TriggerID Alignment

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Content

A. Brief Introduction.

B. Preliminary findings.

C. Strange patterns we notice in ECAL TriggerID.

Motivation

1. Find TriggerID mis-match patterns.
2. Provide debug hints for electronics part colleagues.
3. Align the collected data (Bonus).

Strategy

1. Find muon-like tracks both in e+, π^+ Run files of ECAL and AHCAL.
2. Collect related TriggerIDs separately.
3. Discover shift patterns in these TriggerIDs.

Find Muon-like Tracks

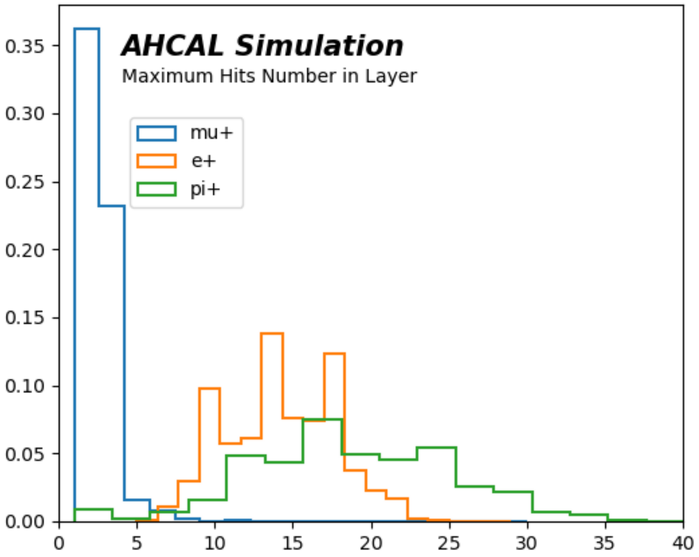
A. In the first stage, we would bypass Fancy PID (Quick Selection).
B. Three criteria:
   1. Not Shower: fired cells < 5 (tunable) in each layer.
   2. (Fired cells / Fired Layers) < 1.2 (tunable)
   3. Fired layers > 0.8 (tunable) * total layers. (ECAL 32, AHCAL 40) .

```
if notshower and (cells_fired / layers_fired < 1.2) and (layers_fired > (0.8 * layer_num)):

    trigger_ID_picked.append(trigger_ID[i])
```

