

F E R M I N E W S

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DIGGING IN 10

Photo by Reidar Hahn

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INTERACTIONS

Communicating particle physics
in the 21st century

TIME for Communicators TO CATCH UP

*If large collaborations
can achieve one goal,
why can't labs speak
in harmony?*



by Neil Calder
Director of Communications
Stanford Linear Accelerator Center

MENLO PARK, Calif.—In high-energy physics, we are accustomed to dealing with paradoxes. We build huge detectors for tiny particles. Studying the infinitesimally small contributes to our understanding of the farthest reaches of the universe.



SLAC photo

Neil Calder

But we have created for ourselves a paradox that produces internal friction and heat, yet precious little light. Although we are outstanding collaborators, we don't communicate with a unified voice.

Competition between labs is a healthy thing that drives the standard of machine performance and detector efficiency ever higher, and has never precluded excellent collaboration between competing labs. However, a good story can only be made better for the media by a dose of rivalry. They will always seek it out.

From the UA1 and 2 at CERN in the 1980s; ZEUS and H1 at DESY; DZero and CDF at Fermilab; CERN's LEP experiments; BaBar at SLAC; Belle at KEK, and the massive LHC experiments, HEP has set new standards in international collaboration. All these detectors are monuments to our ability to work constructively together. Physicists take to collaboration like ducks to water; they are more at home in it than out of it. The Web germinated in a hothouse of collaboration, and now computational grid technologies are riding on the data infrastructure established among HEP institutes.

If our enviable skill lies in mixing powerful collaboration cocktails, why has this skill been largely ignored by the media, while our rivalries have been highlighted? Collaboration requires communication, and the physics community has shown the way. Unfortunately—and herein lies the paradox—in this respect the communications functions of the major centers have been slow to catch up. As the field became increasingly international, and collaboration was woven into its fabric, the labs' communication offices generally missed the trend and continued to trumpet the success of individual labs. That was, and is, a mistake.

All our experiments are international, and experimental results are frequently confirmed by other groups. Clumsy communication, spotlighting the work of

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High-energy physics collaborations number in the hundreds, exemplified by CDF at Fermilab (above), and BABAR at SLAC (below). "Collaboration requires communication, and the physics community has shown the way. Unfortunately ... the communications functions of the major centers have been slow to catch up."

an individual laboratory rather than the wider community, is definitely unwise. Particle physics is defined by extensive and successful collaboration. Particle physics communication must meet the same high standards.

The first steps have already been taken.

Fermilab's Judy Jackson was the catalyst for regular meetings of the heads of communications from the world's leading particle physics labs. Berkeley, Brookhaven, CERN, DESY, Fermilab, Gran Sasso, Jefferson Lab, KEK and SLAC are all represented in this group, currently named the International Committee for Science Communication (ICSC).

Almost all our labs are involved in the LHC, and clear communication among all partners is vital. The future Linear Collider will be an international initiative from the start, and an International Linear Collider Steering Group is already being set up. A unified communication strategy among participants is absolutely essential. The next meeting of ICSC will be held during the July ICHEP conference in Amsterdam. Already on the agenda are proposals for pooling resources and aligning our communications activities. It's about time!

Thus, things are moving internationally. What about within the U.S.? In January 2002, the HEPAP long-range planning group published its plan for the next 20 years of particle physics. This plan outlines an exciting program with elements (a Linear Collider springs to mind) that will demand tight teamwork inside the American HEP community. The communications offices in our laboratories



must step up common projects to create a unified voice of particle physics. DOE PULSE (www.oml.gov/news/pulse) has set a good example to speak with one voice for all the DOE labs.

Meanwhile, Fermilab and SLAC communications offices are already moving as a team. An HEP news web space, "Interactions.org," will launch in June and be followed by further joint activities. Perhaps the time is ripe for a collaborative print publication for HEP in the U.S.? The future in communications is not lab-based, but cross-national and international. ☎

Beam Me Up

With **FIRST BEAM** and a **topped-off detector**, **MiniBooNE** gets ready to **GO**

by Mike Perricone

In science, once is not enough. One result isn't proof. An experiment must be repeatable: someone else must be able to achieve the same result.

The "mini" in MiniBooNE is deceptive. There's nothing small about the stakes for this short-baseline neutrino oscillation experiment at Fermilab, now mere weeks away from taking its first data. Marking the completion of its detector with a final cup of ultra-pure mineral oil—the last of 250,000 gallons of this translucent liquid—MiniBooNE is about to start the quest to repeat the landmark result of the Liquid Scintillating Neutrino Detector at Los Alamos National Laboratory.

LSND was the first accelerator-based experiment to produce evidence of neutrino oscillations. Confirming that result—nailing down accelerator-produced neutrinos that change from one flavor to another—would also indicate the existence of an additional flavor or type of neutrino, beyond the three now known. A fourth neutrino would represent another crack in the Standard Model of particle physics, and a milestone and challenge for particle physicists.

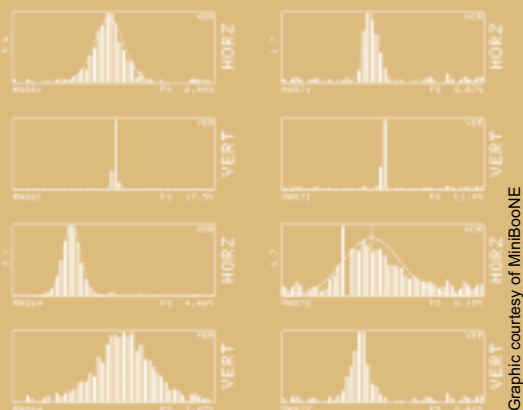
"It's crucial to verify that result with MiniBooNE," said experiment co-spokesperson Bill Louis, a member of LSND at Los Alamos during its run from 1993 to 1998. "My biggest hopes for MiniBooNE would be that it runs well, takes lots of data, and provides a definitive test of the LSND evidence for neutrino oscillations."

The MiniBooNE beam came to life in late April, with a stream of particles originating in the Booster accelerator and traveling about three-fourths of the way down the 680-foot beam pipe to a temporary target. The attempt began late on April 26, with first beam recorded at 4 a.m. on April 29. Beam was halted on May 6 to begin work on what's called "hot handling" of the horn, the device that will be used to focus and direct the intense particle beam onto the permanent target for neutrino production.

"Intense" might actually be an understatement in describing the beam.

"In one year," said Craig Moore of the lab's External Beams department, "we will transport more beam at MiniBooNE than we did in all 17 years of the Fixed-Target Program at Fermilab. It's a very intense beam."

To control the beam, External Beams has built two concepts into the MiniBooNE operation. The first is "auto-tune," an automated tuning program to keep the beam properly positioned inside the beam pipe. The second is



Profile of the first particle beam to reach the temporary absorber in the MiniBooNE beam line.

On the Web:

MiniBooNE

www-boone.fnal.gov

About Neutrinos (for the public)

www.nevis.columbia.edu/~conrad/nupage.html

Liquid Scintillating Neutrino Detector

www.neutrino.lanl.gov/LSND/

Los Alamos National Laboratory

www.lanl.gov



Photo by Reidar Hahn

Fermilab Deputy Director Ken Stanfield (right) pours the ceremonial final cupful of oil into the MiniBooNE detector, assisted by Eric Hawker of the University of Cincinnati. Looking on are Jennifer Raaf, also of the University of Cincinnati, and co-spokespersons Bill Louis of Los Alamos National Lab, and Janet Conrad of Columbia University.

