Using the LCSim Event Browser

Using the LCSim Event Browser

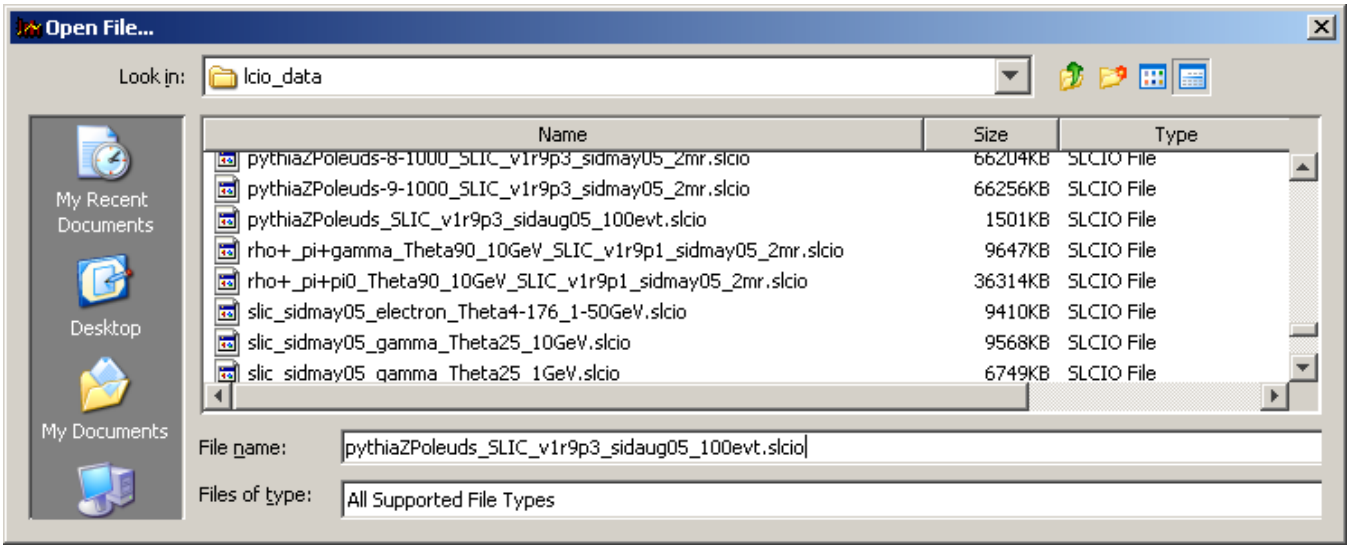
The event data in LCIO files can be viewed using JAS3 with the LCSim Plugin. This tutorial will show you how to open an LCIO data file and browse through it using this tool.

Loading an LCIO Data File

Download this qqbar sample in the sid02 detector to your harddisk. This data file will be used throughout the example.

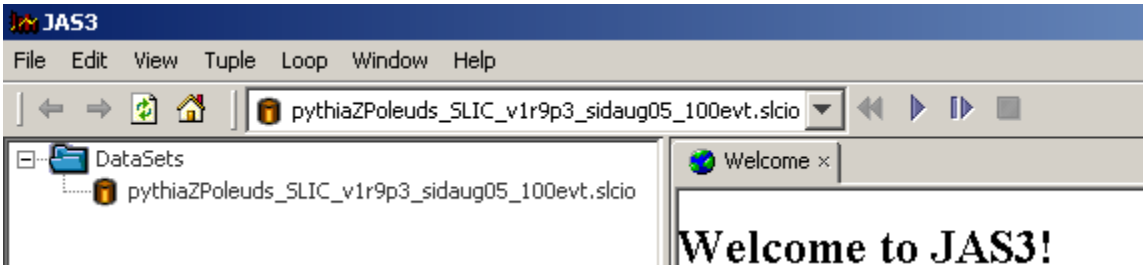
Open JAS3 by clicking on **Start -> Programs -> JAS3 -> JAS3**.

Browse to the data file by clicking on **File -> Open**, navigating to the directory where the file was saved, selecting the file, and pressing **Enter**.



