Note on a Scaling Relation in ALICE Charm Hadronization

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Dear ALICE Heavy-Flavor Group,

We suggest a simple baryon–meson scaling involving charm hadrons in Pb–Pb collisions:

$$v_2(\Lambda_c) - v_2(D^0) \ \propto \ \log\left(\frac{\Lambda_c}{D^0}\right),$$

where Λ_c/D^0 is the yield ratio in the same $(p_T, \text{centrality})$ bin. The proportionality factor is expected to be slowly varying with centrality.

How it can be tested on existing ALICE data

- **Inputs:** published v_2 measurements for D^0 and Λ_c vs. p_T and centrality at $\sqrt{s_{NN}} = 5.02$ TeV; corresponding Λ_c/D^0 yield ratios in matched bins.
- **Binning and matching:** harmonize centrality and p_T binning; when necessary, interpolate within published ranges with conservative systematics.
- **Correlation test:** for each bin, compute $\Delta v_2 \equiv v_2(\Lambda_c) - v_2(D^0)$ and $Y \equiv \log(\Lambda_c/D^0)$. Perform a linear fit $\Delta v_2 = A + B\,Y$ with full covariance of statistical and systematic uncertainties.
- **Cross-checks:** repeat for different centrality classes; verify that the slope B is stable within uncertainties. Compare to p–Pb and pp baselines (where coalescence is weaker) as a control.
- **Systematics:** test sensitivity to feed-down, selection efficiencies, and non-flow corrections; the relation should persist within combined uncertainties if it is genuine.

Why this may be important

- **Universality hint:** a logarithmic link between baryon/meson composition and elliptic flow would indicate a common underlying mechanism (e.g., coalescence-driven degrees of freedom) governing both hadronization and collectivity for charm.

- **Model constraints:** such scaling can discriminate between fragmentation-dominated and coalescence-dominated pictures and reduce parameter degeneracies in heavy-flavor transport models.

- **Compact observable:** Δv_2 vs. $\log(\Lambda_c/D^0)$ gives a one-curve summary across centralities and p_T that is easy to compare with theoretical calculations.

Best regards,

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