FermiNews

Fermi National Accelerator Laboratory

Volume 21 | Friday, February 20, 1998 | Number 4

INSIDE

At URA's Council of Presidents Annual Meeting

Cautious Optimism Over Future Funding for Science

Congressional representatives and Administration officials address policy forum.

by Sharon Butler, Office of Public Affairs

With budget surpluses on the horizon for the first time since Neil Armstrong stepped onto the moon (as the *New York Times* noted), members of the scientific community met in Washington to hear how the field of physics might fare when the nation's red ink turns to black.

At the annual meeting and policy forum of the Universities Research Association, Inc., which oversees the operation of Fermilab, congressional representatives and Clinton Administration officials briefed URA members on future budget scenarios and on proposals in the Senate to double the funding for science.

continued on page 2

Representatives of URA's 87 member universities attended the organization's annual meeting and policy forum.

Future Funding

continued from page 1

Just two nights before, the President's State of the Union address had left the impression that science's day had finally arrived, but the mood at the URA meeting was more reserved. Administration officials were pleased with what they had to offer researchers in fiscal year 1999, but cautioned the assembled physicists, university chancellors, deans, vice presidents and provosts not to become complacent.

The day-long meeting on the eve of the release of the Administration's budget included URA business items for the representatives of the 87 member universities. On the agenda were reports from URA President Fred Bernthal; Fermilab Director John Peoples; the spokesperson for the Pierre Auger Observatory Project, James Cronin; Chair of the URA Board of Trustees Joe Wyatt; and Chair of the Fermilab Board of Overseers John McTague. The group adopted several resolutions with a chorus of "ayes" and formally elected Wayne State University a new member.

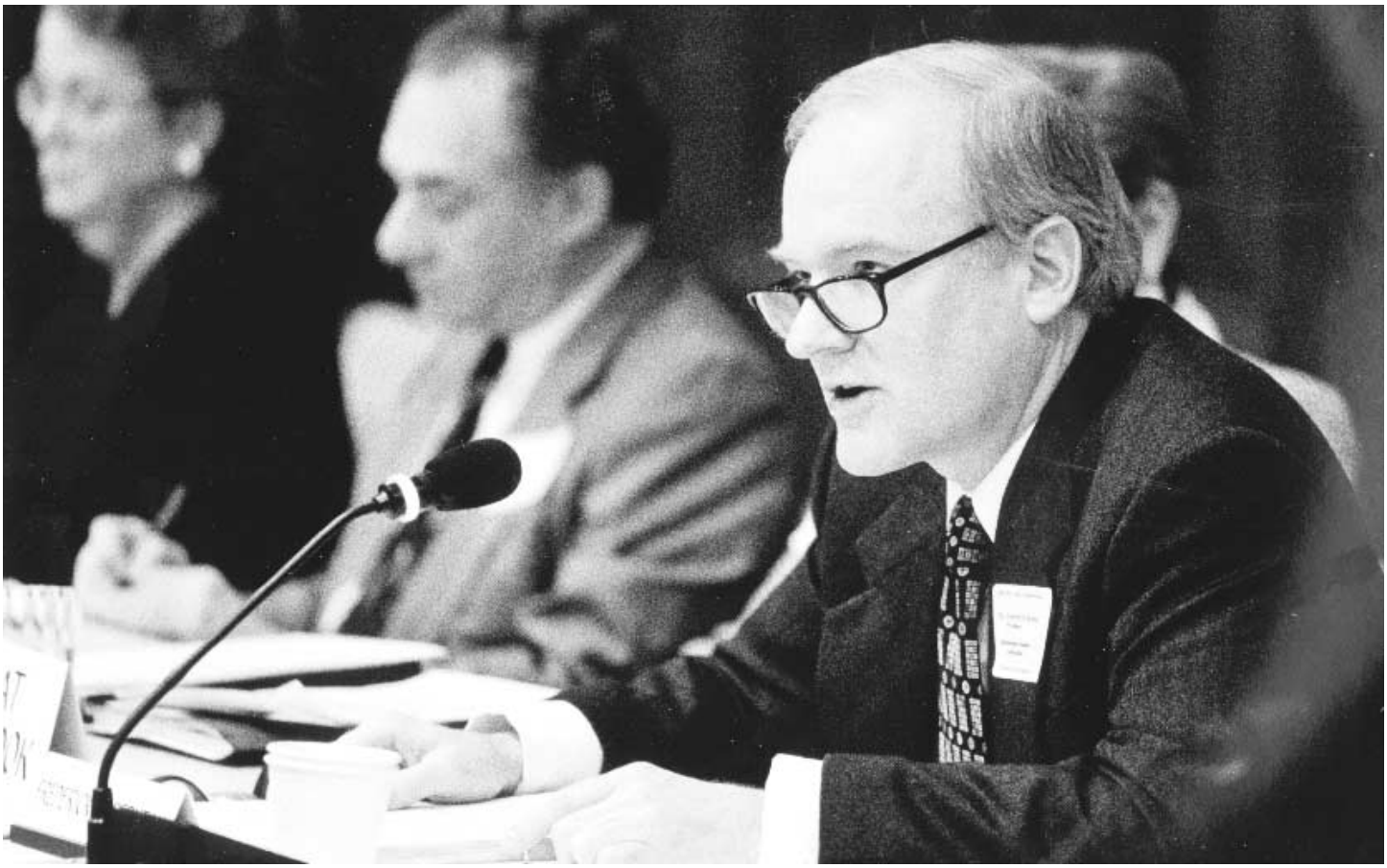
But the policy discussion was the main draw, as scientists wondered whether any of the predicted budget surpluses would be slated for research—more specifically, for particle physics research. With both Republicans and Democrats addressing the forum in the wood-paneled Lecture Room of the National Academy of Sciences, the URA gathering had a sneak preview of the political wrangling that would greet the President's budget proposal in the days to come.

