FermiNews

Fermi National Accelerator Laboratory

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Searching for the Standard Model Holdout

An international collaboration at Fermilab sets out to observe the elusive tau neutrino.

INSIDE

by Donald Sena, Office of Public Affairs

When two collaborations announced the discovery of the top quark at Fermi National Accelerator Laboratory in 1995, many news outlets erroneously reported that the last remaining piece of the current theory of matter and energy, known as the Standard Model, had been found. What reporters and even a few physicists forgot is that the elusive tau neutrino, while firmly entrenched in the Standard Model, has never been directly observed.

In the early 1980s, there was one minor attempt to find the tau neutrino at CERN, the European Laboratory for Particle Physics, and a few proposals emerged at Fermilab. Unfortunately, the CERN study yielded no data, and

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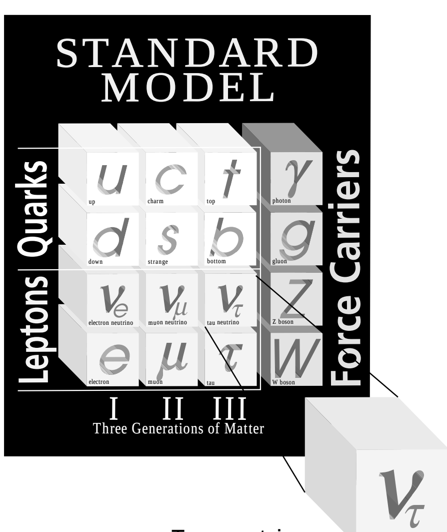


Tau neutrino

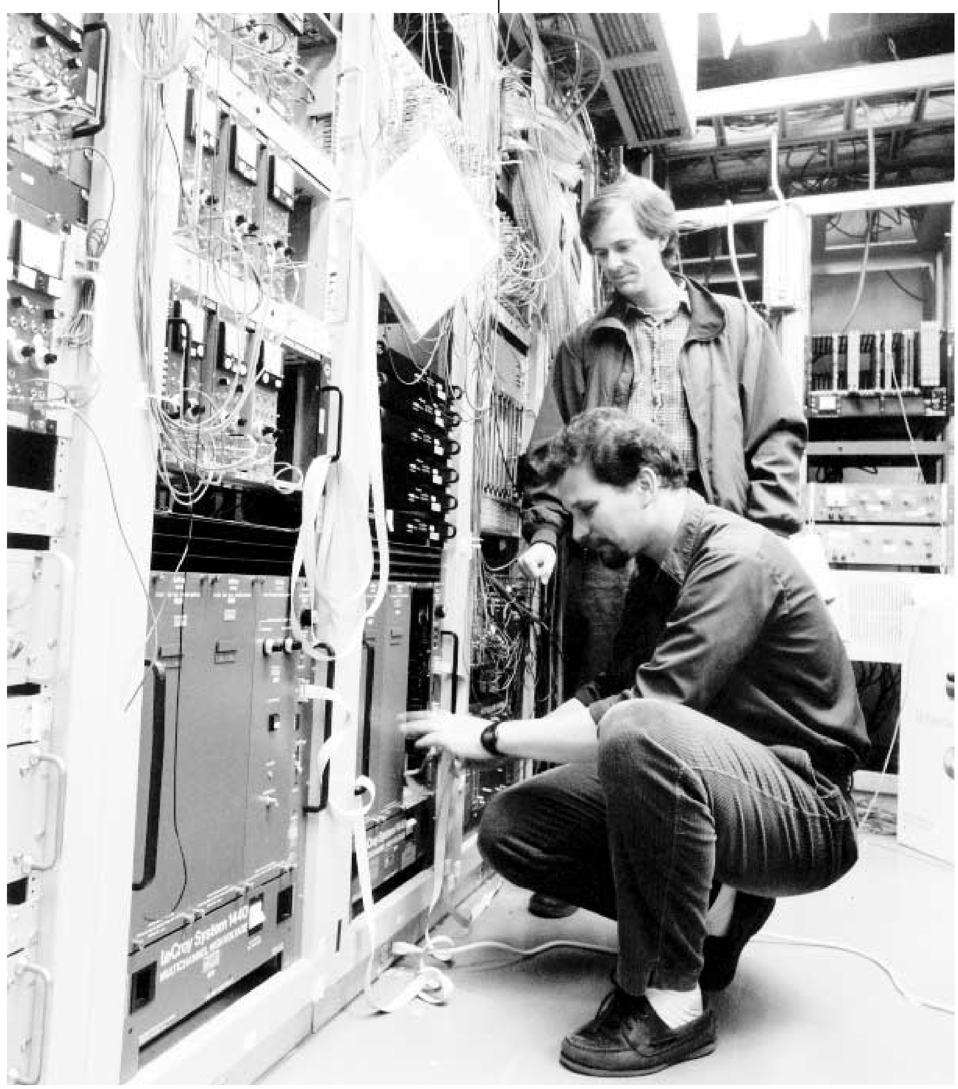
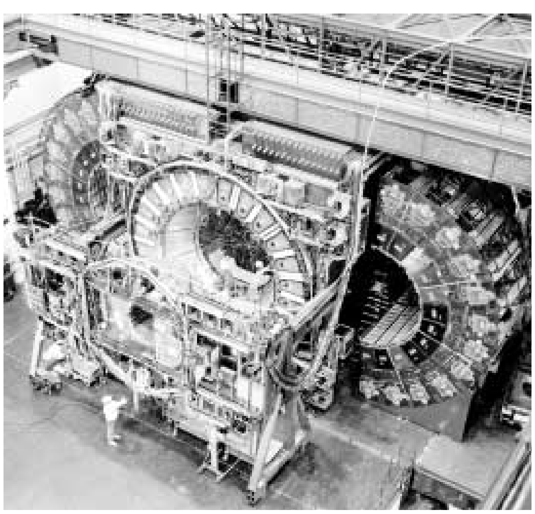


