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MEASUREMENT OF POLARIZATION IN HADRON-HADRON INTERACTIONS AT HIGH ENERGIES

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MEASUREMENT OF POLARIZATION IN HADRON-HADRON INTERACTIONS AT HIGH ENERGIES

(Proposal of an experiment at CERN SPS)

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I. Introduction.

A number of interesting phenomena at high energy hadron-hadron interactions have been observed at CERN, IHEP and NAL. The total cross-section for hadrons flattens in the 30 ÷ 70 GeV/c momentum range and at higher energies reveals new features i.e., it is growing. Strong irregularities in pp -scattering differential cross-section have been observed, for other hadrons they turned out to be not so strong. The real part of the forward scattering amplitude has demonstrated a peculiar behaviour /1/. All these facts have stimulated many new ideas for a better understanding of strong interaction. These data do not give information about the spin dependence of hadron-hadron interaction.

It is the polarization measurements that may give us new data about the spin structure of the process. The polarization data on elastic pp -scattering have been obtained at four momentum transfers up to $-t \sim 2.0\ (GeV/c)^2$ for incident momentum up to P = 45 GeV/c /2,3,4/.

Figure 1 shows the behaviour of the polarization parameter P versus t at various momenta. There is a noticeable polarization up to 45 GeV/c, and it exhibits not a simple behaviour (dip and zero crossing). The polarization for particles and antiparticles is not symmetrical (theory for the asymptotic region predicts a symmetrical behaviour /5/)(fig.2). The experiment of Serpukhov aimed at studying the spin rotation parameter R has shown an existance of the spin-flip amplitude governed by the Pomeranchuk pole. This leads to a conclusion, that spin effects do not disappear asymptotically.

The reasons for great interest in polarization phenomena are the following: they provide

- a direct way to test P and T invariance,
- a most effective way to test various approaches of theory,
- an estimation of the region where the asymptotical theorems are valid.

There exist many theoretical conceptions, but one of the recently proposed predictions[6] shows a change of the sign of P near $t = -1.4 (GeV/c)^2$ (see Fig.3).

The experimental program consists of:

1. Measurement of the polarization in elastic hadron-hadron scattering at momenta 100 ÷ 200 GeV/c and $0.3 \leq /t/ \leq 3 (GeV/c)^2$;
2. Measurement of the polarization in backward scattering;
3. Measurement of the polarization in inclusive reactions at large four-momentum transfer /t/ 4 ÷ 5 $(GeV/c)^2$;
4. Measurement of the polarization in inclusive processes in the target fragmentation region;
5. Measurement of the polarization in binary exchange processes ($\pi^{\pm} p \to \Sigma^{\pm} K^{+}$, $\pi^{-} p \to \pi^{0} n$);
6. Investigation of the polarization phenomena in interactions of the polarized proton beam with the polarized proton target (measurement of the total and differential cross-sections, correlation of polarizations, electromagnetic effects in the polarization etc.).

Points 1 and 2 can be carried out using standard magnets of CERN or IHEP. Points 3 and 4 require using a superconducting magnet[23] of a specific configuration in the forward arm spectrometer. Points 4 and 5 require installing an additional backward magnetic spectrometer for the momentum analysis of recoil particles. For point 5 it is necessary to build a large "frozen" polarized target.

For points 1 ÷ 5 we need a secondary unseparated particle beam with a momentum range from 50 up to 150 GeV/c for both polarities and of the maximum intensity. The second part of our program (p.6) requires a polarized proton beam at ~ 100 GeV/c with an intensity of $\sim 10^5$ ppb and polarization of ~ 40% /7/.

At present the most detailed part of the experiment is that devoted to the study of the polarization for forward and backward elastic scattering of hadrons. It is described below.

The essential part of this apparatus will be used in future to fulfil other points of the proposed program. But a detailed description of the experiments to follow will be given later on.

II. Experimental Set-Up.

Fig.4 shows a schematic diagram of the apparatus assuming that it will be placed in the hadron beam H3 of WEST HALL. It consists of the polarized target, beam equipment, a high momentum spectrometer in the forward direction and a large aperture spectrometer for the recoil particle.

1. The Polarized Target.

The target we plan to use will be of a hydrocarbon type (propanediol $C_3H_8O_2$) with approximate dimensions of 2 cm in diameter and 15 cm in length, located along the beam (see proposal P3)/8/. The target will operate at a temperature of 0.5 K, being cooled by a pumped He^3 system. It will be situated in a magnetic field of 2.5 T created by the standard C-shape magnet

...-22. The density of free (polarized) protons is to be of ...2 g/cm^2 and one expects the polarization of 80 %.

2. The Beam Counters.

We need two Cerenkov counters to detect and identify the minority of the particles in the beam. For example a CEDAR-type counter may be used for labeling pions and kaons in the beam /9/. The desirable counting rate is to be about 10^7/s. We request CERN to supply these counters.

We are studying a possibility of using a small beam hodoscope for monitoring the beam intensity at the polarized target. This type of a detector would be also very useful for an improvement of the experimental angular resolution. Several telescopes are to be located around the beam for a continuous control of the beam parameters. A hydrogen-free "dummy" target will be made whose mass will be identical to that of the nonhydrogenous material in the PT. A part of the runs will be done with this target to evaluate the quasi-elastic background.

It is proposed to replace the polarized target by a hydrogen one without changing anything else in the apparatus. In this case we shall have a possibility on one hand to evaluate accurately background from inelastic interactions on hydrogen and on the other hand to compare our relative differential cross-section measurements with the absolute ones.

