



ProtoDUNE

First look at electrons (e^+)

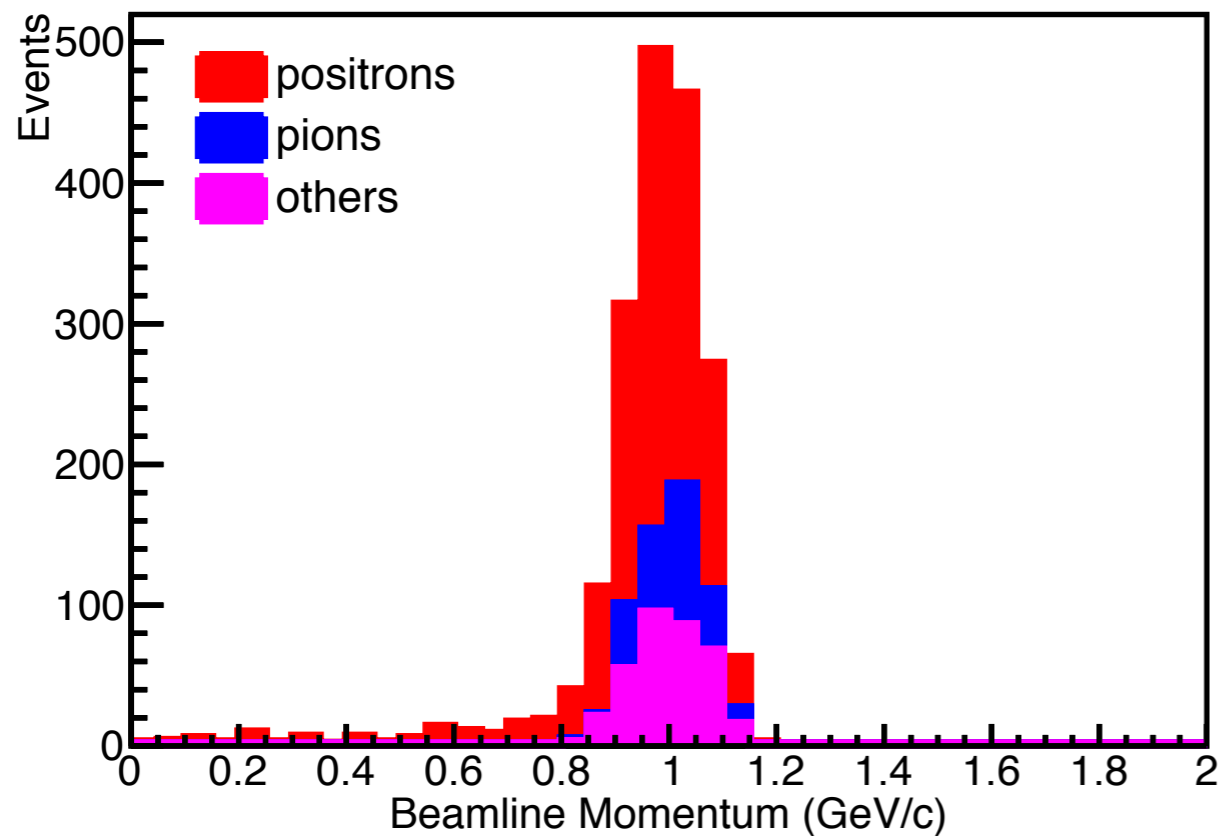
Aaron Higuera
University of Houston

Outline

- Monte Carlo Challenge 11, 1 GeV/c sample
- Data/MC comparisons 1 GeV/c sample
 - Primary beam particle
 - Tracking & Shower efficiency
 - Event Displays

Monte Carlo Challenge 11

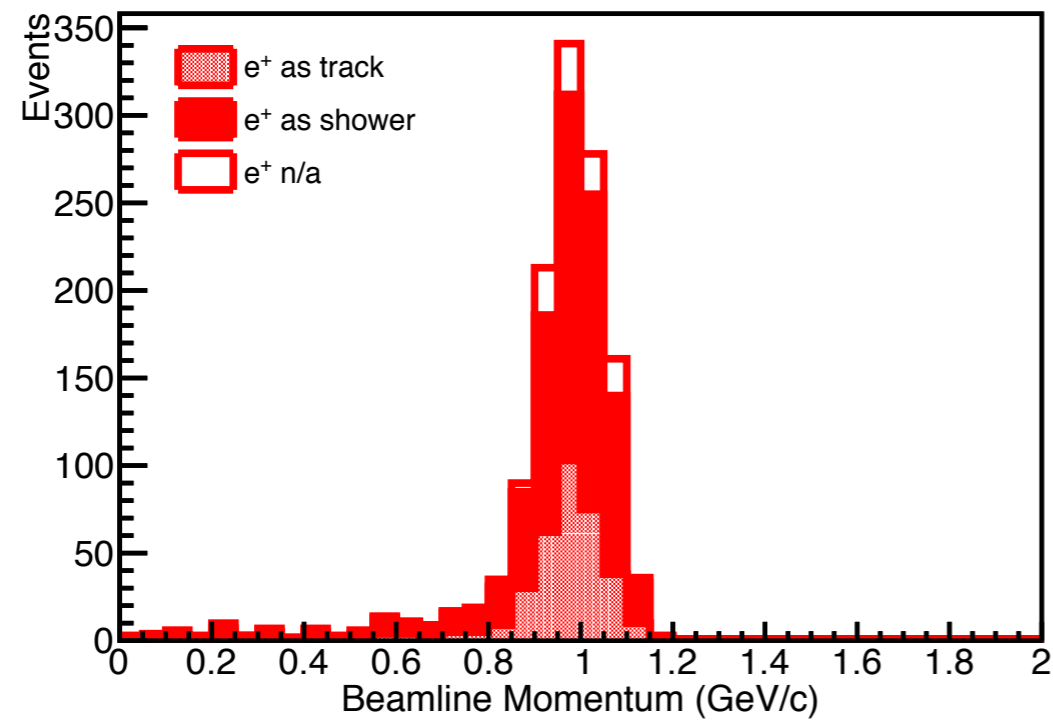
- Using this sample `jhugon_mcc11_pd_sp_reco_sce_1.0GeV`
3ms lifetime, no space charge effect and w/cosmics
1860 events
Pandora reconstruction (PandoraTrack & PandoraShower)



Positrons	67.8%
Pions	14.0%
others	18.2%

Positrons (MCC11)

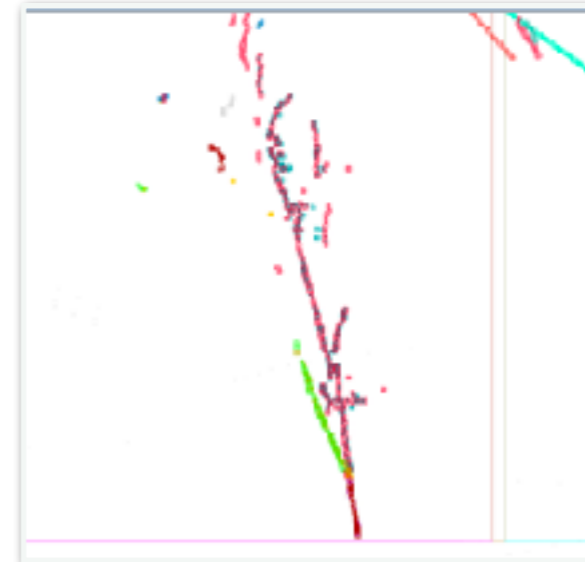
- Positron reconstruction efficiencies (MCC11)



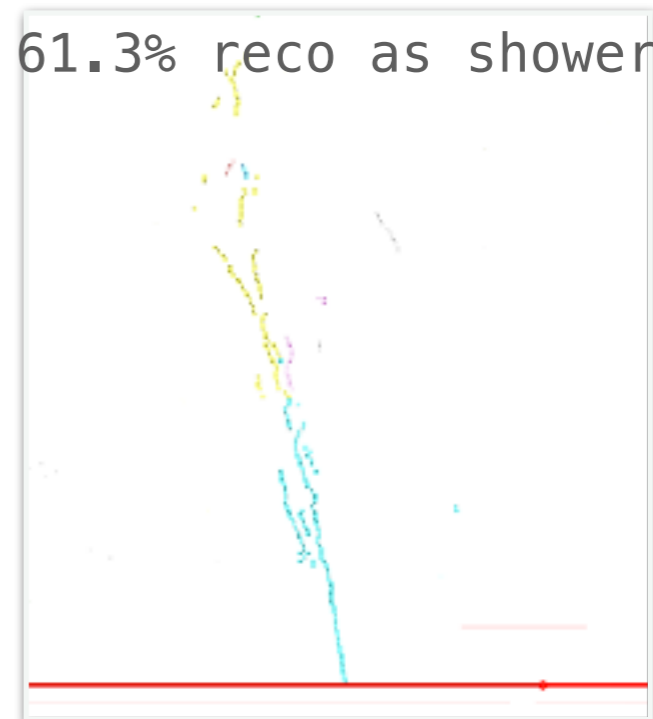
~10.8% do not have a primary track nor shower

~27.9% of those tracks only 15.3% are the primary positron

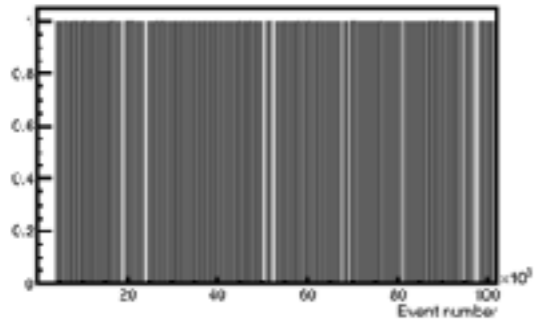
27.9% reco as track



61.3% reco as shower



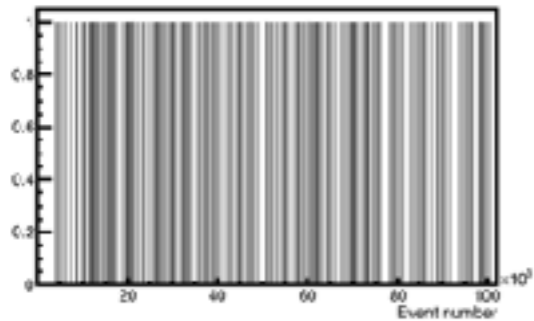
Run 5814 & 5809



Run5814 runset-5814-reco-v07_08_00_04-hv-180kV-beam-1GeV-v0
700 files as of 01/07/19

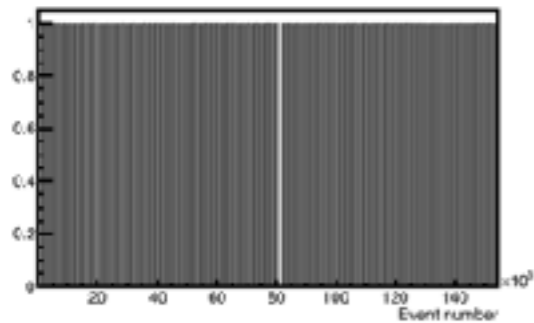
```
GetTimingTrigger()==12
```

```
#entries = 23814, eff = 100%
```



```
GetTimingTrigger()==12 && CheckIsMatched()==1
```

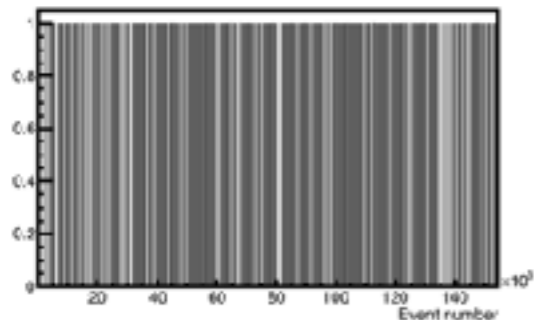
```
#entries = 2793, eff = 11.8%
```



Run5809 runset-5809-reco-v07_08_00_04-hv-180kV-beam-1GeV-v0
1085 files as of 01/07/19

```
GetTimingTrigger()==12
```

```
#entries = 76693, eff = 100%
```

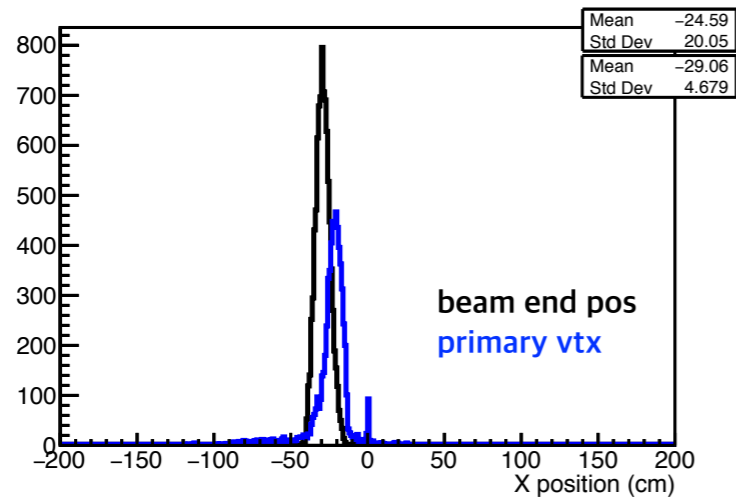


```
GetTimingTrigger()==12 && CheckIsMatched()==1
```

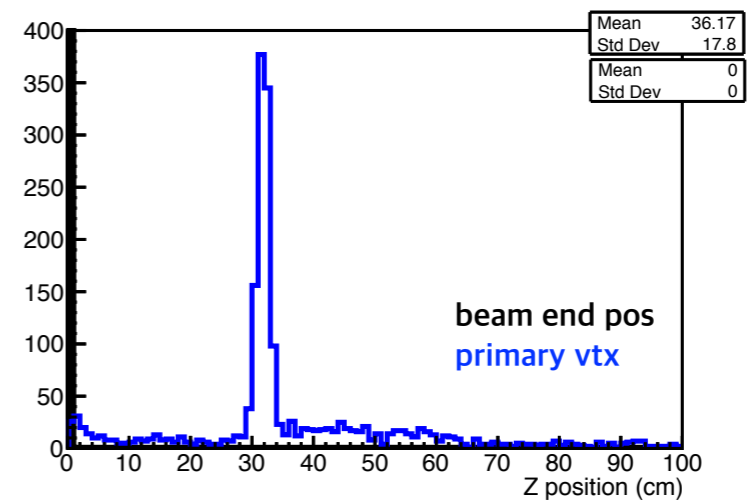
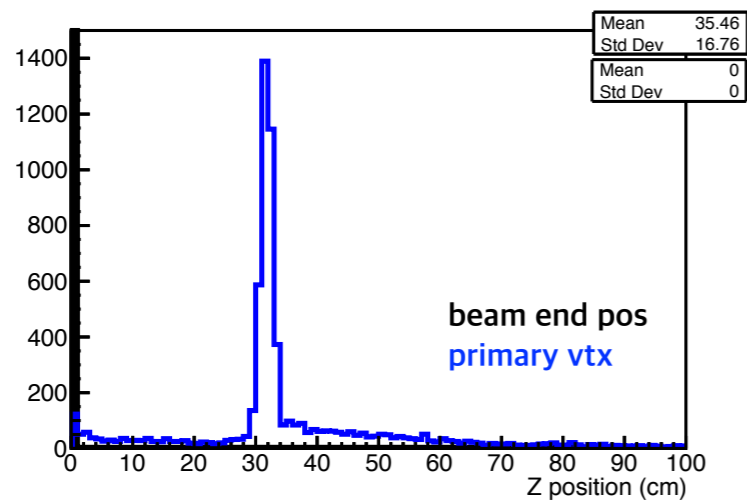
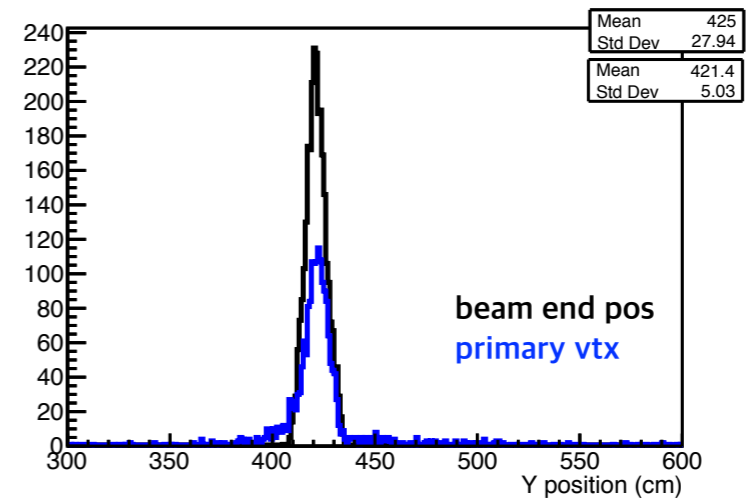
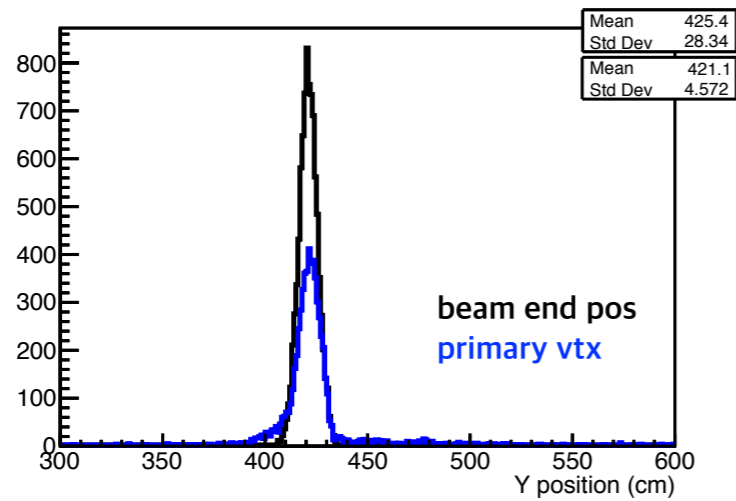
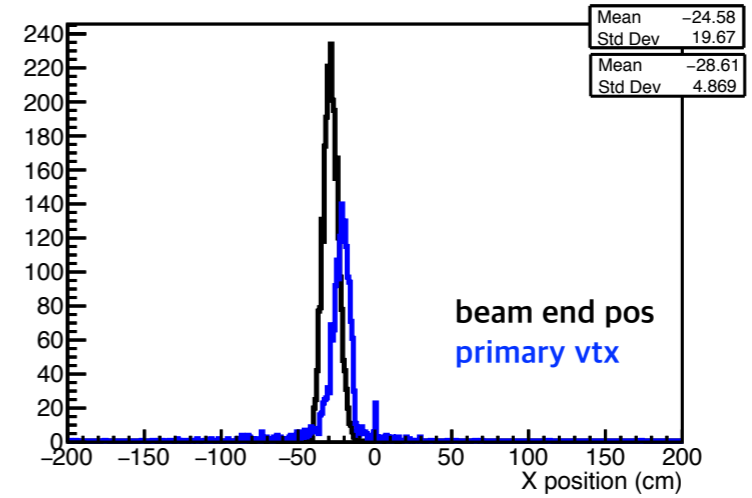
```
#entries = 9017, eff = 11.8%
```