The speakers included John Gibbons, assistant to the President for Science and Technology; Senator Joseph Lieberman (D-Conn.), cosponsor of the National Research Investment Act (S. 1305); Representative James Sensenbrenner (R-Wis.), chairman of the House Committee on Science; and Martha Krebs, director of the Office of Energy Research in the U.S. Department of Energy.

Administration optimistic

Gibbons said he was elated that this was the first mention ever of the National Science Foundation in a President's State of the Union address.

Referring to the projection of budget surpluses as "this extraordinary change in events," Gibbons said he believed that the nation could now "begin to focus more on those investments that in turn will mean continued economic growth and progress in the coming decade." These investments, he said, included education, research and infrastructure.



URA President Fred Bernthal addresses the Council of Presidents Annual Meeting.

Photos by Reidar Hahn

Krebs said she was more optimistic about prospects for science funding than she had been in years. The budget, released on February 2, requested $2.7 billion for DOE's Energy Research programs, an increase of $246 million, or 10 percent, over the 1998 level. (See accompanying article on the Administration's proposed budget for DOE for fiscal year 1999.)

Krebs listed several priority projects for DOE—including U.S. participation in constructing elements of the Large Hadron Collider—where DOE needed to demonstrate commitment, accountability and sound management. "Delivery on the LHC," Krebs said, "is crucial to the future of high-energy physics."

Authorizations, not necessarily appropriations

The optimism of the Administration was reflected in Lieberman's presentation. "With a budget agreement last year and the real prospect in the near term of a surplus in the federal budget, we have entered a new era in American politics," Lieberman said.

"...Basic research is not a luxury; it's a necessity," he added, preaching to an audience of the converted on the merits of funding for science.

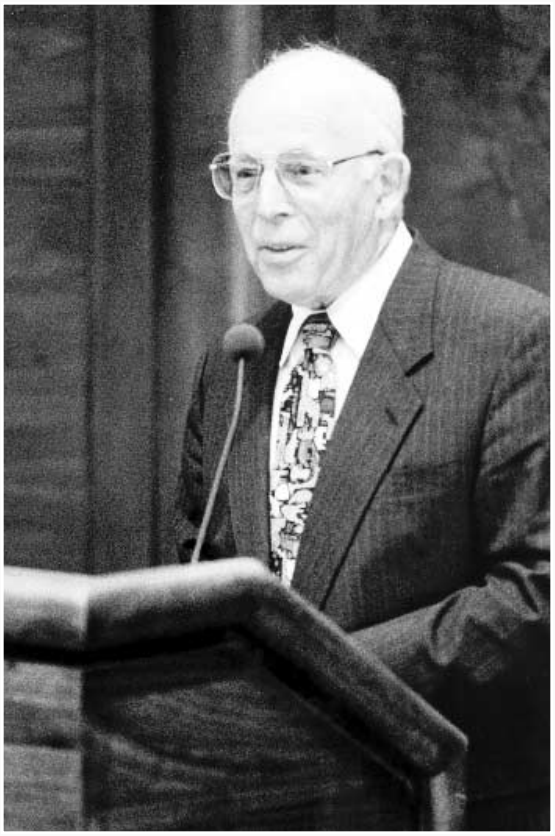
According to Lieberman, federal support for research and development was roughly 2.2 percent of the gross domestic product in 1965; as of last year, that figure had dropped to .8 percent.

"Some recent projections indicate that nondefense federal R&D spending will decline another 14 percent by the year 2000 if current trends continue," Lieberman said. "That's one trend of the 1990s that we cannot afford to linger over and muse about. We need to act now."

Lieberman, along with Senators Phil Gramm (R-Tex.), Pete V. Domenici (R-N.M.) and Jeff Bingaman (D-N.M.) has proposed the National Research Investment Act of 1998, which would double the federal investment in basic scientific, medical and precompetitive engineering research from $34 billion in fiscal year 1998 to $68 billion in 10 years.

"There is money on the table," said Lieberman in answer to a question, "and we can make an argument for [supporting science] in terms of education, economic opportunity and quality of life." While he agreed that basic research in areas such as high-energy physics was more difficult to sell to the public, he said he believed that "we have turned that corner." "The best thing for pure science," he said, "is to lie low and go along."

continued on page 4



John Gibbons, assistant to the President for Science and Technology, said Congress should not judge science from the "input side" —the amount of money allocated to the enterprise—but from the "output side." Investment in science, he says, brings enormous rates of return. On February 13, Gibbons announced his retirement.

Martha Krebs, director of DOE's Office of Energy Research, said priority projects for DOE for the next year include U.S. participation in the building of CERN's Large Hadron Collider.

Future Funding

continued from page 3

While Lieberman claimed "growing, broad and bipartisan support in the Senate" for S. 1305 and endorsement among House leaders of at least the concept of increased federal funding for science, Sensenbrenner was far more reserved. S. 1305, he said, was "putting the cart before the horse." He made it clear he would not countenance any "return...to the bad old days when science authorization simply increased spending for each account by 10 percent every year."

"While I support increasing the federal budget for science," Sensenbrenner said, "I believe that new money must be justified with a coherent, long-term science policy that is consistent with the need for a balanced budget."

"…New money must be justified with a coherent, long-term science policy…."

~Representative James Sensenbrenner

Because appropriations do not necessarily follow authorizations approved by Congress, proposals similar to S. 1305 have not succeeded in the past, the Congressman pointed out.

