

SMART Photonics

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EPIC Technology Meeting on Hybrid Photonic Integrated Circuits
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SMART PHOTONICS AT A GLANCE

Company description

- SMART Photonics is the only pure-play Indium Phosphide foundry in the world
- Established 2012 and technology based on decades of research from Philips and Eindhoven University of Technology (TU/e)
- Supported by >€200M of NL and EU public technology funding
- Employs 153 FTE from its offices at the High Tech Campus in Eindhoven
- Existing shareholders include KPN Ventures, Innovation Industries, Photon Delta and BOM



Ready for ramp-up in production



R&D services



Functional samples



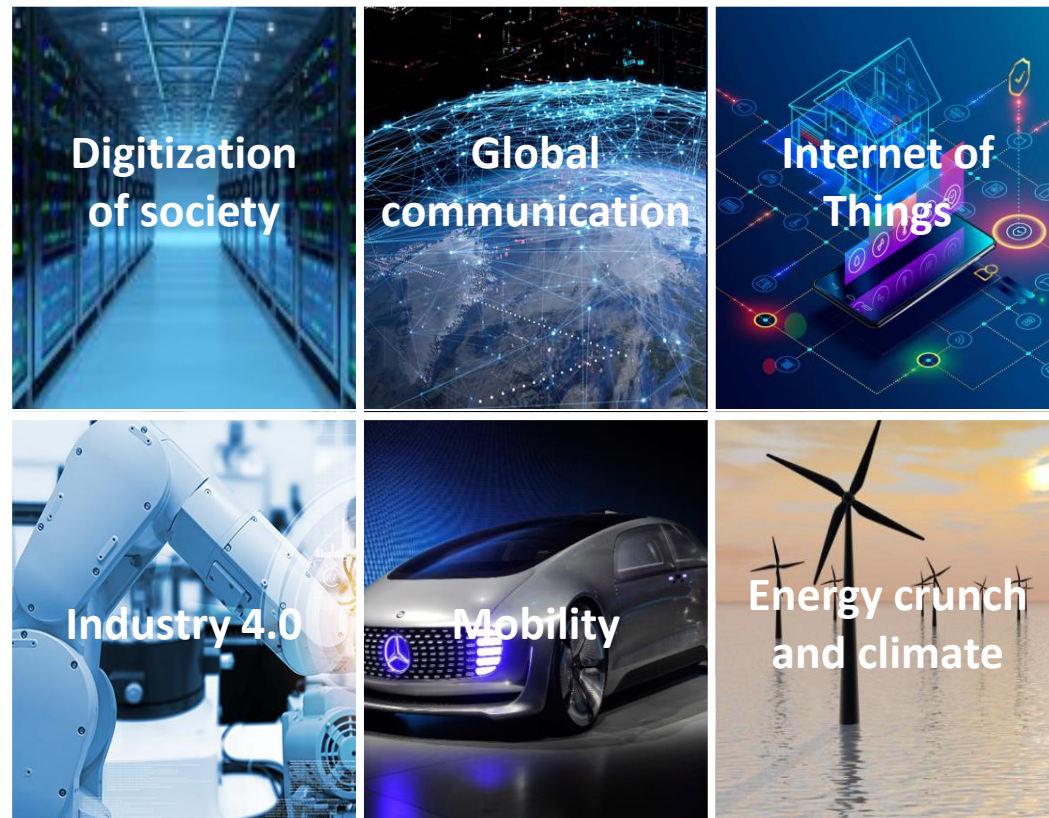
Flexible production



Scale up production

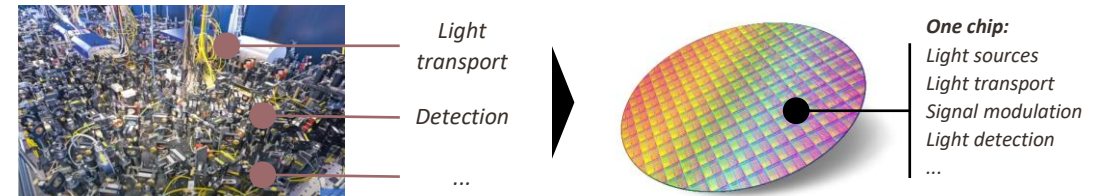
INTEGRATED PHOTONICS HELP SOLVE MAJOR SOCIETAL ISSUES...

