



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

2023, June 23



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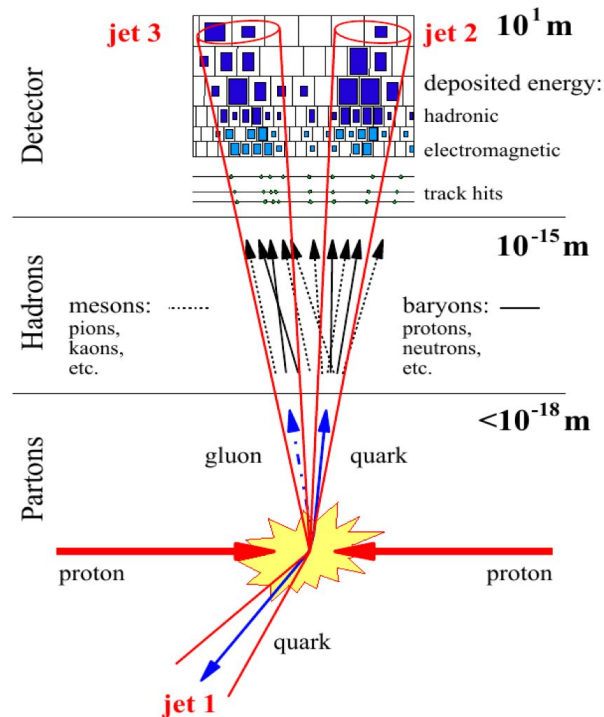
Motivation

- Time information will enhance our understanding of jets
- Many physics program can be improved by using 5D calorimeter information
- **Goal:** potential of cell timing to improve cluster/jet calibration

Scope of our task during HFSF2023

Used sample: π^- events without pileup

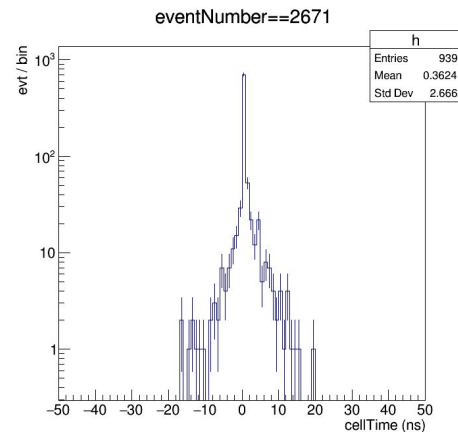
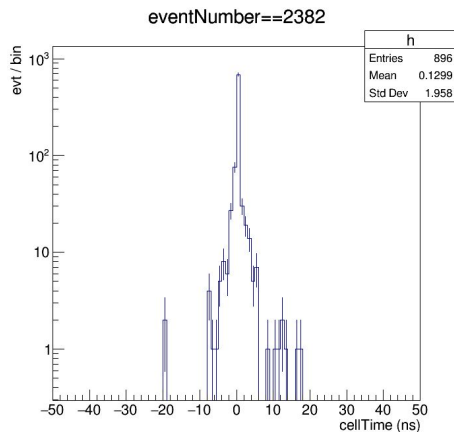
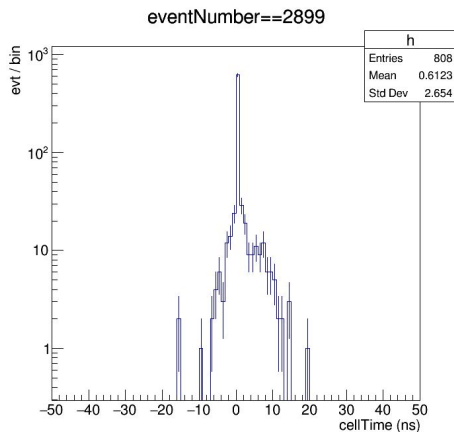
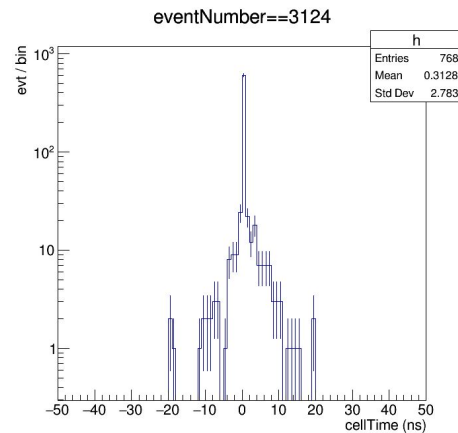
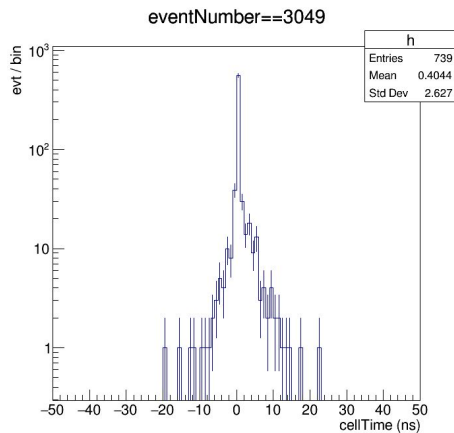
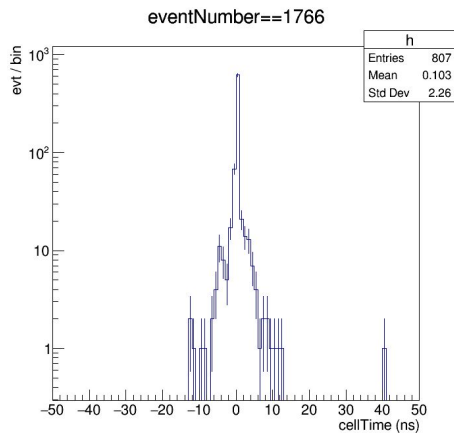
- 1) Pick up a single event
- 2) Study topology, time, deposited energy of the cells in the event
- 3) Study energy responses of the cells in the event
- 4) Study time evolution in the detector cells for a single π^- -event



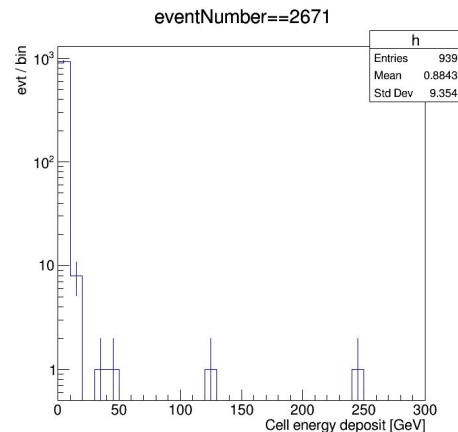
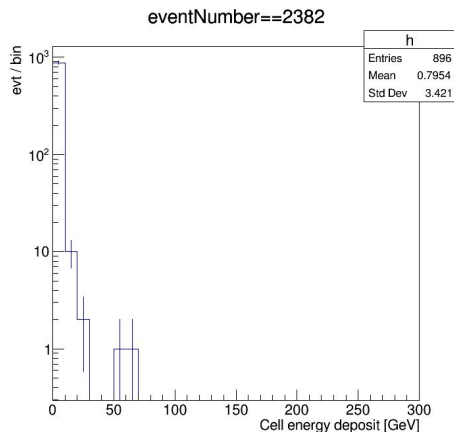
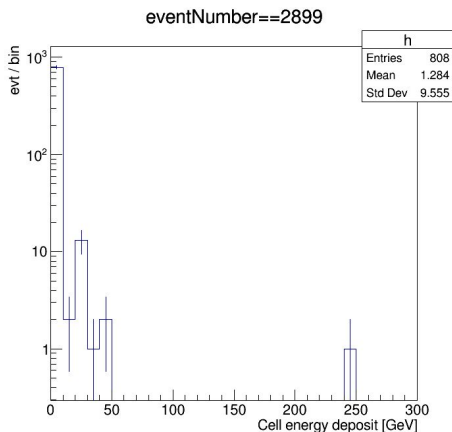
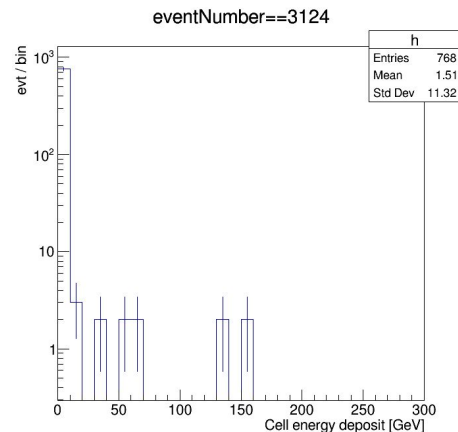
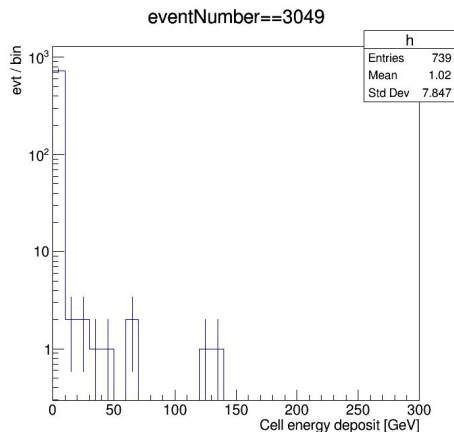
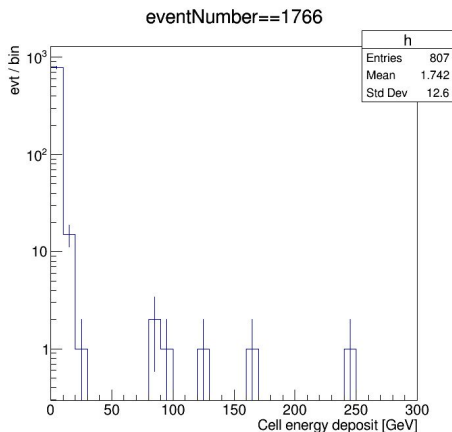
From [arXiv:1506.03239](https://arxiv.org/abs/1506.03239)

