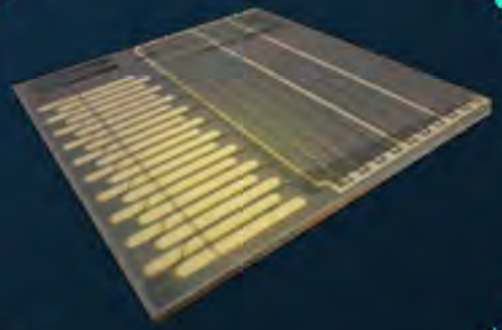
PILOT LINE CPL-5
Advanced Photonic Integrated Circuits

PIC Applications

COMMUNICATIONS & CYBER

LIDAR

CONSUMER



AI & PROCESSING

SENSORS
ROBOTICS

QUANTUM

MEDICAL DEVICES
& DIAGNOSTICS

PIC as Pervasive Technology

Partners' Examples

Co-Packaged Photonic-FPGA Module for Artificial Intelligence

Tyndall intel

Quantum Random Number Generator for Consumer Electronics

ICFO Quside

Silicon Photonic Transceiver Module for Data Centre

PIXAPP Photonic Packaging Pilot Line imec Tyndall

Examples of PICs @ ICFO for Quantum and AI

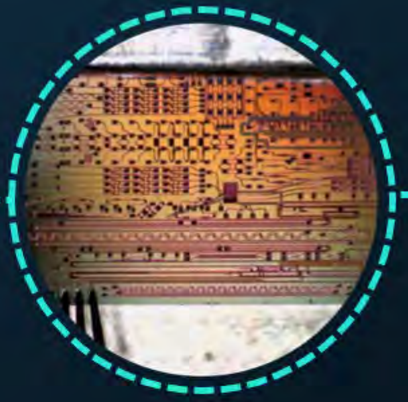
InP CHIP FOR QRNG

Quside

InP CHIP FOR CV-QKD

LUXQUANTA

SOI CHIP FOR ENTANGLEMENT GENERATION



SOI CHIP FOR AI and QUANTUM PROCESSOR

SOI CHIP + PCM FOR AI SWITCHING/INTERCONNECT

PIC Manufacturing Gap

"Approximately 80% of companies (mostly SMEs and start-ups) approaching us for manufacturing support do not meet our selection criteria. We cannot support them as they are too early stage, too high risk and do not have immediate high-volume demands. A Pilot Line would clearly address this gap."

Global Photonics OSAT, May 2024
OSAT (Outsourced Semiconductor Assembly & Test)

