

PHOTONICS spectra®

The Race
to Package
PICs

vanguard

AUTOMATION

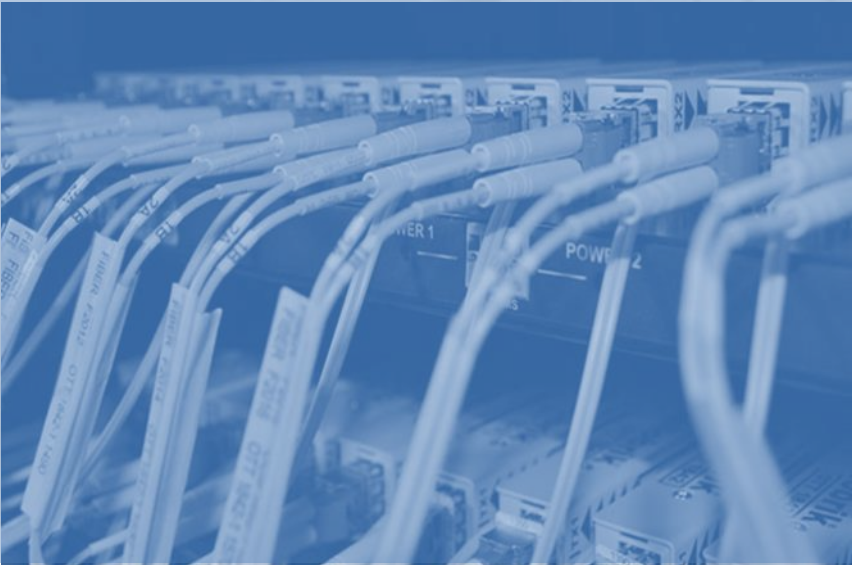
b r i g h t c o n n e c t i o n s

Scaling 3D Laser Lithography Based Packaging of Hybrid Multi-Chip Assemblies from Prototyping to Volume Production

Philipp-Immanuel Dietrich

Photonics Integrated Circuits are Growing at >20% CAGR

Tele and Data
Communications



3D Sensing



Quantum Applications



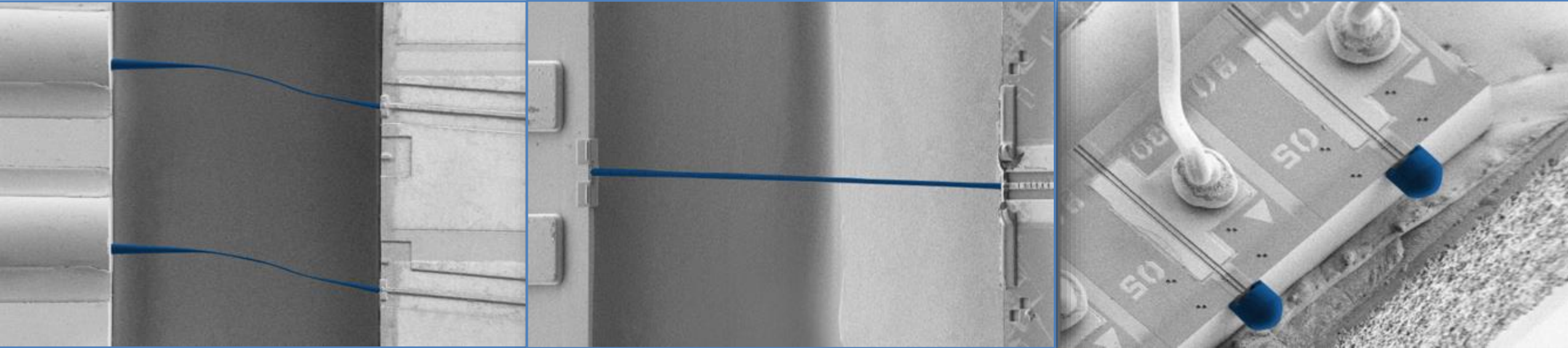
**Packaging of Photonic Systems from Discrete Chips still
Represent a Technical and Commercial Challenge.**

Enabling next Generation Photonic Integration and Packaging Solutions with 3D Laser Lithography Solutions

Laser by Freedom Photonics LLC

Samples bx PIXAPP (Photonic Packaging Pilot Line)

