Midrapidity antibaryon-to-baryon ratios in Pb-Pb and p-Pb collisions measured by the ALICE experiment

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Baryon number (BN) transport:

String junction model

- Valence quarks are connected via non-perturbative configuration of gluon field (SJ).
- Generated baryon is formed around string junction with presence of several sea quarks.
- Deceleration of BN of the beam = BN transport.
- $R = N_{\overline{B}}/N_B$, B = p, Λ, Ξ, Ω
- Probability of BN transfer is $\approx e^{(\alpha-1)\Delta y}$, $\Delta y = y_{beam} - y_{baryon}$
- α depends on configuration in which BN is transported.
- $\alpha_{SJ} = 0.5$ (Veneziano, Rossi) [1] $\leftrightarrow$ $\alpha_{SJ} = 1$ (Kopeliovich) [2]
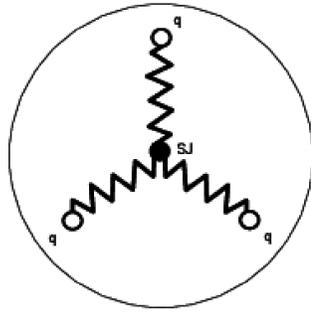
BN transport in heavy-ion collisions

- BN transport can be enhanced by multiple nucleon collisions.
- If there is only small contribution for transport and tight limits on any additional contribution we will observe no centrality dependence for antibaryon-to-baryon ratios and consistent ratios for different baryons.
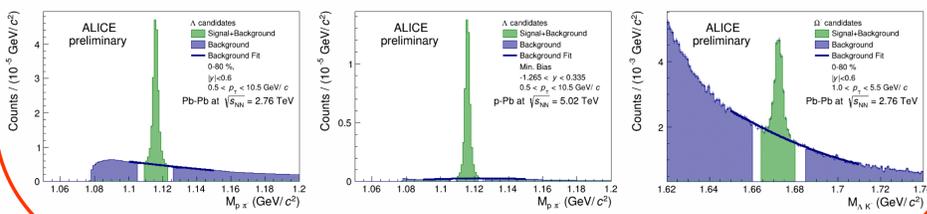
[3]
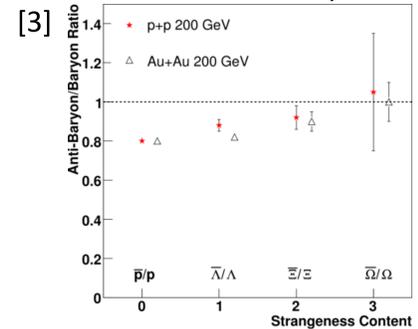
Pb-Pb collision at $\sqrt{s_{NN}}$ = 2.76 TeV
p-Pb collision at $\sqrt{s_{NN}}$ = 5.02 TeV

Analysis

Reconstruction and identification of baryons

- <u>Protons</u> are identified using their specific ionization in the TPC gas.
- For this analysis, (anti)protons were selected within a band of 3σ around the expected value.
- <u>Strange baryons</u> in ALICE are reconstructed by detecting the charged products of their weak decays.
- Each invariant mass distribution is fitted by a combination of Gauss function and polynomial function of second order.
- This fit is used for the determination of the peak position and width.
- Background area was fitted by 2nd order polynomial function. Integral of the function was subtracted from histogram content in the peak region.

Results

Rapidity and transverse momentum dependence

- Preliminary results show no sign of rapidity and transverse momentum dependence.
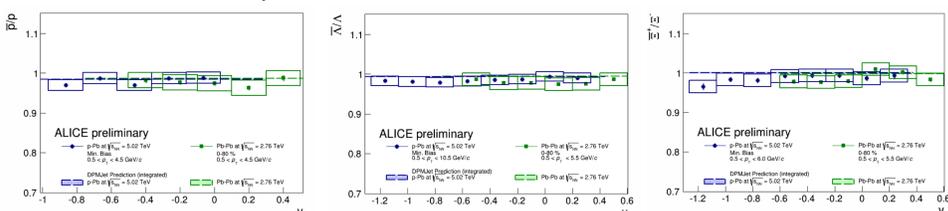
- Experimental points are compared with DPMJet model predictions that include variation of BN transport mechanisms.

Multiplicity density dependence

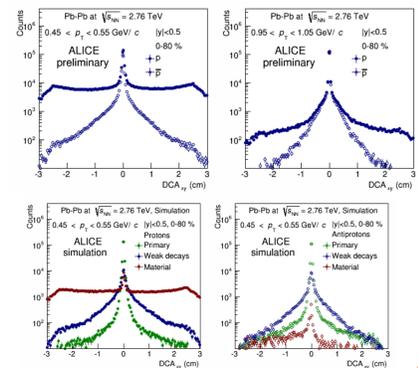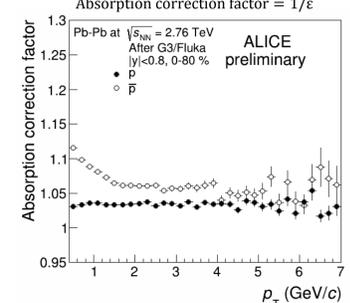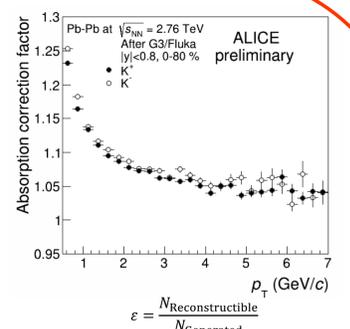- Results show no sign of multiplicity dependence

