



HOTLINE

PRINCETON PLASMA PHYSICS LABORATORY

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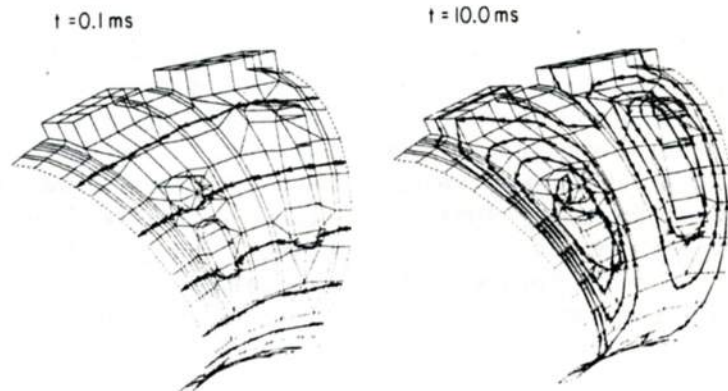
Designing a machine as complex as a tokamak is no easy task. Any alteration to one device parameter may adversely affect other design considerations. One major design difficulty comes from eddy currents, which can have devastating effects on delicate machine components. Fortunately, a PPL-designed computer code named SPARK has significantly simplified the designer's job.

For fusion devices such as TFTR, normal operation of a coil system can induce large electrical eddy currents in surrounding metallic components. Moreover, plasma disruptions can result in the formation of very large eddy currents.

Eddy currents are undesirable secondary electrical currents, caused by rapidly changing magnetic fields. The rate of magnetic field change is important: the faster the change, the stronger the eddy currents produced. Eddy currents are generally unwanted because they waste energy, and can cause both arcing (which can ruin diagnostic results) and resistive heating (which contributes to thermal stress) in the structure of fusion devices.

In addition, eddy currents create force when they flow through a magnetic field. If the forces in a particular

SPARK Code Developed At PPL



SPARK code rendering of a TFTR vacuum vessel segment during a plasma disruption.

component are great enough, significant mechanical stresses can in turn be produced in the components. The resulting pull could be strong enough to damage components, such as the graphite tiles within the TFTR vacuum vessel. Repairing such damage can involve considerable time and money.

Since eddy currents run in closed electric circuits, every effort is made during the machine design phase to eliminate structural loops which can carry them. Yet overdesigning to compensate for every imaginable eddy current occurrence is impractical.

The SPARK code, which is a highly automated, general geometry computer program, was developed in an effort to study the forces acting on conductors with large surface areas. By using SPARK, designers can better predict

many of the damaging effects that eddy currents may produce during machine operation, thus saving money by designing to counteract those effects.

The SPARK code was devised entirely at PPL by members of the Electromagnetics Branch of the Engineering Analysis Division. Staff members work on designing and analyzing magnetic field systems, examining their interaction with associated electrical and mechanical systems. The branch also researches the optimization of magnetic configurations, along with analyses of transient eddy currents and their related magnetodynamic effects.

The initial research spark for SPARK was provided by basic circular coil analyses Uffe Christensen conducted prior to 1979. Don Weissenburger

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began eddy current analysis for the TFTR vacuum vessel in early 1979, devising a dedicated, less flexible computer code after approximately six months of work. It demonstrated the success of the computer eddy current analysis method, and provided the research foundation SPARK was eventually built on.

In its initial form, SPARK took Don approximately 18 months to develop. This preliminary code was used to analyze several designs of the TFTR internal vacuum vessel hardware, including limiters and protective plates. Refinements and improvements to the code are ongoing; since the initial version of SPARK, Don has improved the speed of the major code steps from 10 to 100 times (depending on the system it's being used on). He's also working on increasing the size of the problems the code can handle, as well as SPARK's "user-friendliness."

SPARK is not a tokamak-specific computer code, nor is it dedicated solely to the magnetic fusion program. It can be used for other applications in the field of magnetics, and is currently being used in research projects at Sandia and MIT.

The SPARK code simplifies the myriad complex of mathematical equations needed to calculate transient eddy currents and their resulting fields by employing a mesh network system. The mesh network reduces the number of equations to be solved during analysis, using geometry input to calculate mechanical load output compatible with existing structural analysis programs, such as NASTRAN. The code permits calculation of the force on specific machine areas so the results can then be "plugged into" a structural analysis code with a minimum of reworking. For example, SPARK was used to develop a detailed TFTR vac-

uum vessel model for analyzing the combined effect of the principal eddy currents that occur during plasma disruptions.

