FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY

Answering the Call 2

Photo by Reidar Hahn

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INSIDE:

Answering the Call

by Mike Perricone

It's 3 a.m. at Fermilab. Do you know where your backup 10-ton magnet is? Do you know what it takes to test it, install it, and get it operating?

You're developing specifications for a critical component, the coupler, for the linear collider R&D project. Which design is best from the manufacturing standpoint, and which vendor can produce it within tolerances smaller than the thickness of a human hair?

Parts are coming in for the production of Large Hadron Collider magnets bound for CERN, the European Particle Physics Laboratory. Do the parts meet specifications?

Does your vacuum vessel leak? Does a mechanical measuring tool need calibration? Whatever you need, does it meet the standard of being fit for use?

ON THE COVER: Rob Riley, inspecting an FXC RF disk for the Linear Collider R&D project, brings twenty years of experience to the Quality Control Group of the Material Control Department.

Steve Merkler (below), measuring a coldmass end plate for the LHC IR Quad project, has more than twenty-two years of experience.

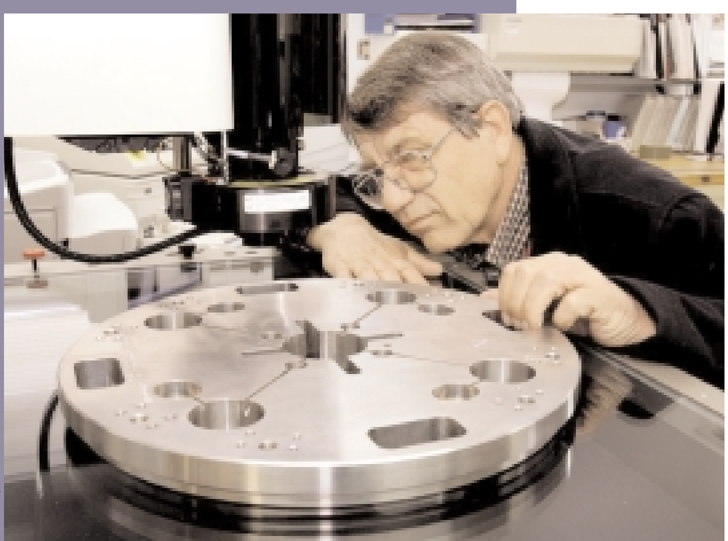


Photo by Reidar Hahn

In all these cases, and many more, the people to call are the Technical Division's Material Control Department. Operating largely out of sight, this efficient squad of some 17 lab veterans with an admirable safety record functions as one of the vital organs of Fermilab.

"We're kind of like your kidneys," said department head Gregg Kobliska. "If they're functioning well, and they're staying behind the scenes, you're happy. If they're not functioning well, they'll get your attention in a hurry."

In Material Control, avoiding that kind of attention is the way they like it.

"There's a long list of things they handle flawlessly," said Rich Stanek, deputy head of the Technical Division.

That long list ranges from moving multi-ton magnets to measuring magnet laminations just thousandths of an inch thick, from compiling exhaustive inventories of tooling and kits to inspecting cranes and lift trucks, and Material Control handles them flawlessly and safely. The department hasn't had a lost-time accident since 1995.

"Our goal is always no incidents, no accidents," Kobliska said. "I think our record is indicative of people taking things seriously."

The record is also indicative of taking seriously what people have to say about the work they are doing. For example, a portion of the parking lot outside IB4, where magnets are inspected and stored, has been recently resurfaced. That was done as a safety measure.

ON THE WEB:

Technical Division
Material Control Department:
www-td.fnal.gov/departments/material-control.html

Photos by Reidar Hahn

Doug Kelley (left) and Cliff Besch remove a spare Tevatron dipole magnet by overhead crane, in the Magnet Storage Building. Material Control keeps track of more than 1,000 backup magnets.

Material Control Department gets the job done by any and every measure

"Before that, it was really rough," said Kobliska. "The change came about from people saying, 'When we're moving these big magnets on trailers, the surface is so rough that something's going to happen.' They told me, and I got the support of Technical Division headquarters to have the area repaired. The credit for safety goes to all levels, to the people who bring it up in the first place, and to the people who control the funds and show they're serious about safety by matching their words with money."

The department is organized in three areas. The Acquisition Group works closely with the lab's Business Services Section in choosing vendors and ordering technical components. Magnet and Component Storage houses and keeps tabs on an inventory of nearly 1,000 magnets, and organizes parts and tooling neatly enough to keep a grandmother happy. Quality Control uses an array of coordinate measuring machines (CMM's) including a portable laser unit for oversized components, instruments for gauging the magnetic properties of steel, leak testers, hardness testers, and rows and rows of meticulously-kept file drawers of micrometers, calipers, thread gauges and more.

Oscar Lira (left) and Ted Beale use the Laser Tracker to compare the straightness of a B2 dipole magnet in various orientations, ensuring tight tolerances for NuMI's primary proton beam.

"Material Control functions like the supply line to the troops, getting them what they need to do their work, when they need it," said Technical Division head Bob Kephart. "Any time the lab ramps up an effort, such as for the LHC, Material Control is always very active. Each time we're looking at manufact-uring an accelerator out of individual pieces, they'll take the items and see how they can be industrialized for mass production. Any time we produce a new magnet, that usually represents a significant investment in new tooling. If you produce that magnet again, it means you need

the Call

the same tooling. The component storage group maintains all that tooling, and sets it all up to do the job. They're a small group that's important beyond their size."

Doug Kelley in the storage group maintains an on-line inventory of parts and tooling, and all the tooling features digital photos to help in identification.

"The database is about 25 pages, with 30 to 40 items per page," Kelley said. "We're responsible for all the components coming in, and keeping track of their quantities and where abouts. Whenever the accelerator ring needs a magnet, we're on call to get it. We basically take in all the parts needed for building a project here in TD. Then they go through inspection and quality control. We put them in stock to be used in a kit later on. If we get a request for a particular magnet, all these related parts are pulled and put into a kit, and given to the Fabrication Group."

