



Heavy-flavour correlations with charged particles

and collective effects in p-Pb collisions at

$\sqrt{s_{NN}} = 5.02$ TeV with ALICE at the LHC

Marianna MAZZILLI for the ALICE Collaboration

18th International Conference on Strangeness in Quark Matter, 10-15 June 2019- Bari

WHY HEAVY-FLAVOUR CORRELATIONS



Angular correlations between heavy-flavour particles and charged hadrons can give us access to the **charm and beauty production** and **fragmentation** mechanism and provide further insight on the heavy-quark interaction with the medium created in heavy-ion collisions (Quark-Gluon Plasma).

- pp:**
- Investigate heavy-flavour quark fragmentation properties and characterize heavy-flavour jets.
 - Possible sensitivity to the different charm and beauty production mechanisms.
 - Reference for p-Pb and Pb-Pb collisions.

- p-Pb:**
- Assess cold-nuclear matter effects.
 - Investigate on the presence of a double ridge (i.e. long-range ridge-like structures in near and away-side regions) observed in h-h correlations [1-3].

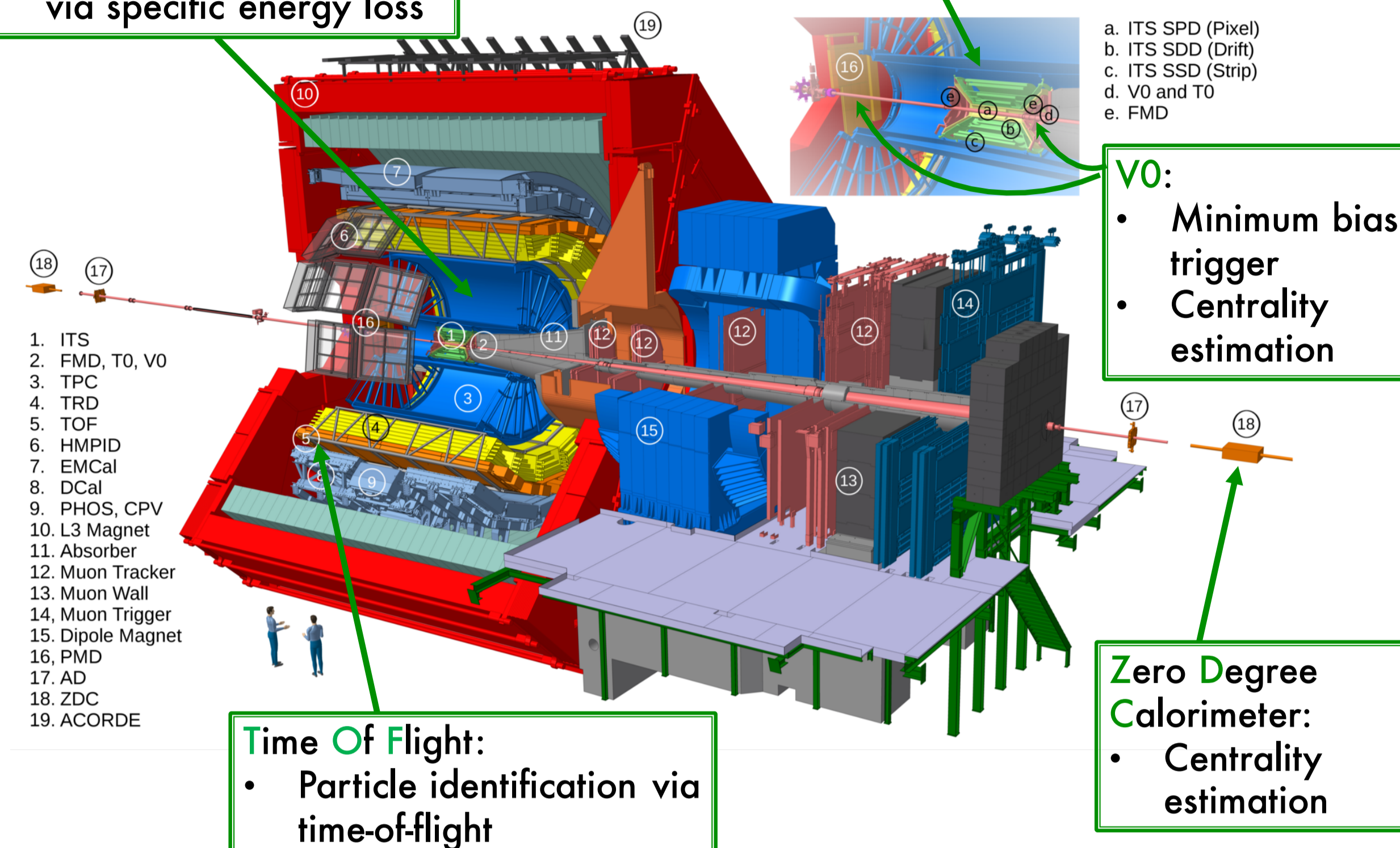
- Pb-Pb:**
- Study medium-induced modifications to charm and beauty fragmentation and hadronization.
 - Determine path-length dependence of energy loss in the medium (away-side region).
 - Possibly sensitive to relative contributions of radiative and collisional energy loss of heavy quarks [5].