Around the polarized target veto counters covering a useless solid angle are to be situated. The main purpose of these counters is to suppress the unwanted reactions.

3. The Forward Spectrometer.

The forward spectrometer is to serve for identifying a scattered hadron and for measuring its angle and momentum. Dimensions and positions of detectors along the beam axis are listed in Table 1.

The scattering angle is measured by the multiwire proportional chambers located in three blocks F1, F2 and F3. Each block consists of two orthogonal planes. Block F2 is rotated by an angle of 45° to provide a track reconstruction in space. The wire spacing in any MWP chamber is equal to 2 mm resulting in transverse momentum resolution of ± 8 MeV/c for the chosen distances of MWPC from the target.

Three blocks of the MWP chambers F4, F5 and F6 are located behind the magnet. They, together with F1 ÷ F3, are used to measure the particle momentum with an accuracy of ± 1 %. As for as we are not in need of a too high bending power, we can avoid prohibitive transverse dimensions of the forward spectrometer elements. Instead, compensation should be made by a good spatial resolution of the associated detectors (see Table 1).

To cope with the high flux and to make a preliminary selection of the events a scintillation hodoscope is located behind block F6 of the MWPC. This hodoscope has 25 x 25 strips in horizontal and vertical planes, respectively.

The momentum analysis within the 100 μster solid angle is provided by two standard dipole magnets of CERN or by one magnet like CP-7A of IHEP with a total effective field of 7.3 Tesla-meters.

A threshold Čerenkov counter TČ 10 m long allows to separate π + K from protons.

4. The Recoil Detection Arm.

The recoil detection arm consists of the proportional chambers R1, R2, R3, R4 located near the target, the proportional chambers R5 and R6 in front of the magnet RAM, the multiwire proportional chambers R7, R8 immediately behind the magnet and R9 in the middle of the arm as well as of the scintillation hodoscopes RHY and RHZ at the end of the arm (see Fig.4).

By shifting slightly the elements of the arm it is possible to operate the set-up in the momentum range of the primary particles of 25-150 GeV/c. The chamber dimensions and their location are shown in Table 2. The analizing magnet RAM has the following parameters: the magnetic field of 10 KG, the window 150 cm wide, 60 cm high and 60 cm long. The vertical angular acceptance of the arm is limited by the magnet aperture and has a maximum of 20°. The minimum resolution of the spectrometer in the range of interest ($0.3 \leq /t/ \leq 3$ (GeV/c)^2) is 5 % = $\frac{\Delta p}{p}$. The hodoscopes RHY and RHZ are planned to use for measurements of secondary particle time-of-flight. This can be used in the trigger for the mass separation in the binary reactions. If the time - of - flight resolution is assumed to be 0.5 ns, then it becomes possible to identify pions and protons up to $/t/ \leq 1.7$ (GeV/c)^2.

5. The Trigger.

The main function of the trigger is to produce a signal for a preliminary fast selection of interesting rare events from all the other crossing the set-up. When 10^8 particles hit the target there occur about 10^7 collisions. Therefore it is very likely that several millions of charged particles would cross the recoil arm. Out of these, at $/t/ \geq 0.3$ (GeV/c)^2, only a small part, about $1.5 \cdot 10^3$ events, is to be elastic ones. In view of this, the trigger should possess a high degree of selectivity. This can be accomplished by different ways, the simp-

last one being the coincidence / anticoincidence of scintillation counters, Čerenkov counters, scintillation hodoscopes and veto counters surrounding the target. For example
$T = D \cdot S1 \cdot RHY \cdot RHZ \cdot FHX \cdot FHY \cdot T\check{C} \cdot \bar{A}$.

The readout of the hodoscope and proportional chamber information may be suppressed by a special electronic device (">1") if "inelasticity" occurs in any arm of the set-up. The anticoincidence counters around the target (not shown in the figure) are also used to reject inelastic events. The trigger is blocked during the information readout from the registers. It is possible to get the trigger dependent on t by including a definite part of the FHX hodoscope into the trigger logic. For elastic events the requirement of having only one particle can be replaced by a time - of - flight selection.

III. The Beam.

The following beam parameters would be suitable for the experiment.

Intensity: protons $- 10^8$ ppb
pions ($\pm$) $- 10^7$ ppb
kaons ($\pm$) $- 10^6$ ppb
antiprotons $- 10^4$ ppb
Dimensions: $\emptyset$ (HWHM) ~ 5 mm
Angular divergence: horizontal $\alpha_H \sim \pm 0.3$ mr
vertical $\alpha_V \sim \pm 1.0$ mr
Spill time - 500 - 1000 ms.

IV. Data Acquisition.

The apparatus described above contains about 10000 wires for proportional chambers and about 100 elements of scintillation hodoscopes. The information about an event will consist of 70 ÷ 100 16-bit words. It will take about 200 ÷ 300 μs to record an event in the computer memory. Assuming the spill time to be 500 ms and accepting the acquisition dead time losses to be up to 10 % we obtain the upper limit of the acquisition rate of about 200 events/burst.

