



photonixFAB

Enabling photonics product innovation with a path to high-volume manufacturing

Project Introduction

Joni Mellin, X-FAB, 13.11.2023

23-11-09



photonixFAB is co-funded by the European Union under grant
agreement no. 101111896

Contents



1 Key Facts, Project Scope & Objectives

2 Industrial Value Chain

3 Technologies

4 Applications & Markets

5 Availability

Key Facts



- Industry driven initiative with 12 partners from 9 countries
- € 47.6 m public + private funding
 - co-funded by the EU under grant agreement no. 101111896
 - top-up funding by Belgium, Germany, France, Israel, Italy, The Netherlands and Switzerland
- Start: May 2023
- Duration: 3.5 years

Consortium partners:

Technology & Manufacturing



Research & Technology



Applications



What do we want to achieve



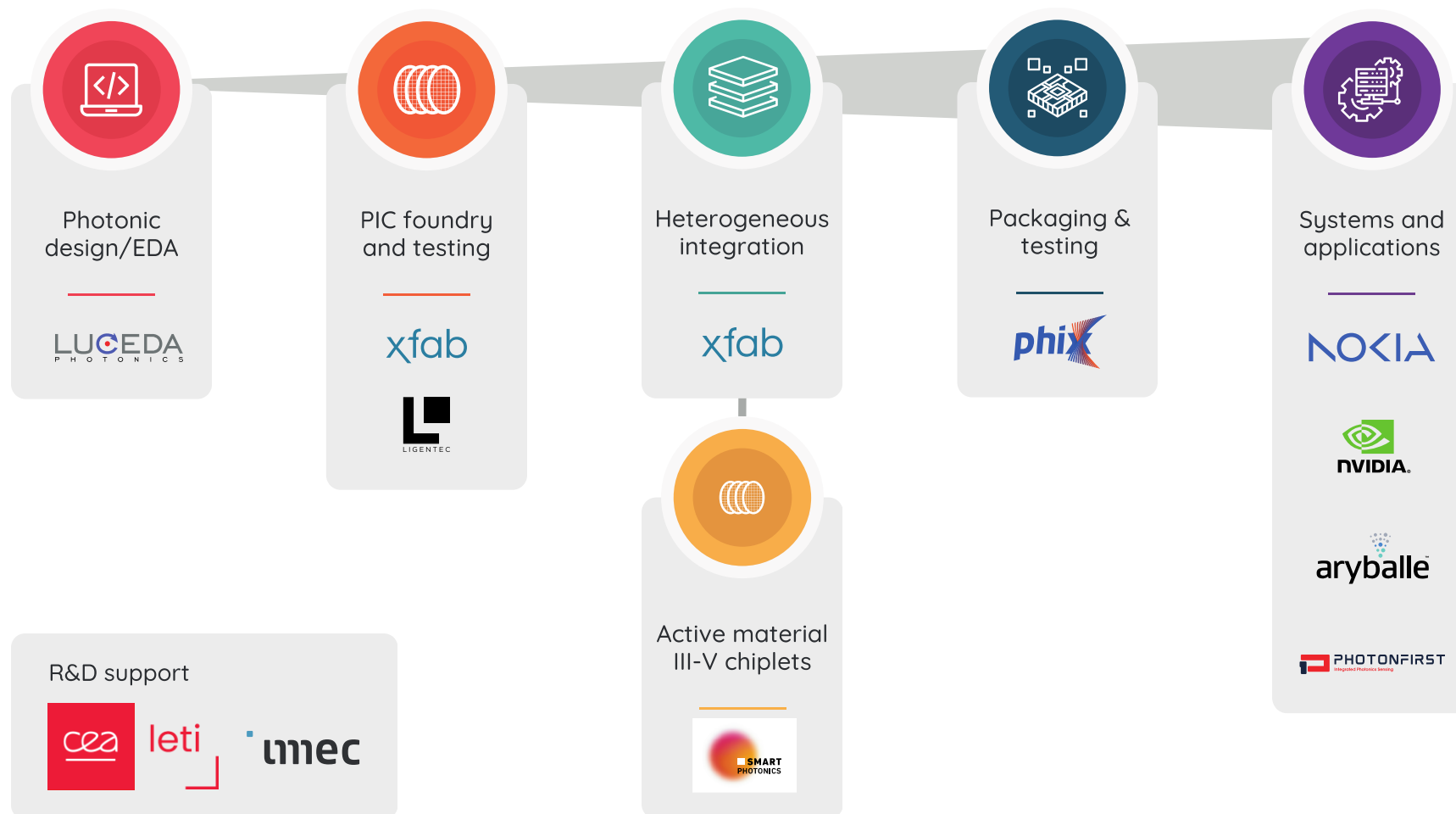
- To establish a European photonics device value chain and initial industrial manufacturing capabilities, providing a path to scalable high-volume manufacturing for innovative product developers.
 - Strengthen the European silicon photonics industrial supply chain on EDA, packaging and testing, essential elements to offer production-ready technology.
 - Develop an internationally competitive offering accessible to SME's and other customers

