

## Scientists develop safer X-rays for children

**European photonics scientists have developed a new 'autocorrect' image processing algorithm to reduce X-ray scatter, meaning children can receive safer, high contrast, low dose X-rays.**

Clinicians will be able to take a low radiation, digital X-ray image - without the need for an anti-scatter grid - thanks to new innovative 'scattering suppression software'.

Developed by photonics scientists at WUT, working in collaboration with innovation incubator ACTPHAST 4.0 and medical imaging company Italray SRL, the new algorithm 'auto corrects' unclear, low dose digital X-rays to generate a higher-contrast image, meaning young children can receive safer scans.

When having an X-ray or CT scan, beams enter the body and ricochet around inside – or become 'scattered'.

Given that the scatter signal interferes with the primary contrast of the patient's physical features such as bones or organs, this scattering process creates 'noise' and leads to a loss in image quality - making resulting X-rays appear blurred.

The scatter, however can be counteracted with an 'anti scatter grid' – a metal plate made of lead strips to encourage parallel beams - improving the image contrast. But, this grid normally requires a higher dose of X-rays, and can therefore be dangerous to small children.

With over [660 million X-rays being recorded in Europe in 2008](#) they are a diagnostic test most of us are familiar with. X-rays can emit harmful ionizing radiation - high-energy particles that penetrate tissue to reveal internal organs and bone structures – which can damage DNA. While scientists have often sought to reduce this ionizing radiation, traditionally it has come at the expense of the type of detector and image resolution.

### Noise Reduction

The photonics scientists have been able to address the image quality problem as a result of scatter from the perspective of the acquired data and the digital image processing.

Dr. Wojciech Krauze, project manager for the collaboration explains: "The partnership between ACTPHAST 4.0, Italray and WUT has looked at ways to reduce the amount of 'noise' – or the removal of errors - in final images.

"It works by minimising the scattering process by taking the original image and estimation of the scatter signal. By partially 'reversing' the scatter our digital image processing

algorithm is able to reduce the amount of noise signal, essentially 'autocorrecting' the blurred image.

"The method is very fast: a physician taking the x-ray image of a patient obtains the corrected 'denoised' version instantly."

"The result is a 'scatter grid quality' image without the need for an actual anti scatter grid," Dr Krauze said.

### **Photonics Innovation**

The SME 'incubator' that helps existing and fledgling businesses with innovation partnership, ACTPHAST 4.0 provided the expertise in photonics to Italray.

Partnering with the 'one-stop shop' digital incubator that provides open access to photonics innovation support for eligible European companies, Italray has seen ACTPHAST make a huge difference.

Peter Doyle, central outreach coordinator, said: "Many SMEs today do not have access to experts in the technical aspects of innovating with photonics. ACTPHAST made the difference in terms of access to photonics technical capabilities and expertise from within our network. We were able to help with the development of software which needed deep photonics expertise.

Companies that have never used photonics before look to ACTPHAST 4.0 to help them develop the photonics components for their next generation products.

"We have worked with Italray to nurture their product and provide access to state-of-the-art technology platforms. ACTPHAST 4.0 links first-time users who would not normally use optics or photonics in their products (as well as those that are already established within the photonics industry) with bespoke prototyping solutions, tailoring their new product innovation to be fit for purpose in the modern digital economy," said Doyle.

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### **About ACTPHAST 4.0**

ACTPHAST 4.0 supports and accelerates the innovation capacity of European companies by providing them with [direct access to the expertise and state-of-the-art facilities of Europe's leading photonics research centres \(the ACTPHAST 4.0 Partners\)](#), enabling companies to exploit the tremendous commercial potential of applied photonics. There are 24 research institutes who together make up the ACTPHAST 4.0 Partners.

Together the ACTPHAST 4.0 Partners provide a full spectrum of photonics [technology platforms ranging from fibre optics and micro optics, to highly integrated photonic](#)

[platforms](#) (7 technology platforms in all), with capabilities extending from design through to full system prototyping.

ACTPHAST 4.0 operates as an open call to all European companies (big and small, but particularly targeted at SMEs) so they can avail of timely, cost-effective, and low risk photonics innovation support, and that the extensive range of capabilities within the consortium can impact across a wide [range of industrial sectors and application domains](#), from communications to consumer-related products, and life sciences to industrial manufacturing.

The access to top-level experts and leading photonics technology platforms provided by the ACTPHAST 4.0 consortium is realized through [focused innovation projects executed in relatively short timeframes](#) (typically 6-9 months) with a critical mass of suitably qualified companies with high potential product concepts. The technical innovation support is supplemented by expert business and financial coaching supports to help ensure that the innovation activities are also commercially focused and primed for market success.

ACTPHAST 4.0 is closely aligned with the Photonics Pilot Lines and Mass Manufacturing in Europe to seamlessly progress successful prototypes developed through the ACTPHAST 4.0 incubator all the way to large-scale production and market-ready products. In addition, ACTPHAST 4.0 includes Europe Unlimited as a 25th partner in the consortium who run the highly successful TechTour program around Europe each year to match venture capital with high potential start-ups and scale-ups in key technology areas.

ACTPHAST 4.0 is [particularly suited to the needs of small to medium-sized enterprises \(SMEs\)](#) who do not have the financial resources to invest in in-house R&D expertise and state-of-the-art technologies, nor to undertake risky innovation projects. ACTPHAST 4.0 support is heavily subsidized for projects undertaken with SMEs (100% subsidy for the first 30K€ of costs for an innovation project and 75% subsidy for all project costs over 30K€ including follow-on projects with the same company. For large-scale companies, the subsidy is 50% on all project costs).

ACTPHAST 4.0 is designed to provide open access to photonics innovation support for all European companies who meet the eligibility criteria, and we have [strict governance structures and systems in place around the key persons responsible for running the program](#) to ensure that ACTPHAST 4.0 remains true to its mission and mandate, and that all decisions are open, transparent and properly accounted for.

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