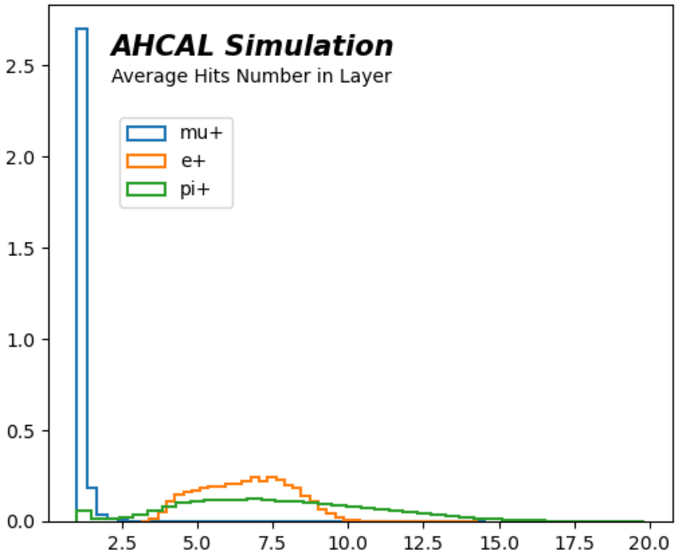
SJTU AHCAL Simulation

◉**Include - μ^+: 160 GeV, e^+, π^+: 20-120 GeV**



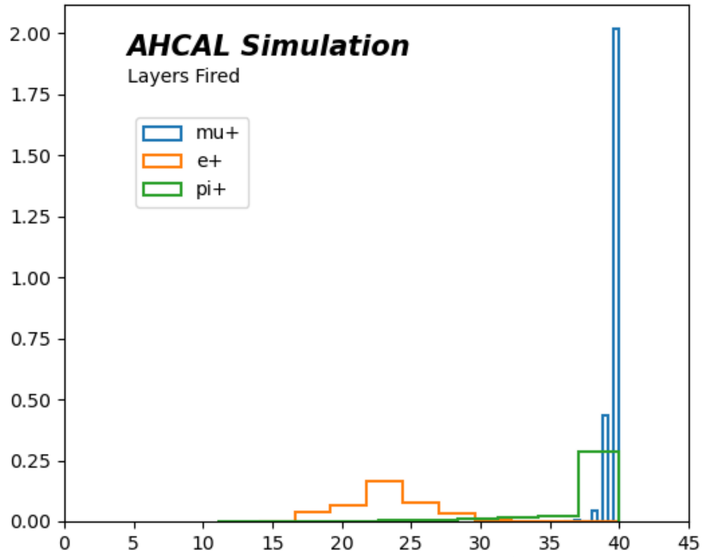
Cut: #< 5

Not shower



Cut: #< 1.2

Cells fired number / Layers fired number



Cut: #>80%

Layers fired

Algorithm

✦**We collected ECAL and AHCAL TriggerIDs representing muon-like track separately.**

✦**We calculated all the combinations of the TriggerID shift:**

✦ $$ECAL_{TriggerID} - AHCAL_{TriggerID}$$

✦**If there is a shift value appearing most, a constant shift dominates.**

Run files checked in this talk

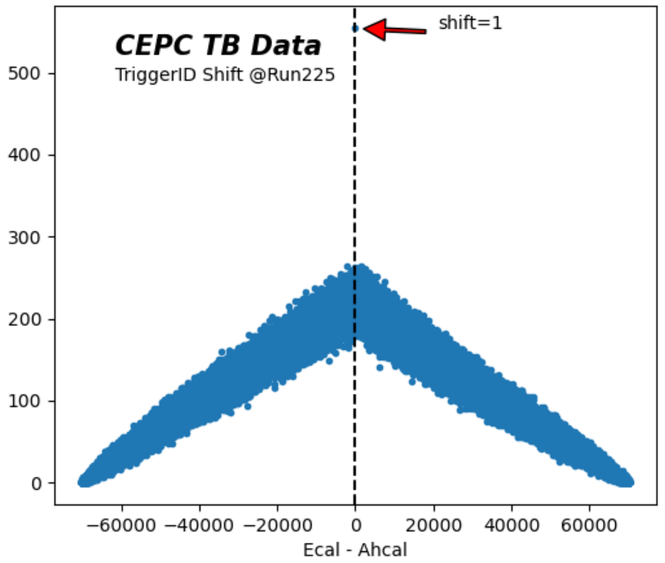
Run #	Type
Run 225	e+ 20GeV
Run 233	e+ 40GeV
Run 235	e+ 40GeV
Run 250	e+ 50GeV
Run 258	pi+ 30GeV
Run 265	pi+ 50GeV
Run 280	Pi+ 100GeV
Run 290	e+ 100GeV

