



Photonic integration for quantum technology

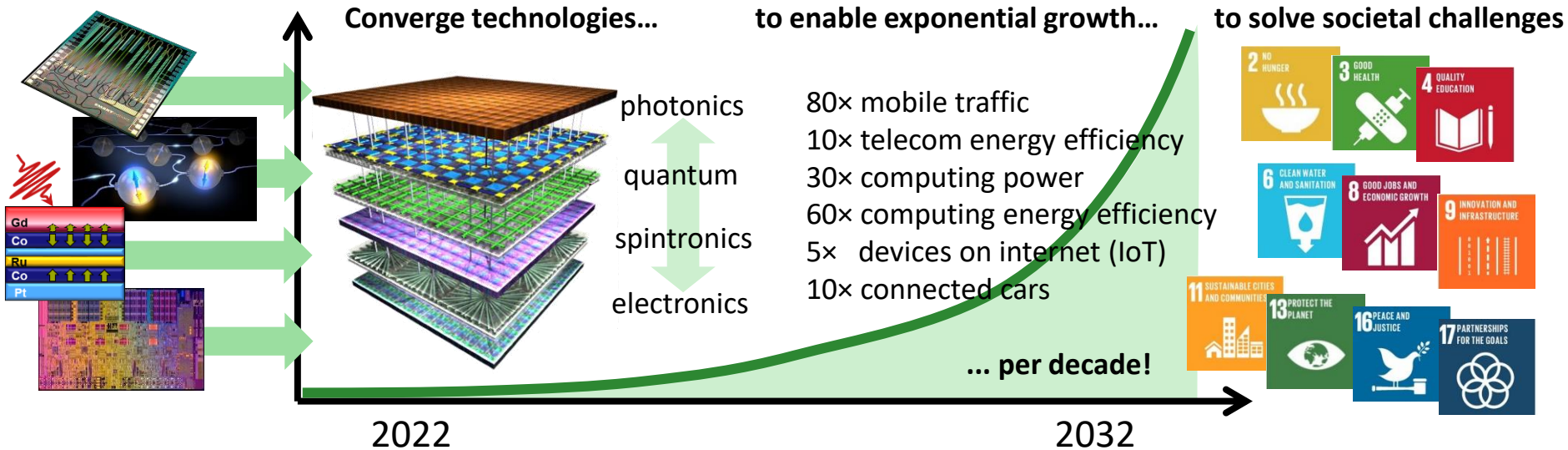
October 12. 2023, EPIC Technology Meeting on Industrial Quantum Photonics Technology, Munich

Martijn J. R. Heck

Department of Electrical Engineering, Photonic Integration

Eindhoven Hendrik Casimir Institute – EHCI

Heterogeneous systems, based on new paradigms in computing, communication and sensing, will become the key enabler of our sustainable information society, thereby addressing our global societal challenges



The bill for an actual (!) quantum technology

Quantum computing needs >1M qubits...

Quantum communication, sensors, QRNG hold promise for ubiquitous implementation

+

Total: millions to billions of components

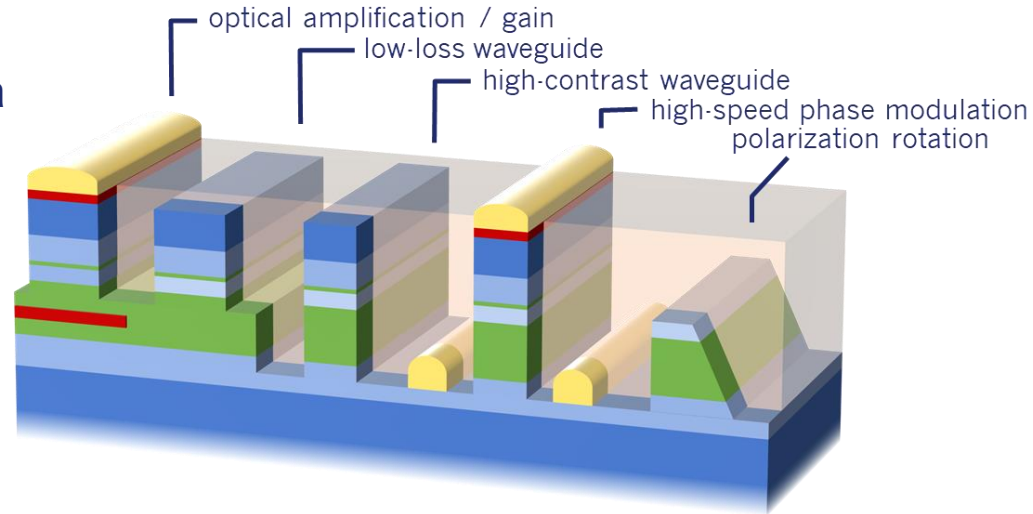
And many of these are photonic and optical...