If you are asked which plugin to chose for opening the file, choose **org.lcsim**. This query may or may not appear on your system. (It only shows up if you have multiple plugins installed that can open the file.)

JAS has changed a bit now that the LCIO file is loaded.



- The name of the file is shown in the select box.
- The JAS tree shows at the lefthand side of the screen with a folder called **Datasets**. The file is listed as a member of this folder.
- The record toolbar shows on the toolbar. This is used to step through records one-by-one or process all of the records in a file.
- The listing under **File -> Recent Files** shows the name of this file, for easy access in a later session.

This is the basic view for LCIO files.

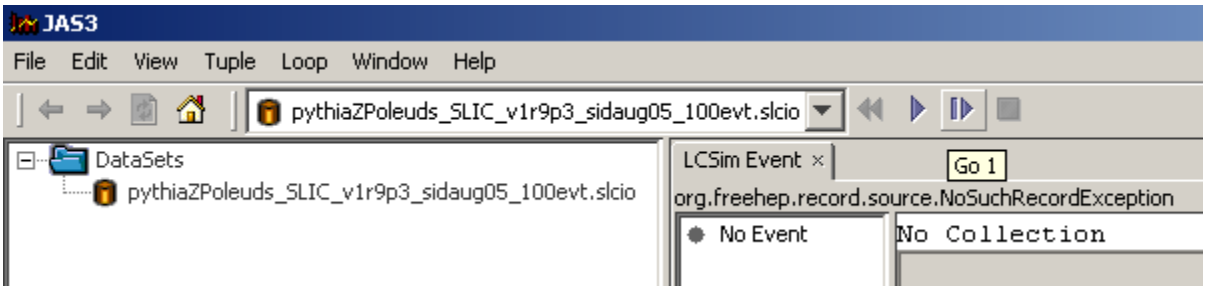
Viewing Collection Data with LCSim Event Viewer

The LCSim Event Viewer shows event data from the collections in the LCIO file. (Collections are sets of objects with the same type, such as CalorimeterHits, TrackerHits or MCParticles.)

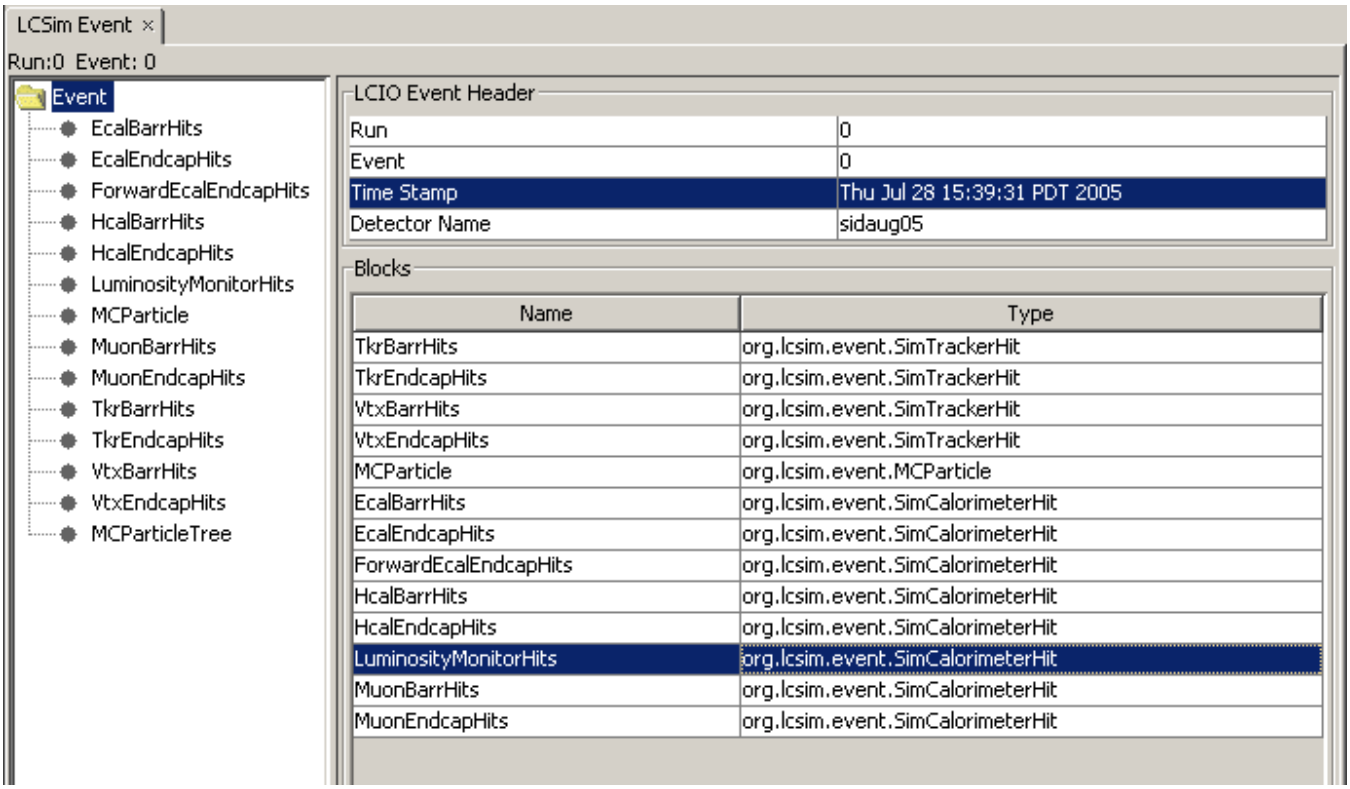
To open the browser, select **File -> New -> LCSim Event Browser**.

