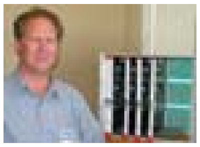
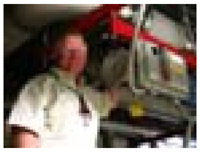


Carl Lundberg



Wayne Johnson

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Mobile natural gas leak detector passes "road test"

Physical Sciences Inc. recently conducted a successful test of its mobile natural gas leak detector. Developed through the Office of Fossil Energy's Infrastructure Reliability program at DOE's National Energy Technology Laboratory, PSI's prototype leak detector demonstrated its ability to spot natural gas leaks from a distance of up to 30 feet from a vehicle moving at speeds approaching 20 miles per hour. The detector uses a scanning laser beam to detect leaking gas. Further testing will focus on demonstrating the mobile detection of natural gas leaks from an operating distribution pipeline. Leakage surveys are critical to maintaining the integrity and safety of the nation's natural gas distribution system.

[David Anna, 412/386-4646; anna@netl.doe.gov]

First observation of parity violation in electron-electron scattering

The extremely challenging E-158 experiment at DOE's Stanford Linear Accelerator Center is successfully finding and measuring a tiny asymmetry (1 part in 10 million, or, 10^{-7}) in how the weak force mediates electron-electron scattering. Results from the first physics run show for the first time that parity (mirror symmetry) is violated in electron-electron scattering where a Z particle is exchanged (left-handed electrons exchange Zs more often than right-handed electrons). "Generating the experiment's first precision measurement was like searching 10 million haystacks to pinpoint the single one that contains the needle," said staff physicist and run coordinator Mike Woods. The E-158 analysis team is working to complete a final precision measurement of the electroweak mixing angle from September's physics run.

[Heather Rock Woods, 650/926-2605; hrwoods@slac.stanford.edu]

First-line responder 'lab' offers variety of other applications

DOE's Sandia National Laboratories is looking for industry partners to license, manufacture and sell a series of compact, hand-held detection systems that place the capability of a fully functional chemistry lab in the hand of a trained operator. While Sandia developed MicroChemLab for homeland security, defense applications, war fighters and first responders, other applications exist in markets such as air and water quality, medical diagnostics, biotechnology and industrial process control. A stationary gas-phase system currently deployed in the Boston subway system has performed more than 100,000 tests with no false positive readings. This autonomous system performs analyses every two minutes around the clock.

[Howard Kercheval, 505/844-7842; hckerch@sandia.gov]

Do nucleons change their size inside a nucleus?

Nuclear physicists have long wondered whether nucleons change their properties when bound inside a nucleus. This possibility was first considered some 20 years ago, when electron scattering from quarks inside a nucleus was discovered to differ significantly from electron scattering from quarks in a free nucleon. Now, data at DOE's Jefferson Lab, comparing the properties of protons bound inside the Helium-4 nucleus with those of a free proton (a hydrogen nucleus), provide hints that it may be more economical to describe nuclei in terms of nucleons which differ in size from free nucleons. This is the second indication that a nucleus isn't merely a set of bound nucleons.

[Debbie Magaldi, 757/269-5102; magaldi@jlab.org]

DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

PPPL researchers study plasma sterilization

Hundreds of billions of plastic food and beverage containers are manufactured each year in the U.S. All of these packages must undergo sterilization, which at present is done using high temperatures or chemicals. But chemicals often leave a residue that can affect the safety and taste of the product and produce undesirable waste. Heat is effective, but necessitates the use of costly heat-resistant plastics that can withstand sterilization temperatures. What if a new method could be found that eliminated the need for chemicals or heat-resistant plastics?

John Schmidt with the Plasma Sterilization appartus

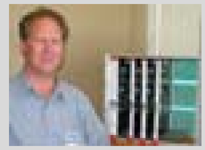
A plasma, a hot ionized gas, just might be the answer. At DOE's Princeton Plasma Physics Laboratory, a team is conducting a small-scale research project studying plasma sterilization. "We have experiments indicating it is possible to kill microbes using a new plasma approach," noted John Schmidt, lead scientist of PPPL's Plasma Sterilization project. Schmidt cautioned, however, that the research is preliminary.

In the PPPL experiment, a one-inch-diameter metal sphere, with a known number of non-toxic spores on its surface, is mounted at the center of a vacuum chamber. After an experiment, the number of spores killed is determined.

PPPL researchers start with "low-temperature" hydrogen plasmas in the range of 50,000 degrees centigrade. At that temperature, the hydrogen ions are moving much too slowly to kill spores quickly. Rapidly pulsing a 50-kilovolt potential between the sphere and the vacuum chamber solves the problem. The sphere is charged negatively and the vessel is at ground. Under these circumstances, the positively charged hydrogen ions accelerate toward the sphere in pulses energetic enough for the ions to pierce the hard outer shell and soft inner core of the spore. Recent experiments employed 4,000 10-microsecond pulses, which reduced the population of live spores by a factor of 100-1000.

***Submitted by** Princeton Plasma Physics Laboratory*

New faces, new places the key to accelerator upgrades

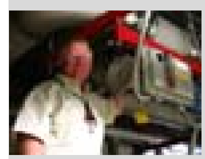


Carl Lundberg

During the 10-week shutdown period of the accelerators at DOE's Fermilab, many employees have been pitching in outside their regular divisions to accelerate the lab's upgrades.

When Carl Lundberg of the Lab's Particle Physics Division Electrical Engineering Department showed up recently to work on vacuum systems for the LINAC and Booster accelerators in the Beams Division, he found that his newly-assigned duties in vacuum-checking would require some quick on the job training in mechanical engineering. He passed with flying colors.

A 23-year Fermilab veteran, Lundberg usually builds and tests circuit boards, but for the past few weeks he and a few colleagues have expanded a regular vacuum team of two into a force of seven. Updates include new collimators for cutting the beam's halo in the Booster and new pipe components with different field characteristics. With sufficient guidance and a fair amount of adaptability, Lundberg said that he and fellow volunteers "just dove into it."



Wayne Johnson

"Sometimes you get a little bit bored with what you're normally doing," says Wayne Johnson, also of the Electrical Engineering Department. That's why he enjoyed the chance to join the LCW (low conductivity water) group during shutdown. Together they maintain the systems running de-ionized cooling water through accelerator electronics. One big task requires taking apart and cleaning several control valves filled with "six-year-old matted grease." Johnson finds the work "kinda neat, different, dirty." Though lacking experience, the new workers caught on quickly and " kind of pushed [Bob Lutz, their manager] out of the way."

The LCW group can work on certain components only during shutdown. Recently they found full-grown clams inside a heat exchanger. After sucking in the clams from cooling ponds, the pumps then continued to provide them with fresh food. Despite such tales, Johnson won't regret going back to his regular job of designing and testing circuit boards.

***Submitted by** Fermi National Accelerator Laboratory*