

# Towards understanding of $K^0_s$ meson production in hadronic interactions

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Recently, the NA61/SHINE collaboration has presented experimental data on  $K^0_s$  meson productions in proton-proton interactions at projectile momenta ( $P_{lab}$ ) of 31, 40 and 80 GeV/c [1]. Earlier, the collaboration obtained the analogous experimental data at

$P_{lab}=158$  GeV/c [2]. As it was shown in [1,2], there are no Monte Carlo models that can well describe all the experimental data. Only at  $P_{lab}=158$  GeV/c, the EPOS model reproduces reasonably well the experimental data.

The description of the experimental data of the NA61/SHINE collaboration by the Geant4 FTF model [3] will be given in our report. According to the FTF model,  $K^-$  mesons are mainly produced by the fragmentation of quarks and antiquarks. Productions of  $K^+$  mesons are connected with the fragmentation of di-quarks. The  $K^0_s$  meson yields are coupled with the fragmentation of either quarks/anti-quarks or di-quarks.

Earlier, we have described [4] experimental data on  $K^+$  and  $K^-$  meson productions in the proton-proton interactions measured by the NA61/SHINE collaboration. In that study, the main problem that we have identified was the tuning of the fragmentation of di-quarks for  $K^+$  mesons. The experimental data on  $K^0_s$  meson production allowed us to check our tuning. Now, we have reached the best description of  $K^0_s$  yields in the proton-proton collisions.

The mechanism of the  $K^0_s$  meson production can be studied using two-particle transverse-momentum correlations proposed by us in [5]. The correlations between  $K^0_s$  mesons and  $\Lambda$  hyperons, protons,  $\pi^-$ ,  $\pi^+$  mesons produced in proton-proton interactions at center-of-mass energy of NN collisions of 10 GeV have been calculated in the Geant4 FTF and Pythia 6.4 models. The strong  $P_T$  correlations between  $K^0_s$  mesons and  $\Lambda$ -hyperons,  $K^+$  mesons, protons have been found. The two-particle  $P_T$  correlations can be studied at NICA SPD experiment. The study of the two-particle correlations can help to clarify the mechanism of quark-gluon string fragmentation.

[1] NA61/SHINE Collaboration (N. Abgrall et al.), arXiv: 2402.17025

[2] NA61/SHINE Collaboration (A. Acharya et al.), Eur. Phys. J. C82 (2022) 1.

[3] Geant4 Collaboration (J. Allison et al.) Nucl. Instrum. Meth. A835 (2016) 186.

[4] A. Galoyan and V. Uzhinsky, XXV International Baldin Seminar on High Energy Physics Problem, Sept. 2023, Dubna, Russia

[5] A.Galoyan, A.Ribon, V.Uzhinsky, MDPI Physics 5 (2023) 3, 823-831

## Section

Heavy ion collisions at Intermediate and high energies

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