

SCANFAX

February 1999

Volume 51, Issue 2



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Institute of Electrical & Electronics Engineers
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from Some Very "Small" Perspectives**

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Chairman

Howard W. Penrose
Phone 630-851-5172
312-355-3480
Fax 630-851-5209
h.penrose@ieeee.org

Editor

Gerry Ryan
Phone 312-214-8124
Fax 312-214-1510

Publisher

Barbara Slack
Slack Attack Advertising

Art Director

Nancy P. Lee
Slack Attack Advertising

Advertising Sales

Beth Vander Grinten
Slack Attack Advertising
608-222-7630

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February 1999

Volume 51, Issue 2

SCANFAX

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In an old iron mine 2,340 feet below the town of Soudan, Minnesota, researchers from Argonne Laboratories and other institutions are conducting experiments on protons and neutrinos, those fundamental subatomic particles that function as the building blocks of all matter.

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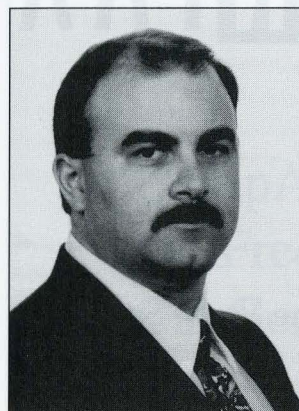
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On the cover: One of the Soudan detector modules is lowered into the same elevator tourists use for the half-mile trip down to the detector cavity. The Soudan 2 detector is a stack of 224 such modules, each about a meter across and weighing 4.3 tons. The detector's underground location screens out cosmic rays.

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Chairman's Message



Howard W. Penrose
IEEE Chicago Section,
Chairman

Welcome to another month of exciting programs organized and presented by your section, sub-sections, and chapters.

This month you will notice another joint meeting between parts of the IEEE Chicago Section and other organizations. In this case it is UniForum Chicago in association with the IEEE Chicago Section, Fox Valley Subsection, Computer Society Chapter, and Engineering Management and Professional Communication for a workshop on Internet Security. In this case, we are looking at a credit for each member who attends. So, in addition to obtaining excellent information on this

topic, you will be contributing to the Chicago Section and the other programs we are providing to you.

Engineers week is February 21 to 27, 1999. There are a number of programs including student outreach programs, Future City, MATHCOUNTS, and poster essay competitions. DuPage is having its annual Area Engineers Week Program at the IIT Rice Campus in Wheaton on February 19 and 20, 1999. I strongly encourage engineers to participate in these programs as they foster the development of our younger generation into selecting a career in engineering.

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The Soudan 2 detector's alternating sheets of iron and detector material were painstakingly assembled by hand. Each module contains a stack of 240 sheets of corrugated iron, interleaved with 7,560 plastic "drift tubes." Two-thirds of the modules were assembled at Argonne's Illinois site, near Chicago; the rest were built at Rutherford Appleton Laboratory in England.

"Universal" Viewpoints from Some Very "Small" Perspectives

By: Christine M. Sloat, P.E.

Have you ever visited northern Minnesota? Activities like canoeing, boating, fishing, cross-country skiing and more draw outdoor enthusiasts to the region regularly. And this time of year, the area is truly a winter wonderland. Would you believe that, about one half mile below the surface of the region's snow covered hills and frozen lakes, engineers and

scientists may be seeking clues to the fate of the universe? In an old iron mine 2,340 feet below the town of Soudan, Minnesota, researchers from Argonne Laboratories and other institutions are conducting experiments on protons and neutrinos, those fundamental subatomic particles that function as the building blocks of all matter.

Everyone with the most basic education knows that protons are the positively charged particles that make up

Would you believe that, about one half mile below the surface of the region's snow covered hills and frozen lakes, engineers and scientists may be determining the fate of the universe?