- This is follow up for HFSF2023 at Louisiana
<https://indico.cern.ch/event/1253459/timetable/?view=standard#14-calorimeter-timing-studies>
- What's new?
 - Five additional events were studied on top of the single event studied during HFSF2023 (eventNumber==1766)
 - All selected events has over 700 cells with energy deposits
 - #clusters in each events are 3~11
 - cellE/cellEdep vs cellTime (slide 10)
 - I don't see any information from it... please, let me know if you see anything that I missed
 - cellE/cellEdep vs cellEdep (slide 11 & 12)
 - At low energy (cellE < 1 GeV), cellE/cellEdep range from 0 to over 100 (is this expected?)
 - GIF is available for one of the selected events
Link to GIF: <https://www.dropbox.com/s/laidx40gf8tu0li/gif2899.gif?dl=0>

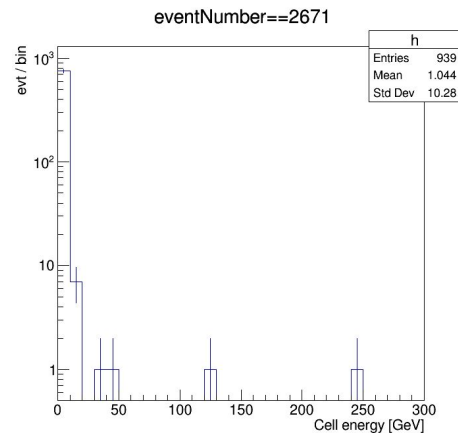
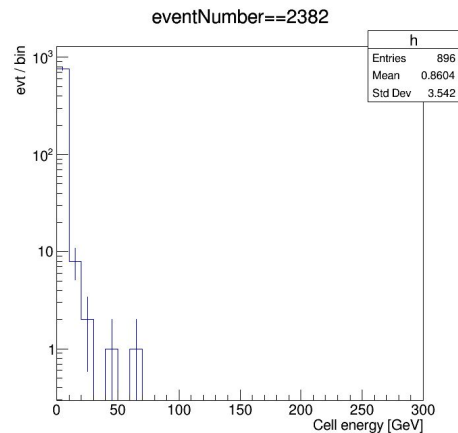
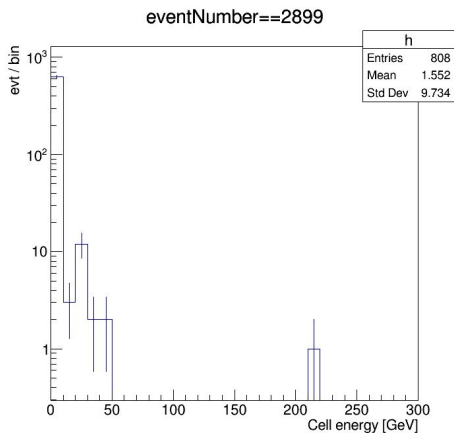
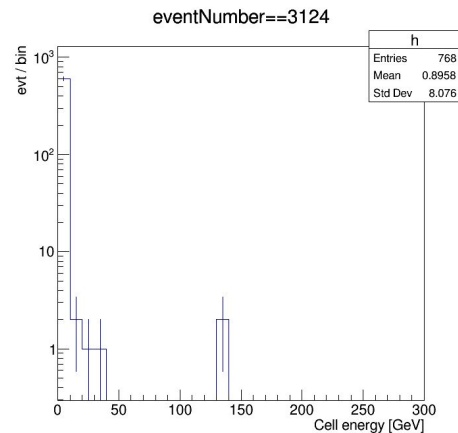
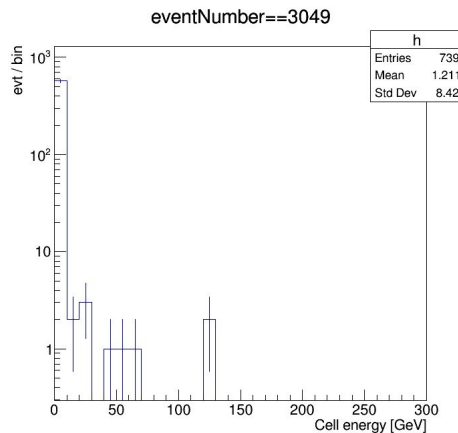
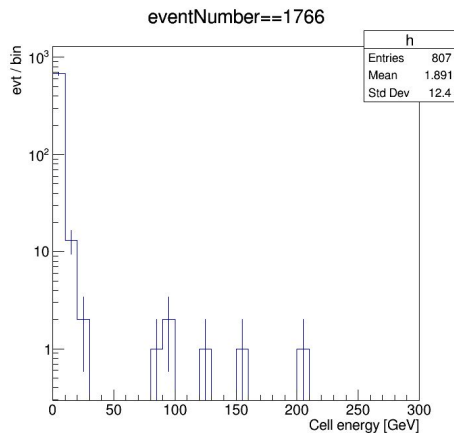
1ns per bin



