

Longitudinal flow-plane decorrelation from multiple-plane cumulants with STAR

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1 The systematic variations (monotonic rotation, random walk, etc.) of anisotropic flow planes (Ψ_n)
2 as a function of rapidity, commonly known as flow-plane decorrelations, could provide new insights in
3 our understanding on the initial conditions of the participant matter and the development of anisotropic
4 flow in heavy-ion collisions opening new possibilities for understanding the three-dimensional structure
5 of the quark-gluon plasma. The factorization ratio observable has been extensively used to quantify the
6 longitudinal flow-plane decorrelation of anisotropic flow at LHC and RHIC energies. However, various non-
7 flow effects also contribute to the ratio measurements and the observable is not sensitive to differentiate
8 different decorrelation patterns. A new cumulant observable $T^{\Delta\Psi_n^{a\rightarrow b}*\Delta\Psi_n^{c\rightarrow d}} = \langle\langle\sin[n(\Psi_n^b - \Psi_n^a)] \sin[n(\Psi_n^d - \Psi_n^c)]\rangle\rangle$
9 has been proposed by Zhiwan Xu *et al.* in Ref. [1], which correlates the four flow-plane angles
10 from backward (η_a), mid (η_b, η_c), and forward (η_d) rapidity regions to probe the genuine longitudinal flow-
11 plane (de)correlation by suppressing non-flow contributions. In this talk we present the first measurements
12 of $T^{\Delta\Psi_n^{a\rightarrow b}*\Delta\Psi_n^{c\rightarrow d}}$ observable using STAR experiment datasets of Au+Au and isobar (Ru+Ru, Zr+Zr)
13 collisions at $\sqrt{s_{NN}} = 200$ GeV for the elliptic and triangular anisotropic flow planes (i.e. $n = 2$ and 3).
14 These measurements provide essential information for establishing the pertinent decorrelation patterns
15 present in the experimental data and a quantitative estimate of the possible systematic variations of the
16 anisotropic flow angles between forward, mid, and backward rapidity regions.

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18 [1] Zhiwan Xu, Xiatong Wu, Caleb Sword, Gang Wang, Sergei A. Voloshin, and Huan Zhong Huang. Flow-
19 plane decorrelations in heavy-ion collisions with multiple-plane cumulants. *Phys. Rev. C*, 105:024902,
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