PhotonDelta

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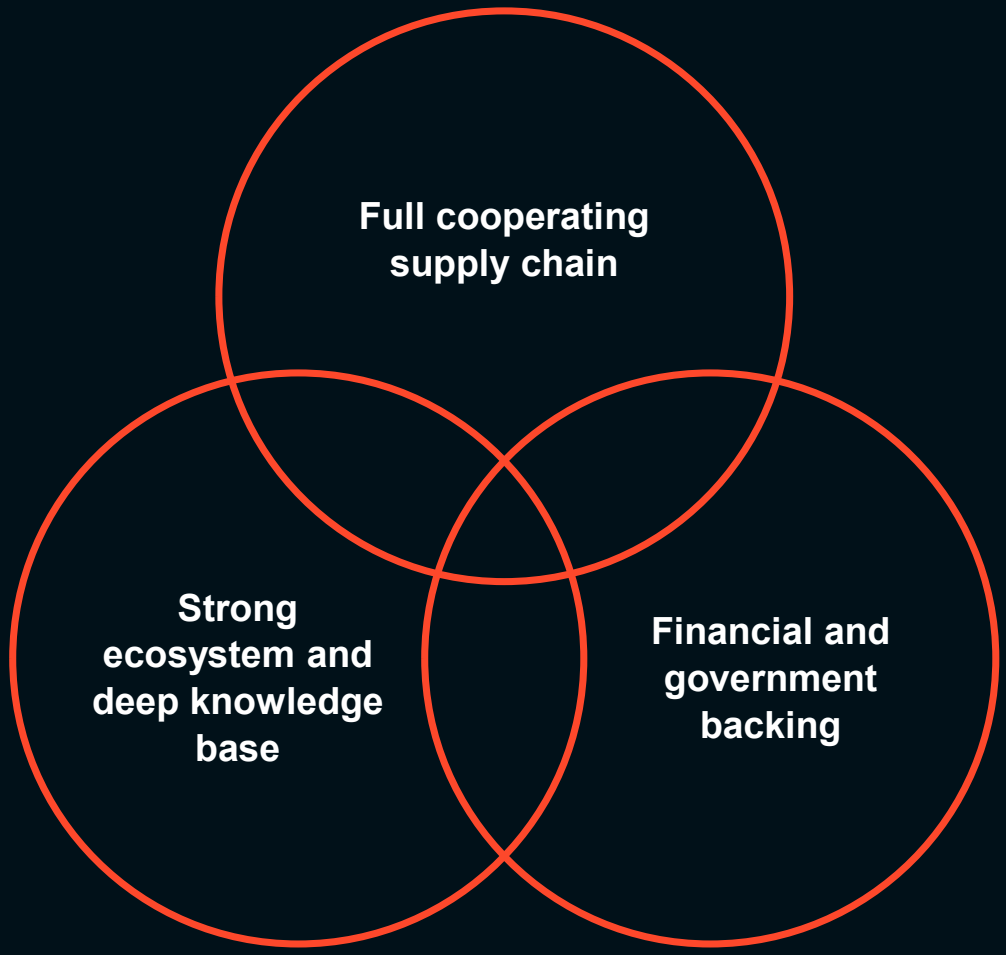
Integrated photonics

Carol de Vries

Introducing PhotonDelta

- A cooperating ecosystem of companies and R&D organizations in Integrated Photonics
- The PhotonDelta organization to support
  - **Economic and ecosystem development**
  - **Execution of 1.1 B€ growth fund program**
  - **International and EU relations**
  - **Market and Talent development**
  - **Start up support and seed investment**



PhotonDelta ecosystem , complete supply chain

1. Design

BRIGHT PHOTONICS
epiphany
STARIC

Tech partners

SYNOPSYS
LUCEDA
GDS FACTORY

2. Manufacturing & Prototyping

LIONIX INTERNATIONAL
SMART PHOTONICS
NEW ORIGIN
ALUVIA
III-V lab
XIVER

Tech partners

ASML
AIXTRON

3. Packaging

phix
PHOTONFIRST
PHILIPS
neways

Tech partners

CITC
ETTEPLAN
TYNDALL
SALLAND
IMS
MICROALIGN
AIXSCALE
SCIL

4. Applications

Data & Telecom

EFFECT PHOTONICS
AIRCISION
astrape
Pilot
signify

Medical

DELTA LIFE SCIENCE
SURFIX
Nostics
EFI
AMAZEC PHOTONICS
VitalWear

Sensing

SCANTINEL PHOTONICS
Tarucca
SENERGETICS
PHOTONFIRST
SENSING360
Spectrik
MMATIDIA
VTEC
FUQON
NXP
DEMCON
MantiSpectra

