

DOE Princeton Plasma Physics Laboratory

PPPL NEWS

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

PPPL Opens Pilot Topical Computing Facility



PPPL Chief Scientist Bill Tang (far right) cuts the ribbon on the Pilot Topical Computing Facility. With Tang, from left, are Oak Ridge National Laboratory's Lee Berry, PPPL's Daren Wah, Geophysical Fluid Dynamics Laboratory's Brian Gross, PPPL's Steve Jardin, PPPL Director Rob Goldston, Lawrence Livermore National Laboratory's Bill Nevins, and PPPL's Doug McCune, Ernie Valeo, and Steve Davis.

Officials and friends at the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) cut the ribbon on the Fusion Energy Science (FES) Pilot Topical Computing Facility (TCF) in October. This facility is part of the new PPPL Fusion Computational Center (FCC), a data analysis and computational physics center that also includes the PPPL Petrel Cluster.

Pilot Topical Computing Facility

The goal of the pilot is to determine the best configuration for a full TCF for the Fusion Energy Science

community. A TCF will support computing throughout the fusion community, offering a unique capability that joins advanced computing and modeling with theory and experiment to improve advancements in the field of fusion. "Predicting the properties of energy producing fusion plasma systems is a formidable challenge. It can only be met with advanced scientific computing in tandem with theory and experiment," said PPPL Chief Scientist Bill Tang, Principal Investigator for the project. Tang explained that future research requires the acceler-

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Computing

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ated development of computational tools and techniques for the timely development of more realistic predictive models. When properly cross validated against experiments, the resultant codes would allow FES simulations of increasingly complex phenomena with greater fidelity.

In support of this mission, the FES researchers actively participate in the DOE Office of Science's Scientific Discovery through Advanced Computing (SciDAC) program. A component of the SciDAC strategy involves establishing TCFs to concentrate on specific sets of scientific applications in which the computer system in the topical facility is optimized for those applications.

The pilot TCF focuses on national FES collaborations involving the SciDAC centers for Plasma Microturbulence, Extended Magnetohydrodynamics, and the Fusion Collaboratory. In addition, the facility includes the strong involvement of Princeton University, which provided matching funds, and NOAA's Geophysical Fluid Dynamics Laboratory in "grid computing" explorations. Grid computing is a distributed computing infrastructure for advanced science and engineering applications involving large-scale resource sharing. This includes not only file exchange, but direct common access to computers, software, data, and other resources. The Department of Energy provided \$250,000 and the PPPL Director provided \$60,000 for the TCF. The University and its newly established Princeton Institute for Computational Science and Engineering contributed \$200,000 for the grid computing explorations.

The PPPL pilot investigates how a TCF can best enable new scientific research. Complementary to its involvement in "capability computing" activities on the most powerful available supercomputing platforms at major centers (e.g., at the National Energy Research Scientific Computing Center and at Oak Ridge National Laboratory), the pilot TCF is addressing important "capacity computing" issues by examining the cost-effective

utilization of commodity clusters dedicated to key FES applications. "Knowledge gained through this pilot project about capability as well as capacity computing issues can be usefully applied toward planning a full Fusion Energy Science TCF," noted Tang.

A large space at PPPL was renovated last summer to accommodate the advanced computing facility. The renovation included the removal of under-floor cables and the installation of new raised flooring, reconditioning and installation of power, the reconditioning of heating, ventilating and air conditioning equipment, and the installation of racks to house the computing equipment. "Everything was ripped out and cable trays were installed for power and signals, along with a raised floor," said Steve Davis, Project Engineer. He said 64 Advanced Micro Devices (AMD) dual-processors, each with a gigabyte of memory, were installed to support the pilot TCF.

Petrel Cluster

In addition, 76 new computers from Datal Systems — AMD dual processors — were added to the Petrel Cluster, which is housed partially in the FCC. Initially, the Petrel Cluster was a prototype system with 34 Intel systems and one dual AMD system that provided PPPL researchers with a local facility for code development and parallel computing resources. The following year, PPPL expanded this system and implemented the pilot TCF. The Petrel Cluster now consists of the 35 original dual processor systems plus the 76 new AMD dual processors.