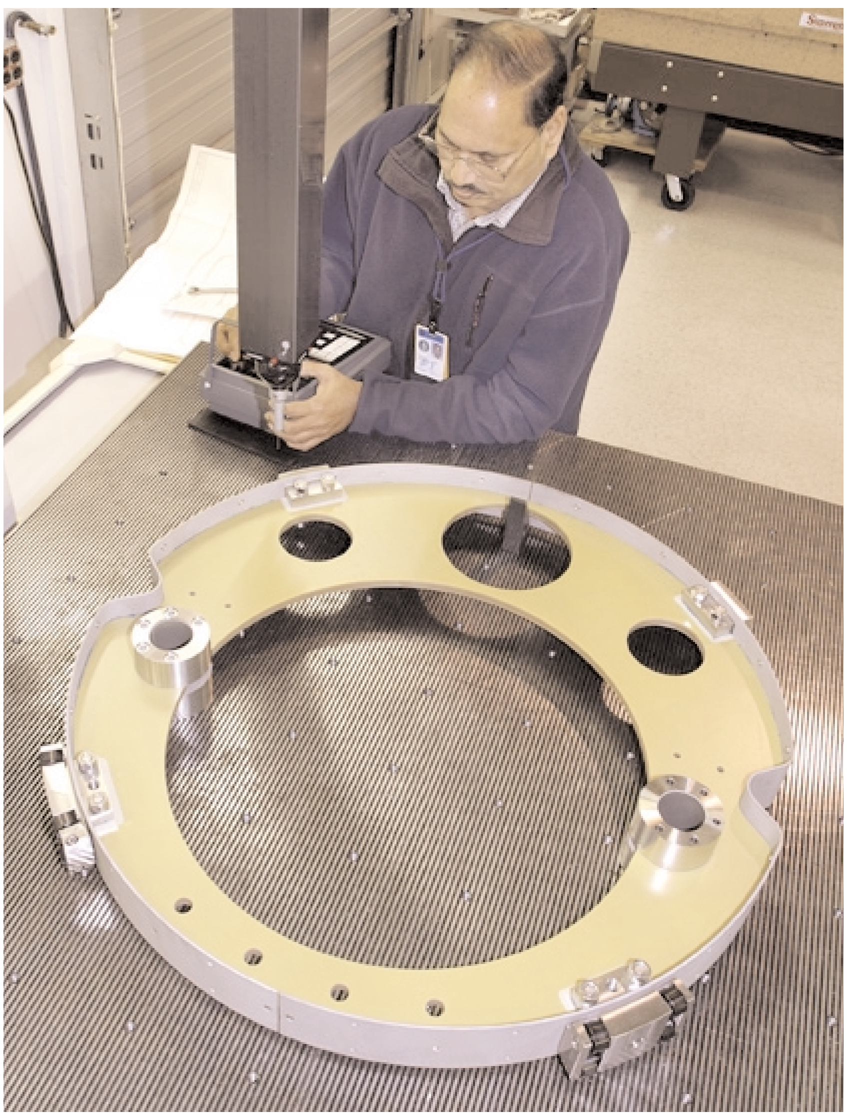


Photo by Reidar Hahn

Sudhir Ghanta measures a suspension support assembly for the LHC IR quad project. The Quality Control Group uses several kinds of coordinate measuring machines, including an Avant Video Measuring System, which is accurate to within about four microns.

Stability is an important ingredient in the department's success. As examples: Kobliska has been at the lab since 1978, Rob Riley of Quality Control is about to mark his 20th anniversary at the lab; Steve Merkler of Quality Control has seen service for nearly 22 years.

"I think there's a message there," Kobliska said. "Every function in Material Control is important. Whenever anybody hires in, we always make sure they understand that. Because if John Zwiebohmer's people in Acquisitions are thinking they've got parts that they don't actually have because Doug's group hasn't done the proper paperwork, then we've failed. Or if Acquisitions has done the right thing, and Doug's group has done the right thing, but QC didn't find a defect in the parts, again we've failed. Or if these people have all done the right thing, and John's group didn't order the right number of parts in first place, we've failed. Everybody is working together, everybody's job is important, for us to be successful."

The outlook of appreciating every contribution carries over into the bigger picture of any effort. Kelley took note of the work on the Compact Muon Solenoid detector bound for CERN, and the collaboration among U.S. and European labs and institutions in Russia and China.

"We're working on our final shipment to Russia, and that should complete the CMS project," Kelley said. "The countries worked together successfully. The world can be going off in all directions, but here at Fermilab we have it all going together."

From Europe and Asia to northern Minnesota for the MINOS neutrino project, to southern Argentina for the Pierre Auger Observatory, to every part of the site, the reach of Material Control extends throughout the lab's mission.

"We rely on good people, and we give them the latitude and the freedom to do their jobs," Kobliska said. "Things get sufficiently complicated that if any one person tried to stay on top of everything, or tried to take credit for everything, if would be rather phony."

Still, some things are beyond even this group's ability to control. The phone on Kobliska's conference table rings once, and stops, and Kobliska gives it a bemused look.

"That phone rings every half-hour," he says. "Nobody can figure out why."

Photo by Ted Beale

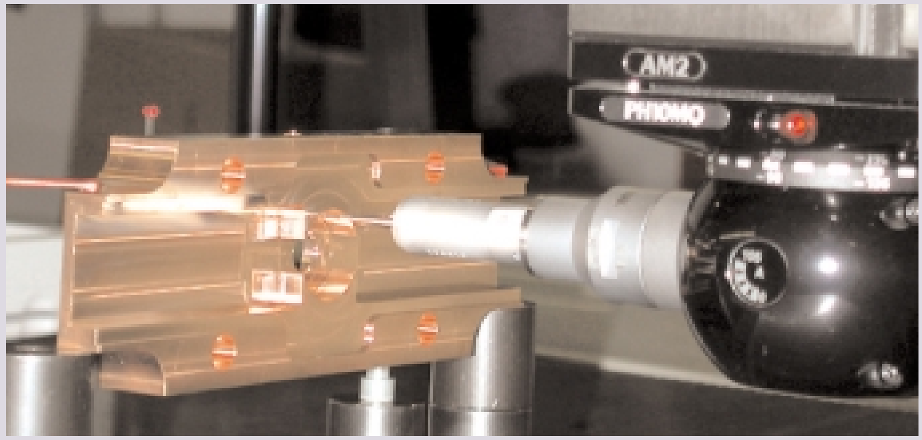
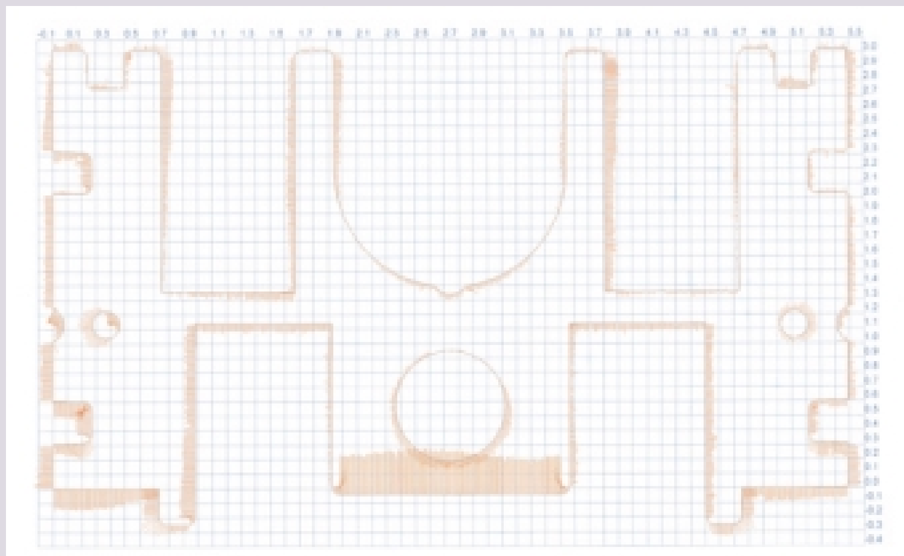


