Bi207 - Charge Equalisation

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Initial tasks

- I created a framework from scratch based on classes instead of functions.
  - Waveform()
  - Peak()
  - Hit()
  - Event()
- An Event object is created at each iteration, and one can retrieve specific information for every hit, peak or waveform.
- Events have attributes that can be used to apply filters on, fill histograms and basically perform the analysis.
- This was done as it was faster for me to understand the data structure based on my own framework.
- **In parallel, I developed the same analysis also using the framework you provided.**

Questions

- In the Furkan Dolek's talk the event display shown does correspond to 20220511 ? The channels do not appear to be ordered as I do see them.
- In the formula for the dL:

$$\Delta L = \sqrt{(\Delta T \cdot \frac{\delta t \cdot v_d}{\delta d})^2 + \frac{4}{3}\left[\Delta C^2 + \Delta I^2 - \Delta C \cdot \Delta I\right]}$$

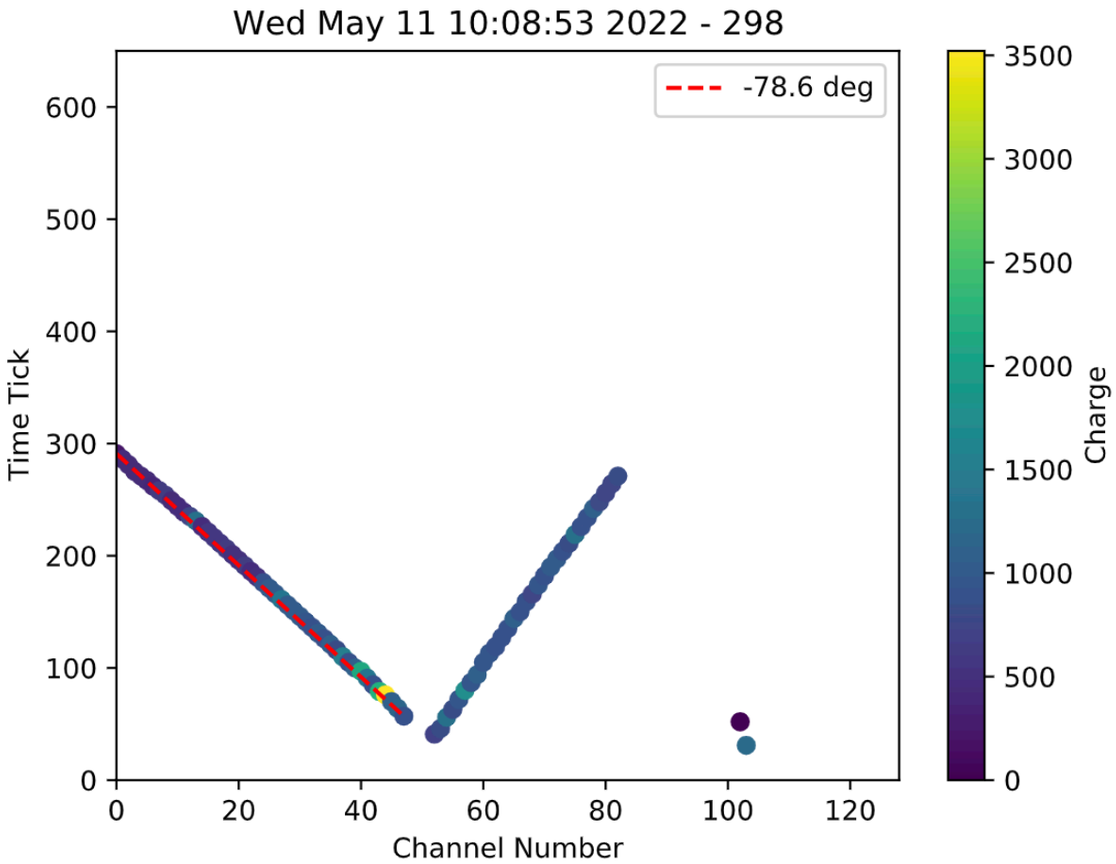
  - The units of both terms in the equation are not the same.
  - The DeltaT is the time spent by the crossing particle in the TPC?
  - DeltaC and DeltaI are the number of collection and induction channels crossed by the particle? In units of number of channels or in mm?
  - Basically, where is the formula coming from?
- The distributions for deltaT and deltaI I obtain look very similar to those from Furkan Dalek's talk. DeltaT is wider in my selection.

