dE/dx analysis of kaon spectra at 20 AGeV
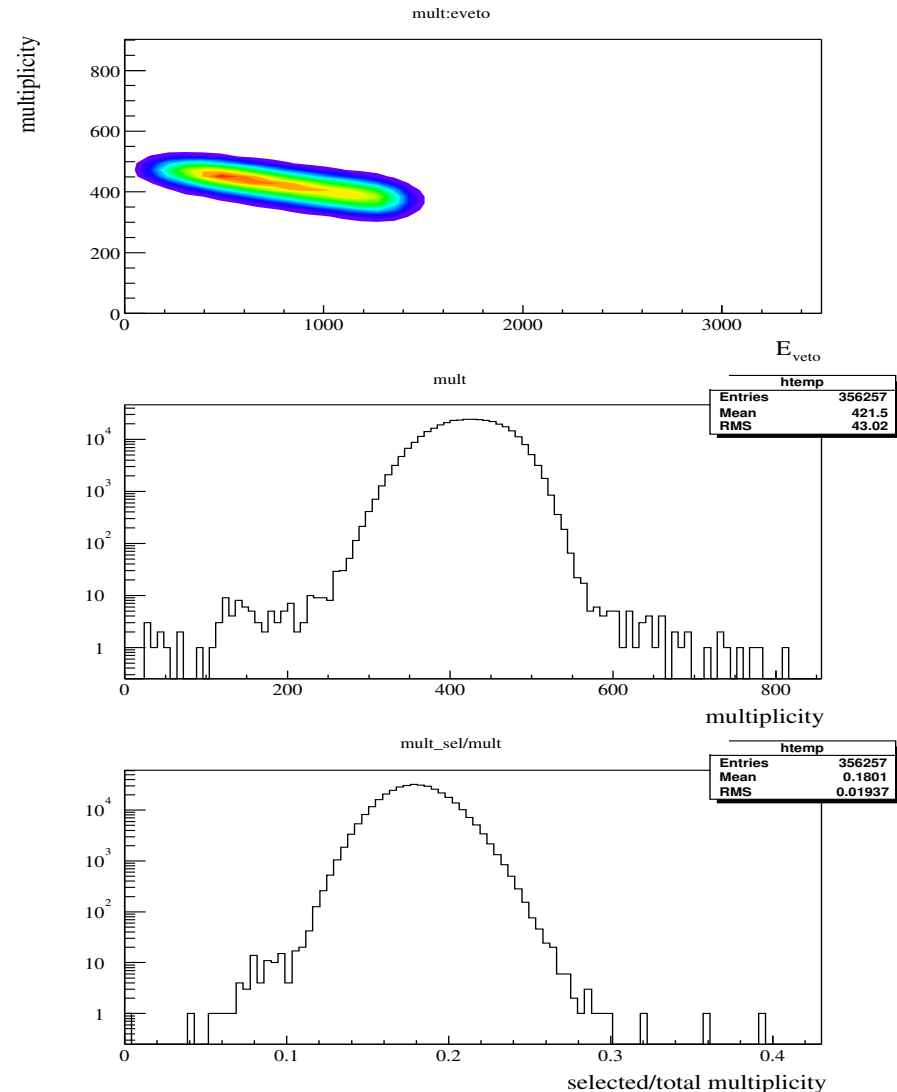
Marco van Leeuwen

Cuts

Standard event cuts (iflag and on-line E_{veto})

Track cuts (same as at other energies)
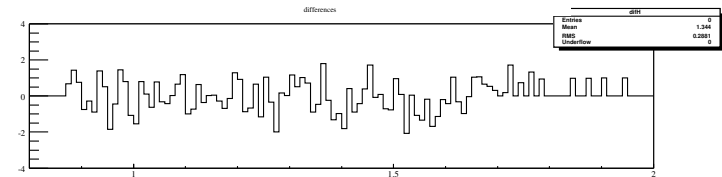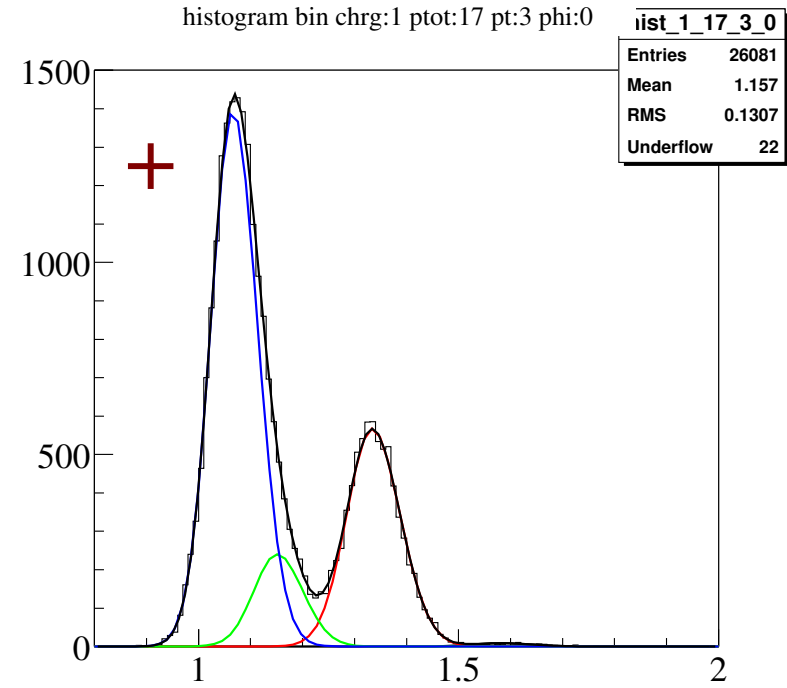- n_max_point[2] >= 50
- right side $|\varphi| < 30^0$
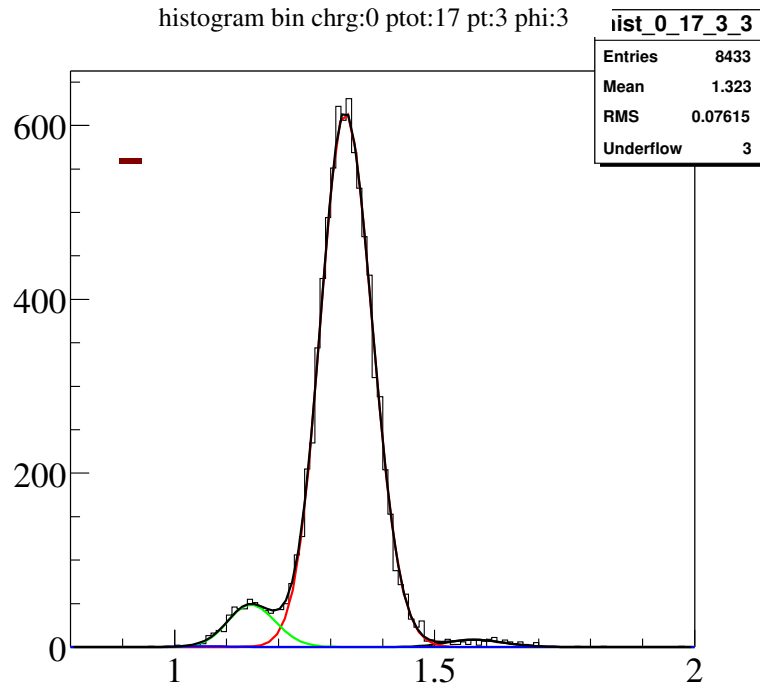- n_point[2]/n_max_point[2] >= 0.5
- require points in VTPC if maximum number of points >= 10 in one of them

approx. 365k events from miniDST used.

