3-D Color X-Rays Could Help Spot Deadly Disease Without Surgery

A new medical scanner, derived from technology used by particle physics researchers at CERN, “is like the upgrade from black-and-white film to color,” one of its developers said.

By Emily Baumgaertner

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Researchers in New Zealand have captured three-dimensional color X-rays of the human body, using an innovative tool that may eventually help diagnose cancers and blood diseases without invasive surgery.

The new scanner has its origins in a tool that contributed to research into the universe's fundamental particles and functions much like a camera. It counts subatomic particles as they meet pixels when its electronic shutter is open. That allows it to generate high-resolution images of soft tissues, including minute disease markers.

“We can make out details of various tissues, like bones, fats, water and cartilage, all functioning together inside the human system,” said Anthony Butler, a radiologist at Otago University in New Zealand, who developed the scanner with his father, Phil Butler, a physicist.

“It really is like the upgrade from black-and-white film to color. It's a whole new X-ray experience.”

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In traditional computed tomography, or CT scans, X-ray beams are measured after passing through human tissue. The resulting image appears white where dense bone tissue has absorbed the beams, and black where softer tissues have not.

The new scanner matches individual X-ray photon wavelengths to specific materials, such as calcium. It then assigns a corresponding color to the scanned objects. The tool then translates the data into a three-dimensional image.

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The researchers have generated images of ankles and wrists, but eventually plan to scan full human bodies.

The technology could contribute to advances in cancer drug development and to understanding heart disease and bone health. Its creators hope it will help doctors design personalized treatment plans involving targeted drug therapies or less invasive surgeries.

The new tool could serve as “a diagnostic road map to a destination,” according to Dr. Gary E. Friedlaender, an orthopedic surgeon at Yale University who treats bone cancers found in complex locations, such as inside the pelvis.

“It’s about being able to first find the explanation for somebody's symptoms, like a tumor, and then find the best way to reach it with the least amount of detours and misadventures,” he said. “We want to minimize the damage to normal tissues.”

The device was adapted from a pixel-detecting tool that physicists use at the Large Hadron Collider, the underground tunnel with a diameter of nearly 17 miles at the European Organization for Nuclear Research, known as CERN. It was originally designed to track particles as they moved through the accelerator tube.

“This is the beauty of it: Technology that was first intended for the field of high-energy physics is being used to improve society,” said Aurélie Pezous, an engineer at CERN who promotes outside application of the research center's technologies. “It’s very exciting for CERN.”

A clinical trial to test the new scanner will enroll orthopedic and rheumatology patients in New Zealand in upcoming months.

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