Fermilab's Alvin Tollestrup

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DOE Pulse

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Research Highlights . . .

Life found in radioactive soil

Scientists at DOE's Pacific Northwest National Laboratory have discovered a variety of living bacteria in an extreme environment beneath a once-leaking high-level radioactive waste storage tank at the Hanford Site near Richland, Washington. Sediments retrieved from beneath the tanks are among the most radioactive in the world to have been studied with molecular biological methods. The sediments had been exposed to radioactive and chemical contaminants for decades, yet despite the extremely harsh conditions, a total of 56 different genera of bacteria were found, representing over 150 different species. The PNNL findings were reported at the recent American Society for Microbiology annual meeting in New Orleans.

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Sandia research brings high-temperature fuel cell closer

A new type of polymer electrolyte membrane (PEM) being developed at DOE's Sandia National Laboratories could bring the goal of a micro fuel cell closer to realization using diverse fuels like glucose, methanol, and hydrogen. This Sandia Polymer Electrolyte Alternative (SPEA) could help fulfill the need for new, uninterrupted autonomous power sources for sensors, communications, microelectronics, healthcare applications, and transportation. A higher-temperature PEM material is one of the goals of DOE's Hydrogen, Fuel Cells, and Infrastructure Technologies Program, and the researchers have demonstrated that under identical operating conditions, the SPEA material can deliver higher power outputs with methanol and hydrogen than Nafion, recognized as the current state-of-art PEM material for fuel cells.

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"Warm" collider technology

An international collaboration based at DOE's Stanford Linear Accelerator Center has met both of its crucial technical goals—clearly demonstrating the viability of using the warm radio frequency (rf) technology to accelerate electrons and positrons to the massive energies needed in the international linear collider. The Next Linear Collider group and the Global Linear Collider group first showed in December that rf supply stations can produce the power required to add 65 mega-electron volts (MV) of energy to the electrons for each meter they travel. The second goal, met in April, shows that newly designed accelerator structures—the copper pipes the electrons travel in—can sustain this acceleration gradient of 65 MV per meter and that the rf power can be shaped into an ideal wave for the electrons to surf on, while keeping an extremely low breakdown rate.

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Mapping carbon flux

Climate researchers take great interest in how the earth's ecosystems store and release carbon into the environment. The Ameriflux network of carbon flux towers, sponsored by several government agencies including DOE, measures carbon uptake and release in 60 U.S. locations. These one-kilometer measurements are extrapolated into a continuous estimate across the U.S.'s 7.8 million square kilometers. Researchers at DOE's Oak Ridge National Laboratory have combined data on climate and soils with satellite-based measurements of vegetation and productivity to produce 90 flux ecoregions. The Flux Ecoregion Website's maps come in several colorful formats with features including zoom and animation—perfect for researchers and cartophiles alike.

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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).

At Fermilab, a full house for "Alvin: The Symposium"

A standing-room-only crowd packed the One West conference room at DOE's Fermilab on Tuesday, June 1 for a symposium honoring the 80th birthday of physicist Alvin Tollestrup, whose many achievements include his indispensable contributions in building the Tevatron with its groundbreaking use of 1,000 superconducting magnets.

"We're using Alvin's 80th birthday as a way to honor him and all the good things he's done for the lab," said Fermilab physicist Peter Limon.

Alvin Tollestrup

The first speaker, Vladimir Shiltsev, honored the Greek definition of symposium ("a convivial meeting for drinking, music and intellectual discussion") by playing Greek music. Shiltsev discussed the Tevatron and other particle physics accelerators, Giovanni Punzi spoke on the CDF Silicon Vertex Tracker, and Jim Annis discussed the proposed Dark Energy Survey. The wide-ranging topics represented Tollestrup's wide-ranging contributions to the lab and to physics, and his focus on the future.

"It was neat to have talks by people that are really doing important stuff, instead of the standard kind of thing where you look back at what has been accomplished over the years," Tollestrup said. "It was great that so many people came."

Tollestrup, whose 80th birthday was March 22, began his particle physics career in 1946 as a graduate student at Caltech, where he spent the next 25 years. In 1975 he arrived at Fermilab on sabbatical, intending to stay only six months. He began working on superconducting accelerator technology, and the short stay turned into a 29-year career at the laboratory—a career that included winning the 1989 National Medal of Technology along with Fermilab's Helen Edwards, Dick Lundy and Rich Orr for their work in the design, construction and initial operation of the Tevatron, which remains the world's highest-energy particle accelerator.

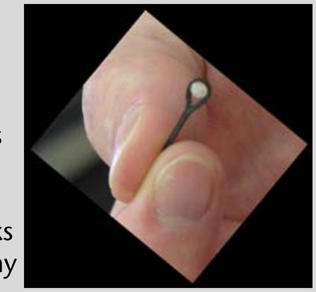
The idea of using superconducting magnets, fostered by Fermilab founding director Robert R. Wilson, was initially received with skepticism. Tollestrup remembers giving a presentation at another lab in "a big room with these guys sitting up there laughing... they thought we were nuts."

Over the years, Tollestrup has worked extensively on the Tevatron magnets, served as co-spokesperson for the CDF experiment, and has become involved in the creation of an astrophysics center at the laboratory. He has also remained energetic in championing the cause of young researchers, sponsoring seminars on careers in accelerator research, and presenting an annual award to postdoctoral researchers which is funded by Fermilab's operating consortium, Universities Research Association, Inc. The research must be performed in conjunction with a Fermilab experiment or accelerator physics project, or under the auspices of the Fermilab Theory Group. The 2004 Tollestrup Award for Postdoctoral Research went to Nicole Bell, of the Fermilab Theoretical Astrophysics Group, for her work in cosmological neutrino research. The award carries a $3,000 prize.

Submitted by DOE's Fermilab

A SEARCH FOR NO COLOR

According to the fundamental theory of particle physics, the subatomic world is a very colorful place. The theory predicts that quarks and gluons, the tiny building blocks of protons and neutrons in the nucleus of the atom, have a special kind of charge called color.



In the experiment, scientists use CEBAF'S accelerator to slam electrons into the nuclei of a target element. Pictured here is a sample aluminum target.

Color charge comes in three varieties: red, blue and green. Quarks only exist in combinations where their color charges add up to no color. For instance, a proton, which has three quarks, has a quark of each color, adding up to white (no color). While a proton itself has no color, color charge from its individual quarks still leaks out, allowing a proton to interact with other particles. That's how protons and neutrons bind together to makeup the atomic nucleus.

But Kawtar Hafidi, an Assistant Scientist at Argonne, and her colleagues are looking for quark-based particles with color charge that doesn't leak out. Hafidi is a spokesperson for the 101st experiment to conclude data-taking at Jefferson Lab, an experiment looking for color transparency.

Hafidi says quantum theory predicts that there are particles that are so small, because their quarks are bound together so tightly, they can coast along without interacting with other particles. When this happens, it's said the medium these particles are traveling through is 'color transparent.'

"It's like the particle becomes invisible to the medium," Hafidi says, "If we see the signal that we're looking for in these results, it will be the first evidence of color transparency ever. It's very important. There are no other theories that can explain the results we're anticipating without color transparency." She expects her team will have preliminary results as early as December.

Submitted by DOE's Jefferson Lab