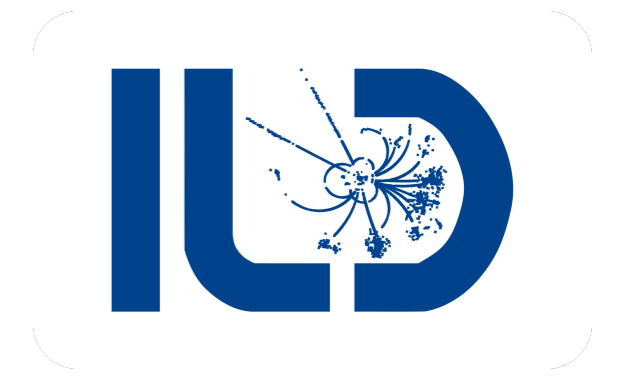




V0s, Pandora & LCFIPlus

R.Ete, Y.Radkhorrani & J. List,
ILD Software Conveners Meeting
Jan 24 2018



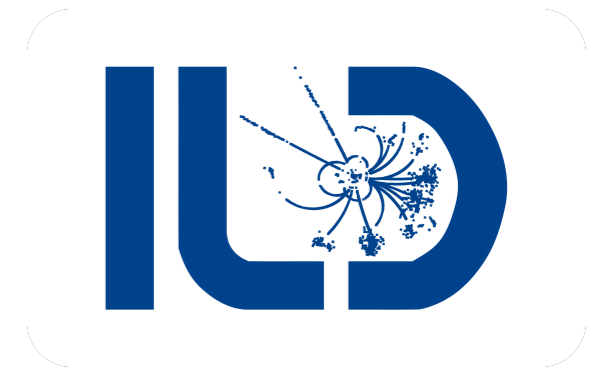


Collections on DST in v01-19-05

```
collection name : BuildUpVertex
collection name : BuildUpVertex_RP
collection name : BuildUpVertex_V0
collection name : BuildUpVertex_V0_RP
collection name : DistilledPF0s
collection name : GammaGammaCandidateEtaPrimes
collection name : GammaGammaCandidateEtas
collection name : GammaGammaCandidatePi0s
collection name : GammaGammaParticles
collection name : KinkRecoParticles
collection name : KinkVertices
collection name : MCParticlesSkimmed
collection name : MCTruthMarlinTrkTracksLink
collection name : MarlinTrkTracks
collection name : MarlinTrkTracksMCTruthLink
collection name : PandoraClusters
collection name : PandoraPFANewStartVertices
collection name : PandoraPF0s
collection name : PrimaryVertex
collection name : PrimaryVertex_RP
collection name : RecoMCTruthLink
collection name : V0RecoParticles
collection name : V0Vertices
```

Why are there 2 sets
of V0 collections?

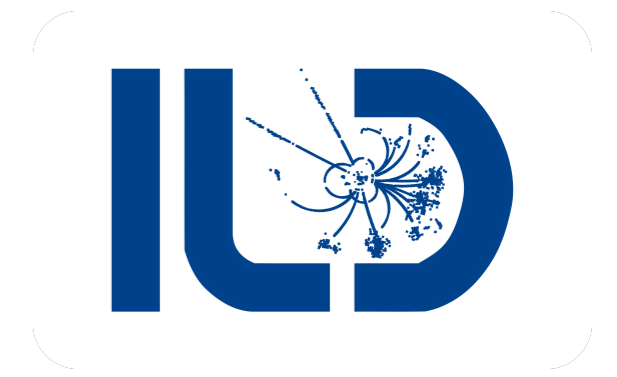
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collection name : RecoMCTruthLink
collection name : V0RecoParticles
collection name : V0Vertices
```

created by LCFIPlus,
V0-RP made out of **2 other**
RPs (PandoraPF0s)

Why are there 2 sets
of V0 collections?



Collections on DST in v01-19-05

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created by LCFIPlus,
V0-RP made out of **2 other
RPs (PandoraPF0s)**

Why are there 2 sets
of V0 collections?

created by V0Finder,
V0-RP made out of **2 tracks
- input to Pandora!**



Collections on DST in v01-19-05

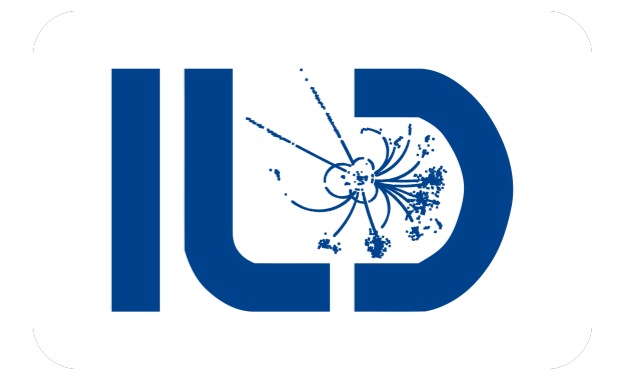
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created by LCFIPlus,
V0-RP made out of **2 other
RPs (PandoraPFOs)**

Why are there 2 sets
of V0 collections?

