Supplement No. 2 to
SLAC Proposal E-56A
November, 1970

REPORT TO PROGRAM ADVISORY COMMITTEE ON STATUS OF E56

A. Review of purpose of E-56.

This experiment was designed to search for new sources of highly penetrating neutral radiation. Among the possibilities which were considered in the original proposal and in subsequent discussion were:

a) Short lived neutrino sources such as heavy leptons and intermediate bosons.

b) Neutral, neutrino like objects having magnetic moments.

c) Photon like particles coupled to conserved quantum numbers like strangeness.

The experiment is carried out by allowing the full beam to enter the beam dump and looking down-stream after about 200 feet of earth shielding. A hole 35 feet deep was excavated behind the hill of the beam dump and 20 tons of spark chamber with trigger counters were placed therein.

B. Distribution of running time.

We have run for a number of days, mostly parasitically, looking for events which are synchronous with the machine and which can trigger our counter banks. A trigger requires a coincidence across the 11 inches of aluminum which comprise the last chamber and hence predisposes toward energetic events with more than several hundred MeV. The running time was distributed as follows:

Beam Energy	Coulombs Into Dump
12, 12.5 GeV	2.07
13.3 GeV	0.96
15 GeV	2.63
17 GeV	1.85
18 GeV	1.43
19, 19.5 GeV	3.00

In addition we ran for a period of 8 hours trying to produce conventional neutrino events by allowing the beam to strike a two radiation-length target 80 feet upstream of the dump. A total of 0.85 coulombs was delivered to the target at that time. A day of running at 360 pps and 50 ma peak current deposits 2.3 coulombs of charge into the dump.

C. Observations.

In the course of the high energy running, particularly at 18 and 19 GeV, we observed a number of events which are quite hard to explain in terms of the expected neutrino background. Calculations indicate that we are entitled to about one neutrino interaction per coulomb with a typical neutrino energy

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of the order of 1 GeV. Indeed we do see such a rate and in fact, with the water target, we have obtained a half dozen conventional neutrino events, as expected. The unusual events appear offhand to fall into two categories:

1. High multiplicity stars with a large mesonic component. The multiplicity would indicate that one must have at least four or five GeV neutrinos to make these and even for such neutrinos they would be highly anomalous. We have a total of six such stars, as follows:

2 - 6 prongs

4 - 3 or 4 prongs

(One of these, a 4 prong star, was obtained at 15 GeV).

2. Events having no visible muon.

There are two clear cases of this at 18-19 GeV and one uncertain case at 17 GeV.

No unusual events were seen in the running below 15 GeV and no unusual events appeared during the run with the water target.

Although the statistical accuracy is extremely poor, we summarize as follows:

$$\text{Unusual event rate at 18-19 GeV} = \frac{7 \text{ events}}{4.42 \text{ coulombs}} = 1.6 \text{ events/coulombs}$$

$$\text{Unusual event rate with water target at 19 GeV} = \frac{0 \text{ events}}{0.85 \text{ coul.}}$$

Anticipated incremental factor for true neutrino events in going to water target = 8.

Anticipated number of unusual events from water target if they were all due to neutrinos = $8 \times 0.85 \times 1.6 \simeq 11$.

There seems then to be some real indication that these events are not of neutrino origin.

D. Request for future running time.

We feel that our results so far are of sufficient interest to warrant a request for additional running time. We will make some major changes in the trigger requirement so as to remove the strong bias toward high energy events. We would also like to explore in some detail the time structure of the radiation which is giving rise to a small but non-negligible singles rate in our counters, a singles rate which is typically about 1/60 count/pulse/liter of scintillator. This counting rate is beam correlated and seems to be quite independent of the general level of skyshine.

Accordingly we request the following:

1. Approximately 5 - 7 days of full-out running (350 pps at 19 GeV and 50 ma.) as soon as possible.

2. One cycle of running time at some convenient time in the Spring of 1971 (or earlier, if possible).