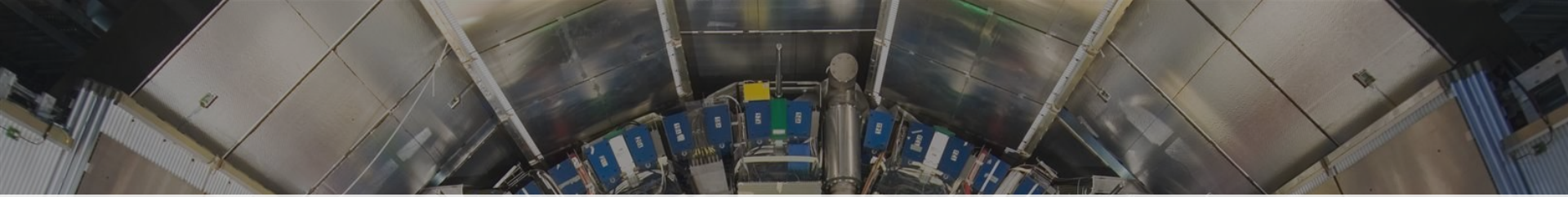


Timing calibration using single pion events

4D Tracking and 5D Calorimetry

https://indico.slac.stanford.edu/event/8684/

2023, January 17

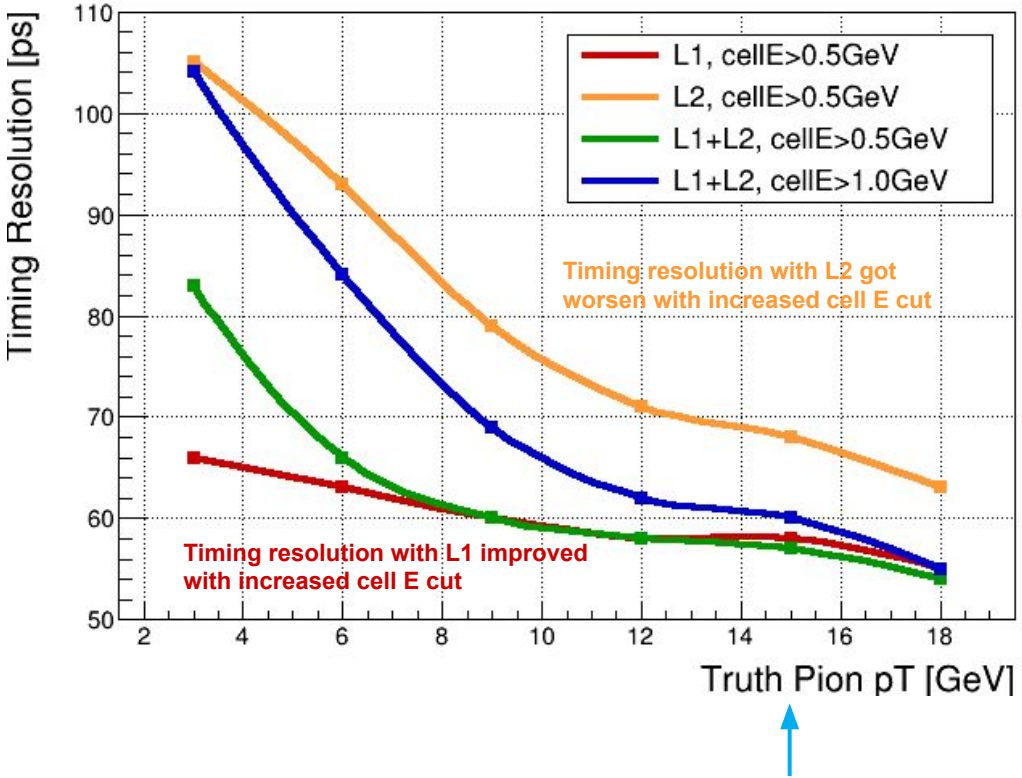
Kim Doyeong 김 도 영

Sanha Cheong
Valentina Cairo
Zahra Farazpay
Ariel Schwartzman
Lorenzo Santi

Primary task

- Checking which layer is more important in the pi0 study
  - Columbia's finding: layer 1 doesn't really play any roles
    - Electron > 20 GeV
  - Our finding: The timing resolution of the neutral pion across all pT (<20GeV) is driven by the LAr layer1 (L1)
    - 1 GeV < pi0 < 20 GeV