What are we going to do



- Extend the industrial manufacturing capability in X-FAB for SiN photonics building on LIGENTEC's SiN platform.
- Establish an industrial manufacturing capability in X-FAB for SOI photonics building on IMEC's SOI platform.
- Increase maturity of heterogeneous integration of active devices (μ TP ready InP platform from SMART) on both SOI and SiN platforms to be low-volume production ready and with a path to high-volume fabrication.
- Enable hybrid photonics packaging and assembly solutions (PHIX)
- Providing EDA & PDK solutions (Luceda)
- Demonstrate platform capability through application partners

Photonics Industrial Value Chain



- Demonstrate platform capability through application partners

→ telecom

→ datacom/data-center

→ sensing (olfaction sensor)

→ fiber-interrogator

3

Technologies

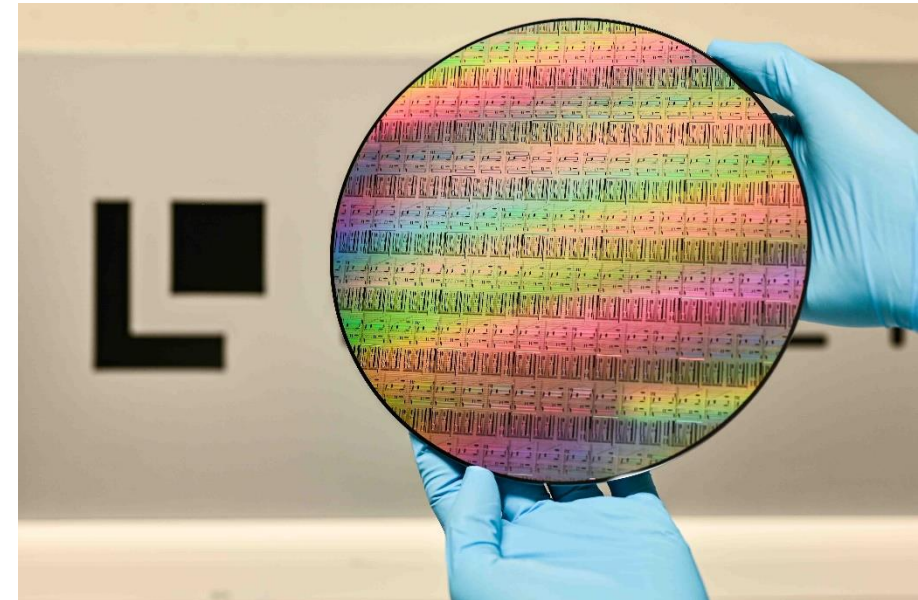
Low-loss Silicon nitride (SiN) platforms



Ideal for quantum computing, sensing and other applications from visual to SWIR wavelengths

Key activities

- Installation of AN350 and AN150 platforms in X-FAB's 200mm high-volume fab
- Enhancing AN800 platform with new process modules
- Enabling early technology access and offering prototyping readiness (MPW runs)
- Industrialization of the installed SiN platforms
- SiN platform enablement for heterogenous integration (micro-transfer printing)
- Extension of photonics wafer and die level testing capabilities



