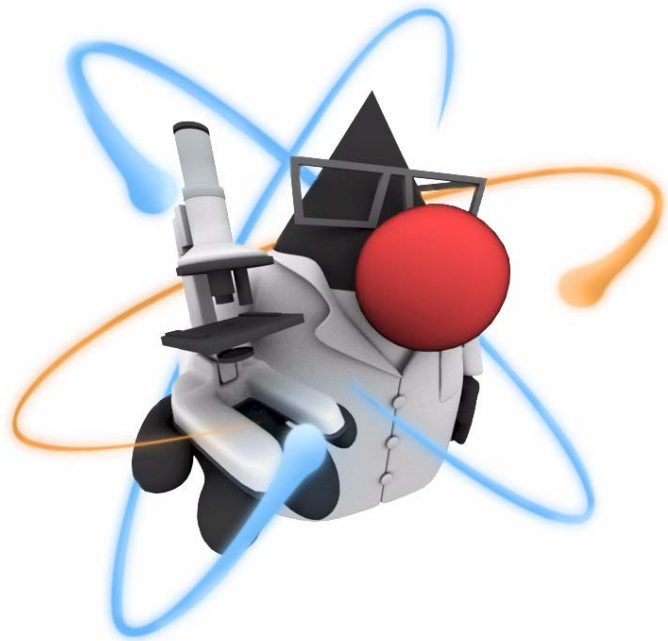
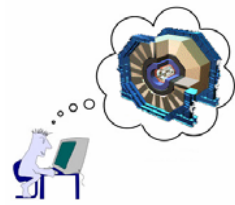


## ALCPG - Fermilab October 2007

**org.lcsim update**

**Tony Johnson  
Stanford Linear Accelerator Center  
tonyj@slac.stanford.edu**

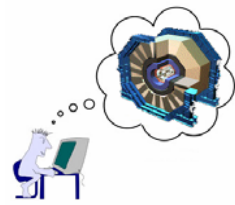




# Outline

---

- **Topics Covered**
  - **org.lcsim Feature Overview**
  - **New IO and related Features**
    - **Relational Tables**
    - **Controlling IO**
    - **Subset Collections**
  - **Plans for 1.2 Release**
  - **Documentation/Tutorials/Communication**

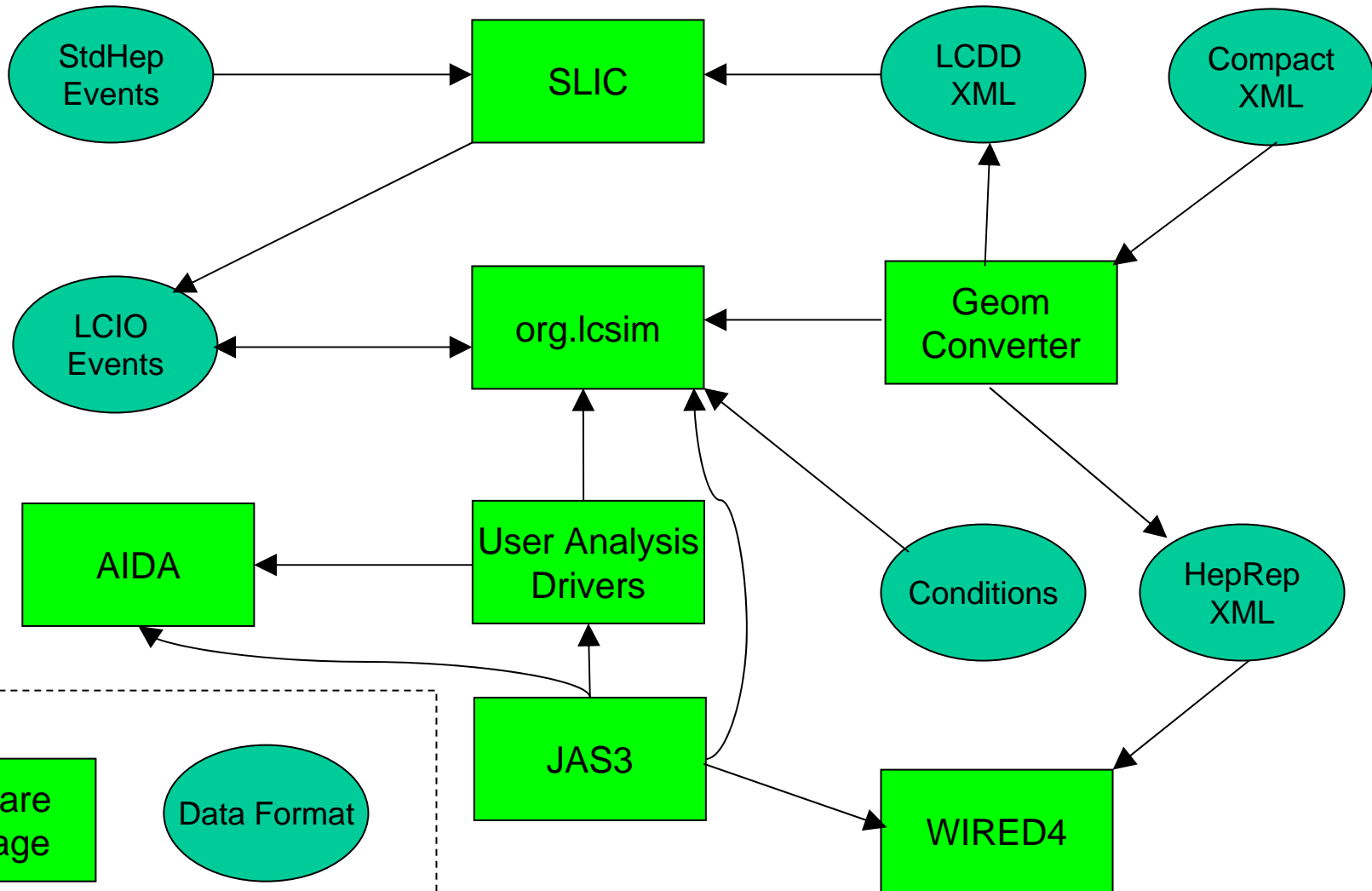
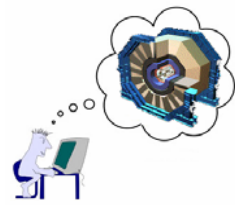


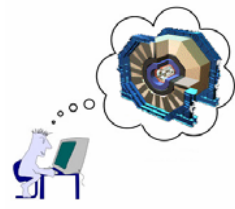
# SLIC + org.lcsim Goals

- **Enable full studies of ILC physics to optimize detector design and eventual physics output**
  - **Use realistic detector geometries**
  - **Full simulation (in combination with fast parameterized MCs)**
  - **Full reconstruction**
    - **Simulate benchmark physics processes on different full detector designs.**
    - **Encourage development of realistic analysis algorithms**
    - **See how these algorithms work with full detector simulations**
- **Facilitate contribution from physicists in different locations with various amounts of time available (normally not much!)**
  - **Software should be easy to install, learn, use**
    - **Goal is to allow software to be installed from CD or web with no external dependencies**
    - **Support via web based forums, tutorials, meetings.**
  - **Compliance with ILC standards**
    - **Fully compatible with LCIO standards for both simulated and reconstructed data.**
  - **Can be run interactively (with JAS, WIRED) or in “batch” mode.**