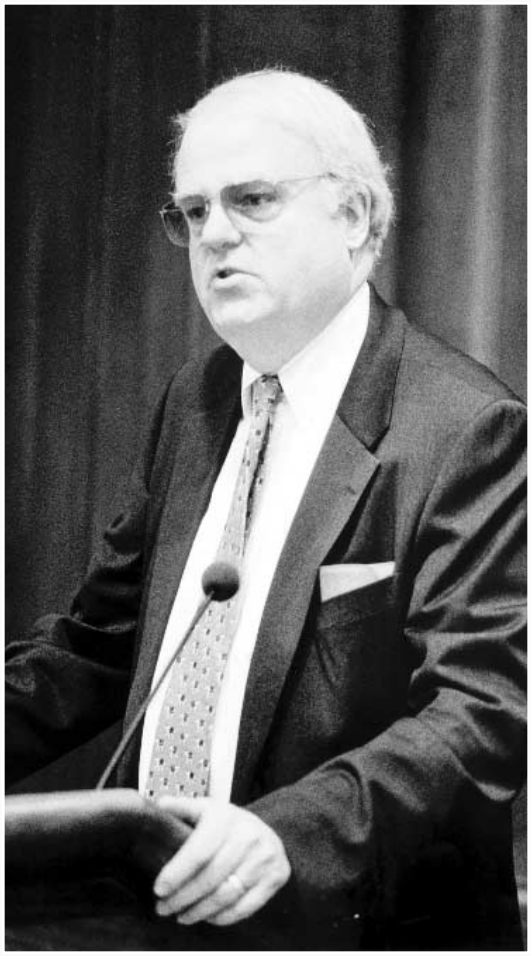
"The authorizations," Sensenbrenner said, "had no credibility with the appropriators, and science was sent to the end of the discretionary spending line where it had to fight for funding scraps."

Sensenbrenner said he did "not intend to let this happen again." But he demanded from the assembled physicists and university administrators a "credible science policy that justifies increased funding and sustains it over time."

Sensenbrenner was equally critical of President Clinton's State of the Union address. While he was pleased that the President had "joined the Congress in recognizing the need to adequately invest in scientific research," he said his "optimism [was] tempered by the fact that President Clinton acknowledged the need to invest in a lot of programs.... President Clinton's rather vague reference to doubling the budget for three scientific institutions leaves many questions unanswered: How long will it take to double those budgets? Where will we get the money? Will other science accounts suffer as a result?"

And with those words, the budget battle lines were clearly drawn right there in the Lecture Room of the National Academy of Science, presaging the full-scale tug-of-war that erupted a few days later when the President formally delivered his budget request to Capitol Hill. ■

Senator Joseph Lieberman has proposed doubling the budget for basic scientific, medical and precompetitive engineering research over the next 10 years.



Photos by Reidar Hahn

Representative James Sensenbrenner warns that authorizations in Congress do not necessarily mean appropriations.

Monumental Change in Science Budgets?

The Clinton budget request for FY1999 calls for more science funding—but not much more for high-energy physics.

by Judy Jackson, Office of Public Affairs

The Clinton Administration's spending plan for FY1999 emerged on Ground Hog Day. And for the first time in years, science funding didn't see its shadow and dive back underground. The good news is that the President's budget request for basic science research funding rose by a full eight percent from FY1998 levels. More good news: the request for both the Department of Energy and the National Science Foundation was up by 11 percent. For DOE's Office of Energy Research, which includes the High Energy and Nuclear Physics Program, the request called for an increase of 10 percent.

When it came to high-energy physics, however, the numbers didn't look so stratospheric. The FY1999 budget request for high-energy physics is $691.0 million, an increase of $11.3 million, or 1.7 percent, from the FY 1998 level of $679.7 million. The request included $65 million for U.S. work on CERN's Large Hadron Collider, as well as $14.3 million for Fermilab's NuMI project and $6.7 million for Wilson Hall repairs.

What will the budget request mean for Fermilab? Well, the results are mixed. For the fiscal year that begins on October 1, 1998, Fermilab's total budget will decline by about $6 million, from about $260 million in FY1998 to about $254 million in FY1999. But construction funding for the Main Injector accounted for $31 million of the FY1998 budget, and the Main Injector project will be complete in the current fiscal year.

After all the additions and subtractions, the so-called "base budget" (it pays for everything but construction) for Fermilab in FY1999 will actually rise by slightly over $9 million to $230.5 million, to pay for such things as the continuing CDF and DZero upgrades, the commissioning and initial operation of the Main Injector, and ongoing Laboratory operations. That's the plus side of the ledger.

On the minus side, Laboratory expenses will increase. Fermilab employees who have been busy designing and building the Main Injector will be needed to operate Run II. The base budget will have to increase by roughly $8 million to cover their salaries, which were previously paid from Main Injector project funds. With accelerators turned back on, next year's power costs will rise by $7 million over this year's bill. Inflation, while not as great as in previous years, will also increase costs. It all adds up to increased expenses of over $20 million.

"Nine million dollars isn't going to cover it," says Fermilab Deputy Director Ken Stanfield.

"This budget request is not a disaster for Fermilab," Stanfield said. "But it doesn't keep pace with inflation. We will manage, but it's going to be extremely tough. We won't be able to start projects like MINOS as fast as we had planned. We will have to move more slowly on R&D for future accelerators. We will postpone the power pole replace-ment that we know we need to do."

Still, Fermilab officials said, they see encouraging signs in Washington for all U.S. scientists. In remarks to the Universities Research Association Council of Presidents last month, Fermilab Director John Peoples praised increased support for science in both the Administration and Congress.