Quantum

QuiX
CUbIQ

Tech partners

HIGH TECH XL
NTS OPTEL
CHILAS
TSG
SUPERLIGHT

PITC · UNIVERSITY OF TWENTE. · TU/e · TU Delft · imec · Holst Centre · OnePlanet Research Center · SAXION HOGESCHOOL · THE HAGUE UNIVERSITY OF APPLIED SCIENCES · Fontys University of Applied Sciences · TNO · Fraunhofer HHI · MIT Massachusetts Institute of Technology · MESA+ nanotechnology · HIGH TECH XL

PhotonDelta early stage startup fund

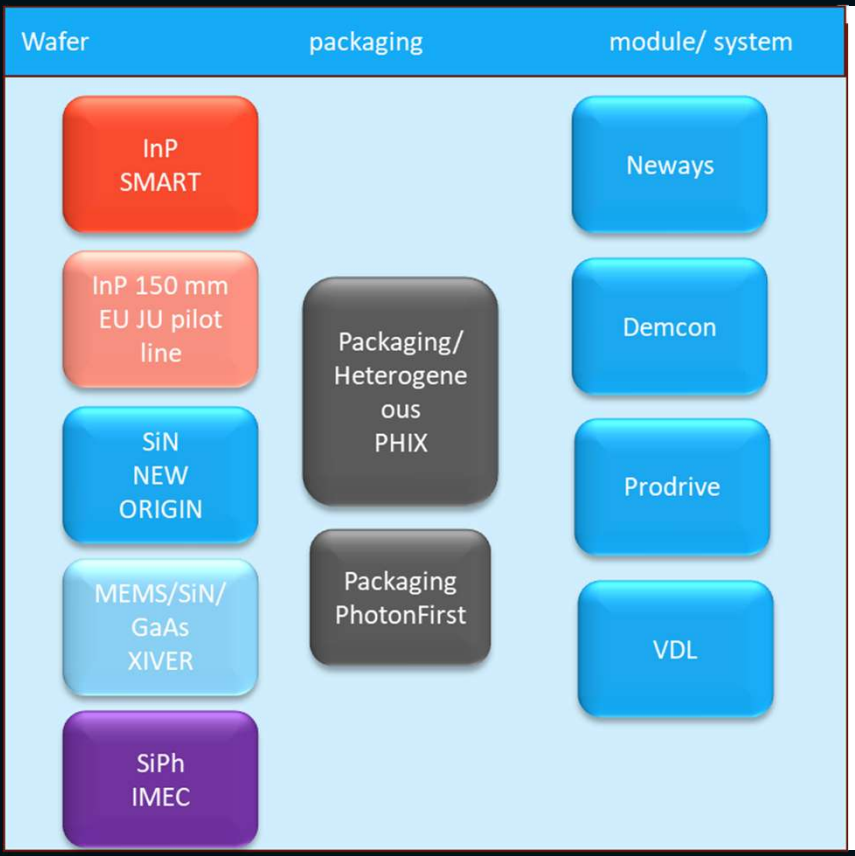
	Health	Datacom / Telecom	Quantum / AI / Compute	Agrifood	AR / VR	Fabrication & packaging	Other
PhotonDelta Startup fund (€60M)	AMAZEC PHOTONICS	astrape networks	CUbIQ	Spectrik	BRILLIANCE	NEW ORIGIN HIGH TECH FOUNDRY	epiphany (Design)
	VitalWear	PHOTON IP	SENERGETICS SENSE IN DATA	SUPERLIGHT PHOTONICS		ALUVIA PHOTONICS	CoolSem
PhotonVentures Fund (€100M)	DELTA DIAGNOSTICS	EFFECT PHOTONICS	QUIX	MantiSpectra	vitrealab	LIONIX INTERNATIONAL	PHOTONFIRST (Sensing)
	SURFIX					SMART PHOTONICS	SCANTINEL PHOTONICS (Lidar)
	EFI					phix	MicroAlign (Fiber coupling)