Photo by Reidar Hahn

Vittorio Paolone (kneeling), from the University of Pittsburgh, and Fermilab scientist Byron Lundberg, the cospokesmen for E872, in the experiment's counting room.

Galileo used the landmark leaning tower of Pisa to perform a famous physics experiment. Today Pisa physicists use the landmark Collider Detector at Fermilab (below) for experiments at the new frontiers of physics.



The University of Pisa

by Judy Jackson, Office of Public Affairs

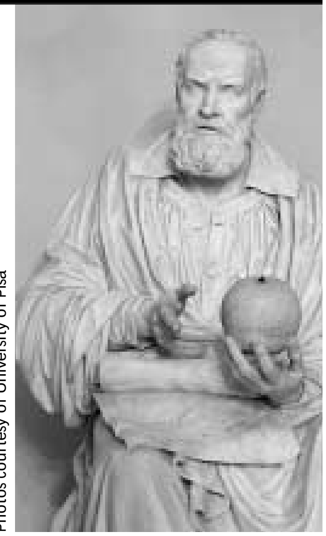
The University of Pisa is not exactly an upstart when it comes to experimental physics. In 1589, a young lecturer at Pisa University performed the most famous physics experiment in history when he began dropping things from the city's landmark leaning tower. Galileo Galilei, the father of modern science, used the tower to investigate the behavior of bodies with different masses as they accelerated to earth. Today, 400 years later, Pisan physicists are still investigating accelerated bodies with different masses; but this time they are observing the behavior of subatomic particles in another landmark locale—the CDF particle detector at Fermilab.

The University of Pisa, founded in 1343, was already a venerable institution by the time Galileo enrolled as a medical student in 1581. (He subsequently changed majors and transferred to the University of Padua, returning to Pisa as a lecturer in mathematics at the age of 25.) In the centuries since, the university has produced many great physicists, although surely none greater than Enrico Fermi, who enrolled as student at Pisa's world-famous Scuola Normale Superiore in 1918. Now, particle physicists from Fermi's first university advance the field of science to which he contributed so much, at the U.S. laboratory that bears his name.

Physicists from Pisa have played a central role in Fermilab's CDF collaboration from its earliest days. Professor Giorgio Bellettini recalls flying home to Italy after a 1979 Photon-Lepton Conference at Fermilab where he and his Italian colleagues had joined in discussions with Fermilab physicists about turning the Tevatron accelerator into a collider, with proton-antiproton collisions at high energy.

"I remember that long flight home, mumbling to each other about whether Fermilab would be able to turn that old Main Ring into an injector for a new machine. Would it work? we wondered. Fermilab had fascinating, intriguing new proposals. Because of those mumbled airplane conversations—and some circumstances at home in Italy—we decided to

Photos courtesy of University of Pisa



Galileo Galilei, University of Pisa physicist

"Pisa as a group brought Italian culture to Fermilab and made all of our lives much richer."

~ John Peoples, Fermilab director

cross the ocean and join CDF. We could have worked at CERN, but the collider program there was already quite advanced. The work at Fermilab looked more daring, more challenging."

From the beginning, the Pisan presence made a defining difference in the CDF detector.

"Pisa has always played an important role in both the intellectual and technical aspects of the CDF collaboration," said Fermilab physicist and CDF collaborator Hans Jensen. "Very early, they brought both technical expertise and insight into the physics. They also established the credibility of CDF. When the project was still in the confidence-building stage, it helped a lot to have Pisa join. Their joining said that both sides were serious about building this detector."

Former CDF spokesman Alvin Tollestrup echoed Jensen's views. "CDF is a much better detector because of the Italians," Tollestrup said. "They brought experience and sophistication from their earlier experience to CDF at a time when we needed reassurance that we really would be able to build such a big, complicated thing."

