

# Energy dependence of $\phi$ production in Pb+Pb

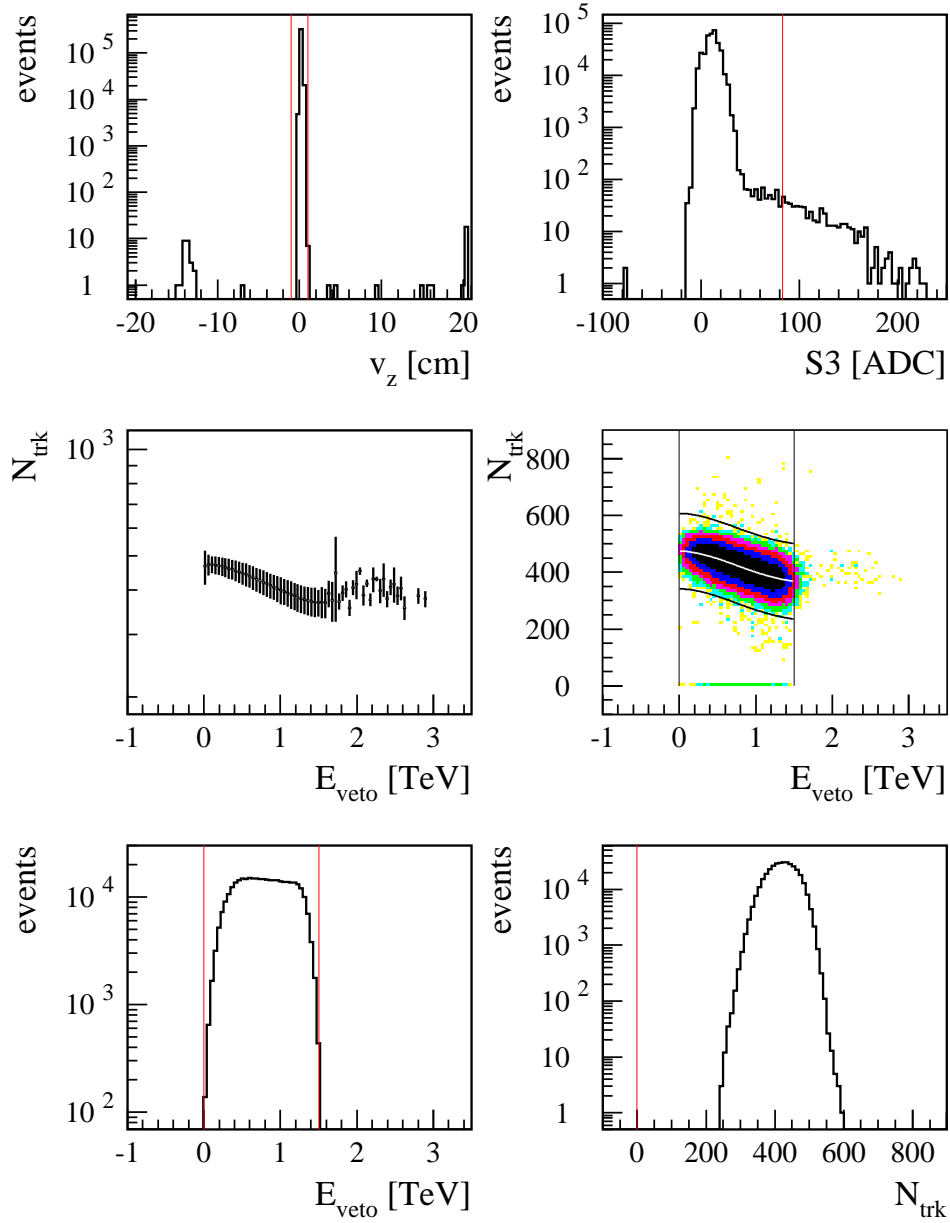
## Status of analysis

V. Friese, GSI

- Analysis of 20 AGeV Pb+Pb
- Analysis of 158 AGeV Pb+Pb (central) from 1996

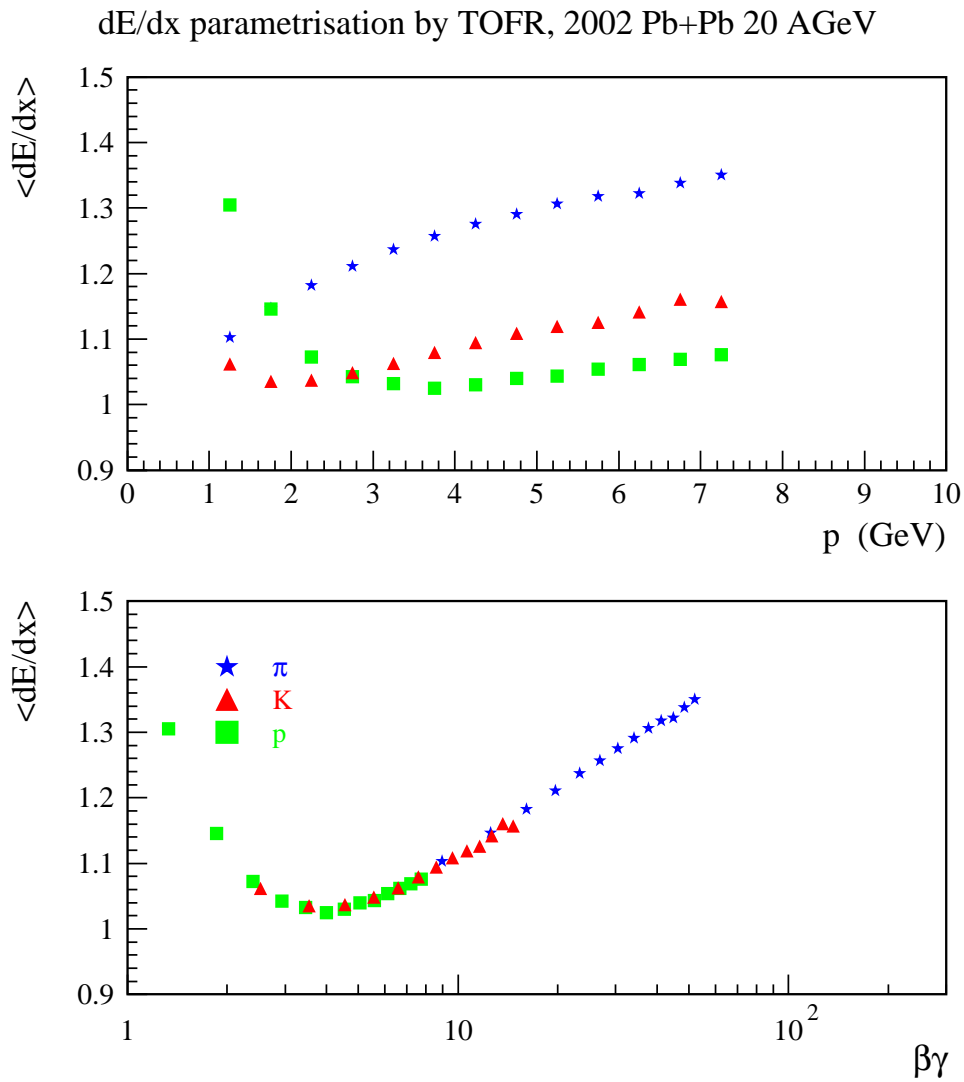
NA49 collaboration meeting, GSI, October 2003

# Event selection, 20 AGeV



356,397 / 359,053 events used (99.26 %)

# dE/dx parametrisation with TOF for $K^+$ / $K^-$ candidate selection

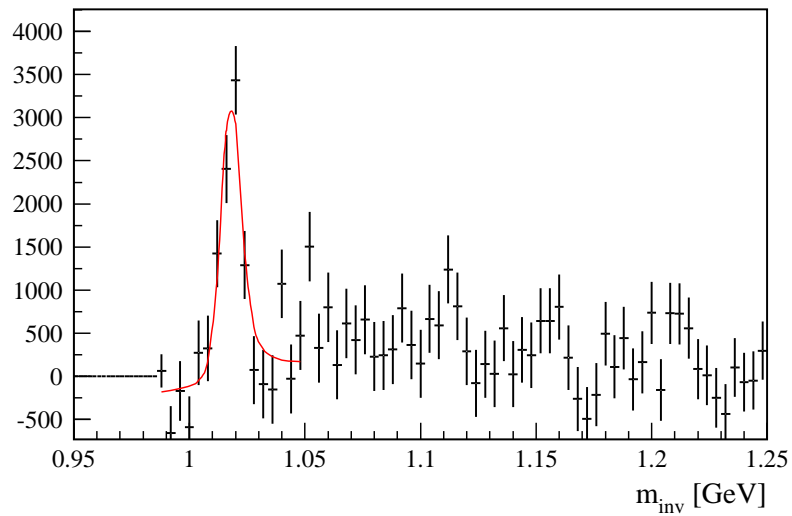
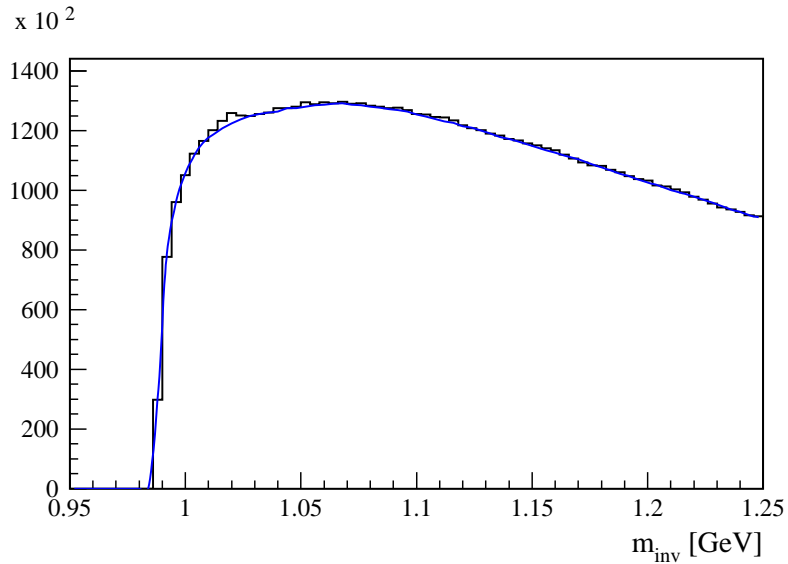


