

Fermilab Proposal **574**

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A STUDY OF THE MECHANISM FOR
MULTIPLE PRODUCTION OF PARTI -
CLES AT OR ABOVE 300 GEV PION
INTERACTIONS IN NUCLEAR EMULSION.

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R E Q U E S T.

We are asking for nuclear emulsion exposure at or above 300 GeV pion beam at Fermilab.

Technical details concerning the emulsion stacks and the exposure are given below.

P h y s i c s.

Last years, in spite of the spectacular results in particle physics, one can observe a great interest in the study of inelastic hadron-nucleus interactions. This is mainly due to the fact that interaction with the nucleus offers the unique possibility of studying the space - time development of the production process. From hadron-nucleus collisions one can obtain information which, due to the time scale, cannot be obtained in hadron-hadron collisions. However, in spite of the progress in studying hadron-nucleus interactions still we are far from understanding the mechanism of multiple production of particles in interactions of hadrons with nuclei.

For several years we have been involved in the analysis of hadron-nucleus interactions using nuclear emulsion technique. We have done three emulsion exposures at Fermilab: E 90 and E 249 with 200 GeV and 400 GeV protons respectively, and E 339 with 200 GeV negative pions.

Our already published /1 - 9/ results concern the following problems:

- multiplicity of both the produced particles and slow particles emitted from the struck nucleus,
- correlations between the particles produced,
- correlations between different parameters describing the hadron nucleus interaction,
- single particle pseudorapidity distributions.

Comparison between the 200 GeV proton and pion interactions /5,9/ favours the models considering hadron-nucleus interactions as a superposition of independent collisions with separate nucleons inside a nucleus. However, this conclusion as well as the others should be verified at still higher energies. Also the latest results concerning the bimodality of angular distribution of fast particles produced in 200 GeV pion-nucleus interactions /10/ /not observed at lower energies/ calls for the analysis of data at still higher pion energies. Therefore we are asking for an exposure of emulsions to above 300 GeV pion beam at Fermilab.

T e c h n i c a l d e t a i l s .

We would like to expose at or about 300 GeV pion beam three stacks of emulsion pellicles. Each stack will consist of about 25 pellicles / 600 microns thick / with the dimensions 1.5 x 2.5 inches. The emulsion surfaces would be placed parallel to the beam within the accuracy of at least 10 mrad.

The density of pion tracks accumulated in emulsion should be about 5×10^4 /cm².

Scanning, measurements and the analysis of data will be performed in the Laboratory of High Energy Physics of the Institute of Nuclear Physics at Krakow, Poland in collaboration with Fermilab under the NSF Grant No. INT75-01319 A01.

We intend to collect about 2000 of unbiased interactions by systematic following under the microscope the primary pion tracks.

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