# FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY

Graphic courtesy CDF experiment

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**Costello:** *What's the guy's name on first base?!*

**Abbott:** *No, What is on second!*

**Costello:** *I'm not asking you who's on second!*

**Abbott:** *Who's on first!*

**Costello:** *I don't know!*

**Abbott:** *Oh, he's on third.*
*We're not talking about him.*
*Now, let's get back to first!*

—"Who's on First," Bud Abbott and Lou Costello

# Focus Groups

## Will Cover the Bases on Labwide Communication

by Elizabeth Clements

Have you ever had a conversation like this one before? As Abbott and Costello prove in their most famous routine, poor communication can become very frustrating very quickly.

In the All Hands Meetings on November 14, 2002, Fermilab Director Michael Witherell addressed the issue of internal and external communication at Fermilab. He emphasized that the way that we talk to each other as a community is vital for our success as a lab.

"We still need to do a lot better at communicating what we are doing and paying attention to the people who work here," Witherell said. "We are looking at a number of changes to improve communication. In particular, we are collecting groups of staff members to talk to us about what we are doing right and what we are doing wrong. We can do a better job of communicating, and we will."

Over the next several months, the Office of Public Affairs will assess communication within Fermilab and evaluate ways to improve it. Understanding how staff members feel about communication within the lab and what they think can be done better will be a major part of this evaluation. Our task is not only to assess the current state of communication within the lab but also to find out what types of communication tools Fermilab employees want. From print to email to personalized web pages, there are many different types of communication tools available. The real question is, how can we strengthen communication within the laboratory community?

### The POL at NIU

Bob Ard

**The Public Opinion Laboratory (POL) at Northern Illinois University, established in 1982, is a survey research facility housed in the Social Science Research Institute of Northern Illinois, DeKalb. Under the direction of Dr. Robert F. Ard, the POL conducts practical studies that contribute to the knowledge and understanding of important social, economic, business, education and health issues. The POL has worked with federal and state agencies, private-sector organizations, and local communities in northern Illinois.**

Photo by Jenny Mullins

"We still need to do a lot better at communicating what we are doing and paying attention to the people who work here," says Fermilab Director Michael Witherell.

Among the questions the focus groups will address is what news employees want, and how they'd like to get it. For example, Lawrence Livermore National Laboratory produces *Newsline*, a weekly online publication for employees. Argonne National Laboratory sends out a daily e-mail newsletter that covers daily seminars, events, cafeteria menus and other news of interest. SLAC has a regular message from the director. There are many different forms of communication that a lab can use. But which format is the best fit for Fermilab?

With an abundance of questions and a desire not to model a survey after an Abbott and Costello routine, Fermilab has turned to the experts at the Public Opinion Laboratory at Northern Illinois University. Over the next month, the Public Opinion Laboratory, a survey research facility, will facilitate a series of focus groups at Fermilab. The information collected from the focus groups will be used to create a survey that will be given to every Fermilab employee in the spring of 2003.

The Director of the Public Opinion Laboratory, Robert Ard, who will be one of the moderators for the focus groups, described a focus group as a "qualitative data gathering technique." In Fermilab's case, Ard believes that the focus groups will be exploratory to learn not only how employees feel about communication at Fermilab, but also why they feel that way.

"Later in this year, we will be conducting a comprehensive survey of the entire Fermilab staff. Before we can do that, we need to know the basic themes of what is on people's minds," said Ard. "Focus groups identify these themes well and answer why they are on people's minds. If you want just a statistical summary about where people stand with regard to an issue, a comprehensive survey is an answer. If you want a cause and effect as to why people feel a certain way, focus groups are the method of choice."

Witherell believes that the information collected from the focus groups and survey will be a strong first step toward improving communication at Fermilab. "Communication is very important in any organization, but in an organization as large as Fermilab, it is very difficult," said Witherell. "The focus groups will give us a chance to hear from people at the lab. An important part of communicating is that we are listening and not just speaking. I hope that we get some fairly clear messages about the types of communication that people feel are important to them and how to improve things."

If you have an opinion about communication at Fermilab but do not want to wait for the survey, the Office of Public Affairs encourages you either to stop by to share your thoughts with us or to join a dialogue at:

**www.fnal.gov/pub/about/public_affairs/communicate/**

Who might be on first, What might be on second, and I Don't Know might be on third, but communication at Fermilab will no longer be out in left field.

# PEAK Experience

## DIXON LEADS BEAMS DIVISION IN SCALING NEW HEIGHTS

by Mike Perricone

Biking, downhill skiing and mountain climbing, including an unsuccessful solo attempt on the Matterhorn—it all sounds like the description of a serious risk-taker.

This daredevil in question, new Beams Division head Roger Dixon, learned the lesson of a lifetime in taking risks seriously, through an over-the-edge experience as a high school ski racer in Breckenridge, Colorado.

"My brother and I were on the racing team, and there was another set of brothers on the team as well," Dixon recalled. "They were better racers, but I was always very competitive and aggressive—too much so, it turned out. One day I put myself in a situation I knew I couldn't handle. I mis-timed a pre-jump, and I wound up in a full-body cast. So I learned to give lessons instead of becoming a professional ski racer."

He also spent enough time off the mountain to become a physicist. In 1977, while working with Maury Tigner as a postdoc in particle physics at Cornell, Dixon moved on to Fermilab. Almost immediately, he took over as Switchyard Group Leader, responsible for extracting beam from the Main Ring for the experimental areas.

"Talk about taking on a mountain," Dixon said wryly. "In retrospect, I probably wasn't ready for that assignment."

But he made the climb. It was just the first, followed by terms as deputy head of the Tevatron II Project, head of the DZero Construction Project, five years as head of the Research Division (1992-1997), and most recently project manager for the Cryogenic Dark Matter Search. Dixon took over as head of Beams on Jan. 15, 2003, succeeding interim head Steve Holmes, who returned to the Directorate as Associate Director for Accelerators. Over the past year, a lab-wide push has brought the Tevatron to record levels of luminosity, but that's just the start of this next climb.

"This is a big mountain, a risky mountain," Dixon said, describing himself as a "catalyst" in meeting the new challenge. "What I know is that the division is filled with extremely talented people. If I'm successful, what will happen is that some very clever people over here will execute some very clever ideas, and they will make the collider beam and the beams for experiments like NuMI and MiniBooNE work very well. We'll meet our goals and I hope go

PROFILE IN PHYSICS

**ON THE WEB:**

**Beams Division:**
www-bd.fnal.gov

beyond them, and after a few years there will be some real heroes, and nobody will have much even noticed that I was here. If I'm successful."

