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Exploring the hadronic phase with momentum and azimuthal distribution of short-lived resonances and understanding the internal structure of exotic resonances with ALICE

Hadronic resonances are crucial probes to understand the various phases of matter created during relativistic heavy-ion collisions. Due to their short lifetimes, the yields of these resonances can be affected by competing rescattering and regeneration mechanisms in the final hadronic phase. Rescattering can alter the momentum of the resonance decay products, limiting their reconstruction through the invariant-mass technique, while pseudo-elastic scattering can regenerate them. Final state observables such as elliptic flow, transverse momentum spectra, and measured yields of resonances could be significantly modified due to the interaction in the hadronic phase. By contrasting the yields of longer-lived resonances, such as the ϕ-meson with shorter-lived ones, such as the $K^*(892)$, it is possible to obtain information about the properties and timescales of the hadronic phase. This contribution will present new results on production yields, spectra, and flow harmonics for $K^*(892)$ and $\phi(1020)$ in Pb–Pb collisions obtained by the ALICE Collaboration. The results will be compared with state-of-the-art models to interpret which underlying mechanism can describe the experimental observations.

In addition to probe hadronic phase, the study of resonances also offers valuable insights into the non-perturbative regime of Quantum Chromodynamics (QCD). Resonances such as the f0(980) and f1(1285) challenge the traditional quark model. Their structure is yet unknown as they could potentially be tetraquark states or meson-meson molecules. Proposed Glueball candidates like the f2(1270), f′2(1525), and f0(1710) also provide opportunities to explore the gluonic bound states predicted by lattice QCD. Utilizing its excellent particle identification capabilities ALICE has recently conducted detailed studies of the exotic resonance production in pp collisions data at $\sqrt{s}$ = 13 and 13.6 TeV. This contribution will present new measurements of exotic resonances such as f0(980), f1(1285), and the glueball candidates to get more insight into their internal structure.

Secondary track

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