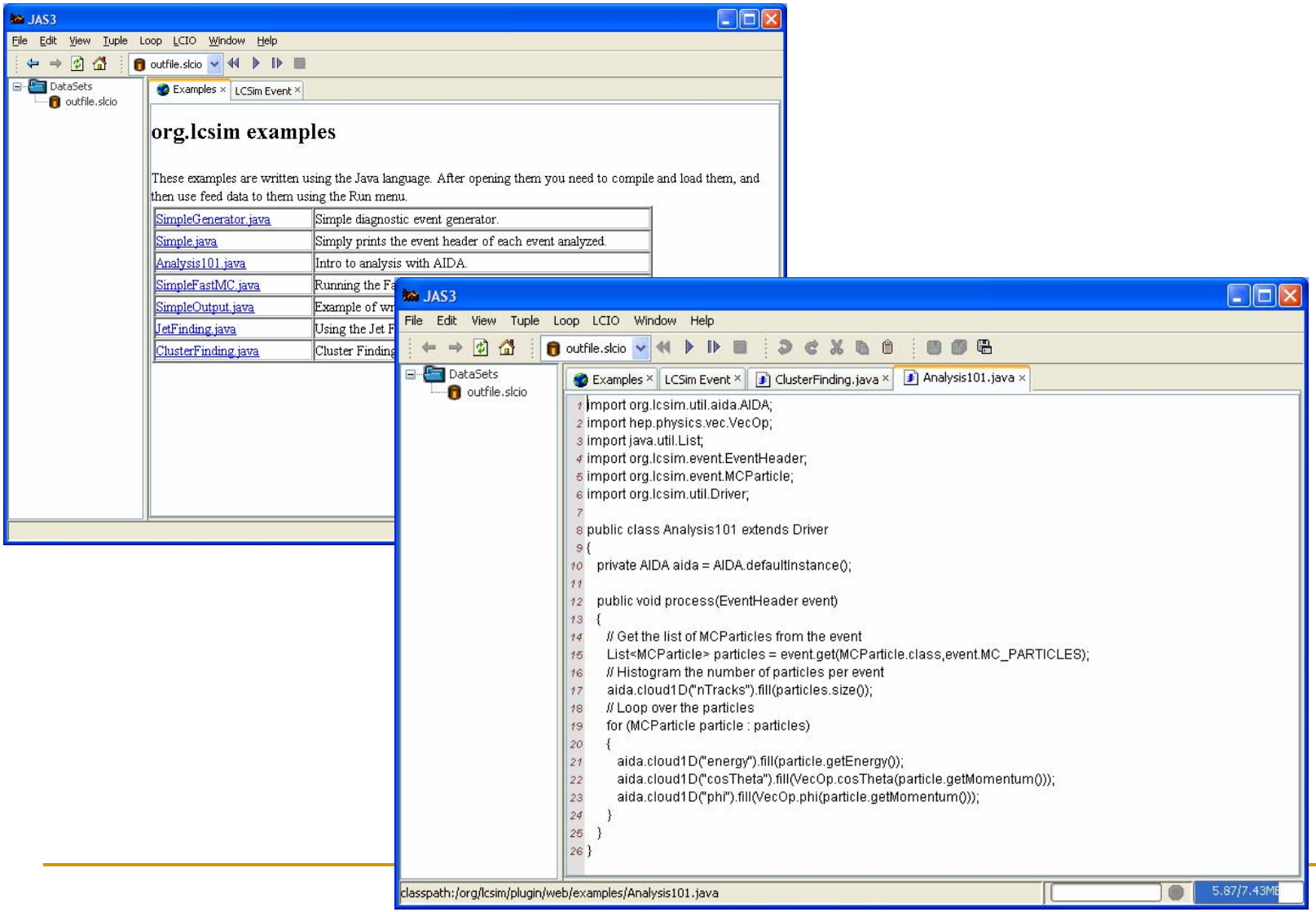
(See many other talks at this workshop)