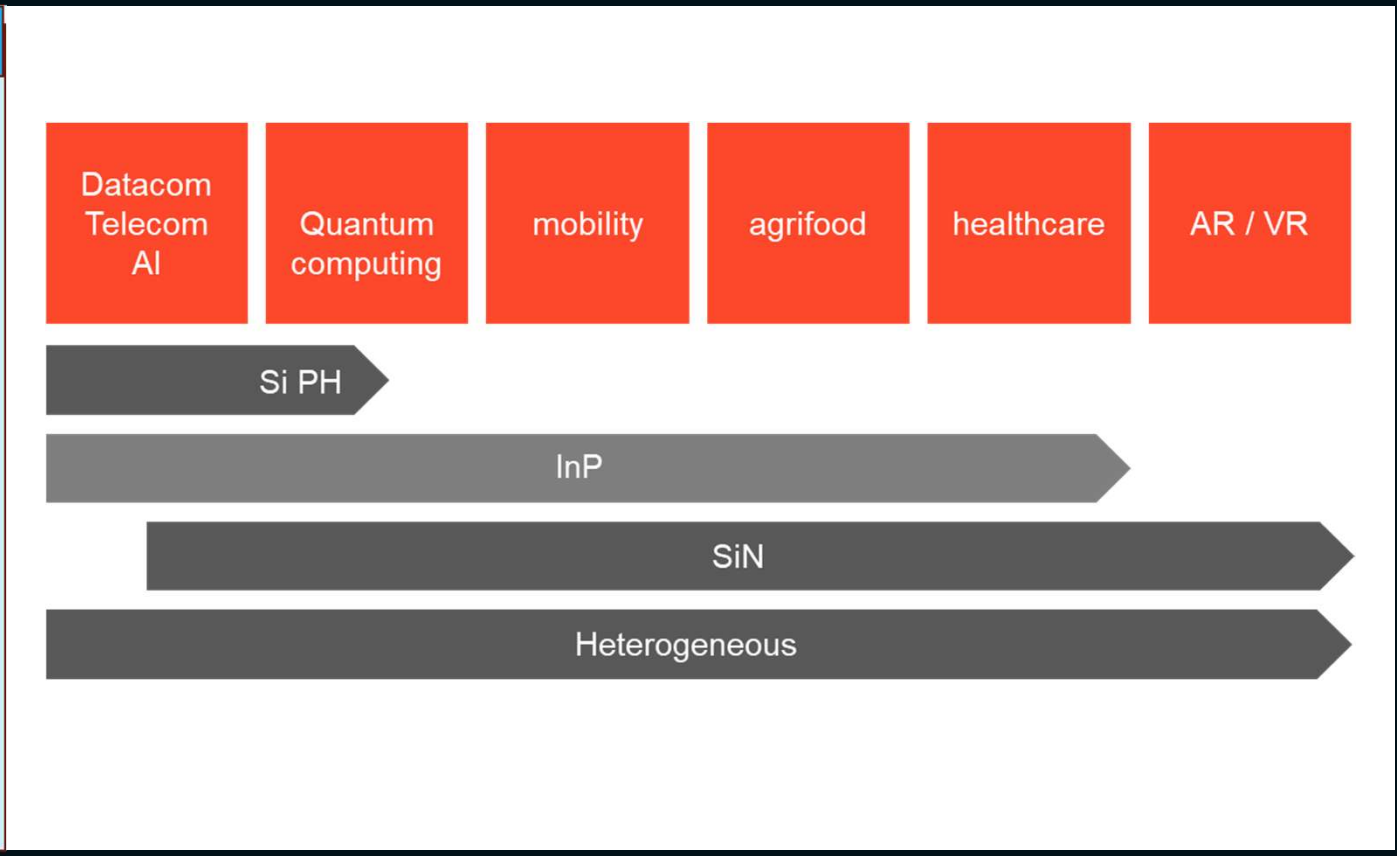
The National Growth Fund PhotonDelta

- The first phase of NGF will end 2025.
- NGF2 starts in 2026 with new proposals with focus on economic development
- Mission: common program with multiple partners and transfer targets
  - **Sensing: OCT, Biochips, spectral sensing (multiple) , Fiber Bragg Grating**
  - **Data/communication: Tranceivers (multiple), photonic switches, 6G**
  - **Quantum: computing, Quantum Key distribution**
  - **Other: Lidar, Augmented Reality**
- Technology programs
  - **Heterogeneous integration, novel materials, metrology and test, standardized work flow/PDK**
- Industrialization: InP (ePixFab), SiN+ (New Origin), Packaging (Phix)

Key Technologies to create optimal solutions

Integrated photonics goes beyond Silicon only. Heterogeneous integration combines technologies to optimize performance and cost. You also need system integrators