Over the past few years, PPPL has built up extensive experience in the implementation and utilization of commodity computing clusters. These are basically modest super-computers built from components that can be purchased "off the shelf." This type of computing, which links desktop machines to support advanced scientific computing, has clearly helped accelerate research progress. "With the new FCC, we installed rack-mountable units from Datal Systems, but from a performance point of view, they are no different than the computer system that any home user might buy," said Davis. ●

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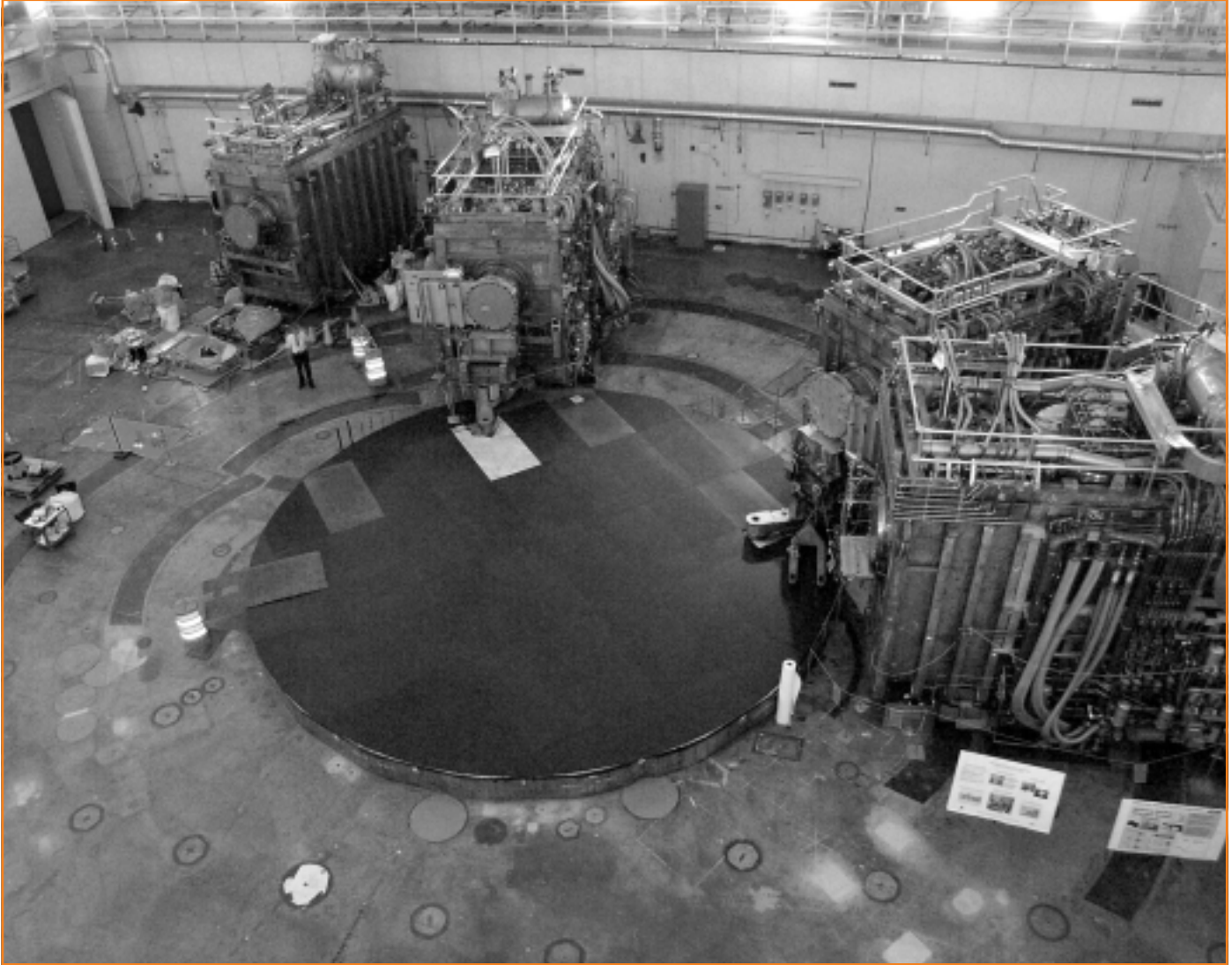
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PPPL Successfully Completes Removal of the Tokamak Fusion Test Reactor



