EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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M E M O R A N D U M

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From : M. Borghini, G. Coignet, L. Dick, L. di Lella, P. Macq, A. Michalowicz and J.C. Olivier

Subject: : Need for a positive high-energy beam and request to modify the d_{23} beam in the South Hall.

We have recently measured the polarization P_o of the recoil proton in π^-p scattering at 6.0, 8.0, and 10.0 GeV/c [1], for momentum transfers from $t = -0.1$ to $t = -0.75$ $(GeV/c)^2$, using 4.5 weeks of PS time on the d_{23} beam. Our results show the existence of important spin effects, and are in qualitative agreement with theoretical prediction based on Regge-pole models [2].

As already pointed out in two preceding memoranda to the EEC [3], an extended research programme on the spin effects present in elastic scattering at high energy demands the use of a high-intensity beam ($\gtrsim 10^6$ pions/burst), of both signs. The following measurements could be performed using such a beam:

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1. Measurements of P_o in the t-interval already explored, but with statistical errors highly reduced, for both π^- and π^+. As a matter of fact, one of the crucial points of the Regge-pole interpretation of high-energy elastic scattering is the comparison of the results obtained with positive and negative pions.

2. The measurements of P_o with $\pi^\pm$ could be extended to t values as high as $\sim 2(\mathrm{GeV/c})^2$.

3. The polarization parameter could also be measured simultaneously for $K^\pm$, p and $\bar{p}$ which will be naturally present in the beam.

4. Experiments requiring a second scattering of the recoil proton would require much less machine time than in the d_{23} beam. These experiments are necessary in order to have a complete description of the scattering matrix at high energy.

The only beam which fulfils all these requirements is, of course, a secondary beam produced at $\sim 0^o$ from the slow-ejected e3 beam. We demand that such a beam be installed as soon as possible, as already requested in a previous memorandum to the EEC[3].

It is possible, however, to extend the measurements of P_o to π^+ and protons simultaneously, with the same statistical accuracy as was obtained for π^-, using a modified version of the d_{23} beam and the same experimental apparatus used until now. After discussions with G. Petrucci, the following modifications have appeared necessary:

1. The production angle must be increased to ~ 70 mrad. The first magnet of the m_4 beam must therefore be removed from the vacuum tank; as a consequence of this, the m_4 beam will not run.

2. The first two quadrupoles and the first 1-metre bending magnet of the m_4 beam must also be removed.

3. It is useful to modify the position of the special magnet (NP10) of the d_{23} beam, to increase the flexibility in varying the beam momentum.

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Switching from the actual configuration to the proposed one, or vice versa, could be done during a normal maintenance stop of the machine.

The modified d_{23} beam will yield a flux of π^+ comparable to the π^- flux of the actual d_{23}, up to ~8 GeV/c, and about $\frac{1}{2}$ at 10 GeV/c[4].

The p/π^+ ratio will vary from ~ 2 at 6 GeV/c to ~ 8 to 10 GeV/c[4]. Using the d_{23} beam it is therefore possible to measure simultaneously P_o also in pp scattering. Running for about four weeks on the modified d_{23} beam will allow us to perform measurements of P_o in π^+p and pp elastic scattering at two or three beam momenta, with statistics comparable to those relative to the experiment with π^-[1], and for the protons, in fact, even better.

This modification to the d_{23} beam, if it will be accepted, should of course be done during the present year. We have considered the perturbations that this modification will induce on the experimental programme on the m_4 beam, and it seems to us that these perturbations will be smaller during next summer.

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REFERENCES

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2. R.J.N. Phillips and W. Rarita, Phys.Rev. 139 B, 1336 (1965); see also UCRL - 16185 (1965).

3. L. Dick et al., Memo 65/1709/5; M. Borghini et al., Memo 65/1825/5.

4. B. Jordan, CERN 65-14 (1965).

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