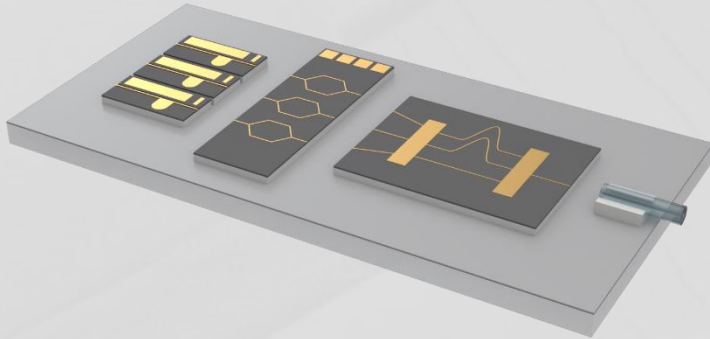
Samples bx PIXAPP (Photonic Packaging Pilot Line)



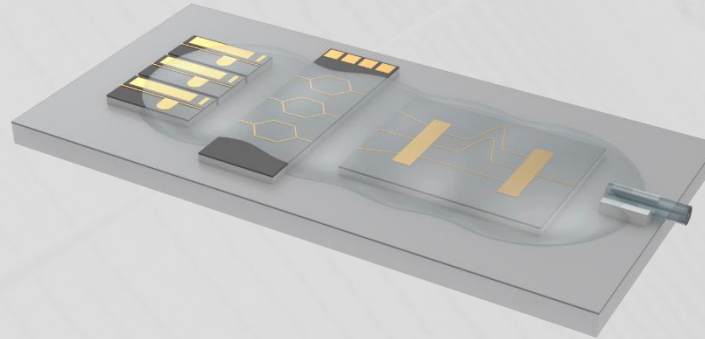
Photonic Wire Bonding and Micro Optical Lenses

