PIX·Europe

Training & Interoperability

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PIXEurope Training Objectives

Objective 6: Establish **highly visible and well-coordinated training and dissemination programmes.** These activities will be managed by **partners who have led-the-way** in providing pioneering PIC training and dissemination programmes.

A. Prepare comprehensive training courses on advanced PIC manufacturing, including online and hands-on courses. PIXEurope will prepare and deliver 28 online, 18 hands-on and specialised one-to-one training courses targeting 1000 attendees per year.

B. Collaborate with the European Competence Centres to roll-out PIXEurope's training courses.

C. Roll-out PIXEurope's training courses during the third year of the project.

D. Organise Open House events, giving users an opportunity to view and evaluate Pilot Line facilities. Dedicated one-to-one visits for more detailed on-site training and consultation will also be provided.

E. Prepare internal training courses so all Pilot Line partners are fully competent in all aspects and technical capabilities of the Pilot Line, especially for new Pilot Line hires.
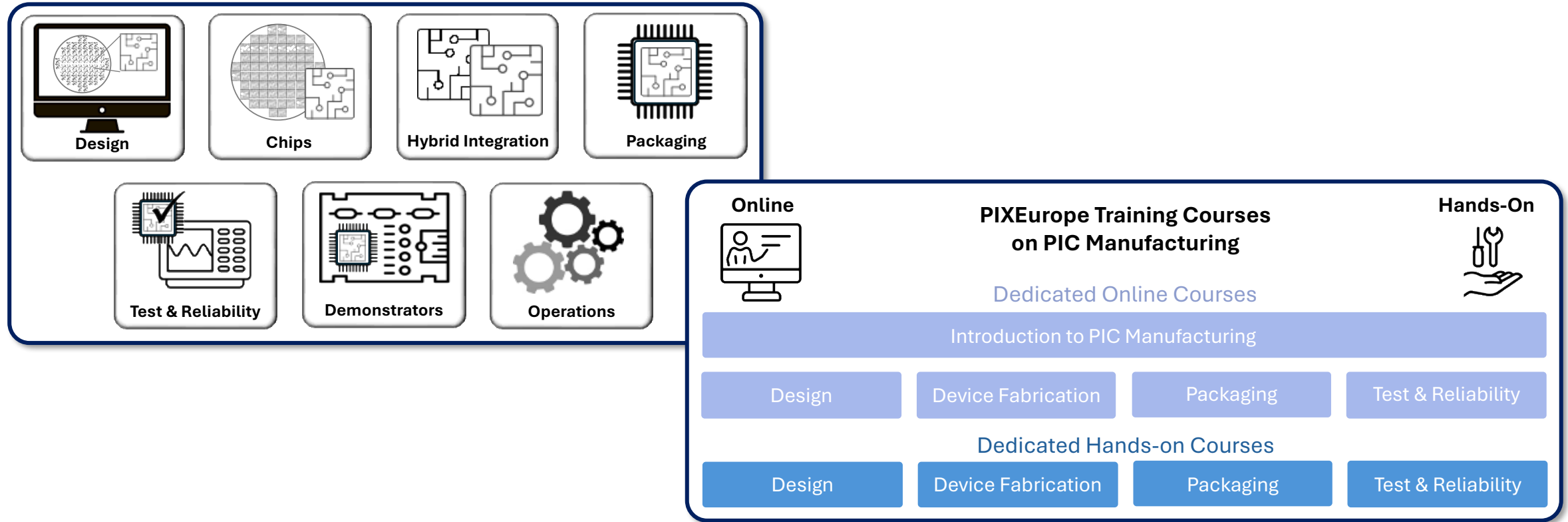
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PIXEurope Training Manager (Tyndall)

Elisabeth Wintersteller

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PIXEurope Training Timeline
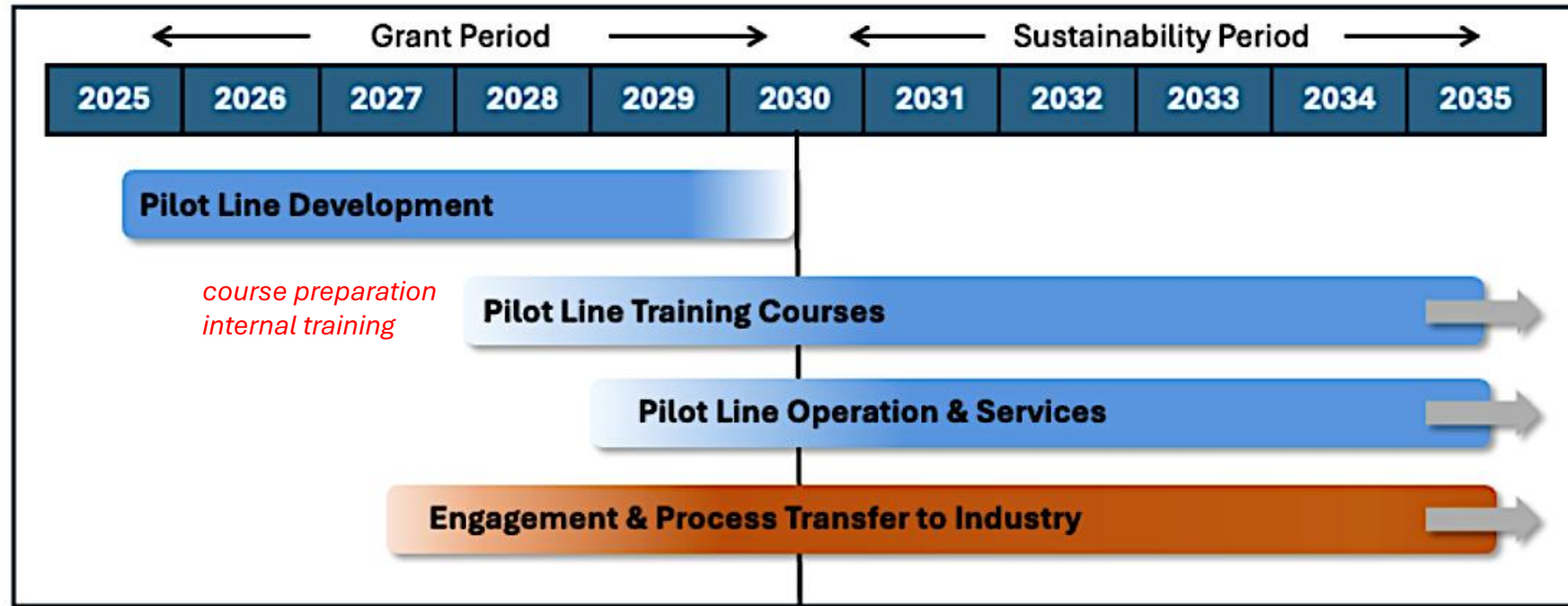
Figure 2: Timeline of PIXEurope Pilot Line from the project grant period to operations and sustainability. Pilot Line services, including delivery of training courses, will be ramped up over time, starting in year 3 and fully operational during the final year of the project grant period.

