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Laser micromachining for packaging

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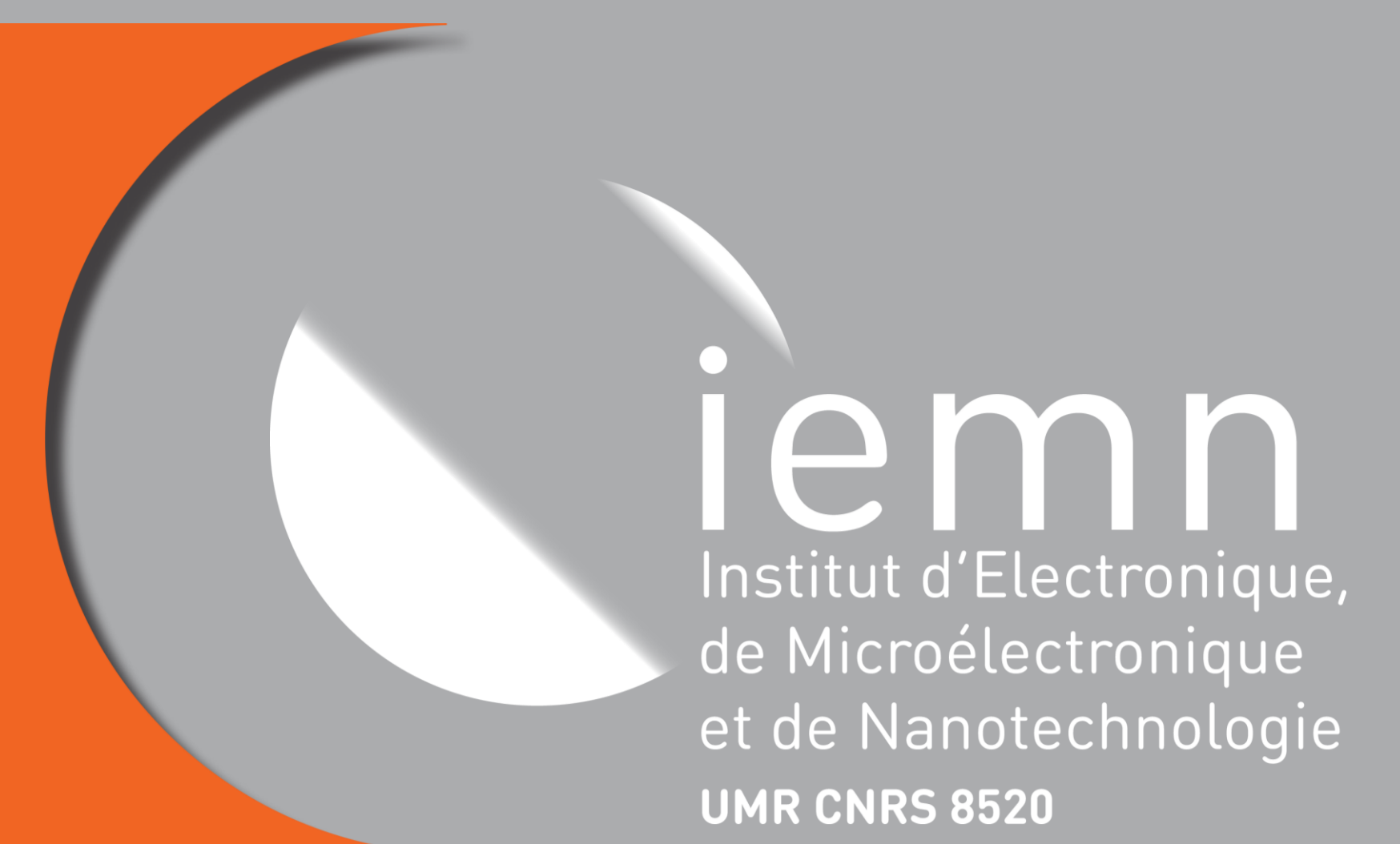
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Laser micromachining for packaging

