

BNL Physicists Play Major Role in D-Zero

Detectors for high energy physics experiments are typically huge, complex affairs and are often given fanciful names. But other detectors, equally grand in stature and scope, get by with more generic appellations.

For instance, the UA1 detector at CERN's Super Proton Synchrotron (SPS) Collider (see box) is simply named for the Underground Area in which it is situated. Nonetheless, it detected the Nobel Prize-winning discoveries of the W and Z particles in 1983.

Almost 100 physicists from 14 universities and laboratories are betting that D0 can have a similarly successful career. Pronounced D-zero, this detector is named for its future location in the ring at the Tevatron I collider (see box) at the Fermi National Accelerator Laboratory (Fermilab).

Ten physicists from BNL are working on the D0 project, which is headed by Physicist Paul Grannis of SUNY at Stony Brook. Other collaborating universities include Brown, Columbia, Florida State, Maryland, Michigan State, Northwestern, Pennsylvania, Rochester and Virginia Polytechnic Institute. Also involved are Fermilab, Lawrence Berkeley Laboratory and CEN Saclay in France.

The detector is slated for operation in 1989. While it is being built, about \$7 million of its estimated \$45 million total cost is expected to be spent by BNL. The project is primarily supported by the U.S. Department of Energy, with additional funding from the National Science Foundation and France.

When completed, the D0 detector will take advantage of the high luminosity expected from the Tevatron. With this feature, D0 collaborators hope to produce more W's and Z's per year of running time than is now possible at CERN. This will allow the particles to be studied in depth.

When the Tevatron's beams collide, the energy at the center of mass will be two trillion electron volts (2 TeV). At such high energies, theorists predict the observation of streams of secondary particles, resulting from quark interactions. These "jets" are also high on the list of phenomena the researchers want to explore.

"Our notion of the physics that we're going to concentrate on has evolved over the entire period of designing this experiment," said BNL Physicist Sam Aronson, "and it's going to continue to evolve as hints of new phenomena come in from the

existing experiments at CERN. But our main focus has not been on a particular physics process, because those things may change in time. Rather, our basic philosophy in designing the detector has been to center on the basic measurements we want to make. This will give us the best chance to be able to do the physics that's available when we get to run."

Howard Gordon, who heads the Omega Group in the Physics Department, is eager to see what that physics is. "As far as I'm concerned, the most optimistic and exciting thing this detector has is the new energy region, which will be the highest in the world for many, many years. So the possibility of discovering some new phenomenon is strong. If there are particles that exist there, they just wouldn't be produced in any other way."

In looking for these particles, D0 will be both in competition and in partnership with the second experiment being built for the Tevatron by another large collaboration. Called the Colliding Detector at Fermilab (CDF), the experiment has been in the works several years longer than D0 and is expected to be at least partially complete for testing of the collider in September 1985. Originally, CDF was the only experiment approved for the Tevatron, but it became obvious that, in order to confirm any findings at one detector, there needed to be another. In the sense that D0 and CDF will be the only detectors operating at those energies, they will be partners, confirming each other's data.

But there will be a healthy competition; each collaboration, of course, would like to be the first to find any new phenomena. Gordon thinks that D0 may have the edge here. "CDF was designed many years before the CERN collider went into operation," he explained, "so they didn't have the benefit of knowing what the physics might be. We think we've learned something from what happened at CERN, and we took that into account when we were designing this experiment."

The detector is designed in three

parts. After leaving the collision region at the Tevatron's D0 intersection, the particles will first be "seen" by a tracking detector. Then the particles' energies will be absorbed and counted in a 600-ton calorimeter, made of uranium and copper plates. From the non-magnetic calorimeter, the particles will enter a 3,000-ton, magnetized iron box where muons — the only particles that should be remaining by then — will be deflected and identified. In all, the apparatus will be 40 feet high and weigh in at 4,700 tons.