PIXEurope Training Timeline

Design | Chips | Hybrid Integration | Packaging

Test & Reliability | Demonstrators | Operations

Online | **PIXEurope Training Courses on PIC Manufacturing** | **Hands-On**

Dedicated Online Courses

Introduction to PIC Manufacturing			
Design	Device Fabrication	Packaging	Test & Reliability

Dedicated Hands-on Courses

Design	Device Fabrication	Packaging	Test & Reliability

- ❑ Training courses for internal & external users on integrated photonic technologies
- ❑ Strong focus on production aspects of the technology
- ❑ Online & hands-on courses, as well as user-dedicated courses
- ❑ Complement existing research-focused training (fully address research-to-production)

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PIXAPP Pilot Line Packaging Training Programme
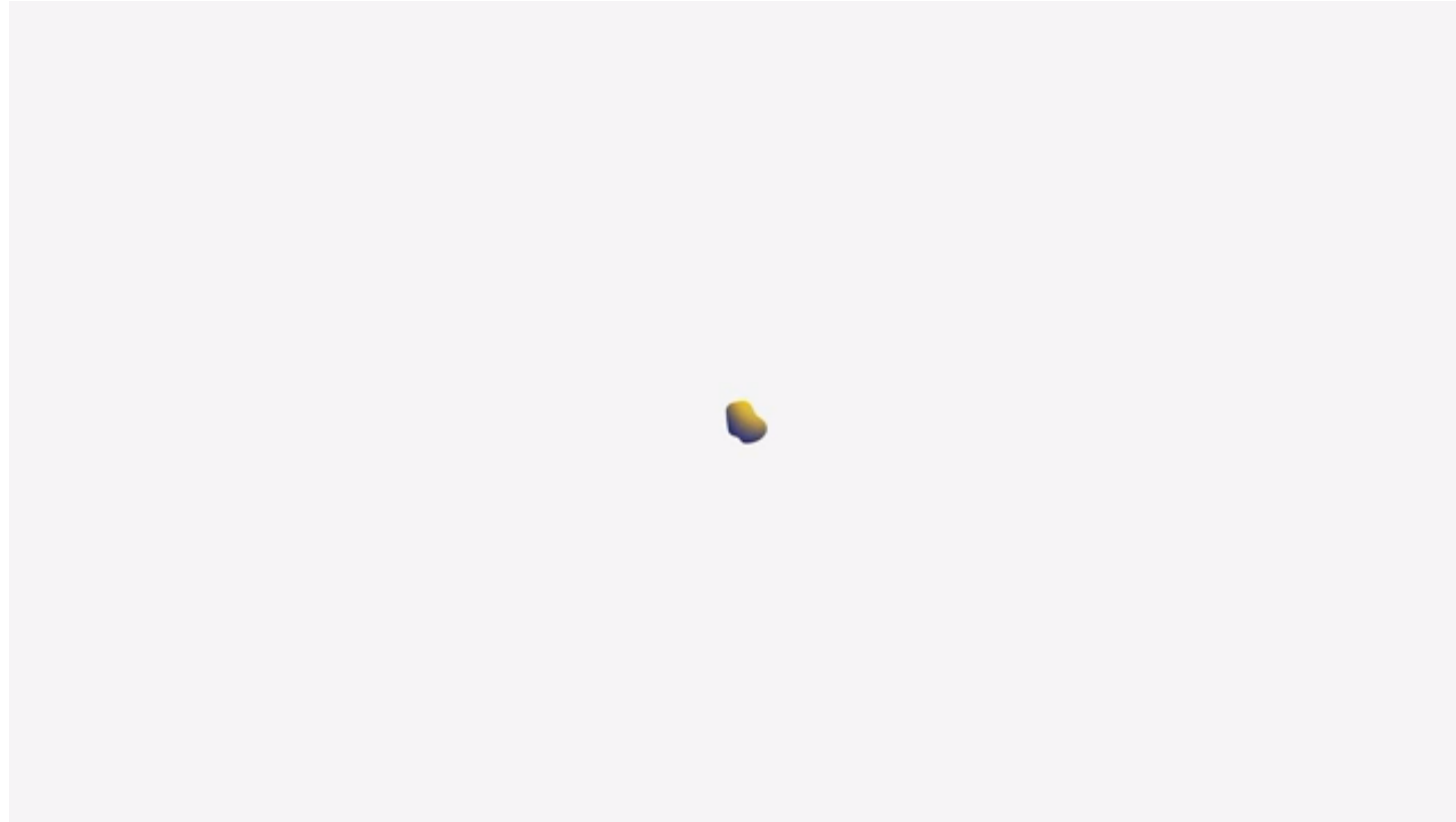
Tyndall MTP Training Course

Micro-transfer Printing Training Course

Access unique training infrastructure

Introduction to machinery, mechanisms, and software exclusively designed for micro-transfer printing.