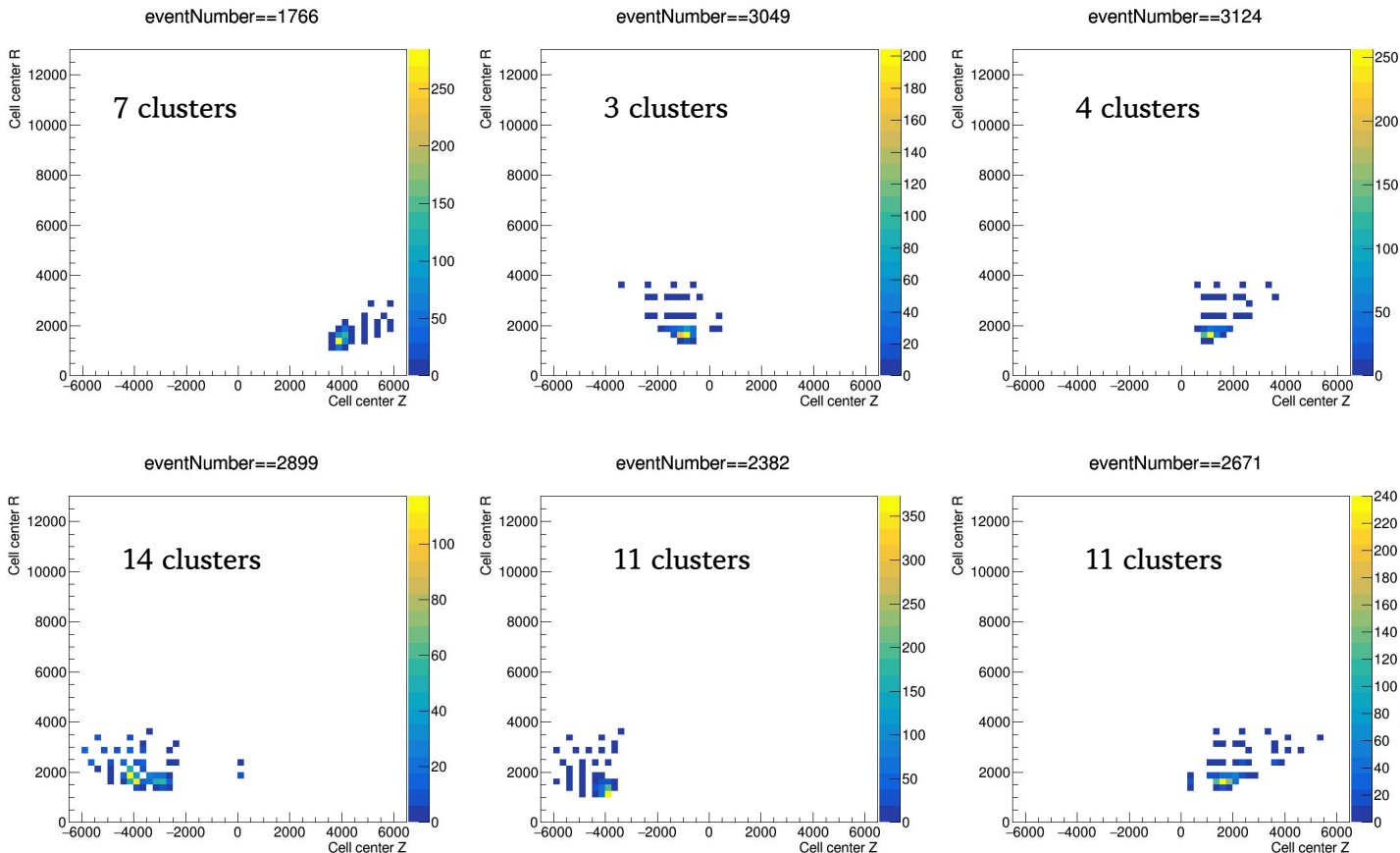
10GeV per bin



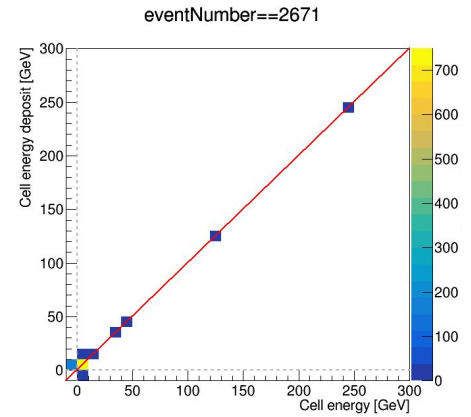
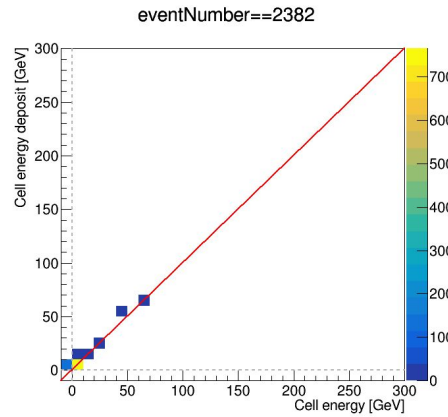
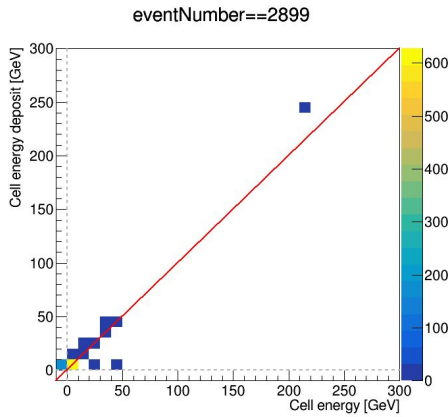
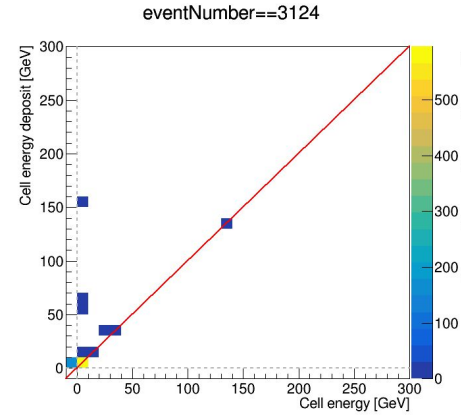
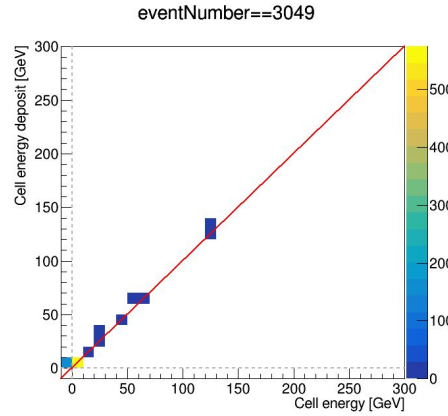
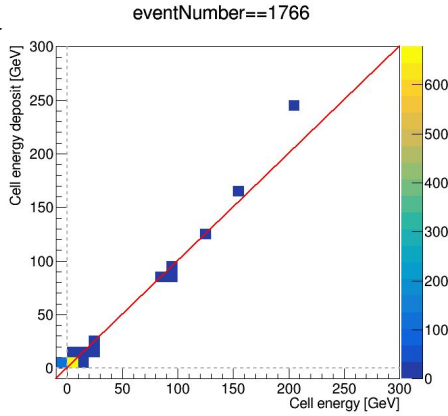
10GeV per bin



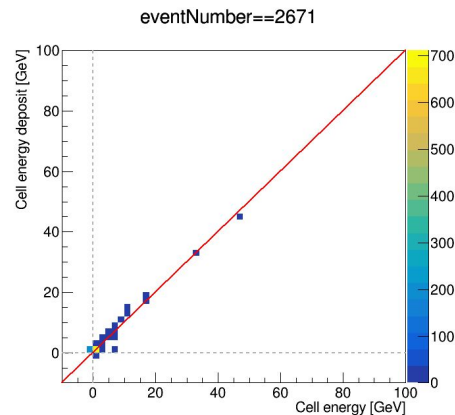
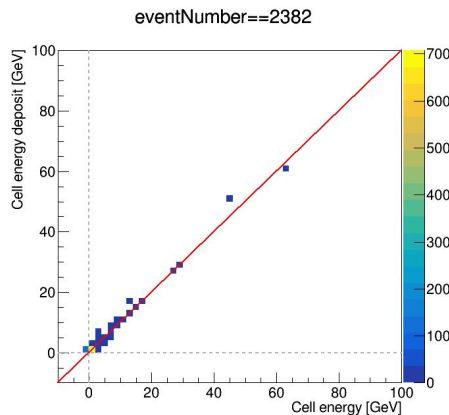
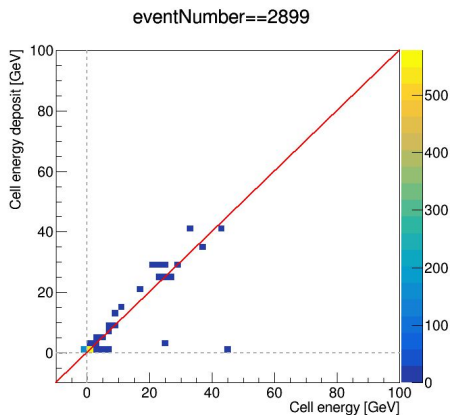
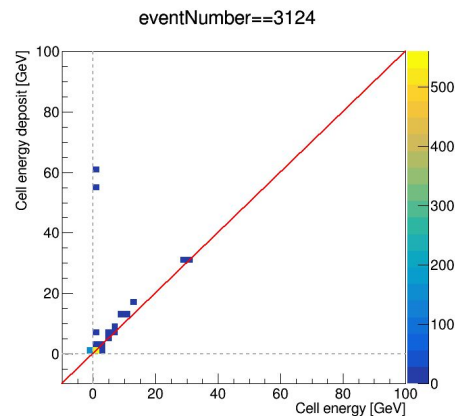
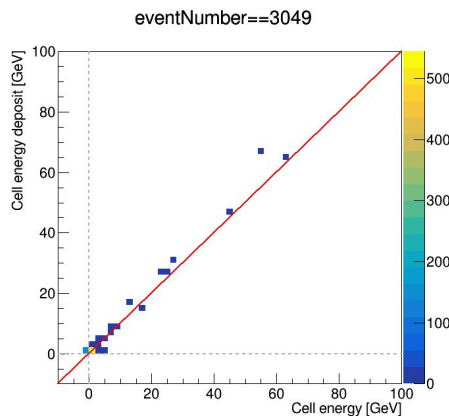
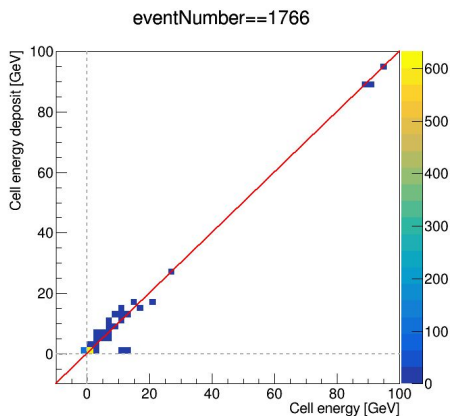
250x250 cells
in each bin



