D_s^+ production at central rapidity in pp collisions at 7 TeV with the ALICE experiment

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Physics Motivation for D^+_s analysis

$D^+_s \rightarrow \varphi\pi^+ \rightarrow K^+K^-\pi^+$ $\quad m(D^+_s) = 1.968$ GeV $\quad c\tau = 147$ µm

In pp collisions:

- Charm meson p_t differential cross section is an Important test for perturbative pQCD calculations
- Measurement of the fraction of charm that goes in D^+_s
- Reference for heavy-ion collisions

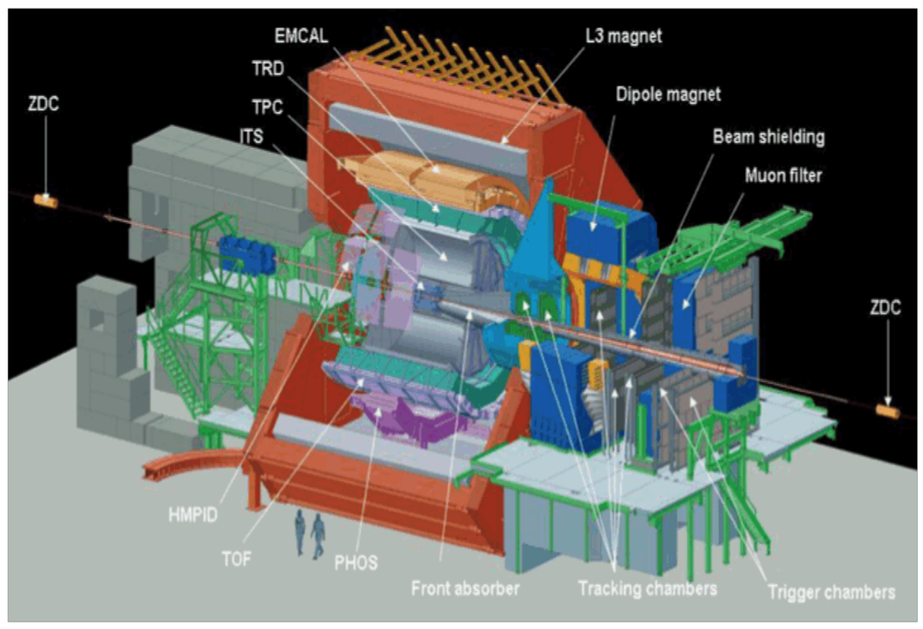
In A-A and p-A collisions:

- Final state effects such as parton energy loss and anisotropic flow
- Study of hadronization mechanisms (fragmentation and recombination)

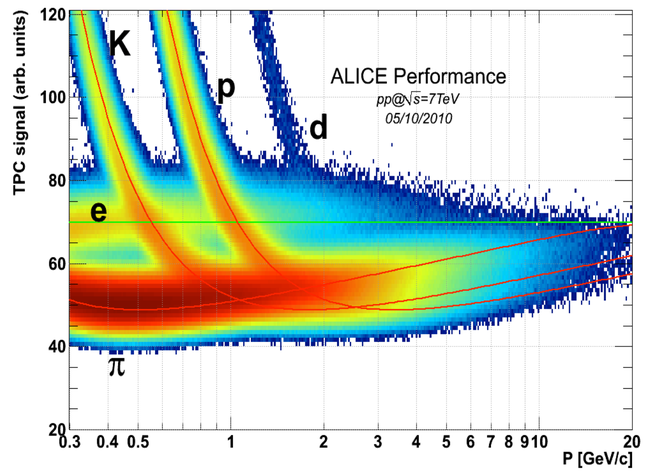
In particular, since strange quarks are abundantly produced in the QGP, the relative yield of D^+_s with respect to non-strange D mesons is predicted to be largely enhanced if charm quarks hadronize via recombination mechanisms in the medium*

