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Studying electron-positron annihilation into $K_SK\pi$ and $K_SK\pi\pi^0$ with the CMD-3 detector

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We studied the process $e^+e^-\to KK\pi$ with the CMD-3 detector at the electron-positron collider VEPP-2000. The statistics collected by the CMD-3 detector in the energy range of $1.2-2$ GeV during the 2011, 2012, 2017, 2019 runs, with a total luminosity integral of $\sim 120pb^{-1}$, was used for the analysis.

The measured cross-section is crucial for the physics of light hadrons from u, d, s quarks, clarifying the hadronic contribution to the anomalous magnetic moment of the muon $(g-2)_\mu$, and independently measuring the resonance parameters of both $\phi(1680)$, $\rho(1450)$. The intermediate dynamics of this process is also of interest, allowing us to check the isotopic relations and prove the dominance of the neutral $K^*(892)$ channel.

We developed a novel methodology for selecting signal events. Including multi-staged kinematic reconstruction. By adding the second stage, we reduced the background $\sim$ 5 more times. This stage depends on a rigorous study of the background. Since we identified - the main physical background to be the process $e^+e^-\to 4\pi$.

The outline of the designed steps:

1. Kinematic reconstruction with 4 charged tracks.
2. Track combination, to distinguish the K_S meson by invariant mass and decay vertex.
3. Restriction on the energy of γ not bound to tracks.
4. Final selection of signal events based on analysis of 2D-distribution of four-track events by energy imbalance ΔE and momentum vector sum modulus of all four particles Δp.
5. Simulation to find efficiency ε and estimate systematic errors.

So, as a result of this work we not only designed a new selection algorithm, but also studied the theoretical aspect of the cross-section in the Vector Meson Dominance Framework. Therefore, we improved the world precision of $\phi(1680)$, $\rho(1450)$ and measured the cross-section of $e^+e^-\to KK\pi$ with the best accuracy.

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