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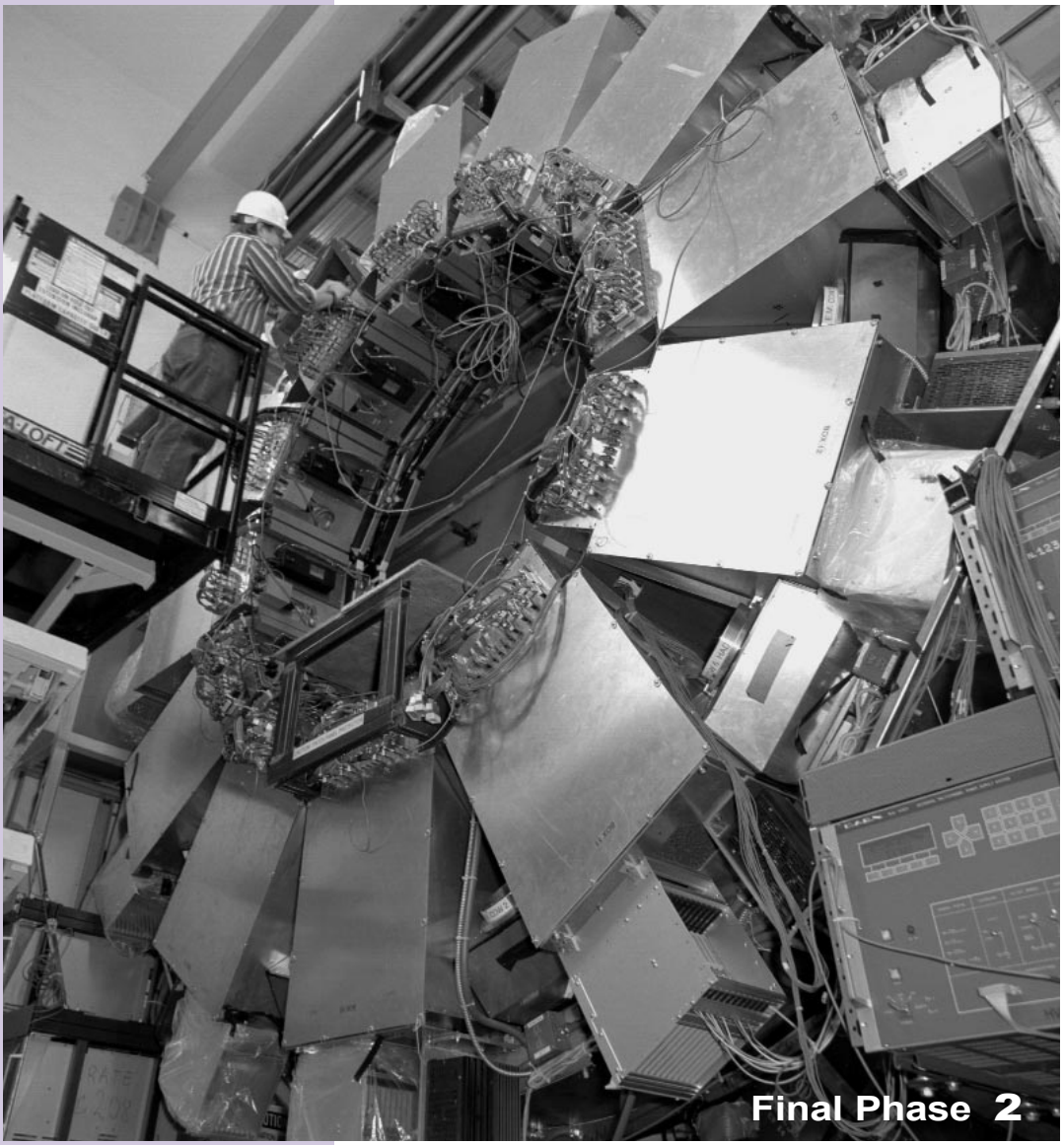

Final Phase 2

Photo by Reidar Hahn

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INSIDE:

FINAL PHASE: *Fermilab's Collider Hit*

by Judy Jackson

Fermilab today is a laboratory poised on the brink of the greatest physics run of its life. The trouble is, the brink keeps moving.

When Collider Run II begins, Fermilab's Tevatron, the world's highest-energy accelerator, souped up with the brand-new Main Injector, will produce more data about more particle collisions at the energy frontier than ever before in the history of particle physics. There is every reason to believe that in those data lie discoveries that will change the way we think about the fundamental nature of matter. There is nothing that Fermilab, the physicists who use Fermilab and the agencies that fund Fermilab want more than to get started on the new collider run. Yet the beginning of Collider Run II at the Tevatron sometimes seems exasperatingly hard to attain.

Technician John Cornele checks connections on mini-drift tubes for the DZero upgrade.

Although the earliest "baseline" plans called for Run II to begin in 1999, more recently Fermilab had announced that Run II would begin with the new millennium, in 2000. Hitting the year-2000 Run II target meant building the new Main Injector accelerator and Antiproton Recycler, reconfiguring the Tevatron and Antiproton Source, and commissioning the resulting new accelerator complex. It also required completing two massive upgrades of Fermilab's collider detectors, CDF and DZero, totally reinvented from their Run I configurations to handle two inverse femtobarns of data from the collider, 20 times more than in Run I. The Main Injector is finished, but completing and commissioning the new accelerator system will take until September 2000. And in September 1999 the detector collaborations broke the news that they would not be ready for full-fledged operation until early 2001.