Course components:
- ✓ MTP machine and mechanisms
- ✓ Alignment guidelines
- ✓ Coupon and print
- ✓ Lab demo and fabrication visit
- ✓ InP, GaAs, GaN and Si based MTP technology

In collaboration with
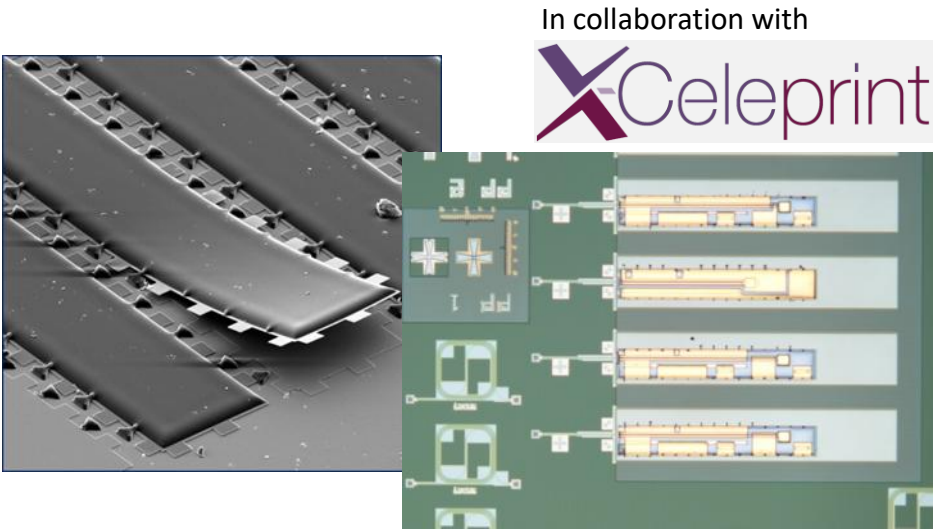
MTP course in a nutshell	
Mode of delivery	In-person lectures and lab sessions
Level/ pre-requisites	Introductory/ None; but fundamental understanding of semiconductor technology beneficial
Length	2 days
No of attendees	8

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PIXEurope Training Catalogue

PIXEurope Training Centres

Partner	Country	Title
JR	AT	Nano goes macro: Large-area micro- and nanostructuring
IMEC	BE	Silicon Photonics for Sensing Applications
VUB	BE	Photonics and Food
VUB	BE	Optical Fibre Sensing Applications
FHG_FEP	DE	OLED for Lighting and Signage Applications
FHG_ILT	DE	Photonics in Manufacturing
FORTH	EL	Optical Fibre Sensors for Industrial Application
FORTH	EL	Laser-based additive micro-manufacturing for Industrial Applications
ICCS	EL	Photonics for Telecom & Datacom applications
AIMEN	ES	Advanced laser welding
AIMEN	ES	Surface functionalization by laser patterning
CARTIF	ES	Operating and digitalization of laser manufacturing cells for beginners
ICFO	ES	Super resolution and advance microscopy imaging techniques
Photonics Finland	FI	Spectral Imaging and its Applications
VTT	FI	Thick-SOI photonics for sensing and imaging
CNRS_FEMTO	FR	Fabrication and characterization of an integrated Electro-Optic modulator
CNRS_IEMN	FR	TeraHertz spectroscopy application to solid, liquid and gaseous samples.
CNRS_IEMN	FR	CNRS-IEMN/Photovoltaics
CNRS_IF	FR	Institut Fresnel / Espace Photonique optical thin film platform
CNRS_L2n	FR	Photonics for Quantum Technologies
CNRS_LCF	FR	Optical Fibers and telecommunications
CNRS_LP3	FR	Handle and use pulsed Lasers for additive fabrication
Tyndall-UCC	IE	Photonics for Biomedical Applications
CNIT	IT	mmWave Generation and Transmission Demo Center/ Title:Graphene photonics for mm-wave wireless links
CNR_IFN	IT	Optical gas sensors for industrial applications
CNR_INO	IT	Quantum Communication applications
TUE	NL	PIC Product
WUT	PL	Quantitative Phase Imaging at Cellular Level
WUT	PL	Fiber-Optic Sensors for Structural Health and Biomedical Monitoring
RISE	SE	Specialty Optical Fibres for sensing applications in Industry
ORC	UK	Build your own Silicon Photonics Chip

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PIXEurope Training Centres

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New European Academy to boost the skills and know-how of industry in exploiting opportunities in the €615B global photonics sector

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Training Proposal Documents

Training Proposal Documents

PhotonHub Experience Centre
Course 01
Photonics Packaging & Integration Technologies

Course Provider
Tyndall Institute
University College Cork
Ireland

Course Schedule

Day & Time	Training Activity
Day 1 (09:00 – 12:00)	Tyndall Orientation, Course Introduction & Packaging Tutorials (lectures)
Day 1 (14:00 – 17:00)	Laser Welding of Optical Fiber to InP Laser in 14-Pin Butterfly Package (hands-on)
Day 2 (09:00 – 12:00)	Electronic Packaging Technologies (hands-on)
Day 2 (14:00 – 17:00)	Fiber Array Packaging to Photonic Integrated Circuit (hands-on)
Day 3 (09:00 – 12:00)	Micro Optics Packaging (hands-on)
Day 3 (14:00 – 17:00)	Reliability & Failure Analysis of Photonic Devices (hands-on)

Next Steps (Training)

1. Liz to make contact with PIXEurope partner training person

2. Evaluate training activity, capabilities and plan of each PIXEurope partner

3. Select first partners who will develop training courses (online & hands-on)

4. Selection based on template course structure

5. Roll-out of first training courses

6. Additional partners to follow over reasonable timescale

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Interoperability (the motivation)

Interoperability activities focus on establishing and optimising the operation of the distributed Pilot Line between partners. In the project, interoperability is strongly linked with WP4 & WP9. In WP9, demonstrators to be developed between the partners in WP9 to evaluate and optimise overall operational efficiency.

