DOE Princeton Plasma Physics Laboratory Vol. 22, No. 8 • April 3, 2001

HOTLINE

The Princeton Plasma Physics Laboratory is a United States Department of Energy Facility

DOE's Gunn Stresses Value of Diversity

To one woman, it was a person swimming in the middle of a pool. To another, it was a donut with a tiny center hole. One fellow thought it was a speck in the universe, while someone else said it was a snake looking up from a hole in the ground.

So who was right? All of them.

Those offering answers were participating in a simple exercise at the Melvin B. Gottlieb Auditorium on March 1. DOE Chicago Operations Office Manager Marvin Gunn had drawn a large circle with a dot in the center and asked people around the room what it was. The drawing conjured up images as individual as, well, each individual.

"The point of the exercise is to see the value of diversity," said Gunn, who addressed all PPPL staff during a visit to the Lab that also included a tour of PPPL and a meeting with the Director's Minority Advisory Committee. "That is what gives us the strength we need to accomplish great things."

Gunn opened the talk by giving a personal overview of his lifelong interest in technology and concluded by discussing the importance of differences among individuals and teamwork. The DOE manager recalled how his interest in science was sparked after receiving a tool kit for Christmas as a child. "I took an old clock radio apart and put it back together without using half of its original parts," he said. His interest in technology and science followed him throughout his high school and college years, when he realized the need for collaboration. Building a model of an atom required teamwork, and his college group involved in the project was melded by their shared interest. "The thing that brought us together was science," said Gunn, who received a mechanical engineering degree from Howard University before going into public service. His philosophy about teamwork continued to guide his career at the Chicago Operations Office, where he said he realized he could not do his job alone — nor could anyone.

Marvin Gunn

The DOE Head emphasized the importance of celebrating individual differences, discussing a staff Unity Day Celebration at his office. "We talked about the differences in how we process information," said Gunn, who has been in his current position since December. He added that individuals must be valued for their unique capabilities and their contributions to a team's success.

"Look at all the inventions, new ideas, and projects — all were done by a systematic assemblage of genius ...We are all geniuses in our own right. Organizing geniuses is a challenge, but a successful team gets it done," said Gunn. ●