Challenges driving change...









... requiring Integrated photonics

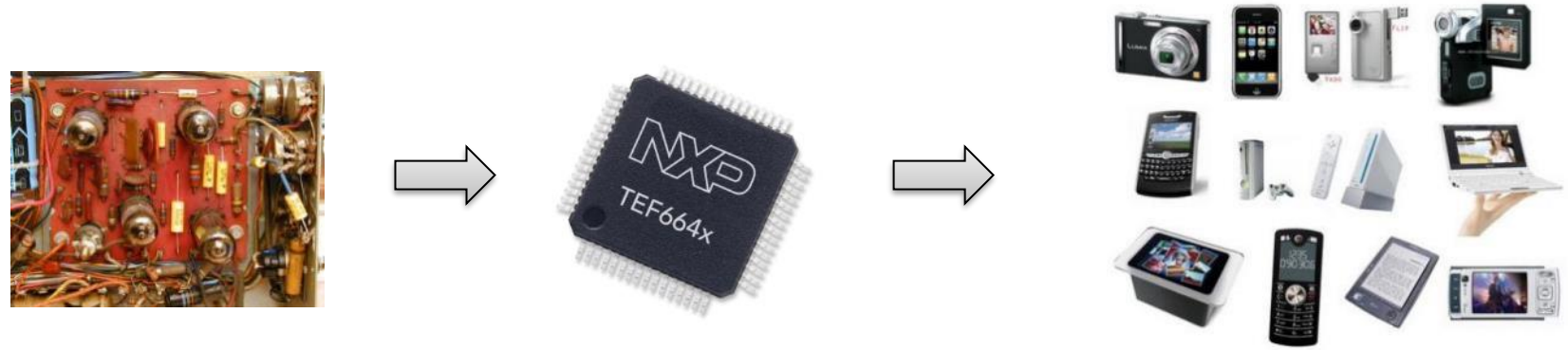
Photonic integrated circuit (PIC) integrate multiple photonic functions, like electronic ICs but with light waves instead of electrons...



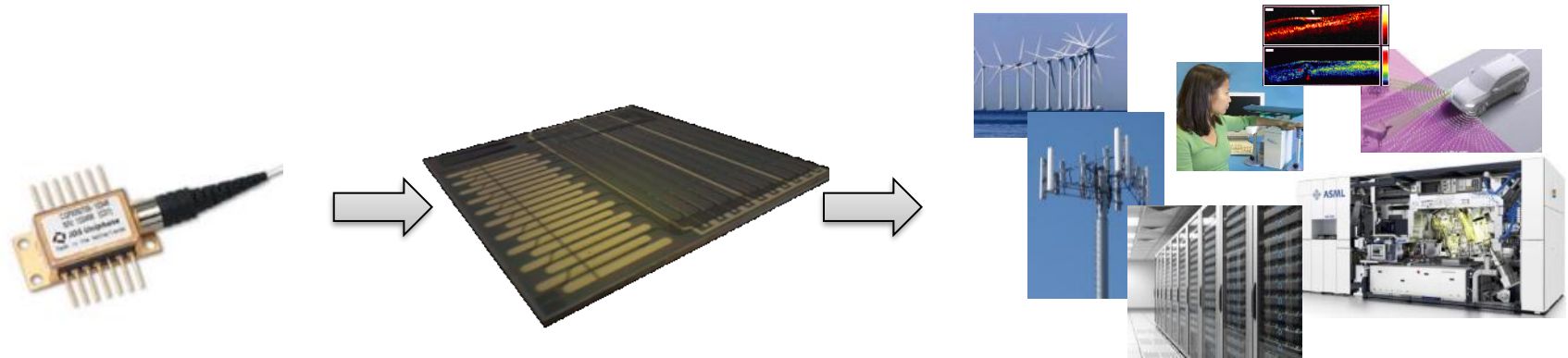
... which has many advantages over discrete photonics or electronic ICs:

 More data	 Increased speed	 Increased reliability
 Less power consumption	 Lower cost	 Small form factor

PHOTONIC INTEGRATION



Electronic integration has changed the world!