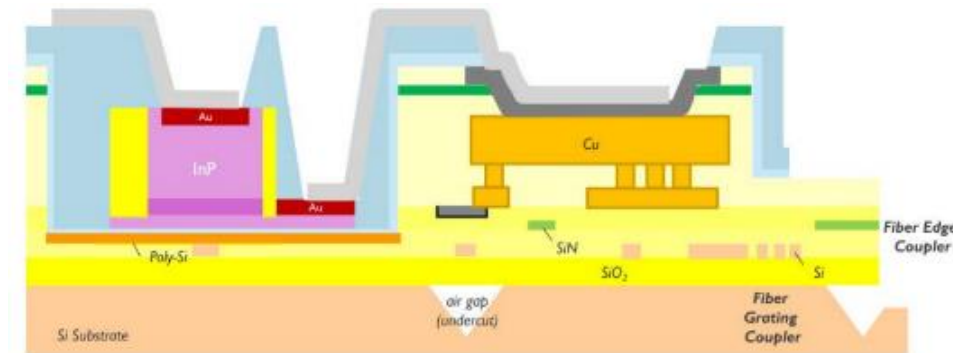
220 nm SOI platform optimized for μ TP



Ideal for datacom, telecom, sensing and more applications

Key activities

- Installation of the imec SOI platform in X-FAB's 200mm high-volume fab
- Enabling early technology access and offering prototyping readiness (MPW runs)
- SOI platform enablement for heterogenous integration (micro transfer printing) of high-performance materials like InP and other



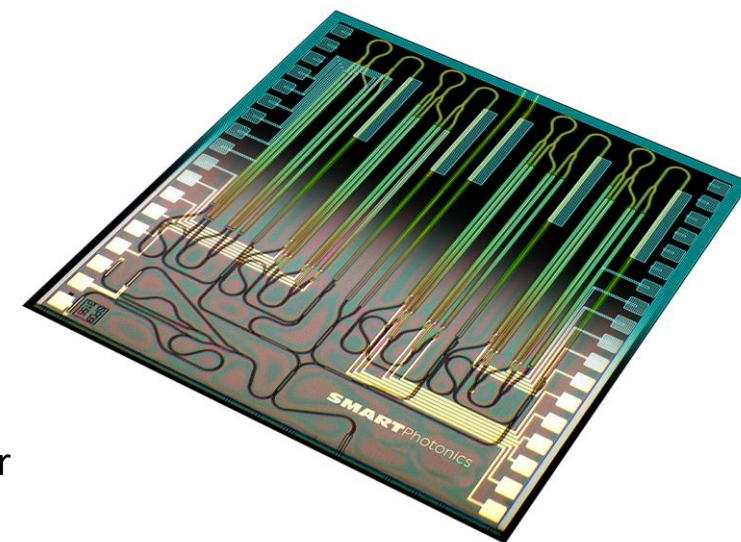
μ TP ready InP chiplets



Combining the best of Indium Phosphide (InP) and Silicon (Si) photonics worlds

Key activities

- InP required for light-generating components, e.g. lasers and amplifiers
- InP photodiodes and MZIs may also be evaluated
- All InP components will be manufactured by SMART and tested by wafer-level probing prior to transfer
- Enabling micro transfer print ready InP chiplet source wafers
- A micro-transfer printing approach will be used to integrate the InP die into the SiN and SOI platforms



