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PROPOSAL FOR AN EXPERIMENT USING 4 - 6 GeV/c PIONS IN EMULSION

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During the last years our group has been engaged in the study of small angle diffraction scattering of high-energy particles in emulsion. It is feasible to go down with angle measurements into the region where interference effects with Coulomb scattering show up.

In a recent analysis [1] of 5.7 GeV/c π^- scattering in emulsion a destructive interference has been observed which indicates a positive real potential of ~ 20 MeV. This number may be compared with the predictions by Johnston and Watson [2] of a positive real potential of 4 MeV derived from pion-nucleon scattering data. There is good agreement between the measured imaginary potential of - (40.7 ± 4.1) MeV and the theoretical one of - 42.7 MeV.

We want to corroborate our experimental result by a study of the small angle scattering of positive pions of 5.7 GeV/c in emulsion.

Preferably the exposure should be made with 5.7 GeV/c π^+, but any momentum between 5 and 6 GeV/c would do. If no separated beams of momentum between 5 and 6 GeV/c will exist this year, we would like to do the same experiment at any momentum above 3 GeV/c which will be available. In that case we like to have two exposures, one with π^+ and one with π^-.

The details of the exposure will of course depend on the properties of the separated beam. The following proposal has sufficient flexibility to adapt it to any beam with an intensity of 50 π^+/ pulse or higher. The total number of pions requested is 40.000, 800 machine pulses would be necessary if the intensity is 50 π^+/ pulse.

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We propose to irradiate a stack with a size of 10 x 15 cm^2 and thickness 16 x 600 μm Ilford G 5 emulsion. The cross section of the beam should be at least 4 cm^2.

Although in principle the proton contamination can be determined by blob count measurements in the emulsion, the beam should contain not more than a few percent protons. We assume that both proton and muon contamination of the beam will be known from other experiments in the beam. From previous experience we know, that our scanning and measuring capacity can handle 500 meter track in half a year, this length will be sufficient to decide on the existence of an interference effect between Coulomb and nuclear potential. To be on the safe side the proposed irradiation will provide around 1500 m followable track. The total usable length will depend on the beam divergence.

1) B. Jongejans. The Aix-en-Provence International Conference on elementary particles 1961, p. 291.

2) R.R. Johnston, K.M. Watson Nuclear Physics 28 (583) 1961.

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