CHARGED PIONS MULTIPLICITIES AT THE NA49 ENERGY

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The wounded quark–diquark model predictions for charged pions multiplicities in PbPb and pPb collisions in the central rapidity region at $\sqrt{s} = 17.3$ GeV c.m. energy are presented.

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1. The NA49 Collaboration published precise results[1] on inclusive production of charged pions in pp collisions at $\sqrt{s} = 17.3$ GeV [1].

This measurement allows to investigate the consequences of the wounded quark–diquark model [2] for particles production in the central rapidity region of pPb and PbPb collisions at the same energy. We conclude that the model provides rather precise predictions (at the level of 2–3%) for the production of charged pions in nuclear collisions.

2. We follow closely the Ref. [3] where the predictions of the model in pPb and PbPb collisions at the LHC energy are presented. Here we only list the parameter values used in the present calculation and show the final results.

In our calculations for the nuclear density we take the standard Woods–Saxon formula with the nuclear radius $R_{\rm Pb} = 6.62$ fm and the skin depth $d = 0.546$ fm [4].

For the total inelastic pp cross section at $\sqrt{s} = 17.3$ GeV we take the value obtained by the NA49 Collaboration $\sigma_{\rm in} = 31.46$ mb [1]. We assume the differential inelastic pp cross section $\sigma_{\rm in}(s)$ to be in a Gaussian form with $\sigma_{\rm in}(0) = 0.92$ [5][2].

[1] Total systematic uncertainty of 2.0% (quadratic sum) and 4.8% (upper limit).
[2] We checked that different values of $\sigma_{\rm in}(0)$ hardly influence final results.

The average number of wounded quarks and diquarks in a single pp collision $w_p^{(q+d)} = 1.18$ (per one colliding proton)[3]. Finally we take $p_q = w_p^{(q+d)}/3$ and $p_d = 2p_q$ where p_q and p_d are the probabilities for a quark and a diquark to interact in a single pp collision, respectively[4].

3. In Fig. 1 we present the predicted relation between $R_{pA} \equiv N_{pA}(0)/N_{pp}(0)$ and the number of wounded nucleons w [6]. $N_{pA}(0)$ and $N_{pp}(0)$ are the midrapidity particle densities measured in pPb and pp collisions, respectively.

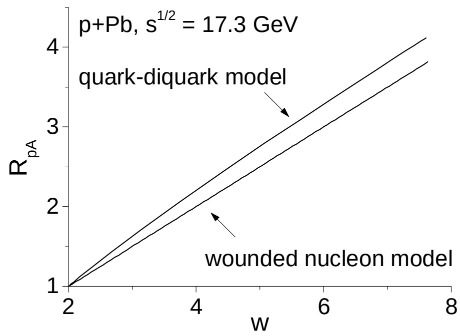

Fig. 1. Prediction of the wounded quark–diquark model for the midrapidity ratio R_{pA} compared with prediction of the wounded nucleon model.

In Fig. 2 the wounded quark–diquark model prediction for the ratio $R_{AA}/(w/2)$ *versus* the number of wounded nucleons w is presented. $R_{AA} \equiv N_{AA}(y)/N_{pp}(y)$ where $N_{AA}(y)$ is the particle density measured in PbPb collision. As explained in [2, 3] this ratio does not depend on y, unless we

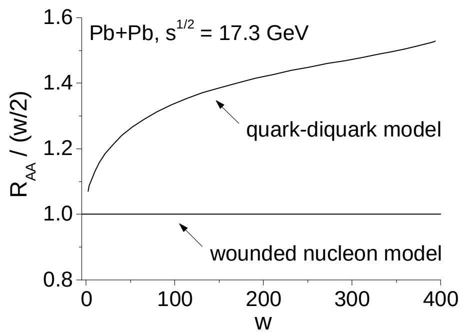

Fig. 2. Prediction of the wounded quark–diquark model for the ratio $2R_{AA}/w$ compared with prediction of the wounded nucleon model.

[3] At $\sqrt{s} = 23$ GeV $w_p^{(q+d)} \approx 1.182$ and changes very slowly with energy [2].

[4] As discussed in [3] the specific relation between p_d and p_q is not important.

are close to the fragmentation regions. It would be very interesting to verify this strong consequence of the model when the data are available.

Multiplying R_{pA} and $R_{AA}/(w/2)$ by the charged pions, $\pi^+ + \pi^-$, [5] midrapidity density in *pp* collisions $N_{pp}(0)|_{\pi^+ + \pi^-} = 1.413$ (with the reasonable uncertainty of 3%) [1] we obtain our final predictions for the charged pions midrapidity densities presented in Fig. 3.

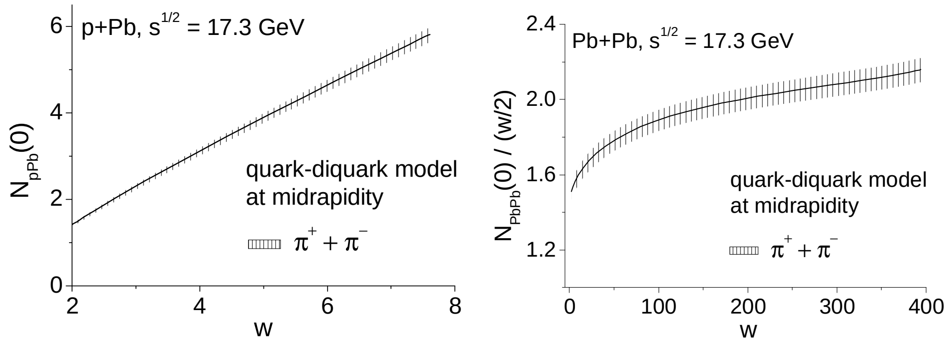

Fig. 3. Predictions of the wounded quark–diquark model for the charged pions midrapidity densities in *p*Pb and PbPb collisions. The error bars reflect the inaccuracy in the *pp* data.

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[5] In the present approach we cannot provide the separate predictions for π^+ and π^- multiplicities. At $\sqrt{s} = 17.3$ GeV the ratio π^+/π^- is strongly influenced by the isospin effect [7].