The Tokamak Fusion Test Reactor (TFTR) Decommissioning and Decontamination Project has been successfully and safely completed on schedule and under budget. The project included approximately 145 person-years of fieldwork. A new and innovative technology, Diamond Wire Cutting, was developed and successfully used for the most challenging phase of the project: segmenting the TFTR vacuum vessel. Above is the former TFTR test cell. At upper left in the test cell is Project Manager Erik Perry.

PPPL Director Chairs New U.S. Planning Effort

P PPL Director Rob Goldston is the chair of a newly established 18-person panel “to develop a plan with the end goal of the start of operation of a demonstration [fusion] power plant in approximately 35 years.” The DOE Fusion Energy Science Advisory Committee created the panel in response to a request from DOE Office of Science Director Ray Orbach. The panel began meeting in October and will present a final report in March. ●

PPPL Celebrates 50 Years



At left, Robert Card, DOE Under Secretary for Energy, Science and Environment, tours the National Spherical Torus Experiment (NSTX) while attending the 50th anniversary celebration at PPPL on June 6. From left are PPPL Deputy Director Rich Hawryluk, NSTX Project Director Masa Ono, Card, Secretary of Energy Advisory Board Executive Director Craig Reed, DOE Office of Science Principal Deputy Director James Decker, and PPPL Director Rob Goldston. In the middle, N. Anne Davies, DOE Associate Director of Science for Fusion Energy Sciences, presents closing remarks. At right is the audience in the MBG Auditorium during one of the 50th talks.

In June, the Laboratory commemorated its scientific achievements during the past five decades by holding a three-day symposium, “A Celebration of High-temperature Plasma Physics.” More than 200 PPPL staff members and others attended the event, which featured technical talks about magnetic fusion, space and astrophysical plasmas, and inertial fusion plasma science, as well as a reception, tour, and banquet.

“The performance of the fusion community and this Laboratory has been outstanding. I really appreciate the value of the science done here,” said Robert Card, Department of Energy (DOE) Under Secretary for Energy, Science and Environment. Card, who described fusion as “the holy grail of clean energy,” was among the featured speakers from PPPL, the DOE, and other institutions.

Card also presented DOE Mentoring Awards to PPPL researchers Charles Gentile, Ronald Hatcher, and Hantao Ji. The citations recognized each recipient for his “dedication as a mentor, to share knowledge and to inspire and instill confidence in the next generation of scientists and engineers by setting high expectations, seeking creative solutions, and immersing inquisitive minds in the world of science.”

Raymond Orbach, Director of the DOE’s Office of Science, gave an encouraging speech at the symposium banquet about the future of fusion energy science research, and N. Anne Davies, of the DOE’s Office of Fusion Energy Sciences, gave opening and closing remarks during the celebration. “This institution – PPPL –

has played a leading role in this research since its founding,” said Davies.

PPPL Deputy Director Rich Hawryluk discussed the scientific progress during the past decade, while Lab Director Rob Goldston presented a talk, “Future Directions in Fusion Plasma Science Research.”

“We have made enormous progress and we have faced enormous challenges,” Hawryluk said about research during the past 10 years. He discussed results from experiments on the Tokamak Fusion Test Reactor, the capability for a high ratio of plasma pressure to magnetic field pressure on the National Spherical Torus Experiment, and the next machine to be sited at PPPL, the National Compact Stellarator Experiment. Hawryluk also noted how recent scientific excitement is driven by a “strong coupling between theory and experiments.”