dE/dx distributions

Fit function

for each charge, p, p_t, φ bin (2x40x20x2 bins)

$$F(x; A_i, x_i, \sigma, \delta, \alpha) = \sum_{i=e,\pi,K,p} A_i \; \frac{1}{\sum_l n_l} \sum_l n_l \, g(x; x_i, \sigma_{i,l}, \delta)$$

parameters:

A_i amplitudes

x_i dE/dx peak positions, assume x_K/x_π, x_p/x_π are independent of charge, φ, p_t

σ resolution

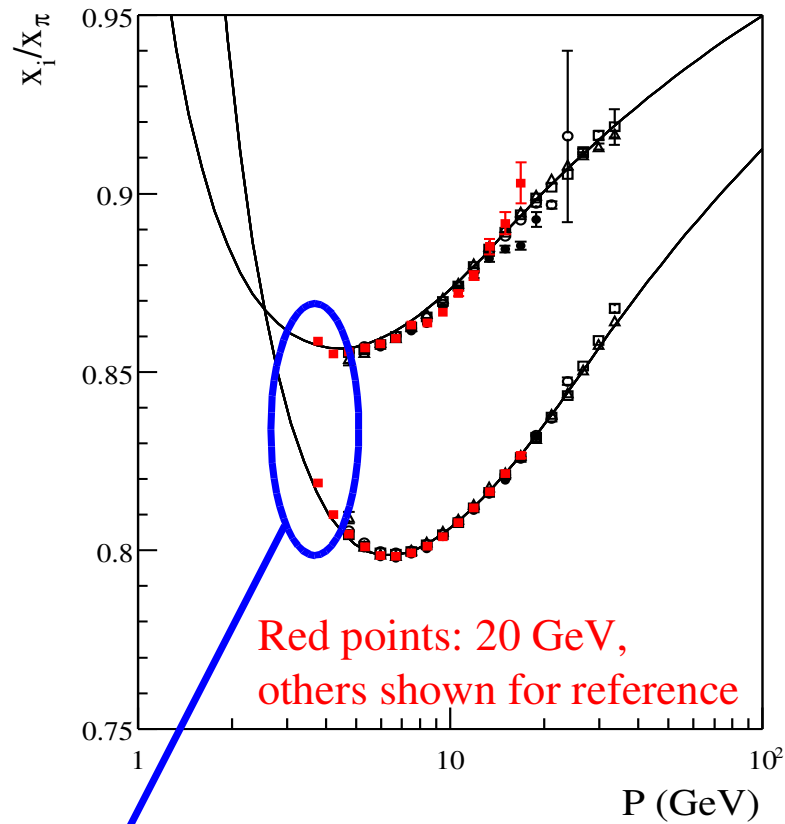α 'width scale parameter', default: 0.625, check sensitivity

δ asymmetry parameter, constant with charge, φ, p_t

$$\sigma_{i,l} = \frac{\sigma}{\sqrt{l}} x_i^\alpha \qquad\qquad g(x; x_i, \sigma_{i,l}, \delta) = \frac{1}{\sqrt{2\pi}\,\sigma_{i,l}} \exp{-\frac{1}{2}\left(\frac{x-x_i}{(1\pm\delta)\sigma_{i,l}}\right)^{2,}} \quad \begin{array}{l} + \textit{for } x > x_i \\ - \textit{for } x < x_i \end{array}$$

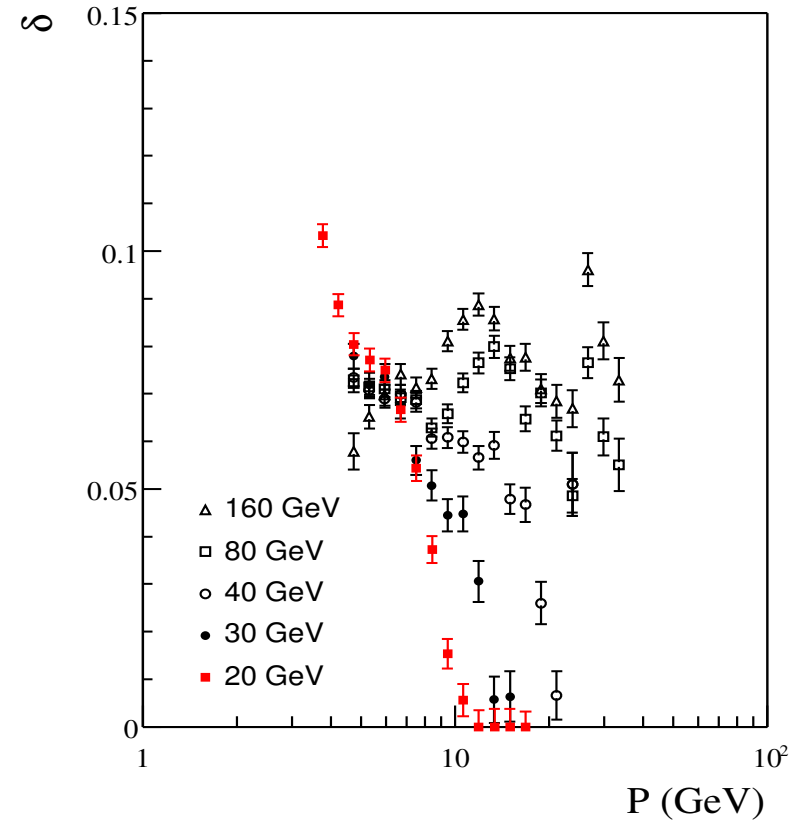technical note: now using log likelihood fit, instead of χ^2, because of lower statistics

