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ϕ meson production in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.36 TeV via the dimuon channel with ALICE

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Strangeness production serves as a powerful probe of the properties of the hot and dense strongly interacting medium created in ultra-relativistic heavy-ion collisions. The enhancement of strange particle yields has long been considered a key signature of the formation of the quark-gluon plasma (QGP). Among strange hadrons, the ϕ meson, composed of an $s\bar{s}$ quark pair, plays a crucial role, as it is sensitive to both strangeness dynamics and possible medium modifications, and at the same time is relatively unaffected by hadronic re-scattering due to its small interaction cross section.

In this work, we report on the measurement of ϕ-meson production via the dimuon decay channel in the forward rapidity region ($2.5 < y < 4.0$) in Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV, with the ALICE experiment at the CERN LHC. The measurement of ϕ meson production via its dimuon decay channel offers several experimental advantages. The dimuon channel, with a relatively low combinatorial background and no strong final-state interactions, allows for a clean reconstruction of the ϕ signal, particularly in the forward rapidity region where the ALICE Muon Spectrometer provides a good acceptance and resolution. The transverse momentum spectra and integrated yields are presented in the transverse momentum range down to p_T $gtrsim$ 2 GeV/c. These new results extend previous ALICE measurements at $\sqrt{s_{\rm NN}} = 5.02$ TeV and $\sqrt{s_{\rm NN}} = 2.76$ TeV, allowing a systematic study of the energy dependence of ϕ-meson production and the $p_{\rm T}$ spectra for different centrality classes. The comparison with model predictions and lower-energy results provides further insight into strangeness enhancement, hadronization mechanisms, and the evolution of QGP properties with increasing collision energy.

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