Much of the critical experience the Pisans brought to CDF came from a previous U.S.-Italian collaboration. From 1968 to 1974, physicists from the University of Pisa and SUNY at Stony Brook worked together on Experiment 801 at CERN. Collaboration members included Bellettini and others from Pisa, as well as Dan Green, Paul Grannis, Hans Jostlein, and Bob Kephart, all now Fermilab physicists.

"So you see how back we date," Bellettini said. "That experiment changed the spirit and size of what you could imagine and build."

After joining CDF in 1980, Pisan scientists joined with physicists from the Italian national high-energy physics laboratory at Frascati to build the detector's steel-scintillator central and endwall calorimeters. The Italians, who had developed great expertise in plastic scintillator technology, produced the scintillating plastic, wave shifters and light guides. They also contributed to the electronics.

"With all the counters, the phototubes, the light pipes and so on that we built, there were 12 navy ship containers that went from Pisa and Frascati to Fermilab," Bellettini recalled.

Collaborating once more, physicists from Pisa and Frascati made key contributions to the geometry of CDF's projective tower calorimeters, which allow direct detection of many of the particles emerging from a proton-antiproton collision.

"Did you ever wonder why the lego plots from CDF look so nice?" Bellettini asked. "The projective tower geometry is a big merit."

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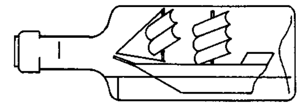

To illustrate the delicacy of the SVX mini-detector-within-a-detector that he advocated, University of Pisa physicist Aldo Menzione included this drawing of a ship in a bottle in the original 1981 CDF design report.

Professor Giorgio Bellettini (plaid shirt), University of Pisa physicist, with CDF physicists Michele Gallinaro, Gino Bolla and Noah Wallace, examining a model of a component of the experiment's silicon vertex detector.

Pisa

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A view of Pisa's Scuola Normale Superiore (through archway, on left) and the adjacent Chiesa di Santo Stefano dei Cavalieri

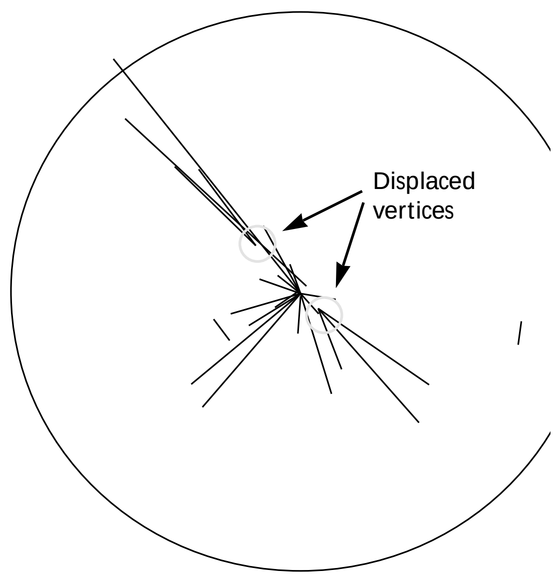
Among the most significant initiatives of the Pisa group was SVX, the silicon vertex detector, the small central detector that has allowed CDF to identify the slightly displaced vertices in particle collisions that reveal the presence of b quarks, an important signal for the identification of top quarks. Although scientists from Pisa, particularly Aldo Menzione, proposed SVX from the beginning, it actually took many years for the collaboration to approve and implement it, as the technology evolved to make it successful.

"From the beginning," Jensen said, "Aldo pushed the SVX. Making it real was a long story, but the Italians believed in it from the start. It was a key factor in the top discovery at CDF."

Bellettini said simply, "SVX was our mania, and it worked out so well." He added that Pisa collaborators also developed the algorithm for detecting the data in the telltale displaced vertex of the *b* quark decay. A Pisa graduate student, Simone dell' Agnello, included the first examples of such displaced vertices in his Ph.D. thesis. Now Pisa collaborators are working on the triggers for the third, and latest, incarnation of SVX, which will operate in Collider Run II beginning in 1999.

Scientists and students from Pisa contribute not only to CDF but to the life of the entire Laboratory. "Pisa is one of the great university groups working at Fermilab," said Laboratory Director John Peoples. "They joined CDF in its earliest stages and contributed immensely to the definition of the detector. Even more important, Pisa as a group brought Italian culture to Fermilab and made all of our lives much richer."

The classic 1911 edition of the Encyclopedia Brittanica describes the Pisans' famous predecessor: "Galileo, the eldest of the Galilei family, was remarkable for intellectual aptitude as well as for mechanical invention." Clearly, he started a Pisan tradition. ■



A computer representation of a proton-antiproton collision as seen by the silicon vertex detector. The displaced vertices reveal the presence of *b* quarks flying off from the center of the collision.

Facility Managers Gather at Fermilab

Head engineers at national laboratories discuss challenges of keeping their facilities operating.

by Donald Sena, Office of Public Affairs

Photos by Reidar Hahn

Bernie Mattimore, from Lawrence Livermore National Laboratory, makes a point during the facility managers' gathering. Pat Smith, from Sandia National Laboratory, looks on.