"These efforts are very heartening to researchers in a wide range of disciplines," Peoples said. "Just as we strongly support increases in funding for biological and medical research, we must make sure that this rising tide also lifts astronomy, chemistry and physics."

If so, by next Ground Hog Day, perhaps prognostications for high-energy physics funding will look a little less wintry. ■

Photo by Reidar Hahn

Photo by Harvard University, Office of News & Public Affairs

The Charles River runs through the Boston-Cambridge area, home of Harvard (above), Boston University, Brandeis University, the Massachusetts Institute of Technology, Northeastern University and Tufts University.

Boston: City of Universities a Critical Link to Fermilab's Past, Present and Future

By Mike Perricone, Office of Public Affairs

The physics of high-energy collisions seemed to be going nowhere during the XVI International Conference on High Energy Physics.

A summary report in that area concluded: "The rate of progress in this field has clearly slowed down in the past few years."

Fittingly, part of that conference seemed to be taking place in the middle of nowhere.

"You couldn't find a good restaurant, and there was quite a shortage of motel rooms," recalls Jack Schneps, then and now of Tufts University.

The time: September 1972. The place: a brand-new but dusty facility on the prairie, the National Accelerator Laboratory, yet to be renamed Fermilab. The banner event of the conference was an inaugural walk through the accelerator's four-mile tunnel. Schneps was there at the beginning.

"I remember Robert Wilson (Fermilab's founding director) was in an exuberant mood, as one would expect," Schneps recalled. "He said it might be a very long time before anyone got to do this again. There was no beam yet, so it was okay for us to walk through."

There is still a trace of wonder in Schneps' memories of the walk.

"We walked past four miles of magnets," he said. "Everything looked new. It was a very exciting time. And I would say the Lab has lived up to its potential."

A quarter-century later, the Lab is upgrading for Run II, with integral roles for six universities from this pivotal location in American history.

Like the inaugural walk through the accelerator, Run II has a particular air of excitement about it, with the higher collision rates of the new Main Injector possibly lighting a path to the Higgs boson and physics beyond the Standard Model.

"I don't want to sound like a used-car salesman," said MIT's Gerry Bauer, "but if we learn how to fully exploit that machine, and if we get lucky, this could be an extremely interesting run. In fact, it has some prospects of being a unique run, as the last run was unique in finding the top quark. It's not impossible we might see the Higgs, though it would be very difficult."

And the future—beyond Run II? Possibly beyond the Higgs? Asking "What if?" is central to any high-energy physicist's thinking, but pondering Fermilab's future is the specific charge of the Lab's Physics Advisory Committee during summer meetings in the high altitudes of Aspen, Colorado (Colorado was one of the sites originally proposed for Fermilab). While the PAC also considers the feasibility of experiment proposals, the annual Aspen meeting has a future focus—especially important with CERN's Large Hadron Collider looming on the not-too-distant horizon.

"We mainly tend to think of the longer range, the next five to 10 years," said PAC member Ken Lane of Boston University. "And one of the major issues we've talked about is the question of a Run III. Will the LHC blow us out of the water between 2003 and 2007? I think the Committee is very much in favor of a Run III, but it depends on what interesting things come out of Run II."

There are encouraging signs from Washington, the key to all hopes for the future of physics research. Representative Joseph P. Kennedy II (D-Mass.), whose 8th Congressional District includes the Boston-area universities, is a booster of increased funding for the sciences.

Representative Kennedy has formed a bipartisan Research and Development Caucus aimed at insuring that federal R&D spending continues to grow "at an adequate rate." The caucus will also be working with the National Business Coalition for Federal Research, organized by the Greater Boston Chamber of Commerce. The Coalition worked with the Clinton Administration and congressional leaders to build support for research funding.

"At a time when advances in technology play an increasingly important role in determining which nations' economies thrive and which do not, the United States cannot afford to squander its competitive advantage in industries like technology, communications, and health care," Representative Kennedy said in a statement. "If the country's labs slow down, so will the engine of economic growth."

Still, the next decade at Fermilab very much depends on "interesting things," and as Bauer said, on getting lucky.

"If God puts that particle there for you to see, then you're lucky," Bauer said. "Maybe we'll fall just short of our goals—but maybe we'll go just beyond. There's some speculation among the theorists that we're right at the edge of walking through a new door."

Boston University

Theorist Ken Lane is on the "road less traveled" toward the Higgs: technicolor, the less-popular brand of electroweak symmetry. Technicolor predicts the appearance of Higgs bosons not as elementary point particles but as bound states. The result would be a fifth force, but as Lane says, "anything that happens with the Higgs would be a fifth force."

At DZero, John Butler and a grad student have been joined by Fermilab's Uli Heintz and his wife, Meena Narain, as assistant professor and assistant research professor, respectively. They're working on the electronics for triggering muons, and their emphasis is on studying the tagging of *b* quarks. "One way is to find muons, and another way is to look for *b*'s decay lengths with high-precision vertex detectors," Butler said. "We're trying to attack from every angle."

Photo courtesy of Ken Lane

BU's Ken Lane tackles questions about larger issues (and larger particles) during the annual PAC conference in Aspen.

Photo by Reidar Hahn

Offering the stabilizing influence of Brandeis University are (from left) Jodi Lamoureux, Dana Partos, Mike Kirk and Hongquan Niu.

Photo by Reidar Hahn

Checking in by videoconference with the rest of the team at Harvard are (from left) Andrew Gordon, Robyn Marak and Maria Spiropulu.

Brandeis University

Jodi Lamoureux can pay less attention to the weather now. Lamoureux, postdoc Steve Behrends and three Brandeis students are responsible for temperature control in the phototubes for the calorimeter at CDF. The old device, removed after the last run, was a gas calorimeter that had to be corrected for changes in barometric pressure. The Brandeis task then was to stabilize high voltages running through a wire.