created by V0Finder,
V0-RP made out of **2 tracks
- input to Pandora!**

Do they find the same V0s ?



An example (500 GeV ttbar testprod)

Event 2 of /ilc/mc-opt/ild/rec/500-TDR_ws/6f_ttbar/ILD_I5_o1_v02_nobg/v01-19-05-p01/00009369/000/rv01-19-05-p01.sv01-19-05-p01.mILD_I5_o1_v02_nobg.E500-TDR_ws.l108683.Pyycyc.eL.pR.n001_001.d_rec_00009369_976.slcio

collection name : **BuildUpVertex_V0**

parameters:

----- print out of Vertex collection -----

parameter _lcio.VertexAlgorithmTypes [string]: **lcfiplus**,

**This is a gamma conversion
at -1.55e+02,-3.21e+01, 5.40e+01**

| [id] | [pri] | alg. type | chi2 | prob. | position (x, y, z) | [par] | [idRecP] |
|------------|-------|-----------|-----------|-----------|--|-------|------------|
| [00001907] | 0 | lcfiplus | +3.65e-03 | +9.52e-01 | -1.63e+02, -3.38e+01, +5.67e+01 | [000] | [000+1908] |

-> ok!

collection name : **BuildUpVertex_V0_RP**

parameters:

----- print out of ReconstructedParticle collection -----

flag: 0x0

| [id] | [com] | [type] | momentum(px,py,pz) | energy | mass | charge | position (x,y,z) | [pidUsed] | [GoodnessOfPID] |
|------------|-------|--------|---------------------------------|----------|----------|----------|---------------------------------|-----------|-----------------|
| [00001908] | 1 | 3 | -8.99e+00, -1.87e+00, +3.13e+00 | 9.71e+00 | 3.48e-01 | 0.00e+00 | -1.63e+02, -3.38e+01, +5.67e+01 | 00000000 | 0.00e+00 |

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):[00003206], [00003212]

tracks ([id]):

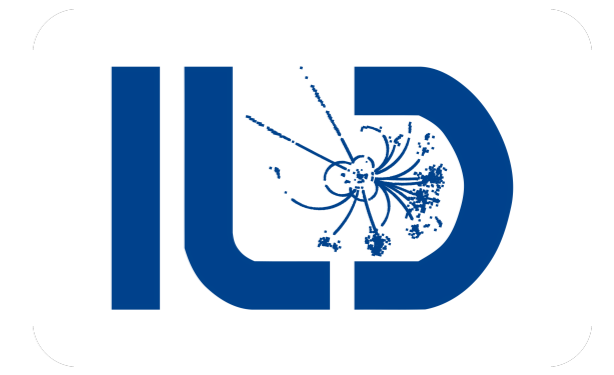
clusters ([id]):

particle ids ([id], PDG, (type)):

**These PFOs have a single track each
are ~100% from e+e- from same photon**

vertices: startVertex(id:[00000000id_aRP: 00000000] endVertex(id:[00001907], id_aRP:[00001908]

-> ok!



V0 finder output for the same event

collection name : **V0RecoParticles**

parameters:

----- print out of ReconstructedParticle collection -----

flag: 0x0

| [id] | com | type | momentum(px,py,pz) | energy | mass | charge | position (x,y,z) | pidUsed | Go |
|--------|-----|------|---------------------|--------|------|--------|-------------------|---------|----|
|--------|-----|------|---------------------|--------|------|--------|-------------------|---------|----|

| | | | | | | | | | |
|------------|---|-----|---------------------------------|----------|----------|----------|---------------------------------|----------|----------|
| [00003512] | 0 | 310 | -1.67e+00, +4.03e+00, +7.94e+00 | 0.00e+00 | 4.98e-01 | 0.00e+00 | +0.00e+00, +0.00e+00, +0.00e+00 | 0.00e+00 | 0.00e+00 |
|------------|---|-----|---------------------------------|----------|----------|----------|---------------------------------|----------|----------|

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):

tracks ([id]): [00002672], [00002692]

clusters ([id]):

particle ids ([id], PDG, (type)):

vertices: startVertex(id:[00003514id_aRP: 00003512] endVertex(id:[00000000], id_aRP:[00000000]

| | | | | | | | | | |
|------------|---|-----|---------------------------------|----------|----------|----------|---------------------------------|----------|----------|
| [00003513] | 0 | 310 | +2.34e+00, +1.07e-01, -1.16e+00 | 0.00e+00 | 4.98e-01 | 0.00e+00 | +0.00e+00, +0.00e+00, +0.00e+00 | 0.00e+00 | 0.00e+00 |
