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Practical considerations for measuring global spin alignment of vector mesons in relativistic heavy ion collisions

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The study of global polarization and spin alignment can help us probe the vorticity field generated by the initial global angular momentum and understand particle production mechanisms during hadronization. For those reasons this topic is gaining increasing interest in recent years. The study of spin alignment (quantified by ρ_{00}) of vector mesons involves the reconstruction of the direction of global angular momentum (L), which is the normal to the reaction plane (RP). In experiments the RP is estimated with correlations among particles and has finite resolution. In this poster, we demonstrate a procedure to correct ρ_{00} for the finite RP resolution. In addition, since the 1st- and 2nd-order RP are usually not the same and they have different sensitivity to L, we derive a relationship to explain the ρ_{00} obtained between the two RP. Furthermore, a deviation of ρ_{00} from 1/3 can be caused by finite acceptance in pseudo rapidity (e.g., the case for STAR and ALICE). We demonstrate that this effect can be corrected elegantly in a data-driven approach. At last, because vector mesons can have an apparent spin alignment in the helicity frame (local ρ_{00}), this will cause an artificial azimuthal angle dependence when study the global ρ_{00} as a function of emission angle with respect to the RP. We lay down a procedure to correct for this effect as well as a procedure to correct for the effect of smearing ρ_{00} in azimuth bins.

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