Only an empty tab reading "LCSim Event" shows, because the plugin requires some data to read.

To feed the LCSim plugin a record, press the **Go 1** button. This button has a vertical bar plus a right arrow.



Now, the viewer should be filled with event information.



This is the event view. (Notice that **Event** is select in the lefthand menu.)

The **LCIO Event Header** section shows the information from the LCIO event header, including run and event numbers, the time stamp, and the name of the simulated detector.

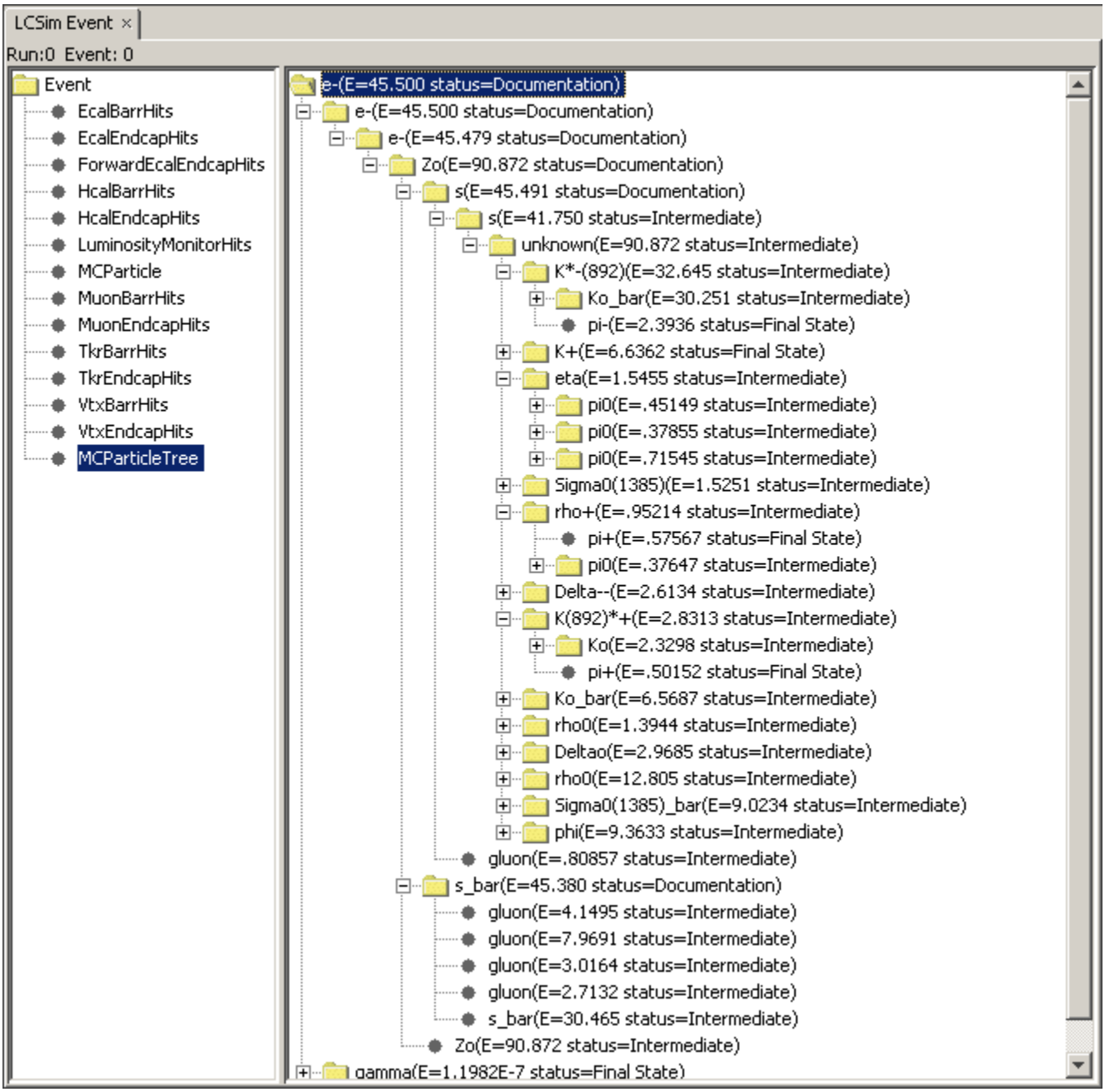
The **Blocks** (basically meaning "Collections") area shows the data collections within this event. For simulated event files, these collections will usually consist of the Monte Carlo Particles (MCParticles) from the physics event, hits in the calorimeter systems (CalorimeterHit), and the hits from the trackers (TrackerHit).

