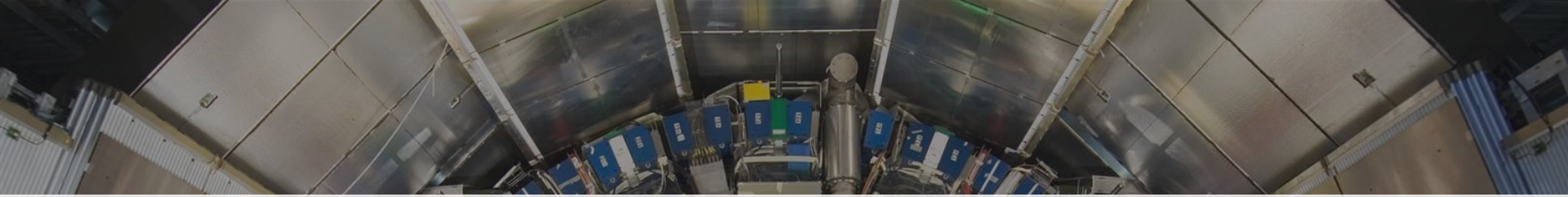


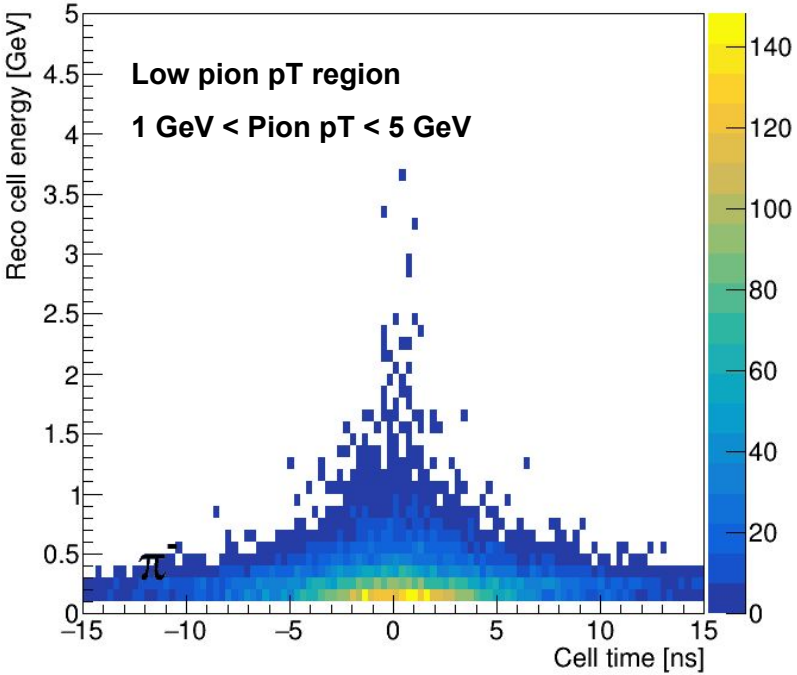
Study the potential of cell timing to improve cluster/jet calibration