Davies, closing the event, said that PPPL should have a birthday party every year so everyone could hear about the Lab’s accomplishments and progress. She noted how different the fusion program is now compared to just a decade ago. Topics now discussed in relation to plasma science research include climate change and CO₂ concentrations, alternate concepts, and vast improvements in modeling and computing.

Said Goldston, “We’re glad we made it to fifty and by the time we make it to a hundred, I think we’re going to be optimizing the details for an economy running on fusion energy.” ●

★ Awards ★ Awards ★ Awards ★ Awards ★ Awards ★

University of Wisconsin Honors Meade



P PPL Advanced Reactor Concepts Head Dale Meade (at left) received the Distinguished Alumni Fellow Award from the University of Wisconsin on May 10 in Madison. The university's Department of Physics established the award to recognize a graduate who has had an outstanding and meritorious career, as well as in appreciation of exceptional service to the Department. At right is University of Wisconsin Department of Physics Chair Don Reeder. ●

Goldston Named Director of the Year

P PPL Director Rob Goldston is a recipient of the 2002 Laboratory Director of the Year Award from the Federal Laboratory Consortium (FLC). Goldston (at right) was among three recipients honored for their contributions to the overall enhancement of technology transfer and the support of the FLC and its activities. PPPL Deputy Director Rich Hawryluk accepted the award on behalf of Goldston during the FLC's national meeting held in May in Little Rock, Ark. ●



PPPL Honored for Science Bowl Work



P PPL recently garnered a plaque for 10 years of continuous involvement in the National Science Bowl®. DOE Under Secretary Robert Card presented the plaque to PPPL Science Bowl Coordinator James Morgan (above) during the National Science Bowl®. The citation recognized the Lab's "support, dedication, and participation in the National Science Bowl for ten consecutive years." ●

PPPL Lauded for Safety Efforts



In recognition of its safety performance in 2001, PPPL recently received two New Jersey Governor's Occupational Safety & Health awards. The honors include a Recognition Award for outstanding performance and a Citation of Merit for the National Spherical Torus Experiment (NSTX) for working through the year without a lost-time injury or illness. From left are PPPL Environment, Safety & Health Head Jerry Levine, NSTX Project Head Masayuki Ono, PPPL Engineering and Technical Infrastructure Head Mike Williams, and NSTX Program Head Martin Peng, with the awards. ●

PPPL Inventors Honored at Annual Dinner



In May, forty-four inventors were honored during the twentieth annual Patent Awareness Program Recognition Dinner. The event recognized inventors who received patents, applied for patents, and disclosed inventions during Fiscal Year 2001. Those honored are from the Research, Engineering, and Technical staff of PPPL, as well as from other institutions that work in collaboration with the Lab. Those who attended the dinner are, from left (front row): Nikolai Gorelenkov, Schweickhard E. von Goeler, Manfred L. Bitter, James Gorman, Nathaniel Fisch, Keith Rule, Lane Roquemore, Geoff Gettelfinger, Phil Efthimion, and Kenneth Hill; (back row), John Desandro, Lewis Meixler, Rich Hawryluk, John Parker, Stephen Jardin, Charles Gentile, Robert Parsells, John Schmidt, Daniel Clark, Mike Kalish, Ben LeBlanc, Andy Carpe, Leonid Zakharov, and Erik Perry. ●

PPPL's Science Education Lab Opens Its Doors



PPPL Science Education Program Lead Scientist Andrew Post-Zwicker (left) works with students at the new Science Ed Lab.

In 2002, PPPL opened its new Plasma Science Education Laboratory. This innovative 3,600-square-foot classroom-laboratory is a fusion of physics research and educational opportunities for students and teachers alike. Large enough to handle a class of 25 or more students, it includes 12 individually powered lab benches that can be moved into a variety of configurations, depending upon the needs of a particular program. There are also small rooms for advanced projects, including small plasma physics experiments. The entire facility has a high-speed wireless connection to the Internet and a variety of desktop and laptop computers available. During the summer, the lab was the site of student and teacher workshops, as well as individual projects. ●

Female Students Take in a Day of Science



PPPL's Virginia Finley (left) gives a presentation about the Lab's environmental efforts to a group from the Rutgers University Douglass Science Institute.

