

Magnet Lab Collaboration Yields 'R&D 100' Honor

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When it comes to learning more about the fundamental nature of matter, a little goes a long way toward advancing science and discovery: The smaller the measurement, the better the results. That's the thinking behind an innovation that has landed a National High Magnetic Field Laboratory scientist a share of a prestigious international award.

Often called "the Oscars of Invention," the R&D 100 Awards recognize the 100 most innovative and technologically significant products introduced into the marketplace during the past year. The editors of R&D Magazine and a panel of independent industry experts select the winners, whose contributions range from a stimulator to restore nerve functionality to a recycling system that turns municipal solid waste into reusable items such as park benches.

Scott Hannahs, chief of user research instrumentation at the magnet lab, worked in partnership with Keithley Instruments, a world leader in advanced electrical test instruments, to create a better system for sourcing extremely small currents and measuring extremely small voltages with high accuracy. This is important because less-intrusive measurements that function at lower electrical currents and voltages are necessary to study the fundamental nature of matter on the smallest scale and at ultra-low temperatures.

"Throughout history, advances in the accuracy of measurement have uncovered gaps in existing scientific theories, leading to new understanding," said Hannahs. "Better understanding leads to new and

better technologies."

The products that Hannahs developed with Keithley, the 6221/2182A AC and DC Precision Current Source with Nanovoltmeter, will help engineers and product developers create breakthrough consumer products and medical devices that can improve characteristics of many of the devices used for fiber optic communications and almost all modern microelectronics. The increased capabilities of the instruments also will help find defects during the manufacturing process, rather than after.

The product features two new functions for which Hannahs is responsible. The new Delta Mode of operation reverses the electrical current and averages the absolute values of the voltages measured. This dramatically improved method eliminates excessive signal noise and drift - two possible byproducts of working with high magnetic fields - thus producing more-accurate measurements.

This general approach has been used for years by scientists who wrote the numbers in notebooks and calculated the averages with a calculator. Hannahs automated the process several years ago using special software developed at the magnet lab. He showed the technique to Keithley engineers during several of their visits to the lab and urged them to make it easier and more generally available.

Keithley agreed, and once the new device had been built, Hannahs tested the features ruthlessly in the challenging test bed that is the magnet lab's DC High Field Facility.

The collaboration between Hannahs and Keithley Instruments is part of a long and lasting relationship between the magnet lab and the instruments company. Keithley donated more than \$100,000 worth of instruments and services to the magnet lab when it was just beginning, resulting in

the designation of the Joseph F. Keithley magnet cell (a place where experiments are performed) in Tallahassee.

The National High Magnetic Field Laboratory develops and operates state-of-the-art, high-magnetic-field facilities that faculty and visiting scientists and engineers use for research in physics, biology, bioengineering, chemistry, geochemistry, biochemistry, and materials science. The laboratory is sponsored by the National Science Foundation and the State of Florida and is the only facility of its kind in the United States. To learn more, please visit www.magnet.fsu.edu

Source: Florida State University

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