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A 1 Elastic Scattering

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Six contributions have been submitted to the Conference on hadron-hadron elastic scattering of high momentum transfer (Table I.) Some details on the experimental technique are summarised in Table II. As can be seen, the resolution allowed in most of the experiments a careful search for eventual structures in the differential cross sections and due to the precision in normalisation, especailly in the CHHAV experiment, an accurate determination of the energy dependence became possible. The obtained differential cross sections are displayed in Figs. 1–6. We remark the following features of the data.

The np cross section measured by the UM group is of the same size as the pp cross section in the forward cone except at $\sqrt{s}=$ 19 GeV and around the diffraction minimum where presumably ρ and A_2 exchange contributions cannot yet be neglected.

The position of the diffraction minimum and that of the second maximum determined accurately by the CHHAV collaboration are monotonously decreasing functions of the cm energy (Table III). It is in qualitative agreement with the idea of geometrical scaling (GS), according to which the size of the interaction region grows with energy with the rate as

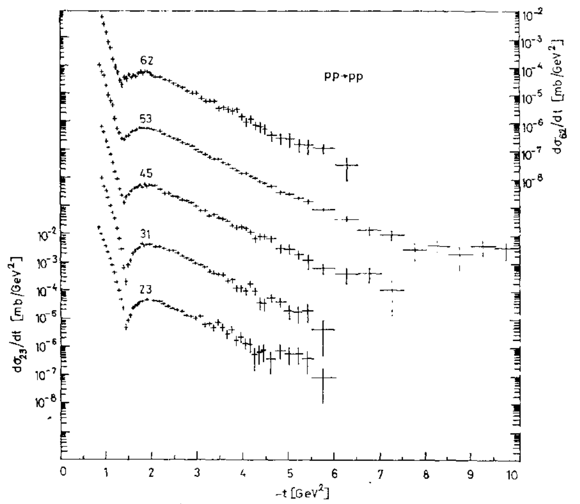

Fig. 1.

Table I.

Collaboration	Paper no.	Reaction	Region of $\sqrt{s}$ (GeV)	Region of $-t$ (GeV^2)
CERN–Hamburg–Heidelberg–Annecy–Vienna (CHHAV)	36	pp	23–62	0.8–10
Cornell–McGill–Northeastern (CMN)	847	pp	19–27	5.4–14.4
Rochester–Rutgers–Imperial College (RRI)	1074	pp	8–22	1.0–2.0
University of Michigan (UM)	671	np	11–27	0.17–3.7
CERN–College de France–Neuchatel (CCN)	post d.l.	pp	5	3.0–13.0
CERN–Pavia–Trieste (CPT)	1070	pd, dd	53, 63	0.07–2.0

Table II.

Collaboration	Detector	Background (%)	t-resolution (%)	Normalisation error (%)
CHHAV	Split Field Magnet (SFM)	4–10	~1.5	5
CMN	Double arm spectrometer	4–12	~2–10	~20
RRI	Jet target	20	p_{rec}=.001 GeV	~20
UM	Double arm (no n energy meas)	3–30	<1	+5 −15
CPT	SFM	not quoted	7 at $-t$=2 GeV^2	5–10

expected from the rise of total cross sections.

As the data of the RRI and CHHAV collaborations show the pp differential cross section in the region of the minimum and second maximum first decreases with the energy and after a local minimum situated around the lower end of the ISR region it rises (Fig. 7). In both cases the rise is in agreement with the GS prediction for $\sqrt{s} \geq 45$ GeV.

Beyond the second maximum both CHHAV and CMN observe a remarkably smooth behaviour of the differential cross section com-

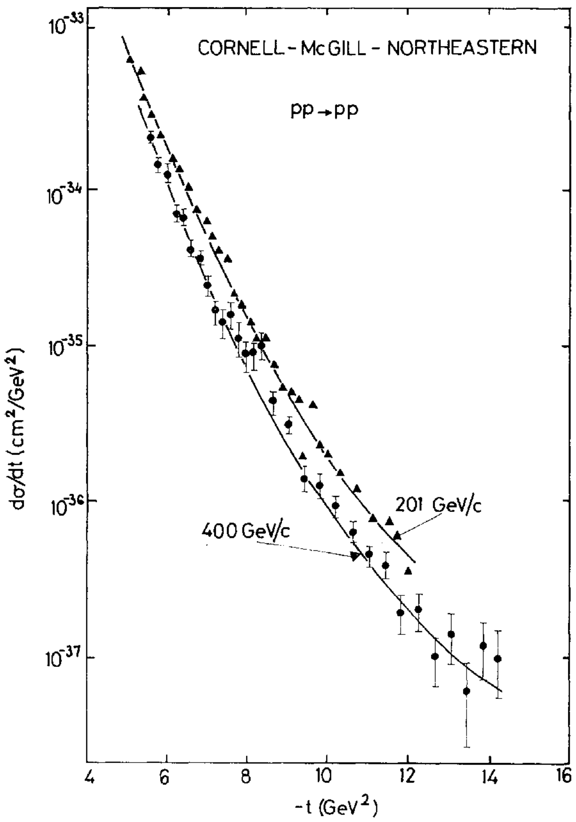

Fig. 2.