The replacement is a scintillator calorimeter, a plastic array wrapped in aluminum foil. The goal is to have the collisions' jet spectra extended to a higher intensity.

"That way we'll be able to measure electrons in the calorimeter and in the end plug as well as we do in the central part of the detector," Lamoureux said. "The stability depends on the temperature of the tube. If it's not stable, the resolution goes down. Now that we don't have to worry about storms, it's a lot easier."

Brandeis professors Jim Bensinger, Craig Blocker and Larry Kirsch are working in a wide variety of physics at CDF, including the search for exotic particles like the Higgs.

Harvard University

"Dirty physics" is what Maria Spiropulu calls it: the search for telltale missing energy that points to the supersymmetric partners of quarks and gluons. "Missing energy is the only thing you see, or don't see," she says. "I know it's crazy. I am searching for nothing."

In perhaps a unique view, Spiropulu sees supersymmetry as "hugging" previous theories of symmetry.

"That's the way physics evolves," she says. "Something encloses the last finding. Every step we take does not say the previous step was a mistake, but instead incorporates the previous step. For example, first there was electricity, then magnetism, then electromagnetism—each discovery was incorporated into a bigger symmetry. And the end of it, if there is an end, would be the Grand Unified Theory."

Spiropulu at CDF is part of a 17-member Harvard crew directed by professors Melissa Franklin and John Huth. The Harvard group is engaged in

continued on page 8

Photo by Reidar Hahn

MIT's Kirsten Tollefson (left) and Gerry Bauer check on improvements to the Level III trigger at CDF.

Photo by Reidar Hahn

Darien Wood of Northeastern examines upgrades in muon detector electronics.

Tufts University Photo, Photo by Mark Morelli

Jack Schneps of Tufts was on the four-mile walk when the accelerator was dedicated, and remains active at Fermilab.

Boston

continued from page 7

a wide array of physics, with Andrew Gordon focusing on precision measurements of *W* mass with Run IB data; Fotis Ptohos working on the top quark cross section and George Michail working on *B* physics and *b* quark mixing.

MIT

The MIT group is working on rejection, although filtering might be a more polite term. The Level III trigger will be the highest authority in sifting through the readouts of proton and antiproton collisions at CDF.

"At Levels I and II, the triggers are actually implemented in detectors and sit on the detectors," said Kirsten Tollefson. "Voltage or current goes to electronic boards with computer chips smart enough to say, 'This is enough energy to make this event interesting.' If events are still interesting, they're passed on to Level III, which is all software and computers."

MIT has the charge of putting together the Level III trigger components and making them work. The approach is a "farm" of 300 to 500 PCs, in place of the former mainframe computers. Right now, the "favored" operating system for the trigger is LINUX, though a formal choice hasn't been made. One unique feature will be the use of commercial switching technology to organize readouts.

"It's used in any digital phone system or any internet-type packet switching," said Gerry Bauer. "High-energy physics often uses its own technology, but in this case industry has the money to drive the development and we're feeding off it. There are enormous demands for data networking in industry, and that's good for us."

Northeastern University

At DZero, where four Northeastern students have recently earned Ph.D.s, Darien Wood and three postdocs are working on the readout electronics and on-line software in the muon detector system.

"For Run II, our main purpose will be to read out the muon detector with more speed, with the higher luminosity available in the Main Injector," Wood said. He and Taka Yasuda also are concentrating in electroweak physics, assailing the *W* and *Z* bosons.

"We hope in Run II to take more precise measurements of the *W* and *Z*," Wood said, "to point up the constraints of the Standard Model and point to something beyond. We made the most sensitive tests of couplings of gauge bosons in the last run, and we hope to continue that in the next run."

Northeastern and BU jointly hosted the annual DZero workshop in 1996, a week of physicists getting together to focus on longer-term issues. "It was between quarters, and we had a couple of hundred physicists in for the workshop," Wood recalled. "We basically took over a building or two."

Tufts University

The long-baseline neutrino oscillation experiment will send beams of neutrinos underground from the Main Injector at Fermilab to the MINOS detector 730 kilometers away, in a mine in Soudan, Minnesota.

"We're very deeply involved in it, if you'll forgive the pun," said Jack Schneps, speaking for the Tufts delegation. "The Fermilab beams are muon neutrinos, and if the muon turns into some other kind of neutrino, then they have mass and it's question of whether or not they mix. If they have mass, we say this is evidence for physics beyond the Standard Model."

Schneps, Tomas Kafka and Bill Oliver are searching for the direct observation of the tau neutrino in the E872 "DONUT" experiment. Experimenters are analyzing data from the first run, with the next run slated for 1999. Rick Milburn and Austin Napier are working on an experiment to examine hundreds of thousands of charm particles, improving the sensitivity of measurements. And Krzysztof (Kris) Sliwa heads up a Tufts team on the CDF upgrade. ■

Kobliska, Carson Earn Employee Awards for Dipole Magnet Savings

By Mike Perricone, Office of Public Affairs

Gregg Kobliska and John Carson have a combined total of nearly four decades of experience at Fermilab. On the dipole magnet project for the Main Injector, the key to Run II, they also combined to produce more than $3 million in savings.

Kobliska, for his project management, and Carson, for his tooling designs, have been named recipients of Fermilab Employee Recognition Awards.

"They worked on a project where every single challenge that could possibly be cooked up was put in front of us," said Director John Peoples at a December 22 ceremony. "And because of these two gentlemen, we triumphed."