F. BRAUD*, J.M. Boucaud, M. Alawar, A. Bhaskar, V. Merupo, S. Arscott, E. Peytavit, D. Gloria, E. Dubois



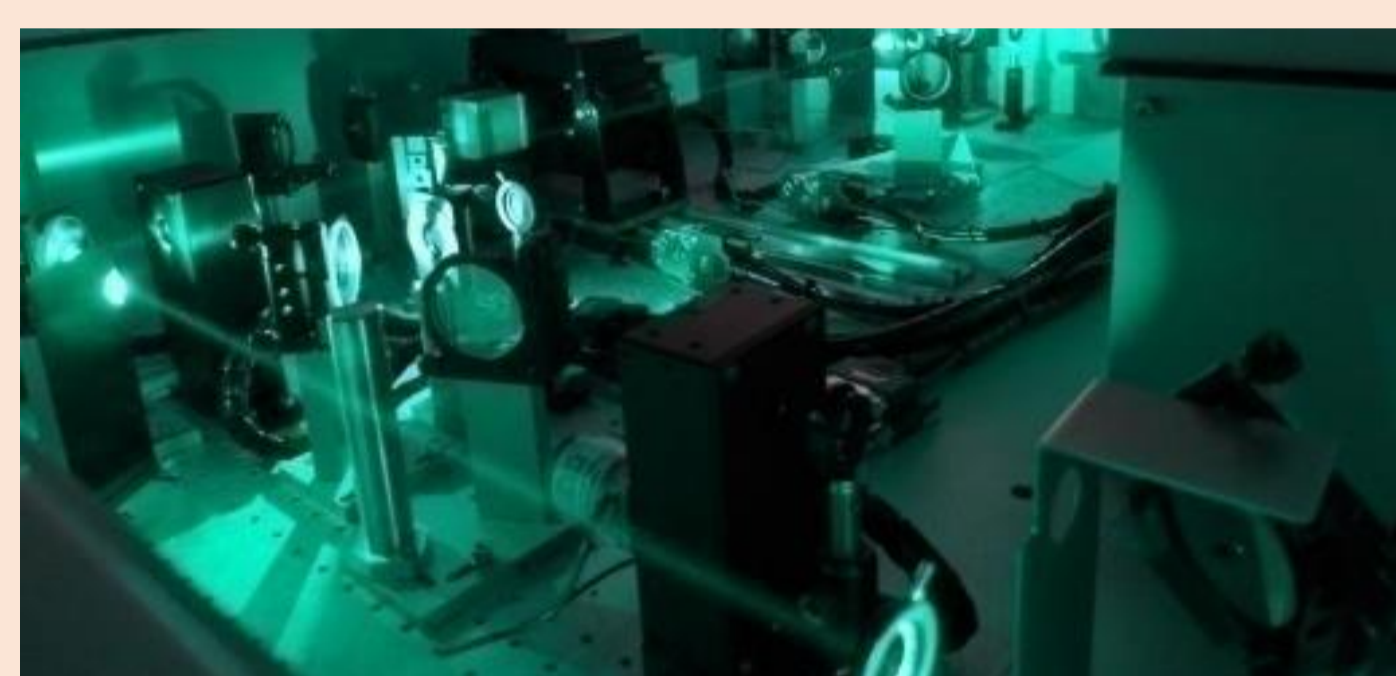
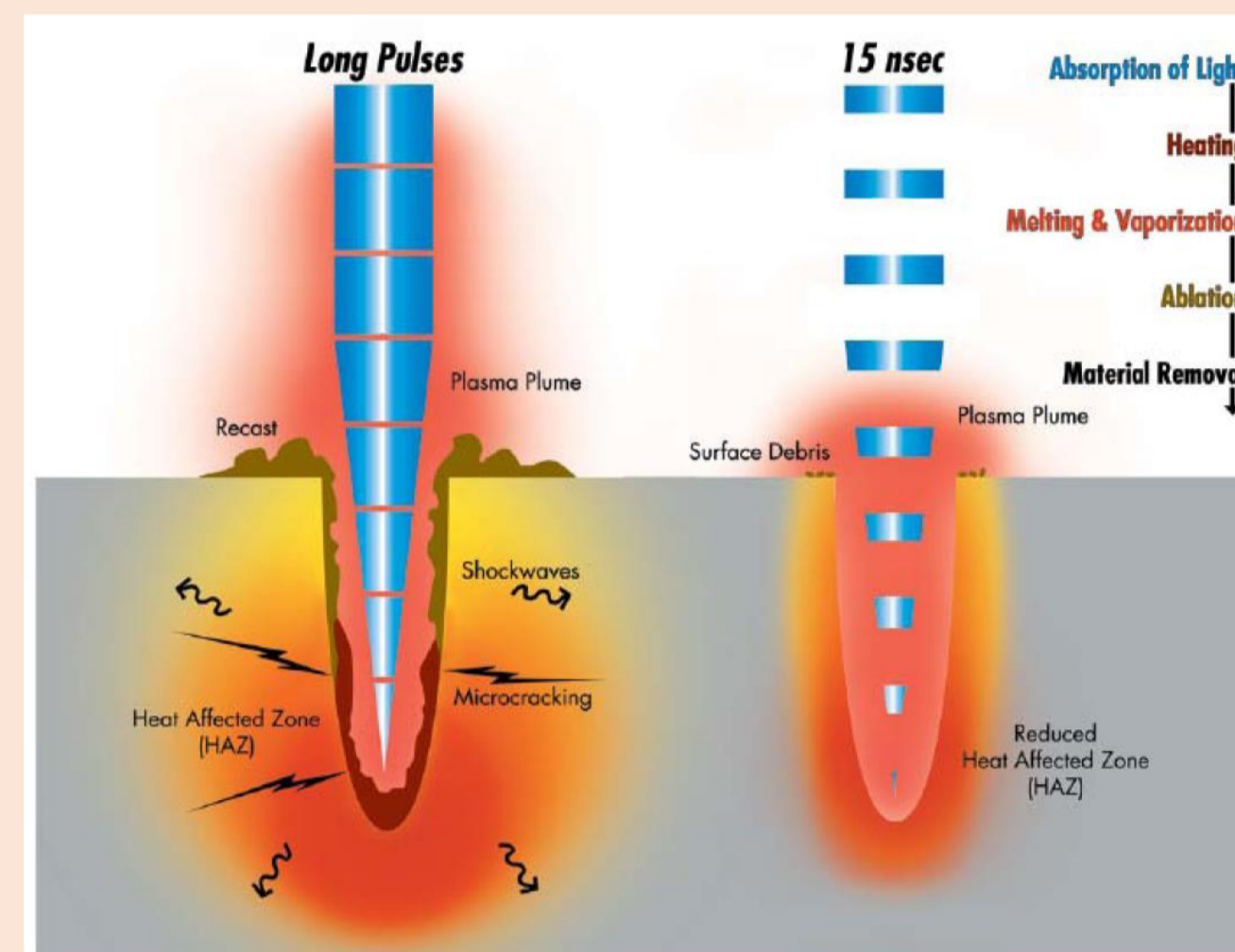
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Principle