Big Displays Come to Life on High-resolution Wall

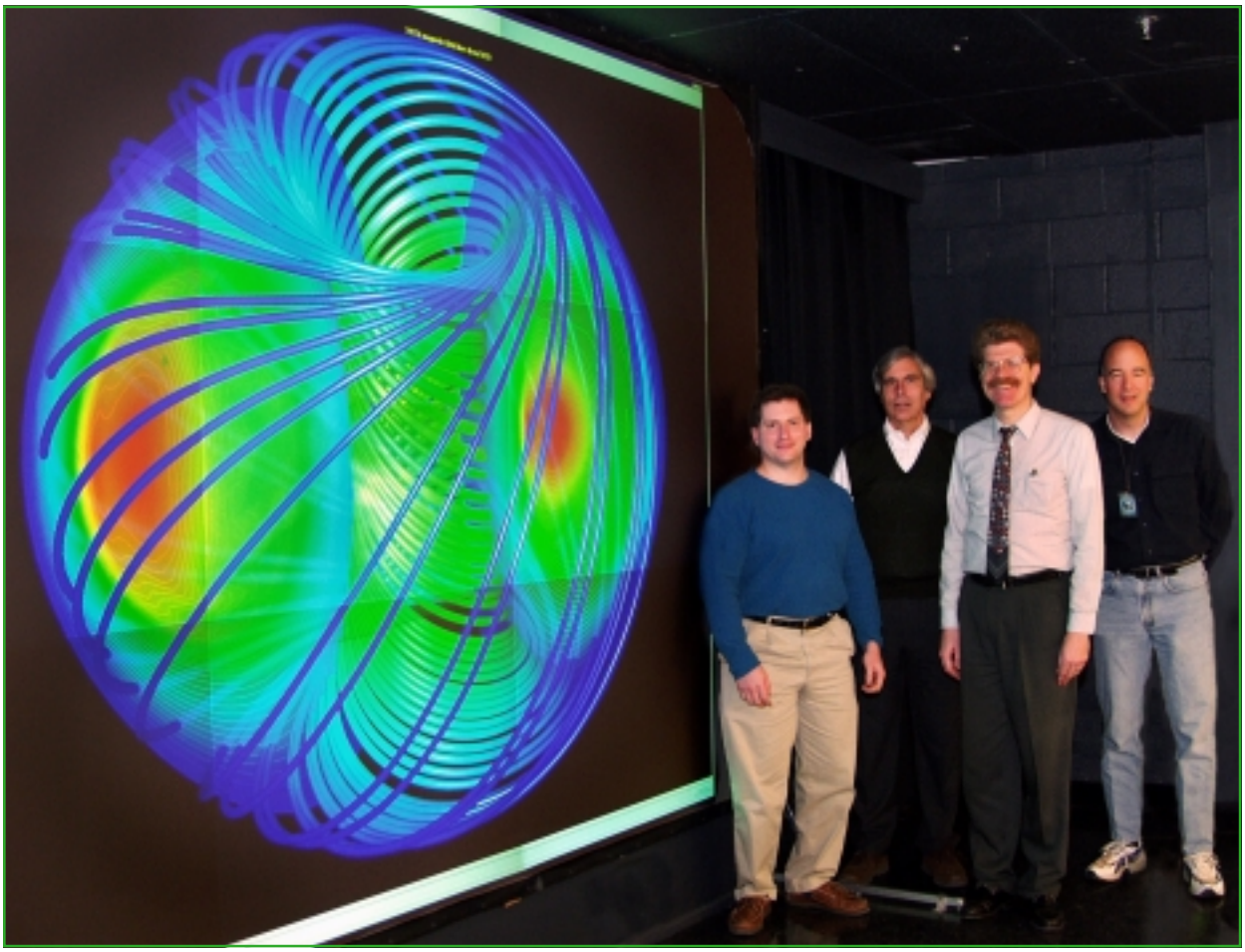

Photo by Elle Starkman

At the High-resolution Wall are, from left, Scott Klasky, Steve Jardin, Irving Zatz, and Doug McCune. The image displayed on the wall is of National Spherical Torus Experiment magnetic field lines.

During the past year, the High-resolution Wall, also known as the Visualization Wall, began operating at PPPL in a room next to the PPPL Library and across from the gym. The wall has a resolution quality more than three and a half times better than high-definition TV. Ten clustered computers work together and nine projectors beam pixelated images onto this large display wall, resulting in superior clarity. The PPPL project originated as a result of a conversation between Professor Kai Li from the Princeton University Computer Science Department and PPPL Chief Scientist Bill Tang. Professor Li's Display Wall on main campus was the model for PPPL's effort. PPPL's Scott Klasky is the driving force behind the assembly of the High-resolution Wall and it's ongoing improvements, and Irving Zatz of PPPL's Engineering and Technical Infrastructure Department, has been a valuable collaborator in the continuing improvement of the facility. Overseeing the project are PPPL's Steve Jardin and Doug McCune. Below, Jardin answers questions about the wall.

What is the main purpose for the construction of the PPPL High-resolution Wall?

The main purpose of the Wall is to provide a very powerful, high-resolution, scalable display so that our theoretical researchers can see the fine-scale structure in their output from big supercomputers. The computers we use, particularly at NERSC (the National Energy Research Supercomputer Center at Berkeley) keep getting faster and more powerful, but desktop monitors have not been keeping pace in terms of their resolution capability.

One way of seeing this is in terms of parallelism. The way big supercomputers are getting faster now is that they combine many (up to 4,000 or more) "standard" computers and operate them in parallel. We call that MPP, or massively parallel processing. The display wall is an initial attempt to make a high-resolution display by com-

bining nine "standard" displays in parallel. Its scalability means that even higher resolutions can be readily achieved with the addition of more processors and projectors.

How common is this type of facility at the National Labs?