> The LCSim Event Viewer can also show reconstruction objects, such as clusters and tracks, but this tutorial will focus on the simulation classes mentioned previously, e.g. hits and tracks.

View a collection's data by clicking on its corresponding icon in the tree on the lefthand side of the LCSim Event Viewer.

Monte Carlo Particles

Open the **MCParticleTree** by clicking on it in the lefthand, event tree menu.



This shows the tree-like hierarchy of Monte Carlo Particles (MCParticles) in the event. A particles "children" can be viewed by expanding it using the "+" button.

More detailed information on MCParticles is available from the **MCParticles** collection, which has one record for every particle in the event.

LCSim Event ×

Run:0 Event: 0

Event
- EcalBarrHit
- EcalEndcap
- ForwardEc
- HcalBarrHit
- HcalEndcap
- Luminosityl
- MCParticle
- MuonBarrH
- MuonEndca
- TkrBarrHits
- TkrEndcapl
- VtxBarrHits
- VtxEndcap
- MCParticle

Collection: MCParticle size:163 flags:0

N	Type	Status	Parent	Energy	Momentum	Start	End	Mass	Charge
0	e-	Other (0)	1	5.1356E-4	[-6.3707E-6,-4.2547E-5,2.7728E-5]	[51.173,-338.54,967.59]	[51.230,-338.55,967.65]	5.1100E-4	-1.0000
1	gamma	Other (0)	27	3.1000E-6	[-2.0050E-6,4.0243E-7,-2.3298E-6]	[53.297,-338.97,970.06]	[51.173,-338.54,967.59]	0.0000	0.0000
2	unknown	Other (0)	27	10.253	[.0054836,.10525,-.030772]	[53.297,-338.97,970.06]	[53.297,-338.97,970.06]	10.253	5.0000
3	gamma	Other (0)	27	.0076770	[-.0020473,-.0054485,-.0050059]	[53.297,-338.97,970.06]	[-305.26,-1283.0,109.15]	0.0000	0.0000
4	e-	Other (0)	5	5.8605E-4	[1.7727E-4,2.1044E-4,8.1412E-5]	[383.84,-195.55,1354.2]	[383.85,-195.54,1354.2]	5.1100E-4	-1.0000
5	gamma	Other (0)	8	2.6711	[.24223,-.70992,2.5637]	[101.89,-452.13,1366.6]	[131.69,-539.45,1682.0]	0.0000	0.0000
6	e-	Other (0)	7	7.3159E-4	[-9.2339E-5,-4.0613E-4,-3.1724...	[4.9370,-534.74,1354.1]	[4.9304,-534.82,1354.1]	5.1100E-4	-1.0000