|------------|---|-----|---------------------------------|----------|----------|----------|---------------------------------|----------|----------|

particles ([id]):

tracks ([id]): [00002662], [00002682]

clusters ([id]):

particle ids ([id], PDG, (type)):

vertices: startVertex(id:[00003515id_aRP: 00003513] endVertex(id:[00000000], id_aRP:[00000000]

collection name : **V0Vertices**

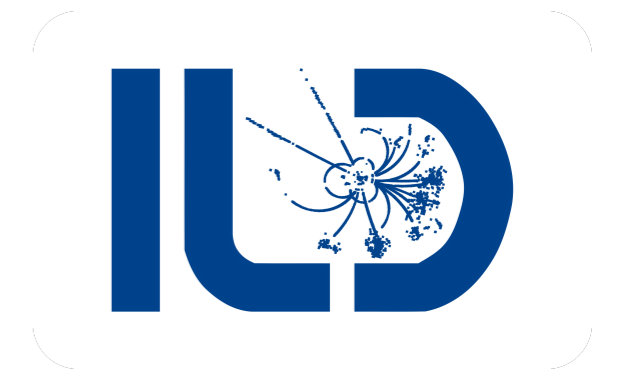
parameters:

----- print out of Vertex collection -----

parameter _lcio.VertexAlgorithmTypes [string]: Unknown,

| [id] | [pri] | alg. type | chi2 | prob. | position (x, y, z) | [par] | [idRecP] |
|------------|-------|-----------|-----------|-----------|---------------------------------|-------|------------|
| [00003514] | 0 | Unknown | +0.00e+00 | +0.00e+00 | -1.98e+02, +4.78e+02, +9.40e+02 | [001] | [000+3512] |
| [00003515] | 0 | Unknown | +0.00e+00 | +0.00e+00 | +4.27e+02, +1.96e+01, -2.11e+02 | [001] | [000+3513] |

- V0Vertex should be *end* position of V0?
- no “position” no “covariance” ?
- none of these 2 coincides with
- the one found by LCFI



V0 finder output for the same event

collection name : **V0RecoParticles**

parameters:

----- print out of ReconstructedParticle collection -----

flag: 0x0

| [id] | [com type | momentum(px,py,pz) | energy | mass | charge | position (x,y,z) | [id Ised GoodnessOfPID |
|------------|-----------|---------------------------------|----------|----------|----------|---------------------------------|-------------------------|
| [00003512] | 0 310 | -1.67e+00, +4.03e+00, +7.94e+00 | 0.00e+00 | 4.98e-01 | 0.00e+00 | +0.00e+00, +0.00e+00, +0.00e+00 | 0.00e+00 |

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):

tracks ([id]): [00002672], [00002692]

clusters ([id]):

particle ids ([id], PDG, (type)):

**This is a K-short to pi+pi-
at -6.33e-01, 1.08e+00, 2.38e+00
-> position doesn't match the V0Vertex :(**

vertices: startVertex(id:[00003514id_aRP: 00003512] endVertex(id:[00000000], id_aRP:[00000000])

| | | | | | | | |
|------------|--------|---------------------------------|----------|----------|----------|---------------------------------|----------|
| [00003513] | 0 310 | +2.34e+00, +1.07e-01, -1.16e+00 | 0.00e+00 | 4.98e-01 | 0.00e+00 | +0.00e+00, +0.00e+00, +0.00e+00 | 0.00e+00 |
|------------|--------|---------------------------------|----------|----------|----------|---------------------------------|----------|

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):

tracks ([id]): [00002662], [00002682]

clusters ([id]):

particle ids ([id], PDG, (type)):

vertices: startVertex(id:[00003515id_aRP: 00003513] endVertex(id:[00000000], id_aRP:[00000000])

**This is also a K-short to pi+pi-
at 4.22e+02, 1.94e+01, -2.09e+02
-> ok !**

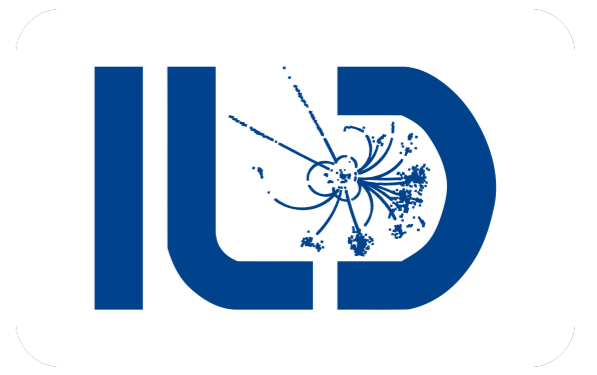
collection name : **V0Vertices**

parameters:

----- print out of Vertex collection -----

parameter _Icio.VertexAlgorithmTypes [string]: Unknown,

| [id] | [pri | alg. type | chi2 | prob. | position (x, y, z) | [par] | [idRecP] |
|------------|------|-----------|-----------|-----------|---------------------------------|-------|------------|
| [00003514] | 0 | Unknown | +0.00e+00 | +0.00e+00 | -1.98e+02, +4.78e+02, +9.40e+02 | [001] | [000+3512] |