3D Laser Lithography for Photonic Packaging – The Process

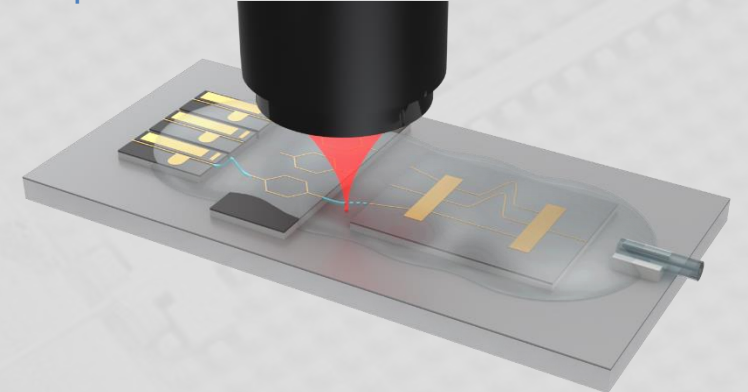
Step 1: Assembly Build-Up



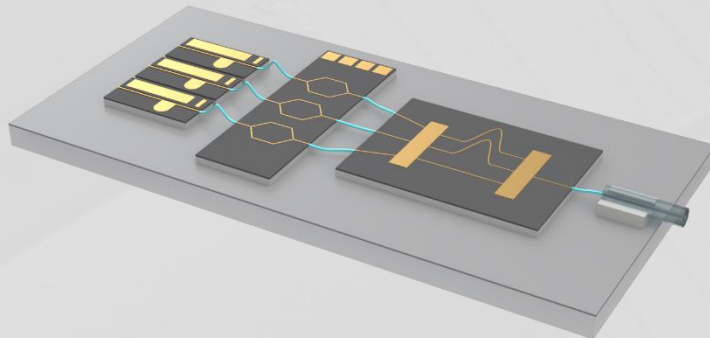
Step 2: Resist and Interface Detection



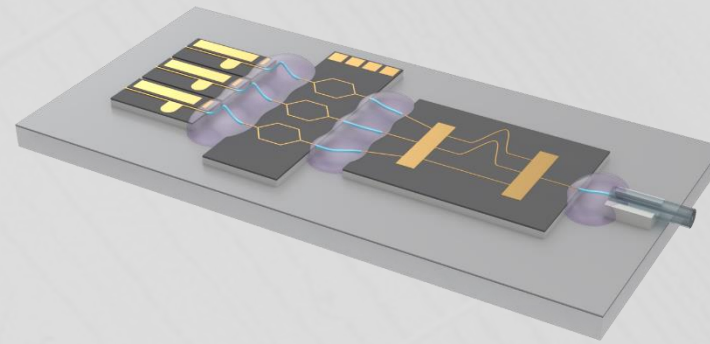
Step 3: Fabrication of PWBs



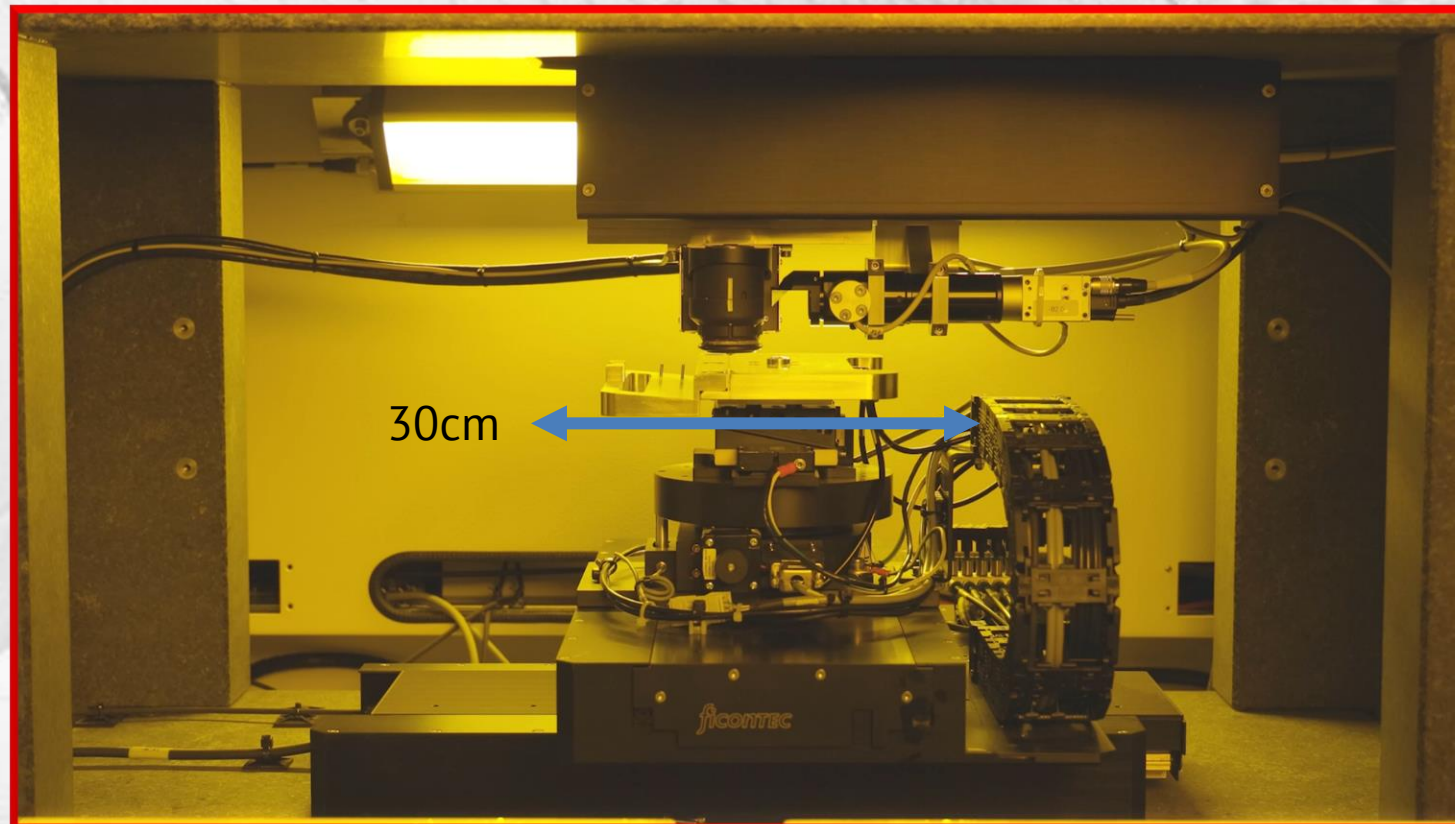
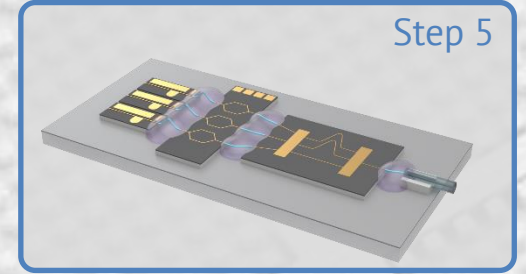
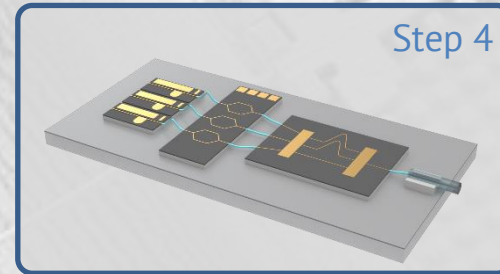
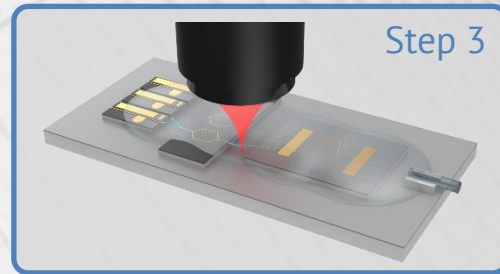
Step 4: Developing and Cleansing