Run 5814 & 5809

5809

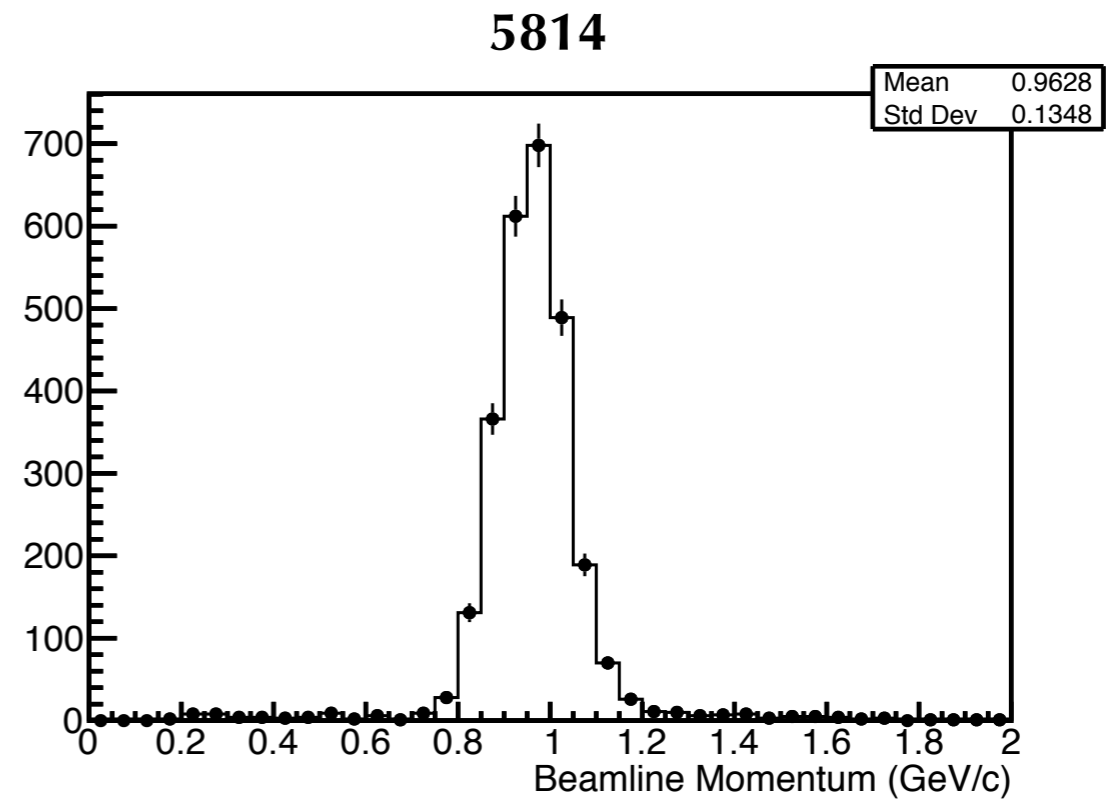
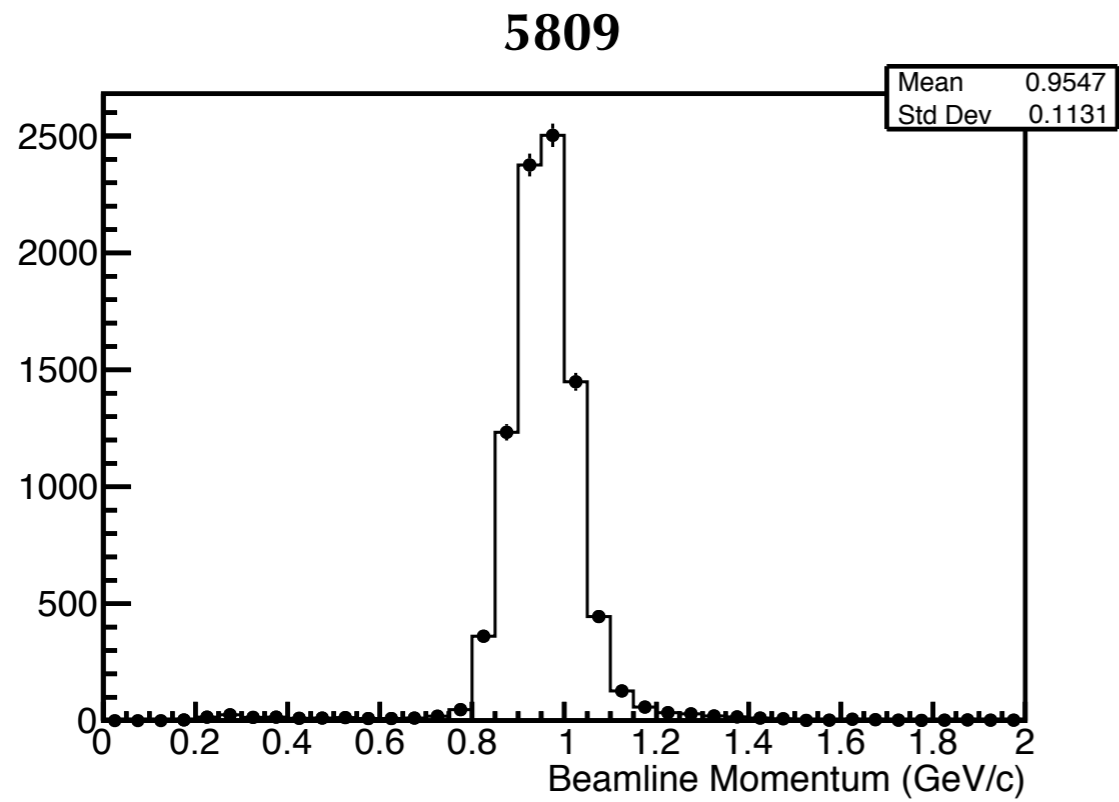


5814



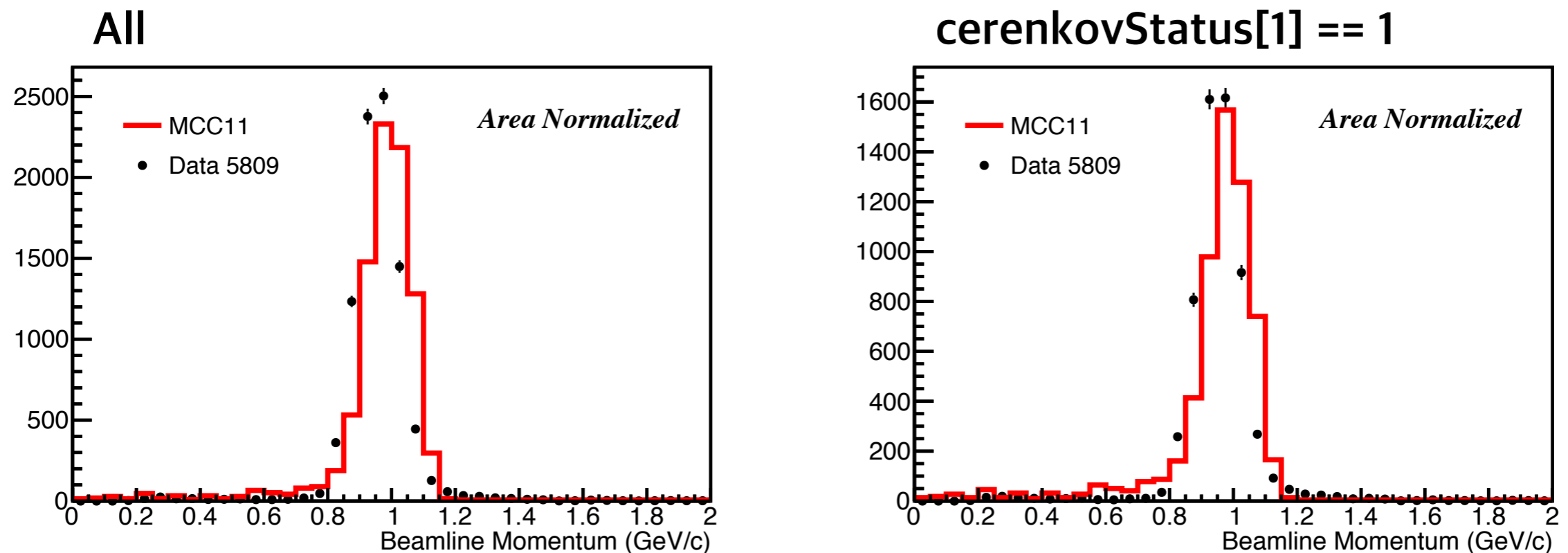
Run 5814 & 5809

- Run 5809 runset-5809-reco-v07_08_00_04-hv-180kV-beam-1GeV-v0



Data/MC

- Run 5809 `runset-5809-reco-v07_08_00_04-hv-180kV-beam-1GeV-v0`
- Positron selection: `cerenkovStatus[1] == 1`



There is a shift between MC & data

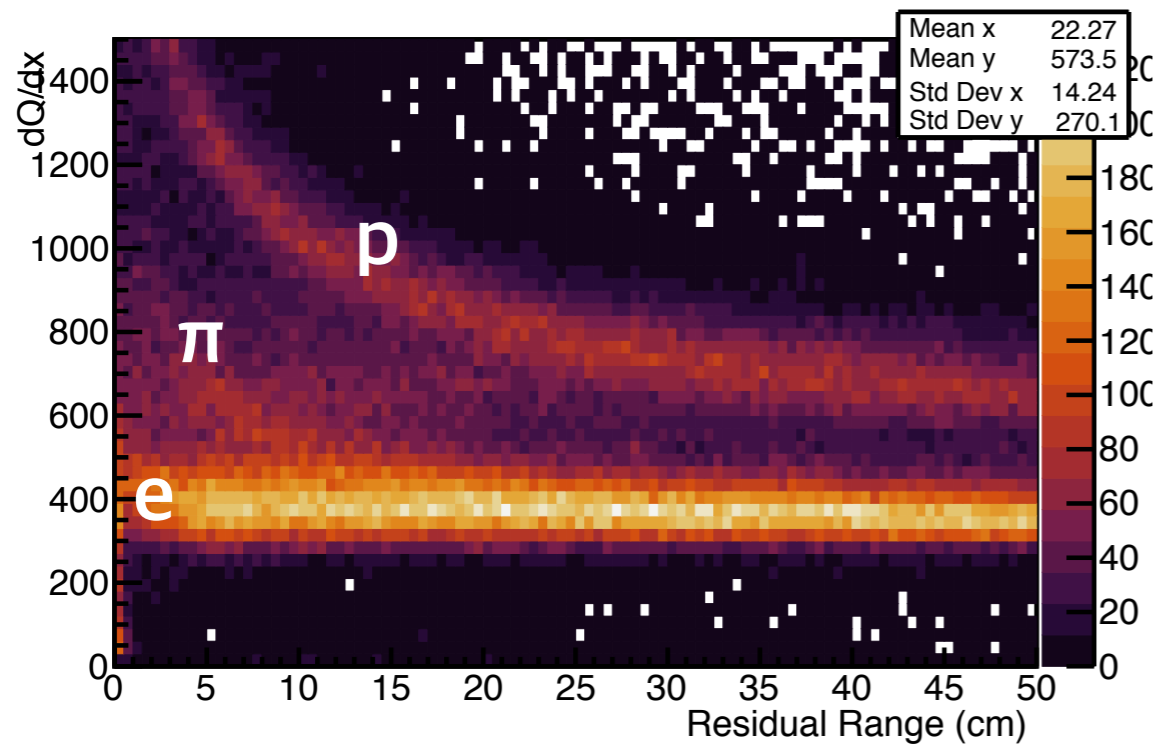
Beamline momentum for MC comes from `MCParticle` (true momentum at creation)

Beamline momentum for data comes from `ProtoDUNEBeamEvent` (reco momentum)

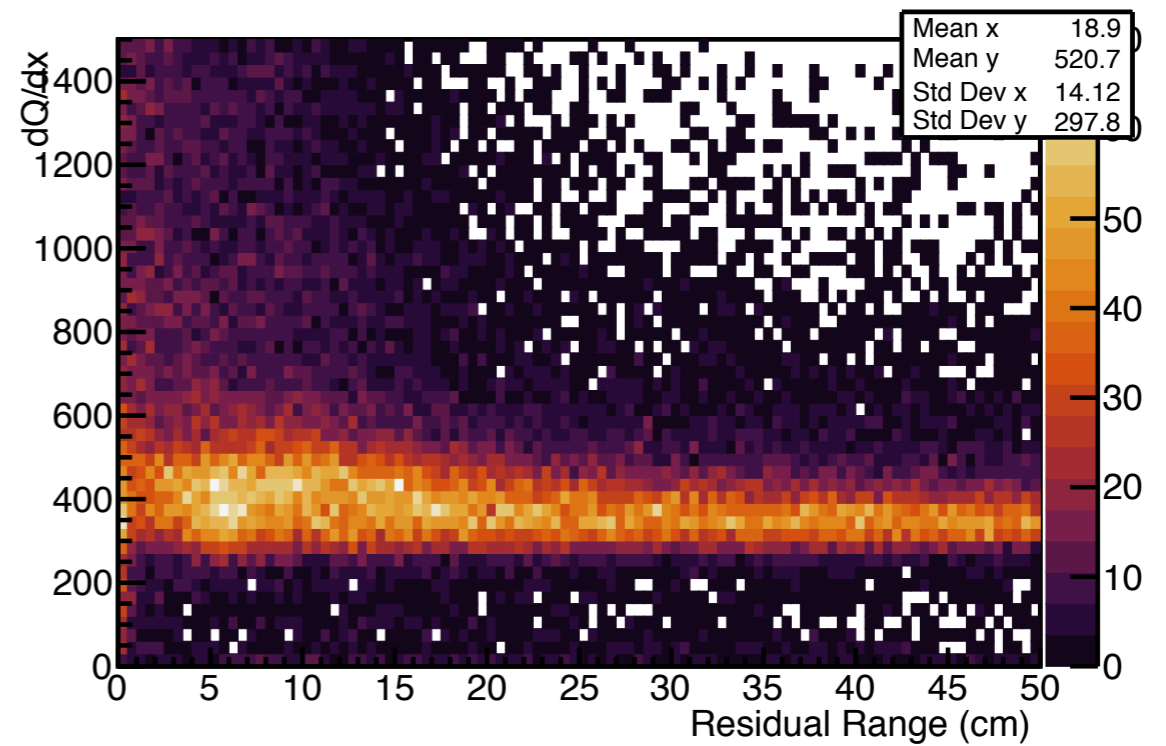
Run 5809

Using primaryTrack info

All events w/reco track



All events w/reco track
cerenkovStatus[1] == 1



Data/MC

Beam component

	MCC11	Data
Positrons (cerenkovStatus[1] == 1)	67.8%	66.2%
others	32.2%	33.8%

Reconstruction efficiency

Primary as	MCC11	Data
track	42.8%	38.0%
shower	43.7%	36.7%
n/a	13.5%	25.3%

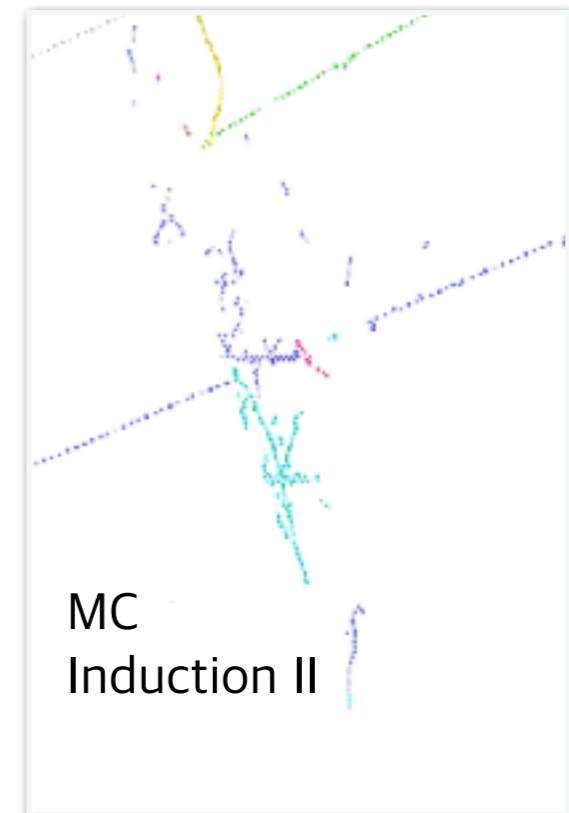
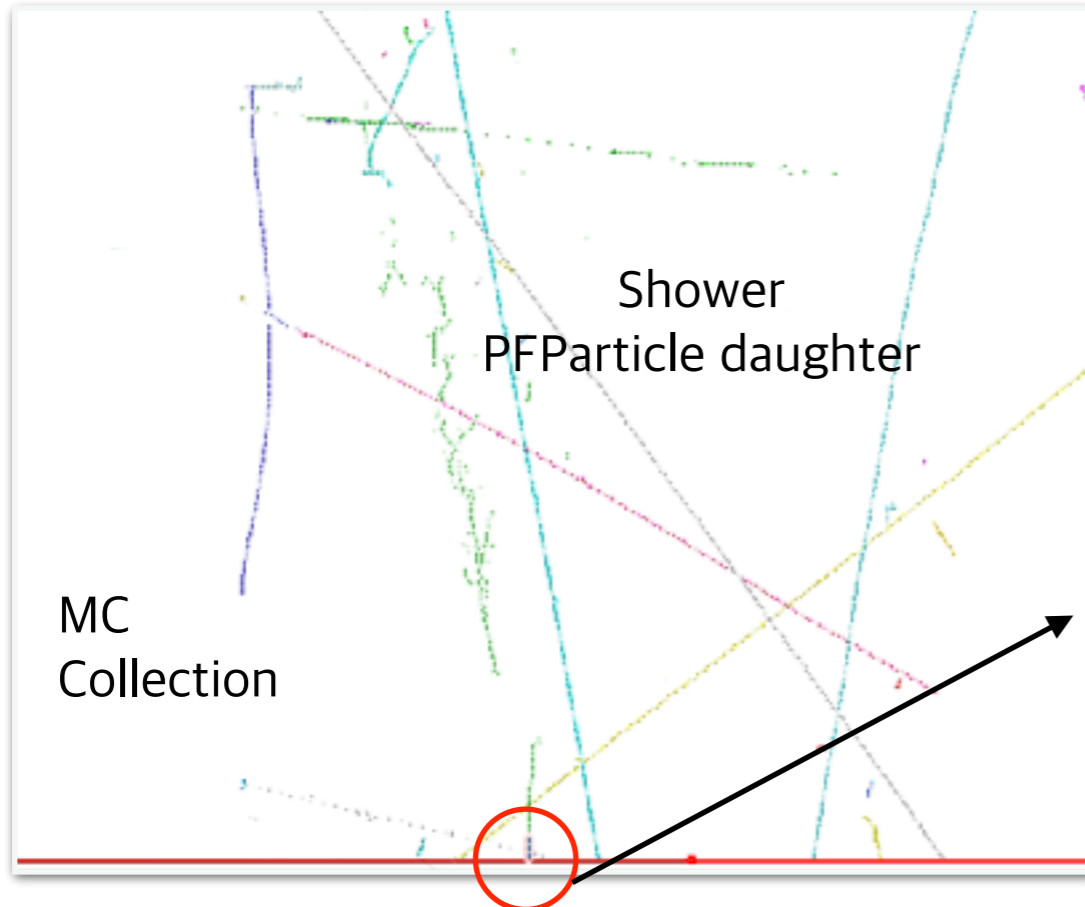
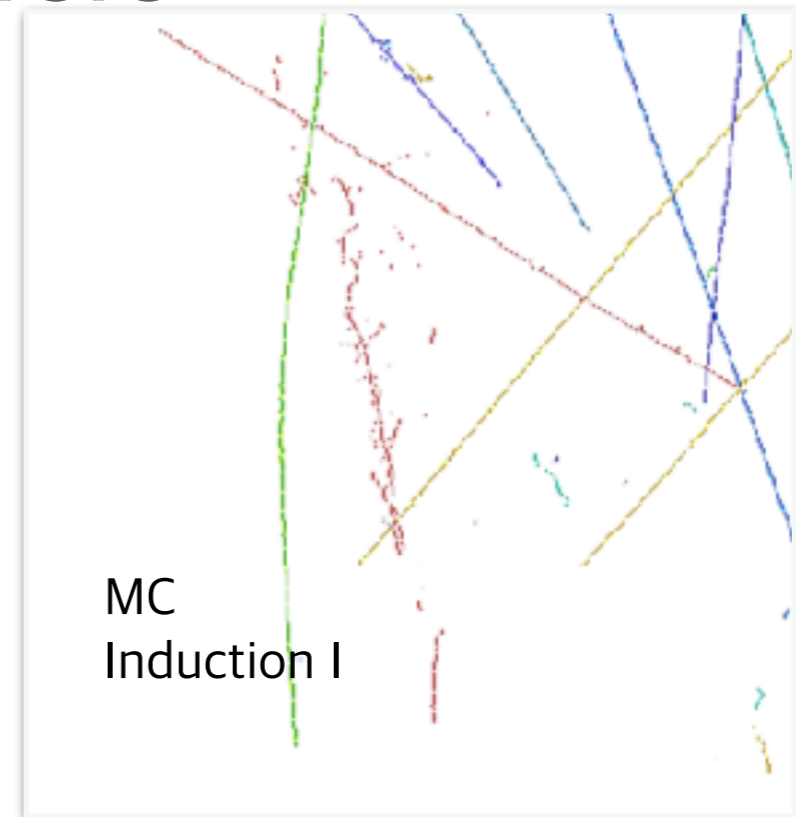
Reconstruction efficiency Positron sample