Time Projection Chamber:

- Tracking
- Particle identification via specific energy loss

Inner Tracking System:

- Tracking
- Vertexing



PROCEDURE & RESULTS



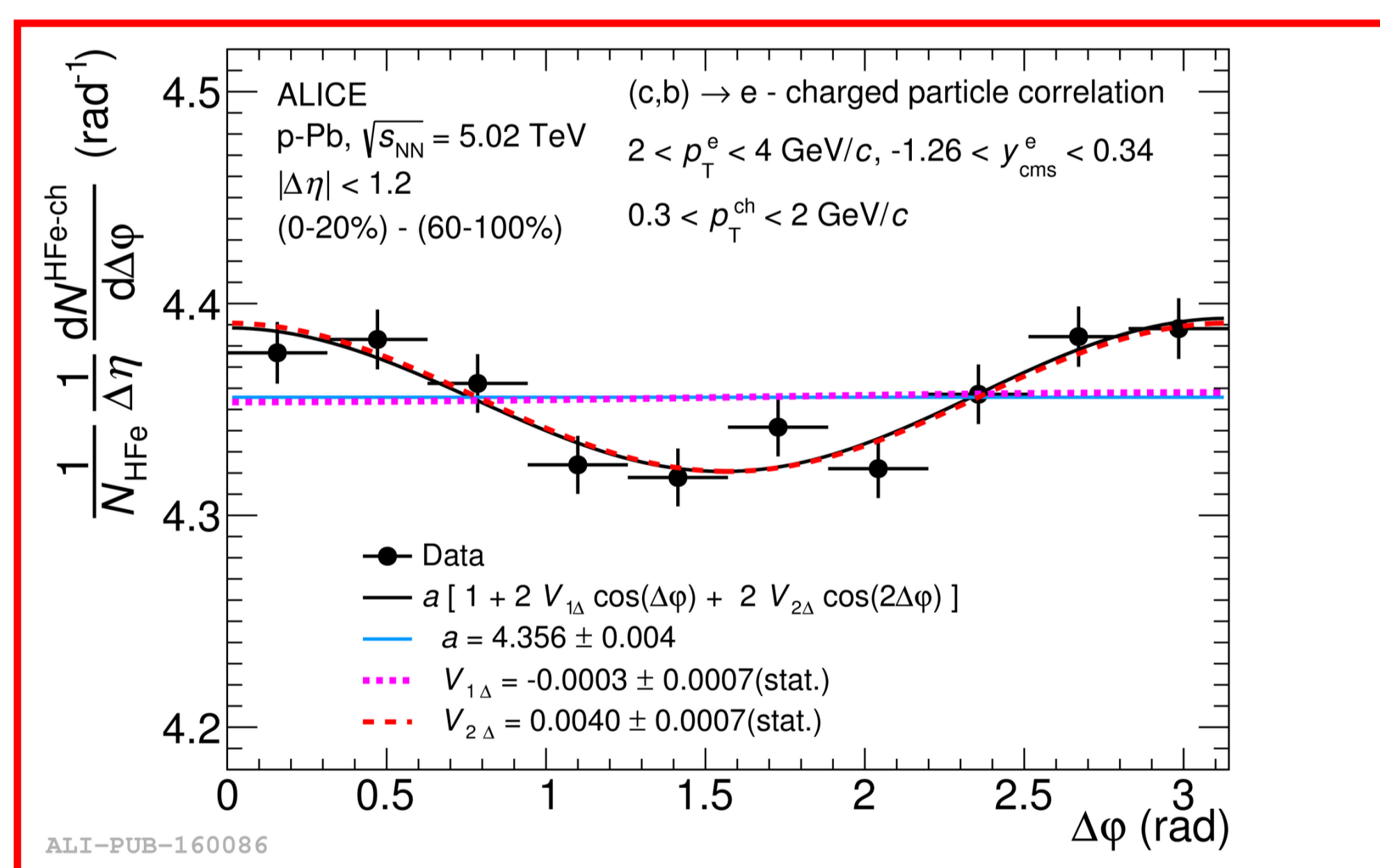
Heavy-flavour decay electron-hadron correlations

Azimuthal HFe-h correlation distributions as a function of multiplicity

- Azimuthal correlations of heavy-flavour decay electrons with charged particles measured for p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV in ZNA classes 0-20%, 20-60% and 60-100% [6].
- Enhancement of correlation pattern under near- $(\Delta\phi=0)$ and away-side $(\Delta\phi=\pi)$ from low multiplicity (60-100%) to high multiplicity (0-20%).

