Factorial moments

Introduction

It was proposed by A. Bialas and R. Peschanski (Nucl. Phys. B 273 (1986) 703) to study the dependence of the normalized factorial moments

$$F_i = M^{i-1} \times \left\langle \frac{\sum_{j=1}^{M} k_j \times (k_j - 1) \times \ldots \times (k_j - i + 1)}{N \times (N-1) \times \ldots \times (N - i + 1)} \right\rangle$$

Note: there is a set of definitions of moments and cumulants.

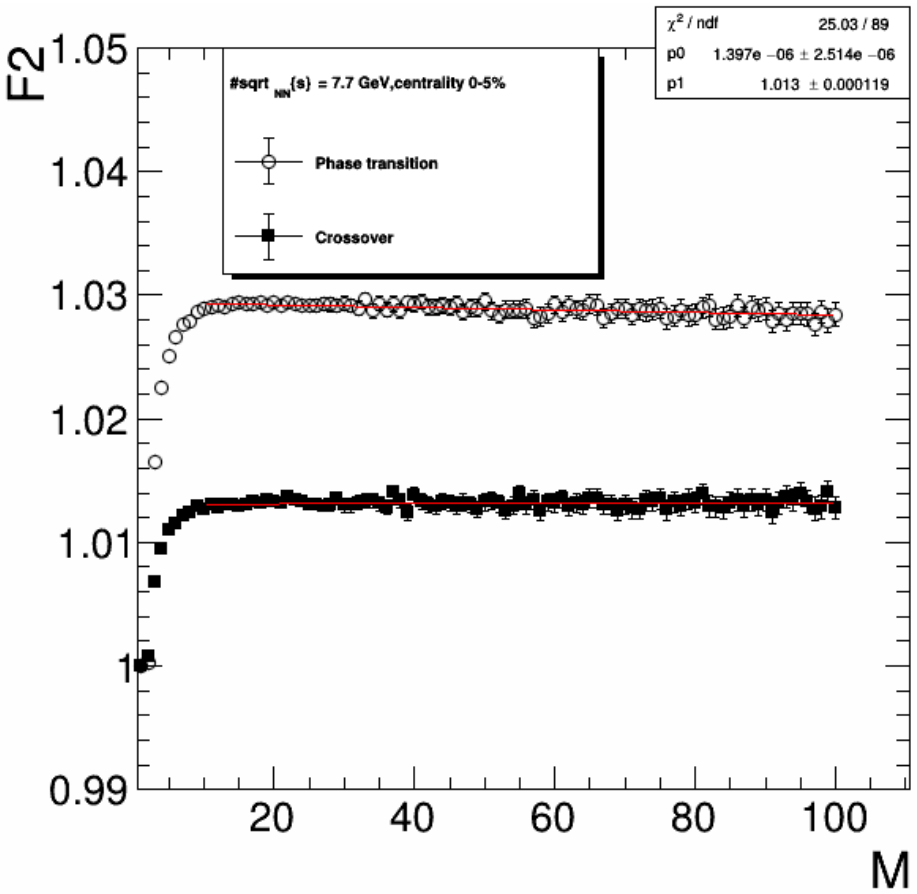
of the rapidity distribution on the size δy (Δy/M, M is the number of bins, Δy is the size of the mid rapidity window):