Facility managers at the nation's laboratories recently gathered at Fermi National Accelerator Laboratory to discuss problems and share solutions to challenges common to large research–dedicated institutions.

Fermilab hosted the facility managers' meeting on April 17–18, as attendees heard reports about engineering innovations, presented overviews of their laboratories and toured Fermilab's latest engineering success, the Main Injector. After Fermilab Director John Peoples welcomed the group, Associate Director Ray Stefanski presented an overview of the scientific mission of the Lab, as David Nevin, head of the Facilities Engineering Services Section, presented an engineering summary of the facilities.

Elaine McCluskey of FESS detailed a major problem confronting Fermilab: structural deficiencies with Wilson Hall. Fermilab has submitted a $33 million "Schedule 44" request for repairs to address structural problems and replace aging plumbing and heating systems in the High-Rise.

As McCluskey described the structural difficulties with the landmark building, one member of the audience said, "It sounds like an architect's bright idea that was forced on the engineers." This remark received an enthusiastic response from the group.

McCluskey explained that the exposed concrete that makes up the two halves of Wilson Hall's distinctive shape "wants to move" in response to temperature changes, but is not designed to do so. The crossover beams were not installed in such a way that they can move when the temperature changes. As a result, stress occurs at the joints between the crossovers and the vertical structure, causing pieces of concrete to break off and fall, especially during times of temperature extremes.

A chunk of concrete that fell through the glass into the cafeteria in 1993 got everyone's attention and forced action to make the building safe. FESS had "diapers" installed at every joint to keep material from falling. At the same time, they commissioned an outside engineering firm to perform a structural analysis of the building's movement, and they installed monitors at many locations to track the movement at the joints.

Ed Murphy of Brookhaven National Laboratory addresses the facility managers, including (left to right) Rudy Bouie of Argonne National Laboratory, John Shaffer of the National Renewable Energy Laboratory and Peggy Williams of Pacific Northwest Laboratories.

Reports

During the course of the meeting, all lab representatives presented their own engineering challenges and success stories. Neil Hartwigsen of Sandia Laboratory spoke of the need to meet the space requirements that his lab's program demands, while keeping up with the maintenance and repairs on those facilities. He said his crew has adopted a "no more, no less" than necessary system when it comes to housing people and equipment and managing space. He also touched upon high–level performance measures his team has been trying to implement into their engineering program.

The Brookhaven National Laboratory facility manager, Ed Murphy, presented what may have been the largest challenge at any of the labs: tritium leaks. Murphy detailed the problems and solutions associated with the tritium concern at Brookhaven, the home to a nuclear reactor. Murphy also said the issue has gotten the attention of at least one U.S. senator, as well as of the local newspapers. ■

Electron, Proton, Bison

April 11: Birth of the first Fermilab bison calf of the 1997 season

1. Mother bison just before birth, with calf's hooves just emerging. Herdsmen do not interfere in normal births.

2. Mother bison licks newborn calf to free it from amniotic sac. The late spring snowfall posed no threat to mother or calf, a herdsman said.

3. Nudged by its mother, the bison calf struggles to its feet. The calf was the first of about 30 expected in the Fermilab bison herd this spring.

4. Twenty minutes after birth, the calf stands on its own.

5. Mothers and calves almost always stay close together in the days after birth.

Photos by Reidar Hahn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Tau Neutrino

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Photo by Reidar Hahn

John Trammel (left) and Dave Ciampa, both from the University of Minnesota, work on the experiment's beamline in the summer of 1996.

Mitsuhiro Nakamura, from Nagoya University, and S. H. Chung, from Fermilab, install the first emulsion module.

Fermilab abandoned its proposals due to cost and other priorities. However, a decade later a small band of scientists from four countries came together and proposed E872, the search for the tau neutrino. The experiment, a part of Fermilab's current fixed–target run, began taking data on April 14 and offers scientists the best chance yet to observe the Standard Model's stubborn holdout.

Gina Rameika, an E872 collaborator, admitted that some particle physicists have said it is not critically important to find the tau neutrino, since they are sure it is right where the Standard Model says it is. However, Vittorio Paolone, cospokesman for E872, said two factors persuaded researchers to go after the tau neutrino. The first, quite simply, is to find the mysterious particle and understand its properties. Moreover, the experiment is a precursor to the Neutrinos at the Main Injector (NuMI) project, the search for neutrino mass. Paolone says it is vital that researchers first directly observe the tau neutrino before they embark on the quest to see if it and the other two neutrinos, the muon and electron neutrino, have mass.

"We felt one should directly observe it, because there could be surprises," said Ken Heller, a scientist from the University of Minnesota working on E872. "History tells us not to take anything for granted."

