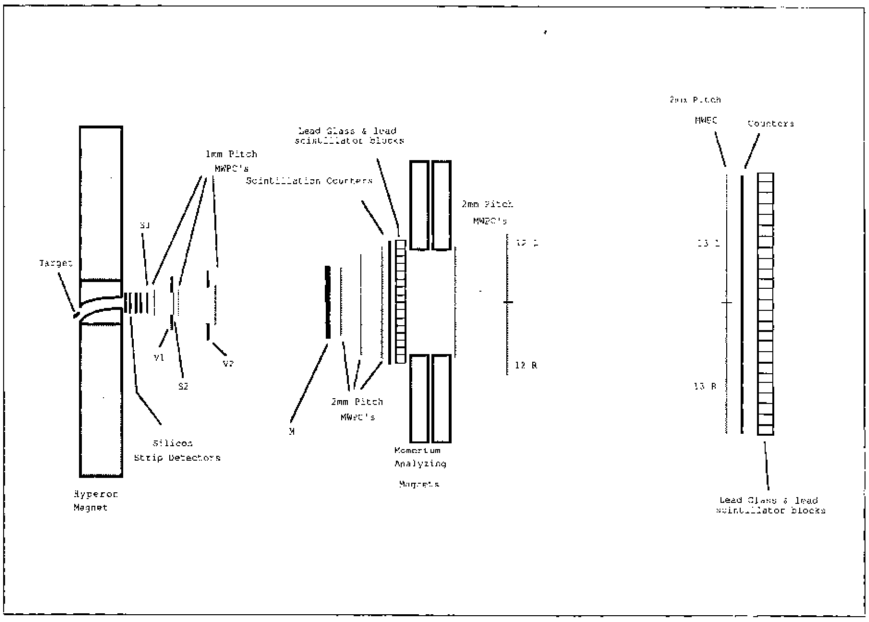
Schematic of the 67m long and 1.3m wide Fermilab hyperon beam spectrometer. Most of the space between detectors is filled with helium bags. M is a multiplicity counter. The last two MWPCs (multiwire proportional chambers) are electronically divided into left and right halves for triggering purposes.



channel magnetically selected the momentum of the negatively-charged secondary particles. The magnetic field was also used to precess the hyperon spins.

A downstream spectrometer, consisting of six 2 mm spacing wire chambers and three 1 mm pitch chambers with 8 planes of silicon strip detectors and scintillators for triggering, picked up hyperon decay products. Photons from the decays were detected by two electromagnetic calorimeters made up of lead glass and lead-scintillator blocks.

Data taking began last August, and by the end of September a sample of more than 20,000 omega minuses showed that the polarization of the particle was too small for a precise measurement of its magnetic moment in the amount of time allotted for the run.

The targeting scheme was quickly changed to give a high energy polarized neutral hyperon beam from primary protons incident at 2 mrad. After collimation, the polarized neutral beam was directed straight at the charged hyperon production target. It took approximately one month to design and install this second stage of the experiment and the data accumulated showed that the technique of passing the spin orientation from the secondary neutral beam to the tertiary charged hyperon beam worked well.

The data will yield high precision measurements of the cascade minus and omega minus polarizations, magnetic moments, decay parameters, and lifetimes. In a preliminary analysis from the first targeting scheme, about 70 million three-track triggers will provide some 10 million cascades and 100,000 omega minuses. Preliminary analysis of the cascade minus polarization is in good agreement with the results recorded by Experiment 620 using 400 GeV beams. Full analysis should give the magnetic moment of the cascade minus to a precision of 1%.

The quality of the data collected in the spin transfer method is similarly high. Approximately 1.5 million cascade minuses and 22,000 omega minuses were produced by the polarized neutral beam, and preliminary analysis shows the particles to be polarized. This will give an initial value for the omega minus magnetic moment. The experiment has been approved to run again, with the goal of measuring the omega minus magnetic moment to higher precision.