Momentum range : 1.0 - 7.5 GeV  
 Extrapolation of kaon dE/dx to  $\beta\gamma = 54$  ( $p_K = 27$  GeV)

## Track cuts, 20 AGeV

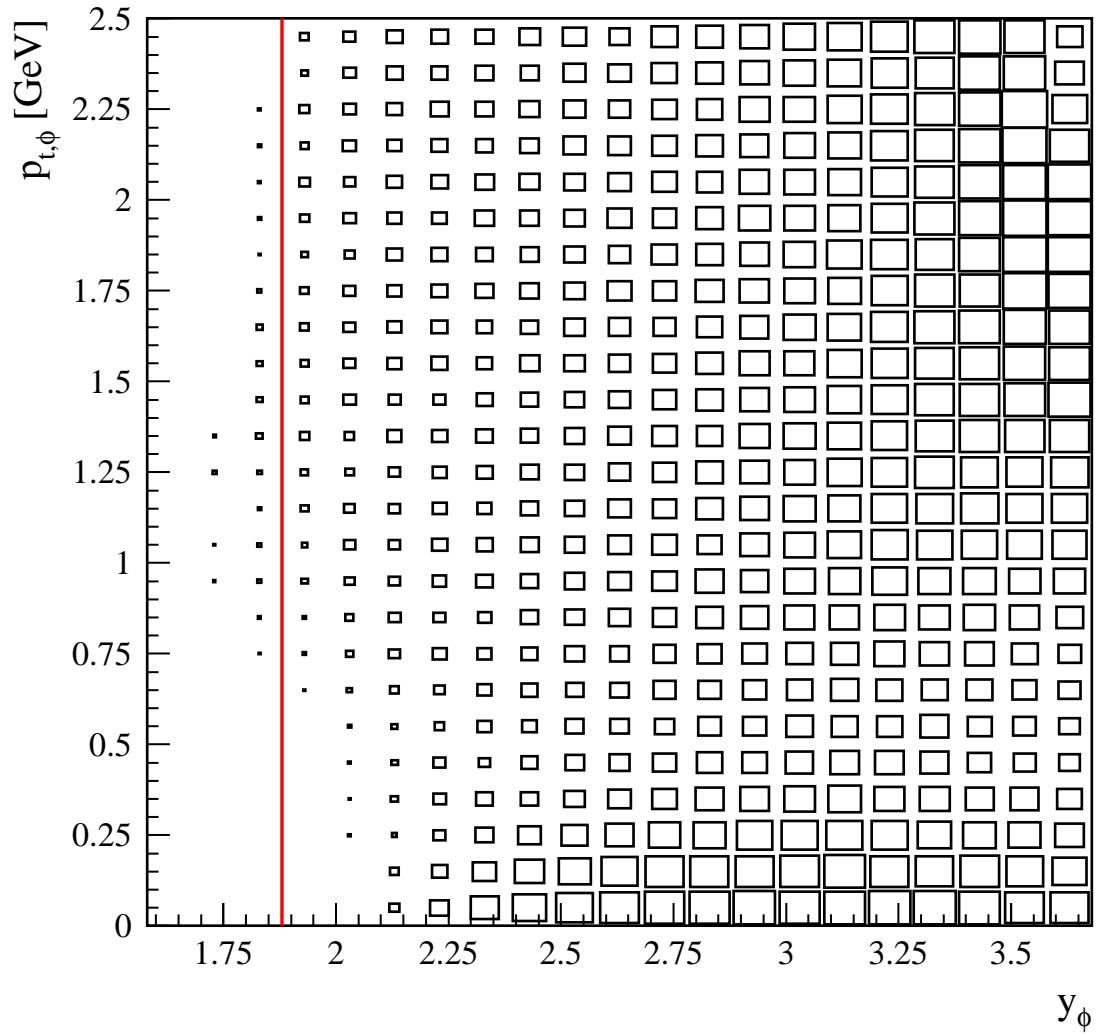
- $\text{track.iflag} = 0$
- MTPC tracks with  $l_{MTPC} > l_{min}$  (standard 1m)
- $2 \text{ GeV} < p < 27 \text{ GeV}$
- $|dE/dx - \langle dE/dx_K \rangle| < a \sigma_{dE/dx}$  (standard 1.5)

## $K^+K^-$ invariant mass in the forward acceptance



- Position of peak :  $m_0 = 1017.9 \pm 0.5$  MeV
- Mass resolution :  $\sigma_m = 3.3$  MeV
- Signal content : 8.600
- signal/background = 1 / 71
- SNR = 11.0

## Geometrical acceptance for $\phi \rightarrow K^+ K^-$ at $B= 1/8 \text{ STD}+$

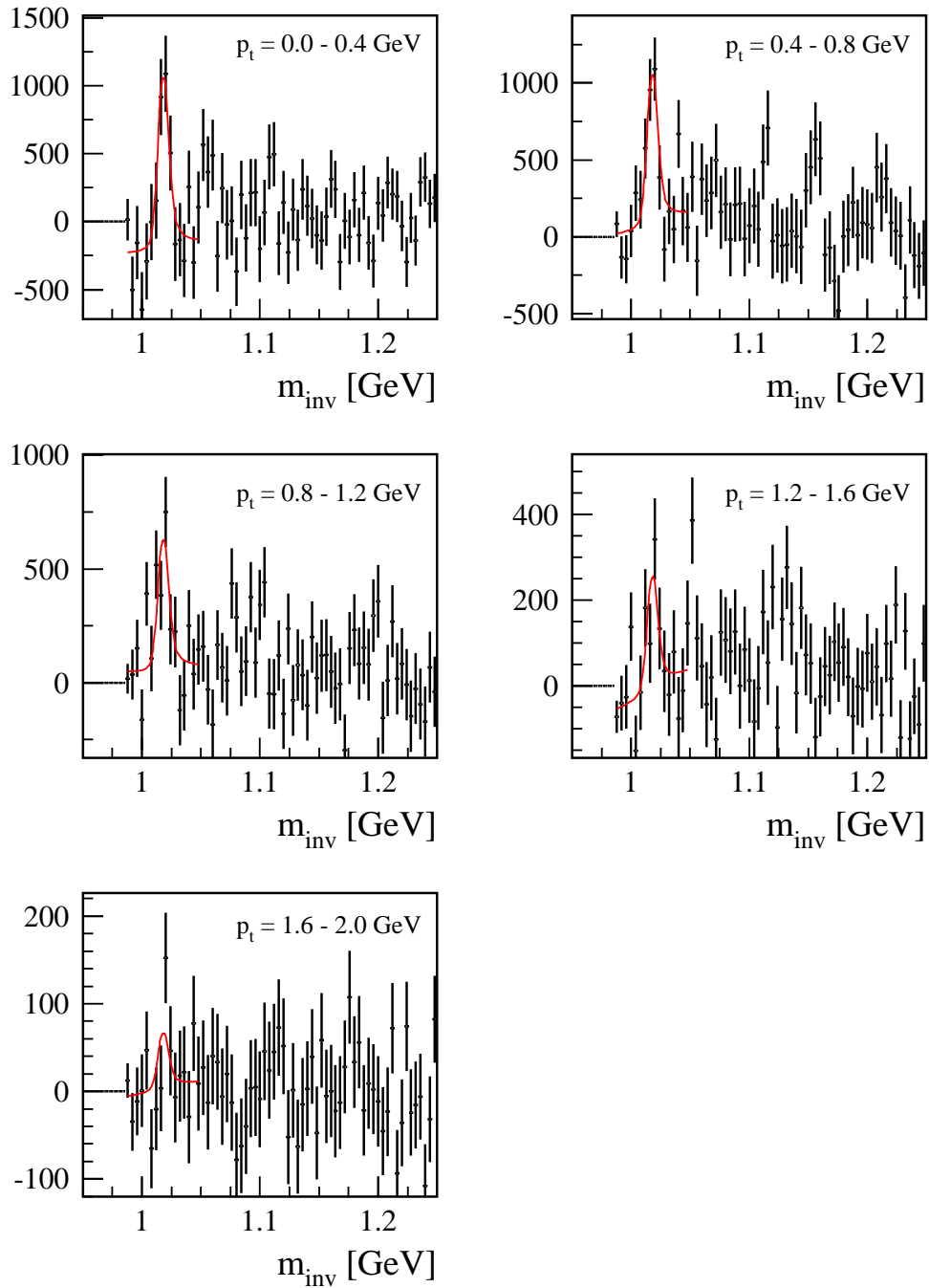


Not well tuned for  $\phi$  !