Timing resolution as a function of pizero pT

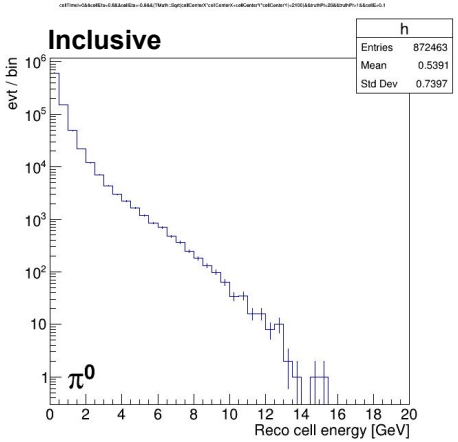


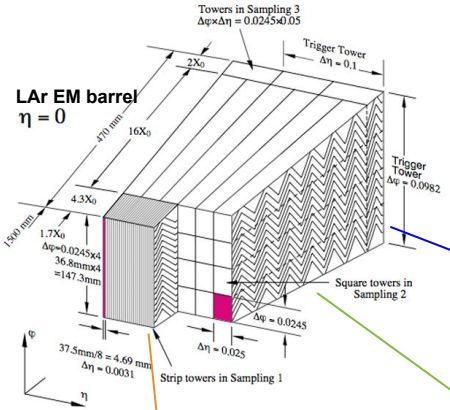
- The timing resolution is enhanced as the pion pT increases
- The timing resolution of the neutral pion across all pT (<20GeV) is driven by the LAr layer1 (L1)
  * Higher pT pions have not been checked yet
- cell E > 1.0 GeV requirement has more of an effect on lower pT pions
- For the highest pT pions (18~20 GeV), the timing resolution converges, regardless of the selection
- Next four slides have the avg. cell time distributions that contributed to this plot

Pions with pT 15 ~ 18 GeV did not affected much

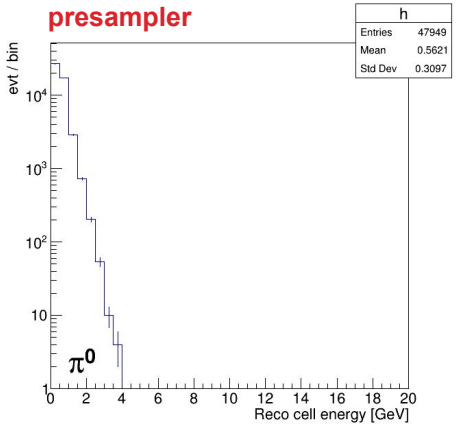
Neutral pion

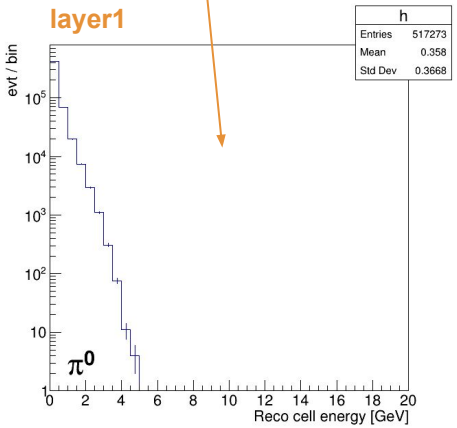
Reco cell E per layer (1 GeV < truth pion p_T < 20 GeV)

