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Beam Test Analysis

correction factors and dEdx

In the last meeting it was commented the possibility of ploting dEdx vs $\beta\gamma$

I found interesting runs in the log:

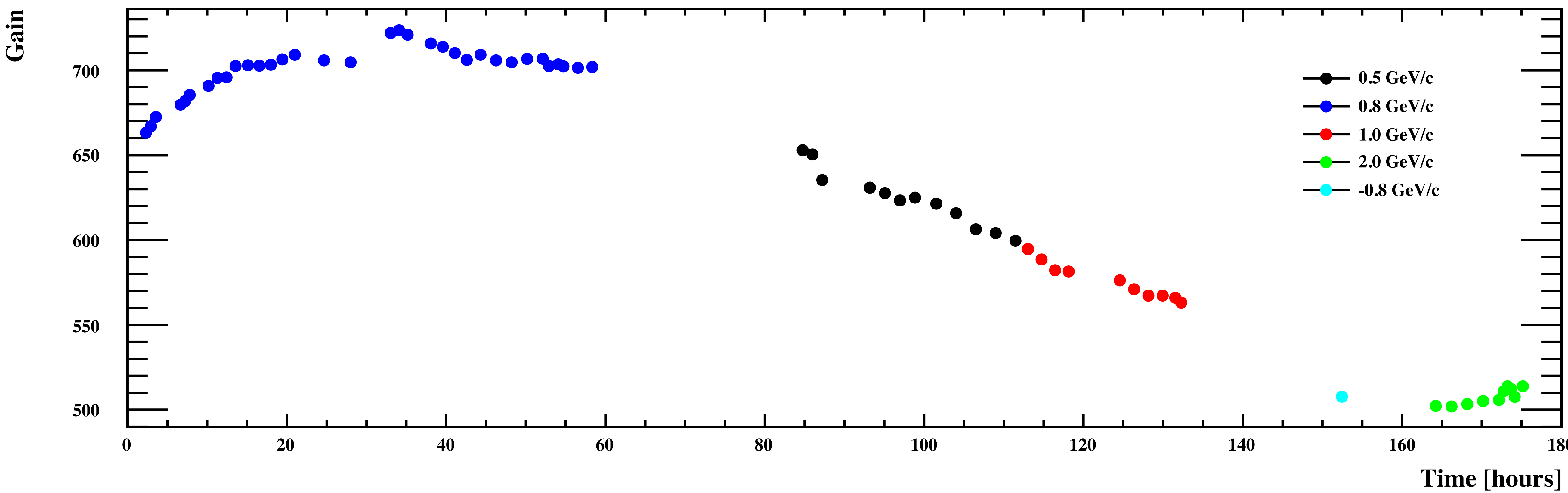
- Pions, Protons, Electrons at 0.5 GeV/c : 403-408 runs.
- Pions, Protons, Electrons at 1.0 GeV/c : 409-414 runs.
- Pions, Electrons, Muons at 2.0 GeV/c : 445-449 runs.

One intermediate run under same conditions to have more continuous experimental conditions:

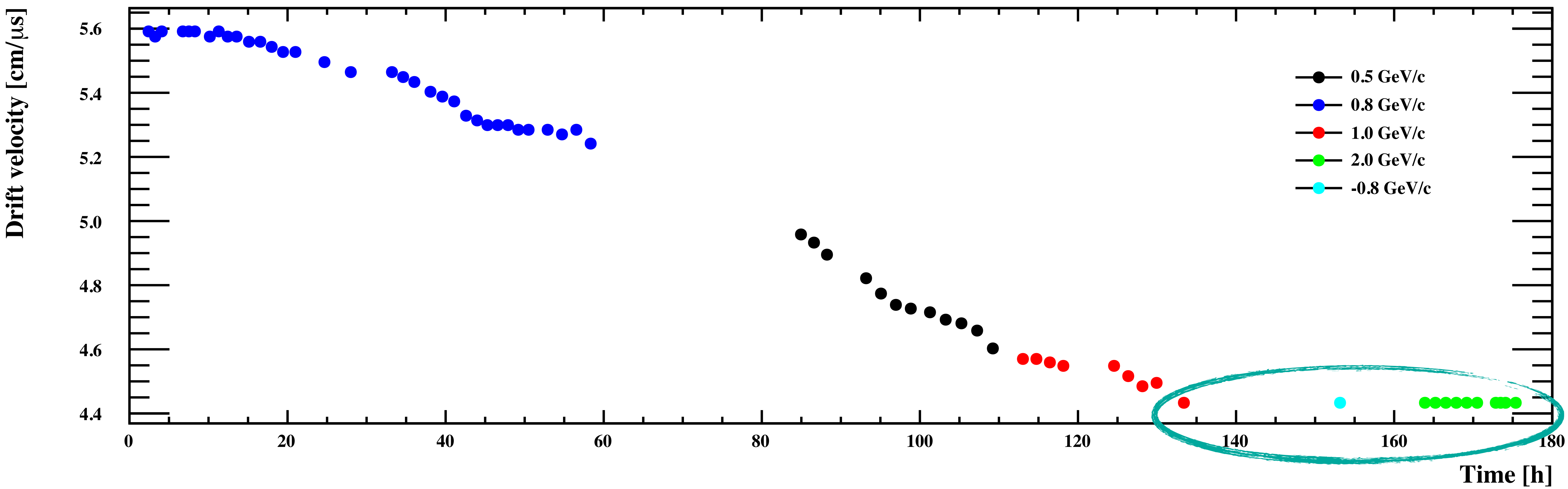
- Anti-Protons 0.8GeV/c

EXTRA COMMENTS:

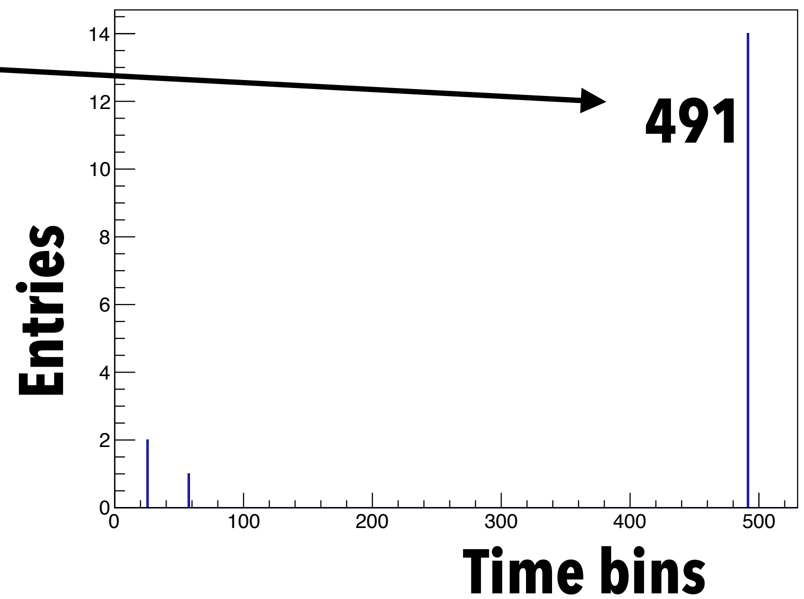
- I am now fully focused on TPC beamtest analysis (stand-by to SFGD reconstruction and others).
- I refurbished the code in such a way that is much easier to analyze larger data sets (better for future beam-tests).
- I will present first uncorrected data to discuss experimental conditions and afterwards the corrected 'Final' plots for the TPC beamtest paper.



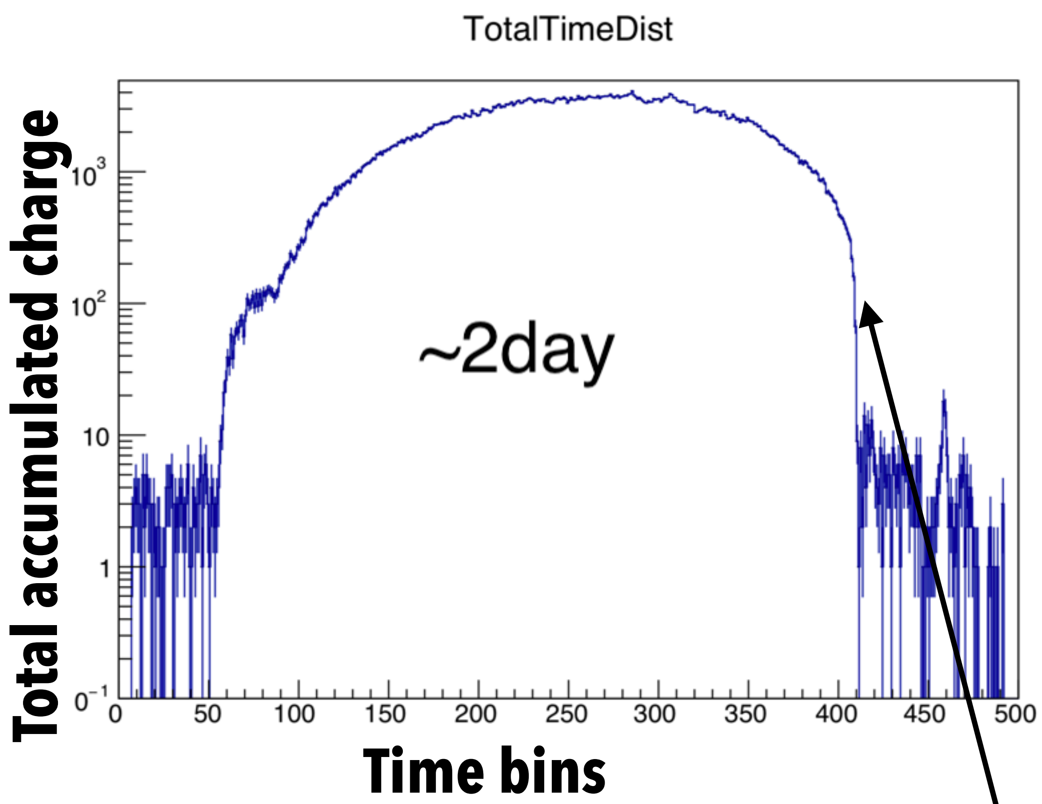
- Errors are included but are so small that are hide by the Markers.
- Clear gain evolution:
    1. First there is an increase: from 660 to 730 in ~30h. 9%
    2. After there is a continuous drop: from 730 to 510 in ~130h. 30%