Fermilab director Michael Witherell emphasized three critical roles for Beams in Run II, and in the laboratory's future: **1**) carrying out the 2003 plan for the collider that was presented to the DOE review committee in October, 2002; **2**) planning the following years of work on the collider program; **3**) providing more protons for the collider program, and for MiniBooNE and NuMI in the neutrino program.Witherell also emphasized Dixon's role, despite the deferential stance.

"Part of what Roger brings is a very modest approach in describing his own role, and that's actually part of what makes him effective," Witherell said. "He has a good picture of how to marshal a large effort, and how to get people to work together effectively. His variety of management responsibilities, from managing the Research Division to managing large construction projects, gives him experience in seeing what will work best in a given situation. Roger also knows the rest of the laboratory very well, which is helpful because we are calling on people from all over the laboratory to support this effort. We are approaching the accelerator work in a project-like style, a very organized way of bringing people and resources to bear in the most effective way. Mike Church is the project leader in that sense, but having Roger as division head will bring more experience in how to carry off very large, and difficult, technical projects."

For Dixon, it all comes back to the mountain, and how the team functions in making the attempt.

"The way you build a team is serious business, especially for a dangerous mountain," he said. "You're going to be depending on those other people to essentially save you, if it's necessary. You have to have as many people as you can who are able to take the lead. You need talented people who are going to share the work. For a very big mountain, there will also be a group of people who basically supply support. As you climb the mountain, you establish a series of camps, and you have to supply those camps, which means a lot of people have to carry loads back and forth. Then eventually your strongest climbers will make their way to the highest camp, and make an attempt on the summit."

That view from the top is what it's all about.

**"The way you BUILD A TEAM is serious business."**

*—Roger Dixon*

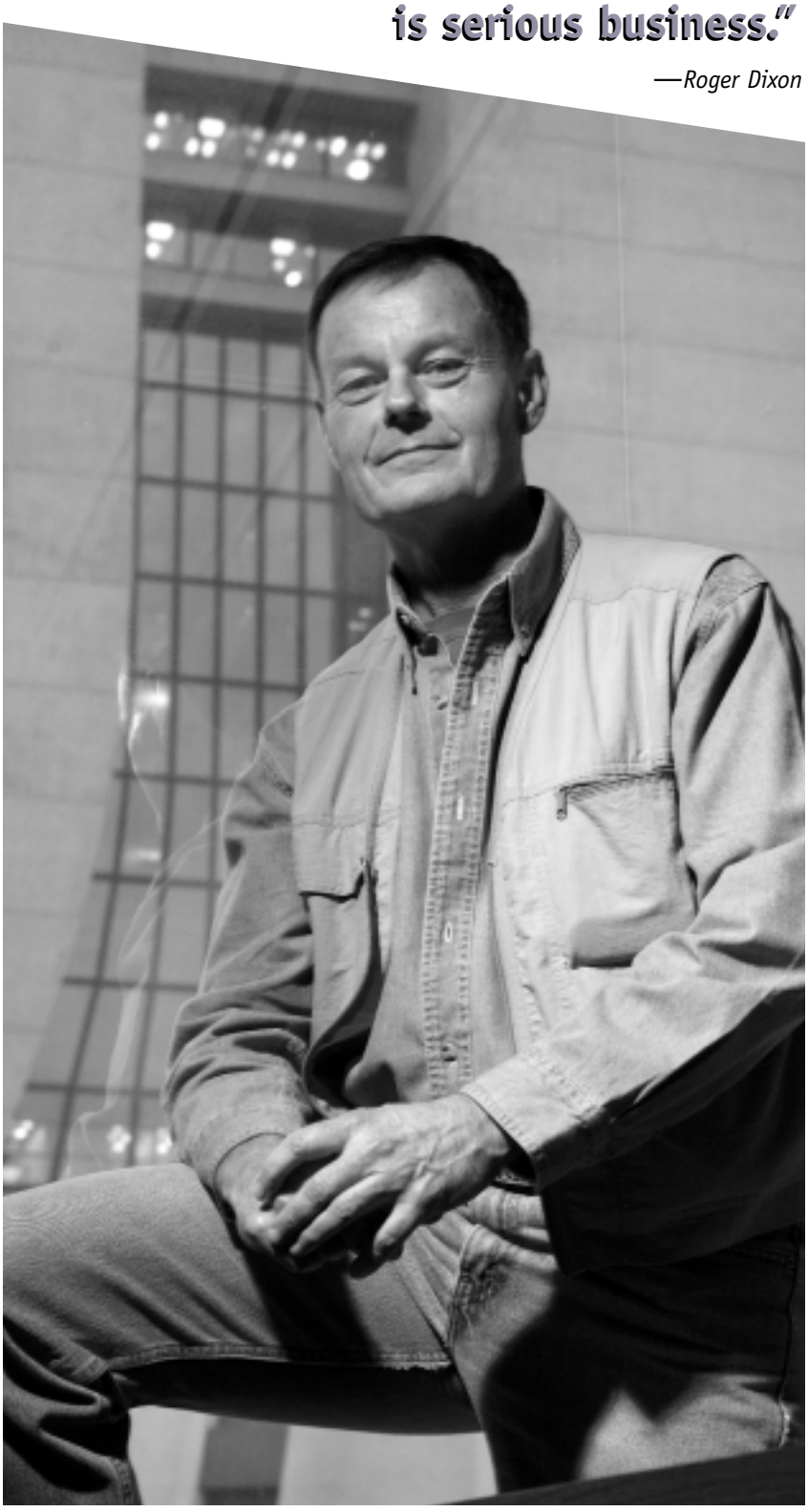


Photo by Reidar Hahn

Roger Dixon is ready to take on "a big mountain" as new head of the Beams Division.

**INTERACTIONS**
Communicating particle physics in the 21st century

# DATA Make You Smarter

by Dan Amidei, University of Michigan
and Chip Brock, Michigan State University


Dan Amidei


Chip Brock

As Collider Run II gets under way with fits and starts it's becoming fashionable to question its goals. But it would be wrong to pre-judge this program. History shows us why.

The aggressive plan for Run II began in 1995-96 when a rag-tag group of users pulled together the *tev_2000* workshop which studied the physics case for extended running of the Tevatron. Previously, SSC preparation had overshadowed the high transverse momentum ("high-$p_T$") potential of a Fermilab program. However, with the cancellation of the SSC and the top quark discovery imminent, the discounted Tevatron began to present a certain attractiveness…

## AULD LANG SYNE

So, in early 1995, about a hundred Fermilab users set out to try to identify the physics opportunities at the upgraded Tevatron. The workshop had no central home, and originally no official link to Fermilab planning and policy. However, as the determination of the participants became evident, Director John Peoples and others enthusiastically lent support to the project. In 1996, our conclusions were published as *Fermilab-Pub-96/082* and vetted in a number of follow-on forums. The result is the current Run II effort. Personally, we count guiding this rogue effort as among our most fulfilling accomplishments.