“e-berm,” an electronic monitoring system intended to help minimize beam loss. Earthen berms are built over accelerators to absorb particles from beam loss; “e-berm” aims at limiting the need for an earthen berm by limiting losses. The concept has been used before at the lab, but this system is an entirely new one developed by Beams Division specialist John Anderson. The system uses toroid magnets for measurements, one at the beginning of the beam line and one at the end. If the measurements are the same at both ends, the beam is intact; if not, beam losses are immediately tracked down and corrected.

Getting the beamline in shape was not without its adventures.

“For some reason, the magnets we installed still had acid inside the lines from their initial cleaning,” said co-spokesperson Janet Conrad of Columbia University. “The Low Conductivity Water (LCW) group worked day and night to flush them so that we could bring up the beamline. Members of MiniBooNE pitched in doing ‘water shift,’ too. It was a good collaboration between us and the lab—the LCW group are really good guys. We

really owe them a lot of thanks. They probably saved us three weeks by working so hard.”

Through mid-June, MiniBooNE and External Beams will study and tune the beam, de-bug the instrumentation, and develop the process of moving the focusing horn in and out of the target area. Then the temporary target will be moved out, and beam will be sent all the way down the line to the horn and permanent target to produce the experiment’s first accelerator-generated neutrinos. In its operational stage, MiniBooNE will produce neutrinos by drawing on the 8 GeV beam from the revamped Booster accelerator, the third component in Fermilab’s accelerator chain after the Cockcroft-Walton pre-accelerator and the linear accelerator (LINAC).

With the detector completed, MiniBooNE has already begun tracking cosmic ray events. But first, collaborators took a break to celebrate.

“What did we feel when we topped off the detector? Tremendously happy, excited, and relieved,” said Conrad. “Jennifer Raaf [of the University of Cincinnati] called me the night the



Photo by Jenny Mullins

Clockwise, from top left: Scientists and technicians gathered for the MiniBooNE top-off celebration; co-spokesperson Bill Louis (right) gets a charge from examining the beam report with (from left) Gordon McGregor, Richard Van de Water and Geoff Mills of Los Alamos; crew members gather outside the MiniBooNE detector building; co-spokesperson Janet Louis shares a toast with Taiji Yamanouchi, head of program planning at Fermilab.



Photos by Reidar Hahn

detector was finally full. It must have been about 9 p.m. She was ecstatic to be finished. The oil fill work was grueling, messy—and in February, it was cold. She and the other ‘oil sheiks’ did a great job.”

The Cincinnati group had been responsible for testing the oil and filling the 12-meter diameter sphere (about 40 feet) with its 1,550 photomultiplier tubes. It was the culmination of months of effort, pumping oil from tanker trucks that in turn had been filled from railroad tanker cars delivering the purer-than-food-grade oil to the Fermilab railhead. At the celebration on May 3, Deputy Director Ken Stanfield poured the honorary final cupful of oil into the plumbing through a bright red funnel.

“The top-off happened at the same time as our first beam into the MiniBooNE line, so we had lots of parties all at once,” Conrad said. “We started on Thursday with the Beams Division champagne toast. That was very classy and a lot of fun. The next day we had the detector top-off party at the detector hall. Jesse Guerra [of the Mechanical Department] brought balloons that we tied to the muon tracker. And then in the late afternoon, we had the Wilson Hall party. It was a good two days for MiniBooNE.”

There were toasts for jobs well done all along the way: Princeton University for mounting the photomultiplier tubes; Louisiana State University on instrument calibration; the University of Cincinnati on the oil procurement and transfer; Indiana University on the data acquisition system (DAQ); Columbia University, Embry-Riddle Aeronautical University and Bucknell University on the PMT testing; the University of Alabama, University of Michigan, University of Colorado, and University of California-Riverside on software, and Fermilab on the tank construction.

Now MiniBooNE, initiated in 1997, is back to focusing on the future, anticipating final beam tests and then the first neutrino results later in 2002. Those results could lead to an expanded effort, the full-fledged Booster Neutrino Experiment (BooNE) with a longer beam line.

“We’ll run MiniBooNE for at least two or three years,” said Louis. “If indeed we verify the LSND signal, then we’ll want to build a second detector at a different distance. That will be the full BooNE experiment, with which we can make precision measurements of the neutrino oscillation parameters.

The world is watching to see what MiniBooNE will find. ☺

Los Alamos offers a critical link to MiniBooNE—and to Fermilab

The evidence for oscillations from the Liquid Scintillating Neutrino Detector at Los Alamos National Laboratory was the starting point for the science of MiniBooNE.

“The concept of MiniBooNE was born out of our connections with high energy physicists after LSND found such an exciting effect,” said Bill Press, Deputy Laboratory Director for Science and Technology at Los Alamos. “It was clearly necessary to check the LSND results. By working at higher energies at Fermilab, the signal for new physics should be much stronger. This natural evolution will—I hope—lead to the discovery of new physics beyond that discovered by SuperKamiokande [in Japan] and the Sudbury Neutrino Observatory [in Canada].”

Los Alamos Physics Division Leader Susan Seestrom cited LSND as an important component of the lab’s LAMP nuclear physics program, and called the potential for MiniBooNE to confirm the LSND results very exciting.

“I am intrigued by the possibility that a combination of neutrino and anti-neutrino running with MiniBooNE could point us toward CPT violation as a mechanism for reconciling the solar neutrino and accelerator neutrino data,” Seestrom said.

Los Alamos has offered crucial support throughout the construction of the neutrino experiment at Fermilab.

Many of the MiniBooNE detector’s photomultiplier tubes were originally used at LSND, as were some of the electronic components. The LANL group at Fermilab (Vern Sandberg, Geoff Mills, Richard Van de Water, Richard Schirato, Jan Boissevain, Ben Sapp, Camilo Espinoza, Neil Thompson, Gerry Garvey, Hywel White, and experiment co-spokesperson Bill Louis) made critical contributions to the phototubes, electronics, DAQ, oil plumbing and detector design.

In addition to MiniBooNE, Los Alamos has longstanding ties to the Drell-Yan experiments at Fermilab, studying quark effects in nuclei, and is part of the upcoming E906 experiment, designed to measure anti-up / anti-down quark distributions. Recently, Fermilab transferred 400 kg of excess beryllium (worth about \$80,000)

to Los Alamos to provide a 20 percent increase in the performance of a new Ultra-Cold Neutron source under construction at the laboratory.