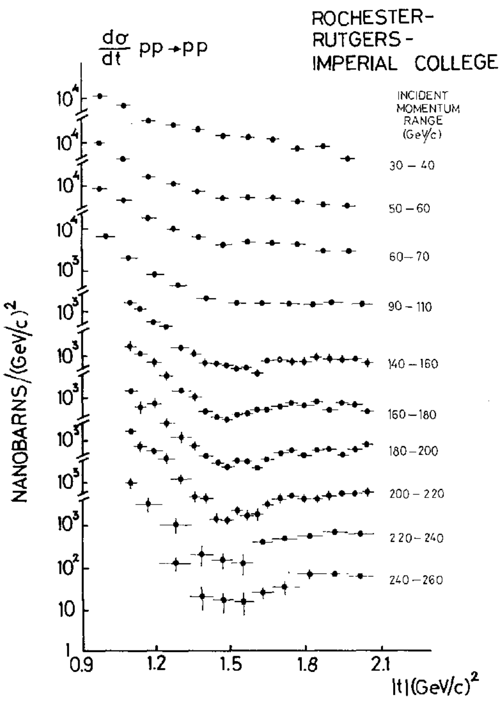

Fig. 3.

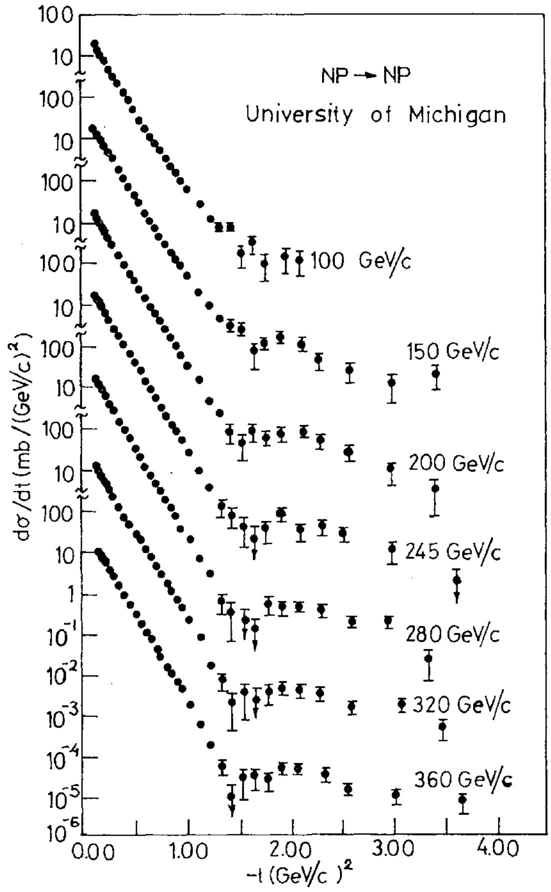

Fig. 4.

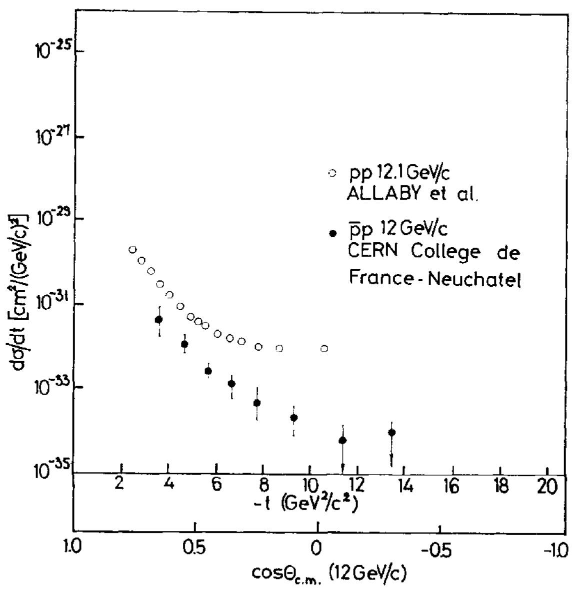

Fig. 5.