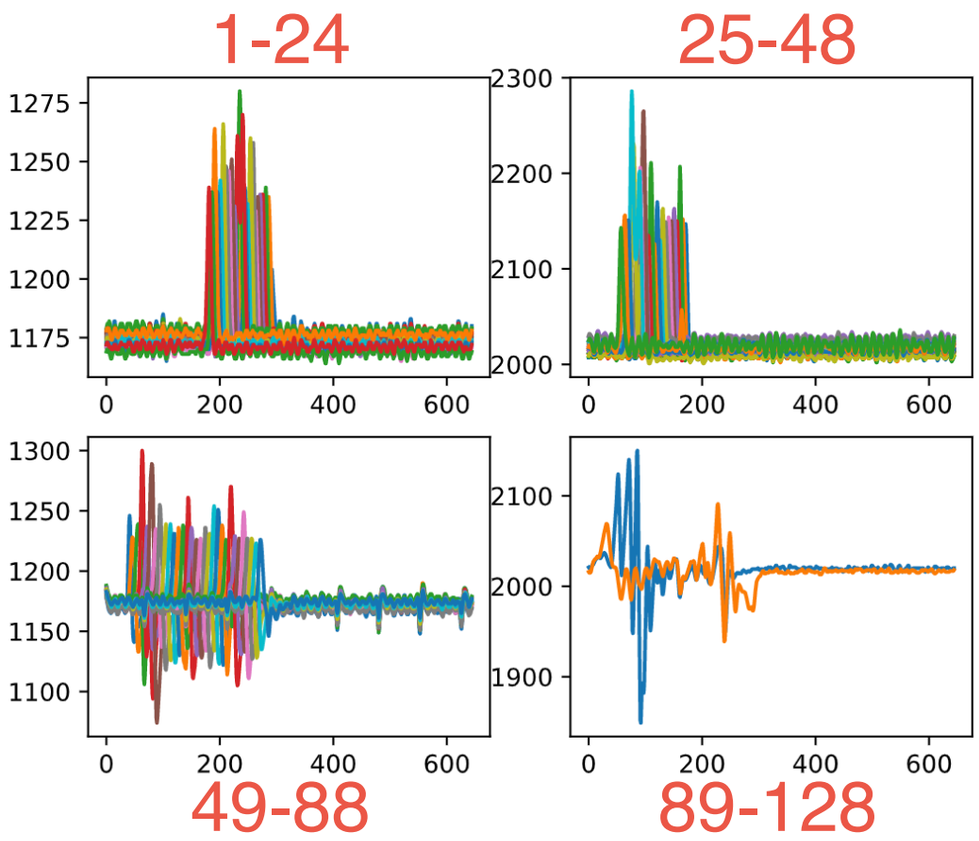
Objectives

- To perform a cosmic-muons selection contained in a narrow solid angle track.
- As these muons deposit the same amount of energy alongside the track, to calculate the charge deposit at every crossed channel.
- By comparing the differences in collected charge over collection channels, equalise the charge gain by assuming same energy deposit over all of them.

Selection parameters

- Number of Collection channels crossed: > 45
- Only forward-looking tracks
- Just single tracks -> No additional hits in the selection