Photonic integration will change the world again!

InP IS AN ESSENTIAL MATERIAL FOR INTEGRATED PHOTONICS

InP is the only material that can integrate active components

Increasing InP content as other materials also require actives

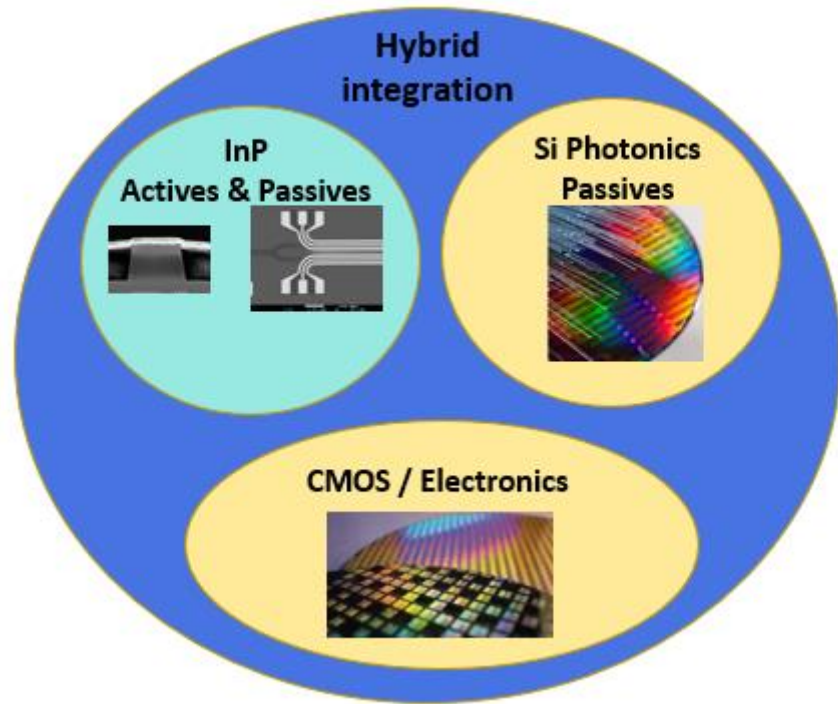
PIC platforms		Most common						
		InP	SiPh	SiN	Glass	Polymer	Silica	LiNbO ₃
Chip components	Passive components (i.e. light propagation)	✓	✓	✓	✓	✓	✓	✓
	Active components (e.g. lasers, detectors)	✓	✗	✗	✗	✗	✗	✗