1. Elastic Scattering.

The number of elastic scattering events detected per pulse is expressed by

$$N_{ev} = 0.6 \cdot N_0 \cdot \frac{d\sigma}{dt} \text{ barn} \cdot \left(\frac{GeV}{c}\right)^{-2} \cdot \Delta t \cdot \frac{\Delta\varphi}{2\pi} \cdot \ell \left[g \cdot cm^{-2}\right],$$

where N_0 is the intensity which is 10^8 pps, $\Delta t = 0.2\ (GeV/c)^2$, $\frac{\Delta\varphi}{2\pi} = 0.055$ (±10°), $\ell = 1.2\ g \cdot cm^{-2}$ (unbound protons), (15 cm $C_3H_8O_2$).

Thus we have $\frac{N_{ev}}{burst} = 0.8 / (\mu b \cdot (GeV/c)^2)$.

Taking into account the repetition time of 3.6 s and the total efficiency of 80 % we obtain

$$\frac{N_{ev}}{day} = 1.5 \cdot 10^4 / (\mu b \cdot (GeV/c)^2).$$

The yield per burst of the elastic pp -scattering will be

$-t\ (GeV/c)^2$	event / burst
≥ 0.3	1500
≥ 0.6	120
≥ 1.0	4

To measure the polarization with the given accuracy it is necessary to have the number of events to be

$N = (1 + K) / (P_T \cdot \Delta p)^2$, assuming that $p = 0$,

where Δp is the given accuracy

P_T is the target polarization

K is the background-effect ratio.

For $K = 1$, $P_T = 0.8$, $\Delta p = \pm 0.005$ we have:

$$N = 1.25 \cdot 10^5 \text{ events.}$$

For the polarization in elastic pp -scattering we have provided $-t = 2\ (GeV/c)^2$, $\Delta p = \pm 0.005$.

P (GeV/c)	Intensity ppb	$d\sigma/dt$ ($\mu b \cdot (GeV/c)^{-2}$)	N days
50	10^8	0.75	11
100	10^8	0.44	19
150	10^8	0.32	26

For the polarization in elastic πp -scattering at $-t = 1$ $(GeV/c)^2$, $\Delta p = \pm 0.005$ we obtain

P (GeV/c)	Intensity ppb	$d\sigma/dt$ ($\mu b \cdot (GeV/c)^{-2}$)	N days
50	10^8	15	0.55
100	10^8	10	0.84
150	10^7	8	11

For the polarization in elastic $\pi^+ p \to p \pi^+$ backward scattering at $-(U - U_{max}) = 0.2\ (GeV/c)^2$, $\Delta p = 3\%$ we get:

P (GeV/c)	Intensity ppb	$d\sigma/dt$ ($\mu b \cdot (GeV/c)^{-2}$)	N days
50	10^8	0.01	23

2. Inclusive Reactions.

A theoretical treatment of the asymmetry in inclusive processes involving an interaction with the polarized target leads to a conclusion that in the region of the beam fragmentation the asymmetry can be used to check the validity of factorization[10]. Indeed, in ref.[11] it was shown that for the factorizing pole exchange the polarization disappears in this kinematic region. According to the estimates by the models taking into account the absorption[10] or the Regge cut - offs[12] the polarization in the target fragmentation region may approach that in elastic scattering, and should be symmetrical for the $\pi^+ p \to \pi^+ X$ and $\pi^- p \to \pi^- X$ reactions and should have the energy behaviour of the type $s^{-1/2}$.

The polarization in the target fragmentation region is not suppressed by factorization. Noticeable polarization effects in this kinematic region are not excluded.

3. Electromagnetic Effects in Polarization.

As was discussed above, the experimental set-up is designed to investigate the polarization effects in elastic scattering with large momentum transfers, in backward scattering and in inclusive reactions as well; without being modified this arrangement may be used with the polarized proton beam. If it turns out after the discussions with CERN that such a beam (with parameters described in ref.[7]) can be transported to the set-up, then very promising and unique possibilities will appear. Among them we should like to mention the following:

- it is possible to study the behaviour of the polarization at small t ($|t| \ll .1 (GeV/c)^2$)[13,14]. Such an investigation is impossible with the available polarized targets due to large nuclear content (~ 90%) in comparison with hydrogen (~ 10%).

The situation changes if use is made of the polarized proton beam and the conventional liquid - hydrogen target. Some other possibilities are also possible in perspective, as for example using a polarized hydrogen stream[15] or intersecting polarized proton beams[16,17]. However in this caseas well as there remain some advantages if use is made of polarized proton beam and convertional liquid hydrogen target:

- it becomes realistic to measure small polarization effects in inclusive reactions especially in the region of the beam or target fragmentation; with increasing the intensity of the polarized proton beam by an order or more it is possible to get to the polarization effects in the central region as well;

- it is possible to measure the contribution of the spin-spin interaction terms to the total pp interaction cross-section[18,19];

- it is possible to measure the contribution of the spin-spin interaction terms[20] to the differential pp-scattering cross-section;

-it is possible to determine the contribution of the reggeon exchanges with unnatural parities to the diffraction dissociation processes.

Of course, the list of the experiments which could be done with the polarized beam and the polarized target is not restricted to the given above. However those mentioned are sufficient to draw interest of experimental physicists to such investigations.

An estimate of the expected polarization effects in the electromagnetic processes are given below.

To estimate the polarization in pp -scattering use can be made of a relation valid at high energies and for small t/14/

$$P(t) = \frac{2\gamma |t|^{3/2} \cdot Im\, a_h}{t^2 |a_h|^2 + (2\alpha\varepsilon)^2}\,, \qquad (3.1)$$

where

$$\gamma = \alpha \left[\frac{E}{M} (\mu_p - 1) + 1 \right]$$

Here M is the proton mass, E is the energy of a proton in the c.m.s.. $\mu_p = 2.79$ is the proton magnetic moment; α is the fine structure constant; a_h is the hadron scattering amplitude independent of the proton spin.

