

Shower Energy Reconstruction in PDVD

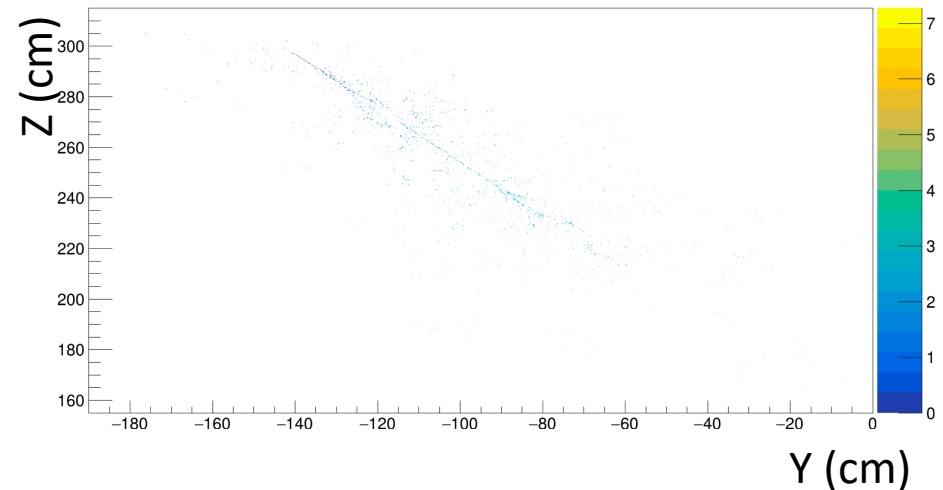
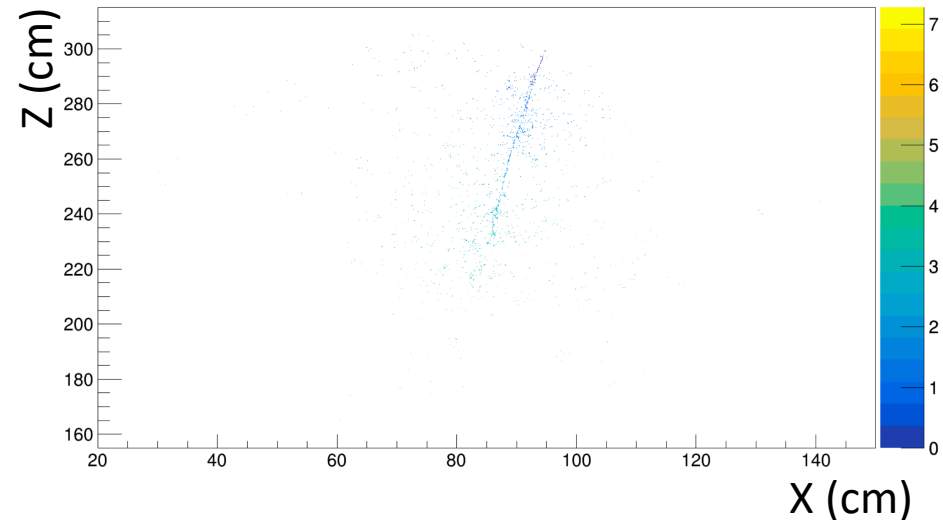
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ProtoDUNE-VD

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1 GeV/c electron sample

- Particle gun starting at the beam entrance
« Ideal case »
- **Dataset:**
 - 10000 electrons available
 - [vd-protodune_vd-protodune_full-reconstructed_v09_88_00d00_protodunevd_reco_gen_protodunevd_electron_1GeV_out1_e1gev_validation](#)
- **Goal:**
 - validate the pandora shower identification
 - perform the calorimetry and estimate the energy reconstruction performance
- **FHICL:**
 - https://github.com/DUNE/dunesw/blob/develop/fcl/protodunevd/gen/gen_protodunevd_singlep.fcl
 - https://github.com/DUNE/dunesw/blob/develop/fcl/protodunevd/reco/protodunevd_reco.fcl
- **Using:**
pandora: @local::protodune_pandora