With so much riding on the Run II start date, what accounts for the detectors' schedule slip? And, perhaps more significant, what now leads Fermilab's management and the collaborations themselves to believe that the current schedule is one they can—no kidding—really achieve?

Collaborators and lab management largely agree on the reasons for the detectors' schedule slip. The upgrades, all acknowledge, are extraordinarily challenging projects that force detector technology to unprecedented new levels. They incorporate

Detectors the Home Stretch—REALLY!

unique, new, one-of-a kind systems, each requiring extensive R&D efforts that make it extremely difficult to set realistic schedules in the projects' early stages. They require components that vendors have never built before, manufactured to unheard-of standards of precision. Often suppliers overestimate their capability to produce components and underestimate the time it will take. Other Fermilab commitments—finishing Run I, building the Main Injector, and other projects—competed for scarce manpower and funding. The funding for the detectors felt the overall squeeze on the U.S. high-energy physics budget. Project management structures had to adjust to project realities. And, perhaps most fundamentally, the long-held Fermilab practice of basing schedules on the most optimistic possible assumptions resulted in timetables that were not grounded in realistic assessments by those closest to the work.

What has changed, now, to convince collaborators and laboratory leadership alike that the current schedule, for beginning Run II in March 2001 means what it says? Experimenters and managers cite four main factors. First, the projects are far enough along toward completion that most of the R&D and vendor surprises are likely behind them. Second, Fermilab has unequivocally made the detector upgrades its clear priority and allocated the manpower and resources necessary to complete them. Third, the Fermilab director has established a new kind of working relationship with the collaborations. Last, and perhaps most significant, the term "Fermilab schedule" is taking on a new meaning.

Detectors are difficult.

Everyone agrees that building a 5,000-ton state-of-the-art particle detector, one designed to wring every ounce of physics from the trillions of particle collisions the accelerator sends its way, is a very challenging job. In fact, challenging may not be the word.

"Both of these detectors have brand-new systems that no one has ever built before," said Director Mike Witherell. "The fiber tracker at DZero is an all-new design. The central outer tracker in CDF is a major design advance. Together, the detectors' silicon systems are 10 times bigger than their predecessors'. The front-end electronics for silicon detectors must be completely developed at the first assembly stage, rather than being added at the end, the way we have typically built detectors in the past."

COVER PHOTO:
Fermilab physicist Mike Lindgren works on wiring for one of the CDF detector's redesigned end plugs. CDF has instituted "installation shifts" for all collaboration members.

Photos by Reidar Hahn

Fermilab physicist Tom Diehl works with DZero's muon chambers.

FINAL PHASE:

Precision silicon technology has a large role in both detectors' upgrades. Technician Jorge Montes uses a coordinate measuring machine in the Silicon Detector Facility.

DZero Cospokesman Harry Weerts agreed.

"It would be easier if we could use mass-produced stuff," Weerts said, "but for the majority of components there are lots of technical development steps before we can go into production. In many cases, we are asking vendors for levels of precision that they have never encountered before. It all takes time."

Herding cats.

The collaborative nature of detector building makes it still harder to predict and plan a project's progress. Project managers have the task of coordinating the efforts of 500 independent-minded, independently funded collaborators to design, engineer, construct and commission the detector they will ultimately use to do new physics. "Herding cats," is how they describe it, and it isn't conducive to strict scheduling.

"Accelerator construction projects are centrally managed," Witherell observed. "The people working on the project are all part of the laboratory's line management organization. But detectors are built by collaboration. We have invented the institution of the international detector collaboration to build these multi-kiloton 'Swiss watches.' Resources are spread over many funding agencies, and collaborators operate in an environment of academic freedom. Essentially, the workers on these projects are all volunteers. When outside people see this, they can't imagine we can ever build anything. We can, but it isn't easy."

Heard the one about the Fermilab schedule?

Like the term "military intelligence," the saying goes, "Fermilab schedule" is an oxymoron. When he was a user himself, Fermilab director Mike Witherell told the Fermilab users' meeting last July, he knew that if a Fermilab schedule actually referred to the future, it was only a draft.

And, said CDF co-spokesman Franco Bedeschi, the laboratory's sliding scheduling philosophy had a vicious-circle effect.

"When managing an experiment, one has to balance the desire to build the best detector possible with the time it takes to build it," Bedeschi said. "This leads you to make different choices depending on how much you trust the laboratory schedule."

In production at last.

Now, say collaboration leaders, they can see light at the end of tunnel. For one thing, they have reason to believe that many of the unpleasant, time-gobbling surprises of earlier stages are behind them. Most of the R&D is done, and vendors are producing and shipping the requisite components at a rate that permits reliable extrapolation.

"Until you start to build something, you really cannot anticipate all the problems," Bedeschi said. "A schedule is always partly guesswork until then. Now, for most things, we are in production. Disaster is always possible, but we can now extrapolate from production rates with much more confidence."

Across the ring at DZero, Cospokesman Hugh Montgomery reported a similar situation. "We like to think that there are very few areas where we are not currently in production," he said.

REALLY!

Priorities and Partnership

For Fermilab's part, the message to collaborators is clear: completing the detector upgrades is the lab's priority, backed up by the resources to get the job done.