SPARK also takes advantage of symmetry; it can extrapolate the eddy currents and forces on the entire vacuum vessel from input recorded for only one segment of the vacuum vessel.

In 1983, SPARK was used in the design of the TFTR bumper limiters. It has also been utilized in advanced studies of proposed devices such as the TFCX, and is now on the NMFEC (National Magnetic Fusion Energy Computer Center) Cray computer system, where it was used to analyze the effect of eddy currents on the TFTR toroidal-field coil system in more depth. The Joint European Torus (JET) team was expected to have a tailor-made version of SPARK operational by the end of February.

Former PPL Assistant Director Dr. Earl C. Tanner, 65, died February 11 in Florida Hospital, Orlando, Fla.

Dr. Tanner joined the laboratory as Assistant to the Director of Project Matterhorn in November 1958. He became Assistant Director in 1964, and was named PPL's Assistant Director of Special Projects in 1977. He authored three books on the history of PPL: "Project Matterhorn," "The Model C Decade," and "The First Princeton Tokamaks."

A member of the American Physical Society, Dr. Tanner served as assistant dean of the Princeton University Graduate School from 1968 to 1969. He retired from the

EARL TANNER



University staff three years ago.

Born in Providence, R.I., Dr. Tanner lived in Lawrenceville for over 25 years before mov-

ing to Lake County, Florida in 1982. He received a bachelor's degree in physics from Brown University in 1941, earning his master's degree from the same school in 1947. He was awarded a Ph.D. in history from Harvard University in 1951.

Dr. Tanner is survived by his wife, Mary Nelson Tanner; a son, Harold M. Tanner; a daughter, Martha C. Tanner; and his mother, Kate Cushman Tanner.

Private memorial services were held in Providence, R.I. Memorial contributions may be made to the Mohonk Preserve, Mohonk Lake, New Paltz, NY, 12561; or to the Florida Hospital, 601 E. Rollins St., Orlando, Fla.

Janitorial Awards

The crew that cleans up your lab or office can now "clean up" with commendations, thanks to the new Janitorial Department awards program.

The program, which officially begins in March, was the brainchild of Janitorial Supervisor Jerry Williams. The program also has the support of Plant Maintenance and Operations Branch Manager Ray Pressburger, Plant Engineering Division Head Connie Stout, and Bob Smart, Associate Head of the Administration Department and General Manager of Facilities.

The program is part of an effort to acknowledge the contributions members of the PPL janitorial staff make toward enhancing their department's overall productivity. To be eligible for the monthly award, staff members must have a 100 percent attendance record during the month. Weekly inspections are made by Jerry Williams and a janitorial foreman, with points awarded for the completeness of a variety of maintenance operations. Points can also be earned for working accident free, making suggestions that are adopted, and by keeping personal appearance, equipment, and work orders tidy. At the end of each month, point totals are tallied and a winner chosen.

The monthly award winner's photo is posted on a special bulletin board near the employee entrance to C-Site. In addition, monthly winners receive an award certificate, a special badge to be worn during the month, and a letter of

commendation entered in their personnel file.

Monthly award winners are also eligible for a semi-annual award, which will consist of a gift certificate to a local merchant or a complementary dinner at an area restaurant. Semi-annual winners will be featured in future editions of HOTLINE.

For further details about the janitorial awards program, call Jerry Williams at ext. 3595.

Directories Available

The Princeton Area Council of Community Services has reprinted three popular directories: Volunteer Opportunities Directory, Child Care Directory, and Senior Directory.

The Volunteer Opportunities Directory identifies and describes volunteer positions available with human service organizations in Princeton area communities. The Child Care Directory provides a wealth of useful information about area pre-school, day care, cooperative, extended day, and after-school programs. And the Senior Directory offers a comprehensive listing of services for older people who live in Mercer, Middlesex, and Somerset Counties.

All three directories are free to the public. Copies may be obtained at local libraries; the Princeton Area Council of Community Services office at 25 Valley Road, Princeton; or by calling 609-924-5865 or 609-799-6033. The Council is supported by the United Way-Princeton Area Communities.



