Measurement of D-meson azimuthal correlations with charged particles in p-Pb collisions at $\sqrt{s}$ = 5.02 TeV with ALICE

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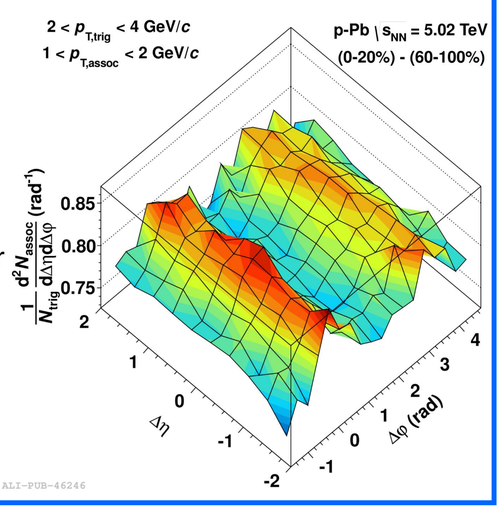
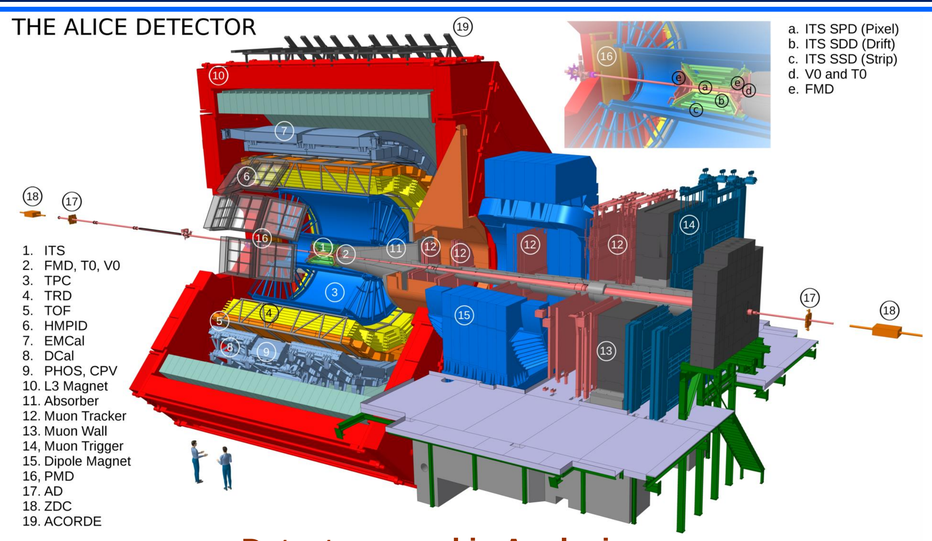
Motivations

- Heavy quarks (charm and beauty) are produced via hard parton scatterings in the initial stage of ultra-relativistic heavy-ion collisions, hence they are ideal probes of the Quark-Gluon Plasma (QGP) created in such collisions at the LHC
- Two-particle angular correlation studies in heavy-ion collisions have provided deep insight into the in-medium partonic energy loss and its dependence on the parton path length in the medium
- Similar information in the heavy-flavour sector can be obtained via correlations of heavy-flavours and charged particles. In **p-Pb collisions these studies** allow us to:
  - Investigate possible **modifications of angular correlations** which could derive from initial-state effects (e.g. CGC) or possible final-state effects (hydrodynamic evolution of the collision)
  - Search for long-range **double-ridge** structure in heavy-flavour sector
  - Act as a reference to disentangle final-state QGP-induced modifications from cold-nuclear-matter effects



ALICE Detector



Detectors used in Analysis

ITS: Inner Tracking System, for tracking and reconstruction of primary and secondary vertices