"We are giving the detector collaborations all the resources they need," said Deputy Director Ken Stanfield. "All the resources that can usefully be brought to bear on the detectors to get them ready to run are being brought to bear."

At the same time, Witherell said he expects a new level of partnership between the detector collaborators and laboratory management.

"Successful projects are not the ones without problems," Witherell said, "but the ones in which problems are brought into the open, analyzed, discussed, and worked on together to find solutions. The project management for the upgrades needs to know that we are collaborating with them. In turn, we need to know that the project management is being straightforward with us. We must have a good give and take."

The message is getting through.

"There is a very positive attitude in the lab," said CDF Cospokesman Al Goshaw. "It is clear that the upgrades are the highest priority, and that we should speak up if we need help. Mike Witherell came to talk to the CDF executive committee about his vision for Fermilab and for the detector upgrades. It had a very inspirational effect. We know the lab is behind us, and in turn we are committed and obligated to the laboratory. We have decided that every collaborator on CDF must have a part in getting the detector ready. Last week we began 'installation shifts' that will continue through June 2000. Every collaborator is in the shift pool, to come in and work for at least a week. It's a requirement for authorship. Franco and I will be taking shifts along with everyone else. I'm looking forward to it as a vacation from being a spokesperson."

Russian physicist Andrei Schukin looks over a muon panel for the DZero detector.

University of Wisconsin physicists Yeongdae Shon and James Beringer examine the muon chamber on CDF's toroid.

Indiana University physicist Tom Marshall and Fermilab engineer Boris Baldine make electronic checks of the DZero muon chamber.

Photos by Reidar Hahn

FINAL PHASE: REALLY!

Time to Step up to the Plate

The collaborations have also heard Witherell's message about a change in the philosophy of Fermilab schedules, a signal that is reinforced at biweekly upgrade project management meetings with the director. With input from the Beams Division, DZero and CDF, the Directorate has produced a schedule that Witherell describes as realistic but aggressive, calling for Run II to begin in March 2001.

"It can be hard to separate using a schedule as a motivational tool from using it to plan the work on a timetable that all agree you can make," Witherell said. "I believe we now have a schedule that we have a good chance of meeting. But it won't be easy. From here on, it's not a question of vendor deliveries. The things with the most impact on the schedule are under the collaborations' control. Now it is up to them to step up to the plate."

Photo by Reidar Hahn

Fermilab physicist Linda Stutte inspects the mini-drift-tube tracking detector for the forward muon system of the upgraded DZero detector. Many of the detector's systems required extensive pre-production R&D.

Associate Director Mike Shaevitz expanded on the new Fermilab definition of "schedule."

"Now it means not the earliest possible date you could conceivably imagine, but the date when you believe, with high confidence, that you can finish," Shaevitz said. "I hope it works. If it does, then people will start believing it."

Out at the collaborations, they believe. Weerts said DZero is now committed to realistic schedules.

"No more taking it as a given that schedules always slip at Fermilab," he said. "Maybe the 'optimistic' type of schedule works for some people, but overall, that system isn't working. We have to stop doing business that way. We are determined that the date will not slip any more. Every two weeks we formally review the schedule at DZero. Meanwhile, it's simple. I have one piece of paper with a checklist of milestones. I go down the list continually and find out what's on track and where we might be having problems. When I find trouble, we figure out how to fix it."

CDF's Goshaw agreed.

"The lab has listened to our input, and we have been very frank about our problems. From their experience in project management, they have added some time, to create a realistic schedule. They have made clear that we will have the resources we need. Now— that's it. That's what we have to meet. If we fail this time around, we all have the message that it would be very damaging not just to Fermilab but to high-energy physics. We have a big responsibility to make this happen."

The new Fermilab "we-really-mean-it" Run II schedule calls for CDF to start a commissioning run in August of 2000, and for both detectors to begin taking data in Collider Run II in March 2001. Will they roll into the Tevatron when they say they will?

DZero's Weerts had the final word

"The only way to restore our credibility is to perform," he said.

Photo courtesy of DOE

Martha Krebs

KREBS Steps Down as Director of DOE's Office of Science

by Sharon Butler

After overseeing some of the nation's finest programs in scientific research, including studies in high-energy physics, Martha Krebs, assistant secretary and director of the Office of Science at the U.S. Department of Energy, has resigned, effective in December.

"DOE and the nation owe Martha Krebs a debt of gratitude for her stewardship for the past six years of some of the nation's premier scientific research. Her expertise, energy, vision, professionalism, and her leadership will be sorely missed," said Secretary of Energy Bill Richardson. "During her tenure in the Office of Science, the Department of Energy has emerged as a global leader in science technology, and technological innovation, and has made groundbreaking collaborations with the scientific community."

DOE's Office of Science, formerly the Office of Energy Research, funds basic research in the agency's national laboratories and in universities throughout the United States. In fact, it is the largest funding source for the physical sciences, including high-energy physics.

Before Krebs took over, DOE's role in basic research was little known or appreciated, particularly in congressional circles, said John Peoples, former director of Fermilab and now Chief Executive Officer of the Sloan Digital Sky Survey. He praised Krebs for succeeding in winning recognition in Washington for DOE's science programs.

In her resignation letter, Krebs counted among her accomplishments "delivering the highest of high technology on schedule, within budget and with a level of performance that enables American scientists to lead the world in many fields."