# Overview: "SLIC + org.lcsim" Framework

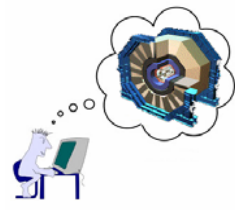




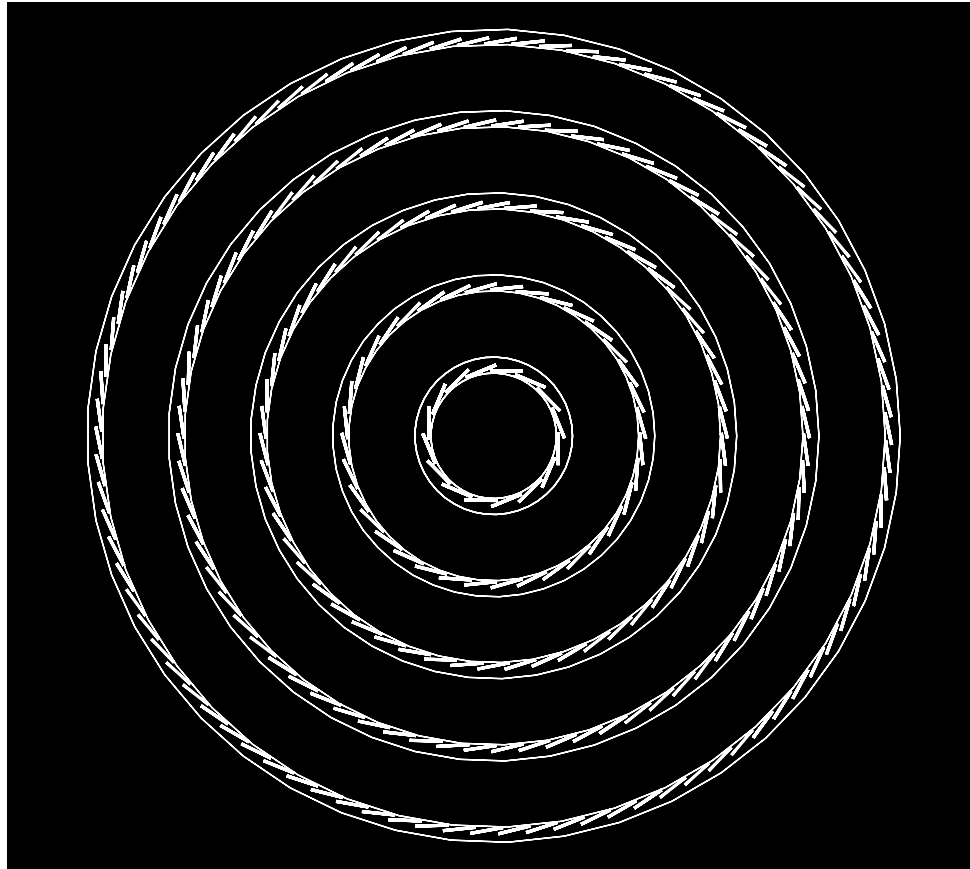
# Geometry in org.lcsim

---

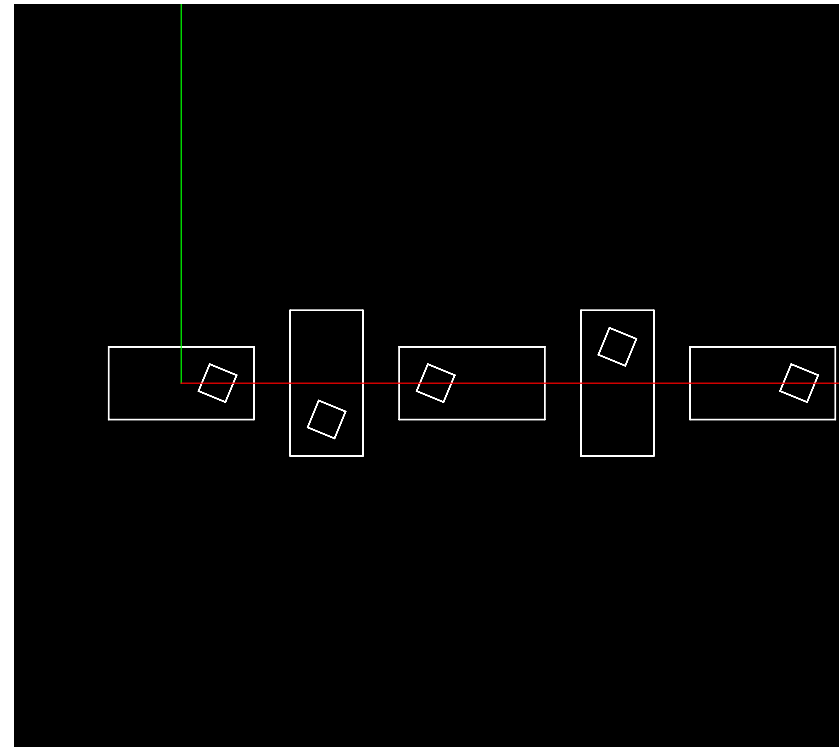
- **Up to now geometry in org.lcsim was at very high level**
  - **Derived from compact geometry description**
    - **Detector -> Global properties of detector**
    - **Subdetector -> Location, layering of subdetectors**
    - **IDDecoder -> Hit position, neighbors, ...**
  - **Not sufficiently detailed for Si strip reconstruction**
- **Detailed geometry created by Tim Nelson, Jeremy McCormick**
  - **Derived from compact description**
  - **Fits into existing compact geometry description**
  - **Gives full positioning of elements at the module level**



