STUDY OF THE K^+p INTERACTIONS FROM 0.85 TO 1.5 GeV/c *

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In an experiment currently in progress at the Bevatron, K^+p and K^+d reactions in the momentum range 0.86—1.58 GeV/c are being studied in a 25-inch hydrogen/deuterium bubble chamber. Preliminary cross sections for the various K^+p reactions have been obtained and are presented below. The most notable feature is the large increase in the inelastic cross section in the region of the thresholds for production of the N^* (1238) and K^*(880) resonances.

For the purposes of this preliminary investigation, approximately 1500 pictures were double-scanned at each of the following five momenta: 0.86, 0.96, 1.20, 1.36 and 1.58 GeV/c. All events were processed through the PACKAGE space reconstruction and kinematic fitting program. Each event was re-examined at the scan table by a physicist to verify the conclusions of the fitting program, and to resolve identification ambiguities, where possible, on the basis of ionization. Residual ambiguous events comprised less than 3% of the total number, and were assigned in the same proportions as the unambiguous events.

At all but the two highest momenta the pion contamination of the K^+ beam was negligible. To correct for contamination at 1.36 and 1.58 GeV/c, film was also taken with incident positive pions of these momenta. A comparison of the pion and kaon film gave estimates of 7% and 18% respectively for the contamination at the two above momenta. Appropriate corrections have been applied to individual partial cross sections.

The results for the cross sections of the various channels, corrected for pion contamination, are shown in Table. For all momenta except 1.58 GeV/c the K^+ flux was determined from a count of the observed τ decays in flight combined with the τ branching ratio of Roe et al. [1] At the highest momentum the τ

Partial K^+p cross sections (mb) as a function of momentum *

Momentum	0.86		0.96		1.20		1.36		1.58	
Reaction	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
$K^+p \to K^+p$	12.0±1.6	12.6±0.7	12.9±2.3	11.5±0.8	12.7±2.1	10.9±0.7	11.5±2.3	8.7±0.6	—	9.6±1.0
$K^+p \to K^+p\pi^0$	0.4±0.1	0.4±0.1	0.9±0.3	0.8±0.2	2.4±0.5	2.1±0.3	2.8±0.7	2.1±0.3	—	0.9±0.3
$K^+p \to K^0p\pi^+$	0.9±0.2	0.9±0.2	3.1±0.7	2.8±0.4	5.2±0.9	4.4±0.4	7.7±1.6	5.8±0.5	—	5.6±0.8
$K^+p \to K^+n\pi^+$	0.1±0.1	0.1±0.1	0.2±0.1	0.2±0.1	0.8±0.2	0.7±0.2	1.2±0.4	0.9±0.2	—	1.3±0.4
Total cross section	13.4±1.8	14.1	17.2±2.9	15.3	21.0±3.4	18.1	23.3±4.6	17.7	—	17.8
Number of K^+ interactions in sample	431		324		496				206	

(1) — Results determined solely from this experiment.
(2) — Results normalized to the data of Cook et al. Uncertainties in the total cross sections are not included in the quoted errors.

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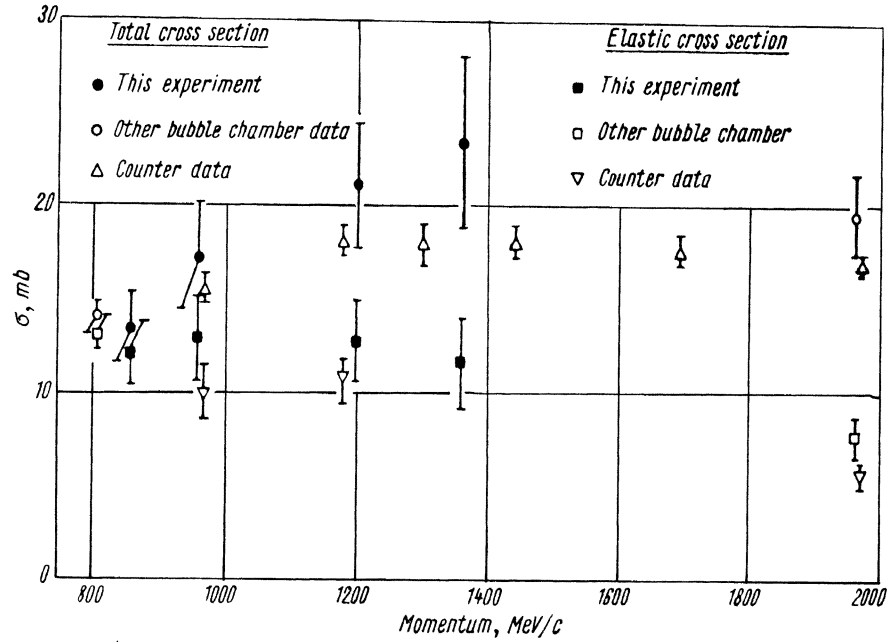