Fit parameters

relative kaon, proton peak position

Asymmetry parameter

Red points: 20 GeV,
others shown for reference

△ 160 GeV
□ 80 GeV
○ 40 GeV
● 30 GeV
■ 20 GeV

We can probably get
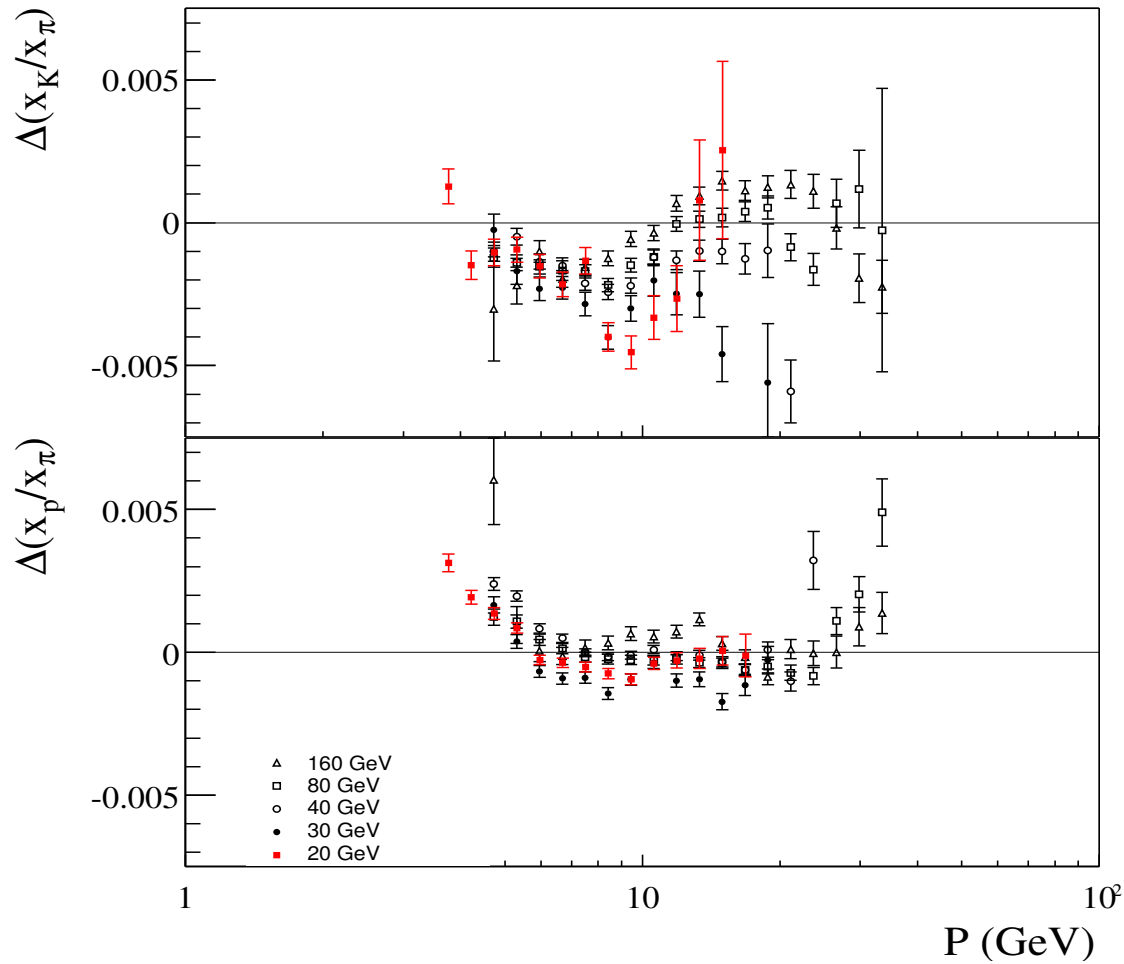two more bins at low
momentum, rapidity

note: tendency of asymmetry parameter to go to 0 at large p
stronger with decreasing energy
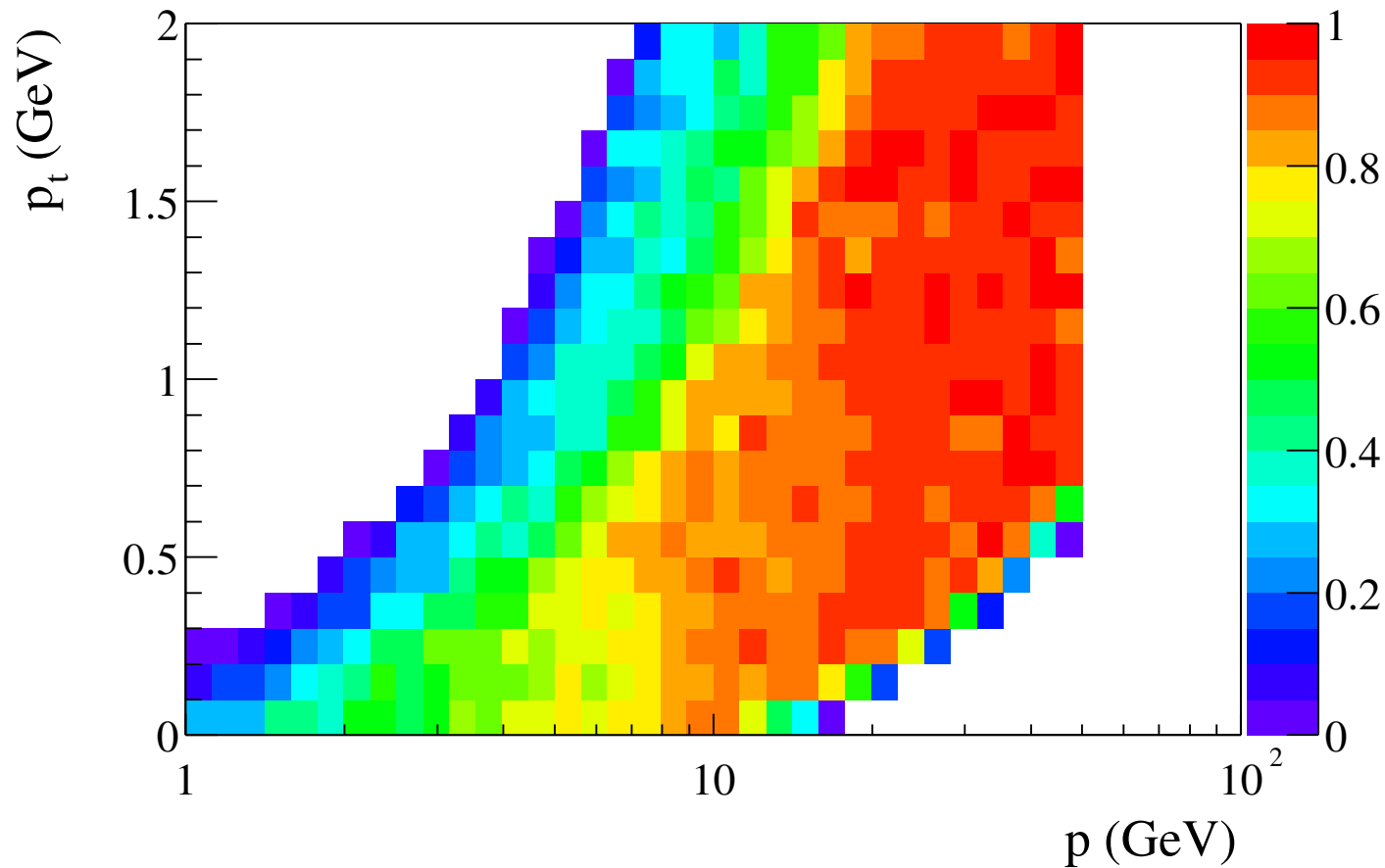
$\longrightarrow$ Effect not yet understood, see later
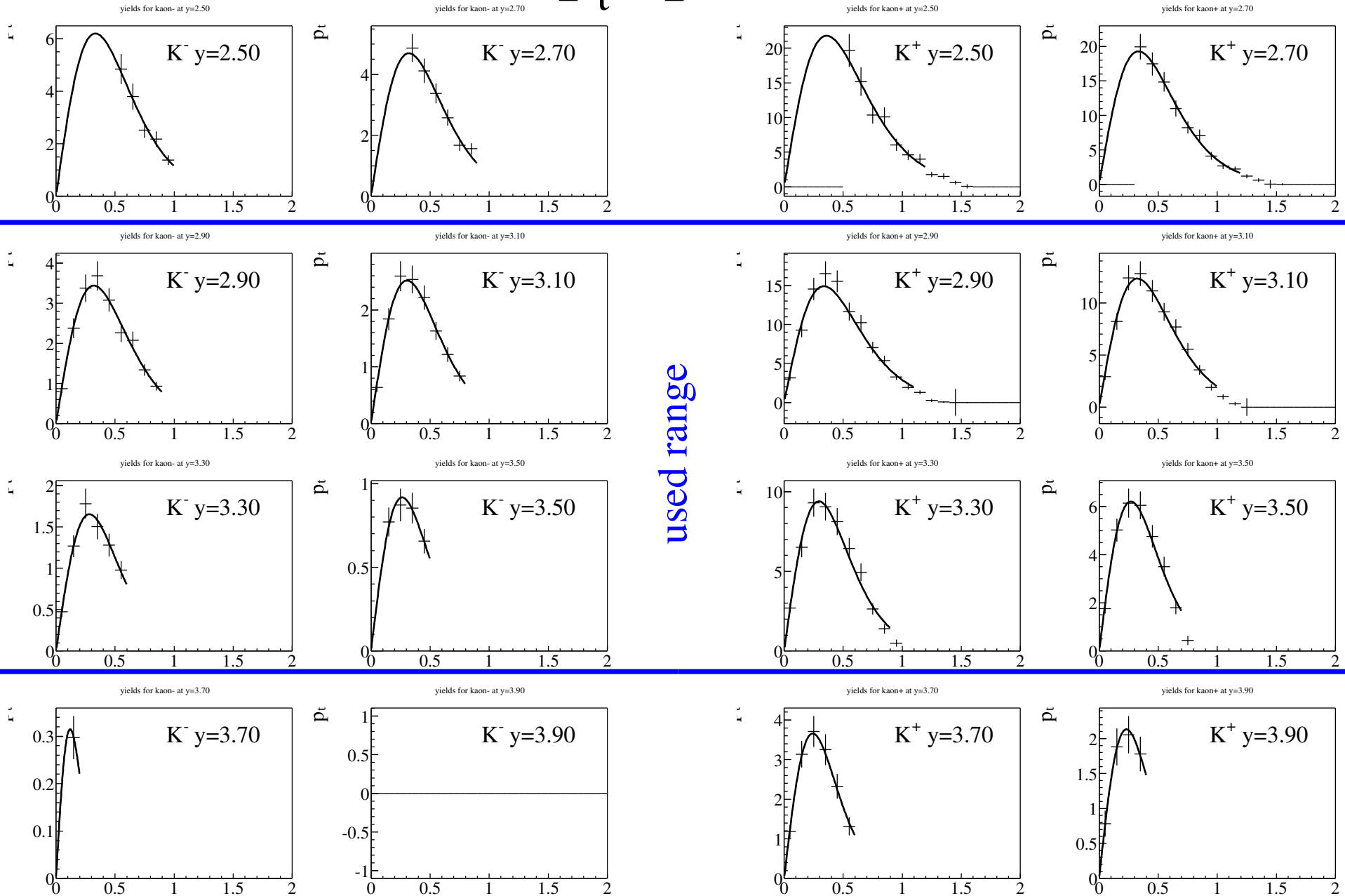
Fit parameters compared to BB

