FermiNews

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INSIDE

The Northern Illinois University experimental high–energy physics team.

The first in a series of *FermiNews* articles about possible future accelerators at Fermilab

Reaching for the Muon

Is a Fermilab group exploring the collider of the future—or only chasing muonbeams?

by Judy Jackson, Office of Public Affairs

Like tomorrow, the goal of particle physics never arrives; it's always a day—or an accelerator—away.

The field of high-energy physics has its collective gaze ever fixed on the future, on the spot just over the horizon, where the next step forward in technology will make possible the next generation of experiments to explore the next new theoretical territory. Particle physics advances by the complex synergy of theory, experiment, and technology, all moving forward together, by lurches and leaps and discoveries and missteps, beyond the horizon into the unknown.

The work of accelerator physicists is never done; there is always the next accelerator to build, and the next after that. Currently, physicists worldwide are putting their minds to the challenge of how to explore the realm of physics beyond the Standard Model. One aim of Fermilab's coming reorganization is to allow the Fermilab scientific community more time and flexibility to work on ideas and plans for an

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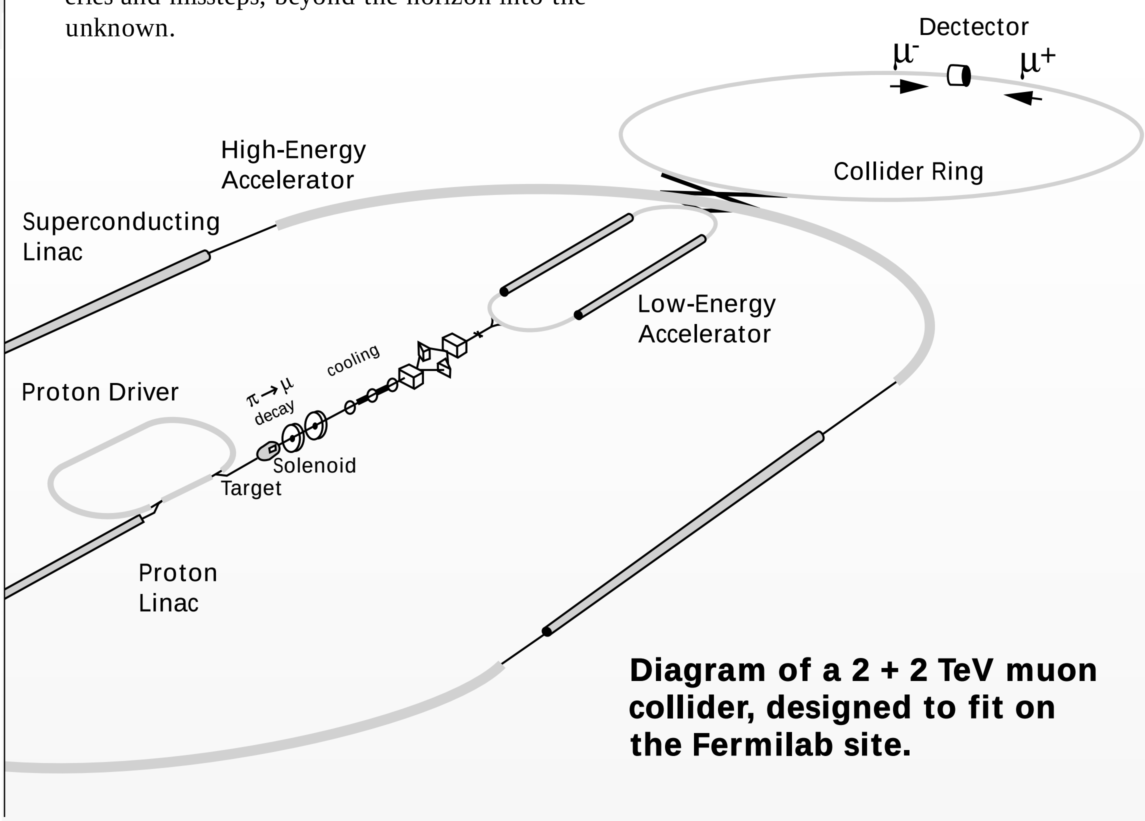


Diagram of a 2 + 2 TeV muon collider, designed to fit on the Fermilab site.

Laboratory Reorganization—

Working It Out

by Leila Belkora and Judy Jackson, Office of Public Affairs

On the evening shift of a working day in early October, Mary Janosi, a beamline operator in Fermilab's Research Division, came calling at the Accelerator Division Main Control Room. The AD Operations crew chief took advantage of a temporary Tevatron shutdown to give Janosi a golf-cart tour of the Tevatron tunnel. Later, she also got a close look at the Booster and Linac.

Janosi's visit was one of the early steps in an expanding program of staff exchanges between the Operations Departments of the Accelerator and Research Divisions that began as soon as the groups learned they would be merging in Fermilab's new reorganization plan. The two groups of operators, who now work in separate control rooms and organizations, will form one department in the new Beams Division, when the reorganization goes into effect on January 1, 1997. The RD Operators already have the Main Control Room's Rookie Books to study, and arrangements for formal cross training will begin soon.

Laboratory Director John Peoples cited the groups' efforts in a recent talk to Fermilab managers on the upcoming reorganization. "The operators from both control rooms are already doing exchange programs," he said. "They are a model for the rest of us."

Dan Johnson, currently head of Operations for the Research Division, will become deputy head of Operations in the Beams Division. Johnson explained that at present, one group of operators runs the accelerator from the Main Control Room, while the other group runs the beamlines from the Operations Center in the fixed-target area. "The idea is to combine both operator groups into one new one. I'll be helping to integrate things so we can operate the accelerator and the beamlines from one location," he said. "Bob Mau's group has good things they do; I think we have good things we do, and hopefully we can come up with the best of both. We have different control systems, different shift schedules, different philosophies on some basic stuff like crew structures and shifts. We use an electronic log book, while the AD uses a hand-written log book—things like that. So far, we're both willing to listen to each other."

