Seeing through just about anything

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Identifying corroding pipes and preventing industrial accidents likely will be just a jumping-off point for technology that can see through just about anything thanks to space particles called muons. Yet eliminating the need to disassemble complicated pipe systems, or apply x-rays or ultrasound, represents a breakthrough in its own right.

Los Alamos National Laboratory physicist Matt Durham recently won the $10,000 “Best Pitch” prize for promoting his team’s Cosmic Plumbing Inspection project at a “DisrupTECH” event. The gathering was hosted by Los Alamos National Laboratory and the New Mexico Angels, an investing group, and attracted more than 100 entrepreneurs, business executives, investors and government leaders from across the country.

DisrupTECH sponsors also included the State of New Mexico’s Economic Development Department, Technology Ventures Corporation, the County of Los Alamos, the New Mexico Technology Council, the Regional Development Corporation and Santa Fe Economic Development.

“The goals of the DisrupTECH forum were two-fold,” said David Pesiri, director of the Laboratory’s Richard P. Feynman Center for Innovation. “To expose industry to potentially world-changing, disruptive, early-stage technologies developed by Los Alamos scientists and to spark the entrepreneurial spirit in our scientists, giving them a chance to present their technologies outside of an academic setting. We hope the experience might give them a new perspective on the end use of their technology.”

Cosmic Plumbing Inspection

Huge steel pipes are a fact of life in just about every industrial or energy infrastructure situation. The pipes move fluids, including hot water and high-pressure steam, but over time the fluids wear the pipes down. Or perhaps the pipes get dinged or damaged in other ways, or changes in temperature cause tiny cracks to appear.

Pipe damage can lead to catastrophic industrial accidents, and even though routine inspections are good practice, they are not always easy. You typically have to shut the pipes down first and remove their customary insulation covers.

Enter Los Alamos’ minimally intrusive muon scattering tomography, which keeps track of naturally occurring muons as they enter and exit pipes. Muons start out as primary cosmic rays, which are everywhere in the universe, until they enter the Earth’s atmosphere and decay first into pions and then muons.

In muon scattering tomography, Durham and his co-investigators sandwich a pipe between two particle tracking detectors. When an errant muon passes through one of the detectors, it sends a message to a computer. The muon continues through the pipe, meets the second detector on the other side and gets measured again.

By calculating the difference between the muon’s entry and exit angles, researchers can recreate the path the muon took through the pipe’s molecules. With enough muons, they can get a pretty good picture of what’s going on inside the pipe—or any other object.

Los Alamos invented muon scattering tomography after the 9/11 attacks to detect smuggled nuclear weapons. Muons can see through cars, boats and shipping containers, for instance.

The only problem is that muon scattering tomography is fairly slow. But the time factor does not faze Durham.

“Four, six, eight hours—that’s about the length of a work shift,” Durham said. “You could have a worker come in, set up a scanning machine, go off to other duties, then at the end come back and make a judgment call.”

Yet some projects require added speed. Working with Los Alamos, the technology company Toshiba plans to put a 24-square-foot muon detector on either side of Japan’s highly reactive Fukushima nuclear plant to find melted fuel within the damaged reactor cores.

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