Now it's 2003. Run II is under way, and we are reminded of how hard it is to mount such enormous accelerator and detector projects. In these tense days, with concern for Tevatron luminosity running high, we re-read our 1996 report, and we were struck by how much of our original motivation still rang true. Under the circumstances, it seemed worthwhile to draw attention once again to our central message and the great opportunity for physics that Run II presents.

In 1996, that message was the unpredictability inherent in a broad research program. When we propose experiments we set goals and use them to evaluate results—an understandable process, up to a point. But as empirical scientists, it behooves us to remember what has been demonstrably true over the decades: in HEP, as in all science, *surprises happen*. In 1996 we chose to make that point with two classic surprises that…

> *"…illustrate a feature of research which deserves protection when future plans are considered. These surprises…are the long lifetime of B hadrons and the extreme large mass of the top quark. The efforts which eventually led to these understandings didn't come from strategic leaps, rather they came from the accumulation of experimental results and techniques over time…no accelerators were proposed, planned, or constructed to make these discoveries. Hints and leads were followed over many years which eventually bore fruit."*

**Respond online at**
**www.fnal.gov/pub/ferminews/interactions/index.html**
**or send email to**
**ferminews@fnal.gov**

**Cover: 3-D display of tracks in the Silicon Detector at CDF.**

### REFERENCES

**Title:** Associated Production of Higgs and Weak Bosons, with H-> b\bar b, at Hadron Colliders
**Authors:** A. Stange, W. Marciano, S. Willenbrock
**Comments:** (changed the analysis of ZH production and the figures for susy), 17 pages + 7 figures, ILL-(TH)-94-8, BNL-60340
**Journal-ref:** Phys.Rev. D50 (1994) 4491-4498

**Title:** Possible Detection of a Higgs Boson at Higher Luminosity Hadron Colliders
**Authors:** Stephen Mrenna, G.L. Kane
**Comments:** 20 REVTEX pages plus 3 figures using psfig.sty, CIT 68--1938

## History lesson

Of course, it sometimes works the other way. The CERN proton-antiproton collider is an example of a discovery precisely engineered by the targeted design of a facility. (Although the early clarity of the W and Z signals surprised everyone.) More frequently, though, surprises occur through the conjunction of prepared minds, a broad experimental program, capable detectors, and the flexibility to react to new results; excitement comes from *data*. In that sense, we argue that the discovery of the $\tau$ lepton, on the heels of the surprising $J/\psi$ discovery, is more typical than the W/Z confirmation.

The two examples we cited had already had important implications for research and detector technology. Again, from the report:

> *"The bottom quark and top quark stories… represent the usual path toward scientific breakthrough. 'Throwing long' is a strategy which has a place as a component of a broad, stable physics program. However, it cannot dominate…As much as anything in science can come with a guarantee, success and surprise seem repeatedly to be the eventual outcomes of the Evolutionary approach in high energy physics. This sort of success doesn't happen accidentally. Rather [it comes]…by the mounting of topical experiments which attract the brightest scientists…and the means to do those experiments in a timely way. We call this Following the Physics, as decidedly distinct from 'waiting for the physics.'"*

On re-reading, it was satisfying to discover that the *tev_2000* report itself, unwittingly, made our point. Two examples:

First, to be sure, many of us came to this work convinced of the importance of a high $p_T$ program at Fermilab. A critical Run II benchmark was the characterization of the top quark and we had reason to be persuasive on that score. How precisely could we determine its mass? We reached the proud conclusion that it's uncertainty would be as little as ±13.5 GeV/$c^2$, or ~8%. However, when truly beautiful data and real backgrounds were paired with reliable detectors and hundreds of cunning and motivated physicists, CDF and DZero eventually achieved an uncertainty of roughly ±5 GeV/$c^2$, from only a handful of top quarks. Detailed understanding of detector responses, competitive crosstalk between the collaborations, and the exploitation of new analysis techniques led to a precision better than twice what we predicted. *Surprises happen:* the data made us smarter.

Second, the mass of the *W* boson is a significant component in constraining the Higgs boson mass within the Standard Model. Estimating the Run I mass uncertainty was easy: it's all statistical and so we knew we could expect a precision better than about 0.1 percent. That's essentially what we found. But, after analysis of Run I data, the central value of the *W* boson mass shifted more than a full standard deviation higher than the 1995 value. In turn, this surprise led to the expectation that in order for the Standard Model to be consistent, the Higgs boson mass must be much lower than anyone had anticipated. Once again: *Surprises happen*.

We've cited two sorts of surprises. The precision of the top quark mass is of the "data make you smarter" sort. There is nothing more stimulating than the mix of committed physicists, real data and fertile imaginations. This kind of progress under battlefield conditions cannot be generated in workshop settings or Monte Carlo simulation. Real data and competition are required ingredients. In contrast, the second example was arranged by nature and statistics. Even though the shift of $M_W$ was consistent with earlier measurements, the consequences were so dramatic that it also constituted a surprise. Plugging these two results into the Standard Model changed everyone's expectations about the Higgs boson: the expectation that the probable window for the Higgs mass could be as low as 100 GeV/$c^2$ *has become the norm* and guides current experimental programs.

> ***"High energy physics is perhaps unique, as the elementary particle scene changes periodically and often dramatically. The difficulty is that the scale for this evolution is long, and an historical perspective is necessary to see incremental progress. If we pause and view the present from the standpoint of 10 to 15 years ago, our current understanding of elementary particle physics would look unpredictably unfamiliar. Sensible planning would ensure that we are able to make this 15 year assertion from any point in the future. The necessary ingredients for this are a set of puzzles stimulating inquiry, the scientists willing to devote considerable energy to their resolution, and the platforms from which significant experiments can be mounted…"***
>
> **from the *tev_2000* report**

Two sorts of surprise—one resulting from cleverness and stress and the other from aggressively pursuing measurements to extreme precision. We can add a third sort, the "who ordered that?" shock that comes from stumbling across unanticipated results. When people think about scientific surprises, it's this kind that usually comes to mind.

Program planning must preserve the opportunity for all three sorts of *surprise*. From history we know they are likely—even probable.