Photo by Ted Beale



Courtesy Material Control Department

Measuring up – micron by micron

Whether components are one-of-a-kind or just one of a million, Quality Control uses precision coordinate measuring instruments to show whether they meet the standards that make them fit for use. Software called PC-DMIS is Windows-based, and integrates with CAD (computer-assisted-drawing) files to direct a touch probe to survey an array of points in three dimensions.

The central component of the NuMI horn (left) was machined from a solid block of aluminum, with an intricate conical shape and extremely thin walls that must transmit large and rapid radiofrequency pulses. Thus, uniformity is the critical property—but the walls were thin enough to generate concern about being damaged by the touch probe tool pressure itself. Rob Riley surveyed the component through a range of cross-sections, inside and out, finding they were within permissible tolerances. Quality Control measured horns for both the NuMI and MiniBooNE neutrino experiments.

Couplers for the linear collider R&D project (top) conduct radiofrequency pulses to accelerate electrons, and Quality Control has been examining different designs to provide feedback in the evolving design of the component. The data will be used in choosing a design, selecting a vendor who can produce the components, and controlling prices. A linear collider would require about a million couplers. Above, data from the Avant optical measuring machine took the form of graphic output—simultaneously showing the outline of the part as designed, and the deviations from the design specifications in an exaggerated scale to make inaccuracies more obvious. The Avant took data on 4,026 points on this lamination for the high-field VLHC magnet option. In the scale for deviation from the nominal dimensions, each gridline represents a distance of 25 microns—and the width of a human hair is usually 50 to 75 microns.

Making Connections

University of Cincinnati and Ohio State University build on their research profiles at Fermilab

by Sena Desai

A group of University of Cincinnati physicists braved the freezing Illinois winter of 2001 testing mineral oils for the 40-foot tall MiniBooNE detector at Fermilab. They found the right oil and the MiniBooNE experiment took off without a hitch.

Almost 400 miles away, in the Ohio State University physics department, a group of faculty members and students built part of an electronic device called the extremely fast tracker (XFT) for Run II at the CDF detector. The XFT was assembled ahead of schedule at Fermilab and the experiment proceeded flawlessly.

Photo courtesy University of Cincinnati

University of Cincinnati researchers at Fermilab. From left to right, Professor Alex Kagan (theory), Professors. Brian Meadows and Alan Schwartz (E791), Professor Randy Johnson and graduate student Narumon Suwonjandee (MiniBoone). Missing: Professor Michael Sokoloff (E791)

"Ohio has produced a lot of good physicists," says Janet Conrad of Columbia University, cospokesperson for the MiniBooNE experiment. She has a theory about the relationship between Ohio and physicists. "There is no more than two degrees of separation between the state of Ohio and any physicist," she laughs. "Almost all physicists have some connection to the state of Ohio."

Bill Reay led Fermilab experiments for Ohio State in the 1970s and 1980s before moving to the University of Kansas. Ohio State expanded its physics department in 1996 and intensified its Fermilab involvement. Grad student Chris Neu of CDF says up-and-coming physics programs benefit greatly from using a facility like Fermilab. "Ohio State University is increasing in stature because there are world-class facilities like [Fermilab] that it can send its students to," he says.

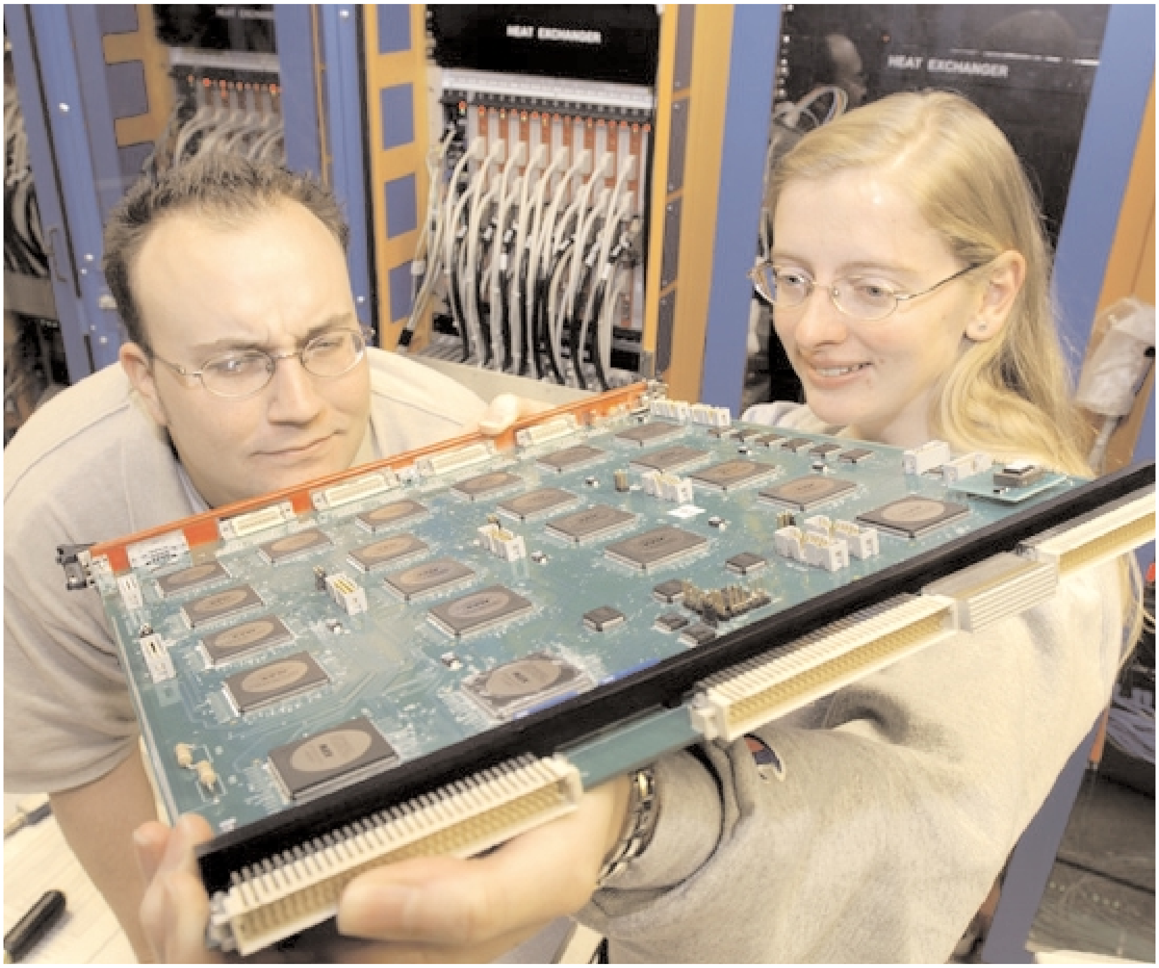
The long-term benefits of this university-laboratory connection are clear. As Congressman Rob Portman, the Representative for the Second Congressional District of Ohio, which includes the University of Cincinnati, says, "The involvement of the University of Cincinnati's physics program with Fermilab's high-energy physics experiments benefits both institutions. A vital part of the university's program is its relationship with Fermilab, where the university's faculty and students participate in research with the best minds in the nation and the world. This interaction is particularly important in the creation of the next generation of scientists in Ohio."