System 1

- Multi-wavelength femtosecond (300fs) diode-pumped (DPSS) lasers (343,515,1030nm)
- galvanometer deflection with extended field of 50x50mm²
- sample stage up to 300x300 mm² with linear accuracy +/- 0.5 μm, repeatability +/- 0.2μm
- Trepan head
- Position synchronized output (PSO)

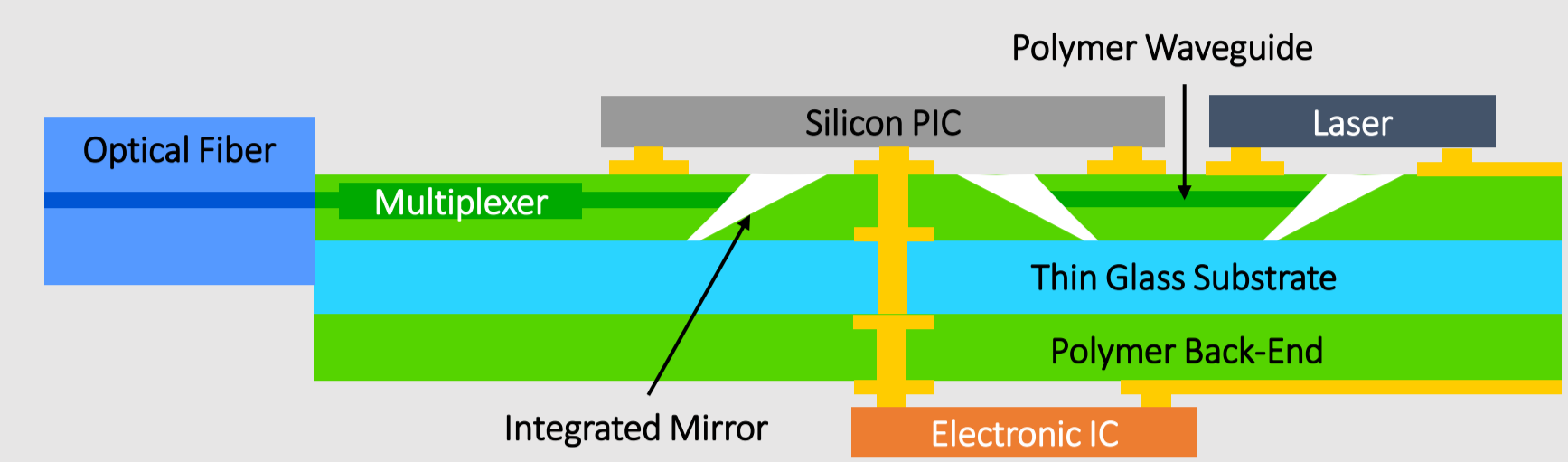


- Materials structuring at reduced thermal budget
- No compatibility issues due to materials and processing chemistry