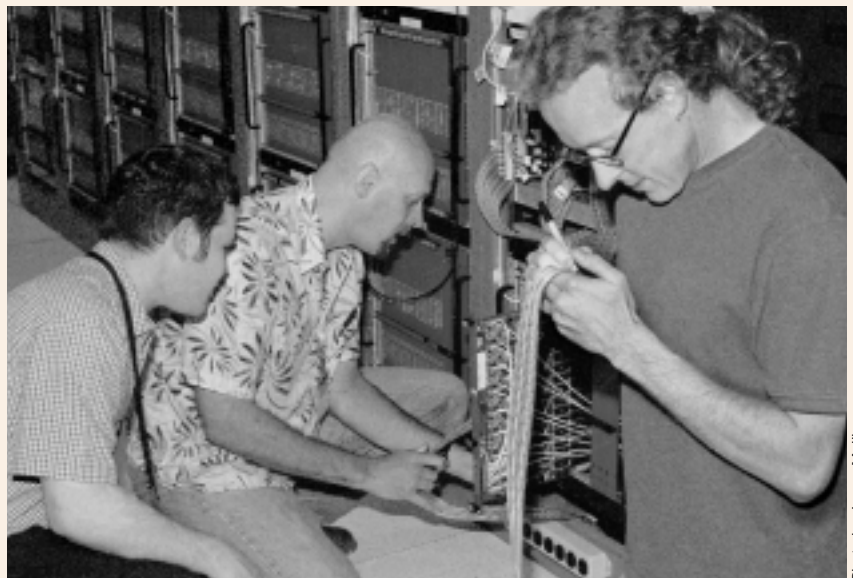
The Advanced Hadron Facility, a central capability in LANL’s future plans for nuclear stockpile stewardship, draws on the expertise in accelerator technology from both Los Alamos and Fermilab. The labs are working closely on magnet design for the AHF. Recently, Los Alamos also became a participant in the Sloan Digital Sky Survey, with the telescope located in nearby Apache Point, New Mexico.

“Cross-disciplinary research makes possible breakthroughs in our understanding of Nature that can’t be achieved in other ways,” Press said. “The connection between Los Alamos and Fermilab through MiniBooNE and the Sloan Digital Survey are good examples of both labs trying to foster the connections between different disciplines. After all, everyone is interested in studying physics at the frontiers—we just use different tools to probe that physics from various angles. This type of synergy between nuclear and high energy physics, and between the laboratories, benefits all of us.”

Seestrom said that, as a national security laboratory, Los Alamos placed a high priority on maintaining strong connections to areas of leading edge basic research.

“The distinctions between nuclear and high-energy physics are becoming increasingly blurred,” she said. “This often becomes an obstacle in funding the best scientific work. It is gratifying when an experiment straddling this line can work as well as MiniBooNE has.”

—Mike Perricone



Gordon McGregor (left) and Richard Van de Water of Los Alamos examine MiniBooNE electronics with Morgan Wascko of Louisiana State University.

Photo by Jenny Mullins

THOSE

Formerly endangered,
these natural engineers
are plentiful in Illinois—
and on the Fermilab site



Rod Walton checks a beaver habitat
on the Fermilab site.

On the Web:

[www-ed.fnal.gov/
entry_exhibits/beaver/beaver.html](http://www-ed.fnal.gov/entry_exhibits/beaver/beaver.html)

'DAM' BEAVERS

by Rod Walton
Fermilab Facilities Engineering Services Section

Along with bison, beavers typify the movement west by Americans during the mid-1800s. Along with bison, beavers were there first.

Pioneers found beaver colonies along virtually all the streams and rivers in the plains, including Illinois, and soon professional trappers followed to reap the rich harvest of hides to satisfy the appetites of Easterners and Europeans. Hides were used for vests, trimmings, and most importantly, top hats.

Before that time, Native Americans held the beaver in high regard. An early Indian word to describe the trait of affability was “beaver-like.” Beavers are, indeed, an affable species. Perhaps they are just too busy to be unpleasant.

Beavers are the largest rodents in North America, weighing in at 30 to 40 pounds, although individuals over 80 pounds are not uncommon. They are vegetarians and eat the young bark and wood of willows and cottonwoods that grow along streams and lakes. Unlike many large mammals, their aquatic habits limit their range to these surface waters.

Beavers have earned their reputation as busy and ambitious engineers. They harvest prodigious amounts of wood for food, then use the leftovers to build lodges and dams. They've been known to gnaw partway through a large tree and then wait for a passing wind gust to blow it over for them. Typically, they build their lodges first, with the small entrance at water level, then go a short way downstream and build a dam of small saplings and limbs, fortified with mud. The rise in water level behind the dam then obscures the entrance to the lodge, creating a safe and secure winter refuge for the beaver families.

The dam-building has fortuitous consequences for the rest of the ecosystem as well. The water backed up behind a beaver dam creates diverse habitat for many other plants and animals. The water can even help to recharge groundwater in underlying aquifers.

However, beavers and the technical handiwork of humans don't always mix well. Beavers can be a nuisance when they gnaw down trees or shrubs that humans appreciate, or inundate a “desirable” plant community, or when their dam-building activities create high water in places where we don't want it—places like an accelerator enclosure, for instance.

Because Fermilab has lots of surface water and very flat topography, beavers frequently build dams here, and they can have profound effects upstream. A typical dam that holds back a foot of water can result in acres of previously dry land becoming a pond bottom. Sometimes the extra water invades our technical spaces or just seeps into basements, causing various amounts of damage.



Photos by Reidar Hahn

Beavers harvest prodigious amounts of wood for food, then use the leftovers to build lodges and dams. Because Fermilab has flat topography and lots of surface water, beavers frequently build dams on the site. A typical dam holding back a foot of water can result in acres of dry land becoming a pond bottom.

Jim Kalina, of the Roads and Grounds department in Fermilab's Facilities Engineering Services Section, occasionally must trap beavers whose earthworks are causing problems for laboratory operations.

"When we first started removing beavers, in the mid-1970's, we trapped as many as thirty animals each year," Kalina said. "But now, we only have to remove around six."

Beavers are a protected species, and the Illinois Department of Natural Resources requires a permit to trap problem animals. Kalina pointed out that Fermilab has about six large beaver families in Lake Law and the Main Ring Ponds.

"They have no adverse effects," Kalina said, "so we leave them alone."

Kalina also noted that Fermilab is constantly experimenting with other remedies. Sometimes

a long pipe that penetrates the dam, and continuously "drains" the beaver pond downstream, works—at least for a while. But often the beaver just moves 50 feet downstream and builds another dam. Various wire and mesh "beaver-deceivers" have been designed to exclude beavers from choice dam sites while allowing water to flow freely. Unfortunately, the industry and imagination of the beavers usually exceeds that of the humans, and such measures have met with inconsistent results.

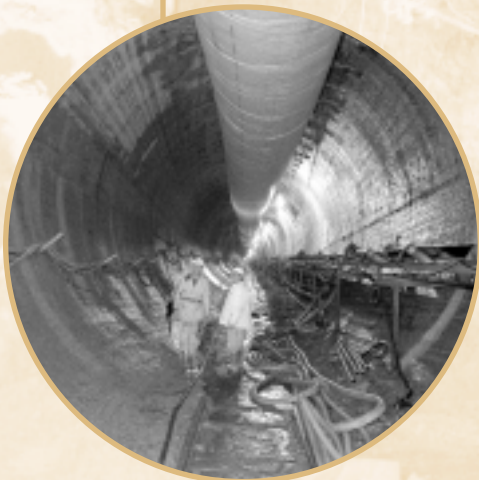
"You have to give them a lot of credit and respect," Kalina said. "They are very good engineers and builders, and they don't give up."

Beavers were actually exterminated in Illinois in the late nineteenth century, but attempts at re-introduction during the thirties were eventually successful. The state's beaver population is healthy again, as Fermilab can attest. 🌱

NuMI excavation almost complete

The construction of the NuMI tunnels and underground halls was the first project at Fermilab that required the removal of solid rock. Miners used a tunnel boring machine and more than 400 blasts to complete the job.