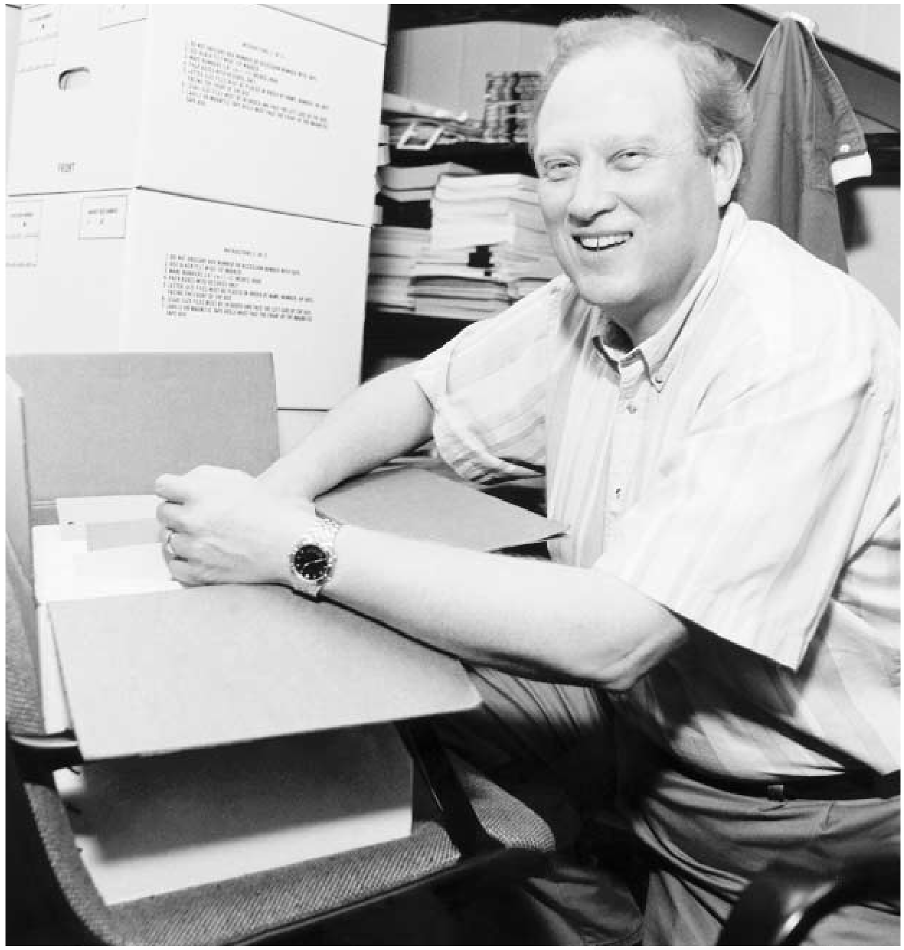


Photo by Reidar Hahn

John Cooper, head of the new Particle Physics Divisio[n] at Fermilab, packs up his office at CDF.

Janosi says that the coming change will be "very good for our group." She believes that opportunities for advancement will be much greater for current Research Division operators in the new configuration.

Meanwhile, John Cooper, head-to-be of the new Particle Physics Division, said his division is going through a "rehearsal and exchange process" and that the final organization of the Particle Physics Division might not be well defined until after Thanksgiving. "By the time everybody leaves for Christmas vacation," he said, "they should know who's going to be their boss and where they're going to be when they come back.... That doesn't mean everybody is going to go shuffling their desks over the vacation, either; I don't think it's particularly efficient for 500 people to change desks, as I can personally testify since I have to change mine." Cooper's belongings are in boxes, and for the moment he considers his backpack to be his office.

Many in the new divisions are still trying to master the details of the reorganization plan. "I only found out about this last week, so I'm still trying to figure out what my responsibilities will be," said Mike Martens, who will be the head of the Tevatron Department in the Beams Division. He's on firmer ground talking about the technical issues facing his group: "Besides keeping the fixed-target run going, our goal is to understand the physics issues for collider Run II."

The reorganization of Fermilab's non-administrative divisions will help align the rest of the Lab's resources to best meet existing obligations and move ahead with collider Run II. Peoples summarized the goals of the reorganization in a talk to employees in mid-October: "A modest improvement in efficiency, a better focus on the two collider detectors, management of declining budgets, and the initiation of conceptual planning for the future."

Cooper, reflecting on the significance of the reorganization, stresses the necessity of keeping the Lab at the leading edge of high-energy physics research by freeing up people to plan for future. "We have to make a place for, and get people working on, projects for the future. Some of those things are the CMS program [a detector Fermilab will help build at the LHC] where the energy frontier will move, and the neutrino oscillation experiment with the beamline that will point toward the Soudan mine. We can see our future pretty clearly for about 10 years out. We will be the supreme facility for that entire time. What a great place to be, right? But we have to think, what happens after that? It has to be younger and younger people who start thinking about that." ■

Photo by Reidar Hahn

Mary Janosi, an operator running the beamlines in the Fixed-Target area, will move from the Research Division to the new Beams Division.

)an Johnson, left, ► vill be Bob Mau's leputy in the eorganization of he Beams Division.

Photo by Jenny Mullins

/ike Martens, seated at ι console in the Main :ontrol Room, will be he head of the 'evatron Department in he Beams Division.

Cross Section

by Doreen Wackeroth, Theoretical Physics
Edited by Leila Belkora, Office of Public Affairs

The concept of cross section is the crucial key that opens the communication between the real world of experiment and the abstract, idealized world of theoretical models. In a high-energy physics experiment, we specify interactions of elementary particles quantitatively in terms of cross sections. The cross section is the probability that an interaction will occur between a projectile particle—say, a proton that has been accelerated in the Tevatron—and a target particle, which could be an antiproton, or perhaps a proton or neutron in a piece of metal foil.

We can measure the probability that two particles will interact in experiments. We can also calculate this quantity in a model that incorporates our understanding of the forces acting on a sub-atomic level. In the famous experiment in which Rutherford studied the scattering of alpha particles off a foil target, the cross section gives the probability that the alpha particle is deflected from its path straight through the target. The cross section for large-angle scattering is the fraction of alpha particles that bounce back from the target, divided by the density of nuclei in the target and the target thickness. The comparison of the measured cross section with the calculated one verified the model of the atom with a minute, massive center, carrying an electrical charge.

We can picture the cross section as the effective area that a target presents to the projected particle. If an interaction is highly probable, it's as if the target particle is large compared to the whole target area, while if the interaction is very rare, it's as if the target is small. The cross section for an interaction to occur does not necessarily depend on the geometric area of a particle. It's possible for two particles to have the same geometric area (sometimes known as geometric cross section) and yet have very different interaction cross section or probability for interacting with a projectile particle.