Drives the use of indium phosphide, silicon nitride and hybrid photonic integration

JePPIX Pilot Line offers industry a path to manufacturing;

JePPIX Multi-Project Wafer Services offers academia and industry a path to prototyping;

JePPIX Knowledge supports education and training for academia and industry.



The ecosystem

JePPIX
Knowledge

JePPIX
MPW Services

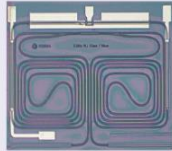
JePPIX
Pilot Line

Over 800 PIC designs realised in JePPIX foundries

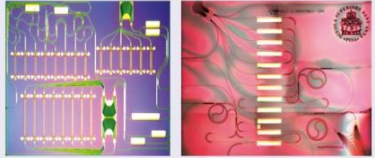
THz and RF circuits



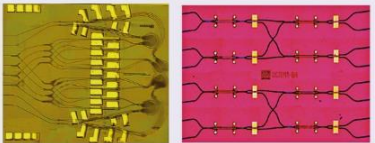
Variety of Lasers



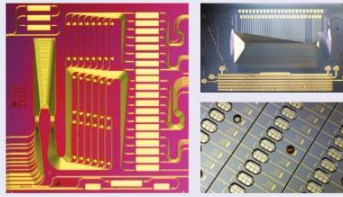
Optical data handling



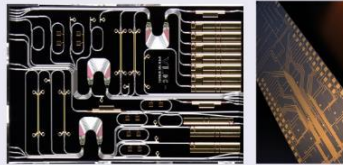
Optical switching



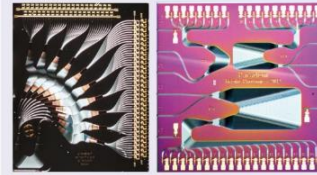
Medical and bio-imaging



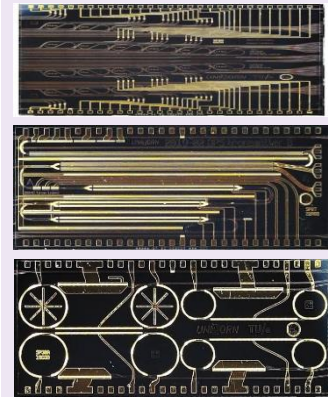
Microwave photonics beam-former



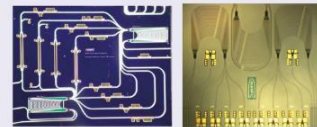
Sensor readout units



QKD transceivers



Fibre to the home



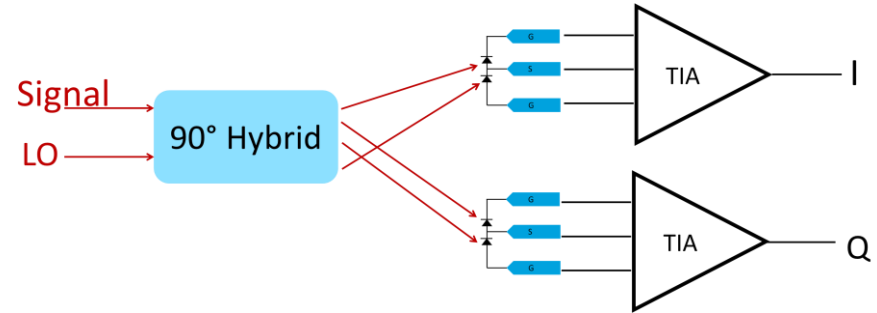
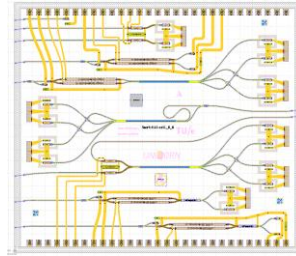
New **pilot line services** launched with manufacturing-grade PDKs and test automation