Primary as	MCC11	Data
track	27.9%	25.0%
shower	61.3%	51.8%
n/a	10.8%	23.2%

Primary PFParticle

Reconstruction efficiency Positron sample

Primary as	MCC11	Data
track	27.9%	25.0%
shower	61.3%	51.8%
n/a	10.8%	23.2%

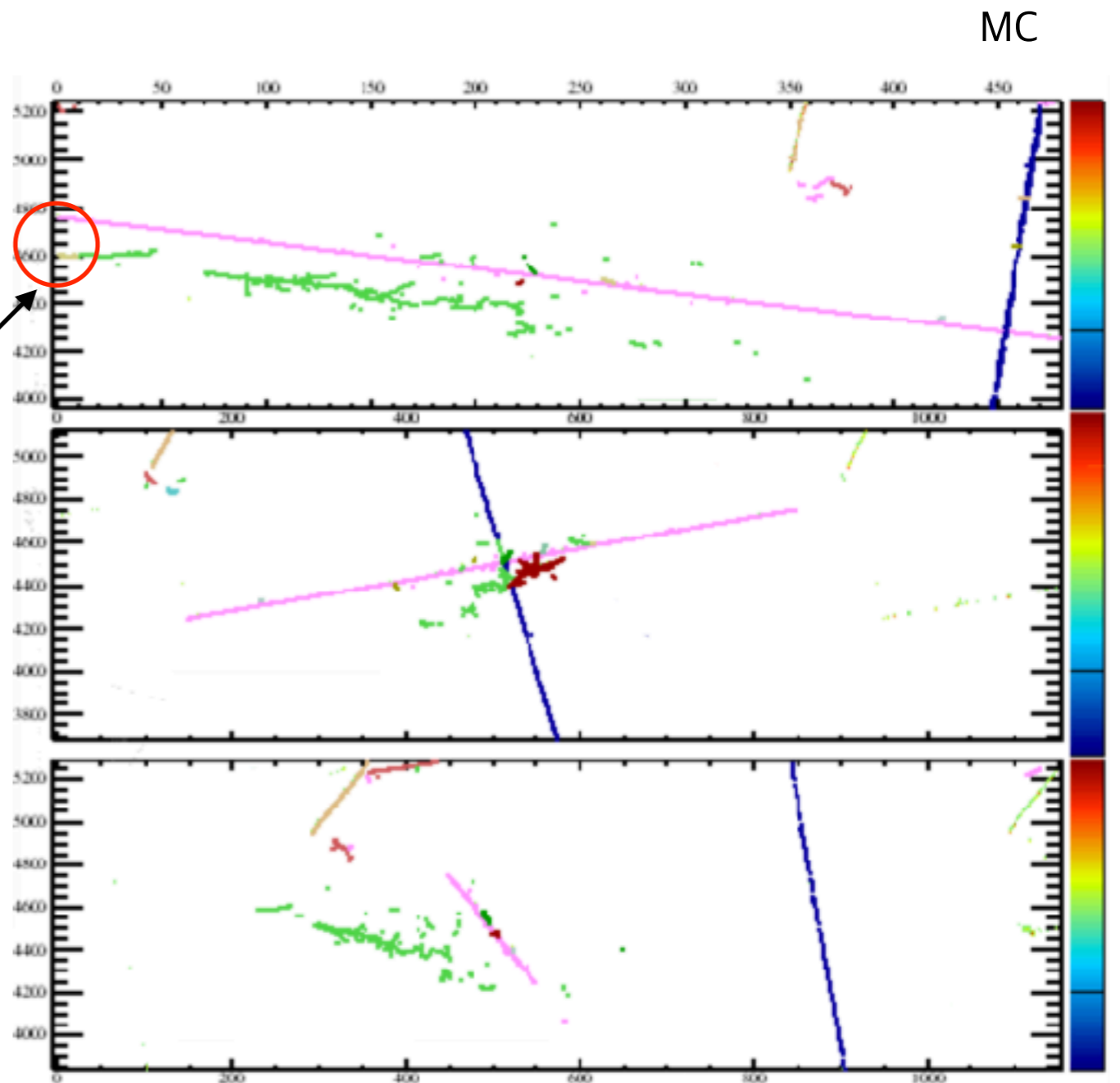


Primary PFParticle

Reconstruction efficiency Positron sample

Primary as	MCC11	Data
track	27.9%	25.0%
shower	61.3%	51.8%
n/a	10.8%	23.2%

Primary PFParticle
cluster



Primary PFParticle

Reconstruction efficiency Positron sample

Primary as	MCC11	Data
track	27.9%	25.0%
shower	61.3%	51.8%
n/a	10.8%	23.2%

MC out of 10.8% that have no track nor shower 33.3% primary beam particle does not reach the detector, 3.5% of have a reconstructed object labeled as daughter and 61.2% does not have a reconstructed object

Data out of 23.2%, 4.2% of have a reconstructed object labeled as daughter

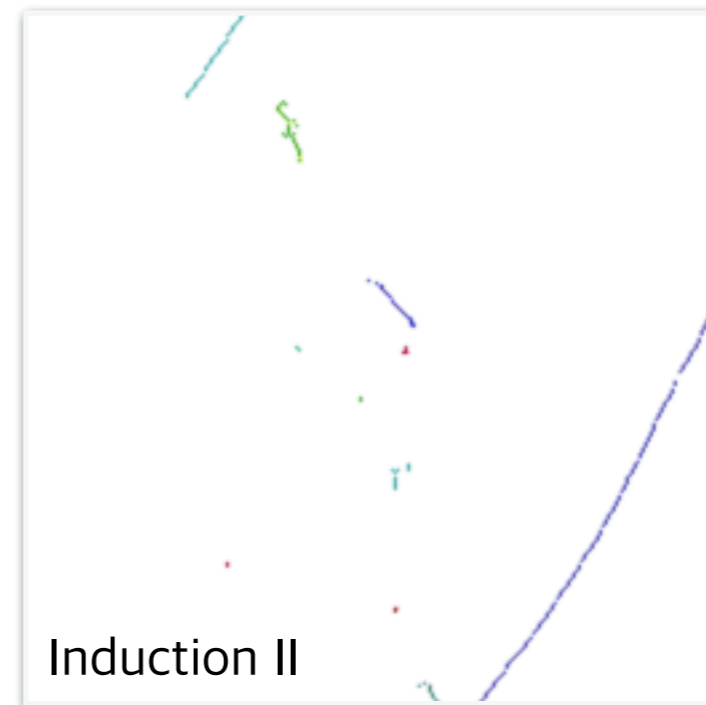
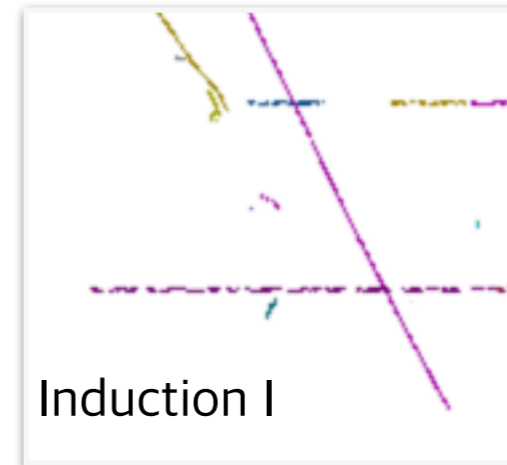
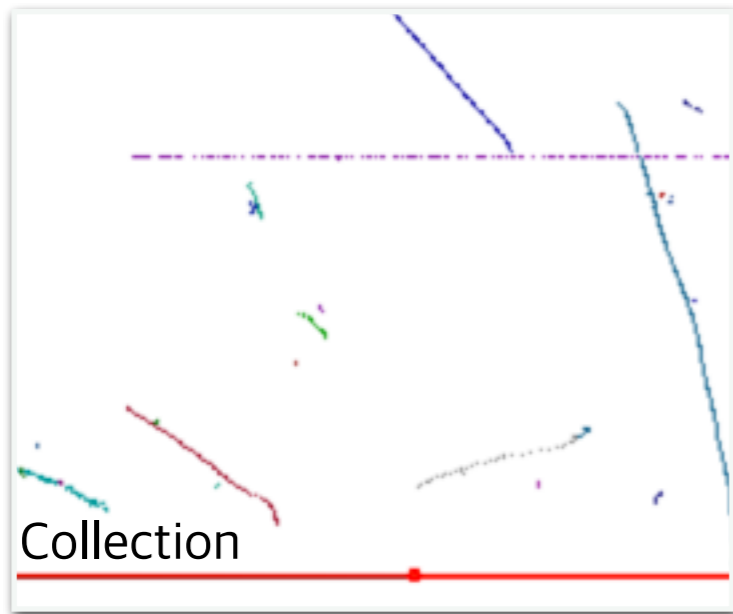
Leet's look at some event displays for positron candidates (`cerenkovStatus[1] == 1`)

Data

Event **no** primary track **nor** shower

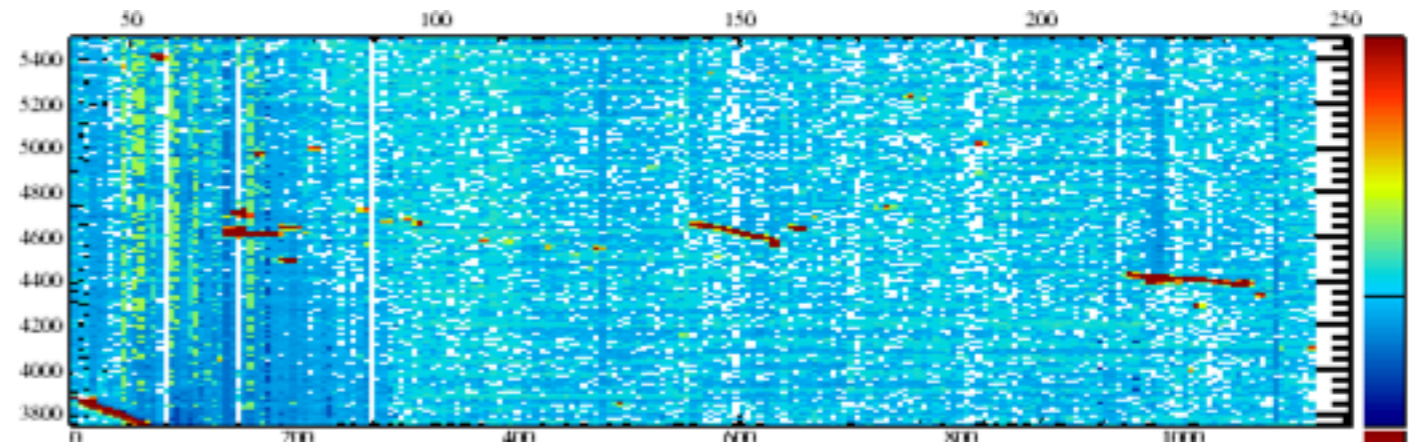
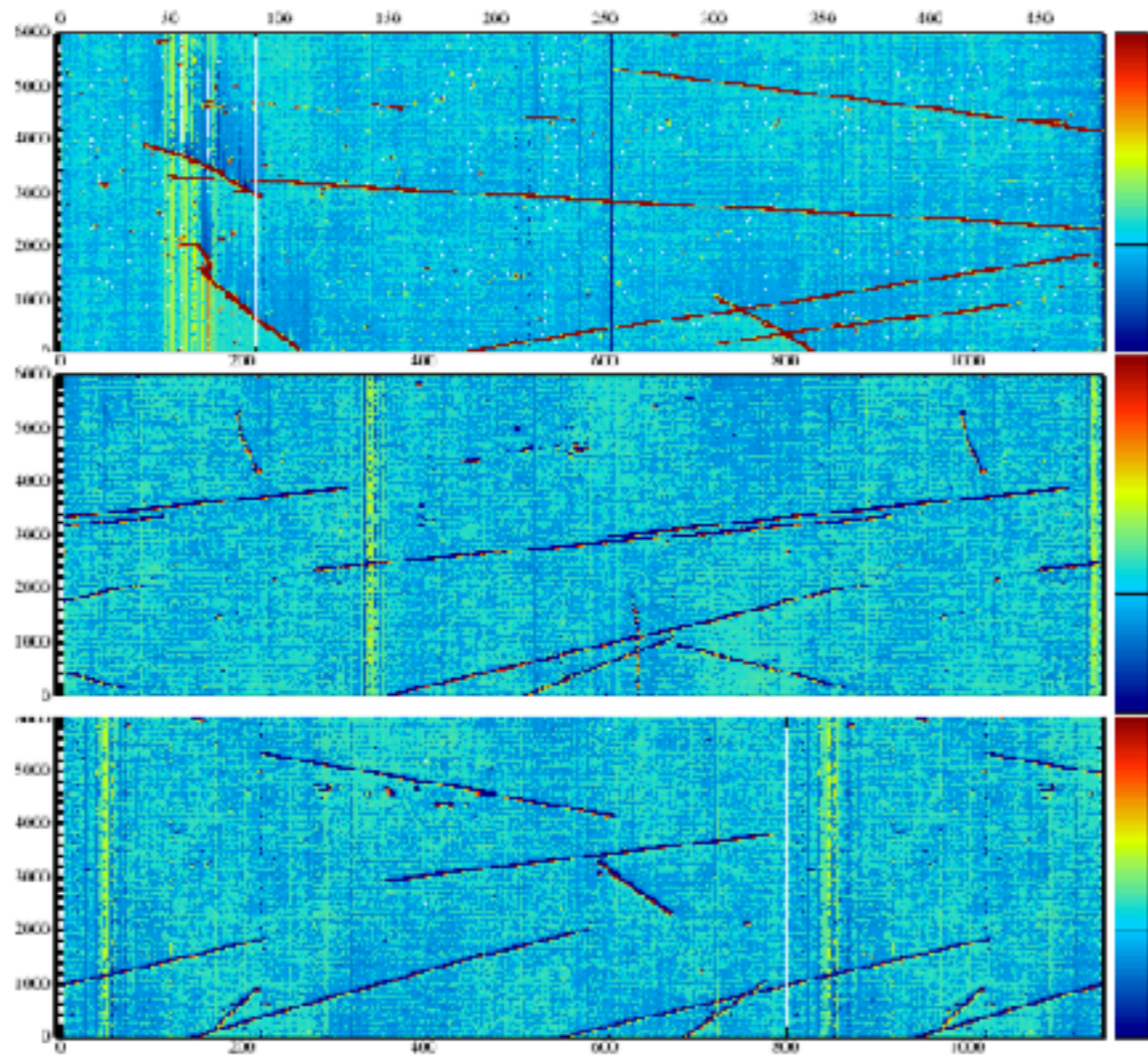
Pandora did not find a beam particle (GetPFParticlesFromBeamSlice)