- April 2000:** S.A. Healy starts excavation
- May 2000:** First blast to remove rock
- July 2000:** First access shaft complete
- Jan. 2001:** Excavation of target hall complete
- March 2001:** Tunnel boring machine begins operation
- June 2001:** MINOS access shaft complete
- Dec. 2001:** TBM completes 3,000-foot-long tunnel
- March 2002:** MINOS hall complete
- May 2002:** Blasting of sump hole will complete excavation



Cover Photo:

The tunnel boring machine finished its journey through 3,000 feet of rock in December 2001. John Sollo (left), Tom Lackowski and other engineers frequently inspected the progress the machine made.

DIGGING IN

by Kurt Riesselmann

It's dark, it's wet and—most of all—it's huge.

Miners of the S.A. Healy company are carrying out the final excavation work for a new underground facility at Fermilab that could easily store thousands of cars, neatly lined up and stacked on top of each other. Since April 2000, construction crews have worked in three shifts, six days a week, to create an intricate system of tunnels and halls.

But this new space isn't tagged as a parking garage. Physicists will use the new caverns to build a research laboratory called Neutrinos at the Main Injector (NuMI). Two large underground halls and 4,000 feet of tunnels will host scientific equipment to create and analyze neutrinos, the most evasive particles of the universe.

Scientists will crash protons from Fermilab's Main Injector accelerator into a graphite target in the first NuMI underground hall, at a depth of 150 feet. The resulting neutrinos will then traverse a second underground hall, 350 feet deep, where a particle detector will record the neutrinos' properties. From there the neutrinos will continue their journey through 450 miles of rock to hit a second detector in a former iron mine in Soudan, Minnesota. While traveling through the rock—no tunnel is needed—the neutrinos may “change flavors,” transforming from one type into another. Because of its relevance to the evolution of the universe, this process is of great interest to physicists.

The only tunnels required for the NuMI project are a tunnel connecting the existing Main Injector accelerator to the new target hall, and a half-mile-long tunnel connecting the target hall to the near detector hall. Miners completed these tunnels in December.

But unlike conventional transportation tunnels, NuMI's will never have traffic jams.

“The NuMI underground construction is different from—and probably a bit more difficult than—a transportation-tunnel project,” said John Sollo, NuMI construction coordinator. “Access to the NuMI main tunnels is only through vertical shafts rather than a drive-in portal from either end.”

In the absence of elevators (to be installed this fall), workers enter the construction site via a metal cage that is lifted and lowered into the tunnels by a crane. Every piece of equipment, from shovels to front-end loaders, has come through the access shafts. And every piece of rock has gone out through one of the shafts. Millions of pieces. Or more precisely: one hundred thousand cubic yards of rock, more than 2,000 truckloads.

Excavating tunnels is nothing for the faint at heart. The environment underground is cold and wet. Temperatures of 55 degrees Fahrenheit are the norm, and fog is not unusual. During the construction, a couple of hundred gallons of water have entered the NuMI tunnels—per minute! Even after the facility is complete, engineers expect a continued inflow of approximately 150 gallons per minute, which will be removed by powerful sump pumps.

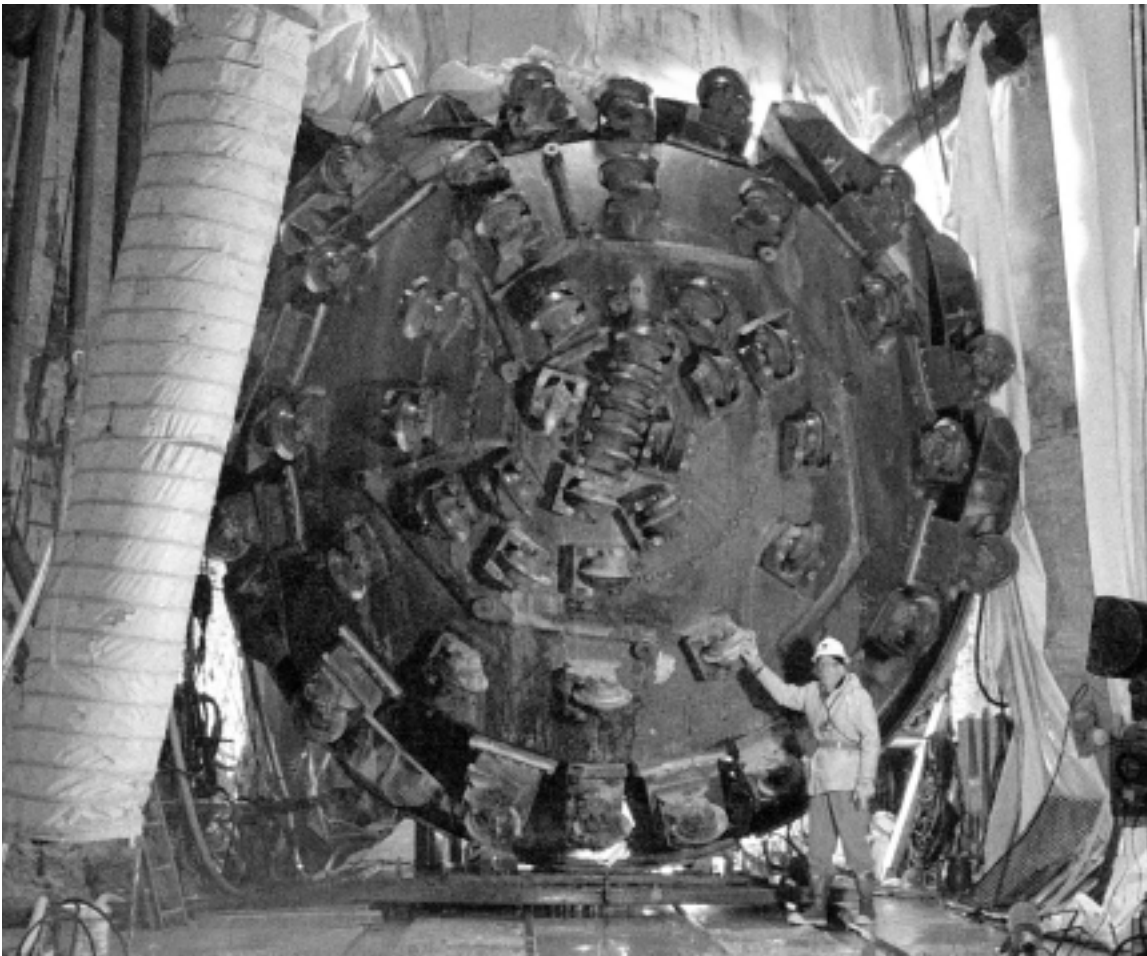


Photo by Reidar Hahn

The assembly of the tunnel boring machine in February 2001 represented an important milestone for the NuMI project.

TAKING NO RISK

Maintaining the safety of workers is an important task. In June 2001 an accident severely injured a man drilling an air vent hole at the surface and led to increased attention to safety procedures and reinforced the training of crew members.

“The only way to improve safety culture is through communication,” said Mike Andrews, who joined the NuMI project after the accident to become the coordinator for environment, safety and health. “We really beefed up the daily hazard analysis program. We have safety meetings, toolbox meetings and daily planning meetings to help the crew members understand what the issues are. The foremen are now very clear on what they mean and how they present it. And the miners know that we don’t just talk about safety, but that we really mean it.”

The new approach has had the desired effect. Since the accident the number of safety incidents per worked man-hour has dropped by almost 50 percent compared to the first sixteen months of the project. For Fermilab’s project managers, however, this is not yet enough.

“Safety constantly needs attention,” said construction manager Dixon Bogert. “It’s fair to say that safety has improved, but it’s not an area in which we can relax.”