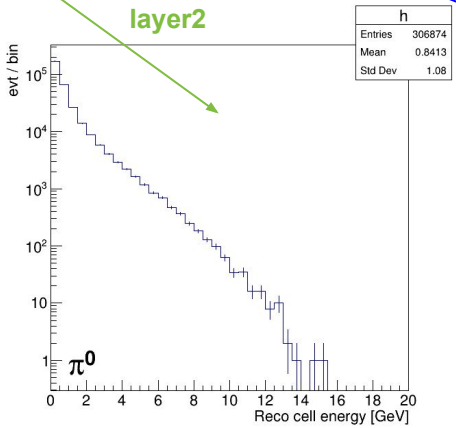


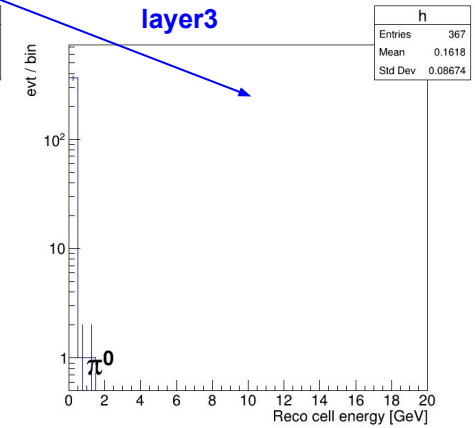


- Check reco cell E range within the region of our interest
- There is no cell which has more than 16 GeV



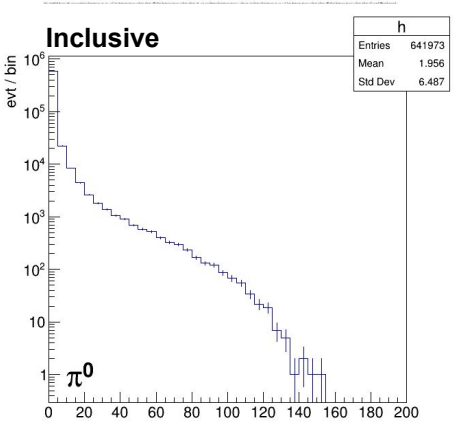


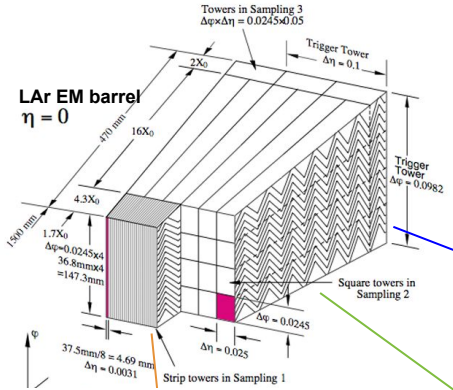




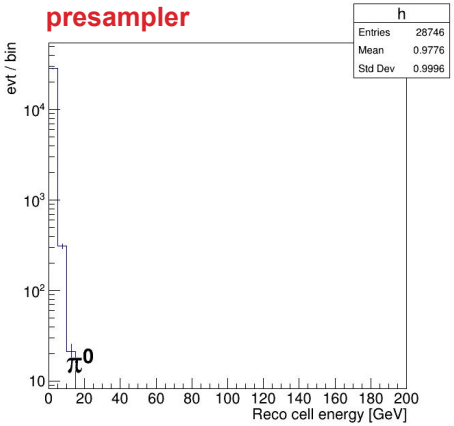
Neutral pion

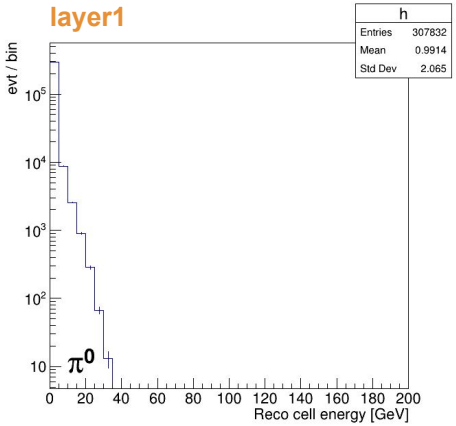
Reco cell E per layer (1 GeV < truth pion p_T < 200 GeV)