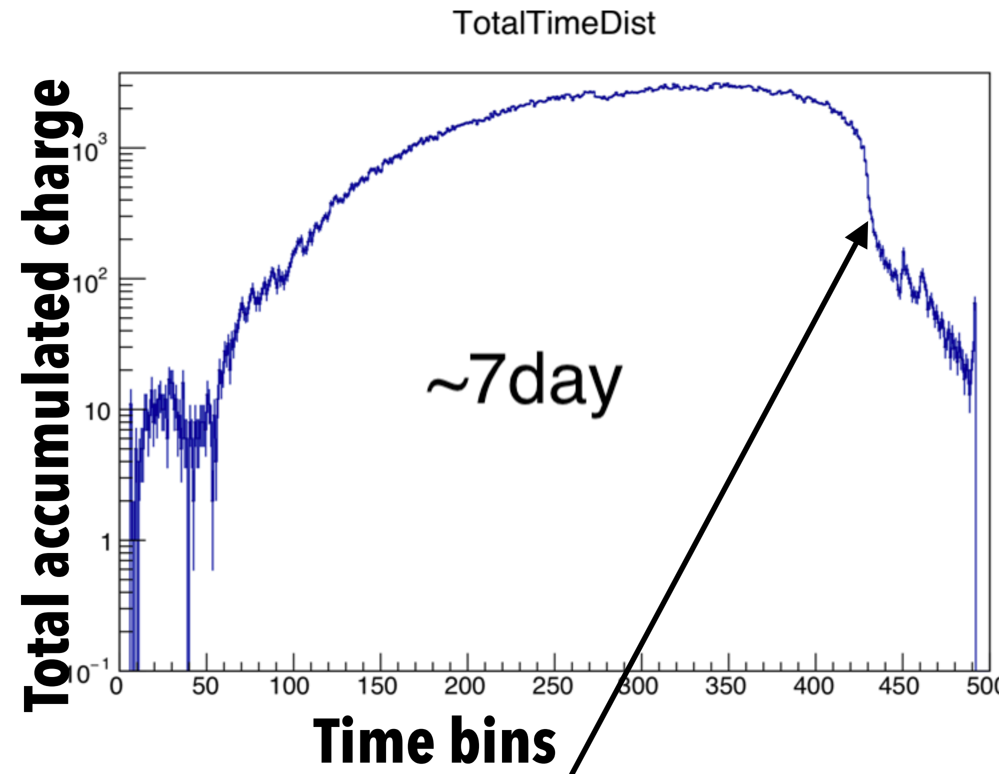


- Something strange happens for t > ~135h: All values are identical.
- After checking the numbers of the 'cathode timebin':
- I had some cuts on 490 tbins on 'CrossingSelection'. ⟶ Nothing changed.
- The cut was at the time of the 'RootConverter' ⟶ Cut at 490 tbins. Changed to 510-> Extremely noisy! Impossible to select nothing.



