

ECAL Reconstruction Software

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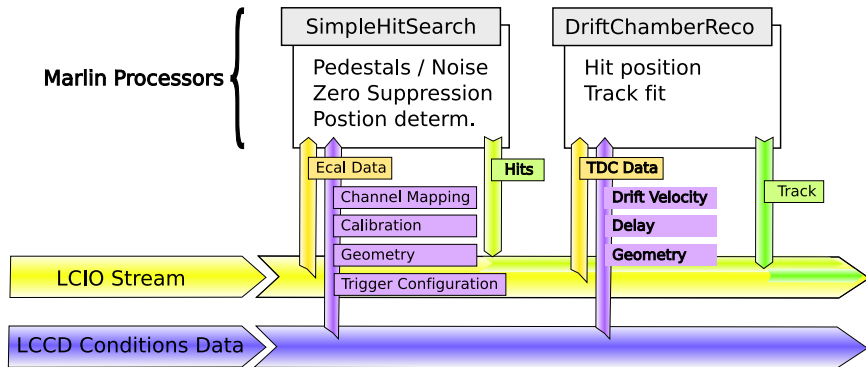
Calice Meeting 12/13 October 2005

Outline

- 1 Introduction
- 2 Marlin Processor Overview

Reconstruction & Analysis Framework

Runs in Marlin framework:



Sources for LCIO Stream / LCCD

LCIO:

- SLCIO files.
- Native DAQ data files through converter.

LCCD:

- MySQL database.
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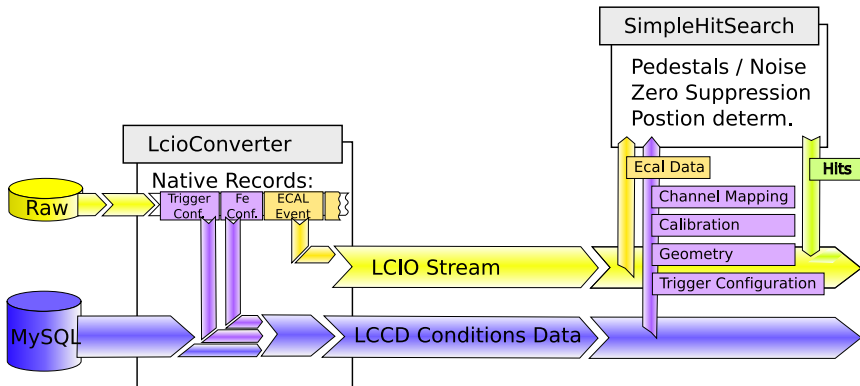
LCCD:

- MySQL database.
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» Conversion »

Conversion to LCIO

Marlin Data Source:



Persistency

LCIO:

- LCIOWriter can write current LCEvent to disk.
(Marlin Processor)

LCCD:

- Conditions data from external sources, never modified.
→ persistent by definition.
- No true here, since LCIO converter creates conditions data.

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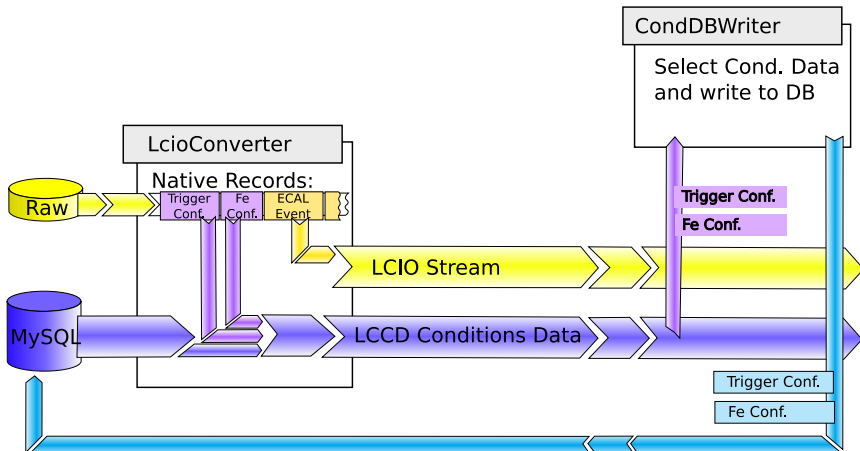
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» CondDBWriter »

Conditions Data Persistency

Marlin Processor which writes selected conditions data to DB:



Processor Overview

Available Processors:

- Reconstruction
- Visualisation
- Analysis
- Utilities

Reconstruction Processors

- SimpleHitSearch:

- Pedestal/Noise determination
- Zero suppression
- Calibration

→ Calibrated hits with 3D coordinate.