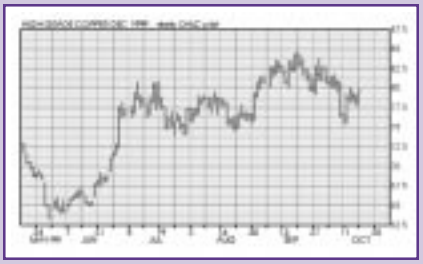
Krebs specifically mentioned several achievements during her career, including the fact that the High-Energy Physics Program developed a new long-range plan after the Superconducting Super Collider was terminated. The main goals of that plan, she said, were expanded investments in university high-energy physics; the on-time, on-budget completion of Fermilab's Main Injector and SLAC's B Factory, and the successful negotiation and ongoing participation of American scientists in the collaboration to construct the Large Hadron Collider and its detectors at CERN.

Krebs said her position as head of DOE's Office of Science was satisfying in spite of—and, indeed, sometimes because of—the challenges that she and her staff faced and overcame.

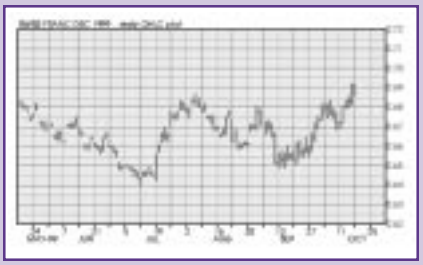
In a letter to her staff, Krebs wrote that deciding to step down was not easy. "The job of Director is not meant to be a career job but it also doesn't have clear milestones, where one can say, 'Now is a good time to leave.' However, I also have confidence that you and the programs will continue to move forward and make great science happen."

In a short note to Richardson, Krebs said she was assured the secretary would continue "his vigorous support of the Department's programs and especially its key role in fundamental science." She also promised the secretary that she would work with him to "provide a smooth transition for these programs."

She added, "It is never easy to say goodbye, especially when the separation will be long and involves people and work you love."



TRAVELS (AND TRAVAILS) IN THE METAL TRADE



From his desktop, Dan Green tracks the daily prices of copper (top) and Swiss francs (bottom).

Photo by Reidar Hahn

by Mike Perricone

If it's Tuesday, this must be…Minsk?

"September was a tough month," said Dan Green, back from a grand tour that saw him on the road for 15 of the last 20 days of September, from Batavia to the Republic of Belarus to Birmingham, England and back. Green is Technical Director and Construction Project Manager for US/CMS, the collaboration working on the Compact Muon Solenoid detector for the Large Hadron Collider at CERN, the European particle physics laboratory in Geneva, Switzerland.

Another day, another country, and every stop has a story. Consider, for example, the Bulgarian brass bottleneck, which occasioned the extra trip from Minsk (in the former Soviet Union) to Birmingham to assure a sufficient supply of brass plates for the Felguera metal fabricating plant in Spain.

Felguera is producing wedges—36 of them, at about 30 tons each—for the barrel section of the hadron calorimeter (HCAL) of CMS. Green likened the process to a marching army which must be fed; in this case, it must be fed brass. But Felguera was looking at a cut-off of rations from its troubled Bulgarian subcontractor.

"The infrastructure in Bulgaria is not very good, and they have trouble with electrical power," Green said. "Some of the former East Bloc countries have done well, and some haven't. Bulgaria is having problems.

"We could see this coming for a few months," he continued. "There was a strike. They lost power. The brass was in a melt in the furnaces when they lost power, and it crystallized. The deliveries slowed down, and we got a call from Felguera. I thought it would be good for them to have another supplier in their back pocket, so we called around and got different budgetary quotes."

The surprise quote came from Battery Rolled Metals in Birmingham, which essentially cut its price in half from its submission in the first round of bidding ("Probably because we quoted them the Bulgarian price," Green quipped). Green flew from Minsk to Birmingham and met with Felguera representatives at the airport. The group visited BRM, and struck a deal with a fast delivery time to keep feeding the Felguera "army."

In making the deal, Green called on some newly developed skills. Like a commodities broker, he keeps a particularly sharp eye on the daily vicissitudes of copper and Swiss francs. Copper is an essential raw material for the brass plates; Swiss francs are CERN's official currency, and Green tries to connect the best copper prices with the best exchange rate into U.S. dollars.

"I watch the Swiss franc every day, because you can swing 10 to 20 percent—and we have, over the last year," he said.

The overall price of copper has dropped sharply from a peak of a few years ago, which Green described as partially resulting from commodities manipulations. The CMS baseline budgeted copper at a conservative long-term average of $1 (US) per pound; within in the last year, the price has been as low as 65 cents per pound, though it has risen since then. The Birmingham price was established from the daily quote on the London Metals Exchange, but Green has found ready access to information on the Internet for his project planning.

"I go to 'barchart.com,' enter the commodity key for high-grade copper, and I get a monthly chart of prices," he said.

By closely tracking commodities like copper, Green has been able to move up purchases and production to take advantage of low prices. With additional money augmented by borrowing from the project's future funding profile, Green has locked in good prices and gained purchasing power by keeping ahead of budgetary inflation allowances.

"We basically doubled the amount of work we had initially planned for Fiscal Year 1999," he explained. "You're borrowing from the future, but if you skew your funding profile earlier, you win on inflation if you can spend the money. We positioned ourselves to be able to spend it. We used our profile to keep the magnets, the big common project, on schedule. That helped CMS and reduced the bite that inflation takes. The upshot is that we've saved money."

