Measuring the Global Spin Alignment of Vector Mesons in Heavy Ion Collisions by STAR

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In non-central Heavy-Ion collisions, a large orbital angular momentum is produced. A part of the orbital angular momentum can polarize the quarks and anti-quarks, hence the vector mesons, inside the medium. Recently, STAR measured the global spin alignment of $\phi(1020)$ mesons in Au+Au collisions from the first phase of the RHIC Beam Energy Scan I (BES I) program [1].

The global spin alignment, quantified by the 00th coefficient of the spin density matrix ρ_{00}, is measured by a fit to the acceptance and efficiency corrected ϕ meson yield versus polar angle (θ^*) between the daughter kaon in the parent's rest frame and the orbital angular momentum direction.

In this poster, we present an alternative approach to extract ρ_{00} by utilizing the $\langle\cos^2\theta^*\rangle$ as a function of pair-invariant mass instead of analyzing the ϕ meson yields in $\cos\theta^*$ bins. The acceptance and efficiency effects are taken into account by using the combinatorial background. This method only uses the signal to background ratio and is insensitive to few percent variations in the yield vs. θ^*. We report preliminary results from this method and compare with previous measurements by STAR.

[1] M. Abdallah *et al.* (STAR Collaboration), Nature **614**, 244–248 (2022).