5809, 1, 22768



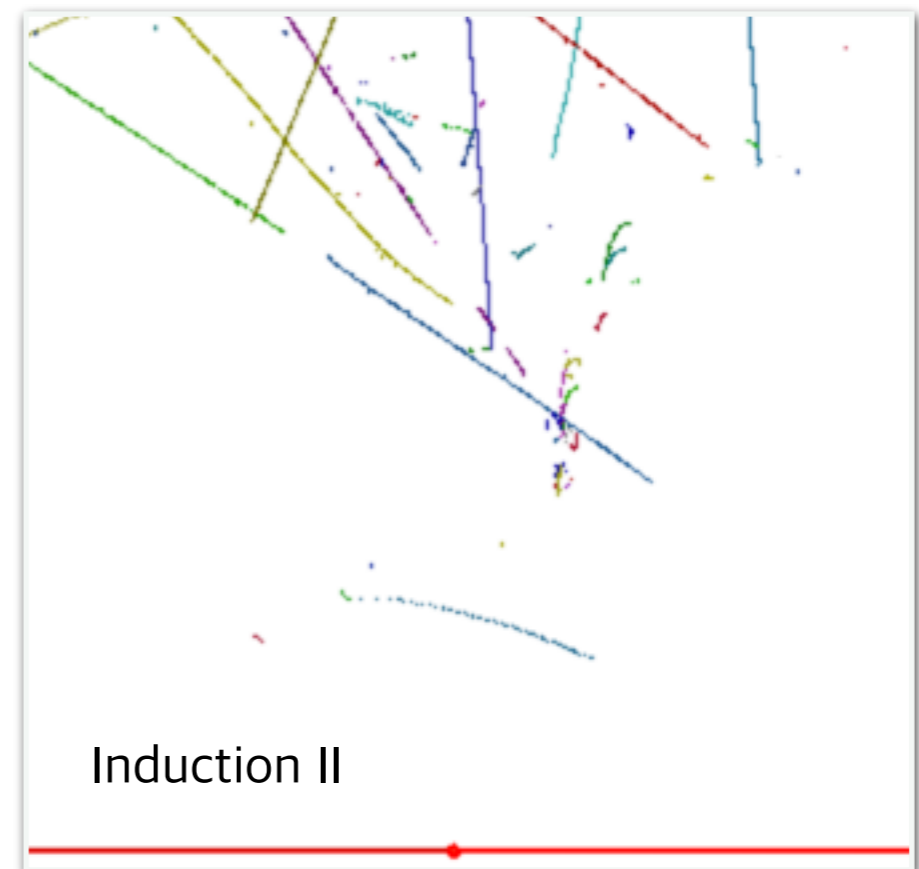
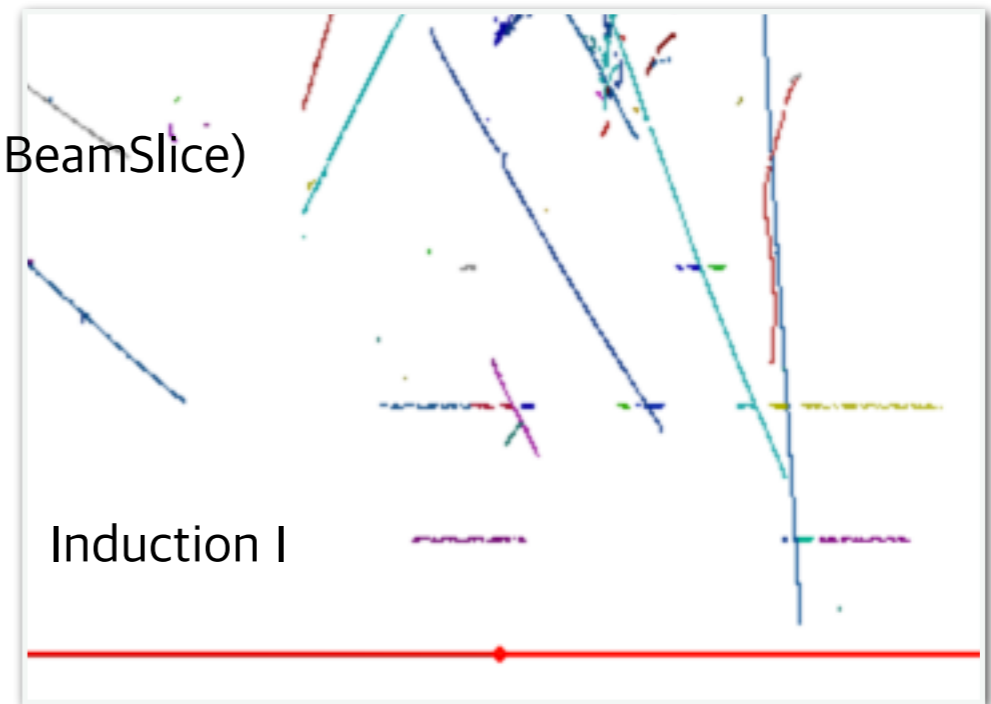
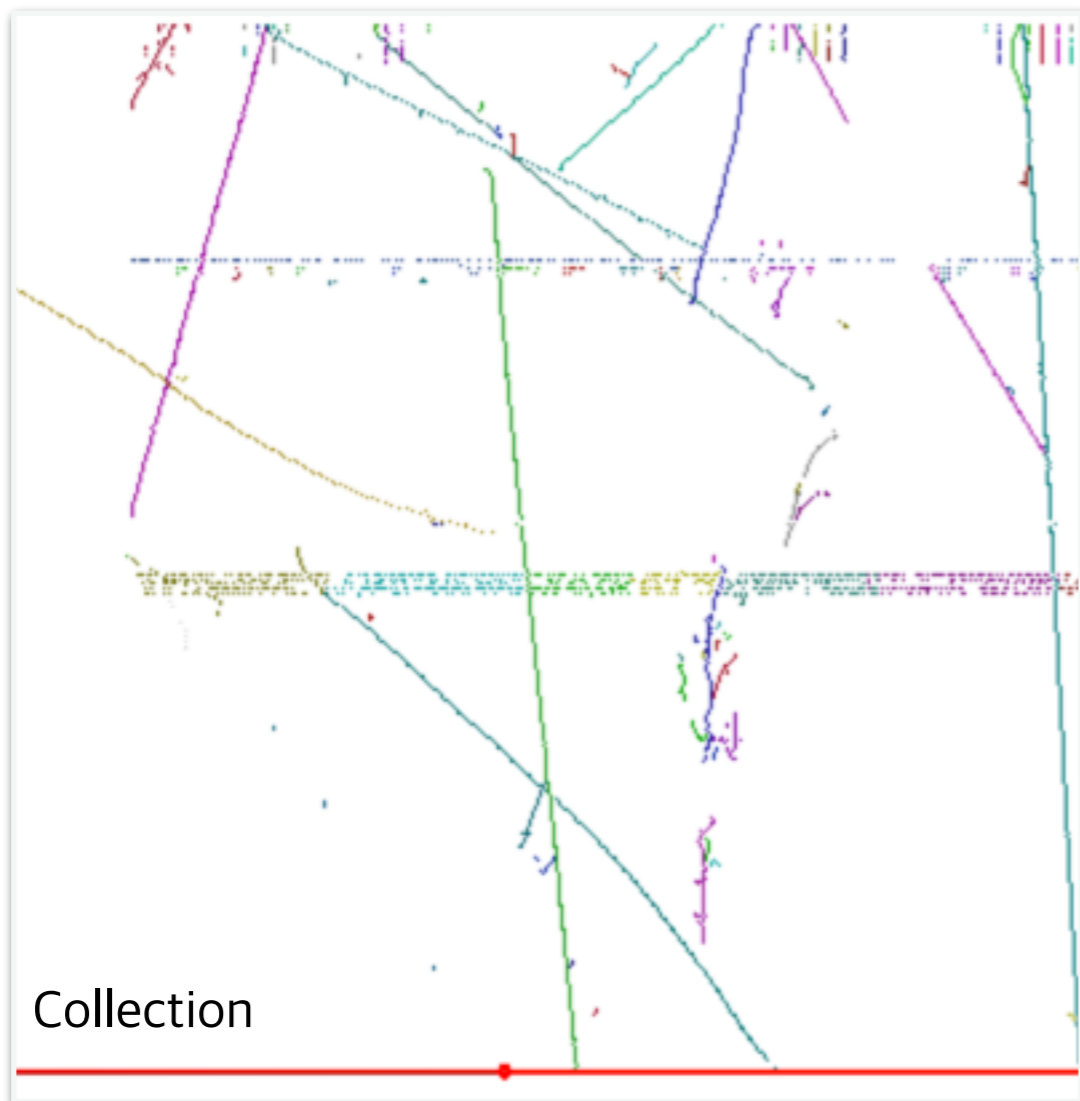
Data

Event **no** primary track **nor** shower
5809, 1, 22768



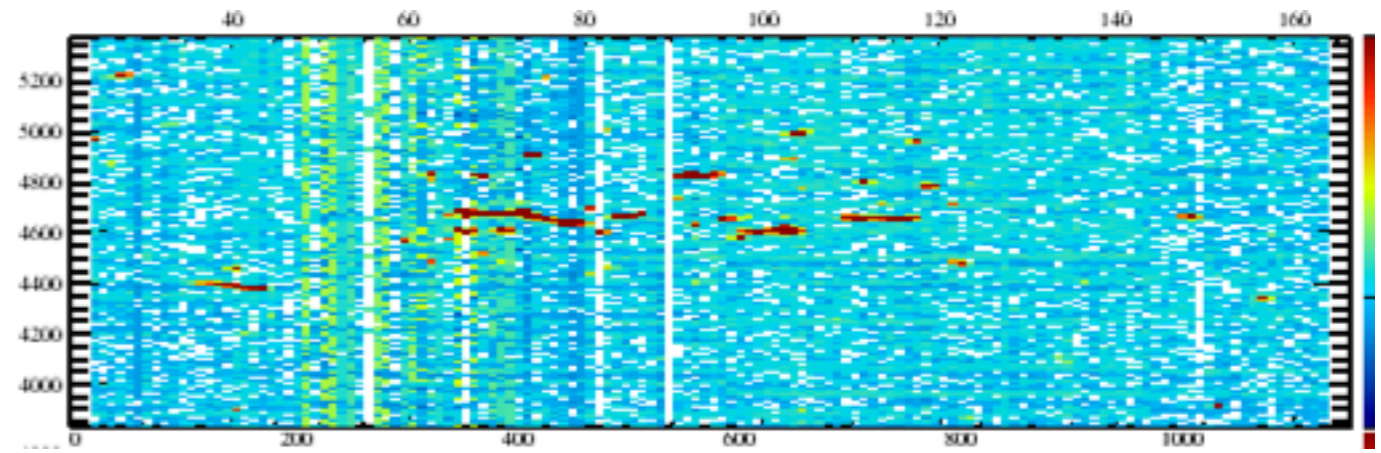
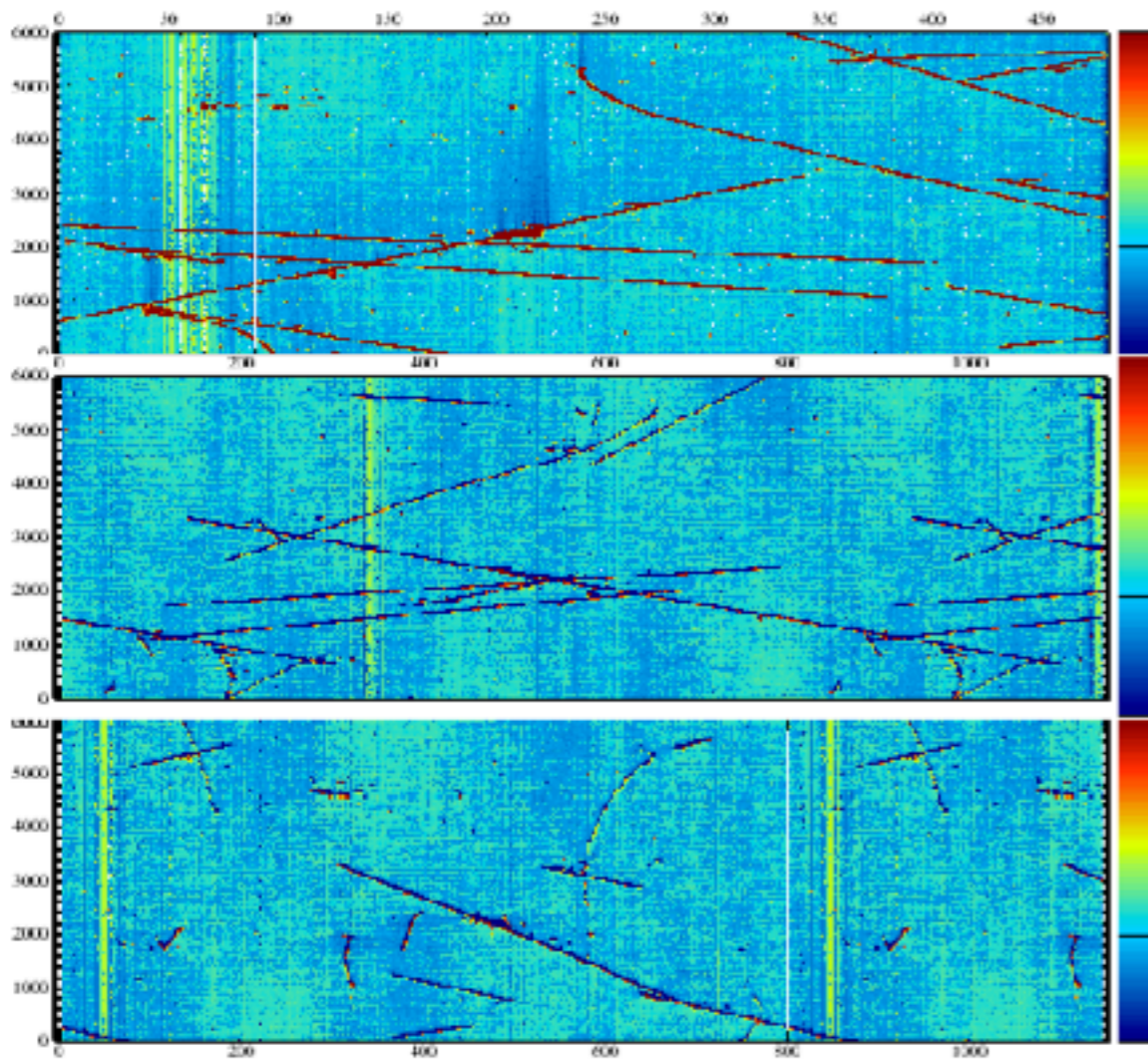
Data

Event **no** primary track **nor** shower
Pandora did not find a beam particle (GetPFParticlesFromBeamSlice)
5809, 1, 23661



Data

Event **no** primary track **nor** shower
5809, 1, 23661

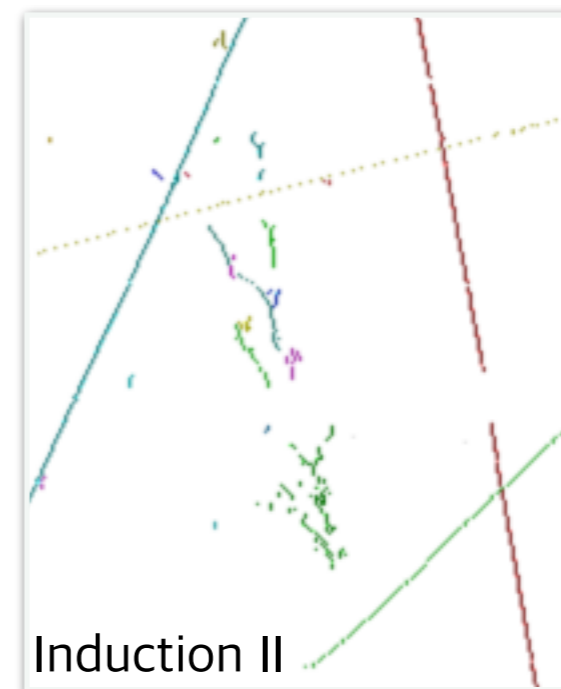
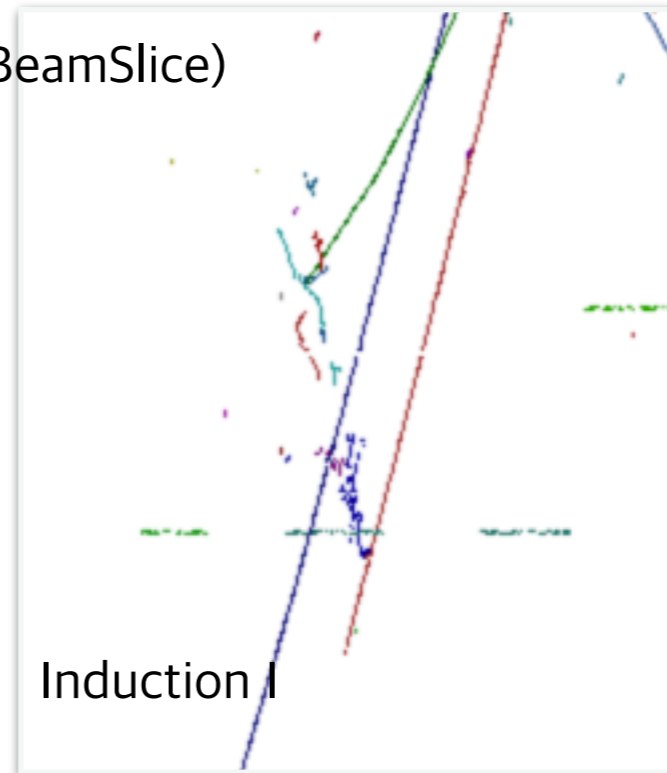
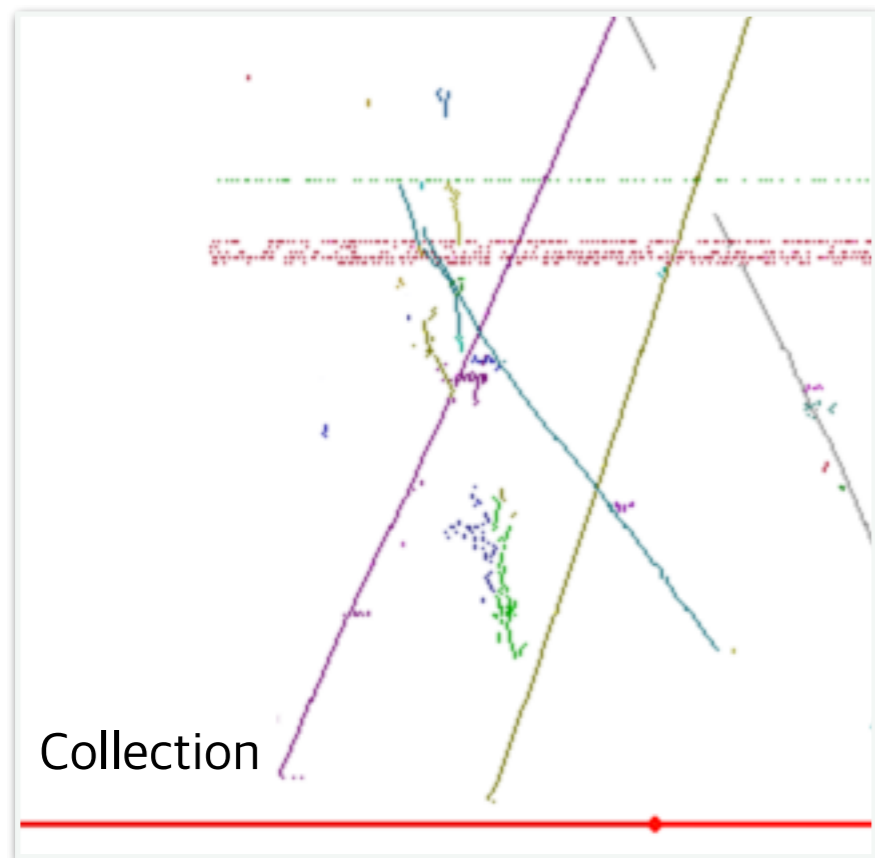