## SiTrackerBarrelTest

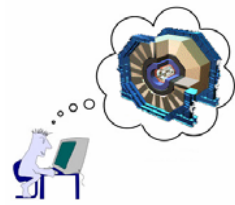


## ShapeRotateTest



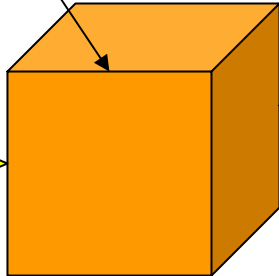


# org.lcsim: Geometry Converter



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

Compact  
Detector  
Description

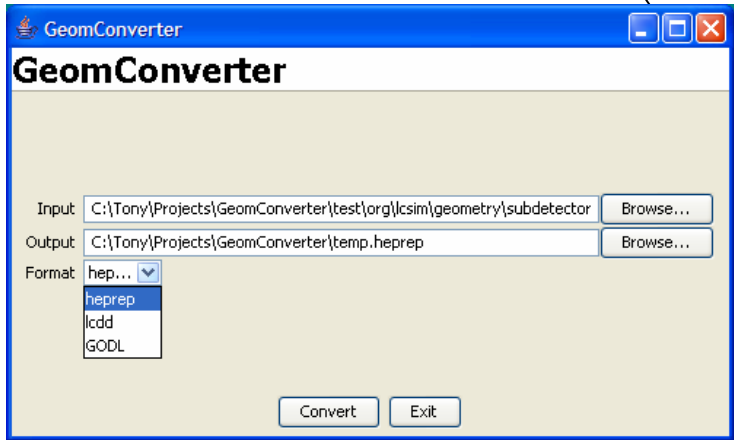


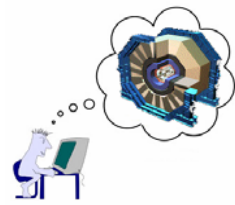
LCDD  
(SLIC)

HepRep  
(Wired)

GODL  
(Lelaps)

org.lcsim  
Analysis &  
Reconstruction

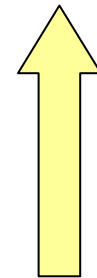




# org.lcsim Contents

---

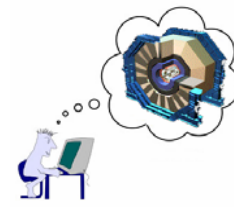
- **Org.lcsim package includes:**
  - **Physics utilities:**
    - Jet finders, event shape routines
    - Diagnostic event generator, stdhep reader/translator
    - Histogramming/Fitting/Plotting
    - Event Display (WIRED)
    - Event Browser
    - Processor/Driver infrastructure
  - **Fast MC**
    - Track/Cluster smearing
    - Outputs ReconstructedParticles
  - **Full Reconstruction**
    - **Goal of org.lcsim**
      - Not “A single reconstruction package”
      - A framework into which reconstruction algorithms can be plugged
      - org.lcsim.recon
        - » Documented, functioning reconstruction code
      - “contrib”
        - » code which compiles and is maintained
      - “sandbox”
        - » ideas, analysis snippets, doesn’t necessarily compile







# org.lcsim Reconstruction Packages

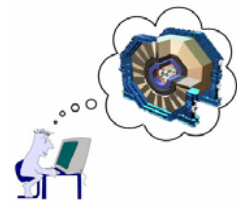


| Package   | Author                 | State                              | Docs/Talks                            | Description   |
|---|------------------------|------------------------------------|---------------------------------------|---|
| <a href="#">org.lcsim.contrib.CalAna</a>                      | ?                      | ?                                  |                                       | ?   |
| <a href="#">org.lcsim.contrib.CarstenHensel</a>               | Carsten Hensel         | ?                                  |                                       | HMatrix cluster analysis  |
| <a href="#">org.lcsim.contrib.Cassell_recon_Cheat</a>         | Ron Cassell            | ?                                  |                                       | Cheat Recon driver  |
| <a href="#">org.lcsim.contrib.EricBenevides_EMClusterID</a>   | Eric Benevides         | ?                                  |                                       | HMatrices analysis of single particle events  |
| <a href="#">org.lcsim.contrib.JanStrube_tracking</a>          | Jan Strube             | complete<br>JUnit tests<br>Javadoc | <a href="#">A New Track Interface</a> | Alternate implementation of Track, FastMCTrack, Swimmer. Awaiting incorporation into main body of code                                      |
| <a href="#">org.lcsim.contrib.JanStrube_vtxFinder</a>         | Jan Strube             | incomplete                         |                                       | Vertex fitter, using the Kalman approach by Grab, Luchsinger. Add the VtxFinderDriver from the sandbox to get an idea of the current status |
| <a href="#">org.lcsim.contrib.JanStrube_zvtx</a>              | Jan Strube             | incomplete                         |                                       | ZVtx implementation, taking advantage of the new Track interface, alpha quality   |
| <a href="#">org.lcsim.contrib.KFFitter</a>                    | Fred Blanc             | ?                                  |                                       | Kalman Filter Fitter  |
| <a href="#">org.lcsim.contrib.LeiXia</a>                      | Lei Xia                | ?                                  |                                       | PFA analysis  |
| <a href="#">org.lcsim.contrib.NickSinev_tracking_wmfitter</a> | Nick Sinev             | ?                                  |                                       | SLD Weight matrix fitter  |
| <a href="#">org.lcsim.contrib.NickSinev_ztracking</a>         | Mike Ronan+Nick Sinev? | ?                                  |                                       | Track cheater?  |
| <a href="#">org.lcsim.contrib.onoprienko_mctrackfinder</a>    | D. Onoprienko          | complete                           |                                       | Configurable cheater track finder and related utilities.  |
| org.lcsim.contrib.onoprienko_tester                           | D. Onoprienko          | functional, under development      |                                       | Track finder performance testing suite  |
| org.lcsim.contrib.SODTracker                                  | Fred Blanc             | ?                                  |                                       | Silicon Outer Detector (SOD) Tracker  |
| org.lcsim.contrib.SiStripSim                                  | Tim Nelson             | ?                                  |                                       | Silicon Strip Simulation (moving soon to org.lcsim.detector)  |
| org.lcsim.contrib.SteveMagill                                 | Steve Magill           | ?                                  |                                       | PFA Analysis example  |
| org.lcsim.contrib.niu   | Vishnu and Guilherme   | ?                                  |                                       | NIU PFA code  |
| org.lcsim.contrib.proulx                                      | ?                      | ?                                  |                                       | ?   |
| org.lcsim.contrib.seedtracker                                 | Richard Partridge      | ?                                  |                                       | Tracking algorithm based on forming track seeds from all 3-hit combinations   |
| org.lcsim.contrib.subdetector_tracker_silicon                 | Tim Nelson             | ?                                  |                                       | Experimental geometry package (Developed further in Geomconverter as org.lcsim.detector by Jeremy)  |
| org.lcsim.contrib.tracking                                    | Tim Nelson             | ?                                  |                                       | Outer-tracker-only track finding  |
| org.lcsim.contrib.uiowa                                       | Mat Charles            | unstable                           |                                       | Template-style PFA implementation (NonTrivialPFA)   |

