Some results on intermittency and particle correlations in p-p and Pb-Pb collisions.

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- **One of the proposed signals for the occurrence of collective phenomenon in relativistic heavy-ion collisions is large fluctuations in the number of produced particles in local regions of phase space**

- **The most intensively studied aspect of multiparticle production might be the nature of multiplicity fluctuations in restricted domain of phase space.**

- **In such studies the starting assumption is always that the observed events can be decomposed into self-similar clusters distributed according to Poisson process. These can result from intermittent particle emission by several independent sources (string, fireballs, quark-gluon plasma droplets or whatever). Further the particles of common ancestry constitute the same cluster and if this happens, Bialas Pointed out that the intermittency indices characterizing the events should vary inversely with particle density.**

The intermittency study is important (physics) to understand the correlation length of the medium and many interesting properties.

If normalized factorial moments , **<F_q>** can be used as quantitative measure of local fluctuation. **<F_q>** is defined by

$$< F_q >= \frac{M^{q-1}}{N_{evt}} \sum_{N_{evt}} \sum_{m=1} \frac{n_m (n_m - 1)....(n_m - q + 1)}{< N >^q}$$

M is the partition number in the available rapidity space, q is the order of the moment,**< .... >** represents average obtained for the entire event and **n_m** is the number of particles in **m^{th}** bin.

"Intermittency" refers to the following power-law behavior and has been observed in many system of collisions.

$$< F_q > \propto \left[\frac{\Delta\eta}{\delta\eta} \right]^{\varphi_q} \quad (\delta\eta \to 0)$$

Reference:

- **R.C. Hwa, C.B. Yang, *Phys. Rev. C* 85, 2012.**
- **W. Kittel, E.A. De Wolf, *Soft Multihadron Dynamics, (World Scientific Singapore),* p. 429.**
- **A. Bialas, R Peschanski, *Nucl. Phys. B* 273, 703(1986); B308, 857(1988).**

Data

proton-proton at 2.76 TeV /LHC11 a (ESDs)

Pb-Pb at 2.76A TeV /LHC11h_2(AOD)

Centralities: 0-90, 0-10, 10-50, 50-90.