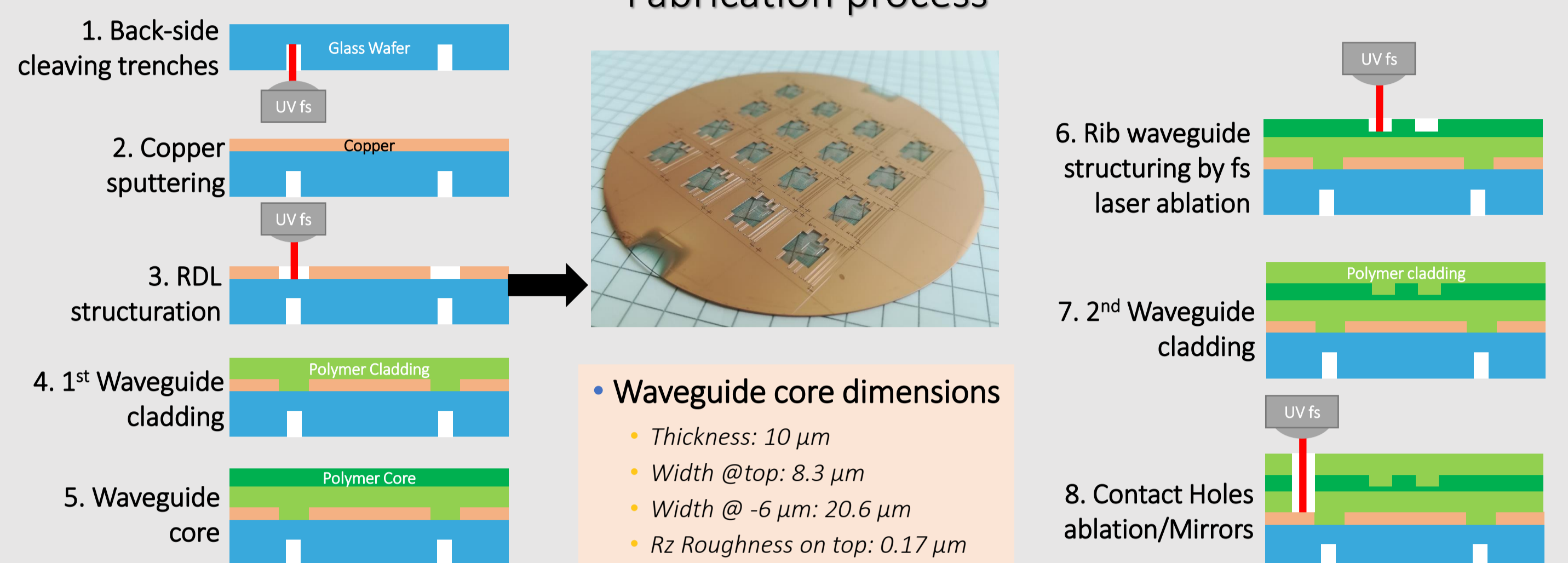
System 2

- High power UV nanosecond DPSS laser (351nm)

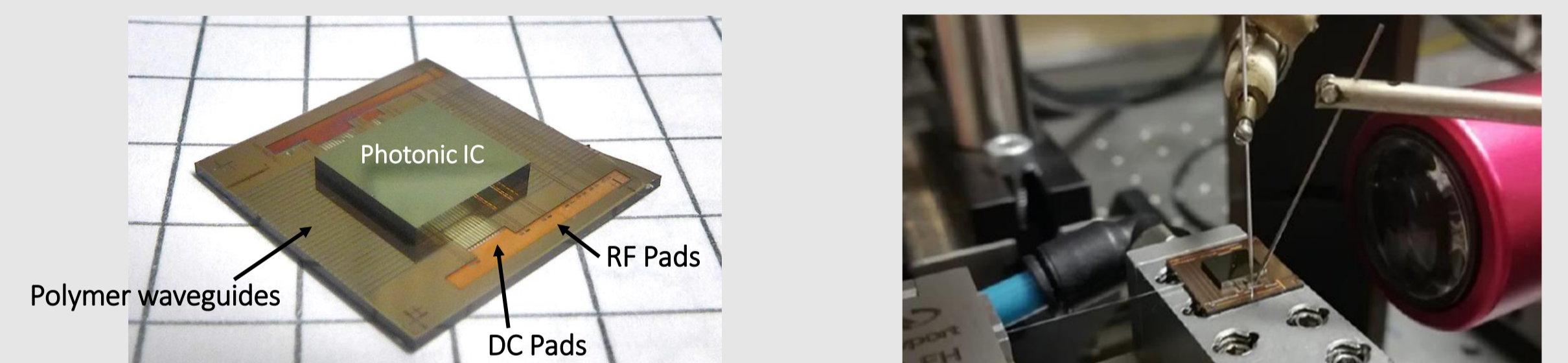
Glass interposer for heterogeneous integration of flip-chipped photonic and electronic integrated circuits