# INTERACTIONS

## Communicating particle physics in the 21st century

### Higgs as sound bite

The *tev_2000* workshop addressed prospects for discovery of a light Higgs boson. Two theoretical papers had appeared predicting that the Higgs might be produced with *W* or *Z* bosons and occur at a surprising rate—requiring significant, but conceivable, Tevatron luminosity. (These predictions were a surprise of their own, given all of the previous ink spilled describing weaker Higgs discovery channels.) These experimental signatures would stand out and benefit from the well-studied top quark detection tools. The *tev_2000* Higgs group cautiously simulated a single detection strategy using conservative estimates for the evolution of future tagging and mass resolution capabilities and found a surprising sensitivity for discovery. This combination of events illustrates a crucial point. The straw-scenario of the light Higgs went from "unlikely" to "probable" because of work of five free-thinking theorists, a handful of workshop soldiers and the unexpected Run I top quark and *W* boson results. With a follow-on workshop, the Higgs search at Fermilab became a high profile target, one with a name and a straightforward strategy. Great, right?

***...from the collider to the fixed target area to the neutrino oscillation program, this facility offers significant short term gains and long term promise. Only Fermilab will allow us to weave this physics tapestry from the many different directions which emerge as important. This capability is necessary in order to test both the details and the tight correlations among all of areas of physics promise. That this evolutionary path is completely within the scope and control of the U.S. program is important for the flexibility and autonomy befitting our history and capability.***

**from the *tev_2000* report**

In fact, Run II luminosity has been slow to reach design levels and impatience and second guessing can be heard. The Higgs search is a clean, simple-sounding goal, an easy sound bite. It's great for the Higgs to gain congressional attention, but we risk being hoist by our own petard. Should the Higgs become the only theme of Run II, and if the Run II luminosity situation is prematurely judged to be lacking, then Run II's history could be written before even the first $fb^{-1}$ of data are on disk. There are at least two problems with such thinking.

First, Monte Carlo sensitivity studies can't be naively applied as sole performance measures for the real lives of these complex experiments.

Suppose that before Run I in the late 1980's, the Physics Advisory Committee had decided that a top quark mass resolution of our eventual ~5 GeV/$c^2$ was the minimally acceptable target. The required Run I running period would have had to be much longer, probably compromising its approval. But, real science, with real data, made us smarter—worth a significant luminosity bonus. The Higgs search scenario envisioned for Run II came from just those sorts of studies that produced the 13.5 GeV/$c^2$ top quark mass prediction.

Second, while the luminosity performance has been disappointing, from our *tev_2000* perspective we note that in the past 5 months, the Tevatron has essentially duplicated the Run I dataset, which originally took four difficult years. This necessary rate of improvement demonstrates that data are making everyone smarter. Although we are not yet where we want to be, we are way ahead of where we were, and gaining.

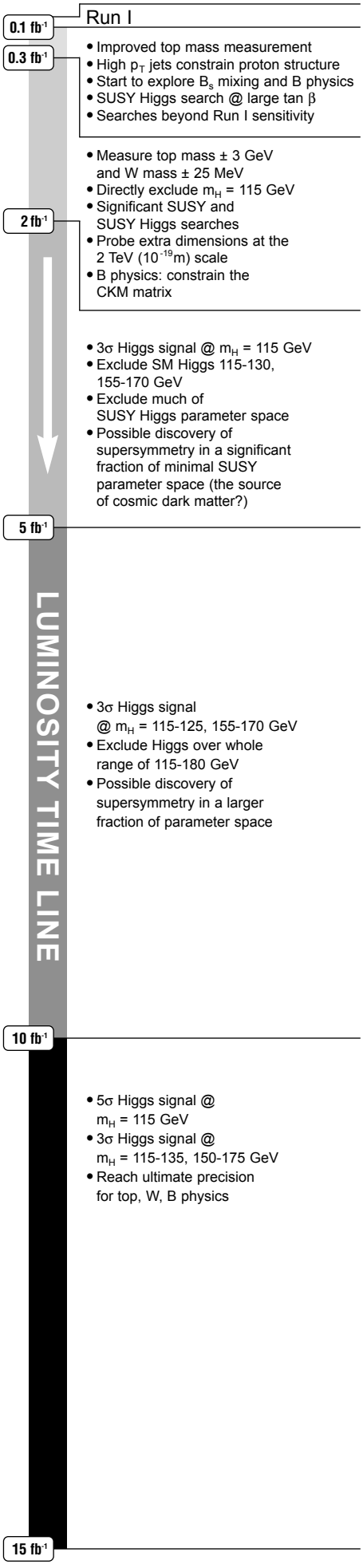
### Applied history

It is easy to downplay optimistic predictions. Skepticism is an important ingredient in science, pitted against the inherent optimism that is the basis of the scientific personality. On the top quark front, an early 1990's prediction of 5 GeV/$c^2$ for a top mass resolution would have met with skepticism. On the Higgs front, any suggestion of a potential for probing electroweak symmetry breaking at any Tevatron configuration was dismissed. As we've seen, smart work by experimenters, a conspiracy of two surprises and clever predictions of new channels for Higgs observability trumped the best wisdom of the early 1990's. History is on our side; expecting that ability, determination and cleverness will find a way to the Higgs is better than grumpy armchair skepticism.

With the past as guide—a guide better than anyone's prediction for untried, unrealized devices—*if the Higgs boson is there* and if a significant fraction of the luminosity goal is delivered, then the same hundreds of people that defied the odds on the top quark mass will focus their manic energies to find this elusive, critical state of matter. We think the odds are high that Higgs hints, discovery or elimination, will occur before the original *tev_2000* discovery threshold. In pace with direct research, even more precise measurements of $m_t$ and $M_W$ by experienced groups with seasoned detectors will constrain the Standard Model. If it's not there? DZero and CDF will determine that too, and give electroweak symmetry breaking in the Standard Model its first crack in 25 years.

# Luminosity Time Line

The physics expected over the range of integrated luminosity for the Tevatron in Collider Run II. Integrated luminosity is the total number of collision events over time.




A realistic estimate for the duration of Run II is that it will encompass the better part of the decade. In this long run the Higgs is only a part of the whole story—recall our surprises, especially the third sort. The figure shows integrated luminosity milestones and the physics payoff at each level. This is a broad program, with precision measurements and discovery potential in multiple subjects. The physics sensitivity increases as we accumulate data, understand the detectors and backgrounds and optimize the complex for luminosity. Does anyone really believe that nothing significant and unpredicted will happen in Run II prior to a Higgs bosons signal? Run I, which so greatly affected how we look at HEP today, is only a small sliver of the whole of Tevatron chronology. A decade with no surprises would be the first such decade in the history of high energy physics.

