Update on BCAL Time Calibration

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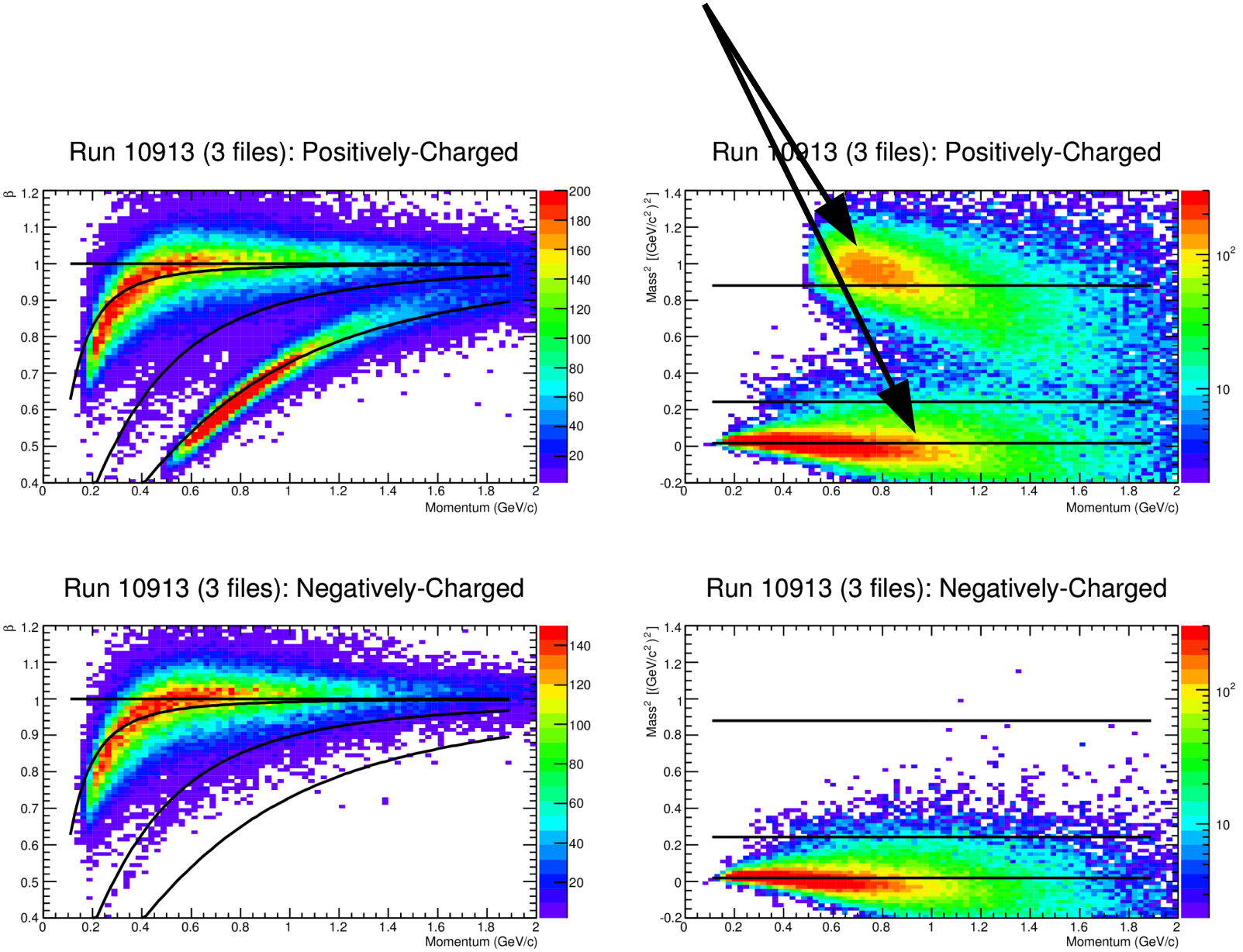
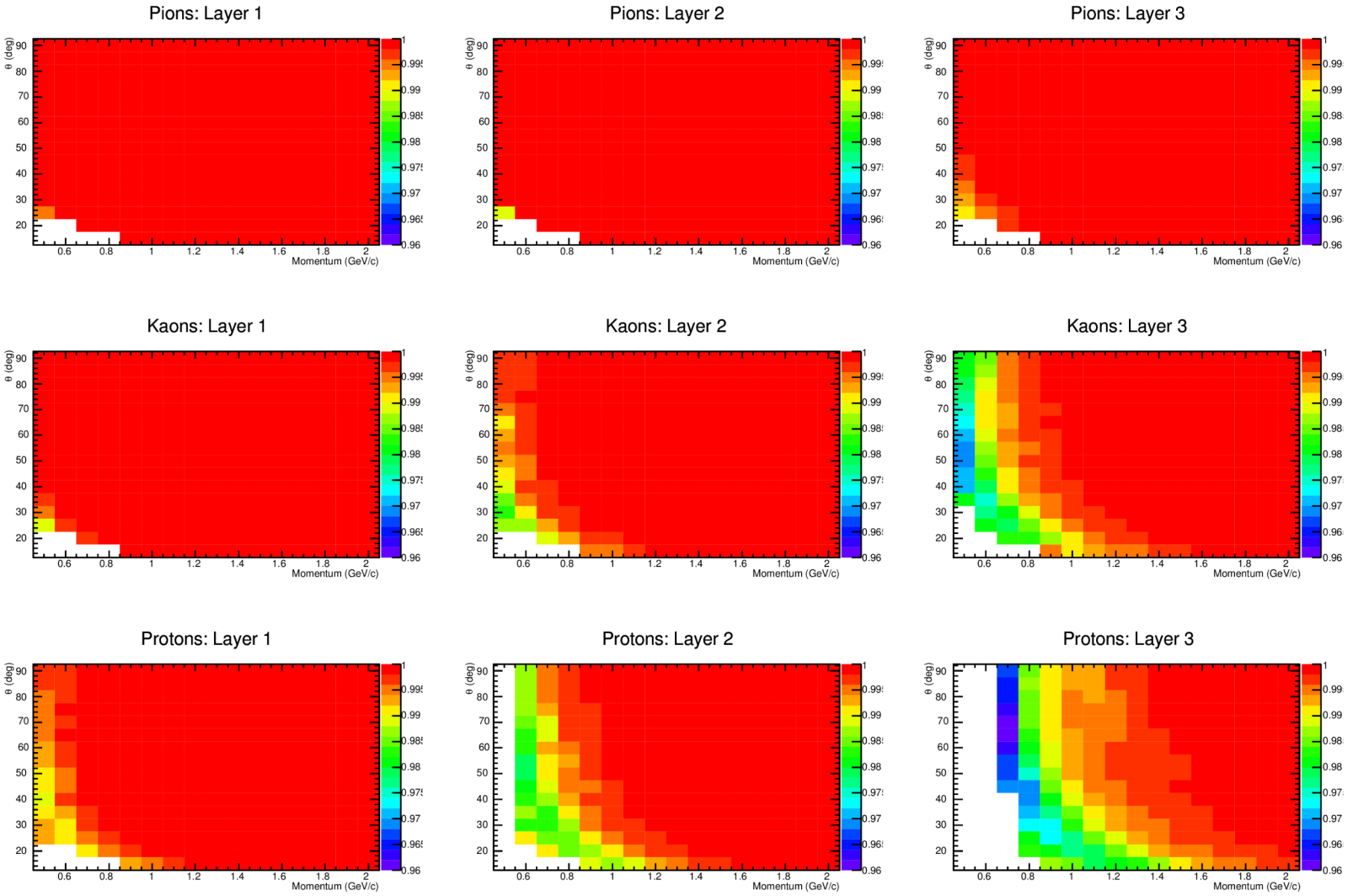
Slope in the Mass^2 distribution. Assumption was that this is the result of dE/dx loss of the cherged particle in the BCAL material.

