$D^+ \rightarrow K^- \pi^+ \pi^+$ Production in pp collisions at LHC with the ALICE Detector

Renu Bala, for the ALICE Collaboration
INFN Sezione di Torino, Italy

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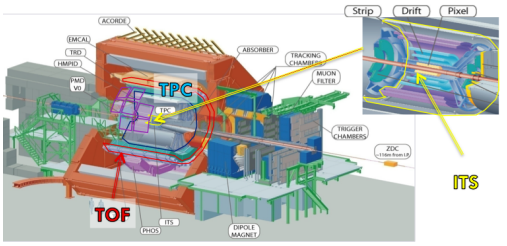
Physics Motivation

✓Due to Their large masses, charm and bottom quarks are created in initial hard parton-parton scatterings and their production can be described by perturbative QCD calculations.

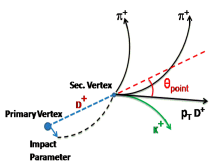
✓Insight on the density of the medium and of the mechanism of parton energy loss can be achieved by measuring charm and bottom p_t differential cross-sections in heavy ion collisions. Comparison with the same measurement in pp collisions is essential for this purpose

✓The measurement of charm production in pp collisions is also of great interest per se, since it will provide a test of perturbative QCD predictions in a new energy domain.

Experimental Set Up: ALICE@LHC



$D^+ \rightarrow K^+ \pi^- \pi^-$: Reconstruction Strategy



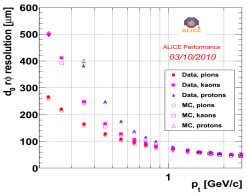
Main Selection: displaced-vertex topology

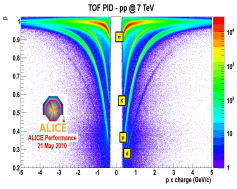
✓good pointing of reconstructed D momentum to the primary vertex

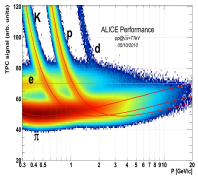
✓distance(d_{ps}) between primary and secondary vertex.

Tracking and Vertexing performance is crucial!
✓Resolution on track impact parameter is 75μm at 1 GeV/c, well described in MC

Combined PID from TOF and TPC to reduce the background at low p_t





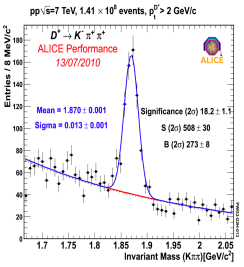


Signal Extraction

The Invariant Mass distributions in each p_t interval extracted after applying topological cuts and PID are fitted to obtain the raw yield.

The fitting function comprises the Gaussian term describing the signal and Exponential term for the background.

Fig. shows the invariant mass spectra for p_t > 2 GeV/c



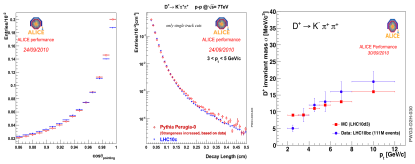
From signal to cross section (i)

$$\left.\frac{d\sigma}{dp_t}\right|_{|y|<0.5} = \frac{1}{2}\cdot\frac{1}{\Delta y(p_t)}\cdot\frac{1}{BR.}\cdot\frac{1}{\varepsilon_c}\cdot f_c\cdot\frac{N^D_{raw}(p_t)\big|_{|y|<\Delta y(p_t)}}{N_{MinBias}}\cdot\sigma_{MinBias}$$

- N_b ^{RAW} Is The Signal extracted from the fit
- ε_c is the efficiency correction for acceptance and cut selections
- f_c is the correction for beauty feed down
- Δy is the Acceptance in rapidity
- BR is the branching ratio
- N ^{MinBias} and σ ^{MinBias} are respectively the total number and the total cross section of minimum bias events

From signal to cross section (ii)

Correction for the efficiency and feed Down (B→D), but first, Data and MC Comparison: Detector Response well described in MC



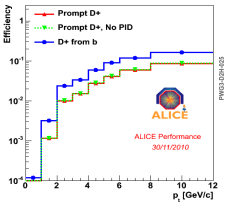
From signal to cross section (iii)

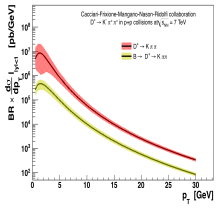
Correction for the efficiency

- 1% to 10% from low to high p_t
- factor 1.5 larger for mesons coming from B decay

Correction for B-feed down

- 15-20%
- Done using FONLL predictions .

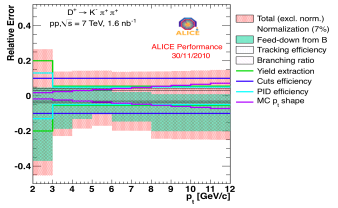




Systematic Uncertainties

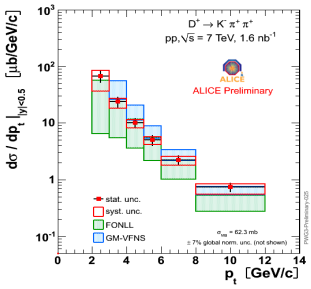
Total systematic 20-40% p_t-dep. + 7% on normalization.

- Main systematic error: B feed-down from FONLL + MC. To be reduced using data driven method (D displacement to vertex, à la CDF) with full 2010 statistics.



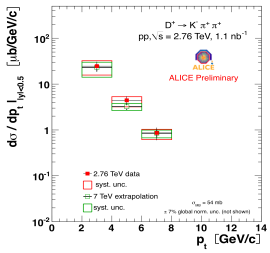
Differential Cross section

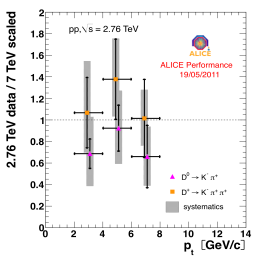
- ✓ 2 < p_t < 10 GeV/c, with 1.6 nb^{-1} (~20% of 2010 statistics)
- ✓ pQCD predictions (FONLL and GM-VFNS) compatible with our data



pp at √s=2.76 TeV

Motivation: To verify the FONLL energy scaling used to build the reference for Pb-Pb data collected at this energy





✓Measured D meson cross section at pp √s= 2.76 TeV is compatible with scaling at pp √s=7 TeV data

Conclusions and outlook

✓Thanks to excellent PID, tracking and vertexing performance of ALICE detector, first measurement of D-Meson cross-section has been obtained in 2 < p_t <10 GeV/c .

✓With full 2010 statistics, we are already able to extend the pt range (2< p_t< 24 GeV/c) and efforts are ongoing to go below 2 GeV/c.