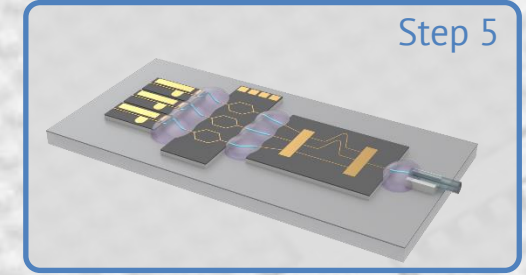
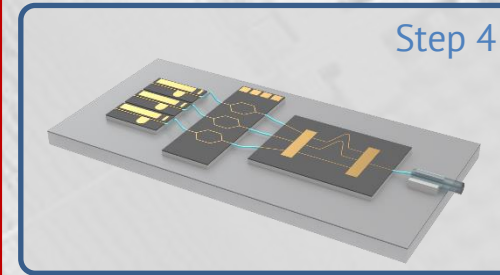
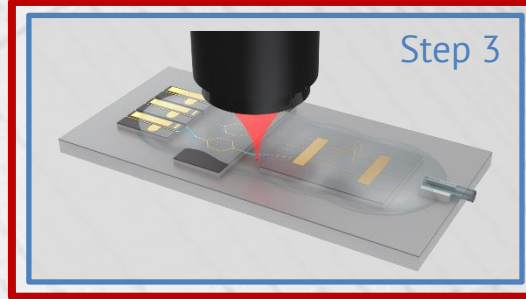
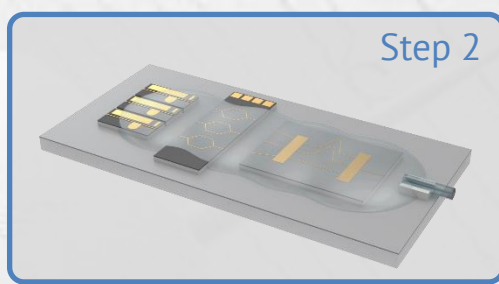
Step 5: Cladding (Encapsulation)