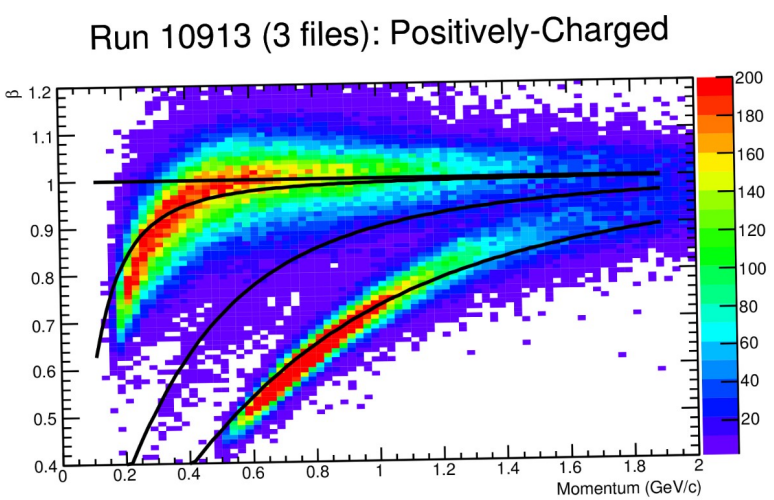


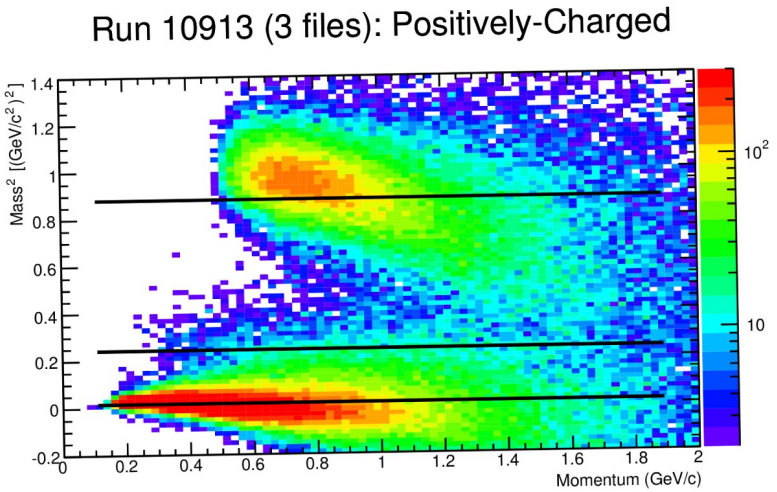
GEANT-3 simulation of the Time(expected)/T(measured) ratio to be used to correct data.

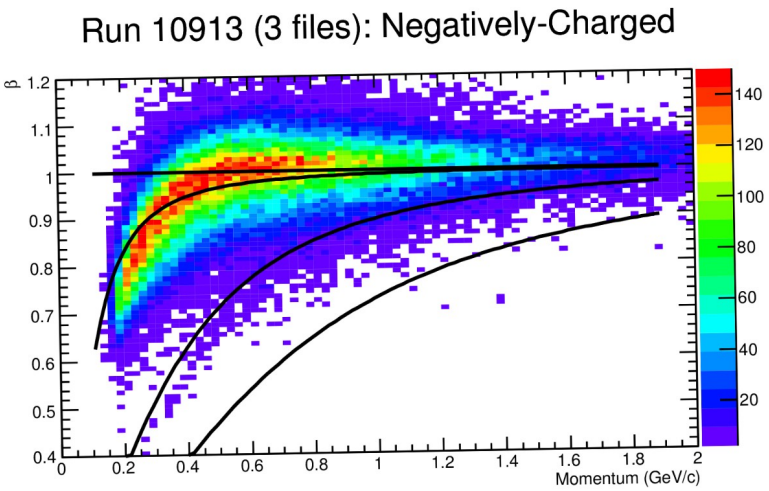
Note: Time(expected) = (L*E)/(p*c)

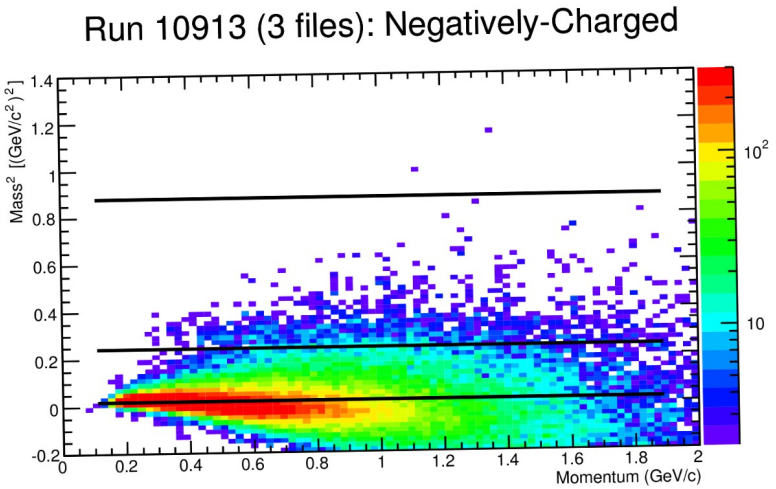


Mass^2 distribution after correction. No significant change in the slope.