Lower momentum cut on kaons reduces acceptance around  $y_{cm}$

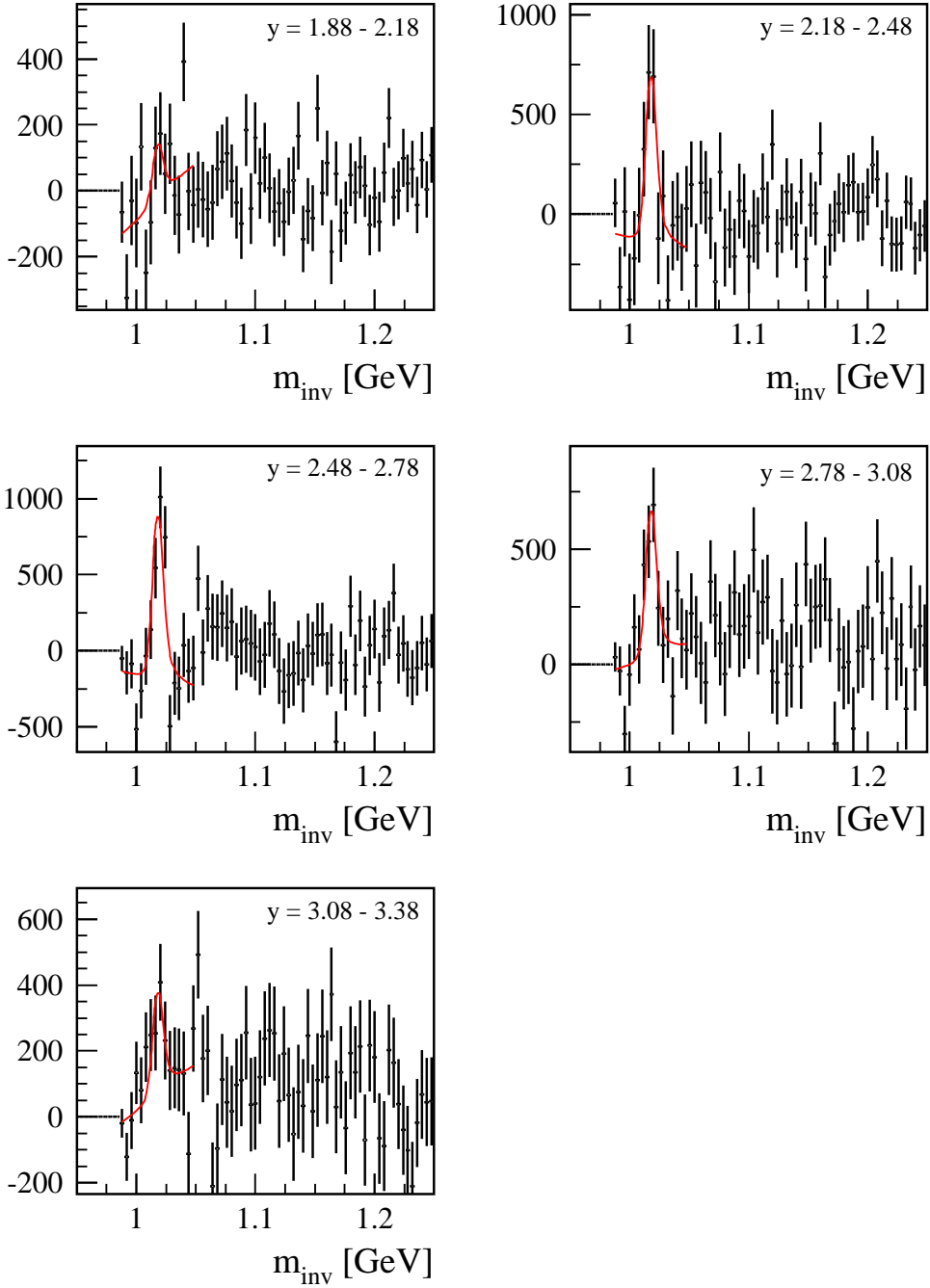
# Signal extraction in $p_t$ bins

Rapidity range 1.88 - 3.68



# Signal extraction in rapidity bins

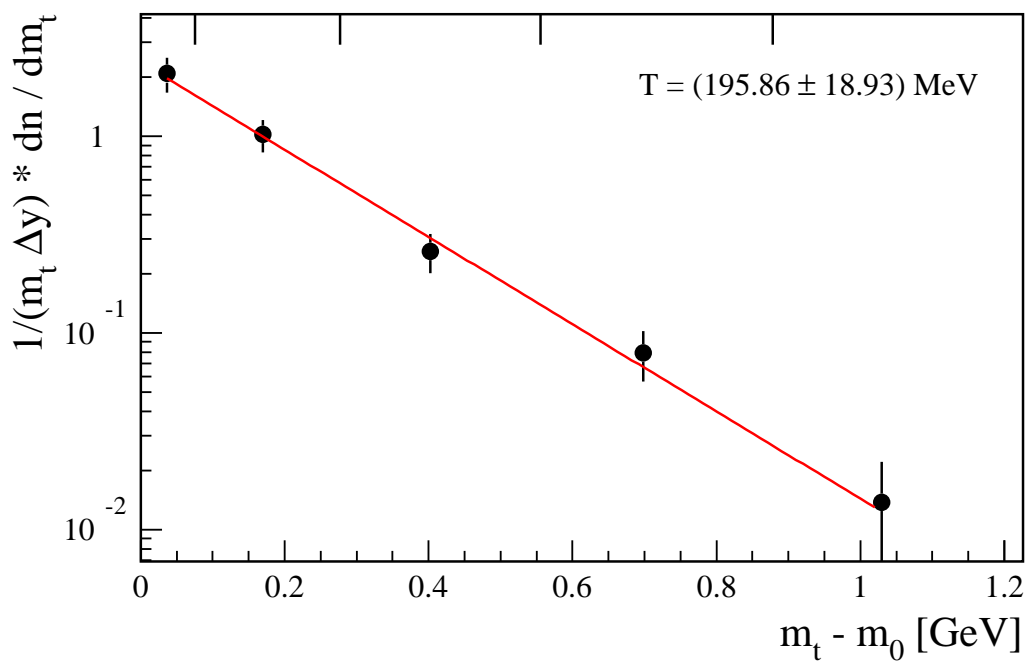
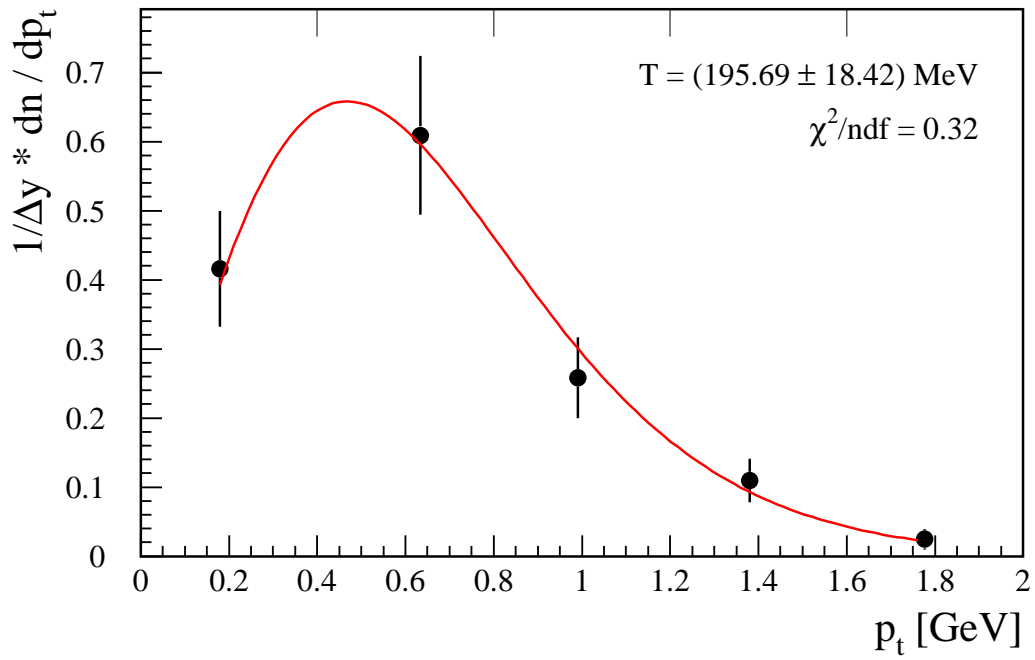
$p_t$  range 0.0 - 2.5 GeV