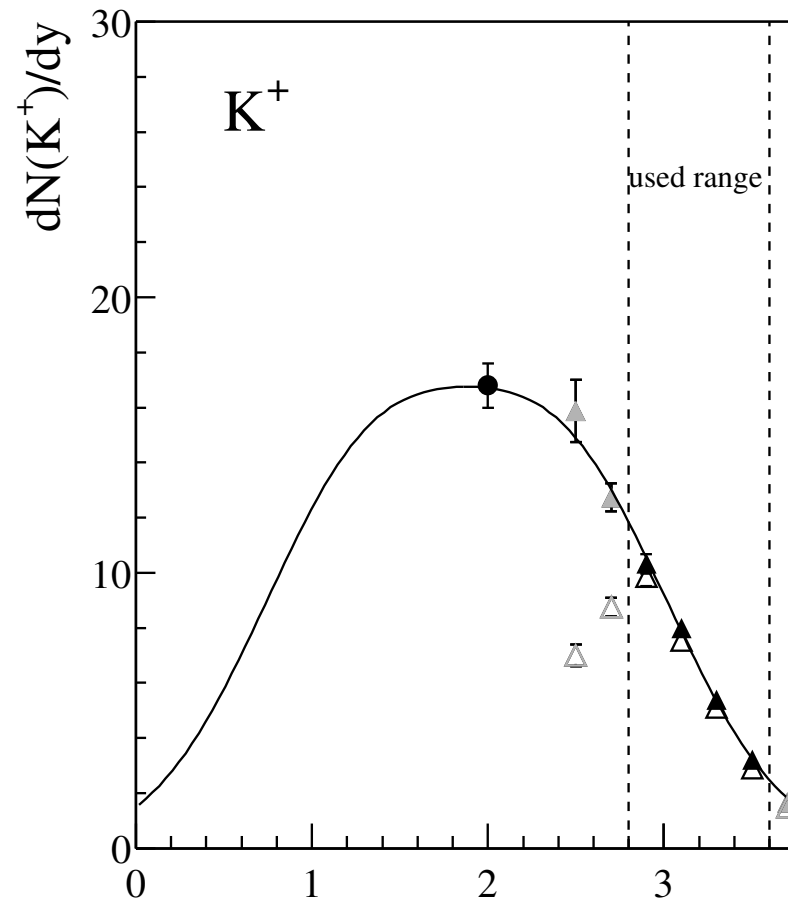Relative positions at all energies agree to the (few) per mille level.
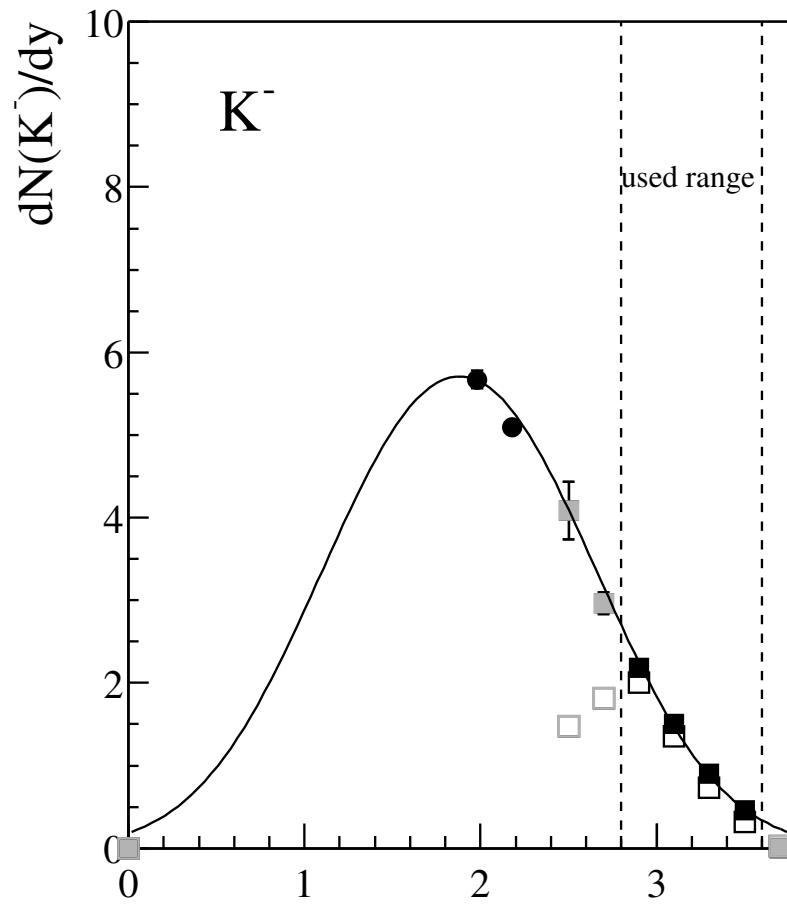
Acceptance at 20 GeV