| Package                              | Author                         | State                         | Docs/Talks                 | Description   |
|--------------------------------------|--------------------------------|-------------------------------|----------------------------|---|
| org.lcsim.digisim                    | Guilherme Lima                 | ?                             |                            | Calorimetry digitization simulator  |
| org.lcsim.mc.CCDSim                  | Nick Sinev                     | ?                             |                            | CCD digitization  |
| org.lcsim.mc.fast                    | Many                           | ?                             |                            | Fast MC package, including tracking, calorimetry                                |
| org.lcsim.recon.cat                  | D. Onoprienko<br>E. von Toerne | functional, under development |                            | Calorimeter Assisted Track Finder   |
| org.lcsim.recon.cheater              | Mike Ronan                     | ?                             | <a href="#">confluence</a> | Recon cheater   |
| org.lcsim.recon.cluster.analysis     | Ron Cassell                    | ?                             |                            | Generic cluster performance analysis  |
| org.lcsim.recon.cluster.cheat        | Ron Cassell                    | ?                             |                            | Cluster cheater   |
| org.lcsim.recon.cluster.clumpfinder  | Mat Charles                    | ?                             |                            | finds dense clumps within clusters  |
| org.lcsim.recon.cluster.directedtree | G.Lima, J.McCormick, Vishnu    | ?                             |                            | Directed tree cluster finder  |
| org.lcsim.recon.cluster.fixedcone    | Norman Graf                    | ?                             |                            | Cluster finder  |
| org.lcsim.recon.cluster.mipfinder    | Wolfgang Mader, Mat Charles    | stable                        |                            | MIP finding   |
| org.lcsim.recon.cluster.mst          | Mat Charles                    | stable                        |                            | Minimal spanning tree cluster finder  |
| org.lcsim.recon.cluster.nn           | Norman Graf                    | ?                             |                            | Nearest neighbour cluster finder  |
| org.lcsim.recon.cluster.structural   | Mat Charles                    | stable                        |                            | Specialized clusterer for hadronic showers                                      |
| org.lcsim.recon.emid_hmatrix         | Norm Graf                      | ?                             |                            | HMatrix package   |
| org.lcsim.recon.ganging              | Ron Cassell                    | ?                             |                            | Allows virtual ganging of calorimeter hits                                      |
| org.lcsim.recon.muon                 | C. Milatene                    | ?                             |                            | Muon finding  |
| org.lcsim.recon.particle             | Ron Cassell                    | ?                             |                            | Perfect PFA   |
| org.lcsim.recon.pfa.cheat            | Mat Charles                    | functional                    |                            | Cheating tools for PFA  |
| org.lcsim.recon.pfa.identifier       | Mat Charles                    | functional                    |                            | Turn more primitive objects (clusters, tracks, etc) into ReconstructedParticles |
| org.lcsim.recon.pfa.output           | Mat Charles                    | ?                             |                            | Modules to produce standard plots for PFAs                                      |
| org.lcsim.recon.pfa.structural       | Mat Charles                    | ?                             | incomplete                 | Iowa PFA implementation (when stable) and associated tools                      |
| org.lcsim.recon.tracking.cheat       | Ron Cassell                    | ?                             |                            | Track Cheater   |
| org.lcsim.recon.tracking.fff         | ?                              | ?                             |                            | ?   |
| org.lcsim.recon.tracking.trf         | Norm Graf                      | ?                             |                            | TRF track finder + fitter   |
| org.lcsim.recon.vertexing.billair    | Norman Graf,<br>(Jan Strube)   | incomplete                    |                            | vertex fitting based on Billair's method. Needs testing                         |
| org.lcsim.recon.vertexing.zvtxp4     | Jan Strube                     | incomplete                    |                            | Vertex finding/fitting, awaiting completion of a vertex fitter                  |
| org.lcsim.recon.ztracking            | M. Ronan                       | ?                             |                            | Track cheater   |

## Conclusions

- Many people are working on reconstruction code
- Effort to persuade people to commit code to “contrib” area has been successful
- But it is not easy for new users to understand how to use or contribute
- We need to work to extend tutorials to also cover reconstruction packages
  - Encourage developers to contribute documentation
  - Start by updating: <http://confluence.slac.stanford.edu/x/f3c>
  - We need realistic analysis examples (see talks following break today)



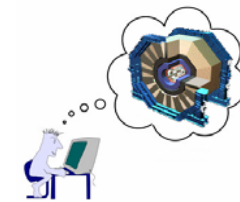
# org.lcsim ongoing work

---

- **IO improvements**
  - Improved LCIO interoperability
  - Features to support data analysis
    - Random access IO
- **Geometry improvements**
  - Detailed geometry
    - Detailed descriptions of barrel, endcap silicon trackers
- **Reconstruction**
  - PFA algorithms being developed/improved/tested
  - Vertexing, Interfacing to LCFI
  - Tracking algorithms
    - Digitization, Clustering, Track fitting
  - Not yet a single top-level driver to perform full reconstruction equivalent to FastMC



# org.lcsim: Examples



JAS3

File Edit View Tuple Loop LCIO Tools Window Grid Help

Examples x

## org.lcsim examples

These examples are written using the Java language. After opening them you need to compile and load them, and then use feed data to them using the Run menu.

|                                     |  |
|-------------------------------------|--|
| <a href="#">Analysis101</a>         | Intro to analysis with AIDA.   |
| <a href="#">BooleanCondition</a>    | Add a boolean value to the EventHeader and read it back again from a different Driver. |
| <a href="#">Cheater</a>             | ReconCheater example that makes perfect clusters, tracks, and reconstructed particles. |
| <a href="#">ClusterFinding</a>      | Find clusters using the Nearest Neighbor clusterer.                                    |
| <a href="#">DigiSimExample</a>      | Digitization example using the Digitsim package.                                       |
| <a href="#">EventGenerator</a>      | Simple diagnosis   |
| <a href="#">FastMC</a>              | Run the Fast M   |
| <a href="#">JetFinding</a>          | Use the Jet Fin  |
| <a href="#">LCIOOutput</a>          | Write LCIO ou  |
| <a href="#">NestedDriverExample</a> | Nest analysis I  |
| <a href="#">PrintEventHeader</a>    | Print the Event  |
| <a href="#">SkipEvent.java</a>      | Skip events us   |
| <a href="#">TrivialPFA.java</a>     | An example PF  |

## org.lcsim Jython examples

These examples are written in Jython. of executing Java examples as well. Y Tutorial visit [Writing a Jython Driver](#)

|                                |   |
|--------------------------------|---|
| <a href="#">mainLoop.py</a>    | The Main Jython w                       |
| <a href="#">Analysis102.py</a> | A modified Jython v simultaneously in m |

JAS3

File Edit View Tuple Loop LCIO Window Help

Rp%3A%2F%2Ftp-lcd.slac.stanford.edu%2Ffid%2FNewData%2FN\_CS00%2FZ%2Fstshp%2Fpythia%2FpythiaZZ\_nunu\_bbbar\_stdshp

DataSets  
outfile.scio  
Rtp%3A%2F%2Ftp-lcd.slac.stanford.edu%2Ffid%2FNewData%2FN\_CS00%2FZ%2Fstshp%2Fpythia%2FpythiaZZ\_nunu\_bbbar\_stdshp