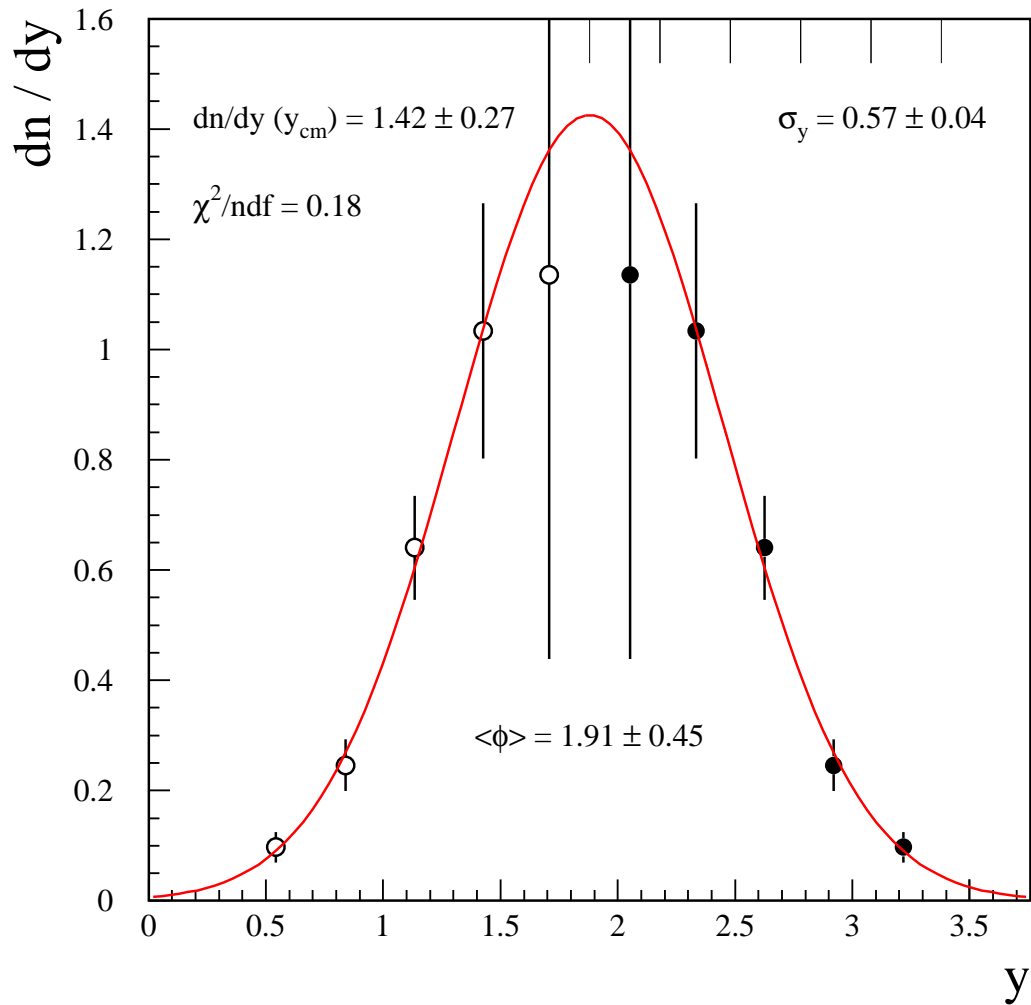


# $\phi$ transverse spectra at 20 AGeV

y range 1.88 - 3.68



# $\phi$ rapidity distribution at 20 AGeV



Very preliminary result :

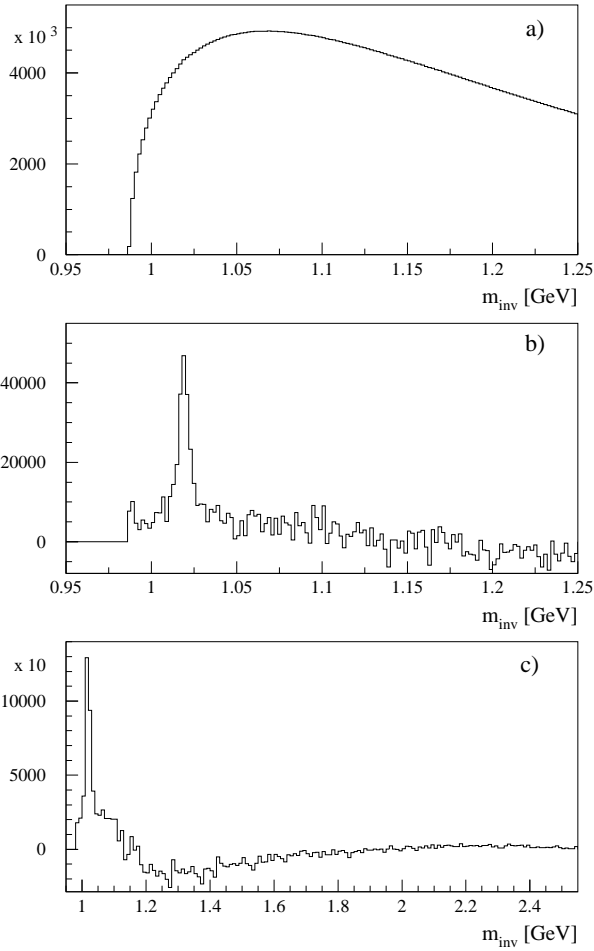
$$\langle \phi \rangle = 1.91 \pm 0.45$$

## $\phi$ in 1996 central Pb+Pb @ 158 AGeV

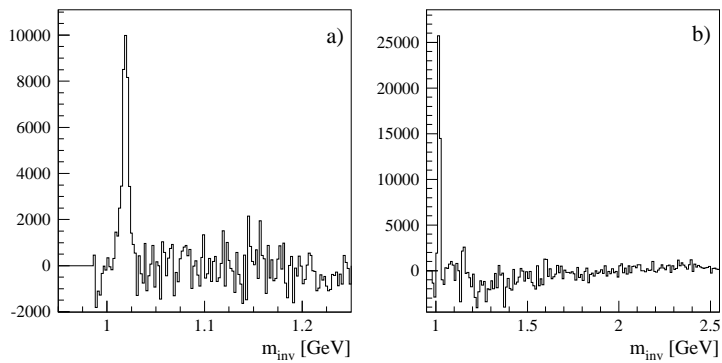
Why a new analysis on published data :

- Slopes at 40 and 80 AGeV are similar, but T at 158 AGeV is significantly higher. Plateau (as for kaons) or not?
- Differences with NA50 (slope, yield) remain
- Quality of 1996 data considered better than 1995 data (dE/dx, tracking)
- For systematic study of energy dependence: All data sets should be studied with the same production chain and analysis method.

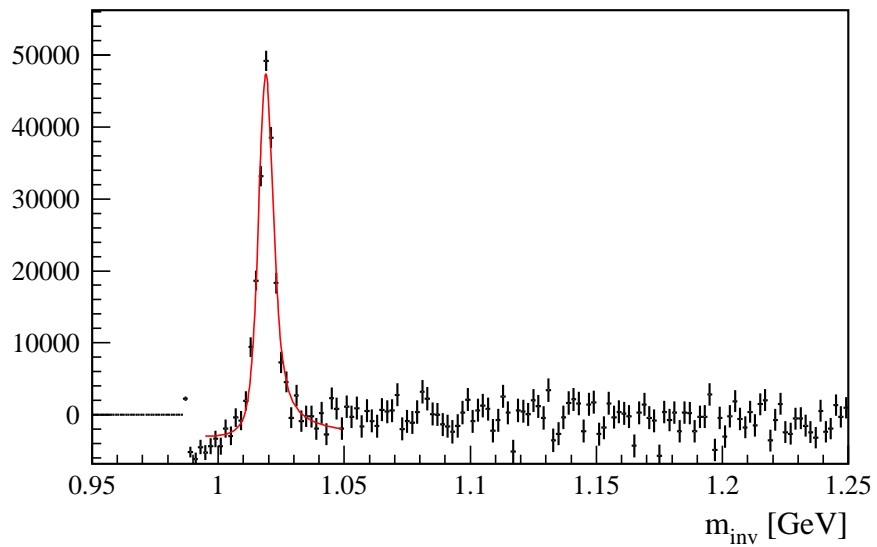
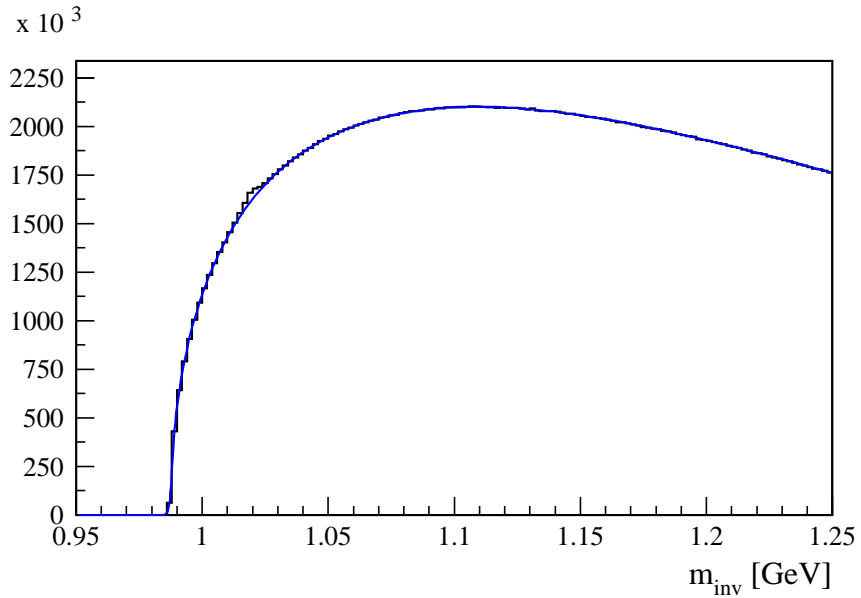
# The old (1995) signal at 158 AGeV