DRIFT VELOCITY





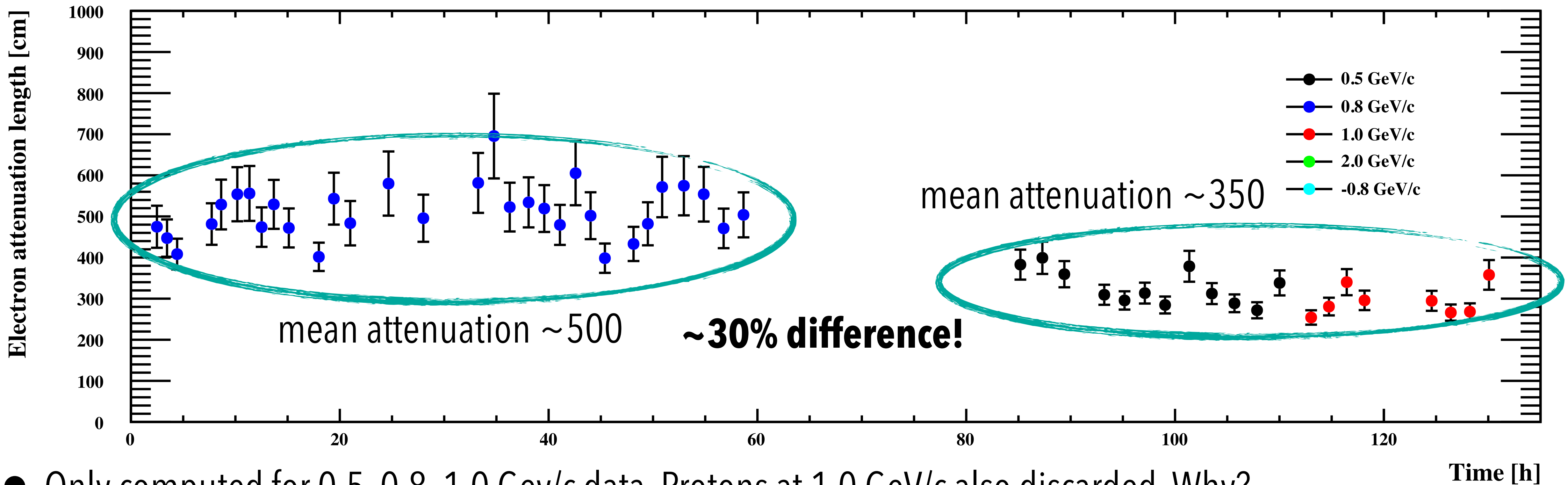
Looking to the charge accumulated in each timebin the effect is clear.

- According to the log, we reduced the flow rate to 30L/h after of the beginning of the beamtest ~30h (on my time axis) and again 5h latter to 25L/h. From memory (I belive the original value was something like 50 or 60L/h, but maybe was during purge.)

- I contacted yesterday Emilio Radicioni to try to understand better this problem.

proportional to drift velocity!

NEW-> Increased data reliability: Ignore datapoint if Fit(180,370) and Fit(150,400) have attenuation length difference > 20%.



- Only computed for 0.5, 0.8, 1.0 Gev/c data. Protons at 1.0 GeV/c also discarded. Why?
- Electron attenuation λ is computed fitting $e^{-x/\lambda}$.
- After lambda is in the units of x, namely timebins. Afterwards it can be converted into cm by using the conversion factor: $k = \frac{lTPC}{\#timebins}$ where $lTPC = 154.1\ [cm]$

  and $\#timebins = binCathode - binAnode$

  If we don't see the Cathode we can no longer compute the electron attenuation.

Work with the data sets where we have the experimental conditions data for the gain, the drift velocity and the attenuation.

The data we already had:

Computed position

Pr,Ele,Pi at 0.8GeV/c at 80,30 and 10cm. (86.2, 35.3, 14.6)