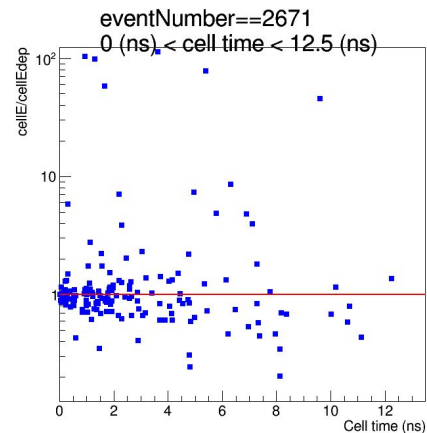
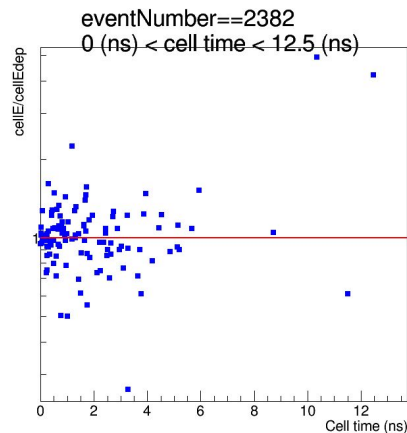
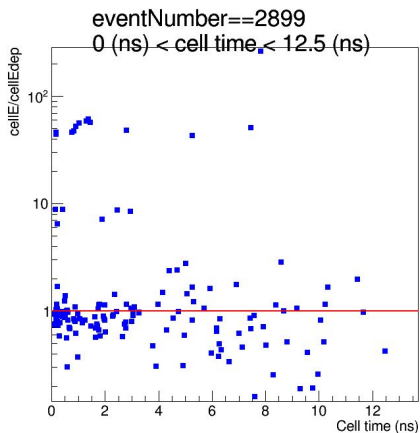
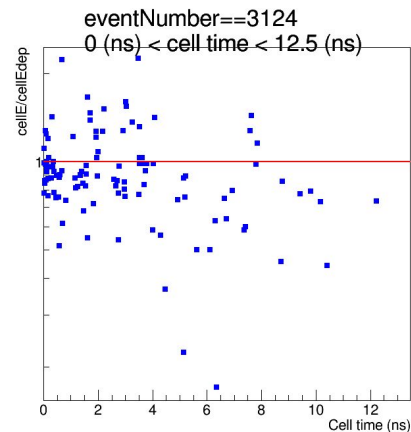
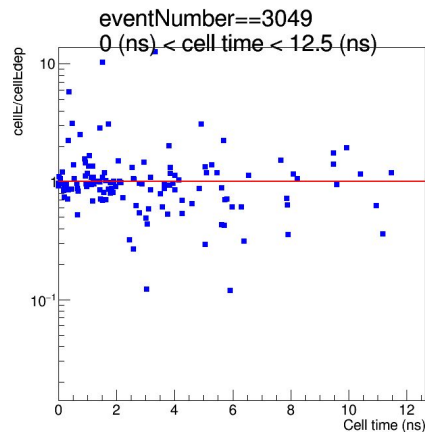
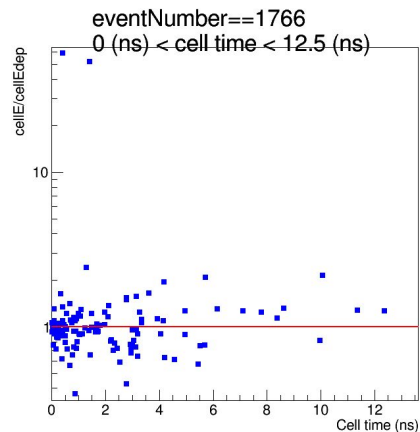
10 GeV x 10 GeV
in each bin



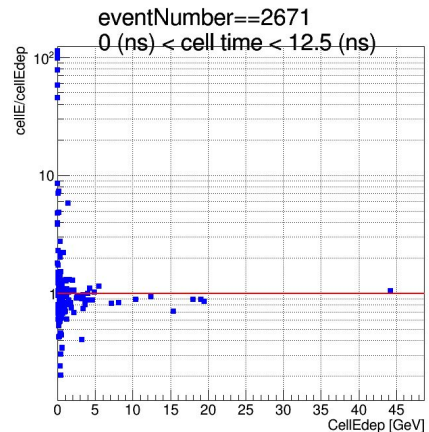
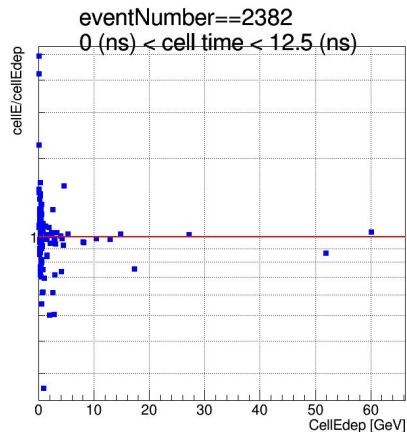
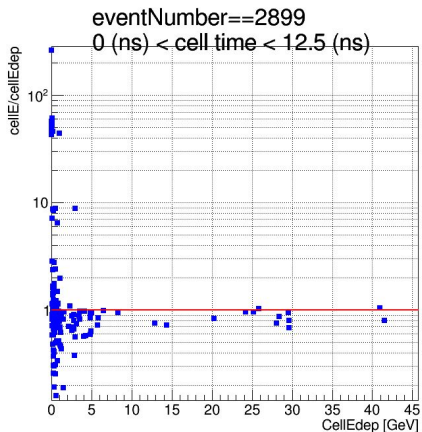
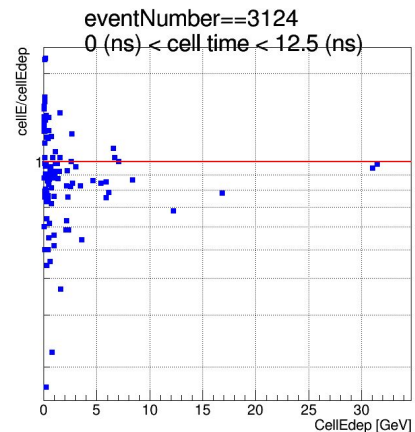
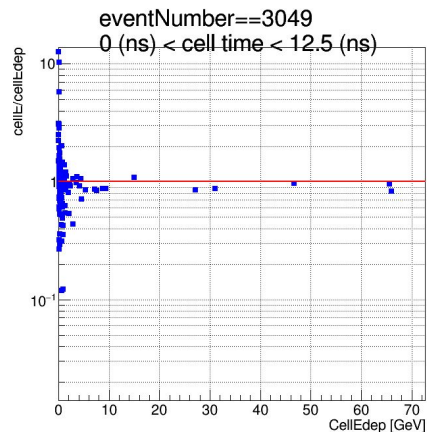
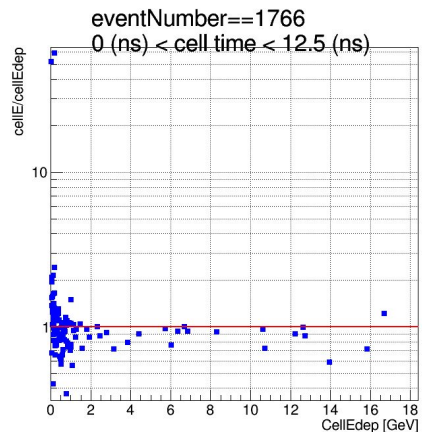
2 GeV x 2 GeV
in each bin



