LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, April 10-13, 2012

San Francisco Chronicle

HERE COMES THE SUN

Operations manager Bruno Van Wonterghem stands in front of a chamber where 192 lasers are focused on a small target.

Livermore scientists report that after years of experiments, they have moved closer to reproducing the blazing energy of the sun's interior in a laboratory setting.

A team of physicists and engineers at the National Ignition Facility have fired an array of 192 laser beams, focused "in perfect unison," and created a single pulse of energy that for 23 billionths of a second generated a thousand times more power than the entire United States consumes in a single second.

The experiment delivered to the facility's target chamber 1.87 megajoules of ultraviolet light, amounting to 100 times more energy than any other laser system in the world.

A megajoule is a million joules of energy, the equivalent of a million watts of electric power. In this one experiment, the virtually instantaneous shot generated 411 trillion watts of power, the scientists said.

To read more, go to *The San Francisco Chronicle*.

nature

IT'S A LONG ROAD TO THE TOP

Future fossil-fuel power: An artist's impression of China's first integrated gasification combined cycle (IGCC) plant, which is to be built in Lingang Industrial Park in the Tianjin Binhai New Development Zone.

In 2008, leaders of the G8 group of nations called for the development of 20 large-scale projects demonstrating technologies for carbon capture and storage (CCS) by 2010, but countries have been slow to embrace the costly plants.

But China seems to be the leader as the state-owned Huaneng Group plans to fire up the first phase of its flagship clean-coal demonstration project. The project would move the project one steep closer to capturing and storing the carbon it emits.

Despite being behind schedule, the plant shows promise, according to Julio Friedmann, head of the Laboratory's carbon management program.

"GreenGen represents both a high degree of technical sophistication and a real commitment on China's part to clean-energy technology," Friedmann said. "There can be no doubt that China has achieved something remarkable."

To read more, go to ***Nature***.

Scientific Computing

A BETTER KIND OF JET ENGINE

Al Chu (left) and Ryan Braby check Sierra, which is housed in the Bldg. 451 computer room.

The Laboratory is packed with the world's most powerful supercomputers working on some stimulating research. One, called Sierra, has been helping scientists explore the Big Bang theory, model the beginning of our universe 13.7 billion years ago, and figure out why elementary particles have mass.

The machine also is seeking to understand how carbon, the backbone of life and a fifth of the weight of our bodies, is formed inside stars. But, starting this month, Sierra will help GE engineers build a better jet engine.

When Sierra started crunching data in 2010, it was the most powerful high performance computer (HPC) working on unclassified research at the Lab. In the next few weeks, a computational combustion engineer at GE Global Research will take over some of the machine's circuits to speed the development of next-generation fuel injectors for GE's jet engine fleet.

To read more, go to *Scientific Computing*.

HPC wire

GOING THE DISTANCE

Kim Cupps, LLNL High Performance Systems Division leader, and Mark Seager, former LLNL assistant department head for New Technologies, inspect a newly installed rack for Dawn, a 500 teraFLOP/s (trillion floating operations per second) IBM BlueGene/P system. Dawn will help lay the foundation for the 20 petaFLOP/s (quadrillion floating operations per second) Sequoia system.

While no one knows exactly what an exascale supercomputer will look like, there likely will be a healthy diversity of processors running those machines.

For now, processors are handling petascale computing.

Later this year, two multi-petaflop Blue Gene/Q supercomputers, powered by the new Power A2 CPUs, will be brought online. Sequoia, a 20-petaflop supercomputer, will be installed at Lawrence Livermore, and Mira, a 10-petaflop machine will go to Argonne. Both are expected to go into production before the end of the year.

So what does this mean for exascale? If history repeats itself, the first such systems will be powered by exotic processors, but eventually more commodity-based silicon will take over.

To read more, go to *HPC Wire*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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