Fully Automated 3D Lithography – vanguard SONATA 1000

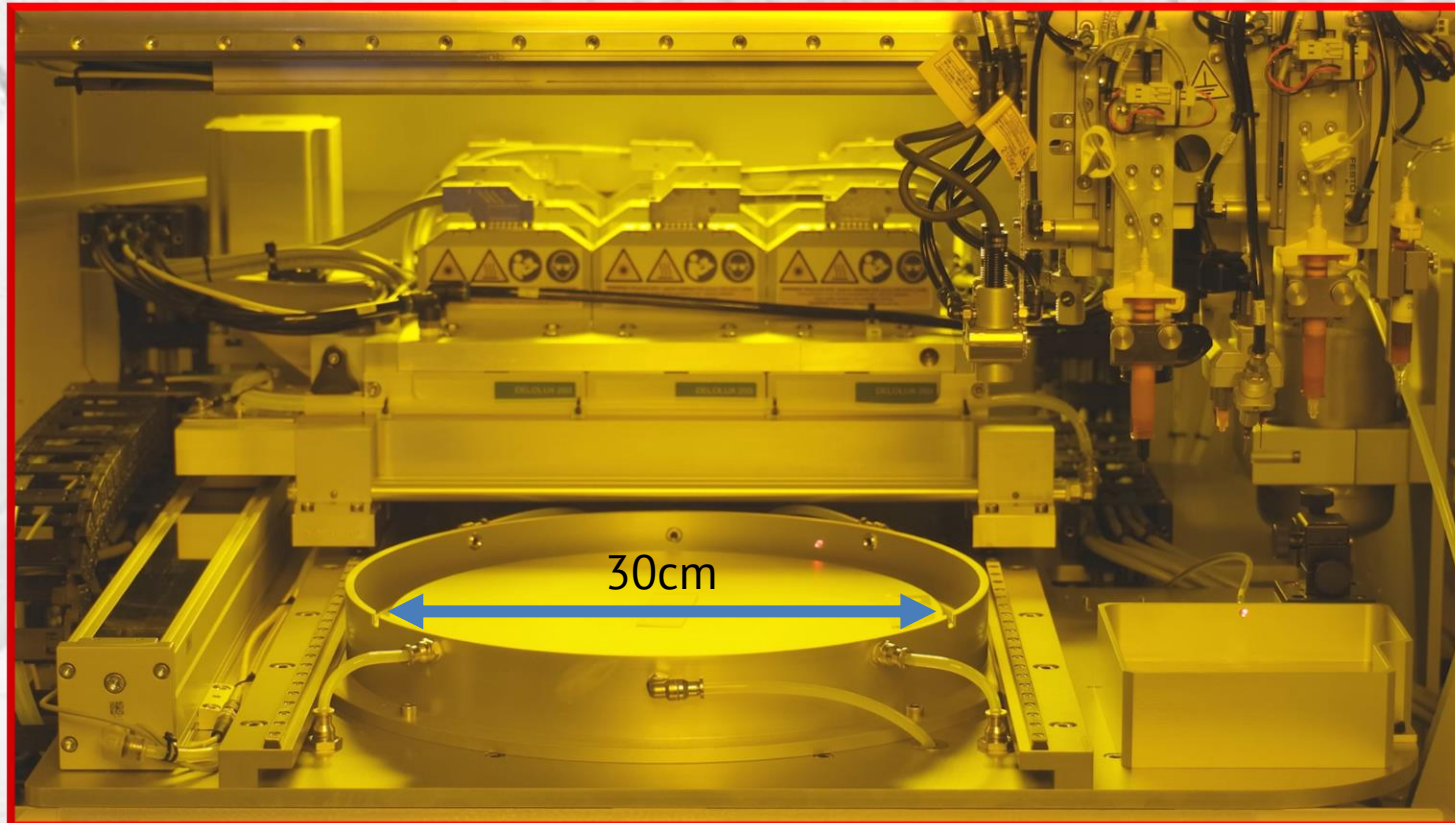
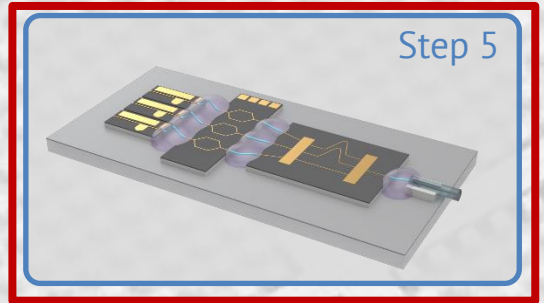
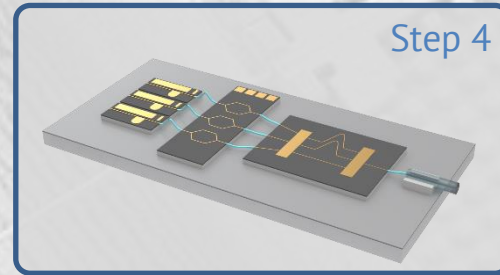
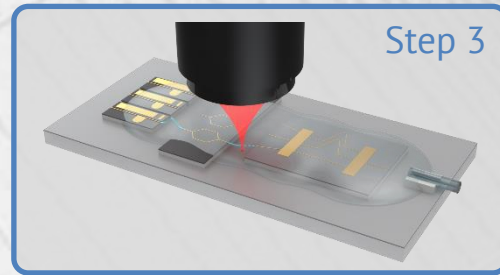
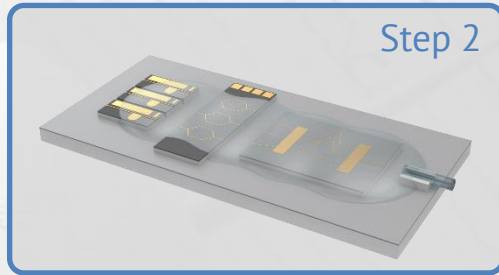