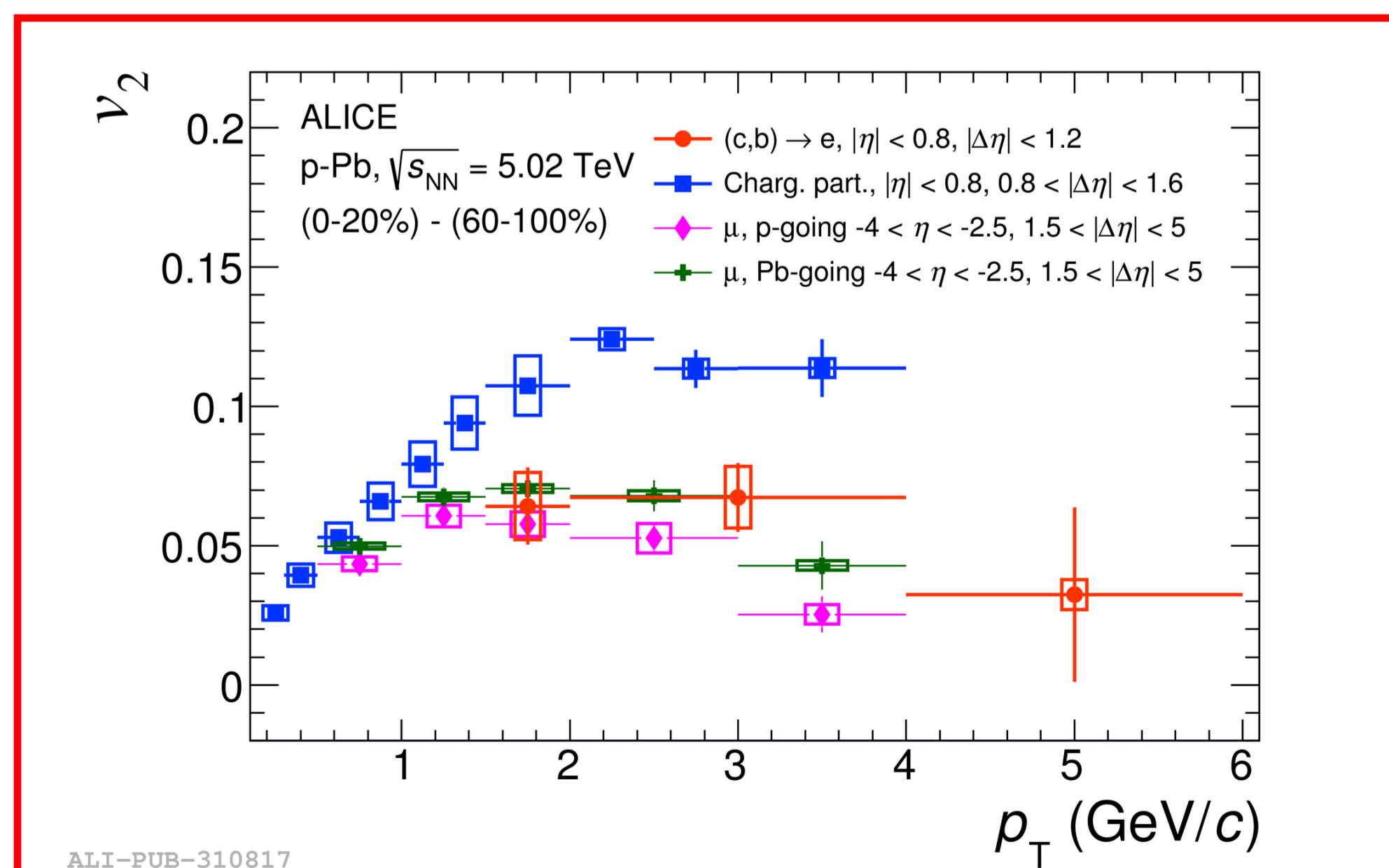
$v_{2\Delta}$ extrapolation

- Low-multiplicity correlation functions are subtracted from the high-multiplicity ones to remove the jet component.
- Fit via Fourier series: $C_{HM}(\Delta\phi) - C_{LM}^{Sub} = a_0(1 + 2v_{1\Delta} \cos(\Delta\phi) + 2v_{2\Delta} \cos(2\Delta\phi))$.



v_2^{HFe} estimation

- First measurement** of heavy-flavour electron $v_2^{HFe}\{2PC, sub\}$ in p-Pb collisions.
- Results show a **positive $v_2^{HFe}\{2PC, sub\}$** for electrons with $1.5 < p_T < 4$ GeV/c with a significance of more than 5σ [4].
- Effect is qualitatively similar to the one observed in the light-flavour sector [1].