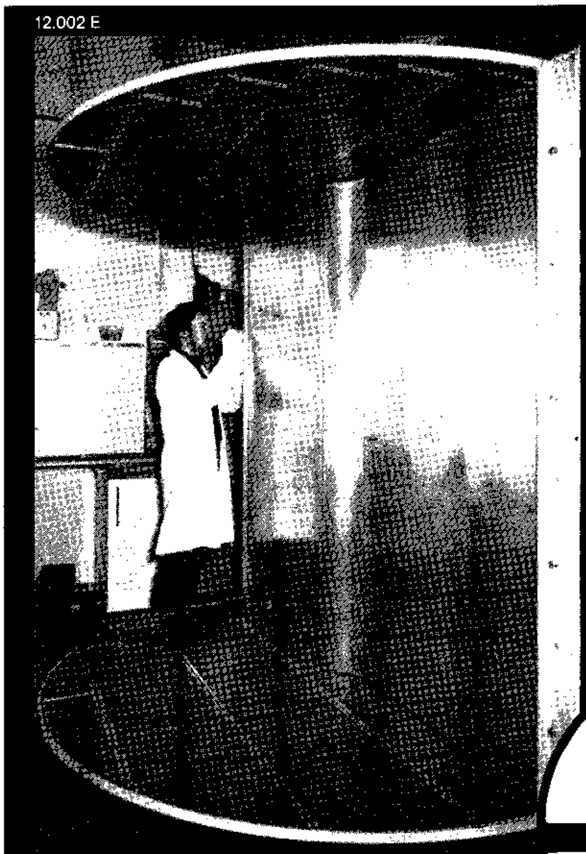
CONFERENCE
Neutrino mass

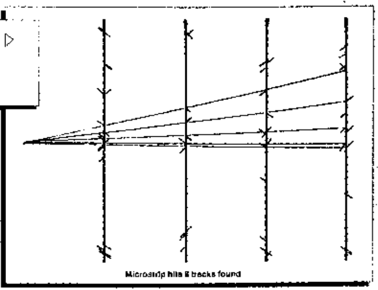
Introduced by Pauli more than fifty years ago as the energy-stealing culprit in nuclear beta decay, the neutrino is the joker in the particle physics pack. Pauli wagered that nobody would ever be able to see it, but lost the bet in Reines' and Cowan's epic feat of detection in the 1950s.

More than thirty years after the first sighting of a neutrino, nobody knows for sure what its mass is. Some cling to the idea of a massless electron-type neutrino (the lightest variant of the particle), others hold out for a small vestigial mass, which makes for some interesting physics.

Interest focused in March on a small international symposium on neutrino mass held at Tokyo University's Hongo campus and organized by Tokyo's Institute for Nuclear Study (Organizing Committee Chairman Sadayuki Kato).

After an introduction by neutrino pioneer Fred Reines of Irvine, the first day of the meeting was given over to reports on precision measurements of the electron-type

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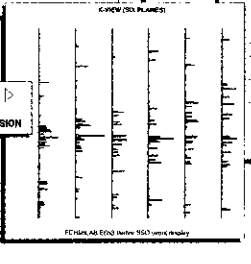
X-VIEW (SIX PLANES)
FERMILAB E653 Vertex SSD event display

(anti)neutrino mass in the beta decay of tritium. ITEP Moscow still hold to 26 electron volts (plus or minus about 20 per cent), while Tokyo INS prefer less than 28 eV, SIN Switzerland less than 18 eV, Los Alamos less than 27 eV, and Munich say 15 (+52-15) eV. Further improvements in accuracy are eagerly awaited.

One neutrino question mark was removed last year with the discovery of double beta decay, where the daughter nucleus is two Periodic Table slots higher than its parent, following emission of two neutrinos (see January/February issue, page 32). Several speakers reviewed progress. A neutrino mass upper limit of about one electron volt coming from double beta decay data is not yet watertight because of insufficient knowledge of detailed mechanisms.

The Japanese Kamiokande underground experiment was able to report its first results on solar neutrinos with energies above 7.5 MeV (see also May issue, page 25), where the signal is a fraction of what is expected from confident predictions of solar neutrino fluxes. This confirms the long-standing results of Ray Davis and underlines the 'solar neutrino puzzle'.

New studies are in the pipeline, including a joint US/USSR effort at the Soviet Baksan neutrino observatory to use gallium, better suited to solar neutrino detection, and two experiments at the Italian Gran Sasso underground Laboratory (see May 1987 issue, page 26).

Yoshio Yamaguchi of Tokai closed the meeting, putting the new results into the chequered context of neutrino history.

From Sadayuki Kato

At the recent International Symposium of Neutrino Mass and Related Topics held at Tokyo's Institute for Nuclear Study, neutrino mass specialists W. Kundig (Zurich) and T. Ohshima (INS Tokyo) compare notes.

NEUTRINOS
Underwater detector

The successes in capturing neutrinos from last year's supernova underlined the usefulness of large underground detectors for this sort of physics, and ambitious new projects are now in the pipeline.

Meanwhile another approach to cosmic neutrino detection, carefully prepared during the past decade, has now taken its first experimental steps. DUMAND – Deep Underwater Muon and Neutrino Detector – aims to use the ocean as the active medium, tracking particles with arrays of photomultipliers picking up the tiny nanosecond flashes of blue Cherenkov light emitted by cosmic particles as they pass through seawater.

Based in Hawaii, the US/Japan/West Germany/Switzerland DUMAND collaboration has successfully deployed its 'Stage I' detector, consisting of a 60 metre string of seven photomultipliers, at depths of up to 4 kilometres in the Pacific west of Hawaii.

About 24,000 cosmic ray muons were recorded, the event rate displaying how the detector string is sensitive out to about 17 metres. In the final detector, neutrinos would be picked up through secondary muons released after collision with a seawater nucleon.

Stage II DUMAND envisages a 20,000 square metre array of nine 330-metre-deep strings each containing 24 sensitive modules. A 4.8 km-deep basin west of Hawaii provides enough depth to screen out most cosmic ray muons (provided the zenith quadrant is excluded), with clear water to ensure good light transmission and minimal biological activity to disturb