PPPL is the first U.S. fusion facility to have such a wall, but others are now following. There are several of these walls at the big national laboratories and in computer science departments.

In layperson's terms, what are some of the "gee whiz" statistics pertaining to the assembly of the wall and its operation?

The High-resolution Wall is basically nine standard displays tiled together to make one display with higher resolution. Each of the nine displays has a resolution of about 800 x 1,000 pixels. Thus, the tiled wall has a resolution of about 2,400 x 3,000 pixels or 7.2 million pixels. The highest resolution digital TV formats that are coming out have about 2 million pixels for comparison. The system has nine projectors and one computer to drive each screen, plus a control computer to give directions to the others. It is clearly the Lab's fastest device for displaying visualization. When the computers are not being used to drive the screen, our researchers can use them in parallel to perform modest-scale scientific calculations.

What are some of the most interesting applications that have been tried at PPPL? What is the routine use (if any) of the wall?

We were somewhat surprised by how much people like to use the wall for making presentations. We have had many meetings held there where most of the presentations did not really need the high resolution that the wall provides, but people like the size and crispness of the display. Also, presenters have found that they can include much more information on their slides without it appearing "too busy" because there is so much room to work with.

We find that more and more, our research groups of six to 12 people are holding working meetings in the High-resolution Wall room and using the wall to show each other the results of their calculations. It is much better than everyone gathering around someone's desktop display, and it does not involve making hard-copy viewgraphs. Also, we are using the wall much more now to view movies of our simulation data. We find that we are noticing details in our simulation data that were not previously apparent.

What are the plans for the visualization facility at PPPL in the near term and the longer term?

Steve Jardin

We are now preparing proposals in several related areas. One area is that of "virtual meetings" with other laboratories. By using the wall, a collection of cameras, and some microphones and speakers, we can make an excellent virtual meeting room where a group here can see and talk with a group at a similar facility at another laboratory. The size and resolution of the wall make this a much more attractive setup than our present videoconference facilities. Also, we have a proposal to make a similar facility in the NSTX Control Room to show many plasma displays simultaneously at a size in which everyone in the control room can see them.

These two ideas can be combined to have remote control rooms for collaborators where they can see and interact with everyone and view all the data. Presently, projects are underway to develop an automatic alignment system for the projectors and to create a portable and scalable wall that can be moved from place to place.

What about the farther out possibilities, e.g., virtual reality?

Things are really moving in that direction. It is just a matter of when and how much it will cost. We are only a few years away from having the capability to create a 3-D real-time virtual walkthrough of an operating device such as NSTX. I think that in five to 10 years we will have collaboration displays that take up two or more walls in a room, and the displays and audio will be so sharp that it will be just like being in the same room as the people you are remote conferencing with.

As for the virtual reality, it is almost here. Some of our Japanese collaborators already have rudimentary virtual reality displays that use four walls and a ceiling. I think the real push will come when someone uses such a display to discover something really new that they couldn't visualize without it. Then it will really take off everywhere. It helps that the home game market is so strong, as that is providing a commercial incentive for companies to keep improving the display components and is driving the costs down. ●

New PEARL Facilities Are Open for Business

The Laboratory recently cut the ribbons on the new PPPL Environmental, Analytical, and Radiological Laboratory (PEARL) and Health Physics (HP) offices.

One of the new PEARL labs.

Tucked behind the Radio Frequency Technology area are the three labs, a mechanical systems room for lab ventilation, offices, and a meeting room that comprise the new facilities for environmental radiological analyses. "The new laboratory facilities represent a significant asset for PPPL. Functions previously performed in the Radiological Environmental Monitoring Laboratory (REML) have been transferred to the PEARL, and plans are underway to utilize the PEARL to expand PPPL's environmental analytical capabilities into diverse radiological and non-radiological areas," said Environment, Safety, and Health Head Jerry Levine.

The Health Physics Group provides monitoring and support for PPPL activities that may potentially result in radiation exposure to individuals and the environment. To ensure compliance with federal, state, and local regulations, the group operates under a program designed to monitor the true concentrations of radiological effluents within the environment.