Pandora configuration

- Default: `$DUNERECO_DIR/scripts/PandoraSettings_Master_ProtoDUNE.xml`

```
<algorithm type = "LArMaster">  
  <CRSettingsFile>PandoraSettings_Cosmic_ProtoDUNE.xml</CRSettingsFile>  
  <NuSettingsFile>PandoraSettings_TestBeam_ProtoDUNE.xml</NuSettingsFile>  
  <SlicingSettingsFile>PandoraSettings_Slicing_ProtoDUNE.xml</SlicingSettingsFile>
```

```
<SliceIdTools>  
  <tool type = "LArBdtBeamParticleId">  
    <BdtName>ProtoDUNESP_BeamParticleId</BdtName>  
    <BdtFileName>PandoraMVADData/PandoraBdt_BeamParticleId_ProtoDUNESP_v03_26_00.xml</BdtFileName>  
    <MinAdaBDTScore>-0.225</MinAdaBDTScore>  
  </tool>  
</SliceIdTools>
```

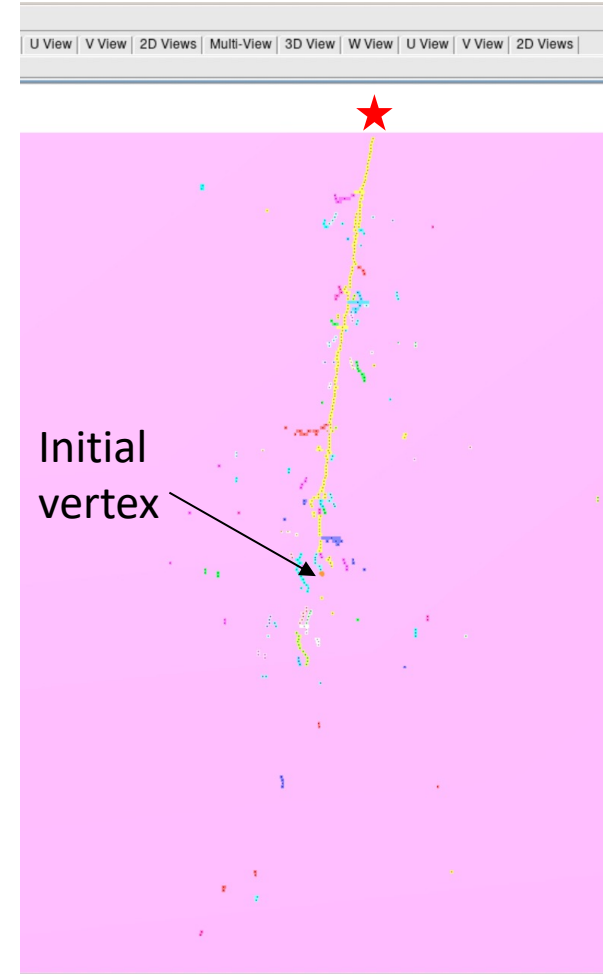
- Want to upgrade to `$DUNERECO_DIR/scripts/PandoraSettings_Master_ProtoDUNE_VD.xml` to include beam entrance position and direction (à la HD config.)

```
<SliceIdTools>  
  <tool type = "LArBdtBeamParticleId">  
    <BdtName>ProtoDUNESP_BeamParticleId</BdtName>  
    <BdtFileName>PandoraMVADData/PandoraBdt_BeamParticleId_ProtoDUNESP_v03_26_00.xml</BdtFileName>  
    <MinAdaBDTScore>-0.225</MinAdaBDTScore>  
    <BeamTPCIntersection>94.8 142.6 0.7</BeamTPCIntersection>  
    <BeamDirection>-0.1340 -0.7007 0.7007</BeamDirection>  
  </tool>  
</SliceIdTools>
```