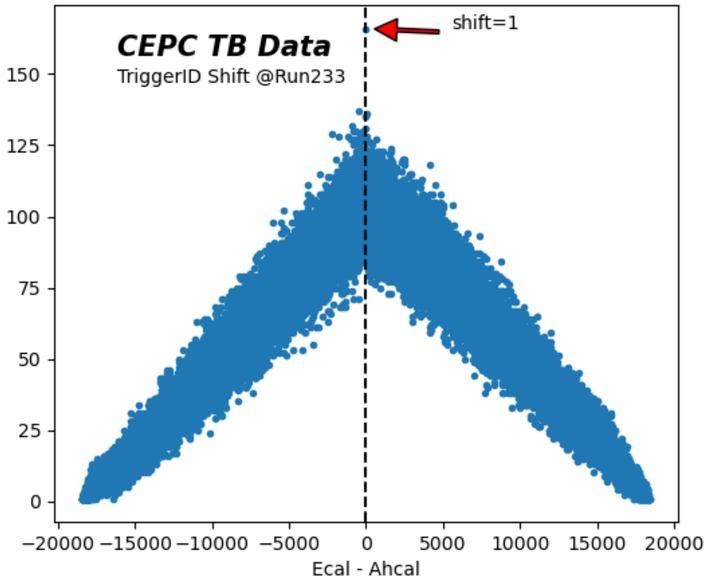
ECAL: /cefs/higgs/wangjx/ScECAL/Result_Diagnose/decode

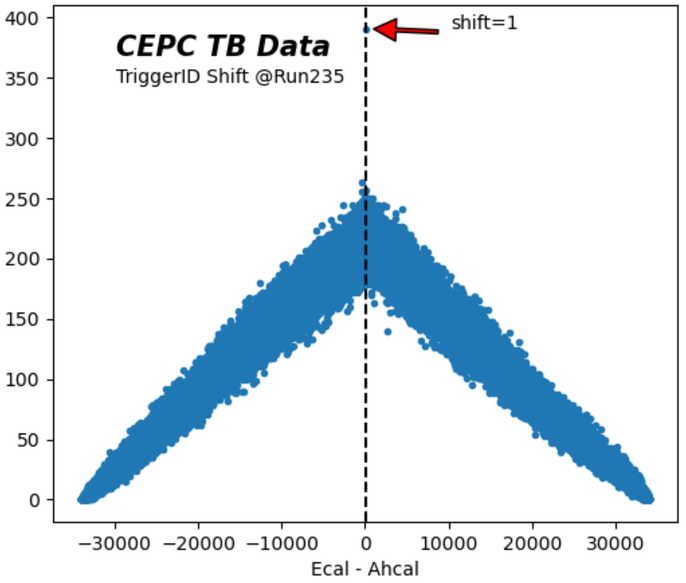
AHCAL: /cefs/higgs/shiyk/Beam_2022/DataBase/Calib/Particle

