Scientific Spokesman:

Leon Lederman
Nevis Laboratories
P. O. Box 137
Irvington, New York 10533

FTS/Off-net: 212-460-0100
914-951-8100

Phase 0.8

Search for Long-lived Massive Objects

(High Energy Calibration Run)

W. Lee, L. M. Lederman, J. Appel
Columbia University

M. Tannenbaum
Harvard University

L. Read, J. Sculli, T. White, T. Yamanouchi
National Accelerator Laboratory

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ADDENDUM: Phase 0.8

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- I. What: We propose to search for particles produced by 200-400 GeV protons with mass between 5 and 25 GeV/c² which have a lifetime $\geq 10^{-7}$ sec.
- II. Why: They may be there.
- III. How: Very simply, we need 3 scintillation counters, a time digitizer and a 200-400 GeV proton accelerator with terrible time structure (50 Mc).
- IV. How? We install a $\sim$ few % transmission target in a beam of 10^{10} protons just upstream of the 8 mrad vertical pitch in the E enclosure tunnel. The subsequent transport system is tuned for 200 GeV if the primary beam is 300 GeV (say). The main beam then hits the jaws of our variable collimator and a 200 GeV beam of secondaries ($\pm 1.2\%$) is transported ≈ 1000 m to the P-C pit entrance where the $\phi 1$ tabletop detector waits. This beam contains pions and electrons and provides valuable energy and hadron rejection calibration data. But, also, it has 2 nsec spiked structure for $v = c$ (pions, protons) particles and a mass dispersion given by:

$$\Delta\beta = 0.0003 \Delta\tau$$

where $\Delta\tau$ is the difference in arrival time in nanoseconds of particles with $\beta = 1 - \Delta\beta$ from those with $\beta = 1$. So, we see:

V. Sensitivity: We assume 10^9 interactions/pulse.

The acceptance of the transport system for pions is 10^{-5} .

This results in 10^4 particles arriving per pulse. The vast majority of these will be in the 2 nsec spikes and will not be permitted to trigger the TAC. The tail of the rf spike and the "terra incognita" between spikes will be recorded. Time is then mass: $m = 2\sqrt{6\Delta\tau}$ GeV.

VI. Is It Practical?: Emminently. We require only the extra target box, and perhaps some skill in the control room in assuring a tightly bunched rf structure and several shifts of running. The same runs will serve to provide a unique, high energy calibration of our ϕ lead

glass detector. (At BNL, the rf structure consists of 12 ~ "1 nsec" bunches separated by 220 nsec. We have measured this shape in some detail and found it to be very clean after ~ 4 or so nsec, if they really try in the control room.) The arrangement, being at 0° , is ideal: "Heavy particles are always made at 0° ." - Anaxagoras.