New x-ray technique targets terrorists and tumours

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Scientists at The University of Manchester have developed a new x-ray technique that could be used to detect hidden explosives, drugs and human cancers more effectively.

Professor Robert Cernik and colleagues from The School of Materials have built a prototype colour 3D X-ray system that allows material at each point of an image to be clearly identified.

The innovative work is reported in the latest issue of *The Journal of the Royal Society Interface* and is published online today, Wednesday 28 November 2007.

The technique developed by the Manchester scientists is known as tomographic energy dispersive diffraction imaging or TEDDI.

It harnesses all the wavelengths present in an x-ray beam to create probing 3D pictures.

The technique improves on existing methods by allowing detailed images to be created with one very simple scanning motion.

The method makes use of advanced detector and collimator engineering pioneered at Daresbury Laboratory, Rutherford Appleton Laboratory and The University of Cambridge.

Scientists believe this advanced engineering will reduce the time taken to create a sample scan from hours to just a few minutes.

This shorter period would eliminate the problem of radiation damage, allowing biopsy samples to be studied and normal tissue types to be distinguished from abnormal.

Professor Cernik said: "We have demonstrated a new prototype X-ray imaging system that has exciting possibilities across a wide range of disciplines including medicine, security scanning and aerospace engineering.

"Current imaging systems such as spiral CAT scanners do not use all the information contained in the X-ray beam. We use all the wavelengths present to give a colour X-ray image. This extra information can be used to fingerprint the material present at each point in a 3D image.

"The TEDDI method is highly applicable to biomaterials, with the possibility of specific tissue identification in humans or identifying explosives, cocaine or heroin in freight. It could also be used in aerospace engineering, to establish whether the alloys in a weld have too much strain."

To develop the technology Prof Cernik and his team have had to overcome two major technological challenges.

The first was to produce pixellated spectroscopy grade energy sensitive detectors. This was carried out in collaboration with Rutherford Appleton Laboratory, Oxford and Daresbury Laboratory, Cheshire.

The second challenge was to build a device known as a 2D collimator, which filters and directs streams of scattered X-rays. The collimator device needed to have a high aspect ratio of 6000:1, meaning that it its width to its length is more than that of the channel tunnel.

This device was built using a laser drilling method in collaboration with The University of Cambridge.

Professor Cernik added: "There is a great deal of interest within engineering communities in the non-destructive determination of residual stresses in manufactured components, especially in critical areas such as aircraft wings and engine casings.

"The TEDDI system can be used for strain scanning whole fabricated components in the automotive or aerospace industries, although we are currently limited to light alloys."

Using detectors made from silicon, the Manchester team has been restricted to looking at thin samples or light atom structures.

But they are developing new, high purity, high atomic weight, semiconductor detector materials that will remove this difficulty and drastically speed up scanning times.

Source: University of Manchester

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