- DriftChamberReconstruction:

- Edge selection
- Track fit
- Visualisation

→ a track.

Simple Hit Search :: end of run report :

--- MySimpleHitSearch Report :

2704 events processed.
2375 events with hits (fraction 0.878328).
1 rejected events (fraction 0.000369822).
300 events used for pedestal noise calculation in
3 sets (random trigger sets).
0 triggers not handled.
0 events without ADC information.
0 events with missing ADC blocks.

- Noise statistics :

0: dead=	0 noise	216: 5.04904 <	6.22956+-	0.474854 <	7.46617 pedestal=	216: -441.17 <
1: dead=	0 noise	216: 4.4799 <	5.50623+-	0.460196 <	7.09155 pedestal=	216: -490.22 <
2: dead=	1 noise	215: 4.428 <	5.73447+-	0.798874 <	9.14075 pedestal=	215: -803.57 <
3: dead=	0 noise	216: 3.23132 <	5.51107+-	0.458442 <	6.55919 pedestal=	216: -586.45 <
4: dead=	0 noise	216: 4.03456 <	5.48326+-	0.459097 <	6.61144 pedestal=	216: -648.27 <
5: dead=	4 noise	212: 4.36214 <	5.63919+-	0.658082 <	12.6086 pedestal=	212: -597.57 <
6: dead=	0 noise	216: 3.53797 <	5.66131+-	1.01557 <	14.9266 pedestal=	216: -464.41 <
7: dead=	0 noise	216: 4.45203 <	5.42226+-	0.492295 <	6.80562 pedestal=	216: -381 <
8: dead=	0 noise	216: 4.10277 <	5.54215+-	0.492809 <	7.12942 pedestal=	216: -549.95 <
9: dead=	0 noise	216: 4.05254 <	5.58003+-	0.458448 <	6.70444 pedestal=	216: -524.85 <
10: dead=	0 noise	216: 4.17089 <	5.3869+-	0.435807 <	6.76511 pedestal=	216: -398.04 <
11: dead=	0 noise	216: 4.4543 <	5.56571+-	0.447932 <	6.79055 pedestal=	216: -327.19 <
12: dead=	0 noise	216: 4.22852 <	5.40546+-	0.478421 <	6.6077 pedestal=	216: -587.31 <
13: dead=	0 noise	216: 4.05886 <	5.51706+-	0.567071 <	7.45762 pedestal=	216: -442.8 <

- **CollectionHistogrammer:**
Collect names of all collections in LCIO stream and gather some statistics.
- **ProgressHandler:**
Catch CTRL-C, terminate Marlin gracefully.
- **CollectionSelector:**
Select collections which are written by the LCIOWriter (obsolete).
- **HistogramWriter:**
Write selected Histograms to ROOT files.

Collection Histogrammer :: end of run report:

--- MyCollectionHistogrammer Report :

- Collections:

EcalClusters:	2374:	0 <	1.00295+-0.0984057 <	3
calorimeter_hits:	2374:	1 <	49.8981+- 9.95543 <	92
driftchamber_hits:	2359:	3 <	7.98262+- 0.216267 <	8
driftchamber_track:	2359:	1 <	1+- 0 <	1

- Transient Collections:

ADC_Collections:	2703:	270 <	270.02+- 0.599445 <	288
BeTrgConf:	2703:	1 <	1+- 0 <	1
BeTrgEventData:	2703:	1 <	1+- 0 <	1
BoardHeaderInfo:	2703:	2 <	2+- 0 <	2
CALDAQ_FeConfiguration:	2703:	32 <	32+- 0 <	32
CaliceEcalCalibrationCol:	2703:	14 <	14+- 0 <	14
CellParameters:	2703:	3024 <	3024+- 0 <	3024
EventHeaderInfo:	2703:	1 <	1+- 0 <	1
ExperimentalSetup:	2703:	1 <	1+- 0 <	1
FeHeaderInfo:	2703:	16 <	16+- 0 <	16
RunInfo:	2703:	1 <	1+- 0 <	1
TrailerInfo:	2703:	2 <	2+- 0 <	2
drift_chamber_parameters:	2703:	8 <	8+- 0 <	8
module_connection:	2703:	14 <	14+- 0 <	14
module_description:	2703:	4 <	4+- 0 <	4
module_location:	2703:	14 <	14+- 0 <	14
testTdcCol:	2703:	16 <	16+- 0 <	16
triggerassignment:	2703:	0 <	0+- 0 <	0

Analysis

- MipSelect:
Dumb clusteriser.
- SimpleHitSearch:
some data quality histograms.
- DriftChamberReconstruction:
residuals, drift velocity
- ClusterHistograms:
cluster properties.

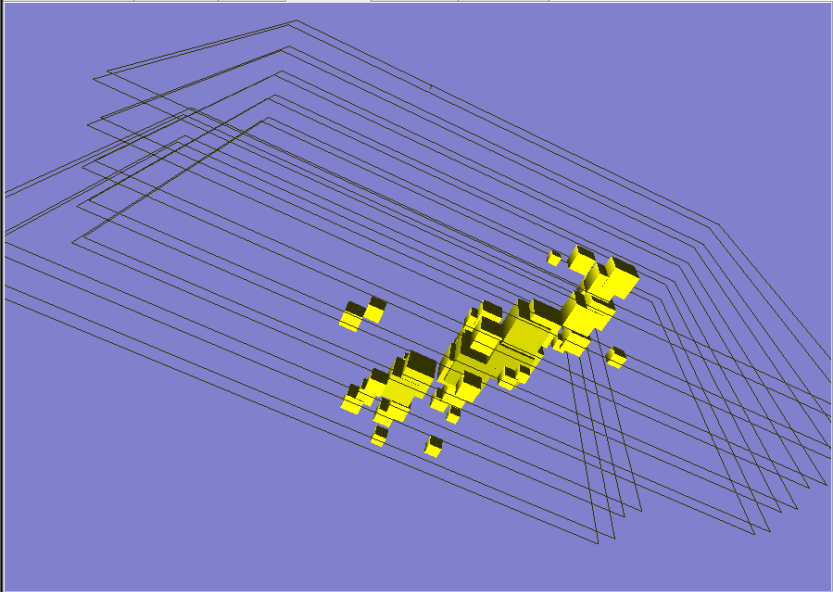
Cluster Histograms :