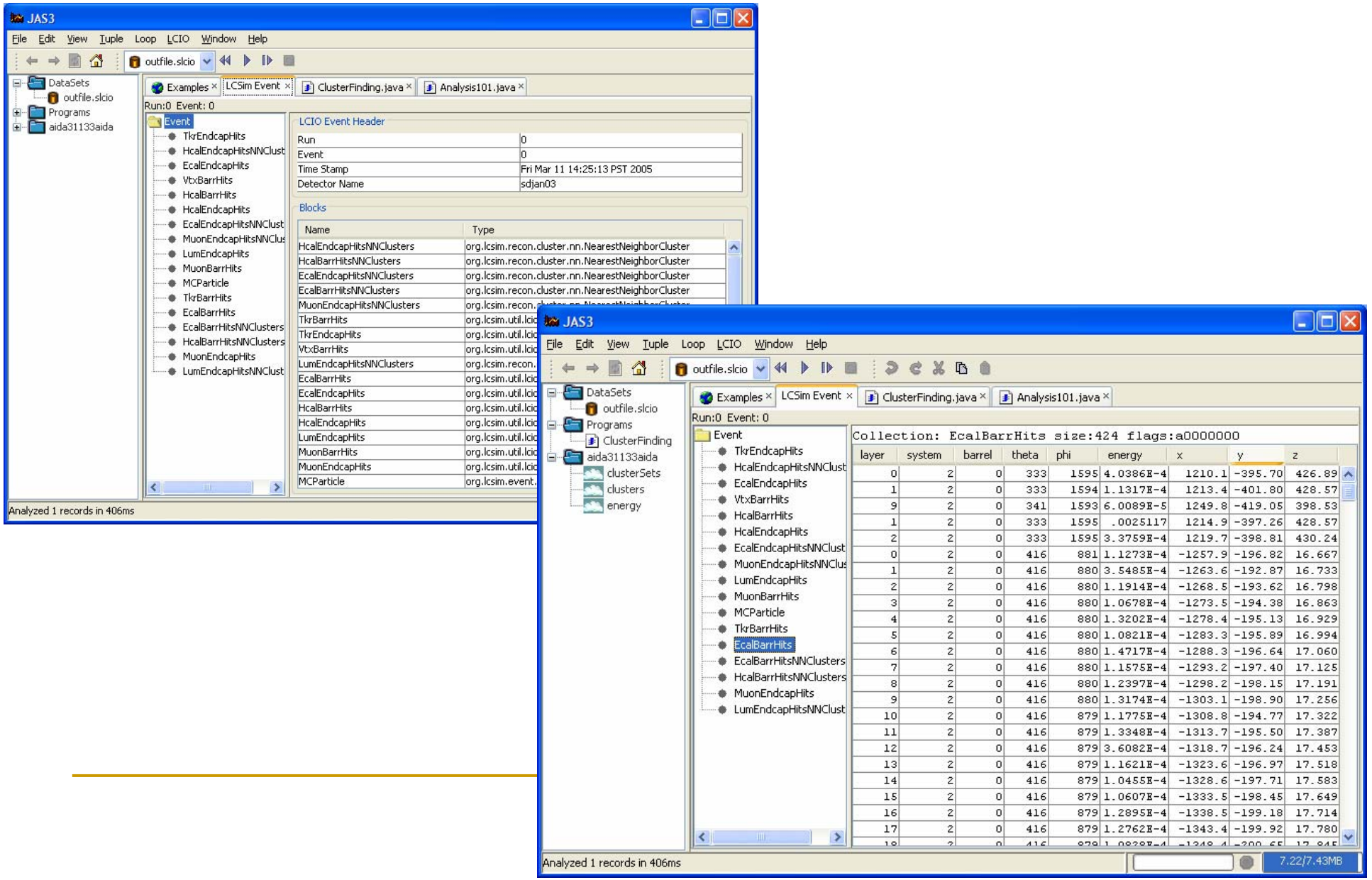
Using org.lcsim with JAS3

- The org.lcsim can be used standalone, withan IDE, or inside JAS3. Same code can be used in all modes, so easy to move back and forth
  - E.g. develop in IDE and run in JAS3
  - E.g. develop in JAS3 and run in batch
- JAS3 org.lcsim plugin adds:
  - Example Analysis Code
  - org.lcim Event browser
  - Easy viewing of analysis plots
  - WIRED event display integration