Physicists, especially students, working at Fermilab gain from being surrounded by senior, experienced researchers. "It is easier working here amongst physicists," says Jen Raaf, a University of Cincinnati graduate student working on the MiniBooNE experiment. "If I don't understand something all I have to do is walk down the hallway and say, 'I don't

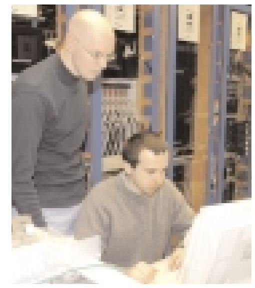
ON THE WEB:

University of Cincinnati:
www.uc.edu

Ohio State University:
www.osu.edu



Graduate student Chris Neu and post-doc Evelyn Thomson of Ohio State University looking at one of the 24 XFT LINKER boards that process signals from the detector.



Photos by Reidar Hahn

Associate professor Richard Hughes and graduate student Radu Marginean of Ohio State University looking at some data from the XFT.

understand this.' And five people will come out and explain things to me."

The University of Cincinnati began working with Fermilab in the early 1980s. But Randy Johnson, a professor in the university's physics department, had first come to Fermilab to do his thesis work while he was a University of California, Berkeley, graduate student in the early 1970s. At the time, the high-rise was not built and all the administrative offices were in the Village.

"Oh, boy, I came here a long time ago," he chuckles. Twelve years later, in 1984, he was hired as a faculty member by the University of Cincinnati and came back to work at Fermilab on the Neutrinos at the Tevatron (NuTev) experiment. "I have seen the laboratory grow," he says. "I have seen a complete cycle of people at Fermilab. The laboratory just keeps rejuvenating."

The Fermilab-University of Cincinnati relationship grew even stronger when Johnson's group joined the MiniBooNE experiment. In 1996, Fermilab researchers launched new plans to study neutrinos—those tiny, ghost-like particles—and began designing the MiniBooNE experiment.

Johnson's group took on the task of finding the right mineral oil for the MiniBooNE detector, a 40-foot ball-shaped tank lined with large photosensors looking inward onto the oil. The neutrinos collide with mineral oil molecules, creating electrons, muons and other particles that emit a cone of blue light called Cerenkov light. The oil must transmit at least 90 percent of the emitted blue light, enabling the photosensors to record the light patterns that are distinct for each particle. Johnson, Raaf, and post-doc Eric Hawker tested different oils looking for the one with the desired optical properties.

Conrad says Raaf actually learned to categorize oils by their fragrance. "She could make a fortune in the perfume industry," laughs Conrad. Once the selection was made, the detector was filled and work began in May 2002.

Congressman Rob Portman, the Representative for the Second Congressional District of Ohio.

Photo by Reidar Hahn

Graduate student Jen Raaf and post-doc Eric Hawker of University of Cincinnati looking at pi-zero production on the MiniBooNE event display.

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Raaf and Hawker then moved onto analysis. Raaf measures the rate at which the neutral pi-zero (π^o) particle is produced—a critical factor in screening out background. MiniBooNE searches for oscillations of muon neutrinos. If one of the photons from the pi-zero decays has very little energy, that event may be mistakenly identified as an electron signal, stemming from an electron neutrino. Hawker helped compile literature for analyzing neutrino cross-sections—measuring the probability that neutrinos will interact in specific ways. "Neutrino experiments need this information,and the MiniBooNE group has become popular among neutrino experimenters because of this," says Conrad.

The University of Cincinnati's Alan Schwartz, Michael Sokoloff, and Brian Meadows studied charm quarks at E791, a hadro-production experiment that collected data in the 1991-92 fixed target run. The experiment reconstructed the world's largest sample, at the time, of charm decays, and used this sample to study a variety of charm production and decay properties. In the last two years the group has worked on the appearance of two light spinless particles, sigma and kappa, which have generated much interest from physicists around the world.

Like Randy Johnson and Fermilab, the relationship between Ohio State University faculty and Fermilab also goes back a long way. Physics faculty from Ohio State University, Richard Hughes and Brian Winer, first worked at Fermilab when they were graduate students from other universities. They were later hired by Ohio State's physics department and returned to Fermilab with their own graduate students, bringing the relationship full circle.

Hughes' interest in physics had actually stemmed from an earlier visit to Fermilab. As an electrical engineering undergraduate at the University of Pennsylvania, he had visited Fermilab and been drawn to the electronics of the CDF detector. He went on to study physics at the graduate level, hoping one day to build electronics for physics experiments. He worked at CDF as a University of Pennsylvania graduate student and later as a University of Rochester postdoc.

Winer, too, had worked at CDF as a University of California-Berkeley graduate student, and later as a University of Rochester postdoc. He played a role in the discovery of the top quark at Fermilab in 1995, and "I was excited about research on the particle in the future," he says.

With Ohio State's involvement in Fermilab research in 1996, Winer got his chance to study the top quark further. The university's physics department hired Winer and Hughes as assistant professors to take advantage of their Fermilab connections.

Since Hughes and Winer had worked on CDF for over six years, they chose to continue working there. "We knew the people and liked the physics there," says Winer. At the time, CDF was upgrading from Run I to Run II, Hughes finally got his chance to build the electronics that he had always wanted to build.

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"So far we had been involved only in analysis, and we wanted to play a role in the upgrading of the detector," says Hughes.

