EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

STUDY OF THE ENERGY DEPENDENCE OF THE REACTIONS $K^{\pm}p \to K^{0}_{S}\pi^{\pm}p$

W. Cleland, A. Delfosse, P.A. Dorsaz, P. Extermann, J.L. Gloor,
O. Guisan, V. Hungerbühler, M.N. Kienzle-Focacci, G. Mancarella,
M. Martin, R. Mermod, P. Mühlemann, C. Nef, P. Rosselet,
R. Sutter, A. Vriens, R. Weill and H. Zeidler

Universities of Geneva and Lausanne, Switzerland

and

CERN, Geneva, Switzerland

ABSTRACT

The Geneva two-arm spectrometer is running at the CERN SPS at incident beam energies of 25, 50, and 80 GeV.

The aim of the experiment is to continue the study on S = 0 and S = 1 boson resonances initiated at 10 GeV at the CERN PS. The energy dependence of these channels will provide useful information on the production mechanism.

Preliminary results on the spectrometer performance are presented.

Presented at the
European Conference on Particle Physics,
Budapest, Hungary, 4-9 July 1977.

Geneva - 21 June 1977

1. INTRODUCTION

The energy dependence of exclusive two-body reactions is an important feature for understanding the dynamics of strong interactions. In the framework of a Regge-pole model, all the reactions dominated by the exchange of a Regge trajectory connecting particles and resonances must decrease rapidly with energy ($\sigma \propto p^{-n}$, n = 1-2). At high energies only the Pomeron exchange, whenever possible, will contribute. A study of exclusive channels at high energies will then give information primarily on the structure of the Pomeron.

The present group performed a high statistics experiment ($\sim$ 30,000 events per beam polarity) for the two-body reactions $K^{\pm}p \to K^{*\pm}p$ ($K^* \to K^0_S\pi$) at 10 GeV/c incident momentum at the CERN Proton Synchrotron (PS). We found evidence that the reactions are dominated by natural parity exchange, and that there is a cross-over between K^{*-} and K^{*+} that is stronger for the $K^*(1420)$ than for the $K^*(890)$ resonance. Such a phenomenon may indicate the presence of a Pomeron contribution in the exchange. The study of the same reactions at higher energies, with comparable statistics, will allow us to define the effective Regge trajectory of the process and to separate the different exchange contributions by amplitude analysis. For this purpose we use the same two-arm spectrometer at the CERN Super Proton Synchrotron (SPS). The system has been adapted to higher energies by a dilation of the forward scale and by adding antigamma counters to avoid the strong π^0 contamination.

2. EXPERIMENTAL SET-UP

The system design is essentially the same as at the PS experiment[1]: a beam spectrometer to identify the incident particle and to analyse its direction and momentum, a recoil proton arm to measure direction and momentum of the recoil proton, and a forward spectrometer to measure the direction of the forward decay particles. No forward spectrometer magnet is used, so the momenta of the forward particles must be calculated by momentum conservation. A threshold Čerenkov counter has been added to the forward system to distinguish π from K and p. (For example, at 50 GeV incident energy we identify π between 7 and 28 GeV/c with an efficiency of 60 to 80%.) A sketch of the system is shown in Fig. 1.

The data acquisition system was improved with respect to the PS experiment by seven miniprocessors, which allow a maximum acquisition rate of 700 events/1 sec burst and perform the full geometrical analysis of the events during the 8 sec interburst. The trigger system was designed to favour the low cross-section events we are looking for with minimum dead-time losses. The K^0 fast trigger requires a V configuration:

$$K^0 \text{ trigger} = \text{beam} \cdot \text{recoil proton} \cdot (\leq 2 \text{ tracks leaving the target}) \cdot \cdot (\geq 2 \text{ tracks downstream}) \ .$$

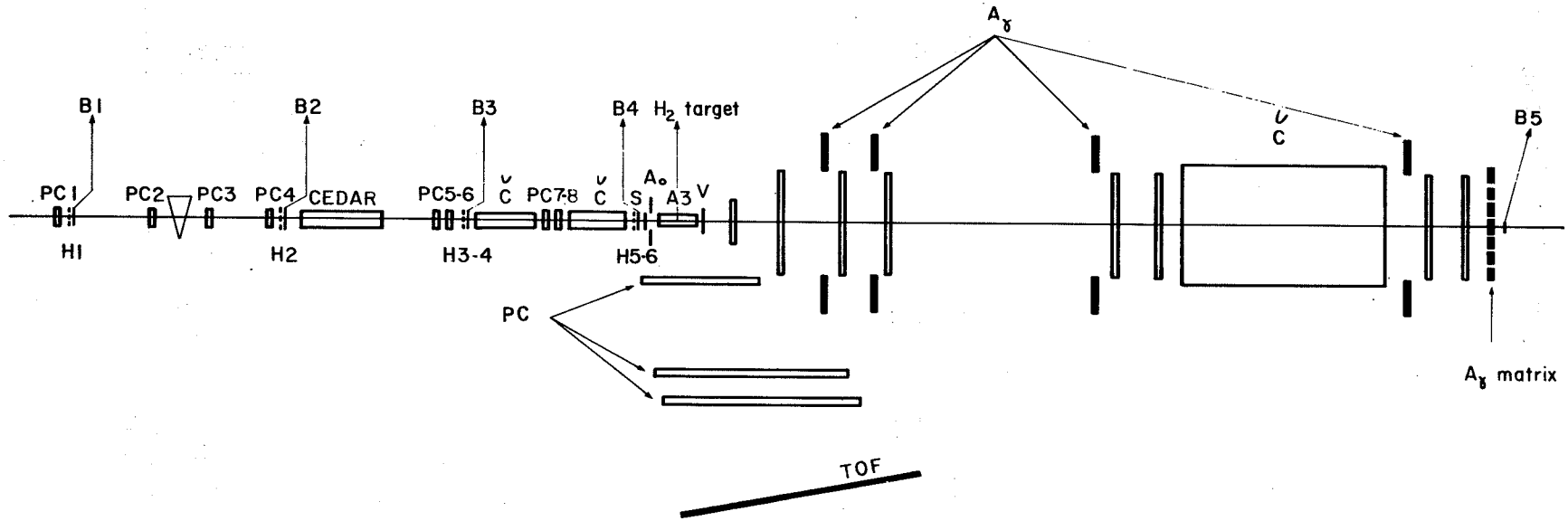
B1
B2
B3
B4
H2 target
B5
PC1
PC2
PC3
PC4
CEDAR
PC5-6
C
PC7-8
C
S
A3
V
H1
H2
H3-4
H5-6
PC
TOF
C
matrix