Most of BNL's efforts will go into calorimetry. "From a physics point of view, this is the most crucial piece of equipment in the detector," said Aronson, and Brookhaven is responsible for a large portion of its design and construction. Gordon is in charge of all calorimetry for the experiment, while Aronson heads the work being done at Brookhaven. A number of physicists and engineers at the Lab are already at work building prototypes and finishing the design.

BNL began testing the uranium calorimeter at Fermilab in May and will continue into the summer. "This type of calorimeter is becoming a standard towards which people are striving in doing high quality calorimetry," said Aronson, "and there are a number of other experiments around the world that may build liquid argon uranium calorimeters. So good measurements at high energies, which we should be able to do this spring and summer, will be valuable not only for us, but also for lots of other people."

BNL is also heavily involved with data acquisition for the experiment, for which Bruce Gibbard is overseer, and with off-line software for analysis of the experiment, an activity being coordinated by Serban Protopopescu. This is no simple matter. While collisions at the D0 intersection will produce about 50,000 new particles each second, Aronson said, "Maybe one or two will be of interest to us. The hard part of the analysis will be to weed out the rest of them."

Other Lab people involved in all (Continued on page 2)

Accelerators Around the World CERN and Fermilab

Brookhaven's particle accelerators are only part of a global network of equipment that researchers rely on in the quest to understand the universe. With this article, the Bulletin begins a series of occasional pieces designed to acquaint BNL employees with particle accelerators associated with other institutions around the world. Because the SPS Collider and the Tevatron are important to the discussion of the D0 detector in the accompanying story, they are the subject of the first article in the series.

With the advent of the electroweak theory in the early 1970's, high energy experimentalists set out to create tools that would allow them to look closely enough at the particle world to prove or disprove the theory. On both sides of the Atlantic, this challenge has been met with different machines.

At CERN, the European Organization for Nuclear Research located in Geneva, Switzerland, the answer was the Super Proton Synchrotron (SPS) Collider, also known as the Spps Collider.

The SPS Collider story began in 1959 when CERN's Proton Synchrotron (PS), a machine very similar to the AGS, began operating, reaching energies of 7.2 billion electron volts (GeV) in the center of mass (E_{cm}), during the collision of the proton beam with a stationary target.

In 1971, a second CERN machine, the Intersecting Storage Rings, or ISR, was commissioned. The ISR was the world's first hadron collider, an accelerator in which two beams of protons, going in opposite directions, collided at different intersections in the ring for an E_{cm} up to 63 GeV. Thus, the ISR showed that colliders could allow much higher energy regions to be reached with relatively small accelerators.

The SPS began operating in 1976, as a scaled up version of the PS, capable of an E_{cm} of 27.4 GeV. At almost the same time, however, plans were being made to change the machine from a fixed target accelerator to a collider, in which a beam of protons would collide with a beam of antiprotons for an E_{cm} of 540 GeV. The PS would be used to inject protons and antiprotons into the SPS and into the ISR.

By mid-1981, the new SPS Collider was operational. Shortly thereafter, experiments UA1 and UA2 were collecting data. The rest is Nobel Prize-winning history. In 1983, the W and Z particles were discovered by UA1, offering important confirmation of aspects of the electroweak theory. Since its 1984 upgrade, the SPS Collider has an E_{cm} of 630 GeV, allowing for the collection of more data and the possibility of further discoveries.

CERN's experiences have also been valuable for those working on the Tevatron at Fermilab, the Fermi National Accelerator Laboratory (FNAL) in Batavia, Illinois. Fermilab began operating a proton synchrotron with a beam energy of 400 GeV in 1972. The FNAL accelerator, with a circumference of four miles, was originally capable of an E_{cm} of about 27.4 GeV, but was later upgraded to an E_{cm} of 30.6 GeV.

In 1979, Fermilab began looking beyond the FNAL accelerator. They started to design the Tevatron, so called because it would accelerate particles to one trillion electron volts (1 TeV).