Results for all Run files checked: /cefs/higgs/siyuansong/Syn/Fig

Preliminary Findings



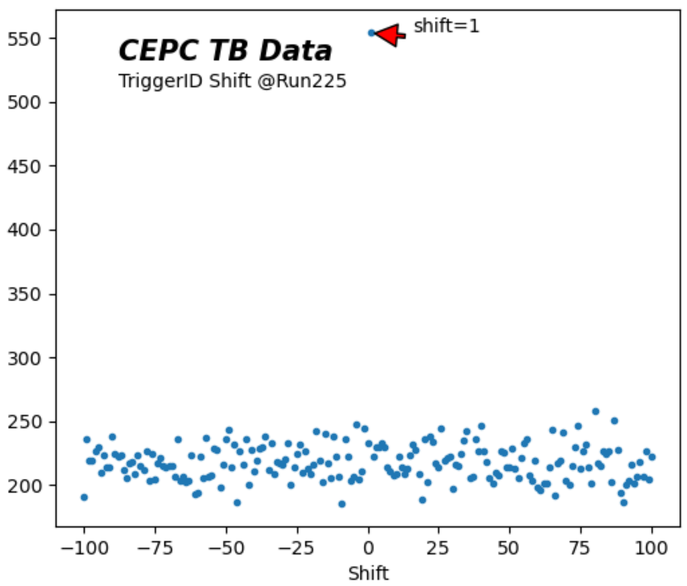


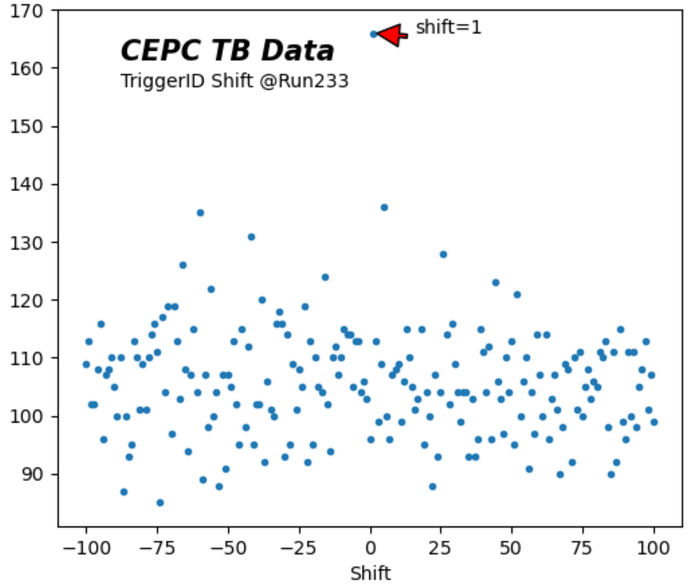


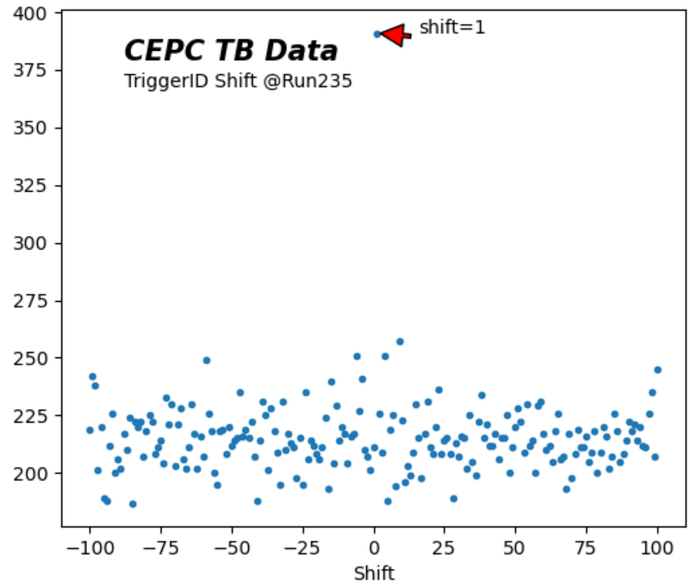
Shift = 1 dominates.

Preliminary Findings

Check shit from -100 to 100, calculate coincidence number.