PIXEUROPE PILOT LINE

DESIGN

FABRICATION

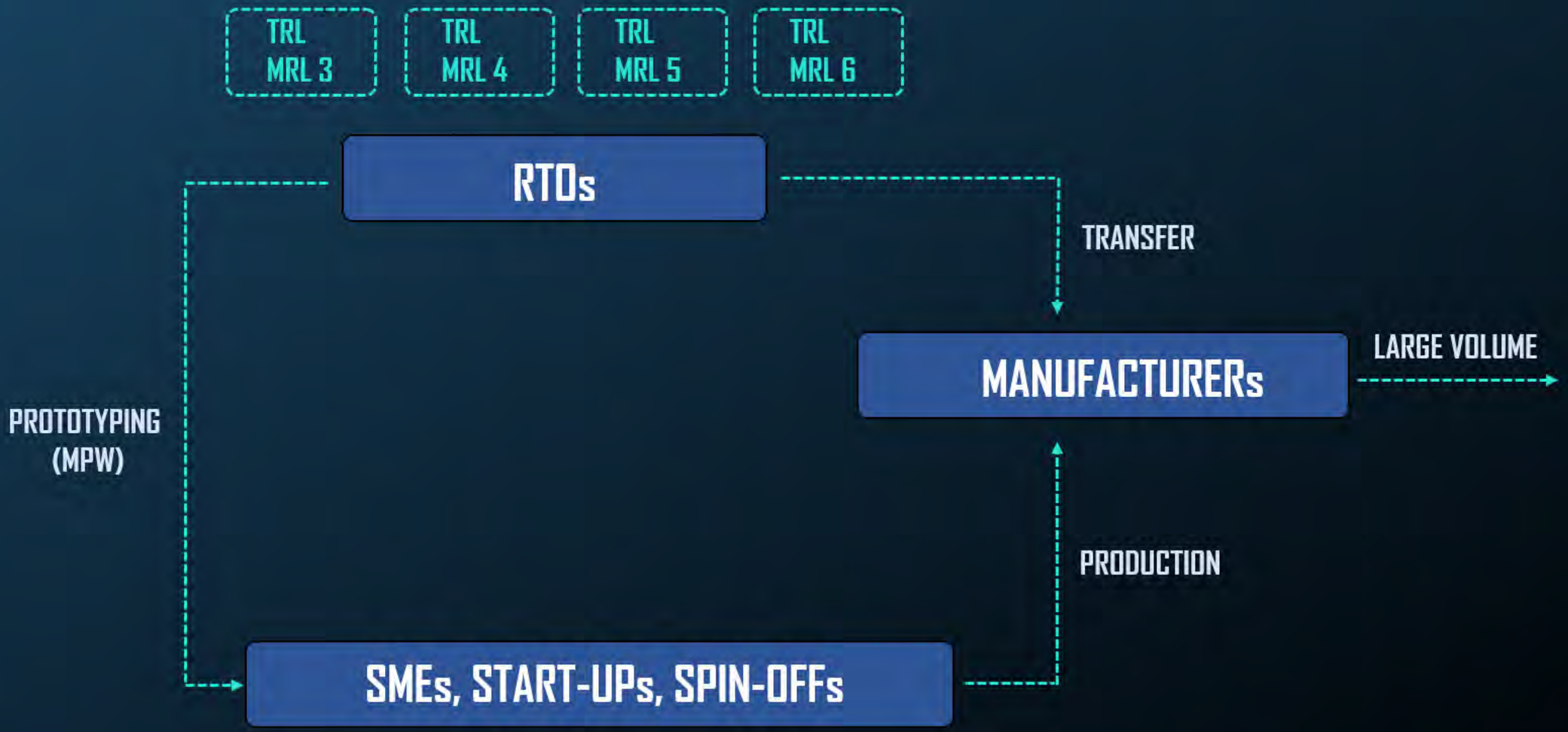
PACKAGING

TEST

RELIABILITY

Lab-to-Fab Gap

TRL & MRL Acceleration



PIXEurope Origin & Main Objectives

- **Create standardised and unified PIC** technologies, from chip design and fabrication, through to packaging and test
- **Increase innovation capacity** and **lower production barriers** for European industry