In 1997, Hughes and Winer, with two postdocs, six graduates and six undergraduates, began building the XFT designed to identify flight paths of charged particles created in the collisions of protons and anti-protons. These trajectories help researchers decide which 30 of the 2.5 million collisions per second are interesting enough to record. This is no small feat, considering the information from the XFT must incorporate input from thousands of channels every 396 nanoseconds, or 2.5 million times per second.

Once the XFT was in place, Neu, a student of the Hughes-Winer group, started doing background work on the Higgs boson, a particle predicted by theory. Neu is developing software relying on neural networks, which would recognizes the signature of the Higgs boson in data samples. He is testing the software on Run I data, trying to perfect a technique for identifying the Higgs boson. The discovery of the Higgs boson, named after British physicist Peter Higgs, would help scientists understand how the Higgs field, analogous to an electromagnetic field, manifests itself in particles through the Higgs boson, accounting for their masses.

However, the Hughes-Winer group says the Higgs is only part of the Run focus. "There is lots of interesting physics in Run II," says Winer. In Run I, researchers had gathered just enough data to establish that the top quark existed. Now, in Run II, they wanted to collect larger samples for studying top quark's properties. "We will be learning something new about this beast," says Hughes.

"Run II will shed a lot of light on the nature of top quark. We will be able to measure its mass with more precision," says Neu. "We will be able to search for exotic, undiscovered production mechanisms for the top quark."

CDF's co-spokesperson Nigel Lockyer says the Ohio State group is small, but very focused and aggressive. "Every one of them is visible," he says.

"Their main contribution is the XFT that worked since day one," says Michael Lindgren, head of CDF operations. "Neu is also working on the most [fascinating] aspect of Run II – the Higgs boson."

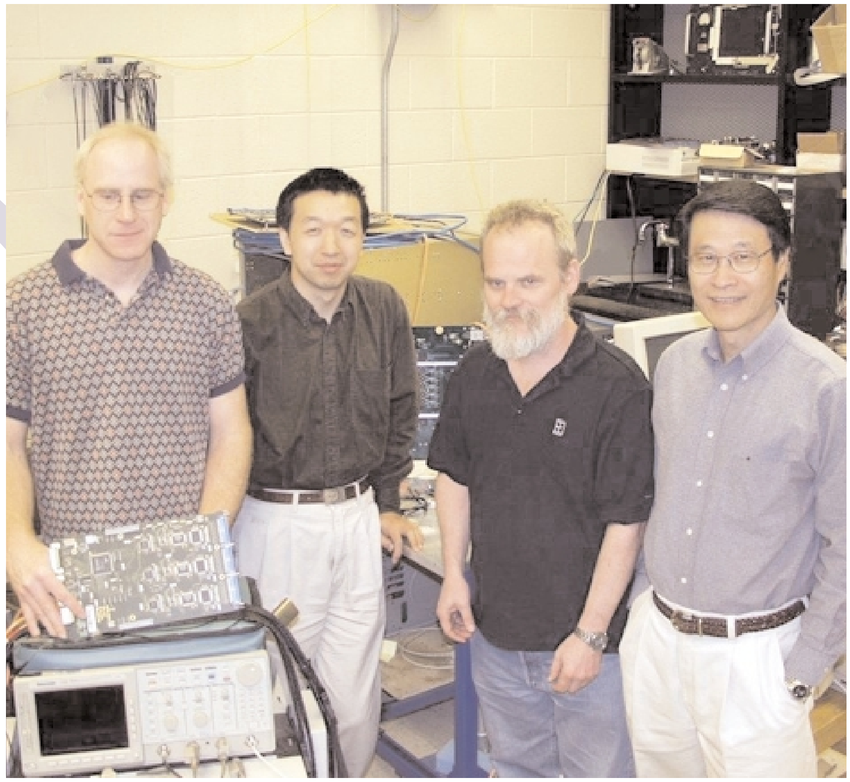
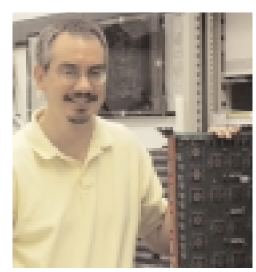


Photo courtesy Ohio State University US-CMS group

The Ohio State University US-CMS group. From left to right: Electronics engineer Ben Bylsma, researcher Jianhui Gu, Professor Stan Durkin, and Professor T.Y. Ling. (Not pictured: postdoc Jason Gilmore)

Ohio State is also part of the US-CMS collaboration, building components for the Compact Muon Solenoid detector of the Large Hadron Collider at CERN, the European Particle Physics Laboratory in Geneva, Switzerland. The CMS detector will search for the Higgs boson and other particles not described in the standard model. A Higgs boson can decay into muons, and Ling's group is designing the electronics for a muon detector.



Associate professor Brian Winer of Ohio State University (CDF)

The growing connections with Fermilab and the involvement of new students help address what Ohio State president Karen Holbrook described as the "quiet crisis" in the declining numbers of young people preparing for careers in science and technology. In her remarks to the American Association for the Advancement of Science Colloquium on Science and Technology in Washington D.C. on April 10, 2003, Holbrook said federal spending on research and development has dipped to its lowest level in 50 years as a percentage of the Gross Domestic Product.

"Federal policy is the number one factor in establishing the research environment in the U.S.," Holbrook stressed. "Investing in research and development keeps the U.S. safe, healthy, environmentally sound, and scientifically competitive."

DASTOW / EARTHDAY

Hot and cold smoke, 3-D glasses, early-birders, tree-planting, butterflies, a buffalo roundup and more—Fermilab staff, users and their families celebrated Earth Day and Daughters and Sons to Work Day on Thursday, April 24.

— Photos by Fermilab Visual Media Services

EYES HAVE IT: Above, 3-D glasses allow a view of the Virtual Reality of the CDF detector; right, early morning birders view the sights in Fermilab's Main Ring. Below, father and daughter Jim Zagel and Cara Zagel, 9, team up for tree planting.