cellTime==0
is excluded



cellTime==0
is excluded

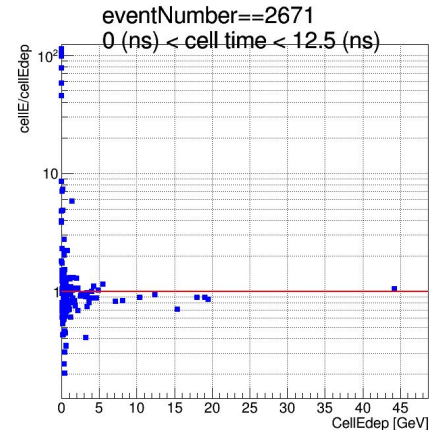


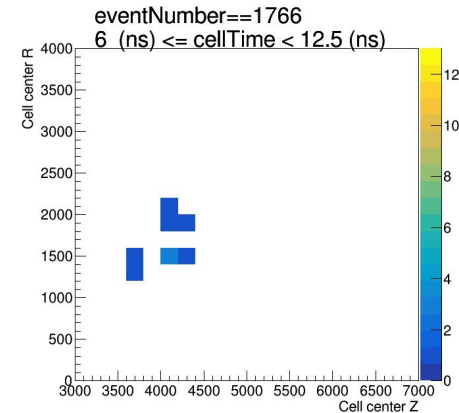
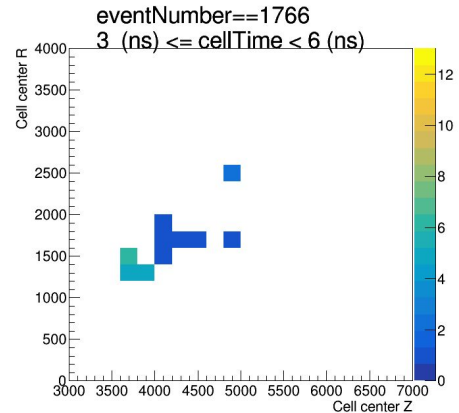
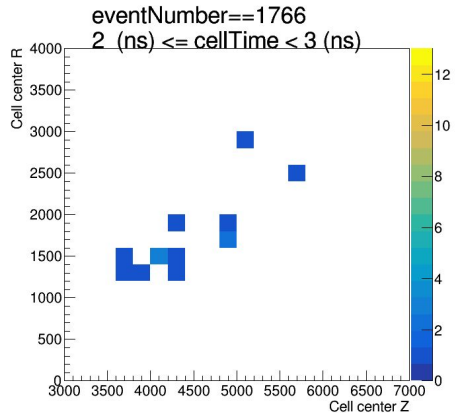
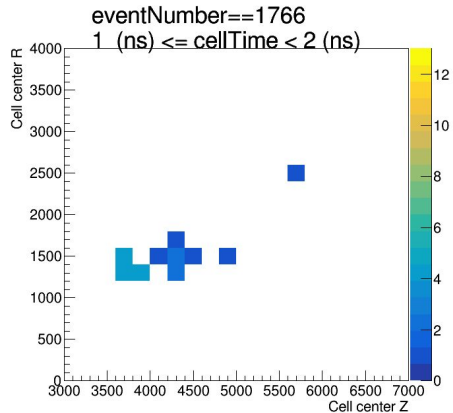
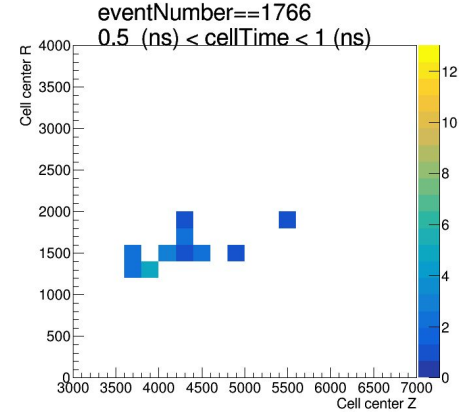
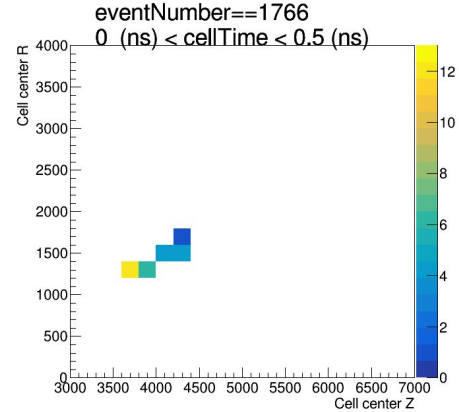
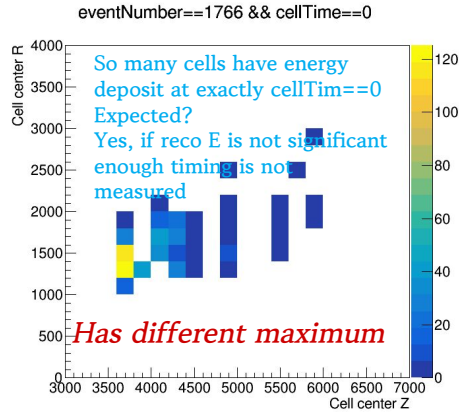
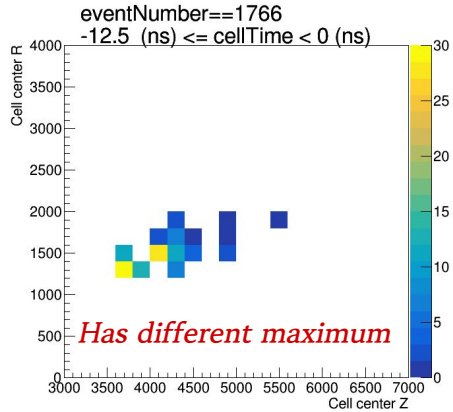
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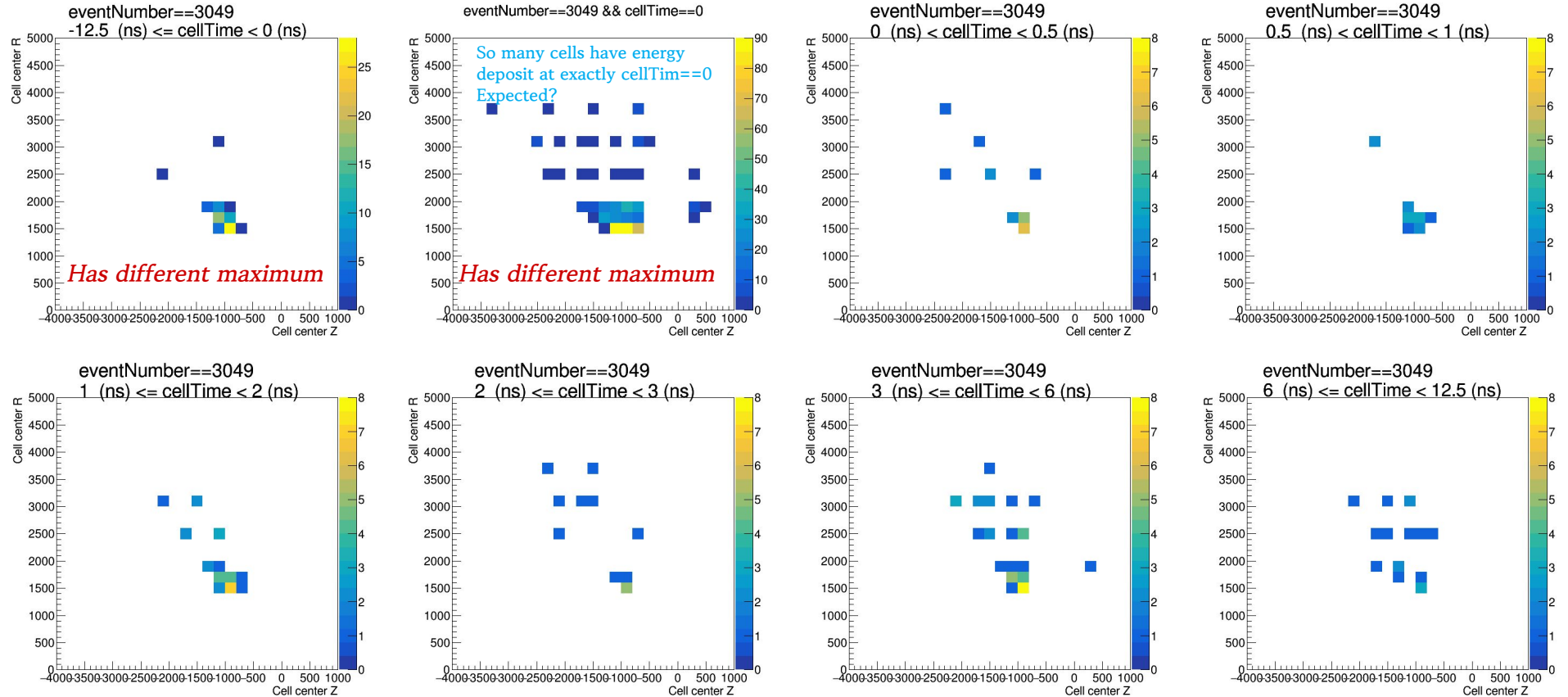
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* Row * cellE * cellEdep * cellE/cel *
*****
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* 49015 * 0.0968004 * 0.0420718 * 2.3008373 *
* 49263 * 0.0393755 * 0.0005045 * 78.046156 *
* 49281 * 0.0716326 * 0.0015690 * 45.654953 *
* 49305 * 0.9460024 * 0.3433818 * 2.7549577 *
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* 49325 * 0.4119082 * 0.0039638 * 103.91575 *
* 49329 * 1.0701829 * 0.0094874 * 112.79962 *
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* 49335 * 0.1087069 * 0.0226030 * 4.8093958 *
* 49405 * 0.0393755 * 0.0005045 * 78.046156 *
* 49417 * 0.9090715 * 0.1244608 * 7.3040779 *
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* 49699 * 0.7415328 * 0.3411464 * 2.1736493 *
* 49769 * 0.1036646 * 0.0269064 * 3.8527746 *
* 49811 * 0.1048348 * 0.0010722 * 97.769428 *
* 49814 * 0.0811605 * 0.0095397 * 8.5076204 *
* 49825 * 0.6609810 * 0.1367734 * 4.8326712 *
* 49833 * 0.5693458 * 0.0808906 * 7.0384656 *
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*****
==> 21 selected entries
    