TPC: Time Projection Chamber, for tracking and particle identification

TOF: Time Of Flight detector, for particle identification

ZNA: Zero-degree Neutron Calorimeter (A-side) for centrality determination

Analysis Details & Results

- D^+, D^0 and D^{*+} mesons are fully reconstructed at central rapidity from their hadronic decay channels:
- Correlation of D mesons with primary charged particles (e, μ, π, K, p) by removing D-meson daughters
- Correction for limited detector acceptance and inhomogeneity by event-mixing technique
- Removal of background correlations (from D-meson combinatorial background under the signal peak) via sideband subtraction technique

$$D^+ \rightarrow K^- \pi^+ \pi^+ \ (3.88 \pm 0.05\%)$$

$$D^0 \rightarrow K^- \pi^+ \ (9.13 \pm 0.19\%)$$

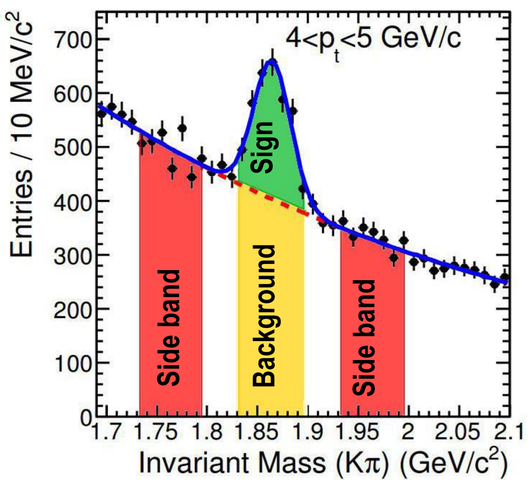
$$D^{*+} \rightarrow D^0 \pi^+ \ (67.7 \pm 0.5\%)$$

- Correction for the contamination of secondary particles
- Correction for feed-down of D mesons from B-hadron decays
- Correction for D-meson efficiency and associated track efficiency
- Projection onto the $\Delta\varphi$ axis, average of the three D-meson specie correlation distributions and fit with the following function:

$$f(\Delta\varphi) = c + \frac{Y_{NS}}{\sqrt{2\pi}\,\sigma_{NS}} e^{-\frac{(\Delta\varphi-\mu_{NS})^2}{2\sigma_{NS}^2}} + \frac{Y_{AS}}{\sqrt{2\pi}\,\sigma_{AS}} e^{-\frac{(\Delta\varphi-\mu_{AS})^2}{2\sigma_{AS}^2}}$$

- Extraction of near-side (NS) and away-side (AS) yield and width to study the jet properties