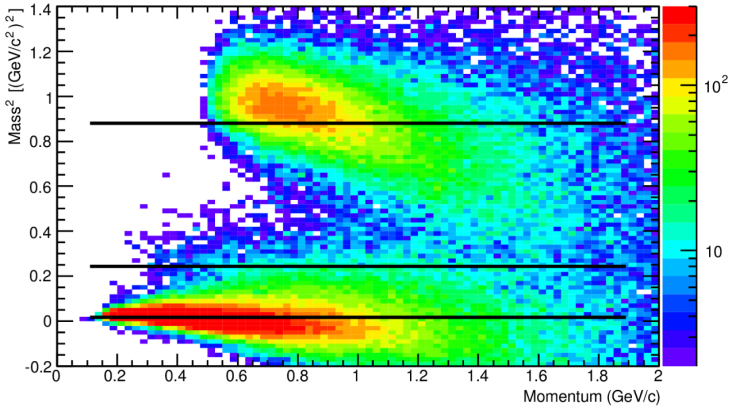




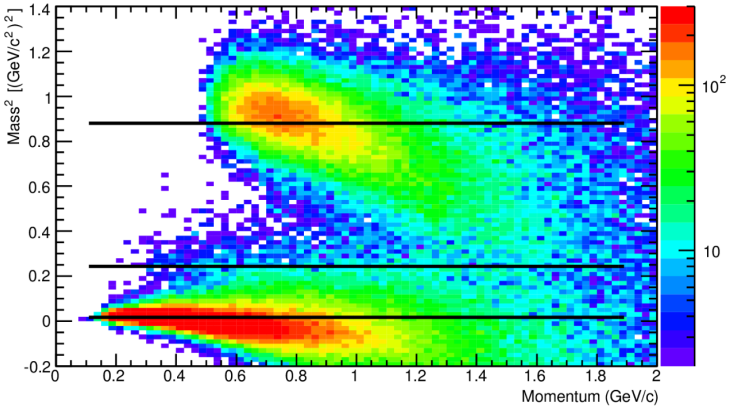




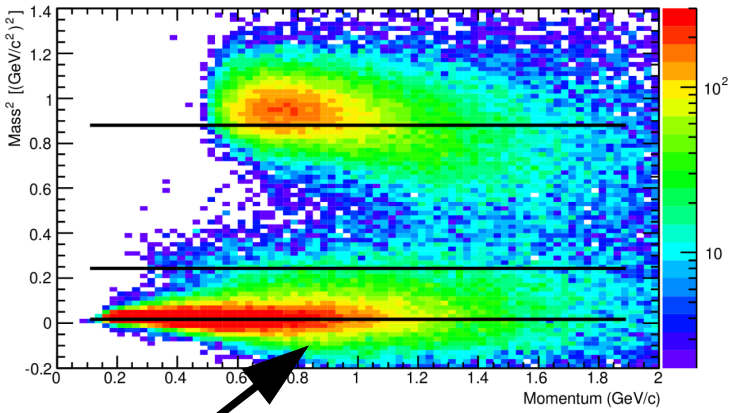
Calibration on π+Neutrals



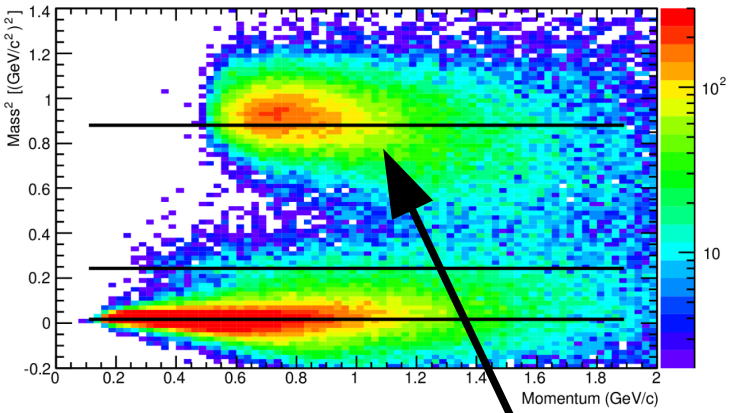
Calibration on Neutrals



Calibration on Pions



Calibration on Protons