GEANT only, no embedding available yet.
Efficiency corrections expected to be small
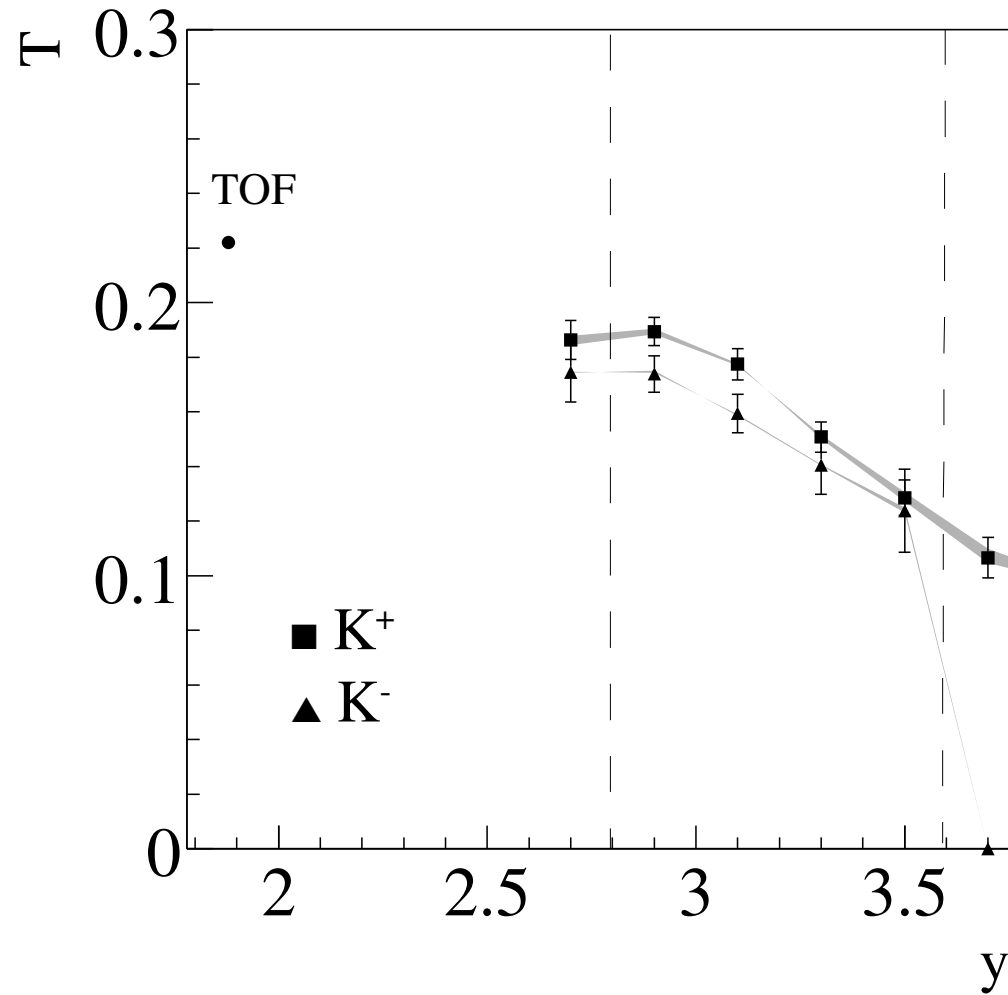
p$_t$-spectra

rapidity spectra

Open points: p_t-spectra summed
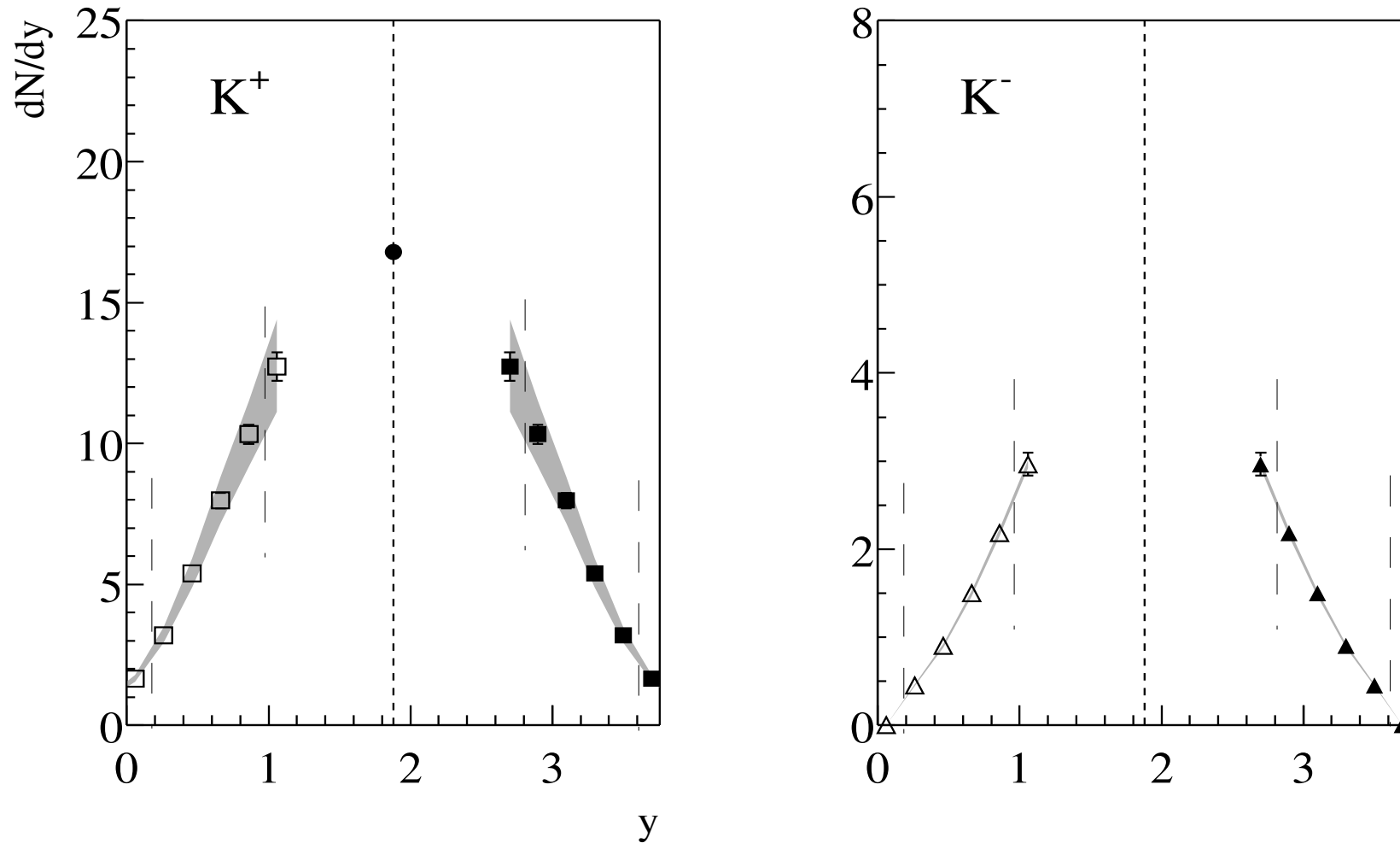
Full points: summed+extrapolation to high/low p_t

