PRESS RELEASE

Cutting-edge 2D laser scanner from Fraunhofer spin-off promises efficiency boost in material processing

With its planar, highly integrated XY scanner for industrial use (PIXIE), an upcoming spin-off of the Fraunhofer Institute for Laser Technology ILT in Aachen aims to set new performance standards. The 2D laser deflection system is faster and much more compact than today's galvanometer scanners. This makes it ideal for parallelized material processing with multi-scanner systems and high-power lasers, whose beam is divided into many independently scanned beams for this purpose. The multidisciplinary, diverse quartet of founders behind PIXIE has its sights set on further application markets.

The planar galvanometer scanner (PGS) requires almost 90 percent less installation space and weighs merely one-tenth of today's galvanometer scanners, reduces the size of laser spots by more than two-thirds, and directs them over workpieces at accelerations 50 percent higher. Technological leaps like this don't happen very often. This is why the minds behind this innovative scanning technology – Lazar Bochvarov, Christina Giesen, Dr. Milena Žurić, and Alexander Hohle – decided to take its commercialization into their own hands. With a newly approved Phase I grant from the "exist Research Transfer" program of the Federal Ministry for Economic Affairs and Energy (BMWE), they now have 18 months to implement their start-up project, PIXIE.

PGS closes the gap between two established scanning methods

The quartet developed the already patented technology at Fraunhofer ILT. The idea for the planar galvanometer goes back to Bochvarov. While working on his doctorate in laser microsurgery, he encountered a lack of high-performance but compact scanners. "The currently available galvanometer scanners are limited by their size. Meanwhile, micro-opto-electro-mechanical scanners (MOEMS) with their mm-sized mirrors are not suitable for many laser surgical and industrial applications," he explains. To solve this dilemma, Bochvarov devised a system that combines the best of both technologies: Like MOEMS, the planar, highly integrated XY scanner for industrial use (PIXIE) integrates the drive and mirror in a single rotor unit.

The key to this was the miniaturization of the electromechanical drive. Instead of moving the mirror with a separate motor, the mirror substrate itself is part of a drive system based on the Lorentz force. This utilizes the precisely controllable force effect of a magnetic field on current-carrying electrical conductor to tilt the mirror, which is

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mounted on an axis with two precision ball bearings. The tilt direction can be reversed fast and precisely by reversing the direction of the current. "In the highly integrated drive, the mirror and motor form a compact unit. The principle can be easily scaled to large apertures," explains the founder. This makes mirror sizes well above 100 mm possible, which is highly relevant for high-power lasers and the parallelization of industrial processes. Several redesigns have successfully reduced installation space and weight, which favors the extremely dynamic deflection of the laser beams. The team now wants to leverage these advantages across the board for industrial laser material processing and surgical procedures. In the meantime, Bochvarov, like his co-founders Žurić and Giesen, will remain active in the field of laser medical technology research at Fraunhofer ILT. In parallel, he is pursuing his doctorate in mechanical engineering at RWTH Aachen University.

Concentrated expertise

Žurić will be responsible for system engineering and setting up automated small-batch production in the spin-off. After completing an interdisciplinary degree in electrical engineering and information technology, her doctorate in mechanical engineering at RWTH Aachen University, and managing various research and industrial projects at Fraunhofer ILT, she brings a wealth of expertise to the table. The same applies to Giesen. A graduate in medical physics, she also conducts research in the field of laser medical technology. She contributes expertise in optical design and sensor technology as well as quality management and certification to advance the industrialization of the scanning technology. Alexander Hohle, an expert in business administration, is also on board: he is a physicist, has an MBA from the Collège des Ingénieurs Paris, and has held various positions in industry. He will be responsible for strategy development, financial controlling, marketing, and human resources.

The team has set itself ambitious goals for the duration of the exist funding. "We are planning a redesign with a view to automated production," explains Žurić. "There is also room for optimization in position sensor technology," adds Giesen. Parallel to the implementation of these tasks, the demonstrator is being used for the first time by pilot customers who have been closely involved in the start-up project from the outset. In addition, long-term tests and the establishment of the supply chain with selected suppliers are now underway. The launch of PIXIE as the "smallest, fastest scanning system on the market" is scheduled to follow in 2027. Based on their market analysis and expressions of interest from potential customers in various application markets, the team hopes for a rapid market ramp-up. "Break-even in 2030 is possible if everything goes smoothly in terms of technology development and production setup," says Hohle.

PIXIE addresses important photonic trends

The founding team has every reason to be optimistic. As the smallest and fastest 2D scanner on the market, PIXIE addresses several current trends in photonics. Laser beam sources with high average power are entering the market, which the industry hopes will solve a long-standing problem: Despite their superior precision and high energy efficiency, lasers are still not commonly used in material processing due to productivity issues. Powerful lasers make it possible to parallelize processing steps by splitting their energy into many individual partial beams. "These partial beams must be directed independently of each other onto workpiece surfaces," explains Bochvarov. But this requires very compact and fast scanners. Conventional galvanometer scanners take up too much space to leverage the efficiency potential of parallelization. And they are also too heavy, especially for robot-guided applications in industry and medicine.

The team has received expressions of interest from machine and plant manufacturers who want to use PIXIE to implement efficient additive manufacturing processes – or to parallelize drilling, cutting, and surface treatment processes with high-power lasers. This makes laser processes interesting for more and more applications in which they can replace environmentally harmful processes such as electrochemical ablation, wet chemical etching, or coatings with PFAS (per- and polyfluorinated alkyl substances), which are known as "forever chemicals." Whether in semiconductor manufacturing, turbine construction, cleaning ship hulls overgrown with mussels and algae, or perforating the finest water filters: parallelized material processing with split high-power laser beams that are quickly and precisely deflected by PIXIE, or with multi-laser and multi-scanner systems, could pave the way for more ecologically and economically sustainable solutions.

Fraunhofer expertise in the background

In their startup venture, the team is supported by Dr. Jochen Stollenwerk, Prof. Arnold Gillner, and Prof. Carlo Holly, three high-ranking experts in laser technology and digital, highly automated laser processes. Fraunhofer ILT's current acting director is part of the circle of mentors. Holly and Gillner were and are department heads. In addition, Dr. Yves Hagedorn, managing director of the Fraunhofer ILT spin-off Aconity3D, and Dr. Claus Schnitzler, managing director of Amphos GmbH, which also originated from the Aachen-based research institute, belong to the advisory board. And in the Fraunhofer Venture start-up network, the team also has access to concentrated expertise in start-up strategies and financing issues.



Image 1:
Dr. Milena Žurić, Christina Giesen, Lazar Bochvarov, and Alexander Hohle (from left to right) are behind the spin-off. They will bring their scanner technology to market maturity through the "exist-Forschungstransfer" program of the Federal Ministry for Economic Affairs and Energy (BMWE).
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Image 1:
At Fraunhofer ILT, the PIXIE startup team has developed the technological foundation for this innovative, already patented scanner. To bring it to market, the team is now spinning off the company.
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