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Directed, elliptic and triangular flow of D mesons in ALICE

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Heavy quarks (charm and beauty) are produced in abundance during the early stage of ultra-relativistic heavy-ion collisions. They therefore experience the full evolution of the Quark-Gluon Plasma (QGP). This makes them unique probes of the collective behaviour of particles in the medium as it expands and cools. The anisotropy of the overlap region between the two colliding nuclei in the initial state is translated into a momentum anisotropy of the produced particles in the final state.

The v_2, or elliptic flow, is an observable that reflects the degree of collectivity in this expanding system. At low momenta it provides information on the collective motion of particles and the degree of thermalisation within the system, while at higher momenta it serves to constrain the path-length dependence of the energy loss of heavy quarks in the medium. The effect of quark recombination can be studied by comparing the measured v_2 of non-strange D mesons (D^0, D^+, D^{*+}) with measurements of strange D mesons (D_s^+).

In addition to the elliptic flow, other flow harmonics provide information about the properties of the QGP. The directed flow (v_1) of heavy-flavour particles is sensitive to the unprecedentedly strong magnetic fields present in the early stages of the collision, and so measurements of its charge dependence are key to constraining the electrical conductivity of the QGP. Finally, the triangular flow (v_3) is driven by fluctuations in the initial state of the system, and is sensitive to the ratio of the shear viscosity to the entropy density, η/s. The v_3 measurement therefore serves as an important constraint on hydrodynamic models of QGP formation, which predict a low η/s at RHIC and the LHC.

This talk will present the latest measurements by the ALICE Collaboration on the directed, elliptic and triangular flow of charmed hadrons in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV. The charge-dependent v_1 of D^0 mesons will be shown, as well as the average D-meson v_2 measured by standard and Event-Shape Engineering (ESE) techniques, and the non-strange D-meson v_3. The non-strange D-meson v_2 results will also be compared with those of strange D mesons. Comparisons with predictions from theoretical models will be discussed.

Collaboration (if applicable)

ALICE

Track

Heavy Flavor and Quarkonia

Contribution type

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