Distortions in the background-subtracted spectrum vanish if pions are excluded (by asymmetric  $dE/dx$  cut) :



## The new (1996) signal at 158 AGeV



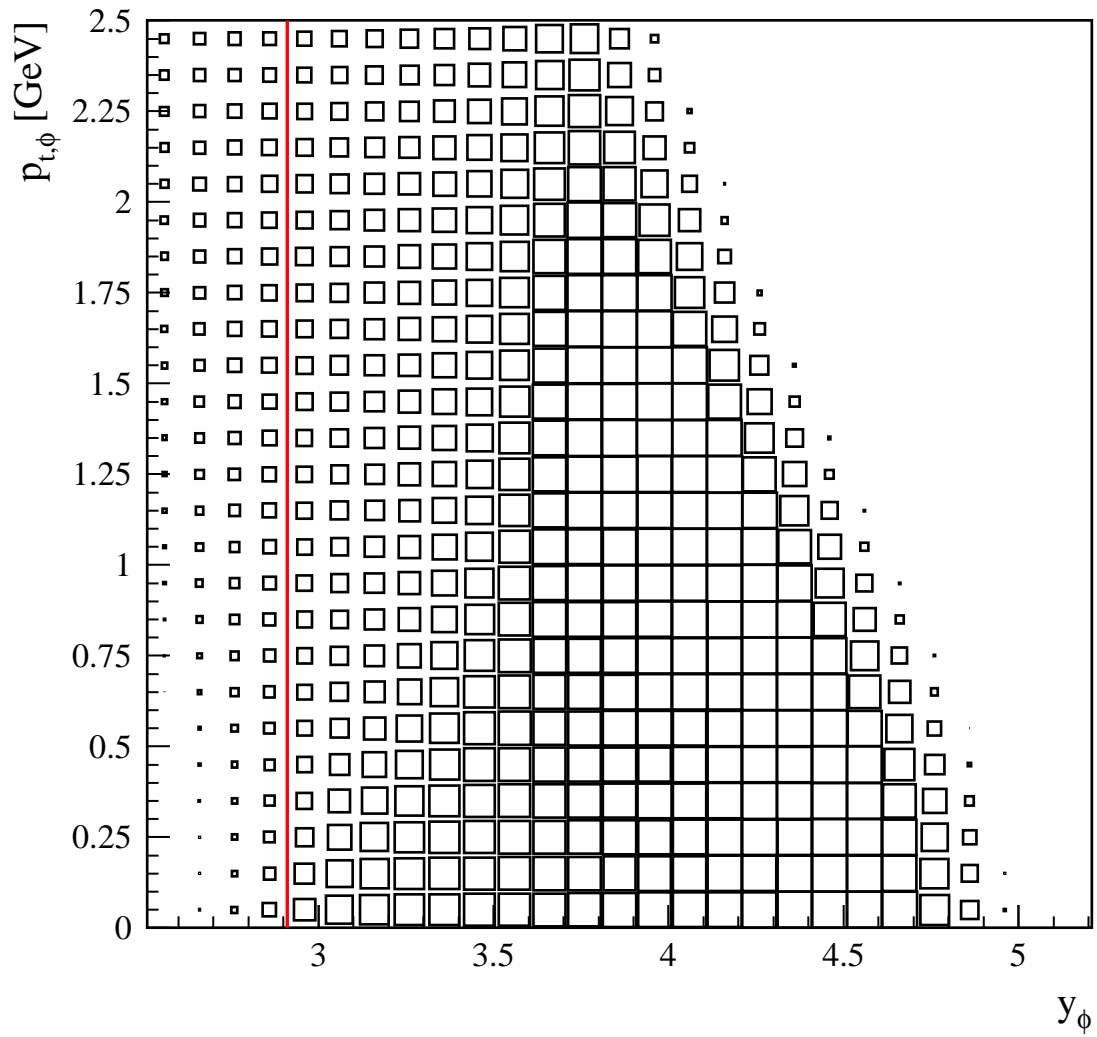
Better  $dE/dx$  (5%  $\rightarrow$  4%) results in a signal of far better quality.

Signal (1012 - 1028 MeV) : 179,000

S/B = 1 / 72

SNR = 49.4

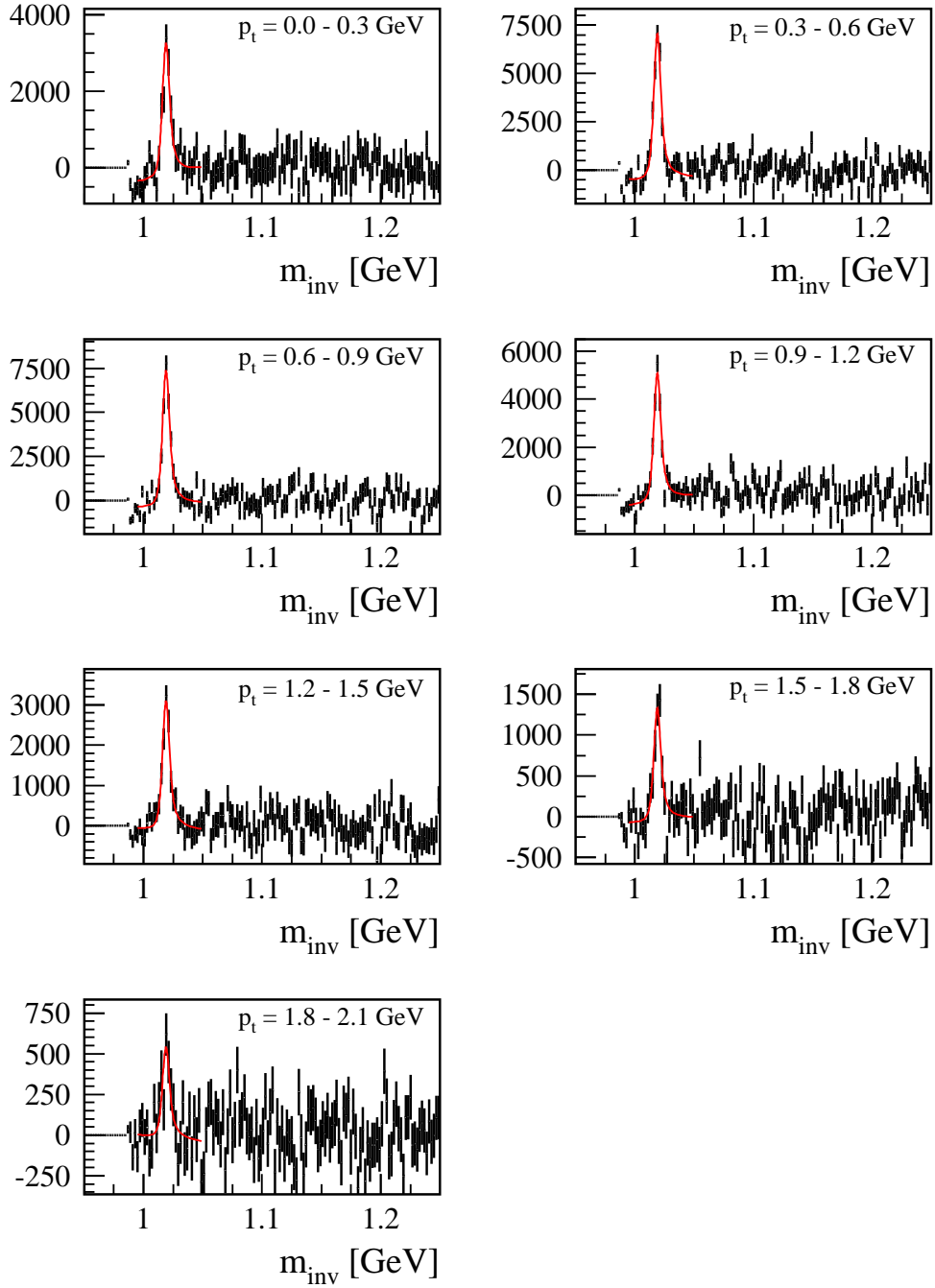
# Geometrical acceptance for $\phi \rightarrow K^+K^-$ at $B=1/1$ STD+