What about the luminosity? Well, taming the complexity in commissioning and running modern particle accelerators is at the edge of the humanly possible. Remember the startup of the SLAC SLC? Heroic efforts in commissioning and running of that complicated machine eventually paid huge physics dividends, but not without early community impatience. But we stuck with it.

We suggest the same will be true with the Tevatron. Run II started out with a set of new machines to be understood, commissioned and integrated into an optimized facility. As the Beams Division people bring the various elements of the Run II complex to operational status, the data will make them smarter, and the luminosity will continue climbing. We're convinced that Tevatron Run II is going to deliver; and so again, we need to stick with it.

With a future international HEP program of incredible richness facing falling annual support for physical science, the demands ahead in the U.S., Europe, and Japan stretch our resources and personnel. The Monte Carlo future can always be made to look more attractive than the unpleasantness of a present burdened with real data and real challenges. However, given the history of surprise that we have outlined and the thousands of scientist-years and hundreds of millions of dollars expended in Run II preparation, prejudging it would be irresponsible. In the extreme, simply performing experiments for which the outcome is certain is not what we do. Rather, we need to keep faith in the plans we have laid out and hope that our sponsors will continue to support us in the pursuit of whatever surprises are in store, including the Higgs boson. Remember, nature repeatedly reveals itself through patient experimentation, and the most likely product is *surprise*.

# Lingua Physica

*"Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world."*

*–Louis Pasteur*

by Judy Jackson

It is a truism that high-energy physics is a science without borders, research that brings men and women of every nationality together in the giant collaborations that characterize the field.

But what does this internationalism really mean? The statistics that we often cite—the 983 physicists from 131 institutions in 29 countries who work on experiments at Fermilab, for example—don't really give a true picture of the United Nations of Physics that characterizes experiment collaborations today. That's because our statistics capture the nationalities only of participating institutions, not of the scientists themselves. So a physicist from Purdue University, say, who actually comes from the Czech Republic, or a Berkeley researcher who hails from Seoul, gets recorded in the "U.S." column because he or she comes from a U.S. institution.

To get a better sense of the nationalities represented in modern physics experiments, *FERMINEWS* conducted a thoroughly unscientific and completely unofficial survey of the laboratory's two largest collaborations, CDF and DZero. We asked the collaborators to tell us by email what languages they speak. We figured that the languages that turned up would give us a pretty good idea of the diversity of the experimenters' nationalities. By the time we finished reading the email returns, we had compiled a list of 62 different languages (not counting Pig Latin) including some we had never heard of.

Of course, English is the official language of Fermilab experiments, the language of collaboration meetings, of publications and of everyday life at the laboratory. Nevertheless, if you walk through the Fermilab cafeteria at lunchtime on any given day, you will almost certainly hear at least a few of the languages on the list.

## Megrelian?

Avto Kharchilava, a member of DZero speaks Megrelian. Avto explains:

"Megrelian belongs to the Georgian family of languages, along with, for example, Abkhazian and Swan—all in the Caucasus. They all have in common very fundamental words, like God, bread, mother, etc., but are very different nowadays. For example, in spite the fact that I am fluent in Georgian and Megrelian, I can't understand the language spoken in Swaneti a (region of Georgia).

Photo by Reidar Hahn

Avto Kharchilava

"A few facts. The Georgian language is spoken by about five million people, while Megrelian by about one million. Megrelian (some call it Mingrelian) has some commonalities also with Laz, the language spoken in regions of the Black Sea coast, Caucasus.

"Thanks for your interest in Megrelian (the language of the region of Georgia where I was actually born and I like so much)!"

## WOLOF?

Moustapha Thioye is a DZero collaborator from the State University of New York who speaks Wolof. We asked him if he'd tell us about his language.

"Gladly!" Thioye wrote.

Wolof is a language spoken in the West African countries of Senegal and Gambia and Mauritania.

- Language family: Niger-Congo.
- Subgroup: Western Sudanic.
- Branch: West Atlantic.

It is the most spoken language in the first two countries. About 80 percent (seven million people) of the population in Senegal speak Wolof even if the Wolof ethnic group itself accounts for only about three million. My own country of origin is Senegal, a former French colony and the western most country in Africa. Hope this little introduction will do.

## LECCESE?

Giuseppe Latino from the CDF collaboration speaks Leccese.

"I'm coming from the district of LECCE so my dialect is Leccese. It is actually an Italian dialect with some mixture—very marginal indeed—of Greek and ancient Latin words. I also spent the last 16 years in Pisa (Tuscany) my wife being from that region, so I also know some Tuscan dialect. But it doesn't help as modern Italian is actually by definition (from Dante and so on ) the language of Tuscany...."

## WHAT ABOUT YOU?

Although it's an impressive list, we are certain there are languages we missed. If you are a Fermilab experimenter and you speak a language that isn't listed, we would very much like to hear from you. Send us an email at **ferminews@fnal.gov** with your name, your experiment, and the languages you speak. We'll keep an updated tally on our website at:
**www.fnal.gov/pub/about/faqs/languages.html**

ბედინერ ახალ წანა !

(That's Happy New Year in Megrelian!)


Photo by Reidar Hahn

| | | | |
|---|---|---|---|
| Afrikaans | English | Kannada | Romanian |
| Arabic | French | Korean | Serbian |
| Armenian | Georgian | Latvian | Spanish |
| Assyrian | German | Limburgs | Swedish |
| Bangla | Greek | Malayalam | Tamil |
| Bengali | Gujarati | Mandarin | The Queen's English |
| Cantonese | Hebrew | Marathi | Tulugu |
| Croatian | Hindi | Megrelian | Turkish |
| Chinese | Hungarian | Polish | Ukrainian |
| Czech | Indonesian | Portuguese | Urdu |
| Danish | Italian | Punjabi | Vietnamese |
| Dutch | Japanese | Russian | Welsh |
| | | | Wolof |