ON THE WEB:

DASTOW at Fermilab: www.fnal.gov/faw/dastow

Make Your Own Web Pages: www-ed.fnal.gov/FermiKids/2003

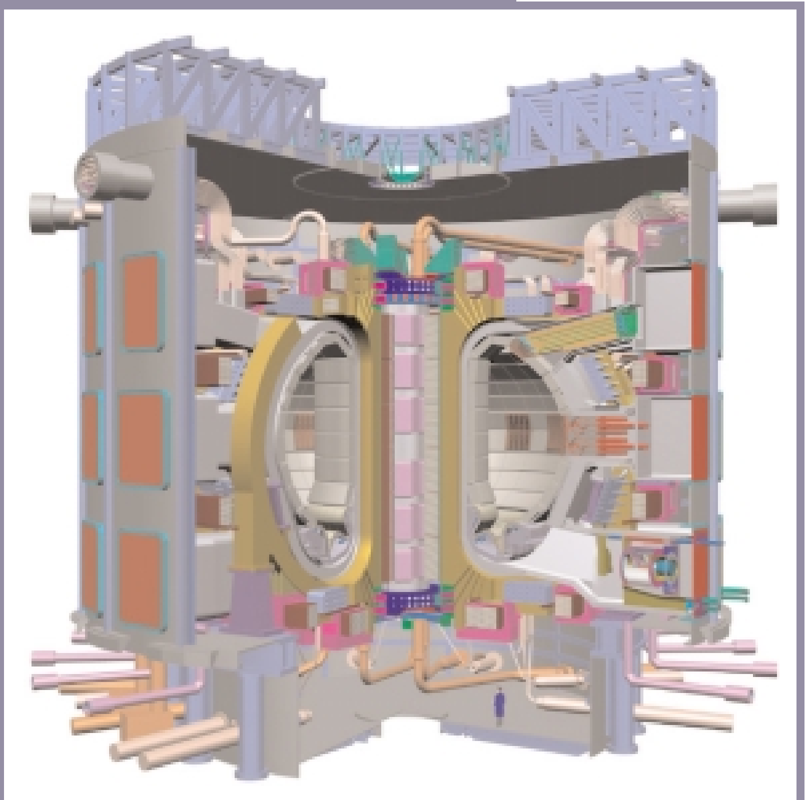
BUFFALO DAYS: Left, Owen Crawford, 7, gets the inside scoop as Don Hanson, above, describes his role as herdsman for Fermilab's American bison.

SMILE: Kids and adults gather for the annual DASTOW group portrait on the front steps of Wilson Hall.

HOT AND COLD SMOKE: Fermilab's firefighters, above, demonstrate how to put out a car fire. Jerry Zimmerman, left, demonstrates some super cool magic in his Cryo Show.

The Future of Fusion Energy

BURNING Plasma



Graphic courtesy ITER

ITER is an experimental fusion reactor that will be designed as a tokamak, a large donut-shaped configuration. The ITER tokamak will use plasma and superconducting magnets to create and maintain controlled fusion reactions.

by Elizabeth Clements

Almost all activities on the surface of the earth are ultimately powered by the sun, whether by today's sunshine or by fossil fuels formed millions of years ago. What if it were possible to harness the physical process at work in a star here on the earth—-to develop an environmentally attractive and sustainable energy source available to all nations and modeled on the fusion process in a star?

The main objective of the international fusion research project, ITER (which in Latin means “the way”), is to develop and demonstrate the science and technology of fusion power for peaceful purposes. If successful, ITER would produce 500 megawatts of fusion power for 500 seconds or longer during each “shot” of the fusion experiment, with a repetition period of roughly 2000 seconds. In contrast, the Tokamak Fusion Test Reactor at the Princeton Plasma Physics Laboratory, one of ITER's predecessors that shut down in 1997, produced a maximum of 11 megawatts for only one-third of a second.

With global energy consumption increasing yearly, the sources remain primarily fossil fuel resources such as coal, oil and natural gas, with some contribution from nuclear power. Fossil fuels have a significant impact on the environment in the form of greenhouse gases, as well as the ways in which they are extracted from the earth. Limited and localized resources are also a source of geo-political instability, making alternative energy sources more attractive.

These factors led President Bush to announce on January 30, 2003 that the United States would join negotiations for the construction and operation of ITER. In his statement, President Bush said, “The results of ITER will advance the effort to produce clean, safe, renewable, and commercially-available fusion energy by the middle of the century...We welcome this opportunity to work with our partners to make fusion energy a reality.”

The president's decision to enter negotiations was based on an extensive process that included the 2002 Snowmass Fusion Summer Study of major next steps, a Fusion Energy Sciences Advisory Committee study of strategies

ON THE WEB:

DOE-Office of Fusion Energy Sciences:
http://www.er.doe.gov/feature/fes.htm

Official ITER Website:
http://www.iter.org/

Photo by Reidar Hahn

This was the scene at the BPPAC meeting at Fermilab on April 29. Jim Yeck, the DOE/NSF U.S. LHC Project Manager who organized the meeting, emphasized the importance of strong central management when working in large international collaborations. He said, “The future of high-energy physics depends on the success of such large global collaborations as the LHC and ITER.”

for the study of burning plasmas, the interim report of an on-going study by the National Research Council, and a cost assessment by the DOE Office of Science.

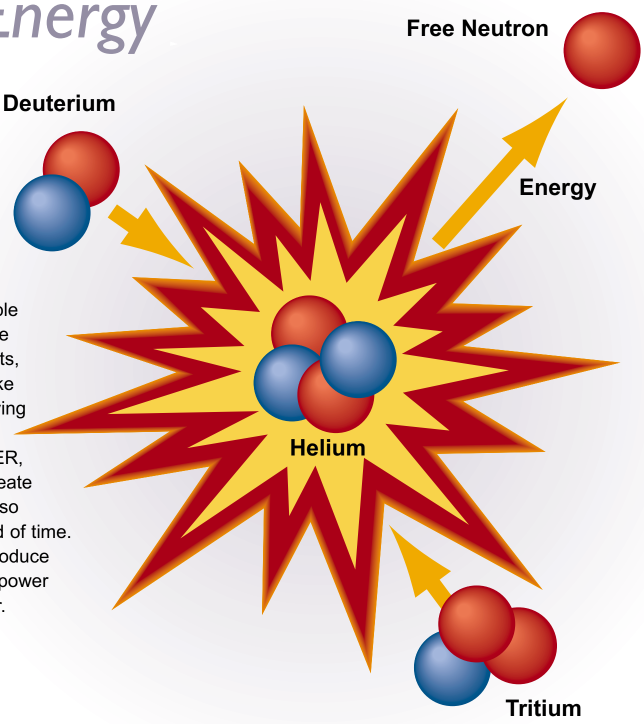
Developing new energy sources will also mean developing new methods of collaboration and cost-sharing. The current estimated cost for the construction project is $5 billion, requiring an international collaboration to shoulder all of the responsibilities. ITER proposes to form an international collaboration of nearly-equal partners. If successful, the ITER model could pave the way for future global science collaborations, such as the Global Linear Collider.