Data

Event **no** primary track **nor** shower

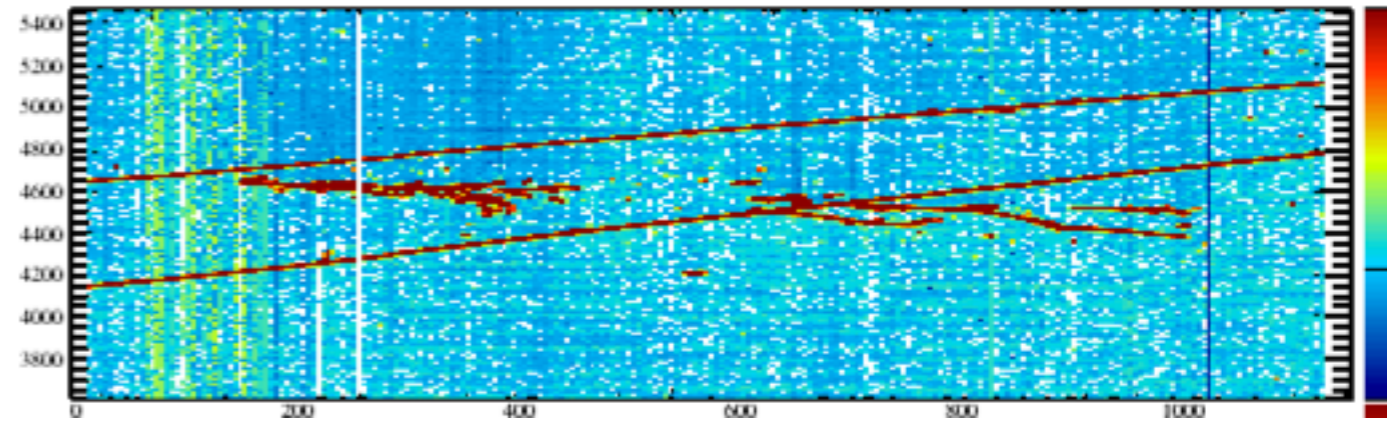
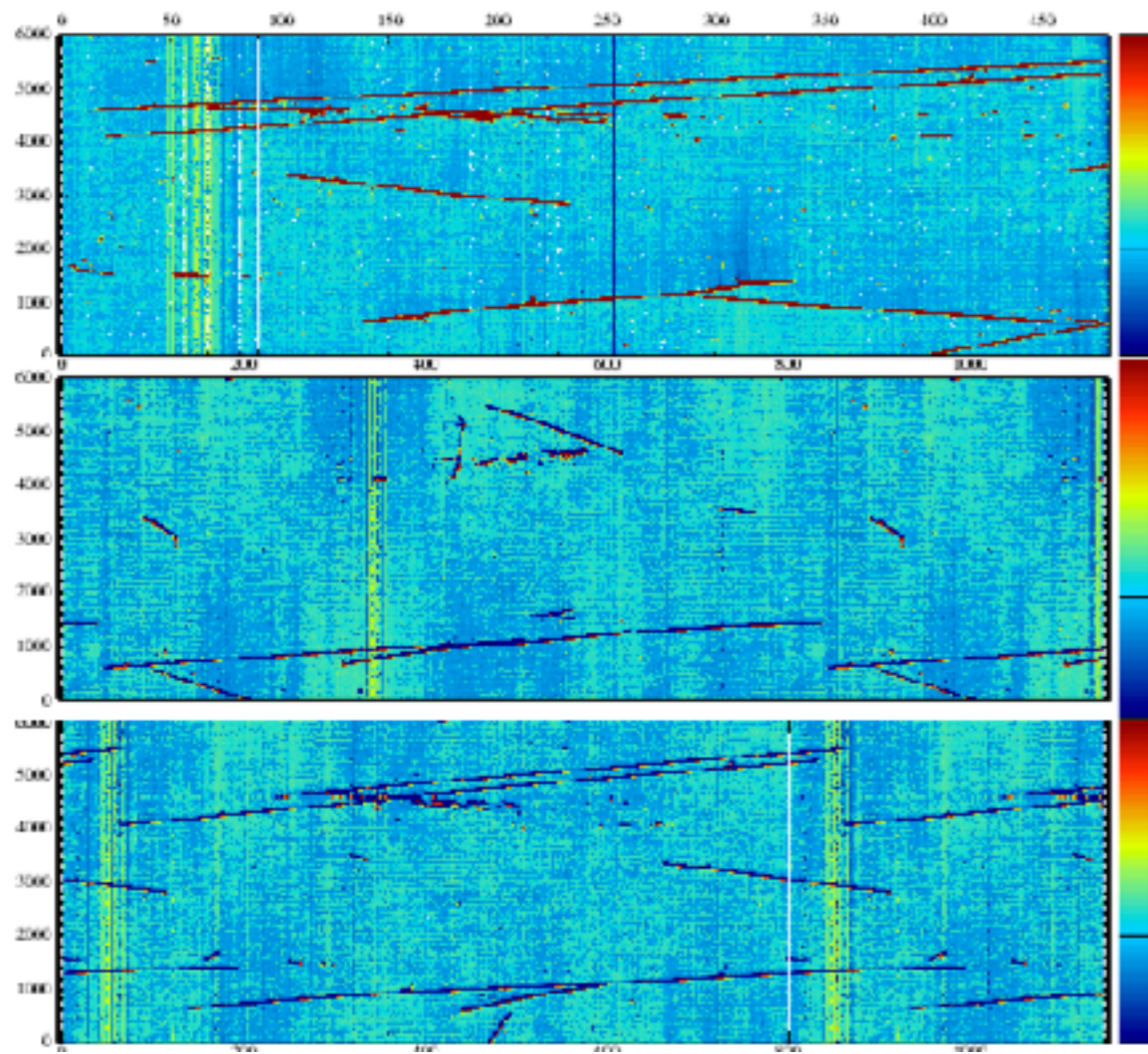
Pandora did not find a beam particle (GetPFParticlesFromBeamSlice)

5809, 1, 22548



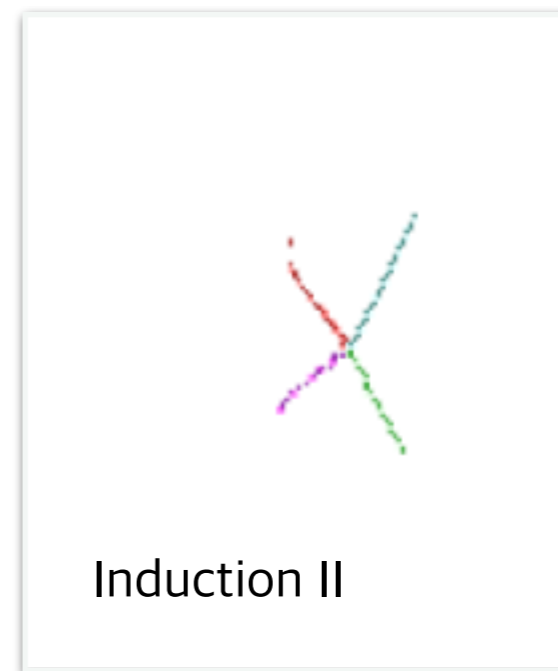
Data

Event **no** primary track **nor** shower
5809, 1, 22548



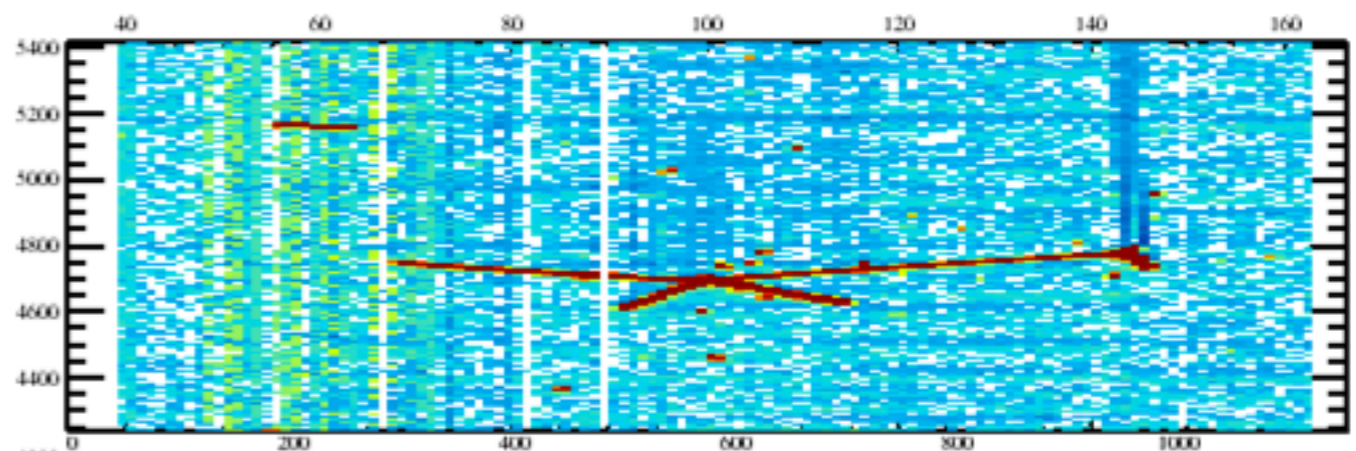
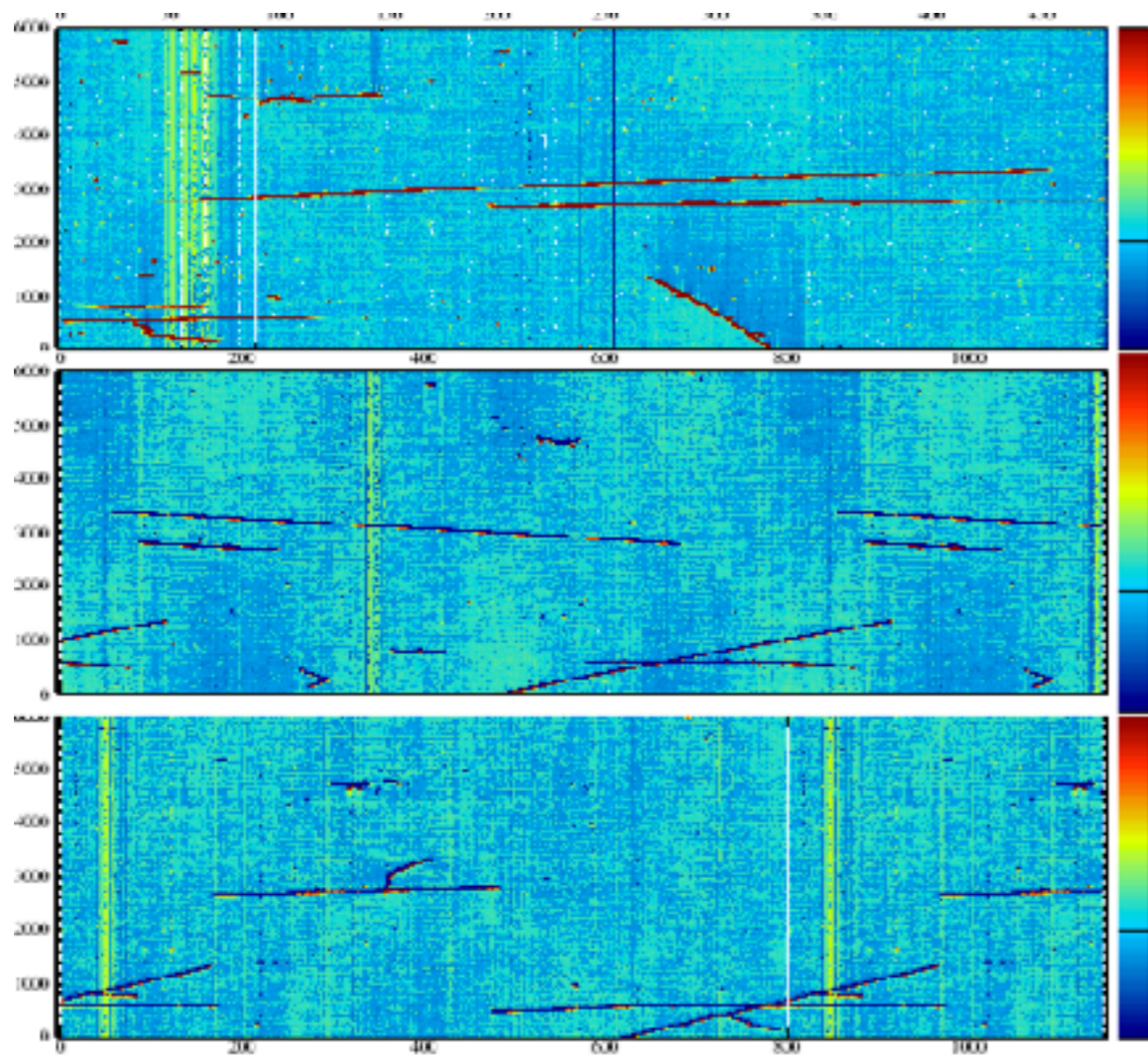
Data

Event w/reco primary track
5809, 1, 22780



Data

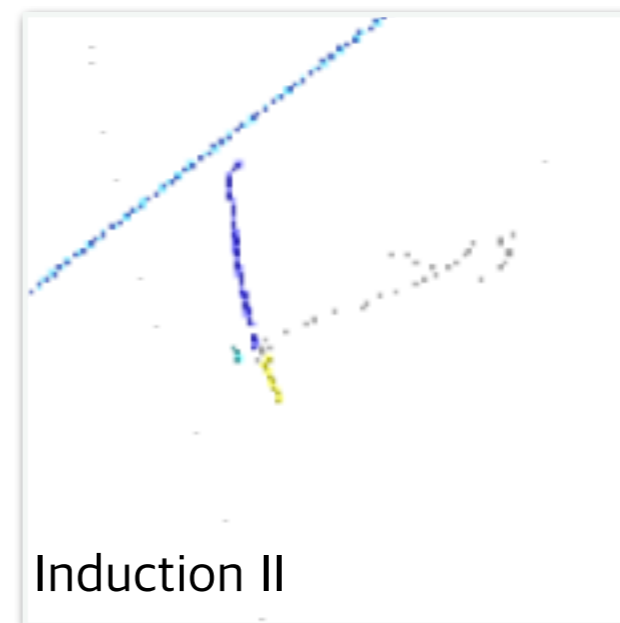
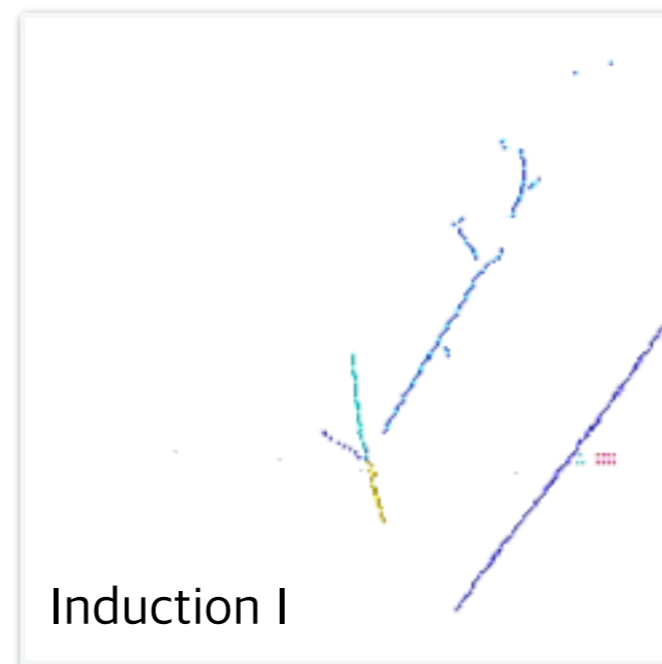
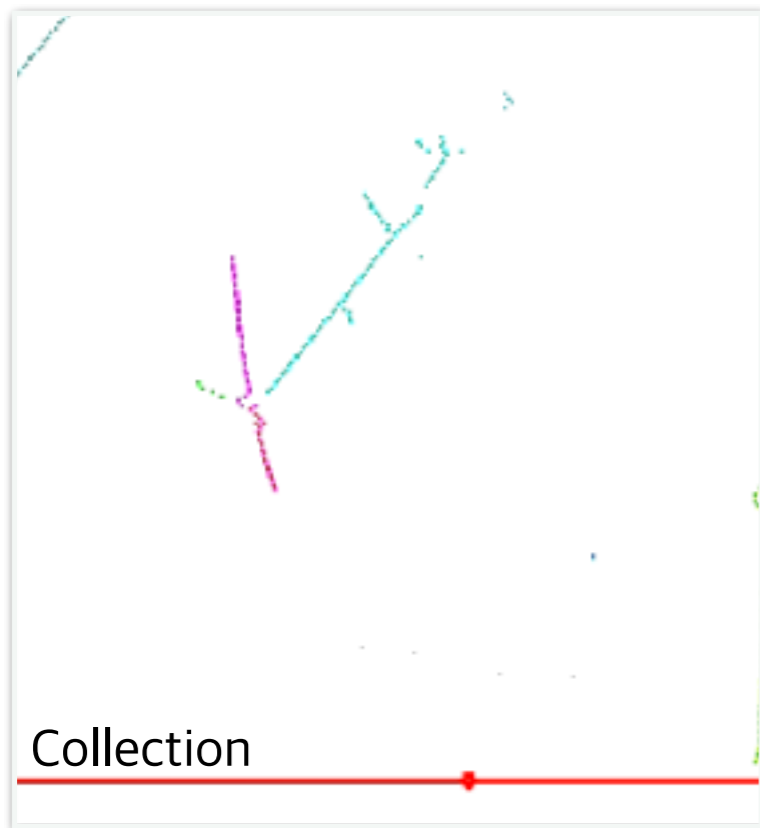
Event w/reco primary track
5809, 1, 22780