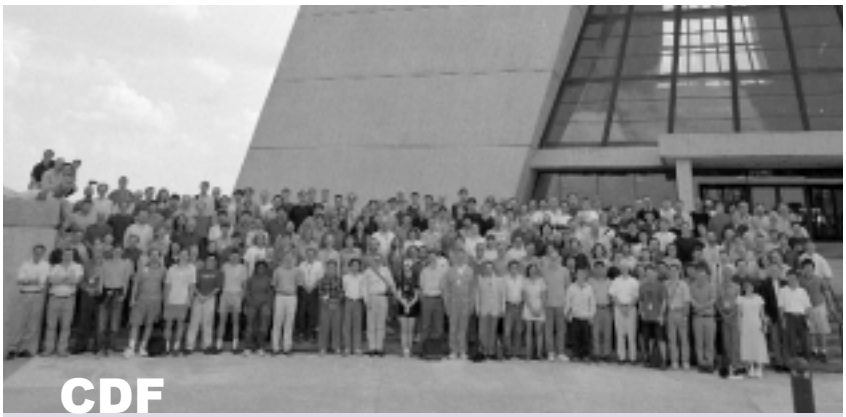



Photo by Fred Ullrich

| | | | |
|---|---|---|---|
| Assyrian | Finnish | Italian | Romanian |
| Belorussian | Flemish | Japanese | Russian |
| Bengali | French | Korean | Serbian |
| Cantonese | Gaelic | Leccese | Slovak |
| Catalan | German | Luxembourgish | Spanish |
| Croatian | Georgian | Mandarin | Swedish |
| Czech | Greek | Marathi | Tagalog |
| Danish | Hebrew | Persian | Taiwanese |
| Dutch | Hindi | Polish | Turkish |
| English | Hungarian | Portuguese | Urdu |

# Married-
# With Particles

Particle Physics

## MADE PAINLESS

**ON THE WEB:**

**CDF homepage:**
www-cdf.fnal.gov

**DZero homepage:**
www-d0.fnal.gov

**H**usband-and-wife physicists Tom Diehl and Brenna Flaugher lent a special touch to the Dec. 12, 2002 session of Virtual Ask-a-Scientist, an online chat session offering participants the opportunity to ask Fermilab scientists questions about high-energy physics.

People of all ages and all science backgrounds are invited to participate, and sessions are announced in the Newsbox of the Fermilab home page. To join a Virtual Ask-a-Scientist chatroom on the day of the session, click a link on the lab's home page and follow directions for logging-in and asking questions. Due to time constraints, some questions may not be answered during the on-line session, but full transcripts are available on-line about a week later. This is an edited version of the Dec. 12 session.

**Moderator:** Welcome to Virtual Ask-a-Scientist! My name is Elizabeth Clements, of the Office of Public Affairs at Fermilab. Our guest scientists are Brenna Flaugher of the CDF experiment, and Tom Diehl of the DZero experiment. The big collider detectors, each host to more than six hundred scientists, are friendly rivals in Fermilab research. And talk about friendly rivals—Tom and Brenna are a married couple, making the situation even more interesting. And now, we're ready for your questions.

**Michael:** Hi, Tom and Brenna. Is it difficult to work as a physicist with your spouse?

**Brenna Flaugher:** Actually we work on different experiments. I think it would be hard to work together all day and then try to forget it at night.

**Michael:** Does it get competitive?

**Brenna Flaugher:** The experiments compete with each other, and during the search for the top quark there was lots of discussion about keeping secrets. Tom and I had a rule—we would not admit to knowing anything about the other experiment unless we heard it at the Fermilab lunch table, too. The Fermilab cafeteria is the best place to hear the latest rumors and secret information.

**Kevin:** Hi, Brenna. What's it like being a woman physicist? Isn't it a pretty "male-dominated" world?

**Brenna Flaugher:** Yes, it is a male-dominated world, but I have gotten used to it. I am frequently the only woman in a meeting, but most times I don't notice.

**Scott:** You say on that on DZero, you're looking for new particles. Have you found any? I thought there were just the 6 quarks and 6 leptons.

**Tom Diehl:** New particles are created in almost every collision and collisions happen at a rate of a couple million per second. But most of those new particles are of kinds that we already know about. DZero actually discovered the 6th quark, along with our CDF colleagues, in 1994. At this time we are looking for a particle, the Higgs boson that may exist and may be responsible for mass. If the Higgs boson is not too heavy, we might be able to produce them with the Fermilab accelerator, the Tevatron.

**Scott:** I'm reading *"The God Particle"* [by Leon Lederman]. Has any progress been made since it was written (1991 I think) on finding the Higgs?


Photo by Jenny Mullins

Brenna Flaugher (left) and Tom Diehl "show the flags" of CDF and DZero, respectively.

**Tom Diehl:** The probability for creating a Higgs particle in one of our collisions is very small. With about a million collisions per second, most of them producing common particles, we measure only about one or two top quarks per day. We think the Higgs is something like 50 times less common than that.

**Brenna Flaugher:** We have made progress on understanding how to look for it and we have more sensitive tests for finding it. But, what we need is lots of data—lots of proton-antiproton collisions and those are just starting to accumulate. We haven't found anything new…yet….

**Wiley:** What are the best things about being a physicist?

**Brenna Flaugher:** The thing I like about physics is it tries to understand and explain why things work the way they do. Learning physics means getting a better understand of lots of things. At Fermilab we look for the fundamental building blocks of matter, which seems pretty cool to me.

**Michael:** How are things working out with Run II?

**Brenna Flaugher:** The experiments are running pretty well and will be making presentations of new results at international conferences in the next few months.

**Gluon:** How is the luminosity doing?

**Moderator:** The luminosity keeps going up, up, up!

**Sophie:** Why do you make the particles go so fast around your accelerator?

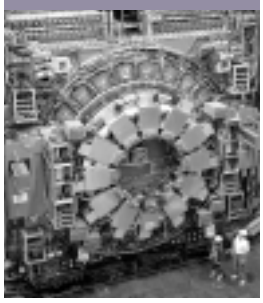
**Brenna Flaugher:** We make them go so fast so that they have a lot of energy when they collide with the anti-protons. This way we have a chance of making new particles by converting the energy to mass ($E=mc^2$)

**Scott:** Does Fermilab study neutrinos?

**Moderator:** Fermilab has many different Neutrino experiments such as MiniBooNE, MINOS, NUMI. Neutrinos are a very hot topic!

**Michael:** I understand why CDF and DZero are located at Fermilab. But why are MiniBooNE and NuMI there, as opposed to someplace else?

CDF Detector



DZero Detector

**Tom Diehl:** The Fermilab complex has several accelerators that can be operated at the same time. While we are studying proton-antiproton collisions at DZero and CDF the beams are contained in the Tevatron accelerator. Meanwhile, the Main Injector is cracking protons into a target and producing antiprotons. Mini-Boone gets its proton beam from the booster. So all of these things can be done at the same time.

**Sophie:** What is the point? What are you going to DO with whatever you find out about the protons colliding with antiprotons? What can it solve?

**Brenna Flaugher:** By smashing the protons and antiprotons apart we learn about what holds them together. We are doing basic research. That means that it doesn't have a direct application right now. But we believe that it is important to learn more about our world (in this case the forces that hold the elementary particles together) and that 10 or 20 years from now it will become useful—but right now we don't now exactly how. One example is the web—it was started by particle physicists who wanted to communicate with each other even though they were in different countries.