patible with an exponential drop of $\sqrt{-t}$. No evidence has been found for further diffraction minima up to $-t=14$ (GeV/c)^2. This fact and the observed ratio of the forward slope and that beyond the second maximum $\gtrsim 5$ indicates that simple Glauber type models cannot give an accurate description of the pp data. A possible modification of these models could be the introduction of inelastic intermediate states in the double-, triple-, etc. scattering terms. With the same modification the CPT collaboration achieved an excellent

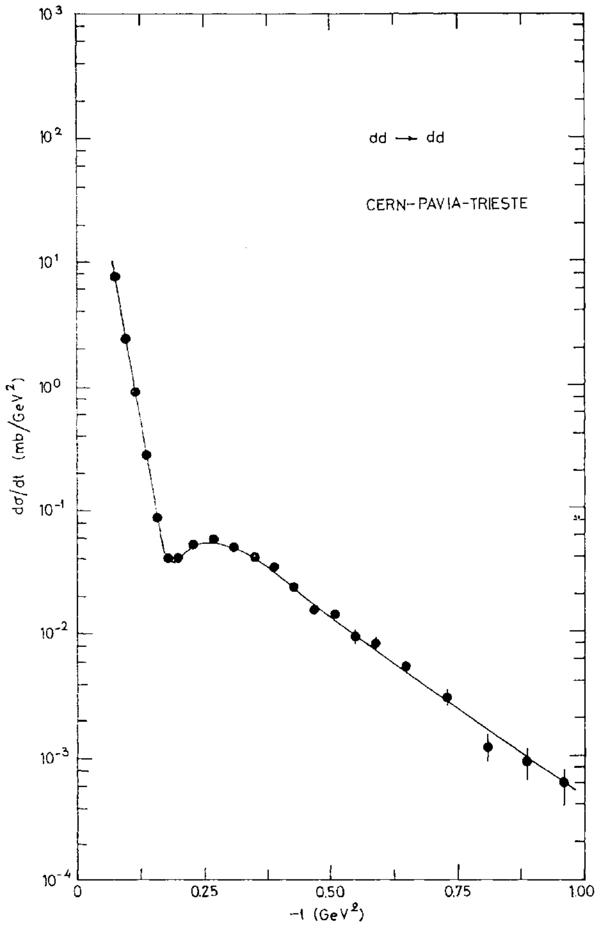

Fig. 6.

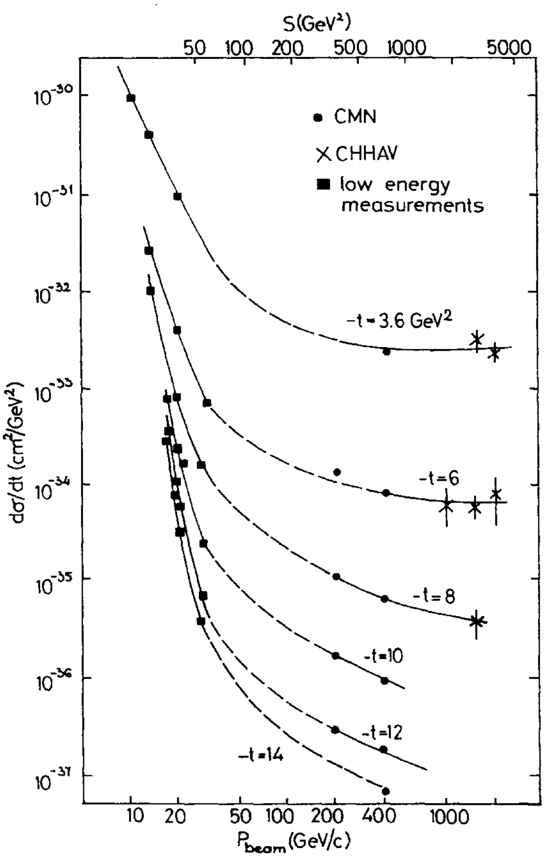

Fig. 8.