The Main Injector ring will use 216 six-meter dipoles and 128 four-meter dipoles to guide protons and antiprotons around the two-mile ring.

Photo by Reidar Hahn

John Carson, who has raised tooling to the level of an art, inspects one of his designs.

The award, which includes a financial bonus, is described in the Fermilab Personnel Policy Guide as "instituted for outstanding contributions to the Laboratory demonstrated by innovation, discovery, extraordinary effort, and / or cost reduction in one of the following areas: technical project management, management of major functional Laboratory areas and scientifically significant programmatic contributions."

For Kobliska and Carson, the correct choice is "all of the above."

Carson has taken machine tooling to the level of art at Fermilab's Technical Division Engineering and Fabrication Department.

"Go to any place where superconducting magnets are made," said Technical Division Head Peter Limon, "and you'll recognize John Carson's work. Even if they weren't built by him, they all have his distinctive features, and I think that's astonishing."

In nominating Carson, Main Injector magnet project manager Gale Pewitt and Recycler magnet project manager David Harding noted six specific innovations where he increased safety, economy, or both in building the magnets.

"As a result of his tooling design," said Pewitt, "we saved about $1 million over the estimate we had for labor."

Characteristically, Carson shared the credit.

"I really feel this award is shared by everybody here," he said. "You can't do any of this without managers who support what you do, who give you the opportunity to put forth your ideas and move ahead with them. You can't accomplish anything without lots of help from other folks....This award is extremely humbling, and I just want to say 'Thank you for the recognition.'"

Kobliska, the Technical Division's Material Control Group head, was a major contributor in setting up Fermilab as a general contractor on the project. Assembling the magnets at the Lab represented only five percent of the total costs; the remaining 95 percent was spent with vendors outside the Lab, as nearby as Skokie and as far away as England.

Photo by Jenny Mullins

Gregg Kobliska managed to find huge savings in the construction of Main Injector dipole magnets.

Pewitt and Harding cited Kobliska's work in dealing with vendors to meet specifications and quality requirements, hiring on-site inspectors, monitoring day-to-day activities—and lowering the price on 15 million pounds of steel. Previously, Fermilab had one vendor supplying magnet steel; Kobliska got bids from five companies and lowered the price by $2 million.

Limon cited Kobliska's efficiency: "Gregg is one of the few managers who knows the meaning of the word 'now.'"

"I have a whole department that understands the meaning of the word 'now,'" Kobliska replied. "They're great people, they solve most problems on their own, and that allows me the time to do other things that offer potential savings. I appreciate them."

Kobliska had special thanks for Pewitt and Harding, Dixon Bogert and Phil Martin at the Main Injector, Steve Holmes of the Accelerator Division, the business office, Charles Matthews in the machine shop, and past and present Technical Division heads who have encouraged him throughout his career.

"I appreciate the many opportunities I've been given at the lab," he concluded. "I'm a very lucky individual." ■

Run II Upgrade UpDate 2000

Derwent Makes Changes at Antiproton Toll Booth

By Mike Perricone, Office of Public Affairs

The next time you're lining up for a toll booth, cool off a little and think kindly of antiprotons and Paul Derwent.

At your toll booth, the number of cars on the highway hasn't changed; they're packed more densely and funneled toward the coin basket. The denser the crowd at the booth, and the more cars going through, the bigger the payoff.

Substitute antiprotons for cars and what you have is stochastic (or random) cooling. That's one of the ways Derwent is upgrading the Antiproton Source in preparation for Run II and the increased luminosity of the Tevatron.

"We need lots of collisions, so that means lots of protons and lots of antiprotons, and a very densely packed beam," said Derwent, who made an unusual switch from particle experiments to beams when he shifted over from CDF in December 1995.

Derwent has the tall, rangy look of a basketball player—with a cast as his credentials. He broke his left wrist playing hoops and faces another month with his hand immobilized. But it hasn't slowed him down in reconfiguring the old Antiproton Source.

"Protons are easy to make," Derwent explained. "All you need is a bottle of hydrogen. Antiprotons are a lot more difficult to produce. First you have to make them, and then you have to accumulate them. And you need high-energy protons to make antiprotons."

To produce them, accelerator operators will circulate protons in the Main Injector, then aim them at a metal target. From the results, they will select particles with a negative charge and a defining momentum of 9 GeV/c. The next step is the Debuncher Ring, where the particle pulses are spread out more evenly along the direction of the wave so that they aren't clumped or bunched