Fabrication process



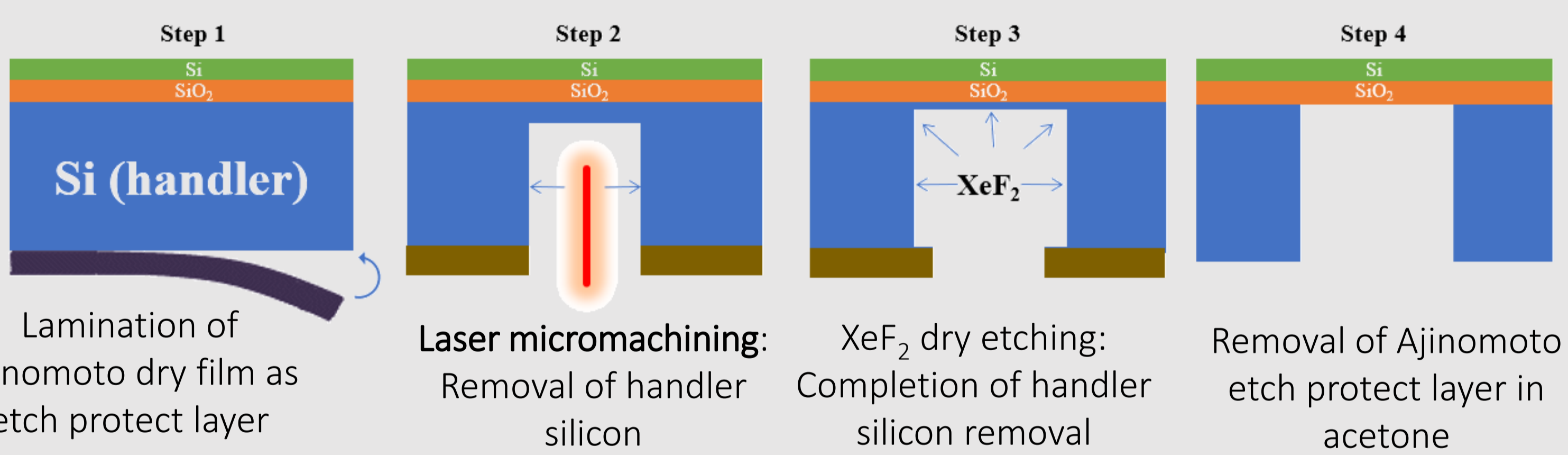
Results



J. M. Boucaud, et al. *Glass interposer for heterogeneous integration of flip-chipped photonic and electronic integrated circuits*. Applied Physics Letters, 125, 054101 (2024) ([10.1063/5.0221309](https://doi.org/10.1063/5.0221309)). ([hal-04665935](https://arxiv.org/abs/2404.04665))

