Multiplicity dependence of D*+-meson production in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV at the LHC

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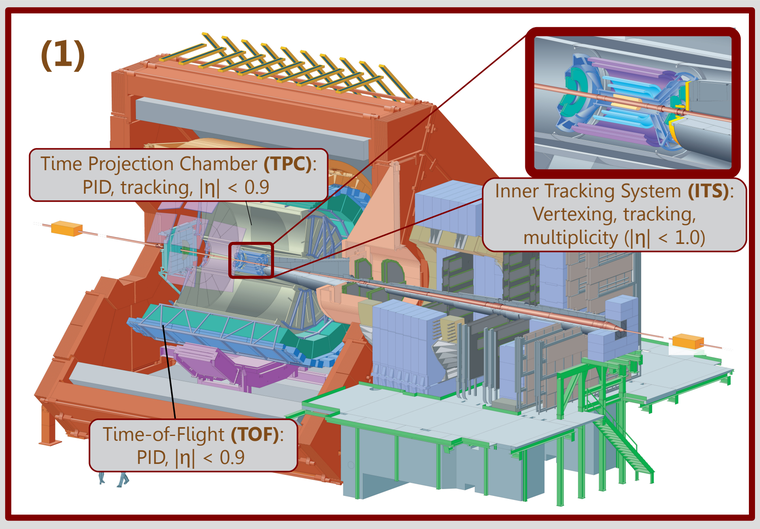
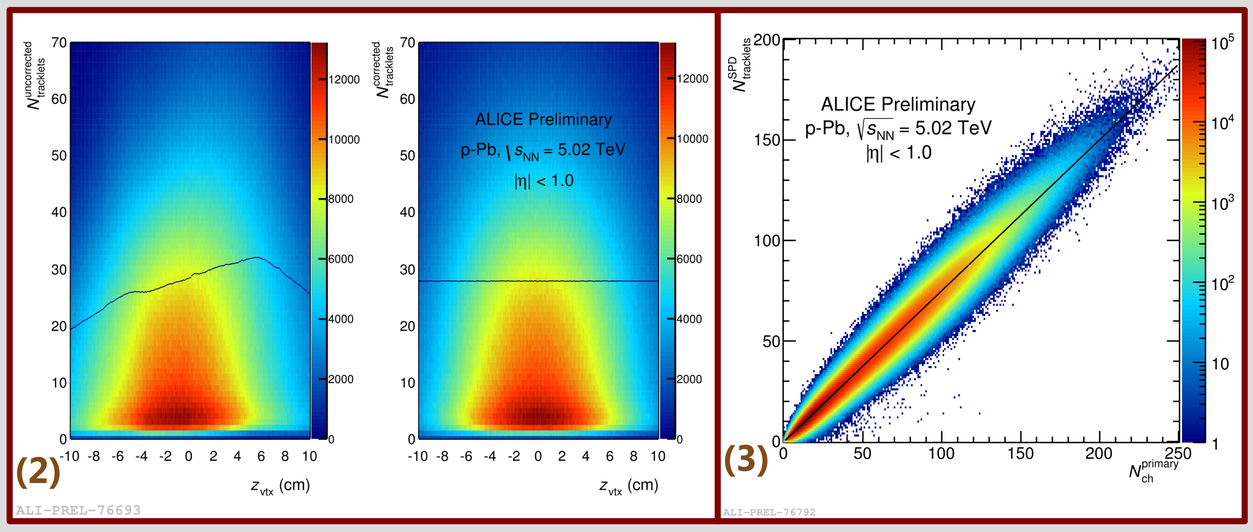
Motivation

ALICE's heavy-ion programme is dedicated to the study of the hot, high-density medium expected to form in high-energy heavy-ion collisions. **Heavy quarks (charm and beauty)** offer an effective probe of the medium as they are formed early in the collision, and so experience the full evolution of the system. Thanks to ALICE's excellent **tracking and PID capabilities** (Fig. 1), it is possible to **fully reconstruct** the hadronic decays of open-charmed D mesons that are produced.

Previous measurements of D-meson production as a function of multiplicity in pp collisions were made to examine the role of **multi-parton interactions**, which are expected to have a relevant role in pp collisions at LHC energies. In contrast, **high-multiplicity events in p-Pb can also be caused by large numbers of binary nucleon-nucleon collisions** ($\langle N_{coll} \rangle$ (p-Pb) = 6.9).