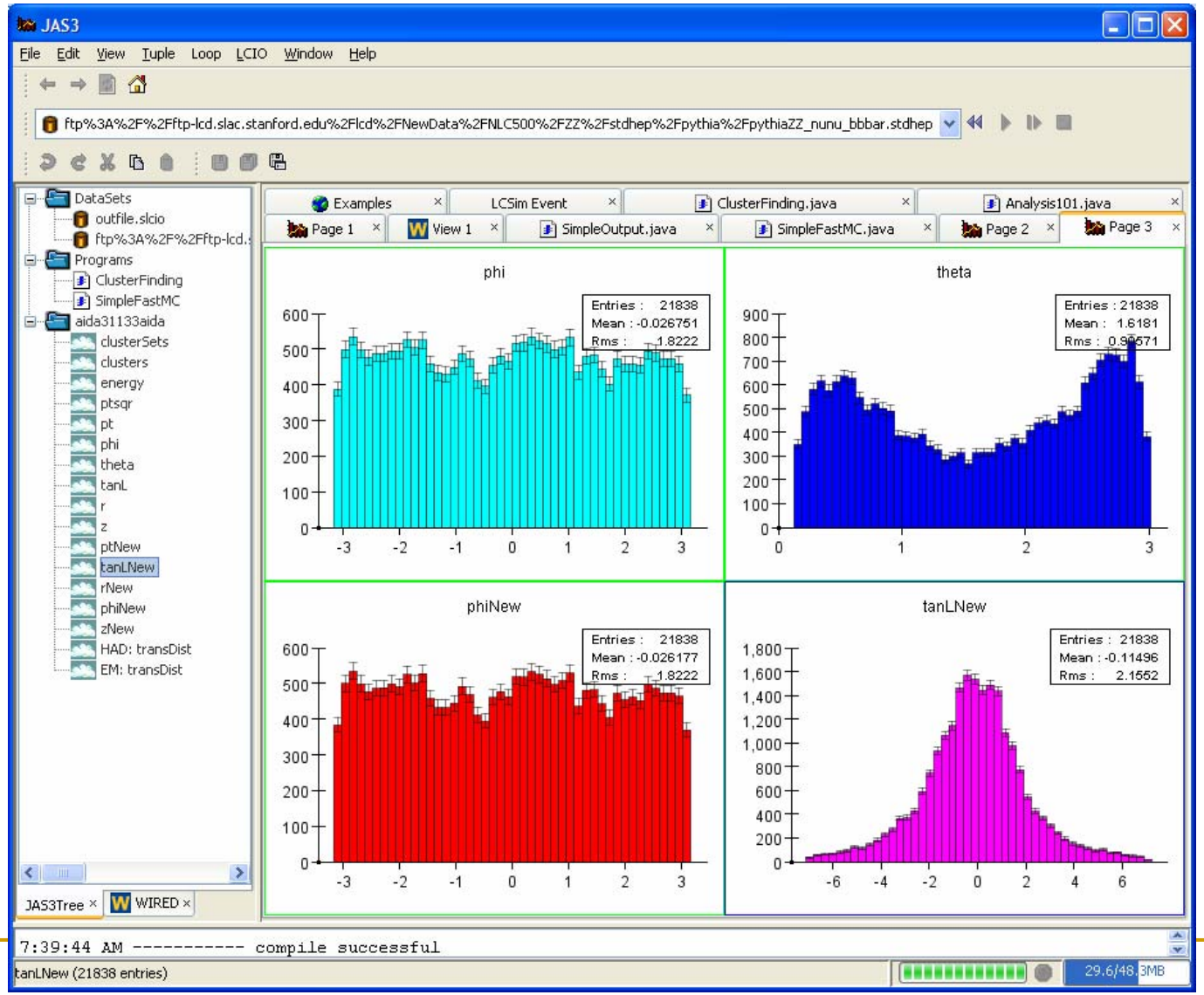
org.lcsim: Examples



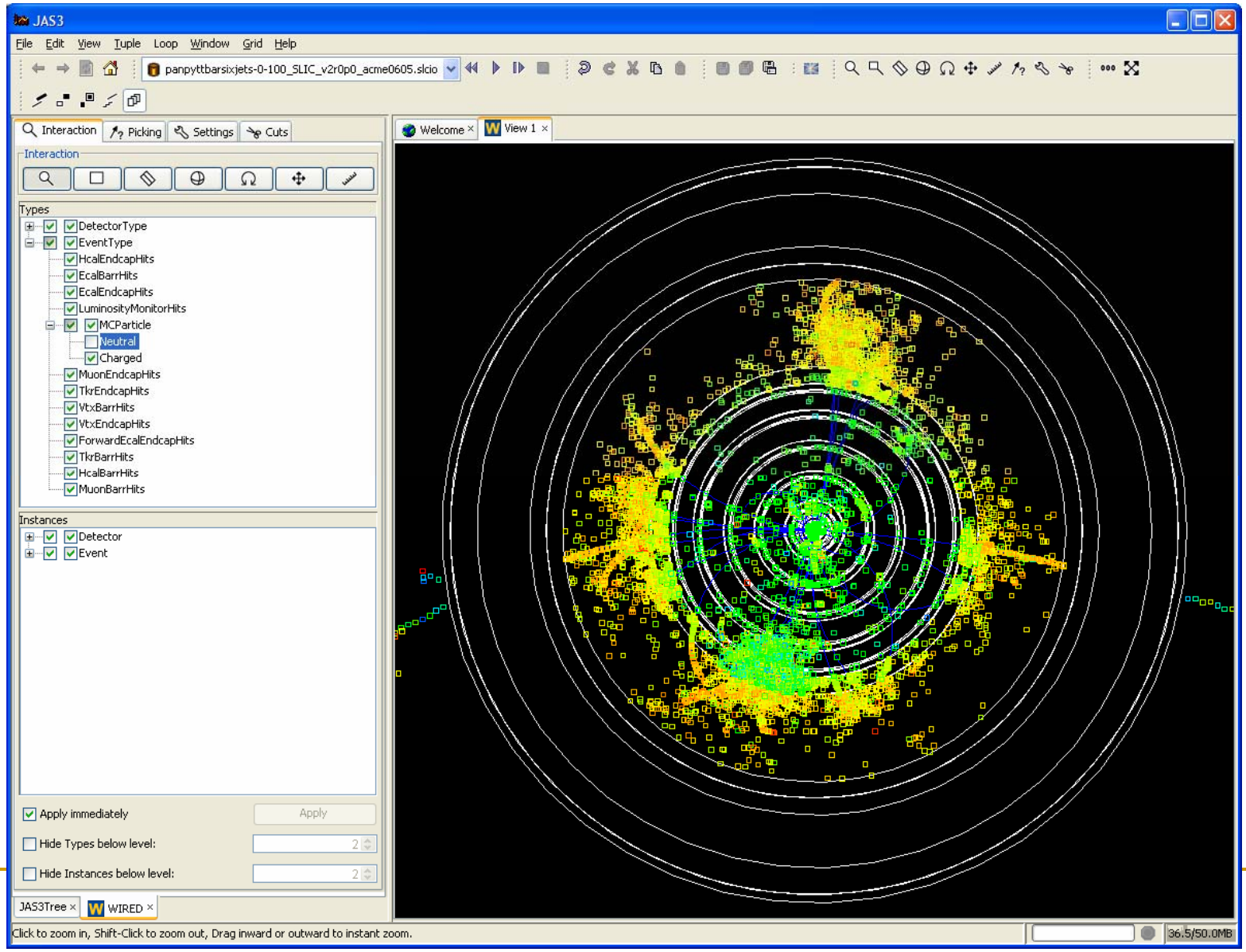
org.lcsim: Examples