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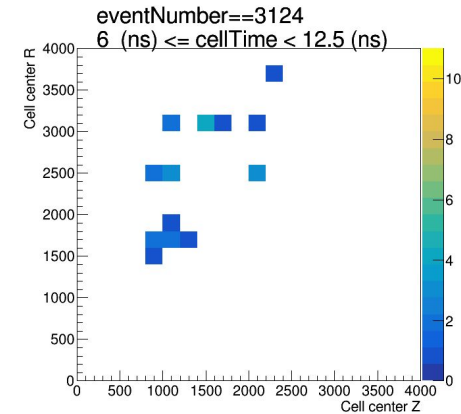
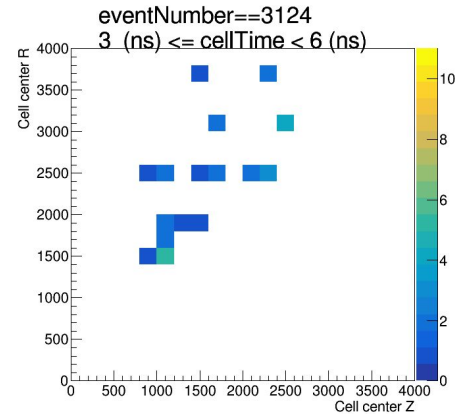
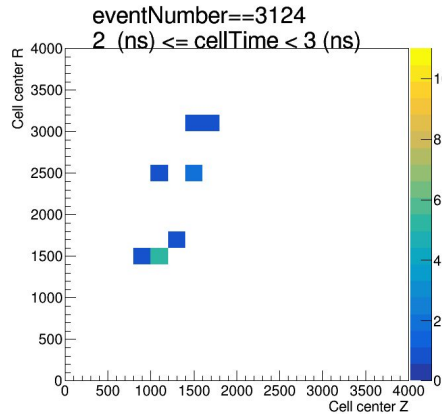
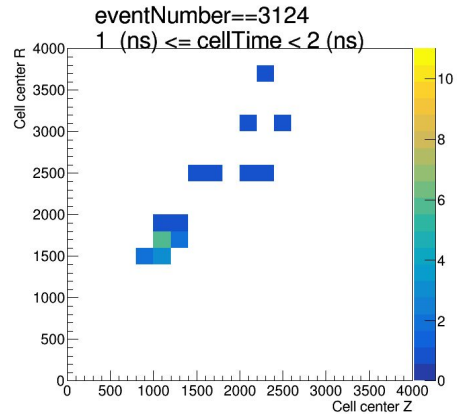
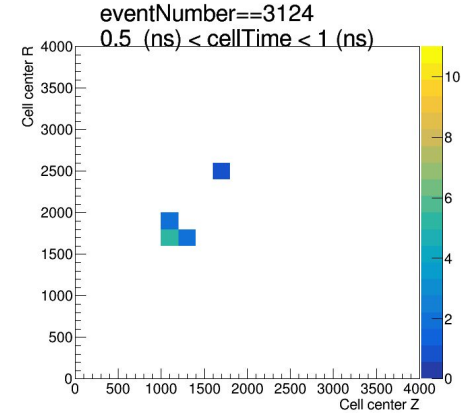
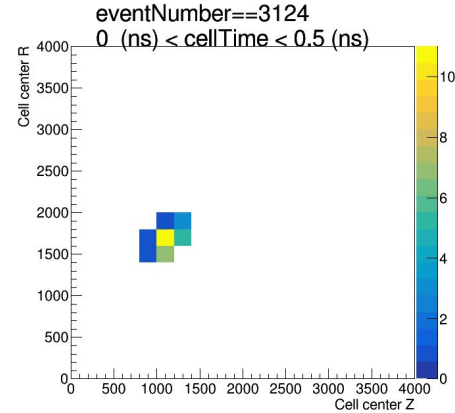
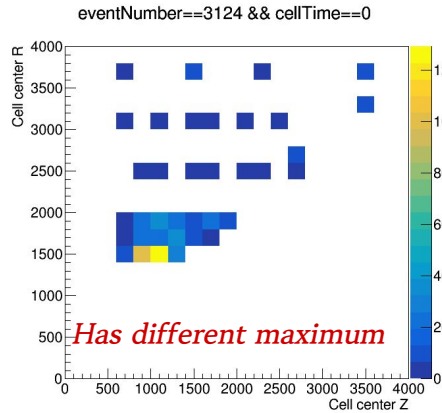
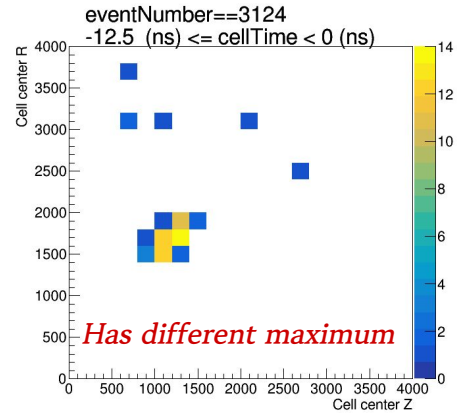
At around CellEdep=0, very high values of the cellE/cellEdep ratio were observed
 → Does this just mean that calibration is inaccurate at low energy?

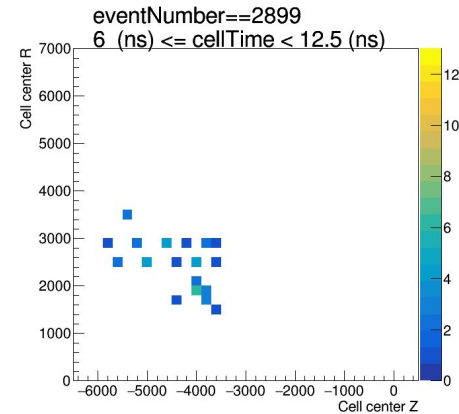
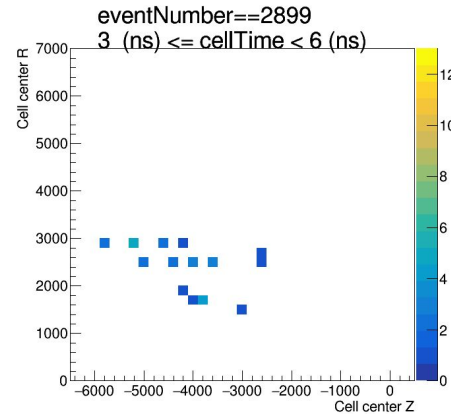
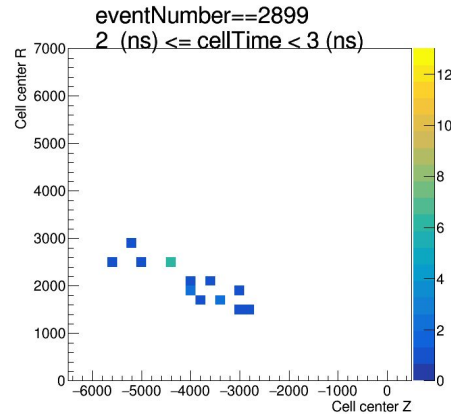
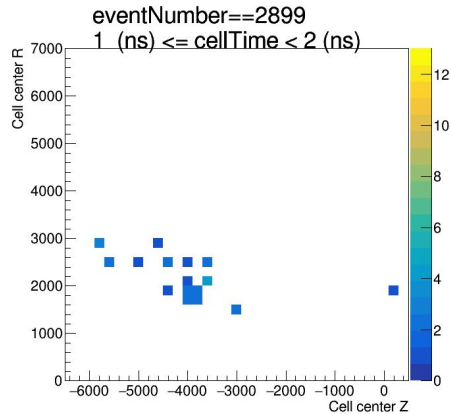
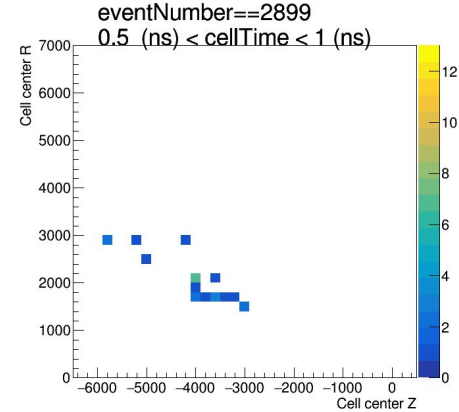
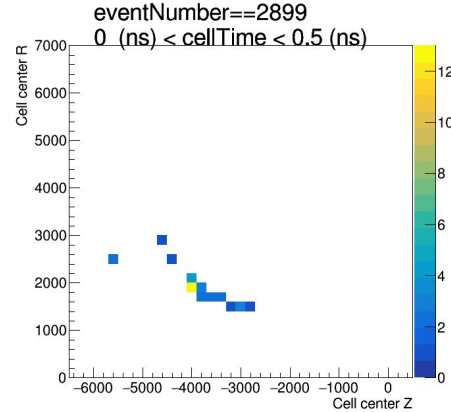
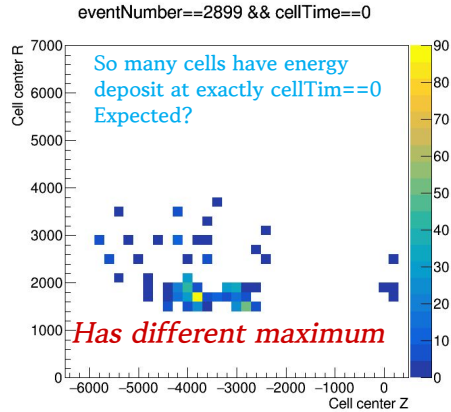
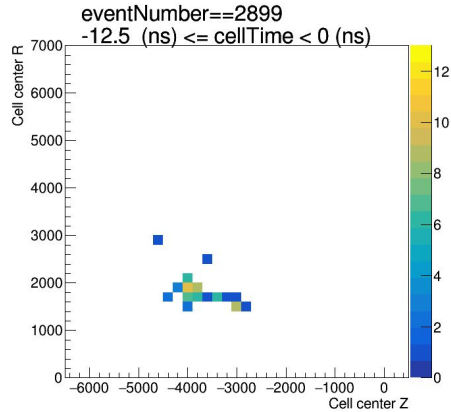
The ratio values look reasonable at higher energy range (~1)