During wartime research on the atomic bomb, American physicists who were bouncing neutrons off uranium nuclei described the uranium nucleus as "big as a barn." Physicists working on the project adopted the name barn for a unit equal to 10^{-24} square centimeters, about the size of a uranium nucleus. Initially they hoped the American slang name would obscure any reference to the study of nuclear structure; eventually, the word became a standard unit in particle physics.

Today, although experimental techniques and theoretical calculations have considerably increased in complexity compared to the early days of scattering experiments, the concept which links theory and experiment has not changed. In the Tevatron, for instance, we measure the probability of producing a pair of top quarks in a proton-antiproton collision. We measure this production cross section by counting the number of top quark events observed in the detector and by knowing the time-integrated luminosity, the product of the number of particles per unit time in the proton and antiproton beam, per area of the beam. By comparing the top quark production cross section with predictions, which are based on a model of elementary particles and their interactions, we probe our understanding of the strongest known force between elementary particles. ■

Photo by Reidar Hahn

Can't hit the broad side of a barn? Try hitting an atomic nucleus. The unit of cross section is the "barn," equal to 10^{-24} square centimeters. This barn, one of many on the Fermilab site, is located at Kautz road.

Deer at Fermilab Becoming Risk to Environment

At left, Joe Trevino, of the Roads and Grounds department, points out tree damage caused by deer.

by Donald Sena, Office of Public Affairs

The growing deer population at Fermilab is posing problems for the Lab's environment, and the damage will worsen as the deer continue to expand their numbers at roughly 13 percent a year, according to wildlife management specialists at Fermilab.

In 1993, Fermilab had approximately 304 deer on site, increasing to 344 just one year later. In 1995, Fermilab wildlife managers didn't have the proper weather conditions to conduct an accurate count. However, Rod Walton, associate head of the Environmental, Safety and Health Section, said he estimates there are now approximately 435 deer on site, figuring 13 percent yearly growth since the 1994 count. He added that ES&H hopes to get an accurate count this winter. [Walton said his team needs 10 inches of snow on the ground and a sunny day to properly count the brown deer against a white backdrop from the air.]

Fermilab has about 10 square miles of land; however, the area of open land is less due to water, civil construction, experimental sites and other "developed" areas. As a result, Walton and his team estimate that there are 35-50 deer per square mile. Many wildlife managers say optimum deer density for this area is 5–20 deer per square mile for a balanced system.

Walton said the deer at Fermilab don't have any natural predators either, allowing their population to expand unchecked by nature. He added that Fermilab doesn't have a deer crisis yet, but, if the present trend continues, he foresees a troublesome situation in the near future.

"As long as we have mild winters—which we've had for several years in a row—and, as long as we keep seeing a 13 percent annual rate of growth, it doesn't take a high–energy physicist to figure out that after a while you're going to have a problem."

The Damage Detailed

In 1992, a wildlife team began a study to gauge how the deer were affecting Fermilab's environment. Part of the study consisted of fencing off some vegetation to exclude the deer, comparing the exclusion areas with places the deer inhabit.

"Basically , what we have found is that the deer have had a marked impact on vegetation in the forest, but not a whole lot in the prairie," said Walton. "Although there are some species in the prairie that the deer eat to the exclusion of everything else."

The deer are eating tree and plant material faster than the plants can regenerate. A careful examination of Fermilab's tree line from a distance reveals trees stripped of their vegetation up to a certain height—limited by how high deer can reach on the trees.

More damage comes in the form of trees killed or deformed from bucks rubbing their antlers on the bark. Car–deer accidents also cause damage each year, especially in the fall during the evening rush.

Lastly, the deer will eventually hurt themselves if their population grows unchecked. There soon won't be enough food, and disease can spread rapidly in large populations.

Possible Solutions

The deer dilemma is not unique to Fermilab. Many sites in various locales have been battling this problem for years. Argonne National Laboratory recently had their deer problem reach crisis levels, according to U.S. Department of Energy officials. After consulting with DOE, Argonne worked with the animal damage control unit of the U.S. Department of Agriculture. After conducting an extensive study, the USDA wrote a comprehensive wildlife management plan that included lethal deer removal.

Near the end of 1995, specialists set up feeding stations and, on a few nights, sharpshooters killed some of the herd. These shooters are trained to kill deer quickly without suffering or wounding. The meat was distributed to charity.

The sharp shooters "have very strict rules of engagement, to use military terms," said Walton. "They don't shoot unless they know they can drop the deer immediately."

DOE officials, however, admit this type of solution can be quite expensive.

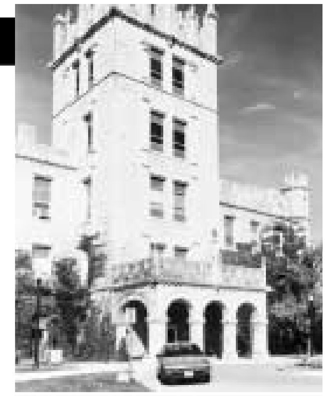
Another solution gaining more popularity in the country is animal contraception. Wildlife experts inject a contraceptive, which can last up to a year or two, into a deer by shooting it with a dart, At the same time, the experts must "mark" each deer with paint or a tag to know which ones have been injected. This method, while called "hopeful" by some at the Lab, is also quite expensive. ■

Photos by Reidar Hahn

Northern White Cedar trees, eaten away as high as the deer can reach, have been hurt by browsing.

Next Exit: The Energy Frontier

Northern Illinois University, just 30 miles from Fermilab, combines theory work, collider physics and a crop of home-grown students for cutting–edge physics research.



Altgeld Hall on the campus of NIU in DeKalb.

by Donald Sena, Office of Public Affairs

Northern Illinois University, a straight shot on I–88 from Fermi National Accelerator Laboratory, also represents a direct route to the energy frontier of high-energy physics for many students reared in the western suburbs of Chicago.

Since the late 1980s, NIU has had an active team participating in sophisticated research and innovative experiment development as part of the DZero collaboration. The collider group from DeKalb includes graduate students and undergraduates in all phases of its work, as NIU doesn't have a doctoral program in physics.