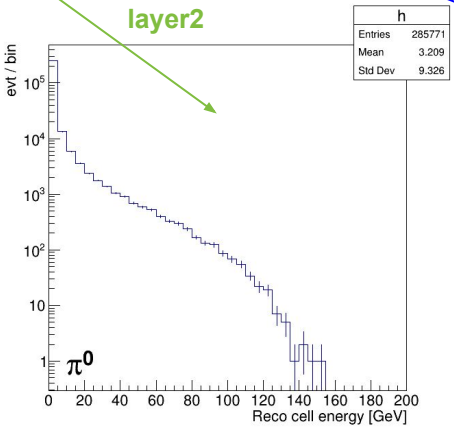


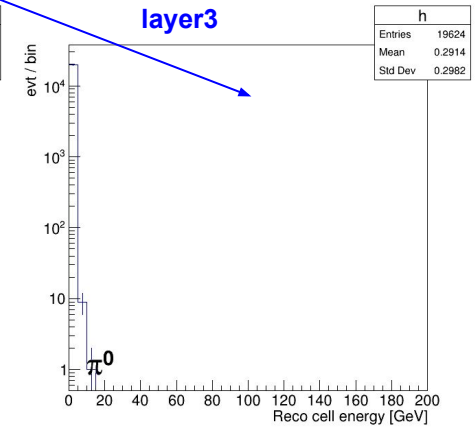


- Check reco cell E range within the region of our interest
- There is no cell which has more than 160 GeV