With the CMS project, Green has grown from career physicist to commodities broker.

"I've spent the last 30 years accumulating an ensemble of skills completely different from the requirements of project management," he said. "As John Lennon said, life is what happens to you while you're making other plans."

Photos courtesy of US/CMS

Representatives of CMS and DWE display the first wheel, comprising one-fifth of the barrel magnetic yoke or flux return, at the factory in Deggendorf, Germany. The wheel includes 1,400 tons of machined steel.

TRIP 1: SEPT. 10-17, 1999

Sept. 10: Depart Fermilab, arrive CERN (Geneva, Switzerland) morning of Sept. 11.

Sept. 11: Discuss purchase of APD (avalanche photo diode) by ECAL (electromagnetic calorimeter) consortium, including US.

Sept. 12: Meetings with Russian and Ukrainian groups.

Sept. 13: Drive to Zurich for CMS Week, quarterly weeklong meetings of entire collaboration.

Sept. 14: HCAL technical meeting. Discuss funding of APD purchase.

Sept. 15: Meetings of CMS Finance Board and US/CMS Project Management. CMS plenary talks. Meeting with Russian collaborators.

Sept. 16: Fly to Deggendorf, Germany. At DWE factory, inspect first "wheel" of CMS barrel magnet.

Sept. 17: Depart Munich for Fermilab.

TRIP 2: SEPT. 22, 1999

Sept. 22: Depart Chicago for Washington DC. Present FY00 requests for US/CMS incremental base program support.

TRIP 3: SEPT. 25-30, 1999

Sept. 25: Depart Fermilab. Arrive Minsk, Republic of Belarus, morning of Sept. 26.

Sept. 26: Meeting with State Committee on Science and Technology to stress importance of Belarus commitment.

Sept. 27: Tour "MZOR" plant and machine shops. Press conference with CERN and SCST officials. Workshop on LHC physics.

Sept. 28: Visit "INTEGRAL" semiconductor plant, largest of its kind in Eastern Europe. Depart Minsk for Birmingham, England. Airport meeting with representatives of Felguera, metal fabricating firm of Spain.

Sept. 29: Visit Battery Rolled Metals in Birmingham with Felguera representatives. Negotiate purchase of approx. 300 tons of brass plates for Felguera, replacing shortfall from original Bulgarian supplier.

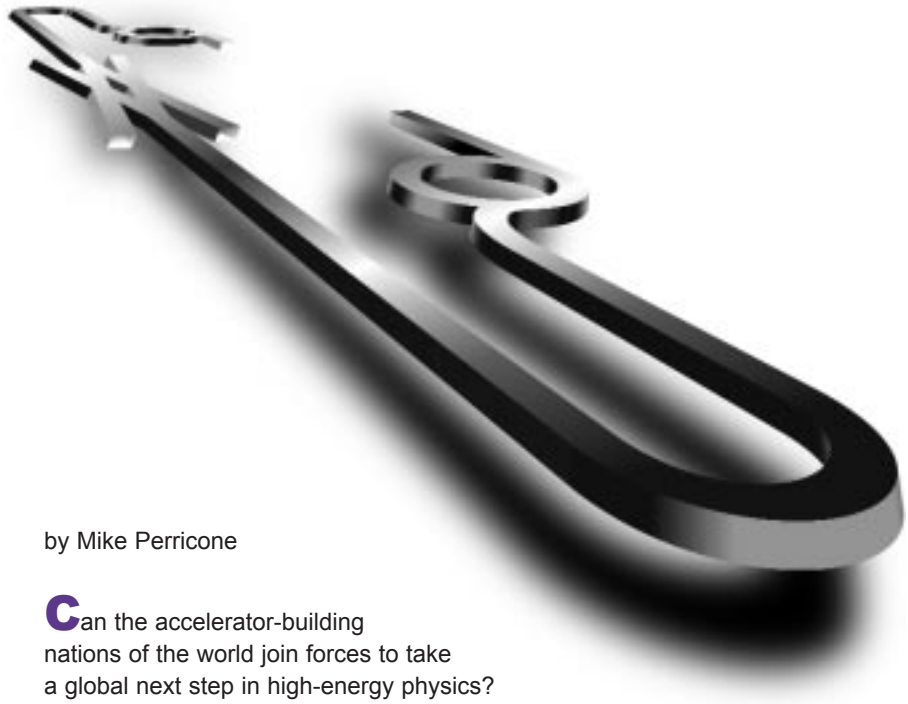
Sept. 30: Depart Birmingham for Fermilab.

Top: Barrel and endcap wedges used for the test beam at CERN.

Bottom: Stacks of machined brass plates at the Felguera metal fabricating plant in Spain.

ACCELERATING

THE DECISION PROCESS



by Mike Perricone

Can the accelerator-building nations of the world join forces to take a global next step in high-energy physics?

Or will daunting economic, political and historical obstacles block the kind of transworld collaboration that most physicists and many policymakers agree will be critical for new machines at the advancing energy frontier?

These were the questions that a high-powered group of the world's high-energy physicists gathered to discuss at a workshop of the International Committee on Future Accelerators, held at Fermilab, Oct. 5-8, 1999. Perspectives differ on what form the next accelerator after the LHC should take; when design decisions should be made; and—especially—where it should be built.