$$-0.9 \leq \eta \geq 0.9$$

no cent

$\langle N_{ch} \rangle = 1375.0$

0-90%

$\langle N_{ch} \rangle = 1480.0$

0-10%

$\langle N_{ch} \rangle = 4600.0$

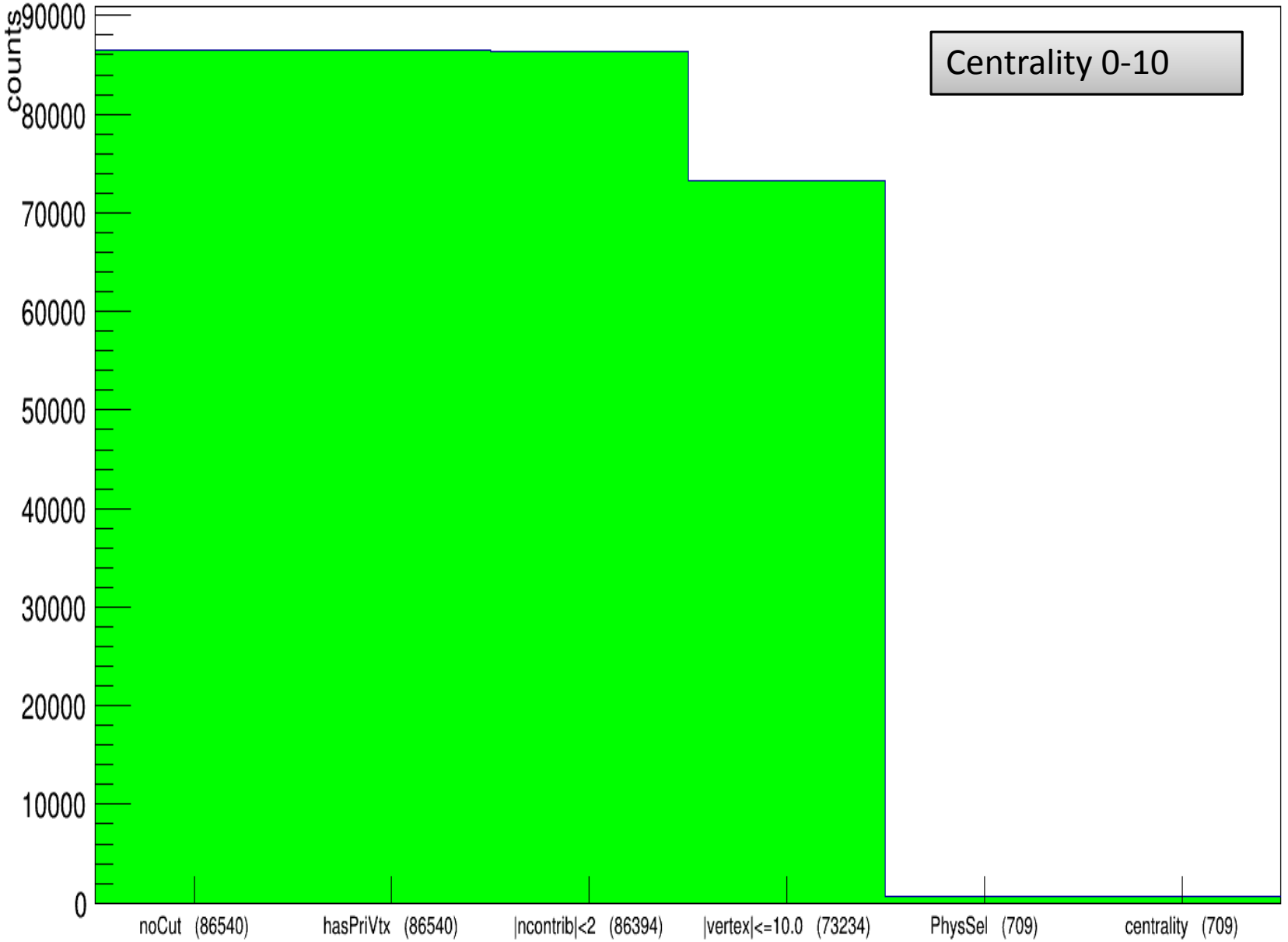
10-50%

$\langle N_{ch} \rangle = 1735.0$

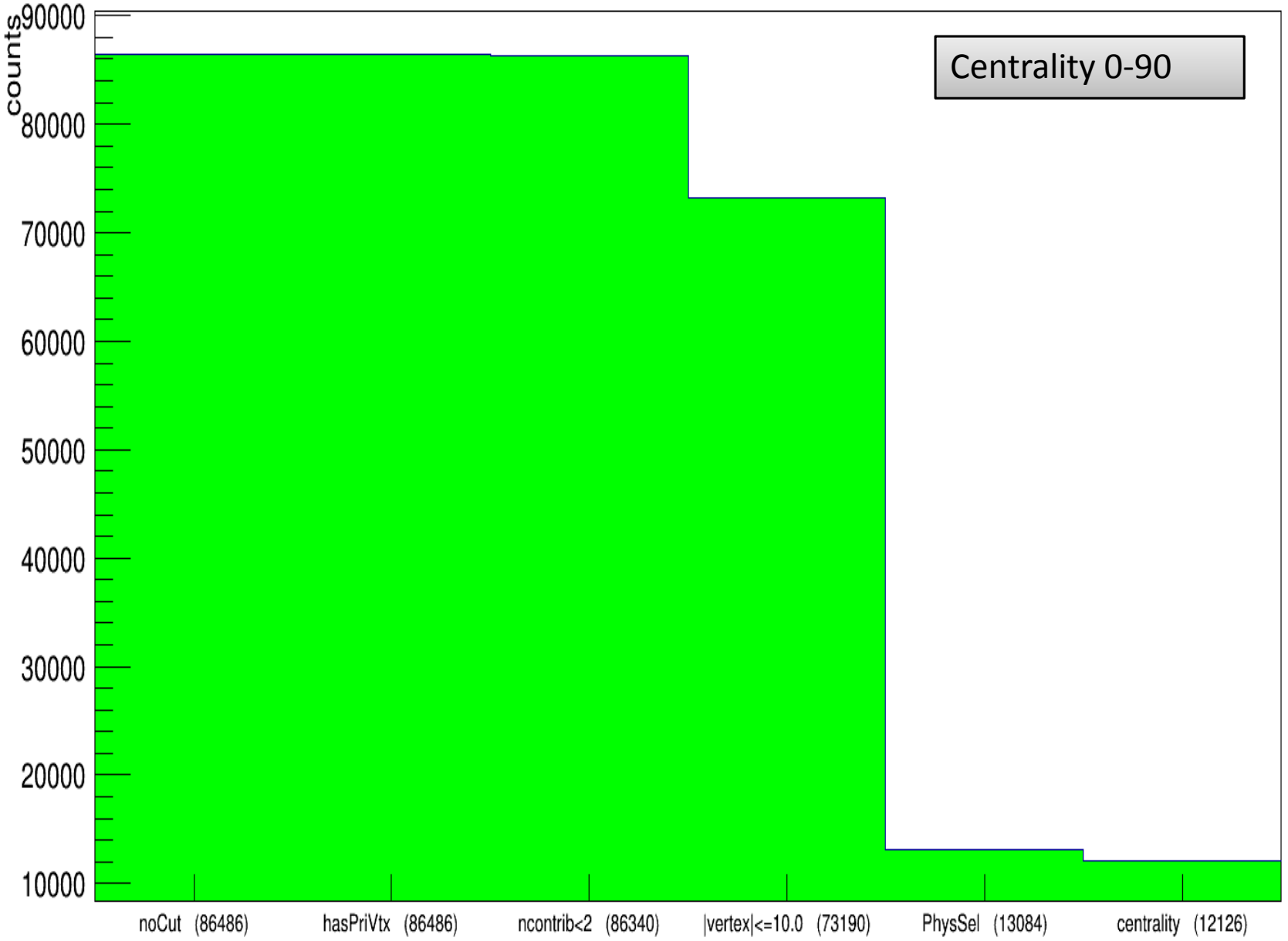
(50-90%)

$\langle N_{ch} \rangle = 1165.0$

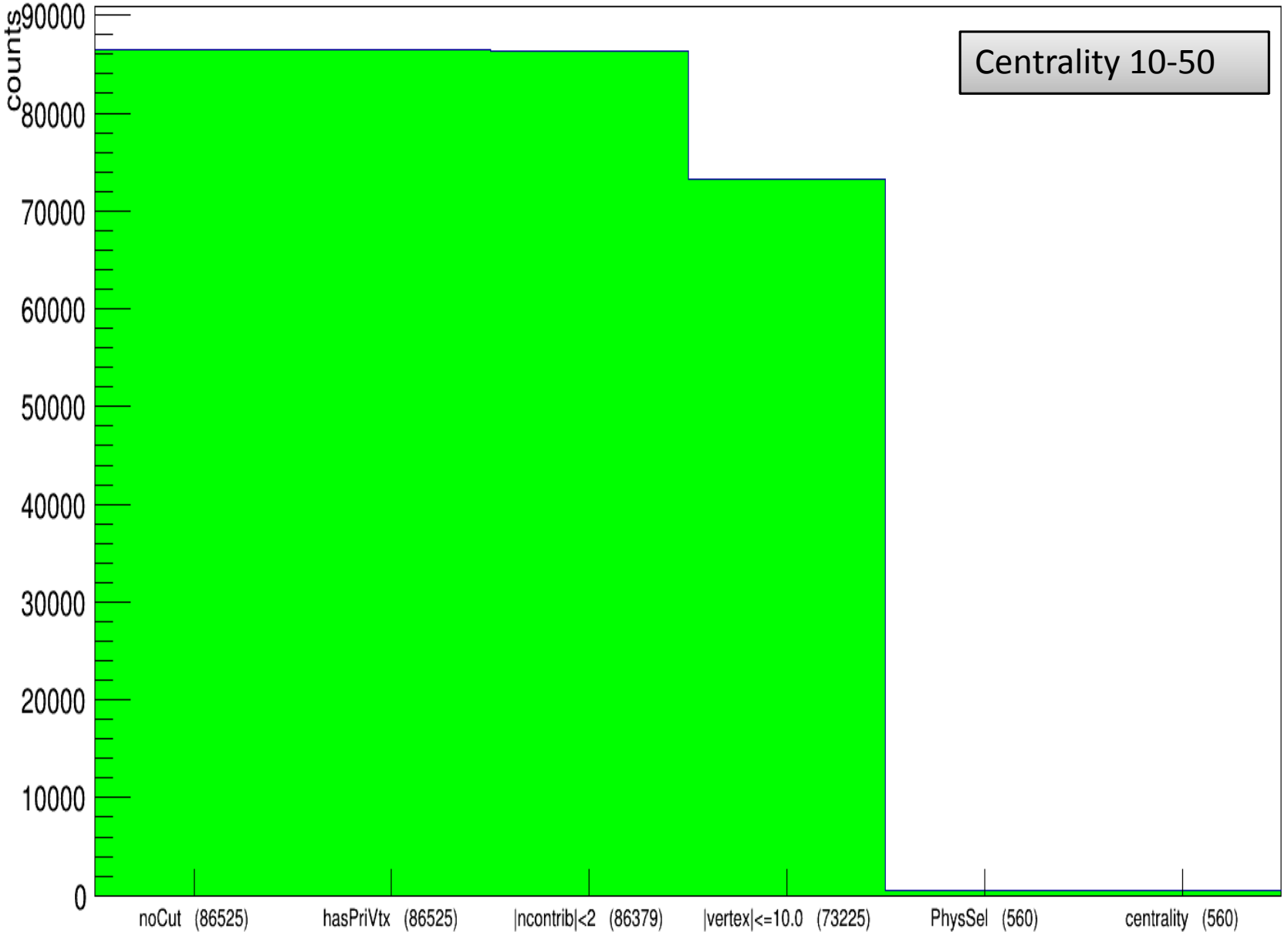
Event counter for different analysis cuts