+

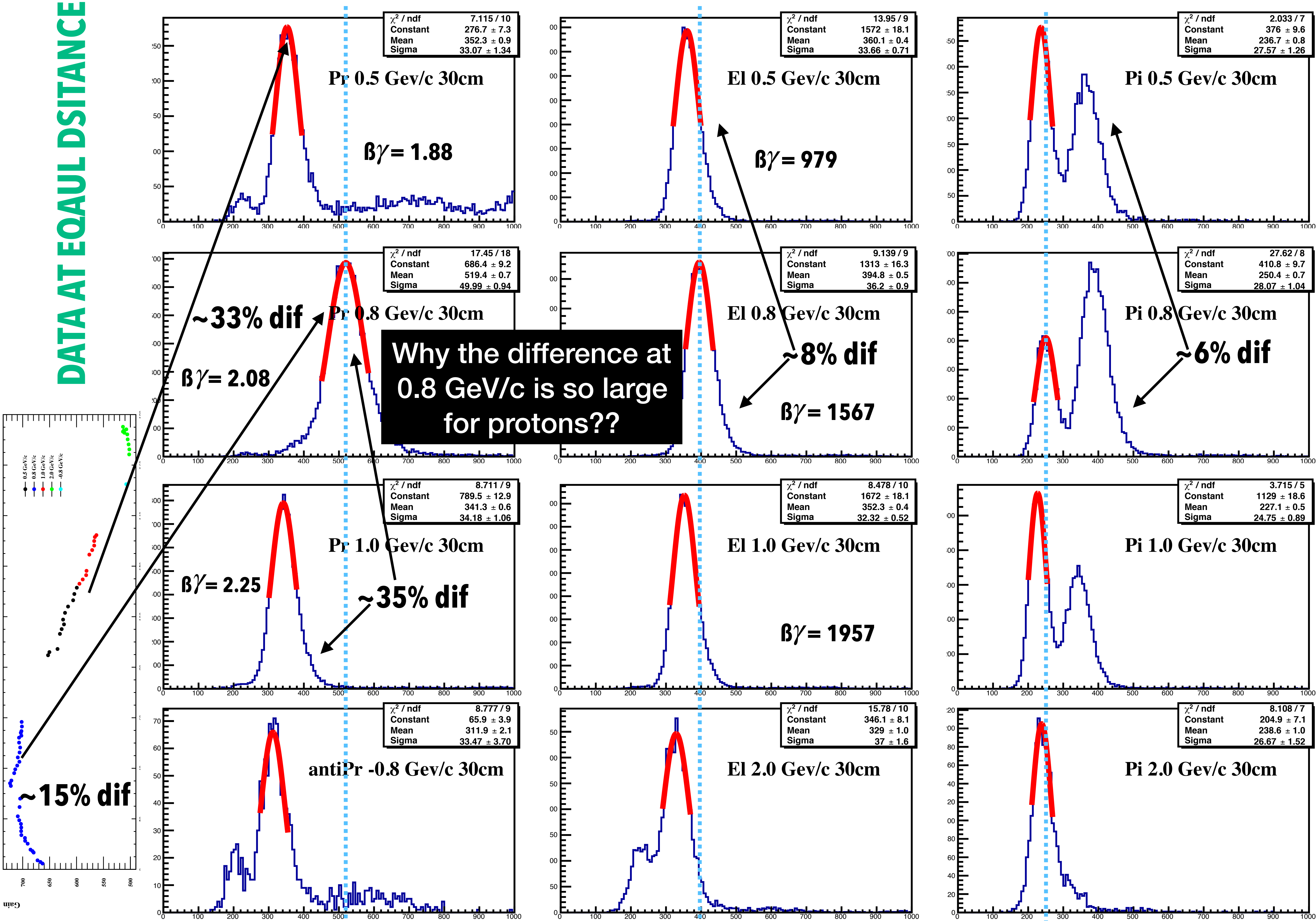
Pr,Ele,Pi at 0.5GeV/c at 30cm. (?) ⟶ **Needs to be computed.**

Ele, Pi at 1.0GeV/c at 30cm. (?) ⟶ **Needs to be computed.**

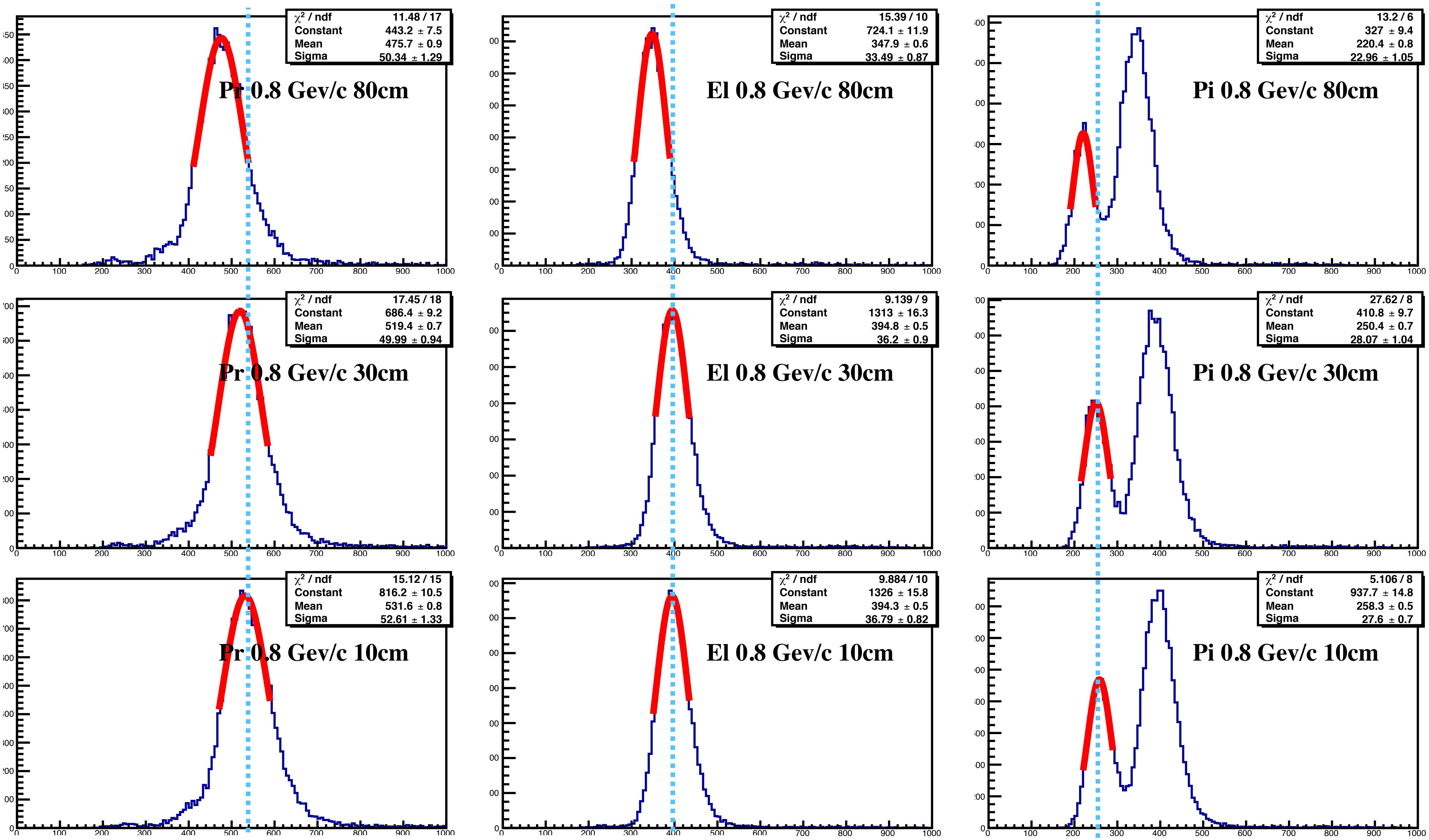
Using all data at 30cm (0.5,0.8,1.0 GeV/c) total of 8 points, compute dEdx vs $\beta\gamma$

