Probing the hadronic phase of large hadronizing system through the study of the $\Lambda(1520)$ resonance with ALICE at the LHC

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Importance of resonance measurements in heavy-ion collisions

- A Quark Gluon Plasma (QGP) state is created in high energy heavy-ion collisions. As the system expands, it cools down and transitions back to hadronic matter. **After hadronisation, the system continues to expand** until all interactions cease (kinetic freeze-out).

- Due to their short lifetimes ($\tau \sim$ few fm/c), resonances can decay within the hadronic medium which in turn can alter their final measured yields due to re-scattering of decay products.

Resonance Lifetime (fm/c): $\rho (1.3) < K^* (4.2) < \Sigma^* (5.5-5.0) < \Lambda^* (12.6) < \Xi^* (21.7) < \Phi (46.2)$
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The production of Λ(1520) measured by the ALICE Experiment in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with full run-2 data sample is presented.

- The signal extraction from the invariant-mass analysis in the Λ(1520) $\rightarrow pK^-$ and charge conjugate decay channel.
- The $p_T$-differential yield is extracted with a combined fit (voigtian signal + residual background) and corrected for the detector acceptance and reconstruction efficiency.
$\rho_T$-spectrum

- The $\Lambda(1520) + \text{cc.} \ p_T$-differential yield measured at mid-rapidity ($|y| < 0.5$) in the six centrality classes is shown.

- The spectral shapes are compared with Blast-Wave[1] and MUSIC hydrodynamic model [2] with SMASH afterburner from Pb-Pb@5.02 TeV predictions.

- The spectral shapes are in agreement with the Blast-Wave [2] (parameters obtained from $\pi/K/p$ fits) and close to MUSIC with SMASH afterburner prediction at low $p_T$ while diverge at high $p_T$.

- MUSIC slightly underestimates the data with possible explanation that this model underestimates overall strangeness production at mid-rapidity.

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The $<p_T>$ increases from peripheral to central collisions (~47% higher in 0-10% than 70-90% centrality values) → higher than Pb-Pb 2.76 TeV [3] values → higher than Blast-wave model ($\pi$K/p) [2] and EPOS3 (with UrQMD) model [4] predictions at 2.76 TeV → But EPOS3 fails to predicts data if UrQMD is off

Predictions from MUSIC+SMASH afterburner [2] predictions are consistent with data in central collisions but underestimates in peripheral collisions, overall better agreement with the data

When SMASH is turned off, the $<p_T>$ is underestimated

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The $p_T$-integrated $\Lambda(1520)/\Lambda$ yield ratio is shown → the ratio is suppressed in central collisions (0-10%) if compared to the values observed in peripheral collisions, p-Pb, pp collisions and predictions from statistical hadronisation models → $62.55\%$ lower than 70-90% peripheral Pb-Pb at 7.1σ level → $60\%$ lower than thermal model predictions [5,6,7,8,9] → follows published PbPb@2.76 suppression trend [3] → Higher precision and wider multiplicity coverage

- MUSIC with SMASH afterburner [2] → reproduce the multiplicity suppression trend, better agreement
- MUSIC without SMASH → first ever prediction without a afterburner, gives a flat curve → matching to peripheral 70-90% Pb-Pb collisions and near to the pp values
- These measurements with highest multiplicity and improved accuracy further confirm the existence of a hadronic phase lasting enough to cause a significant reduction of the reconstructible yield of short lived resonances

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