

Collectivity from interference

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In hadronic collisions, interference between different production channels affects momentum distributions of multi-particle final states. As this QCD interference does not depend on the strong coupling constant α_s , it is part of the no-interaction baseline that needs to be controlled prior to searching for other manifestations of collective dynamics, e.g., in the analysis of azimuthal anisotropy coefficients v_n at the LHC. Here, we introduce a model that is based on the QCD theory of multi-parton interactions and that allows one to study interference effects in the production of m particles in hadronic collisions with N parton-parton interactions ($\sim N_s$). In an expansion in powers of $1/(N_c^2 - 1)$ and to leading order in the number of sources N , we calculate interference effects in the m -particle spectra and we determine from them the second and fourth order cumulant momentum anisotropies $v_n\{2\}$ and $v_n\{4\}$. Without invoking any azimuthal asymmetry and any density dependent non-linear dynamics in the incoming state, and without invoking any interaction in the final state, we find that QCD interference alone can give rise to values for $v_n\{2\}$ and $v_n\{4\}$ even, that persist unattenuated for increasing number of sources, that may increase with increasing multiplicity and that agree with measurements in proton-proton (pp) collisions in terms of the order of magnitude of the signal and the approximate shape of the transverse momentum dependence. We further find that the non-abelian features of QCD interference can give rise to odd harmonic anisotropies. These findings indicate that the no-interaction baseline including QCD interference effects can make a sizeable if not dominant contribution to the measured v_n coefficients in pp collisions. Prospects for analyzing QCD interference contributions further and their possible relevance for proton-nucleus and nucleus-nucleus collisions are discussed shortly.

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