NIU's history at Fermilab, however, goes beyond the experimental group. The senior member of the faculty, Carl Albright, has associated with the Lab's theory group since the formation of that group in 1969. Presently, the university has five experimental physicists / professors, one theorist and two senior research scientists. The department graduates about 10 undergrads a year with physics degrees, along with five graduate students. The faculty members said one of their goals is to develop a doctoral program in high–energy physics, enhancing an already fruitful relationship with the Lab.

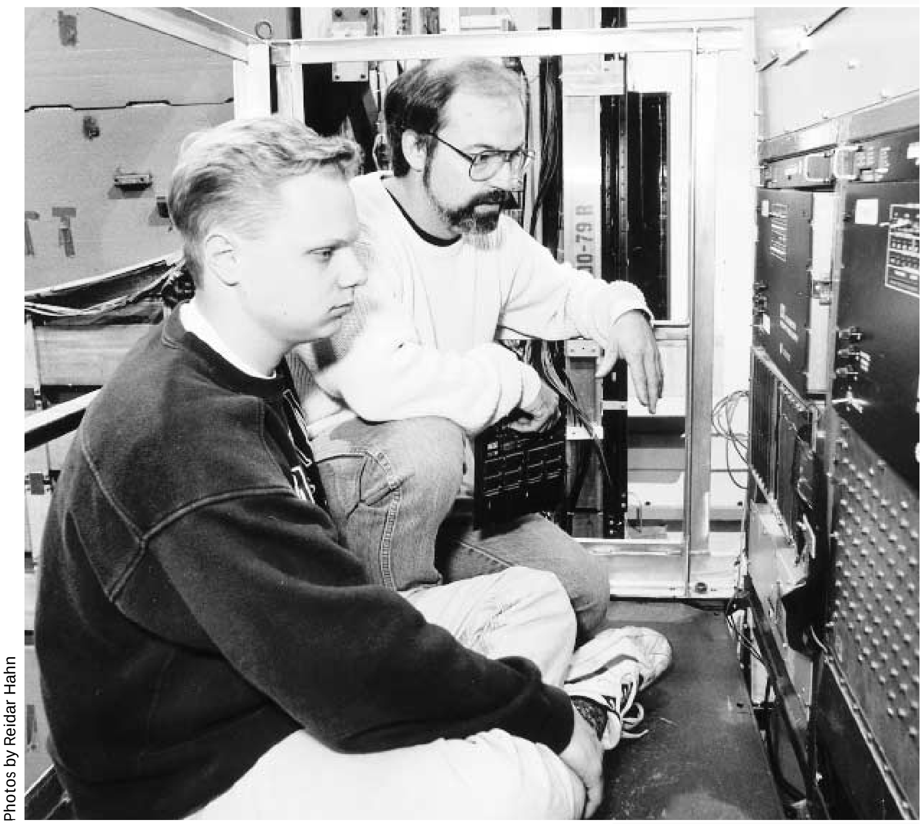
That relationship is one that J. Dennis Hastert (R–IL) takes an interest in. Hastert, whose congressional district includes Fermilab and Northern Illinois University, has been a supporter of science and basic research in Congress through the years. He said support for Fermilab and its mission ensures university professors and their students from around the nation, such as those at NIU, have the resources to expand the world's knowledge of the basic constituents of nature.

"I support basic science—it needs to be done," said Hastert. Also, the universities that do research at Fermilab "produce a lot of the new physicists that do the pioneering studies."

The Congressman also said he would encourage the scientific community to engage in a more open dialogue with the public and government representatives about the benefits of their endeavors in order to bridge the gap between science and the American people.

Theory Group User

Albright spent the late 1960s and early 1970s as NIU's sole high–energy physics professor, until Frank Taylor joined to lead an effort in experimental neutrino physics. Albright, who came to NIU from Northwestern in 1968, performed some of his earlier work at Argonne, but attended Fermilab's groundbreaking with much enthusiasm for what would lie ahead. In the early 1970s, he was interested in neutrino physics, particularly in neutral currents and heavy leptons. He switched focus a bit in the 1980s, studying composite models, and, more recently, he has worked with mass matrices for quarks and leptons to learn why particles have the masses they do. Albright is one of the few at the Laboratory who is both a user and a theorist; most users at Fermilab are experimentalists, but the proximity of NIU to Fermilab makes it easy for him to spend about two days a week here during the academic year.



Photos by Reidar Hahn

Josh Norten (left), a senior at NIU, with Gerry Blazey, particle physics professor, working on components for DZero.

"Over the years, I have found it very enjoyable coming here and associating with

During a recent nterview, Hedin ınd Fortner were ısked what they ıope to "see" in Run II.

They looked at ·ach other, ıodded and Hedin, beating Fortner to the ɔunch, said, 'We want to ;ee the Higgs."

The Higgs ɔoson, which ;ome call the Holy Grail of ɔarticle physics, nay provide :lues to the nystery of mass.

members of the theoretical group," said Albright. "It's a good interaction because there are many different areas represented by members of the group, and the resources that Fermilab provides are outstanding."

Taylor left NIU in the mid–1980s, leaving the university without any experimentalists in high–energy physics. Realizing that a university so close to the world's highest–energy particle accelerator should have experimentalists, the NIU administration hired four high–energy physics professors between 1987 and 1988. The administration wanted their new faculty to bring a large project with them to the physics department. The first hires were David Hedin, then a research scientist at the State University of New York–Stony Brook, and Dan Kaplan, now with the Illinois Institute of Technology. Hedin and Kaplan both worked on the DZero experiment, thus bringing their work on the collider to NIU. In the summer of 1987, Michael Fortner, having just completed his doctorate at Brandeis University, joined Hedin and Kaplan as a postdoc with the group; he was later hired as a professor. In 1988, Sue Willis, former Fermilab postdoc and University of Oklahoma professor, and Jim Green, former postdoc at Rutgers University, joined the group, and Gerry Blazey, a physicist on DZero since 1986, rounded out the staff with his arrival in 1996.

Kaplan and his team of students worked on fixed–target experiments during his tenure at NIU, performing a series of high–intensity experiments looking for the final states of *b* quarks and charm quarks. However, since the new experimental group arrived at NIU, they've devoted 80 percent of their time to DZero, according to Hedin. He added that although the group is relatively small, they have made a solid impact on the experiment.