According to (3.1) the polarization reaches its maximum at

$$-t_m = -\sqrt{3}\, t_c \simeq \sqrt{3} \cdot 8\pi\alpha / \sigma_{tot} \simeq 2.8 \times 10^{-3} (GeV/c)^2 \qquad (3.2)$$

and is equal to

$$P_m \simeq 4.5\% \cdot \frac{Im\, a_h}{|a_h|} \simeq 4.5\% \qquad (3.3)$$

The expected angular dependence of the polarization P(t) is shown in Fig.5. The purpose of the experiment is to measure this angular dependence with an accuracy of $\Delta p = 1\%$. For the intensity $I = 7 \cdot 10^4$ polarized protons per burst, the magnitude of the polarization of $\sim 40\%$ (these parameters correspond to the initial momentum 100 GeV/c/7/) it is possible to estimate a period of time required to carry out this experiment

T = 10 days

4. Contribution of Spin-Spin Term to the Total pp-Interaction Cross-Section.

Provided both the polarized proton beam and the polarized proton target are available this experiment is essentially a set of measurements aimed at finding the following terms in the expression for the total cross section/12/

$$\sigma = \sigma_0 + \sigma_1 (\vec{P}_b \cdot \vec{P}_T) + \sigma_2 (\vec{P}_b \cdot \vec{K})(\vec{P}_T \cdot \vec{K}) \qquad (4.1)$$

Here σ_0 is the total cross-section averaged over spins, it is known, σ_1 and σ_2 are to be determined. In order to do that, it is necessary to make the following measurements:

a) the beam and the target are polarized perpendicular to the incident particle momentum. Then

$$\sigma^{\pm} = \sigma_0 \pm \sigma_1 (\vec{P}_b \cdot \vec{P}_T) \qquad (4.2)$$

and σ_1 is to be determined,

b) the beam and the target are polarized along the incident particle momentum. Then σ_2 is to be measured.

It is easy to show that the measurements of three coefficients σ_0, σ_1 and σ_2 allow to reconstruct completely the imaginary parts of the pp-scattering amplitudes at zero

$$M^1(t) = \alpha(t) + [g(t) - h(t)](\vec{\sigma}_1 \cdot \vec{\sigma}_2) + \\ + 2h(t)[(\vec{\sigma}_1 \cdot \vec{K})\cdot(\vec{\sigma}_2 \cdot \vec{K})] \qquad (4.3)$$

Namely
$$\mathrm{Im}\,[g(0) - h(0)] = \frac{K}{4\pi}\sigma_1$$
$$\mathrm{Im}\,[2h(0)] = \frac{K}{4\pi}\sigma_2 \qquad (4.4)$$
$$\mathrm{Im}\,[\alpha(0)] = \frac{K}{4\pi}\sigma_0$$

The real parts of these amplitudes can be determined from the polarization measurements at small angle, as it has been described above.

The Regge pole model contains two approaches for estimating the expected value of the effects σ_1 and σ_2.

So, in ref./21/ the exchange by the X -reggeon with quantum numbers $J^P = 2^-$, T=0, $G = \sigma = 1$ is assumed (it is likely to be the $X^0(960)$-meson). It is clear that the Regge pole exchange with a regular signature does not give any contribution to σ_1 and σ_2 in the asymptotics at t=0. Then

$$\sigma_1 = \frac{\tau_x(0)}{\tau_p(0)} \cdot \sigma_0$$
$$\sigma_2 = - \frac{\tau_x(0)}{\tau_p(0)} \cdot \sigma_0 \qquad (4.5)$$

The subtraction ratio is assumed to be

$$\tau_x(0)/\tau_p(0) = 0.3 \qquad (4.6)$$

Then according to ref./21/ we obtain

$$\sigma_1 = 0.3\sigma_0 \simeq 12 \text{ mb}$$
$$\sigma_2 = -0.3\sigma_0 \simeq -12 \text{ mb} \qquad (4.7)$$

i.e., there is a very large effect.

Recent results of measurements at Argonne give a value of σ_1 to be less by an order of magnitude than it was estimated in ref./19/.

Another approach consists in that use is made of the exchange by the Regge poles with the regular signatures, but account is taken of the exchange by three or more reggeons simultaneously/22/. Then for the pomeron exchange we have

$$\sigma_1 = -\sigma_2 = Z_0 (\ln S)^{-5} \qquad (4.8)$$

i.e. the polarization effects in the total cross-section vanish with the increasing S, unlike the results of the previous work. A check of these predictions seems to be very interesting. For the above parameters of the polarized beam, to measure the magnitude of σ with an accuracy of 0.1 mb requires the time $T = 8$ days.

V. Conclusion.

We are planning to prepare the apparatus in question at the first half of 1977 and we can use the beam at the second half of 1977. The apparatus could be placed at the H3-beam in the WEST-HALL.

Table 1. Forward arm apparatus.

