Energy dependence of transverse momentum fluctuations

Katarzyna Perl
Institute of Experimental Physics
Warsaw University

What are we looking for?

- Enhanced dynamical fluctuations for systems close to the phase transition
- Exotic, unexpected, interesting effects

Plan

- Data sets
- Event and track selection criteria
- Mixed events
- Mean p_T distributions for data and mixed events
- Two-particle correlation plots
- Conclusions
- What next?

General looking at data

- No acceptance cuts (p_T versus azimuthal angle) – if any effects exist they will be better seen
- No common acceptance
- Forward-rapidity, mid-rapidity, no rapidity cuts

Data sets

- 20 AGeV, STD+, 03A, 7.2% central
- 30 AGeV, STD+, 02J, 7.2% central
- 40 AGeV, STD-, 00C, 7.2% central
- 80 AGeV, STD+, 01E, 7.2% central
- 158 AGeV, STD+, 00B, 7.2% central,

  Eveto < 10868 GeV , run.number > 1398 (10%)

Event and track selection criteria

- Cut on x, y, z position of the fitted vertex
- n.trk.fit/n.trk.out > 0.25

- z.first < 200 cm
- $|bx| < 2$ cm, $|by| < 1$ cm
- n.m.p > 30, n.p/n.m.p > 0.5
- $0.005 < p_T < 1.5$ GeV/c

Mixed events – prepared text files

- /castor/cern.ch/user/k/kperl/MIXED_ENERGY/
- 30k events for 20, 30, 40, 80, 158 GeV (7.2%)
- Mixed events prepared on the basis of real events – multiplicity distribution the same, inclusive spectra the same, each particle for mixed event comes from a different real event
- Event and track cuts – see the previous page
- By construction no correlations (Φ_{pT} consistent with zero)

The structure of mixed event

number_of_particles event_number
id(Geant) px py pz
id(Geant) px py pz
...
...

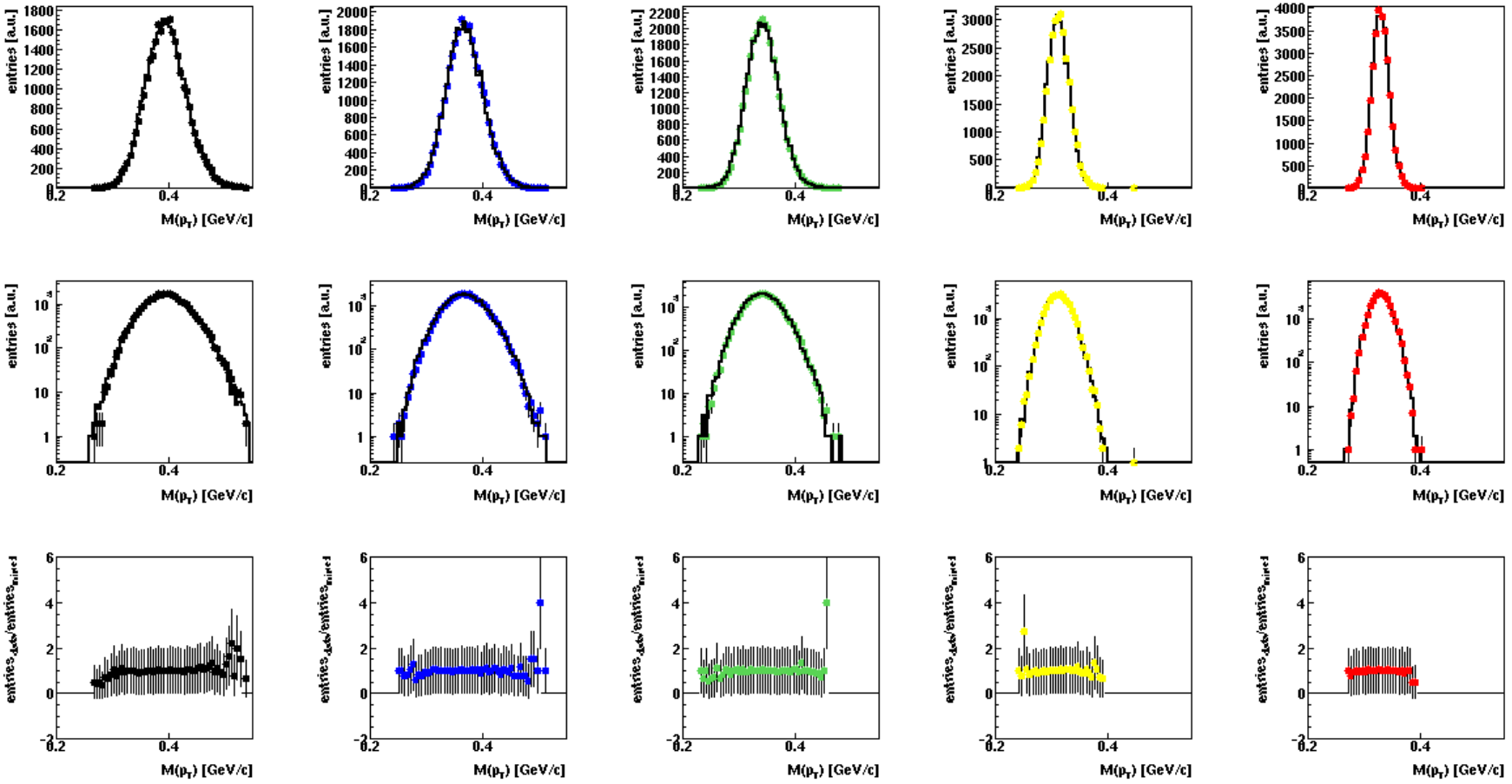
id = = 8 (π^+)
id = = 9 (π^-)
all particles (from real events) treated as pions

