Measurements of D*+-meson production as a function of centrality in p-Pb collisions with ALICE

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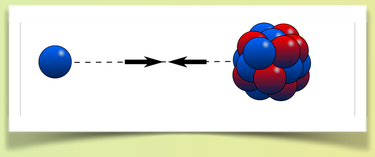
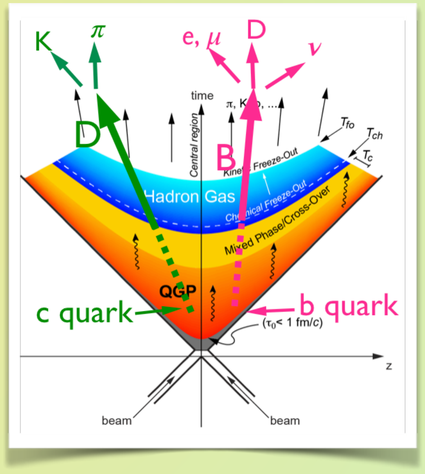
Heavy flavour: physics motivation

Charm and beauty quarks are produced in **hard scattering processes in the inital stages of high-energy heavy-ion collisions** → they are an excellent probe to study the medium created in these collisions.



p-Pb collisions→ investigate **Cold Nuclear Matter** effects in the initial and final state in order to disentangle them from hot nuclear matter effects in Pb-Pb collisions



Measurements as a function of **centrality** in p-Pb collisions allow us to study:

- Interplay between hard and soft processes in particle production
- Hints of collective effects in p-Pb collisions

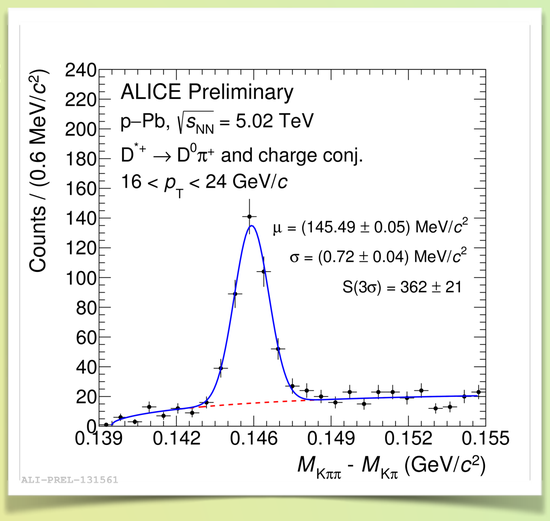
Analysis strategy

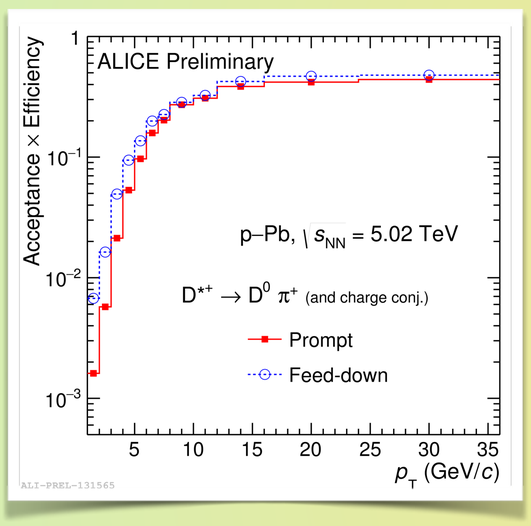
D*+ mesons are fully reconstructed through their hadronic decay channel[1]:

D*+ → D0 (→ K−π+) π+

BR: 67.7%(D*+→D0π+) x 3.89%(D0 →K−π+)

- D*+ yields extracted from an invariant mass analysis of the candidates selected on the basis of the topology of the decay
- K and π are identified to reduce the combinatorial background





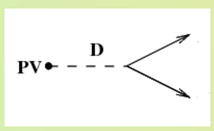
Corrections:

- Acceptance x Efficiency

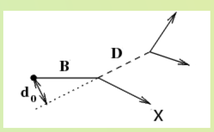
Signal corrected for the acceptance of the detector and for the reconstruction and selection efficiency obtained from Monte Carlo simulations