Multiplicity definition

Multiplicity was determined using the number of tracklets $N_{tracklets}$, i.e. track segments reconstructed in the Silicon Pixel Detector (SPD) within |η| < 1.0. To remove the dependence of $N_{tracklets}$ on the data set analysed and on the z position of the primary vertex, the **multiplicity was corrected event-by-event** by the mean value at that position (black line) and scaled to the overall average. The correction procedure for one of the data samples is illustrated in Fig. 2.

In order to convert $N_{tracklets}$ to $dN_{ch}/d\eta$, it was corrected by the proportionality factor between $N_{tracklets}$ and N_{ch} determined in Monte Carlo simulations (Fig. 3) and divided by the width of the pseudorapidity interval considered. The final results are shown **as a function of $dN_{ch}/d\eta$ normalised to the $\langle dN_{ch}/d\eta \rangle$ measured in p-Pb collisions in ALICE for |η| < 1.0**, i.e. $\langle dN_{ch}/d\eta \rangle$ = 17.6[1].

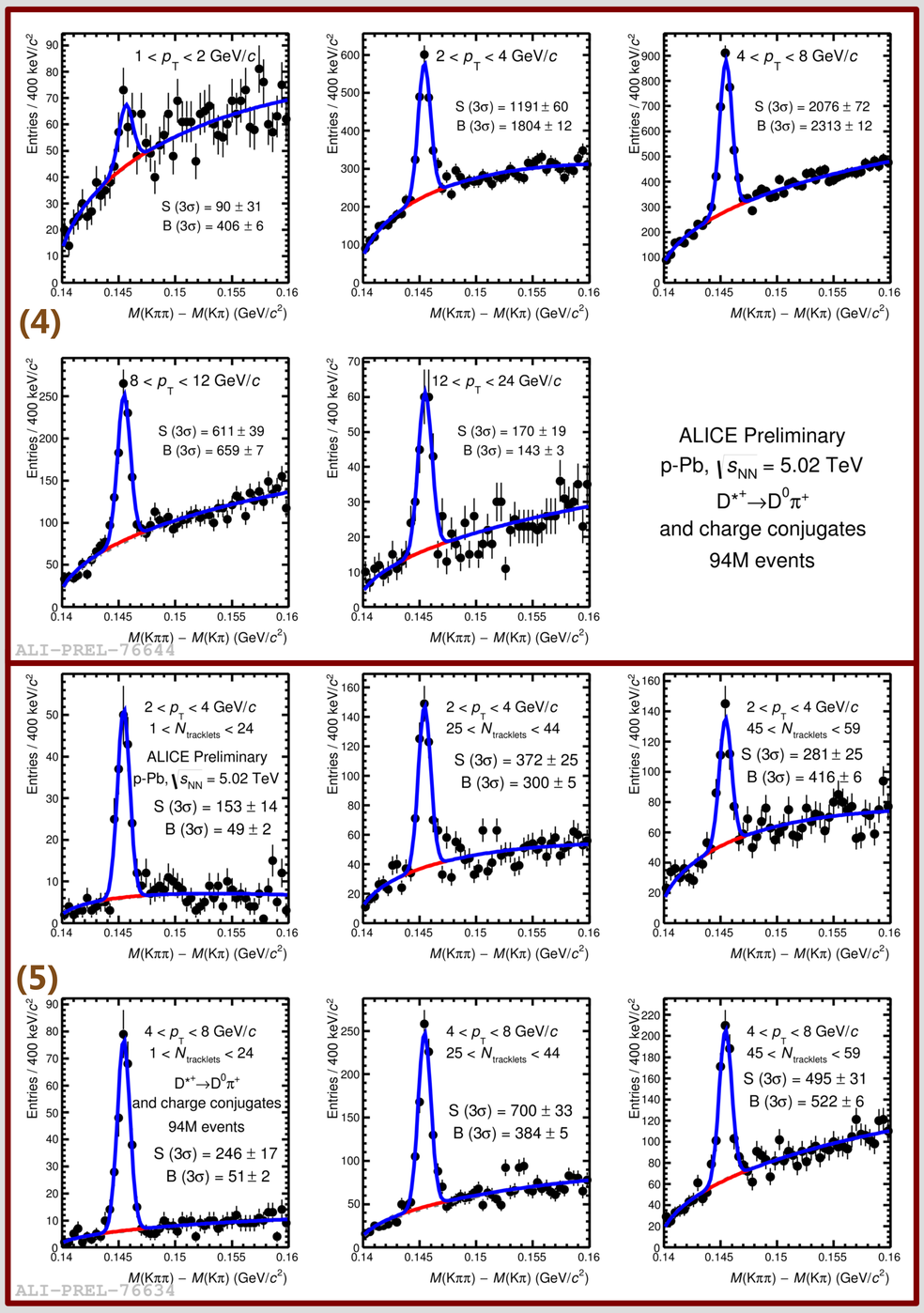
[1] B. Abelev et al. (ALICE Collaboration), Phys. Rev. Lett. 110, 032301 (2013)