Rapidity ranges – multiplicities

	No rapidity cuts	mid-rapidity ($-0.6 < y^* < 1.0$)	forward-rapidity ($1.09 < y^* < 2.59$)
20	233 (100%)	65.7%	27.9%
30	301 (100%)	65.4%	27.9%
40	357 (100%)	63.6%	28.6%
80	519 (100%)	55.5%	32.4%
158	722 (100%)	52.3%	34.3%

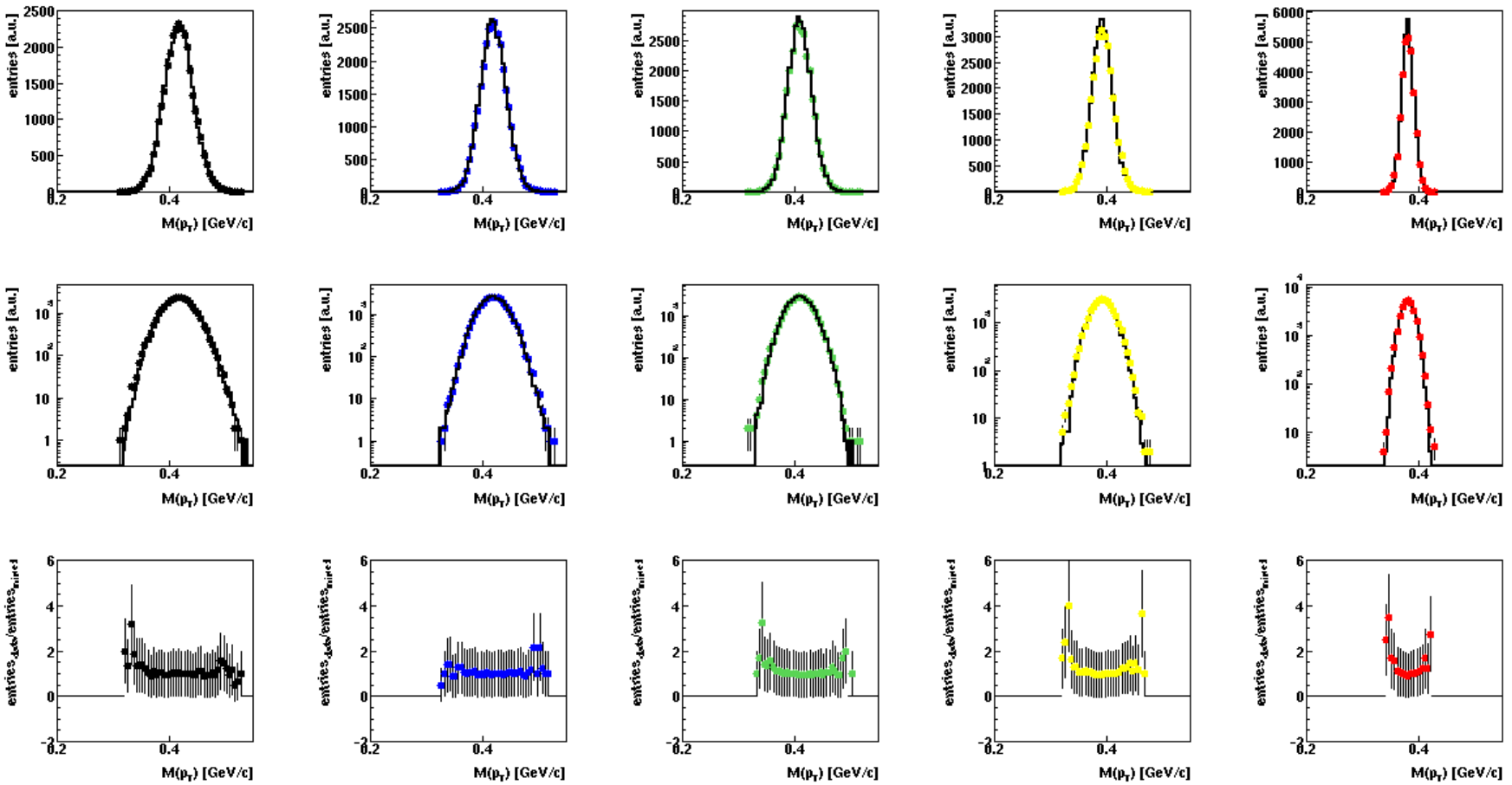
Mean p_T distributions for data (points) and mixed events – forward-rapidity