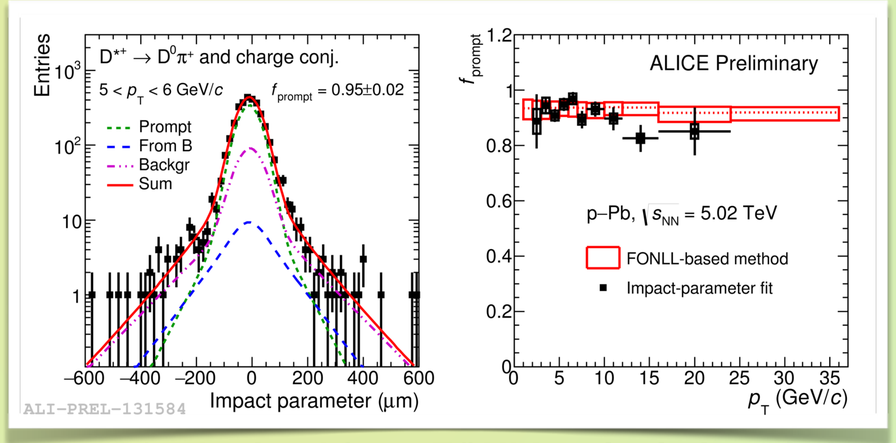
- B feed-down subtraction
  - Contribution of the D*+ mesons from B decays is corrected for by computing the fraction of prompt D*+ in the raw yield, f_{prompt}
  - f_{prompt} is evaluated using a method based on FONLL calculations for prompt and feed-down production cross sections

prompt D



feed-down D





The fraction of prompt D*+ obtained from FONLL calculations is in agreement with results from a data-driven method that exploits the different shapes of **prompt** and **feed-down** D*+ distributions of the transverse-plane impact parameter (d_0)

$F(d_0)=S\cdot\{f_{prompt}\cdot F^{prompt}(d_0)+(1-f_{prompt})\cdot F^{feed\text{-}down}(d_0)\}+B\cdot F_{bkg}(d_0)$

References

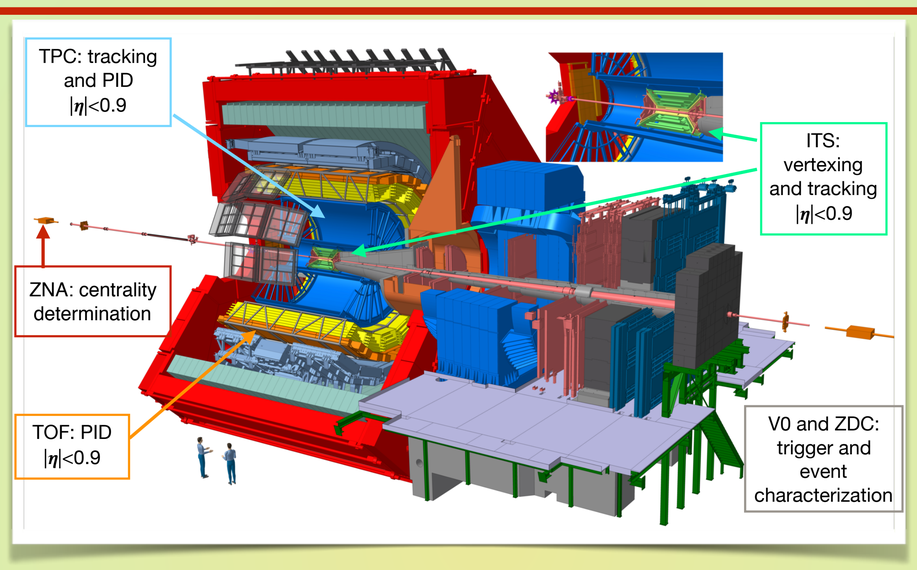
[1] PDG, Chin. Phys. C40 (2016) 100001

[2] HEP 9805 (1998) 007

[3] ALICE-PUBLIC-2017-008

[4] Phys. Rev. C 91 (2015) 064905

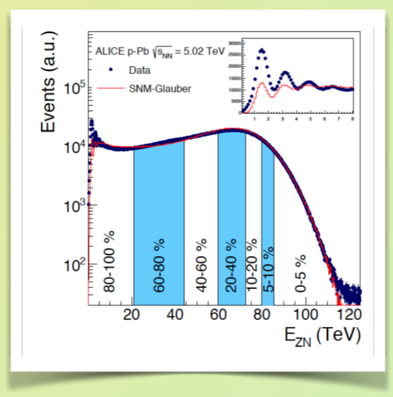
The ALICE experiment



LHC Run 2 p-Pb collisions at 5.02 TeV[3]: $L_{int}=(292\pm10.8)\ \mu b^{-1}$

- 6 times higher statistics with respect to LHC Run 1

Sample divided into **centrality classes** using the energy deposited in the neutron calorimeter on the Pb-going side (ZNA)