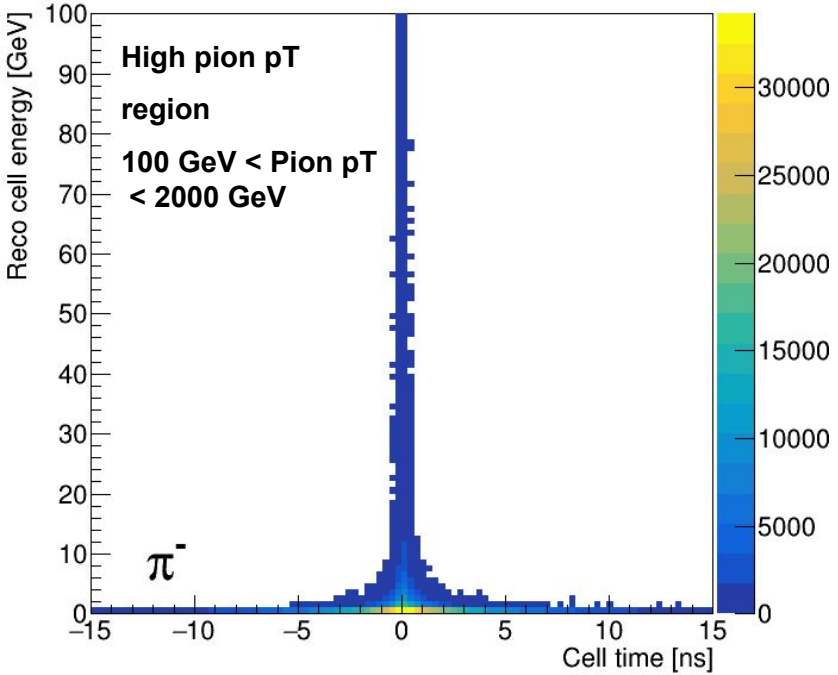
2023, September 22

Kim Doyeong 김 도 영
Zahra Farazpay

Recap

Cell time resolution has reco cell energy dependency which results in double peak and incorrect average assuming RMS is identical for every cells

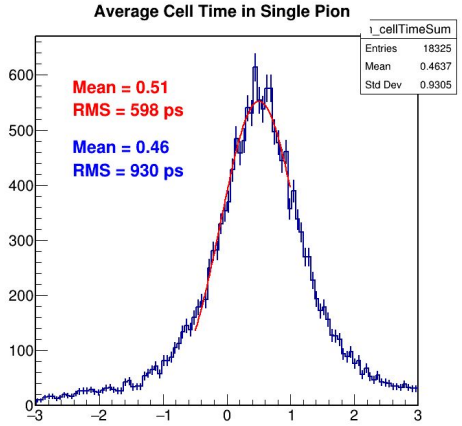


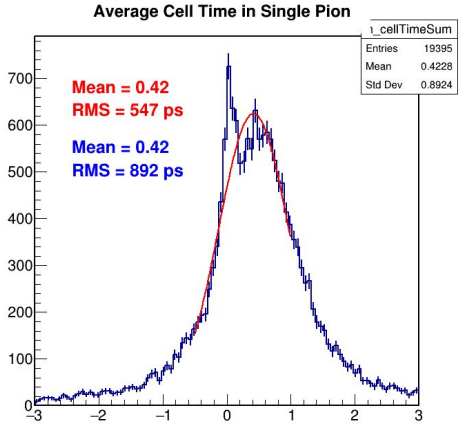


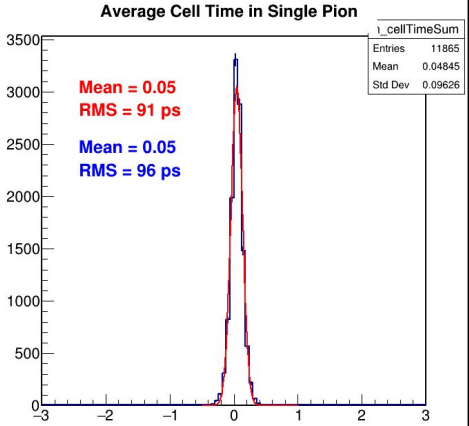
5D Calorimeter

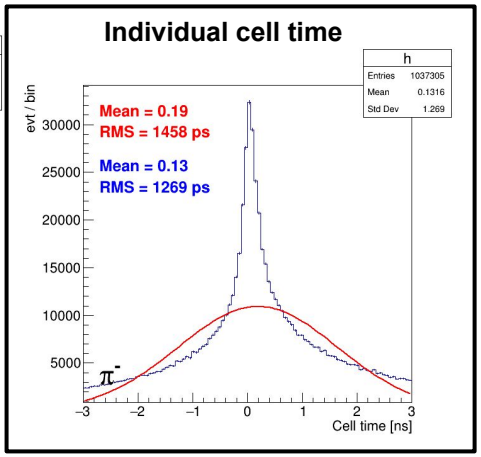
Recap (old: arithmetic mean) slide17

High pion pT region: 100 GeV < Pion pT < 2000 GeV









- cell time with pions which has leading cell E < 10 GeV (1st, 7530 events)
- cell time with pions which has leading cell E >= 10 GeV (3rd, 11865 events)