Neutrino History

Of all nature's building blocks, the subatomic particles known as neutrinos are the most elusive. Neutrinos are hard particles to pin down because they have no electric charge and very little, if any, mass. Wolfgang Pauli first postulated their existence in 1930, and more than 20 years later Frederick Reines and Clyde Cowan reported the first evidence for the particles. In 1962, a group of scientists from Columbia University and Brookhaven National Laboratory performed the first accelerator neutrino experiment and demonstrated the existence of two "flavors" of neutrinos, the electron neutrino and the muon neutrino. [In 1987, Jack Steinberger, Mel Schwartz and Leon Lederman, Fermilab director emeritus, won the Nobel Prize for the discovery.] In 1975, a group of scientists at the Stanford Linear Accelerator, led by Martin Perl, discovered the tau lepton, and subsequent experiments provided strong evidence that there also exists a third species of neutrino, the tau neutrino.

In the 1980s, shortly after the CERN attempt to see the tau neutrino, Fermilab researchers proposed an entire new complex—the Direct Neutral Heavy Lepton Facility—to find the particle. They eventually abandoned the idea. For nearly a decade researchers discussed other ideas for finding the particle, but no solid proposal, or interest, emerged. Then, in 1993 at the home of Fermilab physicists Byron Lundberg and Rameika, a casual dinner conversation begot the current Fermilab experiment.

Rameika was telling Lundberg about the NuMI project, explaining how excited she was at the chance to research neutrino mass—a phenomenon that could help explain a large part of the universe's mass, 90 percent of which is currently unknown.

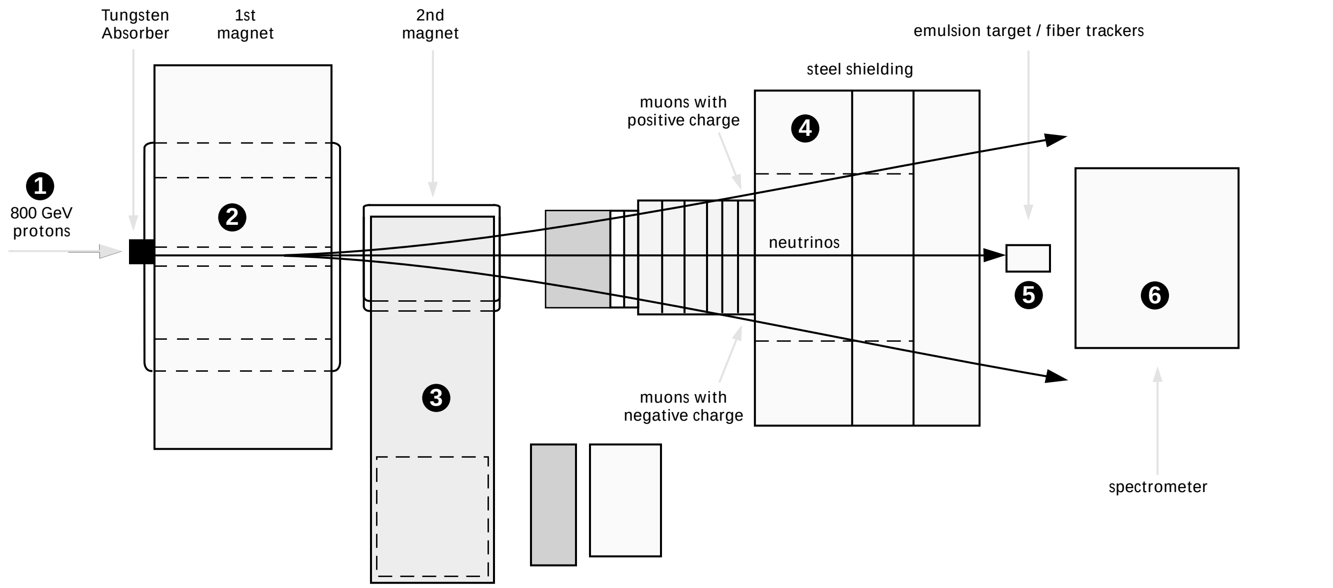
"And Byron said, 'You're right; it's one of the best new topics out there. However, it would sure be nice if someone had seen a tau neutrino,'" Rameika said, recounting the conversation.

Rameika agreed, saying it would be important for researchers first to observe the tau neutrino and its properties so if the particle does strike NuMI's detector, scientists will know what it looks like.

Rameika queried her husband about how one would go about conducting a tau neutrino search, and the next night Lundberg brought home an old memo from Experiment 653, which Lundberg had worked on in the mid '80s with a team from Nagoya University in Japan. E653 searched for *b* particles using emulsion for high–precision tracking. At one point, the collaboration proposed using a similar technique for finding tau neutrinos, but "no one picked up on it, and it fell by the wayside," said Rameika.

Two days after the dinner conversation, Lundberg calculated a way to observe about 100 tau neutrinos in an experiment. Lundberg and Rameika shared the idea for a tau neutrino search with other scientists, including Niwa Kimio from Nagoya University. Over the course of 1993 and early 1994, a collaboration formed and proposed an experiment for the fixed–target run scheduled to begin in 1996—a late addition to the series of experiments already approved.

