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STUDY OF PION-NUCLEUS INTERACTIONS IN PURE EMULSION STACKS AND EMULSION CHAMBERS AT ENERGY ABOVE 500 GeV

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REQUEST

We are asking for an exposure of pure emulsion stacks and emulsion chambers with different targets to a pion beam at energy of 500 GeV or preferably higher.

PHYSICS MOTIVATION AND OBJECTIVES

The motivation and objectives are the same as described in some detail in our similar proposal asking for an emulsion exposure to the Tevatron proton beam.
The proton proposal contains also a list of our publications outcoming from our previous emulsion exposures to proton and pion beams at lower energies, done at Fermilab (E90, E249, E339, E574).
Shortly, we would like to measure multiplicity, inelasticity and angular distribution of particles produced in π^--nucleus interactions and study variation of various parameters and spectra with mass number (A) and primary energy.
Also, we would like to compare pion data with proton data.

TECHNICAL DETAILS

These are also the same as in our proposal for proton exsposure. We would like to expose the following stacks and chambers to 500 GeV (or higher energy) pion beam at Fermilab:

1. Three stacks consisting of about 25 emulsion pellicles (600 microns thick) with dimensions 4 x 6 cm^2.
   The emulsion surfaces will be parallel to the beam

within the accuracy of 10 mrad. The accumulated beam density should be about 5×10^4 pions/cm^2 (a total of $\sim 10^6$ pions). The stack dimensions and beam requirements are the same as in our previous emulsion exposures.

2. Five emulsion chambers, each composed of a target part, a spacer and a shower detector. The target part with dimensions $6 \times 6 \times 4$ cm^3 would consist of plates of different elements sandwiched between emulsion pellicles. Shower detector would have 10 c.u. (~ 7 cm) in depth, transverse dimensions 6×6 cm^2 and would consist of lead plates and emulsion pellicles.

   The emulsion chambers are similar to those used in experiments E336 and E503. The chambers will be exposed with their ingredient plates perpendicular to the beam direction. The accumulated beam density should be about 5×10^3 pions/cm^2 (a total of $\sim 10^6$ pions).

Scanning, measurements and data analysis will be performed in the Laboratory of High Energy Physics of the Institute of Nuclear Physics at Kraków, Poland.

From pure emulsion stacks we intend to collect 1000-2000 unbiased interactions by systematic following the primary pion tracks.

From emulsion chambers we aim to have samples of 100-200 interactions with each of the target elements used.