20 30 40 80 158



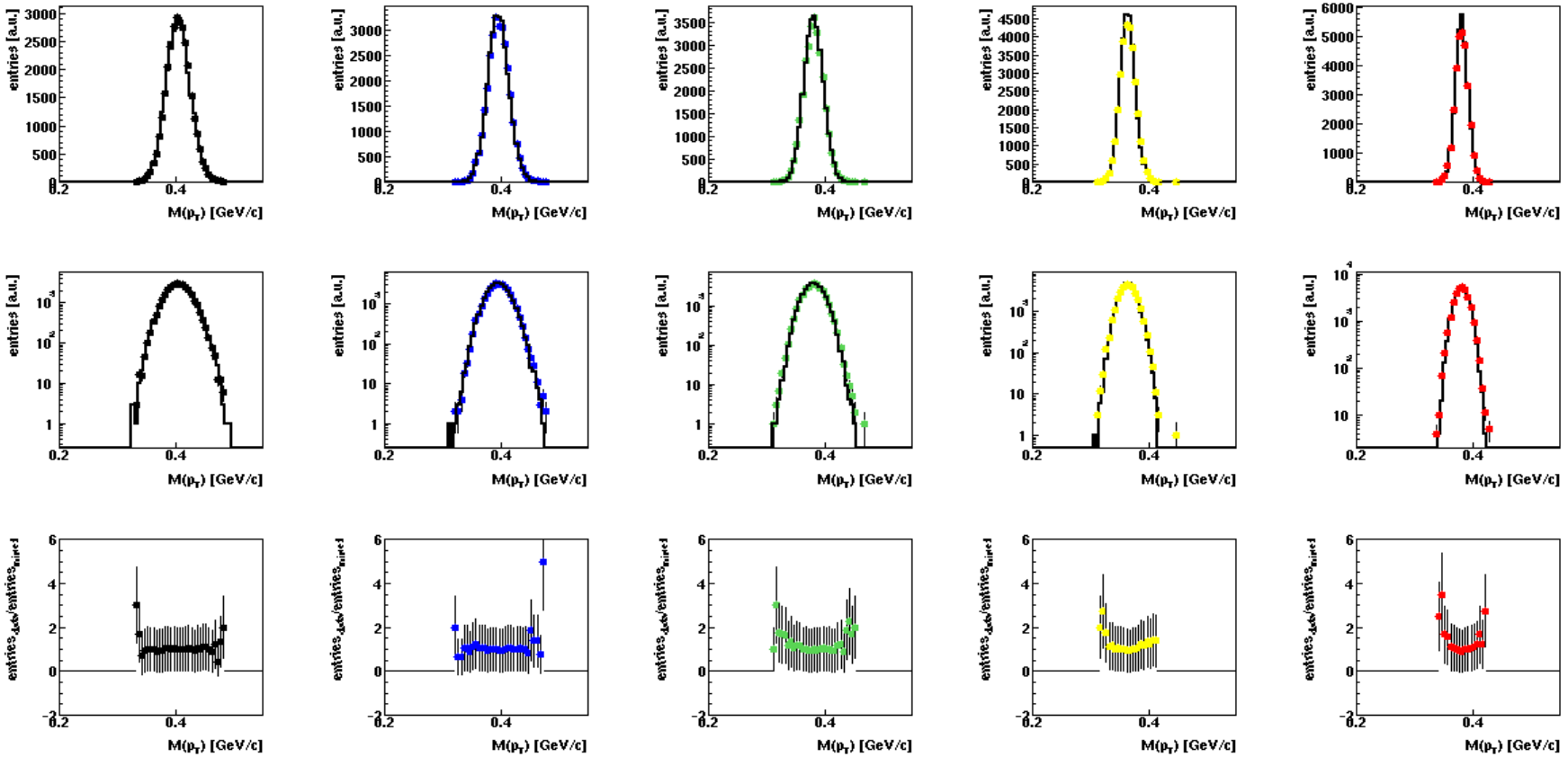
Mean p_T distributions for data (points) and mixed events – mid-rapidity