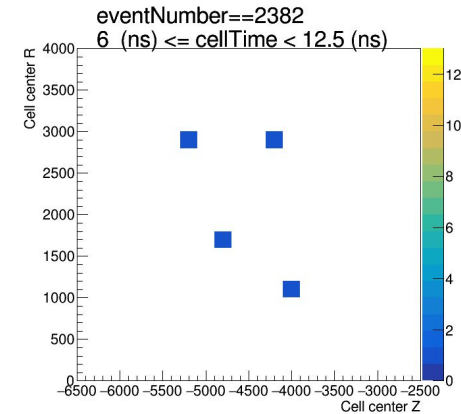
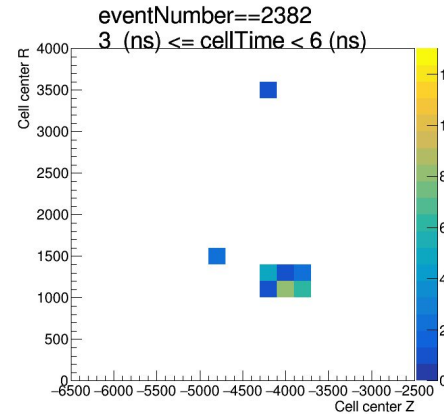
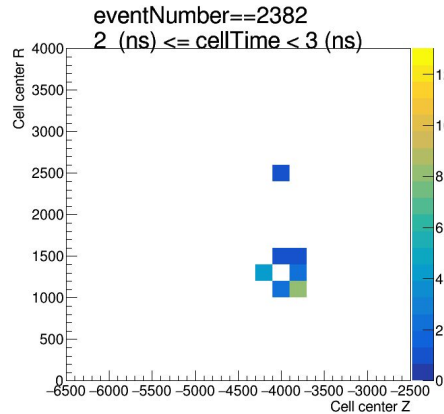
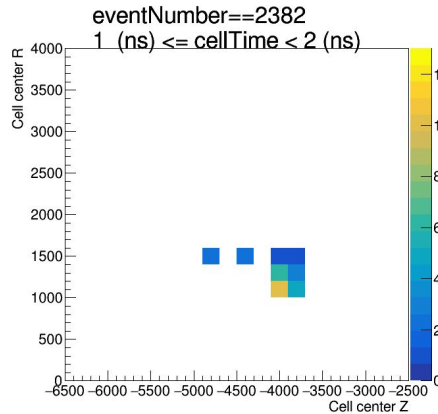
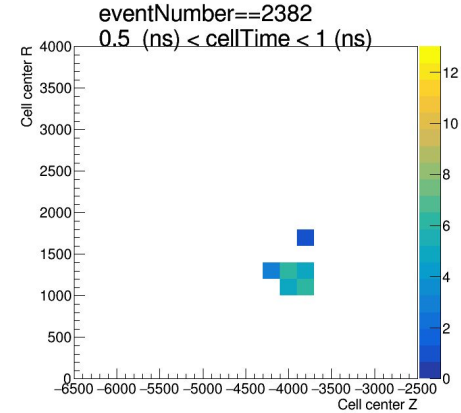
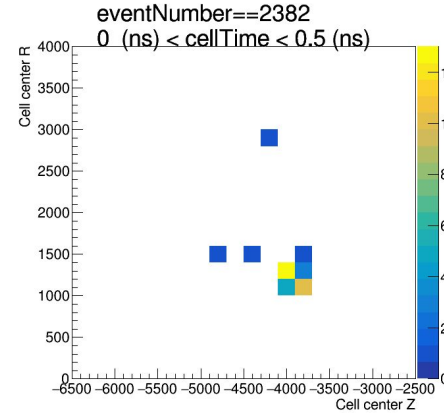
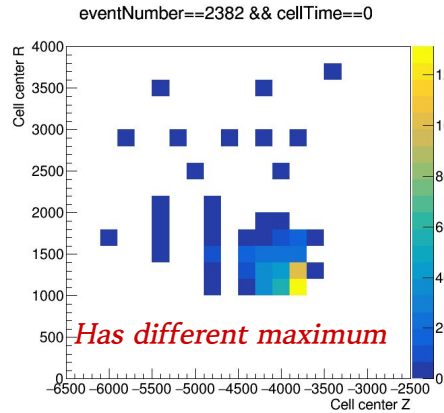
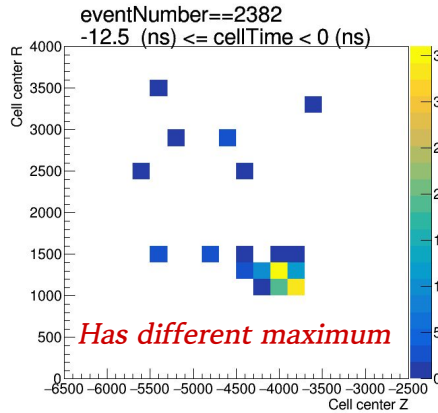


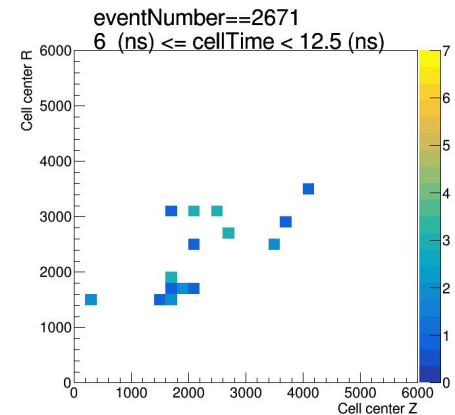
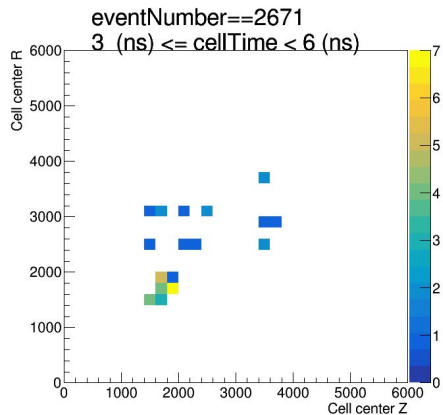
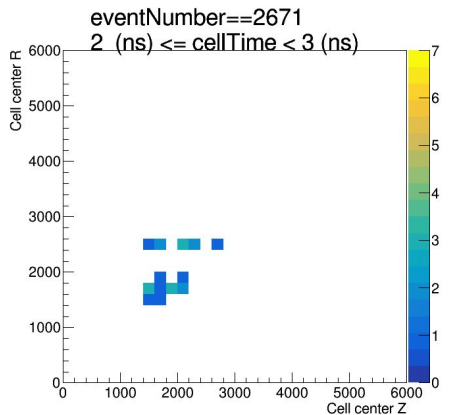
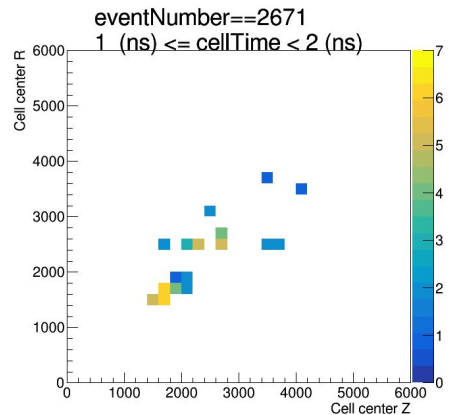
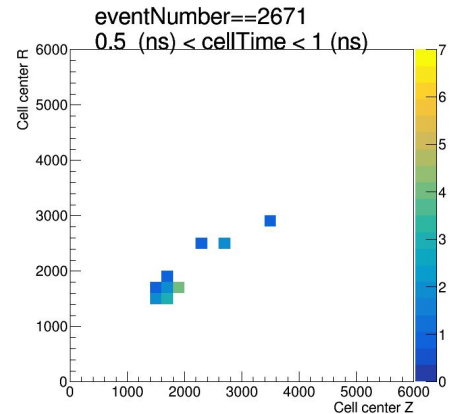
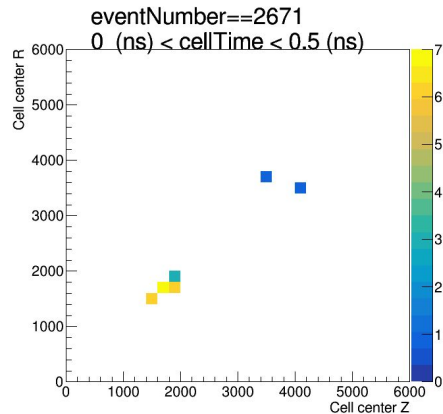
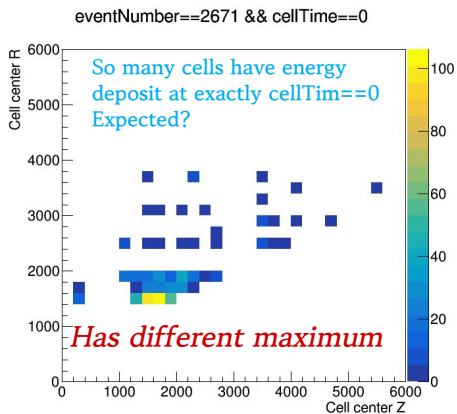
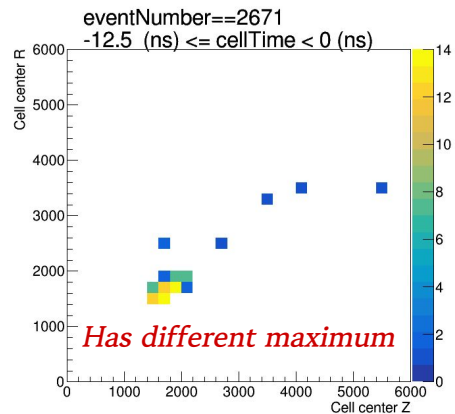