Senistivity test I: slope vs rapidity

Grey band indicates variation
of width scaling parameter α
from 0.5 to 0.75

$$(\sigma_i = x_i^\alpha)$$
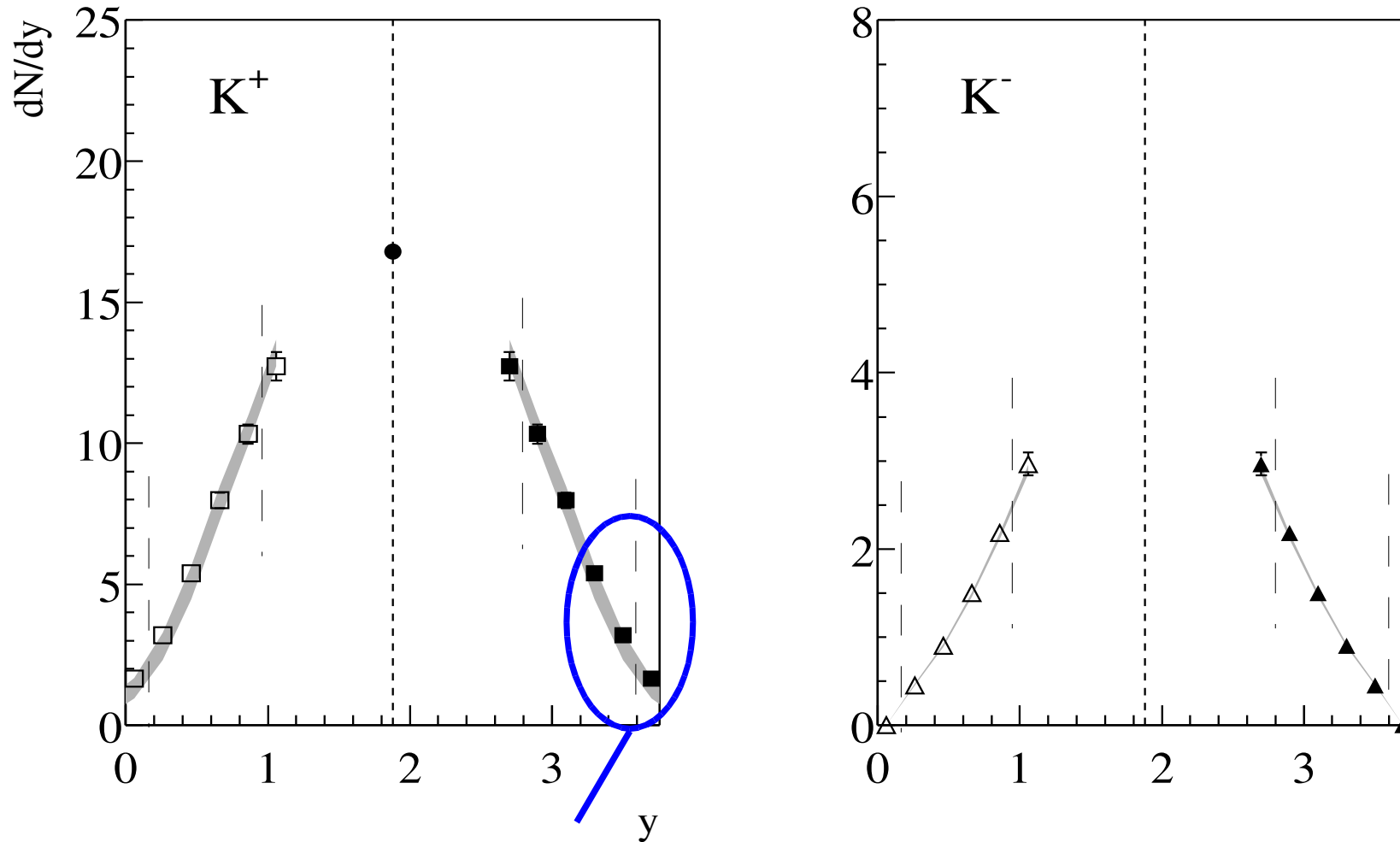
Sensitivity test II: Rapidity spectra

Sensitivity to α increases towards mid-rapidity.
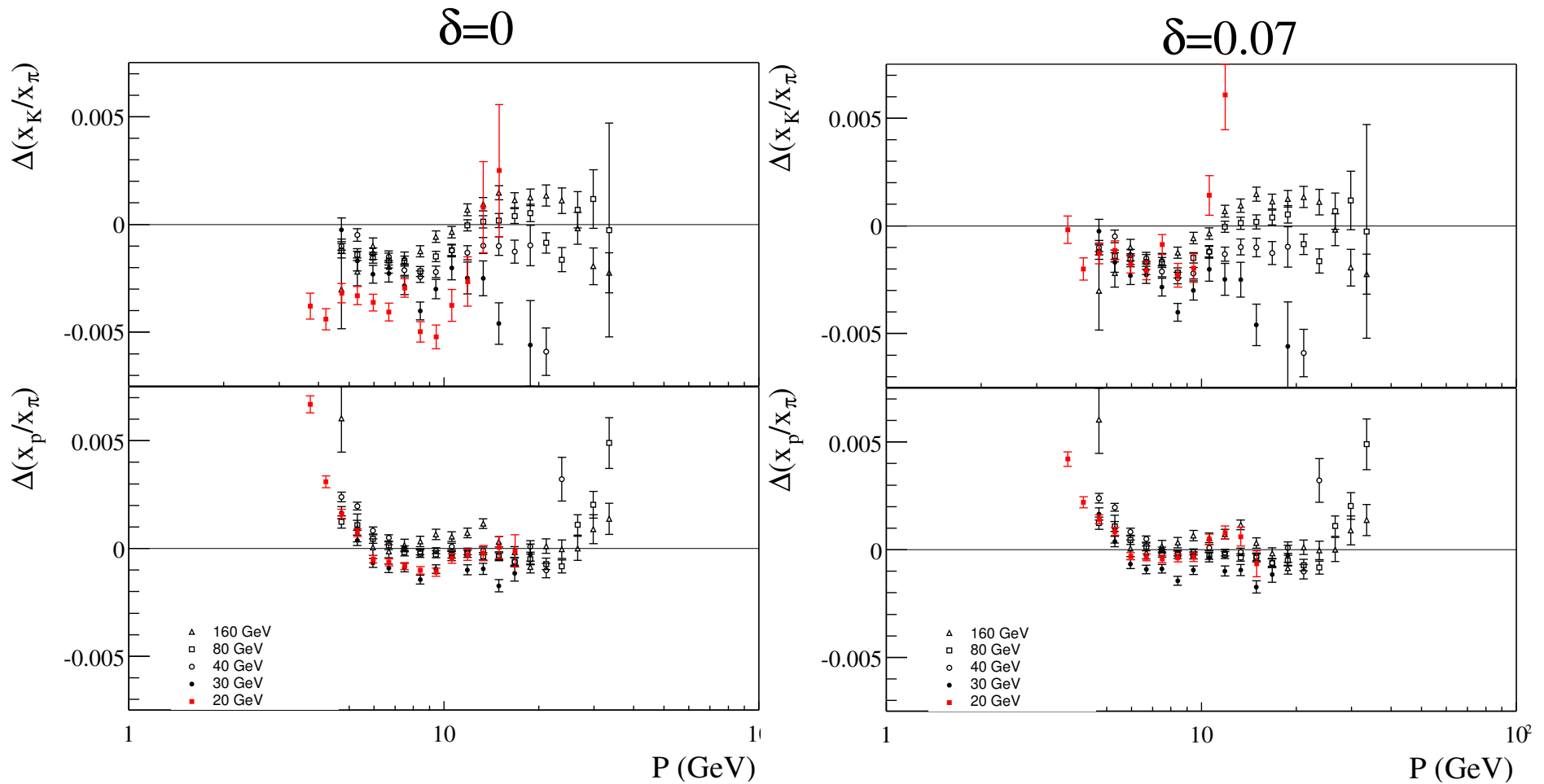note: first bin is in excluded region (large extrapolation to $p_t=0$)