Distributed Pilot Line

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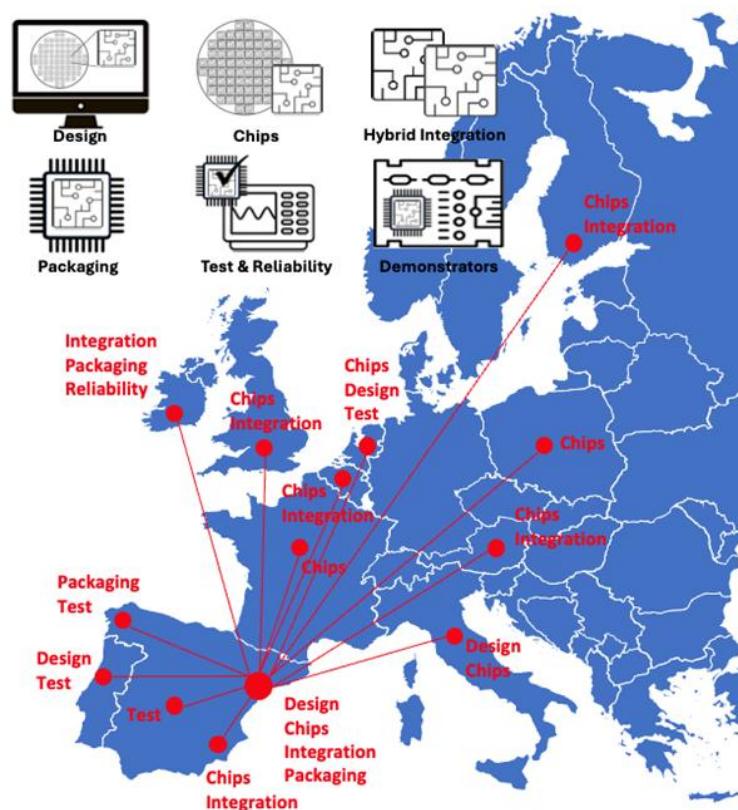
Interoperability (user access)
