## Institute of Nuclear Physics

ИЯФ 57-7І

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**Ф**- MESON MASS DETERMINATION

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**\$\Phi\$** - MESON MASS DETERMINATION

## Abstract

Using the decay kinematics of the  $K_s^o$ -meson produced in the  $\Phi$ -meson decay the  $\Phi$ -meson mass has been determined  $m_{\Phi} = 1020,7 \pm 0,8$  MeV.

as Q -merca mass. The value of the K, -meson mass



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In 1969 the  $\Phi$ -meson resonance investigation has been performed in Novosibirsk using the electron-positron colliding beams /l/. Three main decay modes of the  $\Phi$ -meson were detected in the experiment:  $K^+K^-$ ,  $K^\circ_s K^\circ_t$ ,  $\pi^+\pi^-\pi^\circ$ . As the accuracy of the absolute energy determination by means of magnetic measurements was 1 %, the calibration of an energy scale was made using the table value of the  $\Phi$ -meson mass /2/.

The angular distribution of the detected charged pions produced in the  $K_s^0$ -meson decay contains information on its kinetic energy. The maximum non-collinearity angle is unambiguously connected with the  $K_s^0$ -meson momentum and using its value one can determine the energy of initial particles as well as  $\Phi$ -meson mass. The value of the  $K_s^0$ -meson mass used is known with a high accuracy, 497,79±0,15 MeV/2/. The angular resolution of the spark chamber system is  $1^0$ . Therefore, we can obtain a good accuracy in the  $\Phi$ -meson mass measurement.

In the  $\Phi$  -meson experiment the measurements were performed at 9 values of beam energies. To determine the  $\Phi$  -meson mass 87 events have been used that corresponded to the process

and were obtained at 6 values of the energy in the central part of the resonance peak.

To select this reaction channel the events were chosen with the Ji -meson range less than 93 g/cm<sup>2</sup>. This restriction has been introduced to reduce the background of the process

having a more wide interval of accessible non-collinearity angles  $\omega$ 

The calculation showed that under those restrictions this admixture was about 4 events for the region of angles  $10^{\circ} < \omega < 50^{\circ}$ . Besides that to axclude the events of the process

$$e^{\dagger}e^{-} \rightarrow \pi^{\dagger}\pi^{-}\gamma$$

a restriction has been introduced on the azimuth component of the non-collinearity angle  $|\Delta \Psi| > 4^{\circ}$ .

During the background measurements which were performed when the beams had a vertical gap of 2 mm no events satisfying the  $K_s^o$   $K_t^o$  -channel selection criteria were detected.

In Fig.1 the experimental and theoretical distributions of events are shown with respect to the non-collinearity angle. Because of the energy dependence of the angular distribution the experimental data were recalculated for the figure to be

clear to the energy corresponding to the Presonance maximum. The theoretical distribution shown also corresponds to this energy and it takes into account the radiative corrections /3/, the angular resolution of the spark chambers the background pedestal being included as well. The calculation was performed by the Monte-Carlo method.

The  $\Phi$  -meson mass was determined by the maximum likelihood method:

$$m_{\bullet} = 1020,7 \pm 0.8 \text{ MeV}$$

The error quoted takes into account the uncertainty of the  $\Phi$  -resonance position on the excitation curve ( $^{\pm}$  0,14 MeV) as well as the  $K_S^0$ -meson mass error ( $^{\pm}$  0,15 MeV) and possible systematic errors connected with the non-collinearity angle measurements (less than  $_{\pm}$  0,3 MeV). The table value

$$m = 1019,5 \pm 0,6 \text{ MeV } /2/$$

The authors are grateful to L.M.Barkov and V.S.Fadin for useful advices and discussions.

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## References

1. V.E.Balakin et al, Phys. Letters, 34B, 328(1971).

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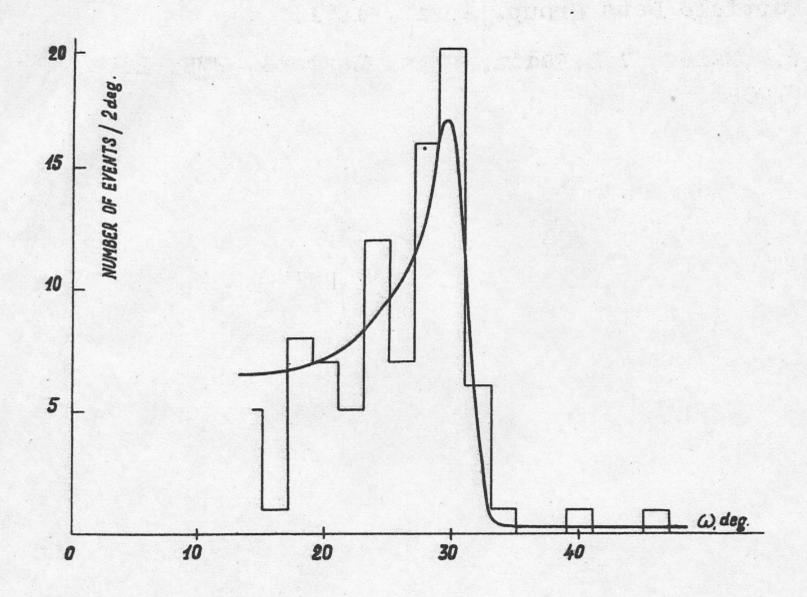


Fig.1. Distribution of the  $K_S \to \pi^+ \pi^-$  events with respect to the non-collinearity angle. The experimental data were recalculated to the energy corresponding to the  $\Phi$  -resonance maximum. The theoretical distribution for this energy is shown by the solid curve.

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Ответственный за выпуск С.И.Середняков
Подинсано к нечати 16.8. Н. ЛИНОЯЧІО
Усл. 0,4 неч.л., тираж 200 экз. Бесплатно.
Заказ № 57 . ПРЕПРИНТ.

Отпечатано на ротапринте в ИЯФ СО АН СССР.