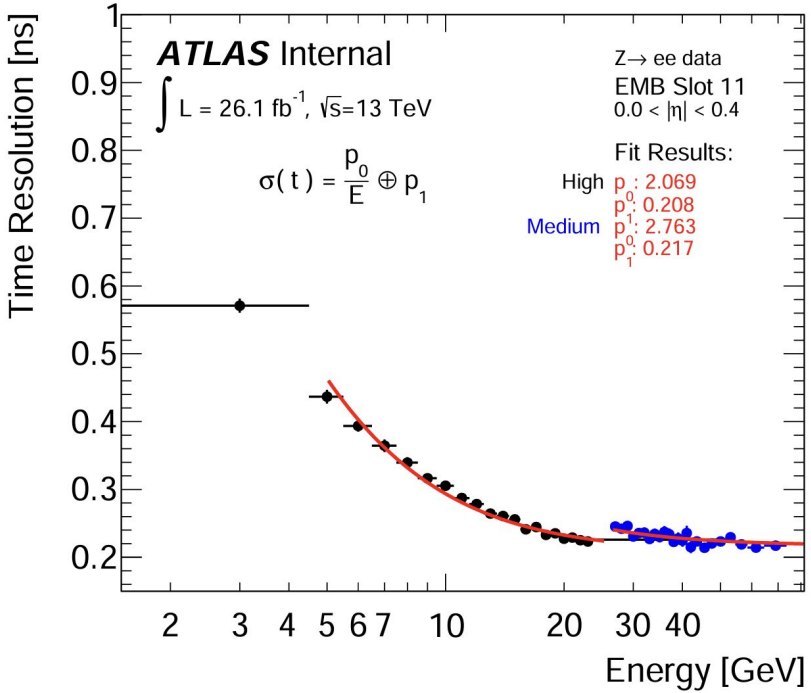


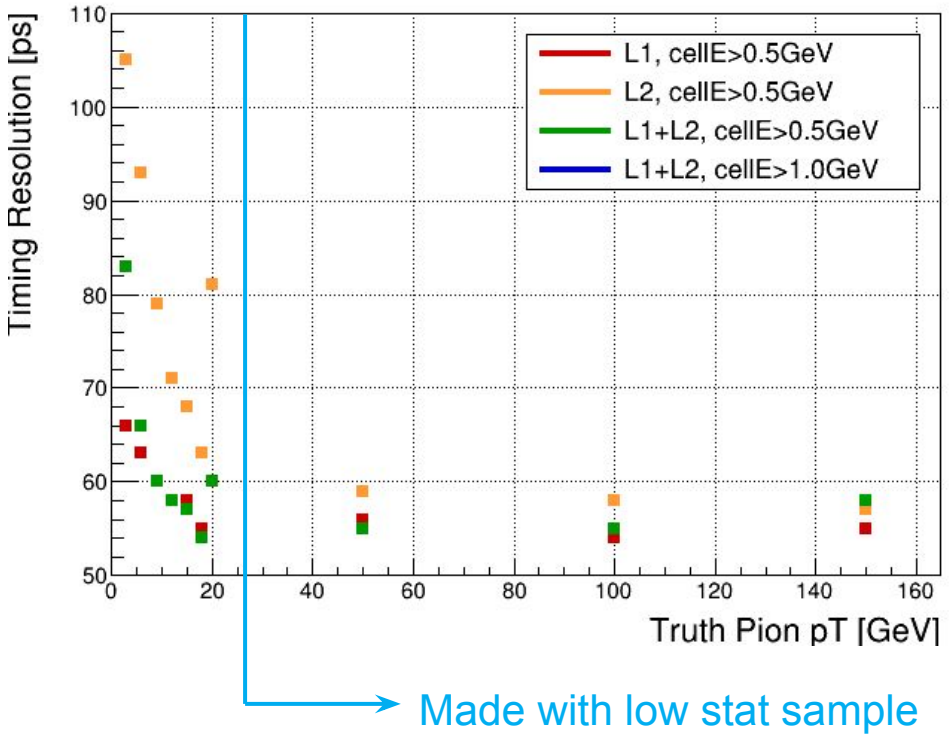




Neutral pion

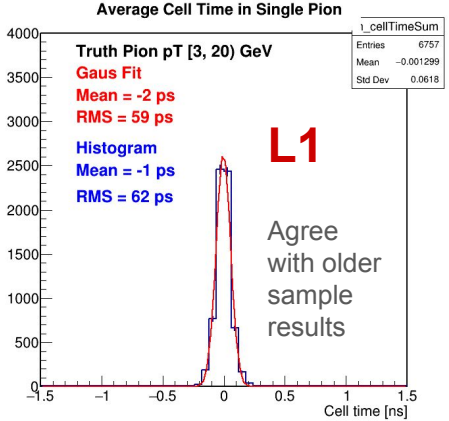
Compare with Columbia's timing resolution plot