Quantum communication – InP platform – CV receiver

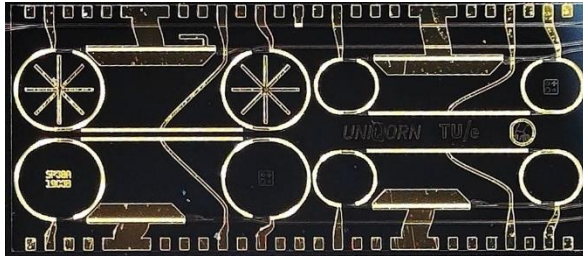
90° hybrid mixers



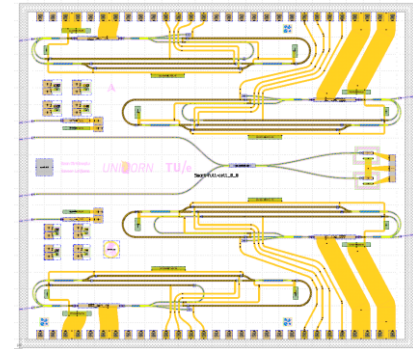
Balanced receiver



Tunable >30 nm, ~60-kHz linewidth lasers @1550



UNIQORN



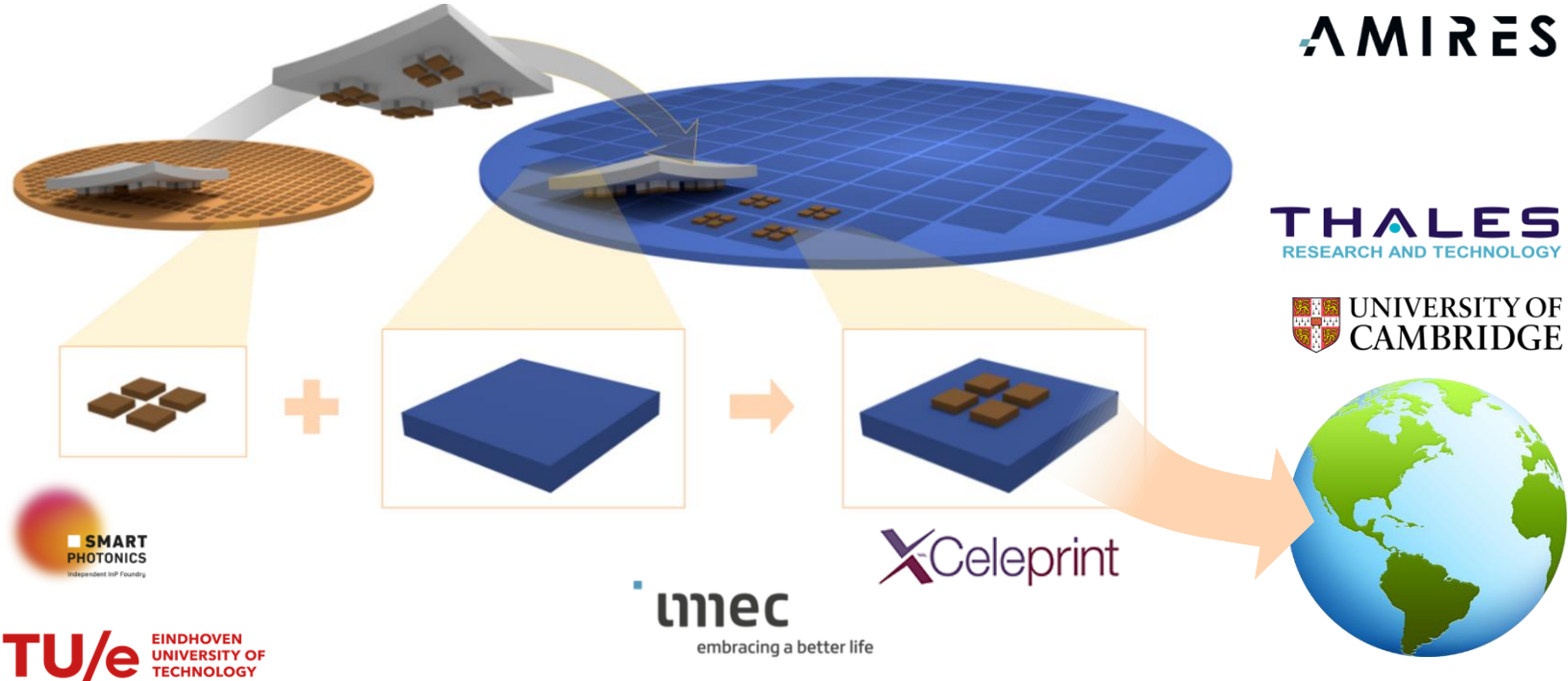
Will we have a QPIC platform? What should it be?

