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Investigating Bottom Quark Energy Loss, Hadronization, and B Meson Nuclear Modification Factors in B^{+} and B_{s}^{0} Decays: Insights from CMS in pp, pPb, and PbPb Collisions

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The exclusive decay channels $\mathrm{B}_{\mathrm{s}}^{0} \to \mathrm{J}/\psi\phi$ and $\mathrm{B}^{+} \to \mathrm{J}/\psi K^{+}$ are investigated. The differential cross sections of $\mathrm{B}_{\mathrm{s}}^{0}$ and B^{+} mesons as a function of their transverse momenta (p_{T}) in proton-proton collisions at 5.02 TeV are well-described by fixed-order plus next-to-leading logarithm calculations, using an integrated luminosity of 302.3 pb^{-1}. By utilizing previous lead-lead collision data at the same nucleon-nucleon (NN) center of mass energy, R_{AA} factors for the B mesons are determined. Additionally, the measurement of the B^{+} meson production cross section is presented with respect to meson p_{T} inclusively and, for the first time, in different charged particle multiplicity ranges. This study is conducted in proton-lead collisions at NN center-of-mass energy of $8.16\ \mathrm{TeV}$, utilizing data collected by the CMS detector in 2016 with an integrated luminosity of 175 nb^{-1}. The analysis focuses on the exclusive decay channel $\mathrm{B}^{+} \to \mathrm{J}/\psi K^{+}$. Inclusive results demonstrate good agreement with fixed-order next-to-leading log calculations, and the ratio of nuclear modification factors is measured for different charged particle multiplicities. These studies provide a comprehensive understanding of $\mathrm{B}_{\mathrm{s}}^{0}$ and B^{+} meson production, shedding light on their behavior in different collision environments and offering insights into the nuclear modification factors associated with these mesons.

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