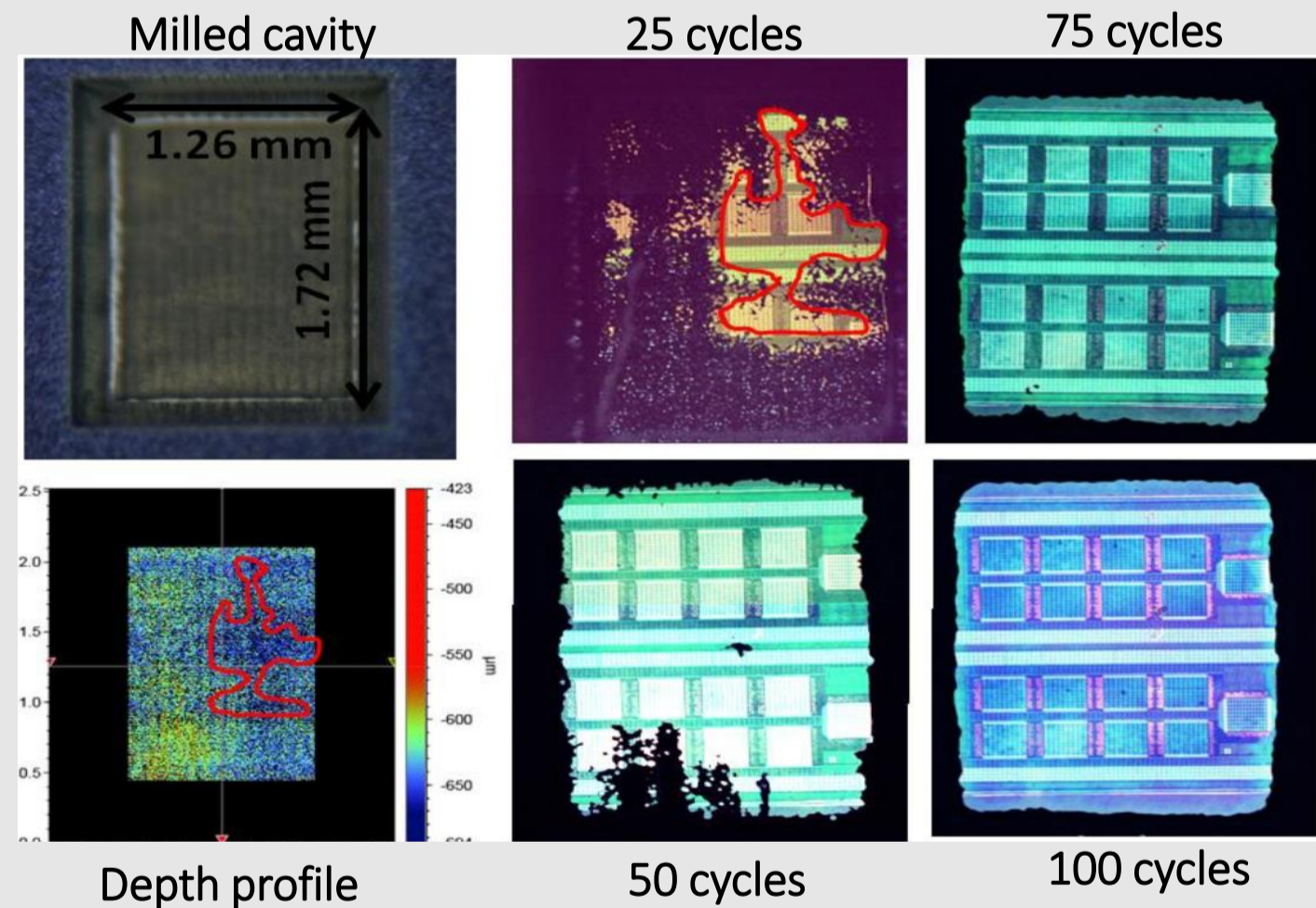
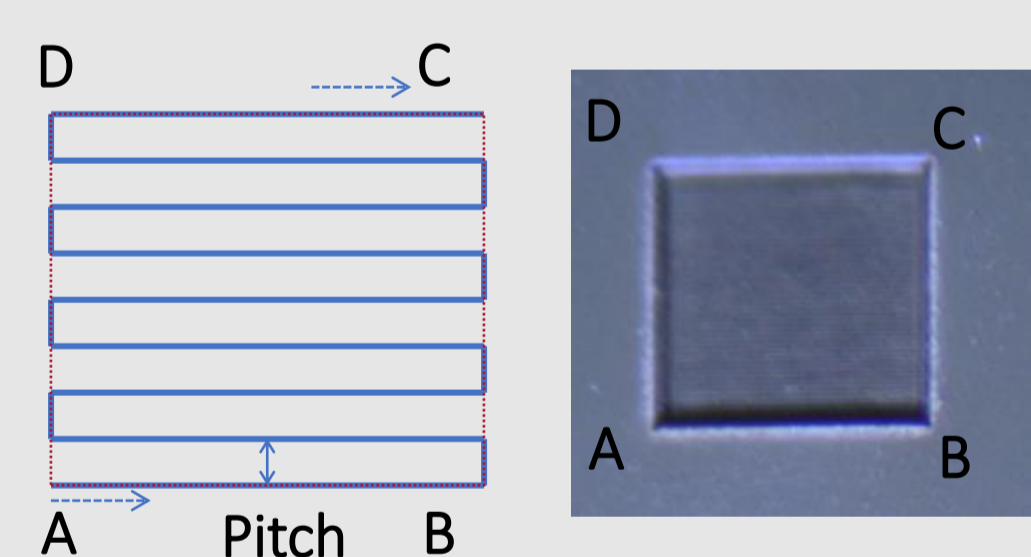
FLAME process