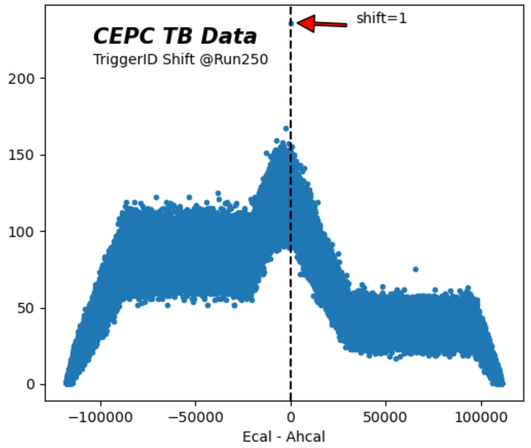


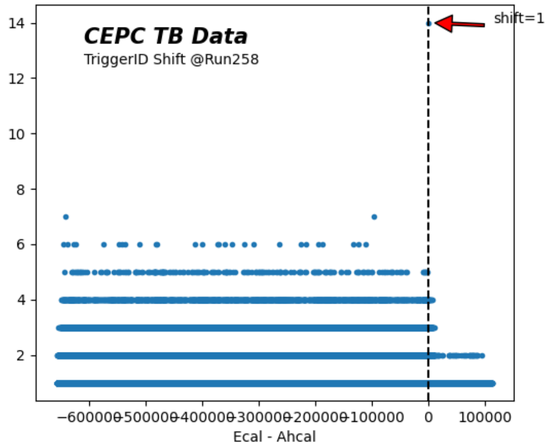


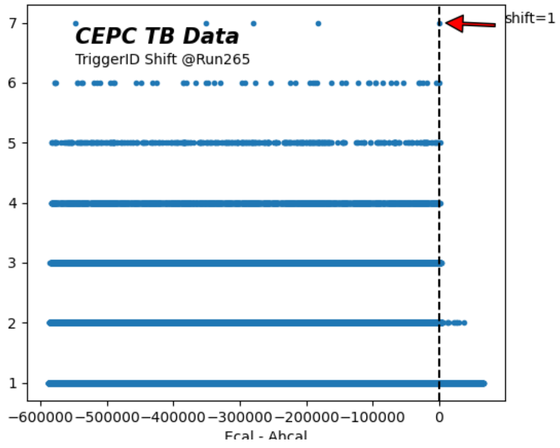


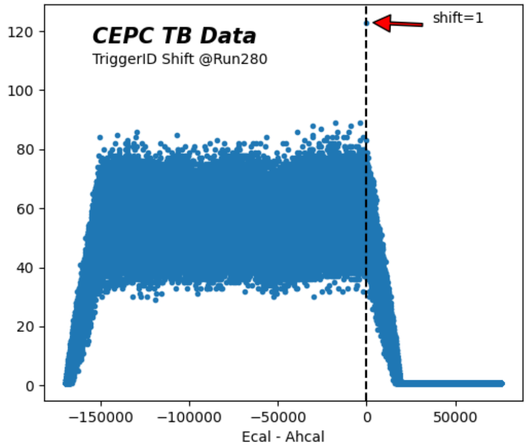
Shift = 1 dominates.

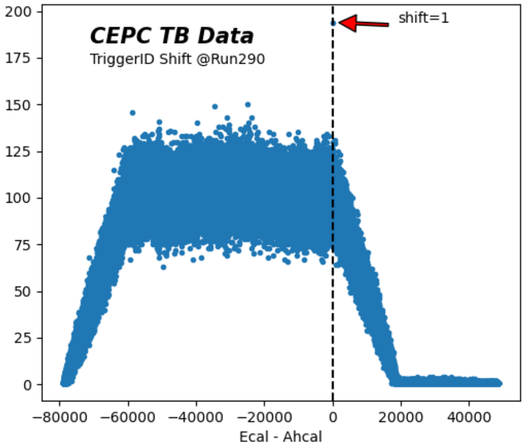
Preliminary Findings











Reasoning in the next page.

Although Shift = 1 dominates, shapes seem strange.

Reasoning

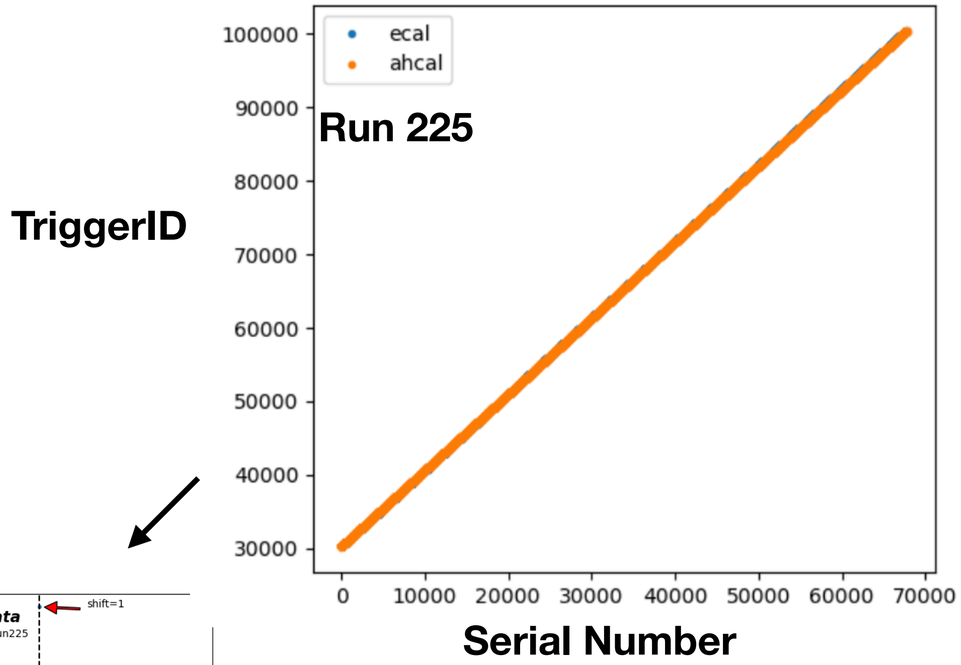
$ECAL_{TriggerID}$ **Picked Number <<** $AHCAL_{TriggerID}$ **Picked Number**