The Tau Neutrino Beamline and Detector



Building the Beamline

The late proposal and approval of E872 put the study behind the other fixed–target experiments; mechanical and technical support didn't arrive until the others had completed their beamline and detector construction. Along with the late setup, the E872 team had the additional challenge of building a complex, nontraditional beamline configuration.

Due to their properties, neutrinos zip through all material with very few interactions to speak of. To see even a scarce few of these interactions, experimenters need a tremendous number of protons to produce an equally tremendous number of neutrinos. Just how many? When complete, the experiment will have produced 100 trillion neutrinos, 95 percent of which will be muon or electron neutrinos. Of the remaining five percent of tau neutrinos, the detector will record fewer than 100 events.

"You have to produce [tau neutrinos] by brute force," said Lundberg, cospokesman for E872.

The protons, accelerated to 800 GeV by Fermilab's Tevatron, speed down the beampipe, crashing into a tungsten beam absorber. The interactions of the protons with the tungsten produce many unneeded particles, most of which are quickly absorbed. However, protons interacting with the tungsten also create all three flavors of neutrinos as well as muon particles, which the absorber can't stop, allowing them all to hurtle toward the detector. Muons, which can have a positive or negative charge, would flood the detector and, in essence, make it blind to neutrino interactions. Thus, the primary design feature of the beamline involves keeping the muons out of the detector, while capturing as many neutrinos as possible (see diagram above).

Another factor for the beam designers was keeping the proton beam as "clean" as possible, as the protons speed down the pipe. Any interaction of protons with devices in the pipe can also produce the dreaded muons. To prevent this, the experimenters designed an unusual beamline that runs without any beam monitors—common devices used in most other high–energy physics experiments to position the particle beam in the beamline. The E872 team must first run the proton beam at low intensity while using monitors, tune it to their required parameters, remove the monitors and crank up the intensity—flying blind, in essence.

The second unusual beamline design feature is the proximity of the detector to the beam dump. The emulsion detector is only 36 meters away from the tungsten dump, considerably closer than

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1. Protons hit the tungsten "absorber."
2. The absorber and the steel in the first magnet absorb most of the particles produced when the protons hit the tungsten; only the muons and the three flavors of neutrinos continue.
3. The muons and neutrinos go through a second magnet; this magnet sweeps the muons on a different path from the neutrinos, which continue straight ahead as they have no charge and are not affected by a magnetic field.
4. About 15 meters of steel shielding absorb any low–energy muons.
5. The three flavors of neutrinos then hit the emulsion interwoven with the scintillating fiber trackers, leaving their tell–tale tracks.
   The second magnet steers the muons to miss the emulsion by about one and one-half meters on each side, depending on the charge of the muons.
6. Finally, the neutrinos hit the spectrometer, producing further data on the interactions.

Tau Neutrino

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in all other fixed–target experiments. Why so close? Neutrinos tend to spread out as they move forward—like the light from a flashlight—so a detector must be as close as possible to capture them. However, the detector must still be far enough away to let muons pass to either side and not flood the sensitive emulsion. Because muons have a charge, a magnetic field can steer them away, while the chargeless neutrinos remain unaffected by the field and continue straight ahead into the detector.

Due to the special beamline design considerations, the researchers needed about four months to debug the beamline. Lundberg said when experimenters first tested the line, they had 20 times more muons in the detector than they wanted; they have since knocked that number down to acceptable levels. The result of the laborious design specifications gives the collaboration the best chance to see tau neutrinos.

Detector Overlap

The experiment's detector layout consists of three components: an emulsion target, conventional spectrometer and scintillating fiber trackers. Emulsion, an older particle detection technique that is like photographic film, is the critical part of the detector; particles traverse the emulsion and leave tracks as they go through. Interwoven with the emulsion are scintillating fiber trackers that use light to capture information about the particle, such as its momentum and position. The last stage of the detection components is the array of drift chambers, which are common to most high–energy physics experiments.

While many fixed–target experiments can process and analyze data as it is collected, the tau neutrino scientists have to wait for awhile to see if they have success. The researchers must complete the full run before removing the emulsion modules. While scientists in the United States will analyze most of the data in the standard electronic detectors, Japanese collaborators will take the emulsion back to Japan for development, processing and analysis of its contents. Only by analyzing and comparing the information in all of the detectors will the scientists know if they have the tau neutrino in their grasp.

Rameika said she expects the collaboration will see the stubborn particle. Since they started later than expected, researchers will receive fewer protons than they had planned. Originally Lundberg and Paolone hoped to see 200 tau neutrinos; now they expect to see about 90. However, with data streaming into their detectors and the muon rates staying low, collaborators are getting eager.

"I think there is little doubt that we will see it; the question is how many of them are there? There is some excitement brewing here," said Lundberg. "We should see the first one in about 18 months or so." ■

Photos by Reidar Hahn

Bruce Baller, an E872 collaborator from Fermilab, in the experiment's control room.