**Scott:** Well, this Web applications developer would like to very much thank those physicists for giving me a job!

**Wiley:** How did physicists help develop the Web?

**Moderator:** Tim Berners-Lee, a scientist from CERN, invented the World Wide Web.

**Tom Diehl:** Physicists at CERN and around the world wanted a faster way to spread our ideas to each other. The web was developed so that we could do that.

**Kevin:** Have the particle physics discoveries of the past been useful? As citizens and taxpayers we all look for practical benefits—applications in our lives.

**Brenna Flaugher:** Practical benefits from basic research are hard to predict. Take the electron—who would have imagined all the uses of today, back when it was discovered? There are many spin-offs from particle physics—neutron therapy for treating cancer, for example. NMR magnets used for medical research were not the point of the particle physics experiments but have been adapted from the understanding we gained from the work.

**Kevin:** So my question, directly, is—why is particle physics worth our support?

**Tom Diehl:** There are lots of reasons. One is practical applications. Those come about in two ways. The first: direct applications. The example we love to use is Thomson's discovery of the electron, our first particle. Right now, we are studying nature at a more fundamental level. When we come up with a direct practical application, if we do, it will have a profound effect. There are indirect applications—spinoffs. We have lots of them because what we do is difficult technologically. We need to invent stuff to do our work.

**Bobby:** If you weren't physicists, what would you be?

**Tom Diehl:** I am an "asking-questions" type of person. I would be a scientist of some kind. Maybe instead of studying elementary particles I would be studying astronomy or astrophysics.

**Brenna Flaugher:** I think maybe an engineer. I have worked with many engineers while helping to build the CDF detector and I think that type of work is interesting. On the other hand, when I started college I wanted to be a vet and work with animals. If I hadn't switched to physics, I might be doing that.

**Scott:** Is working at Fermilab (and other top-notch facilities) like making the major leagues for an athlete (the best of the best)?

**Tom Diehl:** Fermilab is the highest energy accelerator in the world. But there are only 700 Major League baseball players (AL+ NL) in the U.S. and a lot more particle physicists than that. I guess there are about 5,000 of us in the U.S.

**symics:** What types of jobs are available for particle physicists?

**Brenna Flaugher:** The types of jobs doing particle physics are professors at universities, or staff positions at national labs like Fermilab. Some people get their PhDs and then go off to other things—quite a few went to Wall Street and the stock market because writing computer programs that predict the market is somewhat like writing the programs we use in particle physics.

**Scott:** Particle physics is one thing, but can you tell me how to set the clock on my VCR? Thanks for the chat, and good luck with those little particles.

**Moderator:** Thank you, everybody, for participating in this chat session! Good night!

# FERMILAB ARTS SERIES

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

## Libana

Saturday, February 8, 2003

***"There's something otherworldly about the beautiful, ethereal singing of Libana."***

—The Minneapolis Star Tribune

Libana, New England's international touring world music ensemble, is now in its 23rd season of researching, performing, and celebrating songs, dances, and instrumental music from around the world, especially as handed down through women's traditions. The women of Libana present an exhilarating cross-cultural performance, and are experts in many vocal styles from exquisite a cappella Balkan harmonies to the traditional singing of Berber women in Algeria. Frenzied Egyptian drumming and ritual dancing, poignant and supple Hawaiian melodies, and the rhythms of Africa and the Middle East are also among the cultural expressions offered by a Libana concert. Don't miss this beautiful and informative concert on Saturday, February 8 at Fermilab's Ramsey Auditorium.

*Tickets for Libana are $17 ($9 for ages 18 and under).* **To purchase tickets**, or for further information or telephone reservations, **call 630-840-ARTS** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open.

*Ramsey Auditorium is located in Wilson Hall, the hi-rise building on the Fermilab campus. Fermilab is accessible from the west by turning east on Pine Street from Kirk Road, just north of I88. Our address is Kirk Rd. & Pine Street, Batavia. For more information, check out our web page at* **www.fnal.gov/culture.**

## Dragon's Tale: Nai-Ni Chen Dance

**March 8, 2003**

Dragon's Tale is a feast for the eyes, mind, and heart. Bringing to life the culture and traditions of China, this full-length family show leaves children mesmerized at each enchanting, astounding dance, and adults equally caught up in the magic of it all.

*Tickets- $19 ($10 ages 18 and under)*

## Quartetto Gelato

**April 5, 2003**

As the engaging innovators of a fresh approach to classical music, Quartetto Gelato has won the hearts of audiences worldwide since their remarkable 1994 debut season. The concert presentations combine supreme musicianship, irrepressible energy and charming wit, treating their listeners to an unforgettable musical event.

*Tickets - $21 ($11 ages 18 and under)*

# MILESTONES

### AWARDED

To Fermilab theoretical astrophysicist Edward "Rocky" Kolb (ID 06056N): the Oersted Medal, from the American Association of Physics Teachers. Established in 1936, the award recognizes notable contributions to the teaching of physics. Previous winners have included Hans Bethe, Carl Sagan, I. I. Rabi, Norman Ramsey, and Freeman Dyson. Kolb addressed the annual meeting of AAPT in Austin, Texas on Jan. 13. For a description of the award and list of previous winners, go to: www.aapt.org/aaptgeneral/oersted.html.

### RETIRING

- Modeste Phelps, ID 4209 TC-Engineering & Fabrication, Dec. 16
- Halbert Landers, ID 376 BD-AS/Mechanical Support Dept, Dec. 17
- Michael James, ID 1015, CD-Cor Support, Dec. 16
- Ronald Leber, ID 5789, TD-Machine Shop, Dec. 17
- Richard Hance, ID 2654, PPD-Electrical Engineering Dept, Dec. 16
- Jerry Peterson, ED 555, TD-Machine Shop, Dec. 16
- James Schiltz, ID 1775, BS Accounting, Dec. 18
- Moyses Kuchnir, ED 2532, BD-AO Photo Injector Group, Dec. 17
- Barbara Angelos, ID 9397CD-Core Support, Dec. 20
- Taiji Yamanouchi, ID 675, D0-Directorate (G&A), Jan. 7, 2003

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

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

# Chez Léon MENU

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CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

### LUNCH
### WEDNESDAY, JANUARY 22

*Reddened Catfish*
*with Lime Watercress Sauce*
*Calypso Rice and Beans*
*Pear Cornmeal Crunch Cake*

### DINNER
### THURSDAY, JANUARY 23

*Clam Chowder*
*Beef and Vegetable Kebabs*
*Barley Mushroom Pilaf*
*Butterscotch Souffle*