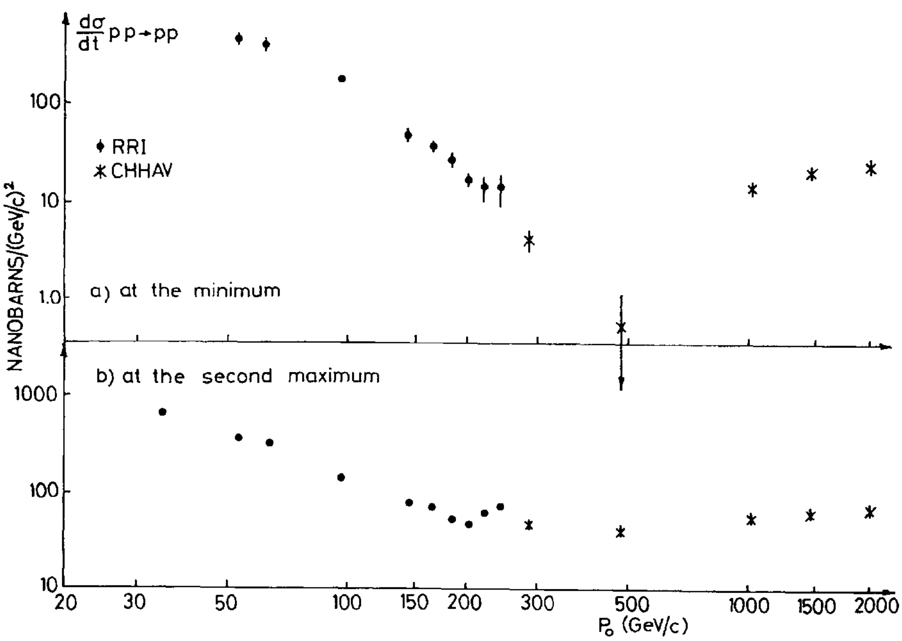

Fig. 7.

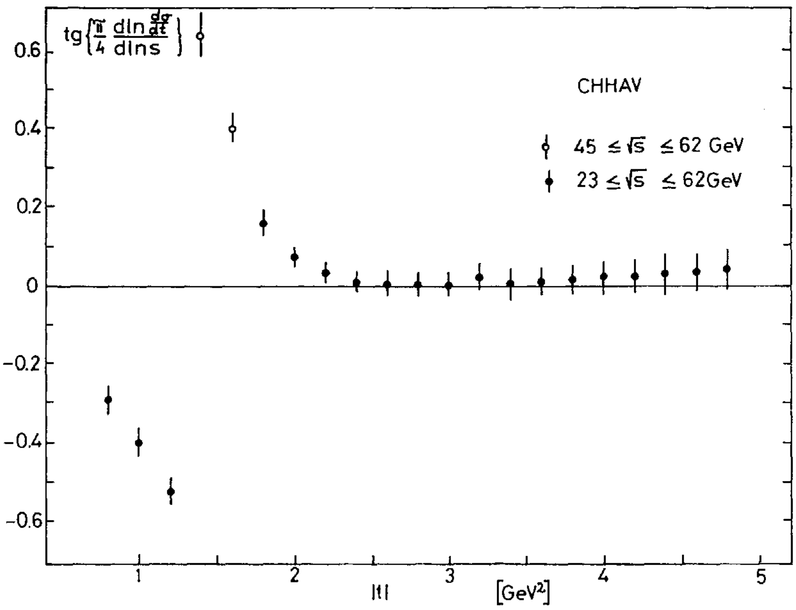

Fig. 9.

Table III.

$\sqrt{s}$ (GeV)	$t_{\min}$ (GeV^2)	$t_{\max}$ (GeV^2)
23.4	1.437±0.003	1.97±0.03
30.5	1.418±0.003	1.93±0.03
44.6	1.361±0.005	1.92±0.10
52.8	1.337±0.006	1.81±0.07
62.1	1.306±0.012	1.81±0.06

description of their measured pd and dd differential cross sections.

The differential cross section at fixed t beyond the second maximum still drops at FNAL energies whereas the energy dependence in the ISR region levels off (Fig. 8). The logarithmic energy derivative of the differential cross section has been determined by the CHHAV collaboration at ISR energies and is shown in Fig. 9. If the amplitude is crossing symmetric and the real part does not dominate this quantity is related to the real-to-imaginary ratio of the amplitude via derivative analiticity relations. It changes sign in the vicinity of the diffraction minimum and is compatible with zero beyond the second maximum.

At fixed cm angle both CMN and CCN finds agreement in pp and $\bar{p}$p scattering with an s^{-10} behaviour and thus with the prediction of the constituent interchange models.

The CHHAV collaboration successfully parametrises their pp data at the three highest lying ISR energies with two components both exhibiting GS. In the full ISR range, however, one of the terms should be replaced by an energy independent exchange contribution to achieve an excellent description.

Most of these features indicate that elastic scattering becomes predominantly diffractive at ISR energies even at high t values and as energy increases the size of the t range increases simultaneously where GS gives a good description.