# X-ray detector on plastic delivers medical imaging performance

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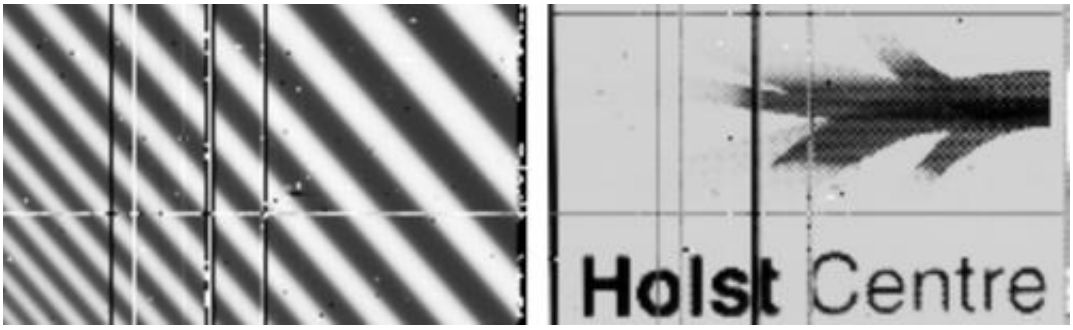


Examples of X-ray image (left) and optical image (right) obtained with Holst Centre's X-ray detector on plastic substrate.

Researchers from Holst Centre and imec have demonstrated the first ever X-ray detector produced on a plastic substrate that is capable of medical-grade performance. The proof-of-concept device delivers high-resolution, dynamic images at 25 frames per second (fps) and 200 pixels per inch (ppi) with high contrast using medical-level X-ray doses.

Digital X-ray systems offer a number of benefits over older, analog systems. Images are available faster, are easier to share and can be achieved using less radiation. However, today's digital X-ray sensors are still produced on large glass substrates, making them heavy, difficult to transport and prone to breakages.

In 2012, the team demonstrated the world's first complete X-ray detector

produced on a thin plastic substrate. An indirect flat panel detector (FPD), it combined a standard scintillator with a novel organic photodiode layer and organic thin-film transistor (TFT) backplane. By using solution-processed organic semiconductor rather than the usual amorphous silicon, the team reduced process temperatures to be compatible with plastic film substrates. They also eliminated a number of costly lithography steps, opening the door to lower production costs.

Now, the same team has delivered a major breakthrough in device performance. It has reduced the photodiode leakage current (the output from the photodiodes at zero light) by a factor of 10,000, down to 10-7 mA/cm2, bringing it well within the requirements for medical detectors. This improves the signal-to-noise ratio, and hence image quality at low radiation dose. At the same time, oxide transistors are used instead of organic transistors. The charge carrier mobility in the metal-oxide TFTs is 10-50 times higher than with amorphous silicon and organic transistors, enabling faster image acquisition.

These advances were integrated into a high-aperture QQVGA (160 x 120 pixels) detector plate with a high resolution of 200-ppi. This plate was integrated with off-board electronics consisting of components that are currently used for medical application, and no modifications needed to be made.

"X-ray detectors on plastic could lead to lighter, more robust and less expensive X-ray systems that are easier to move around the hospital. Two years ago, we were the first to show such devices were technically possible. And now we have shown they can deliver the performance necessary for medical use. Our next goal is to scale up the technology and produce a full-size 30 cm by 30 cm demonstrator module for medical applications," said Holst Centre's Gerwin Gelinck, who headed up the research team.

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