D*+ reconstruction

D*+ mesons are reconstructed in the channel D*+ → D⁰π+. **Topological and PID selections** are made to pair a D⁰ candidate (reconstructed via D⁰ → K⁻π+) with a soft pion at the primary vertex. These selections vary with p_T but not with $N_{tracklets}$.

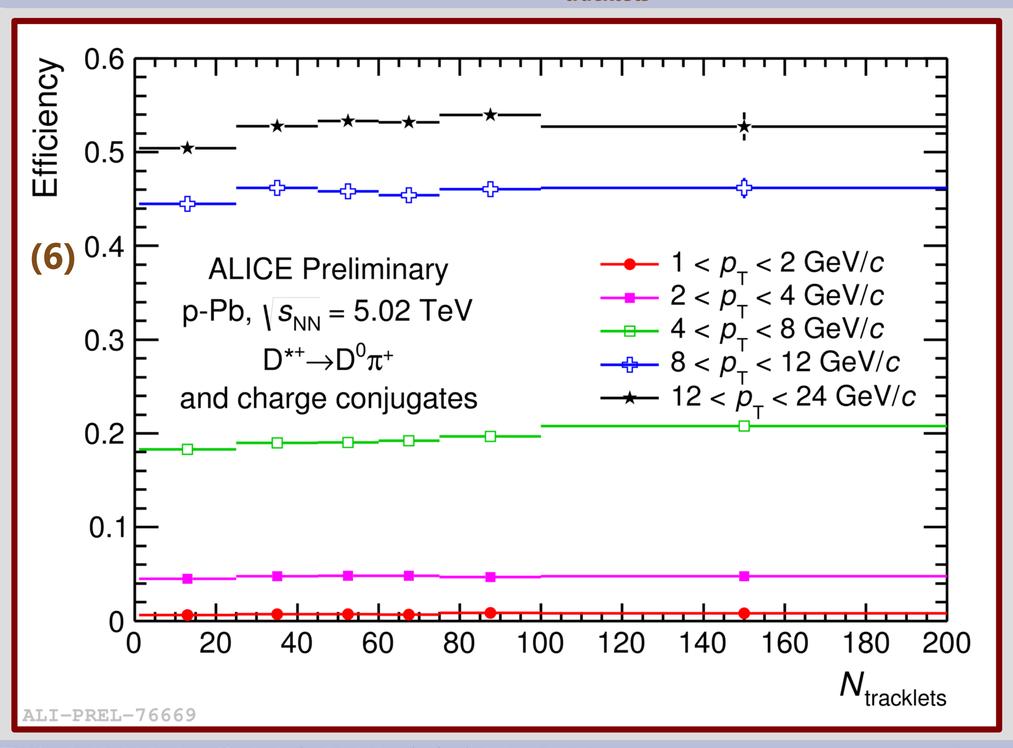
The invariant mass spectra were obtained in p_T bins (a) for all multiplicity (Fig. 4) and (b) in individual multiplicity classes (Fig. 5, where the lowest three $N_{tracklets}$ classes are shown for two p_T bins). The **background was fitted using an exponential function multiplied by a power-law function**, and the **signal was estimated using a Gaussian function**. The width of the Gaussian determined in the multiplicity-integrated case was fixed for all other multiplicity bins in order to reduce statistical fluctuations.