PIXEurope Consortium

SPAIN
ICFO – **Coordinator**
UPV
IMB-CNM (CSIC)
UC3M
UVigo

THE NETHERLANDS
TU/e
TNO
UTWENTE

BELGIUM
IMEC
UGENT

FINLAND
VTT

FRANCE
CEA-Leti

UNITED KINGDOM
UCAM
USOTON

POLAND
WUT

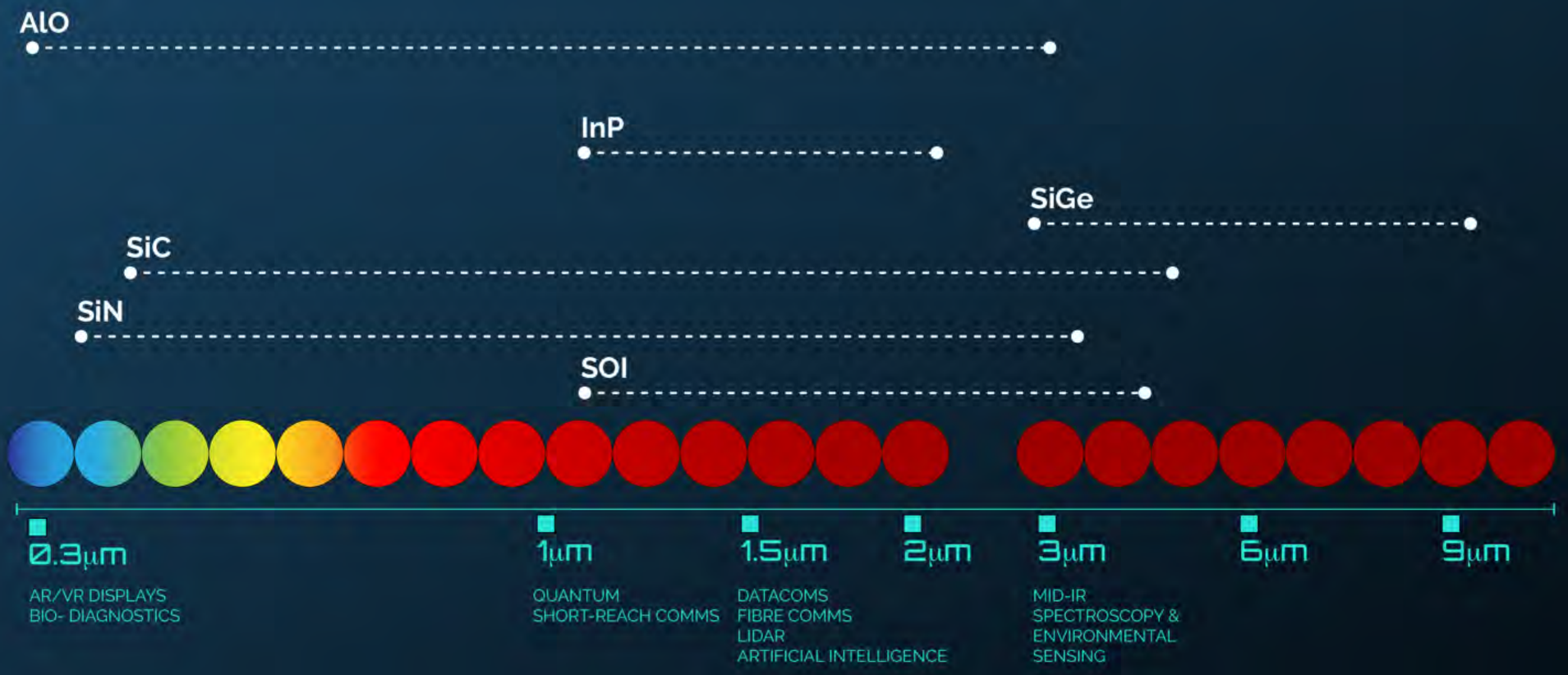
IRELAND
TNI

PORTUGAL
IT

ITALY
POLIMI
FBK

AUSTRIA
SAL

PIXEurope PIC Platforms



MONOLITHIC PLATFORMS

Si, SiN, InP, SiC, SiGe, AlO

HYBRID PLATFORMS (ON MONOLITHIC)

InP, TFLN, AlN, Quantum Dots, Glass, Graphene, 2-D, Phase Change Materials

PIXEurope Horizontals and Verticals

APPLICATIONS

TECHNOLOGY & INNOVATION

Application-specific & programmable devices

Opto-electronic interconnection, packaging and test and reliability

Design and fabrication Si, SiNx, III-V (InP), SiC, Ge-on-Si + hybrids (TFLN, CQD, AlN, ...)