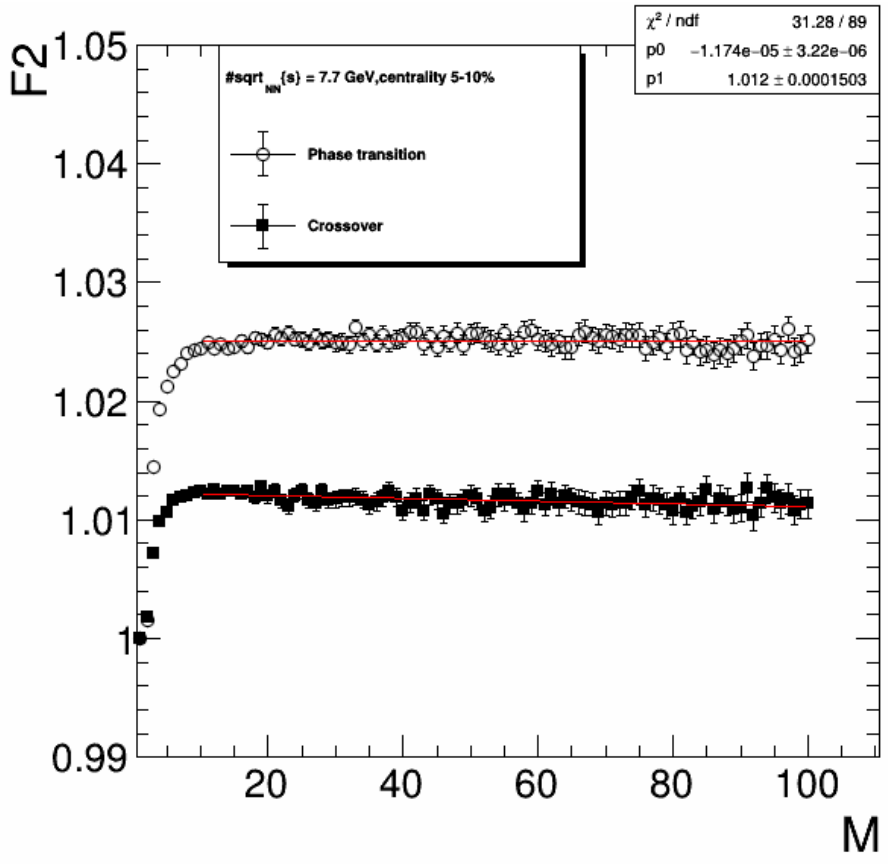
1. if fluctuations are purely statistical no variation of moments as a function of δy is expected

2. Observation of variations indicates the presence of physics origin fluctuations

Intermittency (fluctuations of various different sizes in 1D, 2D and 3D phase space) have been studied at LEP, Tevatron, Protvino in ee, hh, hA, AA interactions at the various energies.