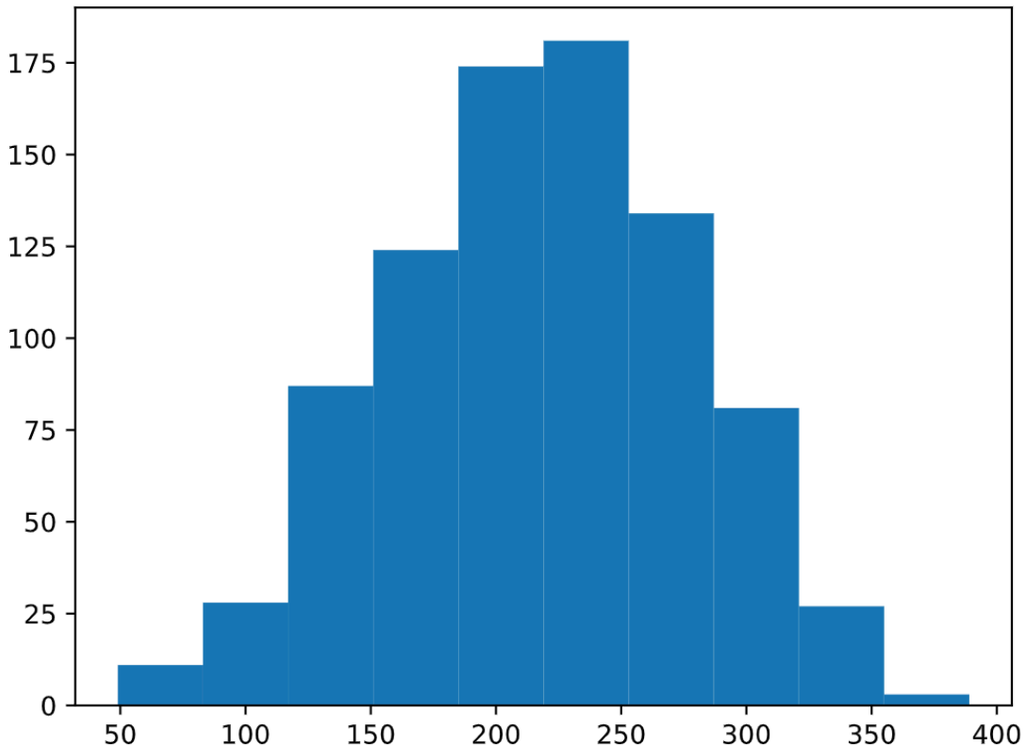


Is it normal to see this behaviour in INDUCTION2?

Variables

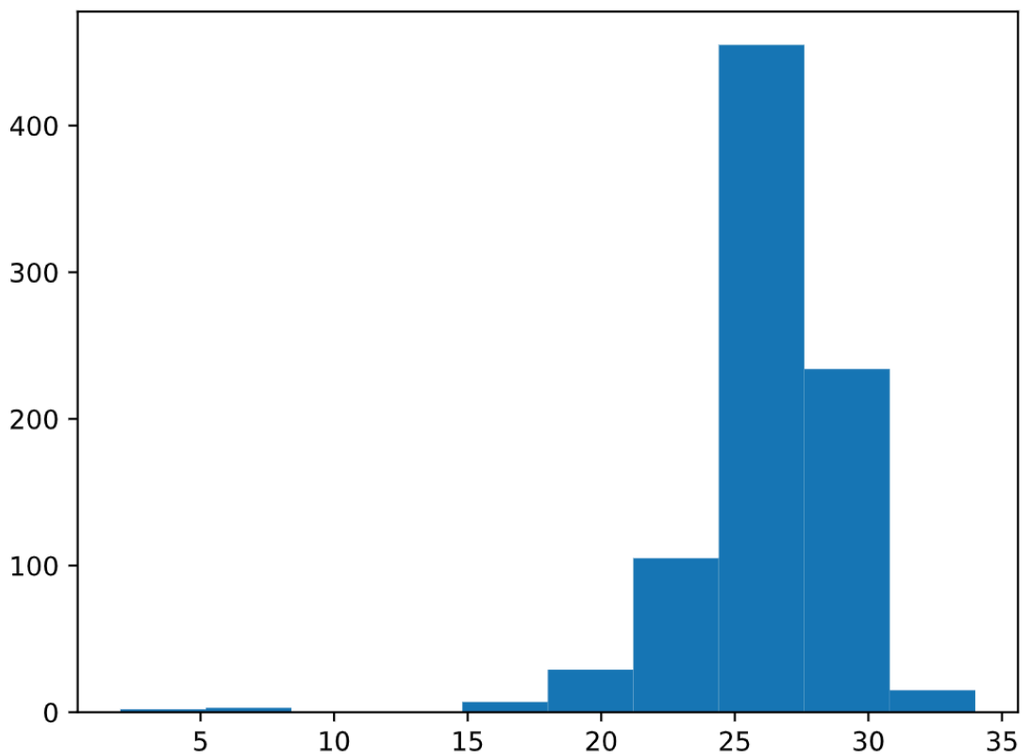
- DeltaT = “Time the track spends in the TPC”
- DeltaI = “Number of crossed induction1 channels”
- DeltaL = “Output from the equation”