Communication

Artificial Intelligence

Sensing

Automotive

Consumer Electronics

Health

Security

Education

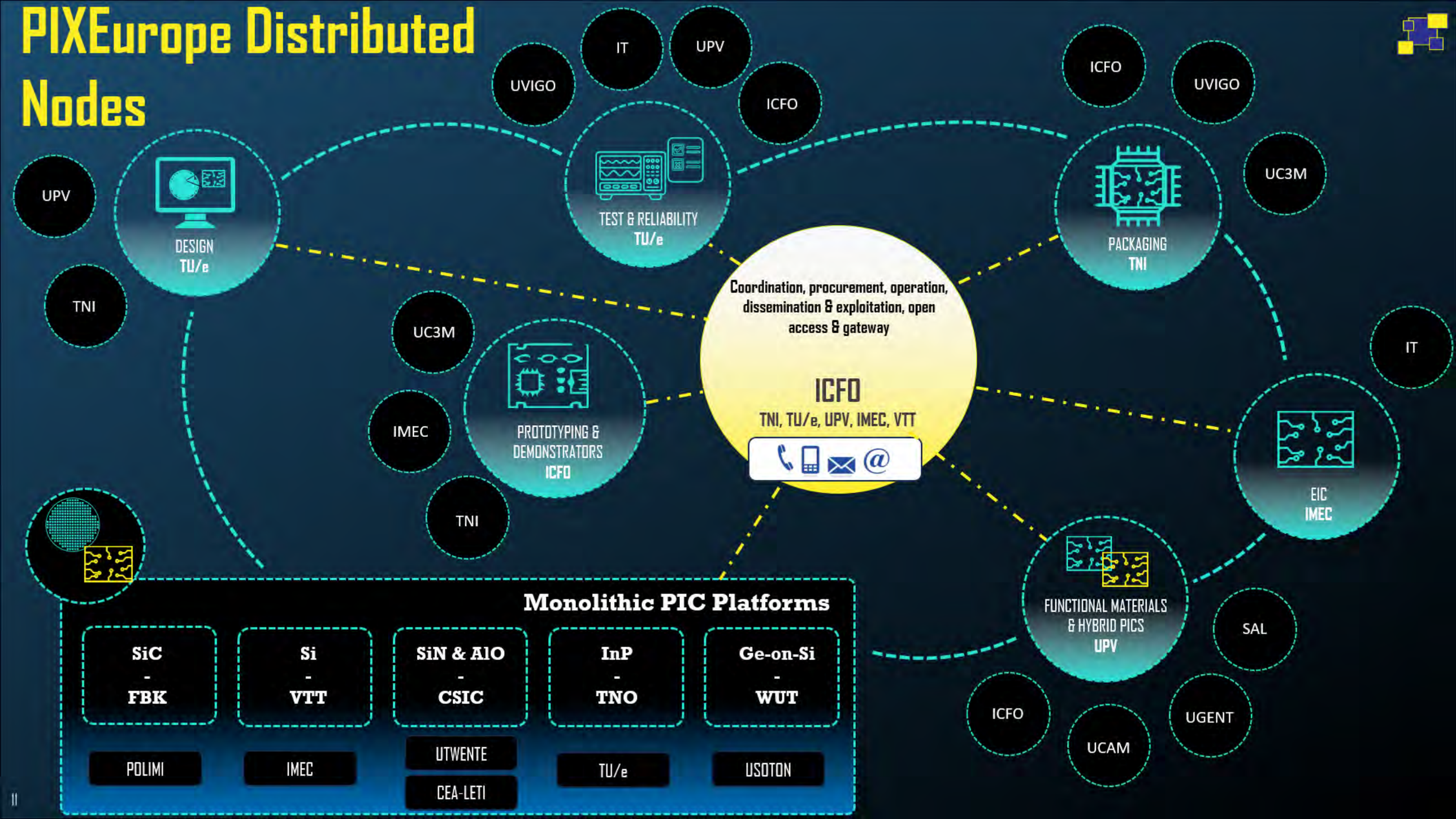
Tech. Transfer

Internationalization

Engagement

GOVERNANCE AND ECOSYSTEM

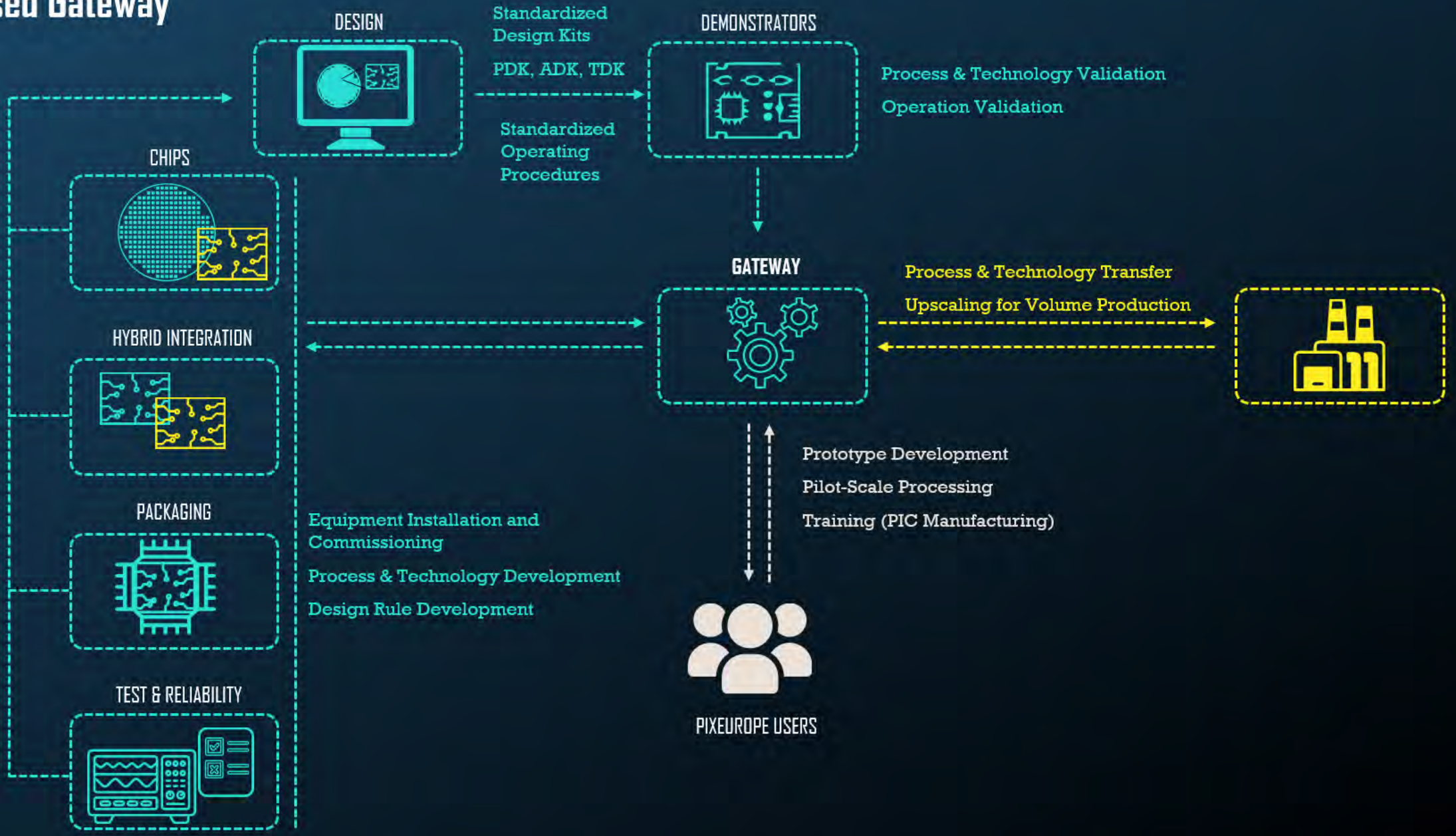
PIXEurope Distributed Nodes



PIXEurope Phases

PIXEurope Operations

Centralised Gateway



PIXEurope Open Access

M6

Collaborative Research
Start with existing infrastructure

M12

Consulting and Training
Underpins industry engagements

M18

Open Infrastructure
New tools becoming installed and operational

M30

Prototyping
First runs become available

EndUsers

- DESIGNERS
- SUPPLIERS
- MANUFACTURERS
- VERTICAL INTEGRATORS

Contact: PIXEuropeGateway@icfo.eu

PIXEurope End-Users

DESIGNERS

MANUFACTURERS

PIX·EUROPE

SUPPLIERS

VERTICAL INTEGRATORS

150+ END-USERS IDENTIFIED

60+ LETTERS OF SUPPORT

PIX.EUROPE

PIXEurope Specific Objectives

- Develop, mature and standardise breakthrough PIC processes and technologies
- Offer advanced services, including standardised MPW runs, advanced packaging and test services
- Unify Europe's top research organisations to establish the world's first PIC Open Access
- Foster a vibrant European PIC industry ecosystem and increase the European capacity in PIC production
- Establish highly visible and well-coordinated training and dissemination programmes
- Collaborate with other European and national semiconductor initiatives, particularly other Chips JU Pilot Lines (CPL1-4), Design Platform and Competence Centres.

PIXEurope Connections to other PLs wrt Scope & TRL

FROM ADVANCED RESEARCH TO SCALABILITY AND FUTURE MANUFACTURING NODES

MATURE PROCESSES

Photonics for quantum (CPL-CQC-1)

PIX EUROPE (CPL-5)

NanoIC

FAMES greener electronics FD-SOI · NVM · 3D · RF · PMIC

WBG Wide Band Gap future power electronics

PhotonHub

PIX4life

JePPIX Pilot Line

PIXAPP Photonic Packaging Pilot Line

photonixFAB

APECS European Chiplet Innovation

CPL-3 IZM Packaging

Existing Photonic Technologies

Heterogeneous Silicon Photonic Technologies

Heterogeneous Electronic Integration