All Folders	Contents of "/R/ROOT Files/TestBeam/Cluster/Cluster_100155_v0.1.0pre2.root/Cluster_100155"			
root	ClusterTrackDeltaX_layer0;1	ClusterTrackDeltaX_layer10;1	ClusterTrackDeltaX_layer11;1	ClusterTrackDeltaX_layer12;1
PROOF Sessions	ClusterTrackDeltaX_layer13;1	ClusterTrackDeltaX_layer1;1	ClusterTrackDeltaX_layer2;1	ClusterTrackDeltaX_layer3;1
/data/goetz/Calice	ClusterTrackDeltaX_layer4;1	ClusterTrackDeltaX_layer5;1	ClusterTrackDeltaX_layer6;1	ClusterTrackDeltaX_layer7;1
ROOT Files	ClusterTrackDeltaX_layer8;1	ClusterTrackDeltaX_layer9;1	ClusterTrackDeltaY_layer0;1	ClusterTrackDeltaY_layer10;1
TestBeam/Cluster/Cluster_1	ClusterTrackDeltaY_layer11;1	ClusterTrackDeltaY_layer12;1	ClusterTrackDeltaY_layer13;1	ClusterTrackDeltaY_layer1;1
Cluster_100155	ClusterTrackDeltaY_layer2;1	ClusterTrackDeltaY_layer3;1	ClusterTrackDeltaY_layer4;1	ClusterTrackDeltaY_layer5;1
	ClusterTrackDeltaY_layer6;1	ClusterTrackDeltaY_layer7;1	ClusterTrackDeltaY_layer8;1	ClusterTrackDeltaY_layer9;1
	MeanX_Layer0;1	MeanX_Layer10;1	MeanX_Layer11;1	MeanX_Layer12;1
	MeanX_Layer13;1	MeanX_Layer1;1	MeanX_Layer2;1	MeanX_Layer3;1
	MeanX_Layer4;1	MeanX_Layer5;1	MeanX_Layer6;1	MeanX_Layer7;1
	MeanX_Layer8;1	MeanX_Layer9;1	MeanY_Layer0;1	MeanY_Layer10;1
	MeanY_Layer11;1	MeanY_Layer12;1	MeanY_Layer13;1	MeanY_Layer1;1
	MeanY_Layer2;1	MeanY_Layer3;1	MeanY_Layer4;1	MeanY_Layer5;1
	MeanY_Layer6;1	MeanY_Layer7;1	MeanY_Layer8;1	MeanY_Layer9;1
	NHits_layer0;1	NHits_layer10;1	NHits_layer11;1	NHits_layer12;1
	NHits_layer13;1	NHits_layer1;1	NHits_layer2;1	NHits_layer3;1
	NHits_layer4;1	NHits_layer5;1	NHits_layer6;1	NHits_layer7;1
	NHits_layer8;1	NHits_layer9;1	TotalSignal_Layer0;1	TotalSignal_Layer10;1
	TotalSignal_Layer11;1	TotalSignal_Layer12;1	TotalSignal_Layer13;1	TotalSignal_Layer1;1
	TotalSignal_Layer2;1	TotalSignal_Layer3;1	TotalSignal_Layer4;1	TotalSignal_Layer5;1
	TotalSignal_Layer6;1	TotalSignal_Layer7;1	TotalSignal_Layer8;1	TotalSignal_Layer9;1
	cluster_angle_zx;1	cluster_angle_zy;1	cluster_centre_x;1	cluster_centre_y;1
	cluster_centre_z;1	cluster_out_flow;1	cluster_line_fit_chi2;1	cluster_pos_x;1
	cluster_pos_y;1	cluster_rms_x;1	cluster_rms_y;1	cluster_rms_z;1
	cluster_signal;1	cluster_track_delta_x;1	cluster_track_delta_y;1	cluster_x_fit_vs_track_x;1
	cluster_x_vs_track_x;1	cluster_y_fit_vs_track_y;1	cluster_y_vs_track_y;1	cut_flow;1
	hit_energy_at_track_pos;1	hit_pos_x;1	hit_pos_y;1	hit_pos_z;1
	hit_signal;1	impact_map;1	n_cluster;1	n_hits;1
	n_hits_per_cluster;1	signal_vs_ncluster;1	signal_vs_nhits;1	total_energy_at_track_pos;1
	x_vs_column;1	x_vs_pad_column;1	y_vs_pad_row;1	y_vs_row;1

Visualisation

- RawValueViewProcessor:
 - Raw ADC values
 - Pedestal subtracted, calibrated values
 - Pedestal, Noise
 - Number of hits per pad
- EventViewProcessor:
OpenGL based 3D Event display
- TriggerAnalysis:
Trigger bits as function of FIFO depth.
- DriftChamberReconstruction:
 - Edges
 - fitted track
- ShowerShapeAnalysis:
visualisation of shower: lateral, radial