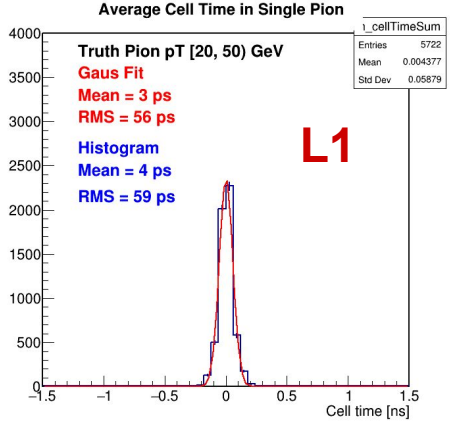


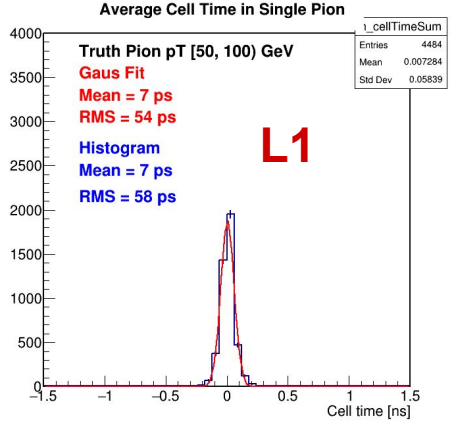


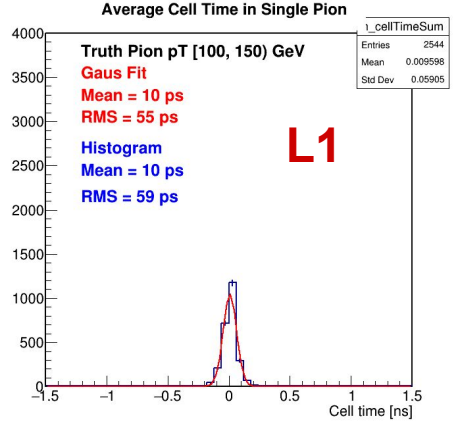
Neutral pion

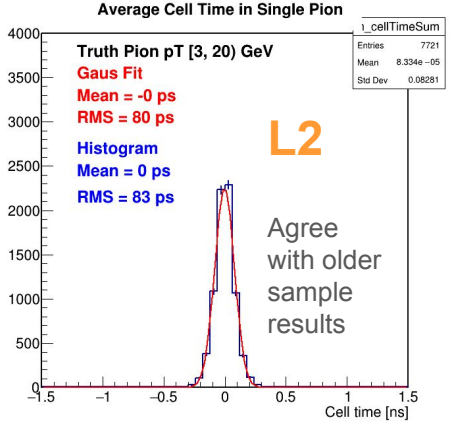
Averaged cell time per pion (cell E > 0.5 GeV)

