

Transverse momentum distribution of charged particles in proton-proton collisions at  $\sqrt{s} = 13$  TeV Julius Gronefeld\* & Edgar P. Lezama\* for the ALICE Collaboration



#### Motivation

- The inclusive production of charged particles in high-energy proton-proton collisions is a key observable to characterize the global properties of the collision.

- Particle production at LHC energies originates from the interplay of perturbative (hard) and non-perturbative (soft) QCD processes. These measurements provide constraints to phenomenological models as implemented in pQCD inspired generators such as PYTHIA.

- Data in pp collisions are reference for the study of nuclear

## **Results**

The transverse-momentum distribution of charged particles is measured in the range 0.15 <  $p_T$  < 20 GeV/*c* and  $|\eta| < 0.8$ 



effects in nucleus-nucleus and proton-nucleus collisions.

**ALICE** (A Large Ion Collider Experiment) is a generalpurpose detector primarily designed for the study of the Quark Gluon Plasma in heavy-ion collisions. ALICE excellent offers particle identification (PID) and tracking capabilities.



For tracking of charged particles, the Inner Tracking System (ITS) and the Time Projection Chamber (TPC) are used.

- The ITS surrounds the interaction region as a six layer structure providing an accuracy of 50  $\mu$ m for the reconstruction of secondary vertices.

- The TPC is the main Particle IDentification (PID) and tracking

The general features seen in the data are reproduced well by the models. Pythia8 (Monash-2013) predicts a harder spectrum than data.



detector of the central barrel.

- The VO detector is mainly used as a trigger detector. It also provides information used for beam-gas event rejection as well as event multiplicity (p-Pb) and centrality (Pb-Pb) classification.

### **Event Selection**

-About 1.5 million events pass the minimum-bias (MB) selection criteria.

-Events are required to have a valid reconstructed vertex within a range of |z| < 10 cm.

-The measurements reported have been obtained for events having at least one charged particle in the pseudorapidity interval  $|\eta| < 1$ (INEL > 0).

## **Track Selection**

- Tracks are reconstructed using the combined information from the TPC and ITS detectors.

- A track is accepted if the number of crossed TPC padrows is at least 120 (out of 159).

2.2>0 ALICE pp  $\sqrt{s}$  = 13 TeV, charged particles, |  $\eta$  | < 0.8 to INEL;  $2 \vdash \text{Data}, \langle N_{ch}^{acc} \rangle = 6.73, \langle N_{ch} \rangle = 9.4 \ (p_T > 0.15 \text{ GeV}/c)$ •  $1 \le N_{\rm ch}^{\rm acc} < \langle N_{\rm ch}^{\rm acc} \rangle$ 1.8⊢  $| \langle N_{ch}^{acc} \rangle \leq N_{ch}^{acc} < 2 \langle N_{ch}^{acc} \rangle$ Ratio 1.6-+  $N_{\rm ch}^{\rm acc} \ge 2 \langle N_{\rm ch}^{\rm acc} \rangle$ 0.8 0.6 0.4 $\vdash$  MC, selection on  $N_{ch}$ EPOS LHC,  $\langle N_{ch} \rangle = 10.0$ 0.2 - PYTHIA 8 (Monash-2013),  $\langle N_{\downarrow} \rangle = 10.1$ 

The correlation of the with spectrum multiplicity İS the prominent for whole  $p_{\rm T}$  range and in particular it is stronger at high  $p_{\rm T}$ .

The general features seen in the data are reproduced the by models, but in detail visible there are disagreements.

- High-purity selection of primary charged particles is achieved with a  $p_{T}$ -dependent cut on the distance of closest approach in the transverse plane between the track and the primary vertex.

#### References

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[4] T. Pierog, I. Karpenko, J. Katzy, E. Yatsenko, and K. Werner, "EPOS LHC: test of collective hadronization with LHC data", arXiv:1306.0121.

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# **Conclusions:**

- Measurement of the transverse-momentum distribution of charged particles produced in proton-proton collisions at  $\sqrt{s} =$ 13 TeV.

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 $p_{\tau}$  (GeV/c)

- Spectrum is significantly harder than at  $\sqrt{s} = 7$  TeV and shapes seem to depend strongly with charged-particle multiplicity as measured in the same kinematic region. - The results are found to be in fair agreement with event

generators commonly used at the LHC.