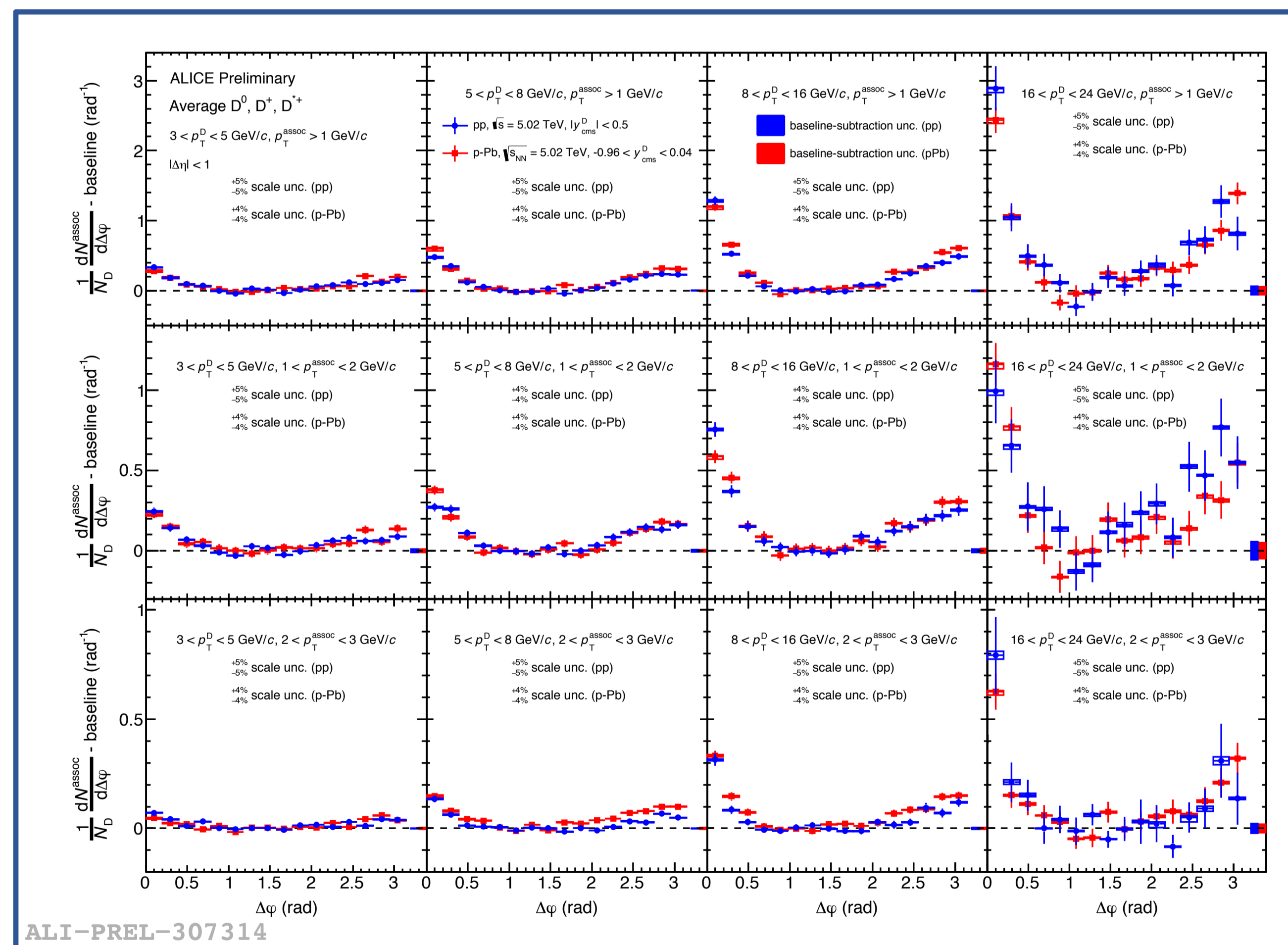


Where does it come from??!