HAVING A BLAST

Mining is labor-intensive work and requires the right tools. To break the limestone and shale, the construction crews have relied on three different excavation methods: drilling and blasting, mechanical removal with a hoe-ram, and use of a tunnel boring machine.

“The various NuMI tunnels and halls have different dimensions and cross sections,” said project engineer Chris Laughton. “Healy chose the excavation methods that they considered the best for the different parts of the project. Using a variety of excavation techniques is not a technical challenge but a logistical one.”

Miners used the tunnel boring machine to excavate the 21-foot-diameter tunnel between the two underground halls. At its best, the TBM advanced by more than 70 feet a day, but more typically mined at less than half that rate. To excavate the



Photo by Reidar Hahn

Miners completed the excavation of the NuMI target hall in January 2001. With a height of 60 feet and walls of rock, the hall's interior is reminiscent of a cathedral. The wall in the back shows the entrance to the decay tunnel.

access shafts and underground halls, miners carried out more than 400 blasts, removing up to ten feet of rock in one blast.

To limit the impact of blasts on both Fermilab's scientific facilities and the surrounding neighborhood, miners had to follow strict specifications.

"The noise and vibration restrictions [specified in the contract with S.A. Healy] were a main issue during drill and blasting," explained Sollo. "Those restrictions are common in urban areas, but unusual for most underground work."

Fermilab closely monitored the noise and vibration created by each blast. Although the blasts never exceeded vibration levels, some blasts were much louder than expected. Unfavorable northeast winds and dense cloud coverage sometimes intensified and projected the noise into the adjacent neighborhood, startling neighbors by rattling windows.

"We've greatly appreciated the patience and cooperation of our neighbors," said NuMI project manager Greg Bock. "Their observations and feedback were as valuable to us as the data we obtained from scientific monitoring equipment."

The NuMI excavation, with only a few blasts still to come, has lasted twenty-six months, so far some six months longer than originally anticipated. According to a revised schedule, accepted by a Department of Energy review committee in September 2001 (see *FERMINEWS*, Sept. 28, 2001, vol. 24, no. 16), the NuMI facility will be operational in 2005.

"This work has taken much longer than we expected," Bock said. "But since March, when Healy significantly increased their work force, progress has been good and we're looking forward to starting the follow-on contract toward the end of the year."

PRECISE AIM

In April, S.A. Healy began the installation of a 2,000-foot-long decay pipe. The work is part of Healy's 30.5-million-dollar contract with the Department of Energy. It presents the first important step in outfitting the tunnels with infrastructure and scientific equipment.

The manufacturer of the steel pipe will deliver fifty-six sections, each forty feet long and seven feet in diameter. Welders have already put together more than a third of the total decay pipe inside the NuMI tunnel.

"There is a bunch of things involved to make sure that the beam goes to the right point in Minnesota," said Wesley Smart, the physicist in charge of NuMI's alignment. "The contractor is responsible for putting things in the right place, and Fermilab surveyors do the quality assurance."

Physicists expect the center of the neutrino beam to hit the far detector in Soudan to within forty feet. To achieve this goal, the alignment of the tunnels at Fermilab must be exact within a few inches. The most critical part will be the installation of all beam-line components. Since neutrinos have no electric charge, it is impossible to manipulate the direction of the neutrino beam after it has been created.

So far, Smart is pleased with what he has seen.

"Healy's picked a good surveyor," he said. "The first part of the decay pipe is within three quarters of an inch of the ideal location. That's what the contract allows."

NEW BUILDINGS TO COME

At the end of the year, a new contractor will begin the second phase of the NuMI project. Physicists Rob Plunkett and Catherine James will supervise the work.

"When Healy is done with its contract," said Plunkett, "the next step is to change the empty hole in the ground to an underground laboratory, from a hostile environment into a friendly one."

A few weeks ago, Plunkett and his colleagues sent out requests for bidding proposals for the new contract, which includes the construction of service buildings on top of two access shafts. The work is expected to take one year and cost more than ten million dollars. It includes a service building that will stand near Fermilab's main entrance (see graphic below).

"It will be an industrial-type building with a big hole—350 feet deep—in the floor," said Rob Plunkett. "The building is mostly used for staging. Eventually, the MINOS detector, one plane at a time, will come through this space."

The Main Injector Neutrino Oscillation Search detector at Fermilab will consist of 280 planes of steel and scintillator. Technicians are currently assembling the planes at Fermilab. It is a smaller version of the detector at Soudan, which is already under construction and almost half complete.

"So much work has to come together," said Plunkett. "It has to grow like an organism."

Three years from now, NuMI will be all grown up and ready to run. 🧩

On the Web:

The NuMI-MINOS homepage:

www.numi.fnal.gov

For our neighbors:

www.fnal.gov/pub/about/community/numi.html

"The **NEXT STEP** is to CHANGE the empty hole in the ground **TO AN UNDERGROUND LABORATORY.**"

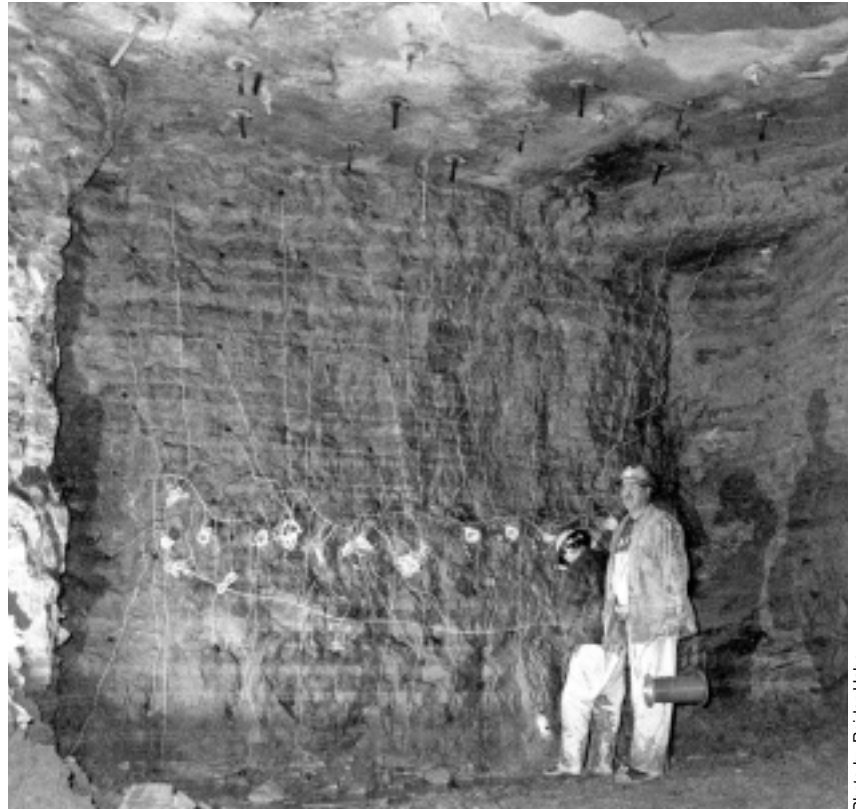
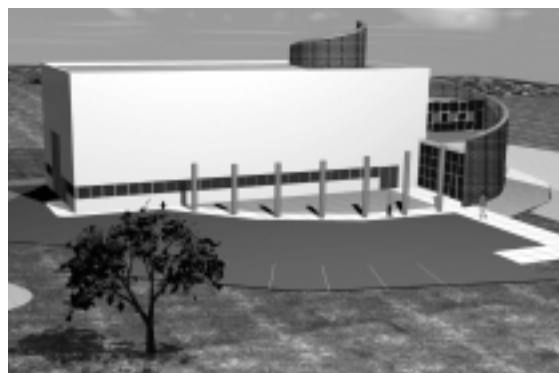
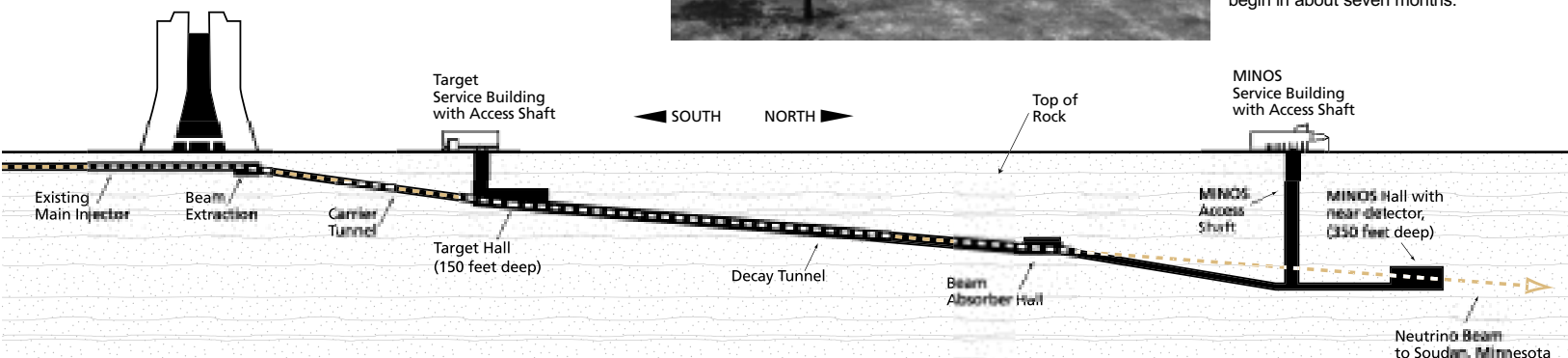