"If it could be built in space," said Albrecht Wagner, head of Deutsches Elektronen-Synchrotron (DESY) in Hamburg, Germany, "it would already be built. But it has to come down to earth somewhere."

Not in space but in cyberspace, an Internet search under "ICFA," turns up the 'International Cemetery and Funeral Association' as its first entry John Peoples, ICFA chairman and Fermilab director emeritus told delegates."

But proceedings were anything but funereal at the four-day workshop on Future Perspectives in High-Energy Physics. The directors of all the world's high-energy physics labs, representatives of many of the world's funding agencies, and scientists from every branch of HEP, grappled with how to move beyond the current nation- or region-centered paradigm, to a new model of world collaboration.

Michael Witherell, Fermilab: "In any international collaboration, we must keep in mind that we need to maintain healthy national laboratories while we build a new global facility."

Hirotaka Sugawara, KEK: "I would urge us not to be hasty in solving our problem."

Jonathan Dorfan, Stanford Linear Accelerator Center: "Intense regionalism is an invitation to extinction."

Luciano Maini, CERN: "If we have less money, maybe can make smaller machines but make them more quickly, and then we can improve them."

Ken Peach, Rutherford Appleton Laboratories: "Politicians want 'The Big Idea.'"

Photos by Jenny Mullins

Many of those present clearly believed that an earth-bound consensus is growing, if far from achieved, on a 20-mile long, high-energy (1-1.5 Trillion Electron Volts) electron-positron Next Linear Collider as the next major step in particle physics. The linear collider concept also appears to be gaining momentum outside physics, as Burton Richter declared during a panel discussion of laboratory directors.

Richter, Director Emeritus of the Stanford Linear Accelerator Center, spoke from the audience to warn that a decision could be made among participating countries without advice from the scientific community.

"The governments all know that we (in particle physics) are heading for a multibillion-dollar linear collider," Richter said. "They are going to start talking to each other. It's important for us to get involved with the governments, so that they take science advisers to these meetings, which are going to happen anyway. They must hear the voice of science, and not just the voices of geopolitics and geofinance."

The "voice of science" could be heard clearly in a talk on Perspectives of High Energy Physics: LHC and Beyond, by Jonathan Ellis of CERN. At the top of the list of physics goals, Ellis said, is measurement of the Higgs boson, postulated as the source of mass; the Higgs should be found in the NLC's energy range. The NLC could also open a window on supersymmetry, by viewing weakly interacting particles which can't be seen at LHC.

The influences of geopolitics and geofinance cannot be ignored, because there is virtually no doubt that the next big machine—NLC or otherwise—can be built only by an international collaboration to share the considerable expenses. As Fermilab Director Michael Witherell stated, the high-energy physics community "must envision the linear collider as much as possible with a worldwide view."

Working from just such a viewpoint, Wagner outlined a "Proposal for a Global Linear Collider Laboratory." The envisioned accelerator complex would be built at an undetermined location, but operated remotely from several laboratories around the world. Physicists would in effect be taking their shifts from their home labs via remote electronic communications. The accelerator would operate with a small onsite crew, built with global funding, with experimenters from far and wide.

During the ICFA reception, Mike Shaevitz (center), Fermilab Associate Director for Research, meets with John Ellis of CERN (left), and Peter Rosen, DOE Associate Director for High Energy and Nuclear Physics.

Photos by Jenny Mullins

Beth Witherell (center), wife of Fermilab Director Michael Witherell, exchanges pleasantries with SLAC Director Jonathan Dorfan (left), and Shoji Nagamiya of KEK.

Wagner cited the example of a synchrotron accelerator in Hiroshima, Japan, operated by remote control from Tokyo. He also noted the many successful remote operations in astronomy and space science, and urged ICFA to set up a task force to study the possibility.

In contrast to Wagner's readiness, there were also voices urging deliberation and caution, including that of Hirotaka Sugawara, Director of KEK, the accelerator laboratory in Tsukuba, Japan.

"I would urge us not to be hasty in solving our problem," Sugawara said in the directors' panel discussion. "I'm afraid of making premature decisions."

The issue of time brought voices calling for both quick and delayed decisions, from both the directors' panel and the audience. Results offering insights into the energy thresholds of new particles are years away, both at Fermilab and at the LHC at CERN, the European particle physics laboratory in Geneva, Switzerland. Meanwhile, the growing scope and expense of high-energy physics machines means a long wait from proposals to operations—as much as 20 years. The hourglass is seen as both half-full and half-empty in terms of decision-making.

Half-empty, according to Richter: "We won't have new information until Fermilab Run II, and until the LHC is operating for a few years. But we can't wait that long to make a decision. We need to ask, what is the right expansion?"

Half-full, according to audience member Alvin Tollestrup of Fermilab (himself a proponent of muon storage rings and colliders): "The NLC would sit for a year looking at one point for events. I think it's a mistake not to wait until the LHC sets a new mass scale. If we decide before that and we're wrong, it will be a waste of money and a disservice to our field."

Rutherford Appleton Laboratories (U.K.) Director Ken Peach pointed out that "money is an intensely political issue, and politicians want 'the Big Idea.'" He was reinforced by a comment from the audience by John O'Fallon, Director of the High Energy Physics Division of the U.S. Department of Energy.

Photo by Jenny Mullins

Future *PERSPECTIVES* in High Energy Physics

"It's enormously hard to sell modest increases in energy for large amounts of money to politicians," said John O'Fallon (center), Director of the High Energy Physics Division of the U.S. Department of Energy. "We're talking about billions of dollars."

