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DOE Pulse

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Arizona models hydrogen plant

DOE, through its Advanced Vehicle Testing Activity, has issued a design report for the Arizona Public Service Alternative Fuel (hydrogen) Pilot Plant. The pilot plant in Phoenix is a model alternative fuel refueling system, generating and dispensing hydrogen, compressed natural gas (CNG) and hydrogen/CNG blends (HCNG). The plant is used daily to fuel internal combustion engine vehicles operating on hydrogen and HCNG blends in Arizona Public Service's fleet. The pilot plant, and the hydrogen and HCNG internal combustion engine test vehicles, are operated through a public/private sector partnership agreement between DOE's Advanced Vehicle Testing Activity, Electric Transportation Applications, Arizona Public Service, and DOE's Idaho National Engineering and Environmental Laboratory.

[Steve Zollinger, 208/526-9590; gaz@inel.gov]

DZero to B quark: 'Tag, you're it!'

Thanks to a new silicon component, the Run II DZero detector at DOE's Fermilab now has the significant ability to identify or "tag" the decay of b-quarks created in high-energy collisions at the Tevatron collider. Particles containing the b quark can live long enough to escape the fireball of the collision. By providing precision measurements along the trajectory of these long-lived particles, DZero's new silicon microstrip tracker can identify these b-quarks. Identifying b-quarks can help us identify the familiar top quark, the Higgs boson, and even more speculative particles predicted by non-standard models. The DZero group, currently led by Meenakshi Narain of Boston University and Gordon Watts of the University of Washington, has been working two years to develop four different b-tagging algorithms.

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Hot, new microtechnology keeps GIs cool

Personal suits may protect soldiers from chemical and biological weapons, yet without portable cooling technology to ward off heat exhaustion and heat stroke, suits meant to save lives can actually quickly incapacitate soldiers. Researchers at DOE's Pacific Northwest National Laboratory are developing heat-actuated lightweight and compact cooling technology capable of sustaining manageable temperatures within the protective garb for several hours at a time. The principles of microtechnology and the high rates of heat and mass transfer at this miniature scale—about the thickness of the human hair—have enabled "manportable" cooling systems. The systems, which may weigh in at about three to four pounds, will chill water that flows through a vest worn by a solider.

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PAD-ding super-thin metal oxide films

Researchers at DOE's Los Alamos National Laboratory have developed a new method for the production of metal oxide films. Called Polymer Assisted Deposition (PAD), the method uses a water-based solution to create a high-quality film of nearly any metal oxide. The films can be made from a single or several different metals with controlled atomic weight relationships. Amorphous, polycrystalline, or epitaxial films can be made with thicknesses from 10 nanometers to hundreds of nanometers or thicker. Using PAD, researchers have produced films of simple metal oxides, such as titanium dioxide and zinc oxide, and complex metal oxides, such as strontium titanate, and indium tin oxide.

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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).

DOE scientists sample the skies

This summer, scientists from the DOE's Argonne National Laboratory, Brookhaven National Laboratory, and Pacific Northwest National Laboratory will be participating in the International Consortium for Atmospheric Research on Transport and Transformation (ICART2) experiment, an effort to understand how pollutants from the Northeastern U.S. affect climate and air quality as they spread over the North Atlantic Ocean. Other collaborators include the National Atmospheric and Oceanographic Administration (NOAA), the National Aeronautics and Space Administration (NASA), the University of New Hampshire, and others (see http://www.al.noaa.gov/ICARTT/).

The DOE scientists, funded and coordinated by the Office of Biological and Environmental Research (OBER) within DOE's Office of Science, will focus on sampling aerosol pollutants and evaluating their effects on Earth's radiation balance and climate forcing for a portion of the study known as the NorthEast Aerosol eXperiment (NEAX). They will conduct regional air-sampling flights from Latrobe Airport, located about 25 miles east of Pittsburgh, Pennsylvania, from July 15–August 15 aboard a G-1 Gulfstream research aircraft operated by PNNL carrying research-grade instruments developed at both BNL and PNNL. Additional ground-based instruments deployed by ANL and PNNL scientists will provide complementary data.

Aerosols such as sulfur compounds result from emissions by fossil-fuel-burning power plants and other industrial processes. By themselves, and by affecting the brightness of clouds, they may increase the amount of incoming sunlight that is reflected back into space, thereby exerting a partial cooling effect on Earth's climate. But because their concentrations are highly variable and because they are removed from the atmosphere fairly quickly, it is difficult to assess these effects and the impact of aerosols on climate without collecting real data.

So the scientists participating in NEAX will conduct studies of aerosol formation and growth in point source and urban plumes with different characteristics. They'll also conduct air-mass scale studies to see how the chemical, microphysical, and optical properties of aerosols evolve as the air-mass ages and is transported away from its source. Ultimately, they hope to characterize how much aerosols and aerosol precursors in the Midwest contribute to the aerosol burden in the western North Atlantic.

In addition to $1 million for the G-1 aircraft and approximately 10 DOE-funded scientists, the Atmospheric Sciences Program within OBER is contributing about $300,000 in funding for the study. All measurement data from DOE will be made fully and freely available to both the scientific community and the public.

Submitted by DOE's Brookhaven National Laboratory

Caolionn O'Connell aims for higher energies

Caolionn O'Connell

In between trail-running expeditions through California's Portola Valley, Caolionn O'Connell can be found luring electrons to surf waves of energy so powerful they rip matter apart. Her group's prototype technologies boost electrons on waves of plasma traveling at nearly the speed of light as a kind of "plasma afterburner" for existing particle accelerators.

Caolionn is a fourth-year PhD student from Stanford University working at the DOE's Stanford Linear Accelerator Center. After undergraduate studies at Harvard University and projects at Fermilab's CDF experiment, she longed for the bright skies and warm weather of her home state. So she returned to California, not one to let travel stand in the way of her passion for the outdoors. Named by her aunt from a traditional Irish fairy-tale, Caolionn jokes that she wishes her name meant "strong and independent woman" rather than the more prosaic but accurate "lass".

Her project accelerates electrons to much higher energies in much less space than existing technologies. "Fitting new higher energy facilities near existing labs is difficult because of how much room they would take up," Caolionn says. "Using plasma wakefield accelerators, we will boost electrons to energies 100 times as high in the same space."

"If we achieve our target acceleration gradients, we could fit an accelerator of SLAC's energy reach on a tabletop," Caolionn says, "It is a tremendously exciting project." sitting outside her control room at the end of the two-mile long SLAC accelerator.

Caolionn's work on the SLAC E164 and E164X projects will contribute to the "Next Next Linear Collider", a leapfrogging project that looks beyond the next Linear Collider, top of the DOE's mid-term priority list for future facilities.

Submitted by DOE's Stanford Linear Accelerator Center