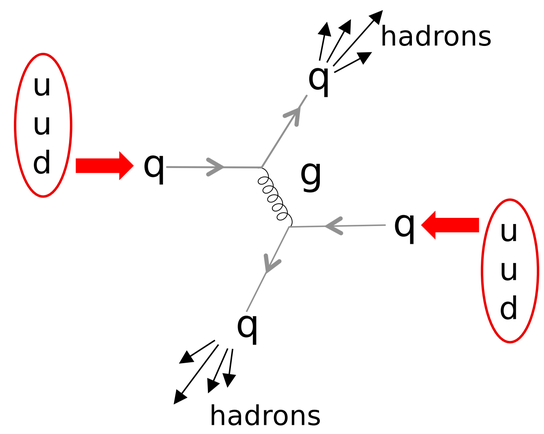
Energy dependence of transverse momentum spectra of primary charged particles in pp collisions measured by ALICE at the LHC

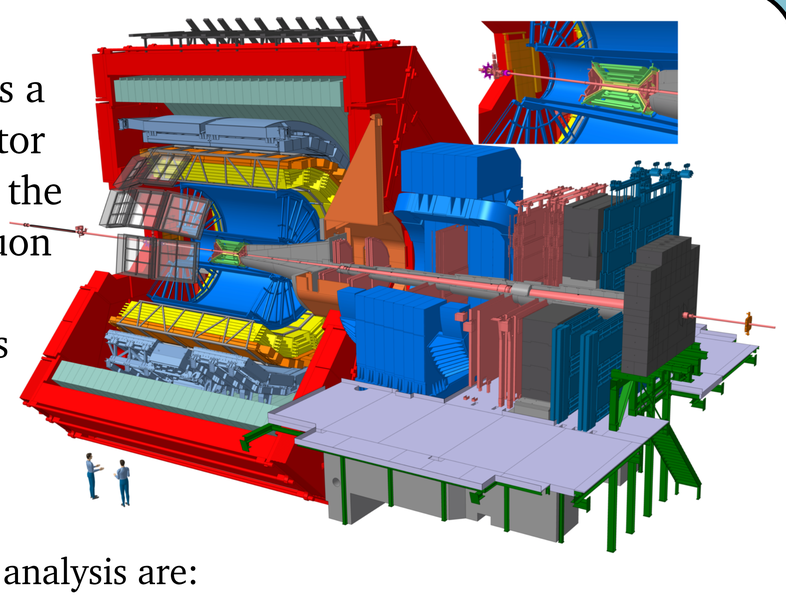
Edgar Pérez Lezama for the ALICE Collaboration

Motivation

- The inclusive production of charged particles in high-energy proton-proton (pp) collisions is an important 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.
- Data in pp collisions serve as reference for nucleus-nucleus and proton-nucleus collisions to study Quark Gluon Plasma (QGP) properties and initial state nuclear matter effects.



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



The detectors used in the analysis are:

- **Inner Tracking System (ITS):** surrounds the interaction region as a six layer structure. The first two SPD layers have pixel sizes of 50 μm (rφ)×425 μm(z), allowing a precise tracking close to the primary vertex and the reconstruction of secondary vertices.
- **Time Projection Chamber (TPC):** is the main Particle IDentification (PID) and tracking detector of the central barrel. It allows reconstruction of tracks and particle identification via ionization energy loss.
- **VZERO:** the V0A and V0C detectors are mainly used for event selection, background rejection and as trigger. They also provide information on the event multiplicity (p-Pb) and centrality (Pb-Pb).

Analysis

- **Event Selection**
  - *13* TeV*:* 1 million of events
  - *7 TeV:* 117 million of events
  - *5.02* TeV*:* 115 million of events
  - *2.76* TeV*:* 50 million of events

  Events are required to have a valid reconstructed vertex within a range of $|z| < 10$ cm from the center of the detector.
- **Track Selection**

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

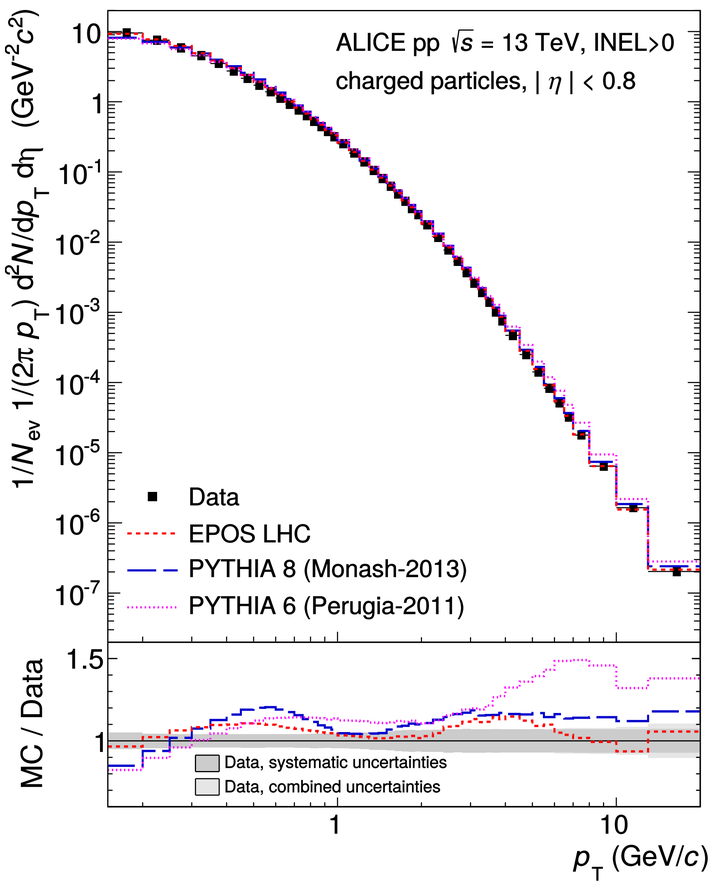
  A track is required to be sampled over a minimum length in the active volume of the TPC.