org.lcsim: Plot Viewing



Using org.lcsim with WIRED4



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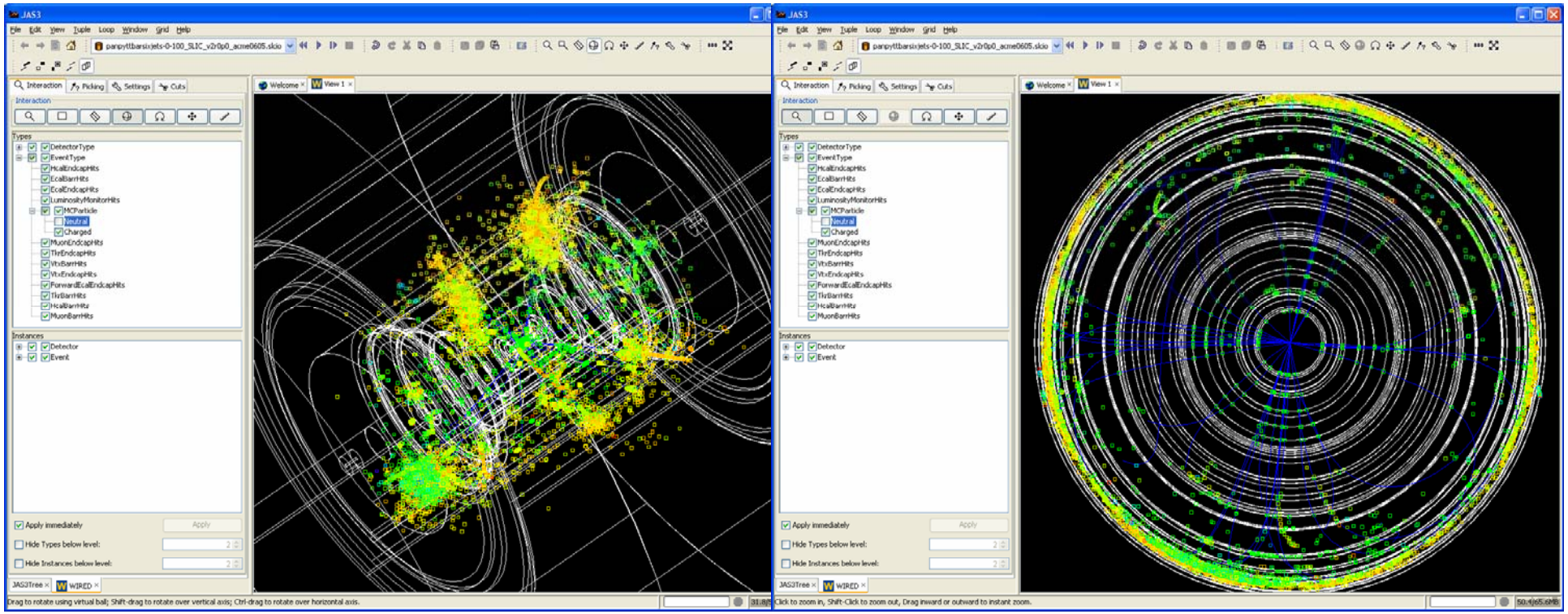

