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The QGSM Description of Baryon Production at LHC: Average Pt versus Energy and Mass + Charge Asymmetry versus Energy

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This study is an example of routine analysis that has led to many impressive implications for the interpretation of high energy hadron physics phenomena.

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1. Notes to poster

The phenomenological approach in the framework of Quark-Gluon String Model (QGSM) [1] has been applied to the description of transverse momentum spectra for baryon hadroproduction at modern colliders.

The analysis of data on hyperon spectra, dN/dPt, in collider experiments (ISR, STAR, UA1, UA5) reveals an important difference in the dynamics of multi particle production between proton-proton vs. antiproton-proton collisions in the region of transverse momenta from 0.1 GeV/c up to 3 GeV/c. From the point of view of the QGSM, the most important contribution to particle production spectra in antiproton-proton reactions goes from fragmentation of antidiquark-diquark side of pomeron multiparticle production diagram. The complete study of the energy dependence of baryon average transverse momenta for the contemporary proton-proton collider experiments (STAR, ALICE, LHCb and CMS) at the energies from sqrt(s) = 200 GeV up to 7 TeV shows the slight growing of average Pt with energy. No dramatic changes were seen in the hadroproduction characteristics on the energy range from Tevatron to LHC, which may be responsible for the "knee" in cosmic ray proton spectra. It allows us to conclude that knee has an astroparticle origin. The average transverse momentum analysis with the different mass of baryons and mesons of existing flavors shows some regularity in the mass gaps between baryon and meson generations. This observation gives the possibility to suggest more hadrons with the following masses: 13.7, 37.3, 101.5, 276, 750 ... GeV that are generated by geometrical progression with the mass factor of order delta(lnM) = 1. These hadrons may bring some new quantum numbers or are heavy multi quark states.

The possibility of QGSM to construct the spectra of various baryons in the entire range of x_F gives advantages in the explanations of many types of asymmetries and ratios that are caused by hadroproduction: the baryon-over-antibaryon excess in the central region of proton-proton collisions, the baryon-to-meson abnormal ratios in nucleus-nucleus reactions, the growing ratios of secondary particles in cosmic ray spectra as well as the recently observed negative asymmetry for heavy flavor baryon/antibaryon spectra at the rapidity point Y=2 in LHCb experiment [2]. The baryon excess at central rapidity that is seen even at LHC energies can be only explained by the contribution from the String Junction transfer [3] that transfers the positive baryon charge from beam protons up to the central rapidity region. Specific form of baryon spectra and secondary interactions provide the diffusion of extra baryons from diquark fragmentation region into the intermediate Pt area of nucleus-nucleus reaction. The leading character of baryon spectra in the region of target fragmentation becomes apparent in the antiparticle-to-particle ratios that are growing with energy in the laboratory system of cosmic matter interactions. The negative baryon/antibaryon asymmetry is the result of interplay of central production and leading baryon production in diquark fragmentation region. Other baryon production phenomena have been described in [4]. It seems reasonable to continue the complex monitoring of baryon production characteristics at the further energies of LHC experiments.

References

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