At the E872 experimental hall, researchers can sometimes be found here catching up on some sleep or relaxing after a 12-hour day.

The recipe for tau neutrinos

First, you send protons hurtling down the beampipe and smash them into a "beam absorber" made of tungsten. The relatively rare D_S (pronounced D sub S) particles emerge, among other particles. The D_S can decay into a tau and a tau neutrino; the D_S can also decay into other "things" plus a tau neutrino. So, for every D_S produced, you have two ways to get a tau neutrino. However, the problem lies in the fact that neutrinos rarely interact with matter; as a result, you must use a large number of protons to get a large number of tau neutrinos.

This experiment will produce a total of 100 trillion neutrinos; of those, the detector in E872 will see fewer than 100 tau neutrinos.

Chez Léon

MENU

Lunch served from
11:30 a.m. to 1 p.m.
$8 / person
Dinner served at 7 p.m.
$20 / person

For reservations call x4512
Cakes for Special Occasions
Dietary Restrictions
Contact Tita, x3524

Lunch
Wednesday
May 7

Chicken, Rice and Vegetables
Rolled in Seaweed Paper
Orange Ginger Flan

Dinner
Thursday
May 8

Fruit of the Sea Salad
Orange and Honey Grilled
Pork Tenderloin
Spring Vegetable Medley
Citrus Cake
with Pomegranate Syrup

Lunch
Wednesday
May 14

Indian-spiced Turkey
with Rice and Mango Salad
Lemon Sorbet with
Lemon Squares
and Raspberry Sauce

Dinner
Thursday
May 15

Roasted Vegetables
with Balsamic Vinaigrette
Medallions of Beef
with Herb Crust and
Cabernet Sauce
Wilted Greens
Crepes with
Grand Marnier Sauce

Fixed-Target Updates April 19—April 28

Collaborators provided this update on fixed-target experiments.

E799 / E832 KTeV "Since KTeV switched over from E799 (rare decays) to E832 (epsilon-prime) running mode in early April, we have made many improvements on efficiency in detector performance, trigger and data taking.
As a result, we are getting a factor of two improvement in overall two-pion yields per week from long–lived kaon decay, when compared with the fall running in 1996. We had a small cooling water leak in our large vacuum system, but it got fixed on April 24 during a 12–hour downtime. In the first off–line look at the E799 rare decay data we just took, the hyperon working group has revealed a new cascade beta decay mode quite cleanly, which has never been discovered before," said Bob Hsiung, KTeV cospokesman.

E866 NuSea "E866 has now switched to measuring the yield of very forward muon pairs from solid targets. The data taking is progressing smoothly," said Chuck Brown of Fermilab.

E835 Charmonium "E835 is taking data at energies below transition to study the parameters of the eta_c resonance, the ground state of charmonium. The efficiency of the deceleration of the antiproton beam below transition has improved. So far we have collected over 5 pb^{-1} of integrated luminosity at the eta_c," said George Zioulas of the University of California at Irvine.

E781 SELEX "The SELEX crew is hard at work in software development. Data-taking is going smoothly, with the major emphasis on improving operating efficiency. The analysis group is continuing the effort to verify and improve the charm-finding code.
This is a non-trivial job, as lots of other experiments know well. We continue to make progress," said Jim Russ.

E862 Antihydrogen "E862 has not been taking data for the last few weeks. Instead, we have been modifying our apparatus to increase the angular range over which it is able to detect antihydrogen atoms. The modifications will increase our geometrical acceptance by approximately a factor of three.
We expect to be taking data with the modified equipment by May 1, said David Christian of Fermilab.

E815 NuTeV "We're approaching 2E18 protons on target and are otherwise running smoothly," said Bob Bernstein of Fermilab.

E872 Donut The collaboration began taking data on April 14. See story on page one for details on the search for the tau neutrino.

E831 FOCUS "E831 / FOCUS is running at full steam and collecting a large sample of charmed events each day. The detectors continue to perform well and according to their building specifications. No major problems are encountered in the data taking and the conditions remain stable. The vertex detector and target microstrips have efficiencies of 99 percent. The expressline—our real time reconstruction monitor —provides daily evidence that we are on our way to achieving our goals. What we need is stable beam and continued good Tevatron performance. We can state that the experiment is in full bloom and juicy charm fruits will be soon available," said Silvano Sala.

E871 HyperCP "Basically, we are running smoothly and taking data," said Craig Dukes from the University of Virginia.

CLASSIFIEDS

FOR SALE

■ ’90 Volvo - Model 240, good condition, runs well, serviced every 6 months. Tuned up April 21, body in good condition, 108k miles Blue Book price $5,000. Best Offer - Call (708) 579-1266.

■ ’79 Suburban, 89k miles, purchased new, complete maintenance record, $2,500. David Raske 630-690-9637.