Induction II

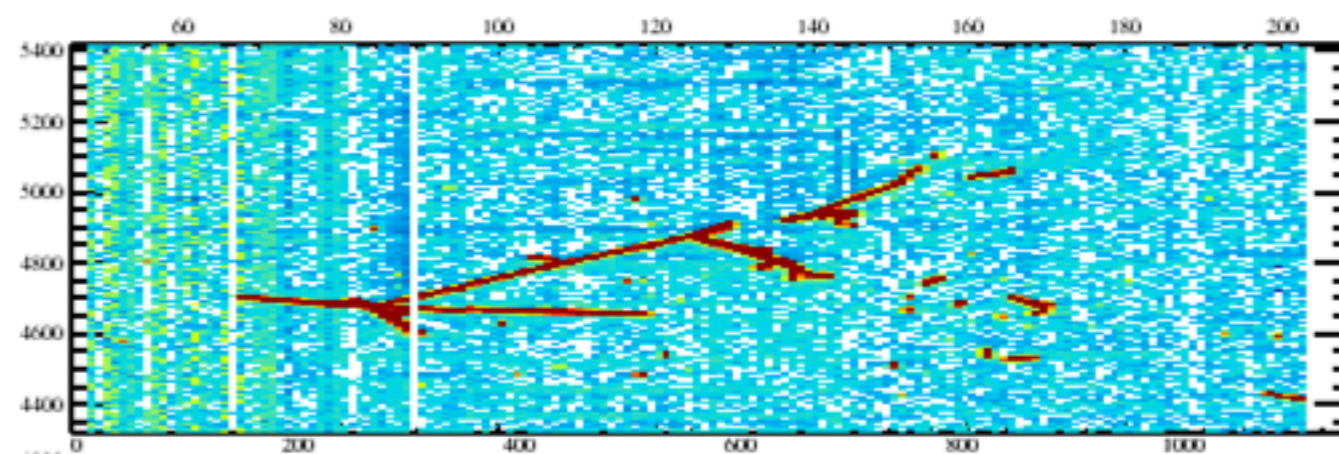
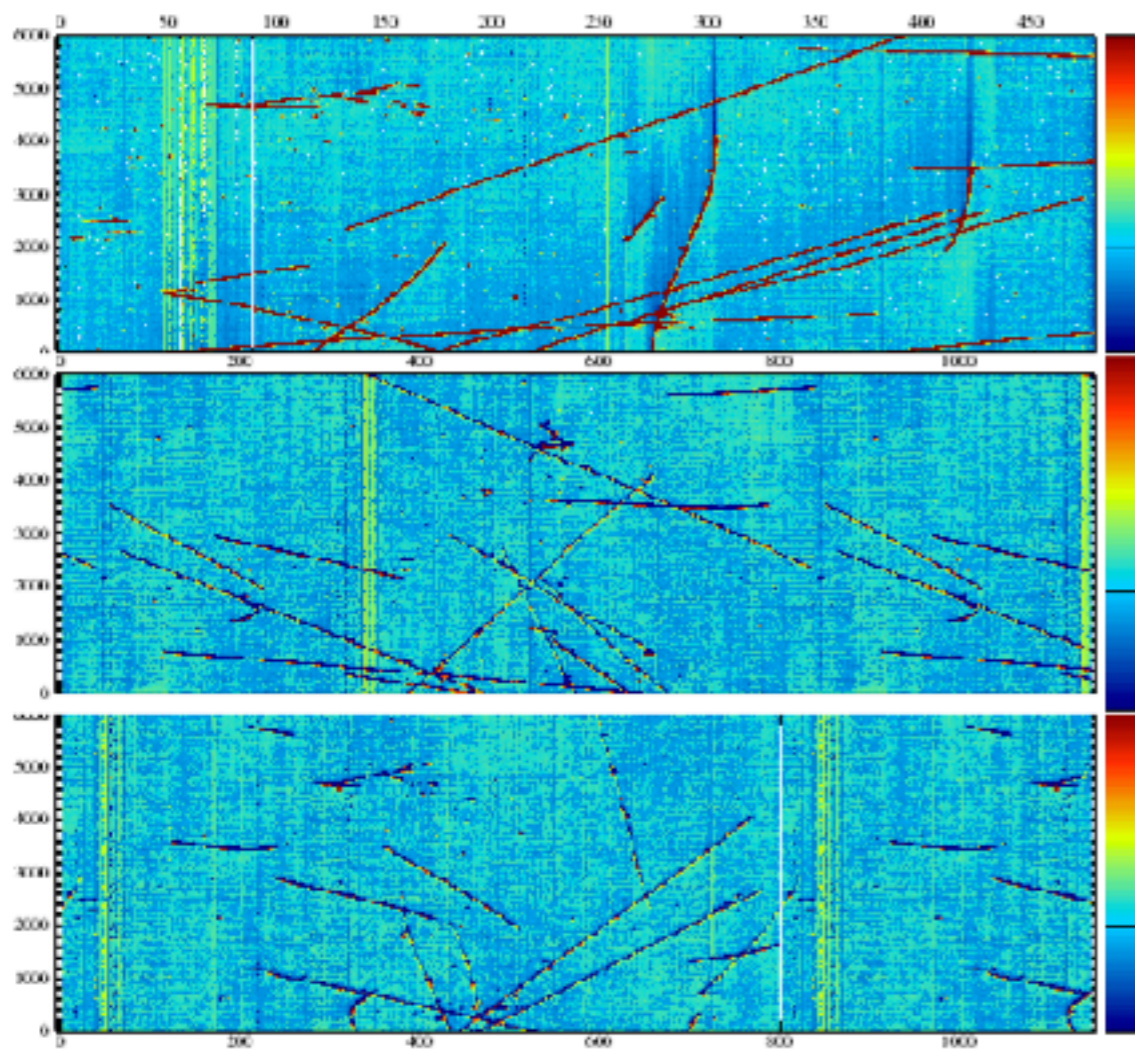
Data

Event w/reco primary track
5809, 1, 22542



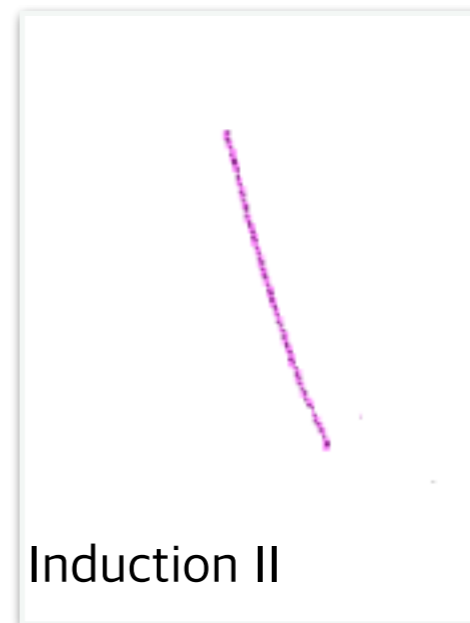
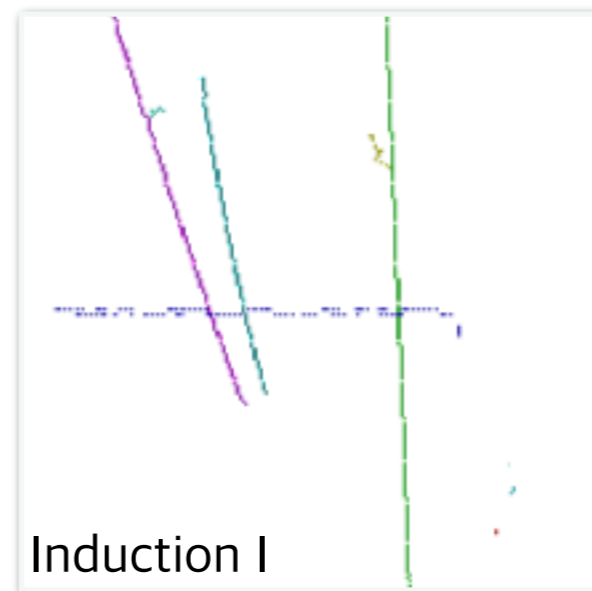
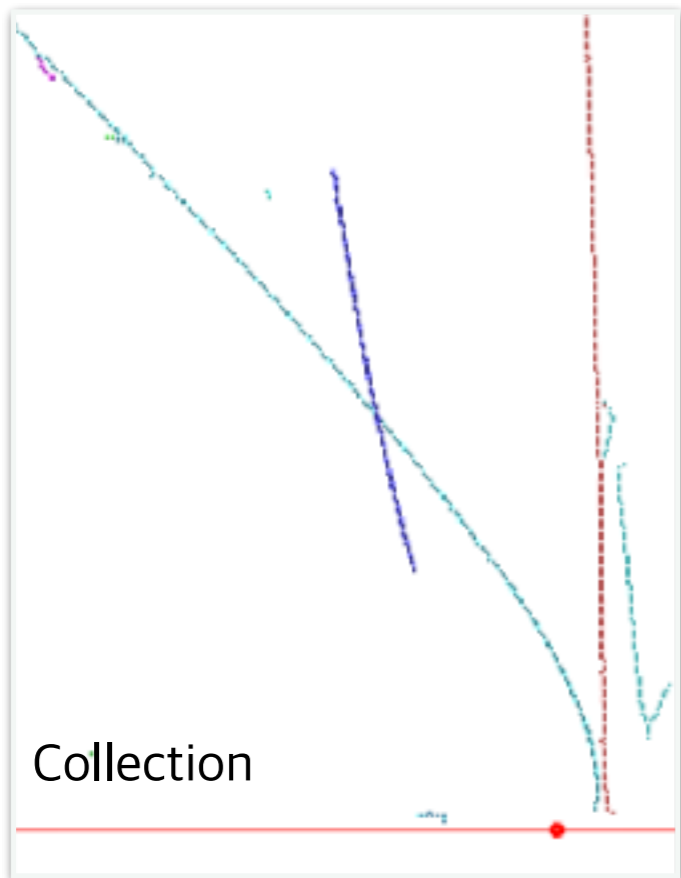
Data

Event w/reco primary track
5809, 1, 22542



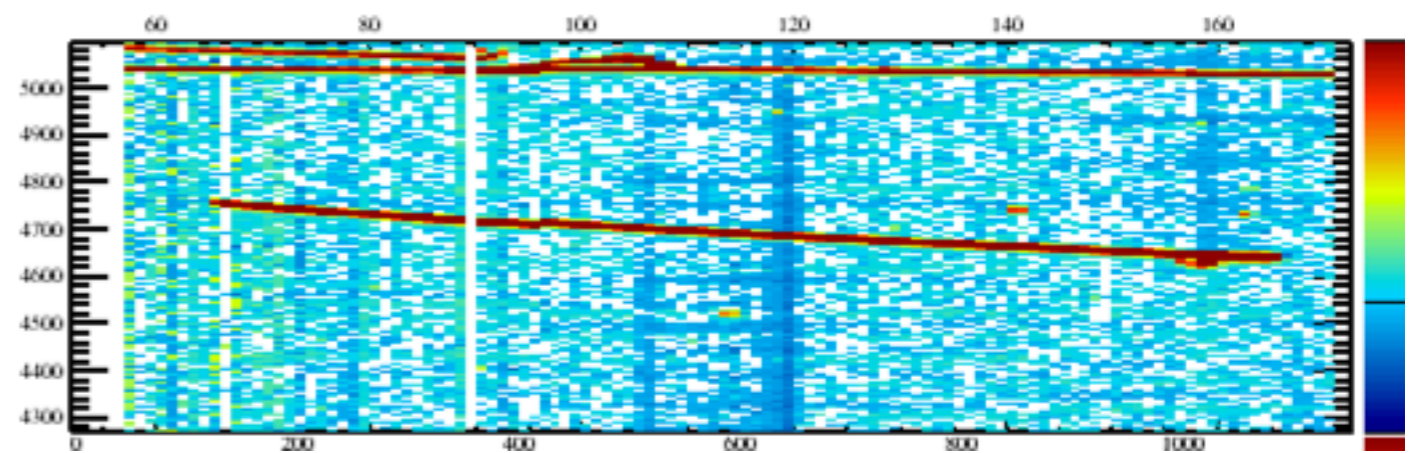
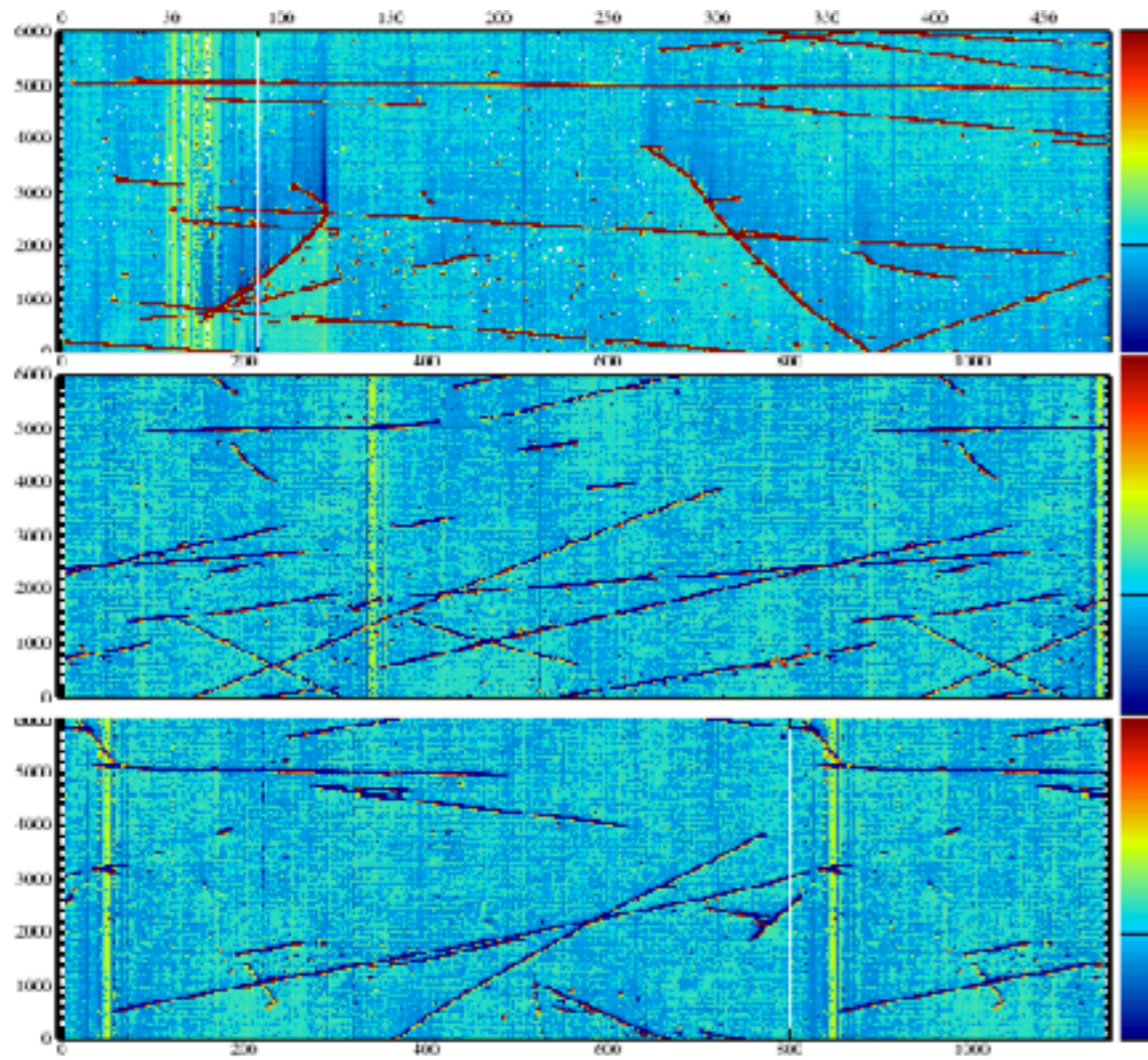
Data

Event w/reco primary track
5809, 1, 22341



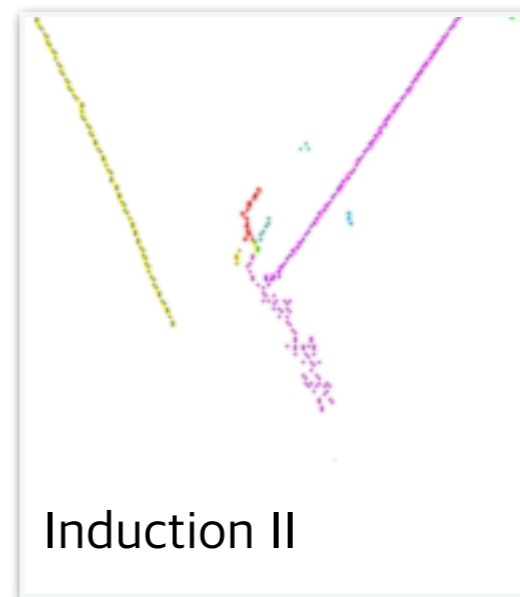
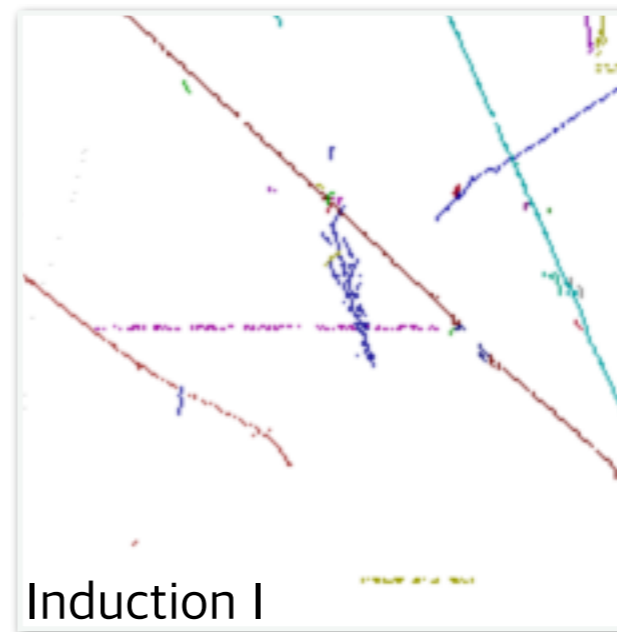
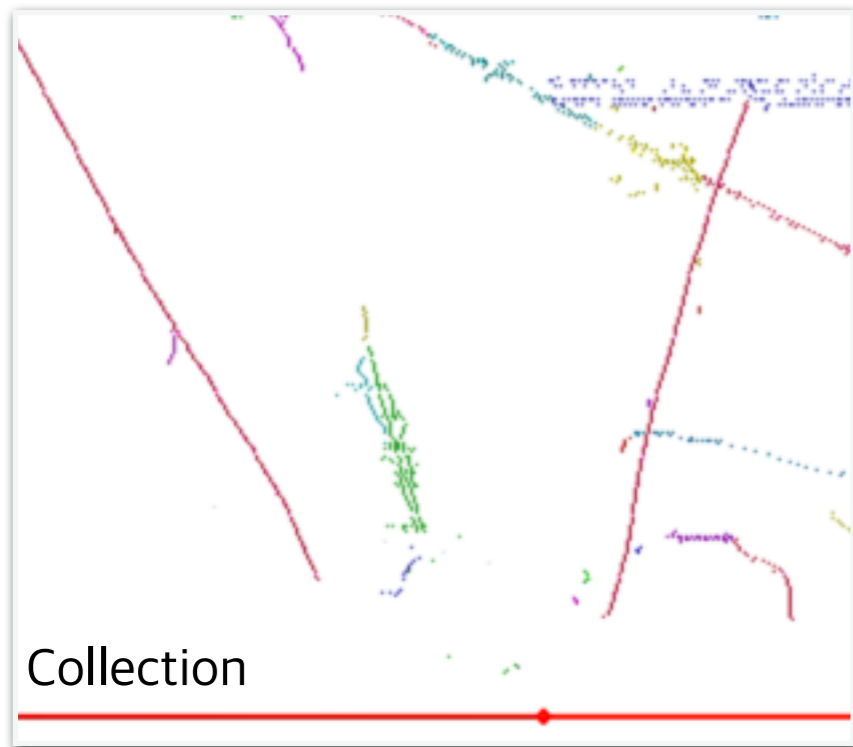
Data