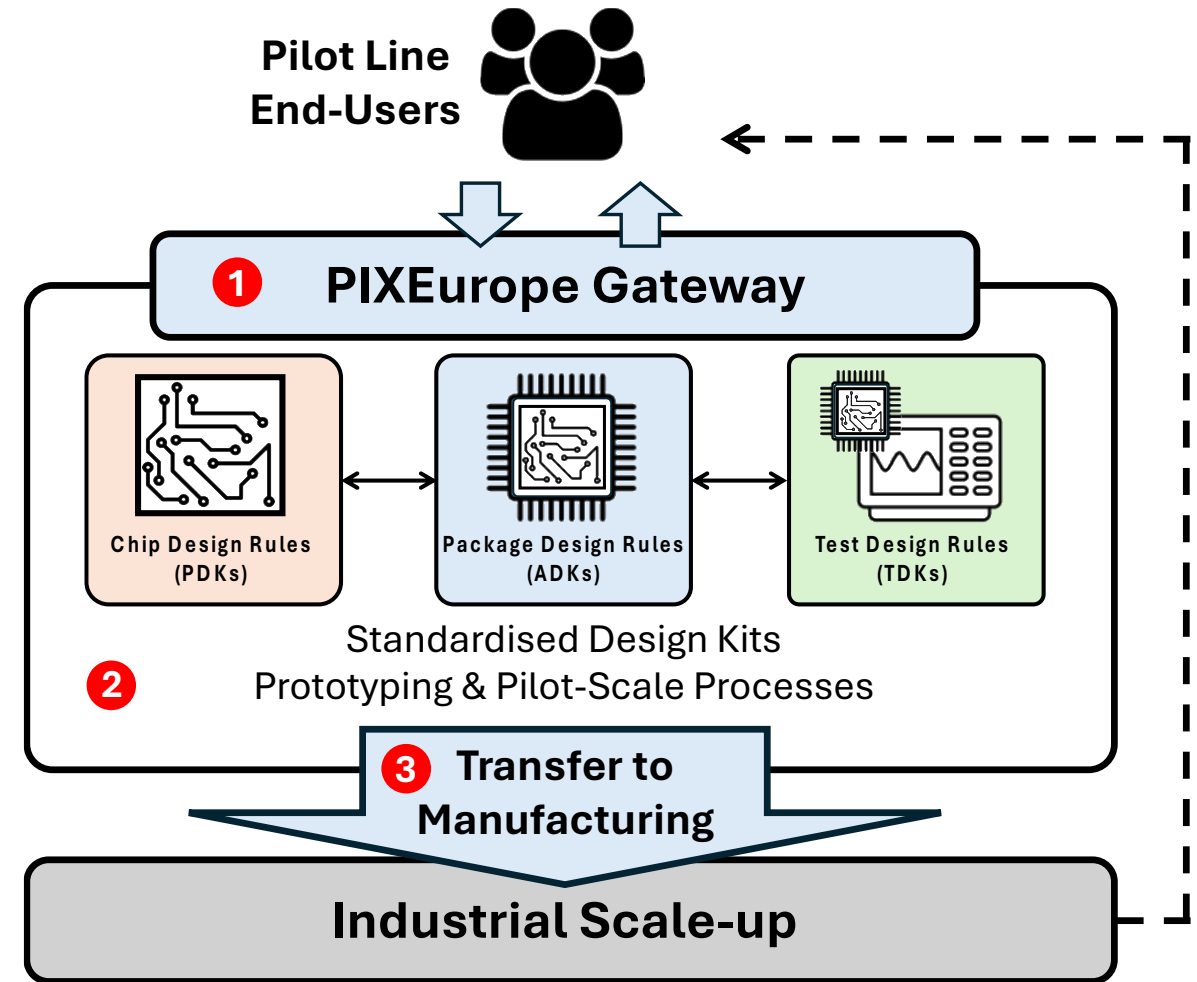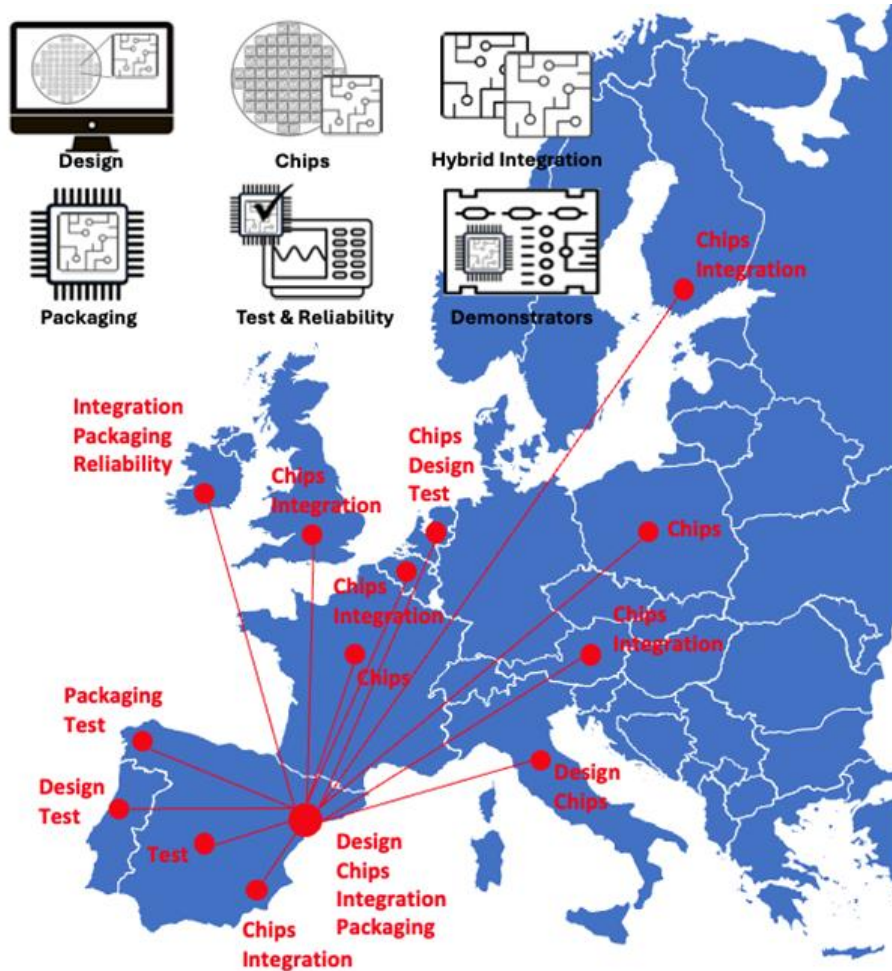
Interoperability (European Design Platform)
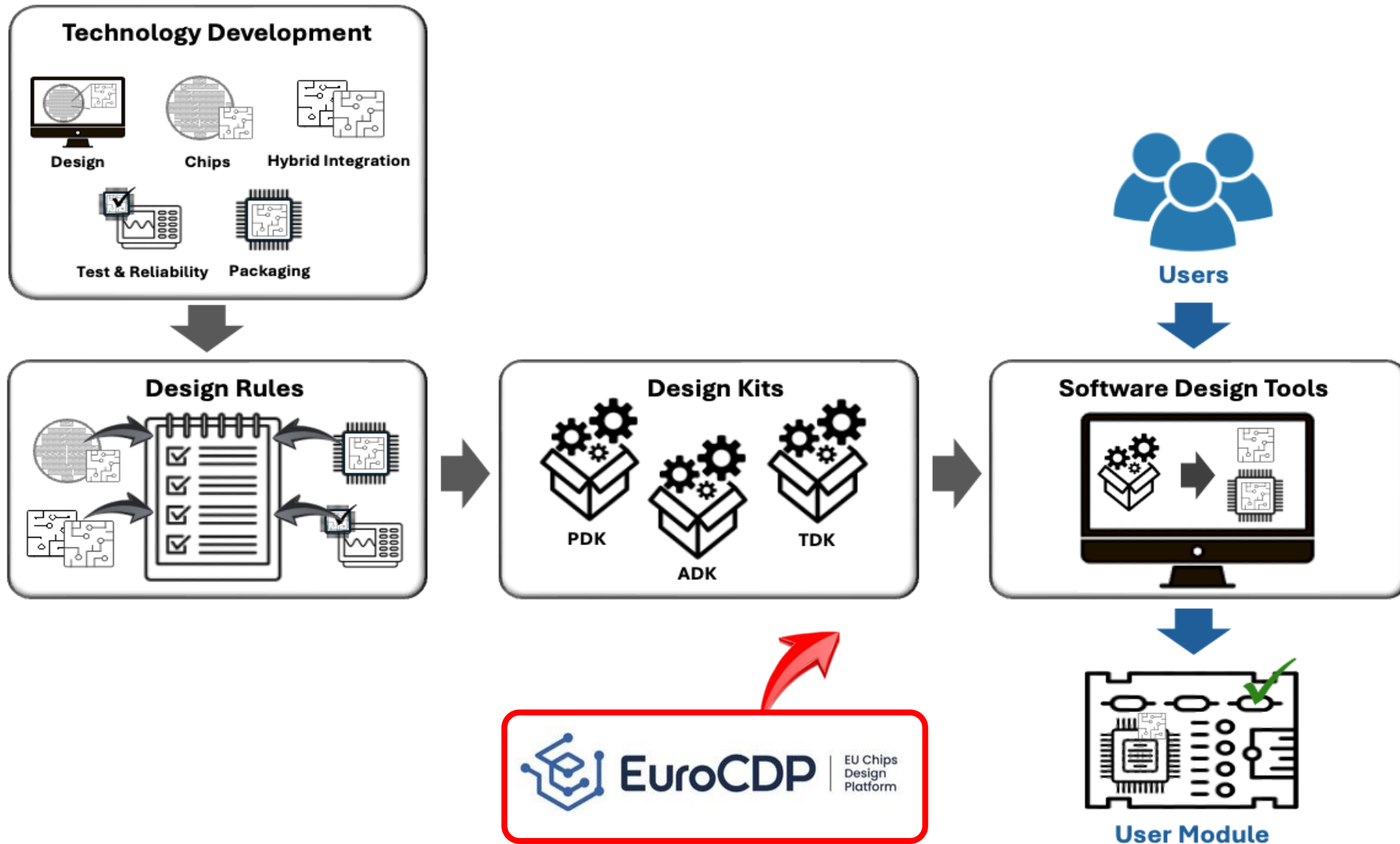
Next Steps (Interoperability)

