A proposal to

Fermi National Accelerator Laboratory

INVESTIGATION OF MULTIPLE PRODUCTION BY π^- MESONS WITH EMULSION CHAMBER

Y.TAKAHASHI, M.BIYAJIMA, T.MATSUDA and O.MIYAMURA

Department of Applied Mathematics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka 560, Japan.

The present proposal is an emulsion chamber experiment of multi-particle production initiated by negative pions with energy greater than 200 GeV.

1. Purpose.

Since the construction of gigantic accelerators, multi-particle production has been studied in various respects, mostly bringing forth the inclusive informations on proton-proton interactions. Among many informations the pronounced leading particle effect and the cluster formation seem to be quite important for the understandings of the dynamical properties of hadronic ensemble, however, detailed knowledge on the structure of them are not sufficient yet.

In order to make further study of these problems, we planned to observe particle production by negative pions with the emulsion chamber.

The first aim of this experiment is to clarify the leading particle effect in connection with the central produced mesons. Because the pion mass is much smaller than that of proton the rapidity of leading particle can distribute more widely than leading proton in proton-proton collision, it is advantageous to observe the correlation length between leading pion and the remaining particles in pion-nucleon collision.

In the present apparatus both the charged particles and the forward going neutral pions can be detectable. The emission angle of them would be measured very precicely. The momentum of charged one can be measurable with feasible accuracy by apllying multiple scattering method.

and that of neutral pions would be determined from the three dimensional development of cascade showers.

2. Apparatus.

The emulsion chamber for this experiment consists of two parts. The upper half is the stack of emulsion plates. The thickness of each plate is 500 μm having surplus 100 μm of nuclear emulsion on both sides. They form the target for interactions and the detector of produced charged secondaries at the same time.

The lower one is the sandwich of emulsion plates intervened by lead plates. For the sake of rapid scanning we will adopt the industrial X-ray films specially designed for this experiment, which enable us to detect energetic gamma rays by naked eyes.

The total thickness of the lead plates is about 15 radiation length. The weight of the emusion chamber is about 12 Kg for each.

3. Irradiation of π^- beam.

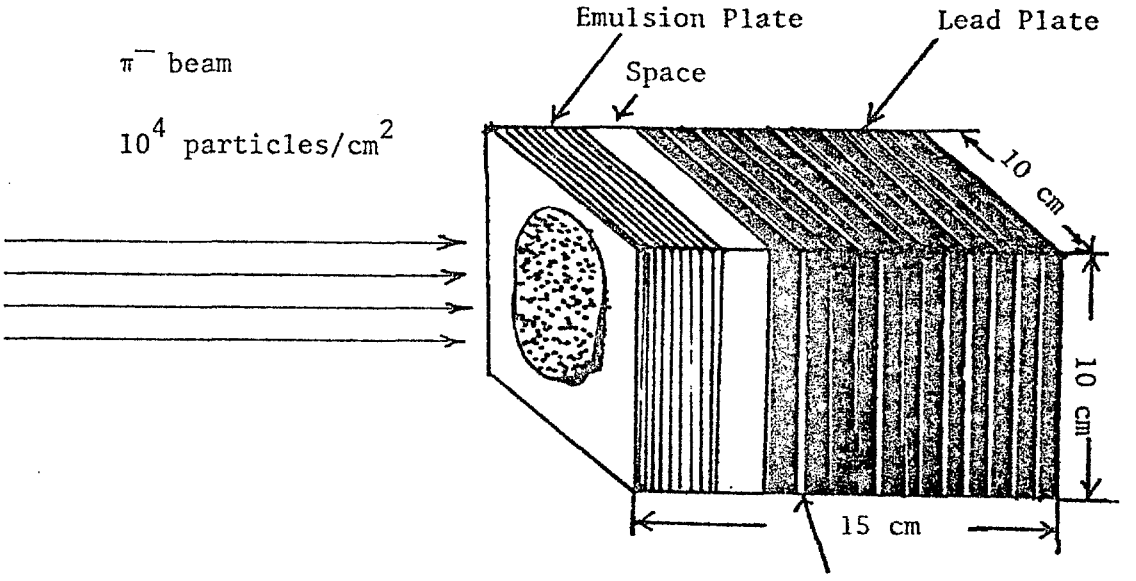
The present experiment is so simple that we need no special facilities other than served for ordinary emulsion experiment.

The median energy of the beams preferred is about 200 GeV. If possible, we hope to get highest one. The other quantities are listed as follows;

The Beam	negative pions
The Median Energy of Beam	about 200 GeV or highest possible
The Intensity of Irradiation	about 10^4 particles/cm^2
Cross Area of Irradiation	a square of 10 cm
Total Number of the Emulsion Chamber to be exposed	10 blocks

4. Schematic View of the Chamber and Arrangement.

The Emulsion chamber will be placed as illustrated below. The beam will hit the plates vertically.



Nuclear Emulsion Plate with X-ray Film