

Ono and Peng realize NSTX vision. Page 2



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Research Highlights . . .



*Happy Birthday!
This issue marks
one year of DOE
Pulse.*

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).

Turning french fry oil into diesel fuel

Imagine a diesel truck driving down the roadway emitting a smell of french fries from the exhaust. That might soon be a reality thanks to the efforts of scientists Bob Fox and Dan Ginosar at DOE's Idaho National Engineering and Environmental Laboratory. The scientists have filed a provisional patent for their discovery of a one-step way to convert used french fry oil into biodiesel fuel and high grade glycerol. This represents an improvement over conventional batch processing technology and promises better process economics. The scientists envision a time when waste-oil-to-biodiesel conversion plants are connected to food processing plants everywhere, giving processors an environmentally sound source of fuel.

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Vive la difference!

Scientists at DOE's Fermilab have announced the observation of a significant difference in the way matter and antimatter behave. Studying the decays into secondary particles of the subatomic particles called neutral kaons, physicists of [Fermilab's KTeV experiment](#) confirmed an asymmetry in the decay of neutral kaons and their antimatter counterparts. Until the mid-1960s, scientists believed that matter and antimatter behaved symmetrically, like mirror reflections of one another. First glimpsed at Europe's CERN laboratory, this asymmetry, called "direct CP violation," gives scientists another clue to the mysterious nature of antimatter. Experiments around the world are poised to explore this asymmetry.

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Vastly different virus families may be related

The broad family of viruses whose members cause measles, mumps and serious respiratory infections in infants may be distantly related to the family that includes HIV, influenza and Ebola viruses. Researchers at Northwestern University and the Howard Hughes Medical Institute at Northwestern used the extremely powerful X-ray beams at the Advanced Photon Source at DOE's Argonne National Laboratory to create images of the viruses. The finding is reported in the journal *Molecular Cell*. "The structure of this molecule suggests a common ancestor among all these viruses, where one would have thought them not to be related at all," says virologist Robert A. Lamb, an author of the study.

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When is a liquid not a liquid?

The glass may be half empty or half full, but the water touching the glass may only be half-liquid. In a finding that may change the way lubricants and thin film coatings are developed, researchers at Northwestern University have for the first time directly observed that molecules of liquid close to a solid surface organize into layered structures much like a solid. They made their discovery using brilliant X-rays at DOE's Brookhaven and Argonne National Laboratories, including Brookhaven's National Synchrotron Light Source. Reflected X-rays, bounced off spherical molecules of an organic liquid, revealed three ordered layers near a silicon surface.

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US/CMS project moves into the production stage

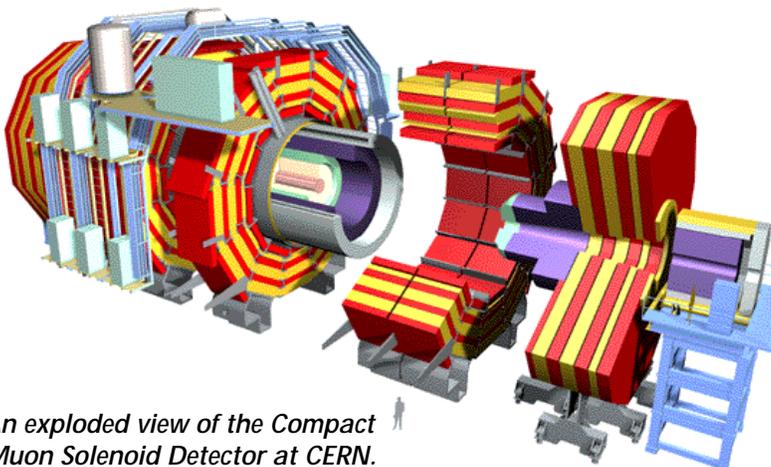
Communication and contact are the critical issues as the US/CMS Project swings into production mode at Fermilab, across the country and around the world.

The project is building one of the giant detectors for the Large Hadron Collider, which will supplant Fermilab's Tevatron to become the world's highest-energy particle accelerator when it begins operating in 2005 at CERN, the European particle physics laboratory. Particle collisions at the LHC will further research into the fundamental structure of matter.

The US/CMS project involves 34 U.S. universities and three Department of Energy laboratories—Fermilab, Lawrence Livermore National Laboratory, in Livermore, California, and Los Alamos National Laboratory, in Los Alamos, New Mexico.

All are building components for the Compact Muon Solenoid detector, a major element of the LHC. The full CMS collaboration involves institutions from 30 countries. By contributing to the LHC, Fermilab scientists, engineers and technicians maintain their status as "co-pioneers" for the new frontiers in accelerator and detector development.

The Fermilab efforts on CMS focus on the hadron calorimeter, which measures the angle and intensity of energy produced in a particle collision, and the muon Cathode Strip Chambers, which measure the position and energy of the muons (heavy cousins of the electron) in CMS interactions.



An exploded view of the Compact Muon Solenoid Detector at CERN. Illustration courtesy of CERN.

The full collaboration holds quarterly meetings at CERN, and there are weekly teleconferences among US/CMS members to monitor technical progress.

Fermilab's Dan Green, serving as the US/CMS project's technical director, emphasizes the value of contact and cooperation in such a far-flung effort.

"Our view is that if problems arise, they are common problems—not just the problem of one country, or the problem of a subsystem where one country bears most of the responsibility," Green says. "We do have a common language, the language of physics. If we keep the discussion on the level of physics, we can often come to an agreement."

Submitted by DOE's Fermilab

A JOINT ASPIRATION

Some science projects require the direction of a superhuman. In the case of the National Spherical Torus Experiment (NSTX), the project needs—simply—"two enthusiastic scientists who have complementary backgrounds and are willing to work together," according to its co-heads.

NSTX, a new, innovative fusion energy research device at the DOE's Princeton Plasma Physics Laboratory, is a national collaborative effort involving 14 institutions. (See http://www.ornl.gov/news/pulse/pulse_v4_98.htm or http://www.ornl.gov/news/pulse/pulse_v25_99.htm.)

Project Director Masayuki Ono and Program Director Martin Peng co-head the project, which began operating in February. "Martin provides the vision and I make it real," remarked Ono about his and Peng's roles. Peng works with many researchers in the fusion community to formulate the research plan and with experimental task leaders to cover the scientific elements of the research, while Ono manages the NSTX operations, working with a national team of physicists, engineers, and technicians to make the project and its experiments possible.

Said Peng, "We are fortunate to have hit on an arrangement in which we have a complementary dual role. We constantly talk about what we are doing and know what we have to do separately, in concert, to make this research program successful."

It is truly a collaborative effort that brings together these co-directors from two national laboratories. Ono is a PPPL employee and Peng is an Oak Ridge National Laboratory employee on a long-term assignment at PPPL. For both, it has been a long road to fulfill their joint aspiration. "High plasma pressure well confined in low magnetic field has always been our great dream," noted Peng. Fifteen years ago this dream motivated him to develop the low aspect ratio "spherical" torus concept that is the basis for NSTX. This could ultimately simplify engineering and make fusion energy affordable and practical.

Both NSTX leaders are enthusiastic and excited about the upcoming NSTX experiments. "I hope NSTX will be a successful physics machine and it will help the fusion program to prosper—that this will ignite broad enthusiasm for fusion," said Ono.

Submitted by DOE's Princeton Plasma Physics Laboratory