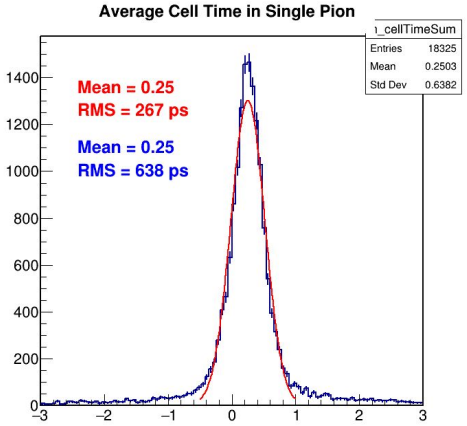
- Both together (2nd, 19395 = 11865+7530 events)

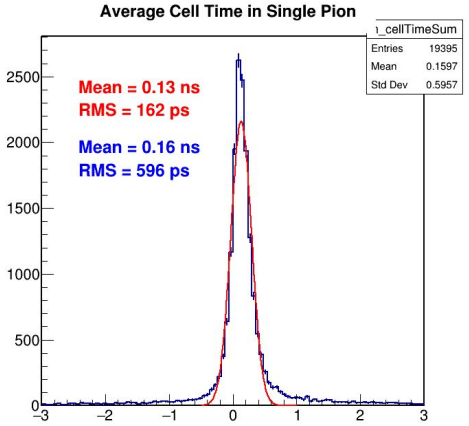
Zoomed in, average all cells that passed the selection, double peak (expected)

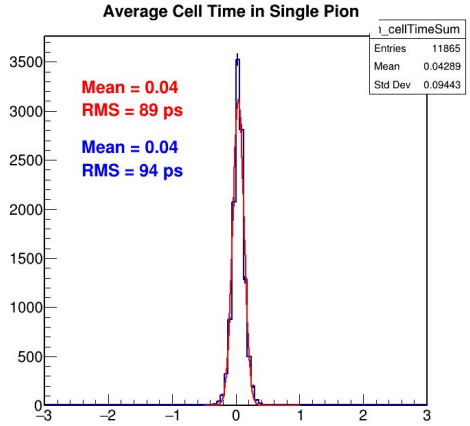
There are two peaks

Weighted average quick check (New: E weighted mean)

High pion pT region: 100 GeV < Pion pT < 2000 GeV







- cell time with pions which has leading cell E < 10 GeV (1st, 7530 events)
- cell time with pions which has leading cell E >= 10 GeV (3rd, 11865 events)