*I. Kuznetsova, J. Rafelski, Eur.Phys.J.C51:113-133,2007

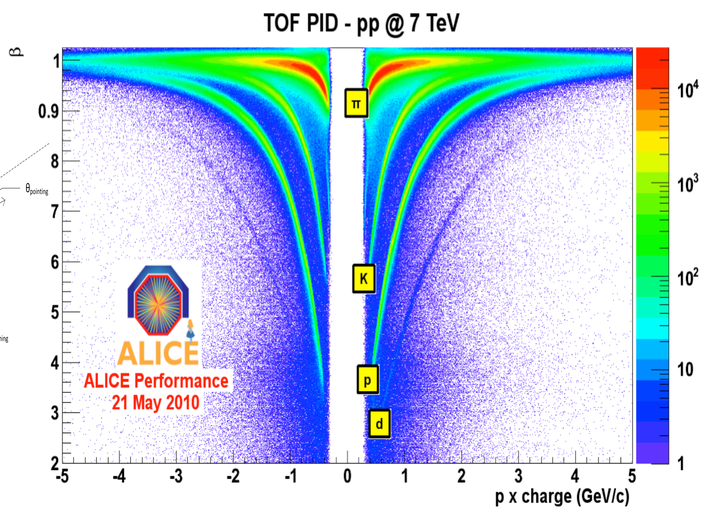
ALICE DETECTOR



Particle identification



PID using dE/dx versus momentum in the TPC and the TOF for kaon identification



PID is crucial for D^+_s analysis due to the presence of two kaons in the final state

Reconstruction Strategy

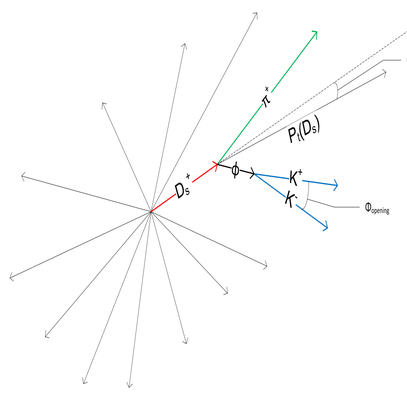
The analysis strategy is based on an invariant mass analysis of fully reconstructed decay topologies originating from displaced vertices:

- Single track transverse momentum and impact parameter selection
- Track combination with proper particle charges
- Secondary vertex reconstruction
- Selection of candidates with topological cuts based on primary and secondary vertex separation and pointing of D momentum to primary vertex
- Particle identification of the decay products

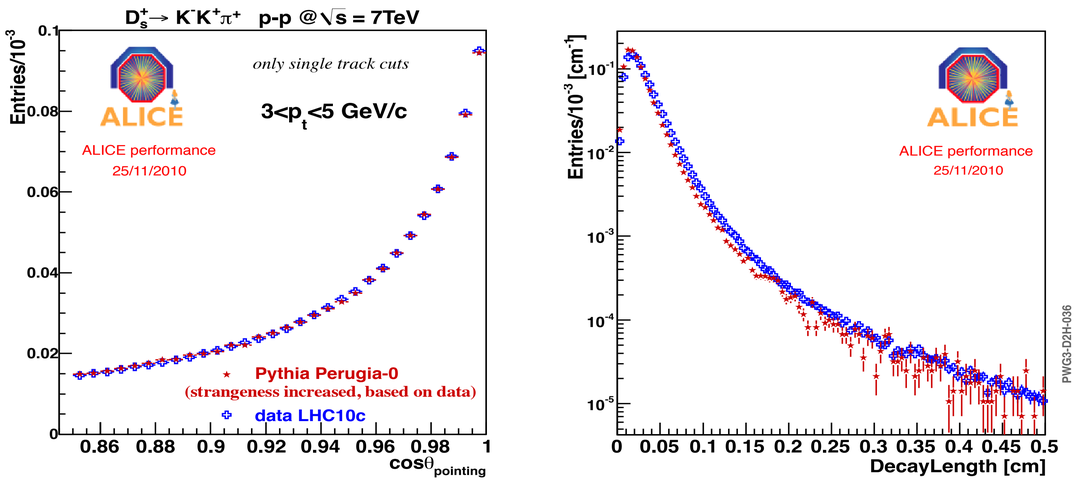
Candidate Selection

Cuts on the following variables are applied to reduce the large combinatorial background:

- Distance between primary and secondary vertex d_{ps} (e.g. $d_{ps} > 300$ µm)
- Cosine of the angle between the reconstructed D meson and the D flight line $\cos\theta_p$, (e.g. $\cos\theta_p > 0.95$)
- Invariant mass of the ϕ reconstructed meson
- Dispersion of the secondary vertex
- Selections related to the angle between the momenta of the D^+_s and its decay products



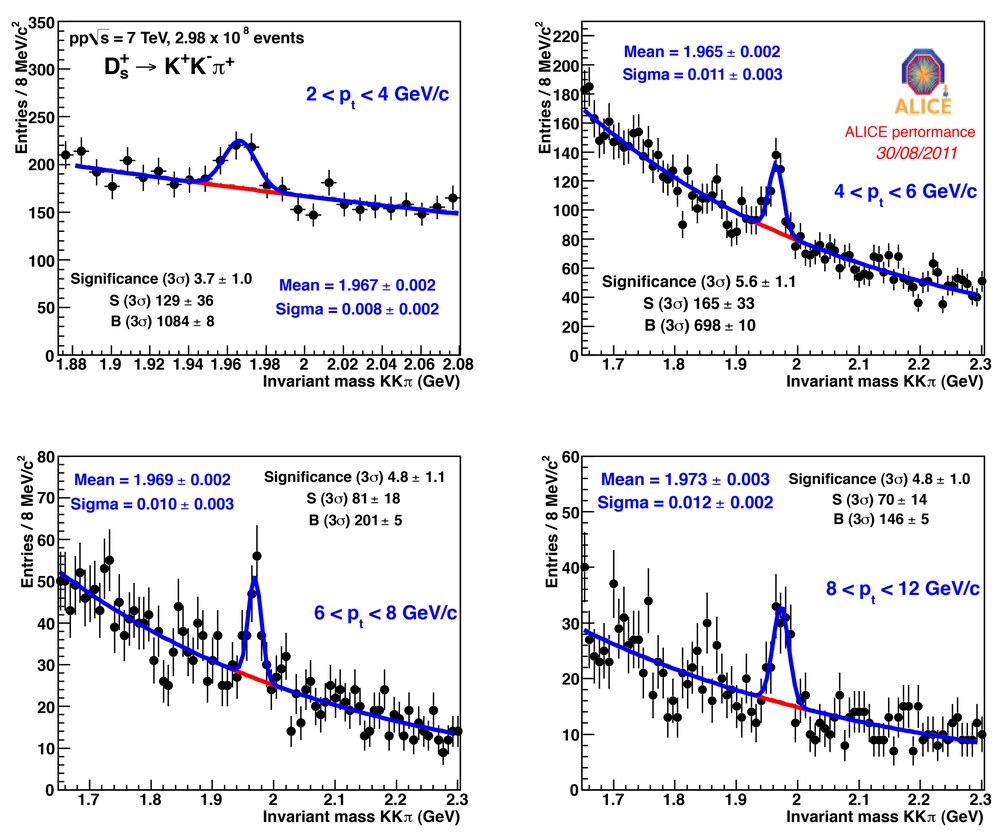
Cut variables , Data vs. MC



Data-MC comparison for the distribution of D^+_S events as a function of $\cos\theta_p$ (left) and decay length (right) performed with loose analysis cuts

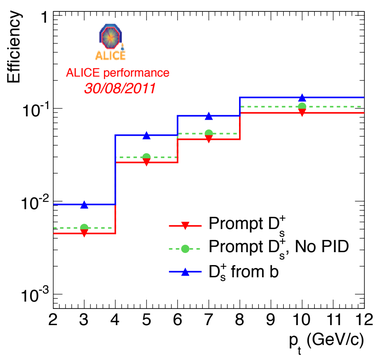
Good agreement between Data and MC

Invariant mass spectra

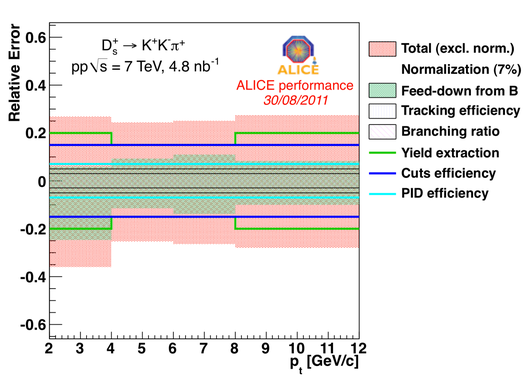


D^+_S invariant mass distributions in four transverse momentum intervals from 2 to 12 GeV/c obtained with the full 2010 ALICE minimum bias sample (≈298 millions of events)