Continued on page 4.

part of every nucleus of every atom in the universe. Researchers in this underground laboratory are studying whether or not protons decay into other particles. A free proton's half-life (the period in which it has a 50-50 chance of decaying into other particles) may be longer than 10 to the 31st power years... that's a one with 31 zeros after it! That's a long time for even the most dedicated of scientists to wait around for! And so, the thou-

sand-ton Soudan 2 proton decay detector is put to work to determine whether these minute particles will eventually "dissolve" into something else. The Soudan 2 detector contains more than 10 to the 31st power protons in the form of iron sheets, which are monitored by sensitive particle detectors listening for a single proton's death rattle.

This phenomenal physics vision is a collaboration between Argonne's High Energy Physics Division, the University of Minnesota, Tufts

University and England's Rutherford Appleton Laboratory and Oxford University. The experiment began taking data in 1988, with 275 of the detector's 960 tons in operation. The electronic signature of a proton's demise would contribute to a better understanding of three of the universe's four fundamental forces: electromagnetism and the strong and weak nuclear forces that bind matter together. (The fourth force is gravity.) In the most basic sense, the experiment's outcome, the fundamental interaction of proton decay, represents a process never before observed. In an expanded sense, outcomes will represent much more. Observing the types and energies of particles released during the "decay mode" would help scientists to choose from among the numerous theories of how fundamental forces were unified during the "creation" of the universe, and then later separated as the Big Bang cooled. About half of the anticipated data sample has been collected to date, and is now being analyzed.

As the search for proton decay continued, at Soudan and other underground detectors, it soon became apparent that cosmic-ray neutrino interactions, predicted to be the main background to proton decay, were very different from theoretical predictions. Cosmic-ray neutrinos originate from cosmic-ray collisions in the earth's atmosphere. Neutrinos have no electric charge and interact only rarely with matter. The particles' mass is believed to be very small, if they have any mass at all. Data about cosmic-ray neutrinos from other experiments have hinted at a phenomenon known as "neutrino oscillation:" neutrinos may spontaneously change from one type to another as they travel. Such oscillations would constitute positive proof that neutrinos do have mass. Current theory calls for three "flavors" of neutrinos: the electron, muon and tau neutrinos. Past experiments have concluded that all neutrino masses are too small to be measured directly. The oscillation phenomenon allows experiments to probe much smaller masses than can be measured directly.

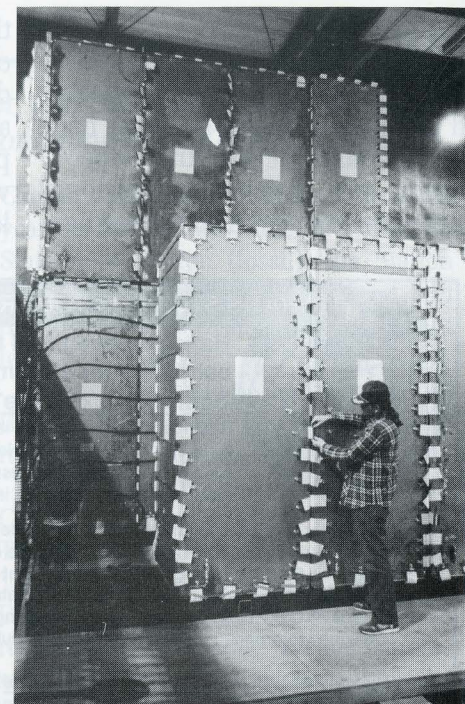
The discovery of neutrino oscillations could provide a new tool that

will dramatically increase our knowledge of energy and matter in the universe. For example, measurements of neutrino masses in oscillation experiments would provide the information needed to expand the "Standard Model" theory of energy and matter (a theory that considers neutrinos completely massless), and shed new light on the nature of mass. Neutrino telescopes here on earth may soon record neutrinos produced by distant stars and galaxies, and interpretation of their observations will require knowledge of oscillations. Finally, neutrinos produced during the evolution of the universe, immediately after the Big Bang, are still all around us. At an estimated 300 neutrinos per cubic centimeter everywhere in the universe, even very small neutrino masses could contribute to the "dark matter" problem of cosmology. And, as with protons, small neutrino masses could even have had a profound effect on the early development of the universe itself.

