

ABSTRACT: The study of resonance production in pp collisions provides stringent constraints on QCD-inspired particle production models. The baryonic resonances $\Sigma(1385)^\pm$ and $\Lambda(1520)^0$ have been reconstructed from the data collected by the ALICE experiment in pp collisions at $\sqrt{s} = 7$ TeV. Transverse momentum spectra for the Σ^* are shown and compared to QCD-inspired models such as PYTHIA and PHOJET, which in general underpredict the experimental results on the yields of strange resonances. The ratios of yields of baryonic resonances to stable particles, namely Σ^*/π^- , Σ^*/K^- and Σ^*/Ξ^- , are compared with both thermal model calculations and corresponding values from STAR at a colliding energy of $\sqrt{s} = 200$ GeV. These results will serve as baseline for the forthcoming heavy-ion results.

INTRODUCTION

Study of **resonance production** is useful:

- in **pp collisions**, it provides a **reference for tuning QCD-inspired event generators**.
- in **heavy-ion collisions**, due to their short lifetime (few fm/c), resonances can both decay and be regenerated by final state interactions inside the hot and dense matter region and therefore are **sensitive to its dynamical evolution**.

Mesonic resonances in ALICE: Φ , K^*

Baryonic resonances in ALICE:
 $\Sigma(1385)$, $\Lambda(1520)$, $\Xi(1530)$, Δ^{++}

Here presented:

$\Sigma(1385)^\pm \rightarrow \Lambda\pi^\pm$ (also c.c.) (BR=0.88*)

$\Lambda(1520)^0 \rightarrow pK^-$ (also c.c.) (BR=0.225*)
from **pp collisions at $\sqrt{s} = 7$ TeV**

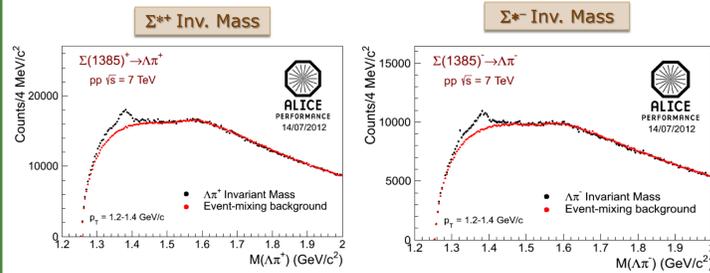
~200M
minimum-bias events
collected
by ALICE
during the
CERN LHC
run in
2010.

*BR=Branching Ratio

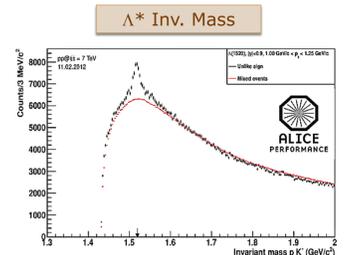
INVARIANT MASS ANALYSIS

Short lifetime \rightarrow **no topological reconstruction is possible** \rightarrow **invariant mass analysis needed** \rightarrow have to deal with the **combinatorial background**

Event mixing technique used to estimate the combinatorial background.



Event mixing normalized to data in the $M(\Lambda\pi)$ region > 1.5 GeV/c² (example for $1.2 < p_T < 1.4$ GeV/c)



Event mixing scaled to data by the number of mixed events (5)

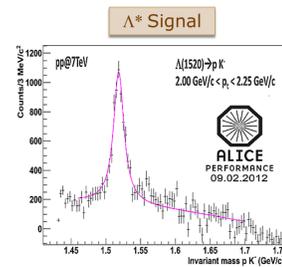
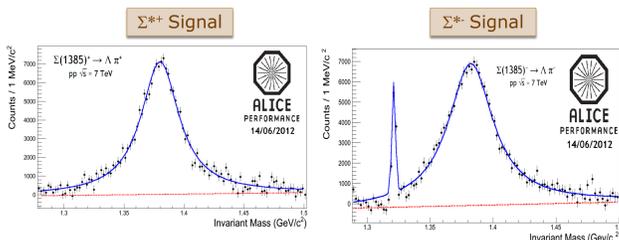
(example for $1.0 < p_T < 1.25$ GeV/c)

Analysis at midrapidity, $|\eta| < 0.8$

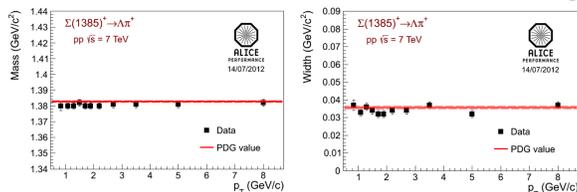
Residual background after the subtraction of the event-mixed background

SIGNAL EXTRACTION

Combined fit: Breit-Wigner for the signal + polynomial for the residual background



MASS AND WIDTH VS P_T

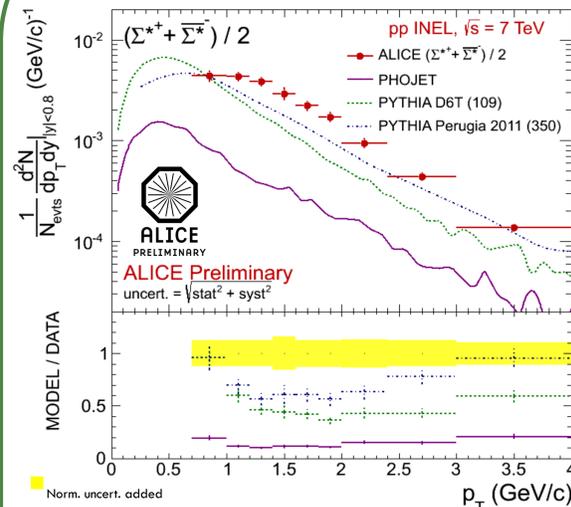


Good agreement with the PDG values.
Note. Only stat. errors shown!