Fig. 1

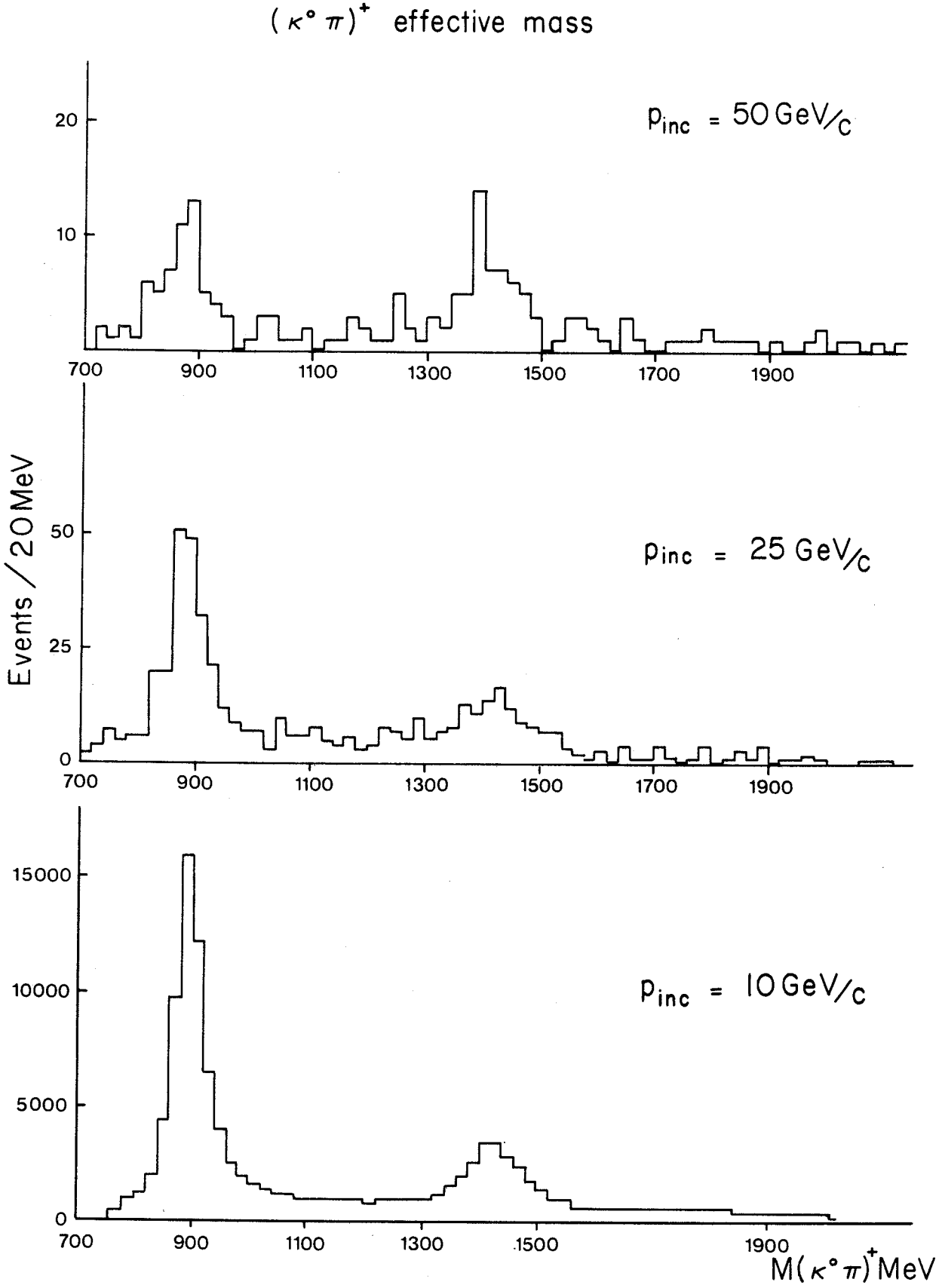
$(\kappa^\circ\pi)^+$ effective mass
p_{inc} = 50 GeV/c
p_{inc} = 25 GeV/c
p_{inc} = 10 GeV/c
Events / 20 MeV
$M(\kappa^\circ\pi)^+$ MeV
20
10
50
25
0
15000
10000
5000
700
900
1100
1300
1500
1700
1900

Fig. 3