CERN/ISRC/70-1

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Memorandum

To : ISRC

From : G. Charpak, D. Drijard, H.G. Fischer, A. Minten and F. Sauli

Subject : Plans for an experiment to measure proton-proton correlations at the ISR.

1. Considerable interest has been recently devoted to the study of the "deep inelastic" proton-proton scattering.[1] This is stimulated by the results of electron-proton scattering[2] and theoretical considerations by Bjorken[3] and Feynman[4], who interpret the experimental results as the scattering of the electron on pointlike constituents of the proton (= partons) at "infinite momentum". This experimental condition of "infinite momentum" is fulfilled in the best possible way at the IRS. Although the physical meaning of a possible comparison between ep an pp scattering is not obvious, we feel that the behaviour of the cross section as function of the quantities t and υ ($\upsilon = E_{in} - E_{out}$) and their correlations are of fundamental interest beyond any model.

2. In an attempt to parametrize inelastic proton-proton reactions by the behaviour of the "leading particles" we propose to measure[5]:

   i) the inelastic spectrum of <u>one proton</u>, integrated over all final states; similar measurements will have been made by production experiments[6], so that this part will be mainly a test and calibration procedure.

   ii) the correlations in the inelastic spectra of <u>two protons</u>; this includes, among others, the correlations $(t_1\ t_2)$, $(\upsilon_1\ \upsilon_2)$, and ϕ (ϕ = angle between the scattering planes of the two protons).

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iii) the correlation between the proton quantities t and ν and the configuration of the "missing matter"; the secondary products will be described in a gross way by quantities like: missing mass, charge multiplicity, and angular distribution.
All measurements can, in principle, be performed simultaneously in the Split-Field Magnet.

3. The technical implications are the following:

i) The SFM is equipped with chambers for trajectory measurements of forward particle in the main magnet and the compensator magnets; large angle secondaries are detected by one layer of chambers arranged in a box around the intersect;

ii) protons are selected by two Cerenkov hodoscopes in the forward cones. The subdivision must be sufficiently fine in order to reduce the probability for double trajectories to a reasonable limit;

iii) it seems unattractive to accept the forward particles by conical vacuum chambers as discussed in the past. An effort to develop a very thin or very light round or elliptic tube should be encouraged.

4. A detailed proposal will be submitted within this year.

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References:

1. E.W. Anderson, E.J. Bleser, G.B. Collins, T. Fujii, J. Menes, F. Turkot, R.A. Carrigan, Jr. R.M. Edelstein, N.C. Hien, T.J. McMahon and I. Nadelhaft. Phys. Rev. Letters 19, 198 (1967).

G.J. Marmer and L.G. Ratner, J.L. Day, N.P. Johnson, P. Kalbaci, A.D. Krisch, M.L. Marshak and J.K. Randolph. Phys. Rev. Letters 23, (1968) 1469.

CERN-Bologna Collaboration, proposal to the CERN-EEC (1969).

2. E.D. Bloom, D.H. Coward, H. DeStaebler, J. Drees, G. Miller, L.W. Mo and R.E. Taylor, M. Breidenbach, J.I. Friedman, G.C. Hartmann and H.W. Kendall. Phys. Rev. Letters 23, (1969) 930.

3. J.D. Bjorken, Phys. Rev. 179 (1969) 1547.

4. R.P. Feynman, Stony Brook Conference 1969 (unpublished).

5. A similar experiment has already been discussed earlier:

J.V. Allaby, A.N. Diddens, R. Dobinson, A. Klovning, D.H. Miller, K. Schluepmann, A.M. Wetherell.
CERN/ISRC/69-29.

6. CERN-HOLLAND-Lancaster-Manchester Collaboration
and
Bologna-Michigan Collaboration.
For references see CERN/ISRC/69-55.