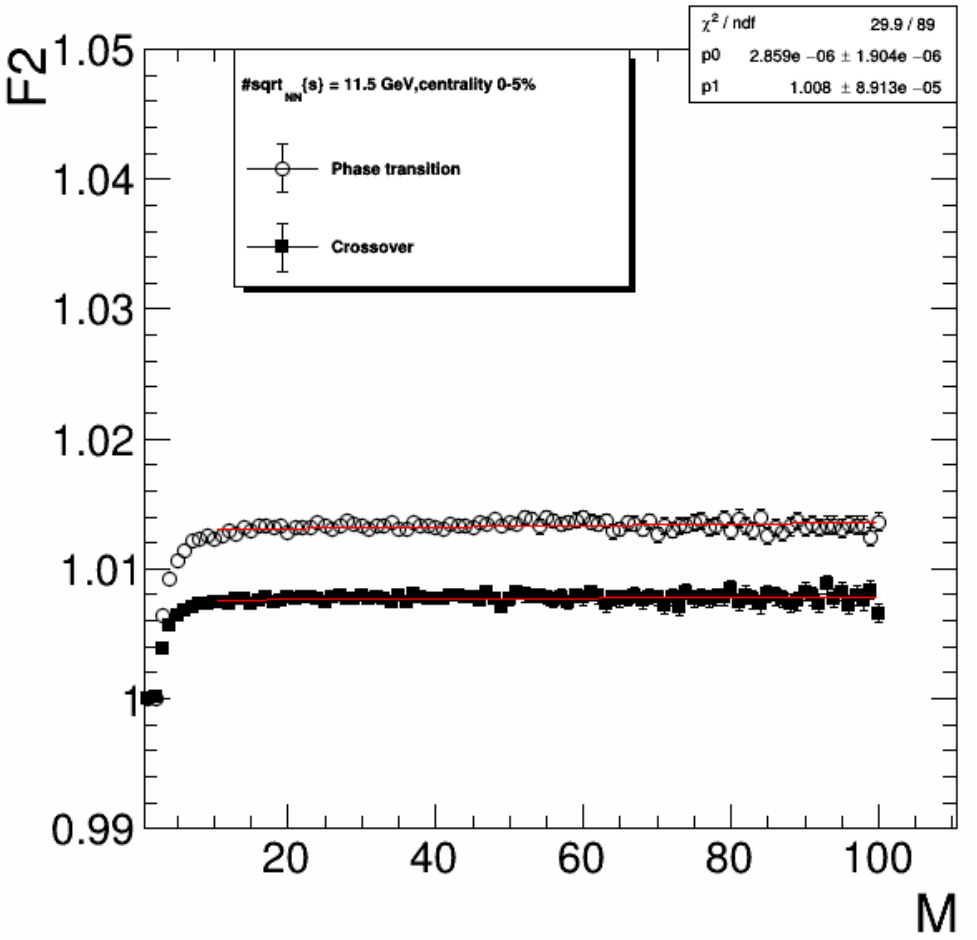
Au-Au, 7.7 GeV

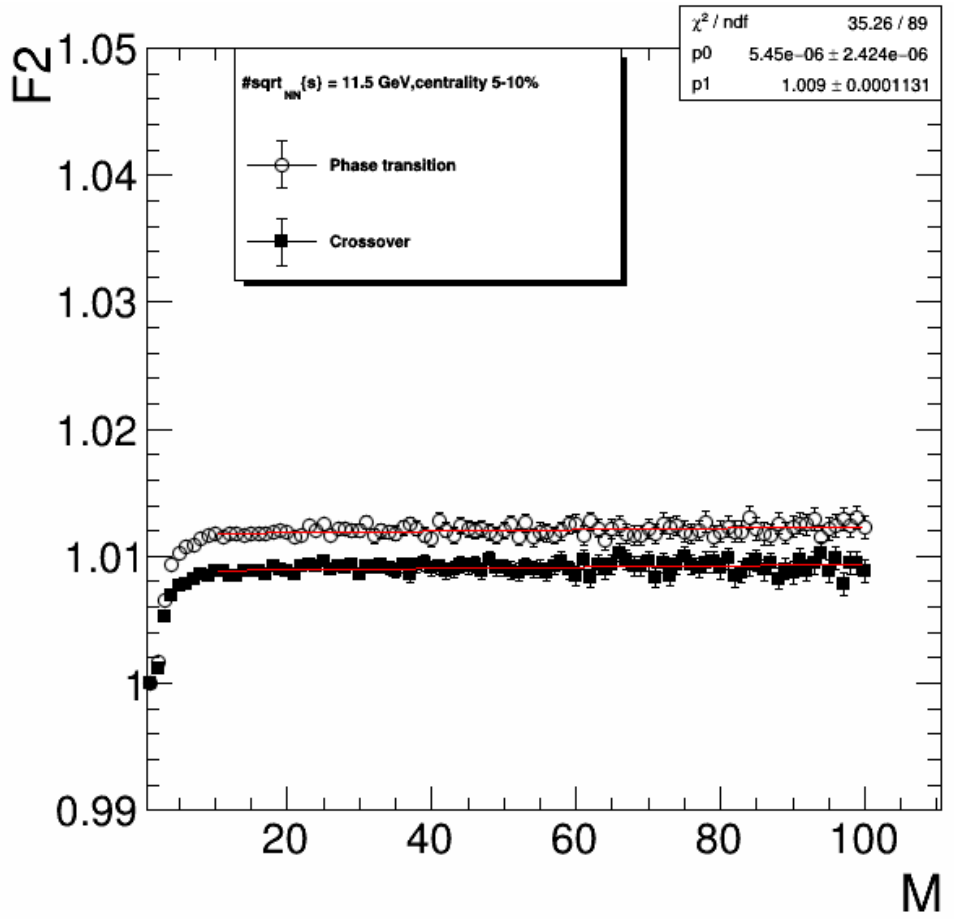




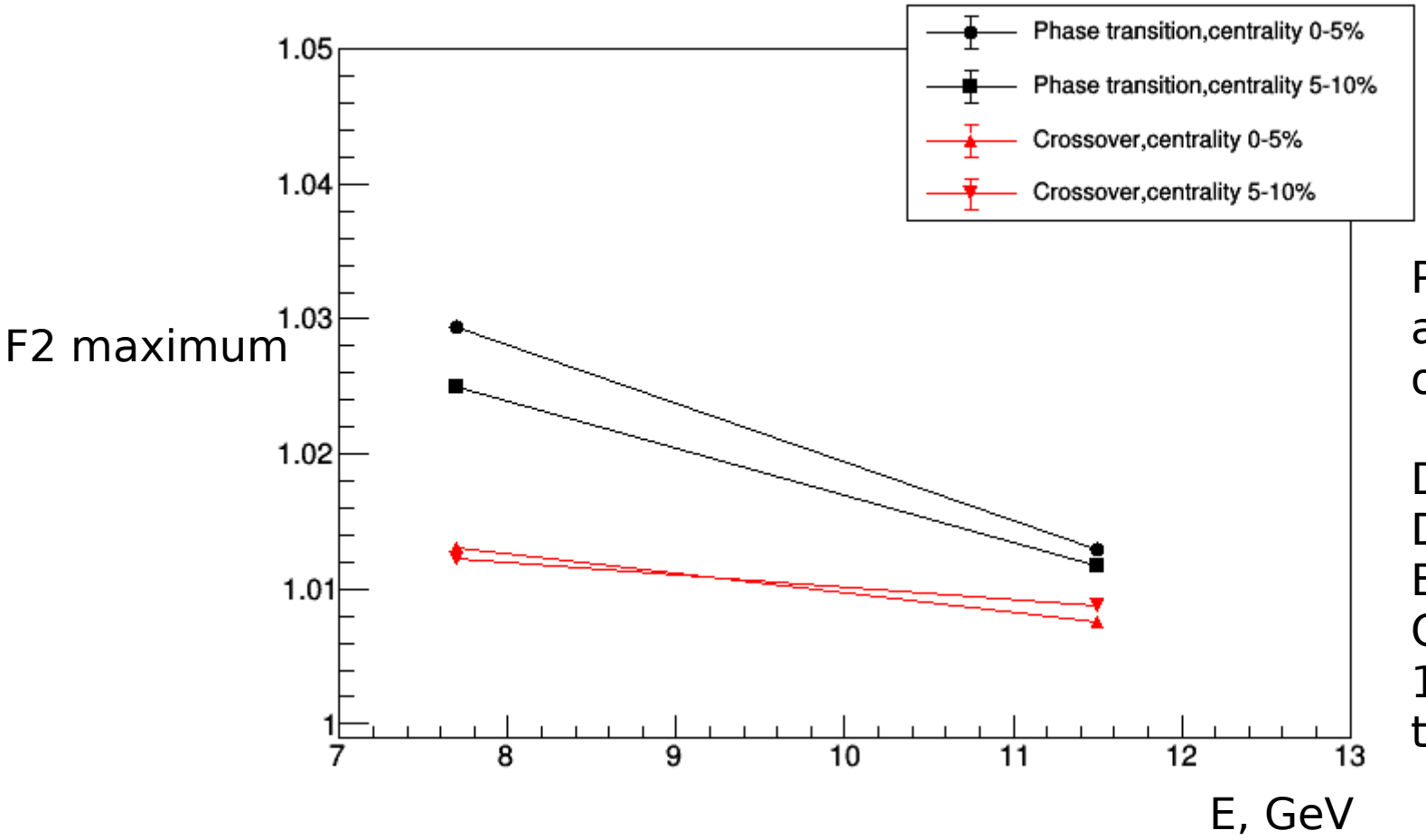
Fit the level of maximum with polinom of the first order: a+b x M
b is of the order of 10^{-6}

Au-Au, 11.5 GeV


F2
1.05
1.04
1.03
1.02
1.01
1
0.99
20
40
60
80
100
M
#sqrt_NN{s} = 11.5 GeV,centrality 0-5%
Phase transition
Crossover
χ² / ndf 29.9 / 89
p0 2.859e −06 ± 1.904e −06
p1 1.008 ± 8.913e −05


F2
1.05
1.04
1.03
1.02
1.01
1
0.99
20
40
60
80
100
M
#sqrt_NN{s} = 11.5 GeV,centrality 5-10%
Phase transition
Crossover
χ² / ndf 35.26 / 89
p0 5.45e−06 ± 2.424e−06
p1 1.009 ± 0.0001131

Energy dependence



Plot the F2 max as a function of energy.

Different energy Dependence is Expected for Crossover and the 1^{st} order phase transition

Recosntruction tracking efficiency as a function of the track p_T