Experiments on neutrinos will take advantage of the Soudan 2 detector.

Actually, Soudan 2 already detects cosmic-ray neutrinos that travel through the 2,340 feet of rock above the instrument... and through the 8,000 miles of planet earth beneath it! The detector will soon have enough data to check the reports of neutrino oscillations from earlier experiments, which used different and less sophisticated detection techniques. And a new project will take advantage of the detector at Soudan, as well as a major upgrade of the accelerator at the Fermi National Accelerator Laboratory (Fermilab) at Batavia, Illinois.

Researchers at Japan's Super-Kamiokande detector recently announced the discovery of neutrino oscillations. Often called the Super-K, the Japanese detector is a stainless steel chamber filled with 12.5 million gallons of water. This enormous "water tank" is lined with sensitive light detectors. The 960 tons of iron plates honeycombed with more than 1,500,000 "drift tubes" that detect charged particles that comprises the Soudan instrument is radically different from the Japanese device.



A technician connects a module to a cluster of workstation computers in the underground laboratory. The computers perform an initial analysis of the recorded data, and allow individual events to be examined by physicists. The computer system was designed and constructed by Argonne scientists.

Continued on page 6.



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Tuesday, February 2

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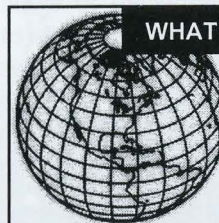
Although Soudan is much smaller, and therefore observes far fewer neutrino interactions than the Super-K detector, any observations made at Soudan become significant as verifica-

tion of the Japanese experiment's conclusions. In addition, the Soudan detector can measure the directions and energies of incoming neutrinos precisely, a capability particularly valuable in the ongoing study of oscillations.

A consistent picture of neutrino oscillations is emerging from the two independent experiments with very different detector types. Preliminary findings from both groups support earlier reports. Physicists on both sides of the Pacific found fewer muon neutrinos than expected, suggesting that some of them had changed into another type, perhaps tau neutrinos. (Preliminary Soudan results reported at the Neutrino '98 conference are available in the proceedings on the World Wide Web at [HYPERLINK](http://www-sk.icrr.u-tokyo.ac.jp/nu98/) <http://www-sk.icrr.u-tokyo.ac.jp/nu98/> <http://www-sk.icrr.u-tokyo.ac.jp/nu98/>)

Experiments with cosmic-ray neutrinos provide only limited information about oscillations. For further progress, scientists have concluded that the carefully controlled conditions of an accelerator neutrino beam will add a new dimension in the study of neutrino oscillations. Such a beam is under construction at Fermilab to provide the world's largest intensity source of high-energy neutrinos. An experiment, called MINOS (Main

Continued on page 8



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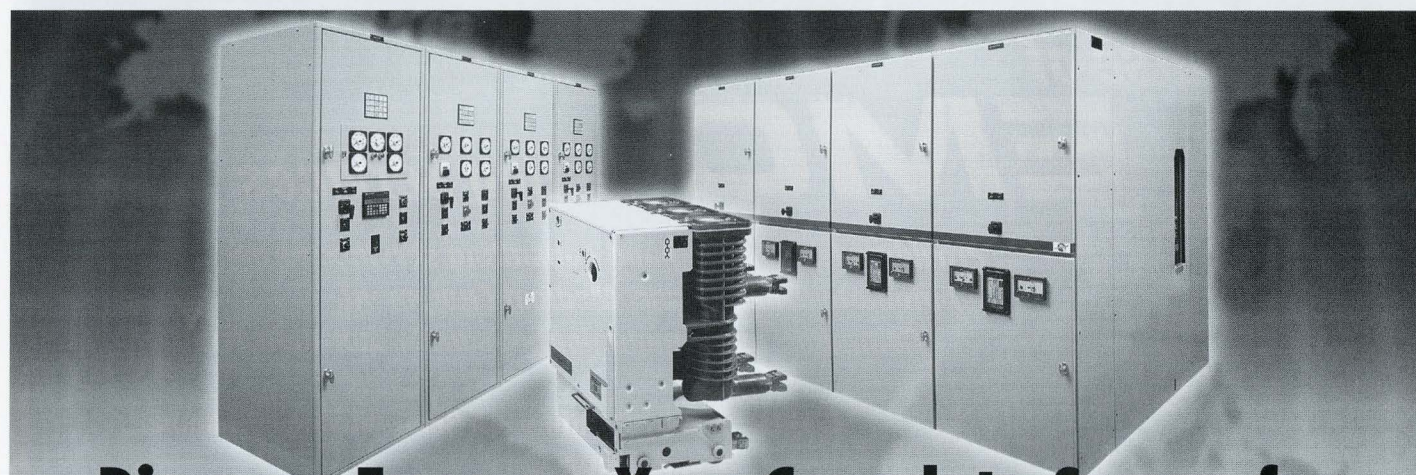
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IEEE PES CHICAGO CHAPTER