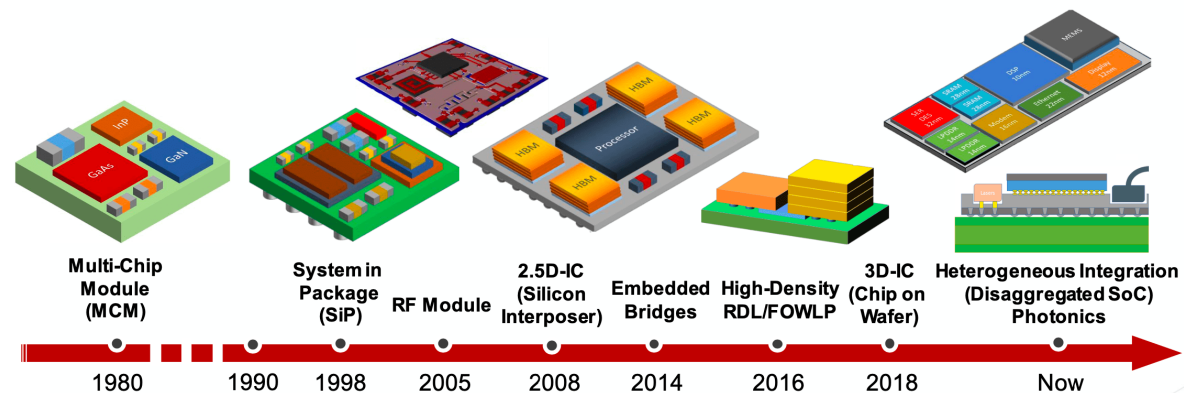
Full InP integration outperforms in terms of bandwidth, integration level, robustness, and flexibility of design

Increasing chip complexity requires more InP active components

SOLUTIONS FOR INTEGRATION



- Photonics is complementary to electronics to enable new applications
- Intimate integration needed
- Multiple technologies stacked together: similar as chiplet / System-in- Package in electronics
- InP Photonics will be one of these technologies!



Source: Cadence

HYBRID INTEGRATION ROADMAP

- Drivers:
- increased integration level
 - reduced cost

Die – die butt
coupling

More functionality
of InP

HYBRID INTEGRATION ROADMAP

Drivers:

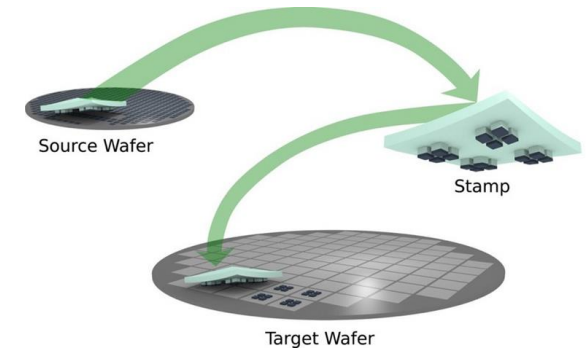
- increased integration level
- reduced cost