Units	Type	Coord.	Distance at 150 GeV/c (m)	Dimension (cm^2)	Spacing (mm)	Number of elements
F1	MWPC	X,Y	20	25 x 25	2	250
F2	MWPC	U,V	25	50 x 50	2	500
F3	MWPC	X,Y	30	50 x 25	2	375
F4	MWPC	X,Y	36	50 x 25	2	375
F5	MWPC	U,V	36.1	50 x 50	2	500
FČ	Čerencov	-	41.3	-	-	-
F6	MWPC	X,Y	46.5	50 x 50	2	500
FHX	Hodoscope	X	47	50 x 50	20	25
FHY	Hodoscope	Y	47	50 x 50	20	25

Table 2. Recoil arm apparatus.

Units	Type	Coord.	Distance from PT centre (cm)	Dimension (cm^2)	Spacing (mm)	Number of elements
R1	MWPC	Z	7	25 x 10	1	250
R2	MWPC	Y,Z	12.5	25 x 10	1	250
R3	MWPC	β +)	30	50 x 25	1	500
R4	MWPC	β	40	50 x 25	1	500
R5 ++)	MWPC	β, Y	95	50 x 50	2	500
R6	MWPC	β, Y	100	50 x 50	2	500
RAM	Magnet		140 +++)	150 x 60	-	-
R7	MWPC	β, Y	190	100 x 100	2	1000
R8	MWPC	β, Y	200	100 x 100	2	1000
R9	MWPC	β	380	150 x 150	2	750
RHZ	Hodosc.	β	390	150 x 150	100	15
RHY	Hodosc.	Y	400	150 x 150	100	15

+) β - is polar angle.

++) turned by 45°,

+++) centre of the magnet.

R E F E R E N C E S

1. A.N.Diddens. High Energy Low Multiplicity Reactions. Rapporteur's talk at the XVII International Conference on High Energy Physics, London, UK, 1-10 July, 1974.
2. M.Borghini, L.Dick, J.C.Olivier, H.Aoi, D.Cronenberger et al. Phys.Lett., 36B, 501, 1971 .
3. A.D.Krisch. Proc. of the Canadian Institute of Particle Physics, Summer School, McGill University, Montreal, 1972.
4. C.Brunston, J.Bystricky, G.Deregel et al. Polarization in protons on protons elastic scattering at momentum 45 GeV/c. Paper 783 (A1) Submitted to the XVII International Conference on High Energy Physics, 1-10 July, 1974, London, UK.
5. S.M.Bilenky, Nguen Van Thieu, R.M.Ryndin. Preprint JINR P-1404, Dubna , 1963 .
6. W.Majerotto. pp and $\tilde{p}$p -elastic scattering including spin. Preprint HEP 6/74 Institut für Hochenergiephysik der Österreichischen Akademie der Wissenschaften, Wien, 1974 .
7. P.Dalpiaz, J.A.Jansen and G.Coignet. "High Energy polarized proton beam from Λ^0 decay" CERN/ECFA/74/4 Vol.1, 284, 1972.
8. W.Barte, R.Birsa et al.. Proposal to measure Polarization in pp and πp - elastic scattering at large momentum transfer (CERN-TRIESTE-VIENNA Collaboration) CERN/SPSC/74-17, SPSC/p8 , 15 February, 1974.
9. J.V.Allaby and C.Bovet. Monitoring of SPS secondary beams CERN/Lab.11/EA/74-5 Geneva, October, 1974.
10. R.J.N.Phillips, G.A.Ringland, R.P.Worden. "Polarization effects in inclusive reactions". Proc.of the IV-th Intern.Conf.

on High Energy Collisions, v.11, p.451, Oxford, UK, 5-7 April,1972.

11. H.D.Abarbanel and D.Gross, Phys.Rev.Lett., 26, 732, 1971.
12. J.Soffer, D.Wray. Preprint CERN REF. TH. 1705-CERN July,1973.
13. А.П.Ванжа, Л.И.Лапидус, А.В.Тарасов. ЯФ. 16,1023, 1972.
14. Е.С.Копелиович, Л.И.Лапидус. ЯФ., 19, 218, 1974.
15. Yovanovich. Talk given at summer study on high energy physics with polarized beams. ANL , July 1974.
16. H.G.Horoward. CERN/ISR-D1/74-42.
17. O.Barbalat, P.Germain, P.Lefèvre, D.Möhl. MPS/DL/NOTE 74-22.
18. S.M.Bilenky, R.M.Ryndin. Phys.Lett., 6, 217, 1963.
19. E.F.Parker, L.G.Ratner et al.. Phys.Rev.Lett., 31, 783,1973.
20. J.R.O'Fallon, E.F.Parker et al.. Preprint 17042, Argonne,1973
21. A.Bujak, A.Filippov et al.. Preprint JINR E2-6847, Dubna, 1972.
22. S.A.Dunne. Phys.Rev.Lett., 19, 1299, 1967.
23. J.Bystricky, G.Cozzika, A.Gaidot et al.,Proposal to measure the target asymmetry in inclusive p and pp reactions at large transverse momentum (Saclay), CERN/SPSC/74-71/P15, 31 May,1974.

