EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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The study of the pion-deuteron elastic scattering is a test of the Glauber multiple scattering theory[1-3]. The validity of the Glauber model allows the interactions on nuclei at high energy to be described in a simplified way as a sum of terms corresponding to the scattering on single nucleons; all the effects due to their motion in the nucleus are neglected. Measurements in the 1 GeV region where the phase-shift analysis is available for the pion-nucleon interactions are, in a sense, particularly suitable for a calibration of the model[4].

We reported already the results obtained in a counter and wire spark chamber experiment at 895 MeV/c[5]. In this momentum range the pion-nucleon cross-sections are changing rapidly, and we thought it worth while to run the experiment at a slightly different pion momentum: (994 ± 10) MeV/c.

The experimental set-up used at the CERN Proton Synchrotron is described elsewhere[5-7]. About 1500 events were collected with a momentum transfer between -0.17 and -0.46 $(GeV/c)^2$ and then corrected for beam contamination and counting losses. The resulting differential cross-section and the corresponding errors are given in Table 1.

The data, plotted in Fig. 1, show the same trend as in previous scattering measurements in deuterium both of pions[5,8,9] and of protons[10]. In particular, no dip is observed in the region where the single and double scattering amplitude interfere. This fact is conveniently explained[11-15] by taking into account that when the deuteron is in the m = 0 state, the cross-section would show a dip at a momentum transfer larger than for the m = ±1 state and less important, so that both dips are washed up; this is shown for our case by the continuous curve of Fig. 1 which is the result of a calculation[16] made in the framework of the Glauber model, and considering both the S- and the D-state of the deuteron.

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Table 1

Differential cross-section $\pi^- d \to \pi^- d$ at 994 MeV/c.
Absolute normalization error < ±20%.

$-t$ $(GeV/c)^2$	$d\sigma/dt$ $mb/(GeV/c)^2$	$\Delta^+ d\sigma/dt$ $mb/(GeV/c)^2$	$\Delta^- d\sigma/dt$ $mb/(GeV/c)^2$
0.17	2.05	0.73	0.73
0.19	1.21	0.19	0.19
0.21	9.68×10^{-1}	1.12×10^{-1}	1.12×10^{-1}
0.23	8.22 "	0.61 "	0.61 "
0.25	4.94 "	0.33 "	0.33 "
0.27	3.52 "	0.28 "	0.27 "
0.29	2.59 "	0.26 "	0.24 "
0.31	2.19 "	0.34 "	0.25 "
0.34	1.58 "	0.43 "	0.24 "
0.38	1.47 "	0.81 "	0.28 "
0.42	1.07 "	0.92 "	0.30 "
0.46	7.44×10^{-2}	0.93 "	0.34 "

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Figure caption

Fig. 1 : πd elastic differential cross-section at 994 MeV/c: (ϕ) present experiment; (——) Alberi and Bertocchi calculation.

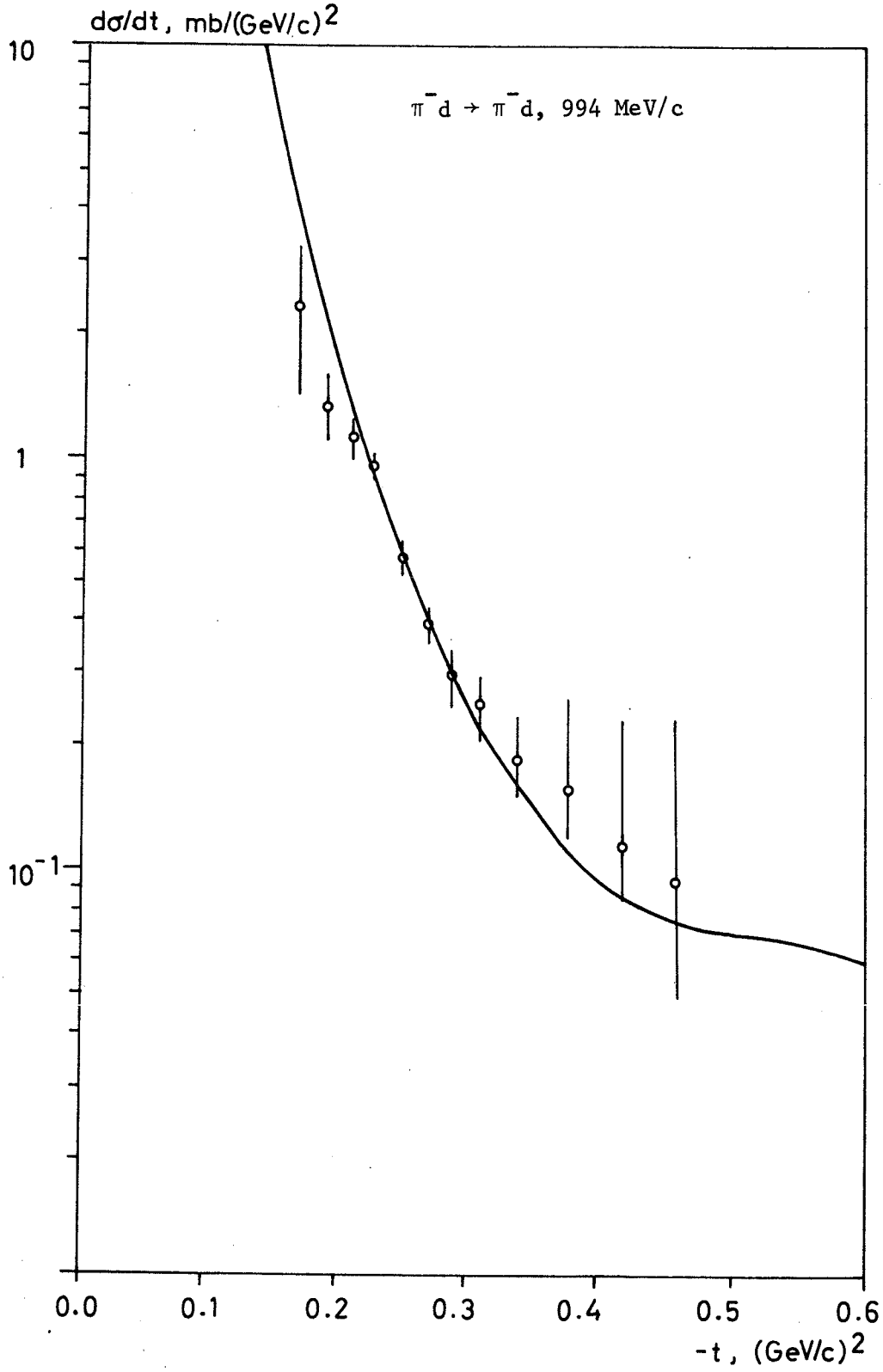

Fig. 1