CEPC Group Meeting

Cui Hanhua 2020 03 06

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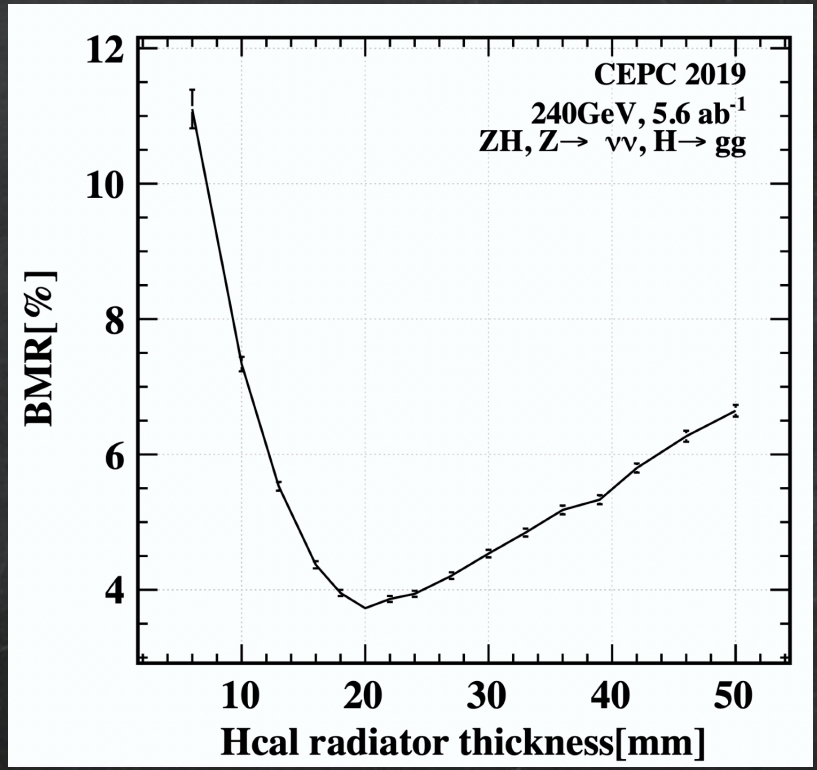
02 Druid Manual

Hcal radiator structure

BMR VS Detector Parameters: Hcal radiator thickness

Baseline (Hcal nlayers=40)
rm yoke05 & ftd

Lowest: RMB=3.72866

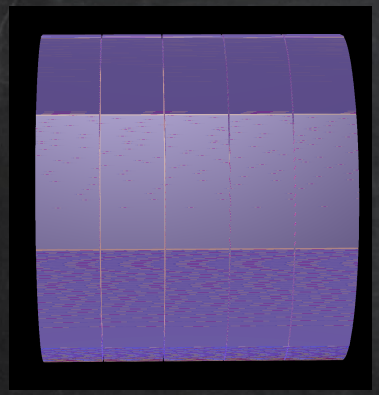


Hcal radiator structure

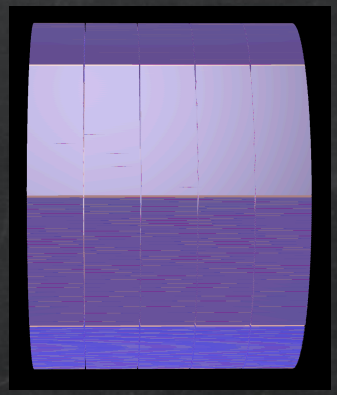
Black(Absorber)=20mm；Gray(extra Iron、PCB、electronics)=6.7mm

EMR VS Detector Parameters: Hcal radiator thickness

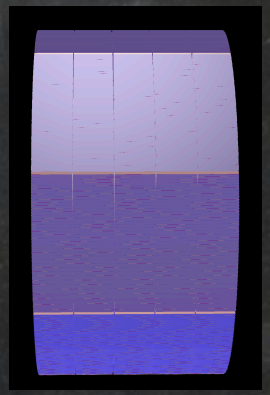
Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:



6mm



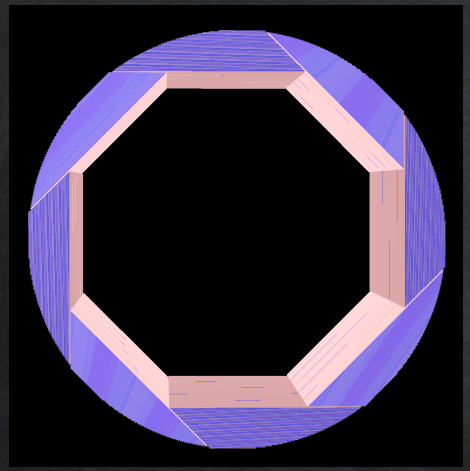
20mm



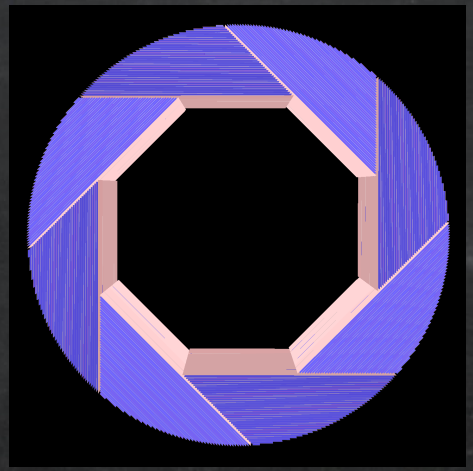
46mm

EMR VS Detector Parameters: Hcal radiator thickness

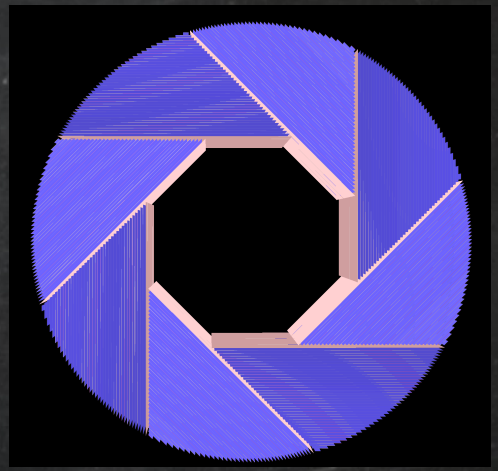
Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:



6mm



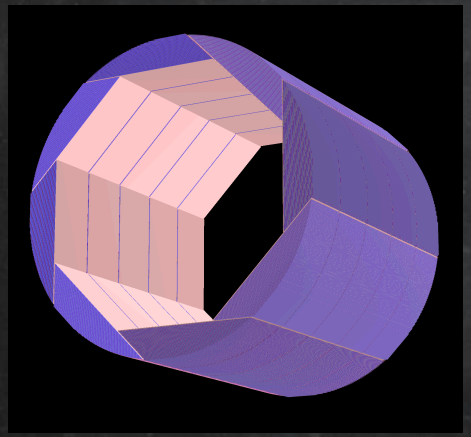
20mm



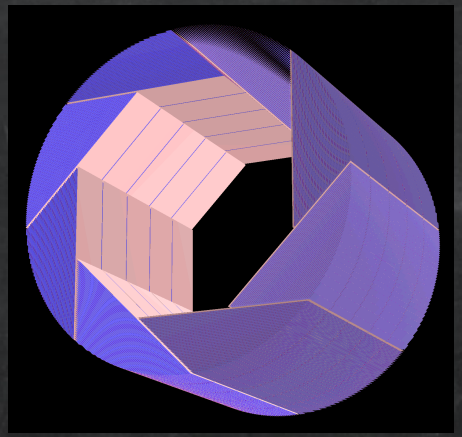
46mm

EMR VS Detector Parameters: Hcal radiator thickness

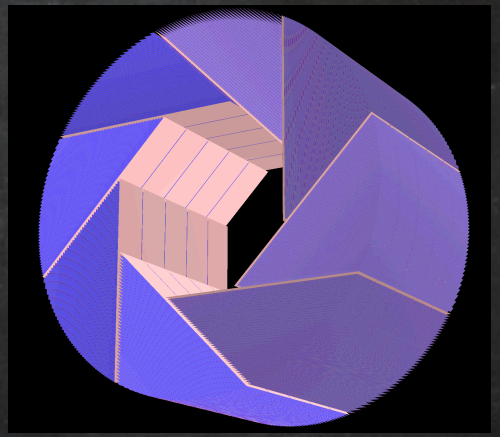
Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:



6mm



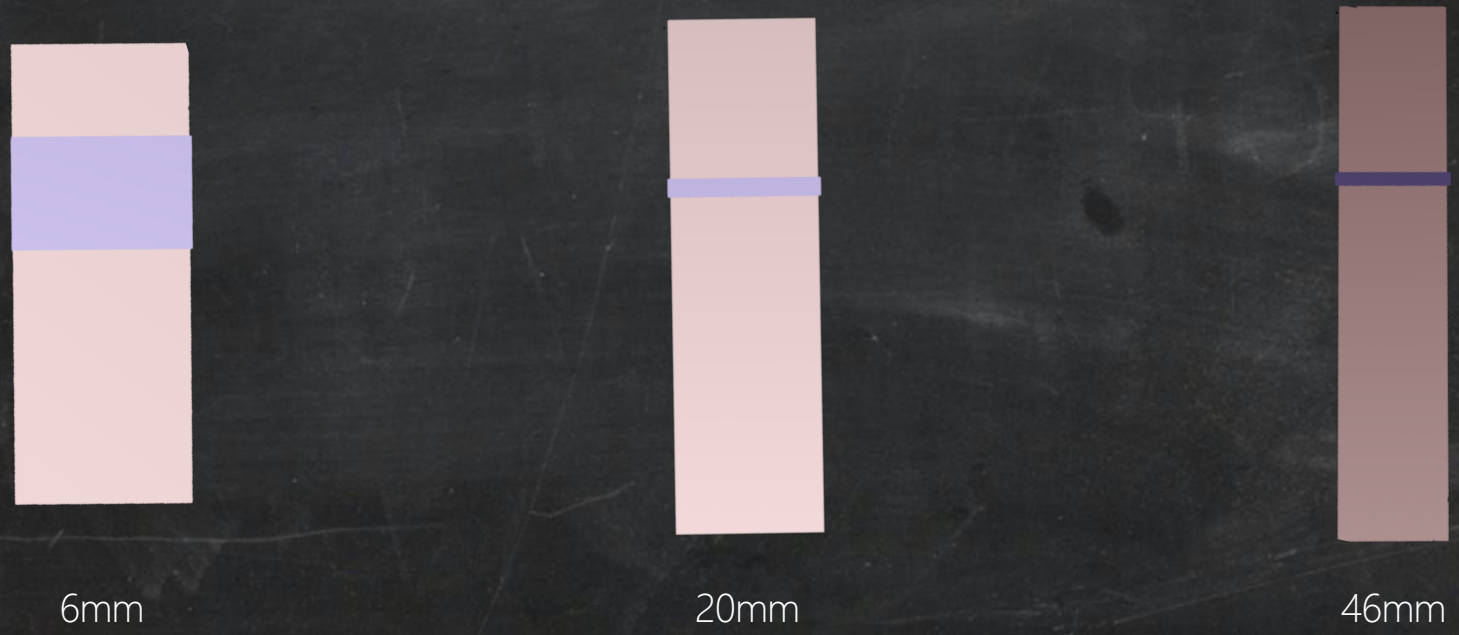
20mm



46mm

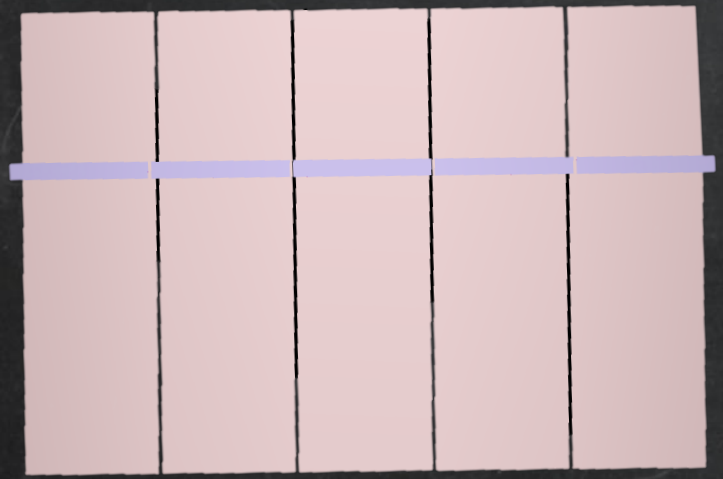
EMR VS Detector Parameters: Hcal radiator thickness

Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:

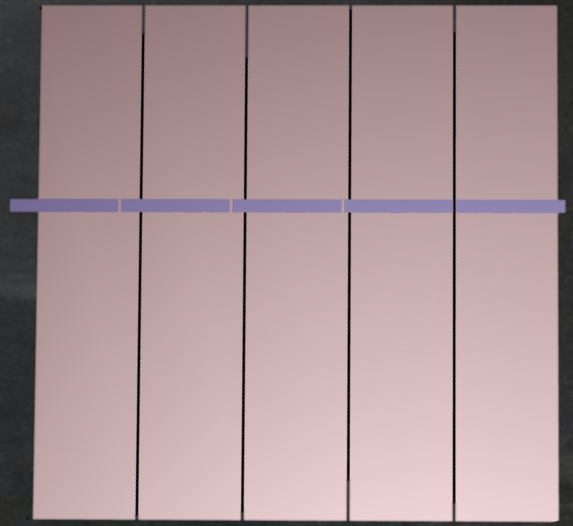


EMR VS Detector Parameters: Hcal radiator thickness

Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:



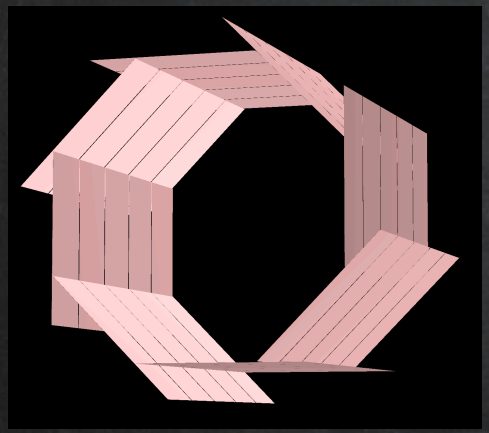
20mm



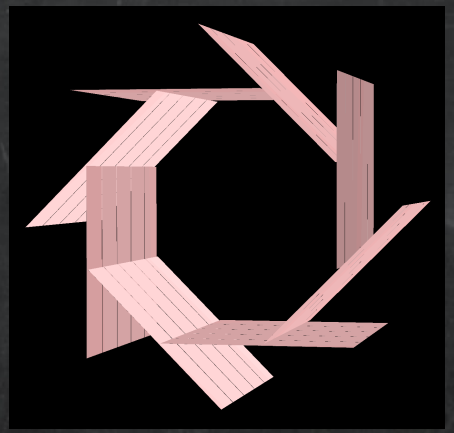
46mm

EMR VS Detector Parameters: Hcal radiator thickness

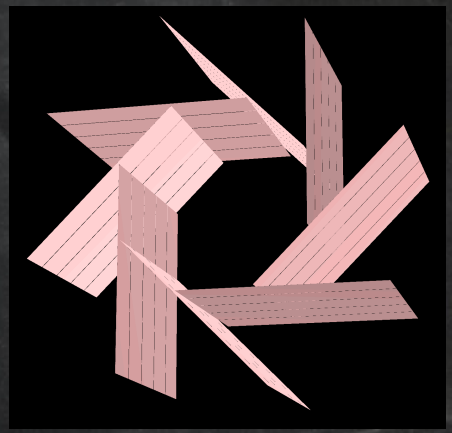
Detector with Hcal radiator thickness = 6mm, 20mm(baseline), 46mm:



6mm



20mm



46mm

Druid Manual

01 Druid Introduction
02 Druid Installation
03 Use Druid
04 Event Information
04 Druid Options

1

Introduction

1 Support

Linear collider detector models: Silicon Detector and International Large Detector,
CALICE test beam calorimeter prototypes.
Druid has been tested on simulated ILC event and CALICE test beam event.

1 Utilize

1 Verification of detector geometry.
2 Analysis of the simulated full events and test beam data.
3 Reconstruction algorithm development and code debugging.

1 Input and output

Druid is between TEve objects and LCIO data files/GDML geometry files.
TEve is a framework for object management, providing hierarchical data organization, object interaction, and visualization through a ROOT Graphical User Interface.
LCIO is a data format.
GDML is a geometry description format.