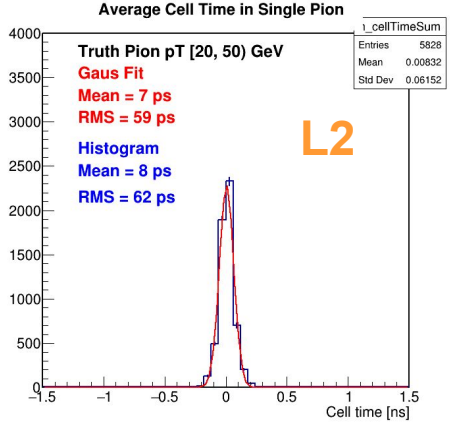


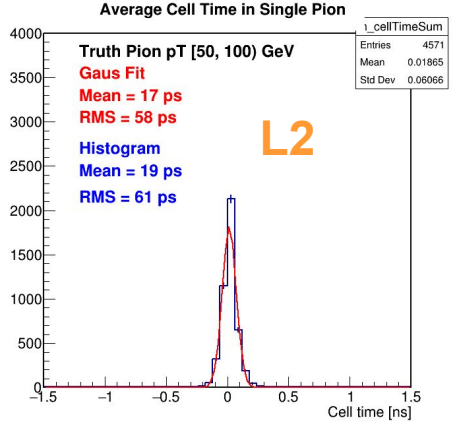


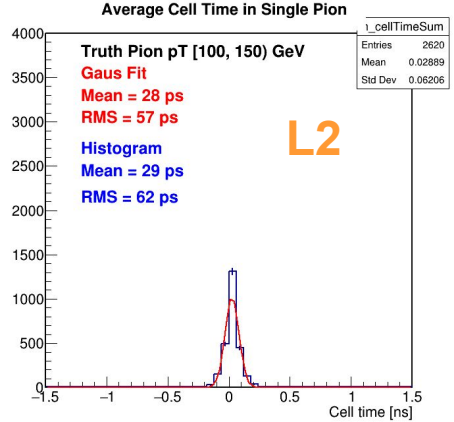












Action items

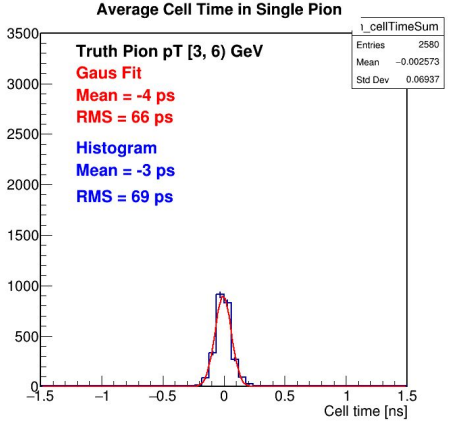
- Finalize layer study
  - Bigger size sample is generating (will be done today)
  - Get better fit function at higher pT range (in particular t0 offset)
  - Add Error bars in my plot
  - Understand the source of better results from layer 1

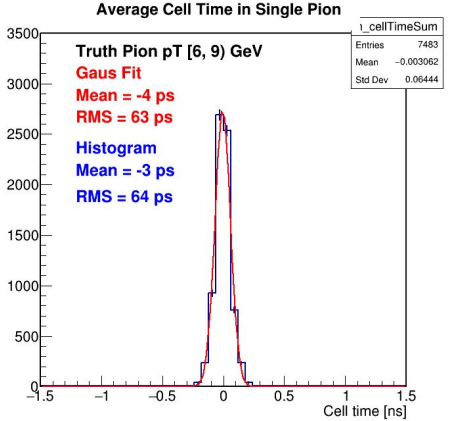
- Once layer study with the neutral pion is done, switch to charged pion
  - Main item was adding tile

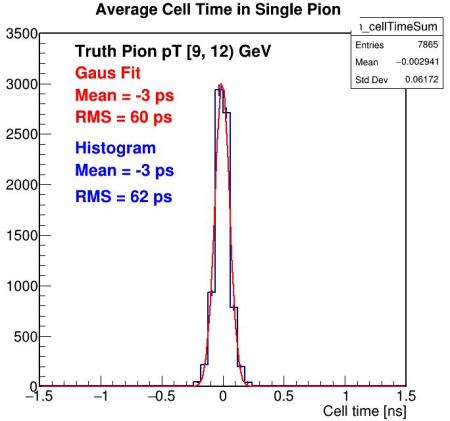
Backup

Neutral pion

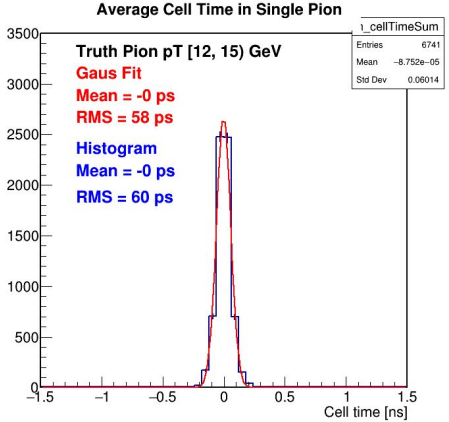
Averaged cell time per pion (L1, cell E > 0.5 GeV)