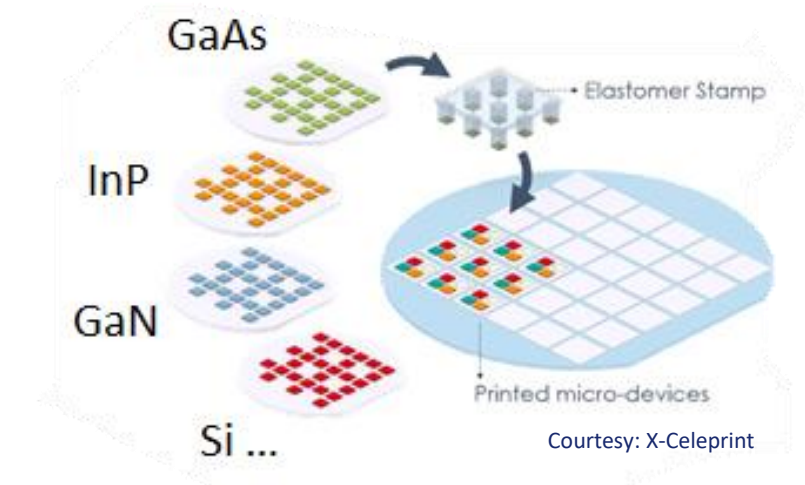
μ TP of InP and other chiplets



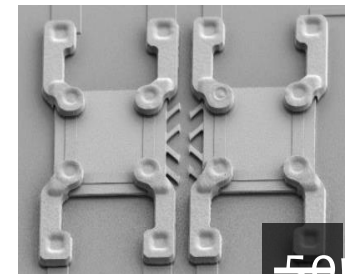
Ideal for high throughput multi-technology chiplet heterogeneous integration

Key activities

- Enabling photonics print precision ($3\sigma < 500\text{nm}$) TRL6 level industrial pilot line at X-FAB
- Transfer printing of InP and other chiplets on SiN and SOI platforms
- Preparation of design rules and guidelines for chiplet transfer printing on SiN and SOI platforms
- Provide early technology access to the Industrial pilot line



Courtesy: X-Celeprint



Courtesy: X-FAB

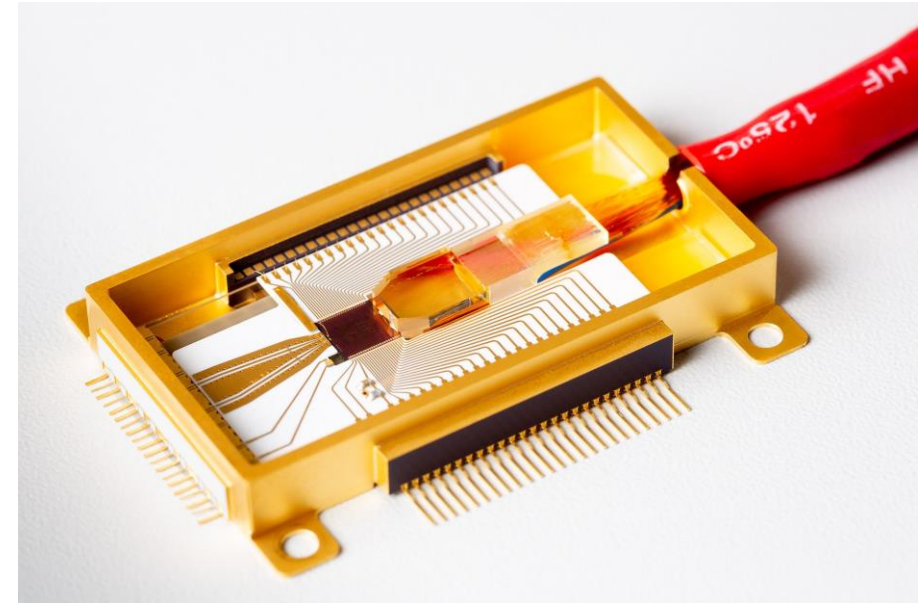
Advanced hybrid photonics packaging & testing



Ideal for scaling up production,
from prototypes to large series

Key activities

- Hybrid assembly and packaging of SOI and SiN-based chips, in scalable volumes
- Interfacing between photonics and DC/RF electronics
- Providing photonics packaging solutions to optimise performance, minimise costs and accelerate the adoption of new technology
- Managing thermal effects, and providing environmental protection to packaged devices
- Standardisation and co-development of an Assembly Design Kit (ADK)



