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Experimental Proposal
to the
National Accelerator Laboratory
to

Study Multigamma and Charged Secondary Topologies Produced by 200 and 500 GeV/c Protons Incident on Neon

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SUMMARY

Incident Beam:	200 and 500 GeV/c Protons
Detector:	30" Bubble Chamber Filled with a Neon-Hydrogen Mixture
Run Time:	50,000 Pictures at Each of Two Energies
Objectives:	Search for Schein-DeBenedetti Multi-Gamma Events.
	Survey Neutral and Charged Particle Production.
	Complement to Approved Experiment NAL #22.

It has been suggested [1] that magnetic monopole production and annihilation may be responsible for the anamolous multigamma events seen by Schein and DeBenedetti [2, 3]. We will look for multigamma events, whether due to monopoles or not, in a future spark chamber experiment at NAL (NAL Exp. #22). As a complimentary study, we propose here to also search for multigamma events using the 30" bubble chamber filled with a neon-hydrogen mixture [4]. Should the cross section for this process be as large as 25μ barns, we could observe some of these events. However, even if the cross section is lower by up to five orders of magnitude, we would see it in our counter search.

This experiment in neon would also provide information about the character of γ's from π^0 mesons as well as charged prong distributions. Since the π^0 gamma rays are expected to be a serious background in our counter experiment, which could confuse the interpretation of true multigamma events, it would be well to study them in a highly visual device like a neon-hydrogen bubble chamber. An understanding of the multiplicity and angular distribution of all γ's produced, regardless of origin, at these high energies would be both useful and interesting data in their own right.

Finally, the prong cross sections and associated γ's would be easily obtained during the scanning process. Comparisons with proton-proton data could reveal any nuclear or neutron effects while the detected gammas could be associated with π^0 production and allow an estimate of π^0 multiplicities. The lack of information on neutral spectra is well known.

Analysis of an anticipated multigamma event will be, by definition, complicated, and so the number of protons per picture must be limited to a few in order to enhance the possibility of unambigious interpretation. However, the photons from anamolous showers are all believed to lie in small forward cone, so a larger number of interactions per picture can be accommodated if the incident protons are spatially spread over the entire entrance window of the chamber.

With a collision length in neon of 40", three incident protons per burst would, on the average, produce one interaction in the upstream two-thirds of the chamber. Since the radiation length in neon is about 17" the average interaction in this upstream portion of the chamber would yield γ's which would see one radiation length of material before escaping from the chamber. With a spatially dispersed beam we believe we could handle about six incident protons per picture. In 50,000 pictures we could see a cross section of $\sim$ 25μ barns and still have events which could be analyzed with confidence.

The pictures will be scanned at VPI & SU on three tables and measured if necessary on a Hermes. The scan will consist of a count of the number of beam tracks and an itemization of the interactions by prong and associated showers and/or vees. Anomalies will be investigated fully should they appear. From this, prong distributions and estimates of π^0 production, at least, will be obtained.

We would be in a position to assist in the bubble chamber run. We would like the first exposure as soon as the chamber is filled with neon and the proton beam becomes available. The second exposure is requested as soon as practicable after the machine has achieved its full energy of 500 GeV. Data analysis on each phase is estimated to be complete within a few months after the film is received.

REFERENCES

[1] = [Ruderman and Zwanziger, Phys. Rev. Letters 22, 146 (1969)].

[2, 3] = [M. Schein, et al., Phys. Rev. 95, 855 (1954), and Phys. Rev. 99, 643 (1955); A. DeBenedetti et al., Nuovo Cimento 12, 954 (1954).]

[4] = [This investigation was suggested by R. R. Wilson in a NAL newsletter.]