Programs  
ClusterFinding  
SimpleFastMC  
aid31133aida  
clusters  
energy  
pt  
phi  
theta  
tanL  
z  
phiNew  
tanLNew  
rNew  
phiNew  
zNew  
HAD: transDist  
EM: transDist

phi: Entries: 21938, Mean: -0.026751, Rms: 1.8222

theta: Entries: 21938, Mean: 1.6191, Rms: 0.28071

phiNew: Entries: 21938, Mean: -0.026177, Rms: 1.8222

tanLNew: Entries: 21938, Mean: -0.11496, Rms: 2.1552

JAS3Tree x WIRED x

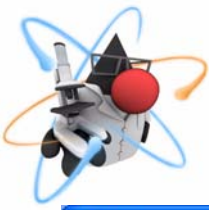
7:39:44 AM ----- compile successful

tanLNew (21938 entries)

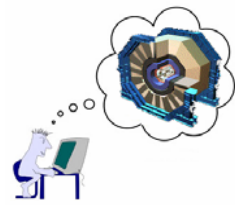
```

1 import org.lcsim.util.aida.AIDA;
2 import hep.physics.vec.VecOp;
3 import java.util.List;
4 import org.lcsim.event.EventHeader;
5 import org.lcsim.event.MCParticle;
6 import org.lcsim.util.Driver;
7
8 public class Analysis101 extends Driver
9 {
10     private AIDA aida = AIDA.defaultInstance();
11
12     public void process(EventHeader event)
13     {
14         // Get the list of MCParticles from the event
15         List<MCParticle> particles = event.get(MCParticle.class,event.MC_PARTICLES);
16         // Histogram the number of particles per event
17         aida.cloud1D("nTracks").fill(particles.size());
18         // Loop over the particles
19         for (MCParticle particle : particles)
20         {
21             aida.cloud1D("energy").fill(particle.getEnergy());
22             aida.cloud1D("cosTheta").fill(VecOp.cosTheta(particle.getMomentum()));
23             aida.cloud1D("phi").fill(VecOp.phi(particle.getMomentum()));
24         }
25     }
26 }

```



# org.lcsim: Event Browser



JAS3

File Edit View Tuple Loop LCIO Window Help

outfile.scio

Examples x LCSim Event x ClusterFinding.java x Analysis101.java x

Run:0 Event: 0

LCIO Event Header

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

Blocks

| Name                     | Type  |
|--------------------------|---|
| HcalEndcapHitsNNClusters | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| HcalBarrHitsNNClusters   | org.lcsim.recon.cluster.nn.NearestNeighborCluster |
| EcalEndcapHitsNNClusters |   |
| EcalBarrHitsNNClusters   |   |
| MuonEndcapHitsNNClusters |   |
| MuonBarrHits             |   |
| LumEndcapHits            |   |
| LumBarrHits              |   |
| MCParticle               |   |
| TkrBarrHits              |   |
| TkrEndcapHits            |   |
| VtxBarrHits              |   |
| VtxEndcapHits            |   |
| MuonEndcapHits           |   |
| MuonBarrHits             |   |
| HcalBarrHits             |   |
| HcalEndcapHits           |   |
| EcalBarrHits             |   |
| EcalEndcapHits           |   |
| HcalBarrHits             |   |
| HcalEndcapHits           |   |
| LumEndcapHits            |   |
| LumBarrHits              |   |
| MCParticle               |   |

Analized 1 records in 406ms

JAS3

File Edit View Tuple Loop LCIO Window Help

outfile.scio

Examples x LCSim Event x ClusterFinding.java x Analysis101.java x

Run:0 Event: 0

Collection: EcalBarrHits size:424 flags:a0000000

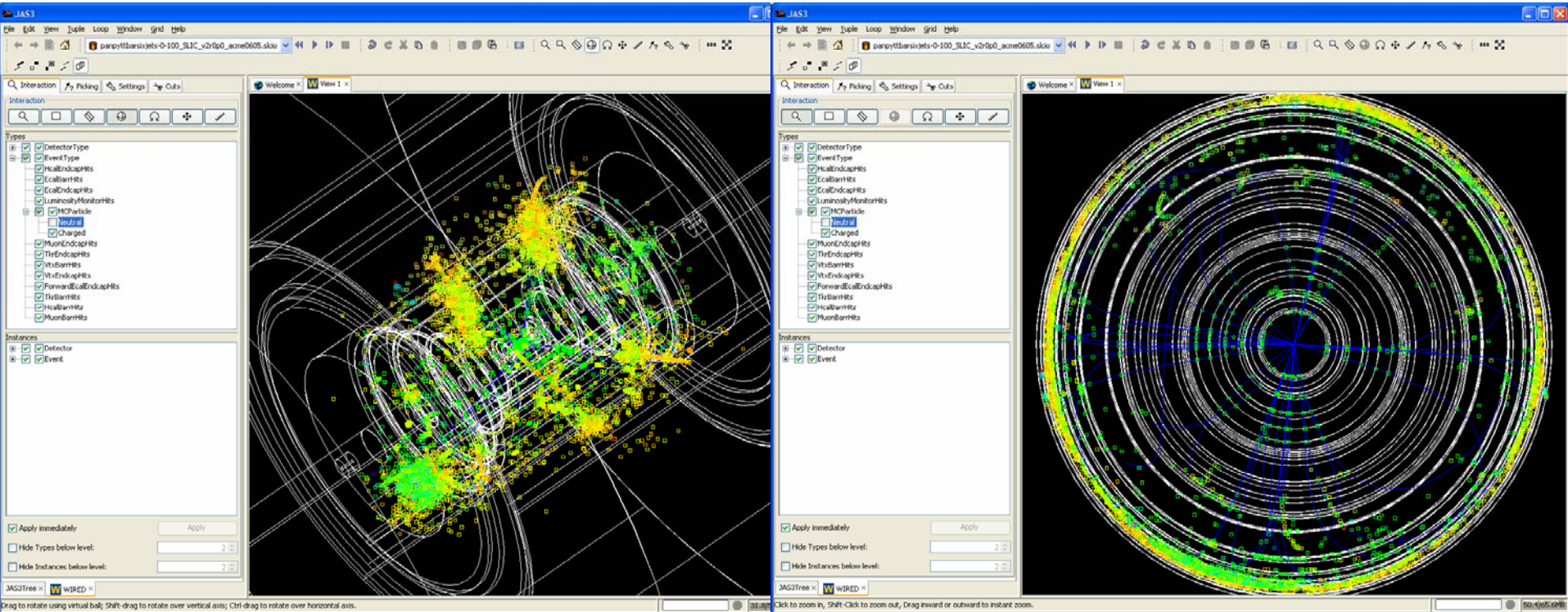
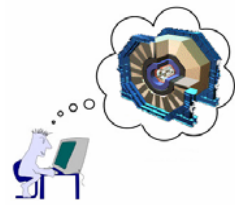
| layer | system | barrel | theta | phi  | energy    | x       | y       | z      |
|-------|--------|--------|-------|------|-----------|---------|---------|--------|
| 0     | 2      | 0      | 333   | 1595 | 4.0386E-4 | 1210.1  | -395.70 | 426.89 |
| 1     | 2      | 0      | 333   | 1594 | 1.1317E-4 | 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  | 1.0238E-4 | -1348.4 | -200.65 | 17.845 |

