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Event-by-event mean transverse momentum fluctuations in pp collisions at $\sqrt{s}$ = 13 TeV using the ALICE detector

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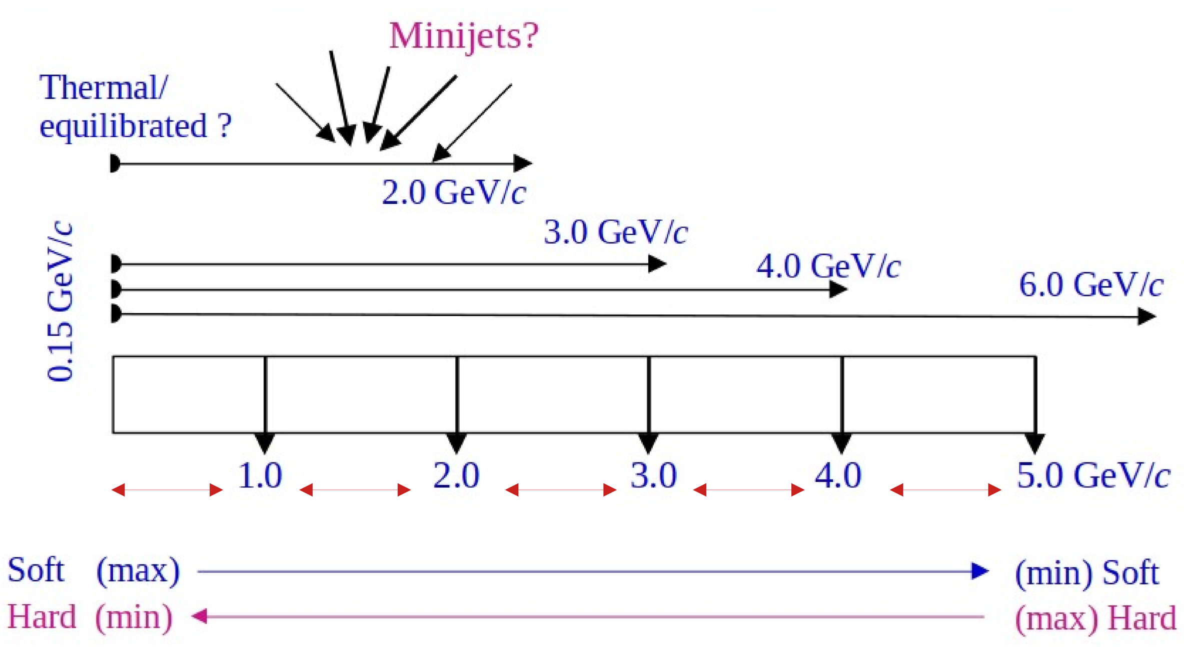
Motivation

- Study of event-by-event p_T fluctuations for small collision systems.
- Expectation of QGP droplet formation in high-multiplicity collisions?
- A reduction in the dynamical mean p_T fluctuations with increasing charged particle density has been observed.

- A study of the interplay of soft and hard p_T correlations in mean p_T fluctuations to understand the equilibration and thermal – non thermal sources.
- Models, PYTHIA (pQCD) and EPOS (core-corona) would help in revealing these sources.



Observable

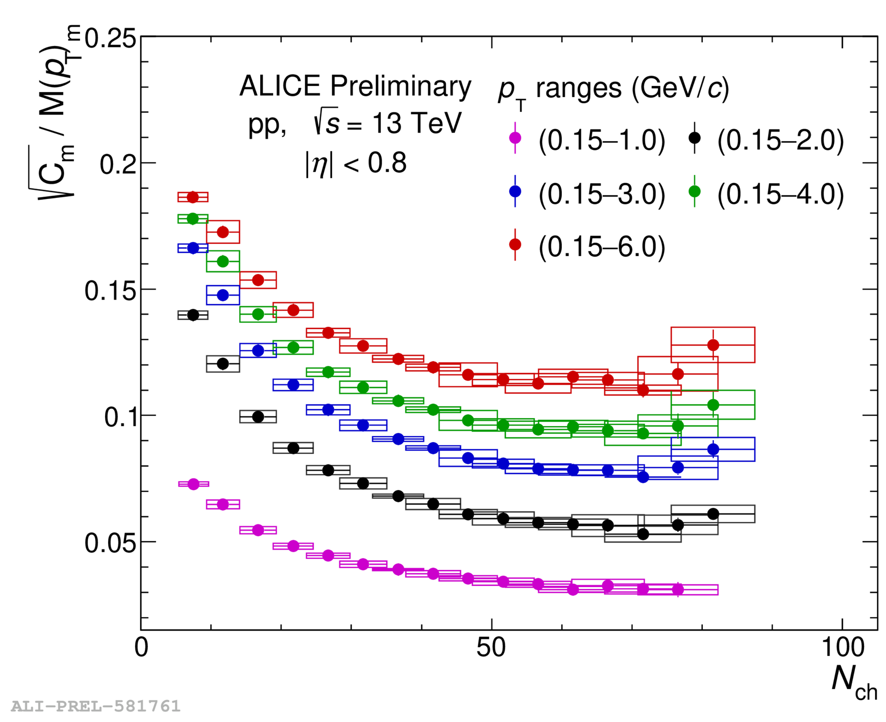
- The two-particle correlator, C_m is taken as a measure of dynamical component of mean p_T fluctuations. For statistical fluctuations $C_m \rightarrow 0$.