### LUNCH
### WEDNESDAY, JANUARY 29

*Chili Roasted Game Hens*
*with Jalapeno Orange Sauce*
*Cinnamon Basmatic Rice*
*with Raisins*
*Sauteed Greens*
*Chocolate Amaretto Cake*

### DINNER
### THURSDAY, JANUARY 30

*Curried Butternut Soup*
*Broiled Red Snapper Fillet*
*Steamed Green Beans*
*Lemon Scented Rice*
*Warm Pear Shortcake*
*with Brandied Cream*


FERMI NEWS

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**The deadline for the Friday, January 31, 2003 issue is Tuesday, January 21, 2003.** Please send classified ads and story ideas by mail to the Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

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# CLASSIFIEDS

## FOR SALE

■ '01 Hyundai Accent GL, 25K miles, red, 4 doors, AM/FM/Cassette, dual front airbags, A/C, P/S, good condition, $7,000. Contact Jorge at 630-840-2534 or barreto@fnal.gov.

■ '97 Mitsubishi 300 GTSL, auto., fully loaded, 74K miles, excellent condition, $16,000 o.b.o. Contact Chad 815-405-4668.

■ '96 Ford Taurus, 79K miles, fair condition, original owner, $2,500. Contact David Butler 630-840-3370 or email, dbutler@fnal.gov

■ '95 GMC Sierra 2500 pickup, new brakes, P/S, P/B, P/L, cruise, heavy duty towing package, cloth seats, 6CD changer, electric trailer brakes. Contact Larry at 630-840-4386 or allen@fnal.gov.

■ '94 Aerostar, 98K miles, P/W, P/L, ABS. Great condition. $2,995 o.b.o. Contact Steve at 630-840-4227 or sgould@fnal.gov.

■ '89 Acura Legend, 127K miles, leather seats with automatic adjustment in normal working condition. Asking $2,250. Contact 630-840-3217 (after 8:00 p.m. or before 10:00 a.m.).

■ '86 Toyota Corolla, new tires, new brakes, 150K miles, some rust. 630-466-3743.

■ Tires and wheels,(4) KMC Evolution 17x7 universal 5-lug wheels, with NITTO NT450 225/45 ZR 17 tires. Less than 10K miles on these, stored winters, $750 o.b.o. Contact Ed Dijak 630-840-6300, 630-665-6674 home, dijak@fnal.gov.

■ Treadmill, PRO-Form 730 CS, with full various function. Only used a few times, bought at $799, asking $400 o.b.o. Contact 630-840-2710.

■ Weight bench with leg lift & squat bracket, bar bell, some weights & aerobic rider all for $25. Contact 630-840-4606 or 630-820-1856

■ Vintage 1970's Ludwig drum set, Green Sparkle, 5pcs., including hi-hat. Great for a collector, or beginner. Excellent condition, asking $650. Contact Jeremy at 630-557-2166.

■ Couch and matching loveseat. Refrigerator. Contact 630-840-6633.

■ Oberhamer figure skates. White, ladies size 7-AA, blades SLM 8/23, excellent quality and condition, $75. Contact Michelle 630-840-8062.

■ 48″ round Formica top table with 6 molded chairs w/steel legs. Heavy duty. In excellent condition. $60. Contact Linda at 630-840-3082.

## FOR RENT

■ House 3BR, 2Bath and with furniture in Batavia is immediately available. Rent $1,200/month. As option, this house can be rented as 2 one-bed room units at $650/month and $600/month. Contact Helen at 630-299-8085 for more details.

■ Duplex, downtown Naperville, view of Riverwalk, built in 2002. 3-4 Bedrooms, 2 full baths, all appliances. Beautiful kitchen/ living/ dining area. Balcony and patio, hardwood floors, garage, attic space. Available February 2003. $1,750 per month. Contact 630-355-8279, email AJ60540@yahoo.com.

■ Spacious bedroom with private bath on independent floor, one car garage; spacious living area shareable on same floor; use of laundry and main kitchen; located in a family house in residential Naperville. 20 min from the lab. Available beginning of December. $495/mo. Contact 630-840-2574, office hours.

# CALENDAR/LAB NOTES

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

## FEBRUARY 13, 2003: NALWO

■ National Accelerator Laboratory Women's Organization cordially invites Fermilab women visitors and guests to a morning "coffee hour" at Aspen East from 10 a.m. to noon. Light refreshments; children welcome. Visit www.fnal.gov/orgs/nalwo/coffee.htm

## BARN DANCING

■ The next Fermilab Folk Club Barn dance is Sunday, Jan. 19 at 2 p.m. with music by the Stringalings and calling by Paul Ford. Barn dances are held in the Warrenville Community Building and feature traditional square and contra dances. Admission is $5 for adults, $2 for age 12-18, and free for under 12 years old. Come with a partner or without; bring the family or not. For more information contact Dave Harding (x2971, harding@fnal.gov) or Lynn Garren (x2061, garren@fnal.gov) or check the webpage at http://www.fnal.gov/orgs/folkclub/ .

## HOUSING ASSIGNMENTS – SUMMER 2003

■ The Fermilab Housing Office is now taking requests for houses, apartments, and dormitory rooms for the Summer of 2003. Since there will be a large influx of experimenters, and requests are anticipated to be in excess of our available facilities, you are urged to submit your request for reservations to the Housing Office **by Monday, March 3, 2003.** Requests can be made for any period and need not commence on any particular date.

For further information, please contact the Housing Office at: Telephone: 630-840-3777, fax: 630-840-2823, email: housing@fnal.gov

Individual housing requests can be made by using our Online Housing Request form at http://fnalpubs.fnal.gov/housing/housing_request.html

(Requests for multiple housing units are best handled by direct email to housing@fnal.gov.)

## CALL FOR ENTRIES

**Fermilab Arts and Craft Show**

May 1, 2003 to June 2, 2003.

Open to all Fermilab employees, visiting scientists or graduate students, retired employees, contractors and any member of his or her immediate family. Questions?? Contact 630-840-6825, Georgia@fnal.gov.

## ASK-A-SCIENTIST AT WILSON HALL

The popular Ask-A-Scientist program has returned to the 15th floor of Wilson Hall, every Sunday from 1:30 p.m. to 3:30 p.m. Scientists will meet visitors to answer questions ranging from "What is dark matter?" to "How do you accelerate a particle close to the speed of light?" Visitors must use the Pine Street entrance on the west side of the lab, and obtain the special "Ask-A-Scientist" pass to proceed to the viewing area of Wilson Hall.



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