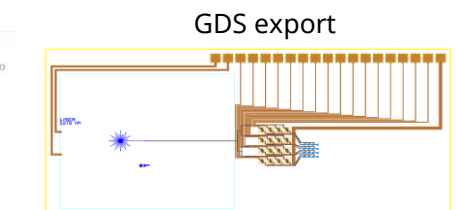
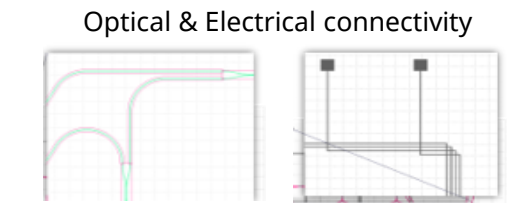
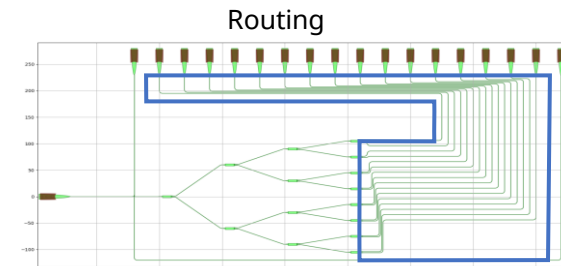
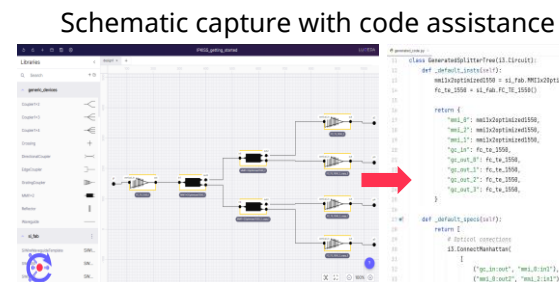
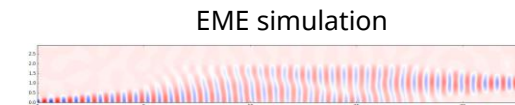
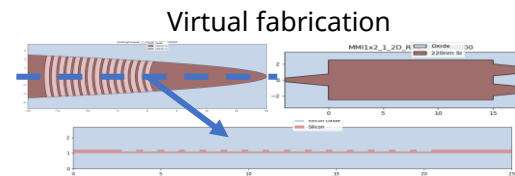
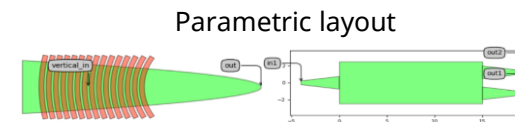
Photonic design and PDK enablement



Ideal EDA solution for PIC and optical component designs

Key activities

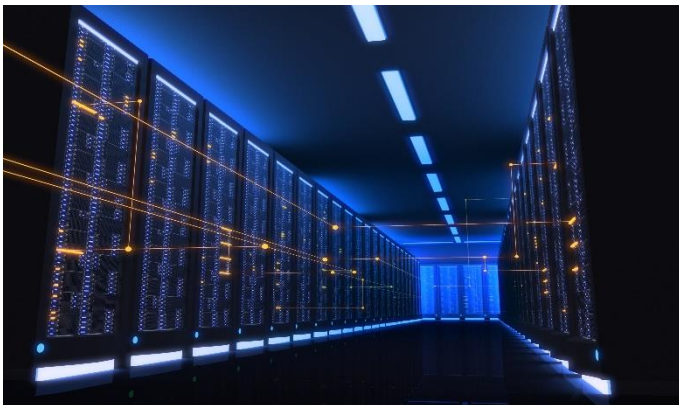
- Photonic component layout and simulation
- Circuit implementation
- Optical and electrical routing
- Schematic capture
- Layout and tape-out
- Circuit simulation – transient and frequency domain
- Data-driven compact models
- Functional verification
- Design IP Management and Design Kit Quality Assurance



