Transcript

Phased Contrast X-Ray Imaging

TRANSCRIPT

(Image of Erin Miller, Ph.D.)
Erin A. Miller, Ph.D.—Physicist, Simulation & Analysis: Hi, my name is Erin Miller. I'm a physicist at Pacific Northwest National Laboratory. For the past three years we've been working on a project called Phased Contrast X-Ray Imaging; we're hoping to use it for enhanced explosives detection.

(Images of empty airport security checkpoint, screenshot of Phased Contrast X-ray image, cardboard shipping boxes, suitcases, vials of white powder)
Miller: This area of research was initiated by a group in Switzerland. We're looking to apply it to problems in explosives detection; things like mail scanning, or luggage scanning. It can also be used for detecting contraband, small parts inspection, or materials characterization.

(Animation of how X-ray functions; image of "Object of Interest"; animation showing rays going from left to right; image of "Silicon Gratings")
Miller: This technique works very similar to a regular X-ray radiograph, which is based on the absorption of the X-rays. So, the guts of this are that you have the X-ray source on the left in the figure, the object of interest in the middle, and then you have the detector on the right.

(Video clip of "Actual Silicon Gratings")
Miller: This differs from a standard imaging setup by the addition of three silicon gratings, which allow us to detect distortions in the X-ray wave front. That is a separate piece of information than what we can get from a standard radiograph.

(Animation of security checkpoint scanner with package running through, showing the X-ray imaging; package disappears leaving "Object of Interest"; "Gratings" appear; slide of "Absorption" image appears; slide of Phase Contrast" image appears; slide of "Scatter" image appears)
Miller: One scenario might be, if you were trying to screen mail for someone trying to hide something in a small package. You would run your package on a conveyer belt through a detector, just like a regular X-ray system, but it's a little bit different. With this technique, there are some gratings that we add to the normal X-ray measurement. When we do our processing, we get out three distinct images:

1. An absorption image, which is what you get out of a conventional radiograph.
2. A phase contrast image, which is based off the distortions.
3. And then a scattering image, which is very sensitive to texture on a nanometer to micron scale.

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(Text appears on "Scatter" slide)
Miller: The scatter turns out to be a very sensitive indicator of things like powder, wood, or paper—where there's a lot of small scale texture.

(Image of "Absorption," "Phase Contrast," and "Scatter" appear, merge, and fade into X-ray function diagram with object of interest and silicon gratings)
Miller: It's the combination of these three different pieces of information, two of which—the phase and the scatter—we didn't have before with the conventional X-ray system. This has us excited to find new ways, better ways, to find explosives.

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