Corrections

- The TPC of the ALICE experiment is symmetric around mid-rapidity and has full azimuthal coverage.
- Many detector effects such as the acceptance, reconstruction and particle identification are the same for particles and anti-particles and thus cancel out in the ratio.
- Effects which we need to correct for are absorption and secondary particles produced in material.

$$\varepsilon = \frac{N_{Reconstructible}}{N_{Generated}}$$
Absorption correction factor = $1/\varepsilon$
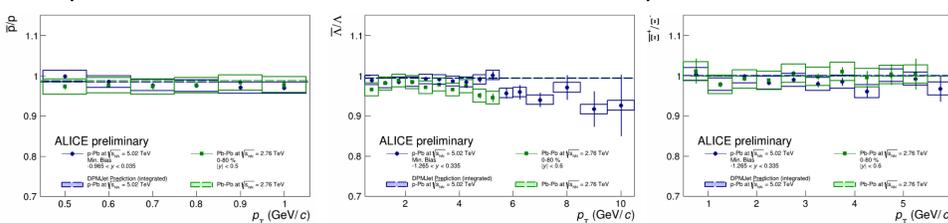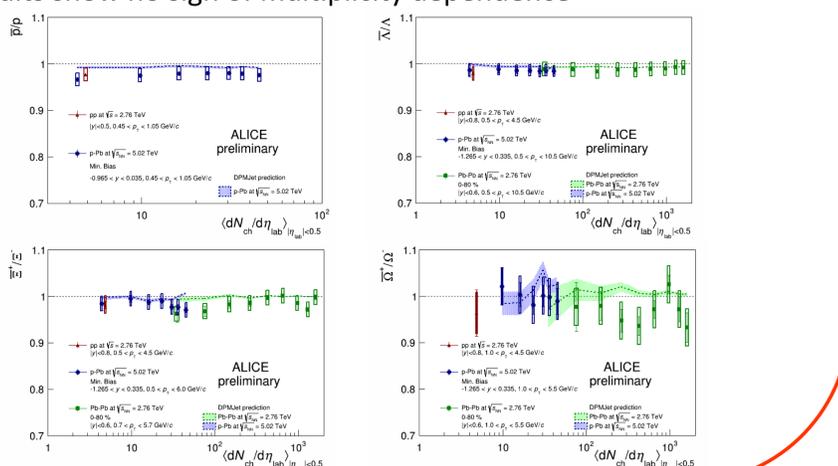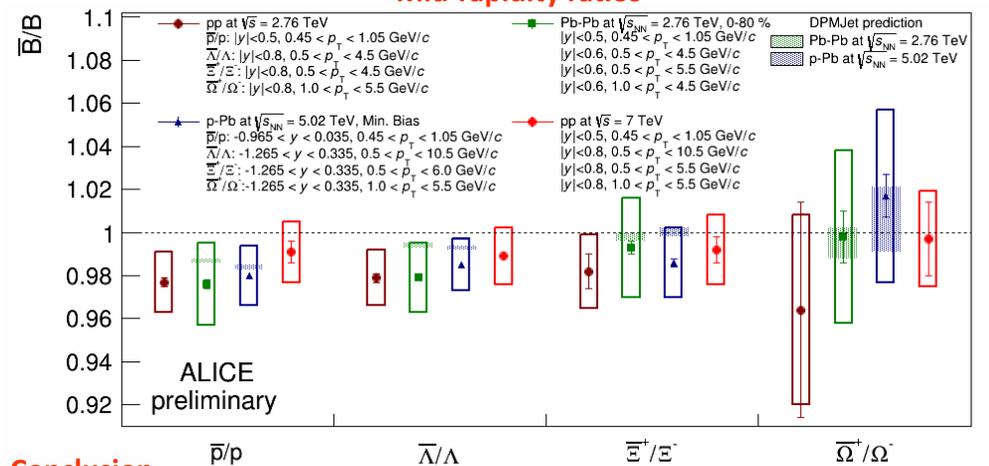
Absorption correction

- To correct for absorption, we multiply by a correction factor defined as the ratio of generated particles to reconstructible particles.
- Reconstructible particles are considered to be those that have an associated track reference in the TPC in simulation.
- Reconstructible mother is a mother which decayed in the considered charged channel.

Contamination by secondary protons

- (Anti)protons contaminated by secondaries produced in the material and feed-down.
- Effect taken into account by studying the distribution of distances of closest approach (DCA$_{xy}$) of tracks to the primary vertex.
- DCA$_{xy}$ distributions are very different for primaries and secondaries; data distribution can be fitted with MC template distributions to compute fractions of secondaries.

Mid-rapidity ratios

Conclusion

- We measured antibaryon-to-baryon ratios in pp and Pb-Pb collisions.
- Ratios in Pb-Pb and p-Pb are compatible within uncertainties.
- Results from pp, p-Pb and Pb-Pb collisions are very close to unity => The contribution of the BN transport process with $\alpha_{SJ} = 1$ is compatible with zero for Pb-Pb at $\sqrt{s_{NN}}$=2.76 and p-Pb at $\sqrt{s_{NN}}$=5.02.

[1] B. Z. Kopeliovich and B. Povh, Phys. Lett. B 446, 321 (1999)

[2] G.C.Rossi, G.Veneziano, Nucl. Phys. B123, (1977) 507

[3] STAR Collaboration, Phys. Rev. C 75 (2007) 064901