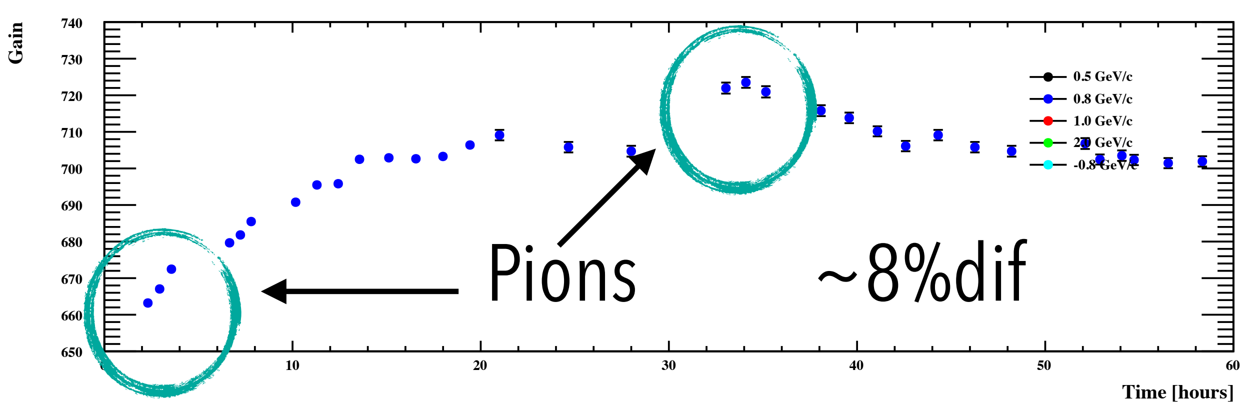
Using 0.8GeV/c data at different distances compute dEdx resolution vs distance (as we did in the past)

