

Research conducted on the accelerator system sets the stage for improvement of detection of nuclear materials

By Jordan Stidham



Through the U.S. Department of Homeland Security Domestic Nuclear Detention Office Summer Internship Program, Clark Hickman gained experience researching accelerator physics. The research he contributed helped him realize the monumental impact of his hard work.

Throughout his childhood, Clark Hickman was encouraged by his parents, both scientists, to explore the world around him with curiosity and an open mind. Also, he was mentored by his grandfather, who was a leading figure in the actuarial science field for decades.

Even so, Hickman did not consider a career in science until his final years in high school, when he began to learn about the particles that make up the universe.

“The topic absolutely fascinated me, as did the ability of all of physics to describe our world using a set of math equations, equations that we could apply to anywhere in the universe,” said Hickman, now a graduate student at North Carolina State University.

To learn more about particles and atoms, Hickman majored in physics as an undergraduate. He sought research experience and began applying for opportunities related to particle and nuclear physics. His academic adviser emailed him project descriptions from the U.S. Department of Homeland Security (DHS) Domestic Nuclear Detention Office (DNDO) Summer Internship Program, and several caught Hickman’s attention.

The DNDO Summer Internship Program provides opportunities for undergraduate and graduate students to participate in projects at federal research facilities across the United States. Participants address issues related to national security and nuclear detection to help DNDO meet its mission of preventing nuclear terrorism and training future generations of scientists.

During Hickman's summer internship, he was assigned to the Technology Innovation Directorate (TID) under his mentor, staff scientist Emilio Nanni, Ph.D. Hickman was a part of the team working on a DNDO-funded project at the Stanford Linear Accelerator Center (SLAC) National Accelerator Laboratory in Menlo Park, California. In addition to his main project assignment, Hickman participated in other projects at TID that were complementary to, and sometimes overlapped, his research for DNDO.

SLAC has been tasked by DNDO to build a linear accelerator (linac) to use for non-intrusive inspection of cargo containers and trucks for special nuclear materials. Linacs may be used to produce high-energy X-rays that can be directed to inspect materials of interest. The linac system to be built for DNDO is meant to be cost-effective, energy agile and relatively small in size so it can be transported easily within ports, airports, border crossings and other points of entry into the United States.

The entire scope of the SLAC project for DNDO spans several years of research, development and manufacturing. The summer internship project centered on solving a small part of the whole problem. Hickman primarily focused on modeling the system to ensure it met the DNDO's requirements.

Hickman's internship was beneficial to his interests in graduate school. Thanks to this experience, Hickman has been invited to join several laboratory groups that focus on nuclear/accelerator physics. Coincidentally, one of these groups is developing a design for a linac similar to the one he researched while at SLAC.

Hickman said, "This project was a great way to get introduced to it [coding and simulations], skills that might come in handy for later projects. I also learned a lot about the basics of accelerator physics, knowledge that has come in handy as I have explored potential research in the field."

When asked what his overall impression of the experience was, Hickman responded, "I had a really fun time. Not only was I able to learn a lot about accelerator physics, but I was able to meet some great people and make some great connections as well, connections that may be useful as references for future jobs or positions."

Ultimately, Hickman has plans to complete graduate school at North Carolina State University and continue to do research in particle and nuclear physics as a career. He added, "I enjoy learning and challenging myself to find new discoveries that might contribute to science and our society as a whole. I am always looking for new opportunities to grow and learn, both as a physicist and a person, and this internship definitely provided me with another opportunity to do just that."

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