Figure captions

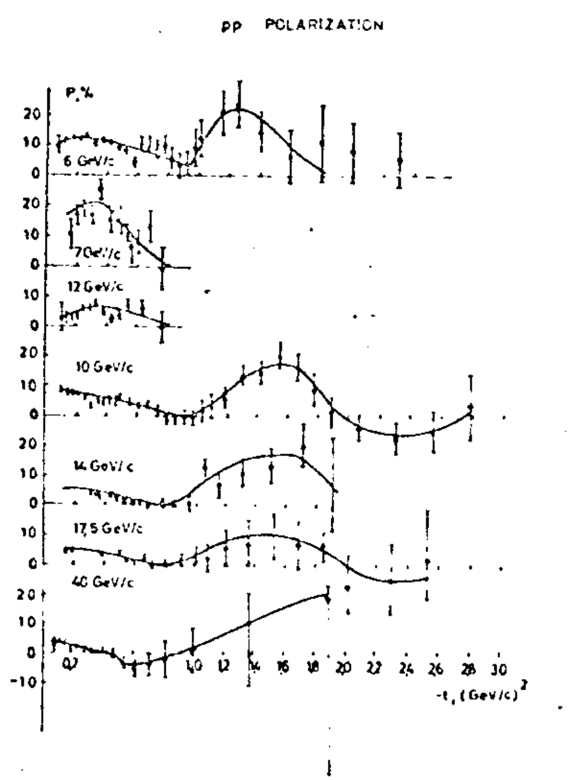
Fig. 1. Summary of pp polarization data .

Fig. 2. Polarization of different hadrons versus S at $-t = 0.2\ (GeV/c)^2$.

Fig. 3. pp -polarization predictions according to the model of Majerotto (Ref.6).

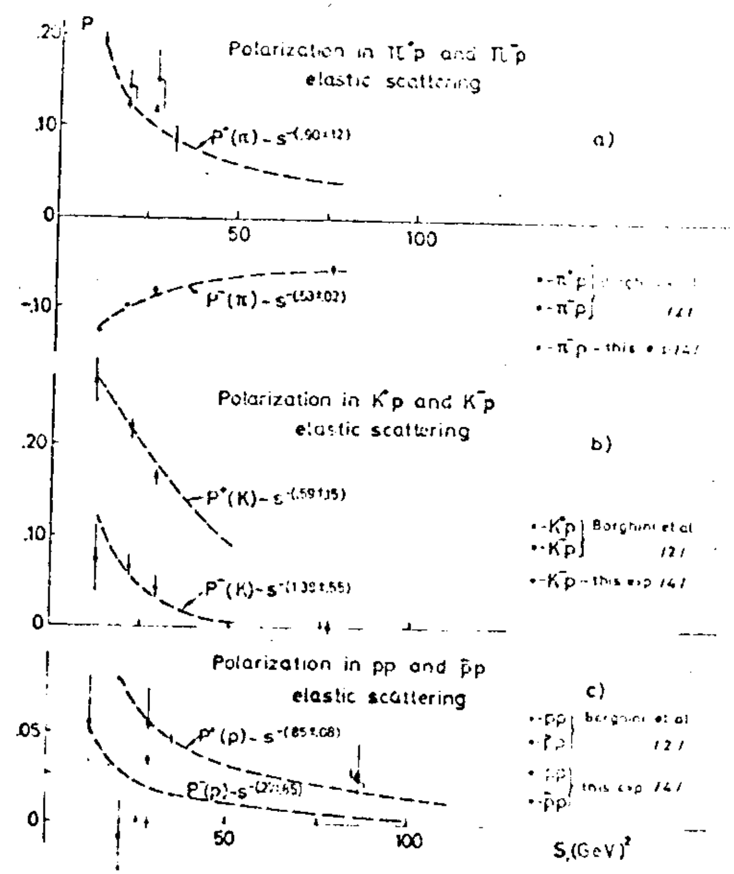
Fig. 4. Experimental set-up for pp and $\pi^{\pm}p$ -elastic scattering.

Fig. 5. Expected polarization in electromagnetic pp -scattering (Ref. 14).



pp POLARIZATION
P,%
6 GeV/c
12 GeV/c
10 GeV/c
14 GeV/c
17,5 GeV/c
40 GeV/c
-t, (GeV/c)^2

Fig 1



Polarization in π^+p and π^-p elastic scattering
a)
$P^+(\pi) \sim s^{-(.90\pm.12)}$
$P^-(\pi) \sim s^{-(.53\pm.02)}$
Polarization in K^+p and K^-p elastic scattering
b)
$P^+(K) \sim s^{-(.59\pm.15)}$
$P^-(K) \sim s^{-(1.39\pm.55)}$
Borghini et al /2/
K^-p - this exp /4/
Polarization in pp and $\bar{p}p$ elastic scattering
c)
$P^+(p) \sim s^{-(.85\pm.08)}$
this exp /4/
S,(GeV)^2

Fig.2.