2

Installation

2 Installation

Install LCIO

您的内容打在这里

Install ROOT

下载root_v6.12.06.macosx64-10.13-clang90.tar.gz，不能dmg，下载好root之后直接source root的bin/thisroot.sh

Make Druid

去Druid的src里面make clean之后重新make

1 Use ilcinstall.
2 At IN2P3 svn server https://llrforge.in2p3.fr/svn/Druid
3 At IN2P3 svn server http://llr.in2p3.fr/~ruan/ILDDisplay
4 At DESY SVN server https://svnsrv.desy.de/viewvc/Druid/trunk/

Download Druid

druid_env.sh（见下页）
bashrc （见下下页）

Druid Environment

2 Environment

druid_env.sh :

```
unset LCIO
source /Users/cuihanhua/studying/software/root_v6.12.06.macosx64-10.13-clang90/bin/thisroot.sh
export ROOTSYS=/Users/cuihanhua/studying/software/root_v6.12.06.macosx64-10.13-clang90
export LCIO=/Users/cuihanhua/studying/software/LCIO-02-12-01
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:$LCIO/lib
export PATH=$PATH:$DRUIDDIR/bin:$LCIO/bin
export PATH="$ROOTSYS/bin:$PATH"
export LD_LIBRARY_PATH="$ROOTSYS/lib:$LD_LIBRARY_PATH"
export DRUIDDIR=/Users/cuihanhua/studying/software/Druid_SL6_2
export PATH=$PATH:$DRUIDDIR/bin
```

2 Environment

bashrc :

```
export ROOTSYS=/Users/cuihanhua/studying/software/root_v5.34.38
export LCIO=/Users/cuihanhua/studying/software/LCIO-02-12-01
export JAVA_HOME=/Library/Java/JavaVirtualMachines/openjdk-12.0.2.jdk/Contents/Home
export PATH=$JAVA_HOME/bin:/Applications/CMake.app/Contents/bin:$ROOTSYS/bin:$LCIO/bin:$PATH
export CLASSPATH=.:$JAVA_HOME/lib/dt.jar:$JAVA_HOME/lib/tools.jar
export DYLD_LIBRARY_PATH=$ROOTSYS/lib:LCIO/lib:$DYLD_LIBRARY_PATH
```

2 Installation

"lcio.h" file not found

make clean;
rootcint -f GlobalDict.cc -c -I/Users/danyu/workplace/ilcsoft/lcio-v02-00/include ../include/EventNavigator.hh ../include/GlobalDefs.hh ../include/MultiView.hh LinkDef.h，把里面lcio路径换成自己的
make

```
cuihanhuadeMacBook-Pro:src cuihanhua$ make
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildGeo.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c CaloHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c EventNavigator.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c GUI.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c loadevent.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildPFOs.cc
BuildPFOs.cc:553:1: warning: control may reach end of non-void function [-Wreturn-type]
}
^
1 warning generated.
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c ClusterHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Vertex.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildMCParticles.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Druid.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c TrackerHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c TrackAssignedHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c MultiView.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Connect.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c RecoJets.cc
rootcint -f GlobalDict.cc -c ../include/EventNavigator.hh ../include/GlobalDefs.hh ../include/MultiView.hh LinkDef.h
Warning in cling::IncrementalParser::CheckABICompatibility():
  Possible C++ standard library mismatch, compiled with _LIBCPP_VERSION '4000'
  Extraction of runtime standard library version was: '8000'
In file included from input_line_12:7:
./../include/GlobalDefs.hh:23:10: fatal error: 'lcio.h' file not found
#include "lcio.h"
         ^~~~~~~~
Error: rootcint: compilation failure (./GlobalDict0635279186_dictUmbrella.h)
make: *** [GlobalDict.cc] Error 1
cuihanhuadeMacBook-Pro:src cuihanhua$
```

2 Installation

Xcode升级

系统升级导致出错：找不到sdk， sdk是系统升级前的版本的
报的错是AvailabilityMacro打不开，导致这样的
通常是因为xcode，xcode升级：xcode-select --install ，更新之后重启

```
cuihanhuadeMacBook-Pro:src cuihanhua$ make
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildGeo.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c CaloHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c EventNavigator.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c GUI.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c loadevent.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildPFOs.cc
BuildPFOs.cc:524:1: warning: control may reach end of non-void function [-Wreturn-type]
}
^
1 warning generated.
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c ClusterHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Vertex.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c BuildMCParticles.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Druid.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c TrackerHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c TrackAssignedHits.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c MultiView.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c Connect.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c RecoJets.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c geometry.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c trajectory.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c segment3.cc
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c point.cc
point.cc:320:9: warning: '/*' within block comment [-Wcomment]
        /*if ( (project_onto_line(onc, mid, n) - project_onto_line(qp, mid, n)).norm() > step / 2 ) {
        ^
1 warning generated.
g++ -g -O -I../include `root-config --cflags` -I/Users/cuihanhua/studying/software/LCIO-02-12-01/include  -c fitting_root.cc
rootcint -f GlobalDict.cc -c ../include/EventNavigator.hh ../include/GlobalDefs.hh ../include/MultiView.hh LinkDef.h
Error: cannot open file "AvailabilityMacros.h"  /Users/cuihanhua/studying/software/root_v5.34.38/include/RConfig.h:384:
Warning: Error occurred during reading source files
Warning: Error occurred during dictionary source generation
!!!Removing GlobalDict.cc GlobalDict.h !!!
Error: rootcint: error loading headers...
make: *** [GlobalDict.cc] Error 1
cuihanhuadeMacBook-Pro:src cuihanhua$
```