"It's enormously hard to sell modest increases in energy for large amounts of money to politicians," said O'Fallon. "We're talking about billions of dollars."

Also in the category of billions of dollars is the Very Large Hadron Collider, postulated as the machine to move the high-energy frontier beyond the scale of the LHC. There were several references during the conference to the 1996 meeting in Snowmass, Colorado, where the NLC was envisioned as complementary to the LHC at CERN, while VLHC would achieve a 10 TeV center of mass energy with superconducting magnet technology. VLHC would also require a circular ring at least 50 miles in circumference and possibly larger, depending on the kind of magnet technology selected. By comparison, Fermilab's Tevatron is four miles in circumference; the LHC at CERN is 27 kilometers, or about 16 miles in circumference.

As Michael Harrison of Brookhaven National Laboratory said in his presentation, VLHC (indeed, any large-scale project) would require long-term planning to decide on the concept, establish a sense of direction, launch research and development, guide the magnet development, and attempt to minimize the cost of big-ticket items.

"The VLHC could almost be built today," Harrison said. "The technical issues are less difficult than other issues."

As with any large-scale project, those "other issues" clearly are economic and political.

While ICFA adjourned without an endorsement of a specific machine, many of the participants will be heading next to an international conference lending credence to a sense of momentum for NLC: The 8th International Workshop on Linear Colliders, held from Oct. 21-26 at Frascati National Laboratory in Rome, Italy. Jonathan Dorfan, Director of Stanford Linear Accelerator Center, summed up the importance of reaching an international consensus on the direction of high-energy physics.

"No matter which accelerator we eventually build," said Witherell, "we will have to use the world's existing laboratories as resources. All the labs will have to organize to build a big, complicated project. The laboratories are our assets. In any international collaboration, we must keep in mind that we need to maintain healthy national laboratories while we build a new global facility."

Dorfan concluded: "We must try to write a global road map, and address regional balances over time. Intense regionalism is an invitation to extinction."

LETTER TO THE EDITOR

Photo by Jenny Mullins

Rajendran Raja (left) confers with Fermilab Director Michael Witherell (center) and SLAC Director Emeritus Burton Richter during the recent ICFA conference at Fermilab.

Combined channel thresholds

→ Gaussian approximation in combination
→ 30% better $m_{b\bar{b}}$ resolution than Run 1
→ Run 2 acceptance ×1.3 NN improvement
→ 10% systematic error on background
→ all except $\ell^{\pm}\ell^{\pm}jj$

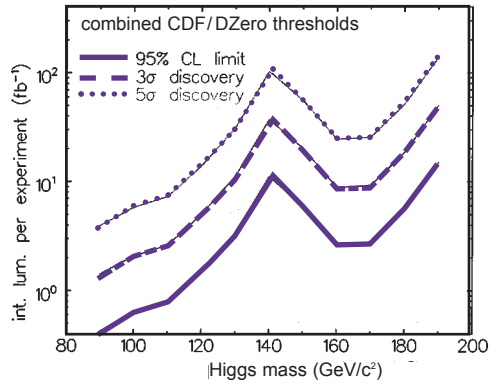


Figure shows the Integrated Luminosity per experiment needed to discover the standard model Higgs boson as well as to set 95% confidence limits as a function of the Higgs mass.

To the Editor of *FERMINEWS:*

It was with some amusement that I read the correspondence between yourself and the author of the article in the September 2nd issue of FAST, the electronic French review of advances in science and technology. This underscores the need for scientific precision when discussing these matters as can be seen from the enclosed plot taken from the conclusions of the Fermilab Run II workshop on Higgs.

Let us take the following plausible scenario that LEP does not discover the Higgs in its current run. It is widely expected in this case that they will be able to rule out standard model Higgs masses below 110 GeV/c^2 at the 95% confidence level. (This means that they can be wrong with a probability of 5%. Most of this likelihood is concentrated at Higgs masses just below 110GeV/c^2.)

As can be seen from the plot, in order for Fermilab to extend the Higgs mass lower limit beyond 110GeV/c^2 at the 95% confidence level, an integrated luminosity of 0.7 - 0.9 fb^{-1} per experiment is needed, depending on what smoothing algorithm one uses on the plot. This is 7-9 times more data than has been obtained in Run I. If however, one is trying to make a discovery of a Higgs boson of mass 110 GeV/c^2 , then more stringent standards of probability are required and to obtain a 5 standard deviation signal would require an integrated luminosity of 10 fb^{-1} per experiment, again depending on the smoothing algorithm. Recent versions of the Fermilab schedule show us receiving 15 fb^{-1} per experiment by the year 2007, so it is not unreasonable to conclude that 10 fb^{-1}would be obtainable only by the year 2005. This era used to be designated as Run III, in previous versions of the Fermilab schedule, a document not noted for its precision. The bottom line is that depending on what one is talking about, extending the Higgs mass lower bound or making a discovery, both the French article and your response to it have merit!

Yours Sincerely,

Rajendran Raja
Fermilab

LAB NOTES

CHARITIES PROGRAM

The Charities Program has a new procedure this year. Check out the Fermilab at Work web page for directions & instructions on how to properly fill out your form. If you have any questions, concerns, need assistance or do not have access to the web you may request paper forms by phoning Equal Opportunity Office At x4633, http://www.fnal.gov/faw/charities/charity.html

SMOKE DETECTORS

The Fermilab Fire Department would like to remind everyone, when changing your clocks, please change the battery in your smoke detector and test it.