Photo by Reider Hehn

Miners, here wiring explosives inserted into the rock, set off more than 400 blasts to create three shafts and two huge underground halls. Four blasts, needed to create a 20-foot-deep sump hole, remain to complete the excavation.



The MINOS service building, shown here in an architect's drawing, is prominently located near the Fermilab main entrance. It will continue the Robert Wilson legacy of unique and aesthetic architecture. A spiral, reminiscent of a particle track, relates the building's appearance to the research conducted inside. Construction of the building will begin in about seven months.



GEORGE WINSTON HIGHLIGHTS FERMLAB ARTS SERIES 2002 SUMMER SEASON

Pianist George Winston, one of the most influential recording artists of the past twenty years, caps off the Summer 2002 Season of the Fermilab Arts Series in Wilson Hall's Ramsey Auditorium with an August 10th performance. Rounding out the summer season are Cherish the Ladies, one of America's most noted Irish bands, and Los Folkloristas, a group known as one of Mexico's national treasures. All events begin at 8 p.m. on Saturday evenings in Ramsey Auditorium. Tickets for all Fermilab events are available now. For further information or telephone reservations, call 630/840-ARTS weekdays from 9 a.m. to 4 p.m. Check the Web site at www.fnal.gov/culture.

JUNE 15 CHERISH THE LADIES

Tickets - \$21 (\$11 for ages 18 and under)

"Cherish the Ladies from the USA made their connection from the first note, skillfully managing the cheers and tears for every second of a torrential two-hour set. The band brilliantly strutted the very Irish-American sound which simultaneously exudes a tremendous joie de vivre and deep nostalgia."

—*The Irish Times (Dublin)*

For more than 15 years, Cherish the Ladies has been making Irish music and dance along with world-wide goodwill. In 1983, Mick Moloney noticed that the Irish tradition of passing music down from father to son was now including many daughters as well. He approached Joanie Madden with the idea of a series of all-women concerts, and Cherish the Ladies was born. Their first album, "The Back Door" (1985), was chosen as the Best Folk Album of the Year by the Library of Congress and received a National Endowment for the Arts grant for touring. Since that time they've shared the stage with Emmylou



Cherish the Ladies

Harris, James Taylor, Joan Baez, Kathy Mattea, the Clancy Brothers, Tommy Makem, and the Boston Pops, in a performance that earned them a Grammy nomination. In 1992 they were chosen to perform in an all-star musical tribute to Bob Dylan.

Cherish the Ladies is led by Joanie Madden, whose flute and whistle playing have earned her numerous awards, including the 1997 Traditional Musician of the Year. She has made appearances on over a hundred albums with artists ranging from Pete Seeger to Sinead O'Connor, including three Grammy Award-winning recordings. Completing the band are Mary Rafferty, accordion; Mary Coogan, mandolin, banjo and guitar, on which she was featured as one of the top four guitarists in Celtic music by *Acoustic Guitar Magazine*; Deirdre Connolly, vocals; Donna Long, fiddle; and noted fiddler Liz Knowles, from *Riverdance*.

JULY 13 LOS FOLKLORISTAS

Tickets - \$19 (\$10 for ages 18 and under)

"The only predictable thing about one of their performances is that something peculiarly true and beautiful will surface during the evening."

—*Christian Science Monitor*



Los Folkloristas

Embarking on their 35th anniversary season, the musicians of Los Folkloristas continue their mission set in 1966, "to preserve and record the traditional music of Mexico and Latin America." Carrying more than 100 instruments in their collection, and performing music of up to 15 different countries and pre-Columbian Mexico, this seven-member ensemble presents a musical journey through Latin America. In addition to traditional instruments, Los Folkloristas brings an abundance of organic instruments such as turtle shells, dried coconuts, and gourds. Background explanations are provided, offering descriptions of the universal themes of love, respect, and understanding found in this music, regardless of the country or time in which it was written. As ambassadors of traditional Latin folk music, Los Folkloristas' successes include the release of more than 30 albums world-wide, acclaim from the National Association of Independent Record Distributors, and contributions to music scores for the award-winning film *El Norte* and the recent release *My Family*. So representative is their music of the Mexican heritage that *The Excelsior* of Mexico City referred to them as "without a doubt, the most important group in Mexico today."



Los Folkloristas

AUGUST 10 GEORGE WINSTON

Tickets - \$23 (\$12 for ages 18 and under)

"Winston is the undisputed master of contemporary solo piano, and his lyrical style is often imitated but never duplicated."

—*Dirty Linen*

Celebrated pianist/composer and Windham Hill flagship artist George Winston closes out the summer series at Fermilab. In 1998, Winston celebrated his 25th anniversary as a recording artist. His first album, "Ballads and Blues," was released in 1972 and later picked up by Windham Hill Records. Among his most memorable albums include "Autumn," "December," "Winter Into Spring," and "Summer." "Autumn," which recently celebrated its 20th anniversary, almost single-handedly launched Winston, Windham Hill Records, and the genre of contemporary adult instrumental music.

Inspired by blues, rock, R&B, and jazz, Winston began playing organ and electric piano in 1967. He switched to acoustic piano in 1971 after hearing recordings by some of the legendary swing pianists, specifically Fats Waller and Teddy Wilson. His current work is about two-thirds R&B/rock/standards, and about one-third melodic music. His latest recording, "The Night Divides the Day - The Music of the Doors," is tentatively scheduled for release this year.