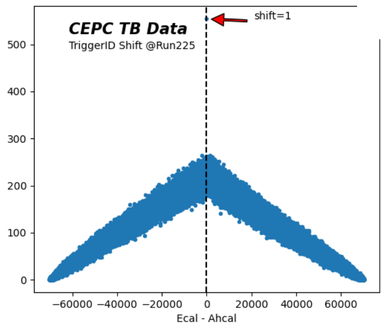
```
1    ECAL: 467
2    AHCAL: 20233
```

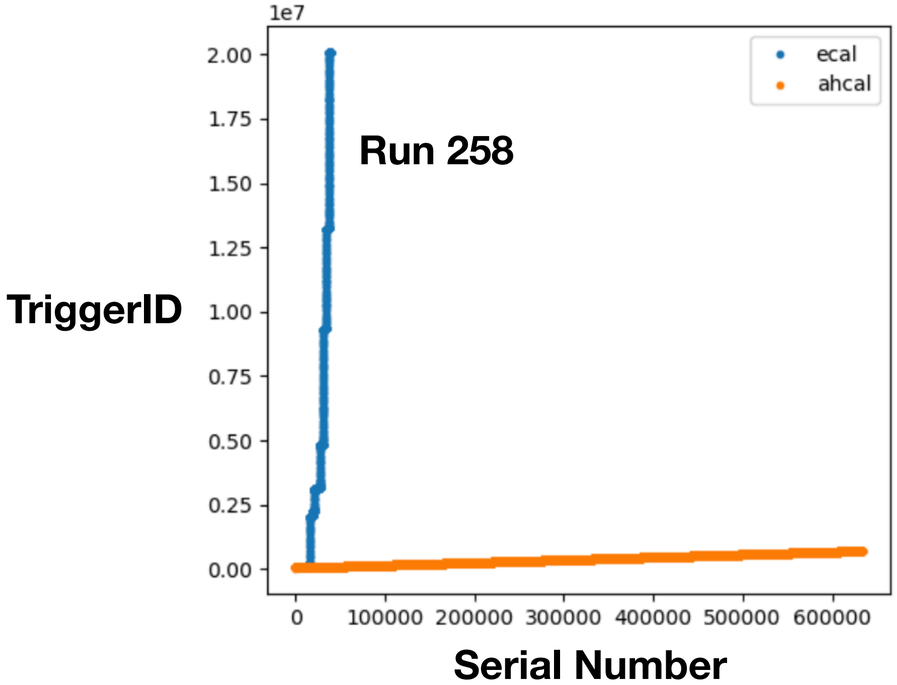
I dropped ECAL TriggerIDs much larger than AHCAL TriggerIDs