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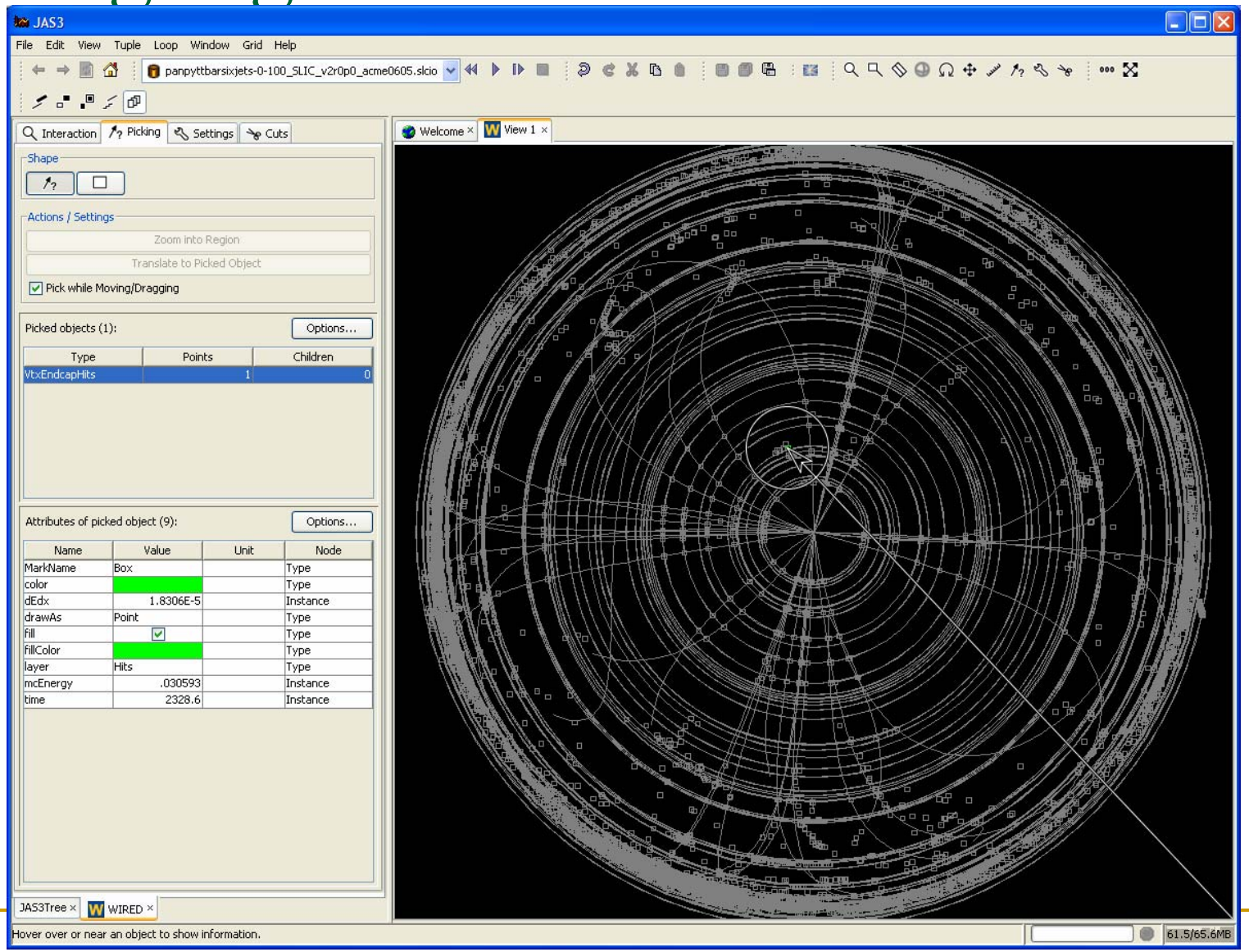