DeltaT



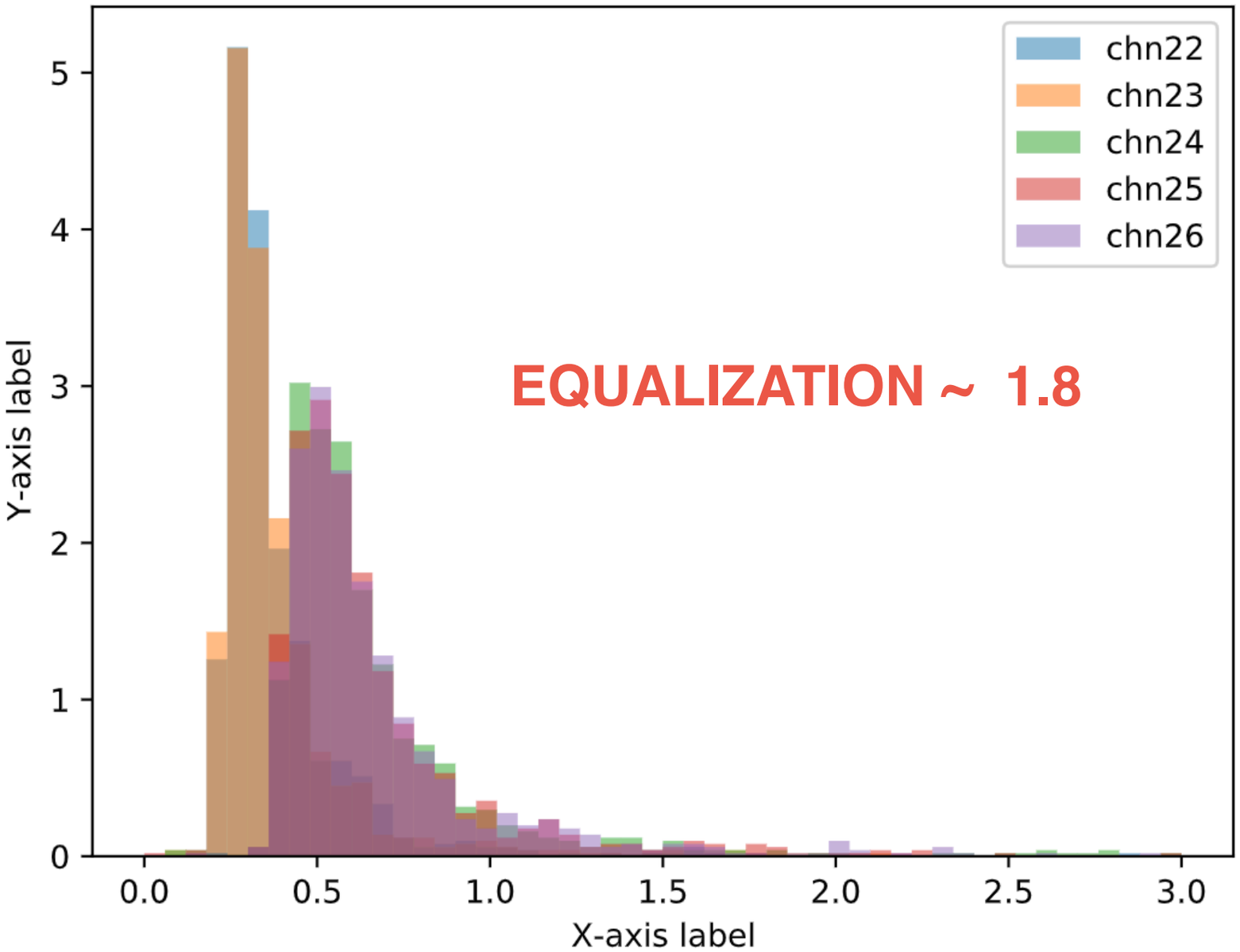
Time Tick

DeltaI



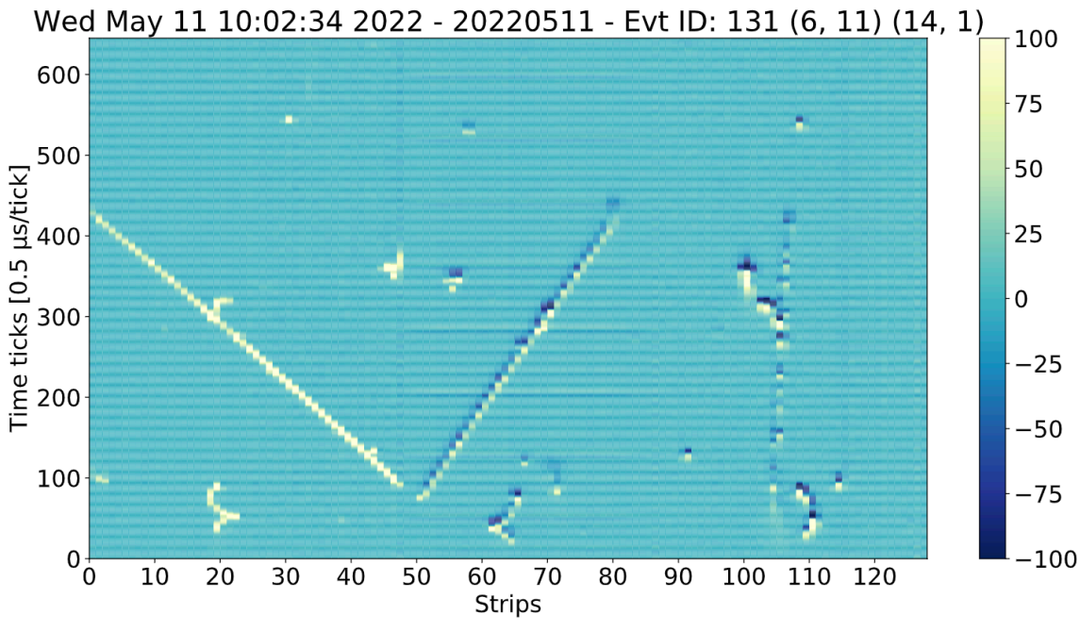
Induction Channel

Equalisation



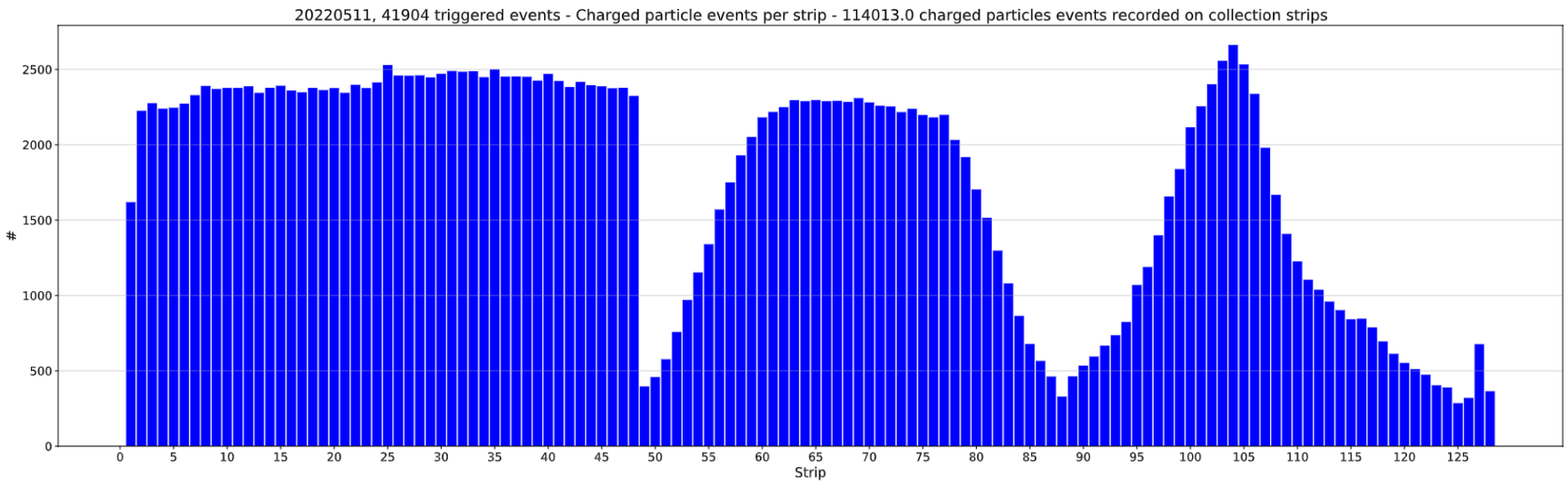
Selected Events

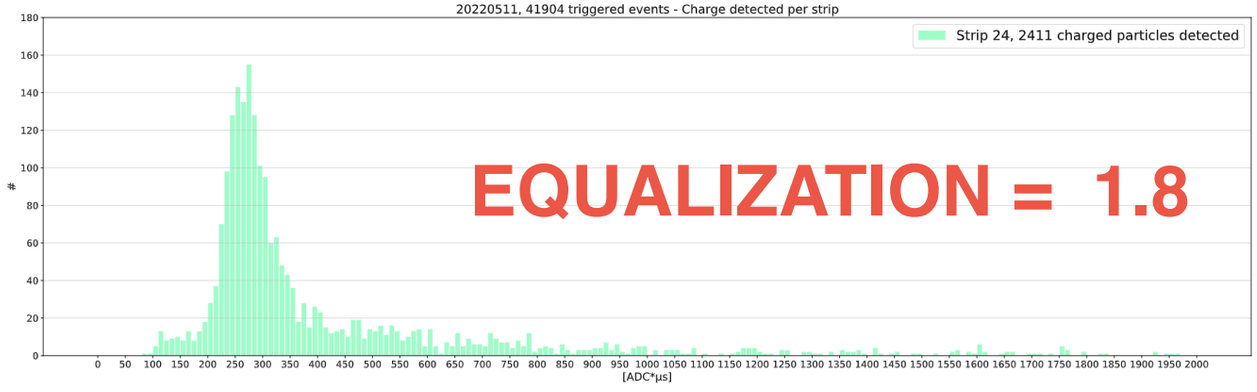
- Desired events:
  - Single track
  - No more hits across the volume



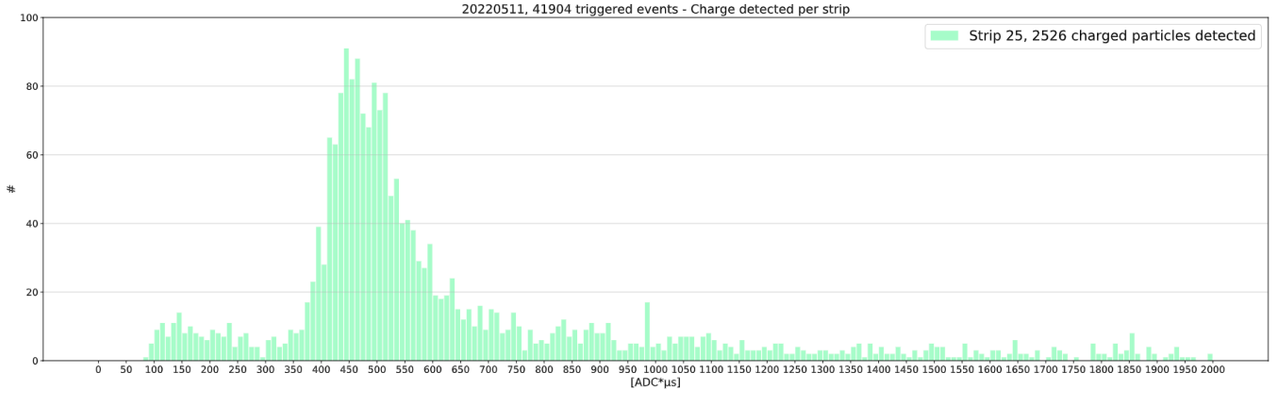
- Undesired events:
  - Multiple tracks
  - More hits across the volume

Selection: main framework





EQUALIZATION = 1.8



- Channel 24:
  - MPV ~ 260
- Channel 24:
  - MPV ~ 460

Landau Fitting

- Have faced some difficulties in landau fitting.
- As DeltaL is not well understood, probably distributions are not the ones expected to be fitted.
- Expected to be done once correct dL calculation is performed.
- The idea is represent the MPV as a function of channel number, fit two horizontal lines and find the mean & std of each lines -> Estimate the error of the equalisation.
- The script.stats.landau module seems not to be accessible with the current python installation:
  - Looking for alternatives

Ideas

- I have been thinking on create a new datafile containing data from all json files, and “hdf5” file.
- It can be very fast read using pandas module and one can read it by chunks in order to not get into memory troubles.
- The idea is to include the plotting functions from your framework into my OOP framework, to display events the same way.
- All other features are already included, including the coherent noise removal.