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EMULSION EXPOSURE TO Σ^- BEAM AT FERMILAB

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Request

We are asking for an exposure of seven emulsion stacks to the Σ^- beam at Fermilab during the running period Nov., 1980 - Feb., 1981. The stacks would consist mainly of pure emulsion pellicles; some emulsion pellicles would contain embedded microgranules (with a diameter of $\sim$ 15 μm) of several heavy metals (^{52}Cr, ^{108}Ag, ^{184}W). After exposure and development, the plates would be searched for multiparticle production events both in pure emulsion - by systematic track following, and in metal granules - by an area scan. For samples of events found (sample size 100 - 1000 events) , the charged multiplicities and angular distribution of secondaries will be determined.

Motivation

The proposed exposure is a part of a comprehensive study of multiparticle production process on nuclei as a function of energy, projectile type and target mass, carried out at Fermilab by both laboratories, either in collaboration (E382) or separately (E90, E249, E339, E508, E574 - Krakow, E171, E237, E387, E471, E524 - Seattle). Data from the proposed exposure would be compared with the data from our previous emulsion exposures to proton and π^- beams.

As pointed out in ref. [1] the measurements of particle production by hyperon beams in central rapidity region would be very useful for testing quark models of hadron nucleus interactions. In the quark model [1] the A-dependence of the particle production is sensitive to the number of constituents in incident hadron. Other models [2,3] relate the A-dependence to the cross-section (or number of collisions) of the projectile.

Technical details

We would like to expose to Σ^- beam six stacks, each consisting of 5 $\div$ 10 emulsion pellicles on glass and having dimensions 10 cm x 10 cm x (1 $\div$ 2) cm. In addition we would like to expose one stack with dimensions 4 cm x 6.5 cm x 1.5 cm, consisting of 25 stripped emulsion pellicles. The stacks would be placed in turn into the beam, close to the downstream end of E497 targetting magnet, with pellicles

surfaces parallel to the beam within the accuracy of 10 mrad. We are asking Proton Department for constructing and installation a simple remote control system which would allow to place an emulsion stack into Σ^- beam, reposition it few times to expose the entire stack and take it out of the beam and high background region.

The parameters of the hyperon beam were already measured [4]. Its size is 0.5 cm horizontally and 1 cm vertically. At 250 GeV and zero deg. production angle, the negative beam consists of 10^5 particles per 10^{11} protons of 350 GeV, incident on target. It is hard to run at less than 10^{10} protons/pulse. The fraction of Σ^-s in the beam at 300 GeV (from 350 GeV incident protons) is 53 % ; the rest are mainly π^-s. Since we do not have a possibility of tagging we would require a beam with the highest fraction of Σ^-s possible. We would prefer to have 200 GeV Σ^- beam which would allow us a straightforward comparison with our proton and π^- data, but the purity of the beam should have the highest priority. The accumulated density of tracks in emulsion should be 10^4 - 10^5 / cm^2 . Thus we would need about 10 pulses per stack.

Stacks will be prepared and developed in Seattle. 75% of scanning and measurements will be done in Krakow, the rest in Seattle. Analysis of data by both labs.

References

[1] A. Białas, Fermilab-Conf-79/35-THY.

[2] L. Caneschi and A. Schwimmer, Nucl. Phys. B102 (1976) 381.

[3] S. Brodsky, J. Gunion and J. Kuhn, Phys. Rev. Lett. 39 (1977) 11

[4] J. Lach, private communication.