Presently, the PEARL staff analyzes samples from 16 ground water wells, 25 surface water and rainwater locations, one Liquid Effluent Collection Tank (LECT) discharge, and 14 air sources. PEARL environmental measurements include the following: weekly analyses of D-Site exhaust stack air monitoring systems for tritium; weekly analyses of onsite and offsite air monitoring systems for tritium; periodic analyses of samples from the D-Site LECTs for tritium and gross beta *[gross beta counting measures the radioactivity in a sample produced by beta (electron) decaying radionuclides (e.g., tritium) without providing any information about the identities of the radioactive isotopes present]* prior to discharge of tank contents to the sanitary sewer system; monthly analyses of ground water samples for tritium; monthly analyses of surface water and rainwater samples for tritium; and periodic analyses of process water samples and oil samples. All of these measurements help determine the environmental impact of PPPL's operations.

The new facilities include wet, hot, and counting labs, each of which are about 25 feet by 25 feet in size and include oak desks. At the wet lab, staff prepare samples of water from the D-Site LECTs, rainwater, surface water, ground water, soil, and biota, as well as prepare the environmental Differential Atmospheric Tritium Samplers (DATS). At the hot lab, staff process D-Site stack DATS, bioassays, and tritiated oil. At the counting lab, environmental and process equipment samples are analyzed for tritium and gamma radiation. One full-time lab technician is employed in the PEARL, along with two part-time student assistants. Several other PPPL Health Physics' employees also work in the PEARL as needed.

"These labs are perfectly sized," noted Health Physics Manager George Ascione. Before PEARL was completed, the REML staff and operations had been housed for 12 years in a trailer next to the Firehouse. "The trailer was meant to be temporary," noted Levine.

Office space in the new area received fresh paint, new flooring, carpet, lighting, and ceiling tiles. A third-floor area was converted into a meeting room.

Levine said plans to expand the PEARL's capabilities are underway. "We will pursue upgrading our capabilities to analyze for uranium, plutonium, and gross alpha and beta radiation to provide assistance to power plants and to the New Jersey Department of Environmental Protection. We now have the capability to measure Chemical Oxygen Demand (COD) in water, which is the amount of oxygen consumed when organic matter is oxidized; this is one measure of the cleanliness of the water. Our COD measurements indicate the overall level of organic contamination in the LECT water, and is governed under our discharge license with the Stony Brook Regional Sewer Authority," he said. Levine added that the group will continue to enhance its ability to perform other chemical analyses, such as sulfur content in fuel oil for our boilers.

Planning for the PEARL began more than three years ago. In December, the HP group moved the laboratory equipment from REML and set up the new labs. Among hefty items relocated were three two-ton gamma shields

Checking out the new PEARL facilities are (from left) Jeff Makiel, Carl Szathmary, George Ascione, Charles Kircher, Jerry Levine, and Rich Gallagher.

from the REML to the PEARL counting lab. The shields protect against background gamma radiation from the gamma counters. Staff from the Tokamak Fusion Test Reactor (TFTR) Decommissioning team assisted with the move. "Everyone pitched in and the operations were never affected," said Levine, explaining that weekly DATS from the TFTR stacks continued to be analyzed on schedule during the transition.

"The new PEARL is really an asset for PPPL. With these enhanced facilities — including larger labs and new equipment — our Health Physics group now is able to perform its functions better and expand its analysis capabilities. Just as a chef needs the proper cooking utensils and a well-equipped kitchen to produce meals, our staff needs the right tools and properly outfitted labs to analyze samples," said Ascione. ●

Students at PEARL Learn Skills While Helping Out

Employers are not the only ones who benefit from having student assistants around. The pupils themselves gain hands-on experience and learn what it is like to work in a field they are contemplating.

Such is the case at the PEARL, where staff and students alike find mutually rewarding benefits. Sabrina Chrzanowski and Patricia McIntosh assist Carl Szathmary with collecting air and water samples and lab operations, while picking up lab skills and learning how to communicate with staff.