Acceptance is limited by upper momentum cut on kaons

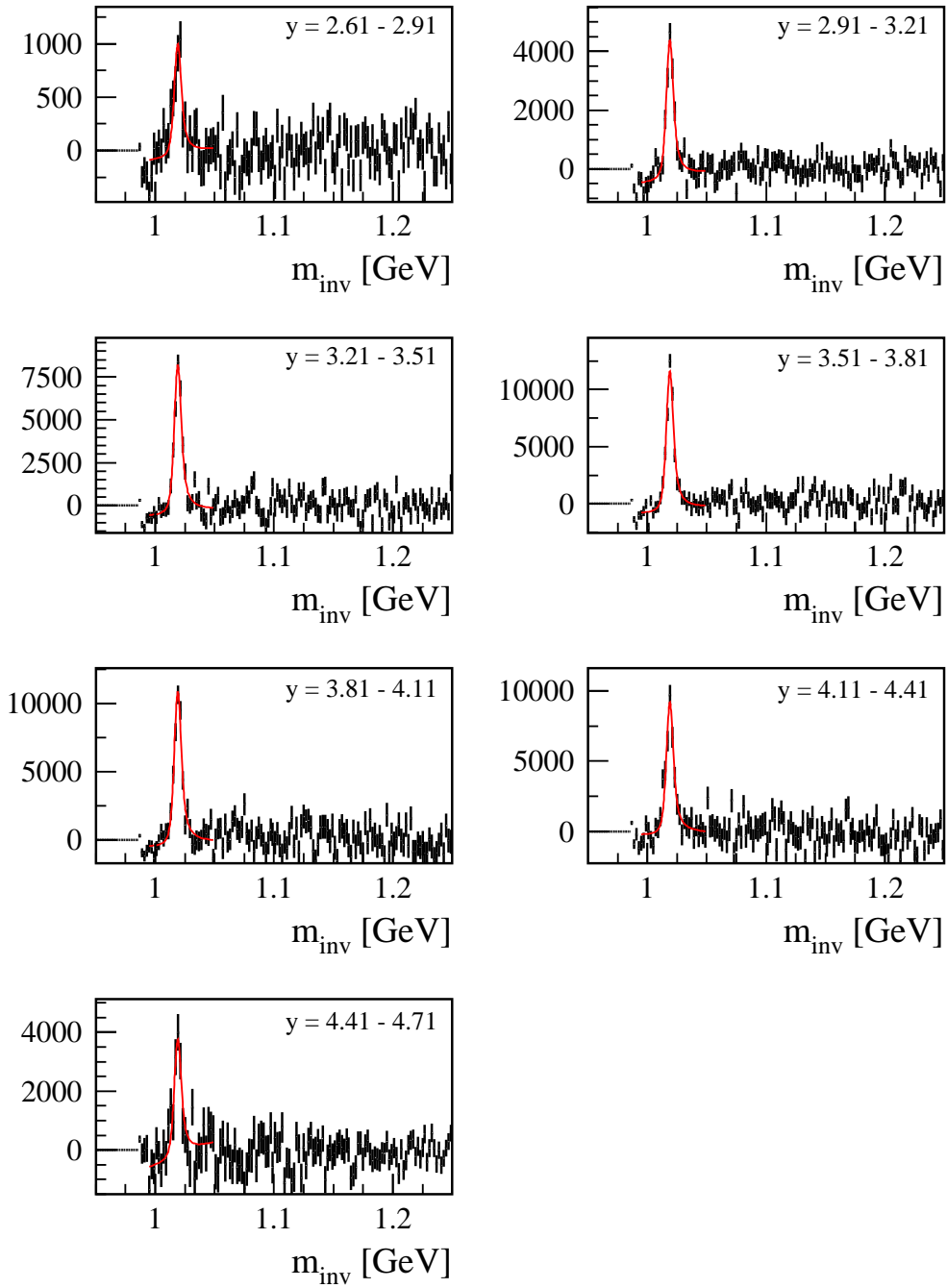
# Signal extraction in $p_t$ bins 158 AGeV

Rapidity range 2.91 - 3.91



# Signal extraction in rapidity bins 158 AGeV

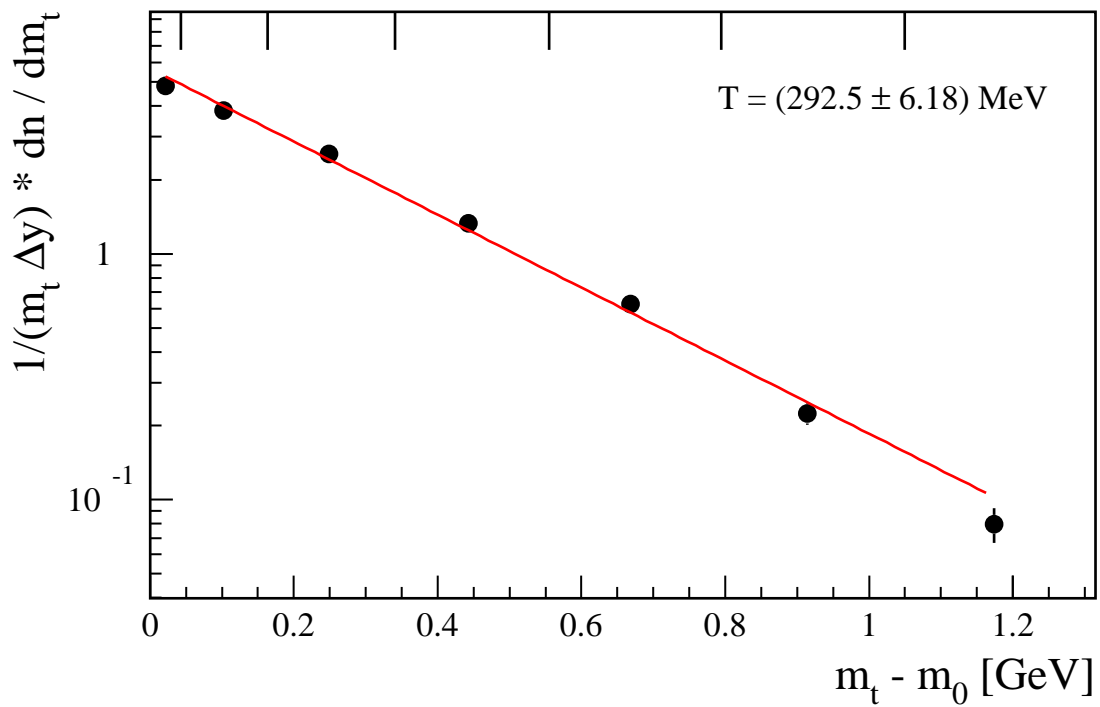
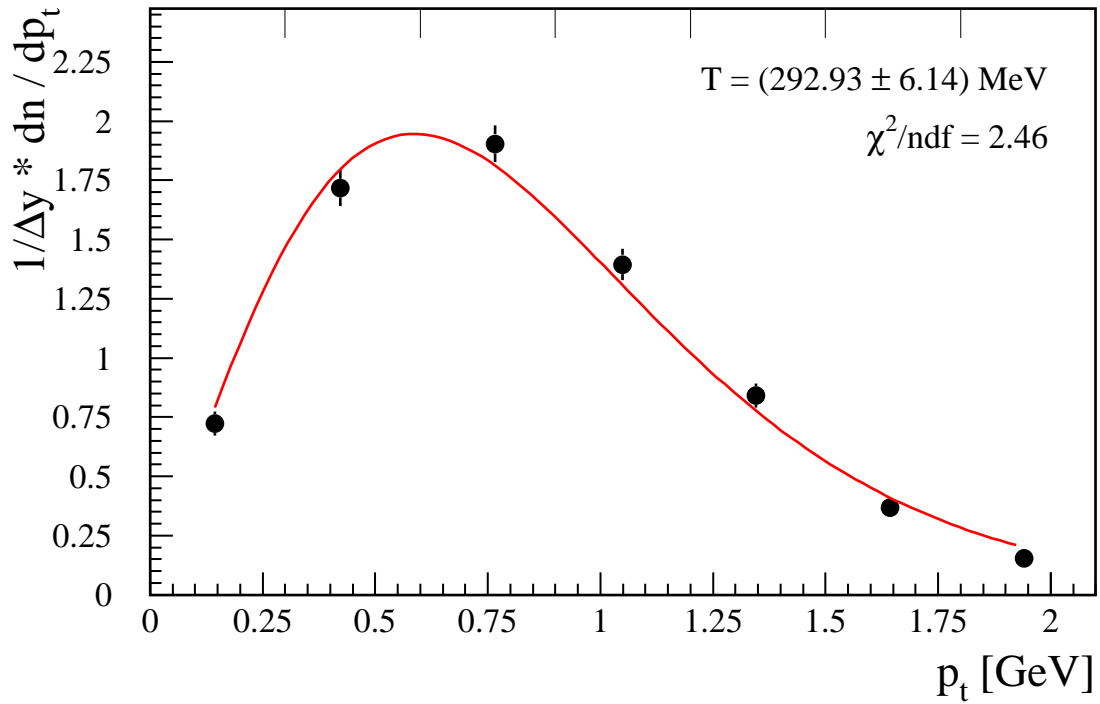
$p_t$  range 0.0 - 2.5 GeV