George Winston

In addition to his seven solo piano albums, Winston has recorded solo piano and guitar soundtracks for four children's animated videos, including "The Velveteen Rabbit" (narrated by Meryl Streep), "This Is America, Charlie Brown - The Birth of the Constitution," "Sadako and the Thousand Paper Cranes" (narrated by Liv Ullman), and "Pumpkin Circle" (narrated by Danny Glover). He was also the focus of a feature length video produced by PBS, "George Winston—Seasons in Concert."

CALENDAR

JUNE 5 - Virtual Ask-A-Scientist

The next chat will take place Wednesday, June 5, 1-3 p.m. Central Time. Janet Conrad, co-spokesperson of Fermilab's MiniBooNE experiment, and Brian Connolly, researcher at Fermilab's DZero experiment, will respond to questions live on-line. Theme of this chat session is "Neutrinos at Fermilab." Further information at www.fnal.gov/pub/inquiring/virtual/.

JUNE 6 - BANNER CONTEST

The MiniBooNE collaboration is looking for a design for the banner to be displayed on top of the MiniBooNE enclosure. Submit your entries by June 6. Details at www.fnal.gov/pub/news02/booNE_banner.html

JUNE 7 - REGISTRATION DEADLINE

Fermilab Family Outing: Join us under the Fermilab tent at the Kane County Cougar Stadium for a picnic and baseball game (Cougars vs Burlington Royals) on Saturday, July 20. Cougar visors giveaway, Jesse White Tumblers and fireworks. Beverages at 4:00 p.m., picnic starts at 4:30 p.m. and picnic ends/game begins at 6:00 PM. Cost:

Website for Fermilab events: <http://www.fnal.gov/faw/events.html>

\$10.00, includes reserved seating and all-you-can-eat picnic. Event open to Fermilab employees, visiting researchers, on-site contractors and immediate families only. Registration by June 7. See: fnalpubs.fnal.gov/benedept/recreation/special.html.

JUNE 9

The next Fermilab Folk Club Barn dance is Sunday, June 9 at 6:30 p.m. with music by The Bloody Banjoists and calling by Paul Watkins. Barn dances are held in the Warrenville Community Building and feature traditional square and contra dances. Admission is \$5 for adults, \$2 for age 12-18, and free for under 12 years old. Come with a partner or without; bring the family or not. Check the webpage at www.fnal.gov/orgs/folkclub/.

JUNE 11

Wellness Works Brown Bag Seminar, Noon to 1 p.m., Curia II: "Legal Issues Facing the Elderly and Their Caregivers," with attorney Daniel Parsons. Registration required: Bernie Dugan, x3591 or bdugan@fnal.gov

SUMMER ACTIVITIES

Employees, Users, On-Site Contractors and Retirees, for information regarding access to the Fermilab site for participation in the Recreation Office summer activities go to <http://fnalpubs.fnal.gov/benedept/recreation/leagues.html>

MEET SCIENTISTS AT SCIENCE EDUCATION CENTER

The popular Ask-a-Scientist program takes place every Saturday from 1 to 3 p.m. at Fermilab's Lederman Science Center. Scientists will meet visitors and answer questions. The Science Center with its hands-on science displays is open Monday through Friday from 9 a.m. to 4 p.m. and every Saturday from 9 a.m. to 3 p.m. Visitors must use the Pine Street entrance.

ONGOING NALWO

Free English classes in the Users' Center for FNAL guests, visitors and their spouses. The schedule is: Monday and Friday, 9:30 a.m. to 11:00 a.m. Separate classes for both beginners and advanced students.

MILESTONES

AWARDED

- Ph.D. to Mark Mattson, Carnegie Mellon University; for his research on baryons with two charm quarks as part of the SELEX experiment.
- Ph.D. to Jason Kasper, Northwestern University; for his research on bound states with charm quarks (experiment E835).
- Ph.D. to Jeremy Ed Sweezy, Georgia Institute of Technology; for the development of an enhanced neutron therapy beam.



■ To Fermilab: a recognition award for Service Excellence by the Heartland Blood Center, for increased participation in the last two blood drives. Bob Thomas and Lori Limberg accepted the award.

■ To Bill Bardeen (ID 02519N, PPD-Theoretical Physics Staff): an honorary degree from the University of Minnesota, for his "contributions to the many parts of the Standard Model of the Structure of Matter" and many other accomplishments. Bardeen received his Ph.D. from the University of Minnesota in 1968.

RETIRING

- James Shallenberger, ID 282, effective July 11, 2002, last day May 31.
- John Slowiak, ID 1406, ES&H Fire Group, effective May 31, last day was May 8.

DIED

■ Boyce D. McDaniel, the Cornell University physicist and Manhattan Project scientist who gave the atomic bomb its final check before the first test at Trinity site in July 1945, died of a heart attack May 8 in Ithaca, N.Y. He was 84. For the full obituary, see <http://www.news.cornell.edu/releases/May02/Obit.McDaniel.bpf.html>

DEDICATED:

■ A new backup generator and other infrastructure improvements for the Feynman Computing Center on April 25. The work is part of the Utility Incentive Program at Fermilab. The DOE Federal Energy Management Program, represented by Vic Petrolatti (left), recognized the laboratory's UIP achievements with a FEMP award, accepted by Fermilab engineer Steve Krstulovich.



LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
\$10/PERSON

DINNER SERVED AT 7 P.M.
\$23/PERSON

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CONTACT TITA, X3524
[HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML](http://www.fnal.gov/faw/events/menus.html)

LUNCH
WEDNESDAY, MAY 29
*Grilled miso marinated
beef salad with ginger
mustard vinaigrette
Almond cake*

DINNER
THURSDAY, MAY 30
*Baked goat cheese and
baby green salad
Veal piccata with lemon and capers
Baked polenta
Sautéed spinach with pine nuts
Pear and hazelnut tart*

LUNCH
WEDNESDAY, JUNE 5
*Seared Salmon with Asian
Noodles and Vegetables
with Ginger and Cilantro*

DINNER
THURSDAY, JUNE 6
*Spicy Shrimp Satay
Ancho Fired Pork Tenderloin
Vegetable of the Season
Lace Cups with Fresh Fruit*

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The deadline for the Friday, June 14, 2002, issue is Monday, June 3, 2002. Please send classified ads and story ideas by mail to the Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

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CLASSIFIEDS

FOR SALE/AUTO

■ '00 Ford Focus ZX3 hatchback, 5 speed manual trans, AC, pwr windows, pwr locks, tilt wheel, remote entry/antitheft system, compact disc, dual front air bags, alloy wheels, orange color, 19.5K miles, more than a year remaining on factory warranty, \$9,100 (Kelly Blue Book \$10,445, NADA Book value \$12,400) Contact David Butler x3370 or dbutler@fnal.gov

■ '00 Yamaha V-Star 650 Classic. 650cc air-cooled, 4 Stroke V-twin, 5 speed transmission with shaft drive. One owner, 4.1K miles. Dry weight: 495 Lbs. Added leather saddle bags and windshield. Garage stored, excellent condition. Kelley Blue Book value \$5,485 (w/bags & shield), priced to sell at \$5,000 o.b.r.o. Call: Carrie at 847-903-8989, Ray at x3671 or email vstar650@attbi.com. Picture at <http://home.attbi.com/~vstar650/>

■ '98 Explorer XLT, 4x4, V6, light blue w/gray leather, A/C, cruise, tilt, pwr windows, pwr locks, pwr driver seat, CD/tape, running boards, roof rack, alloy wheels, off-road size tires, original owner, runs and looks great, asking \$8,800 o.b.o. MUST SELL! contact Terry at 630-782-9936 or blackjackkarney@msn.com (Below Kelly Blue Book \$11,375 and N.A.D.A. \$13,650)

■ '98 Dodge Dakota club cab SLT truck. Black with gray cloth interior, 3.9L V-6 engine, automatic 4-speed, PS, PB, AC, intermittent wipers, AM/FM/cassette, tilt wheel, power locks, and windows, sliding rear window, rear cap and much more. 45K, 6 year warranty. \$10,800 o.b.o., 630-505-0276.