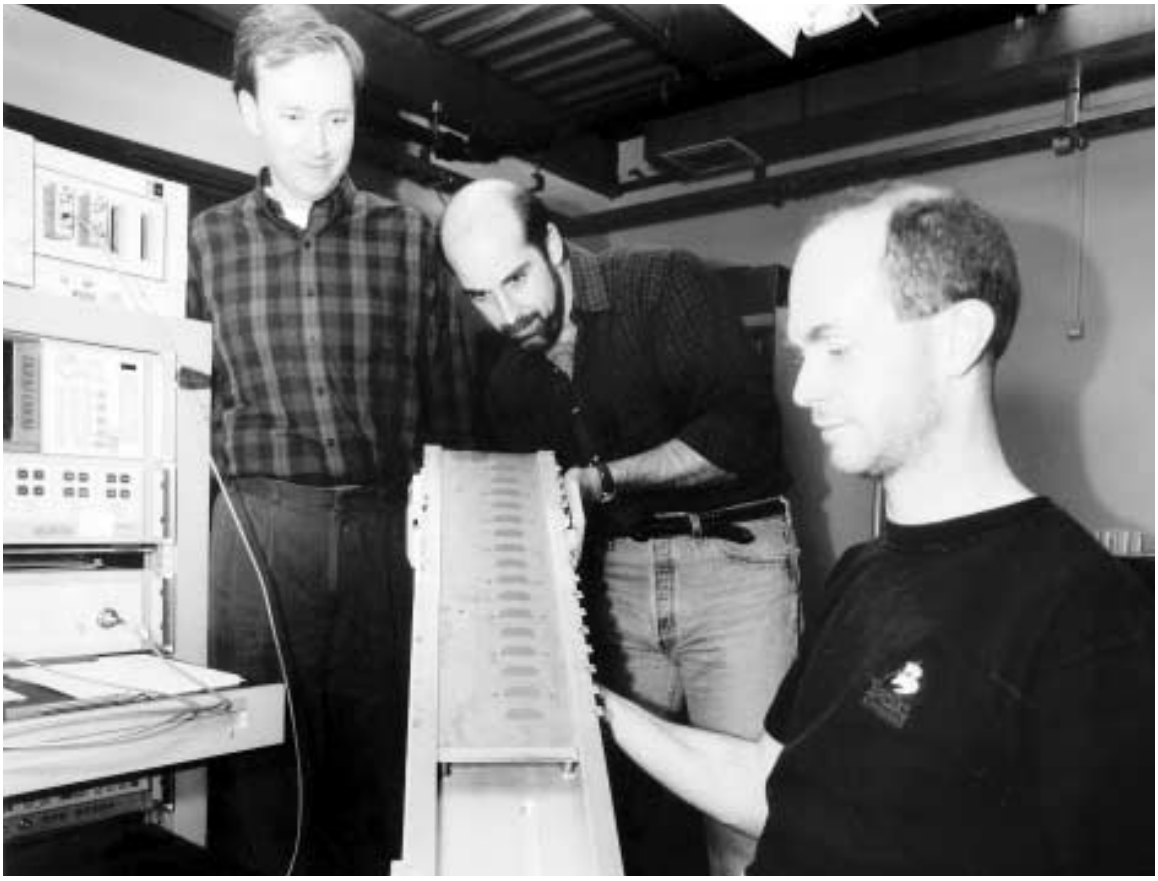


Photo by Reidar Hahn

Paul Derwent (left) examines a beam pickup array with Al Sondgeroth and Dave Vander Muelen (seated) of the Beams Division's Pbar Source Department.

in pockets. By the time the particles exit the Debuncher, pions and muons have decayed. What's left are the stable antiprotons.

From the Debuncher, the antiprotons are transferred to the Accumulator Ring, where the individual pulses are pushed together into a dense core. The goal is to transfer 100 million antiprotons to the Accumulator in every pulse of 1.5 microseconds, with about 2.5 hours required to gradually stack up 500 billion antiprotons in the Accumulator to meet the needs of the collider. Various cooling systems, including stochastic cooling and the stack-tail system, slowly build the distribution of particles into a dense core.

Antiprotons pay for the use of the facilities with some of their temperature—temperature being a measure of their average kinetic energy. They receive a "kick" delivered by a signal from one point on the Accumulator Ring to a diametrically opposite point along the beam's path. The kick keeps them in line, reducing their tendency to move in directions at tangents or cross-purposes to the beam path.

Derwent uses computer modeling to test the locations and configurations of eight beam pickup arrays, plastic-backed copper panels each with 16 crescent-shaped pickup perforations. The arrays collect the current induced in the wall of the beam pipe and produce a single output. This signal is amplified and relayed across the diameter of the ring to meet the beam. Another set of pickups reverses the process—takes in the single signal and disperses it to the beam, delivering the kick, focusing the beam and improving its quality by concentrating the distribution of energy.

The trick is to have the signal reach the beam pickups concurrently with the beam, which travels at nearly the speed of light but on a longer path around the ring.

"You need very precise timing," Derwent said. "The beam is traveling very close to the speed of light, so one nanosecond (a billionth of a second) represents one foot of the distance traveled, and each pickup (perforation) is only one centimeter. The timing needs to be kept constant at a level of 10 picoseconds (10 trillionths of a second)."

Imagine being that fast and accurate when you're slamdunking dimes, and you may never view a toll booth in the same way again. ■

CALENDAR

FEBRUARY 27

Fermilab International Film Society presents: *The Garden of the Finzi-Continis,* Vittorio De Sica (dir.), Italy (1970). Admission $4, at 8 p.m., Ramsey Auditorium, Wilson Hall.

FEBRUARY 28

Fermilab Art Series presents: Caribbean Jazz Project, $20. Performance begins at 8 p.m. in Ramsey Auditorium, Wilson Hall. For more information or reservations, call 840-ARTS.

MARCH 3

Wellness Works presents: Covert Bailey, Body Fat in America, at 12–12:30 p.m., 1 West.

MARCH 8

Barn dance at the Village Barn from 7–10 p.m., with live music by the Chicago Barn Dance Company. Contra, square, and circle dances. All dances are taught. All ages and experience levels are welcome. You don't need to come with a partner. Admission $5. Children under 12 are free. For more information, contact Lynn Garren, x2061, or Dave Harding, x2971.

MARCH 15

Barn dance at the Village Barn 2–5 p.m. Contra, square, and circle dances. All dances are taught. All ages and experience levels are welcome. You don't need to come with a partner. Admission $5. Children under 12 are free. For more information, contact Lynn Garren, x2061, or Dave Harding, x2971.

ONGOING

NALWO coffee mornings, Thursdays, 10 a.m. in the Users' Center, call Selitha Raja, (630) 305–7769. In the Village Barn, international folk dancing, Thursdays, 7:30–10 p.m., call Mady, (630) 584–0825; Scottish country dancing, Tuesdays, 7–9:30 p.m., call Doug, x8194.

