NC State Nuclear Reactor Program Celebrates Scientific Breakthrough

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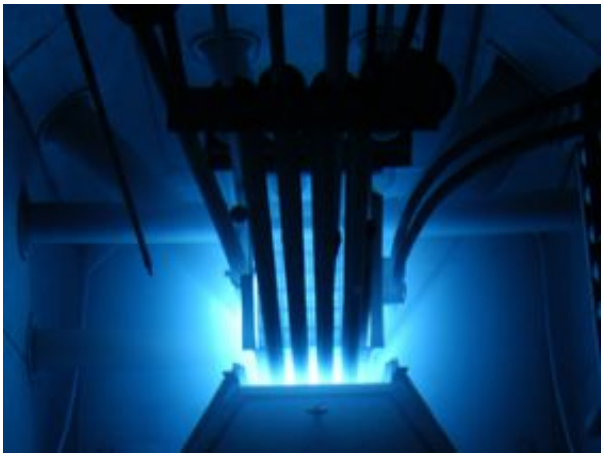

The core of the NCSU PULSTAR reactor at 1-MW power. Credit: NC State University

There were high-fives all around NC State University's PULSTAR nuclear reactor earlier this month, as students, staff and faculty celebrated a new scientific benchmark - they had just produced the most intense operating positron (antimatter electron) beam anywhere in the world.

"There is a reactor in Munich, Germany, that has been generating those types of radiation beams for some time now, and our analysis of the data shows that we have exceeded what they have reported," said Dr. Ayman Hawari, associate professor of nuclear engineering and director of the

Nuclear Reactor Program at NC State.

"Our excitement comes from the realization that now it has become possible to achieve certain objectives that were not possible before," he said. "Thinking from a scientific point of view, you immediately think, 'We're going to be able to do what we thought we should do.'"

Success was two years in the making - the positron project began in 2005 as a collaboration between NC State, the University of Michigan and Oak Ridge National Laboratory with the support of the U.S. Department of Energy and the National Science Foundation.

"The idea here is that if we create this intense beam of antimatter electrons - the complete opposite of the electron, basically - we can then use them in investigating and understanding the new types of materials being used in many applications," Hawari said.

Now that the powerful beam has been generated, members of NC State's nuclear engineering program and their collaborators will turn their focus to developing instrumentation such as antimatter spectrometers and potentially long-discussed antimatter microscopes, which would allow for a much more detailed look into materials at the atomic level.

"We're starting to see into the future," Hawari said. "Successes like this at a university reactor are actually starting to drive big ideas and big thoughts around the country and around the world for the applications of these successes."

NC State holds a storied place in nuclear history - in 1953, the university became the host of the first university-based nuclear reactor in the world. Since then, NC State has a continuous history of operating four different reactor facilities - including the PULSTAR, which became operational in 1972 - all designed for teaching, research and community

service.

"We have an active nuclear engineering program that is one of the largest in the country," Hawari said. "We supply hands-on experience for our nuclear engineers working toward degrees at the bachelor, master and doctoral levels of this program.

"Our students are able to take classes and use the reactor in their day-to-day course work," he said. "In addition, they are able to get trained on reactor operations and obtain federal licenses from the Nuclear Regulatory Commission as nuclear reactor operators."

Currently, there are approximately 25 universities across the United States with active nuclear reactors on campus, ranging from smaller, demonstration-type reactors to larger, project-oriented reactors such as the one at NC State. The number of nuclear engineering programs without reactors is larger, but students at other universities can gain experience with the PULSTAR reactor through a Web-based interface.

"About two years ago, we created a virtual version of the reactor's data systems, control systems and readout systems so students lacking the advantages that we have here at NC State can take classes with us over the Internet and learn that way," Hawari said. "Students at the University of Tennessee and Georgia Tech have been doing that on a regular basis, and now we are discussing that with other engineering programs not only across the country but internationally as well."

As the virtual program continues develop, another trend has developed - students who received their undergraduate degrees elsewhere are coming to NC State to continue their education in pursuit of higher degrees.

"The reactor is a huge recruiting tool," Hawari said. "After they get exposure to the reactor and the facilities online at their own universities,

many of them become excited about the possibility of coming to NC State for hands-on experience."

From their assistance with the positron beam to "real-world" analysis of materials from the World Trade Center and Space Shuttle Columbia disasters, NC State's nuclear engineering students are involved in virtually every facet of the reactor program.

"Our graduate and undergraduate students are fully engaged in all of the projects we have at the reactor," Hawari said. "Without exaggeration, the work done at this reactor is on par with the work done at the best international scientific facilities in the world.

"We are unique, and we are doing things on the cutting edge of radiation science."

Source: By Dave Pond, NC State University

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