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Quarkonia as probes of initial and final states in small systems with ALICE

Measurements in pp and p-Pb collisions, so-called small systems, besides serving as baseline for studying vacuum production and cold-nuclear matter effects, respectively, have recently shown intriguing features. In particular, measurements in high-multiplicity events have revealed striking similarities with heavy-ion collisions, where the formation of a quark-gluon plasma is expected. One of the possible scenarios proposed for describing these findings, which include among others collective effects, is the presence of multiple parton-parton interactions (MPIs). At LHC energies, MPIs affect both the soft component of the event, as well as the hard scales responsible for heavy-quark production. Quarkonium associated production, such as double J/ψ production in the same event, provides a direct way to study MPIs. Conversely, quarkonium measurements which correlate soft and hard components of the event, such as multiplicity dependent production or azimuthal correlations between quarkonia and hadrons produced in the same event, represent an indirect method to investigate MPIs. In addition, these studies can reveal any other potential underlying mechanisms taking place in the final state, such as possible dissociation effects for loosely bound excited quarkonia. In case of charmonia, the corresponding measurements for the non-prompt component, originating from beauty hadron decays, allows for extending such correlations studies to the open beauty hadron sector.

In this talk, new published measurements of double J/ψ production at forward rapidity, as well as new preliminary multiplicity dependent measurements of non-prompt J/ψ fractions at midrapidity, in pp collisions at $\sqrt{s} = 13$ TeV, will be shown. Recent multiplicity dependent measurements of $\psi(2S)$ and $\Upsilon(nS)$ states ($n = 1, 2, 3$), along with excited-to-ground state ratios, carried out at forward rapidity in pp and p-Pb collisions at $\sqrt{s} = 13$ TeV and $\sqrt{s_{NN}} = 8.16$ TeV, will be presented. Furthermore, recently published prompt and non-prompt J/ψ production at midrapidity in p-Pb collisions at $\sqrt{s_{NN}} = 8.16$ TeV, will be discussed. The status of ongoing analyses on J/ψ production as a function of multiplicity or sphericity at central and forward rapidity, in pp and p-Pb collisions, will also be shown. Results will be compared to available model calculations.

Collaboration / Activity

ALICE

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