Sensitivity test IIb: Rapidity spectra

grey band indicates variation of δ between 0 and 0.07
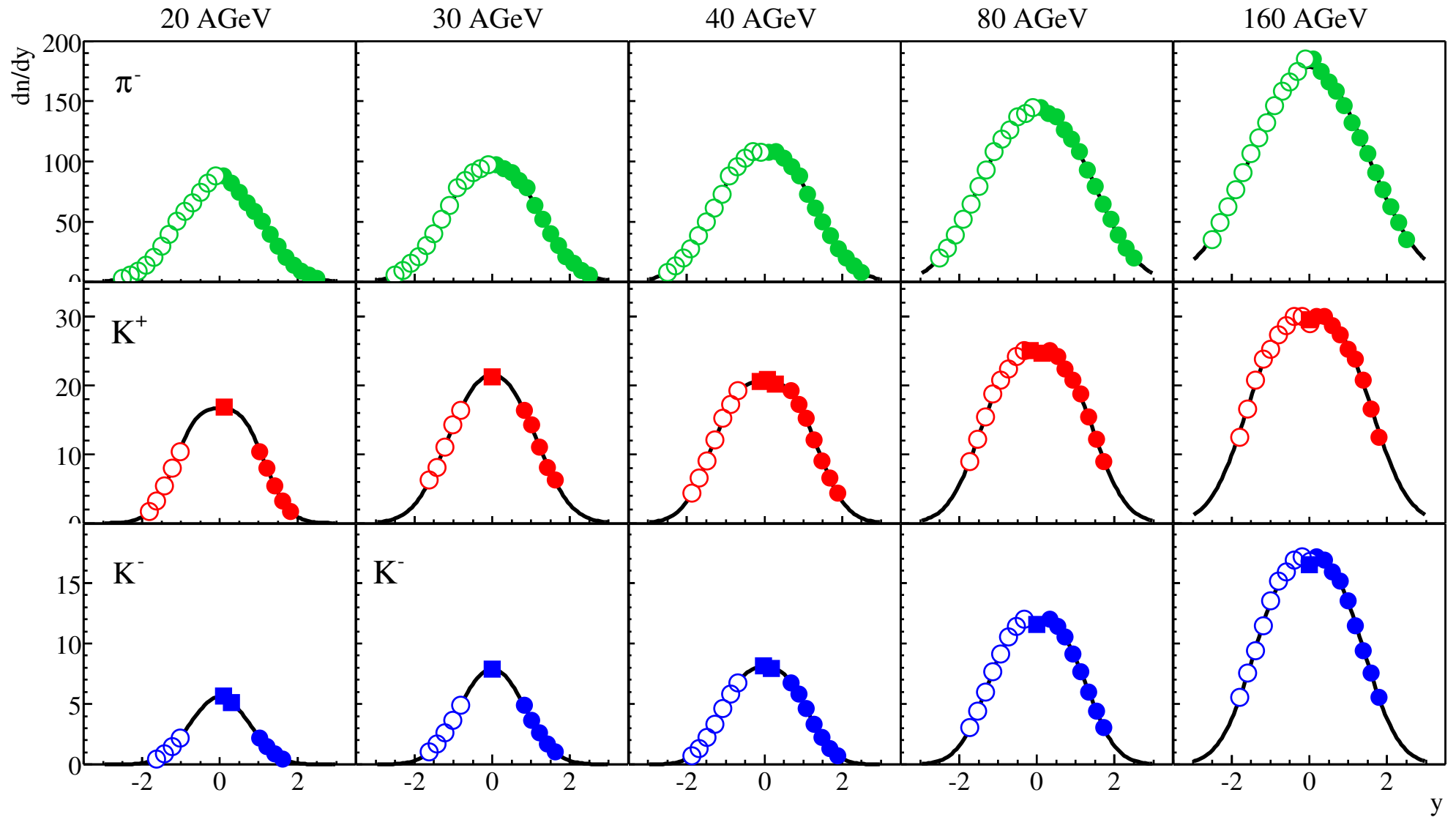

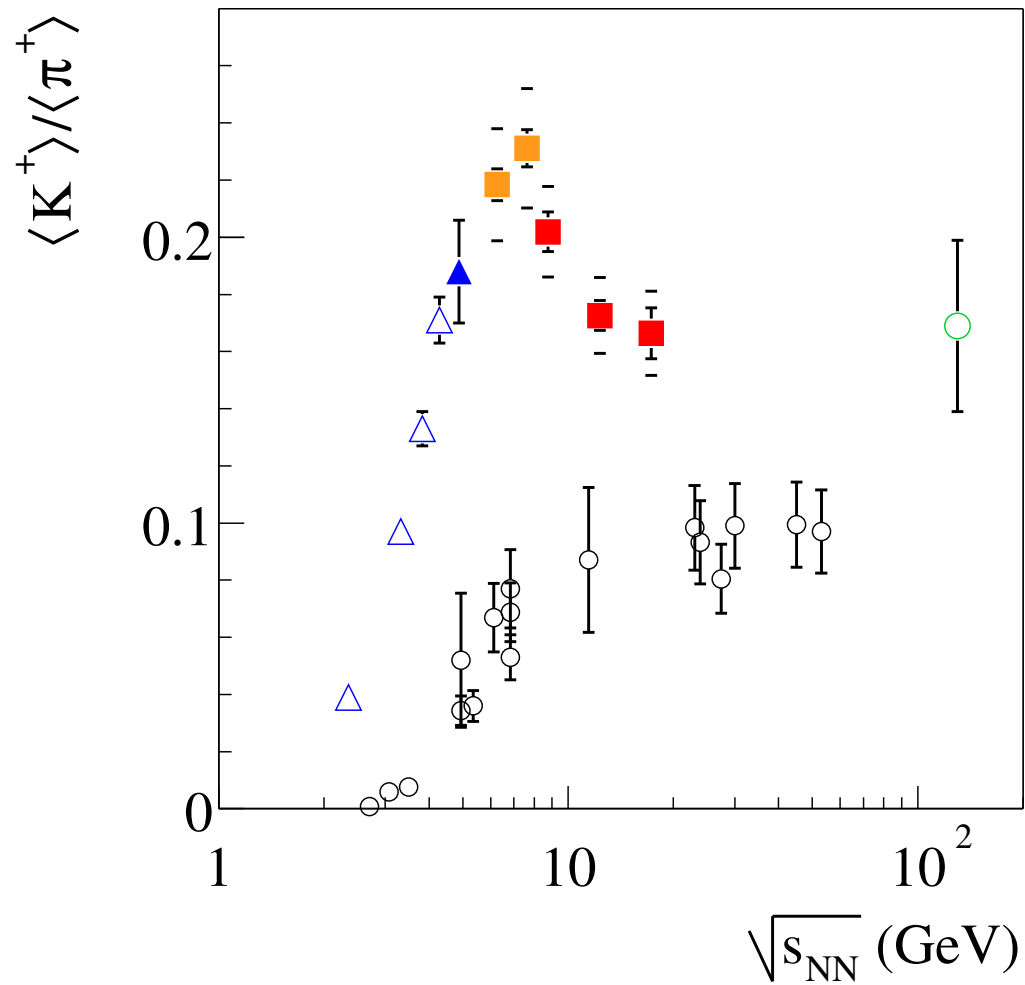10-30% effects in this corner!

