



Letter of Intention

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Measurement of proton-proton scattering at 10 GeV/c

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A series of measurements of small angle elastic and inelastic proton-proton scattering, using on-line data reduction and sonic spark chambers, is currently in progress at 19.2 GeV/c. The data confirm the existence of an appreciable (about 30%) real part in the scattering amplitude and further reveal interesting features in the inelastic scattering. The momentum spectra of the scattered protons at angles between 2 and 8 mrad exhibit striking peaks corresponding to missing masses of about 1400 MeV. At larger angles the intensity of these 1400 MeV peaks decreases rapidly, indicating that the phenomenon has a very strong dependence on momentum transfer.

Previously, evidence for this phenomenon has been obtained in a p-p experiment at 60 mrad scattering angle and at momenta between 3 and 6 GeV/c¹⁾.

The existence of a P_{11} pion-nucleon state of mass about 1400 to 1450 MeV has recently been discussed both theoretically and experimentally²⁾³⁾. It is interesting to speculate on the possible mechanism of excitation of a mass 1400 MeV baryon state in very low momentum transfer collisions, having the low(1/2, 1/2) quantum numbers of the proposed P_{11} state.

It is clear that it is of considerable interest to extend the experimental data from pp collisions to other energies. It is proposed, therefore, that during week 10 (4-9 March) the PS be operated at 10 GeV/c in order to investigate this question. Good statistical accuracy is needed to study the momentum spectra in detail. At a rate of 5 triggers per machine cycle, 5 days of running time would give about $2 \cdot 10^6$ triggers and about 10^5 inelastic events.

Valuable data on the elastic differential cross section will also be obtained during these measurements. A remeasurement of the elastic cross section at 10 GeV/c appears to be necessary in view of the difference in the amount of the real part of the scattering amplitude found in the previous CERN experiment ($43 \pm 4.3\%$), that found in the Brookhaven experiments at 8, 10, 12 GeV/c (about $25 \pm 10\%$; preliminary data) and that found in the Nimrod experiment ($29 \pm 3\%$) at 7.8 GeV/c.

References.

- 1) Cocconi, Lillethun, Scanlon, Ting, Walters, Wetherell, Phys. Letters 8, 134 (1964).
- 2) Bareyre, Bricman, Valladas, Villet, Bizard, Seguinot, Phys. Letters 8, 137 (1964).
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- 3) An alternative possibility has been discussed by Dalitz and Moorhouse (preprint, Oxford, Dec. 1964).