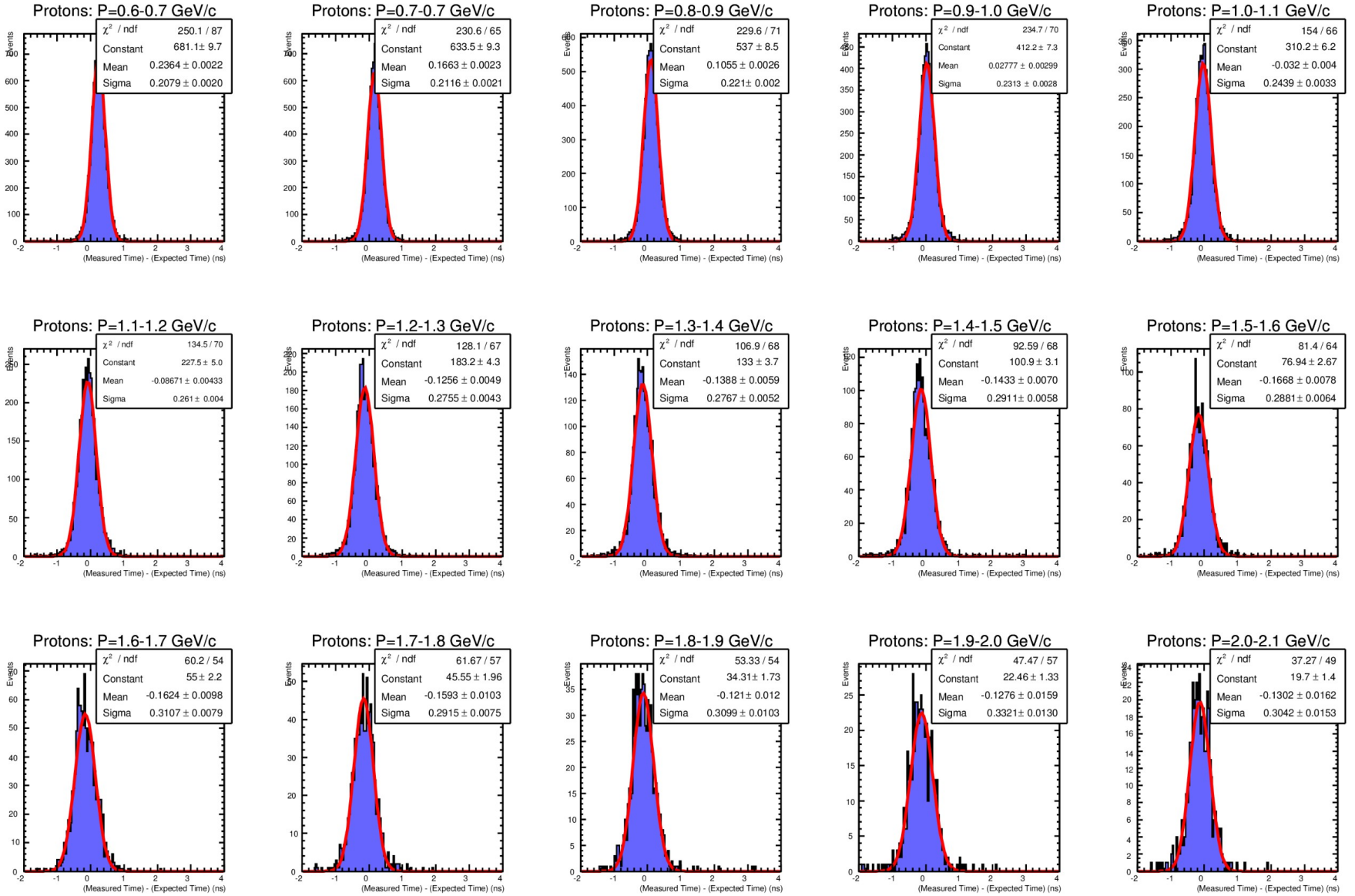


No slope on pions.

Almost no slope on protons.

PID-dependent calibration is needed for precise timing.

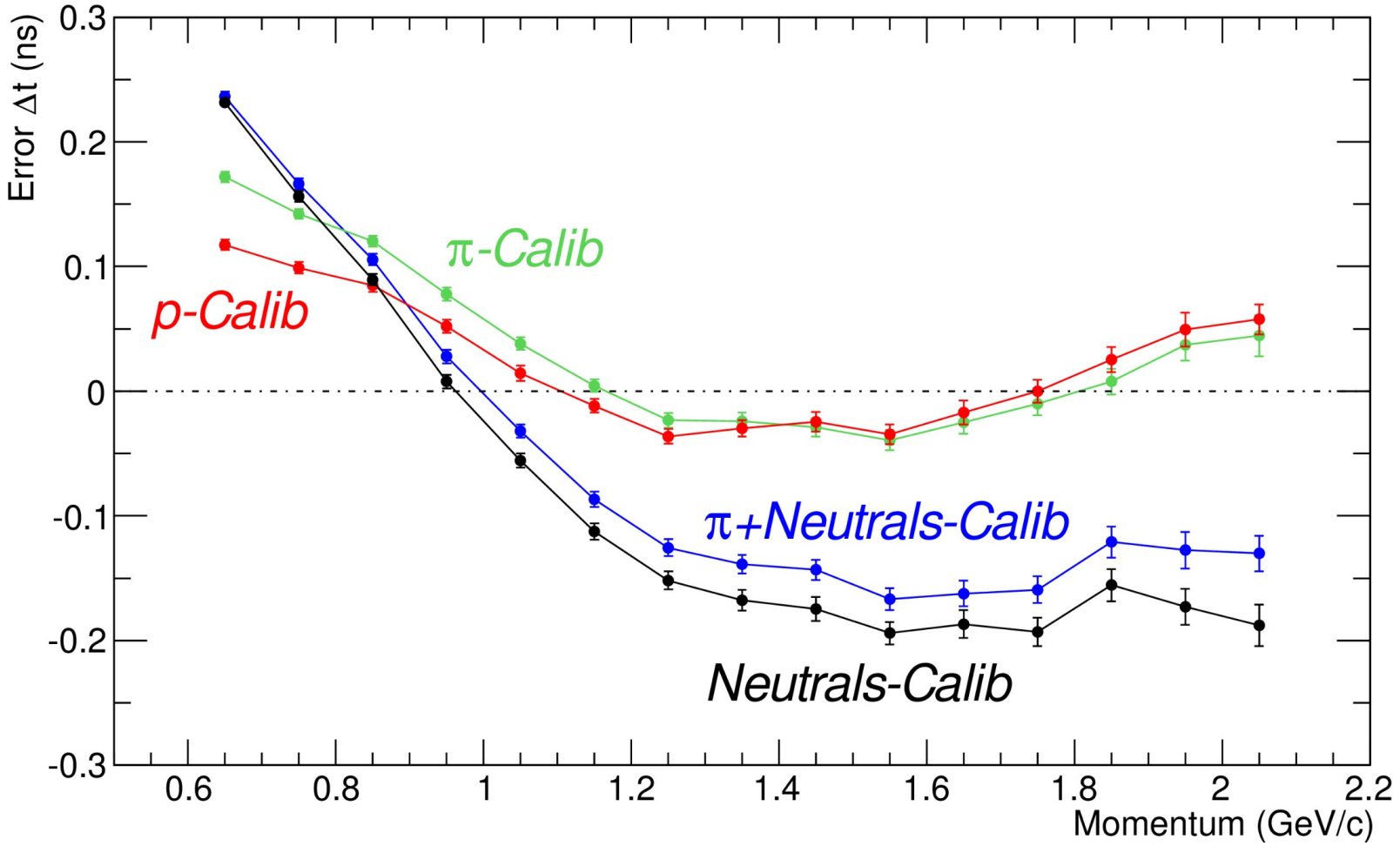
Time(meas)-Time(exp) for protons in momentum bins. (“Pions and neutrals” calibration.)



