

RECONSTRUCTION AND FIRST OBSERVATION OF THE CHARMED BARYON

Λ_c IN p-p COLLISIONS @ $\sqrt{s} = 7$ TeV WITH ALICE

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HEAVY FLAVOUR

Motivations:

✓ In p-p collisions:

- measure charm and beauty cross section
- test of pQCD predictions in a new energy domain
- necessary baseline for Pb-Pb

✓ In Pb-Pb collisions: probe the properties of the medium

- created in the hard initial collision → experience the whole collision history
- possible comparison heavy quarks/light partons → energy loss

Production:

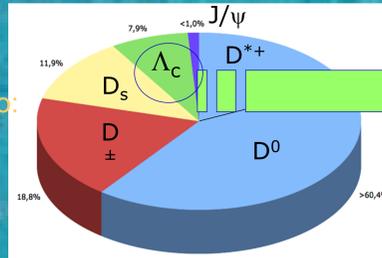
Theoretical predictions (NLO)

→ charm & beauty reference

(0-5%) per Event	RHIC Au+Au 0.2 TeV (0-5%)	LHC p+p 7 TeV	LHC p+p 14 TeV	LHC Pb+Pb 2.76 TeV (0-5%)	LHC Pb+Pb 5.5 TeV (0-5%)
$c\bar{c}$	10	0.10	0.16	56	90
$b\bar{b}$	0.05	0.003	0.006	2	3.7

MNR code (FO NLO): Mangano, Nason, Ridolfi, NBP373 (1992) 295
Shadowing included for Pb-Pb calculations

σ_{cc} @ LHC grows by a factor 10 wrt RHIC, σ_{bb} by a factor 50!



Where does the charm go?

The charmed baryon Λ_c : ID card

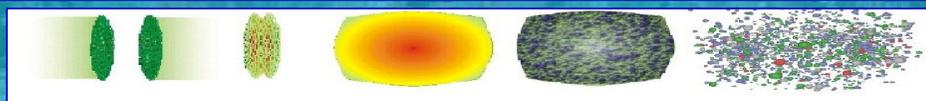
- 8% of charm goes in Λ_c
- Mass: 2.2864 GeV/c²
- $c\tau = 59.9 \mu\text{m}$ → very small!
- Decay channel under study: $\Lambda_c^+ \rightarrow p K^+ \pi^+$: B.R. $5 \pm 1.3\%$

Λ_c is interesting because:

- Needed to measure the baryon to meson ratio
- Useful to measure the total charm cross section
- Never measured in pp, Pb-Pb

THE ALICE EXPERIMENT

Dedicated to *Quark Gluon Plasma* investigation in heavy ion collisions



Detectors needed for the analysis:

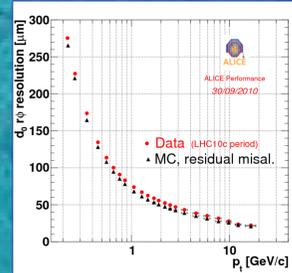
Central barrel ($|\eta| < 0.9$):

- ITS for vertexing, tracking, PID
- TPC main device for tracking, PID
- TOF for PID

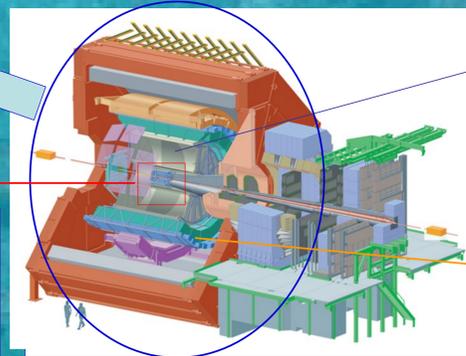
ITS

Impact parameter: distance between the track and the primary vertex

$d_0 < 80 \mu\text{m}$ for tracks with $p_t < 1 \text{ GeV}/c$

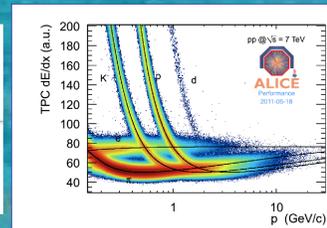
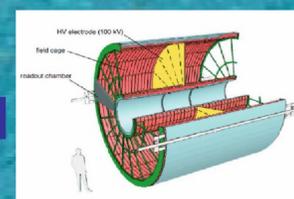


Excellent vertexing and tracking performances

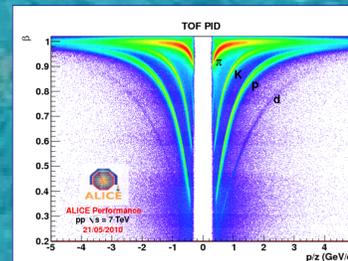


TPC

TOF



TPC and TOF allow a good separation of p, K, π in different momentum ranges



Λ_c ANALYSIS

✓ PID essential to exploit the analysis:

use both TPC and TOF to identify p, K and π

✓ Topological cuts to reduce background

Examples:

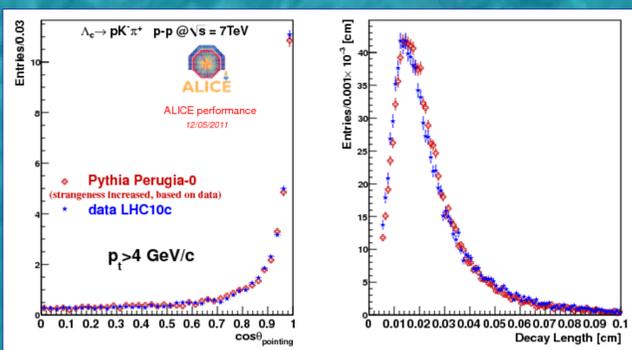
- displaced secondary vertex as signature of Λ_c decay: cut on decay length
- good pointing of reconstructed Λ_c momentum to the primary vertex

Quality check: good description of the cut variables in the Monte Carlo simulation!

Example (with loose cuts → mainly background)

cosine pointing angle

decay length



Charm candidates "production" (vertexing)

Raw signal extraction

Corrections (efficiencies, acceptance, feed-down from B)

- Invariant mass analysis to extract the raw signal yield
- Fit in two steps: first the background in the side bands with a polynomial, then background + signal in the full mass range

Analyzing 200 M of pp collisions @ 7 TeV..

the signal is found in 3 p_t bins

Next steps:

- compute corrections for efficiencies and acceptance from detailed Monte Carlo simulation
- evaluate the feed-down from beauty
- evaluate systematics
- .. to arrive to a cross section measurement