Wafer level transfer
printing small dies

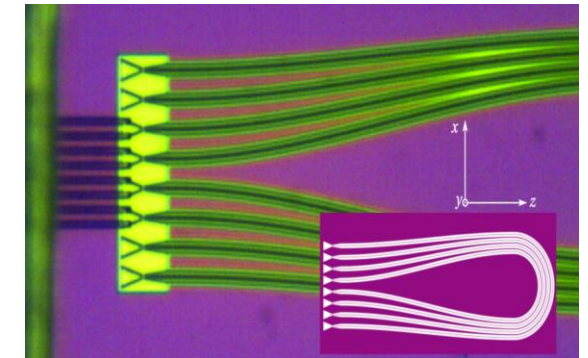
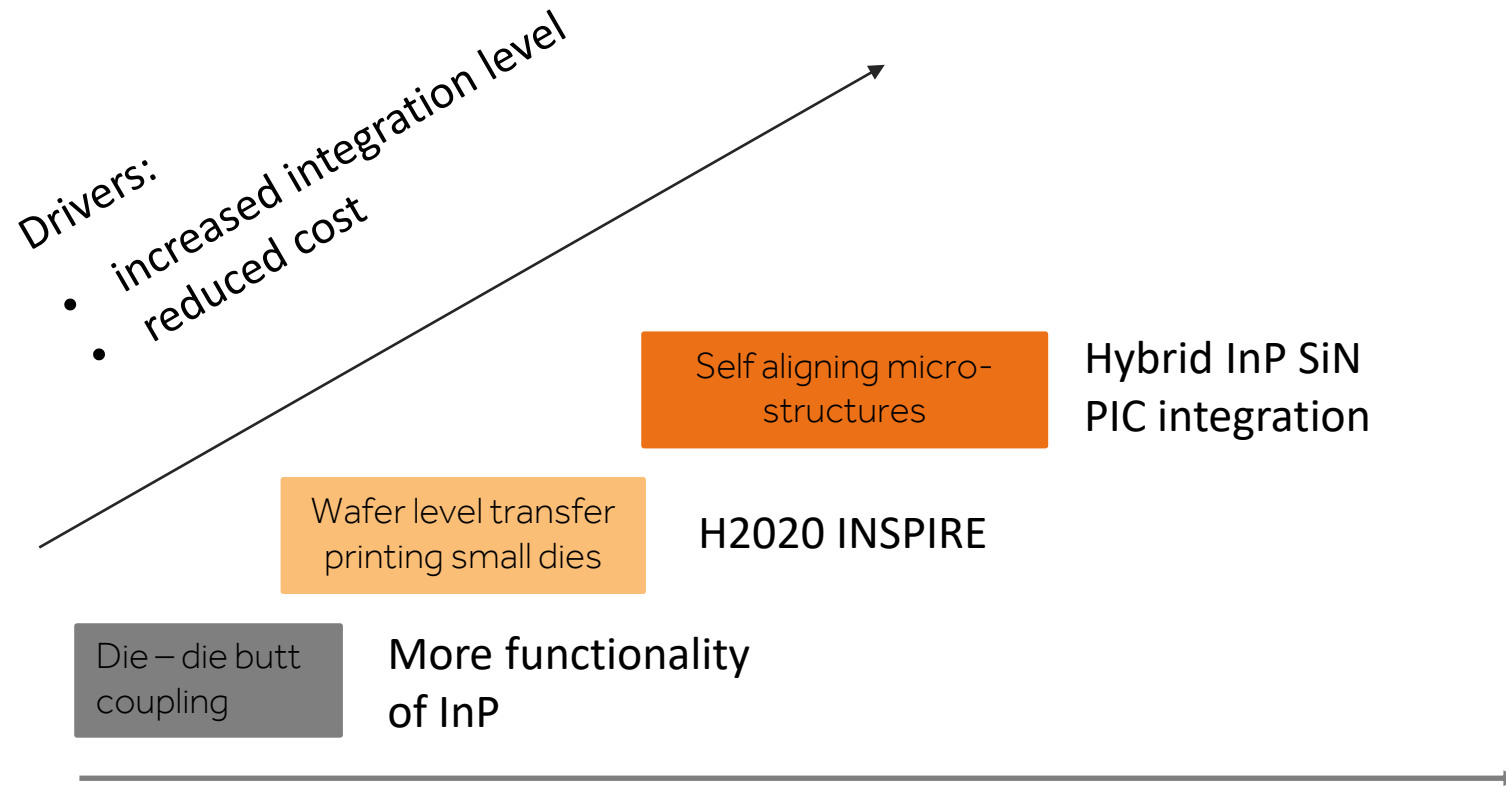
H2020 INSPIRE