Conversion of Two Zion 1220 Mva Generators to Synchronous Condenser Operation

Wednesday,
February 10, 1999

Raymond F. Cameron, Staff Engineer, and Thomas W. Kay, Technical Studies Director in T&D Planning, Commonwealth Edison Company

About the topic:

During the spring of 1998, Commonwealth Edison Company successfully modified two retired 1220 Mva nuclear generators for operation as synchronous condensers. This presentation will discuss the planning studies which identified the need for the synchronous condenser, alternative starting mechanisms considered, and operational issues and experience with the synchronous condenser.

The justification for the synchronous condenser was demonstrated by planning studies which showed the critical need for voltage support after the Zion generators were retired. The synchronous condensers enabled ComEd to maintain voltage stability margins to the same level as before the generators were retired.

During the design stage, one of the biggest challenges in the conversion to synchronous condenser was designing the starting mechanism. Several alternatives were investigated, including utilization of a starting motor to accelerate the generators to synchronous speed, and utilization of a variable frequency drive to accelerate the generator from a standstill.

The first synchronous condenser was synchronized ahead of schedule on May 25, 1998. The second unit was synchronized on June 2, 1998. The synchronous condensers proved to be a very valuable asset during operation during the summer of 1998. Operation of the synchronous condensers enabled ComEd to maintain adequate voltage stability margins throughout the summer.

About the speakers:

Ray Cameron works for ComEd in Chicago. His current position is as an equipment specialist in the Technical Services Area where he shares responsibility for the technical requirements of large power transformers on the ComEd system. Ray has worked for ComEd since 1972 (26 years). Prior to his current position, Ray was involved with large rotating machinery (motors and generators) and isolated phase bus duct at

LUNCH MEETING

ComEd's generating stations. Over the years he has also worked at Zion Station, State Line Station (fossil), the Station Electrical Engineering Department and the Operational Analysis Department (electrical testing).

Ray is a graduate of the University of Illinois at Chicago Circle, where he received a B.S. in Engineering.

Tom Kay works for ComEd in Chicago. His current position is Technical Studies Director in the Transmission & Distribution Planning Department. In this position, he is responsible for special system studies such as stability and switching transient studies; equipment, line and cable ratings; and computer support for engineering analysis. Tom has worked for ComEd since 1980 (18 years). Prior to his current position, Tom was involved with the development and implementation of EMS and SCADA systems, distribution automation, automated meter reading, and other engineering positions.

Tom is a graduate of the University of Illinois in Urbana-Champaign, where he received a B.S. and M.S. in Electrical Engineering. Tom is a Registered Professional Engineer in the state of Illinois.

Location:

Chicago Bar Association, 321 South Plymouth Court (near Jackson and Dearborn), Chicago, IL 60604.

Time:

Social: 11:30am.
Lunch: 12:00pm.(optional)
Presentation: 12:15pm.
Meeting Adjourns: 1:00pm.