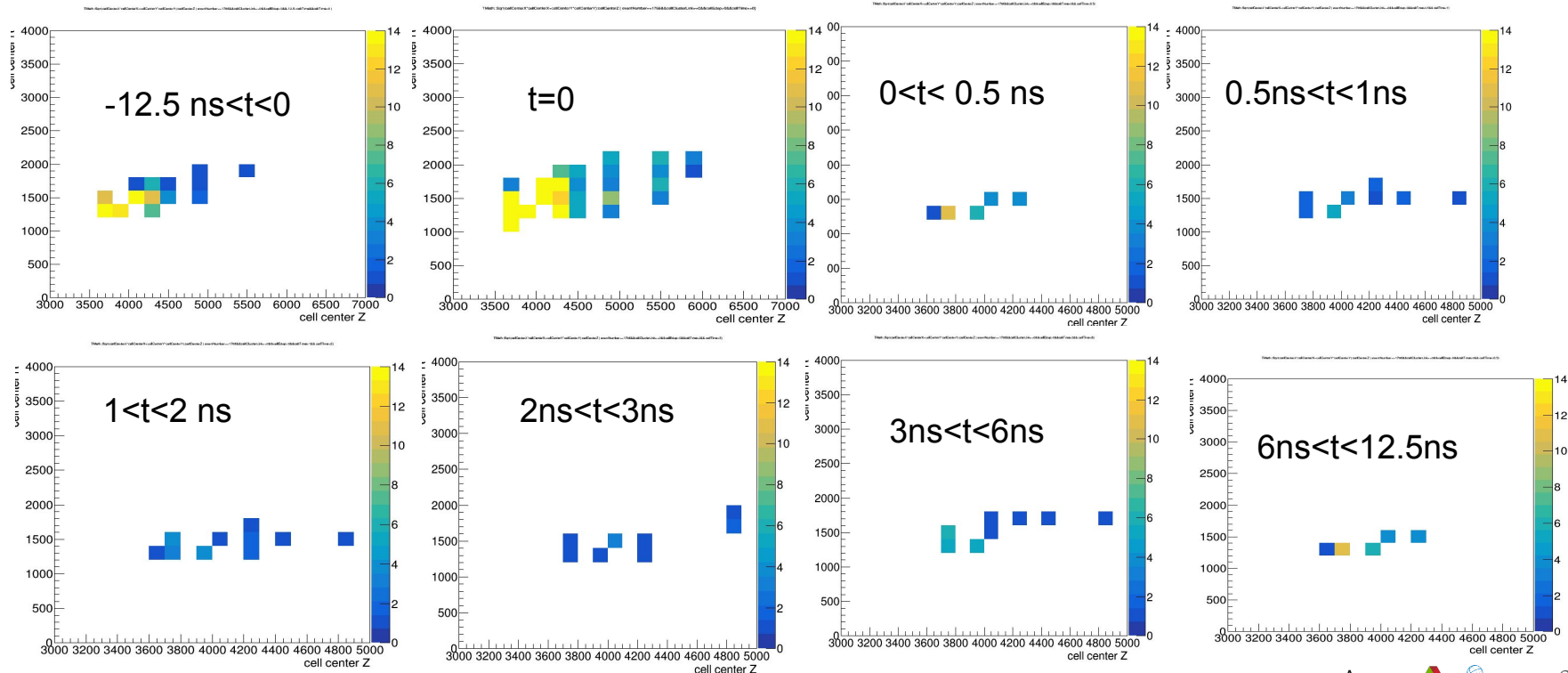


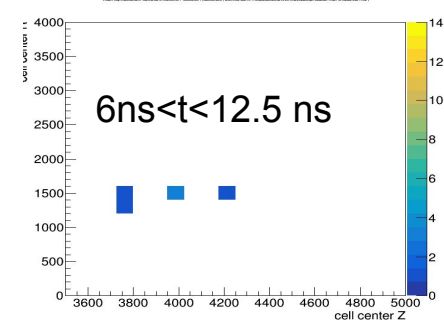
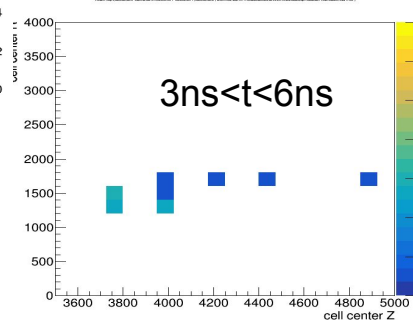
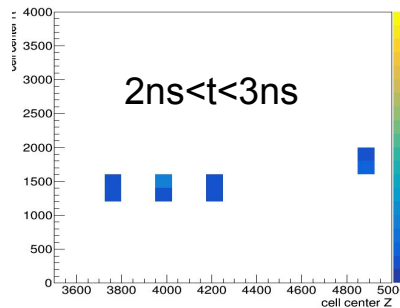
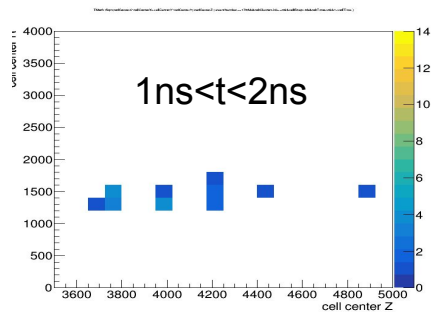
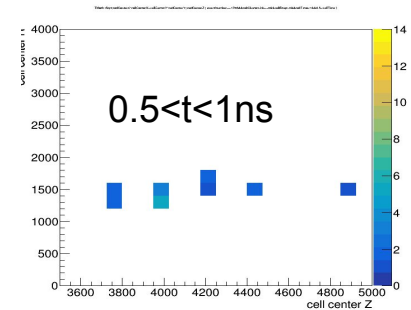
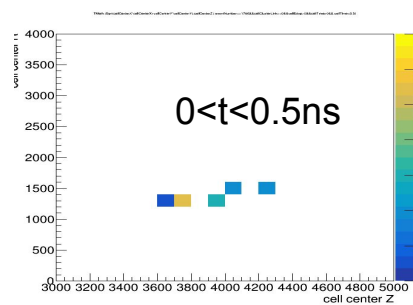
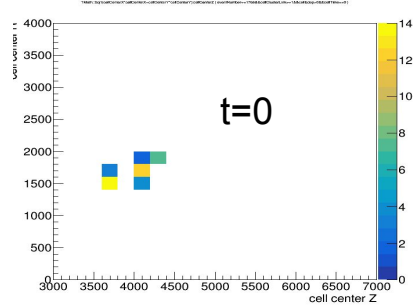
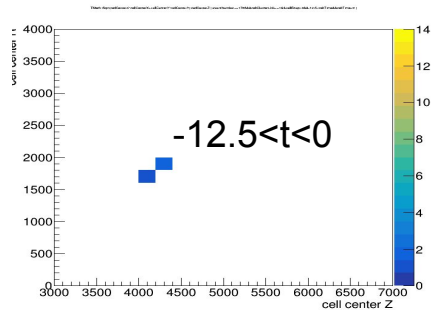


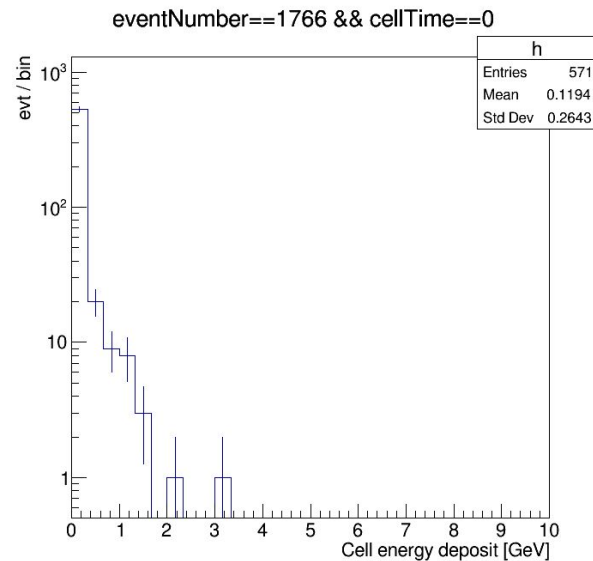
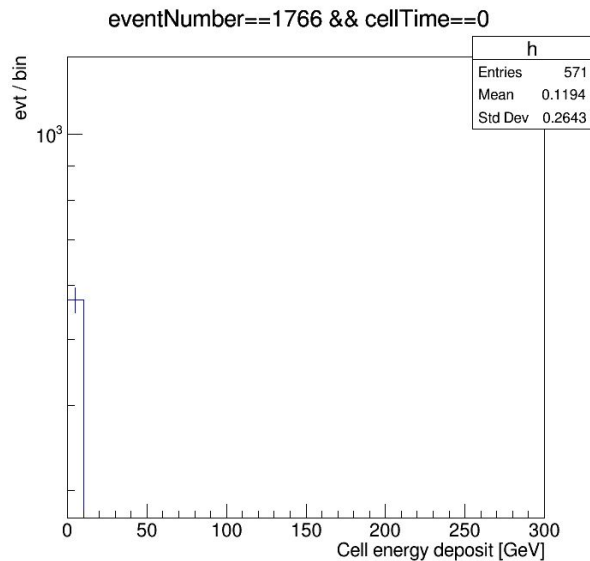
- We can study time evolution of individual cluster - Zahra performed some studies
- Any other suggestions/thoughts?

Backup

Event Number= 1766, cluster Index = 0, number of cells in the cluster=602







Time evolution in the detector cells for a single cluster in a π^- event

Event Number= 1766, cluster Index = 0