Serve many of the existing QT approaches, so:

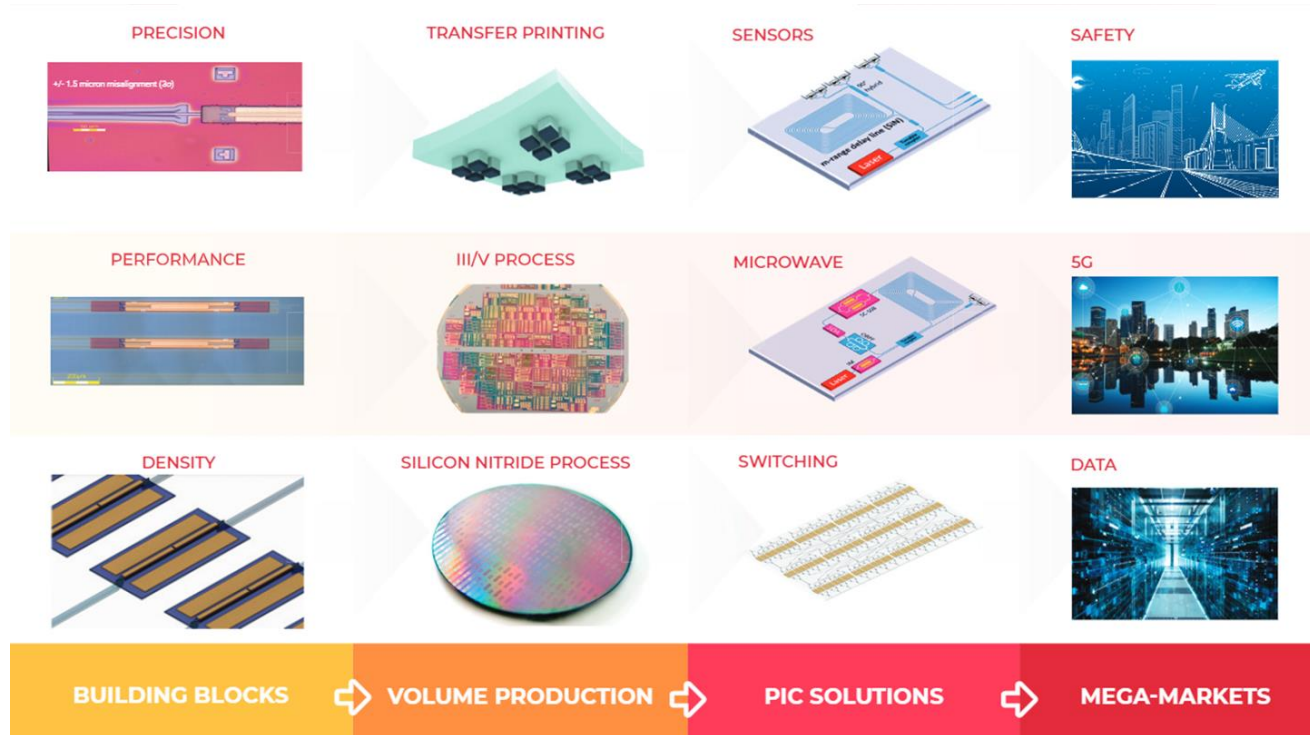
- flexible in wavelengths, from visible to IR, and in their combination;
- performance, e.g., ultra-low loss and minimum tolerance margins;
- single photons: options for integrating single photon sources and detectors;
- possibly also addressing ion, cold-atom, superconductor, and diamond approaches;
- low(er) unit volumes are okay;

Our vision is that this calls for a **modular** platform. Our INSPIRE platform could be the basis.