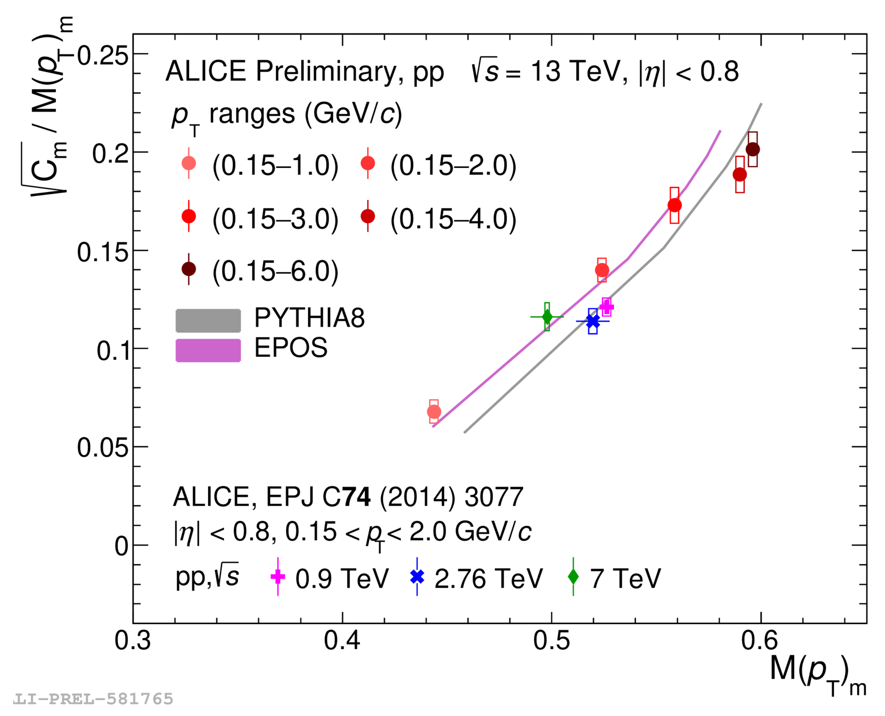
$$C_m = \frac{1}{\sum_{k=1}^{n_{\mathrm{evt},m}} N_k^{\mathrm{pairs}}} \sum_{k=1}^{n_{\mathrm{evt},m}} \sum_{i=1}^{N_{\mathrm{acc},k}} \sum_{j=i+1}^{N_{\mathrm{acc},k}} (p_{\mathrm{T},i} - M(p_{\mathrm{T}})_m) * (p_{\mathrm{T},j} - M(p_{\mathrm{T}})_m)$$

Where, $n_{\mathrm{evt,m}}$ denotes the number of events in multiplicity class m,
$N_k^{pairs} = 0.5 * N_{acc,k} * (N_{acc,k} - 1)$ is number of pairs in an event k, and
$M(p_T)_m$ is the mean p_T of all tracks of all events in a given multiplicity class.