"I've learned all about the processes — from how to sterilize bottles to distilling water samples to writing a procedure for Health Physics. It is great to learn how to work in a lab," said Sabrina, a part-time student employee who spends one day a week at PEARL assisting Szathmary.

Patricia has acquired a mix of lab and people skills since coming to PPPL a month ago. "I've learned a lot of different communications skills, how to interact with other employees, and lab terminology, as well as lab skills, which have helped me at school," said Patricia, a Trenton High School senior who spends three half-days each week as an intern at PEARL.

Sabrina, daughter of PPPL's Jim Chrzanowski, said her work includes collecting samples at 10 environmental sites at and surrounding PPPL. These samples are returned to the lab, prepped, and checked for tritium. Sabrina also makes up concentrations for doing Chemical Oxygen Demand testing. She worked at PPPL for Szathmary the past two summers. "I've always liked it here," said Sabrina, who is attending Bucks County Community College in lieu of her senior year at Neshaminy High School. Other tasks include writing procedures and filling out paperwork on samples, which are logged into a computer and assigned a number. Test results are recorded on the computer. Sabrina, who plans to do environmental field and lab work after completing college, also picked the wall and floor colors for PEARL.

Sabrina Chrzanowski

Patricia McIntosh

Patricia collects air samples and distills rainwater, as well as sets up laboratory systems, cleans bottles, and analyzes samples. These tasks, she hopes, will prepare her for future lab and fieldwork in the environmental arena. "I had done some lab work at school, but I hadn't worked with materials like this," Patricia noted.

She lauded using a "hands on" approach for picking up skills rather than relying strictly on a textbook. Patricia is earning 10-15 credits this semester for her efforts and is the first Trenton High School student to get an internship at PPPL's PEARL. "I hope to set a path for many more to follow," said Patricia. The internship was set up by the Lab's Science Education Program.

Patricia, who will graduate in June, said she is looking at environmental engineering as a career option, and has applied to several colleges. She joked that she expected to meet mad scientists when she came here, but instead encountered wonderful people and an interesting, fun place.

As for Szathmary, both students have been a tremendous help to the Health Physics staff. He said, "Sabrina is an asset. If I'm not here, she can do it all. Patty is learning more each week and is almost at a point where she can explain each procedure she works on in the lab." Szathmary added that he has been working with students since 1995.

"Being a mentor is very rewarding. There's something about teaching a student your skills and helping them get a jump on their future," he said. ●

PPPL Hosts Mini-conference for Girls

More than 160 Female Students from Area Schools Participate in "Expand Your Horizons Day"

At top right, PPPL physicist Martha Redi (far left) moderates a panel discussion, "Science: What's It Really Like?" Panelists, from left, are Elaine LaLanne, of the New Jersey Institute of Technology, Princeton University graduate student Elizabeth Foley, and Lisa Dyson, of the Massachusetts Institute of Technology. At top left, an exhibitor attracts the interest of a group of girls. At bottom left, the young visitors enjoy a presentation by Jill Holz, an engineer at the NASA Goddard Space Flight Center.

More than 160 seventh through 12th grade female students from area schools came to PPPL on March 16 to participate in the "Expand Your Horizons Mini-Conference for Young Women in Science, Mathematics, and Technology." The conference included talks by various women in the sciences, a panel discussion, exhibits, and lunch. The guest speakers and panelists were from the Fashion Institute of Technology, the Massachusetts Institute of Technology, the NASA Goddard Space Flight Center, PPPL, Princeton University, the New Jersey Institute of Technology, UCLA, and the University of Pennsylvania.

PPPL Science Education Program Head Pamela Lucas said, "This is the first year we have offered this program and I believe it is really important to reach girls this age. Based on comments received from the students, it is very likely we will make this an annual event. One student said, 'This conference opened my eyes to tons of career possibilities, broadened my horizons, and also stimulated my mind. I loved it.'"

