SLAC Proposal No. 56

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I. Title

A Search for Short-lived Sources of Neutrino-like Particles.

II. Experimenters

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III. Description of the Experiment

We propose herewith a speculative experimental program which has a high probability of yielding no significant result. Nevertheless we feel that the total investment involved in both money and effort is sufficiently small and the possibilities sufficiently exciting to warrant its implementation at the earliest possible time.

Specifically, we propose to search for hitherto unknown particles which have neither charge nor strong interaction and which can be produced at S.L.A.C. through either electromagnetic interactions or

as decay by-products of other hitherto unknown particles. The full electron beam will be allowed to enter a beam dump in front of enough steel to stop all muons. Behind the steel shield we will set up a large, sixty ton, spark-chamber, lead-wall array and search for the presence of energetic charged particles which arise from either decay or interaction. The detailed arrangement of experimental equipment will be described shortly. In the meantime we will list some of the speculative processes whereby we might obtain a non-zero result.

1. Suppose the muon neutrino had a magnetic moment as small as 1/100 of the electron moment. (The upper limit on its mass is only about 2 MeV). We would then produce $\sim 10^6$ neutrino pairs per second and would have no problem detecting them by means of a large detector (the flux would lead to about 10 events/day in a 60 ton detector due to weak interactions).

2. Suppose any neutral particle whatsover existed with a magnetic moment and no strong interactions. We might be able to detect it through its decay, electromagnetic or weak interaction, if it penetrated the shielding wall.

3. Suppose a hitherto unknown source of muons exists to account for the recent results of Keuffel's group. We might expect the possibility of neutrinos in association with these muons and hence it is of interest to search for short-lived neutrino sources. We can detect a flux of as few as 10^5 neutrinos per second entering our 60 ton apparatus from such a source.

The neutrino background from decays in flight of pions, kaons, and muons is not important. The pions and kaons will interact within a foot or two after production and hence only about 1% of them will decay effectively. The neutrino flux from their decays should not

exceed 100/cm^2-sec. and will lead to at most 1 event per day.

There is no use in really belaboring the speculative possibilities. This is in every sense of the word a survey experiment within a region which has never been explored and as such deserves the general support of the laboratory. As will be seen, the experiment will run largely parasitically whenever end-station A is at high energy and high intensity and is thus done at minimum cost. All of the experimental equipment needed is now in hand and the experiment can be started as soon as construction can be completed.

IV. Experimental Set-up

We propose to fill the last 15 meters of the end-station A beam-dump tunnel with steel and dig a 45' shaft of dimension 25' x 25' behind the tunnel, as shown in figure 1. RAD has estimated the cost of excavation and establishment of power and lighting to be about $90,000. The cost of shielding should not exceed $100,000., even if it must be bought on the outside. Within the excavation we propose to mount existing spark chambers (20 tons) and lead blocks as shown in figure 2. The total weight of the array, including lead, is about 60 tons. Camera equipment and film as well as all of the counters needed to detect events now exist and are ready for installation.

V. Accelerator operation

We would like to run the machine at as high an energy, with as much intensity, in as poor a duty cycle as is possible. We realize however that there is a real advantage to running this experiment as a parasite and are prepared to do so over a long period of time.

VI. Timetable

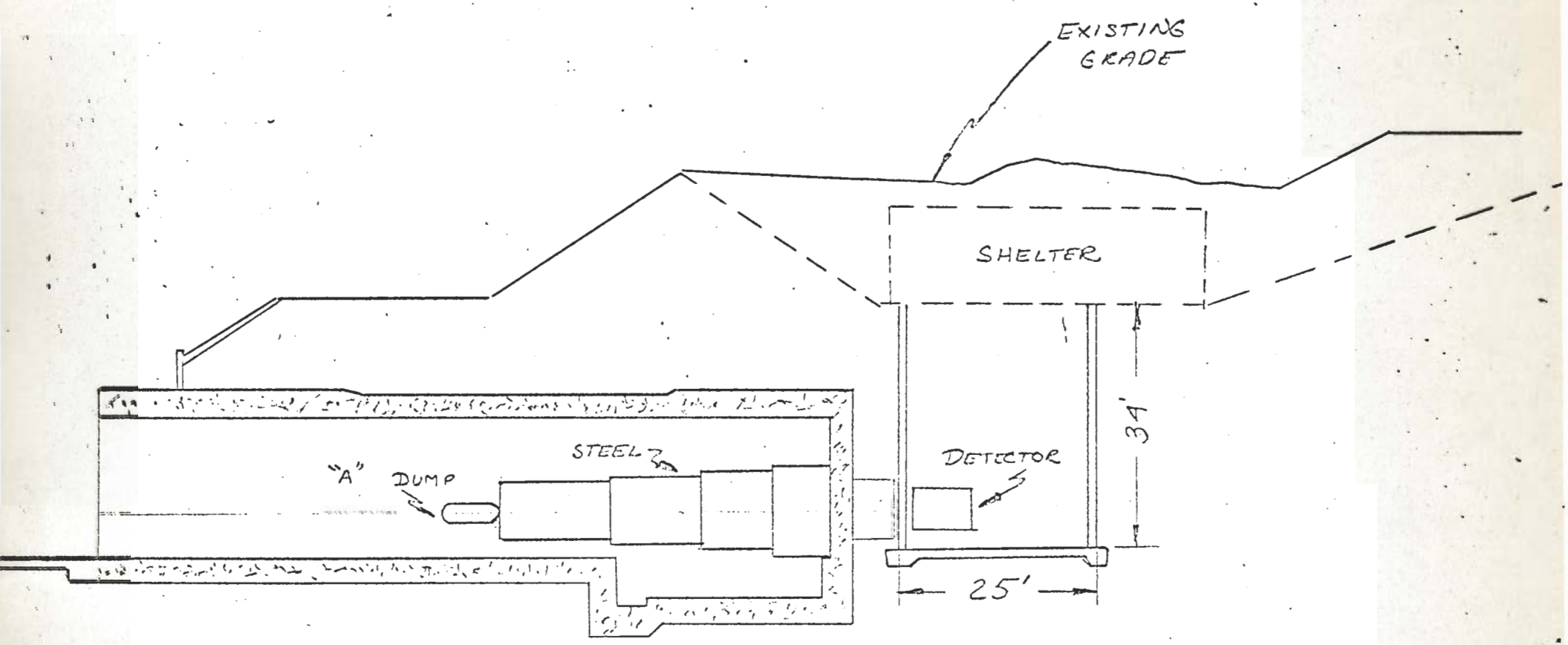
We will be ready to run as soon as the excavation can be completed and the shielding put into place. All of the experimental equipment, from chambers to camera to film is in hand and ready to use.