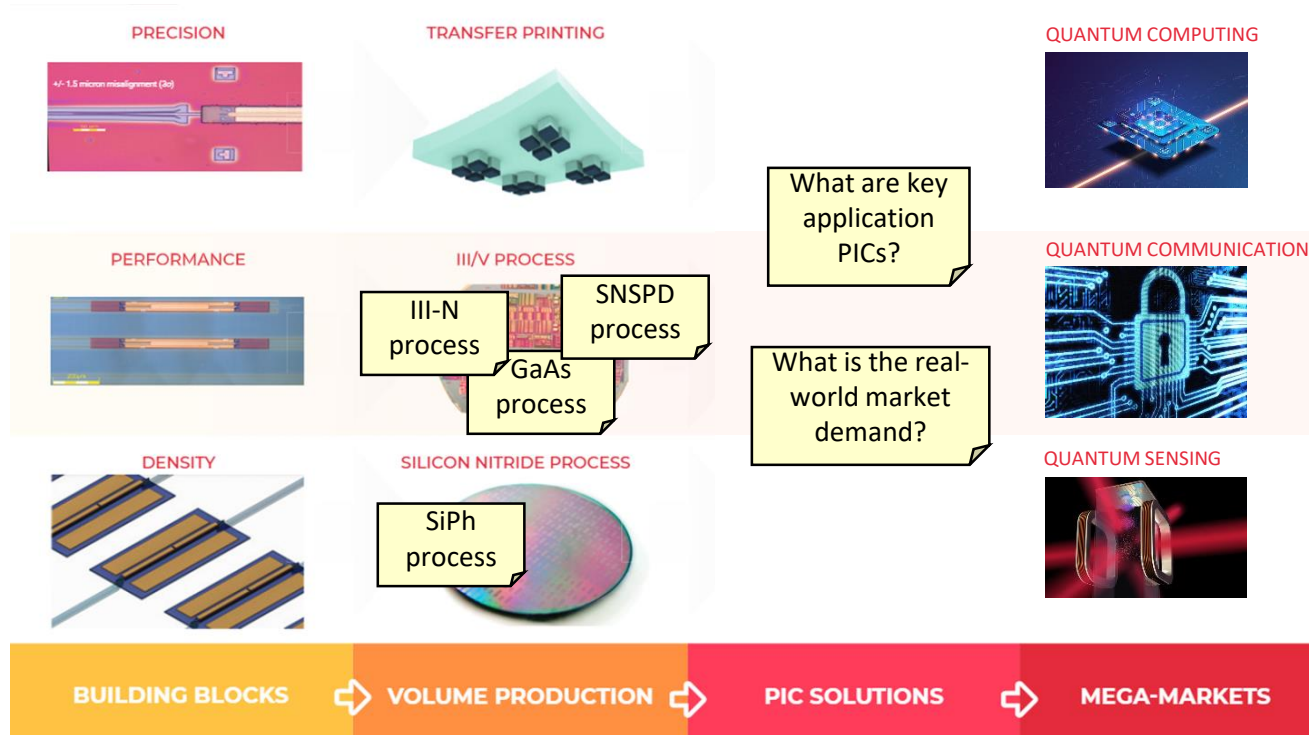
INSPIRE project – micro-transfer printing



INSPIRE high-level overview



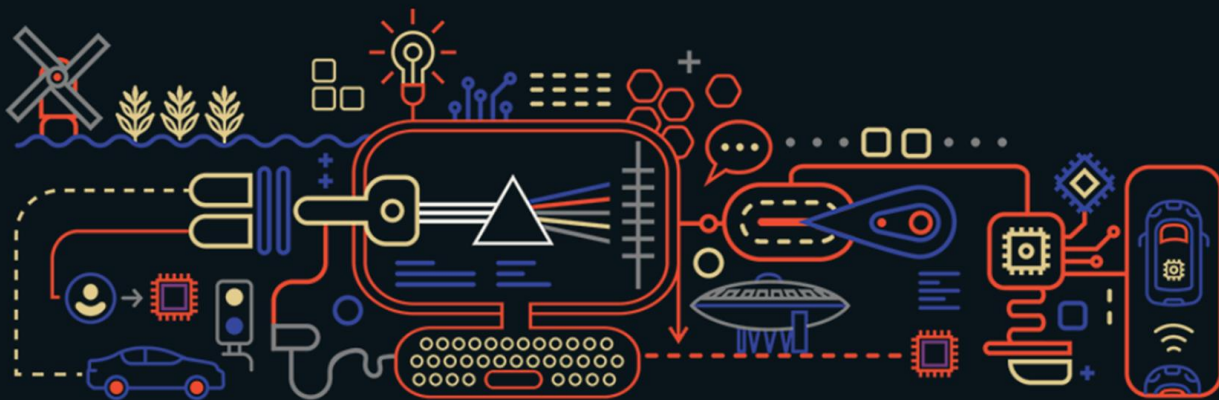
INSPIRE as QPIC platform?



Conclusion

- We already have “QPIC platforms”... for some QT applications
→ most credible route to real technology;
- Modular platforms required for most other QT applications
→ use should be (mostly) beyond QT;
- No consensus on technology roadmap (QPIC specs) yet → field is not ready for scaling;
- Available technology will drive QT, not the other way around... but this is an opinion :-)

Let's engage and put the T in QT!



PIC Summit Europe

7 - 8 November 2023



Get
tickets

Europe's most influential event in the photonic chip industry. Over 400 visitors from more than 20 countries.