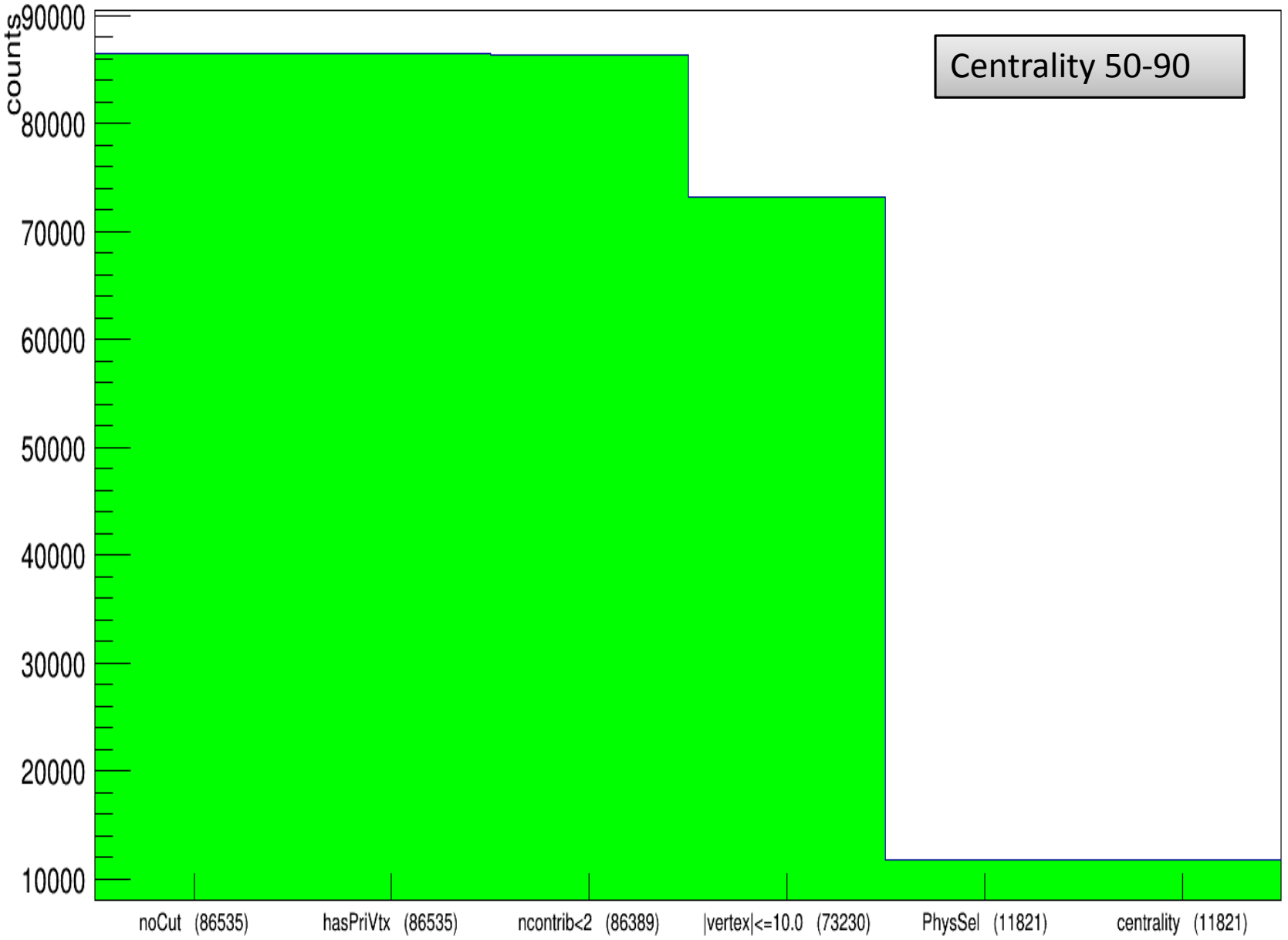
Event counter for different analysis cuts