The Tevatron design evolved into two phases. First, a ring made of superconducting magnets was to be built under the existing accelerator, in the same tunnel, to create a proton synchrotron that would save energy while reaching higher energies. This Doubler/Energy Saver project was dubbed Tevatron II, and the new ring was to contain two beam lines, so it could also function as a collider. For the second phase, called Tevatron I, protons were to circulate through one beam line, while antiprotons were to be accelerated in the opposite direction in the other beam line. The old FNAL accelerator would be used in the production of antiprotons.

TeV II, which began operating in 1983 with an E_{cm} from 31 to 36.2 GeV, was upgraded in 1984 to its present E_{cm} of 38.7 GeV. With a beam energy of 800 GeV, TeV II is closing in on its goal of 1 TeV (1000 GeV). Slated for completion in 1986 or 1987, TeV I will combine the 1 TeV energy available in each beam for a collision E_{cm} of 2 TeV.



Sam Aronson (left) and Howard Gordon discuss calorimetry for the D0 detector. A schematic of the calorimeter covers the blackboard behind them.

Blanche & BERA

Question: Who and what do aerobic dancers, basketball players, campers, fly tyers, ham radio operators, rifle & pistol shooters and swimmers at the Lab have in common?

Answer: Blanche Laskee and the Brookhaven Employees' Recreation Association (BERA).

BERA sponsors 44 activities in which Lab employees participate, and Laskee is the liaison between it and the Lab. BERA's 37th fiscal year began on May 1. In addition to dues and program charges established by each activity, the Laboratory provides a significant amount of financial support for BERA.

Laskee has worked at the Lab for 27 years, spending her first 10 years at the Brookhaven Graphite Research Reactor as division receptionist and then as reactor operations secretary. In 1968, Laskee made a career change by moving into Personnel's Recreation Office, which until 1971 was located in the gym where the exercise rooms are now. When she was appointed recreation supervisor, she became the first woman to hold the position.

The idea for a Laboratory-sponsored, employee recreation association that would promote athletic competition, social activities and cultural exchange was born in March 1948. BERA's first constitution was adopted that June, and the first BERA board of trustees was elected the following year.

The first activities sponsored by BERA were eight: a bridge club, camera club, choral group, dance & party committee, film society, rental library, tennis club and theater group. The number of clubs grew to 28 during



Recreation Supervisor Blanche Laskee at BERA's newest recreation facility, the Parcourse Fitness Circuit. In the background, BERA member Vincent Polywoda is hot on the trail of physical fitness.

the 1950's and since then has progressively expanded to its present 44. Of the original clubs, only four remain: the camera club, choral group, tennis club and theater group.

BERA members are active and retired employees of BNL, AUI and the Brookhaven Area Office of DOE and their immediate family members. Also included are BNL or AUI guests and visitors, non-laboratory employees on site and their immediate family members.

The six trustees of the BERA board are Vice President John Connelly (Pl.Eng.), Corresponding Secretary Mickey Haller (C&P), Lois Marascia (DNE), Bernie Silverstein (S&EP), President Ken Sutter (DAS) and Ed Taylor (AMD). They meet on the second Thursday of each month to take care of the affairs of the Association. Two new board members are elected each March, and each serves a three-year term. The BERA board has appointed Donna Dowling (Pers.) as

Recording Secretary, and Richard Eggert (AUI) serves as Treasurer.

About 550 BERA members take part in the Softball League, thus making softball the most popular BERA activity. "The birth and growth of BERA clubs reflect the changing times," explains Laskee. "For example, as running became more popular in America, so did the Runners' Club, and after aerobic dancing was created as a way to work out, the Aerobic Dance Club was founded.

"Since my two loves are music and cooking, I have particular interest in the Concert Series of chamber music and the Cooking Exchange," says Laskee. "I would like to see the Choral Group as a year round activity, instead of just at Christmas, and I would also support an organized instrumental group of some sort — how about a Brookhaven National Laboratory Marching Band?"