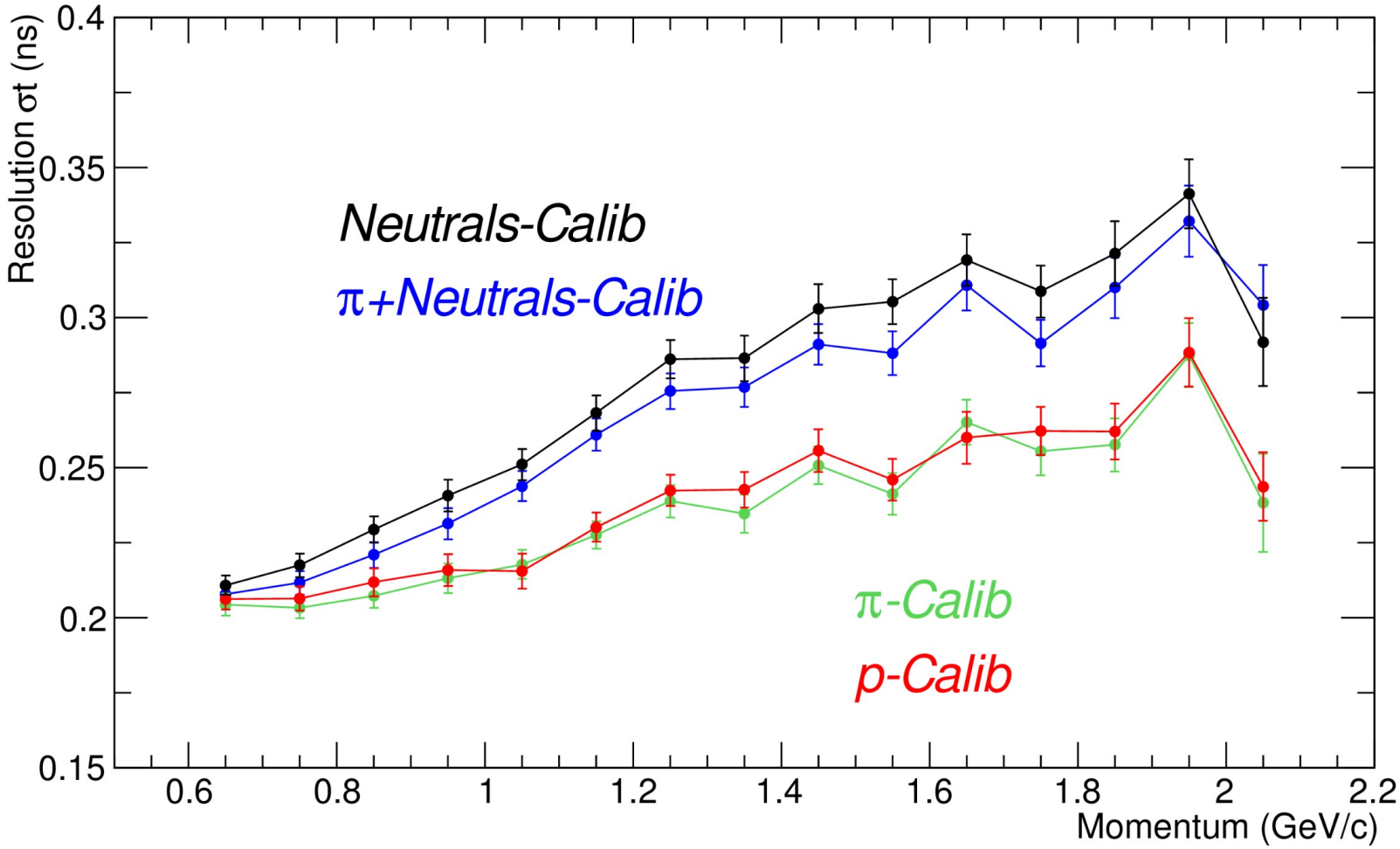
Peak position represents the systematic shift, and the width is for the time resolution.

Note very clean gaussian shape of the spectra.

Systematic Error in Protons Timing (TDC)

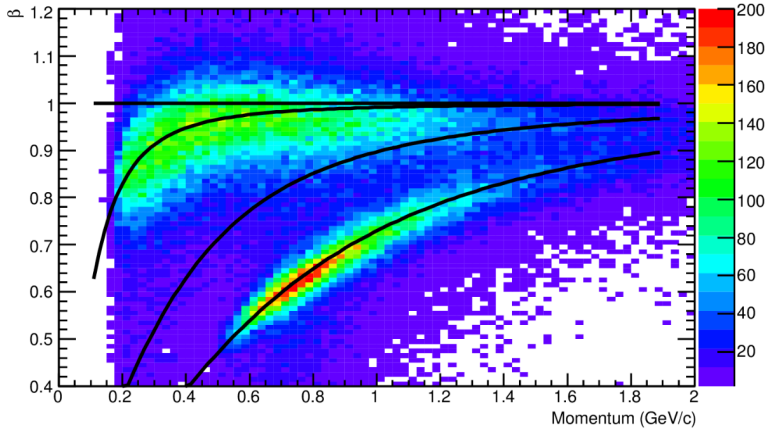


Resolution of Protons Timing (TDC)