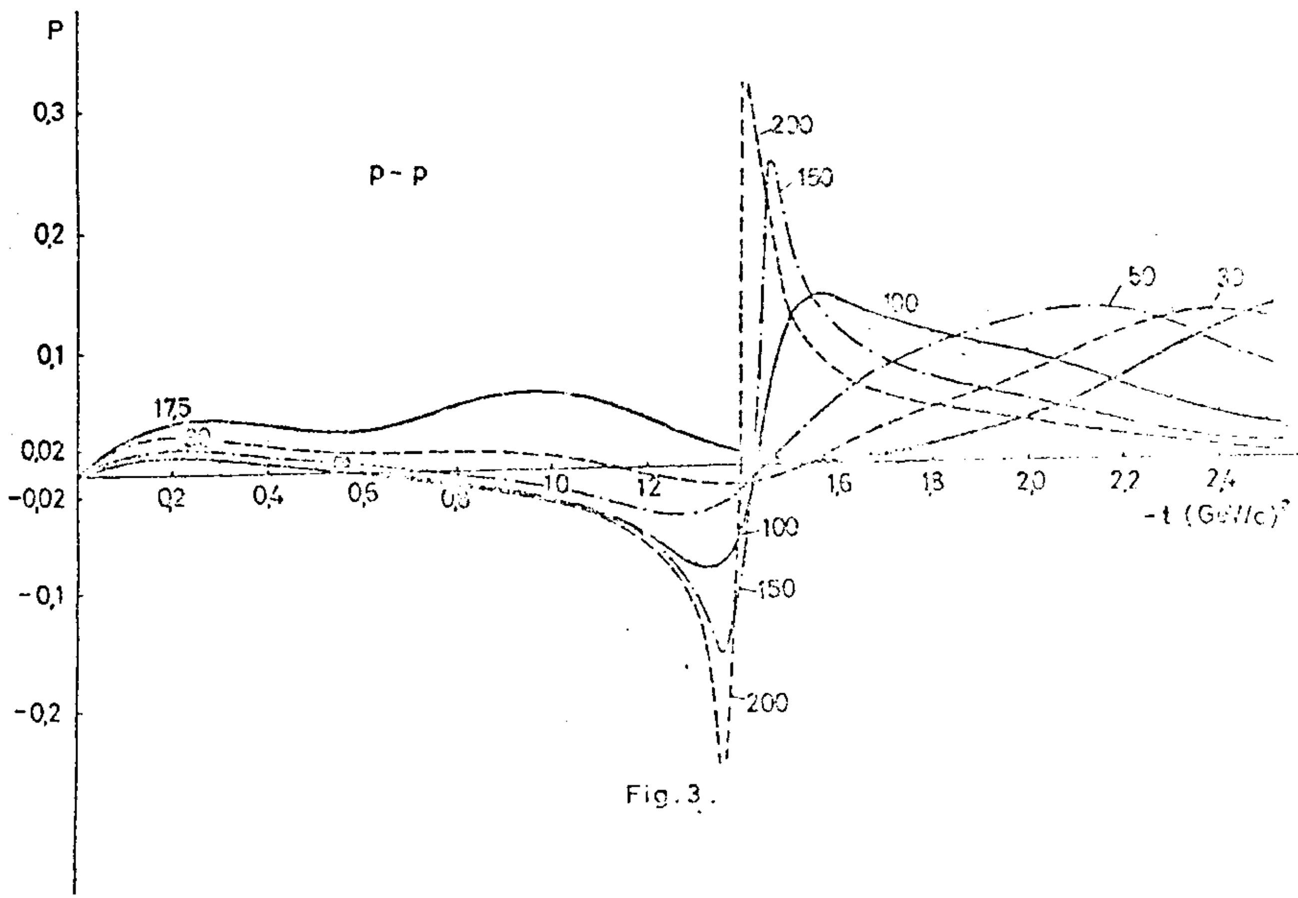
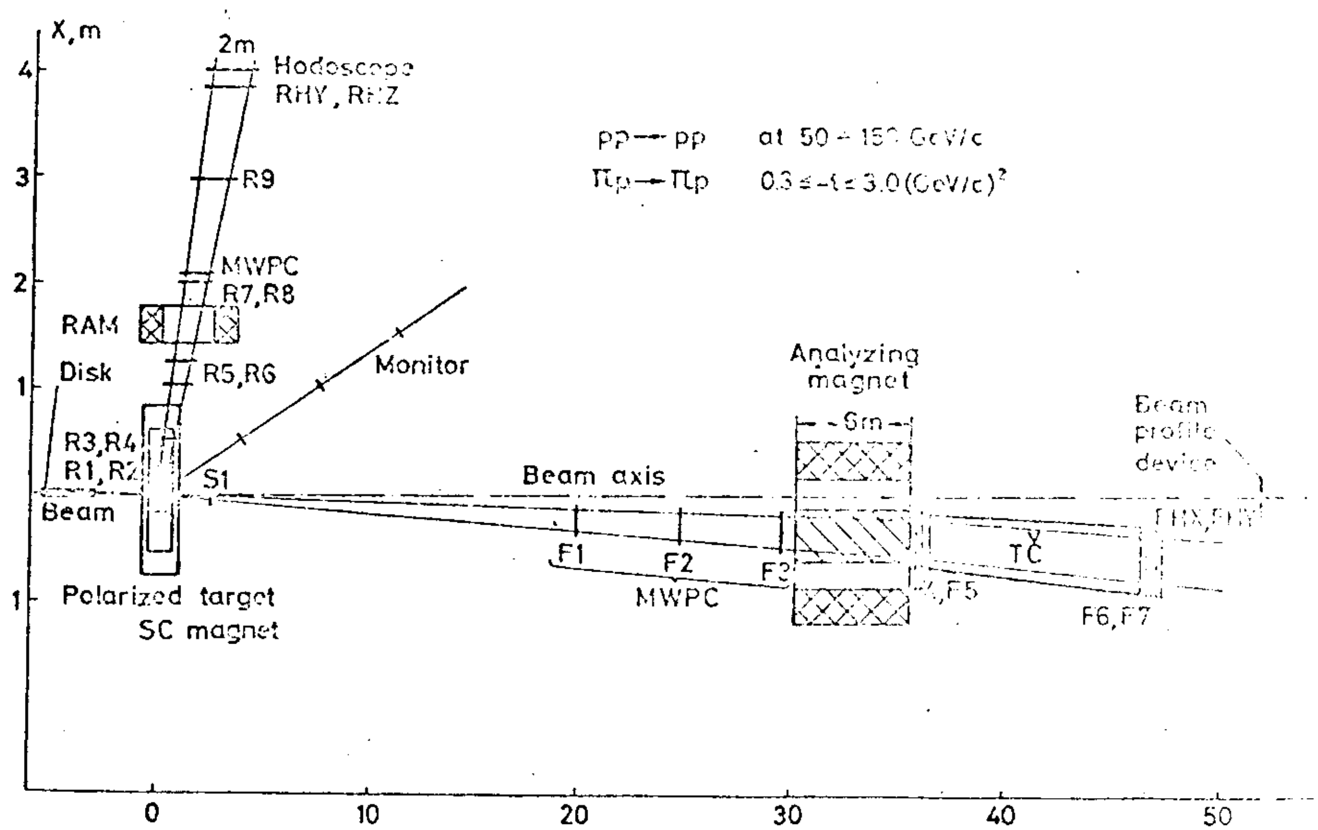