Femtosecond Laser Assisted Micromachining and Etch



XeF₂ etching

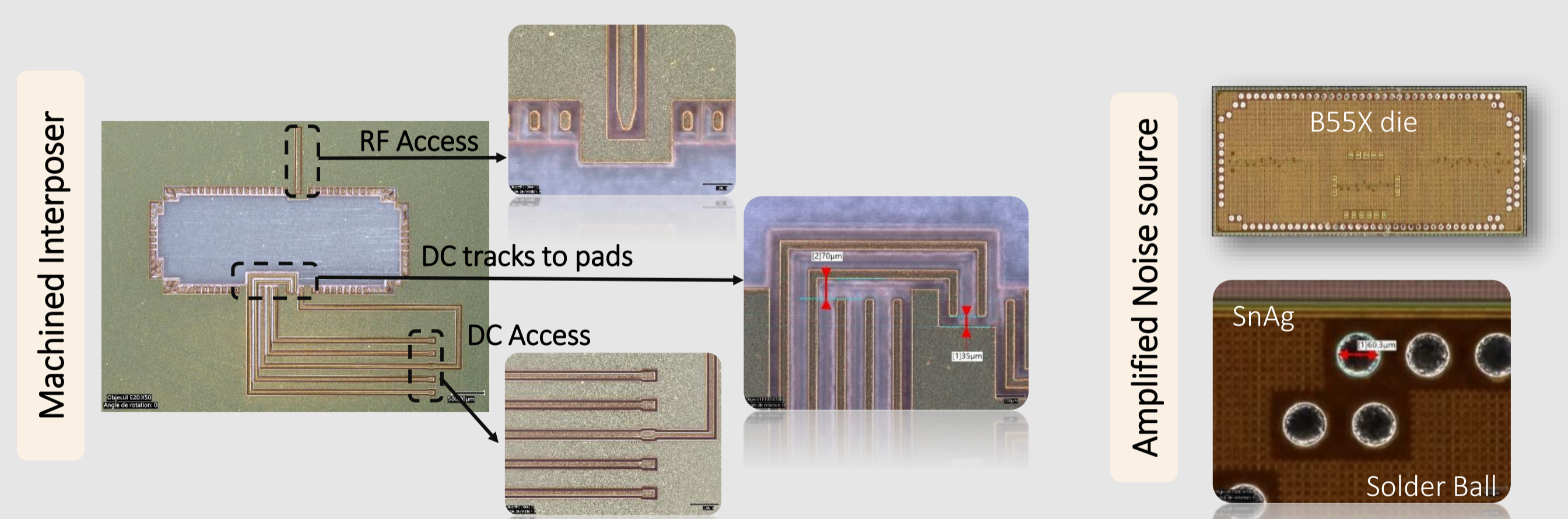
Laser micromachining



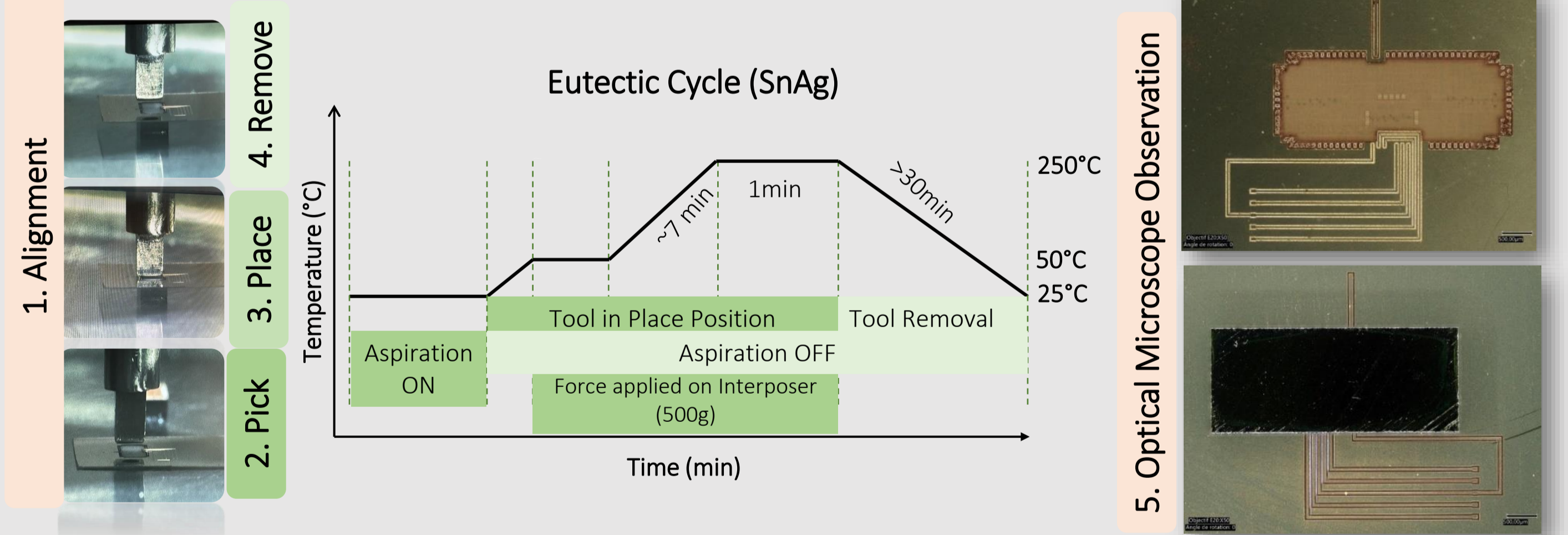
Progression of etching with number of cycles