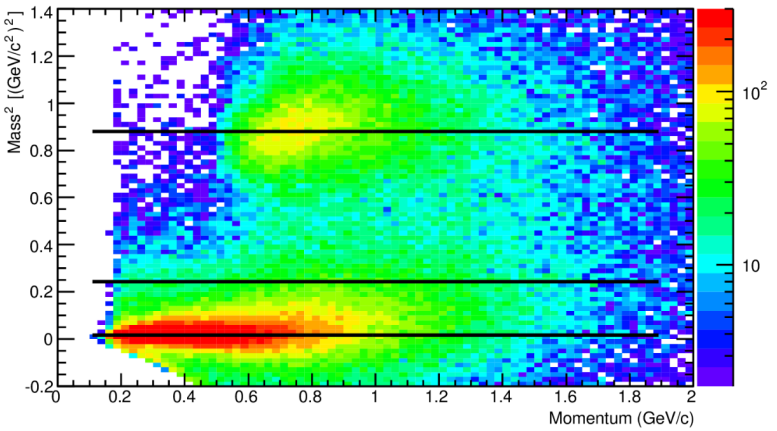


Time measurements with fADC

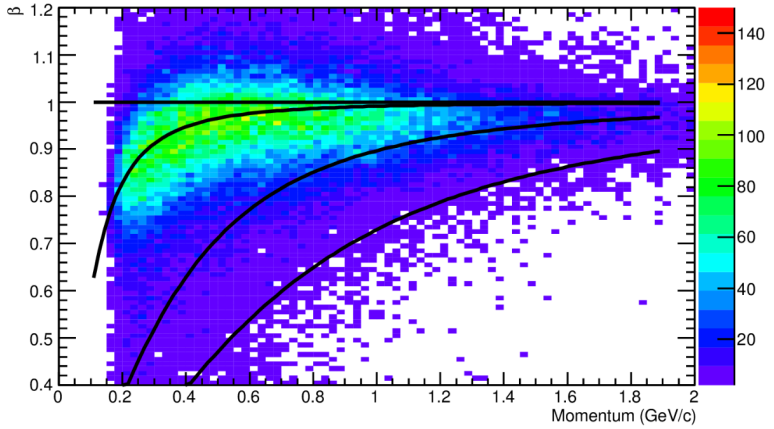
Run 10913 (fADC Time): Positively-Charged



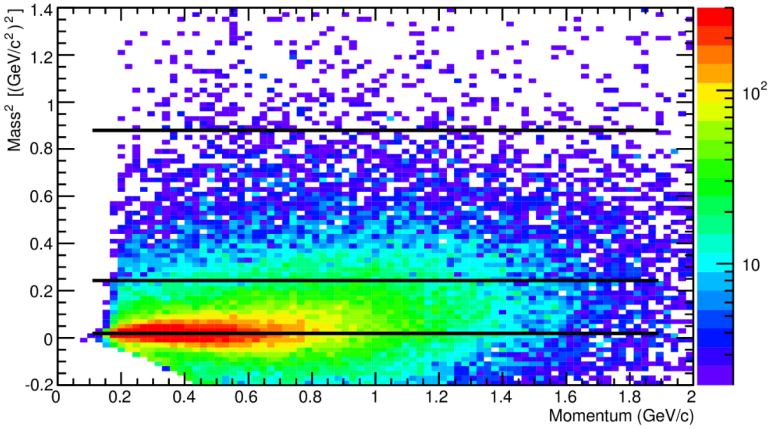
Run 10913 (fADC Time): Positively-Charged



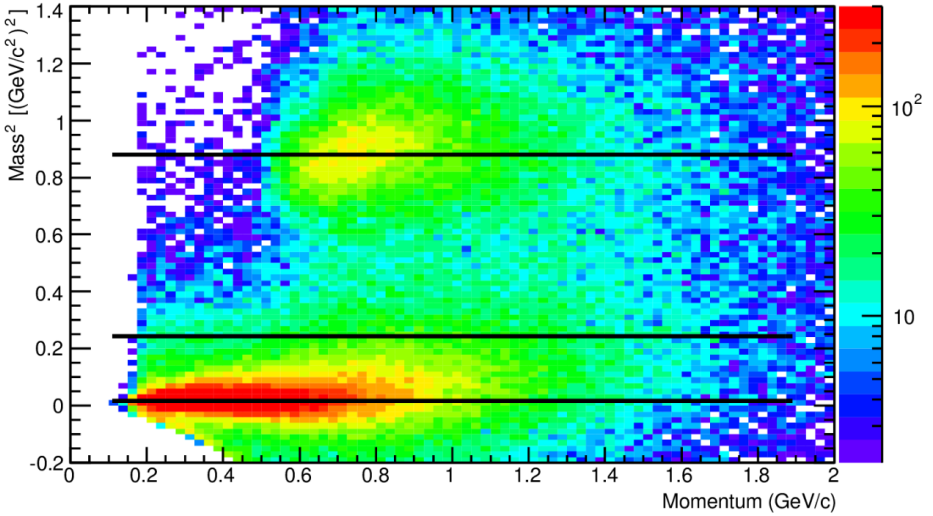
Run 10913 (fADC Time): Negatively-Charged



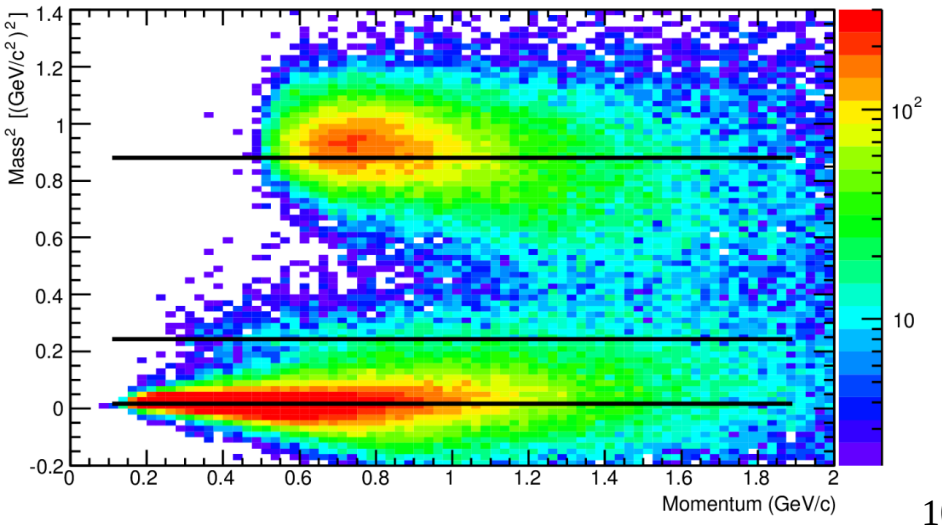
Run 10913 (fADC Time): Negatively-Charged