DZero

NIU has always been associated with the muons and triggers for the complex particle detector. Muons, produced by collisions of protons and antiprotons, are particles that can pass through the outer layer of the detector and "trigger" their presence by means of hardware and software mechanisms, which record where particles hit in the detector. The NIU group had the responsibility for the muon triggers and for writing much of the upper–level muon data acquisition "code" for Run I. [The muon system has 170 wire chambers that muons pass through. The muons are bent by a magnet as they pass through the detector. The code determines if the particle "hits" in the muon area of the detector are indeed muons, and the code also determines the muons' momenta.]

Photo by Reidar Hahn

Carl Albright, a physics professor at NIU and a user associated with Fermilab's theory group.

"Like any detector, there are 100,000 or more lines of code plus analysis procedures, and it was primarily NIU's responsibility to develop these procedures both in the off–line reconstruction and as part of the triggers," said Hedin.

Many students, including several undergraduates, worked to build the muon chambers and test them.

NIU professors were also the "triggermeisters" for DZero in the early years of the experiment. There are typically 50 to 60 different triggers, each targeting a certain area of physics or particle interactions. A triggermeister ensures there is a good mix of physics coming in on all of the triggers. The computer intake for the detector is limited, so these collaborators must preserve as much information as possible while weeding out the stuff they don't need. The first two triggermeisters on DZero in 1992–93 were Fortner and Blazey, the latter then at the University of Rochester.

The NIU team was also involved with the analysis of Run I data, specifically the identification of muons; muons correlate with jets to signal that a *b* quark has decayed.

"Muon identification was critical because that was the only tool that specifically was being used to enhance *b's* on DZero," said Fortner.

Upgrade

The NIU team will continue to focus on DZero with the upgrade for Run II, expected to begin in 1999 when the Main Injector is ready. The Main Injector will bring much higher luminosity—or number of particle collisions per second—to the detector, and the trig-

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Muon Collider

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accelerator at Fermilab to follow the Large Hadron Collider now planned at CERN, the European Particle Physics Laboratory. They seek an accelerator design to take particle physics deep into unexplored territory.

The process of creating a new accelerator begins with imagining what might be possible, and then moving from "might be" to "could be" (or "couldn't be") by carefully examining all of the potentials and problems of its design. The Future Accelerators at Fermilab Advisory Committee, a group of 10 scientists, meets each Tuesday morning to examine and discuss various alternative accelerators that might someday be built at the Laboratory. Among several possibilities they think about is a kind of accelerator called a muon collider.

' We want to know whether a muon collider might be part of the near-term future of research in our country, or whether it's something that will have to wait for a awhile."

\- Alvin Tollestrup

The idea of building a muon collider has incubated for almost two decades, but has attracted wide attention only within the past five years. In 1979, accelerator physicist David Neuffer first wrote about muons as a possible solution to problems with electron colliders; he has continued working on muon collider problems ever since. "I used to think it was impossible to build a muon collider," he said in a recent interview. "Now it's only very difficult."

"Comparing electron and muon behavior in a hypothetical collider would occasionally appear as a problem to solve on a physics exam," added accelerator physicist Robert Noble. "But it wasn't until the early 1990s that many people really began to look at it seriously."

The possibility of using the subatomic particles called muons in a particle collider holds out many intriguing promises. Muons are leptons, fundamental particles with no internal structure, unlike hadrons (such as the protons accelerated by the Tevatron) with their complex internal structure of quarks and gluons. Physicist Leon Lederman expands on the late Louis Alvarez's metaphor of hadrons as colliding garbage pails: "When they collide," Lederman says, "you get a lot of eggshells, coffee grounds, banana peels—and every now and then a pearl." This possibility of finding pearls among the coffee grounds gives hadron colliders the name "discovery machines."

In contrast, lepton collisions are clean; they don't produce the "garbage" of hadron collisions. All of the collision energy is available for conversion into new particles, at specified levels of energy. Thus a lepton collider can "sit on" the energy of a postulated "pearl," and go and look for it, rather than sending physicists

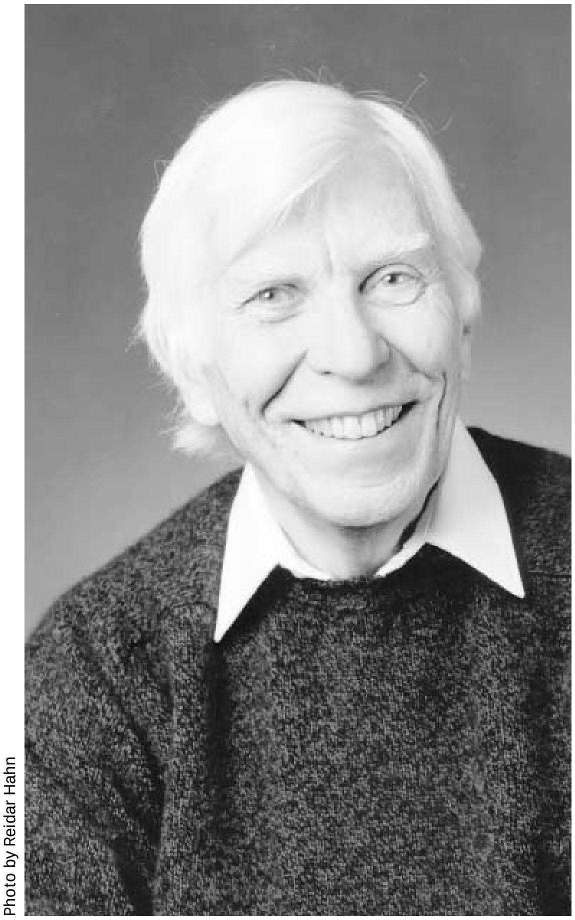


Photo by Reidar Hahn

Alvin Tollestrup, "spiritual leader" of the muon collider effort at Fermilab. Tollestrup believes a muon collider could permit indirect experiments to test Grand Unification Theory.

poking through the coffee grounds and eggshells of a hadron collision. Electron accelerators take advantage of this property to create clean, high-energy collisions. However, at high energy, accelerated electrons lose energy to phenomena known as bremsstrahlung and synchrotron radiation; and the higher the energy, the more of it they lose, effectively limiting the achievable energy of electron colliders. But because the mass of the muon is 207 times the mass of the electron, muons don't suffer such large energy losses.