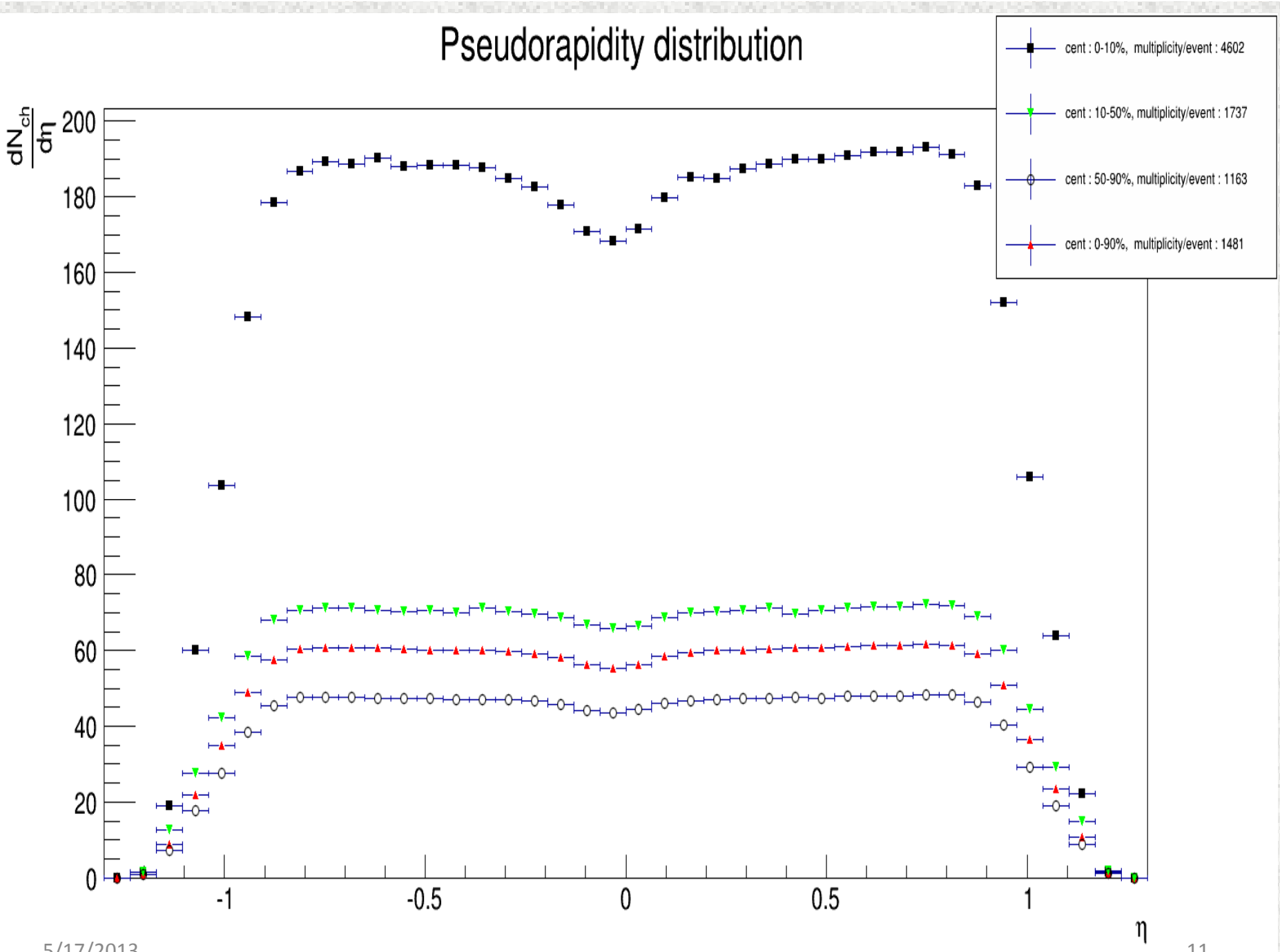


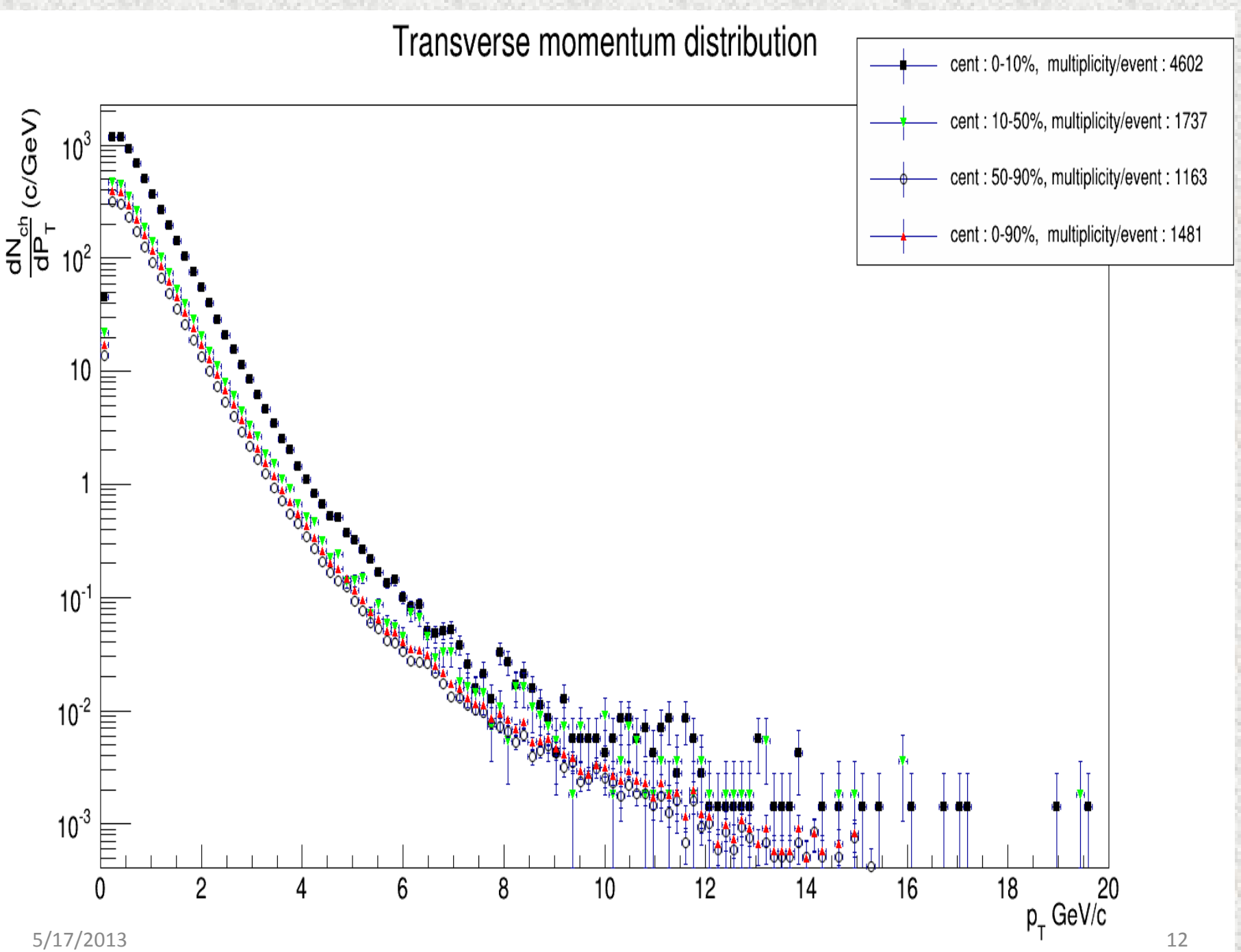
Event counter for different analysis cuts