Analized 1 records in 406ms

7.22/7.43MB

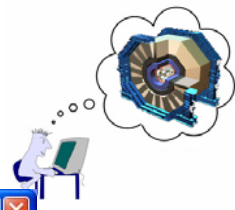


# Using org.lcsim with WIRED4





# Using org.lcsim with WIRED4



JAS3

File Edit View Tuple Loop Window Grid Help

panpyttbarsixjets-0-100\_SLIC\_v2r0p0\_acme0605.slcio

Interaction Picking Settings Cuts

Shape

Actions / Settings

Zoom into Region

Translate to Picked Object

Pick while Moving/Dragging

Picked objects (1):

| Type          | Points | Children |
|---------------|--------|----------|
| VtxEndcapHits | 1      | 0        |

Attributes of picked object (9):

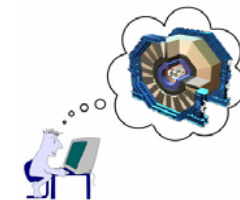
| Name      | Value                               | Unit | Node     |
|-----------|-------------------------------------|------|----------|
| MarkName  | Box                                 |      | Type     |
| color     |                                     |      | Type     |
| dEdx      | 1.8306E-5                           |      | Instance |
| drawAs    | Point                               |      | Type     |
| fill      | <input checked="" type="checkbox"/> |      | Type     |
| fillColor |                                     |      | Type     |
| layer     | Hits                                |      | Type     |
| mcEnergy  | .030593                             |      | Instance |
| time      | 2328.6                              |      | Instance |

JAS3Tree x WIRED x

61.5/65.6MB



# Using org.lcsim with WIRED4



The screenshot shows the JAS3 software interface. The main window displays a particle detector simulation with concentric circular layers and a central green point. Data points are shown as yellow and orange squares, with blue lines connecting them. The interface includes a menu bar (File, Edit, View, Tuple, Loop, Window, Grid, Help), a toolbar, and several control panels.

**Interaction Panel:**

- Apply Cuts
- Invert Cuts
- Cuts:
- Table:

| Apply                               | Name | Invert                   |
|-------------------------------------|------|--------------------------|
| <input checked="" type="checkbox"/> | ECut | <input type="checkbox"/> |
- From types: [Empty field]
- Show:

| Apply                               | Name                  | Inter... | Unit | Invert |
|-------------------------------------|-----------------------|----------|------|--------|
| <input type="checkbox"/>            | dedx                  | all      |      |        |
| <input checked="" type="checkbox"/> | energy $x \geq \dots$ |          |      |        |
| <input type="checkbox"/>            | momen...              | all      |      |        |
| <input type="checkbox"/>            | mome...               | all      |      |        |
| <input type="checkbox"/>            | radius                | all      |      |        |
| <input type="checkbox"/>            | time                  | all      |      |        |
- log

**Energy Scale:**

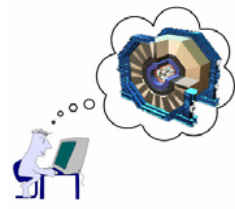
energy:  $x \geq 8.2742E-4$

**Bottom Panel:**

JAS3Tree x WIRED x

Click to zoom in, Shift-Click to zoom out, Drag inward or outward to instant zoom.

37.2177.2MB



# New IO Features

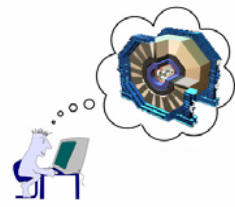
- **Enhanced control over what parts of an event get written out**
  - **By default entire event will be written out, except collections flagged as transient**
  - **Now possible to specify either what should be written out, or what should not be written out.**
- **Subset Collections**
  - **Useful for writing lists of MCParticles or ReconstructedParticles which meet some criteria**

```
List myCollection = new ArrayList();  
// Fill collection  
event.put("MyCollection", myCollection);  
event.getMetaData(myCollection).setTransient(true);
```

```
LCIODriver writer = new LCIODriver("mcfast.slcio");  
writer.getWriter().addWriteOnly("MCParticle");  
writer.getWriter().addWriteOnly("Jets");  
  
LCIODriver writer2 = new LCIODriver("mcfast2.slcio");  
writer2.getWriter().addIgnore("MCParticle");  
writer2.getWriter().addIgnore("Jets");
```

```
List<MCParticle> particles = event.getMCParticles();  
List<MCParticle> half = new ArrayList<MCParticle>();  
int i = 0;  
for (MCParticle particle : particles)  
{  
    if (i++ % 2 == 0) half.add(particle);  
}  
event.put("SomeParticles", half);  
event.getMetaData(half).setSubset(true);
```

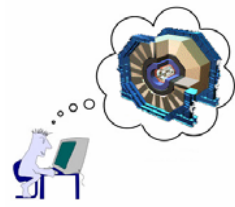




# Relational Tables

---

- **Allow arbitrary relationships to be created between objects**
  - **E.g. ReconstructedParticle->MCParticle**
- **Supports**
  - **1-1, 1-n, n-1, n-m**
  - **Relations can be weighted or un-weighted**
  - **Relations can be efficiently navigated in either direction**
    - **Find all the MCParticles which contributed to a given Reconstructed Particle**
    - **Find all the ReconstructedParticles which have contributions from a given MCParticle**
- **Can be stored/read-from LCIO files as collections of LCRelations**
  - **Provided the objects referred to can be stored as LCIO objects**
- **Can be viewed using Event Browser**



# Relational Table Examples

- **Create relationship**

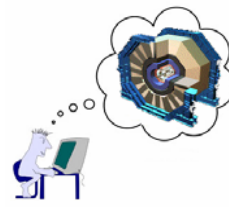
```
// Build a relational table between reconstructed particles and the corresponding MCParticles
RelationalTable<ReconstructedParticle,MCParticle> table =
    new BaseRelationalTable (ReconstructedParticle.class,MCParticle.class,
        RelationalTable.Mode.ONE_TO_ONE,RelationalTable.Weighting.UNWEIGHTED);
for (MCFastReconstructedParticle reconParticle : rpList)
{
    MCParticle mcParticle = reconParticle.getMCParticle();
    table.add(reconParticle,mcParticle);
}
event.put("ReconParticleToMCP",table);
```