Event w/reco primary track
5809, 1, 22341



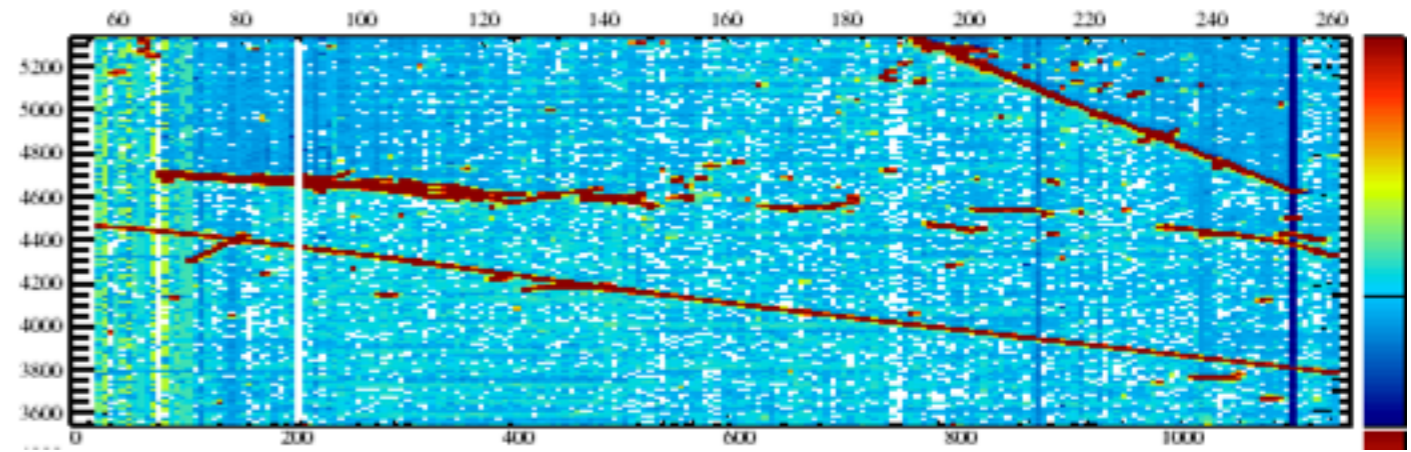
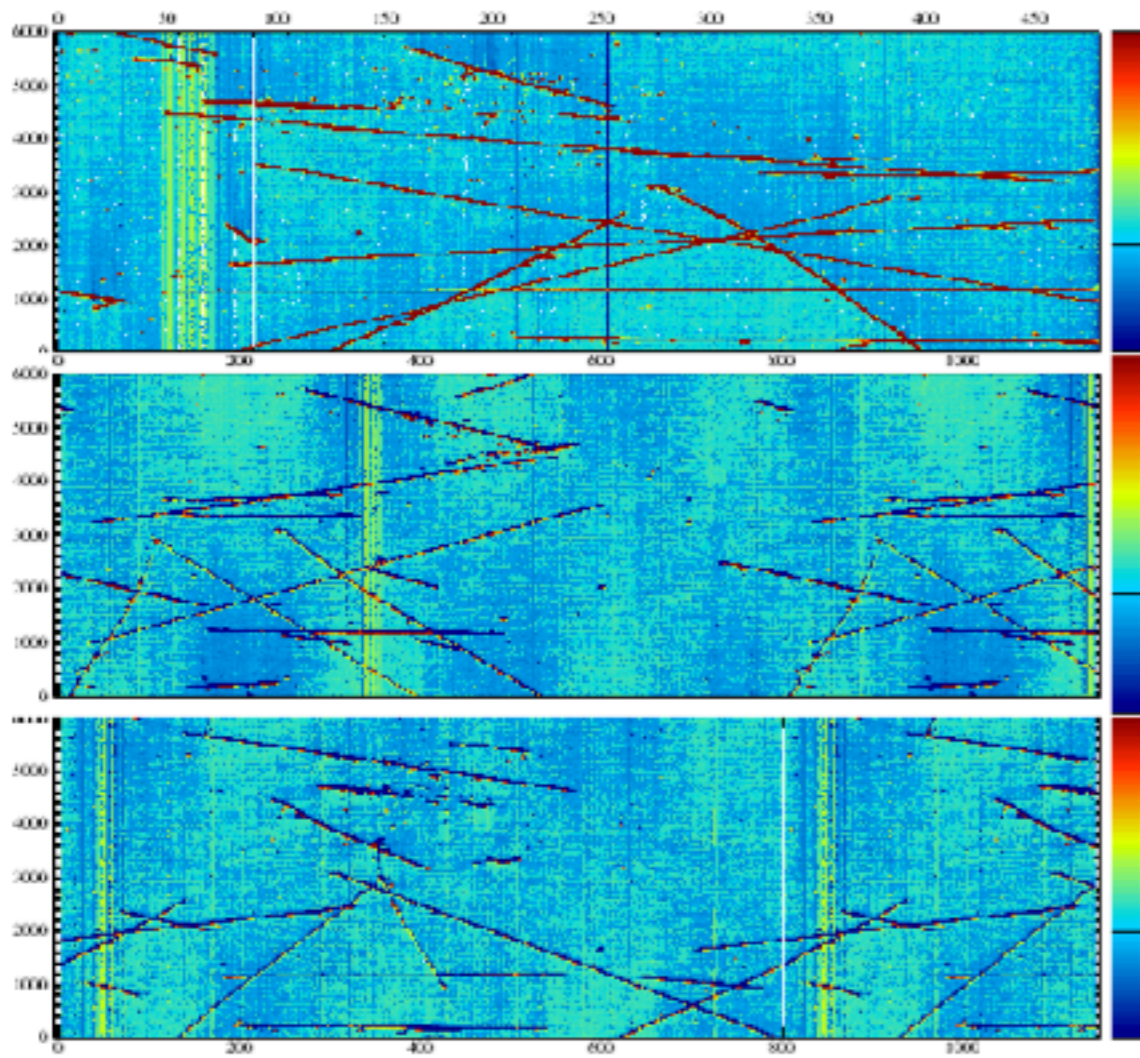
Data

Event w/reco primary shower
5809, 1, 22328



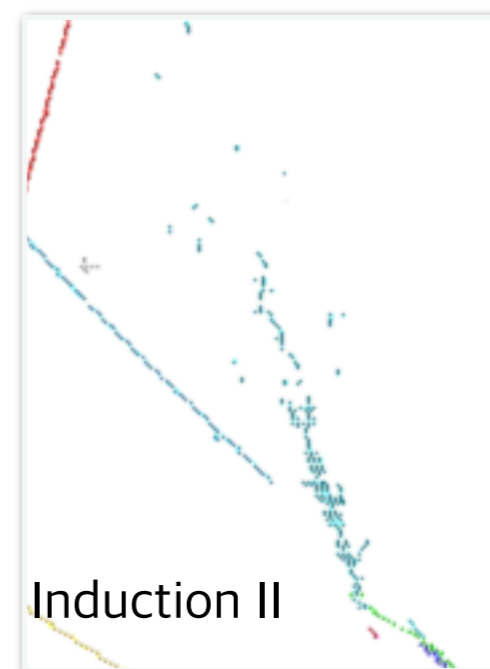
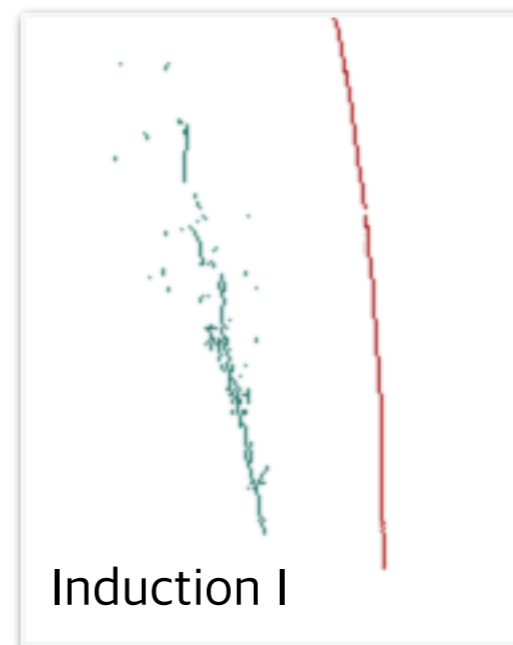
Data

Event w/reco primary shower
5809, 1, 22328



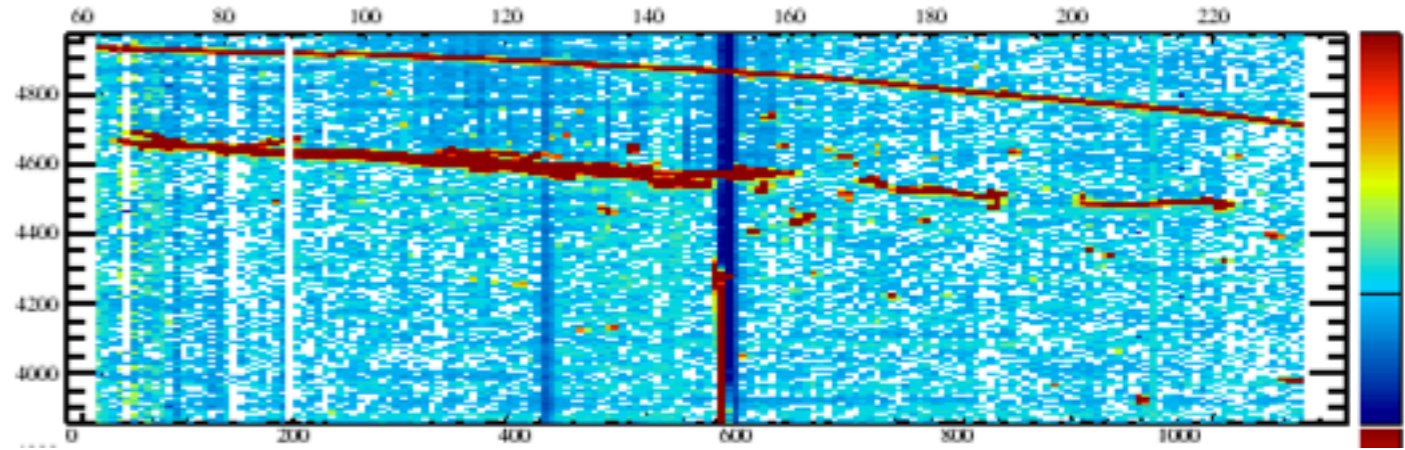
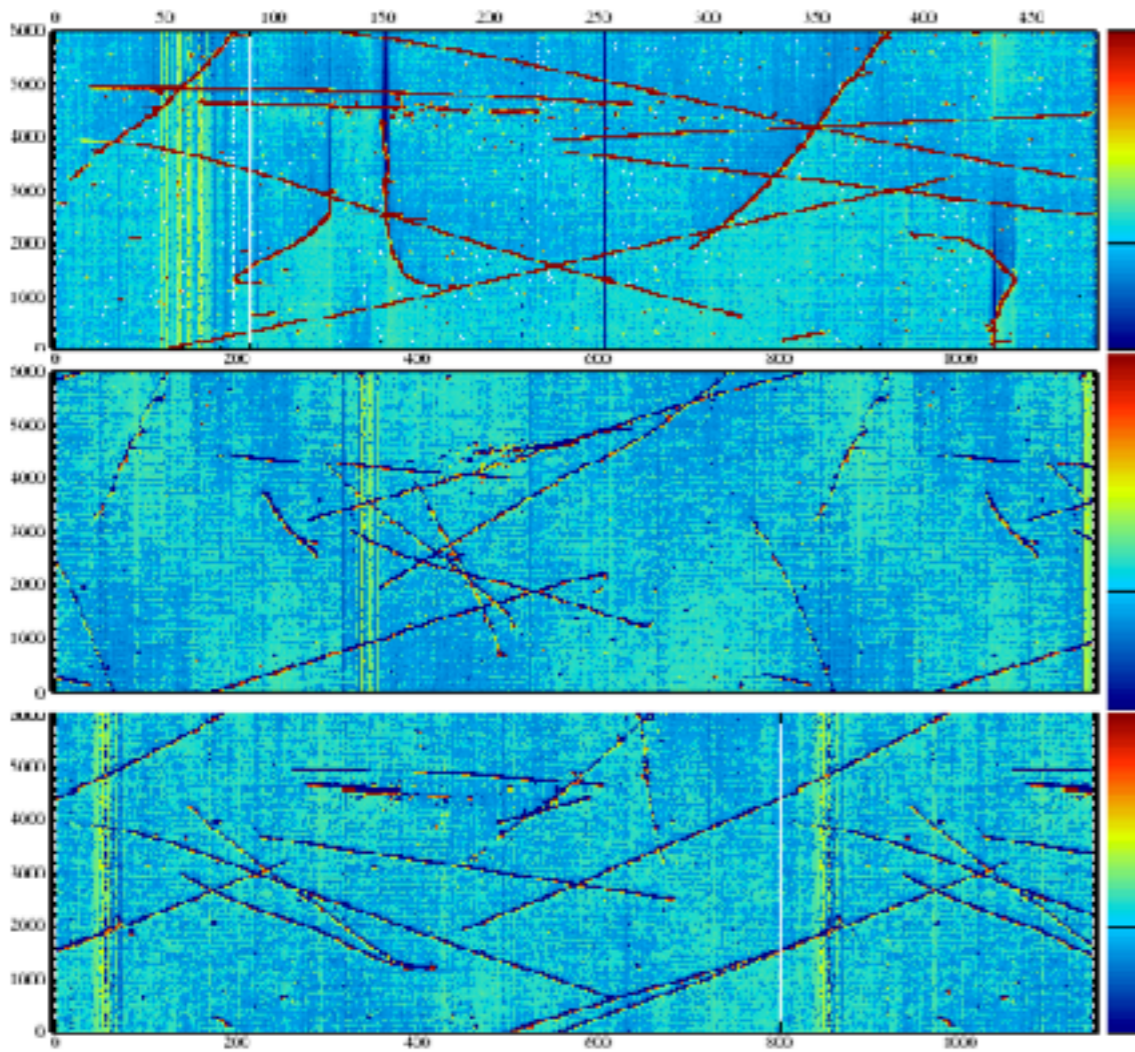
Data

Event w/reco primary shower
5809, 1, 22553



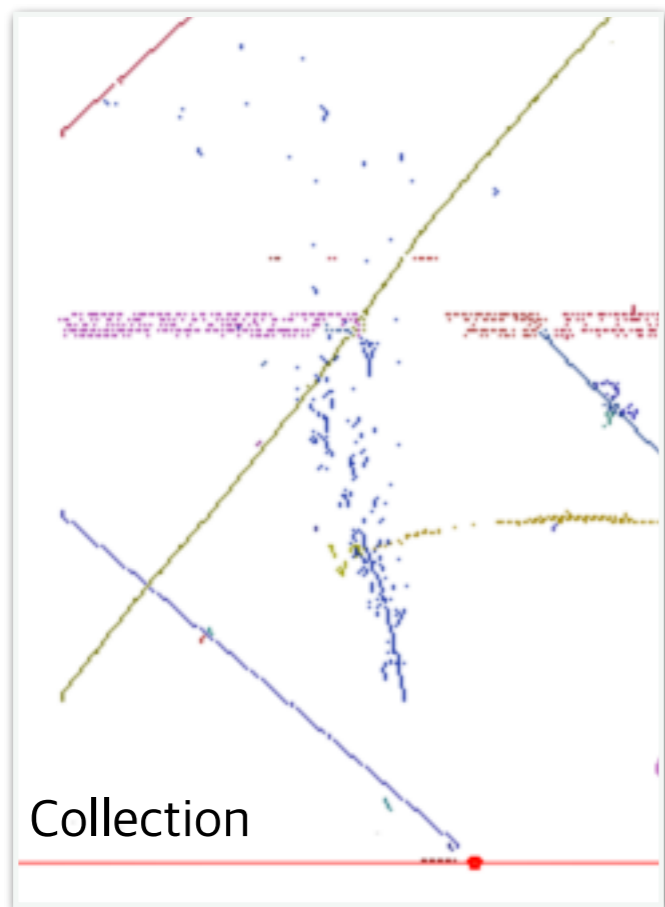
Data

Event w/reco primary shower
5809, 1, 22553

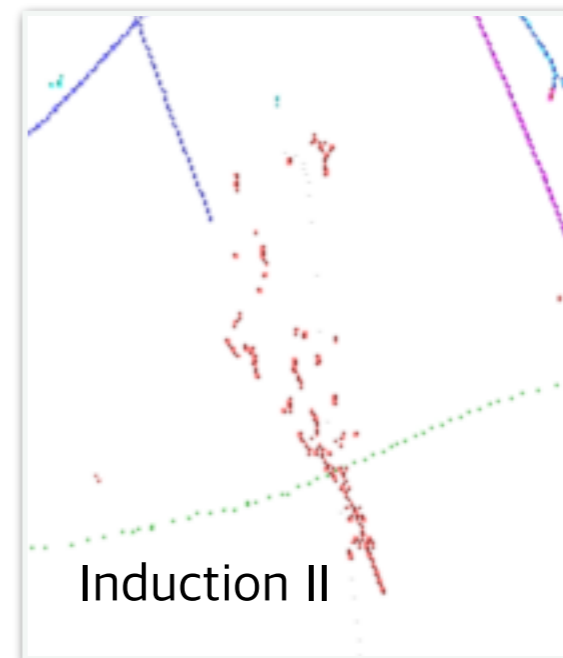
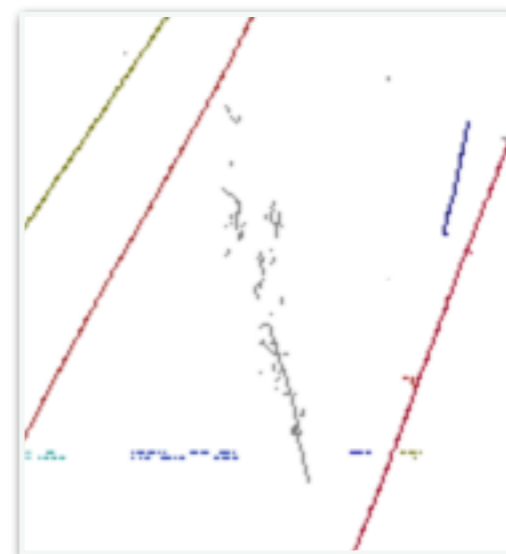