Fig. 1. K^+p elastic and total cross sections as a function of momentum. In addition to the results of this experiment, data from [2, 5, 6] have been included.

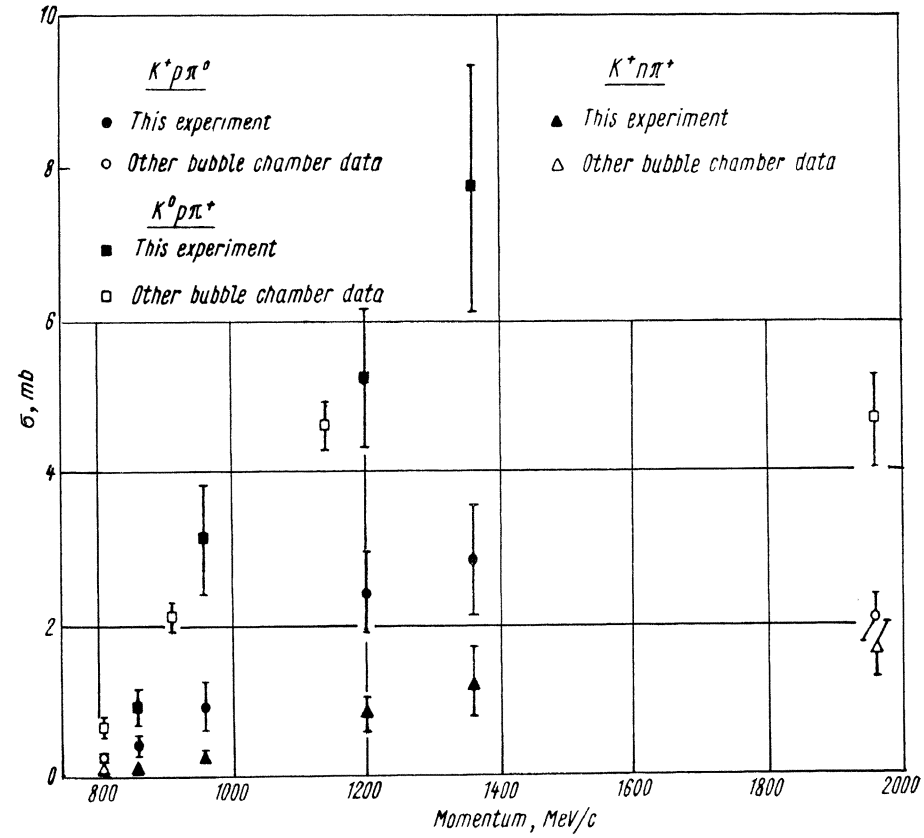

Fig. 2. K^+ p inelastic partial cross sections as a function of momentum. Data from [3—6] have been included.

statistics were insufficient to make this determination meaningful. We also list the results obtained with the total cross sections normalized to the measurements of Cook [2]. The results of this experiment together with data from other experiments in the same energy range are shown in Figs. 1 and 2. A preliminary study of the three-particle final states indicates that the initial rise in the inelastic channels is accompanied by substantial formation of the $N^*(1238)$ resonance. At momenta of 1.20 GeV/c and higher there is in addition substantial production of the $K^*(880)$ resonance. The cross section for double pion production remains less than 1/2 mb up to 1600 MeV/c.

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