1. **Review project demonstrator details** (follow-up with relevant partners)

2. **Prepare process flow & partner roles** (draft)

3. **Prepare Gantt chart and timelines** (draft)

4. **Identify inconsistencies in process flow/interoperability**

5. **Close collaboration with PIXEurope Gateway**

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Interoperability (PIXEurope project demonstrators)

Consortium partners have significant experience managing distributed technology development, leveraging their unique capabilities to create complex integrated photonic modules. This figure shows how TNI, IMEC, and VTT previously collaborated with industry partners in the PIXAPP Pilot Line project to develop a silicon-photonic PIC-based 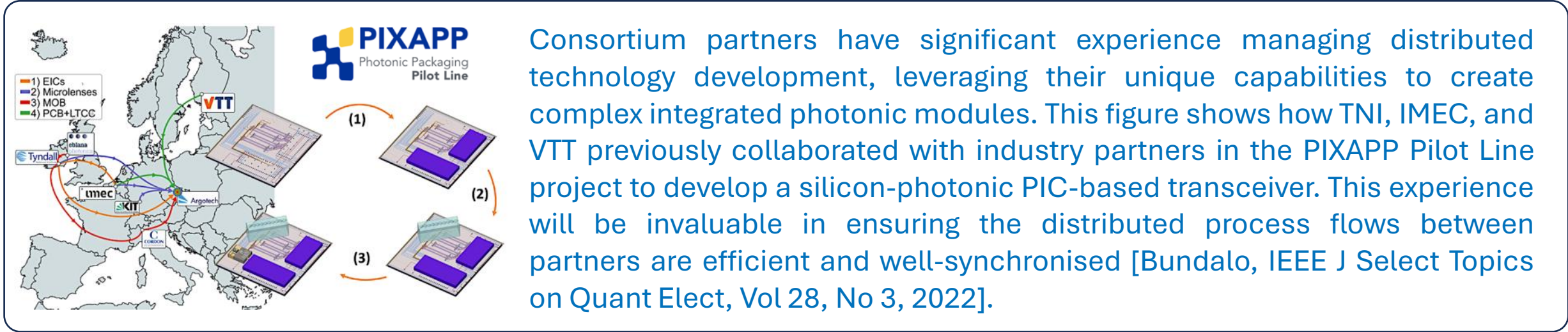transceiver. This experience will be invaluable in ensuring the distributed process flows between partners are efficient and well-synchronised [Bundalo, IEEE J Select Topics on Quant Elect, Vol 28, No 3, 2022].

Demonstrator 3: Next-Generation SFF Pluggables for PON optical transceivers

1. Laser-induced forward transfer (LIFT) hybrid bonding
2. Flip-chip bonding of EIC and PIC
3. Non-contact RF access port using dielectric waveguide
4. Pluggable Optical IO, using Integrated Micro-Optics

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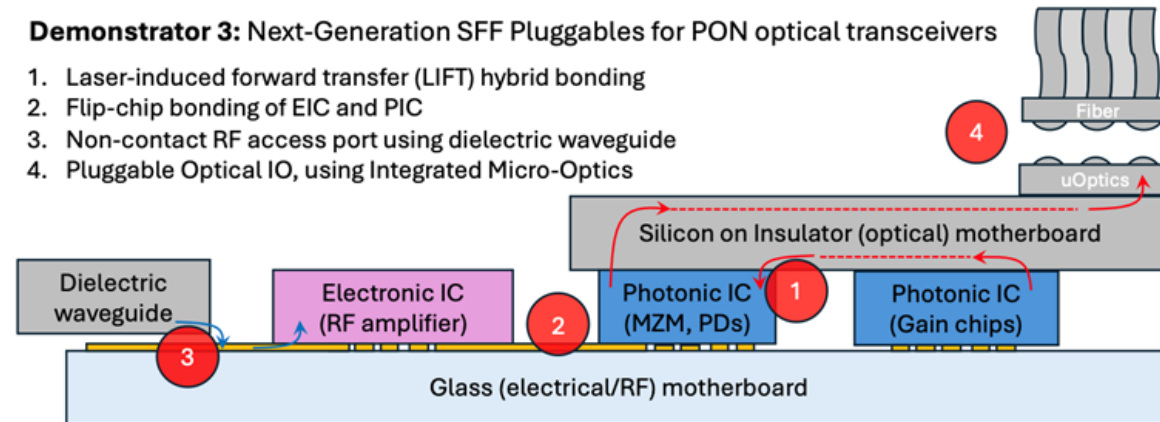
Interoperability (demonstrator process flow)

Interoperability (demonstrator Gantt chart & timeline)

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Interoperability (demonstrator details)