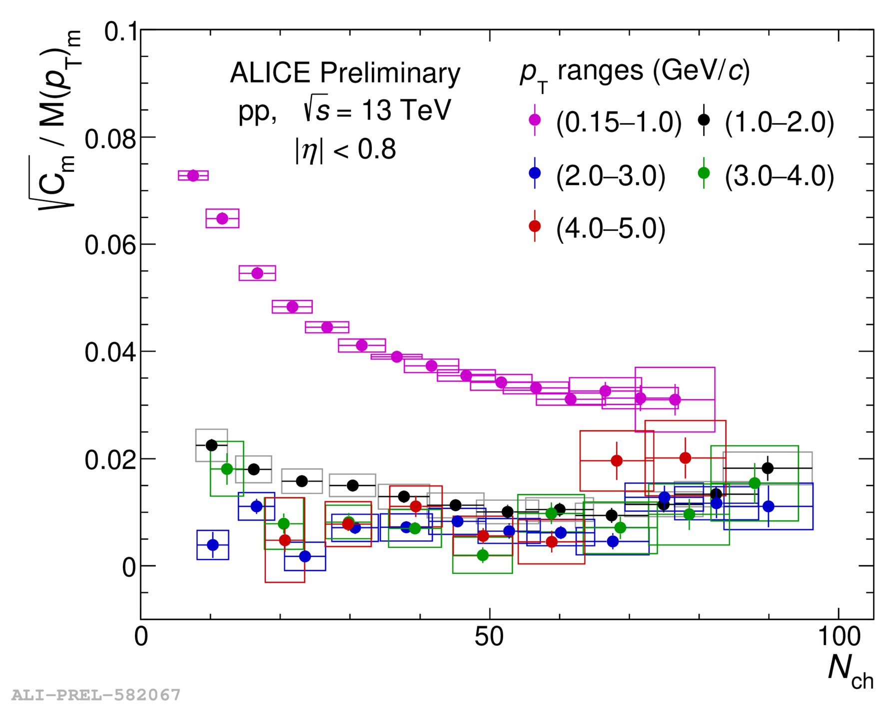
$$M(p_{\mathrm{T}})_m = \frac{1}{\sum_{k=1}^{n_{\mathrm{evt},m}} N_{\mathrm{acc},k}} \sum_{k=1}^{n_{\mathrm{evt},m}} \sum_{i=1}^{N_{\mathrm{acc},k}} p_{\mathrm{T},i}$$