■ '96 Dodge Neon Highline 4 door, 4-cyl. 2.0L automatic, AC, power steering, power door locks, AM/FM/cassette, ABS. Color: black. Available July 1 (with approx. 65K miles). Must sell. \$3,500 o.b.o. (bluebook: \$3,900 at 70K). fblekman@fnal.gov or x4250.

■ '96 Chrysler Cirrus LX, original owner, 89K miles, 11K miles left on extended factory warranty, new tires, excellent cond, asking \$4,500, call Gregg x4893 or 630-466-0737.

■ '93 Buick La Sabre, forest green, 135K miles, V-6, loaded with all the extra's, AM/FM/CD very clean \$4,000 o.b.o. 815-405-4668.

■ '92 Chevy Lumina 7 passenger van, 125K miles, power windows/locks, AM/FM/cassette, body is in excellent condition, garage-kept. \$2,000 o.b.o. Please call Steve x8879, or SCarrigan@fnal.gov

■ '91 Chevy 2WD extended cab pickup, dark green, well maintained, \$4,000 o.b.o. 630-327-1853.

■ '87 Honda Accord LX, gold, 4 door, 5 spd., radio/cassette, cruise control, power steering, power mirror, power windows, power lock. Runs great \$975 o.b.o. Lucas x4366 or nxuan@fnal.gov

FOR SALE/BOAT

■ '87 Catalina 22 sailboat, CDI furling jib, 9.9 HP Evenrude electric start motor, pop top enclosure, cockpit cushions, trailer, new rigging, boom vang, 4 winches. \$6,500. lipton@fnal.gov or x4132.

■ '73 Crestliner 14' boat with Sea Bird trailer. 5-1/2 HP Johnson Seahorse motor, 2-electric trolling motors, Garmin Fish Finder, dual anchors with cranks, misc fishing poles, tackle, vest, etc. \$1,500 o.b.o. Call 630-505-0276.

FOR SALE

■ Brown & Sharp (TESA) Micro-Hite 350 LNIB \$3,500 o.b.o. fagan@fnal.gov or x2914

■ British Bobby bicycle. Raleigh DL-1. Large frame. 37-1/2" seat height. Good condition. \$275. crawford@fnal.gov or x2394.

■ DR WALK BEHIND WEED CUTTER, 5.5 HP, electric start, large rear wheels, new cutting head included (value \$100), Great for cutting on slopes or uneven ground. Great condition. \$250 o.b.o. Call Craig 630-505-0276.

■ Toro Riding Lawn Mower, 11 hp., 32in. cut, runs good, with rear bagger. \$200. Call 708-301-4256, ask for John.

■ John Deere tractor. 11 HP, older was not used for a while. Runs good. \$325 o.b.o. Trailer, 4-8 feet wide, \$75 o.b.o. Pull-out dining table, extends to 10 to 12 feet. \$70 o.b.o. Call Tim x4070

■ Elliptical fitness crosstrainer - heavy duty \$100 Greg 630-557-2523 or x4606.

■ Delta 10" tilting top table saw, \$400; Walker Turner 12" x 36" wood lathe w/cast iron stand and accessories, \$700; Delta heavy-duty 24" scroll saw with Delta stand, \$200; Craftsman 1" stationary belt sander w/extra belts, \$70; Detail Master electronic wood burning station, \$100; Auto body in-line sander, \$25; Craftsman buffer-polisher \$25. Contact David Butler at x3370 or e-mail dbutler@fnal.gov

■ Nordic Track Pro \$300 o.b.o. Call Chrisman 840-6657 or 630-858-7860.

■ Resin patio set (blue). Large round table and four chairs with matching umbrella stand, \$150.

■ Girls bike (appropriate for ages 8-10). Dark purple. Great condition \$25; crogers@fnal.gov or x3824.

■ Metal desk \$40, beer tap handles \$10 each, deep fry thermometer \$5, Michelob bar light \$10, Call Greg x4606 or 630-557-2523.

■ Contemporary, full-size, four post canopy bed with like new mattress and box springs \$300; two night stands (match bed) \$50 each; flowered full-size quilt, pillow shams, neck roll pillow, eyelet bed skirt, mattress pad, and two sets of sheets, \$75; corner computer table w/adjustable keyboard shelf, \$100; framed contemporary prints, 39" w x 31" h, \$50 each; Brother portable electric typewriter, \$25; Kenmore zig-zag sewing machine with carrying case, \$50. Contact Cynthia at 312-317-2383 or sazama@fnal.gov.

■ Lane 4 pc. Contemporary dining room set, caramel colored burl wood. China Hutch: Twin, lighted cabinets with two glass doors. Each cabinet measures: 37w x 72h x 14d. Table: 42" round with 2-18" leaves and pads w/glass top. Server: Measures 40w x 34h x 18d. Has pull/out extension and 2 doors w/shelving and drawer inside. Glass top also. \$950 o.b.o. Three section entertainment unit; cream colored high gloss finish. Cylindrical audio tower on swivel base. Extra large TV cabinet with pull/out swivel and component storage. Upper and lower cabinets for component speakers. Bar with wine glass storage behind doors. Open glass shelf display area with radius corner and mirrored back. Unit arranged as shown measures 10 ft. wide by 7 ft. high, \$950 o.b.o. Contact John Fomusa at x3842 or fomusa@fnal.gov (can email pictures).

■ Vitamaster Northern Trails Plus ski machine with electronic readout for speed and ear clip to measure pulse rate. Height adjustment to increase level of difficulty, \$50. Alpine Climber stair step machine, 4 level difficulty adjustments, electronic readout (needs battery), \$25 o.b.o. Need to clear out to make room for basement stained glass shop. Email rsward@fnal.gov or call 840-6652

■ Musical instruments: Ludwig Bell Kit for beginning drummers. Includes bells, practice pad, stand, and zippered carrying case for \$150. Also, Yamaha Portatone PS-25 electric keyboard with molded carrying case for \$50. Call T.J. at 630-840-3299 or sarlina@fnal.gov.

■ Telex flight headset, \$40, o.b.o. 640-584-2801, Jim Griffin.

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■ Beautiful 3 bedroom tri-level in Lake Holiday, 2 bath, professionally landscaped, Sandwich Schools, large lot, 3 beaches, boating, fishing, water-skiing, low taxes. \$139,900. Call x3499.

FOR RENT

■ Spacious one bedroom apartment (with dish washer, washer/dryer) in Huntington Apartment Complex, to sublet July 1 until October 31 (or longer). \$800 per month. Call 630-428 2778.

■ One big bedroom and bathroom on independent floor in family house. Quiet residential Naperville. Car garage, laundry, living room available. \$495 per month. Ready April 30. Call 840-2574 during office hours.

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