	⟨T_{pPb}⟩	⟨N_{Coll}⟩	N_{events}
0-10%	0.17	14.0	60 M
60-100%	0.05	2.3	250 M

$$\langle T_{pPb}\rangle = \frac{\langle N_{coll}\rangle}{\sigma_{NN}}$$

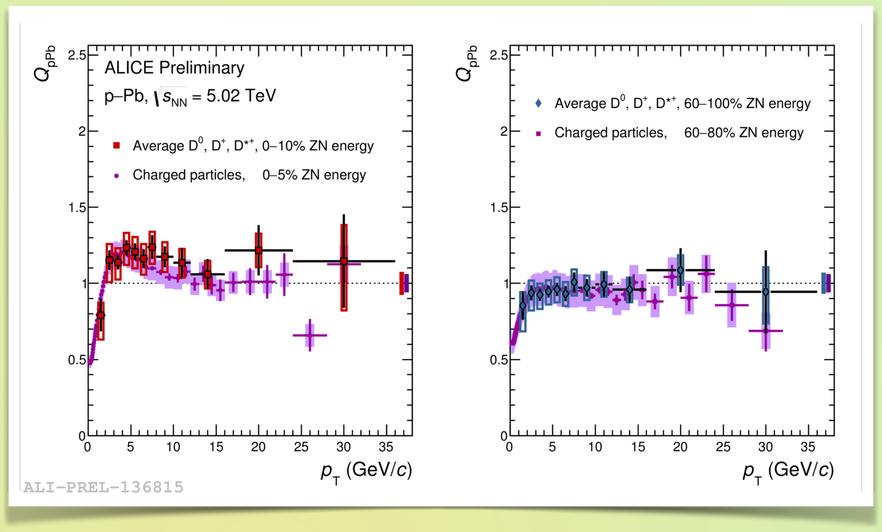
where ⟨T_{pPb}⟩ is the average nuclear overlap function and ⟨N_{coll}⟩ is the average number of collisions obtained from the hybrid method[4] assuming that the charged-particle multiplicity measured at mid-rapidity scales with the number of participants.

Results and conclusions

Q_{pPb}: Nuclear modification factor in a given centrality class

$$Q_{pPb}=\frac{\left(\frac{dN^D}{dp_T}\right)_{pPb}}{T_{pPb}\times\left(\frac{d\sigma^D}{dp_T}\right)_{pp}}$$

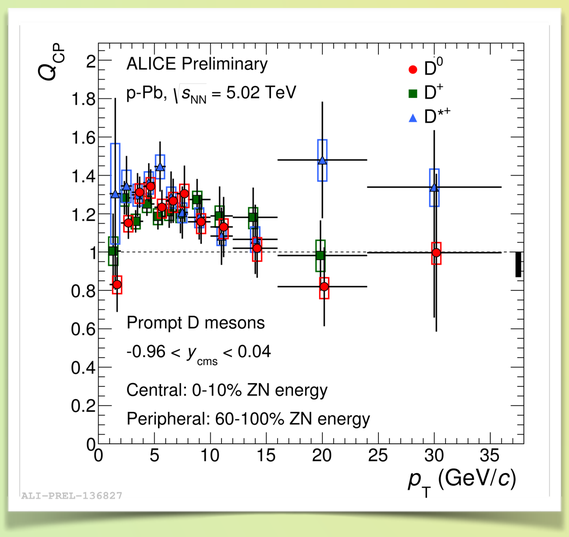
D-meson pp reference obtained by scaling the measurement at 7 TeV

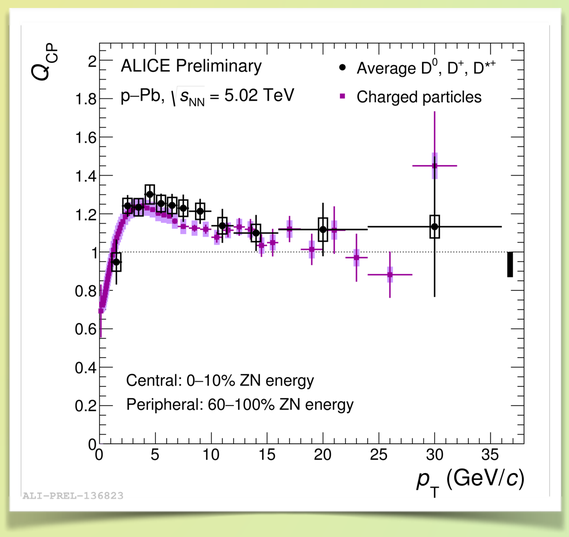


- Q_{pPb} in 0-10% and 60-100% centrality classes compatible within uncertainties
- **D-meson Q_{pPb} consistent within uncertainties with charged-particle Q_{pPb}** in both centrality classes[4]

Q_{CP}: Central/peripheral ratio

- ☑ Independent of the pp reference
- ☑ Track reconstruction, selection and PID efficiency cancels in the ratio → reduced systematic uncertainties





- D*+, D0 and D+ Q_{CP} consistent within uncertainties
- **Hint of D-meson $Q_{CP} > 1$** in $3<p_T<8$ GeV/c by 1.5σ
  Might be induced by initial or final state effects. Might indicate charm radial flow in p-Pb collisions
- **D-meson Q_{CP} consistent within uncertainties with charged-particle Q_{CP}**[4]