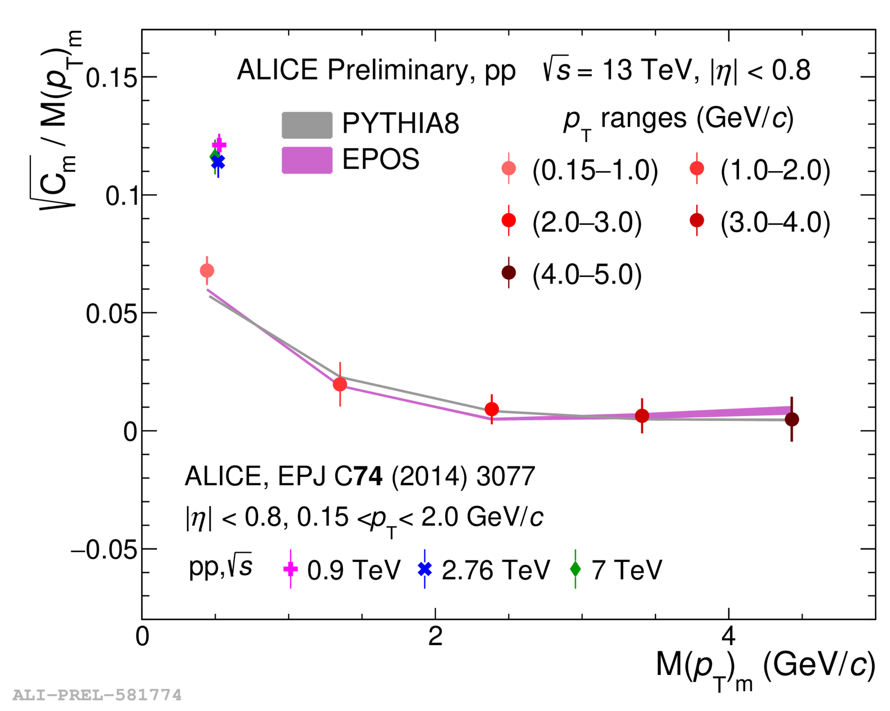
Results & Discussion



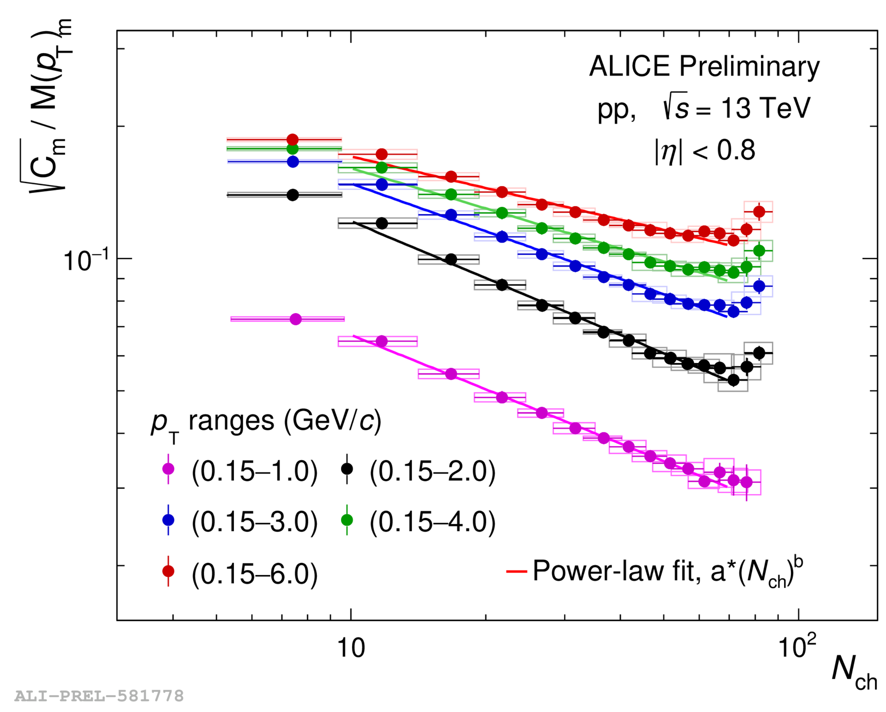


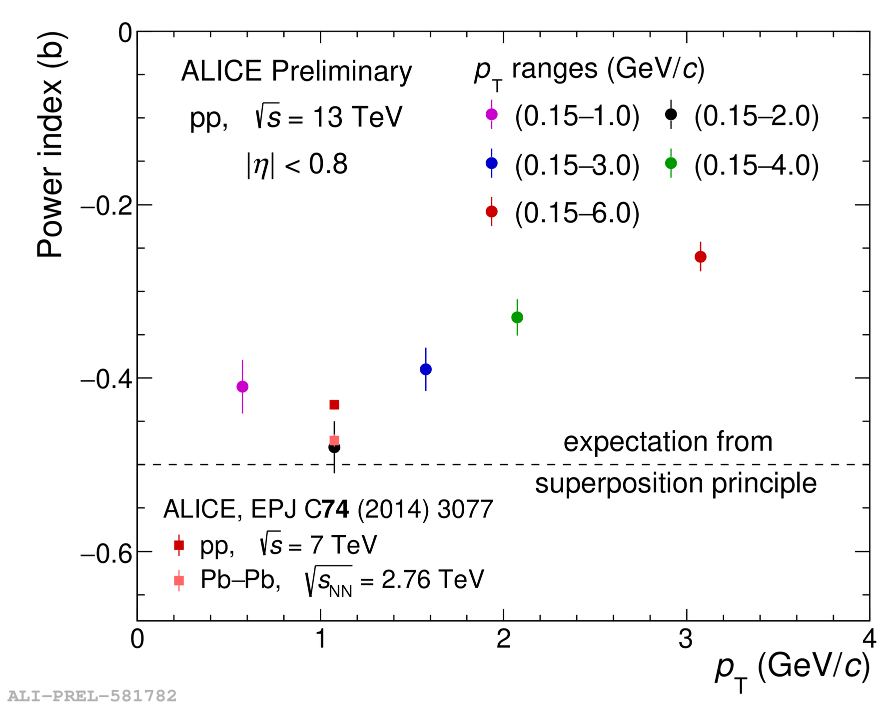
- For a given N_{ch}, correlation strength increases when the p_T acceptance window is widened.
- Inclusive correlation values increase sharply with a small increase in $M(p_T)_m$.





- For fixed-width p_T windows, the correlations are the same even for higher p_T values.
- The inclusive correlation values are nearly zero. As observed in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV.