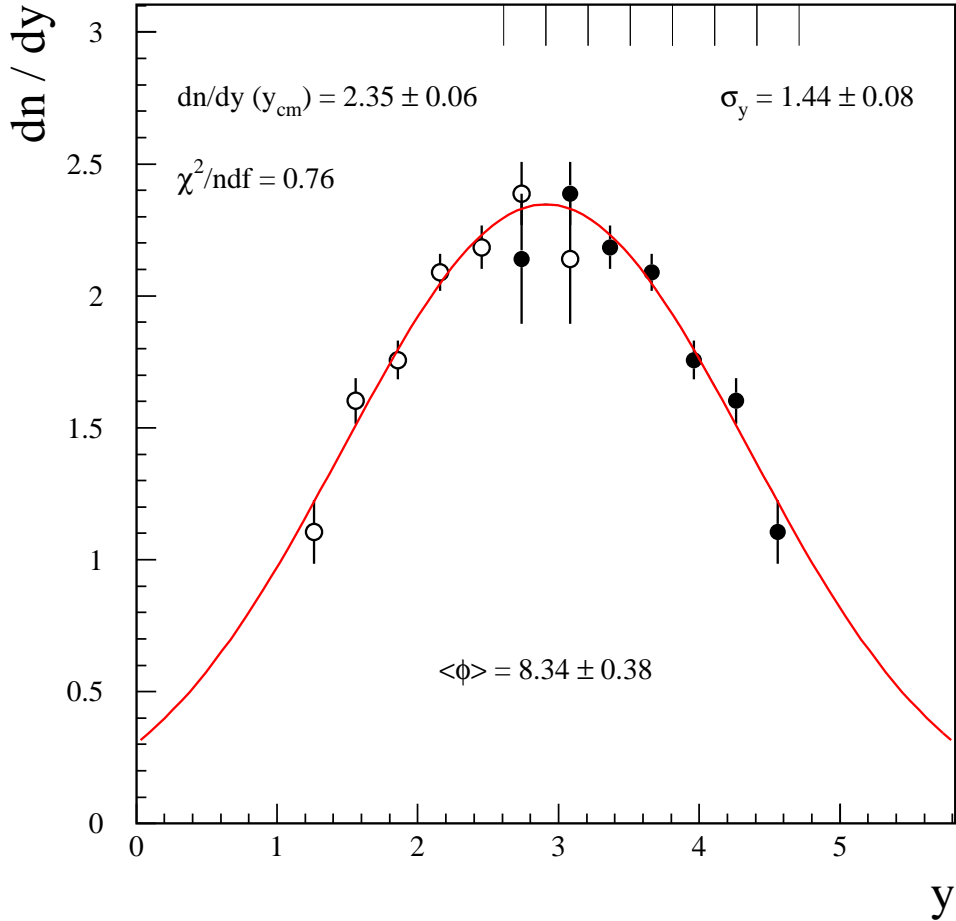


# $\phi$ transverse spectra at 158 AGeV

rapidity range 2.91 - 3.91 GeV



## $\phi$ rapidity distribution at 158 AGeV

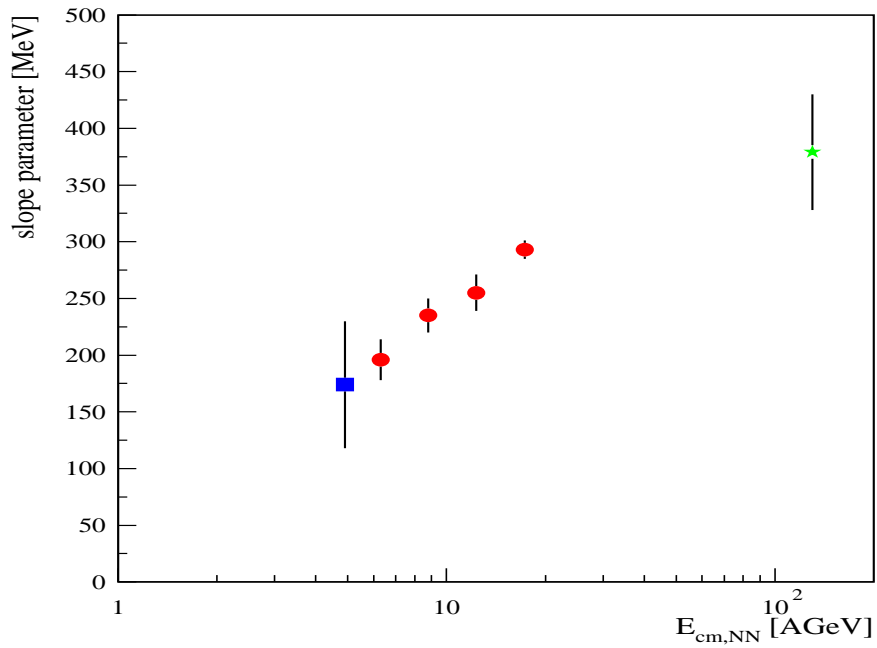
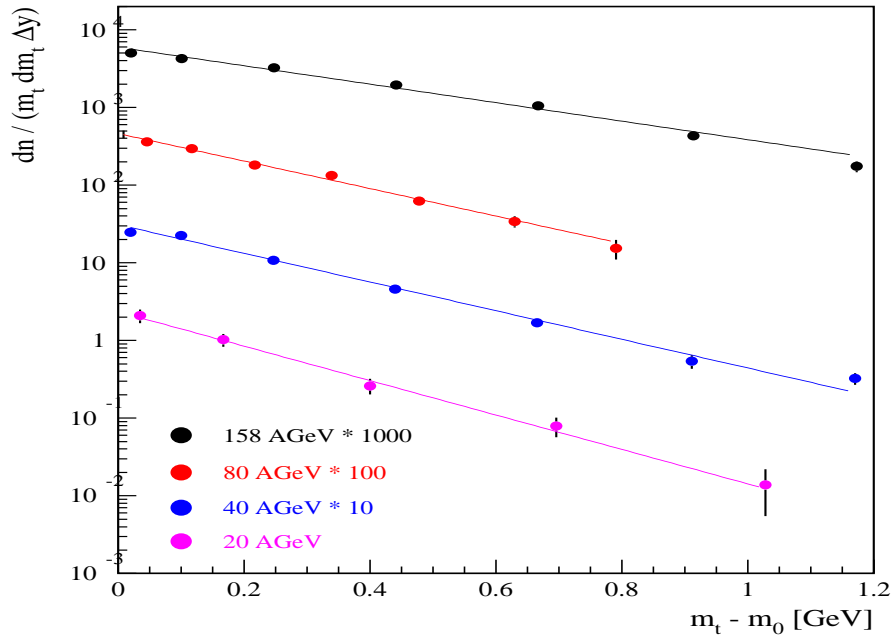


Comparison of results

Parameter	old (published)	new
T [MeV]	$305 \pm 15$	$293 \pm 6$
$\frac{dn}{dy}(y_{cm})$	$2.43 \pm 0.15 \pm 0.29$	$2.35 \pm 0.06$
$\sigma_y$	$1.22 \pm 0.16$	$1.44 \pm 0.08$
$\langle \phi \rangle$	$7.4 \pm 0.8 \pm 0.9$	$8.3 \pm 0.4$
$\langle \phi \rangle$ (publ.)	$7.6 \pm 1.1$	$8.3 \pm 0.4$

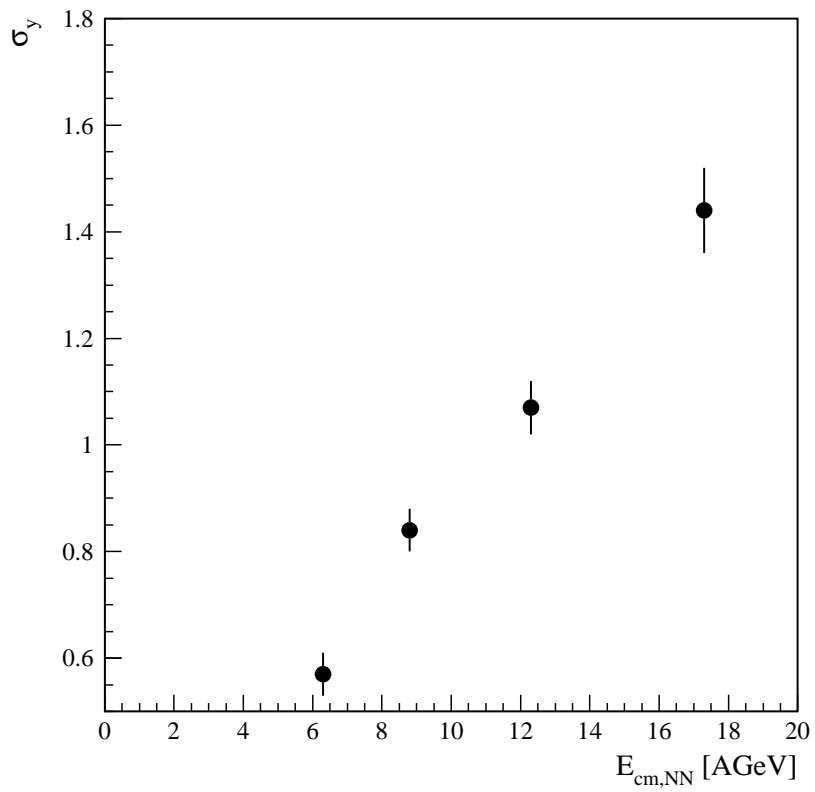
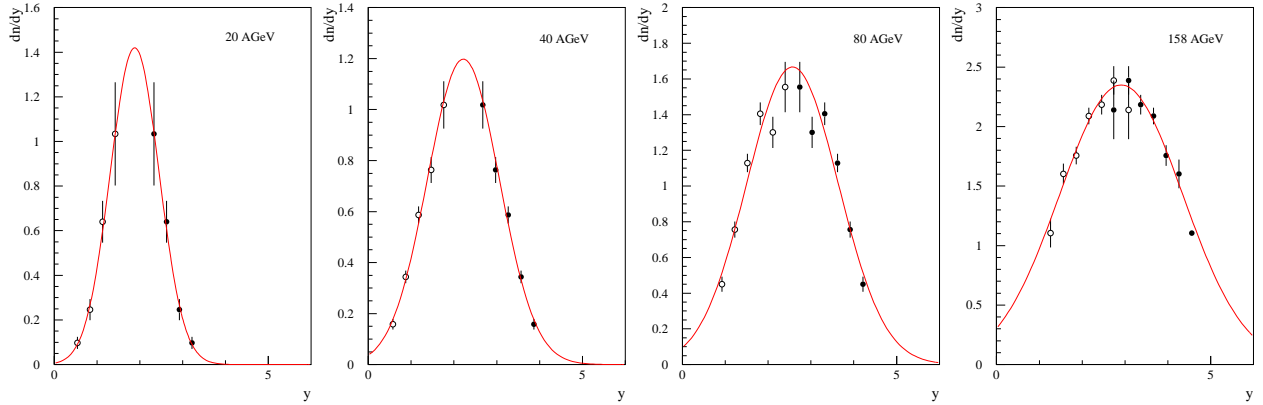
New results fully compatible with published ones