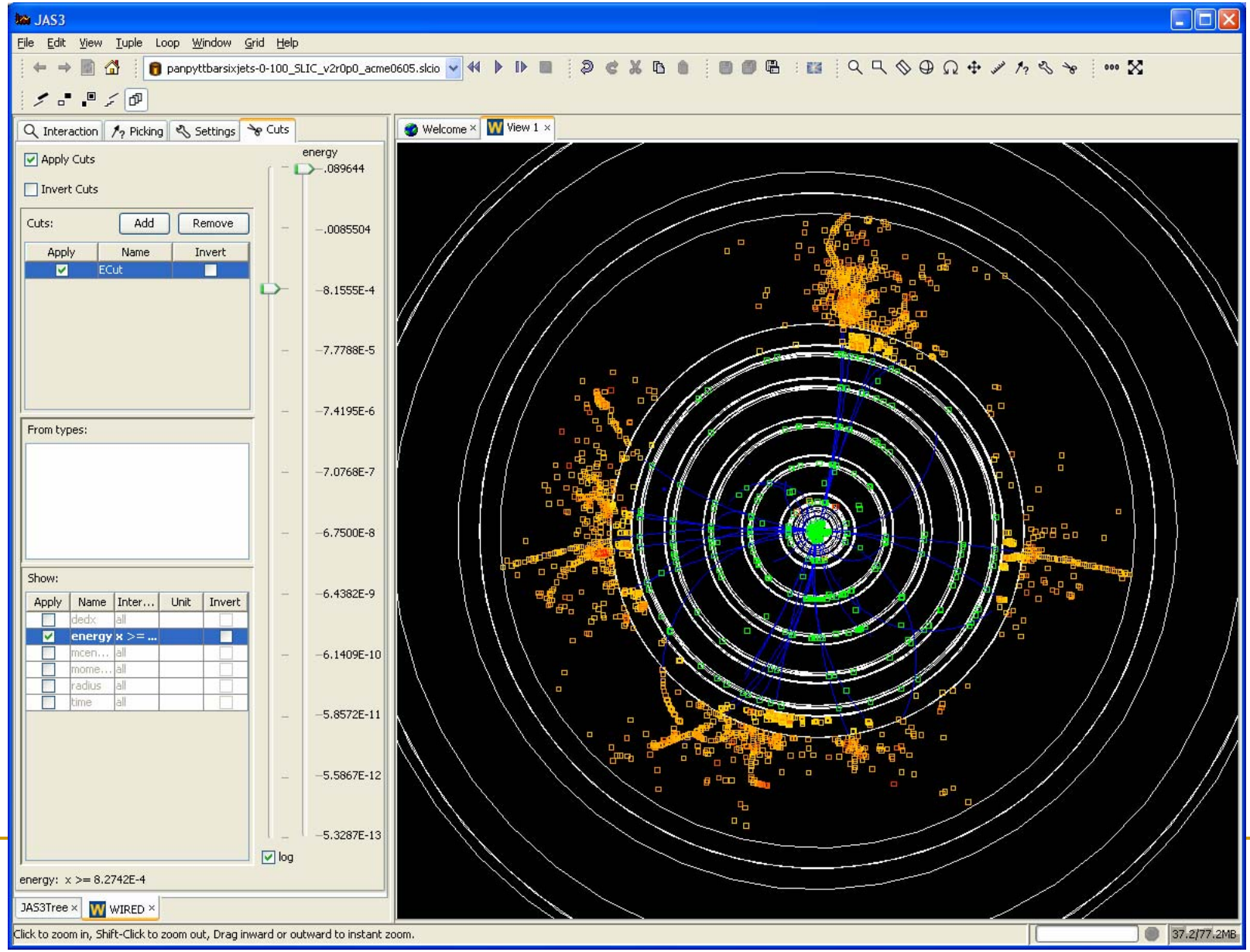
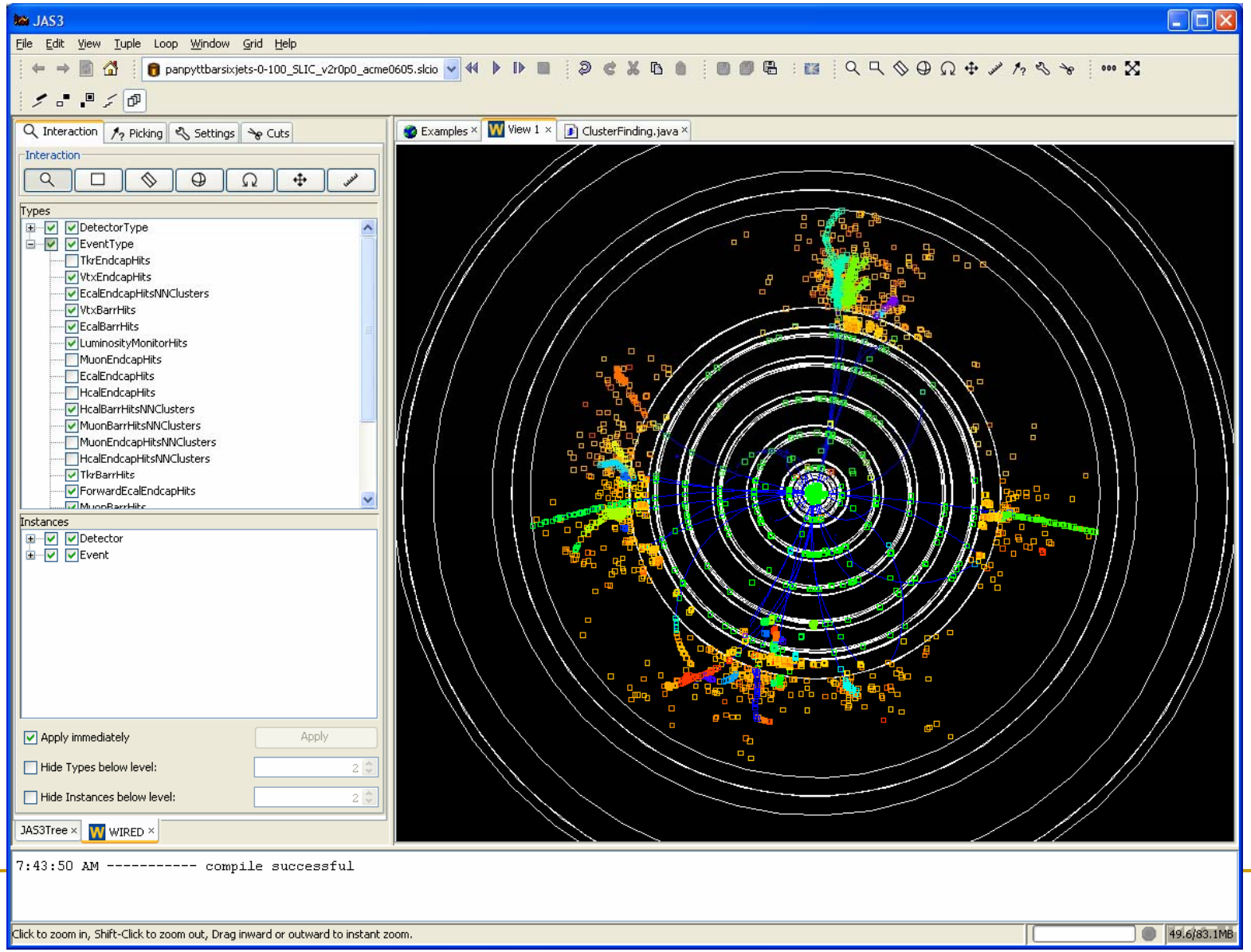