- **Use relationship**

```
//Retrieve a given relationship
RelationalTable<ReconstructedParticle,MCParticle> table =
    event.getTable (ReconstructedParticle.class,MCParticle.class);
List<ReconstructedParticle> particles =
    event.get (ReconstructedParticle.class,event.MCFASTRECONSTRUCTEDPARTICLES);
for (ReconstructedParticle particle : particles)
{
    MCParticle mc = table.to(particle);
    // Do something
}
```

– **For more info see**

<http://www.lcsim.org/software/lcsim/apidocs/org/lcsim/event/RelationalTable.html>



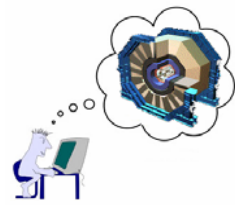
# Plans for Next Release

---

- Most code development is done using “HEAD” of CVS
- Anyone who downloads the “released” version of org.lcsim currently gets a very old version
- All IO additions promised for next release now complete
- Code for 1.2 release has been tagged in CVS
  - Currently in testing phase, only critical bugs will be fixed before release.
  - Updating documentation to correspond to released code
  - Expect to have release available next week
  - Will create a separate web area for API docs for each released version of code
- Going forward need to have more frequent releases
  - Make better use of maven so that examples can be built using released version of code.
  - Make better use of JIRA so that users can see what has changed since most recent release
- Making a well tested and documented release is a lot of work
  - Anyone who would like to help is more than welcome!!



# Resources for getting started/working with simulation/reconstruction tools



## <http://lcsim.org/> Web Site

### – Tutorials

- Software installation
- Using tools
- Simple Analysis Examples
- Developers Guide

### – Datasets

### – Documentation

## Confluence Wiki

- More tutorials
- More documentation
- Frequently asked Questions
- You are encouraged to comment on, add to, or correct existing documentation
  - <https://jira.slac.stanford.edu/signup/>

**Introduction**

This site is designed to provide physicists the tools needed to investigate the physics potential of a linear  $e^+e^-$  collider. Many of the tools necessary to generate Monte Carlo events, simulate the response of typical detectors, and conduct the ensuing analysis of the "data" can be found at this site or others linked from here.

**Getting Started**

- [org.lcsim Tutorial](#) - instructions on setting up and using the Java reconstruction framework

**Datasets**

- [ILC Datasets](#) - instructions for accessing datasets via anonymous FTP

**Detectors**

- [Detectors](#) - list of available compact format detector descriptions

**Wiki**

- [ILC Confluence Wiki](#) - collaborative documentation site

**Feedback**

- [LinearCollider.org Forum](#) - get feedback from the experts

Dashboard > Linear Collider > Home

Welcome Tony Johnson | [History](#) | [Preferences](#) | [Administration](#) | [Log Out](#)

**Home**

View Edit Attachments (0) Info

Added by Tony Johnson, last edited by Jeremy McCormick on Apr 02, 2007 (view change)

Labels: (None) [EDIT](#)

**ILC Wiki**

This is the [International Linear Collider](#) space on [SLAC's Confluence Wiki](#). Much of the content is related to [Detector Simulation](#) and the [Reconstruction and Analysis](#) of simulated physics events. We welcome your comments and suggestions. You can add a comment by using the textbox at the bottom of each page. Here is the [Full Content Index](#) for this space.

**Contributing to the ILC Wiki**

If you are affiliated with the ILC and would like an account on this Wiki you can [sign up here](#).

**Links**

This includes top-level Confluence pages and some important external sites.

**Reconstruction and Analysis**

- [org.lcsim Tutorials](#)
- [org.lcsim Wiki](#)
- [org.lcsim Frequently Asked Questions](#)
- [org.lcsim homepage](#)
- [GeomConverter homepage](#)
- [LCIO](#)
- [Marlin](#)

**Detector Simulation**

- [SLIC FAQ](#)
- [SLIC Wiki](#)
- [MOKKA](#)
- [ILC Detector Simulation FAQ](#)
- [ILC Detector Simulation Picture Gallery](#)

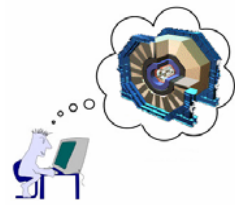
**News**

| Title   | Author              | Date Posted    |
|---|---------------------|----------------|
| <a href="#">org.lcsim Package overview</a>                            | by Tony Johnson     | (16 hours ago) |
| <a href="#">HFP Framework Links</a>                                   | by Jeremy McCormick | (18 hours ago) |
| <a href="#">Java Links</a>  | by Jeremy McCormick | (19 hours ago) |
| <a href="#">Re: org.lcsim Package overview</a>                        | by Jeremy McCormick | (20 hours ago) |
| <a href="#">How do I turn on histograms in Drivers (e.g. FastMC2)</a> | by Tony Johnson     | (03 Apr)       |
| <a href="#">org.lcsim</a>   | by Tony Johnson     | (03 Apr)       |
| <a href="#">How can I write out an LCIO file from org.lcsim?</a>      | by Tony Johnson     | (03 Apr)       |
| <a href="#">Contributing to ILC Software Projects</a>                 | by Jeremy McCormick | (02 Apr)       |

**Recently Updated**



# Resources for getting started/working with simulation/reconstruction tools



## Discussion Forums

- <http://forum.linearcollider.org/>
  - SLIC, org.lcsim, analysis tools
  - All software forums are quite active
    - Good to see discussions between users beginning to increase

Welcome **tonyj**, your last visit was on Tue, 10 April 2007 07:48

Show: Today's Messages :: Unread Messages :: Unanswered Messages :: Show Polls :: Message Navigator