Canada, the European Union, Japan and the Russian Federation were the members of the ITER collaboration immediately prior to the U.S. joining (or re-joining; the U.S. was a partner until the late-90’s when Congress withdrew from ITER for budgetary reasons). The U.S. and China are the newest members, and South Korea has recently expressed an interest in joining. With such a large international collaboration, the U.S. must first prepare for negotiations by conducting cost estimates for a range of possible in-kind contributions; then, identify the U.S. mission and objectives, compile the U.S. interests, and seek to find scenarios mutually beneficial for all the partners. In early March, Dr. N. Anne Davies, Department of Energy Associate Director of Science for Fusion Energy Sciences, named Princeton Plasma Physics Laboratory’s (PPPL) Ned Sauthoff as U.S. ITER Planning Officer, and Charles Baker of the University of California at San Diego as deputy. Davies cited Sauthoff’s background in international collaborations and project management. Baker is the director of the U.S. fusion program’s Virtual Laboratory for Technology.

As U.S. ITER Planning Officer, Sauthoff’s main objective is to engage the fusion community and to build on the studies forming the basis for the president’s decision.

To foster effective participation by the fusion community, Sauthoff formed the Burning Plasma Program Advisory Committee (BPPAC). This advisory committee consists of physicists from institutions across the nation who will examine the components the U.S. would be interested in

The Future of Fusion Energy



Fusion is a relatively simple process: the binding of the nuclei of two light elements, such as hydrogen, to make heavier elements thus giving off tremendous amounts of energy. The key for ITER, however, is to not only create a fusion reaction but to also sustain it for a long period of time. If successful, ITER will produce 500 megawatts of fusion power for 500 seconds or longer.

contributing, and the roles the U.S. sees for itself in the ITER project, as well as other tasks. BPPAC is evaluating current successful models of international collaboration, such as the Large Hadron Collider located at CERN.

On April 29-30, BPPAC met with the LHC group at Fermilab to learn from their management experience as part of one of the largest international collaborations at CERN. Although the groups come from different scientific communities, the challenge of working in a large global collaboration is common.

Jim Yeck, the DOE/NSF U.S. LHC Project Manager, who organized the meeting, recognizes the importance of scientific communities working together.

"The future of high-energy physics depends on the success of such large global collaborations as the LHC and ITER," he said. "The LHC group is happy to help because we have experiences that are relevant. In large projects, you encounter issues of international relations, but the bottom line is that scientists want to do science. Scientists will do whatever it takes to extend the field of research."

Speakers at the meeting included Deputy Director Ken Stanfield, US-CMS Research Program Manager Dan Green, USLHC Accelerator Project Manager Jim Strait, and the Head of Fermilab's Office of Project Management Oversight, Ed Temple. Yeck noted that "a consistent message from the LHC people is the importance of strong central management."

Photo by Reidar Hahn

Ned Sauthoff, of the Princeton Particle Physics Laboratory, was named the U.S. ITER Planning Officer in March.

BPPAC plans to examine other models of international collaboration and does not expect to complete its analysis until the end of the summer. The ITER project hopes to begin construction in 2006 and become operational in 2014. Canada, France, Spain and Japan have all submitted offers to host ITER, but further negotiations are necessary to reach a consensus. Sauthoff cited the importance of contact with the LHC project.

"We have had a very fruitful interaction with the LHC group," Sauthoff said. "Both LHC and ITER are big science adventures and we have not had enough opportunities to share our experiences. I'm looking forward to more beneficial interactions."

Fusion is a theoretically simple physical process: the binding of the nuclei of two similar atoms. For example, the nuclei of deuterium (one proton and one neutron) and tritium (one proton and two neutrons) can be forced to bind together. The result will then split into a neutron and a helium nucleus, with two neutrons and two protons—otherwise known as an alpha particle—plus another particle that does not carry much energy. The mass of the two incoming nuclei is greater than the mass of the product. This loss of mass translates into energy, which can both heat the plasma and provide power for useful work.

The fusion reaction is sustained in what is called a "burning plasma," a nearly fully- ionized gas in which the fusion power captured by the plasma keeps the plasma hot. A burning plasma is dominated by this self-heating; however, this condition has not yet been achieved in a laboratory. The dynamics of the self-heating will be a fundamentally new and key feature studied in ITER.

The plasma, in this case an ionized gas of deuterium and tritium nuclei, will be heated by an external source to a temperature of at least 100 million degrees centigrade. Once this temperature is reached, the deuterium and tritium nuclei will begin to fuse, forming helium nuclei and neutrons. These magnetically-confined helium nuclei will then collide with deuterium nuclei in the gas, transferring some of their energy to the deuterium nuclei and heating the gas further. The plasma becomes self-heating—like a star—and a strong external energy source is no longer necessary.

ITER would be the first magnetic confinement fusion experiment to produce burning plasma. The reaction would produce ten times the amount of external power injected into it.

"By the time our young children reach middle age, fusion may begin to deliver energy independence and energy abundance to all nations rich and poor," said U.S. Secretary of Energy Spencer Abraham. "Fusion is a promise for the future we must not ignore."

FERMILAB ARTS, LECTURE AND FILM SERIES

To purchase tickets for Arts and Lecture Series events, or for further information or telephone reservations, **call 630-840-ARTS** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open. **Film Series:** *All shows are Friday nights at 8 p.m. in Ramsey Auditorium. Tickets are $4 for adults, $1 for children (under 12), and $2 for Fermilab students, and are sold only at the door. Please join us for refreshments and discussion after the film.*
For more information, check out our web page at **www.fnal.gov/culture.**

ARTS SERIES

Orquesta Aragon

May 10, 2003

Founded 60 years ago, Orquesta Aragon is recognized as the premiere charanga group in Cuban Music. In keeping with the charanga-style, Orquesta Aragon is a 13 piece band that does not feature a brass-section, but rather vocals, flute, and violins on top of a rhythm section of piano, bass, congas, timbales, bongo and clave.

Tickets - $26 ($13 ages 18 and under)

FILM SERIES

Friday, May 9, 2003

Mulholland Drive

USA (2001), 145 min. Dir: David Lynch.

Lynch's atmospheric film noir intertwines the stories of Betty (Naomi Watts), a perky Hollywood hopeful, and Rita (Laura Harring), amnesiac from a car accident along Mulholland Drive, with strange and macabre doings in the world behind the scenes of showbiz.

CALENDAR/LAB NOTES

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

ARTS AND CRAFTS SHOW

■ Fermilab Employees' Arts and Craft Show, May 1-June 2, Wilson Hall gallery (second floor crossover). Reception May 9, 2003 from 5pm - 7pm. During the reception the Fermilab Singers will perform.

BARN DANCING

■ The Fermilab Folk Club presents a barn dance Sunday, May 11 at 6:30 p.m. with music by Paul Tyler & Friends 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 those under 12. Come with a partner or without; bring the family or not. For more information contact Dave Harding (x2971, harding@fnal.gov) or Lynn Garren (x2061, garren@fnal.gov) or check the webpage at http://www.fnal.gov/orgs/folkclub/ .