Security Checkpoints

The Forrester Security Office welcomes suggestions from employees for improving security measures in either a small area or lab-wide. Employees may write a memo or telephone the Security Office with their ideas. Each PPL employee can contribute to the security of the lab by practicing a few simple preventative measures:

- Make certain that your office or lab is locked whenever you leave.
- Always lock your office or lab before going to lunch or leaving for the day.
- Attractive personal property or sensitive items should never be left unattended. Take such items with you, or lock them in your desk or filing cabinet whenever you are leaving.
- Keep a record of the serial numbers of your personal property, including sensitive items, and secure it in a safe place for possible future reference. You may want to include information on brand name, model number, serial number, or other descriptive information.
- Check the whereabouts of your personal property frequently. Misplaced items are easily stolen.
- Keep your auto locked and avoid leaving property where it is visible. Never leave the keys in the vehicle.

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Security will engrave your personal property with your name, initials, and/or Social Security number if you desire.

Remember, once you have something stolen the best chance for recovering it is a rapid and accurate reporting of ALL the information to the Security Department. Don't wait -- report any thefts immediately!

First Call For Help

Need help and don't know where to turn? FIRST CALL FOR HELP provides free confidential social and health services information and referral to those who live and work in the greater Princeton area. A service of the Princeton Area Council of Community Services, the helpline is staffed from 9 a.m. to 4:30 p.m. Monday through Friday. Call 609-924-5865 or 609-799-6033.

TRANSITIONS

The HOTLINE offers its congratulations to the following employees, who recently became proud parents:

Mike Serediuk of the Tech Shop and his wife Paula, whose daughter, Christina Marie, was born on December 29;

Jim Corl of TFTR and his wife Diane, whose daughter, Jamie Lee, was born on January 13;

Jo Crosby of Plant Maintenance and Operations and her husband John, whose daughter, Nicole Elizabeth, was born on February 19.

University League Notes

The International Center's annual International Festival will be held on Sunday, April 21. Anyone interested in planning for or participating in the Festival should call Paula Chow of the University League at 609-452-5006.

Meg's



Guinea Pigs

FREE TO GOOD HOME --

Healthy adult guinea pig. Comes with all accessories and three months' supply of food and litter. Call Meg Gilbert in Personnel, ext. 2036.

Safety Training

The following Health and Safety training courses are scheduled for March:

<u>Course</u>	<u>Responsible Instructor</u>	<u>Date Scheduled</u>
Defensive Driving	P. Zeedyk Ext. 3736	March 12, 19, and 26 8:30-11:45 a.m.
Fire Extinguisher Training	S. Larson Ext. 3166	March 12 and 26 2-3:30 p.m.
Self Contained Breathing Apparatus	S. Larson Ext. 3166	March 13 9:30-11:30 a.m.
Back Injury Protection	M.A. McBride Ext. 3468	March 14 8:30 a.m.-12:30 p.m.
Cardiopulmonary Resuscitation (CPR)	S. Larson Ext. 3166	March 18, 20, and 22 9 a.m.-noon OR 1-4 p.m.

Employees must obtain permission from their immediate supervisor to attend these classes. Supervisors must call the responsible instructor to enroll their employees.



United Way

AT WORK

What to do with the children is a problem facing a growing number of working parents in the greater Princeton area. Even when a child care agency is found, how can parents be confident that it is reputable?

To help solve this perplexing problem, a free child care directory listing nearly 50 local programs is available from the Princeton Council of Community Services. The Council is a member agency of the United Way-Princeton Area Communities.

The directory lists child care programs and agencies by community, as well as by the type of program available (day care, extended day, or after-school). Programs are currently listed for Cranbury, East Windsor, Hightstown, Lawrenceville, Montgomery Township, Rocky Hill, Princeton, and West Windsor.

The name, address, and telephone number for each program is included, along with the director's name, the age group served, total enrollment, length of school year, and hours of operation. Details on staff composition, holidays, food service, registration requirements, tuition cost, registration deadlines, and other distinctive features are also listed.

The directory offers detailed guidelines on how to select a good preschool program. For

example, the directory recommends that parents visit at least three schools for an entire morning or afternoon class session prior to comparing programs. When visiting, parents should observe the teachers, the children, and the physical appearance of the building. Parents should also request a sample of the curriculum.