20 30 40 80 158

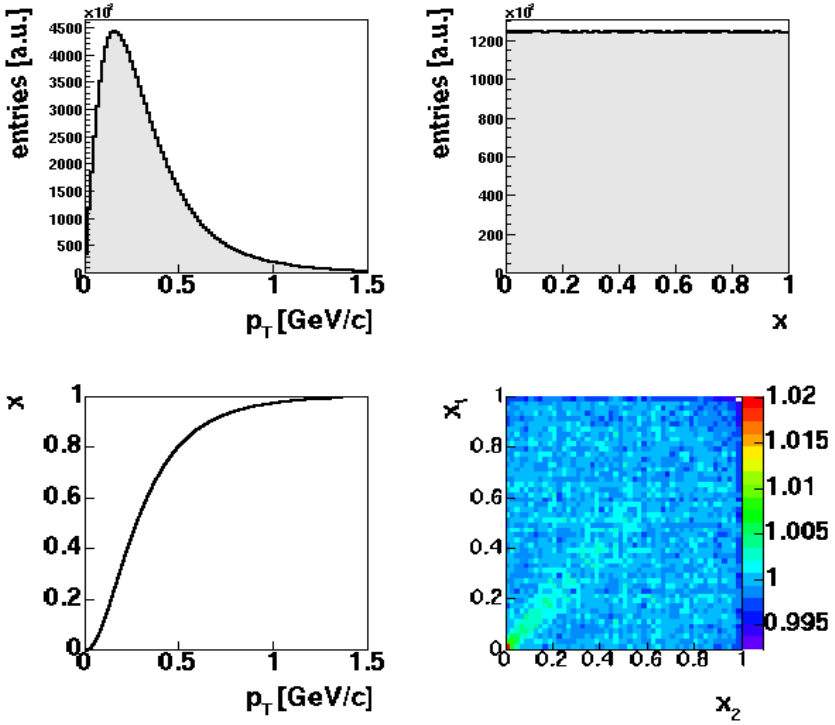


Mean p_T distributions for data (points) and mixed events – no rapidity cuts

20 30 40 80 158



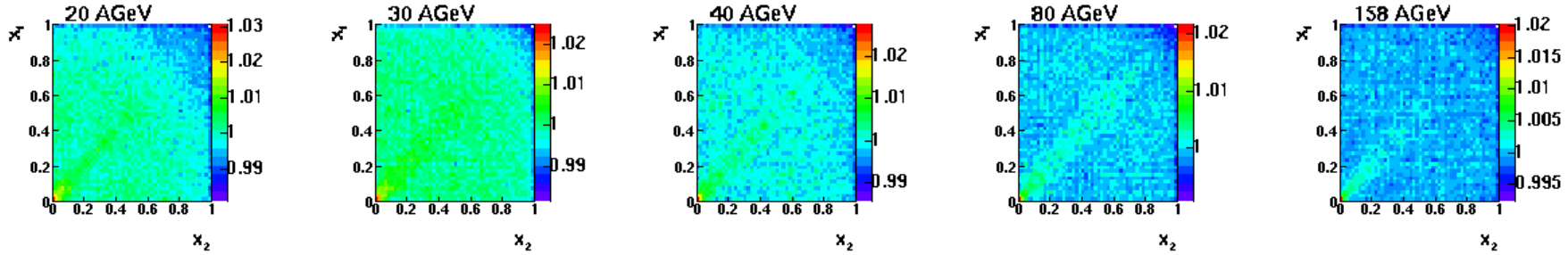
Two-particle correlation plot