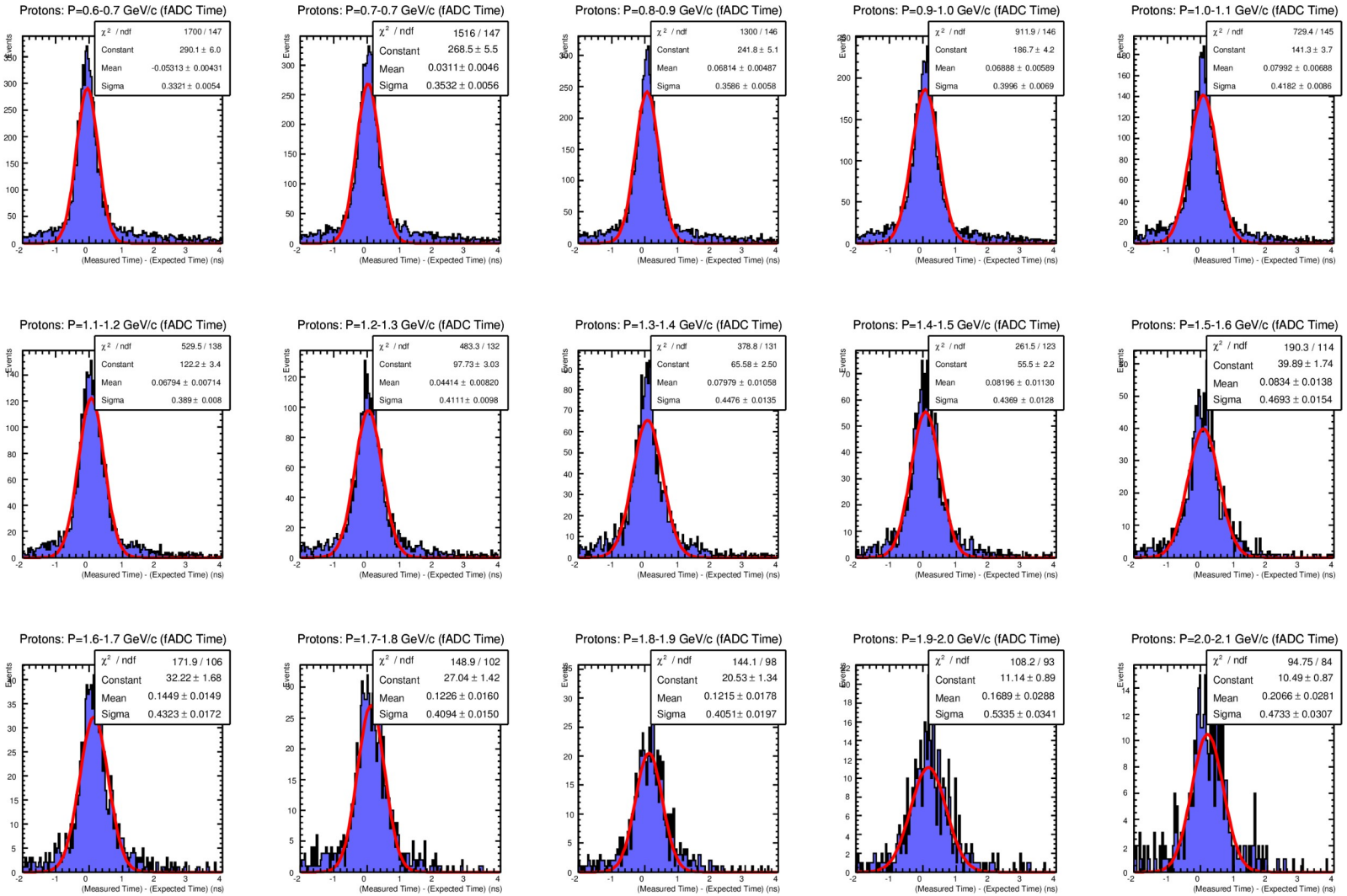
Run 10913 (fADC Time): Positively-Charged