Muons would appear to be the perfect particles for a collider—they give clean lepton collisions, and they don't radiate energy—were it not for one serious flaw: they don't live very long. Muons are only muons for two microseconds, before they decay into electrons and neutrinos. However, accelerating them to high energies can extend their lifetimes to 40 milliseconds, enough time to take 1,000 turns around a collider ring, and perhaps long enough to make themselves useful.

The trick in building a successful muon collider is to find a way to take advantage of the muon's useful qualities within its short lifespan—and to deal with the products of its decay. Building a detector for muon collisions is "essentially trying to do an experiment behind a beam dump," says Fermilab physicist Steve Geer, who has been working on designing just such an experiment. "It will take very clever shielding design to minimize the number of decay particles getting into the detector." The properties of the muon mean that while the collisions themselves would be clean, the backgrounds arising from muon decay would be very large. "The large backgrounds make it challenging but not impossible," Geer says.

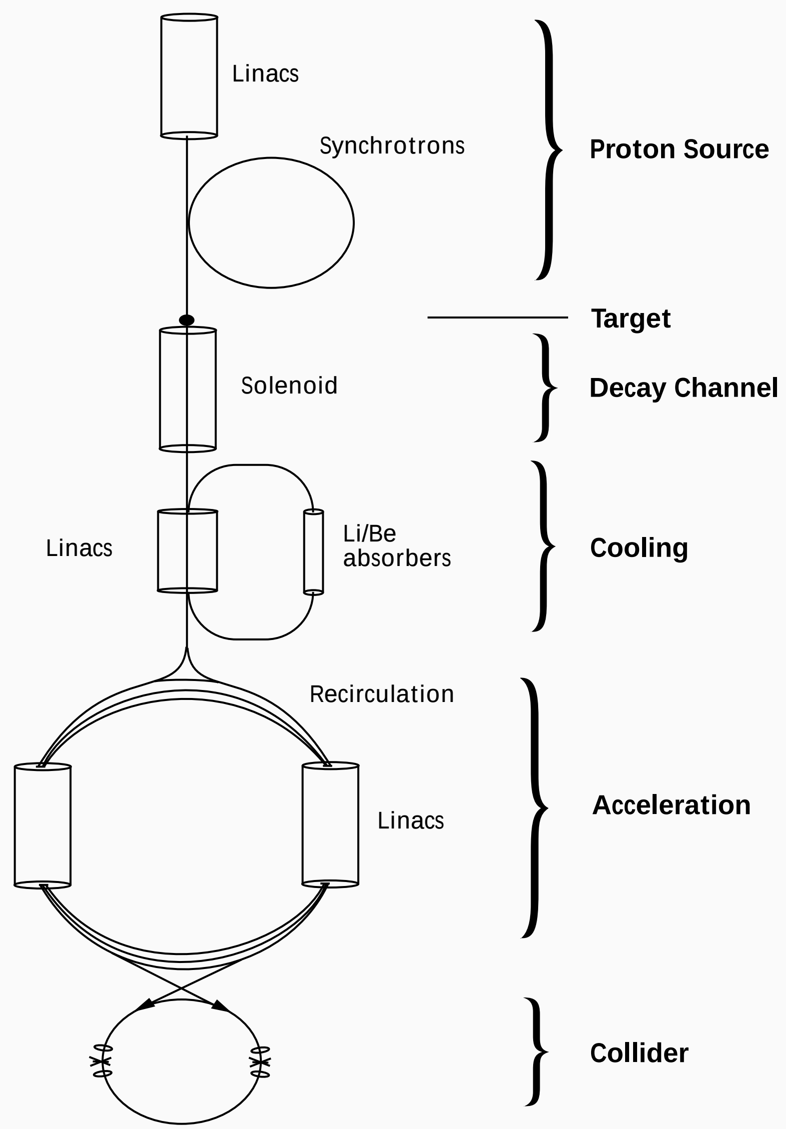
Physicist Alvin Tollestrup, who describes himself as the "spiritual leader" of the muon collider effort at Fermilab, said the group's goal, within the next 12 to 18 months, is to reach an understanding of the feasibility of a muon collider. "We want to know whether a muon collider might be part of the near-term future of research in our country, or whether it's something that will have to wait for a awhile," he said. "We can do all the paper studies, but ultimately we will need to do experiments to determine the feasibility of a muon collider. Within the next year or so, we would like to learn whether it's worth getting an experimental program going."

A dozen Fermilab physicists, along with scientists from Brookhaven, Berkeley Lab and U.S. universities, have been working for about two years on the design of a muon collider with 4TeV center-of-mass energy, a level that would be very hard to achieve with an electron machine, said Noble. "After all this work," he added, "we've found no physical flaw in the concept. We will still need inventions to make it possible, if we ever attempt to build one."

A muon collider at the 4 TeV level would fit on the Fermilab site. It would lie deep underground, to provide adequate shielding. While it might use some existing facilities, the Laboratory would have to build much of a muon collider from scratch, Noble said. Although a collision energy of 4 TeV is only about twice the energy of the protons and antiprotons that now collide in the Tevatron, all the energy in a muon machine is available for conversion into new particles, making the effective physics "reach" up to 10 times as great for some areas of exploration.

Is there a muon collider in Fermilab's future? A year from now, Noble, Geer, Tollestrup and their colleagues hope to have a better answer. Meanwhile, all say the challenge of the muon collider excites them, and they invite wider scientific participation in the study. "For one thing," Tollestrup said, "right now you don't have 450 other names on a paper you might write." ■

Schematic of the stages in a muon collider complex.



How to make muon collisions

Send an intense beam of protons to a target, producing pions. Capture the pions in a magnetic field, where they decay into positive and negative muons. Cool the muons into intense, coherent beams and quickly accelerate them to collision energy. Collide. Repeat as necessary.

~ From the Fermilab Sisterhood Cookbook

Updates

October 10—October 23

ACCELERATOR

The Accelerator Division reported that the fixed-target experiments received a proton beam for six hours out of a scheduled 24 hours on Thursday, October 17. At about 12:30 p.m. on that date, Tevatron abort kickers pre-fired. Beam was quickly reestablished to users but a second quench at 2:53 p.m., caused by Tevatron tuning, brought the beam down again. Beam was reestablished at 6:05 a.m. on Friday, October 18, but a Tevatron quench protection monitor "died" causing a full-house quench soon after.

