**Title:** Charmonium production as a function of charged-particle multiplicity in p–Pb collisions at $\sqrt{s_{NN}}$ = 8.16 TeV with ALICE at the LHC

**Keywords:** Charmonia, charged-particle multiplicity, proton-nucleus collisions, ALICE, LHC

**Abstract:** In ordinary matter, quarks and gluons can only be found in a confined state, forming hadrons. However, lattice QCD predicts the existence of the quark-gluon plasma (QGP), a deconfined state of quarks and gluons, at extremely high energy density and temperature. In nature, QGP may have existed during the first microseconds of the universe, where such extreme conditions occurred. Such conditions are reproduced in the laboratory by colliding heavy ions at sufficiently high energy. Due to its short lifetime, the QGP can not be characterized by direct observations. The influence of its formation on particle production is used to characterize it. In heavy-ion collisions, besides QGP effects, the observables might also be affected by the presence of the nuclei, the so-called cold nuclear matter (CNM) effects. To disentangle the QGP effects from the CNM effects, proton-nucleus collisions are used as a control system in which QGP is not expected to be formed. One of the main tools used to probe QGP is quarkonia. Quarkonia are bound states of heavy quark-antiquark pairs ($c\bar{c}$ or $b\bar{b}$ pairs). Due to their large mass, heavy-quark production mechanism takes place at hard scales of QCD, while the formation of the bound states involves soft QCD scales. Quarkonia are, therefore, sensitive to both perturbative and non-perturbative aspects of QCD. In addition, their measurement in p–Pb collisions provides information on CNM effects, such as nuclear shadowing or the interaction with comoving particles. Recent measurements reveal that J/Ψ yields increase with charged-particle multiplicity in pp and p–Pb collisions at the LHC. Different mechanisms were proposed to explain this observation. One of them is the influence of multiple parton interactions in the initial state of the collision. Measurements of the excited charmonium states, e.g., $\Psi(2S)$, as a function of charged-particle multiplicity, are essential to disentangle the impact of possible final-state effects. In this thesis, we present the measurement of charmonium yields as a function of charged-particle multiplicity, measured at central rapidity ($|\eta| < 1.0$). J/Ψ and $\Psi(2S)$ are reconstructed in their dimuon decays within the rapidity region $2.03 < y_{\mathrm{cms}} < 3.53$ and $-4.46 < y_{\mathrm{cms}} < -2.96$. This measurement is performed using in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 8.16 TeV collected by ALICE at the LHC (CERN). In addition, we present preliminary results of the systematic uncertainty of the muon spectrometer tracking efficiency in Run 3. This study was performed using a data set of pp collisions at $\sqrt{s}$ = 13.6 TeV.

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