A. Bhaskar, et al., *Large-area femtosecond laser milling of silicon employing trench analysis* Optics and Laser Technology, 138, pp.106866 (2021) ([10.1016/j.optlastec.2020.106866](https://doi.org/10.1016/j.optlastec.2020.106866)). ([hal-03091197](https://arxiv.org/abs/2003.03911))

A G-Band Glass Interposer Technology for the Integration of an Amplified Noise Source based on SiGe BiCMOS 55-nm Technology

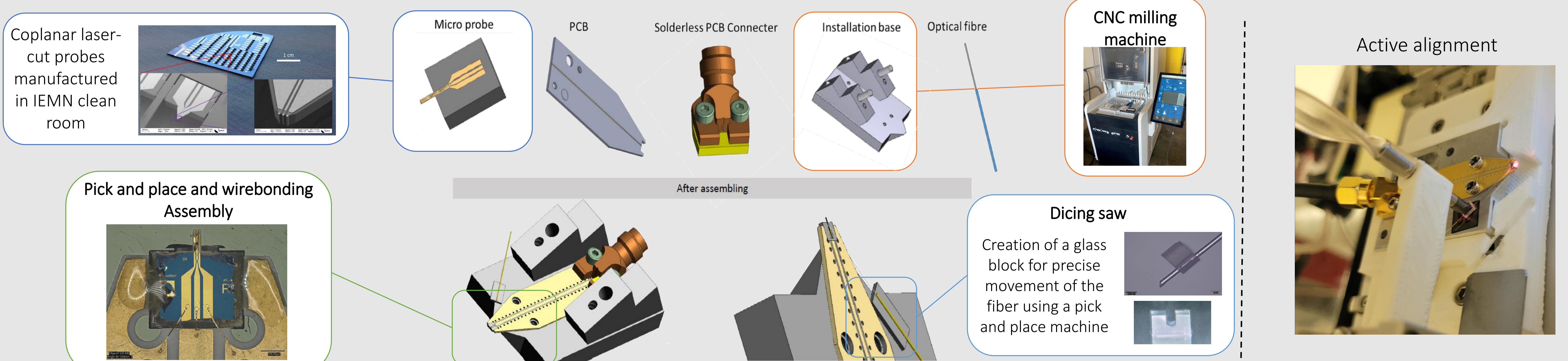


Pick and Place Assembly



M. Alawar, et al., *A G-Band Glass Interposer Technology for the Integration of an Amplified Noise Source based on SiGe BiCMOS 55-nm Technology*, 2024 IEEE Radio Frequency Integrated Circuits Symposium (RFIC 2024), (2024) ([10.1109/RFIC61187.2024.10599954](https://doi.org/10.1109/RFIC61187.2024.10599954)). ([hal-04662978](https://arxiv.org/abs/2404.04662))

Laser Microstructuring for Advanced Packaging Solutions



C. Tannoury, et al., *Photonic THz mixers based on iron-doped InGaAs embedded in a plasmonic microcavity* APL Photon. 8, 116101 (2023).
J. Marzouk, et al., *Miniaturized MEMS-based GSG probes for microwave characterization*, 44th European Microwave Conference, Italy, pp. 1150-1153, (2014)