Lunch tickets can be purchased in the lobby bookstore (\$10.50). Please call the IEEE Business Office at (800) 898-IEEE to make your reservation. For more information, please visit the Chicago Chapter IEEE PES web site: http://www.ece.iit.edu/~flueck/chicago_pes/ Dr. Alexander J. Flueck; email: flueck@ece.iit.edu, Electrical and Computer Engineering; phone: 312.567.3625, Illinois Institute of Technology, fax: 312.567.8976, Chicago, IL 60616-3793. <http://www.ece.iit.edu/~flueck/>

Injector Neutrino Oscillation Search), has been designed to study in detail the oscillation effects observed at both Soudan and Super-K. This latest experiment is a collaboration between high-energy physicists at Argonne, Fermi and 21 other institutions in the US, Britain, Russia and China.

When the MINOS experiment is functional, Fermilab's Main Injector will be used to generate a beam of nearly pure muon neutrinos, aimed

into the ground at a three-degree angle toward the northwest, in direct line with the Soudan installation. To a neutrino, the intervening 453 miles of solid rock are as transparent as a pane of glass. If neutrinos do oscillate, as the Super-K results indicate, the beam arriving at the underground Soudan laboratory is expected to create signals indicating a significant number of tau neutrinos, or perhaps some other type produced by oscillations. The experiment should be able to confirm Super-K results in a very pre-

cise way, and will also be able to identify, for the first time, the type of neutrinos produced by oscillations.

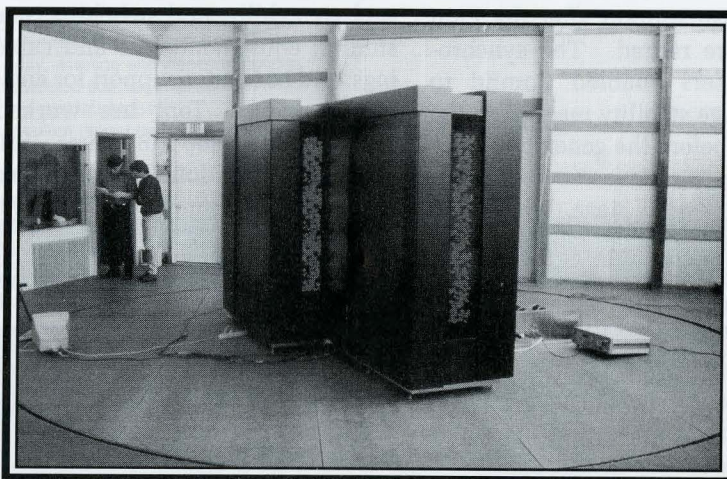
Very similar neutrino detectors at both Fermi and Soudan will measure the MINOS neutrino beam, allowing precise studies of the changes in beam composition caused by oscillations. In addition, adjusting the beam energy can maximize changes. Argonne and other MINOS collaborators will construct a new 8,000-ton neutrino detector adjacent to the Soudan detector. The MINOS experiment is scheduled to begin taking data in 2002.

And so, the next time you travel between Illinois and the outdoor wonderland of northern Minnesota, consider this... small, subatomic particles may be travelling with you, well below the Earth's surface. And when they arrive at their destination, these neutrinos may very well change our scientific outlook on the universe.

Our thanks to the Public Affairs Office at Argonne for supplying information and text for use in this article. To follow the progress of these experiments, visit the web sites of both Argonne HYPERLINK <http://www.anl.gov/> and Fermi HYPERLINK <http://www.fnal.gov/> <http://www.fnal.gov/> ■

Christine M. Sloat, P.E. is sole proprietor of Copper Creek... a consulting group. The enterprise specializes in public relations for engineered projects and products, as well as training programs for program and project management issues related to engineering. Clients include several trade/technical publications, the Wisconsin Governor's New Product Award Program, and the Wisconsin QBS (Qualification Based Selection) Program. Holding a B.S. in Civil Engineering from Michigan Technological University, and specializing in water resources, Ms. Sloat also performs engineering services for erosion control, dam design, and other surface water related engineering projects.

