Production of ϕ-mesons in pA collisions*

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One of the goals of the experiment on the ϕ meson production in pA collisions is to determine the ϕ properties in nuclear matter of normal density [1]. According to the theoretical predictions the ϕ meson change in mass is small and the main medium effect on the ϕ is significant increase of its width up to an order of magnitude compared to the free (vacuum) value of 4.4 MeV. The experiment was carried out at initial kinetic proton energy of 2.83 GeV with ANKE spectrometer in February-March 2007. Two sets of data were obtained in parallel. The first contains K^+K^- correlations with perfect hardware K^+ selection using the delayed veto technique and the absolute measurements of K^+K^- TOF difference. In the second set triple K^+, K^- and $p, d, T(^3H)$ or ^3He correlation were measured using only TOF technique. The measurements were done with four strip targets: C, Cu, Ag and Au. Up to now only the first set of data with K^+K^- correlations was analyzed. K^+K^- invariant mass spectra from all the four targets look similar. The example of them from Au target is presented in Fig. 1.

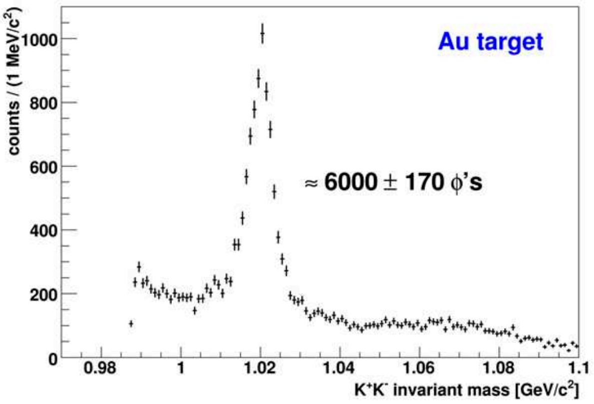

Fig. 1: Invariant mass distribution for K^+K^- pairs from pAu collisions.

The numbers of selected K^+K^- pairs under ϕ peaks correspondingly from C, Cu, Ag and Au targets are given in Table 1.

Table 1: Number of detected ϕ-mesons in the data set of two particle K^+K^- correlations.

solid strip targets	C	Cu	Ag	Au
detected ϕ's $\approx$	6700	5000	5000	6000

The positions and the widths (taking into account our resolution) within 0.5 MeV coincide with the vacuum values since ϕ mesons are reconstructed from practically undistorted K^+ and K^- mesons from ϕ's decaying outside nuclei. An information about a modification of ϕ width can be obtained from an A-dependence of the additional nuclear ϕ absorption compared to that caused by quasi-free ϕN inelastic reactions on the nuclear nucleons. To get this A-dependence the data on ϕ production were relatively normalized to the fluxes of π^+ mesons with the momenta 500 ± 25 MeV/c at the angles ≤ 4 degree simultaneously measured for each targets. The cross sections of these π^+ mesons production are proportional to $A^{2/3}$ within 2%. The preliminary ratios of these normalized ϕ yields from Cu, Ag and Au to the yield from C-target are given in the Table 2, which reasonably coincide with ones predicted in [2].

Table 2: Preliminary ratios of ϕ yields from Cu, Ag and Au to the yield from C-target.

	C/C	Cu/C	Ag/C	Au/C
ratio	1.	0.46	0.39	0.29

The final answer to these ratios will be given after the relative corrections on the detection efficiencies and acceptances are done. First simulations shows around 14% smaller ϕ-meson detection acceptance on Au target in comparison to C. The input distributions for the simulations where generated using a microscopic transport code for nuclear collisions (JAM) [3]. We also plan to check our π^+ normalization with π^- mesons which has been detected in parallel. The absolute values of the cross sections for ϕ meson production will be also calculated. The triple correlation data need more time for the analysis and it is in progress. A first look on these data shows that by detection one forward going proton in coincidence with the K^+K^- the π^+ normalized Au/C ϕ production ratio decreases by a factor two relative to the Au/C ratio given in Table 2. This expectable effect is due to the additional distortion of the outgoing protons.

References:

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