Data

Event w/reco primary shower
5809, 1, 23012

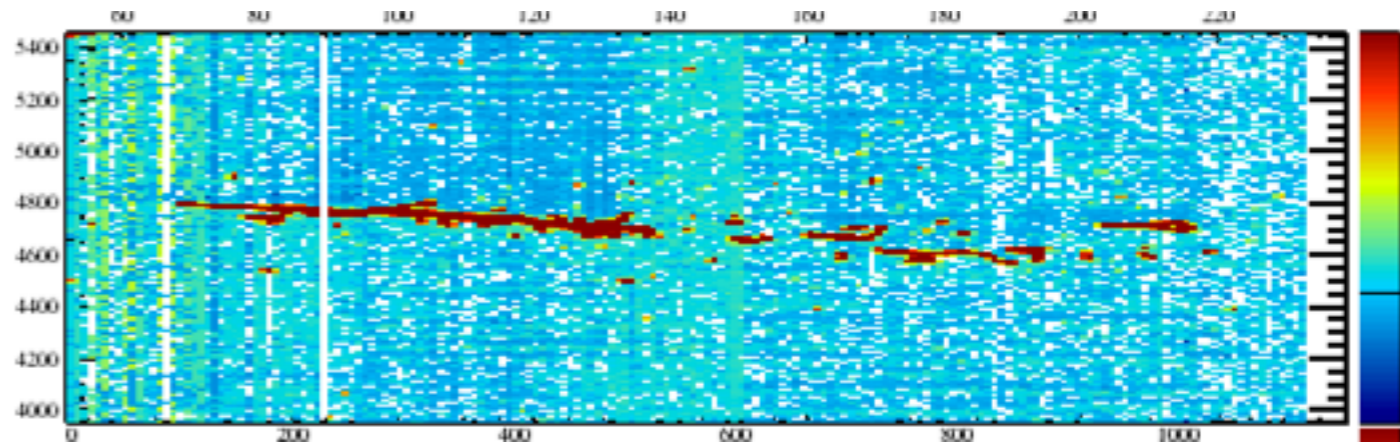
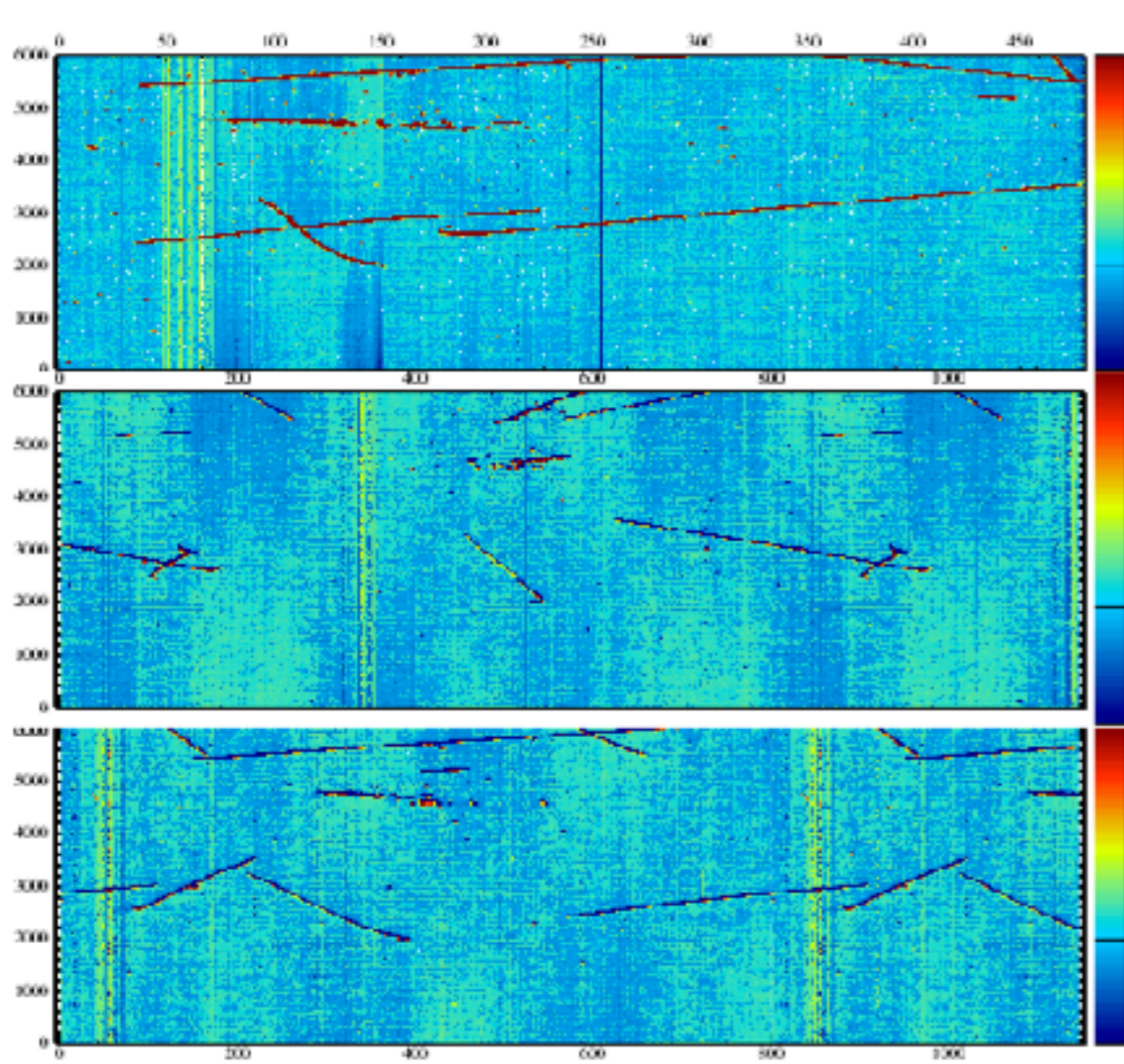


Induction I



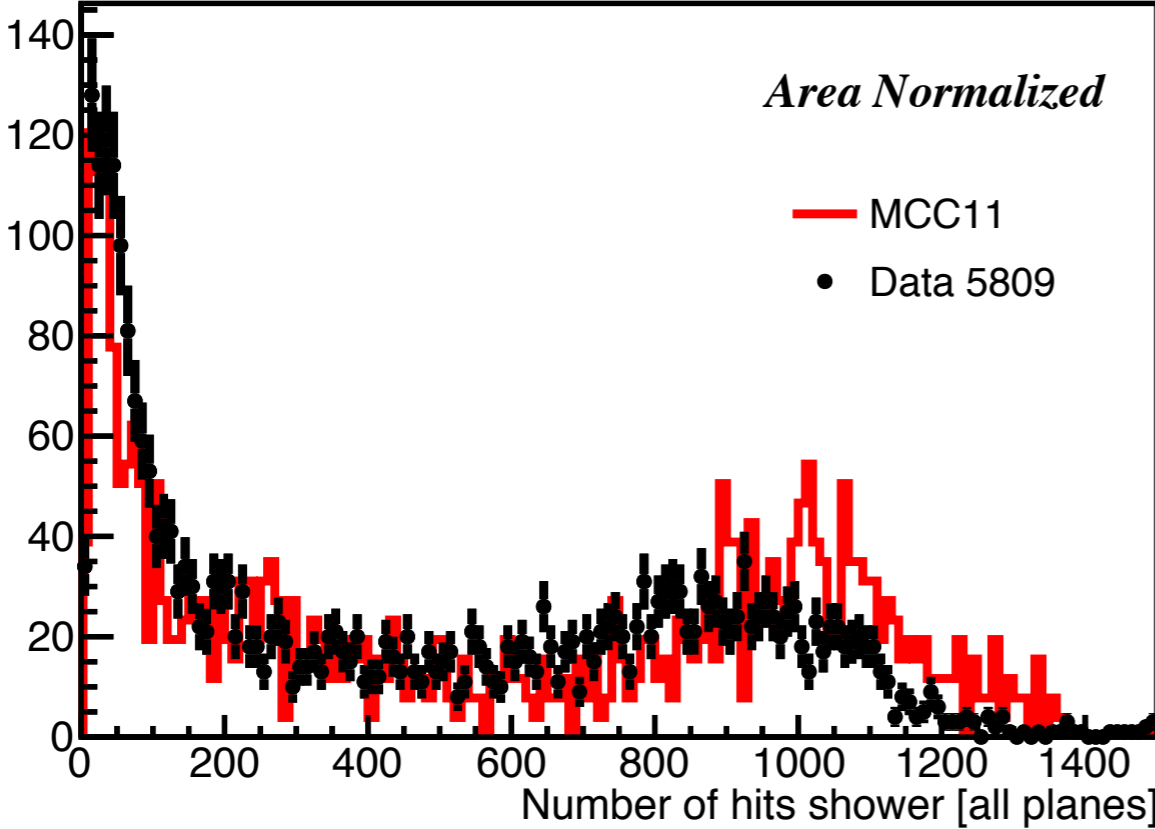
Data

Event w/reco primary shower
5809, 1, 23012



Shower Reco

Primary shower number of hits Data/MC

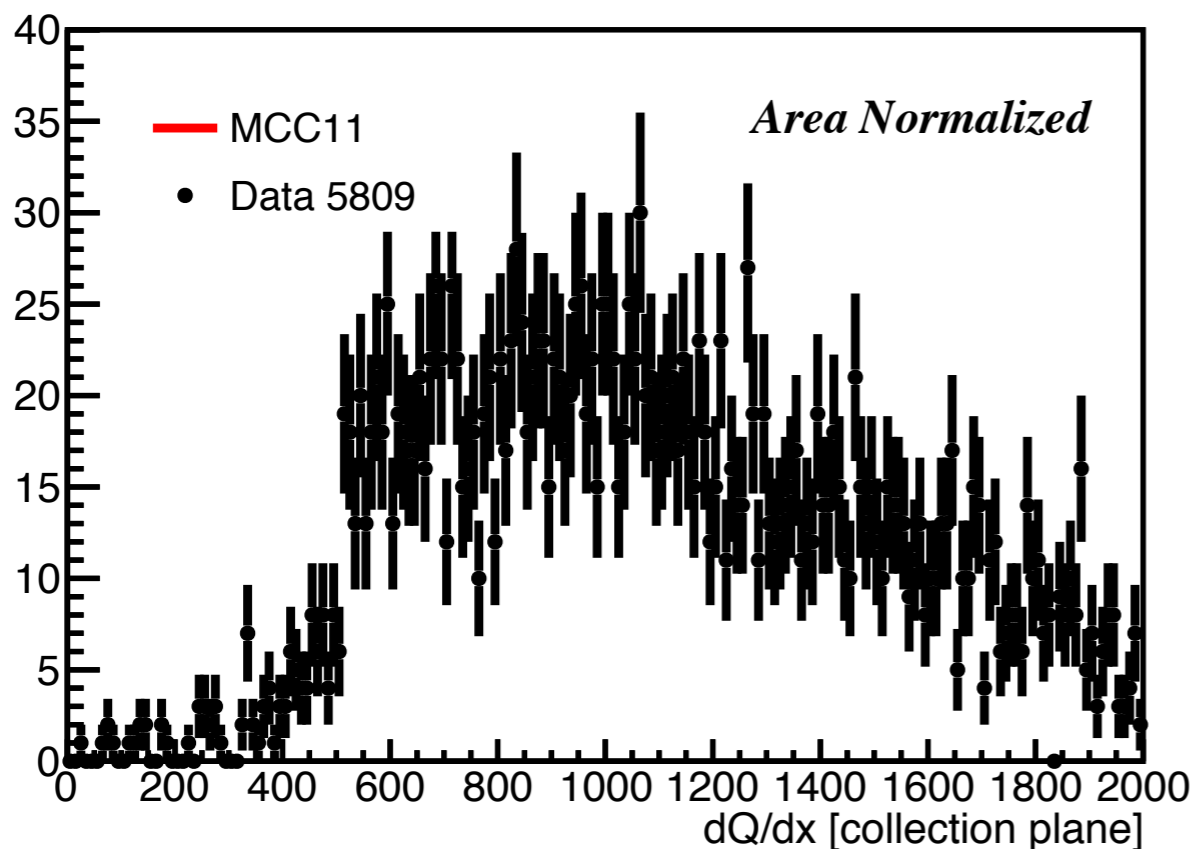


Shower Reco

- Look at dQ/dx (only collection plane)

Pandora does not return calorimetry information for shower object

Caveat I'm using my own simple calculation of dQ/dx base on shower vertex and space point for each hit nearby the vertex



What am I missing?

T0 correction

Lifetime correction

Recombination correction

angular correction (pitch)

Need to find detector properties

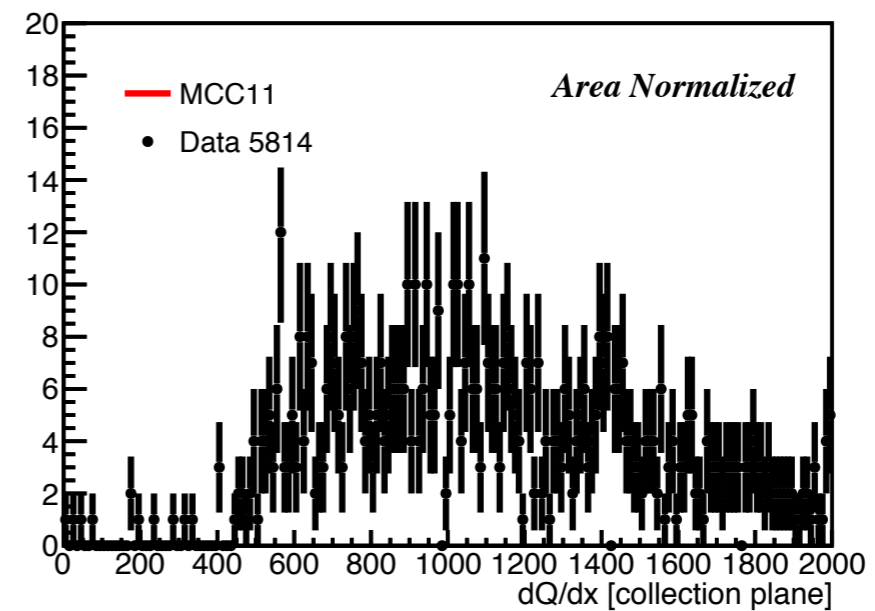
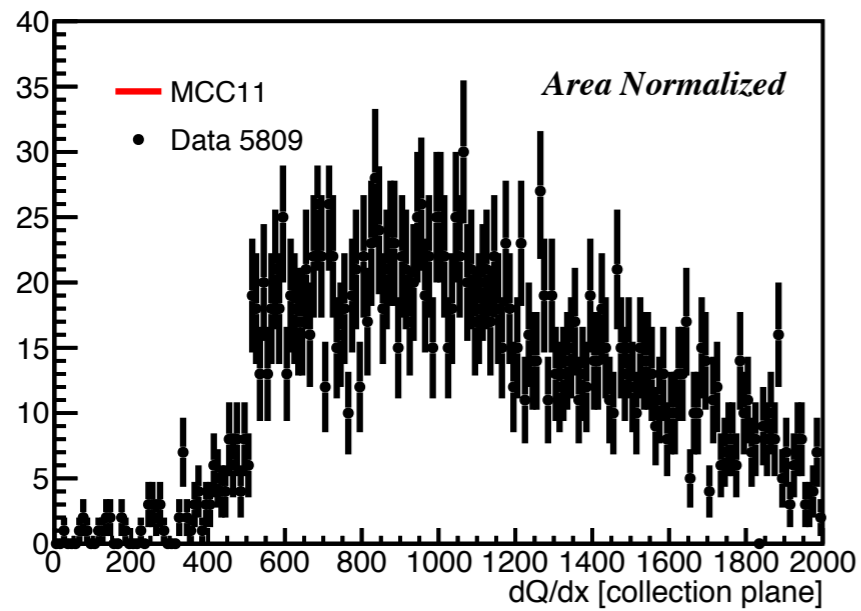
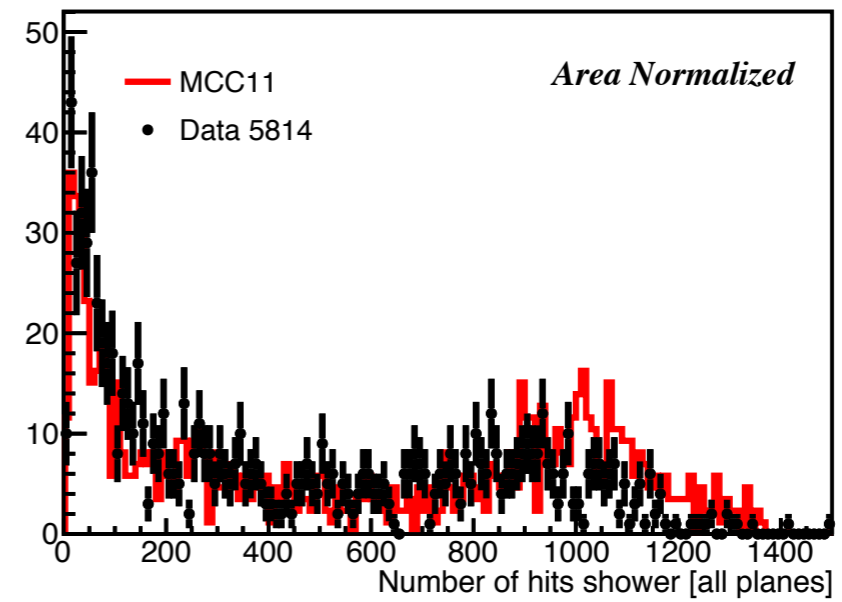
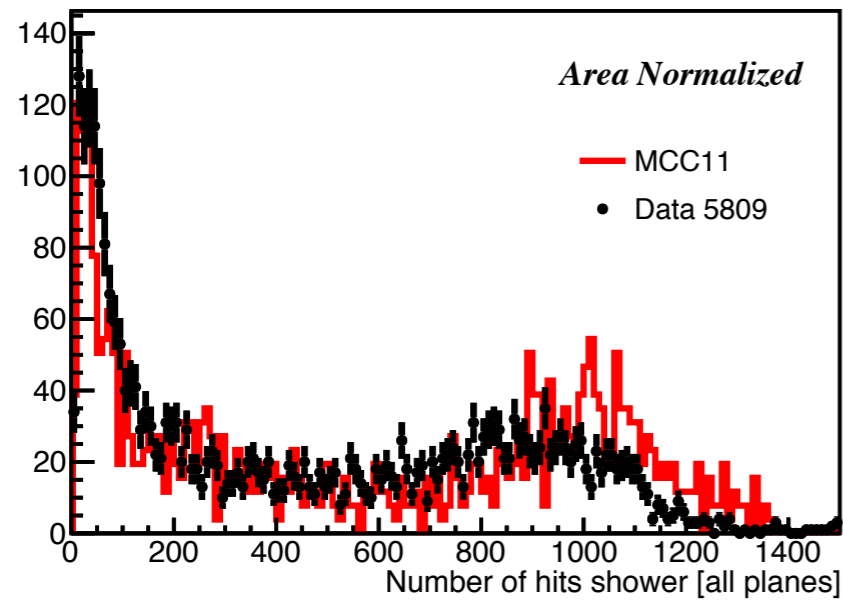
electron lifetime, etc

Comments

1. Large fraction of events with beam trigger are missing beamline information
2. Improve on positron selection (`cerenkovStatus[1] == 1`), not robust enough
3. Data/MC reconstruction efficiencies within expectations
4. Pandora is missing a key part for shower objects, there is no calorimetry information
5. Suggestions?

The End

Shower



Shower

With `dune10kt_calorimetryalgmc`