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Speaker	Topics
Doug Price	Firewalls and Proxies (Proxy Servers)
Glenn Stafford	Host Monitoring Tools: cops, tripwire, iss, topwrappers, Satan, Santa, Tiger, etc.
Mike Andrews	Router configurations: logic IP filtering, Cisco Access Lists, etc.
Hemant Shaw	Common Attack methods and their corresponding countermeasures
Venkat	Java Security, Digital Signatures, etc.
To be announced	Anticipated topics: Intrusion Detection, E-Commerce

Location:

College of DuPage in Glen Ellyn, IL, 22nd Street and Lambert Road, between Butterfield Road and Roosevelt Road. For more detailed travel directions please contact Joe Feitler via e-mail at j.feitler@ieee.org or at 630-467-8310 (office) during business hours. (also accepts voice mail)

Time: 9:30 am to 5:30 pm

Cost: \$75 for UniForum Chicago Members

\$75 for IEEE members with a reservation prior to Feb. 10th, 1999.

\$40 for IEEE student members with a reservation prior to Feb. 10th, 1999.

\$100 for non-members, for later registrations, and "walk-ins." (includes lunch and handouts)

Notes:

1. Please make your checks payable to "UniForum Chicago"
2. We cannot accept credit card payments or purchase orders
3. Student attendance may be limited due to space limitations
4. Late registrants and "walk-ins" may be subject to space limitations
5. IEEE student members and members: please bring your IEEE membership cards to verify your eligibility for reduced fees!

Early reservations are recommended due to the limited number of 60 available seats in the room.

For reservations please contact our IEEE Business Office at 800-898-IEEE (800-898-4333) during business hours using your IEEE membership number to ask for a reduced fee before the deadline.

The announcement for this workshop also appears at UniForum's Web Page: <http://uniforum.chi.il.us>

If you need more information about the topics being covered please call UniForum's Workshop Coordinator Al Thomas at 630-859-1685 or send him e-mail at a_c_thomas@hotmail.com

IEEE CHICAGO, FOX VALLEY SUBSECTION, COMPUTER SOCIETY, JOINT CHAPTER ON ENGINEERING MANAGEMENT & PROFESSIONAL COMMUNICATION

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ANNUAL AWARDS BANQUET

Saturday, April 24, 1999

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AWARDS

IEEE Fellow Awards

IEEE College/University Student Chapter
Awards

You may wish to form a group for a table of 10.

**FOR TICKET INFORMATION & TABLE RESERVATIONS
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Please contact us by April 15th to let us know if you prefer
a fish or vegetarian meal.

ANNUAL AWARDS BANQUET

Please mark your calendar for
Saturday, April 24, 1999 to honor
our new IEEE Fellows whose names
we do not know as of December 21,
1998!

Our section will also recognize
several award winners from our
local student chapters.

Our evening's entertainment pro-
gram and music arrangements are
in the last stages of negotiations.

Our committee has started our
annual solicitation campaign for
supporters of this event to help us
minimize the cost of attending
(IEEE Student Members and their
personal guests: \$30.00, others:
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WANTED!!

We are also looking for more com-
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some of their current committee
tasks to new fingers, heads and
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Joe Feitler