VII. Machine time

We would like to be sure of a total of 500 hours of running at optimum conditions--full intensity, highest energy, shortest pulse length. If these can be secured parasitically then no time request is necessary for the major part of the running. We would like about 200 hours as "prime user" during which time we can vary the beam energy and explore background.

VIII. Analysis

Analysis requires no special equipment and no large amount of computer time.



SCALE 1" = 20'

FIGURE 1 - NEUTRINO FACILITY.

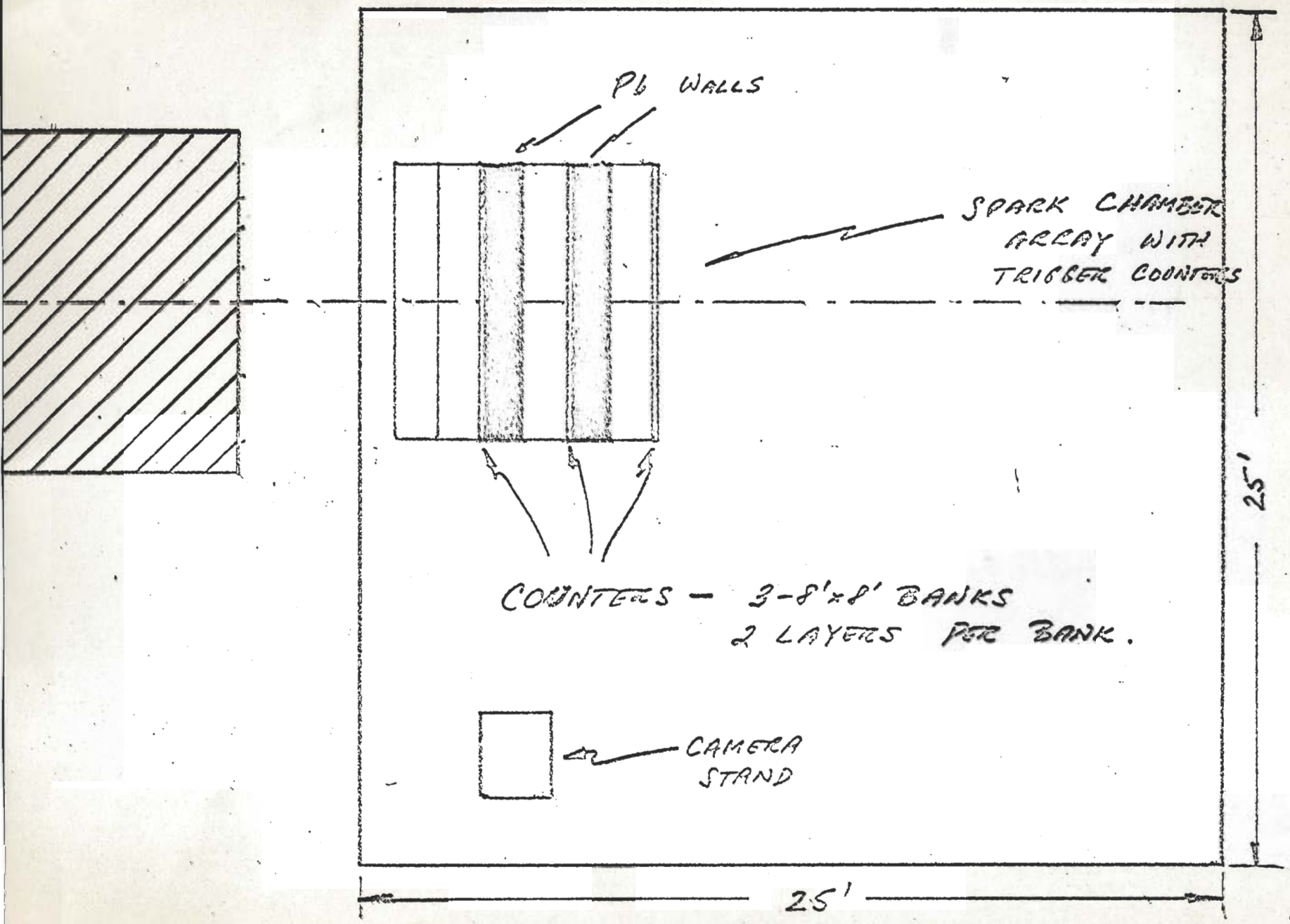


FIG. 2. INITIAL CONFIGURATION - SLAC NEUTRINO SEARCH.