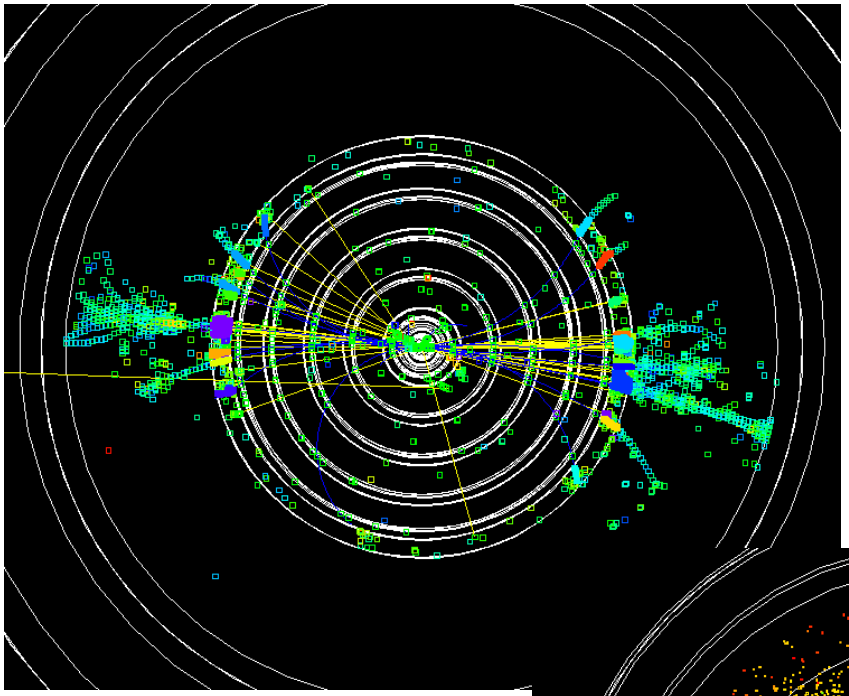
Using org.lcsim with WIRED4



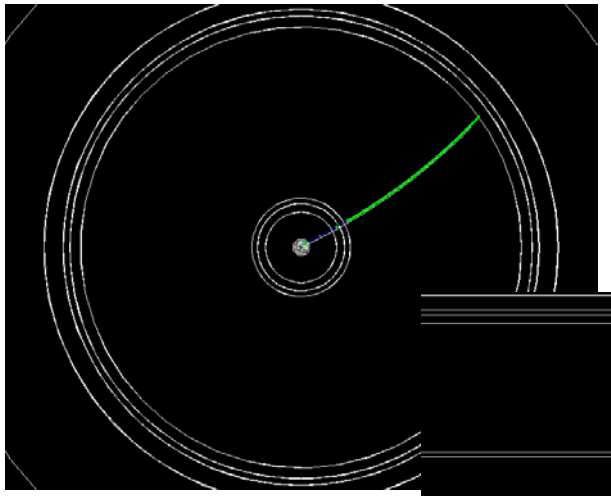
Using org.lcsim with WIRED4



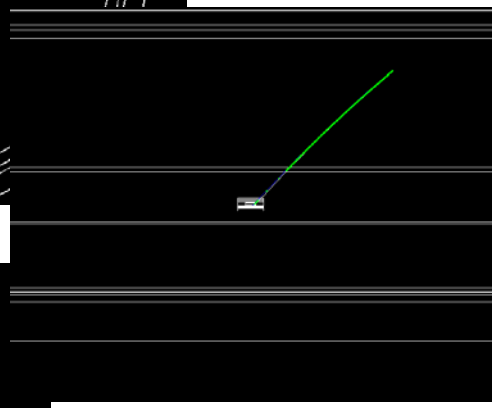
Interoperability

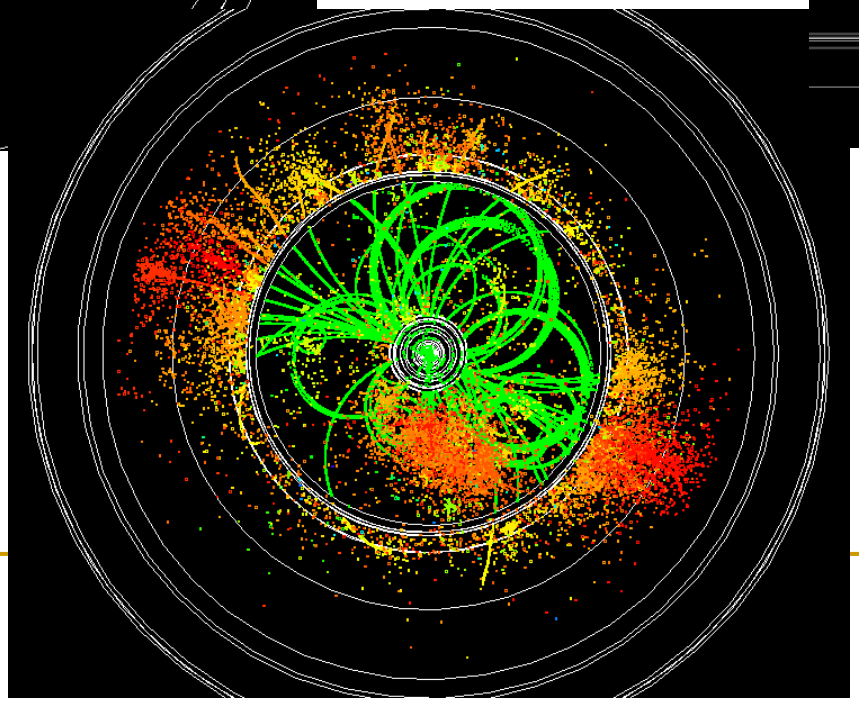


SiD



LDC

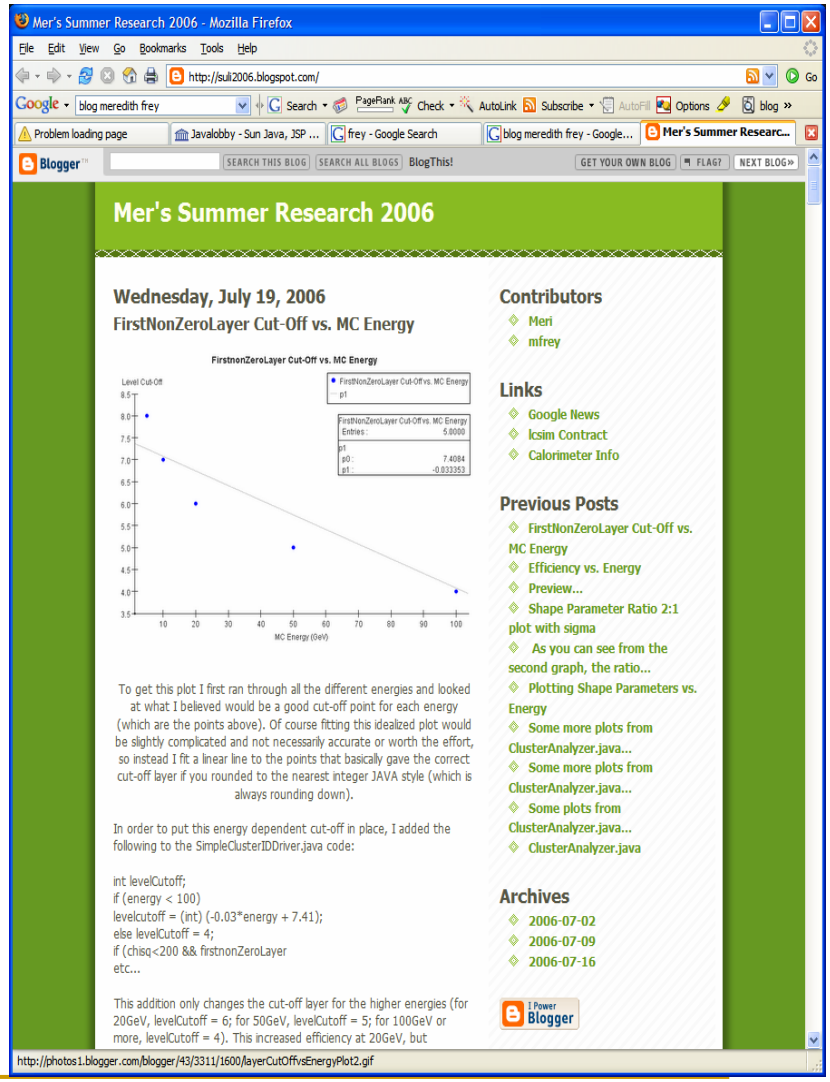




GLD

How hard is it to get started with org.lcsim?