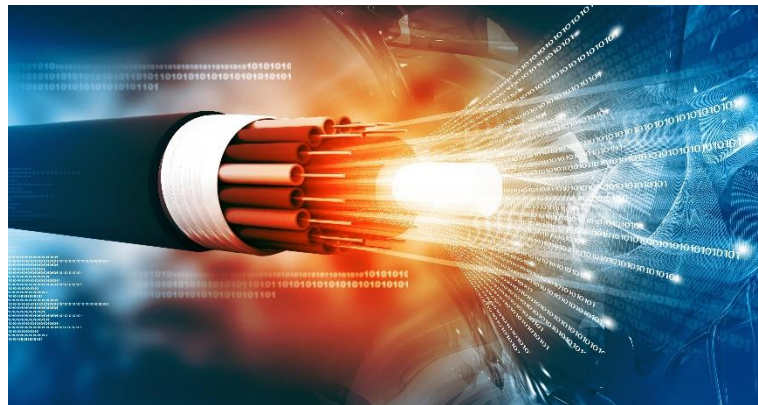
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Applications & Markets

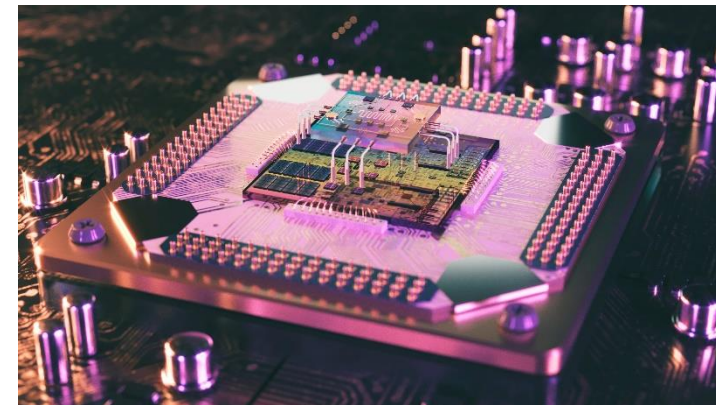
We support main Applications & Markets



Datacom, AI and computing



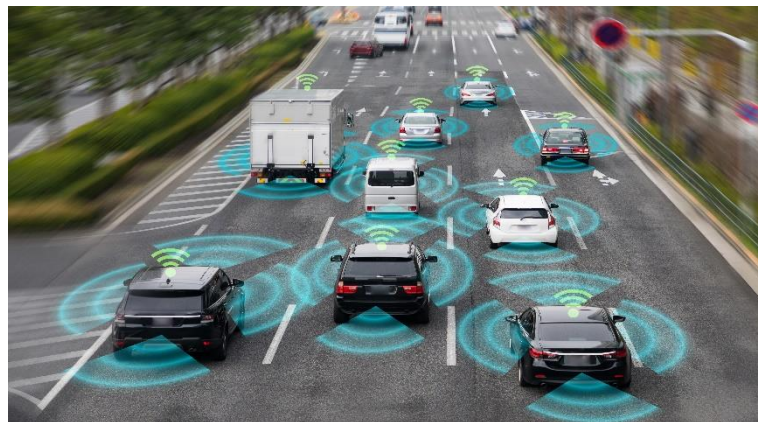
Telecom



Quantum computing & technologies



Medical, diagnostics and biosensing,
consumer medical



Automotive, PIC enhanced LIDAR



AR/VR, industrial and environmental sensors

5

Availability

Availability in high volume industrial fab



Key technologies

Early technology access for SIN / SOI platforms

Commercial MPW program for SIN / SOI (TRL8+)

Early technology access for μ TP ready InP chiplet technology (TRL6+)

Early technology access for InP μ TP on SIN / SOI platforms (TRL6+)

Packaging & testing solution Assembly PDK for the SIN / SOI platforms

Availability

Early 2025

Late 2025

Early 2025

Mid 2025

End 2024

Note:

- More detailed availability will be communicated later
- ***Prototyping and small scale production is available today through partners***

Acknowledgement



photonixFAB is co-funded by the European Union under grant agreement no. 101111896. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Key Digital Technologies Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.

The project is supported by the Key Digital Technologies Joint Undertaking and its members including top-up funding by Belgium, Germany, France, Israel, Italy and the Netherlands. The project is also supported by Switzerland separately.



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Thank you!

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23-11-09



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