The beam experienced smoother running during the weekend of October 18 to October 21; during that time, there were 55 hours of proton beam out of a scheduled 72 hours. A few quenches during that period required attention. On Monday, October 21, the day shift and half of the evening shift were spent repairing a fault on a feeder for the Main Ring. The Accelerator Division used this opportunity to make accesses to the Antiproton Ring, Main Ring / Tevatron and the Switchyard.

From 8 a.m. on Tuesday, October 22 to 8 a.m. on Thursday, October 24, the Accelerator Division supplied a reliable proton beam with 42 hours of high-energy physics out of a possible 48 hours.

FIXED-TARGET

Collaborators provided this update on fixed-target experiments.

E835 Charmonium "There was some progress in the deceleration but it's not complete yet, and we expect to take data this weekend," said Rosanna Cester, spokeswoman for E835, on October 24.

E799 / E832 KTeV "We are moving toward stable running for data-taking after we fixed the trigger and readout of the CsI calorimeter, as well as the improvement of drift chamber gas purity. We have now achieved 80 micron resolution for the drift chamber and one percent energy resolution for the CsI," said Bob Hsiung.

E866 NuSea "E866 has achieved reliable operation at our design intensity. Excellent quality data are being recorded, many of which have already been analyzed. Preliminary results indicate that the antiquark sea is not flavor symmetric. We are now concentrating on obtaining a very precise measurement," said Patrick McGaughey.

E862 Antihydrogen "We're still looking for our first antihydrogen event. We haven't had much luminosity, but we're beginning to get nervous," said Dave Christian, spokesman for E862.

E815 NuTeV "The experiment is continuing to improve its new test beam and accumulate data. The beam spot is much improved thanks to the efforts of the Operations Department and we are using our high-intensity SEED monitors for more detailed beam measurements," said Bob Bernstein.

E872 Donut "We're hoping to take beam on our dump target Friday evening (October 25)," said Dave Ciampa. He added that Fermilab staff did the final safety walk-through on Thursday, October 24.

E781 SELEX "We're still taking data and fixing all of the small problems that crop up," said Mark Mattson, a graduate student from Carnegie Mellon.

E831 FOCUS "Over the past few weeks, E831 has been studying the accidental rates in its triggers. These studies eventually led to the detection of 'super buckets' in the beam being delivered from the accelerator. The Accelerator Division was extremely cooperative in helping us diagnose the problem and eventually they installed a new bunch-spreader, which cured the problem. As a result, we are now able to take a much higher beam intensity and collect data at a correspondingly higher rate," said Peter Kasper.

E871 HyperCP "We are still installing the final phase of our detector, doing mostly cable work," said Kam-Biu Luk on October 24. "We expect to start tuning our beamline tomorrow and continue into next week."

Main Injector Milestone

On October 4, Main Injector construction reached a milestone as two low-conductivity water pipes completed the two-mile circumference loop around the Main Injector. From left to right, John Satti, Level 3 manager for utilities; Maurice Ball, Engineer; John Baxter, Welder for Borg Mechanical (subcontractor for Martam); Karl Williams, Task Manager and Norm Leja, Task Manager, inspect the location of the last weld point joining two major headers.

Chez Léon

MENU

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

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

Wednesday Lunch November 6

Crepes with Ham, Gruyere and Chives with Madeira Sauce
Marinated Vegetable Salad
Mocha Mousse w / Toasted Hazelnuts and Cookies

Thursday Dinner November 7

Booked

Wednesday Lunch November 13

Roasted Cornish Hens w / Mustard, Herbs of the Provence and White Wine
Succotash w / Tomatoes and Chives
Pumpkin Cheesecake in Pecan Crust

Thursday Dinner November 14

Curried Squash Soup
Salmon with Sesame Crust in Spinach and Watercress Sauce
Julienne of Carrots w / Garlic and Dill
Brown Sugar Almond Cake with Carmel Frosting

LAB NOTES

1997 RECREATION FACILITY MEMBERSHIP

Recreation Facility memberships for 1997 went on sale September 2 in the Recreation Office, WH15W. Sale hours are 8:30 a.m.-5 p.m., Monday through Friday. Regular memberships are $60 and student memberships are $30. Only renewal memberships may be purchased through Fermilab internal mail, MS 126. Please enclose completed application form and check. Applications are on the Web under the Benefits / Recreation page. All 1996 memberships expired October 1. For more information, call Jean x2548.

VOLUNTARY CHARITY CONTRIBUTIONS

Fermilab employees can voluntarily contribute to charities through payroll deduction. Participants can choose from over 150 charities. Approved charities by the Internal Revenue Service are tax deductible. For more information contact Ruby Coiley at x8365.

OPEN ENROLLMENT, HEALTH CARE REIMBURSEMENT PLAN

Reimbursement accounts offered as part of Fermilab’s Flexible Benefits Plan can help employees reduce health care costs. Reimbursement accounts allow employees to withdraw tax-free dollars that they set aside (up to $2,000) through salary reduction to pay for eligible health care and dependent care expenses. Using before-tax dollars to pay these expenses effectively lowers their actual cost. An open enrollment period for these accounts will be in effect during the month of November. Employees currently enrolled will receive new forms; all other employees should contact the Benefits Office, 15WHSW, M.S. 126, x3395, for enrollment forms or information. Completed forms must be returned to the Benefits Office by the close of business November 27, 1996 for coverage to be effective on January 1, 1997.

TUITION REIMBURSEMENT FORMS DUE

If you use the tuition reimbursement program, and are enrolling for the Winter term, please turn in your forms well before the Laboratory's holiday shutdown. Forms received the week before the shutdown may not be processed until after we return in January.

NIU

continued from page 7

gers and data acquisition system must keep up or all that extra luminosity will be wasted.

“The luminosity is going up, and the ability to rapidly make decisions and keep good physics and throw away the junk is only getting harder and harder,” said Hedin.

During a recent interview, Hedin and Fortner were asked what they hope to “see” in Run II. They looked at each other, nodded and Hedin, beating Fortner to the punch, said, “We want to see the Higgs.”

The Higgs boson, which some call the Holy Grail of particle physics, may provide clues to the mystery of mass.

Blazey is in charge of the entire trigger upgrade for the collaboration, a monumental job for the DZero veteran. The NIU professors and their students are responsible for the new generation of muon triggers. Recently, the team has done computer simulations and are developing hardware prototypes of the triggers. This past summer five undergraduates and three graduates students helped with this effort.