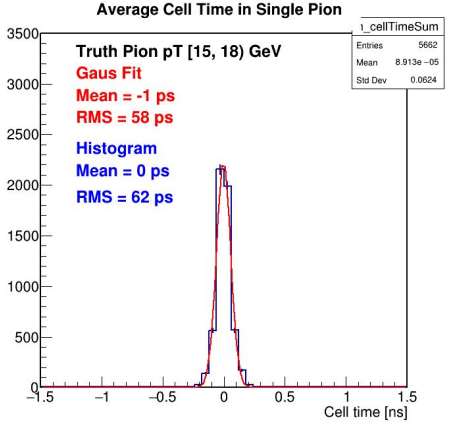


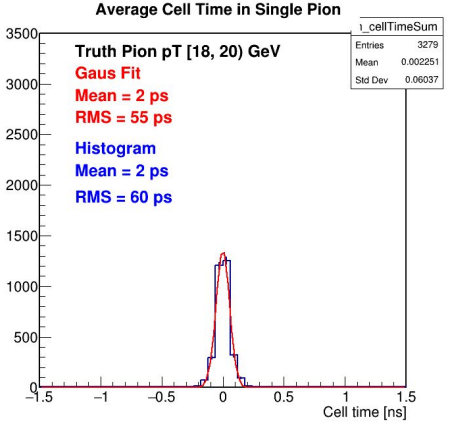


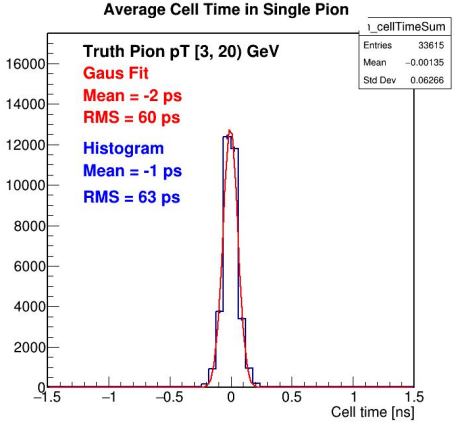


- Barrel (|eta| < 0.8)
- LAr EM layer 1
- At least one cell in a pion has reco cell E > 1.0 GeV in LAr EM layer 1 or 2
- Reco cell E > 0.5 GeV



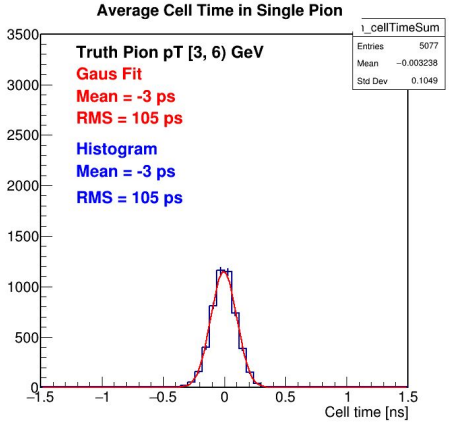


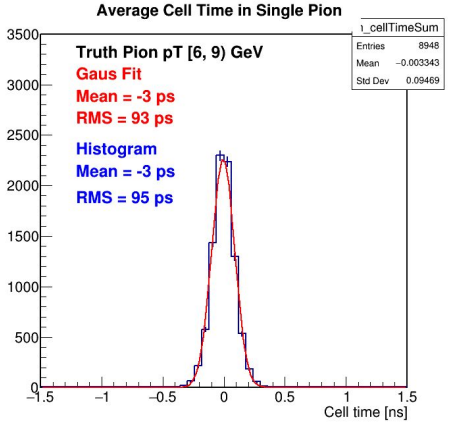


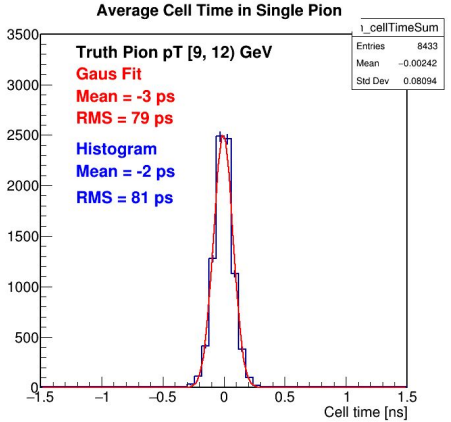


Neutral pion

Averaged cell time per pion (L2, cell E > 0.5 GeV)







- Barrel (|eta| < 0.8)
- LAr EM layer 2
- At least one cell in a pion has reco cell E > 1.0 GeV in LAr EM layer 1 or 2
- Reco cell E > 0.5 GeV