- 11 p_T -bins
- Lowest 0.7-1.0 GeV/c
- Highest 6-10 GeV/c

Further details:
• Normalization to inelastic (INEL) events

SPECTRA VS. MODELS



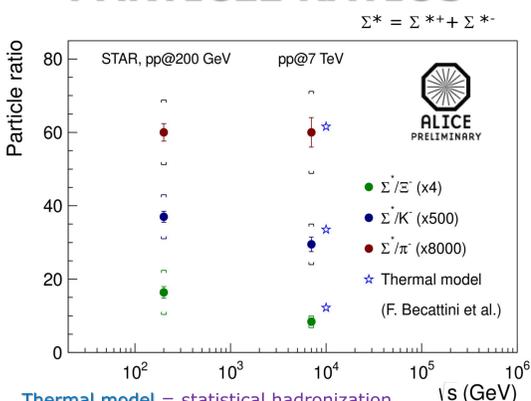
PYTHIA D6T reference tune
PYTHIA Perugia 2011:

- adapted to recent LHC measurements, i.e. multiplicity + p_T spectra at $\sqrt{s} = 0.9$ and 7 TeV
- describes hyperons better in general [4]

From Lévy-Tsallis fit:
 $dN/dy_{INEL} = (8.3 \pm 0.7 \pm 1.5) \times 10^{-3}$
 $\langle p_T \rangle = (1.15 \pm 0.02 \pm 0.05)$ GeV/c

- **All the investigated generators underestimate** the data.
- Pythia tune with the highest yields \rightarrow still well below the data, at intermediate p_T (Note: **PYTHIA Perugia 2011** looks **ok** at higher p_T)

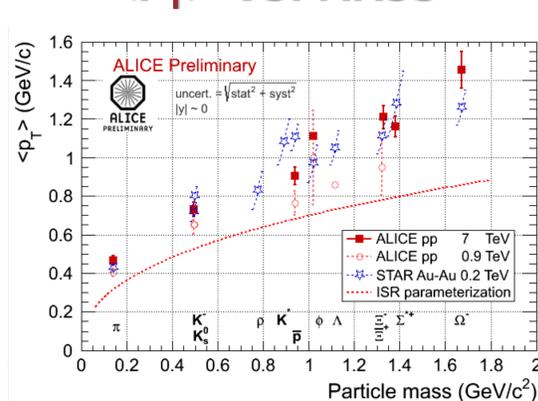
PARTICLE RATIOS



Thermal model = statistical hadronization model with $T = 170$ MeV and $\gamma_s = 0.6$ [1]

- Σ^*/π^- **energy-independent** as predicted by the model (grand-canonical) [1]
- Σ^* and π^- for STAR from [2-3]
- Σ^*/K^- in agreement within errors
- K^- for STAR from [3]
- Σ^*/Ξ^- **decreases with energy** \leftrightarrow increased multistrange production
- Ξ^- for ALICE from [4], for STAR from [5]

$\langle P_T \rangle$ VS. MASS



ISR parameterization = for π , K , p at $\sqrt{s} = 25$ GeV

- \rightarrow **ISR param. below** the 7 TeV data...
- $\rightarrow \langle p_T \rangle$ in 7 TeV pp collisions (energy 300x higher): quite different from $\langle p_T \rangle$ at lower energy
- $\rightarrow \langle p_T \rangle$ **compatible with** or higher than STAR data in **central Au-Au at $\sqrt{s_{NN}} = 200$ GeV**

SUMMARY

- ❖ $\Sigma(1385)^\pm$ and $\Lambda(1520)^0$ have been reconstructed by the ALICE experiment in **pp collisions at $\sqrt{s} = 7$ TeV**
- ❖ Differential **p_T -spectra** for the Σ^* have been compared with QCD-inspired models which **underpredict** the data
- ❖ Σ^*/π^- and Σ^*/K^- ratios are in agreement with predictions from a thermal model [1]
- ❖ In $\langle p_T \rangle$ vs. mass, Σ^* follows the trend of other particles in ALICE@7 TeV

REFERENCES

1. F. Becattini, P. Castorina, A. Milov and H. Satz, J. Phys. G38 (2011) 025002 and private communication
2. STAR Collaboration, Σ^* , Phys Rev Lett 97, 132301 (2006)
3. STAR Collaboration, π and K , Phys. Rev. C 71, 064902 (2005)
4. ALICE Collaboration, Ξ , Phys. Lett. B 712 (2012) 309-318
5. STAR Collaboration, Ξ , Phys. Rev. C 75, 064901 (2007)