Method of Signal Extraction



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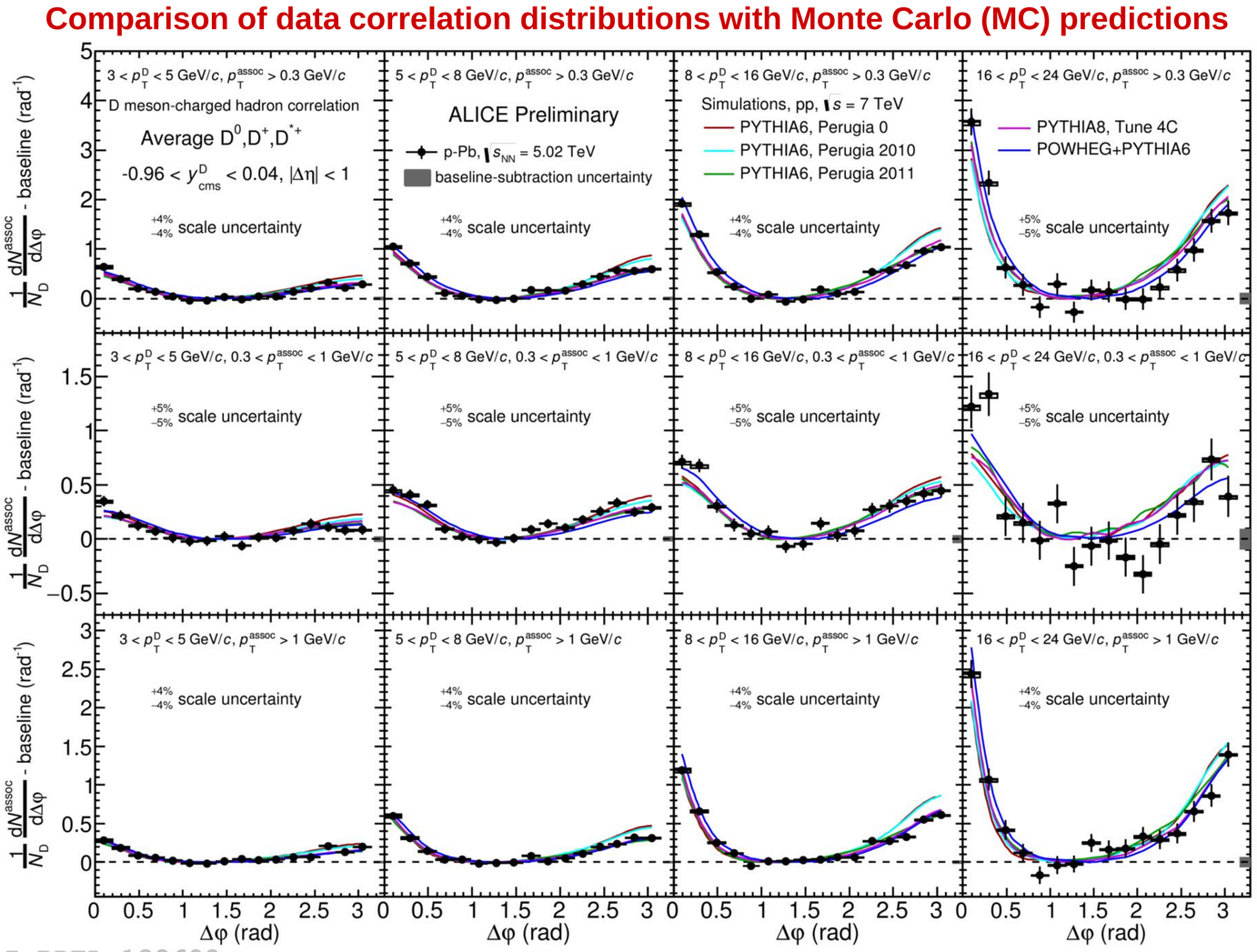
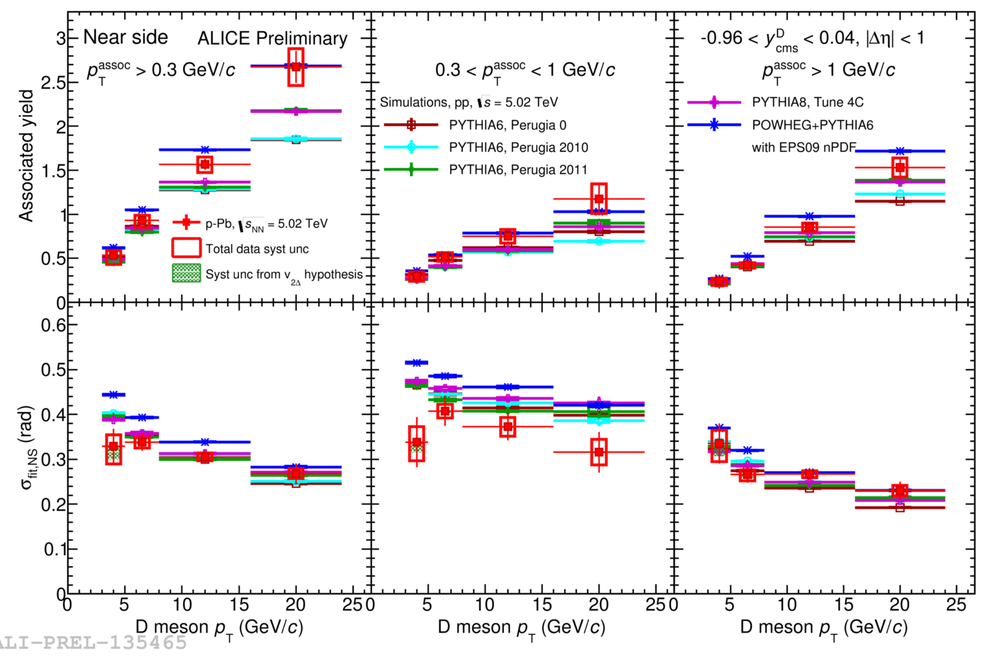
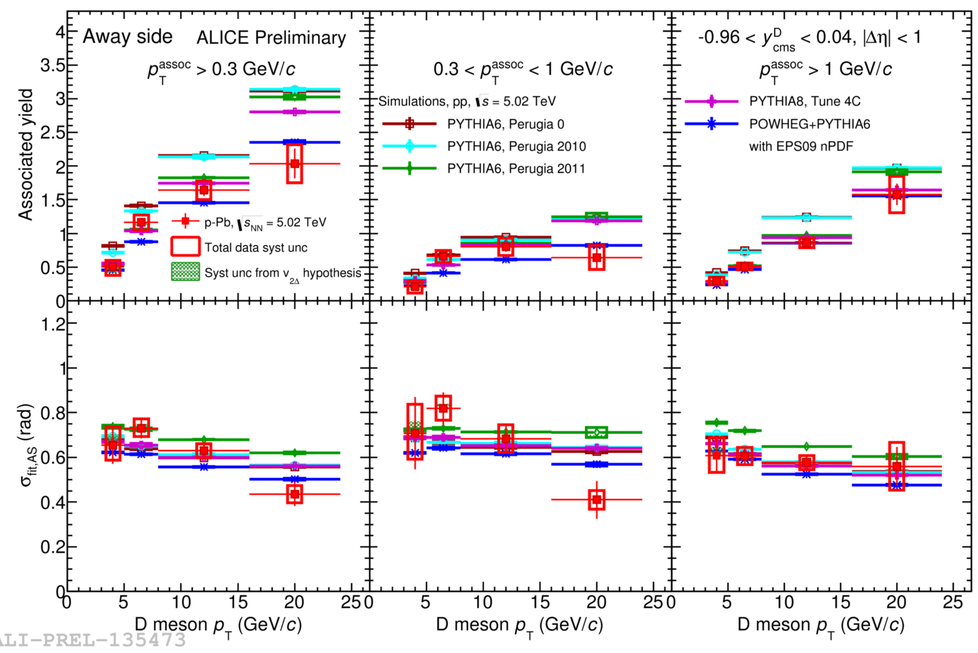
Comparison of data correlation distributions with Monte Carlo (MC) predictions



NS and AS correlation distribution shape, and its p_T evolution, show good agreement with expectations from Monte Carlo simulations obtained with PYTHIA and POWHEG event generators

Comparison of NS, AS Yield and Sigma with MC predictions





NS and AS yields and sigma evolution with transverse momentum are well described Monte Carlo simulations obtained with PYTHIA and POWHEG event generators

Summary

- ✓ D-meson azimuthal correlations with charged particles in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV studied with run-2 data with ALICE at the LHC
- ✓ The results obtained improve significantly its precision w.r.t. run1 data
- ✓ The correlation distributions, as well as the features of correlation peaks, are well described by Monte Carlo simulations obtained with PYTHIA and POWHEG event generators

References

Ref: [1] Yu.L. Dokshitzer, D.E. Kharzeev, Physics Letters B 519 (2001) 199-206

Ref: [2] B. Abelev et al. (ALICE Collaboration), JHEP 01 (2012) 128.

Ref: [3] J. Adam et al. (ALICE Collaboration), Eur. Phys. J. C 77 (2017) 245