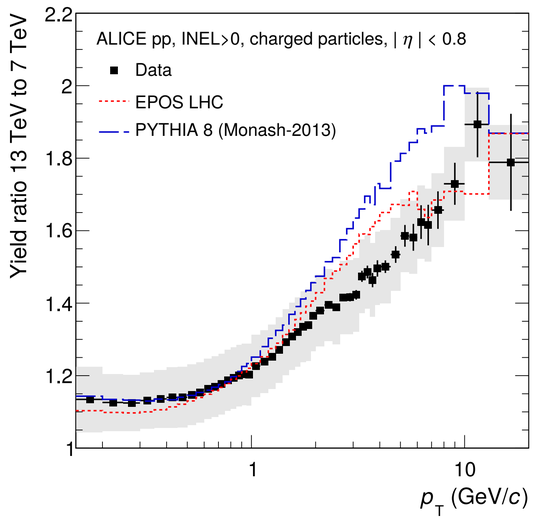
  High-purity selection of primary charged particles is achieved with a p_T-dependent cut on the distance of closest approach in the transverse plane between the track and the primary vertex. The contamination of secondary tracks is estimated to be about 6% at low p_T.
- **Particle composition**

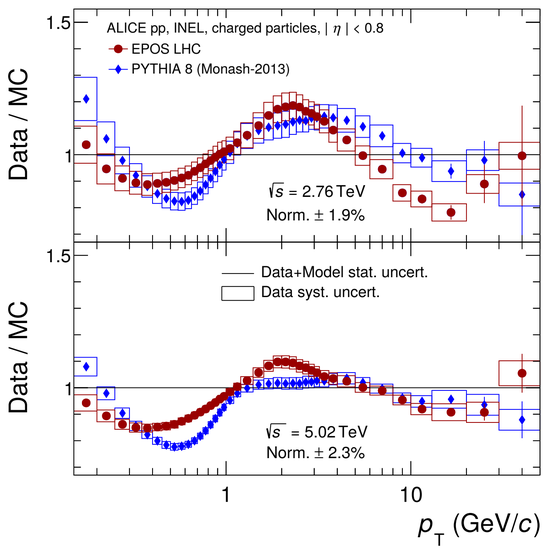
  Since the relative abundances of particle species is not correctly reproduced by the MC generators, we have reweighted the particle species dependent efficiencies by the relative abundances derived from pp collisions at $\sqrt{s} = 7$ TeV.

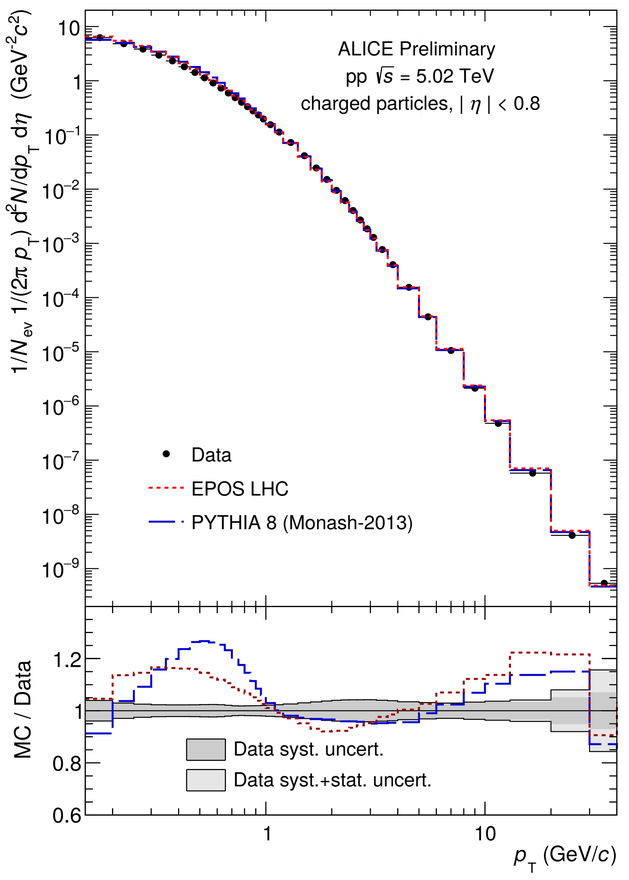
Results

The transverse-momentum distributions of primary charged particles are measured in the range $0.15 < p_T < 50$ GeV/c for pp collisions at 2.76 TeV and 5.02 TeV, and $0.15 < p_T < 20$ GeV/c for 7 TeV and 13 TeV.









- The spectrum at $\sqrt{s} = 13$ TeV is significantly harder than at $\sqrt{s} = 7$ TeV.
- At high (7 GeV/c to 50 GeV/c) and mid-p_T (1 GeV/c to 5 GeV/c) the results are in fair agreement with event generators commonly used at the LHC.
- Spectra agreement with event generators is found to be approximately energy-independent.

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