MILESTONES

MILESTONE TO COME

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$8/PERSON

DINNER SERVED AT 7 P.M.
$20/PERSON

Chez Léon MENU

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

LUNCH
WEDNESDAY, NOVEMBER 3

Lasagne Bolognese

Arugula and Sweet Red Pepper Salad

Coffee Ice Cream with Chocolate Frangelico Sauce and Chocolate Cinnamon Cookies

DINNER
THURSDAY, NOVEMBER 4

Closed

LUNCH
WEDNESDAY, NOVEMBER 10

Raspberry Chicken

Garlic Mashed Potatoes with Scallions

Carrots Glazed with Madeira

Lemon Cheesecake

DINNER
THURSDAY, NOVEMBER 11

Roasted Garlic and Goat Cheese

Bouillabaisse

Watercress and Mixed Green Salad with Mustard Vinaigrette

Apple Almond Turnovers with Ice Cream

FERMI NEWS

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CLASSIFIEDS

FOR SALE

■ '94 Dodge Intrepid. Power locks, windows, steering, brakes, a/c, cruise, am/fm cassette. Silver with grey interior. Newer battery and brakes. 70k. $4,500 obo. Beth, x4203 or Mike (815) 439-7740.

■ '91 Dodge Colt, black, 2D Hatchback, automatic, 103K miles. Needs work but still runs. $250. Call (630) 759-2939 and ask for Sue or Jay.

■ '88 Subaru GL. 2 door hatchback, 5 speed manual, front wheel drive. Good condition, lots of new parts, including clutch, fuel injector, exhaust, timing belt. Asking $1,000 obo. Call Dennis at (630) 840-5296 or send e-mail to dshpakov@fnal.gov.

■ Entertainment cabinet vg condition $50, Kitchen table-round butcher block $25, 6 piece bdrm set, dresser, mirror, chest, night stand, bedframe and hamper $250, cabinet - coffee table $25, console stereo with turn table, am/fm, 8-track (yes, 8 track), make an offer. Carol x2992 days, (630)876-3293 evenings.

FOR RENT

■ House for rent, St. Charles, old neighborhood, two bedrooms, large yard, nice location, close to river and bike path. $850 steinbru@fnal.gov or phone 587-9464

WANTED

■ Music stand, portable or otherwise. thatcher@fnal.gov or x8364.

CAT CARE

■ X-Large indoor/outdoor kennels in beautiful woodland setting. Lots of TLC. Make your Holiday reservations now. Discounts available. Call Laura x2767. Eves call 393-9553.

FREE

■ Free, to a good home 1 yr old female guinea pig w/long black and brown hair. Comes with: 20 gal tank with tunnels, remaining cedar bedding chips, food bowl, remaining food, and water bottle. If interested please call (630)759-2939 and ask for Sue or Jay.

CALENDAR

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

NOVEMBER 9

Novelist Alex Matthews, author of the Cassidy McCabe mystery series, will speak to the Fermilab Writers' Club on Tuesday, Nov. 9, 11:30 AM to 12:30 PM in WH2NE (aka, "The Snake Pit"). Matthews, a psychotherapist who lives, writes and sets her novels in Oak Park, will address character development in fiction. Titles in the Cassidy McCabe series include *"Wanton's Web," "Vendetta's Victim" and "Satan's Silence."* Contact Bruce Worthel (worthel@fnal.gov), X8663

NOVEMBER 12

Film Series Presents:

Woman in the Dunes (Suna no onna). Dir: Hiroshi Teshigahara, Japan (1964), 123 min. Nominated for Best Foreign Film and Best Director Academy Awards and winner of the Jury Special Prize at Cannes. Ramsey Auditorium, Wilson Hall. Tickets are $4.00

NOVEMBER 20

Arts Series Presents:

Natalie MacMaster, a violinist from Nova Scotia performs in flat-out-star quality. This fiddler and step dancer from Nova Scotia has become Cape Breton's musical ambassador. Performance begins promptly at 8:00 p.m. Ramsey Auditorium, Wilson Hall. Tickets are $18. For more information call (630) 840-ARTS or contact http://www.fnal.gov/culture/

ONGOING

English Classes, Thursday at the Users, Center, 10-11:30, free classes. NALWO coffee for newcomers & visitors every Thursday at the Users, Center, 10:30-12, children welcome. In the auditorium, International folk dancing, Thursday, 7:30-10 p.m., call Mady, (630) 584-0825;

SUNDAY, NOV. 14

Barn dance in the Kuhn Village Barn from 7 to 10 p.m. Music provided by Joel Mabus, Lynn "Chirps" Smith, and Fred Campeau. Calling will be by Dot Kent.

SUNDAY, NOV. 21

Afternoon barn dance in the Kuhn Village Barn from 2 to 5 p.m. Music provided by Danny Miller and Friends. Calling will be by Paul Ford.

*All barn dances are taught and people of all ages and experience levels are welcome. Admission is $5, children under 12 are free (12-18 $2). The barn dances are sponsored by the Fermilab Folk Club. For more info, contact Lynn Garren, x2061 or Dave Harding, x2971.

http://www.fnal.gov/directorate/public_affairs/ferminews/

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