7	gamma	Other (0)	8	4.3694	[.47874,-1.3041,4.1427]	[101.89,-452.13,1366.6]	[139.17,-553.68,1689.2]	0.0000	0.0000
8	pi0	Other (0)	13	7.0406	[.72098,-2.0140,6.7063]	[101.89,-452.13,1366.6]	[101.89,-452.13,1366.6]	.13498	0.0000
9	gamma	Other (0)	12	1.4230	[.20817,-.31454,1.3721]	[101.89,-452.13,1366.6]	[150.66,-525.82,1688.1]	0.0000	0.0000
10	e-	Other (0)	11	6.6883E-4	[3.5669E-4,1.5175E-4,-1.8963E-4]	[219.28,-141.75,654.10]	[219.32,-141.73,654.08]	5.1100E-4	-1.0000
11	gamma	Other (0)	12	.24037	[.087680,-.039409,.22031]	[101.89,-452.13,1366.6]	[228.53,-509.05,1684.8]	0.0000	0.0000
12	pi0	Other (0)	13	1.6633	[.29585,-.35395,1.5924]	[101.89,-452.13,1366.6]	[101.89,-452.13,1366.6]	.13498	0.0000
13	K0_S	Other (0)	27	8.7039	[1.0168,-2.3680,8.2987]	[53.297,-338.97,970.06]	[101.89,-452.13,1366.6]	.49767	0.0000
14	pi+	Other (0)	27	13.597	[-.058580,-4.9735,12.654]	[53.297,-338.97,970.06]	[25.936,-727.82,2021.8]	.13957	1.0000
15	gamma	Other (0)	17	.31719	[.050835,-.11784,.29006]	[53.297,-338.97,970.06]	[177.77,-627.51,1680.3]	0.0000	0.0000
16	gamma	Other (0)	17	3.8969	[.16079,-1.3898,3.6370]	[53.297,-338.97,970.06]	[84.727,-610.64,1681.0]	0.0000	0.0000
17	pi0	Other (0)	27	4.2140	[.21162,-1.5076,3.9271]	[53.297,-338.97,970.06]	[53.297,-338.97,970.06]	.13498	0.0000
18	e-	Other (0)	19	6.5786E-4	[-2.5980E-4,5.2280E-5,-3.1848E-4]	[110.01,-525.21,1354.2]	[109.98,-525.21,1354.2]	5.1100E-4	-1.0000
19	gamma	Other (0)	21	.46503	[.099399,-.019274,.45388]	[53.297,-338.97,970.06]	[209.27,-369.21,1682.2]	0.0000	0.0000

From this table, you can see the type, energy, momentum, start and ending points, etc. of each particle.

Calorimeter Hit Collections

Select **EcalBarrHits** from the event menu.

LCSim Event ×

Run:0 Event: 0

Event
- EcalBarrHits
- EcalEndcapHits
- ForwardEcalEndcapHits
- HcalBarrHits
- HcalEndcapHits
- LuminosityMonitorHits
- MCParticle
- MuonBarrHits
- MuonEndcapHits
- TkrBarrHits
- TkrEndcapHits
- VtxBarrHits
- VtxEndcapHits
- MCParticleTree