Fully Automated 3D Lithography – vanguard BrightWire3D



The screenshot displays the software interface for the 3D lithography process. On the left, a 'Process' list shows various steps such as 'FocusOnSample', 'Numeric Calculation', 'Set Current Taper', and 'Shape Detection'. The 'Save Process' button is highlighted. Below the list are controls for 'Goto', 'Enabled', 'Wait for Execution', and 'Log Row'. On the right, the 'ImageDisplay' window shows a grid of images and a detailed view of a single image with detection results. The detection results include 'Score: 0.916', 'Score: 0.915', 'Detection OK. SI surface at -1.80 μm', and 'Detection at 0.20 μm'. The interface also includes a 'Run Process' button and a 'Single Step' button.

Fully Automated Post Processing – vanguard REPRISE 1000



One Platform – vanguard SYMPHONY 1000

Software-Defined Fabrication of PWBs and Micro-Optical Lenses

Automated 3D Lithography
Based Nano Fabrication



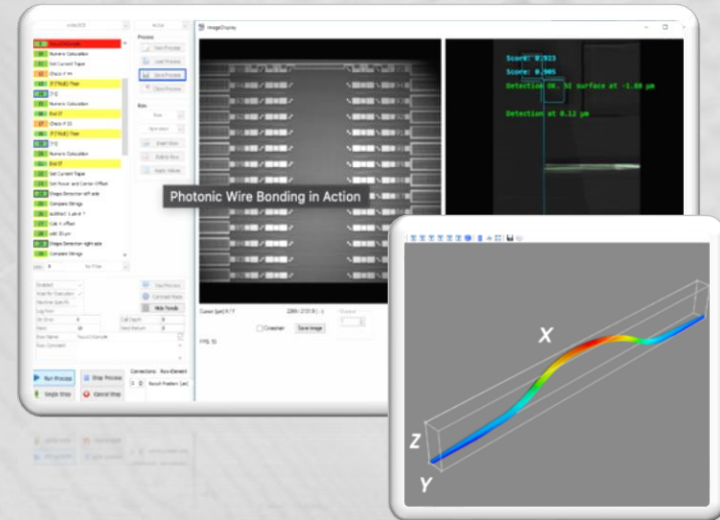
SONATA 1000

Automated Pre- and Postprocessing
(Development and Encapsulation)



REPRISE 1000

Software for Machine Control, Process
Development and Management

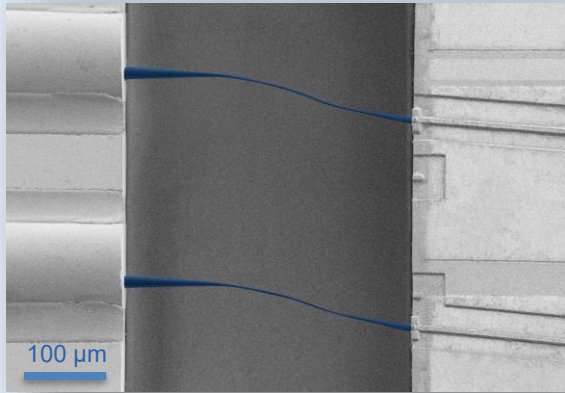


Composer and BrightWire3D

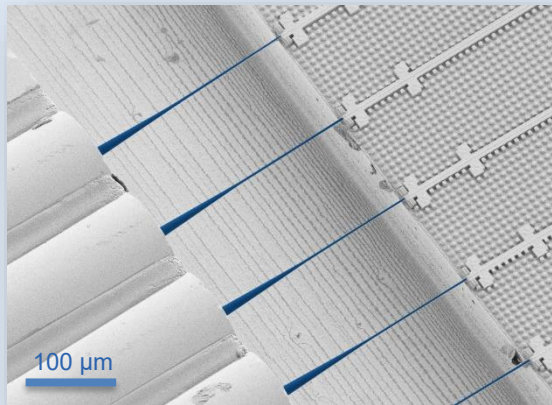
Standard Fabrication Processes | Materials | Product Support and Services