■ ’87 Winnebago motor home, Ford 7.5 liter eng., 64k miles, 24.5 ft, sleeps 5, self contained, furnace and air, excellent condition inside & out— ready to go. $12,000 call Jackie, x3027 or Joe (630) 932–1450.

■ Dome Tent Timber Top 11' X 9' w/ a queen size air mattress and 12 volt air pump. New last year, total package was $ 170.00. Used 2 weeks last summer now all for $ 110. 250,000 BTU Propane space heater w/ 40 lb. tank, $ 115. Call Jim at x2205 or e-mail tweed@fnal.gov.

■ Golf club, McGregor V.I.P. titanium driver w/ excel lightweight graphite shaft. Like new condition. Asking $165. Jack Mateski, x2812.

■ Kodak DC50 Digital camera, like new in original packaging. $500. Dean Validis, x3700 or (630) 279-7056 evenings.

■ Johnson Outboard Motor 9-1/2 HP rebuilt in ’95 $500 obo; 16 ft. Fiberglass DuoMarine Boat needs work, hardware already removed and rough sanding completed, $150 obo; Compaq Tech PC Case with Monochrome built in monitor currently has a 286 in it, $50 obo; Compaq Deskpro Computer w/ monochrome monitor, $25 obo; IBM 5150 desktop w/ monochrome monitor, $25 obo; Ski’s - Atomic Arc 195 Salomon 547 Sport Bindings, size 12 US or 13 EU Trappeur 2000 boots. Have ski and boot bag, $200 obo. Contact Terry, x4572 or skweres@fnal.gov.

FOR RENT

■ 2 bedroom apartment in duplex, includes garage, large yard, quiet street, all new, 10 min. from Wilson Hall. Contact Alan Baumbaugh, x4044, or (630) 851-4829, or Baumbaugh@fnal.gov.

CALENDAR

MAY 9

International Film Society Presents:
Anne Frank Remembered, UK/USA (1995), 122 min. Director: Jon Blair

Jon Blair’s Academy Award-winning documentary chronicles the daily life of the Frank family as they hid from the Nazis in Amsterdam with a detail that never sensationalizes, and gives a fresh perspective to the martyred teenager, Anne Frank. It assembles rare documentary footage and moving interviews with the survivors. Narrated by Kenneth Branagh. Diary excerpts read by Glenn Close.

MAY 19-23

National Bike To Work Week

LAB NOTES

Summer Day Camp

There are still openings in all three sessions. For more information contact the Recreation Office at x2548, or x5427 or jeanm@fnal.gov.

Scuba Lessons

Every Tuesday 5:30 - 9:00 p.m. at the Users Center and Village Pool. Cost is $125. Student provides mask, fins, and snorkel. Registration forms can be picked up at the Recreation Office or copied from the web, http://www.fnalpubs.fnal.gov/benedept/recreation/recreation.html. Deadline for registration is May 9. For more information contact the Recreation Office, x2548 or x5427.

Swimming Pool Memberships

Pool membership is open to Fermilab employees, visiting researchers, eligible contract personnel and their immediate families. The pool will open Memorial Day Weekend, May 24 at Noon. Applications are available in the Recreation Office.

Season rates: single, $30; family (up to 4), $60; each additional family member, $5 (spouse, dependent child residing in the same household); children 2 and under do not require a pool tag.

Daily and guest fees are $3/day. Guests must be accompanied by a Fermilab employee.

POOL HOURS:

Weekdays:	1 p.m. - 8 p.m Family swimming
*new hours:	Noon - 1 p.m. Adult Lap swimming
Weekends:	Noon - 7 p.m. Family swimming
Holidays:	Noon - 5 p.m. Family swimming
All other hours	pool closed

Children’s Swimming Lessons

Fermilab offers children’s swim lessons on Monday, Wednesday and Friday. Beginners classes are from 10:45 a.m. until 11:30 am and inter-mediate classes from 10:00 a.m. until 10:45 a.m. Children in the beginners class must be at least 42" tall or five years of age. Class is first come, first serve. Cost is $20/session. Enrollment is limited to one session. Applications will be available beginning May 1 in the Recreation Office, WH15W. Session I: June 16 - July 18; Session II: July 21 - Aug. 22.

SEWS Testing

The Sitewide Emergency Warning System (SEWS) is scheduled for re-testing on May 6 at 10 a.m.

In areas that experienced problems in the previous test, the ES&H Section is seeking help from other divisions/sections in verifying the correct functioning of their emergency warning units. This should be accomplished by assigning individuals to listen for the warning at a representative number of units, then reporting the results to their Safety Officer. As with all SEWS tests, cancellation could occur in the event of severe weather or an actual emergency. Any questions please call, Bill James x8901.

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The deadline for the Friday, May 16, 1997 issue of FermiNews is Tuesday, May 6.

Please send your article submissions, classified advertisements and ideas to the Public Affairs Office, MS 206 or E-mail: ferminews@fnal.gov

FermiNews welcomes letters from readers. Please include your name and daytime phone number.

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