Schools and programs that brought students include the College of New Jersey College Bound Program in Ewing; High Technology High School in Lincroft; Northern Burlington High School in Columbus; Helen A. Fort Middle School in Pemberton; Columbus Elementary School, Grace A. Dunn Middle School, Granville Charter School, Arthur Holland Middle School, Joyce Kilmer Elementary School, and Trenton Central High School, all in Trenton; Vineland High School-South in Vineland; West Windsor-Plainsboro High School-North in Plainsboro; and Woodbridge High School in Woodbridge.

Exhibitors for the event included Bristol-Myers Squibb, Communications Workers of America, FMC Corporation, Lucent Technologies, PPPL Science Education Program, and the Princeton Environmental Institute. The day was organized by PPPL's Science Education Program and cosponsored by the Director's Advisory Committee on Women and the Director's Minority Advisory Committee. ●

Olympics TorchTalk Concludes Science on Saturday

Above, Richard Kelso lights the Olympic Torch during the March 17 Science-on-Saturday lecture, "Keeping the Flame Alive — Flames of the Sydney 2000 Olympic Games." At right, a young visitor attending the talk, holds the torch.

This year's Science-on-Saturday series at PPPL concluded on March 17 with a talk, "Keeping the Flame Alive — Flames of the Sydney 2000 Olympic Games," by Richard Kelso.

Kelso described how a team of Adelaide engineers in Australia designed the fuel and combustion systems for the Olympic torch and the stadium cauldron for the Sydney Olympics. He was the Chief Design Coordinator of the Torch Development Team and Joint Leader of the Stadium Cauldron Design Team for the Sydney 2000 Olympics.

Kelso also discussed aspects such as external aerodynamics, fuel selection, storage and delivery, burner design, material selection, recycling, and testing. Kelso is a Senior Lecturer in the Department of Mechanical Engineering at the University of Adelaide in Australia, who is presently on sabbatical leave and is a visiting research engineer at the Department of Mechanical and Aerospace Engineering at Princeton University.

Science on Saturday is a wintertime series of free lectures geared toward high school students, but open to everyone. Started as a grass-roots effort 17 years ago at PPPL, it attracts about 300 people each Saturday. This year's series, which included eight talks, was organized by Ronald Hatcher, Janardhan Manickam, and James Morgan.

Popular Program

Said Morgan, "The Science-on-Saturday program is so popular that Dr. Kelso contacted us and volunteered to participate as a lecturer. We were fortunate that he was at Princeton University during the series."●

Proposed Compact Stellarator Reviewed at PPPL

PPPL's Michael Zarnstorff (standing, left) and Jeffrey Freidberg, of the Massachusetts Institute of Technology (standing, right) discuss the proposed National Compact Stellarator Experiment (NCSX) during the recent NCSX Physics Validation Review meeting held at PPPL.

The Physics Validation Review of the proposed National Compact Stellarator Experiment (NCSX) was held March 26-28 at PPPL.

The 13-member peer review committee addressed a Department of Energy charge that had several elements, including scientific merit, soundness of the NCSX physics basis, and relevance to fusion program goals. Committee members were also asked whether the level of experimental flexibility and robustness satisfies the Fusion Energy Science Advisory Committee (FESAC) requirements for the compact stellarator to attain proof-of-principle status. The review committee gave a strong affirmation on these questions and commended the preconceptual engineering design concept. Professor Gerald Navratil of Columbia University served as the Scientific Chair of the review.

Prior to the meeting, the project team prepared a document "NCSX Physics Validation Report" to assist in the review process. This report documents the motivation and goals for NCSX, its physics and engineering design characteristics, its physics basis, and plans. It is posted on the NCSX web site at http://www.pppl.gov/ncsx. ●

HOTLINE

Editor/Writer: Patti Wieser
Photography: Elle Starkman
Graphic Artist: Greg Czechowicz
Layout: Greg Czechowicz and Patti Wieser

The HOTLINE is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. It is primarily an internal publication. Correspondence and requests to reprint material should be directed to the Editor, PPPL HOTLINE, P.O. Box 451, Princeton, NJ 08543; Interoffice correspondence should be addressed to MS-38, LSB Bldg., C-Site; fax 609-243-2751; telephone 609-243-2757; e-mail pwieser@pppl.gov.