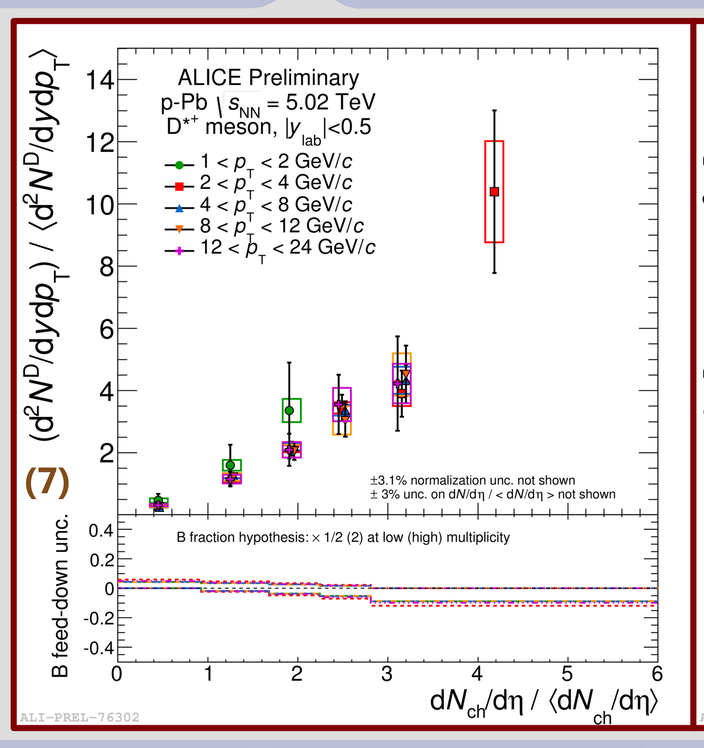
Since the topological selections were independent of multiplicity, **the selection efficiency determined in Monte Carlo (Fig. 6) in the analysed bins varied by less than ~10% as a function of $N_{tracklets}$.**

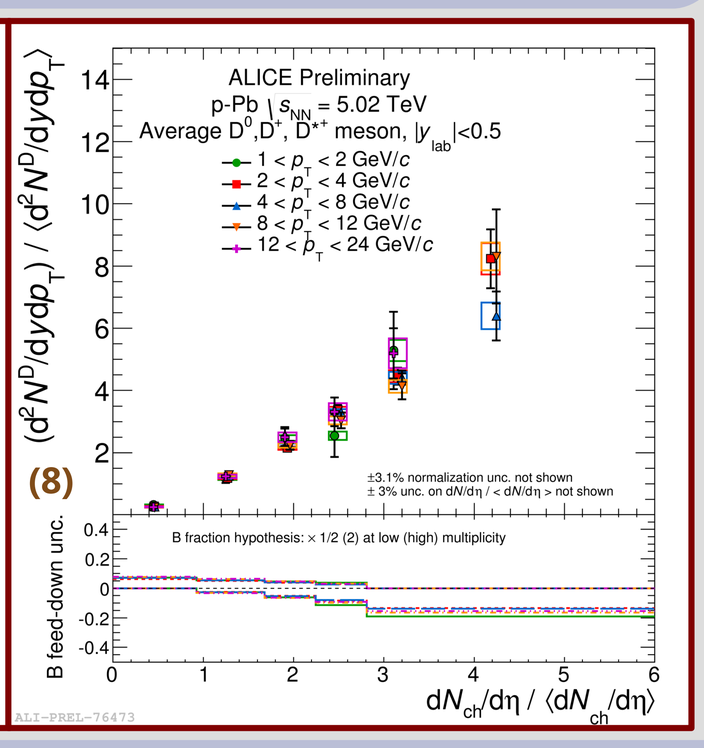


Results

The **per-event corrected yields** in each multiplicity and p_T bin were **divided by the multiplicity-integrated ones**. These self-normalised yields are shown for D*+ (Fig. 7) and the average of D⁰, D+ and D*+ (Fig. 8). The results for the three meson species were found to be in agreement with one another. There was also **no dependence of the self-normalised yield on p_T**, which is analogous to what was observed for similar measurements in pp collisions. The **overall trend is similar to that observed in pp collisions** at $\sqrt{s}$ = 7 TeV.







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