| [00003515] | 0 | Unknown | +0.00e+00 | +0.00e+00 | +4.27e+02, +1.96e+01, -2.11e+02 | [001] | [000+3513] |



V0 finder output for the same event

collection name : **V0RecoParticles**

parameters:

----- print out of ReconstructedParticle collection -----

flag: 0x0

| [id] | com | type | momentum(px,py,pz) | energy | mass | charge | position (x,y,z) | lnid | lead | GoodnessOfPID |
|------------|-----|------|---------------------------------|----------|----------|----------|-------------------|------|------|---------------|
| [00003512] | 0 | 310 | -1.67e+00, +4.03e+00, +7.94e+00 | 0.00e+00 | 4.98e-01 | 0.00e+00 | +0.00e+00 | | | |

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):

tracks ([id]): [00002672], [00002673]

clusters ([id]):

particle ids ([id], PDG, (type)):

This is a K-short to pi+pi- at -6.33e-01, 1.08e+00, 2.38e+00 match the V0Vertex :(

vertices: startVertex(id:[00003513]

[00003513] | 0 | 310 | +2.34e+00, +1.07e+00, 0.00e+00

covariance(px,py,pz,E) : (0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00, 0.00e+00)

particles ([id]):

tracks ([id]): [00002662], [00002663]

clusters ([id]):

particle ids ([id], PDG, (type)):

Why doesn't LCFIPlus find them as well?

vertices: startVertex(id:[00003515 id_aRP: 00003513] endVertex(id:[00000000], id_aRP:[00000000]

Also a K-short to pi+pi- at -0.2, 1.94e+01, -2.09e+02 -> ok !

collection name : **V0Vertices**

parameters:

----- print out of Vertex collection -----

parameter _lcio.VertexAlgorithmTypes [string]: Unknown,

| [id] | [pri] | alg. type | chi2 | prob. | position (x, y, z) | [par] | [idRecP] |
|------------|-------|-----------|-----------|-----------|---------------------------------|-------|------------|
| [00003514] | 0 | Unknown | +0.00e+00 | +0.00e+00 | -1.98e+02, +4.78e+02, +9.40e+02 | [001] | [000+3512] |
| [00003515] | 0 | Unknown | +0.00e+00 | +0.00e+00 | +4.27e+02, +1.96e+01, -2.11e+02 | [001] | [000+3513] |

----- print out of Vertex collection -----

----- print out of Vertex collection -----



PandoraPFOs vs Tracks

- V0RecoParticles are input to Pandora
- Pandora unites the daughter tracks into one PFO, which corresponds to the V0RecoParticle
- there are no PFOs for the individual tracks
- and since LCFIPlus runs only on PandoraPFOs, it cannot find any V0 which as already been found by the V0Finder!

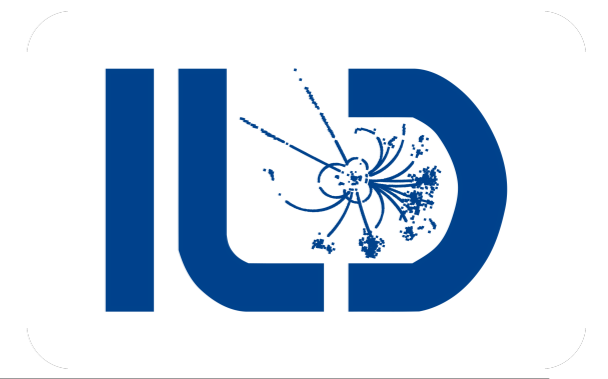
So

- we have 2 collections of by construction *complementary* V0s
- both are in principle valid & useful
- state of filling of data members is very different
- even meaning of some data members is interpreted differently (eg startVertex vs endVertex)
- quality of content also very different:
 - LCFIPlus V0 have vertex fit, probability etc
 - V0Finder doesn't?

=> this is a mess!

It all hinges on the fact that LCFIPlus uses PandoraPFOs instead of tracks to find vertices....

Other observations on the side (mostly known?)



- event header information missing
- truth link broken on DST (collections are there, but pointer to MCParticle = 0)
- BCalParticles & Clusters missing
- PandoraPFANewStartVertices contains not very useful information
- replication to DESY still in a random state?
Sometimes REC files are there, but no DSTs / merged-DSTs, sometimes other funny combinations...