2 Installation

无法打开"Druid"

设置-安全性和隐私-通用-锁点开-允许，点开允许之后再打开的时候除了取消和删除就还有一个打开了

3

Use Druid

3 Druid input

1 gear xml file (fast and lightly weighted): CALICE Test beam; ILD subdetectors inside the HCAL.
2 gdml file: every geometry information the simulation software needs to know: size, material, orientation, sharp of every volume.
For lcio files, display the first event takes a longer time.

3 Use Druid

type: bin/Druid

1 bin/Druid *.steer: Specify parameters in steering file
2 bin/Druid *.slcio: Display the first event in lcio file
3 bin/Druid *.slcio n: Display the event n in lcio file
4 bin/Druid *gdml.root /*geom.xml: Display the detector geometry
5 bin/Druid *.slcio *gdml.root/*geom.xml: Display the first event in lcio file and the detector geometry
6 bin/Druid *.slcio *gdml.root/*geom.xml n: Display the event n in lcio file and the detector geometry
7 bin/Druid *.slcio *gdml.root/*geom.xml n1 n2: Display event with RunNumber = n1 and EventNum = n2 in lcio file and the detector geometry

3 Steps of Druid reading gdml file

1 Dump gdml file from the late version of Mokka (higher than mokka-07-03):

Mokka -U Model.macro (you can modify the parameters in it, or remove sub-detectors)
>Mokka/Visu/Detector/DumpGDML (produce total detector "World.gdml")
>exit

2 Convert the gdml file into a root file (with suitable version of root, such as 5.22.00):

root -l
TGeoManager::Import("World.gdml");
gGeoManager->GetTopVolume()->Draw("ogl");
TFile *f=new TFile("World.root","recreate");
gGeoManager->Write();
f->Close();

3 Use Druid to read:

Druid World.root

4

Event Information

4 Event Information

Event information is stored in different collections (MCTruth level, Digitization level, reconstruction level) in a LCIO file.
GDML file can be written by the simulation software (geometry information of the simulation: the size, the material, the orientation, the shape of every volume).
Druid displays each volume.

4 Event Information

Monte Carlo truth information:

MCParticle: displayed as tracks or arrows (for the mother particle).
SimCalorimeter Hit: displayed as cuboids with different size, orientations (according to different subdetector) and colors (according to energy, PID of the particle that creates this hit, PID of the origin of this hit (mother particle at the vertex), randomly generated color and uniform color).
SimTracker Hit: displayed as points with different colors (according to charge).

Reconstructed information:

Calorimeter Hit (Digitized calorimeter hits): displayed as cuboids with different orientations, colors (according to energy information).
Tracker Hit (Digitized tracker hits).
TrackAssigned Hit, Vertex, ClusterHit: low level reconstructed objects with different colors (according to charge).
Reconstructed Particle: displayed as tracks, while the calorimeter hits assigned to this reconstructed particle is also displayed, with different color options as PID of reconstructed particle, randomly generated color and uniform color.

MCParticle and Reconstructed particle collection are divided according to the PID/energy, hits groups are divided according to the subdetectors.

5

Options

5 Eve page

Eve page: all the displayed objects: geometry and event information.

1 Hide/Display: click on the small box in front of the group in the Eve page. Druid will remember the status of display/hide for different objects from last event.

2 Change background color/illumination setting

3 Set reference point.

4 Display depth (hierarchy of geometry): interactively mask the geometry details. The deeper you go into the structure, the more detail is the geometry description. If you focus on the event information, the lowest display depth (the default) (the contour of sub detectors are displayed) is sufficient.

5 Files page

5 Options page

1 Navigate to different events: click on the button with forward/backward arrow or enter a specified event number into the box ‘Go to Evt’ and then type enter.