Die – die butt
coupling

More functionality
of InP

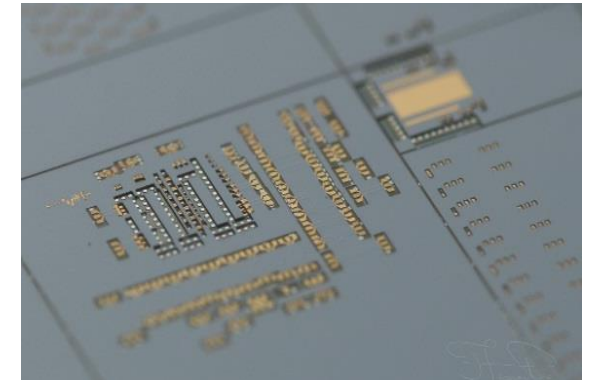
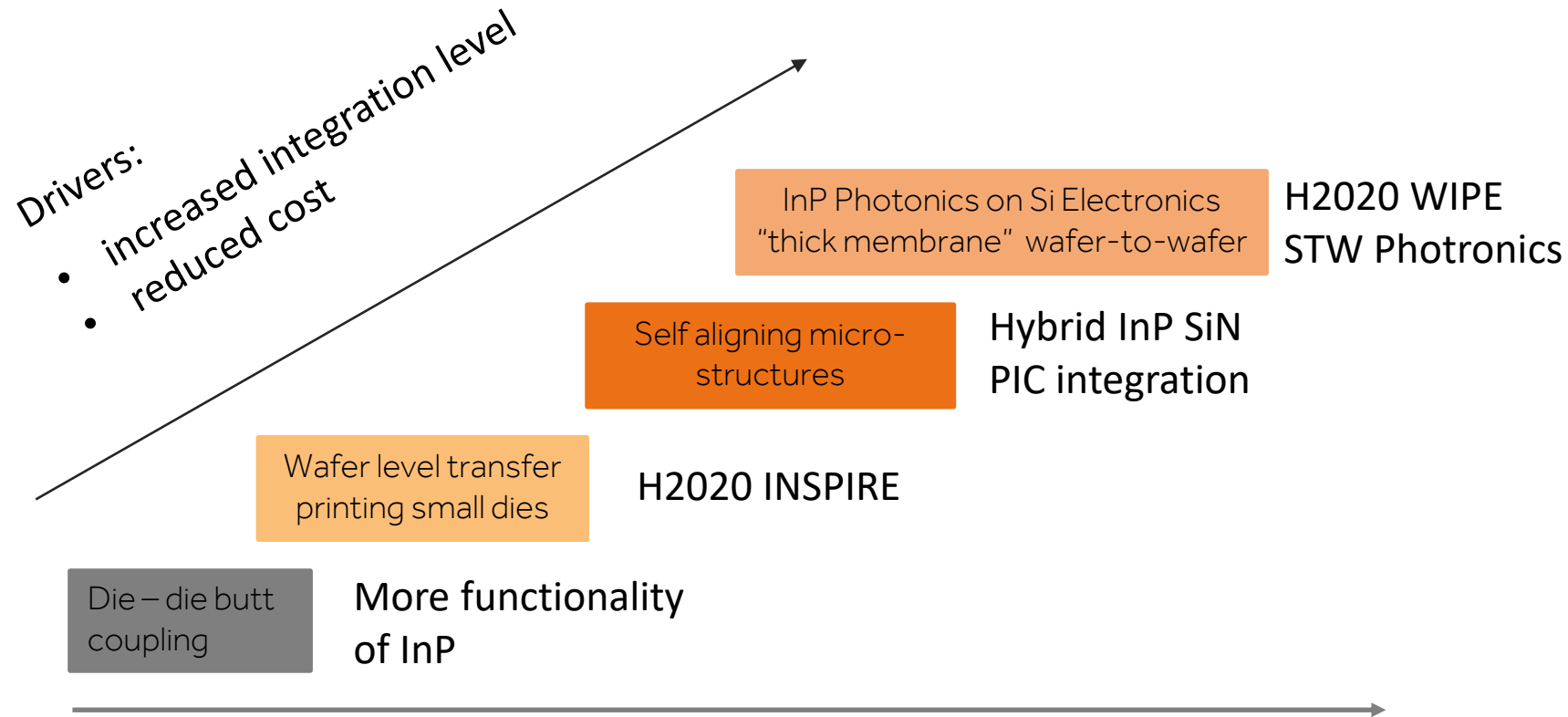


HYBRID INTEGRATION ROADMAP



Eight SiN flexible waveguides visible left, landing on a InP PIC; Example shown with Lionix waveguides and Oclaro PIC

HYBRID INTEGRATION ROADMAP



wafer-to-wafer bonding of PICs, loads and drivers in the WIPE project

HYBRID INTEGRATION ROADMAP

Drivers:

- increased integration level
- reduced cost

Die – die butt coupling

Wafer level transfer printing small dies

Self aligning micro-structures

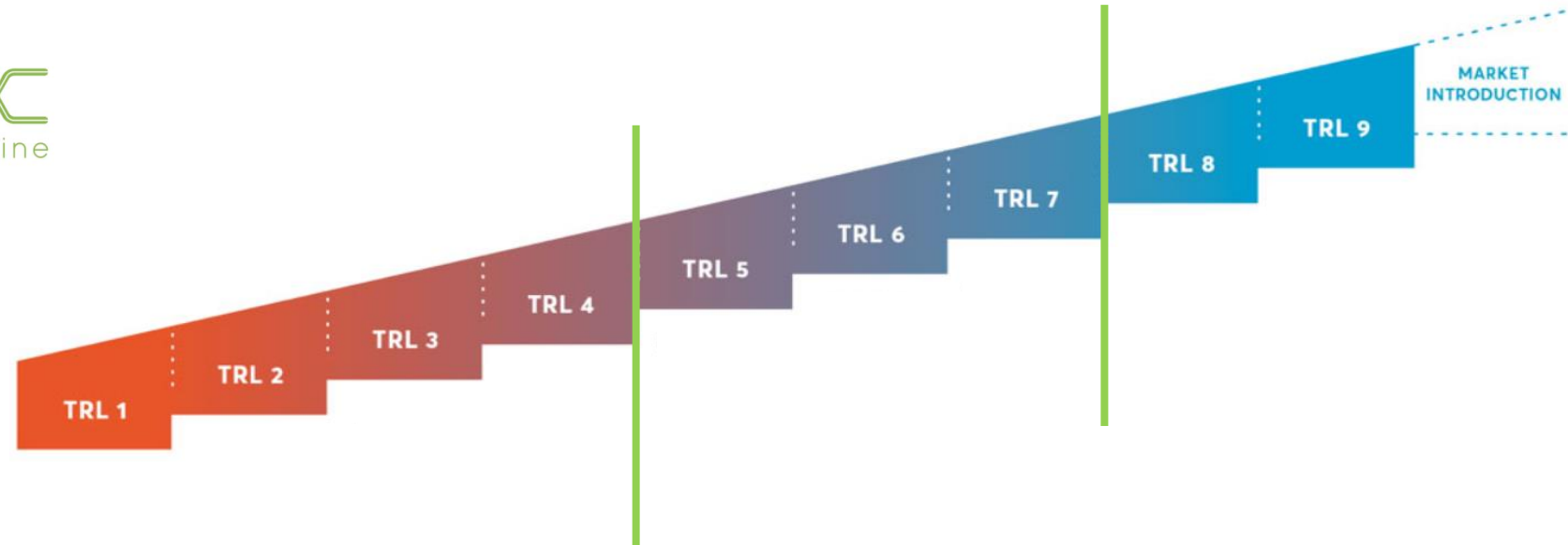
InP Photonics on Si Electronics
"thick membrane" wafer-to-wafer



wafer-level { InP photonics wafer + Si electronics wafer

Die-level { InP discrete laser + Si Photonics wafer

JEPPPIX PILOT LINE



- ✓ Accelerate the uptake of PIC technology in new markets
- ✓ Accelerate time to market with predictive design for fewer and faster product design cycles
- ✓ Enable sustainable production in Europe creating aligned, scalable and inter-locking services and value chains
- ✓ Qualify foundry processes, by sharing process optimization across products

JEPPIX PILOT LINE PARTNERS

design software



foundries



design houses



packaging



testing



THE EPIC QUESTION

What can we offer you?

- Indium Phosphide platform
- Rapid prototyping & manufacturing of optical chips
- Strong process technology foundation and know-how
- Extensive portfolio of high-performance design/process building blocks

What can you offer us?

- Ambitious companies
- Partners to develop new applications
- System integrator partner
- Collaborations in research projects



 **SMART
PHOTONICS**

Independent InP Foundry