Conversational English classes, 9–11:30 a.m., Thursdays, Users' Center.

LETTER TO THE EDITOR

May I bring to your attention that the U.S.S. Princeton, referred to in "Twenty-One Tons of Broken Symmetry" (*FermiNews*, January 23, 1998), was not a "battleship" (not a generic word) but an "Essex" class aircraft carrier and is among five now listed as being, at least in part, at Fermilab. Suggest you reference the "Village Crier" (what *FermiNews* developed from), vol. 7, no. 14.

As a side note, I served in an air group squadron on the U.S.S. Philippine Sea, one of the five, during the early days of the Korean War (1950–1951) and remember "Essex" class carriers quite well.

Sincerely,

Richard L. Nelson

(Payroll no. 145) Retired

CLASSIFIEDS

FOR SALE

■ '96 Corvette "Collector's Edition" Sebring Silver, black interior, automatic, loaded, very clean, $27,000. Call Jim, x3371 or (815) 729–9072

■ '94 F150 Ford pickup, 36k miles, extended cab, dual fuel tank, bed liner, a/c, am-fm radio. Excellent condition, $10,900. Call Debbie, x3045 or (630) 985–2241 (evening).

■ '94 Mazda B2300 cab +1/2 pickup truck. Clean, 31k miles, 5 speeds. Best rational offer. Call Greg, 1–888–896–4204 or (630) 554–2259.

■ Inherited new van, must sell one of the following: '87 Nissan Maxima, 139K miles, great condition, $3,500, or '88 Plymouth Voyager, 135K miles, new tires, great condition, $3,000. Contact Jerry, x4571, (630) 801–9408, or Jerryz@fnal.gov.

■ American Racing Equipment aluminum wheels (4), 15" x 8", with P275/60R15 BF Goodrich T/A radial tires. Fits full-size Chevy truck (5 lugs). Never used in winter. $400. Contact: x4396, (630) 859–8596, or pritchard@fnal.gov.

■ '96 Fishing Boat, Sun Dolphin Pro 110. Length 125", width 54", weight 145 lbs. Capacity 461 lbs, and HP rating 15. $550. Call Steve Barath, (630) 554–1922.

■ Keyboard, ergonomic Infogrip BAT chord (left hand) for Macintosh, unused, asking $200. (I bought it because of carpal-tunnel syndrome but have since recovered.) Original packaging and documentation. Contact Dan, (312) 567–3389 or kaplan@fnal.gov.

■ Digital Camera, New Apple QuickTake 200 Color, $200. Call Pete, x4699 or (630) 879–1541.

■ House, 4-bedrm ranch in Batavia, 2 bathrm, large eat-in kitchen, living room, family room, 2-car detached garage with storage room. Large yard w/mature trees. Geneva schools. Price reduced, must sell, $120,000. Call Peter or Penny, (630) 879–0837 (evenings).

FOR RENT

■ Rent w/option to buy. Home in Summerlakes. <1 min. from Fermilab by car. 3 BR, 1-1/2 baths, 2 stories w/attached 1-car garage. LR, DR, kitchen, fireplace, deck, storage, pool & clubhouse privileges, whole house fan, ceiling fans in most rooms, whole house humidifier. Freshly painted. Move-in condition. $1,300/mo. with $200/mo. credit toward purchase option @ $127,000 (locked) or $1,200/mo. and $200/mo. credit with floating purchase price (determined by market value). For details, contact Henry, x4157, page 0141, ehschram@fnal.gov or (630) 665–2434

FREE

■ Tire, BF Goodrich non-radial tire (one only), size F78-14ST. Raised letters, approx. 7/32" tread remaining. Call Henry, x4157, page 0141 or (630) 665–2434.

WANTED

■ Commodor 64/128 games, especially "The Train." Good chance to clean out those closets and crawl spaces. Contact Tom, x6366 or pedersen@fnal.gov.

■ Enclosed trailer, 5' X 8'; Kodak slide projector; snowblower, 5hp or larger. Call Ed Dijak, x6300 or (630) 665–6674 (after 4 p.m).

LAB NOTES

■ The Fermilab Golf League at Phillips Park is looking for players. We play every Thursday night from early May to the end of August. For more information and to sign up, contact Steve Baginski, x3721 or Baginski@Almond.fnal.gov, or Joe O'Malley, x2504.

■ Reach out to Europe! Host families are needed for a group of students from Spain (ages 14–18) who will be visiting Naperville from approximately July 1 to August 1. The students will have two excursions a week and their own spending money. It is not necessary to have a teen in the family; some of our best placements have been families with young children or no children. Be a part of this exciting and educational opportunity! For more information, please call: International Education and Exchange, Meg Stromberg, Local Coordinator, (630) 778–7366.

MILESTONES

HONORED

■ Phil Livdahl (retired), by St. Olaf College. Livdahl, who received the Distinguished Alumni award, is a former deputy director of Fermilab.

RETIRED

■ Filip Johnson, ID 1489, on February 27, from TD/Development and Test.

FermiNews
Fermi National Accelerator Laboratory

Published by the
Fermilab
Office of Public Affairs
MS 206
P.O. Box 500
Batavia, IL 60510
630-840-3351
ferminews@fnal.gov

Fermilab is operated by Universities Research Association, Inc., under contract with the U.S. Department of Energy.

The deadline for the Friday, March 6, 1998, issue of FermiNews is Tuesday, February 24.

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.

☆ U.S. GOVERNMENT PRINTING OFFICE:
1998--646-054/80010

50%
TOTAL RECOVERED FIBER
10% POST-CONSUMER FIBER