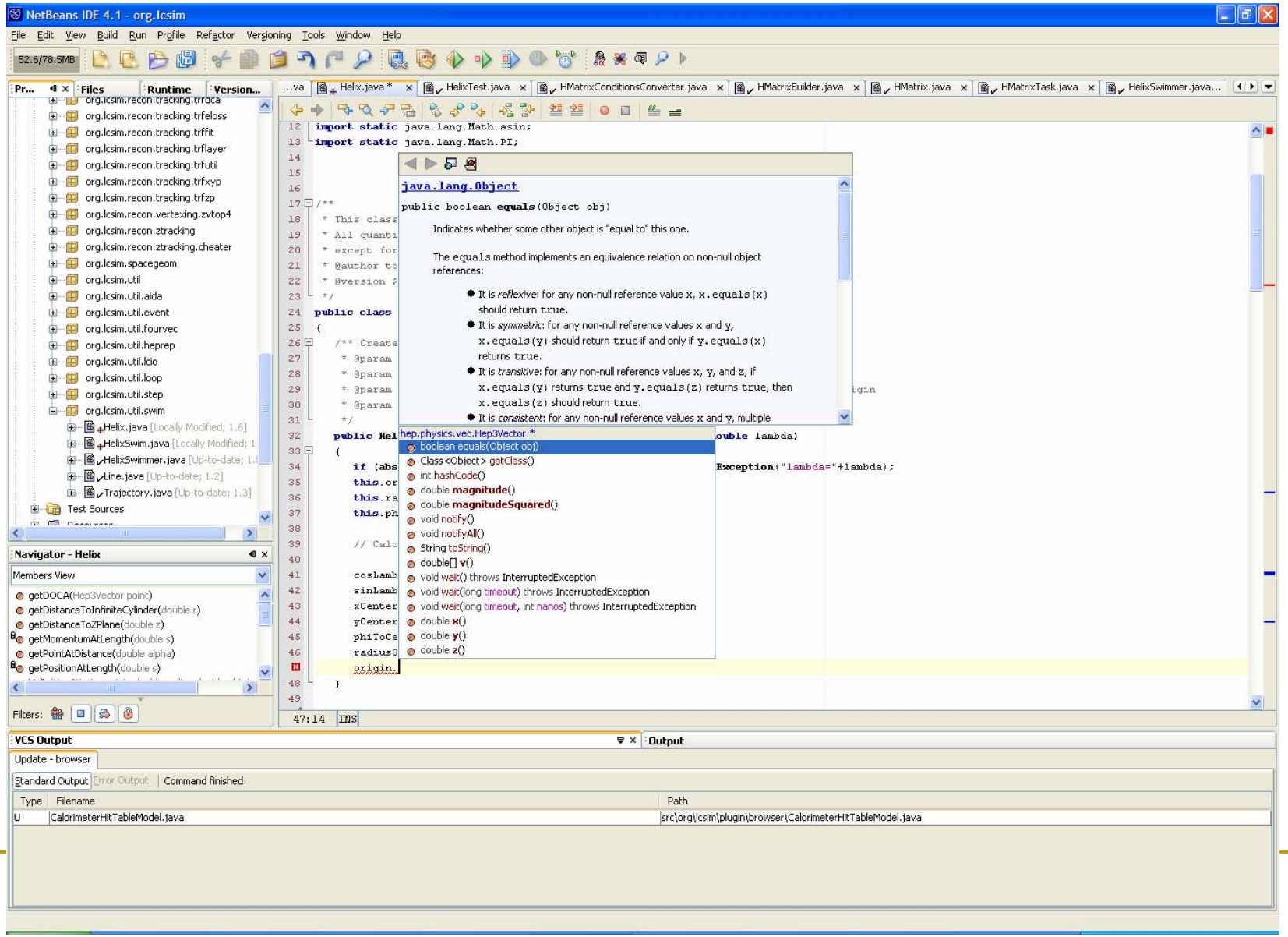
- Works on Linux, MacOSX, Windows
  - Should take about 15 minutes to install JAS3 and org.lcsim plugin.
- Case Study: SLAC Summer student
  - 2 semesters of Java experience
    - (no C++, Fortran *etc*)
  - Using tutorial on lcsim.org Wiki; installed software, downloaded data, and got useful results in one day (and fixed a few errors in the documentation along the way).
  - Regular analysis updates have been appearing on her blog ever since!
- Even if you don't have Java experience you can get started almost as fast
  - (the only thing you will miss is the core dumps)
- Start here:
  - https://confluence.slac.stanford.edu/display/ilc/lcsim+Getting+Started
  - Problems? Attend Tuesday afternoon "Simulation" phone meeting or use discussion forum at http://forum.linearcollider.org/



Becoming an org.lcsim developer

- To get started you just need “Java”, “cvs”, “maven”
  - Maven is a Java based project management tool
  - Single command “maven”
    - downloads dependencies, compiles code, runs tests, deploys code
- All code in CVS
- To check-out and build all code:
  - set CVSROOT=“pserver:anonymous@cvs.freehep.org:/cvs/lcsim”
  - cvs co GeomConverter
  - cd GeomConverter
  - maven
  - cd ..
  - cvs co lcsim
  - cd lcsim
  - maven
- Find more documentation at:
  - http://lcsim.org/
  - Read/Contribute to the Wiki at: https://confluence.slac.stanford.edu/display/ilc/Home
  - Discuss at: http://forum.linearcollider.org/
- We strongly encourage developers to use IDE
  - Netbeans, Eclipse both free, easy to learn, very powerful
  - Use mevenide to teach IDEs about maven systen

Using org.lcsim with Netbeans



Where Next?

- Some clean-up of “Track/Track Parameters” and “Geometry” interface
  - Form org.lcsim clean-up “Task Force”
    - Jeremy and Jan Strube are seconded
    - Other volunteers welcome
- Complete Tracking/Vertexing packages
- Migrate some contrib code to main code base
- We are close to complete tracking/PFA/vertexing/flavor tagging chain.
  - Should create fully simulated/reconstructed data to complement Fast MC studies
- Interoperability
  - LCIO works nicely
  - Geometry interoperability remains elusive but highly desirable
  - Ability to call C++ (MarlinReco) modules from org.lcsim
    - Perhaps more possible with new version of SWIG

Conclusion

- org.lcsim Framework is mostly complete
  - If there are limitations which are impeding your work, let us know!
- User contributed reconstruction software growing rapidly
  - Several more contributions promised soon