P
0,3
0,2
0,1
0,02
-0,02
-0,1
-0,2
p - p
17,5
200
150
100
50
30
100
150
200
0,2
0,4
0,6
1,6
2,0
2,2
- t (GeV/c)²

Fig. 3.



X, m
Z, m
2m
Hodoscope
R9
MWPC
R7,R8
RAM
R5,R6
Disk
R3,R4
R1,R2
Beam
S1
Monitor
Polarized target
SC magnet
Beam axis
F1
F2
MWPC
Analyzing
magnet
TC
F6,F7
Beam

Fig.4.

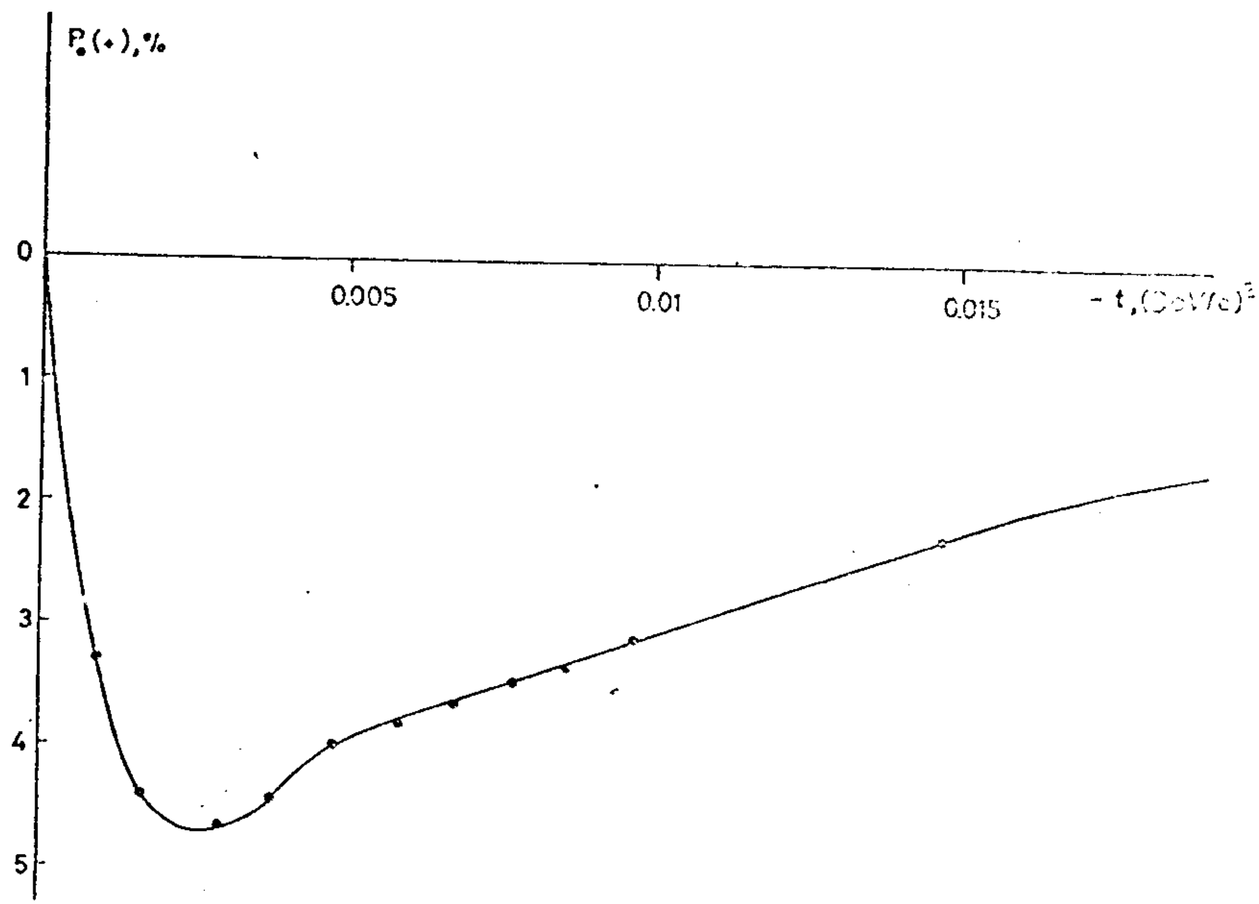


Fig.5.