Laskee supervises the day-to-day operation of the swimming pool, gymnasium, recreation building in the apartment area, Recreation Park, six tennis courts, the Parcourse fitness trail and the Astronomy Observatory.

Laskee is assisted by Recreation Representative Guy Mastrion and Recreation Assistant Richard Parsons, who coordinate BERA activities held after work hours. Additional BERA employees include two attendants who mind the gym and its equipment after hours, recreation building attendants and lifeguards.

BERA also operates a Sales and Service office in Berkner Hall, which offers film processing, sells camera supplies and entertainment tickets, and is the official redemption center for BERA participation awards.

— Marsha Belford

Speaking Out

Maurice A. DuBois, Reporter
Roger Stoutenburgh, Photographer

We queried BERA members to find out which activities they participate in.

Dick Hildenbrand (AGS) — I'm in the Golf League and the Motorcycle Club. I like competing in BERA golf tournaments. I got into motorcycling when the gas crunch hit, but now motorcycling is more fun than economy.



Adrienne Usher (P.R.) — I participate in volleyball because we have a very good team, and I love to win. I also play softball to socialize. I'm in the Cooking Exchange because I like to cook — and I like to eat.



Pat Carr (Med.) — I play volleyball and softball, and I occasionally take the aerobics class. Taking part in BERA activities is convenient, and I've enjoyed the sports and meeting people. It's been a positive experience.



Steve Perlstein (AGS) — I've been at the Lab for a little over a year, but I haven't joined a BERA club yet — though I've thought about it. I would like to participate in the R/C Model Aircraft Club and the Rifle & Pistol Club. I like BERA's concerts, and I love swimming at the pool — I wish they would finish repairing it soon.



Mary Durham (Pl. Eng.) — I belong to the Afro-American Culture Club because it brings cultural awareness to its members and the general community. Since we have a Commodore 64 computer at home and my kids want to use it, I am a part of the Commodore Users Club. I don't know much about the computer, so the knowledgeable members of the club are helping me. I used to play softball, but my son is now in Little League, so I attend his games instead.



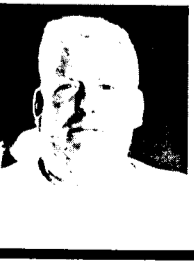
Jean Ramirez (DNE) — I enjoy volleyball and softball. The sports are fun and I like the people. I've met a lot of people who I would never have met at the Lab if they hadn't been on my team or in my league.



Yin-Nan Lee (DAS) — I play badminton and table tennis — for fun and to keep in shape. I am also a member of the Commodore Users Club. I appreciate BERA's supplying sports facilities, and I think BERA provides the opportunity for employees with the same interests to meet, which probably would not happen otherwise.



Ken Andersen (Pl. Eng.) — I like camping, and I enjoy the Camping Club. We've been doing it for 20 years. We like the wilderness, the travel and the people we meet.



Stockroom Closing

Building T-158 will be closed for inventory on May 23 and May 24. Please make all necessary withdrawals of stock prior to 3 p.m. Wednesday, May 22. This will give Supply & Material Division sufficient time to prepare for the inventory. Emergency requirements should be processed through John Scharpeger, Ext. 2974.

Reports Available

The following reports are now available to the Laboratory staff and to affiliates of the DOE, AUI and NRC. Others may purchase the reports from the National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. Staff members should call Ext. 5068.

NUREG/CR-2331
BNL-NUREG-51454
Vol. 4 #2

Safety Research Programs Sponsored by Office of Nuclear Regulatory Research. Quarterly Progress Report April 1 - June 30, 1984. Compiled by A.J. Weiss

NUREG/CR-3026
BNL-NUREG-51609

Feasibility Study on the Acquisition of Licensee Event Data. W.Y. Kato, et al.

BNL-51731

Hydronic Distribution Systems for Use with Condensing Boilers. R.F. Krajewski, J.W. Andrews

BNL-51808

Study on the Application of Coal-Water Slurry Fuels to Marine Transportation Vehicles. C.R. Krishna

NUREG/CR-3943
BNL-NUREG-51812

The BWR Plant Analyzer. Final Report. W. Wulff, et al.