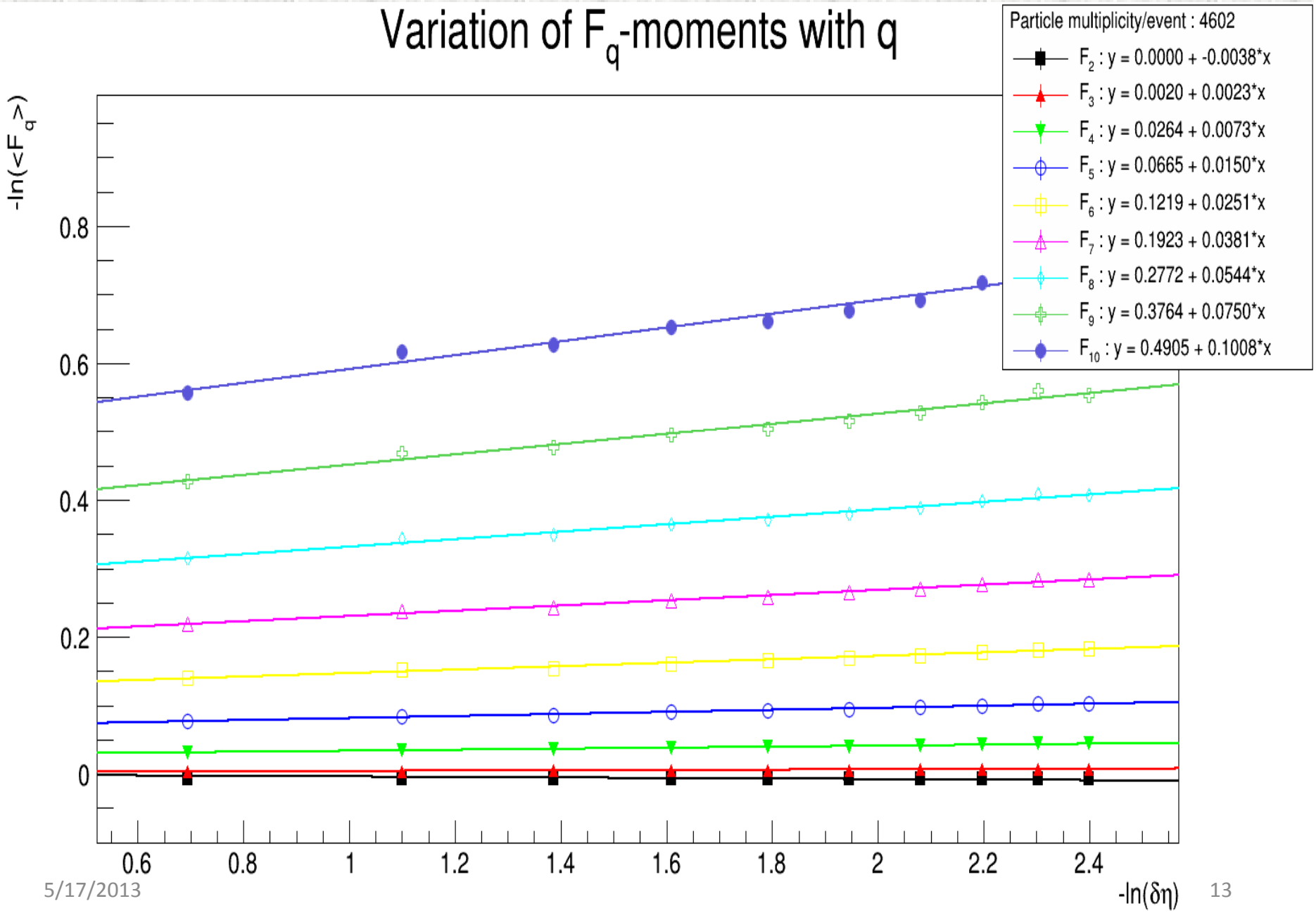
Event counter for different analysis cuts



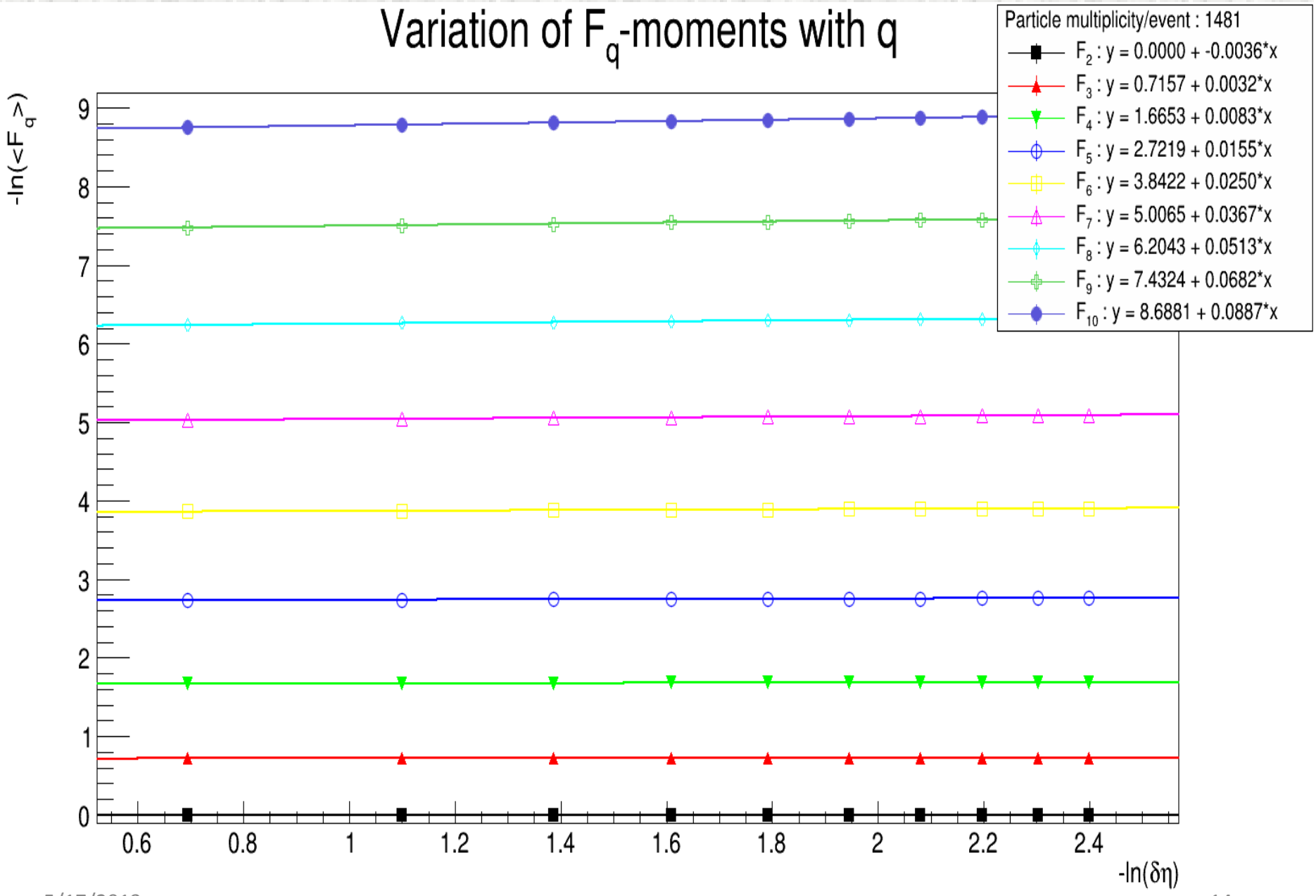

Pseudorapidity distribution
cent : 0-10%, multiplicity/event : 4602
cent : 10-50%, multiplicity/event : 1737
cent : 50-90%, multiplicity/event : 1163
cent : 0-90%, multiplicity/event : 1481
$\frac{dN_{ch}}{d\eta}$
200
180
160
140
120
100
80
60
40
20
0
-1
-0.5
0
0.5
1
η


Transverse momentum distribution
cent : 0-10%, multiplicity/event : 4602
cent : 10-50%, multiplicity/event : 1737
cent : 50-90%, multiplicity/event : 1163
cent : 0-90%, multiplicity/event : 1481
$\frac{dN_{ch}}{dP_T}$ (c/GeV)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
0
2
4
6
8
10
12
14
16
18
20
p_T GeV/c