Students

The NIU professors said their ability to involve students in the research at Fermilab is one of the highlights of working at the university. Since 1987, 45 undergraduate students and 25 grad students have participated in work on the DZero experiment, with some of those graduate students going on to get Ph.D.’s in high–energy physics. Hedin said regardless of the students’ choice for a career—be it physics, teaching or business—their experience here is invaluable. Also, the NIU–Fermilab connection has brought many students to the Laboratory in the summer, as much of NIU’s enrollment is from the surrounding area.

“It’s clear we view education as one of the high priority items of the science we are doing. Students come to Fermilab and...are exposed on a day–to–day basis to stuff hot off the shelf,” said Hedin.

Josh Norten is one of those students; a senior undergraduate at NIU, he has worked at Fermilab for three summers. He is presently testing prototypes for the muon upgrade. Norten, who wants to be a high school teacher, said he has enjoyed his time at the Laboratory.

“I have learned a great deal of physics working here,” said Norten. “Equally as important, I have learned great communication skills. I have also interacted with many people from other cultures. These experiences will help me in many ways in the future.” ■

CLASSIFIEDS

FOR SALE

■ Jarvinen, no wax, cross country skis, 195 cm, Nordic bindings and boots, men's size 9 1/2 and poles, exc. cond. $70. for package. Dynastar down hill skis, 185 cm, like new, Tyrollia 280 bindings, women's boots size 9, and poles, exc. cond. $75 for package. Call Pam at x3352 or (630) 896-7867.

■ Color television (no remote), $50; lots of like-new jeans, size 4 - $10-each; brown leather bomber jacket, needs new zipper, size 36-$35; gorgeous wedding dress, white silk satin, no lace, long sleeves, $300 obo; grey laminate console style desk, $75. Call Janet, x2059 or MACKAY@fnal.gov

■ Honda 1994 Civic Si Hatchback. 125hp VTEC engine, power moonroof, AC, cruise, ps, pb, alloy whls / perf. tires + winter whls / tires, always reliable, 32mpg. $10,500. Call x5405 or rockwell@fnal.gov

■ TOYS: Little Tikes Family Kitchen with dishes, like new, $30. Fisher-Price Flip Track Mountain (car roadway, train tracks, and vehicles,) like new, $15. Call Theresa at (630) 584-9613.

■ Aurora / Fox Valley 3 Bedroom Townhome, 20 minutes from Fermilab. Walking distance to Fox Valley Mall. Backs to lake, deck has great view. 1,700 sq ft, 3 Bedrooms 1.5 baths, large pantry, new roof (1995). New paint, ready to move in. $92,000. Call Jeff, x8472 or (630) 978-1717.

■ Dog crate, 30" x 20" x 24", slide-out tray, $20; older Sears exercise bike, $10. Call Steve, x4975.

■ 1989 Chevy Cavalier, 5 spd, a / c, ps, new tires, runs good. 71,000 miles. $3,500 o.b.o. Call Chuck, x3428 or (630) 879-3347.

LETTERS TO THE EDITOR

Great article on the Roads and Grounds guys. (*FermiNews*, October 4.) A very deft handling of the benefits to the environment with the practical needs of running a laboratory. Too often in articles of this kind, the "environmental thing" takes over - you handled it just right. Was it just serendipitous that your photo article provided the explanation of a "savannah" that was first raised in the Profiles? I tend to associate savannahs with other countries so I was delighted to learn something. And congratulations to FermiLab for having the fortitude to stick with an organization named "Roads and Grounds" in an era when euphemisms are generally chosen for this very necessary and much appreciated set of duties.

— Kris Forsberg

Is *FermiNews* a magazine for employees or lab management propaganda? How about just giving up—save us some money. The content of this 'publication' makes most of us laugh. Then we spread yet more disrespect for the management of the lab.

Adios.

— Bob Joshel

CALENDAR

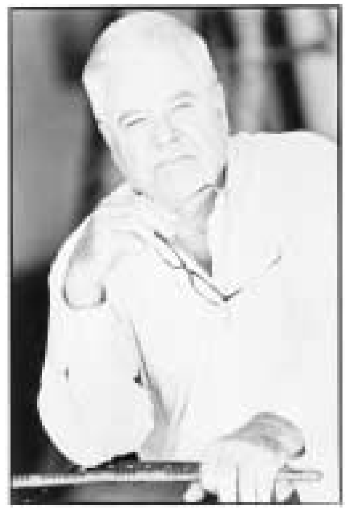
NOVEMBER 1

NALWO potluck supper in the Village Barn, 5:30 - 8 p.m. Please bring a dish to serve 6 or 8 or contribute $3 to cover costs. We will also collect $1 from those adults drinking alcoholic beverages.

NOVEMBER 5

Immunization Clinic for Flu, Pneumovax, and Tetanus by Visiting Nurses Association of Fox Valley. In the One West Conference Room. 11 a.m.–1 p.m.

NOVEMBER 16



William Windom performs THURBER at Fermilab's Ramsey Auditorium on Saturday, November 16 at 8 p.m. Tickets are $15 and available through our box office at (630) 840-ARTS.

Probably best known for his Emmy Award winning role as the lead of NBC-TV's 1969-70 series, "My World and Welcome To It" based on the writings of James Thurber, William Windom will be bringing his one-man show back to Fermilab.

Coming Up: BEAUSOLEIL on January 18, 1997 for $17.

MILESTONES

RETIRED

John Pollock, on October 31, 1996. He started at Fermilab on February 1, 1968. Pollock worked for the Business Services Section / Information Systems as a computer professional.

Ronald Norton, on October 4, 1996. He started at Fermilab on March 9, 1970. Norton worked for the AD-Cryogenics System as a Technical Specialist.

BORN

Tony Richardson II on July 15, 1996 to Angela Richardson (LS / Library) and Tony Richardson. Nancy Penson (LS / Travel) is now a proud grandma.

Jodie Candice was born on September 23, 1996 to Candy and Jerry Makara (AD / CHL). She weighed 9 pounds, 6 ounces and was 21 inches long. She is welcomed home by her 3-1/2 year old brother Nicholas Andrew.

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FermiNews

Fermi National Accelerator Laboratory

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The deadline for the Friday, November 15 issue of FermiNews is Tuesday, November 5.

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

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

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