Copies of the directory are available from the Council's office at 25 Valley Road, Princeton, or at any of the libraries in the 13 communities served by the Council and the United Way. These communities include Cranbury, East Windsor, Griggstown, Hightstown, Kingston, Montgomery Township, Plainsboro, Princeton, Rocky Hill, West Windsor, and adjacent areas of Hopewell, Lawrence, and South Brunswick Township. The Council can be reached by calling 609-924-5865 or 609-799-6033.

This directory is possible thanks to contributions to the United Way, which support the services of its member agencies.

Volunteers:

People People

The following volunteer listings were provided to the HOTLINE by the Princeton Area Council of Community Services, a member agency of the United Way-Princeton Area Communities. For further information on any volunteer position, contact each agency directly.

- The Mercer County Unit of the American Cancer Society is seeking ex-smokers, nurses, and sales personalities to help with

their educational programs. Drivers are also needed to transport patients to and from treatment, as are fundraisers to work on a variety of year-round events. More details are available from the Unit by calling 609-394-5000.

- The Citizen Advocacy Program is designed to help integrate people suffering from mental retardation, cerebral palsy, or epilepsy into society, and to help insure their legal rights. Volunteers are screened, trained, and matched on a one-to-one basis with a handicapped individual. Volunteers offer practical assistance, such as teaching a client to cook, shop, use public transportation, or learn money management skills. Lend your assistance to the Program by calling 609-443-1733.

- The Florence Crittenton Home in Trenton is a residential maternity care facility for unwed mothers. Volunteers are needed to teach arts and crafts, as well as other subjects of interest to teenagers. If your interest is piqued, call the Home at 609-695-8579.

The next three volunteer positions were furnished by the United Way of Somerset Valley. Additional information is available by contacting each agency directly.

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- Big Brothers/Big Sisters of Raritan needs volunteers willing to establish a one-to-one relationship with a child from a single parent household. To become a child's "special someone," call 201-722-3630.
- The Carrier Foundation of Belle Mead is seeking volunteers to help out in the patient library, at the registration desk, and in the pharmacy. Admission and clerical aides, crafts teachers, and patient visitors are also needed. To offer your aid, call the Foundation at 201-874-4000.
- The Douglass Developmental Disabilities Center of Douglass College, New Brunswick needs volunteer tutors to work with one or two autistic children. Supervision will be provided by members of the Center's professional staff. To lend a helping hand, call 201-932-9137.

The next volunteer opportunities were supplied by the Voluntary Action Center (VAC) of Middlesex County. For further information about any listing, contact the VAC at 201-249-8910.

- Is finding money your forte? The United Campus Ministry at Rutgers University needs volunteers to work with its board on financial management, fundraising, and budgeting. Call the VAC for more details

- A number of agencies need clerical assistance, and many also need drivers to take their clients shopping, to the doctor for treatment, and so on. For a list of specific agencies, call the VAC.

These final volunteer openings were submitted by the Voluntary Action Center (VAC) of Morris County. For more information on any of these listings, contact the VAC at 201-538-7200.

- Enjoy bowling? Spend a Sunday morning at the lanes with an eager group of handicapped bowlers. Call the VAC to get the ball rolling.
- Experienced adult trainers, as well as group and discussion leaders, are being sought for a fall pilot program. The program will be presented to boards of directors of non-profit organizations. Discussion leaders will receive training, and can schedule their own time. To offer your aid, contact the VAC.
- A national health organization will be conducting their annual fund drive in April. Community chairpeople are needed now to help organize the campaign. This short-term assignment requires organizational experience rather than solicitation. To lend a hand, call the VAC.

OSHA Violations

The following safety reminders are drawn from a list of common OSHA (Occupational Safety and Health Administration) violations:

- All wood parts shall be free from sharp edges and splinters, as well as visually sound and free of shake, wane, compression failures, decay, and other irregularities. Low-density wood shall not be used.
- Ladders shall be inspected frequently, and those which have developed defects shall be withdrawn from service for repair or destruction, and tagged or marked as "Dangerous, Do Not Use."
- Ladders must be maintained in good, useable condition at all times. Hardware fittings and accessories should be checked frequently and kept in good working condition.
- Every automatic sprinkler, fire detection, or other alarm system, exit light, fire door, or other emergency equipment must be continuously maintained in proper operating condition.

The PPL Hotline is issued by the Princeton University Plasma Physics Laboratory, a research facility supported by the U. S. Department of Energy. Correspondence should be directed to PPL Information Services, Module 2, C-Site, James Forrest Campus, ext. 2754.