Collection: EcalBarrHits size:304 flags:e0000000

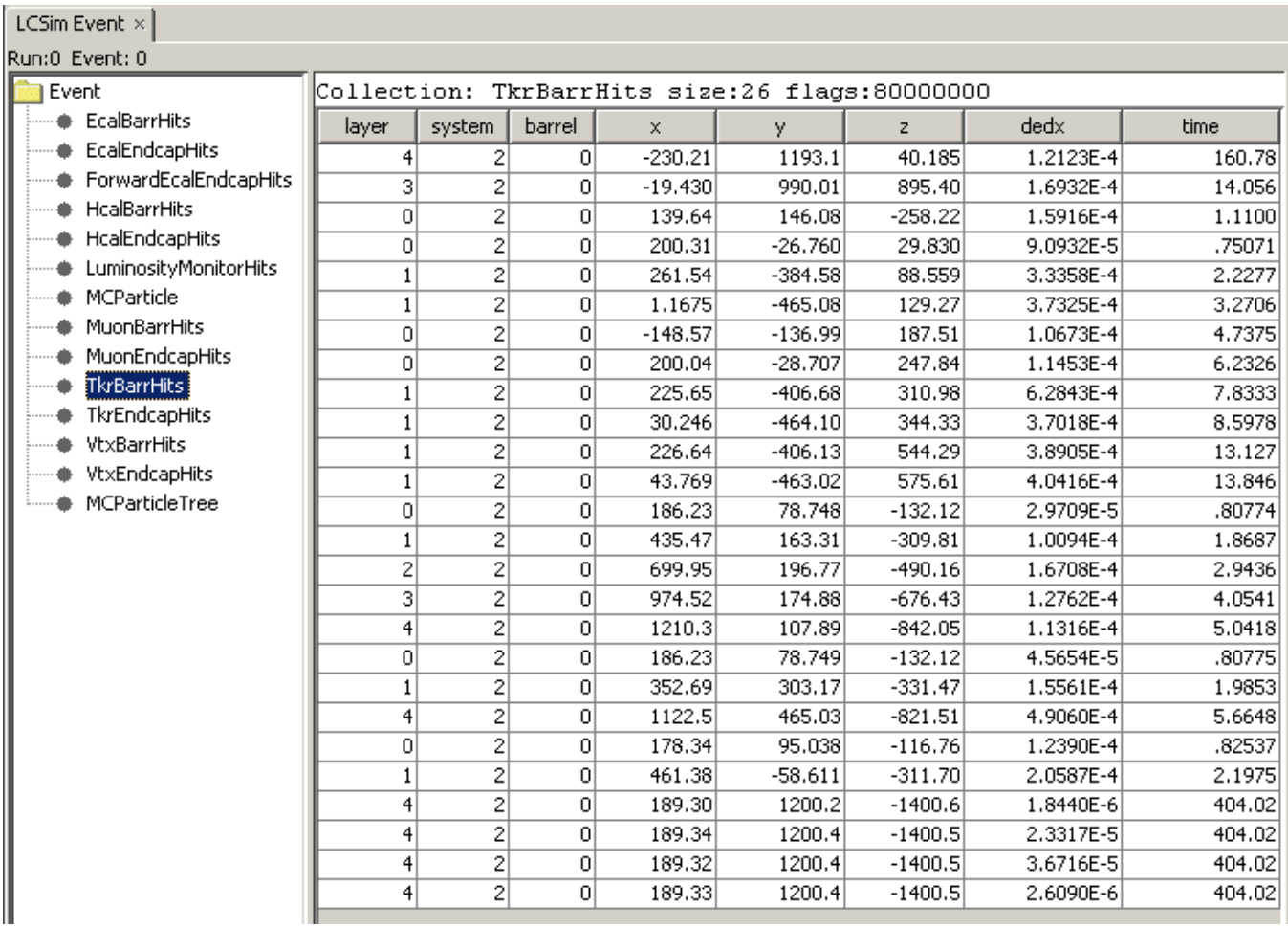
layer	system	barrel	theta	phi	energy	x	y	z
0	2	0	656	259	2.6503E-4	873.12	926.85	-681.90
4	2	0	655	264	1.6824E-4	868.56	951.53	-684.73
4	2	0	654	265	1.5132E-4	865.57	954.26	-679.55
4	2	0	656	260	4.0875E-4	880.45	940.54	-689.93
5	2	0	657	260	1.6591E-4	883.02	943.28	-697.17
2	2	0	772	144	8.8920E-4	1151.1	561.68	-1476.0
3	2	0	772	144	9.8871E-4	1154.5	563.33	-1480.4
4	2	0	772	144	.0014083	1157.9	564.97	-1484.7
11	2	0	776	128	5.0582E-5	1208.9	516.40	-1554.0
5	2	0	772	144	2.0894E-4	1161.2	566.62	-1489.0
5	2	0	771	143	9.6232E-4	1163.0	562.97	-1479.6
3	2	0	773	145	5.1100E-4	1152.7	566.95	-1489.8
3	2	0	772	145	5.2431E-4	1152.7	566.95	-1480.4
6	2	0	772	144	1.3163E-4	1164.6	568.26	-1493.3
5	2	0	772	143	8.2387E-6	1163.0	562.97	-1489.0
7	2	0	777	148	3.1772E-5	1160.7	584.54	-1546.0
2	2	0	772	145	.0010657	1149.3	565.30	-1476.0
0	2	0	793	76	4.3329E-4	1236.7	303.09	-1679.4
1	2	0	793	75	7.1480E-4	1241.3	300.08	-1684.3
2	2	0	793	75	.0011169	1245.0	300.96	-1689.3