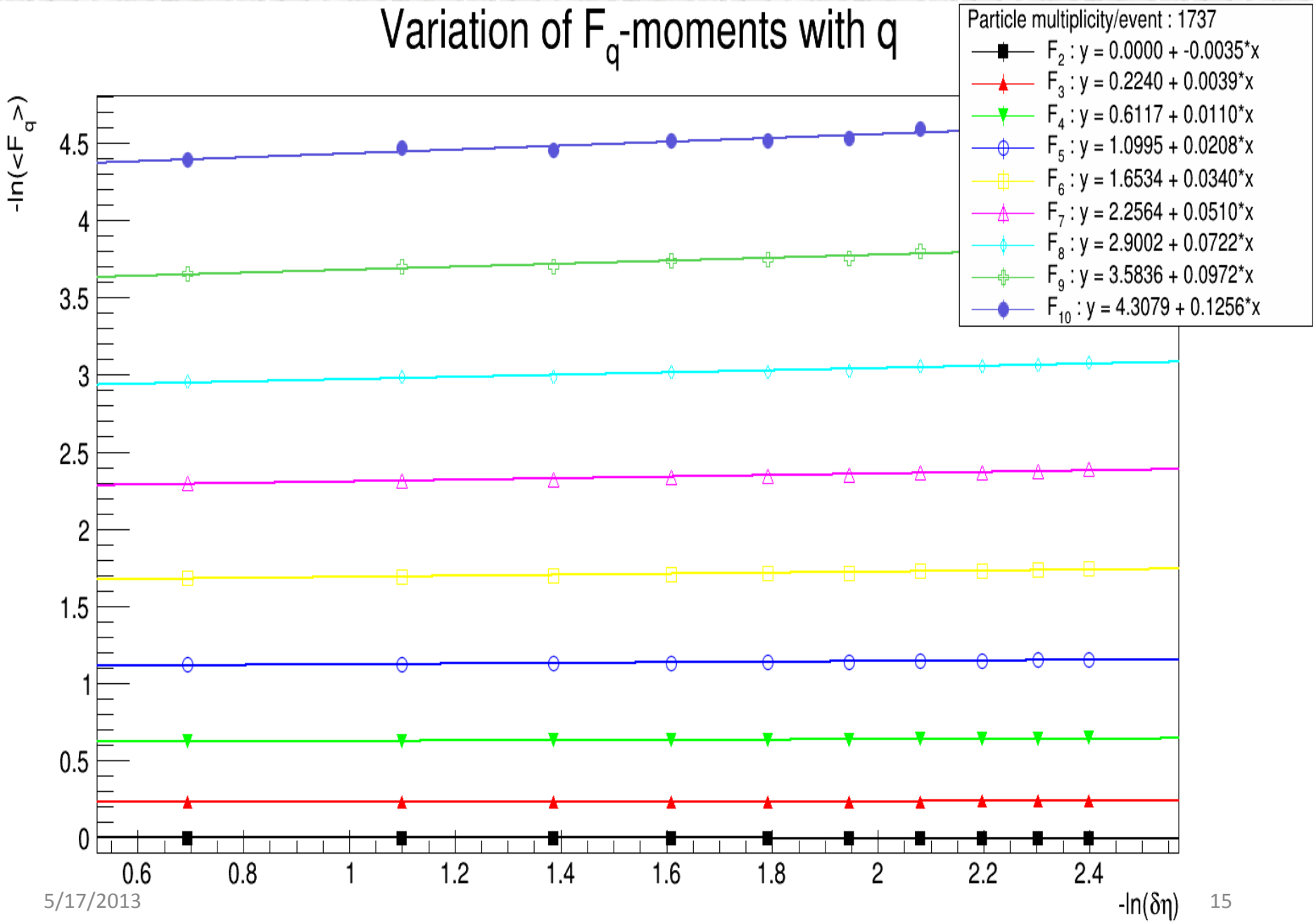
Centrality 0-10



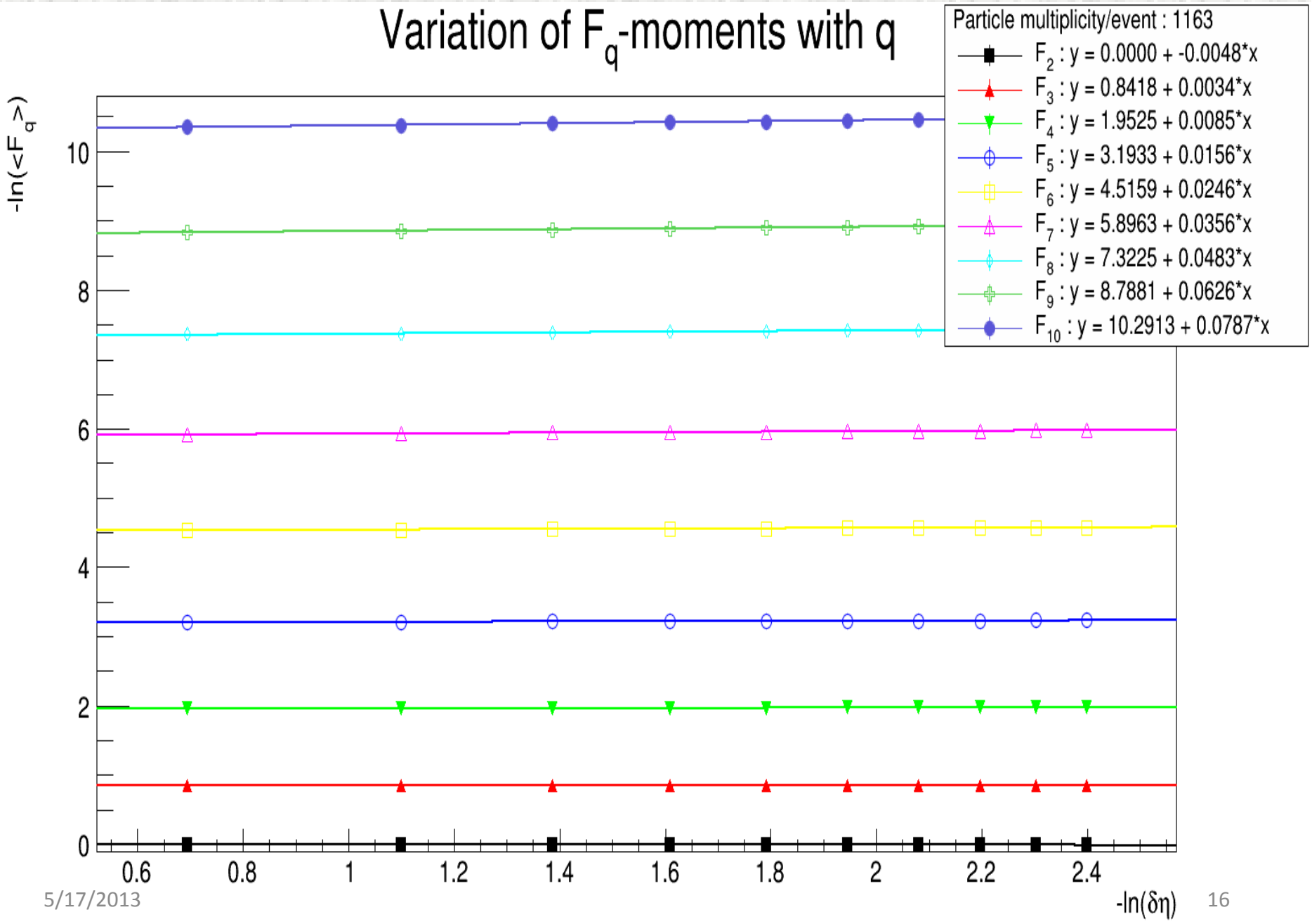
Centrality 0-90

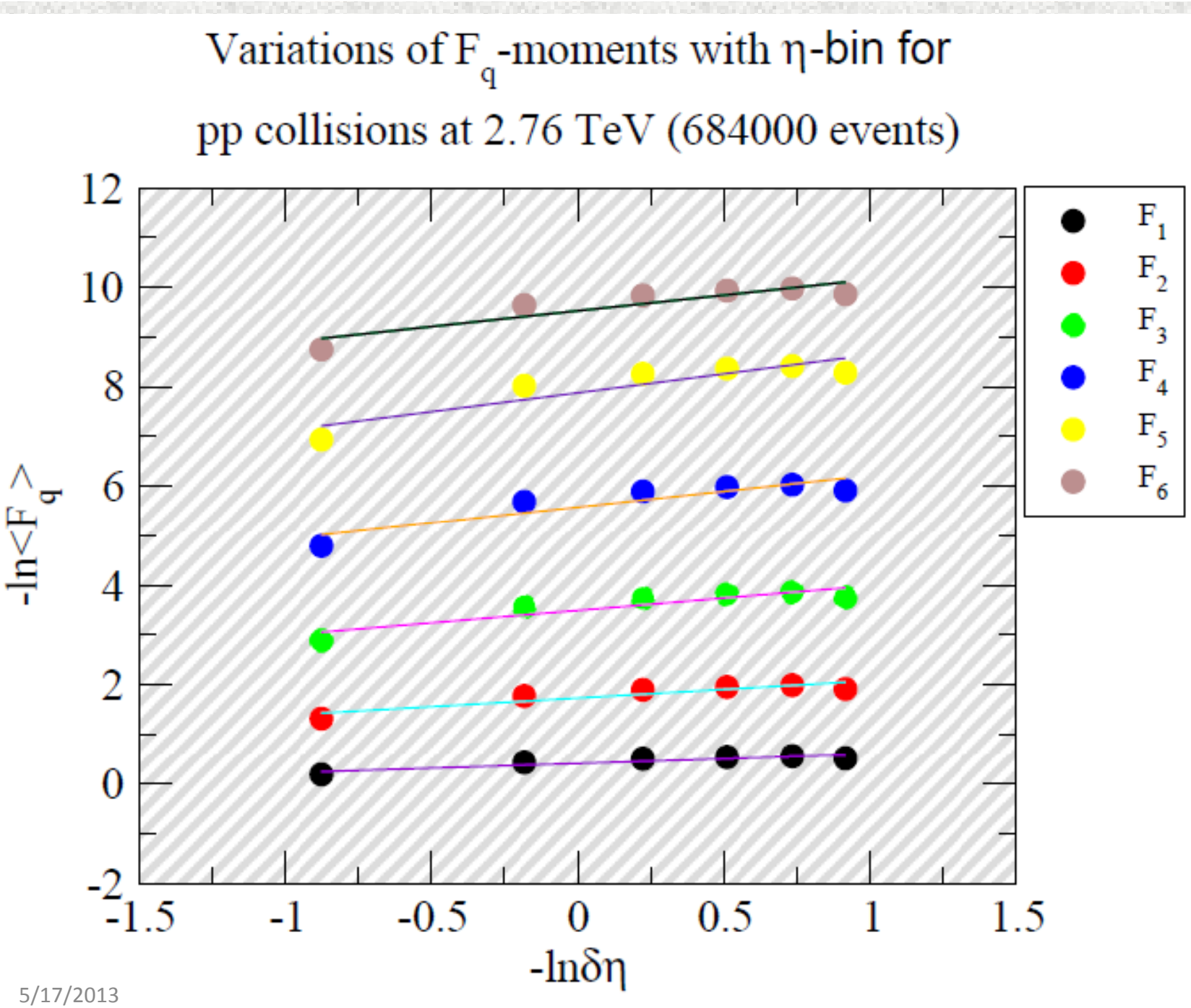


Centrality 10-50

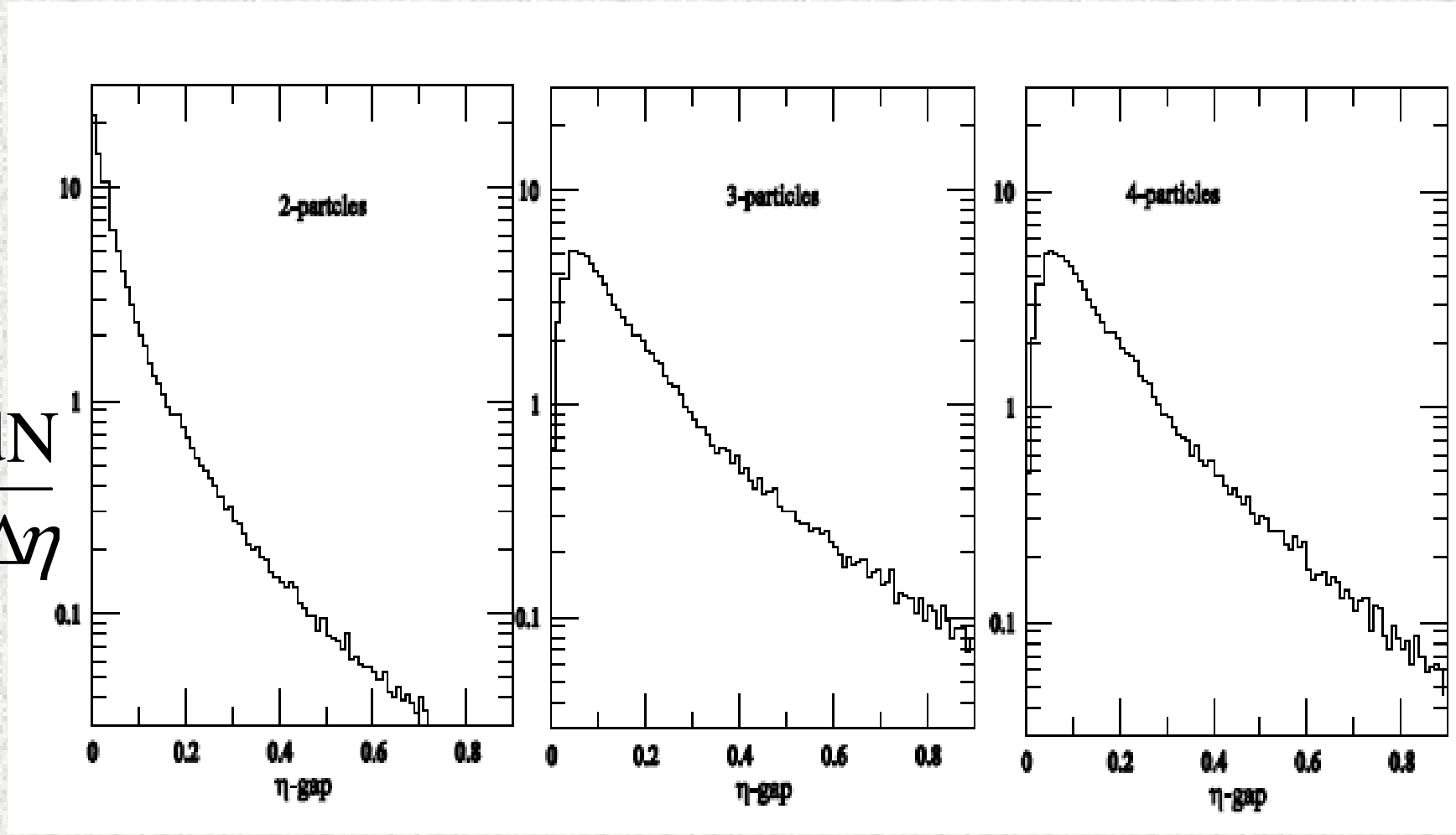


Centrality 50-90



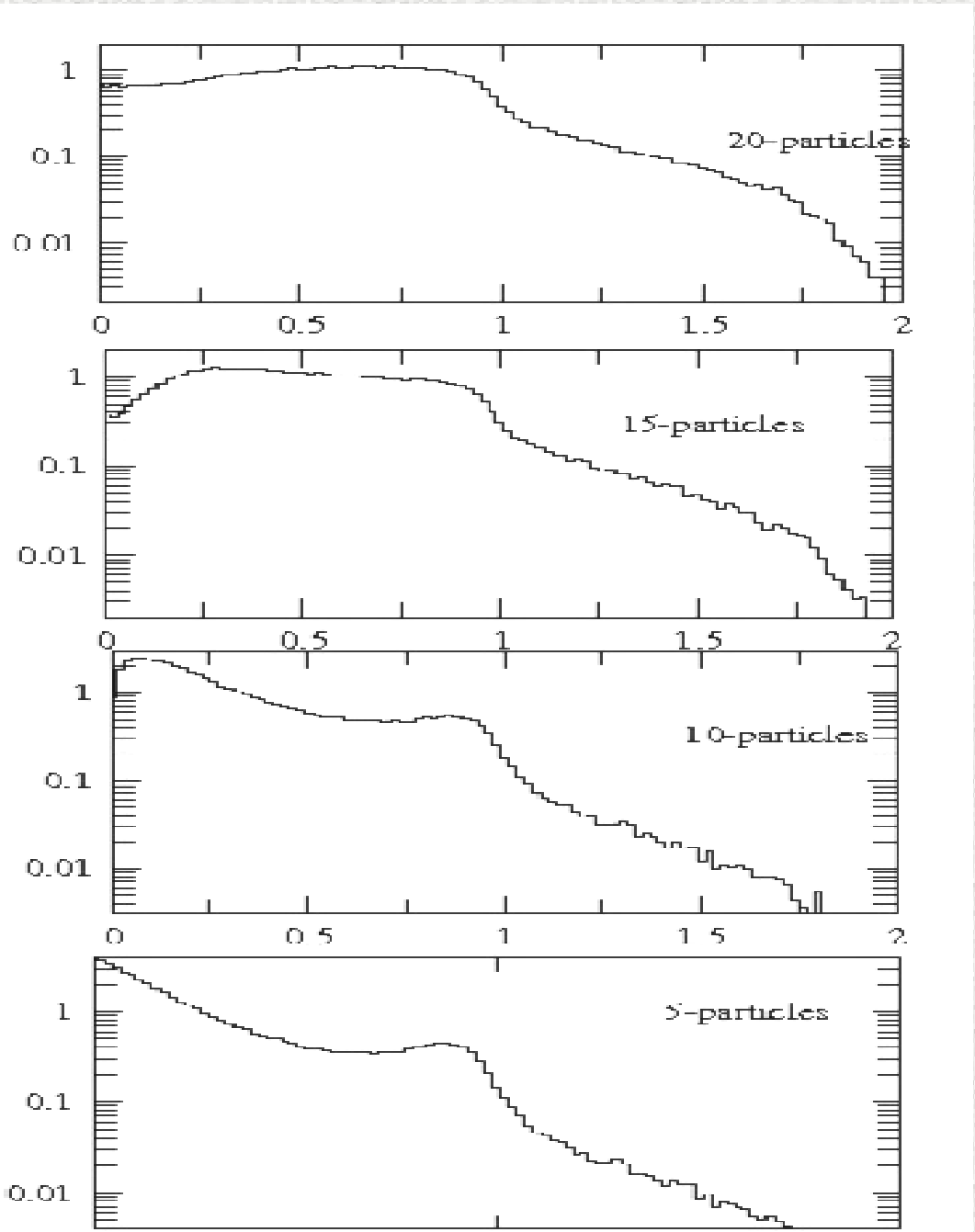

Variations of F_q-moments with η-bin for
pp collisions at 2.76 TeV (684000 events)
$-\ln\langle F_q \rangle$
$-\ln\delta\eta$
12
10
8
6
4
2
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
F_1
F_2
F_3
F_4
F_5
F_6

$$\frac{1}{N}\frac{dN}{d\Delta\eta}$$



$\Delta\eta$

$$\frac{1}{N}\frac{dN}{d\Delta\eta}$$



$\Delta\eta$

Conclusions:

- **Intermittency seems to be present in central PbPb collisions at 2.76A TeV and in pp collisions at 2.76TeV**

- **Presence of cluster of particles (2,3,4 and even higher) is quite prominent**

- **A significant intermittency signal is observed in 630 GeV j5p collisions measured in the UA1 central detector. It occurs with similar magnitude in different variables: pseudorapidity, rapidity and azimuthal angle. The signal increases with decreasing charged particle multiplicity in the event. Its strength in a sample of low p_t tracks and its multiplicity dependence are not reproduced by commonly used Monte Carlo models of high energy interactions**

- **Phenomenoa of Multifractality and erraticity**

INTERMITTENCY STUDIES IN $p\bar{p}$ COLLISIONS AT $\sqrt{s}$ *= 630 GeV*

UA1 Collaboration, CERN, Geneva, Switzerland, Nuclear Physics B345 (1990) 1—21

Future-plan

full statistics of PbPb-2011 (LHC11h period) has not yet been analysed,Analysis is ongoing.

we would like to continue this study for different particle species also for different p_t and ϕ bins.

Such analysis can be carried out in 2-dimenions also ($\eta\phi$, ηp_t,ϕp_t).


THANK YOU