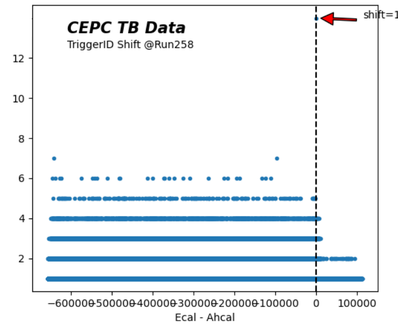
ECAL TriggerIDs sometimes become extremely large

Abnormal ECAL TriggerID



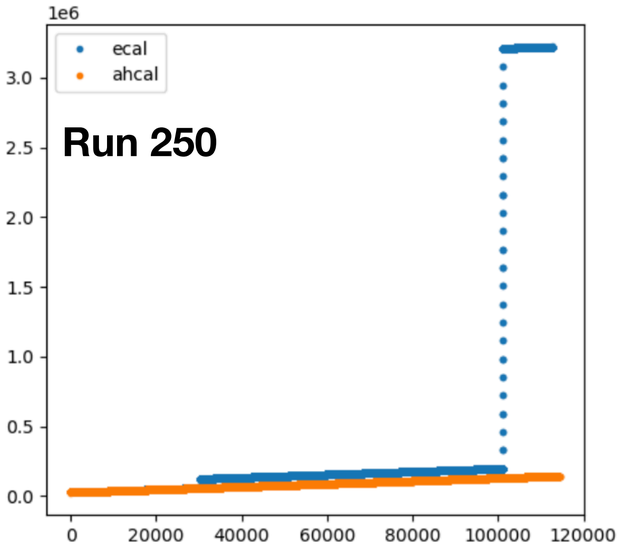


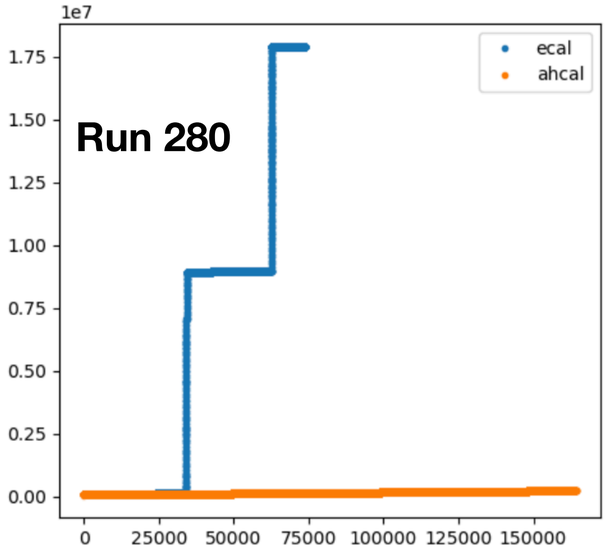


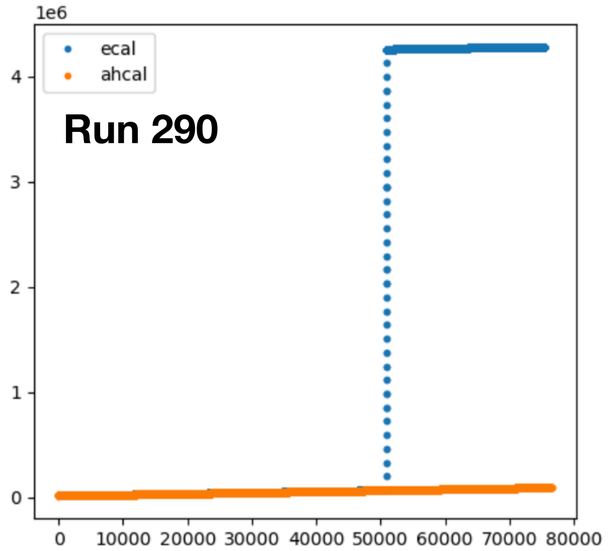


ECAL TriggerIDs in Run 225 look acceptable, but in Run 265, they increase quickly.

