General #1A #21

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NEUTRINO PROGRAM AT NAL

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The Neutrino Area is characterized by the following features: a target and focusing region 200'x44"x44", a decay region 36"Øx1280', a 3000' earth muon shield, a "monochromatic" experimental area in the center of the shield and a "wide band" experimental area at the end of the shield. At present experiment No. 21 is located in the monochromatic area and the 15' bubble chamber and experiment No. 1A are located in the wide band area.

Three types of neutrino focusing systems will be used; a bare target (no focusing), a quadrupole-bending magnet system (monochromatic beam) and a horn focusing system (wide band beam). The relative fluxes from these beams are respectively 1:1/40:~5. A comparison of these neutrino spectra with those from other laboratories was made.

The detector for experiment No. 21, as well as the detector for experiment No. 1A, consists schematically of a target region, a hadron calorimeter and an iron core magnet to bend and identify the muon. The energy of a specific neutrino event is determined in experiment No. 1A by the calorimeter while for experiment No. 21 it is determined primarily by the beam. The calorimeter of experiment No. 21 is not as big as that for experiment No. 1A.

The results to date from experiment No. 21, which have been published (PRL 31, 180 (1973) and CALT 68-396), are from a 170 ton target and a muon magnet 5'Ø by 8' long. The data collected in January 1973 was for $3x10^{16}$ protons on their target at 300 GeV/c and

the monochromatic beam tuned at 160 GeV/c. This beam tune produced $\langle E_k^{\nu}\rangle \sim 145$ GeV/c and $\langle E_{\pi}^{\nu}\rangle \sim 50$ GeV/c. They accumulated 112 analizable events. Mass limits on the intermediate vector boson were set via the reaction $\nu+Z\rightarrow\mu^-+W^++Z$ by assuming a branching ratio η for $W^+\rightarrow\mu^++\nu$. The W^+ mass limit is set at 90% C.L. from 3-5 GeV/c for $10\%<\eta<100\%$. The point like scaling behavior was roughly checked by looking at the x and y plots at $\langle q^2\rangle$ versus E_ν, where $x = q^2/2M\nu$, $Y = \nu/E_\nu$. This test was only made for neutrinos. This experiment is presently receiving an exposure of $\sim 2\times10^{17}$ protons on their target which should result in ~1000 good events. This run which is primarily a heavy lepton search should be sensitive to heavy lepton masses of about 6-8 GeV.

Experiment No. 1A has published (PRL 30, 1084 (1973)) results on the neutrino-antineutrino cross section ratio. From their January 1973 run using a bare target with 300 GeV protons and collecting both neutrino and antineutrino events and assuming the $E_\nu = 2E_\mu$ they report that $\frac{\sigma_{\bar{\nu}}\ (P+n)}{\sigma_{\nu}\ (P+n)} = 0.35\pm0.18$. During this run the target was 60 tons of liquid scintillator and 60 tons of iron. They are presently completing runs at 300 and 400 GeV with several thousand events at each energy to search for neutral currents etc.

The 15-foot bubble chamber is expected to be operating within the next few months. The neutrino horn focusing system is expected to be operating also within the next few months. Therefore, a neutrino program using hydrogen could start before the end of 1973. Within six months sufficient neon should be available for 30% operation. The approved neutrino physics lineup for the 15-foot

chamber is as given in the following table. The D_2 and TST proposals have been deferred and the monochromatic beam proposals have been rejected.

TABLE I

Experiment Number	Chamber Filling	Beam	Number Photos - Number Events
45A	H_2	ν	300,000 - 15,000
31A	H_2	$\bar{\nu}$	200,000 - 7,000
28	H_2-Ne ($\geq$30%)	ν	100,000 - 10,000
53	H_2-Ne ($\geq$50%)	ν	100,000 - 20,000
180	H_2-Ne (-)	$\bar{\nu}$	50,000 (500,000) -
172	H_2-Ne (-)	$\bar{\nu}$	50,000 -
155	H_2	ν	100,000