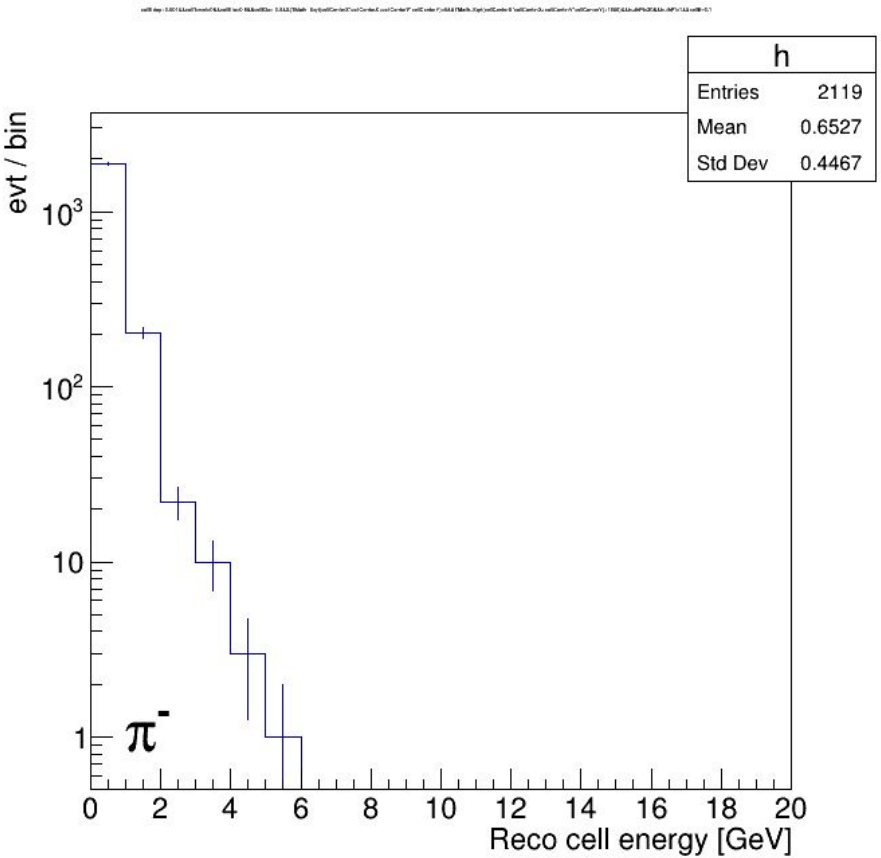
- Both together (2nd, 19395 = 11865+7530 events)

Weighted average with reco cell E enhanced averaged timing resolution suppressing contributions from low energy cells

There are two peaks

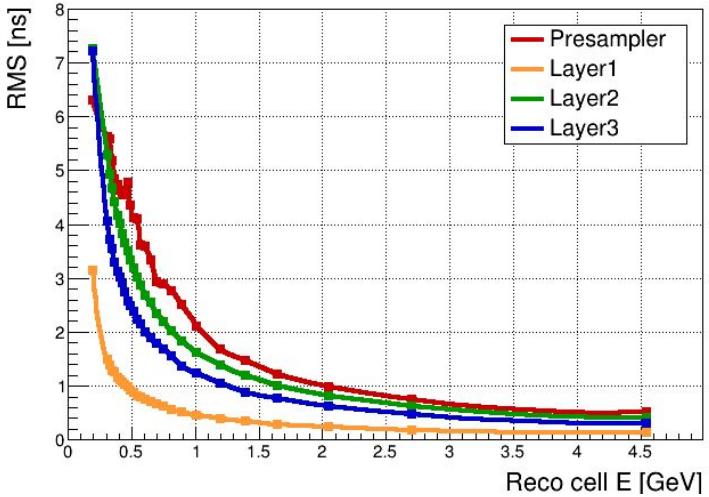
RMS vs Reco Cell E
Mean vs Reco Cell E

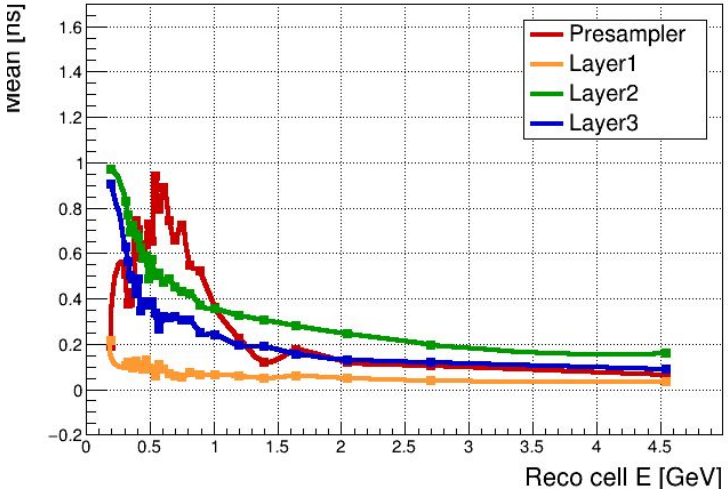
Reco cell E (1 GeV < truth pion p_T < 20 GeV)