Admin: | Group(s) Manager

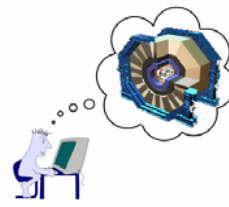
| Forum   | Messages | Topics | Last message   |
|---|----------|--------|--|
| <b>Software Tools</b> - Developers and users discussion forum   |          |        |  |
| <a href="#">Fast Simulations</a>  | 4        | 4      | Mon, 24 July 2006<br>By: <a href="#">mitaroff</a>            |
| <a href="#">LCIO</a><br>Discussion of LCIO data format.   | 191      | 64     | Fri, 16 March 2007<br>By: <a href="#">gaede</a>              |
| <a href="#">org.lcsim</a><br>Discussion forum for developers of org.lcsim reconstruction and analysis package, plus related projects (GeomConverter etc). | 84       | 21     | Tue, 03 April 2007<br>By: <a href="#">bjasper</a>            |
| <a href="#">Marlin et al</a><br>Discussion, questions and feedback concerning Marlin, MarlinReco, Gear and related projects                               | 50       | 20     | Thu, 29 March 2007<br>By: <a href="#">samson</a>             |
| <b>Analysis and Reconstruction</b> - Linear Collider Reconstruction and Analysis  |          |        |  |
| <a href="#">Analysis Tools</a><br>General discussion of analysis tools  | 14       | 5      | Mon, 24 July 2006<br>By: <a href="#">mitaroff</a>            |
| <a href="#">Reconstruction</a><br>General reconstruction discussion   | 56       | 21     | Mon, 29 May 2006<br>By: <a href="#">fabio</a>                |
| <a href="#">Results</a><br>Got some cool results to share. This is the place to post them.  | 0        | 0      | n/a  |
| <a href="#">Tracking &amp; Vertexing</a><br>Forum for discussions related to tracking and vertexing.  | 51       | 15     | Tue, 13 March 2007<br>By: <a href="#">killenberg</a>         |
| <a href="#">Individual Particle Reconstruction</a><br>aka "Energy Flow", "Particle Flow", E-Flow, P-Flow, PFA   | 1        | 1      | Thu, 13 October 2005<br>By: <a href="#">NormanGraf</a>       |
| <a href="#">EUDET Telescope</a><br>Discussions about EUDET pixel beam telescope -- mainly analysis software and DAQ issues.                               | 21       | 4      | Fri, 02 March 2007<br>By: <a href="#">antonio.bulgheeron</a> |
| <b>Simulation</b> - Detector Response Simulation  |          |        |  |
| <a href="#">Full Simulations</a><br>Discussion of tools and techniques not covered by any more specific forum.  | 4        | 3      | Thu, 15 July 2004<br>By: <a href="#">musat</a>               |
| <a href="#">Mokka</a><br>Forum for discussing <a href="#">Mokka</a>   | 160      | 66     | Mon, 09 April 2007<br>By: <a href="#">hooberman</a>          |
| <a href="#">LCDG4</a><br>Geant4 simulation program for the ALCPG.   | 13       | 7      | Thu, 07 July 2005<br>By: <a href="#">lima</a>                |
| <a href="#">Common Simulation Framework</a><br>Open discussion on development of a common simulation framework or toolkit.                                | 3        | 3      | Sat, 05 June 2004<br>By: <a href="#">lima</a>                |
| <a href="#">slc</a><br>Forum for discussing <a href="#">slc</a> (Simulator for the Linear Collider)   | 18       | 9      | Wed, 14 February 2007<br>By: <a href="#">miengo</a>          |

Unsubscribe Merge Topics

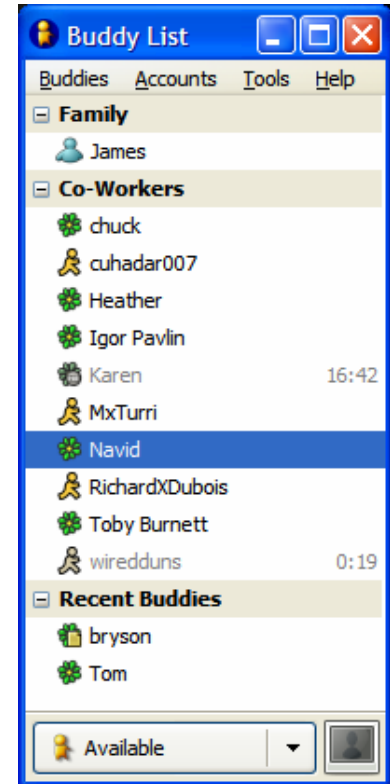
| Topic  | Message  |
|--|--|
| <a href="#">Cheater example</a>                          | By: <a href="#">bjasper</a> on Thu, 29 March 2007 14:19              |
| <a href="#">Re: Cheater example</a>                      | By: <a href="#">tonyj</a> on Thu, 29 March 2007 15:16                |
| <a href="#">Re: Cheater example</a>                      | By: <a href="#">bjasper</a> on Sat, 31 March 2007 21:18              |
| <a href="#">Re: Cheater example</a>                      | By: <a href="#">tonyj</a> on Mon, 02 April 2007 17:32                |
| <a href="#">Re: Cheater example</a>                      | By: <a href="#">tonyj</a> on Tue, 03 April 2007 14:24                |
| <a href="#">Re: Cheater example</a>                      | By: <a href="#">bjasper</a> on Tue, 03 April 2007 23:10              |
| <a href="#">org.lcsim frequently asked questions</a>     | By: <a href="#">tonyj</a> on Thu, 15 March 2007 11:55                |
| <a href="#">Re: org.lcsim frequently asked questions</a> | By: <a href="#">zhaohw</a> on Thu, 22 March 2007 15:44               |
| <a href="#">Re: org.lcsim frequently asked questions</a> | By: <a href="#">tonyj</a> on Thu, 29 March 2007 07:39                |
| <a href="#">SmTrackerHit getLayer method</a>             | By: <a href="#">stevens_lorj</a> on Thu, 15 February 2007 19:20      |
| <a href="#">Re: SmTrackerHit getLayer method</a>         | By: <a href="#">NormanGraf</a> on Fri, 16 February 2007 08:53        |
| <a href="#">Re: SmTrackerHit getLayer method</a>         | By: <a href="#">stevens_lorj</a> on Mon, 19 February 2007 22:15      |
| <a href="#">Re: SmTrackerHit getLayer method</a>         | By: <a href="#">Dmitry Onoprienko</a> on Tue, 20 February 2007 15:05 |
| <a href="#">Re: SmTrackerHit getLayer method</a>         | By: <a href="#">stevens_lorj</a> on Mon, 26 February 2007 21:17      |

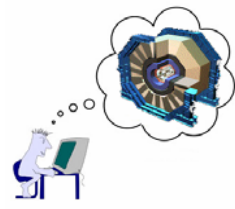


# Resources for getting started/working with simulation/reconstruction tools



- **Instant messaging**
  - Great for quick questions
  - I use GAIM, many other options
    - <http://gaim.sf.net/>
  - Norman, myself, Jeremy available much of the time
    - <http://confluence.slac.stanford.edu/x/Rnk>
- **Tuesday software meeting**
  - 1:30pm Pacific Time
  - We are happy to answer questions/solve problems during or after these meetings
    - We can use desktop sharing to interactively view/solve problems
- **Personal Tutorials**
  - We are prepared to go anywhere anytime
    - Real\* or virtual





# Conclusions

---

- **Conclusions**
  - **Basic framework for simulation/reconstruction/analysis exists and is mostly stable and usable**
  - **Active work on reconstruction algorithms increasing**
    - **Still more work to do to get end-to-end full reconstruction**
- **Documentation, Tutorials *etc* exist**
  - **Good at introducing tools, getting users started**
  - **Tends to fade out for more advanced reconstruction**
    - **Needs some work – please contribute**
- **Communication**
  - **Many tools exist – encourage more active use**
  - **If the framework doesn't do what you want, complain!**