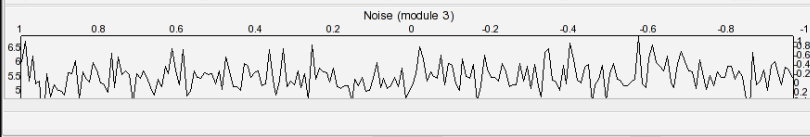
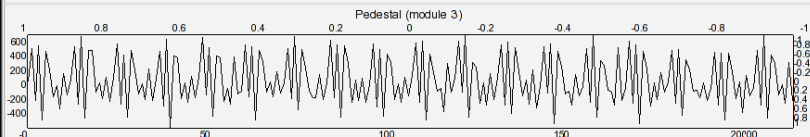
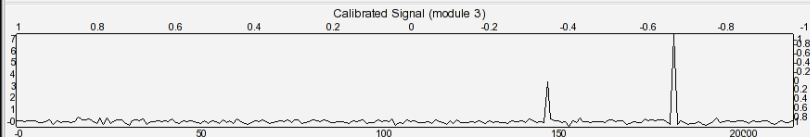
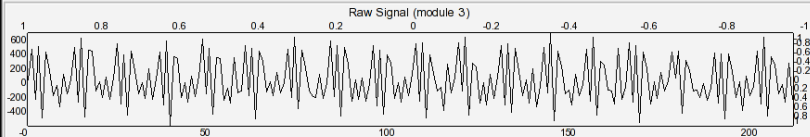
Drift Chamber Display Value Display Histograms Event Display Shower Shape Trigger Display



Show snapshots only Auto Change every [s]: Run: 100176 Event: 3448

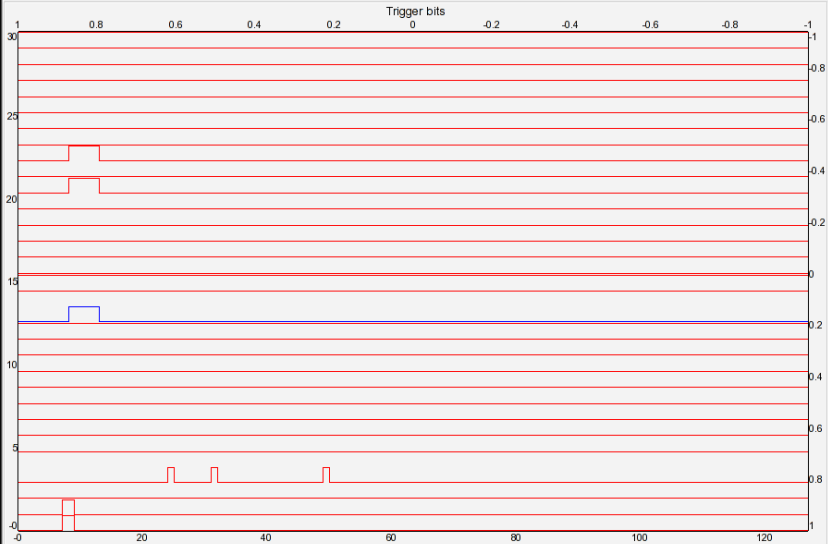
Drift Chamber Display Value Display Histograms Event Display Shower Shape Trigger Display

One Module One type Calibrated ADC 3



Show snapshots only Auto Change every [s]: 10.0 Run: 100176 Event: 3470

Drift Chamber Display Value Display Histograms Event Display Shower Shape **Trigger Display**



x= 87.3962 y= 7.64935

Show snapshots only

Auto Change every [s]:

10.0

Forward

Run: 100176 Event: 3456

Drift Chamber Display Value Display **Histograms** Event Display Trigger Display

DriftChamber

Position

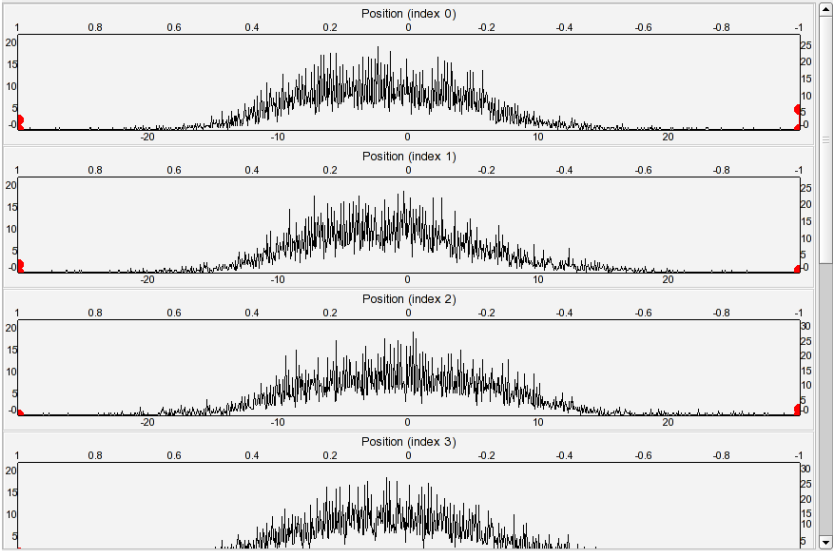
Major/Layer Index

0

Combine bins

0

Log Y



Show snapshots only

Auto Change every [s]:

10.0

Forward

Run: 100176

Event: 7102

Close GUI

Conditions Data Base Tools

Tools to:

- initialise a MySQL conddb.
- populate the conddb:
 - ECAL geometry, calibration constants
 - cell mapping
 - drift chamber geometry, calibration constants
 - table position, beam type, energy (useful?).
- print contents of the conditions data base.
(very simple tool)

Simple Conddb Browser :

```
> conddbInfo --db localhost:CaliceCondDB:Marlin:Marlin?
```

```
/CaliceEcal/module_description  
/CaliceEcal/module_location  
/CaliceEcal/mapping  
/Calice/ExperimentalSetup  
/CaliceEcal/calibration_constants  
/TsukubaDriftChamber/drift_chamber_parameters  
/CaliceTrigger/triggerassignment
```

```
> conddbInfo --db init string --folder /CaliceEcal/calibrationConstants --details
```

```
CondDB objects of folder /CaliceEcal/calibration_constants:
```

```
2004:/12/17 0: 0: 0. 0. 0 - 2016:/ 1/ 1 0:59:59. 0. 0. 0:0 :
```

```
LCGenericObject: Calibration constants of all cells of all modules.
```

```
1 string parameters :
```

```
  TypeName:
```

```
    EcalModuleCalibration
```

```
collection with 14 elements
```

```
type=C id= 3 cells= 216 broken=1 cal.: 215:0.0202979 < 0.0215203+-0.00060689 < 0.0231812  
type=C id= 4 cells= 216 broken=0 cal.: 216: 0.02046 < 0.0219609+-0.000638091 < 0.0235519  
type=C id= 5 cells= 216 broken=0 cal.: 216: 0.019941 < 0.021886+-0.000808376 < 0.023998  
type=C id= 6 cells= 216 broken=0 cal.: 216:0.0203606 < 0.0219084+-0.000751655 < 0.0242102  
type=C id= 7 cells= 216 broken=4 cal.: 212:0.0169156 < 0.0218027+-0.00063893 < 0.0230855  
type=C id= 8 cells= 216 broken=0 cal.: 216:0.0208328 < 0.0218238+-0.00047234 < 0.0236193  
type=C id= 9 cells= 216 broken=0 cal.: 216:0.0197848 < 0.021017+-0.000531023 < 0.0222175  
type=C id= 10 cells= 216 broken=0 cal.: 216:0.0200979 < 0.0212936+-0.000590263 < 0.0228158  
type=C id= 11 cells= 216 broken=0 cal.: 216:0.0198251 < 0.021488+-0.000705752 < 0.0235547  
type=C id= 12 cells= 216 broken=0 cal.: 216:0.0200229 < 0.0213326+-0.000508408 < 0.0226971  
type=C id= 13 cells= 216 broken=0 cal.: 216:0.0215517 < 0.0215517+- nan < 0.0215517  
type=C id= 14 cells= 216 broken=0 cal.: 216:0.0215517 < 0.0215517+- nan < 0.0215517  
type=C id= 15 cells= 216 broken=0 cal.: 216:0.0215517 < 0.0215517+- nan < 0.0215517  
type=C id= 16 cells= 216 broken=0 cal.: 216:0.0215517 < 0.0215517+- nan < 0.0215517
```

Summary Outlook

- Flexible set of utilities to analyse data of Calice Prototype.
- New Version [v0.1.0](#) about to be released.

see: <http://polywww.in2p3.fr/~gaycken/Calice/Software/>

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