2 Select rotation center: click on this button and then click on the selected displayed object.

3 Reroll objects color: many objects (hits, tracks, clusters, PFOs...) are colored to the index information, click this button will generate another color according to their index(the order of the object in its collection).

4 Back home: first click this button and then on the display screen, the display will be forced back to the original orientation and scale.

5 Options page

5 Switch between collection scenarios: click on this button will switch between a minimal selected collections and the maximal. To give fastest performance, the minimal scenario is set as the default.

<table>
<tr><td rowspan="6">minimal selected collections:</td><td rowspan="1">simulated data file:</td><td>MCParticles</td></tr>
<tr><td rowspan="5">reconstructed data file:</td><td>all detector hits</td></tr>
<tr><td>MCParticles</td></tr>
<tr><td>all detector hits</td></tr>
<tr><td>reconstructed particle flow objects</td></tr>
<tr><td>PS: the intermediate reconstructed objects, such as digitized hits, tracks and clusters, are not displayed</td></tr>
<tr><td>maximal selected collections:</td><td colspan="2">every collections that Druid can</td></tr>
</table>

5 Options page

6 Specify the style (size, color) for detector hits(simulated, digitized, cluster or reconstructed particle assigned calorimeter hits and tracker hits).

For the color option with energy: we use standard root palette 1, and the default setting is to make blue for 1 mip hits, red for hits energy larger than 10 mip and purple for hits energy smaller than 1 mip.

For user interested in low energy hits, we provided a global scale factor (with initial value = 10) function to change the color setting.

An additional option for HCAL hits according to the semi-digital HCAL is provided, where you can specify the three thresholds (with ratio 1:10:100) between each. When this option is active (with setting thresholds larger than 0), we have purple for hits with energy lower than the smallest threshold, blue for hits with energy between 1st and 2nd threshold, green for hits betweern 2nd and 3rd threshold, and red for hits with energy higher than largest threshold.

Each time you change the color or size option, the screen will output the list of collections that has been redraw.

The default size and orientation of calorimeter hits are set corresponding to different detector geometry concepts.

The hit size can be changed independently for each type and the hit color can be specified according to different information.

The simulated hits can be colored to the energy, the type or index of the particle induces this hit, the time, or a uniform color.

The digitized calorimeter hits are colored to the energy.

The clustered hits are colored according to the index of the cluster.

5 Options page

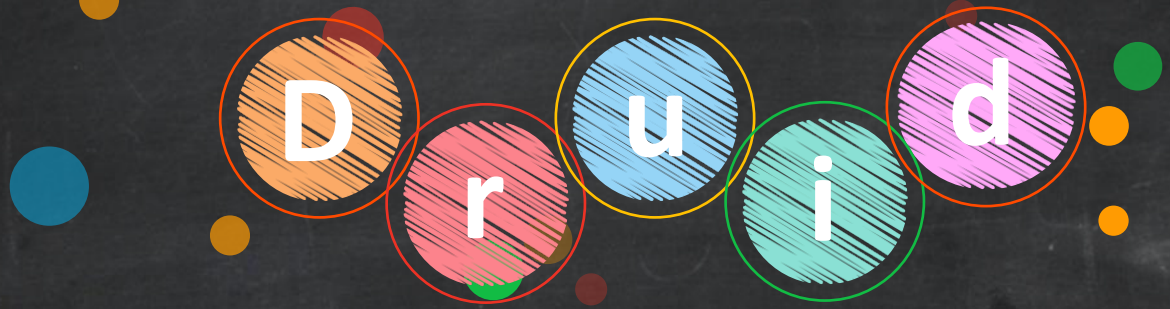
7 Minimal transverse momentum of MCParticles in the small window below the buttons.
8 Cut parameters: a cut away view can be used to removes part of the display to focus on the inner part of the display, for example the cut on the minimal transverse momentum on the MCParticle list, the cut on the energy of calorimeter hits.

5 General Options

zoom (zoom in, zoom out)
rotate
shift the whole display
project the whole event on different planes
Readout text information on individual objects by putting your mouse on the object.

5 Analyze reconstruction algorithm performance

By comparing the Monte Carlo truth objects and the digitized/reconstructed objects, Druid provides a platform to analysis the reconstruction software performance.
People can easily tell if this dropping is expected or not by reading the text information attached to each of those hits.



Thank You!