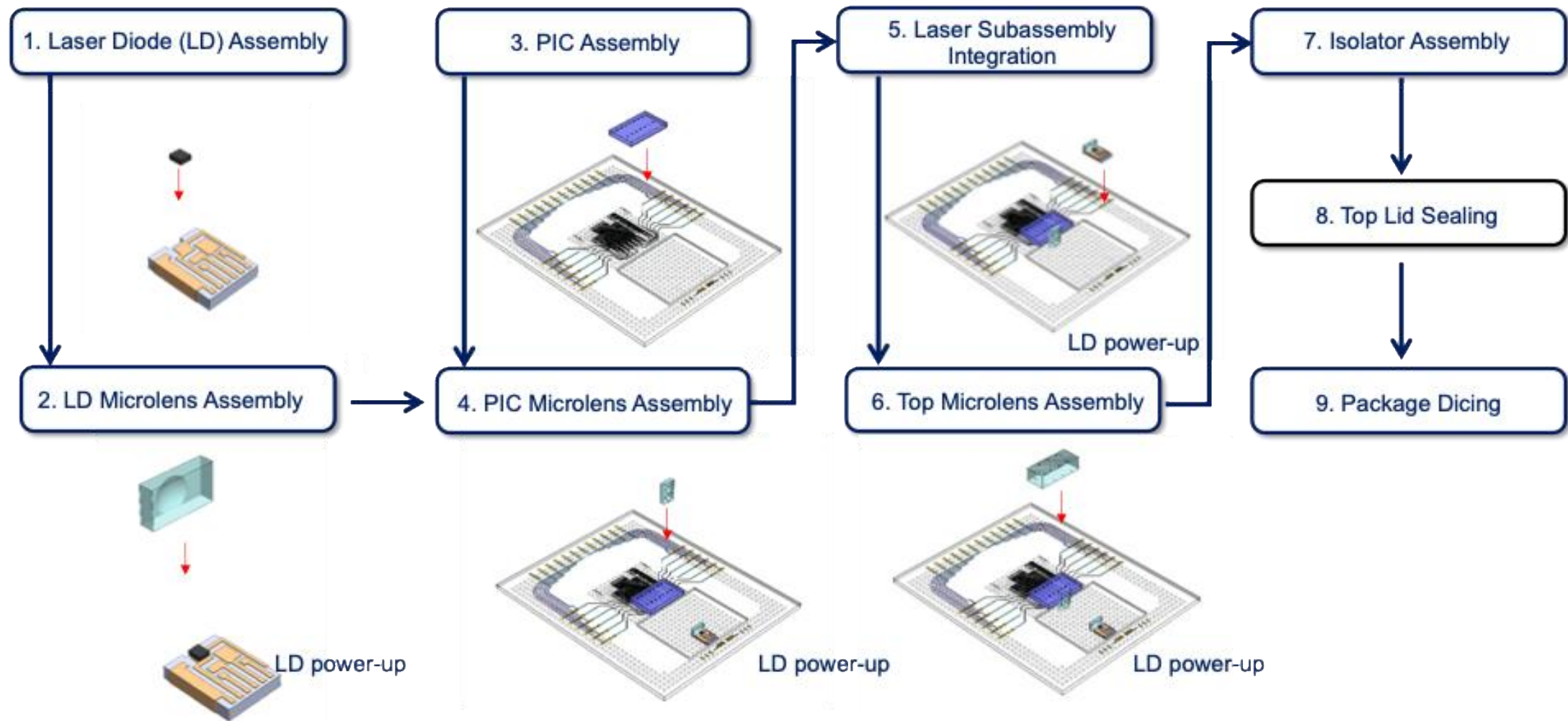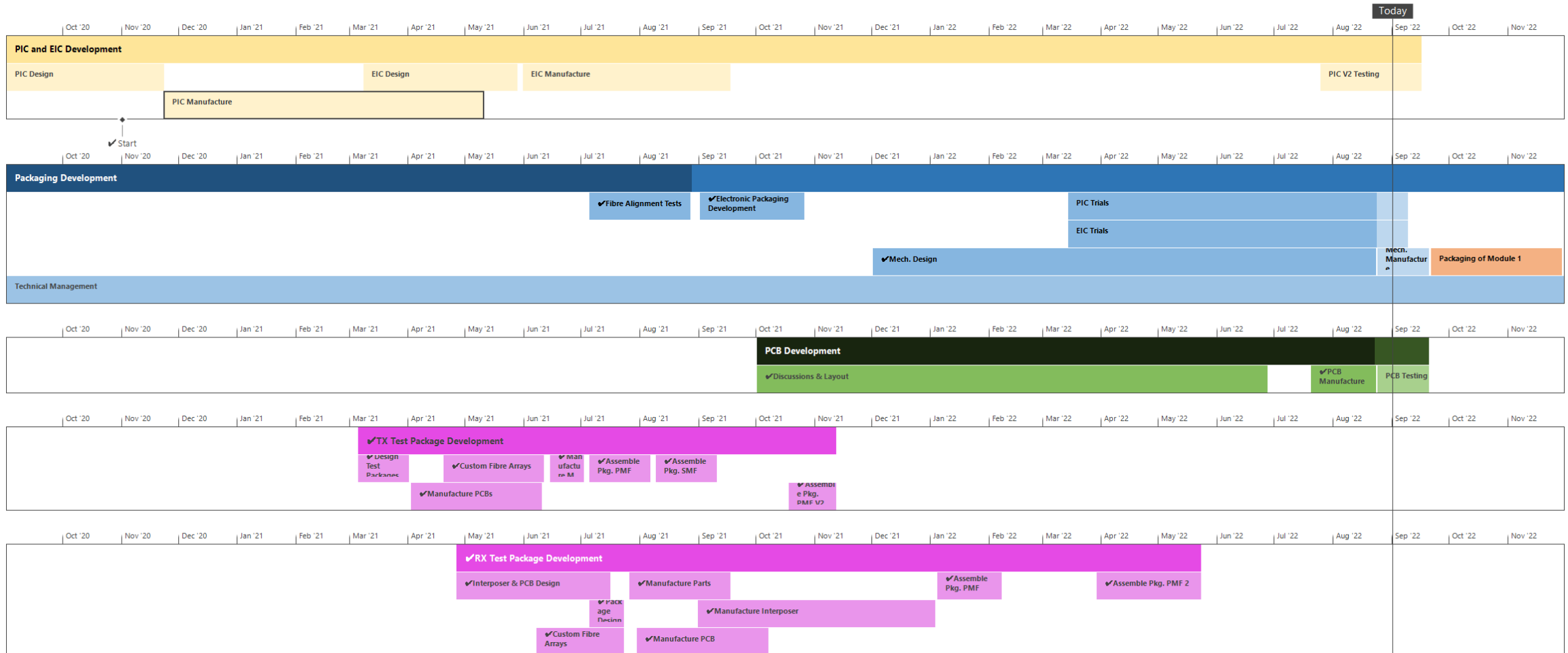| Demo	Name	Coordinator	Design	Monolithic chips	Hybrid Integration	Packaging	Test
1	Optical Space Switch	ICFO	ICFO	UTWENTE	SAL	TNI	ICFO
2	Ultra High-Speed Coherent Transmitter	IMEC	IMEC	IMEC	IMEC	-	IMEC
3	Next-Generation SFP for PON Optical Transceivers	UC3M	UC3M	TNO, VTT, IT	TNO, IT	TNI, ICFO	UC3M, TU/e, IT
4	Visible Light Engine for Displays	TNI	ICFO	CSIC, TNI, UGENT	TNI	TNI, ICFO	ICFO
5	MIR Photonic Sensing Blocks	WUT	WUT, POLIMI, FBK, USOTON, SAL	UTWENTE, FBK, USOTON, SAL, WUT	UCAM	-	WUT
6	LiDAR Transmitter for Multi-Modal Sensing	TU/e	TU/e	TU/e	-	TNI, ICFO	TU/e
7	Programmable Photonic Processor	UPV	UPV	CSIC, CEA-LETI	UPV	TNI	UPV
8	Co-Packaged Optics & Electronics for AI	IMEC	IMEC	IMEC	IMEC, TNI	TNI, ICFO	IMEC