- Check reco cell E range within the region of our interest
- There is no cell which has more than 6 GeV

RMS & Mean vs Reco cell E per EM LAr Barrle layer

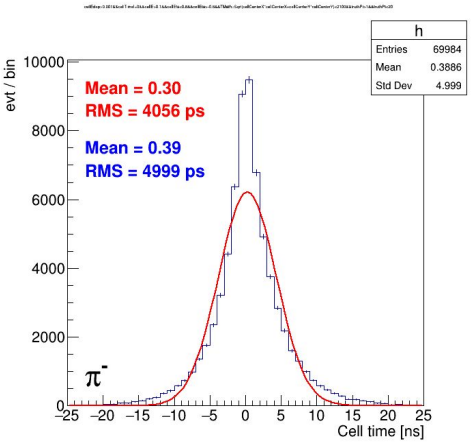


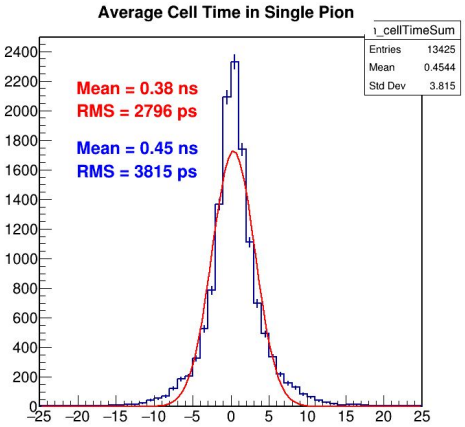


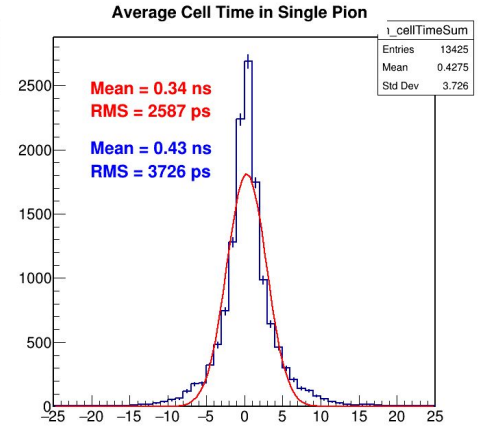
- Mean and RMS were found using every cells with 0.2 GeV < truth pion E < 2000 GeV (generated sample) - more statistics
- Binning was chosen such that distribution with presampler has roughly ~1000 entries (23 bins in total)
  - Other layers have more statistics but uneven
- Points represent the median values of each bin, and the last bining end is 6.0 GeV

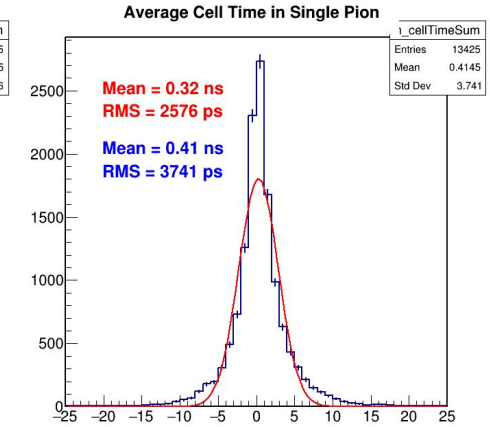
5D Calorimeter

Various way to average (1 GeV < truth pion p_T < 20 GeV)









Individual cell time | **Arithmetic mean** | **Cell E weighted** | **1/RMS^2 weighted**

- At low pion pT region, cell E weighted works very similar to 1/RMS^2
  - Even though cell E weighted does not consider layer, inaccuracy coming from the binning in 1/RMS^2 can be larger

- Can make higher pT region distributions for cross check

Backup