BNL-51825

Brookhaven Highlights. April 1983 - Sept. 1984

BNL-51831
Vols. I, II

Study of Space Utilization and Technical Approaches to Heating in Buildings with Irregular Occupancy. Final Report. Prepared by Gard, Inc.

NSLS Users Convene

The fourth annual NSLS General Users Meeting will be held Thursday, May 23, and Friday, May 24, at Berkner Hall. After Deputy Director Martin Blume welcomes the Light Source users, the recently appointed chairman of the National Synchrotron Light Source, Michael Knotek, will give an overview of NSLS operations. Other speakers will review the status of the VUV and x-ray rings and their respective beam lines, discuss Phase II expansion and a 6 GeV ring, and report on experiments performed at the NSLS. About 250 Light Source users from BNL and other institutions are expected at this meeting. To sign up and for further information, please call Eileen Pinkston, Ext. 4194, before 5 p.m. this afternoon.

D-Zero

(Continued)

aspects of D0 include Physicists Wlodek Guryn, Stephen Kahn, Melvin Month, Michael Murtagh, Iuliu Stumer and Peter Yamin, as well as Engineers Walter Gubler, John Koehler, Peter Kroon and Monty Montag. "Mainly," said Gordon, "Brookhaven is providing leadership, including scientific leadership. In return, we'll not only get to do some important and interesting physics, but we'll also be gaining some expertise for major detectors for future accelerators, like the proposed Superconducting Super Collider and the Relativistic Heavy Ion Collider. Our calorimeter, for example, might serve as a very important model for future calorimeters."

— Anita Cohen

Coming Up

Geoffrey Hind, senior biochemist, Biology Department, will give the 215th Brookhaven Lecture on Wednesday, May 29, at 4:30 p.m. in Berkner Hall. His topic will be "Photosynthetic Cycles and Plant Productivity."

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Cooking Exchange

Wednesday, May 22, will be the final Cooking Exchange meeting of the 1984-85 program. The theme is Foods of the 23rd Olympiad, which will be a catch-all for anyone who still wishes to demonstrate her recipes before the International Dinner.

The annual International Dinner, which is the highlight of the Cooking Exchange year, will be held on Friday, May 31. Only those members who have given recipe demonstrations at least once during the past season will be invited to attend.

The Cooking Exchange is open to employees and their immediate family members. Meetings are held in the Recreation Building from 12:30 to 2:30 p.m. For the \$1.00 donation those present receive copies of the recipes prepared, along with a sampling of each dish. Coffee and tea are also served. Babysitting is provided at 50¢ for each child.

For more information concerning the activities of the Cooking Exchange, contact Dee Polychronakos at 744-3578.

Astronomical Society

Observation night this month will be Friday, May 17, beginning about 8 p.m., with the following Friday as the rain date. Those planning to attend should call Bob Mills, Ext. 5043, or Rick Jackimowicz, Ext. 3803, during the late afternoon in question. There will be an informal meeting immediately preceding the observation session, starting at 7 p.m. in the Center.

Runners' Corner

Today at noon in Room B of Berkner Hall, the BNL Roadrunners will show a video tape of the first place finish by one of the three 3-person BNL teams at the Dix Hills 10 Kilometer Race held Sunday, April 28. The winning team was made up by Terry Sullivan (DNE), Peter Boni (Physics) and Ed Gallagher (MIS). Individually, out of about 1,000 runners, Sullivan won the race in 31:51, Boni finished third overall, and Gallagher placed 32nd.

A team of ten BNLers finished tenth out of over 100 teams from the New York metropolitan area in the New York Xerox Corporate Marathon Relay on Saturday, April 13. Each of the ten members ran a 2.6 mile loop and handed off a baton to a teammate; when all were done, the team completed a full 26.2 mile marathon.