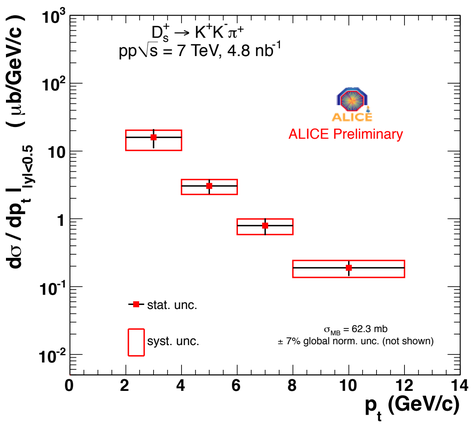
p_t differential cross section in pp, |y| < 0.5



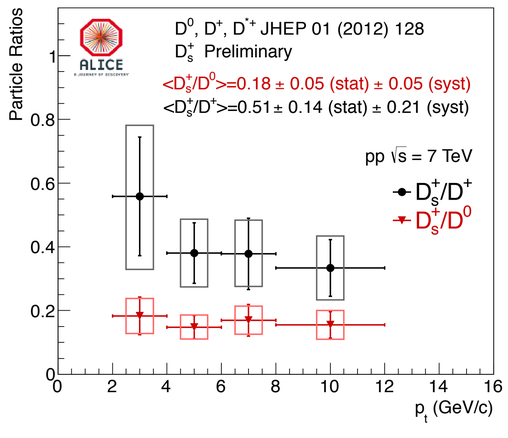
Reconstruction and selection efficiency for prompt D^+_S meson and D^+_S from B decays



D^+_S systematic uncertainties as a function of p_t



Preliminary p_t differential cross section.
B-feed down corrections estimated using FONLL.

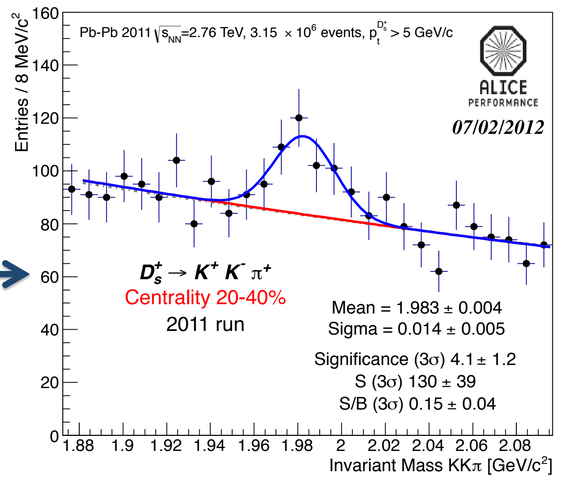


Ratio of p_t differential cross sections:
D^+_S/D^+ and D^+_S/D^0 . p_t integrated values are also shown

Conclusions

ALICE detector has good capabilities in the exclusive reconstruction of D^+_s via hadronic decays:

- D^+_s p_t differential cross section measured in the 2-12 GeV/c transverse momentum range
- A first hint of signal of D^+_s mesons in Pb-Pb collisions has been observed in the centrality range 20-40 % for transverse momentum of the candidate $p_t > 5$ GeV/c (2011 run, partial statistics)
- Extraction of the signal in different p_t bins with improved significance for the full 2011 Pb-Pb data sample is ongoing



Invariant mass distribution of D^+_S candidates with $p_t > 5$ GeV/c obtained from the analysis of 3.15 millions of Pb-Pb events in the 20-40 % centrality range (2011 Pb-Pb run)