**Elastic pi+ p, K+ p and p p Scattering in the Region of Coulomb-Nuclear Interference at Momenta 42.5-GeV/c and 52.2-GeV/c**

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1. INTRODUCTION

This work is devoted to measuring total and differential se-

values ​​of elastic scattering of pi-mesons, K-mesons and protons on protons at

initial pulses of 42.46 and 52.21 GeV/s. The experiment was carried out to determine

division p(O) - the ratio of the real part of the amplitude of elastic scattering vpe -

ed to the imaginary by observing the interference between the Coulomb and nuclear

ny interactions. The measurements were carried out at small scattering angles,

corresponding to the squares of the transmitted four momentum: 0.0015 < |t|

<0.05 (GeV/c)^2. For elastic scattering of protons on protons, rho(0) is measured

reno up to energies of 500 GeV, and our data confirm the intentions,

performed by the recoil particle registration method. Data on rho(0) in the energy range 20 4-60 GeV for positive

there were no pions or kaons, and the results presented here are the first

new data on real

II. EXPERIMENTAL SETUP

The experiment was carried out on a high-energy accelerator channel

for IHEP. An unseparated beam of secondary particles of positive charge

Yes, it was output from the internal target with birth angles close to zero. The measurements were carried out on a hodoscopic magnetic spectrometer / 4 /.

This setup was used to measure rho(0) for elastic scattering.

the formation of negative pions on protons. Installation for beam measurements

ke positive particles differed only in the presence of 3 threshold

kovskvkh counters for recording the type of incident particle. A bunch of suckers

consisted of 91.1% protons; 7.6% pions and 1.3% kaons at a momentum of 42.5 GeB/s

and 96.4% protons; 3.1% peons and 0.5% kaons at a momentum of 52.2 GeV/s.

For

to improve the pulse resolution of the installation, a special doskol for impulse analysis. The pulse resolution of the installation is equal to

but ±0.4%. To increase the rate of collection of elastic scattering events

a fast digital solver was used

III. MEASUREMENTS AND DATA PROCESSING

The hodoscopic installation was set up in three stages:

1. A beam of positive particles was output along the axis of the experimental

installations. The efficiency of the spectrometric part of the setup was determined.

ki, beam composition, fraction of m-mesons in the beam, geometric constants

doscopes and subsequently these parameters were continuously monitored.

2. Using the lenses of the head lens of the channel, a complete

displacement of the focal plane of the intermediate focus of the beam with the plane

hodoscope for impulse analysis. After achieving the best impulse -

resolution, the pulse spectrum of the beam was measured and the absolute

the absolute value of the average momentum Po and its spread. Produced at

selecting a certain number of direct beam events to find all

its parameters.

3. The digital solver was configured. Knock out

the cutoff threshold for the scattering angle was determined, the 100% efficiency was checked

direct beam suppression efficiency and 100% detection efficiency

tions of events with scattering angles in theta > theta\_min.

Next, statistics were collected with a target filled with water.

native, and with an equivalent background layout.

Data analysis and processing were carried out on a computer

not ICL-1906A. When calculating differential sections, the first stage

processing consisted of geometric reconstruction of tracks and verification of re-

cross sections of tracks of an incident and scattered particle in the target volume. Events

scatterings satisfying the intersection criterion were used to

structure of histograms of impulse distribution in order to highlight the area

ty of the elastic peak and subtraction of the background of inelastic events under the elastic peak.

The contribution of inelastic events under the elastic peak did not exceed 0.7%. According to selected

For certain elastic scattering events, angular distributions were constructed for

full N (t) into empty N (t) targets and the differentiation was calculated from them cross section in cm^2/(GeV/s)^2

Here K is a coefficient that takes into account the weakening of the effect in hydrogen; K^H\_1 and K^H\_2 - normalization coefficients for measurements with full and empty

targets; epsilon is the efficiency of the spectrometric part of the installation, determined

shared from measurements with an empty target; n =3.906\*10^24 pr/cm^2 – number target protons per cm^2; P\_0 - initial impulse; deltaOmega(t) - solid angle

for a given interval t. To calculate solid angles (using the Monte-

Carlo) used initial data on the geometry of the installation and para-

beam meters determined experimentally for each type of incident

particles and each initial energy. Multiple in the experiment for each type of falling

particles and each initial energy. Multiple coulombs were taken into account

scattering on matter located in the path of particles. Finally

the values ​​of the differential cross sections were determined after introducing corrections

for multiple, multiple and single scattering according to the Mollier theory.

In table 1 shows the obtained values ​​of differential cross sections

indicating errors made up of statistical measurement errors and

errors in calculating solid angles.

Systematic measurement errors may be due to the following:

general reasons:

- change in the efficiency of the installation according to different series of measurements.

This gives the largest error in the differential cross section - 0.6%;

- uncertainty in the value of the average impulse delta P\_0/P\_0 = 0.2%.

This error includes shunt current instability, magnetic inhomogeneity

field and the inaccuracy of the geodetic determination of the angle of rotation in

magnets;

- inaccuracy in determining the amount of hydrogen in the target

Delta n/n = 0.18%;

- uncertainty in background subtraction under the elastic peak - 0.2%;

- inaccuracy of the correction for mu-mesons - 0.25%;

- contribution of random events - 0.2%;

- errors in measuring the total cross section: 0.3% - for protons;

0.5% - for pi+ mesons; 0.7% - for K+-mesons.

All of the above systematic errors give the following

errors in rho value (0): 0.011 - for protons; 0.012 - for pi+ -mesons;

0,014 - for K+-mesons.

The differential cross sections obtained in this work show

we are in Fig. 1.

Simultaneously with the measurement of differential cross sections in the experimental

The total interaction cross sections were determined from beam attenuation. At

When calculating the total cross sections, corrections were introduced for the contribution to the measured quantity.

the magnitude of elastic and inelastic interactions (measured in the same

experiment), corrections for Coulomb interaction, interference

tion of Coulomb and nuclear scattering and on the content of mu-mesons in the beam

ke. The values ​​of the total cross sections obtained in this work are found

in good agreement with the data /9/ and are given in table. 2.

Table 2

Results of two-parameter approximation of expression (2) of experimental data on

Coulomb-nuclear interference in order to determine the parameters rho (0) and b. The values ​​of the total cross sections are also given at sigma\_tot found in this work with an indication of the total error.