Topic 2: In what way are QGP-like effects in small systems related?



Conveners: Anthony Timmins and Aleksas Mazeliauskas Secretary: Alice Ohlson

Group members and posters presented









Probing the underlying PDF of $v_2(p_T)$

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following:

[2] JHEP 1807, 108 (2018)

Underlying PDF of v_2 Measurements of flow coefficient v2(m) us ing multiparticle cumulants shed light on the underlying probability density function (PDF) of v_2 . In particular, we can tost the following ALICE Preliminary VDM 10-20% • If v₂(m) is driven by the initial state coventricity (r_2) , then ×,(8),+(4) $\frac{v_2(4)(p_2)}{v_2(6,8)(p_2)}$. +,00+,4 independent of py-VDM 30-47% If the underlying probability dens function (PDF) of v₂ is given by 98.40-50% Jessel-Goussian distribution, then $v_3{4} = v_2{6,8}.$ In order to probe the shape of the under ing v_2 PDF we calculate the skewness and kurtosis (γ_2) of the distribution [1 $\gamma_1 = -6\sqrt{2}v_2\{4\}^2 \frac{v_2\{4\} - v_2\{6\}}{(v_2\{2\}^2 - v_2\{4\}^2)}$ p, (GeVic) $\gamma_l = -\frac{3v_2\{4\}^4 - 12v_2\{6\}^4 + 11v_2\{8\}}{(v_2\{2\}^2 - v_2\{4\}^2)^4}$ latios of v₂: $(6, 8)/(6, 4) \neq 1$, difference of order of a perce Previous studies [2] have reported similar v₂ PDF not described by Bessel-Gaussian distri measurements for the integrated flow, is now for the first times we can study the underlying PDF as a function of centrality and p_{T} . a trivial evolution of ratio with 2-7 and centrality v₂ sensitive to medium transport parameters ight point to a needed refinement of the traditional r) relation between v_2 and e_2 ments of p2-differential v2 using multiparticle cumulants provide insight into the underlying probability density function [1] Phys. Rev. C 85, 014913

Thanks Jonatan Adolfsson, Gösta Gustafson, Vytautas Vislavicius, Dong Jo Kim, Marius Utheim, Wenbin Zhao, and Antonio Ortiz for discussions











Anisotropic flow in small systems



- What is the mechanism of the coordinate-momentum anisotropy transmutation?

Compelling evidence that final state anisotropy is driven by initial state geometry









Coordinate-momentum anisotropy transmutation possibilities

Hydrodynamics





String shoving

Escape mechanism





New anisotropic flow measurements and calculations?



- Measurements of higher order flow harmonics in pp and p-Pb
- Systematic comparison of hydrodynamic and stringy harmonic flow in small systems

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August 19-23, 2019, in Lund, \$

Anisotropic flow at mid p_T



- Coalescence calculations describe baryon and meson v_n and ratios at mid p_T ✓Increasing contribution from jets induces turn over
- What other mechanisms cause vn to turn over?





Radial flow in small systems



- Strong evidence of faster expansion in pp & p-Pb compared to Pb-Pb
- Leads to smaller systems freezing out with smaller radii





Radial flow in small systems



Do heavy flavor particles exhibit same radial flow as light particles? ✓ E.g. Investigate blast wave fits on light flavors and their "predictions" for heavy flavor spectra

3rd International ping on QCD Challenges from pp to AA



Strangeness enhancement



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0.95

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0.18

0.16

0.1

What is the mechanism and how : in phase space?







Searches for jet quenching in small systems



• Effect likely small \rightarrow more precise and novel measurements needed



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Heavy flavor flow and R_{pPb}



Heavy flavor flow and R_{pPb} follow similar trends as light hadrons





- Same cross check should be made with jet quenching models for light hadrons

Hydro+transport model predict D⁰ flow and mild R_{AA} suppression for small systems



Summary of proposals in light systems

- Experiment
 - \checkmark More orders of v_n in pp and p-Pb ✓Two-particle correlations with strange hadrons

Theory

✓Higher harmonic flow using string mechanisms Hydro predictions for two particle correlations with strangeness ✓ Blast wave predictions for heavy-flavor spectra \checkmark Simultaneously predictions of light hadron v_n and R_{AA} at high p_T

$$L_{\scriptscriptstyle QCD} = \sum_{\scriptscriptstyle q} \, \overline{\psi}_{\scriptscriptstyle q} \Bigl(i \gamma_{_{\scriptscriptstyle \mu}} D^{^{\scriptscriptstyle \mu}} \cdot m_{_{\scriptscriptstyle q}} \Bigr) \psi_{_{\scriptscriptstyle q}} \cdot rac{1}{2} Tr \Bigl[\, \overline{G}_{_{\scriptscriptstyle \mu
u}} \, \overline{G}^{^{\scriptscriptstyle \mu
u}} \Bigr]$$





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