# Energy dependence : Transverse spectra / Slopes



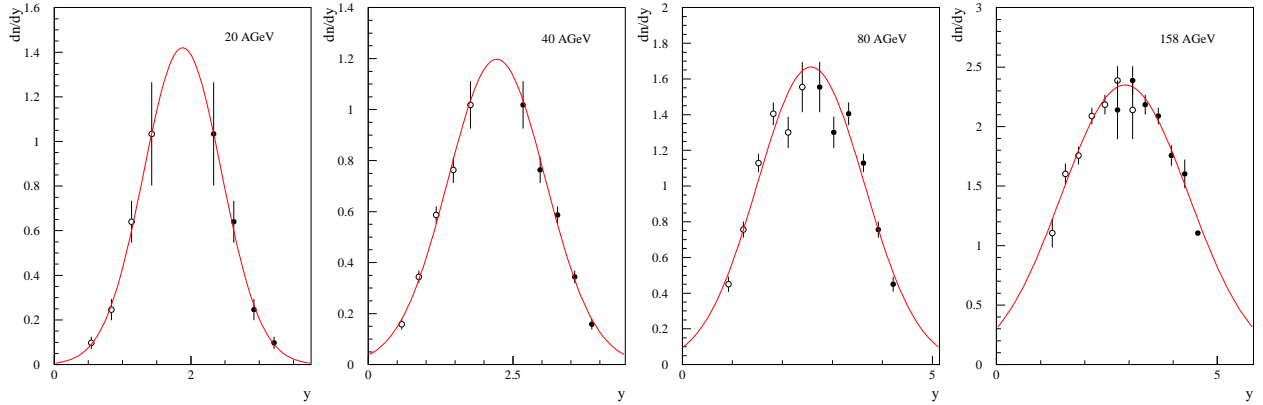
Constant slopes at SPS ruled out (sorry, Marek!)

# Energy dependence : Rapidity distributions

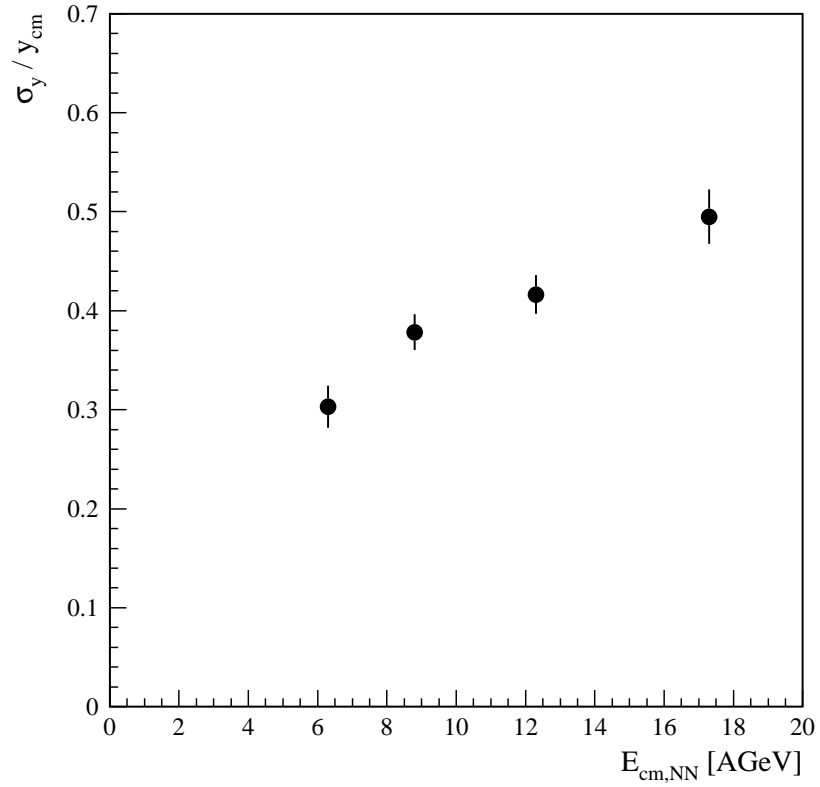


Width of  $y$ -distribution increases fast with energy...

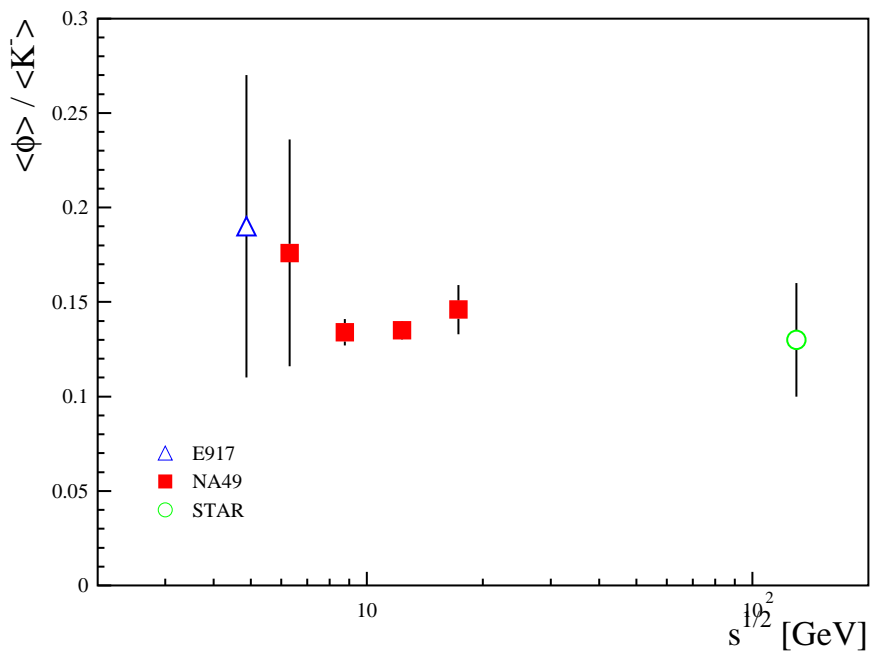
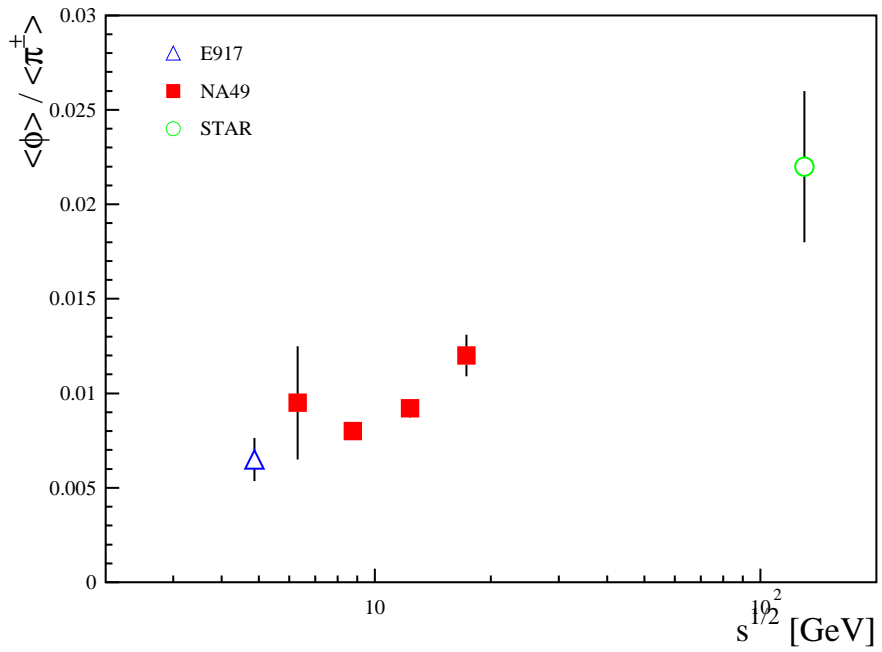
# Energy dependence : Rapidity distributions



...even when normalised to  $y_{cm}$



# Energy dependence : Yield ratios



30 AGeV point will follow soon.