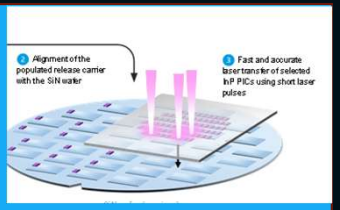




Photonic heterogeneous integration landscape

Assembly and packaging

- Affordable packages
- High volume placement
- Placement accuracy



- Alternatives for goldboxes
- System solutions, interposers
- reliability

Inspection and test

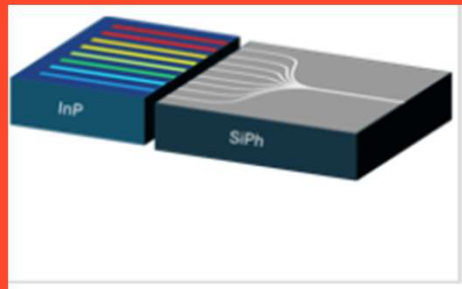
- in line inspection
- Wafer level testing
- Design for test
- Known Good Die strategy
- Production test tools

Cost

Level of integration

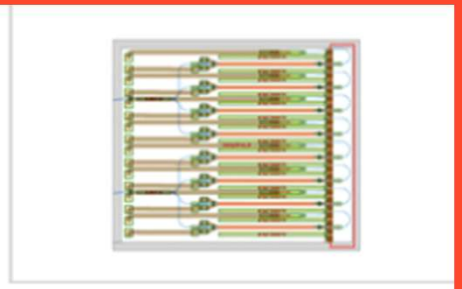
Using InP Lasers and amplifiers

Laser arrays



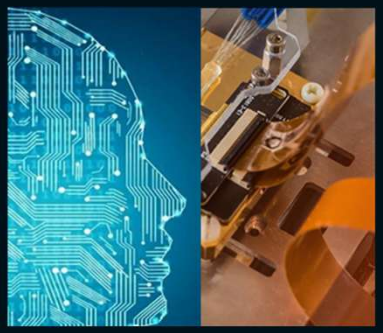
many small lasers on wafer

integrated solutions



Integrated photonics can revolutionize markets

In the same way semiconductors did, disruptive solutions for volume markets. Addressing global challenges


