
SIGILLVM : VNIVERSITATIS · STVDII : PRAGENSIS

PandoraPFA for FCC-ee LAr Calorimeter

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Noble Liquid Calorimetry for Future Accelerator Experiments

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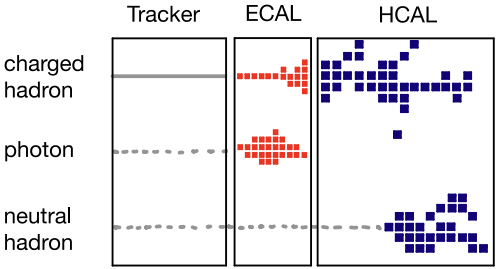
Particle Flow

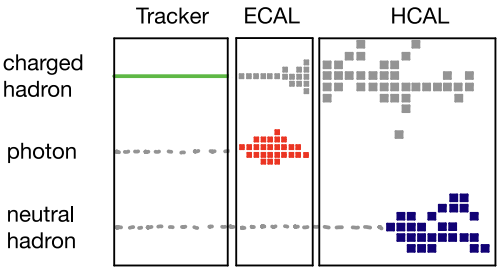
source



$E_{jet} = E_{ECAL} + E_{HCAL}$

$30\% + 70\%$

- Reconstruct every particle in the event with the best possible precision
- Combine the measurements in subdetectors in an optimal way



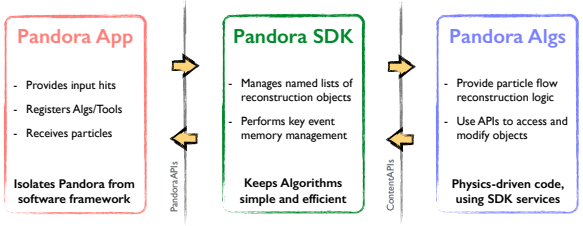
$E_{jet} = E_{charged} + E_{\gamma} + E_{neutral}$

$60\% + 30\% + 10\%$

- Charged particles dominated by tracker
- Calorimetry mostly for neutral particles
- **Enemy: Confusion**

PandoraPFA I.

- Framework which employs multitude of pattern recognition algorithms to **form/manipulate clusters** and **create PFOs** (particle flow objects)
- To facilitate different algorithms there are several layers
- The algorithms can be selected in a steering xml

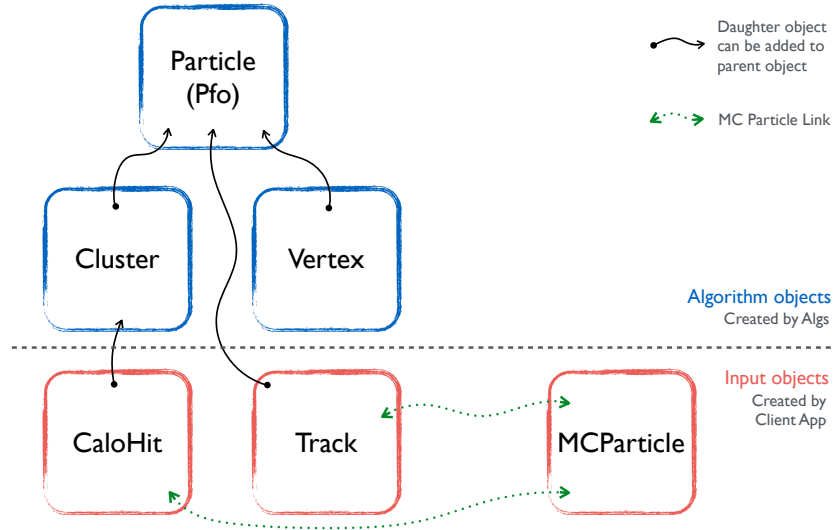



```
<algorithm type = "ConeClustering" instance = "Reclustering1">
    <TanConeAngleFine>0.24</TanConeAngleFine>
    <TanConeAngleCoarse>0.4</TanConeAngleCoarse>
    <AdditionalPadWidthsFine>2</AdditionalPadWidthsFine>
    <AdditionalPadWidthsCoarse>2</AdditionalPadWidthsCoarse>
    <SameLayerPadWidthsFine>2.24</SameLayerPadWidthsFine>
    <SameLayerPadWidthsCoarse>1.44</SameLayerPadWidthsCoarse>
    <MaxTrackSeedSeparation>100</MaxTrackSeedSeparation>
    <MaxLayersToTrackSeed>0</MaxLayersToTrackSeed>
    <MaxLayersToTrackLikeHit>0</MaxLayersToTrackLikeHit>
    <TrackPathWidth>0</TrackPathWidth>
</algorithm>
```

source

PandoraPFA II.

source



Wrappers

DDMarlinPandora

- Developed for ILC
- Pandora application wrapped inside Marlin processor
- Conversion between LCIO and Pandora datamodel
  - CaloHits
  - Tracks
  - MCParticles
  - Geometry
- Provides xml settings file

k4MarlinWrapper

- Wraps Marlin processor inside Gaudi algorithm
- Converts from EDM4hep datamodel into LCIO datamodel
- Marlin processor is steered by python script instead of xml file

The Plan for Running Pandora

Run Pandora inside `DDMarlinPandora` inside `k4MarlinWrapper`

- Considered to be **quickest** way to have Pandora running
- **Disadvantage:** two datamodel conversions
- Over time, development of the native Key4hep wrapper
- **First step:** Get just Pandora clustering algorithm run

```
from Configurables import MarlinProcessorWrapper

pandora = MarlinProcessorWrapper('DDMarlinPandora')
pandora.OutputLevel = DEBUG
pandora.ProcessorType = 'DDPandoraPFANewProcessor'
pandora.Parameters = {
    'Verbosity': ['WARNING'],
    'PandoraSettingsXmlFile': ['/some/path'],
    'CreateGaps': [False],
    'ECalCaloHitCollections': ['ECalBarrelCells']
}
ApplicationMgr().TopAlg += [pandora]
```

What is Missing?

PandoraPFA/`DDMarlinPandora` requires following components:

- Geometry description in DD4HEP format
  - IDEA-LAr already described in it, needs adjustments
- Calorimeter hits
  - Conversions provided by `DDMarlinPandora/k4MarlinWrapper`
- Tracks alongside with vertexes
  - Requires custom code, base class provided
- MCParticles
  - Conversions provided by `DDMarlinPandora/k4MarlinWrapper`

Also required are:

- Conversion of PFOs from Pandora datamodel
  - Conversions provided by `DDMarlinPandora/k4MarlinWrapper`
- Calibration of the calorimeter clusters
- Review of CLIC and ILD specific code
- Optimization of the algorithms