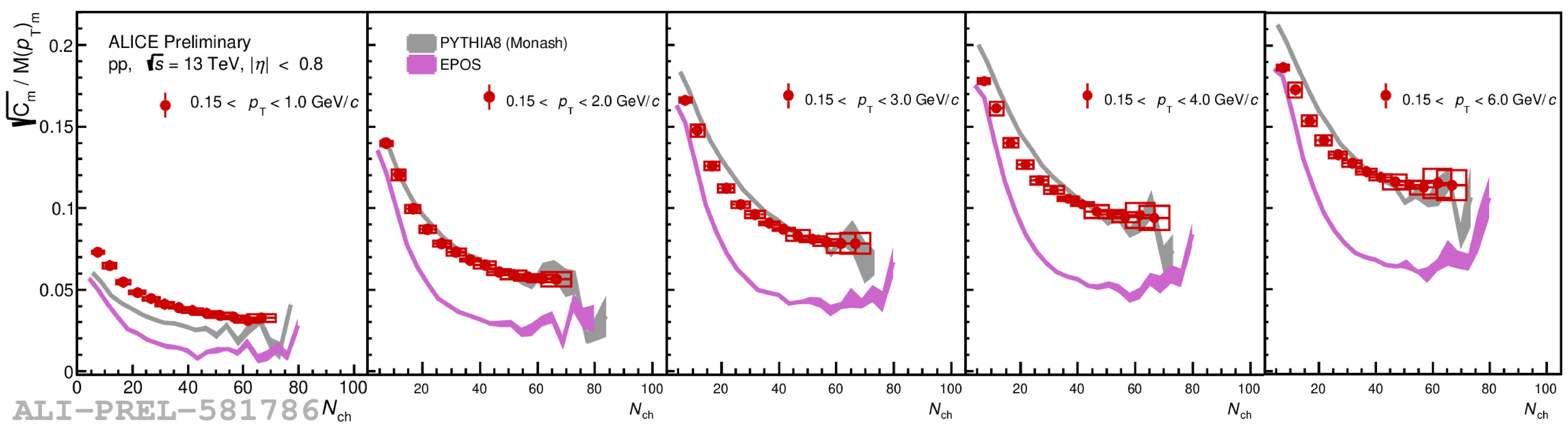


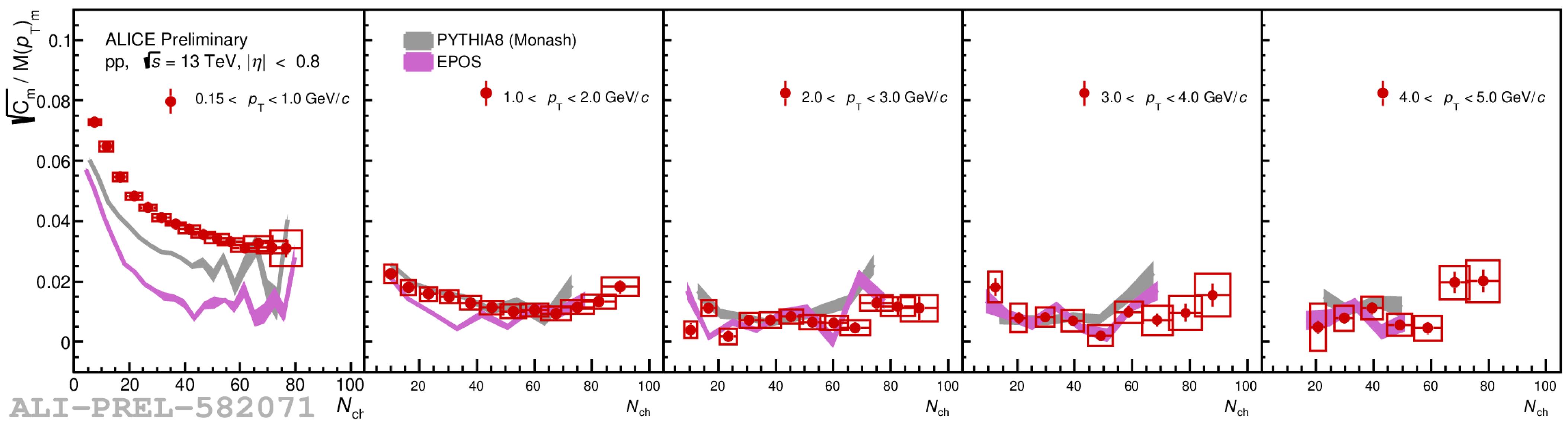


- The power-law fit of the form $a*(N_{ch})^b$ in the range 10 < N_{ch} < 70.
- For a wider range of p_T windows, the variations of b (power index parameter) show that the system moves farther away from equilibrium.

- PYTHIA and EPOS agree qualitatively.
- PYTHIA (pQCD inspired) describes the data more accurately. The relative difference between EPOS and the experimental data increases with wider p_T acceptance windows.
- The contribution from soft processes becomes less important with high p_T limits, EPOS (corona) and PYTHIA agree with each other and with the data.

- Suggesting hard processes are the dominant sources for mean p_T fluctuations.





References:

1) ALICE Collaboration, Nat. Phys. 13 (2017) 535.
2) ALICE Collaboration, Euro. Phys. J. C74, (2014) 3077
3) CMS Collaboration, Phys. Lett. B765 (2017) 193
4) CMS Collaboration, Phys. Rev. Lett. 116 (2016) 172302
5) https://indico.cern.ch/event/1139644/contributions/5491628/
6) STAR Collaboration, Phys. Rev. C72 (2005) 044902.
7) CERES Collaboration, Nucl. Phys. A811 (2008) 179.