This view shows one record for each hit in the "EcalBarrHits" collection. These hits are objects of type SimCalorimeterHit. All of the Calorimeter hit collections (including both endcaps and barrels) are decoded in an identical fashion, so the Hcal and Muon collections will look quite similar.

Not all of the fields may make sense to you, but ones to notice for Calorimeter hits include layer, which is the logical subdetector layer of the hit, energy (e. g. the raw, uncompensated energy deposition) and position (X, Y, Z).

Tracker Hit Collections

Now click on **TkrBarrHits** in the event tree menu.



layer	system	barrel	x	y	z	dedx	time
4	2	0	-230.21	1193.1	40.185	1.2123E-4	160.78
3	2	0	-19.430	990.01	895.40	1.6932E-4	14.056
0	2	0	139.64	146.08	-258.22	1.5916E-4	1.1100
0	2	0	200.31	-26.760	29.830	9.0932E-5	.75071
1	2	0	261.54	-384.58	88.559	3.3358E-4	2.2277
1	2	0	1.1675	-465.08	129.27	3.7325E-4	3.2706
0	2	0	-148.57	-136.99	187.51	1.0673E-4	4.7375
0	2	0	200.04	-28.707	247.84	1.1453E-4	6.2326
1	2	0	225.65	-406.68	310.98	6.2843E-4	7.8333
1	2	0	30.246	-464.10	344.33	3.7018E-4	8.5978
1	2	0	226.64	-406.13	544.29	3.8905E-4	13.127
1	2	0	43.769	-463.02	575.61	4.0416E-4	13.846
0	2	0	186.23	78.748	-132.12	2.9709E-5	.80774
1	2	0	435.47	163.31	-309.81	1.0094E-4	1.8687
2	2	0	699.95	196.77	-490.16	1.6708E-4	2.9436
3	2	0	974.52	174.88	-676.43	1.2762E-4	4.0541
4	2	0	1210.3	107.89	-842.05	1.1316E-4	5.0418
0	2	0	186.23	78.749	-132.12	4.5654E-5	.80775
1	2	0	352.69	303.17	-331.47	1.5561E-4	1.9853
4	2	0	1122.5	465.03	-821.51	4.9060E-4	5.6648
0	2	0	178.34	95.038	-116.76	1.2390E-4	.82537
1	2	0	461.38	-58.611	-311.70	2.0587E-4	2.1975
4	2	0	189.30	1200.2	-1400.6	1.8440E-6	404.02
4	2	0	189.34	1200.4	-1400.5	2.3317E-5	404.02
4	2	0	189.32	1200.4	-1400.5	3.6716E-5	404.02
4	2	0	189.33	1200.4	-1400.5	2.6090E-6	404.02

Similar to the calorimeter view, this shows a record for each tracker in the collection.

The key values of interest are probably layer, position (x, y, z), dedx (e.g. raw energy deposition), and time.