Calibration on Protons

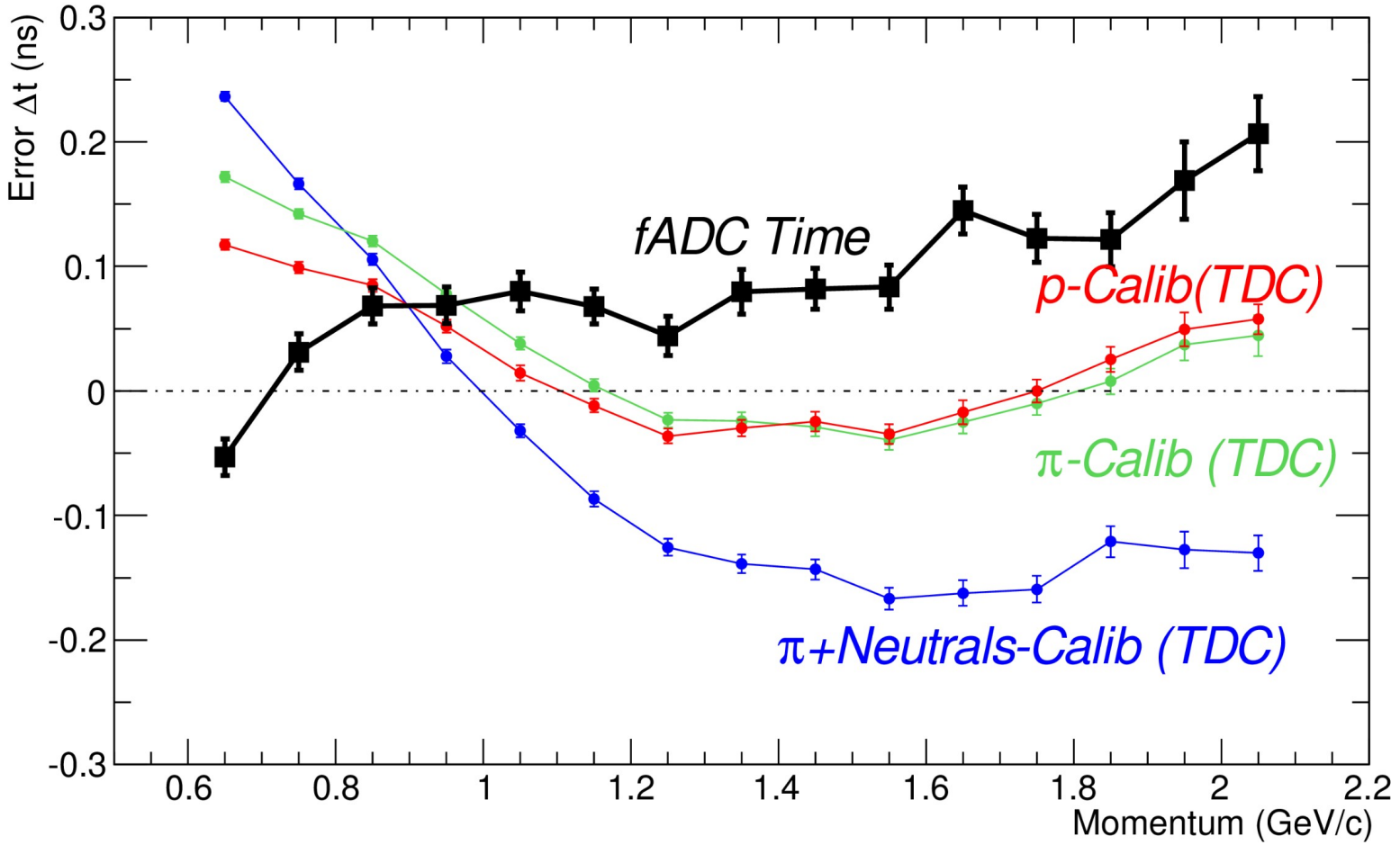


Time from fADC

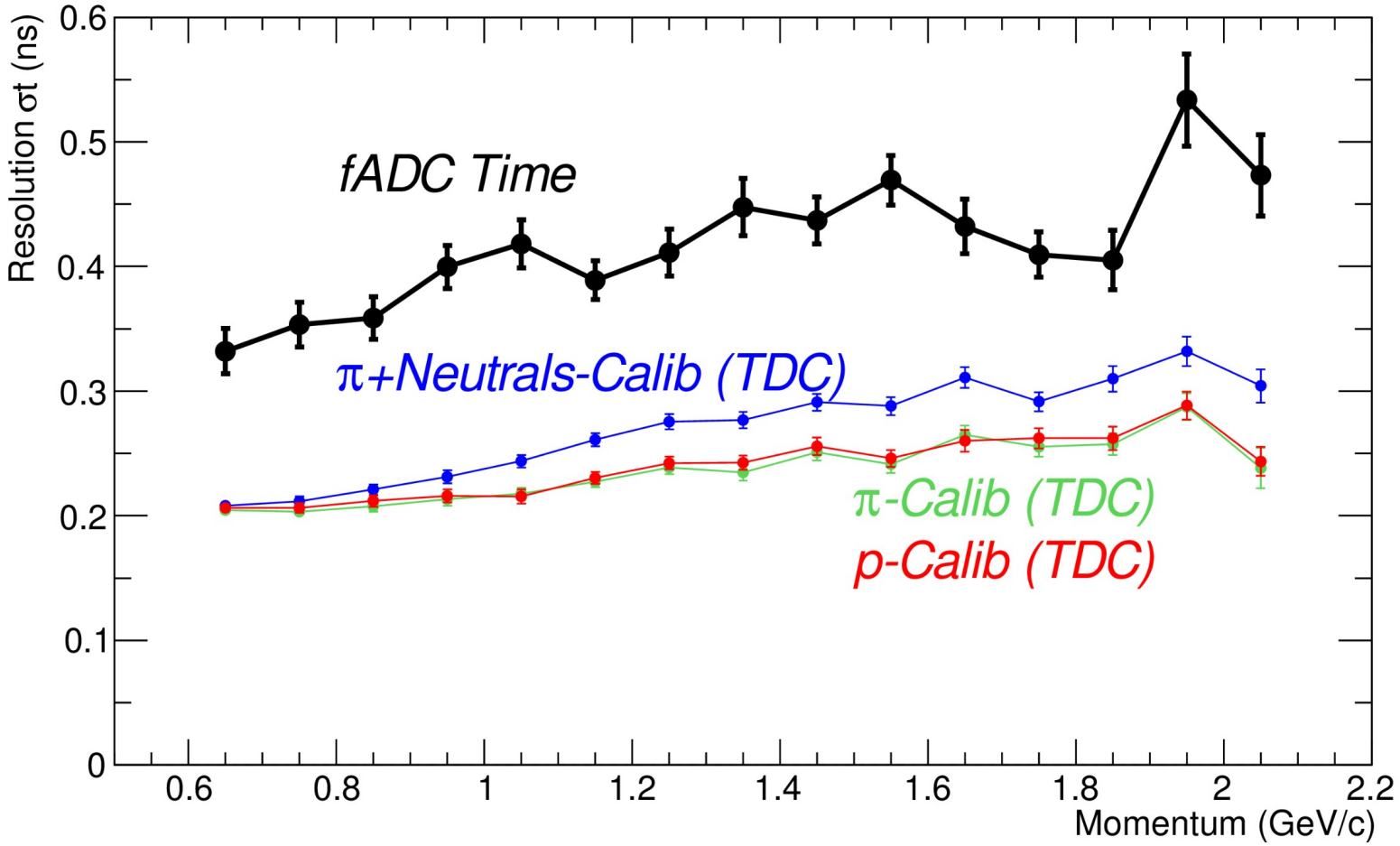


Note the tales in the spectra (to be compared with slide #6).

Comparison of Systematic Errors in Protons Timing (TDC vs fADC)



Comparison of Resolutions in Protons Timing (TDC vs fADC)



Conclusions:

1. “Rough” time calibration (viz., the one that is done on pions and neutrals) provides resolution of about 400-450 ps that is enough for clusterization.

2. Ionization energy losses in the BCAL material can not explain the slopes in the $Mass^2$ distributions for the charged particles.

3. For precise timing, the PID-dependent time calibration is needed; that can reduce the momentum-dependent (or Z-dependent) systematics in the time measurements by the factor 3 (viz., from about 300-350 ps to 120 ps for protons), and improve the time resolution by the facor 1.5-2 (viz., 200-300 ps for charged particles).

4. The time measurements with fADC have the systematics that is comparable with PID-dependent time measurements with TDC; the time resolution with TDCs is about 2 times better.

5. The significant tales (4 ns and more) in the fADC time distributions probably lead to significant probability of RF-bucket mis-identifications.