Twenty-one female students participating in Rutgers University's Douglass Science Institute came to PPPL for a day of science during the summer. The young women toured the National Spherical Torus Experiment and learned about PPPL's environmental efforts. The visitors also had an opportunity to hear about careers at PPPL from various members of the staff. In addition, students participated in hands-on physics activities in the new Science Education Laboratory. The Douglass Science Institute offers pre-college women, who are interested in science and engineering, a chance to explore scientific research in a collegiate setting and learn the skills needed to be successful female scientists. The PPPL visit was coordinated by the Lab's Science Education Program staff. ●

New Rocket Scientists



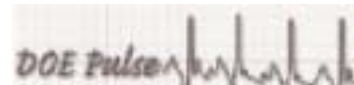
About a dozen Trenton-area students came to PPPL for two weeks during the summer to learn about energy and future energy sources. As participants in the second annual Plasma Academy, the ninth through twelfth graders studied the energy of motion and flight by designing, building, and testing water rockets, in addition to other activities. The academy was coordinated through the Mercer County Community College Upward Bound Program in partnership with PPPL. Above, academy participants test their water rockets. ●

Communiversality 2002

Photo by Tony DeMeo



PPPPL provided an exhibit at Communiversality Day, the annual town-gown festival in Princeton last spring. More than 1,000 individuals stopped by to learn more about fusion. Above, PPPL physicists Robert Budny (far left) and Hutch Neilson field questions. ●



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PPPL Holds Second Annual Safety Forum

In October, PPPL convened its 2nd Annual “Safety Forum,” which was designed to engage PPPL staff in the review, discussion, and improvement of the Lab’s health and safety program. The forum was a special opportunity to collectively consider ways to improve safety and reduce the risks of injury while working at PPPL. The forum included presentations by PPPL Director Rob Goldston, PPPL Deputy Director Rich Hawryluk, and ES&H and Infrastructure Support Head Jack Anderson (above, right), and a welcome by Michael Roberts, of the DOE’s Office of Fusion Energy Sciences. In addition, work group sessions provided an opportunity for staff to focus on specific topics, such as hazard analysis, training, and communication. ●



America Recycles Day



PPPL celebrated “America Recycles Day” in October with exhibitors at the Lab and a special program. The program featured a skit starring PPPL’s Margaret Kevin-King (left) and Thomas McGeachen (right), and John Bennevich (middle), as well as a report about PPPL’s performance in recycling and buying recycled-content items in 2002. ●

Firefighters Conduct Fire Prevention Demos

PPPL’s Site Protection staff showed off their finest gear and gave demonstrations at the Lab during Fire Prevention Week, celebrated the second week of October. With the theme, “Team UP for Fire Safety,” the firefighters encouraged employees to recognize the role they play in keeping their homes — and workplace — fire-safe. The Lab’s firefighters offered fire extinguisher training in the Cafeteria Courtyard, as well as distributed handouts about fire safety and exhibited fire fighting clothing and equipment.

Displays included photos of hazards, which employees were invited to identify. Equipment on display featured a self-contained breathing apparatus used by firefighters when entering burning buildings and a thermal imaging camera that identifies heat. “Being able to find hot areas in a smoke-filled building or room helps firefighters find victims more easily and quickly, often saving lives,” said Captain Dave Neuman of the special camera. Neuman organized the Fire Prevention Week activities for staff. ●

At top right, PPPL Site Protection staff members Michael Loh (left) and Kevin Rhoades operate the Fire Prevention Week displays and demonstrate (at bottom) how to operate a fire extinguisher (with Loh at right) in the Cafeteria Courtyard.