Demonstrator 7: Photonic Processor

1. Hybrid Bonding of EIC
2. Transfer Printed SOAs/ RGB Lasers
3. Interposer for Electrical Control/monitoring/driving and biasing of phase shifters/SOAs
4. Pluggable (C+O band)/Free Space Optical (visible) IO

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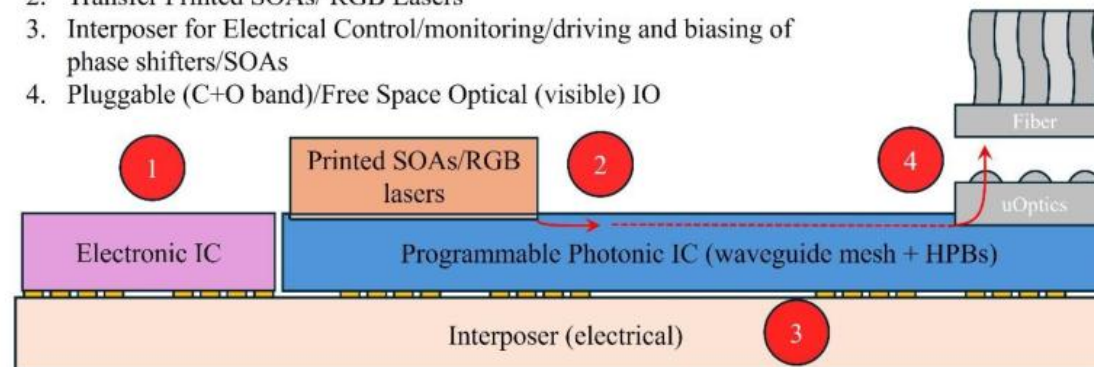
Interoperability (demonstrator details)

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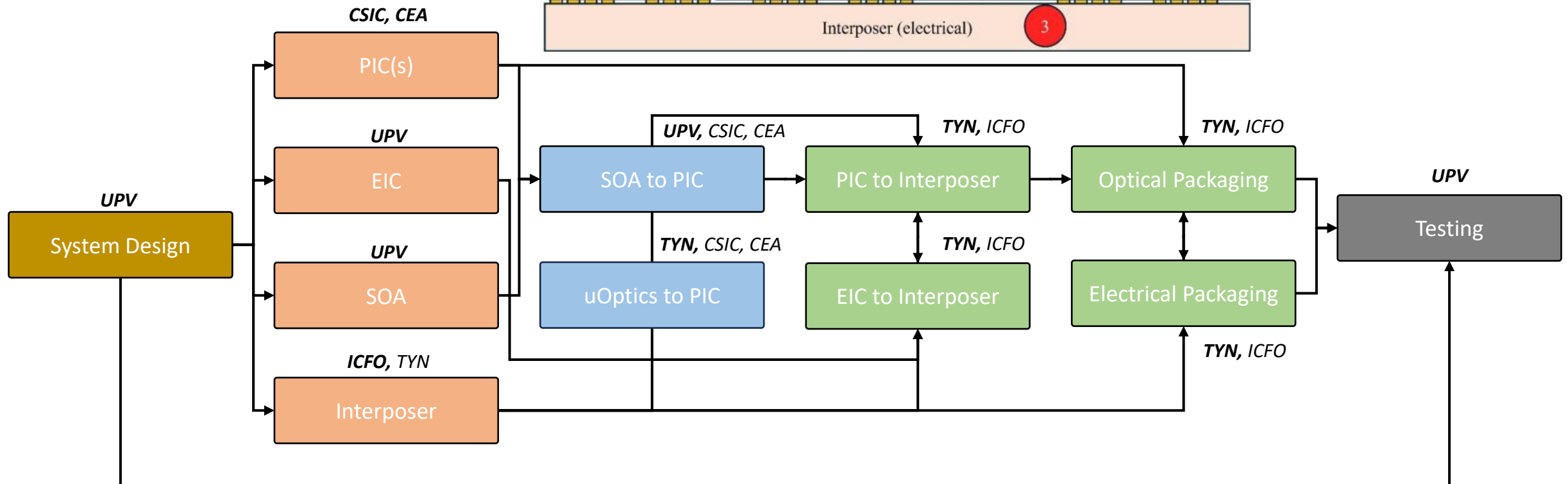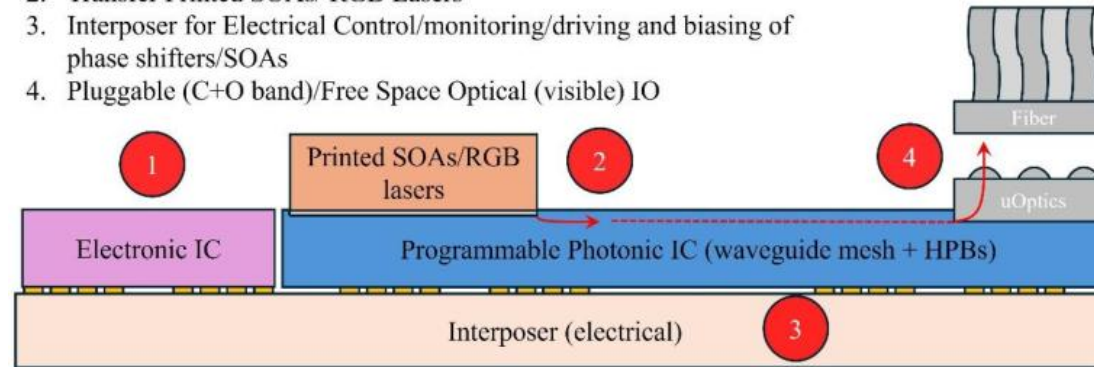4. Pluggable (C+O band)/Free Space Optical (visible) IO

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