Next Generation Photonic Integration and Packaging Solutions

Photonic Wire Bonds

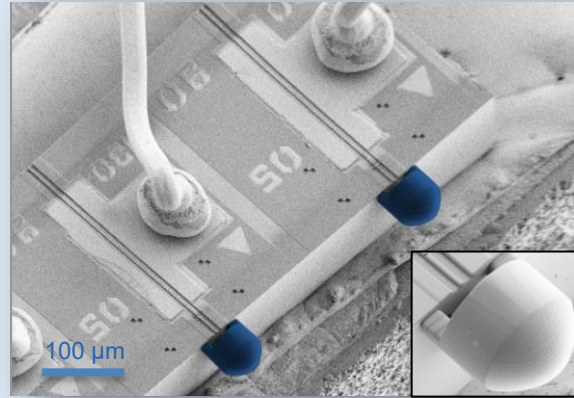


Laser by Freedom Photonics LLC

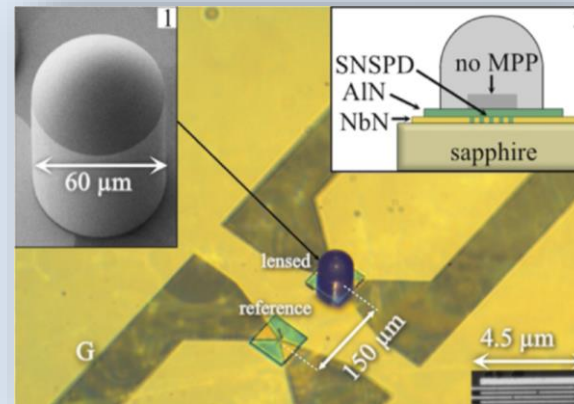


PIC by Institut für Mikroelektronik Stuttgart

Micro-Optical Elements

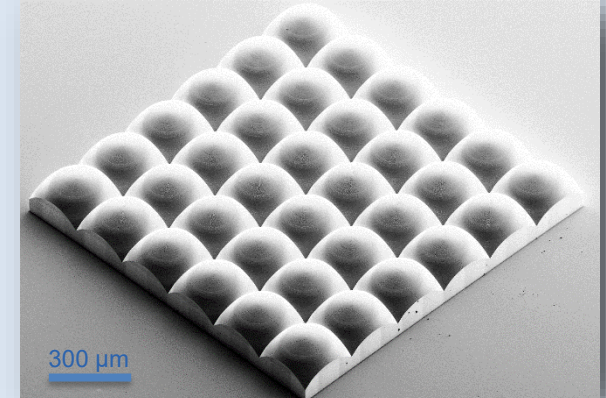


Samples by PIXAPP (Photonic Packaging Pilot Line)



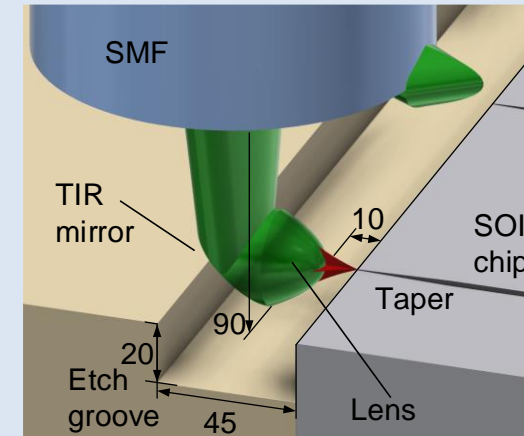
Xu et al., Superconducting nanowire single-photon detector with 3D-printed free-form microlenses, Opt. Expr. 29, 27708-27731 (2021)

Write Field Extension



Design by Moveon Technologies Pte Ltd.

Wafer-Level Probing



From Design to Production

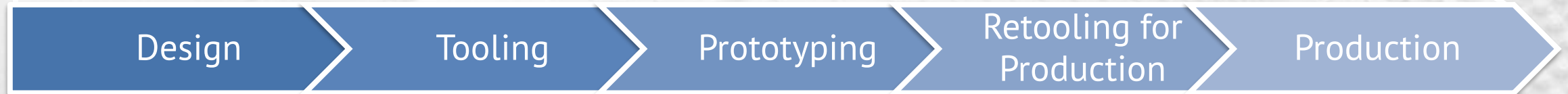
3D Nano Fabrication (Inherently Software-Defined)



Short Innovation Cycles

Supply Chain Flexibility

Design Flexibility



“Traditional” Approach (Inherently Hardware-Defined)

End-Users and Ecosystem Partners

