DOE Pulse
Science and Technology Highlights from the DOE National Laboratories

Number 255 February 25, 2008

Research Highlights...

INL's Michael Assante

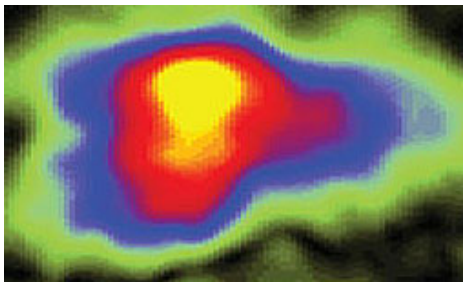
See below.

INL researchers revamp nuclear simulations

Researchers at DOE's Idaho National Laboratory are developing nuclear reactor simulation capabilities, including a model of fuel performance. These simulations take advantage of computational tools like meshing, where structure is divided into smaller areas computers can model. Each area within the fuel mesh, for example, will contain a host of physical information; including temperature, the number of neutrons being created, and structural state. This simulation capability will eventually model a reactor from the scale of atoms to an entire reactor assembly, enabling a fundamentally different approach to nuclear simulation. The goal is a bottom-up nuclear reactor simulation with improved predictive capabilities, improving safety, boosting efficiency and helping researchers anticipate challenges.

[Teri Ehresman, 208/526-7785, Teri.Ehresman@inl.gov]

A first in microfluidic MRI



Parahydrogen-induced polarization produces a strong MRI signal on the microscale.

Visualizing gas-phase reactions with magnetic resonance imaging (MRI) could significantly improve the design of future microcatalytic reactors, including "labs-on-a-chip," and could also affect catalyst design. Alexander Pines of the Materials Sciences Division at DOE's Lawrence Berkeley National Laboratory led a team that developed enhanced MRI of microscale catalytic reaction products using hyperpolarized parahydrogen gas. MRI is unique for its ability to measure velocity- and spatially-dependent quantities, which the researchers demonstrated by tracking gases and liquids in

microfluidic devices, as well as in the void spaces of a tightly packed catalyst reactor bed, without the use of tracer particles or gases.

[Lynn Yarris, 510/486-5375, lcyarris@lbl.gov]

Livermore engineer Jim Candy's sound science

James V. Candy

James V. Candy, Engineering Directorate chief scientist at DOE's Lawrence Livermore National Laboratory, is now applying his pioneering signal and image processing work in underwater acoustics to the detection of radioactive contraband for homeland security. Candy has developed “model-based signal and image processing techniques” that have improved acoustical detection and measurement for applications in national security, materials science and medicine. Applications include vibrational failure detection for prosthetic heart valves; target localization in ocean acoustics (i.e. submarines); communications in room acoustics; detecting and imaging flaws in materials for nondestructive evaluation; biomedical imaging for ultrasonic cancer detection; time reversal processing for signal enhancement, detection of radioactive contraband in containers; and synthetic aperture for detecting and tracking underwater and airborne targets.

[Don Johnston, 925/423-4902, johnston19@llnl.gov]

SNS sets a record

DOE's Spallation Neutron Source at Oak Ridge National Laboratory has been confirmed by the Guinness Book of World Records as the world's most powerful pulsed neutron spallation source. The SNS recently ramped up beam power to more than 300 kilowatts,

Aerial view of the SNS site, part of Oak Ridge National Laboratory in Tennessee.
Click image for larger version.