Datacom/AI

Grand Challenges:
- Digitization of Society
- Exponential growth
- Data usage

Quantum/

Grand Challenges:
- Secure communication
- Digitization of Society

Mobility

Grand Challenges:
- Autonomous driving
- Electric vehicles

Healthcare

Grand Challenges:
- Point of care
- Aging population
- Workforce availablitry

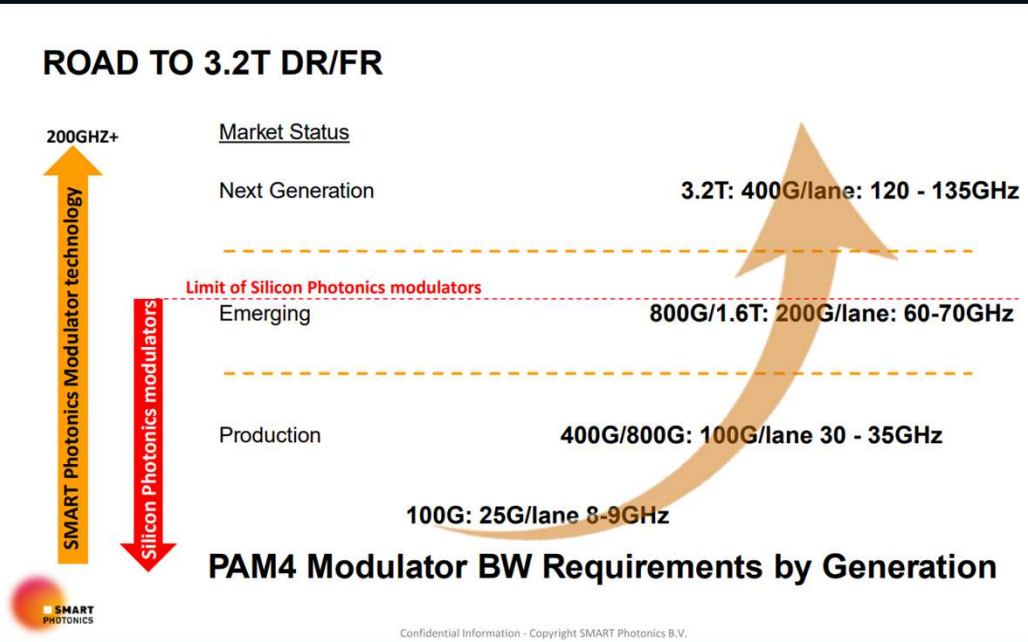
Agrifood

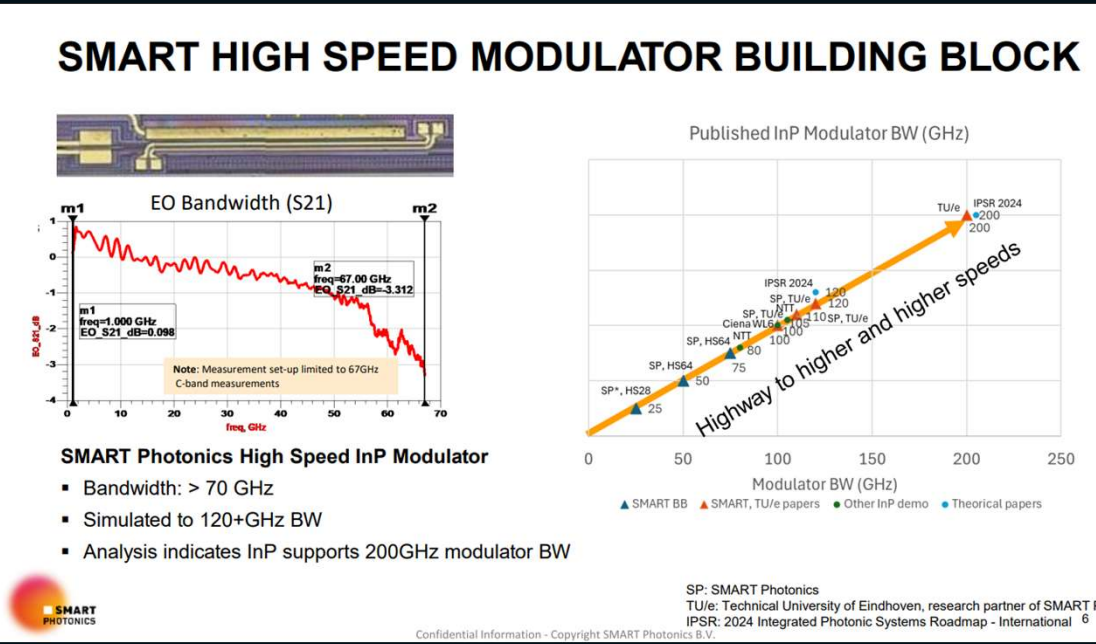
Grand Challenges:
- Sustainable farming
- Climate change
- Precision agriculture

— Integrated Photonics used in Datacom/telecom is already a multibillion € market

— Other markets are emerging but also have multibillion € potential

The need for speed: InP developments





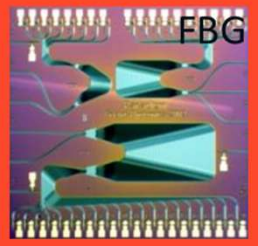
InP can integrate lasers , modulators and detectors, and can follow speed roadmap. It faces competition from TFLN (modulators) and perhaps BTO

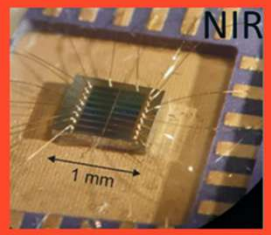
Complete set of technology platforms for Agrifood and Health

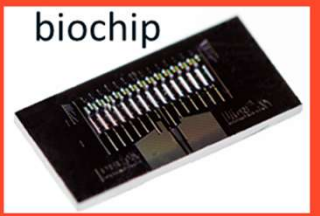
- Near infrared spectrometer sensors (800nm-2400 nm)
- Mid Infrared sensors (2-15 um)
- THz sensors (500GHz-3000GHz)
- Photoabsorption and photoacoustic gas sensors
- Raman spectrometers
- Speckle sensors
- Optical Coherence Tomography sensors
- Biochips
- Fiber Bragg Grating sensors

If it is worthwhile we can put it in a PIC

Technology platforms allow for scale and faster development







Bringing it all together

Semiconductor design

Integrated Photonics

Heterogeneous integration

Quantum

Semiconductor tools

Infinite opportunities

Satellite communication

Mobile 5G/6G
Photonic infrastructure

Ubiquitus sensing
IoT, wearables

AI
Secure communication

Precision agriculture
Point of Care Healthcare