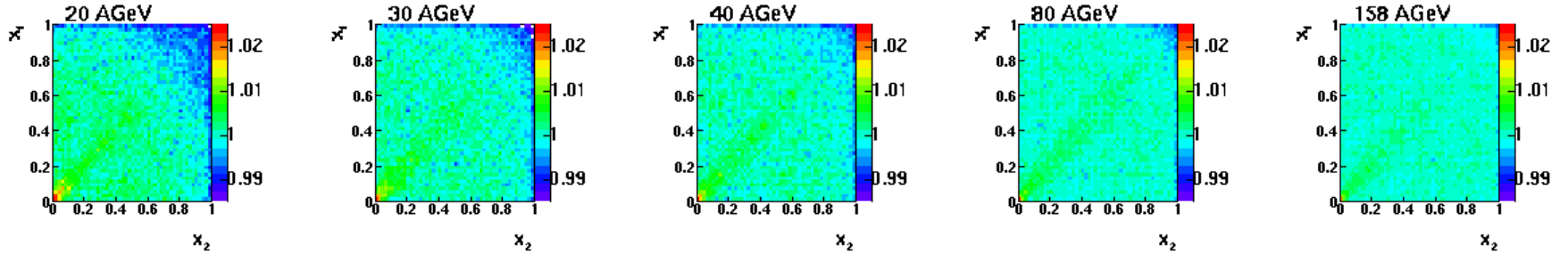
- Example for 158 AGeV
- Forward-rapidity
- No acceptance cuts

Two-particle correlation plots – forward-rapidity

own scale:

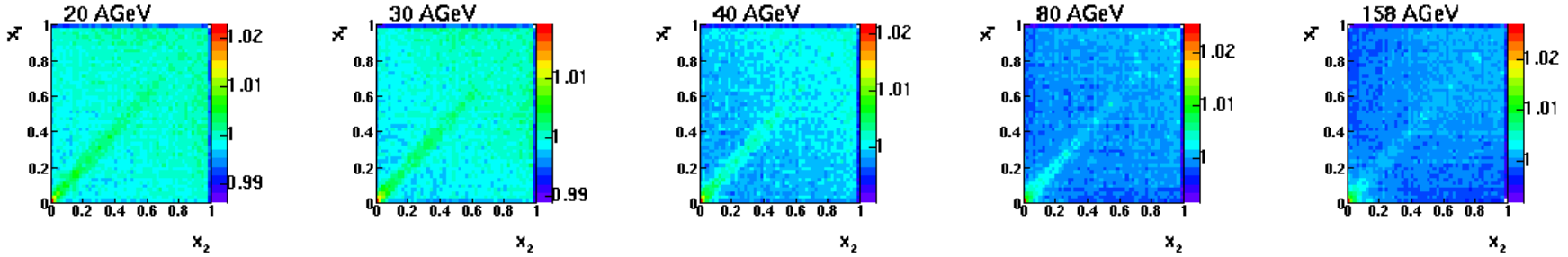


common scale:

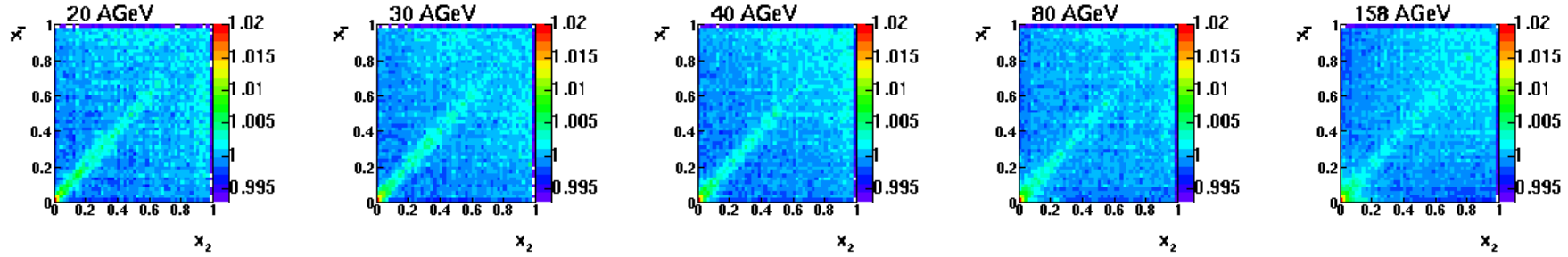


Two-particle correlation plots – mid-rapidity

own scale:

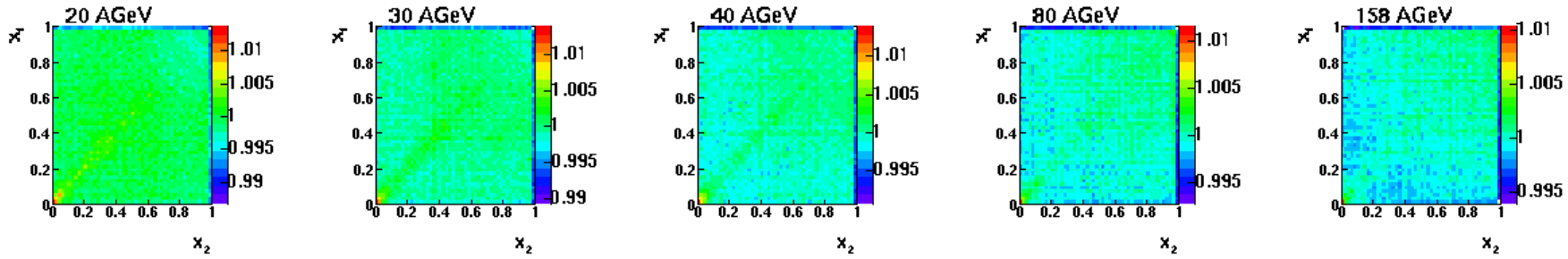


common scale:

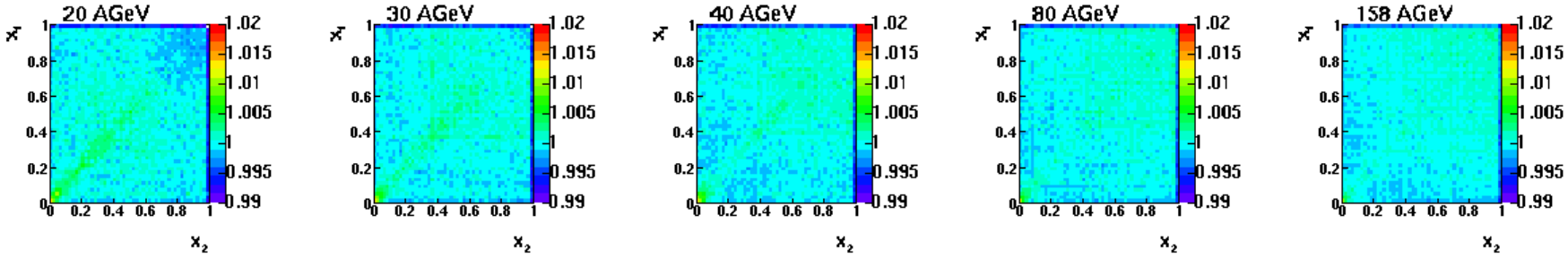


Two-particle correlation plots – no rapidity cuts

own scale:



common scale:



Conclusions (observations rather)

- Correlations are rather small (dominated by BE), the reason - limited geometrical acceptance (?)
- Energy dependence of the difference in $M(p_T)$ between data and mixed events for mid-rapidity (??)
- Energy dependence of two-particle correlation plots – better seen for forward-rapidity

What next?

- Acceptance cuts (p_T versus azimuthal angle)
- $M(p_T)$ for data and mixed events for mid-rapidity at 158 AGeV (stability checks)
- Φ_{pT} fluctuation measure (stability checks - systematic errors, TTR corrections – Geant simulations and reconstruction of mixed events)