Abnormal ECAL TriggerID







Conclusion

A. Shift=1 dominates in all files I randomly selected, consistent with findings using EventDisplay in December.

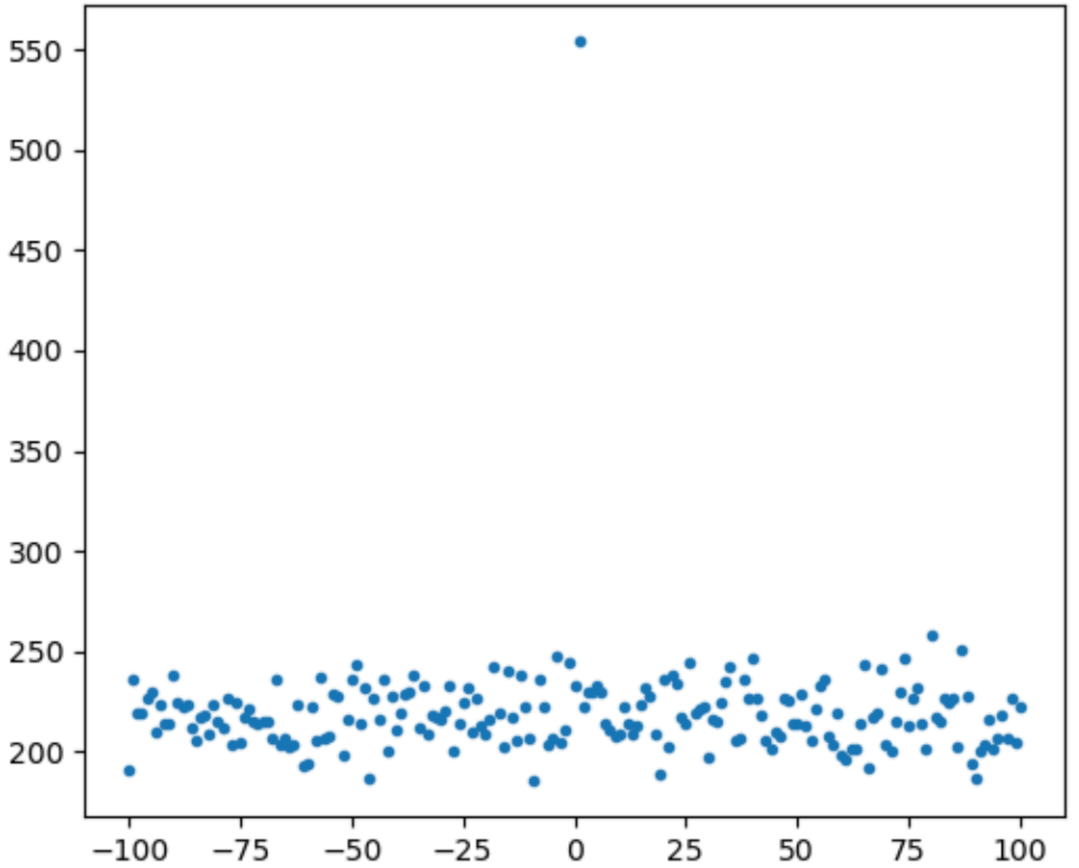
B. ECAL TriggerIDs are abnormal in many Run files.

C. I understand algorithm when decoding .dat files leads to these extremely large ECAL TriggerIDs, so errors root in .dat files, and this might cause TriggerID mis-match.

D. Electronics part colleagues would help a lot if they take these hints and check .dat files and TLU codes.

SJTU AHCAL Simulation

Particle\E (GeV)	20	30	40	50	60	70	80	90	100	120	160	Total	Finished
mu+											100k	100k	100k
e+	10k	10k	10k	10k	10k	10k	10k	10k	10k	10k		100k	100k
pion+	10k	10k	10k	10k	10k	10k	10k	10k	10k	10k		100k	100k


550
500
450
400
350
300
250
200
−100
−75
−50
−25
0
25
50
75
100