Fitted positions with fixed δ

δ=0

δ=0.07

Keeping δ fixed at 0.07 gives large deviations at high *p*

K, π rapidity spectra

Energy dependence

No K⁻ yet, will be available soon...
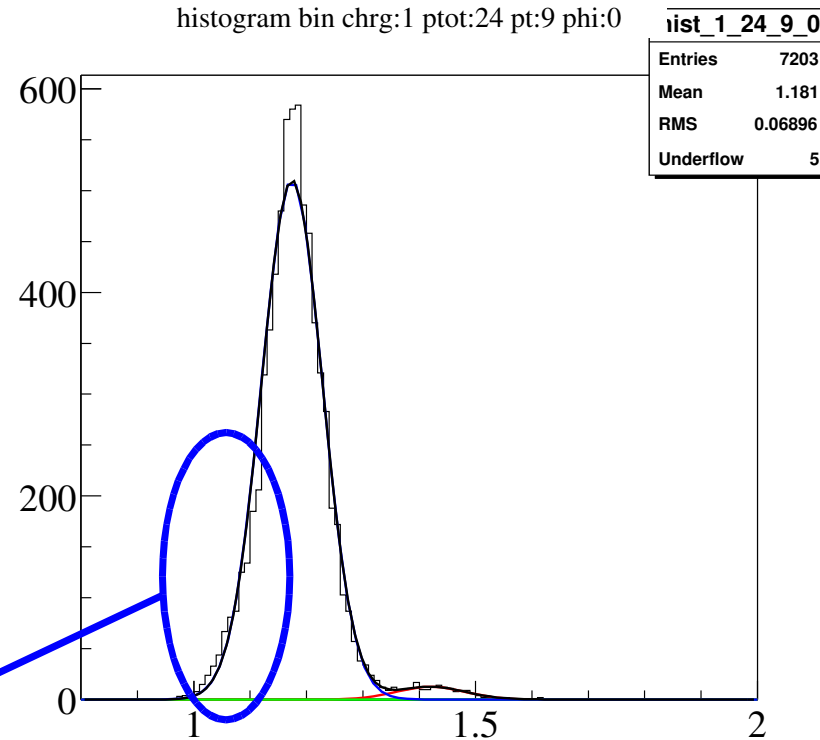
Conclusion

20 (and 30) AGeV data have been analysed following the strategy established for other energies

(final efficiency corrections will be determined from embedded events for pion analysis)

Some fit parameters behave qualitatively different than at other energies (asymmetry parameter)
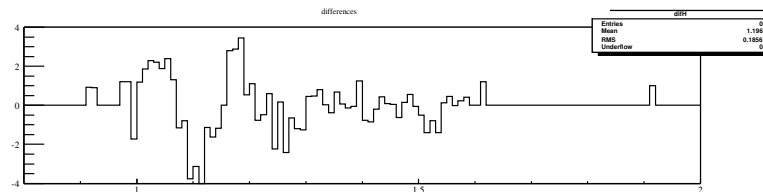
⟶ Need to find out whether these are important and/or need special treatment (next slide)

Example of a problematic bin

histogram bin chrg:1 ptot:24 pt:9 phi:0

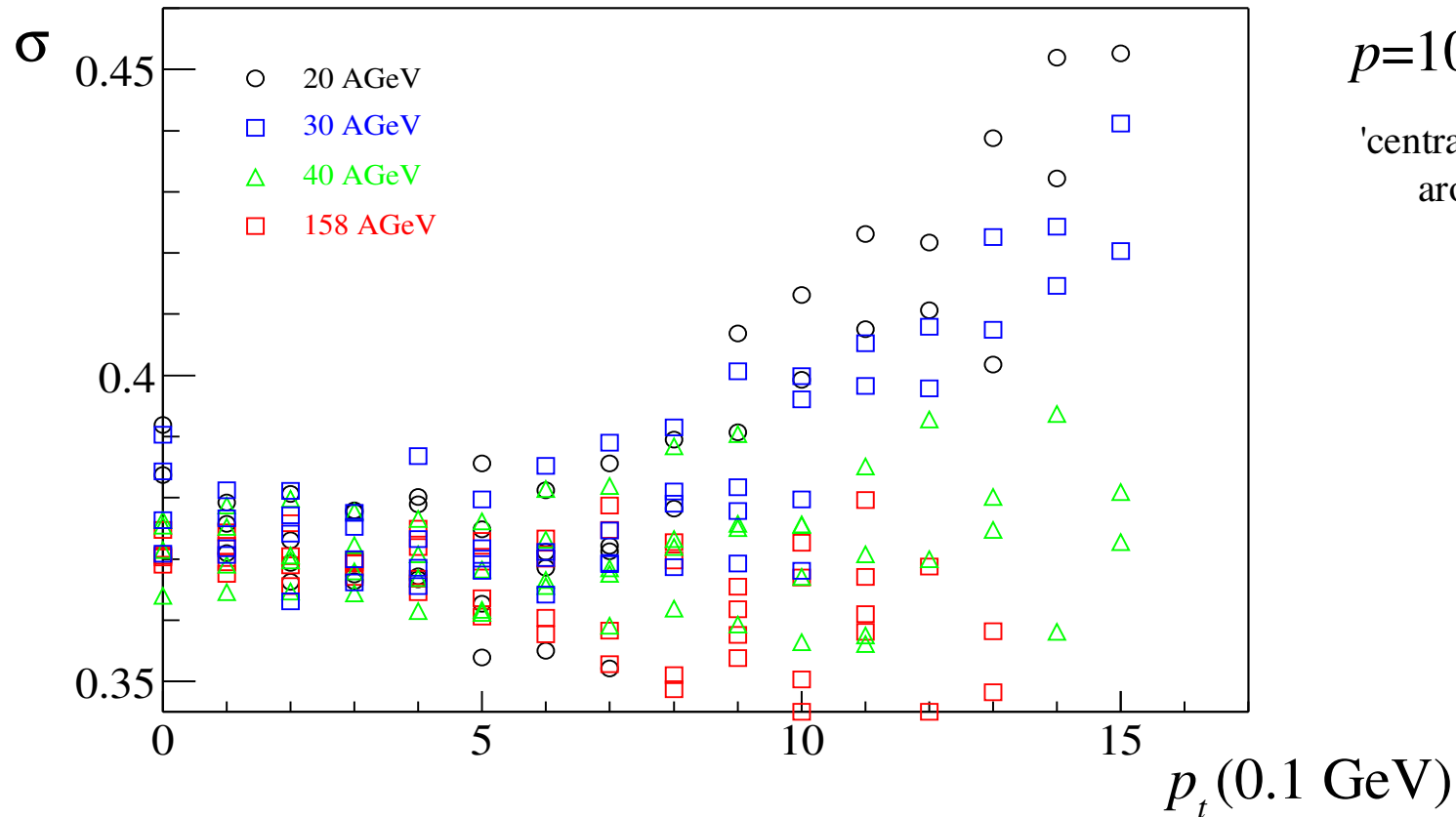| hist_1_24_9_0	
Entries	7203
Mean	1.181
RMS	0.06896
Underflow	5

bin at:

$p = 17$ GeV

$p_t = 1$ GeV

$(y_K = 3.4)$

This tail is at the wrong side: negative asymmetry δ.

This bin is close to a sector boundary; tail could be due to a calibration problem

Another problem?

p=10 GeV

'central acceptance',
around y=2.9

Legend:
○ 20 AGeV
□ 30 AGeV
△ 40 AGeV
□ 158 AGeV

σ axis: 0.45, 0.4, 0.35

x-axis: p_t(0.1 GeV), values 0, 5, 10, 15

40 and 158 GeV: resolution more or less independent of p_t

20 and 30 GeV: resolution strongly decreases above ~ 1GeV p_t

note: σ should be relatively insensitive to tracklength