D meson-hadron correlations

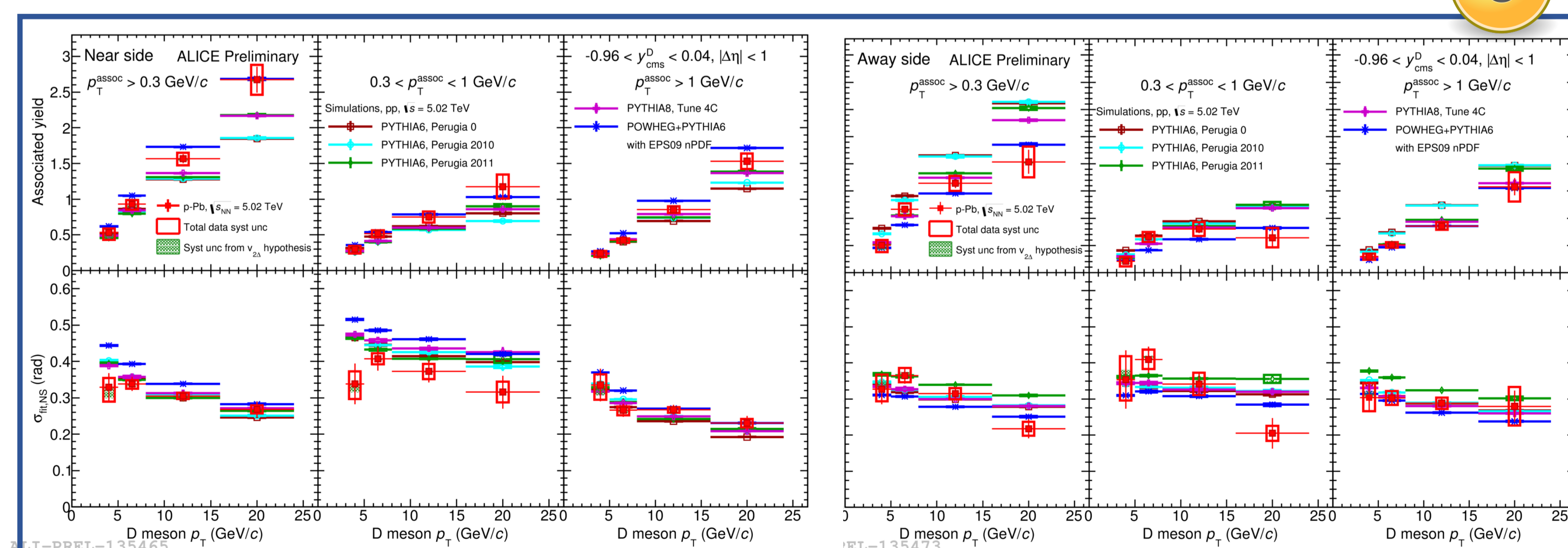
Comparison of $\Delta\phi$ correlation distribution in pp and p-Pb at $\sqrt{s_{NN}} = 5.02$ TeV

- Compatibility within uncertainties found for the azimuthal correlation distributions in pp collisions and p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV, for all the kinematic ranges.
- From these results, no discrepancies induced by possible cold-nuclear matter effects are observed.



Near-side (NS) and away-side (AS) physical observables and comparison with model expectations

- Shape and p_T dependence of $\Delta\phi$ correlation distributions qualitatively described by PYTHIA6, PYTHIA8 and POWHEG.
- Overall compatibility of NS and AS yields with PYTHIA6, PYTHIA8 and POWHEG+PYTHIA models.
- Good description of NS and AS sigma; except at low p_T^{assoc} for the NS, especially w.r.t. POWHEG.



References:

- [1] ALICE Collaboration, Long-range angular correlations of π , K and p in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV, *Phys. Lett. B* **726** (2013) 164-177
- [2] CMS Collaboration, Observation of long-range, near-side angular correlations in proton-proton collisions at the LHC, *JHEP* **1009** (2010) 091
- [3] ALICE Collaboration, Forward-central two-particle correlations in p-Pb collisions at $\sqrt{s_{NN}}=5.02$ TeV, *Phys. Lett. B* **753** (2016) 126-139
- [4] ALICE Collaboration, Azimuthal anisotropy of heavy-flavour decay electrons in p-Pb collisions at $\sqrt{s_{NN}}=5.02$ TeV, *Phys. Rev. Lett.* **122**, 072301 (2019)
- [5] M. Nahrgang et al., Heavy-flavor azimuthal correlations of D mesons, [arXiv:1310.2218](https://arxiv.org/abs/1310.2218)
- [6] ALICE Collaboration, Centrality dependence of particle production in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV, *Phys. Rev. C* **91** (2015) 064905