The team included Diane Hatton (NSLS), Sharon Zuhoski (DAS), Joe Bauerfeind (AGS), Skip Medeiros (DAS), Lou Addressi (AGS), Don MacKenzie (DNE), Bob Liegel (Physics), Peter Boni (Physics), Terry Sullivan (DNE) and Trevor Sears (Chemistry). Gus Prince (DNE) coached BNL's team. The fastest BNL male runner was Sullivan, with a time of 13:08, and Hatton, who had a time of 17:28, was the fastest BNL woman.

On Saturday, May 11, Peter Boni (Physics) placed first in the Mount Sinai Harbor Five Miler with a time of 25:48.

Reminder:

The BNL Roadrunners Club is sponsoring a free running clinic on Saturday, May 18, at 6:30 p.m. in Berkner Hall. The speaker will be Bill Squires, former coach of such world-class runners as Bill Rodgers, Alberto Salazar and Grete Waitz. He also

coached the late Ted Landry, a former BNLer and Roadrunners president who was killed last July while bicycling. Squires will talk about "How to Put Speed Into Your Running the Easy Way."

The clinic is offered in conjunction with Ted's Twosome Five-Mile Race, a race held in memory of Landry on Sunday, May 19 at 10 a.m. Entry fees are \$7 for singles, \$10 for couples, and anyone who registers by today will receive a long-sleeved commemorative T-shirt. Registration the day of the race will be held at the gym. For information, contact Bill Thomlinson, Ext. 3937.

Camera Club

Would you like to expand your photographic knowledge to include dark-room procedures? Are you interested in learning how to print or enlarge your pictures? Attend the next Camera Club meeting, Thursday, May 23, at 5:30 p.m. in the Recreation Building. Members and non-members are welcome at all meetings.

Softball

Games for week of May 6

League III

Survivors 12 - No Names 6

TNT won - Nads (forfeit)

Farm Team - (Bye)

League IV

Who Cares 7 - Kidz-R-Us 5

Mole-Esters 25 - September 10

Turkeys vs. Farm Busters

(game postponed)

League V

No Feedback 10 - Underalls 7

Foul Ups 10 - Simply Awesome 2

Mudville Sluggers 24 - Space Kadets 16

NYC Train Trip

The Hospitality Committee is planning a group railroad trip to New York City on Wednesday, May 29. Departure will be at 7:55 a.m. from the Patchogue LIRR station. Round-trip fare for adults is \$5.00; children under five years ride free.

Reserve a ticket by sending your fare through the U.S. mail to BNL, P.O. Box 322, Upton, New York 11973. Please do not send cash. Checks or money orders, payable to BNL, must be received by Friday, May 24. Put the date of the trip, your BNL life number and your phone number on the back of your check or money order. Your tickets will be given to you at the railroad station on the day of the trip.

Arrivals & Departures

Arrivals

Roger A. Katz AGS

Departures

Michael G. Hauptmann S&EP

Volleyball Champs



DINKERS (Mixed League - Div. A): From left, Dennis Weygand, Sandee Litcher, Don Litcher, Adrienne Usher, Bob Meier, John Usher. Absent when photo was taken - Annette Meier. —photos by Rosen



TNT (Mixed League - Div. B): Tirre Farmer, Denise Miesell and Allen Jones. Absent when photo was taken - Kathy Norden, Marty Leach, Bob Brown, Marg Desmond and Linda Farmer.



CAPTAIN MIDNIGHT (Mixed League - Div. C): Kneeling, from left, Ani Aprahamian, Dan Benz, Ann Mutschler. Standing, Vanessa Samuels, Lisandro Cardoso, Ron Nawrocky, Jim Wicksted, Marta Nawrocky. Absent when photo was taken - Bernie Benz.



PHOENIX (Open League): Foreground, John Usher and Greg Matthews. Standing, Dennis Weygand, Sandee Litcher, Don Litcher, Adrienne Usher and Bob Casey.