Pandora display

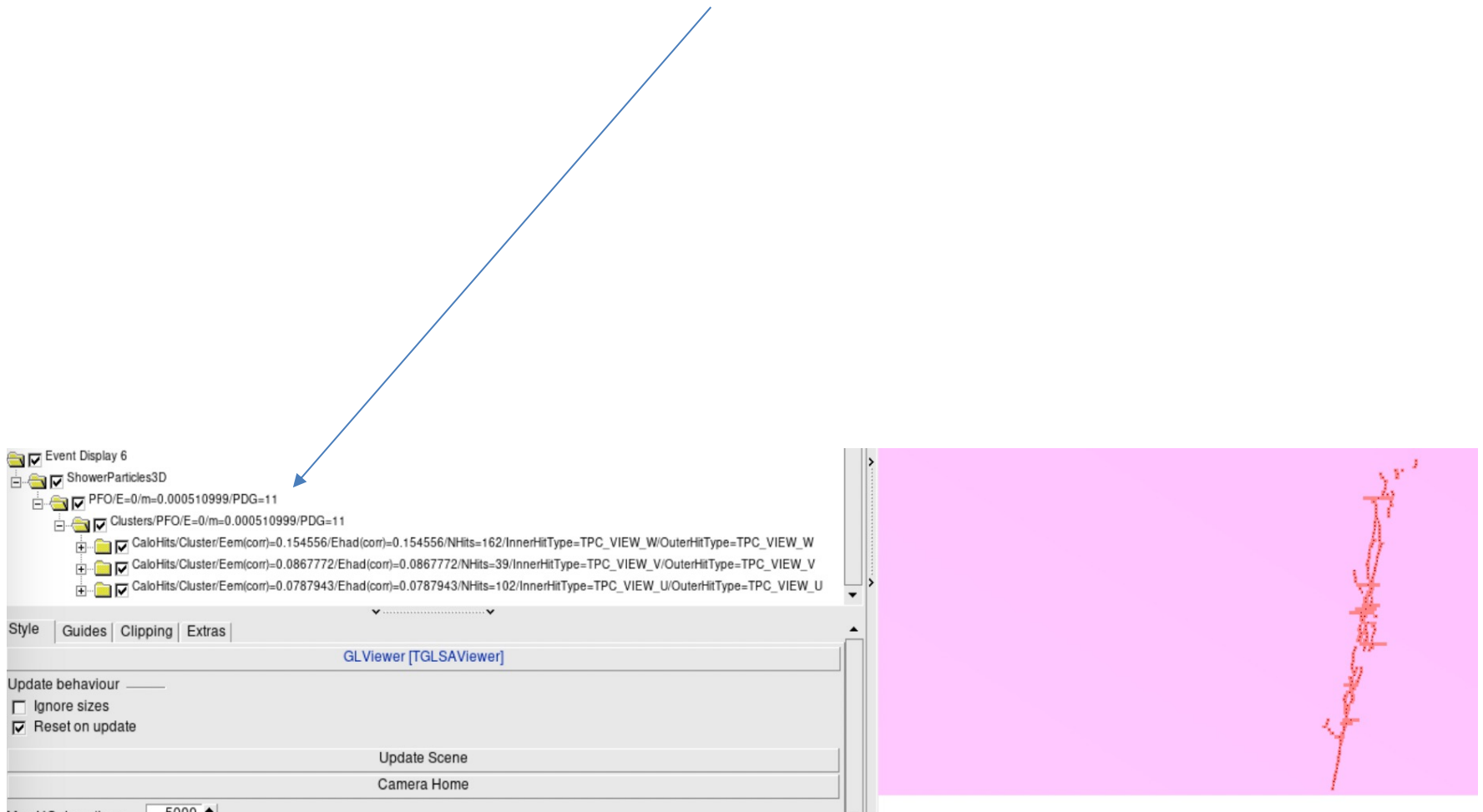
- Realized the beam entrance as defined in the particle gun was on the opposite side of the actual one
- Pandora particle flow goes with growing Z
- Shower reconstructed by the wrong side...

Beam entrance



Pandora display

- This is now fixed => – can reconstruct a single primary electron



Calorimetry

- Adaptation of (dunetpc time) PDSP module to latest DUNE sw versions by Mateo B. - discussions with Ewerton B. and Linhui G.
1. **Loop over reconstructed particles to catch a primary electron**
 2. **Pick-up hits associated to the primary shower**
Compute the ROI (peak time +/- 5 RMS) – NB: I fixed a bug
 3. **Loop over the wires associated to the hits**
Sum-up wire signal to compute the deposited charge
Correct for the electron lifetime
 4. **Store the relevant shower outputs**

Pandora display

- This is now fixed => – can reconstruct a single primary electron
- But 8 times out of 10, pandora would reconstruct an electron shower as a pion. One critical issue for beam matters is its direction w.r.t. to one of the induction plane : 45 deg. vs 30 deg