DATA AT EQAUL DSITANCE



DATA WITH EQUAL MOMENTUM

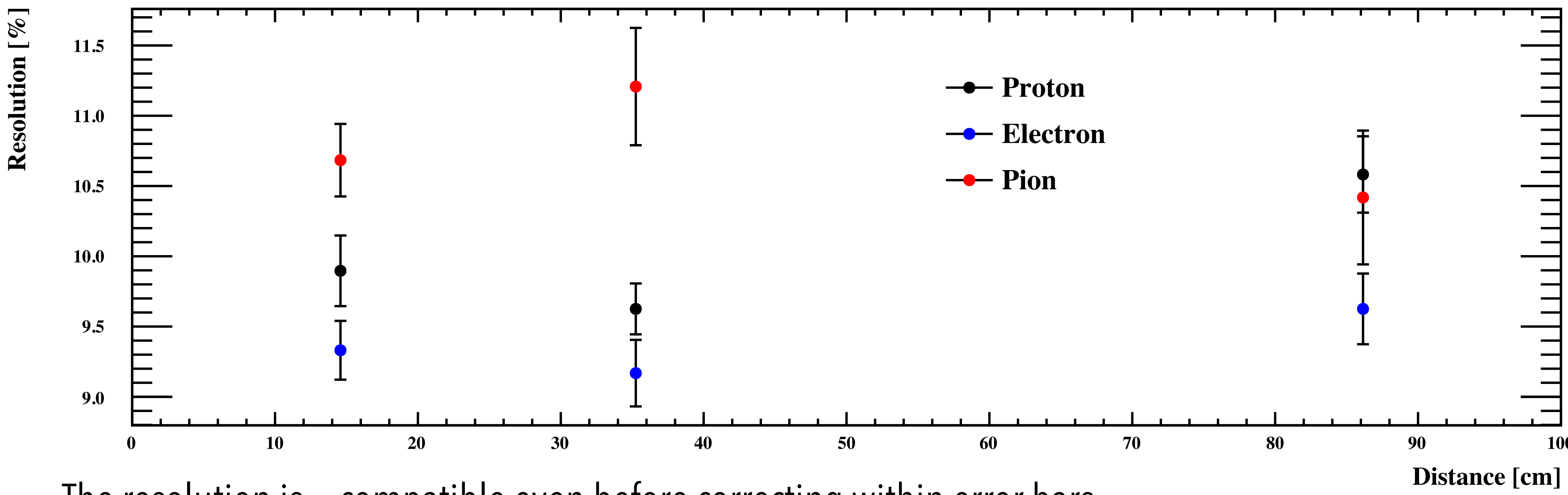




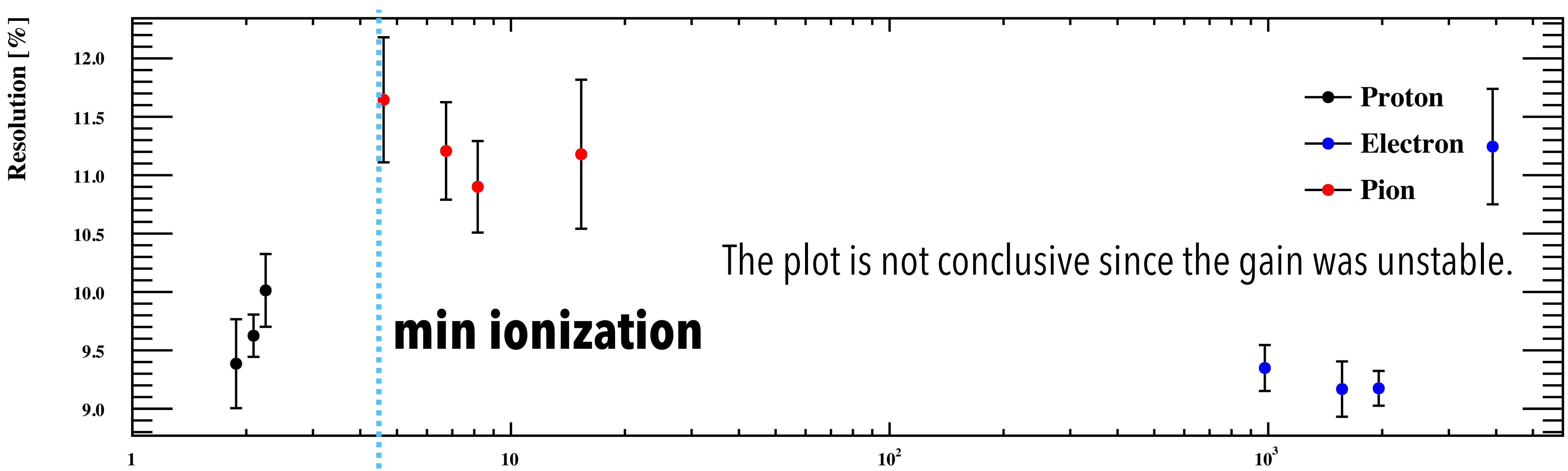
Max dEdx Mean **Pr** % dif ~ 10%

Max dEdx Mean **El** % dif ~ 12%

Max dEdx Mean **Pi** % dif ~ 15%



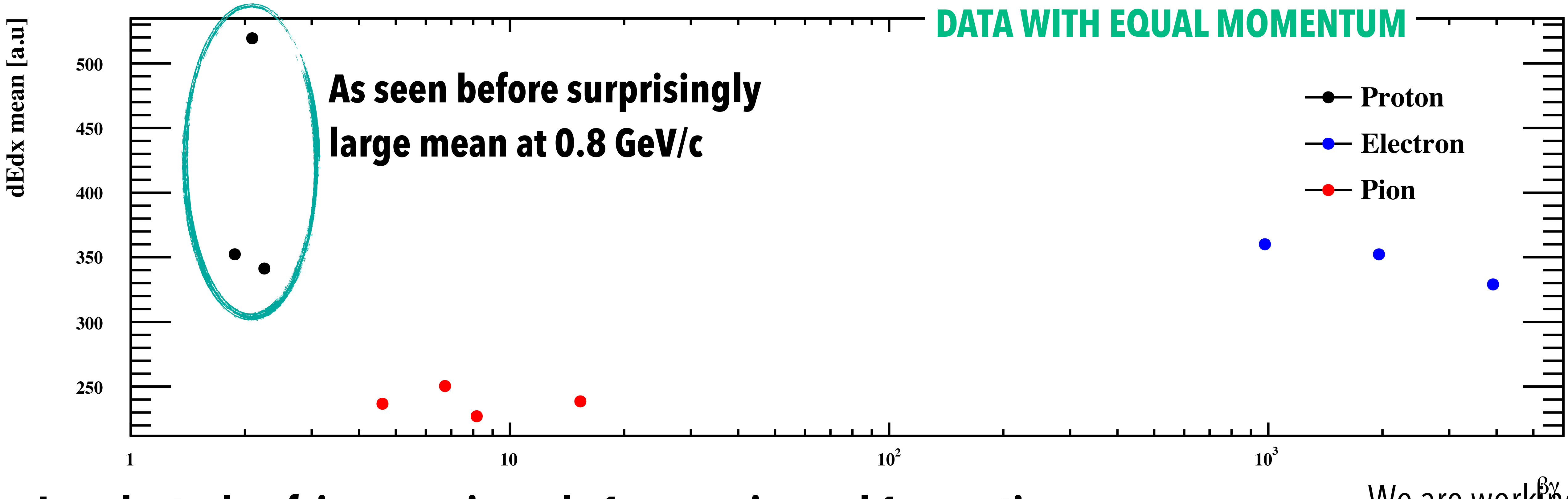
The resolution is ~compatible even before correcting within error bars.



worse res → better res

~according to Bethe-Bloch (and assuming larger ionization improves res)

DATA WITH EQUAL MOMENTUM



In order to do a fair comparison, do 1 conversion and 1 correction:

We are working with very horizontal tracks (negligible angular effect)

A. Convert the dEdx [a.u] into $MeV\,cm^2/g$

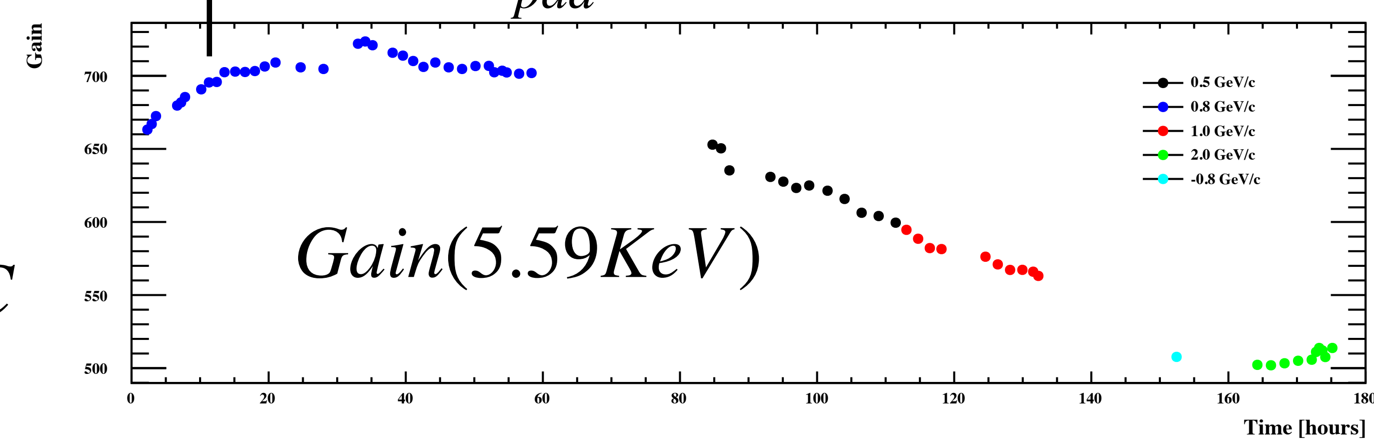
$$digitizedQ_{pad}/l_{pad} \longrightarrow N_e(MM)/l_{pad} \longrightarrow MeV\,cm^2/g$$

$$\rho = 1.784 \cdot 10^{-3} g/cm^3$$

$$l_{pad} = 9.6mm$$

$$N_e(MM) = \frac{Q_{pad} \times MAX_Q}{N_{ADC} \times Q_{elec}}$$

$$MAX_Q = 4096 \quad N_{ADC} = 120fC$$



B. Apply the electron attenuation correction as presented in previous presentations.