MAY 29, 2003: NALWO

■ invites all Fermilab women, visitors, and guests to the annual Spring Tea hosted by Ms. Beth Witherell at Site 29; 10am - Noon. Please bring a favorite dessert or appetizer to share. http://www.fnal.gov/orgs/nalwo/03529Tinvite.htm. For additional information please contact Sue, x5059 or mendel@fnal.gov

Chez Léon MENU

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

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

FOR RESERVATIONS, CALL X4512
CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

Lunch
Wednesday, May 14

Barbecued Ribs

Sweet Potatoes w/Chipolte

Collard Greens Timboli

Yogurt Cake w/Ice Cream & Rhubarb Sauce

Dinner
Thursday, May 15

Grilled Squid

Spiced Pork Tenderloin w/Wilted arugula & spinach

Strawberry Shortcake

Lunch
Wednesday, May 21

Raspberry Chicken

Sauteed Peapods and Wild Rice

Strawberry Layered Cake

Dinner
Thursday, May 22

Zucchini Pancake w/Smoked Salmon and Yogurt Dill Sauce

Veal Medallions w/Sun dried Tomatoes & Capers

Julienne of Carrots and Green Beans

Bourbon Walnut Tart

F E R M I N E W S

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The deadline for the Friday, May 23, 2003 issue is Tuesday, May 13, 2003. 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

■ '98 Dodge Neon, 2 Dr, 2.0l DHOC, 5-spd., AC, AM/FM stereo cassette, 1 Yr. CarMax warranty remaining, 48K miles. $4,000. Contact 630-840-5216 or brew@fnal.gov.

■ '98 HONDA-PRELUDE, 65K miles, auto, CD, premium sound, $ 12,800 o.b.o. Contact 630-840-3377 or ykalin@fnal.gov

■ '96 Jaguar Vanden Plas. 53K orig. mi. Black ext., cream int. Loaded. Premium Connolly leather. $17,500. Contact gerryb@fnal.gov or 630-840-3930.

■ '89 Harley-Davidson FLHS, 22K miles, excellent condition, $11,000 o.b.o. Also: 45-gallon hexagon aquarium, 69 inches high, lexan construction, $150 o.b.o. Contact Chuck at 630-840-4949, or cmorrison@fnal.gov.

■ Century fiberglass truck cap for S10 shortbed. Black, sliding side windows w/screens, sliding window to cab. 3rd brake light. $500. Contact Bill Dymond at 630-840-6323, dymond@fnal.gov or 815-787-9415.

■ Set of sheepskin seat covers and cargo floor mat for BMW X5, $225. Contact Roberto 630-840-6771

■ Two used/new car buying guides in like-new condition: 2003 Consumer Reports "Used Car Buying Guide" (236 pp.) and 2003 Consumer Guide Car & Truck Test "Buying Guide" (256 pp.) for new cars (including 2004 models). Cost $10 each new. Asking $7 each, o.b.o. Contact: pbg@fnal.gov or 630-840-3662

■ 1987 25' Sea Ray cuddy cabin, 454 / 310hp with 180 hours. 1995 B&M haul Rite trailer. To much to list... $12,500. Contact Ed Dijak, 630-840-6300, 630-665-6674 home, dijak@fnal.gov

■ Restored 1937 wood and canvas Old Town 16-foot (model: OTCA 16) sailing canoe, $2,500. Contact 630-840-6416.

■ Bike 26″ female 10 speed Murray Montero all-terrain pink & gray, $40. Contact Ken at 630-840-4225.

■ Shogun triathlon racing bike, 21″ chrome-moly frame tri-bars & original drop bars, Shimano 600 components, toe cages or "Look" cleats, tools, shoes and teardrop helmet, $400. Also: hammer dulcimer, cherry wood , 21/11 string, new - never used. Contact Steve at 630-840-4607 or conlon@fnal.gov

■ 10″ compound miter saw: 15 A motor, 4900 RPM, doubly insulated, carbide blade, transparent blade guard, automatic brake, dust bag, side extension arms, adjustable stop block, hold down clamp, miter cut, bevel cut, compound cut, ($120 value), asking for $70. Contact 630-840-4597 (day), 630-879-0198 (evening), or NG@FNAL.GOV.

■ Rockford Fosgate dual 12″ Subwoofer – wired for 4 ohms impedance, exc. condition. $125 Call Roberto at 630-840-6771

■ Hide-a-bed couch and loveseat, good shape, cloth light brown. $150 o.b.o. Contact Tony at 630-840-6527.

■ New Marvin picture bay window, 113″x79″, $700. Contact Roberto at 630-840-6771

■ Regulation size ping pong table that folds up and rolls out of the way. Very good shape, $70. 6-hp Johnson outboard motor (long shaft) with tank and line. Not pretty, but runs great! $125. Contact Dave at 630-840-3366

LOOKING TO BUY

Canoe in good condition, length in the 13-16 feet, range. Weight less than 60 lbs. Contact Daniel at 630-840-3604 or daniel@fnal.gov.

LOOKING TO RENT

Furnished three bedroom house or apartment, for the period of July 1 - July 31, 2003. Location near Fermilab preferred. Please contact Jae at yu@fnal.gov or 817-272-2814.

HOUSE FOR RENT

Wayne, Ill.: 2 bdrm; great room with skylights, in wooded rural setting; ideal for 1-2 adults; 15 minutes from FermiLab; $1150/mo plus utilities; deposit plus references. Contact 630-377-7372.

BIBLE EXPLORATION

We meet from Noon to 12:35 p.m. every Wednesday in the Small Dining Room (WH-1SW) to explore the Bible - with no strings attached. If you would like to check out the Number 1 best seller of all time in a relaxed, no-obligation setting, please join us. The current study is entitled "Journey into Happiness." Info at 630-840-3607 or dykhuis@fnal.gov

MILESTONES

BIRTHDAY CELEBRATION

■ In September 2001, the University of Chicago hosted a contest to design a website for Enrico Fermi's 100th Birthday, with the first prize a trip to Chicago. This winning group of four high-school seniors and their instructor journeyed from Instituto G.W. Leibniz in Bormio, Italy, and toured Fermilab on April 29. They had previously visited Argonne National Laboratory and the University of Chicago, viewing archives that include Enrico Fermi's Nobel Prize and personal papers.
Their prize-winning web site:

www-news.uchicago.edu/fermi/Group19/enricofermi/

Scientific content, layout and design and organization of the site were all elements that the judges considered awarding the top prizes.

Cristian Boffo (left) of Fermilab's Technical Division, who is originally from Italy, shows the visitors the site model on the 15th floor of Wilson Hall.

Photo by Reidar Hahn

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