*Publicity and Ticket Chair,
1999 Awards Banquet Committee*

Calendar of Events

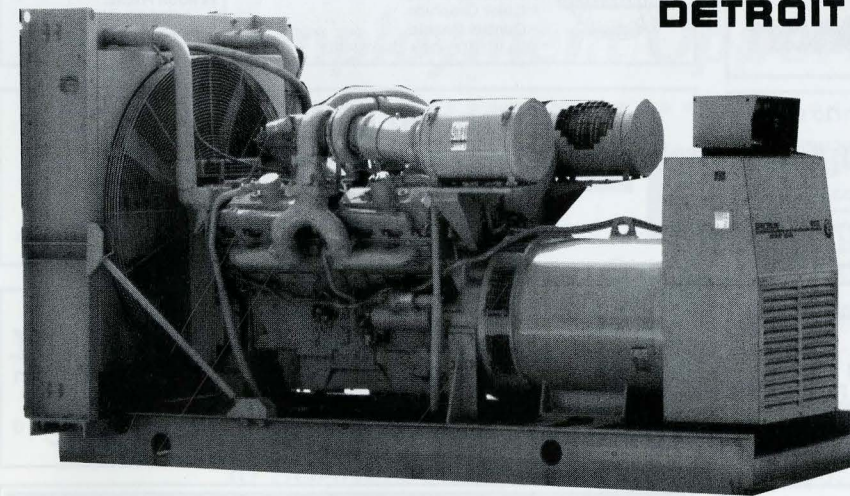
DATE	EVENT
Feb. 9, 1999	IEEE Chicago Section EXECUTIVE COMMITTEE MEETING
Feb. 10, 1999	Power Engineering Society CONVERSION OF TWO ZION 1220 MVA GENERATORS TO SYNCHRONOUS CONDENSER OPERATION
Feb. 20, 1999	IEEE, Fox Valley Subsection, Computer Society Chapter, Joint Chapter on Engineering Management and Professional Communication INTERNET SECURITY WORKSHOP
Feb. 21-27, 1999	National Engineers Week
April 24, 1999	IEEE ANNUAL AWARDS BANQUET

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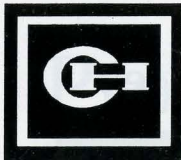
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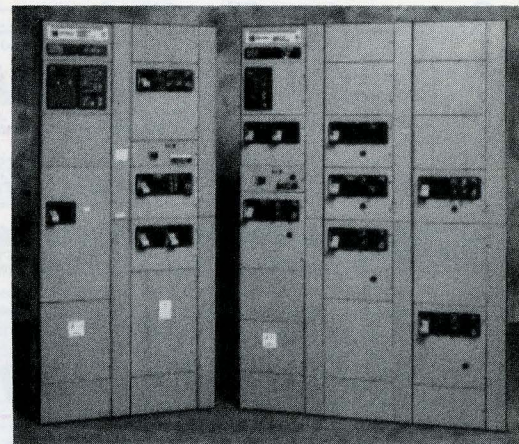
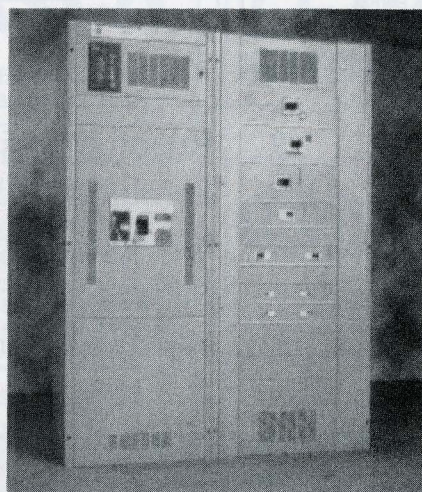
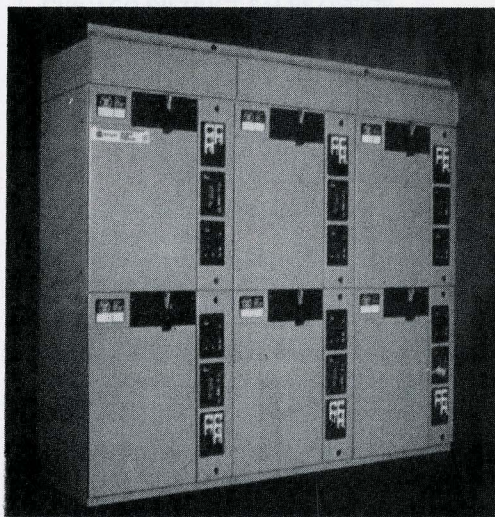


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