



THE EUROPEAN **PILOT LINE** AND ONE-STOP-SHOP  
FOR THE MANUFACTURING OF **FREE-FORM MICRO-OPTICS**



# Phabulous

Funded by



PHOTONICS PUBLIC PRIVATE PARTNERSHIP

PHOTONICS<sup>21</sup>



## PHABULOuS Online Workshop free-form micro-optics for AR/VR

# Challenges in AR / VR

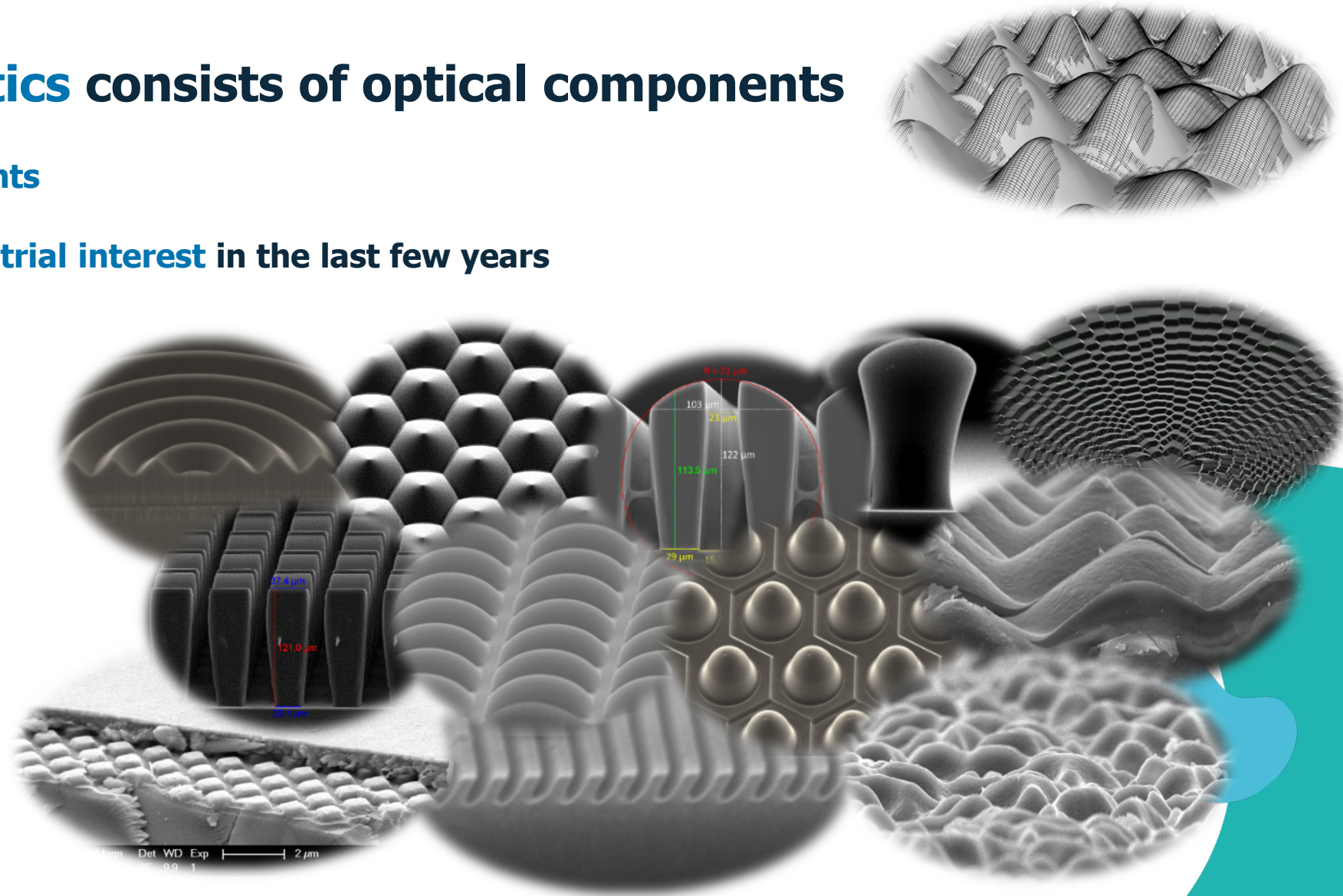
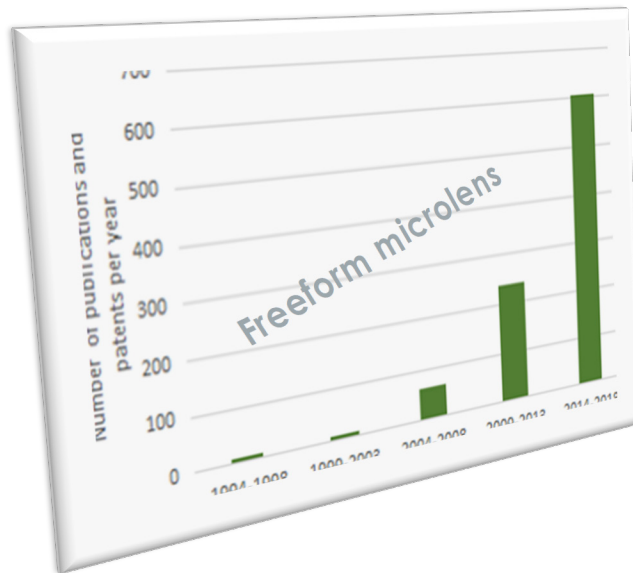
- Size reduction / miniaturisation
- Field of View (FOV)
- Resolution
- Contrast
- Price



# Free-form micro-optics (FFMO)

**Free-form micro-optics** consists of optical components

- with **no symmetry constraints**
- gaining **an increasing industrial interest** in the last few years





MICRO-OPTICS IS...

# Phabulops

... is the European **pilot line** and **one-stop-shop**  
for the manufacturing of **free-form micro-optics**

... offers

- accelerated innovation & production cycles
- manufacturing services
- prototyping → piloting → large volume production

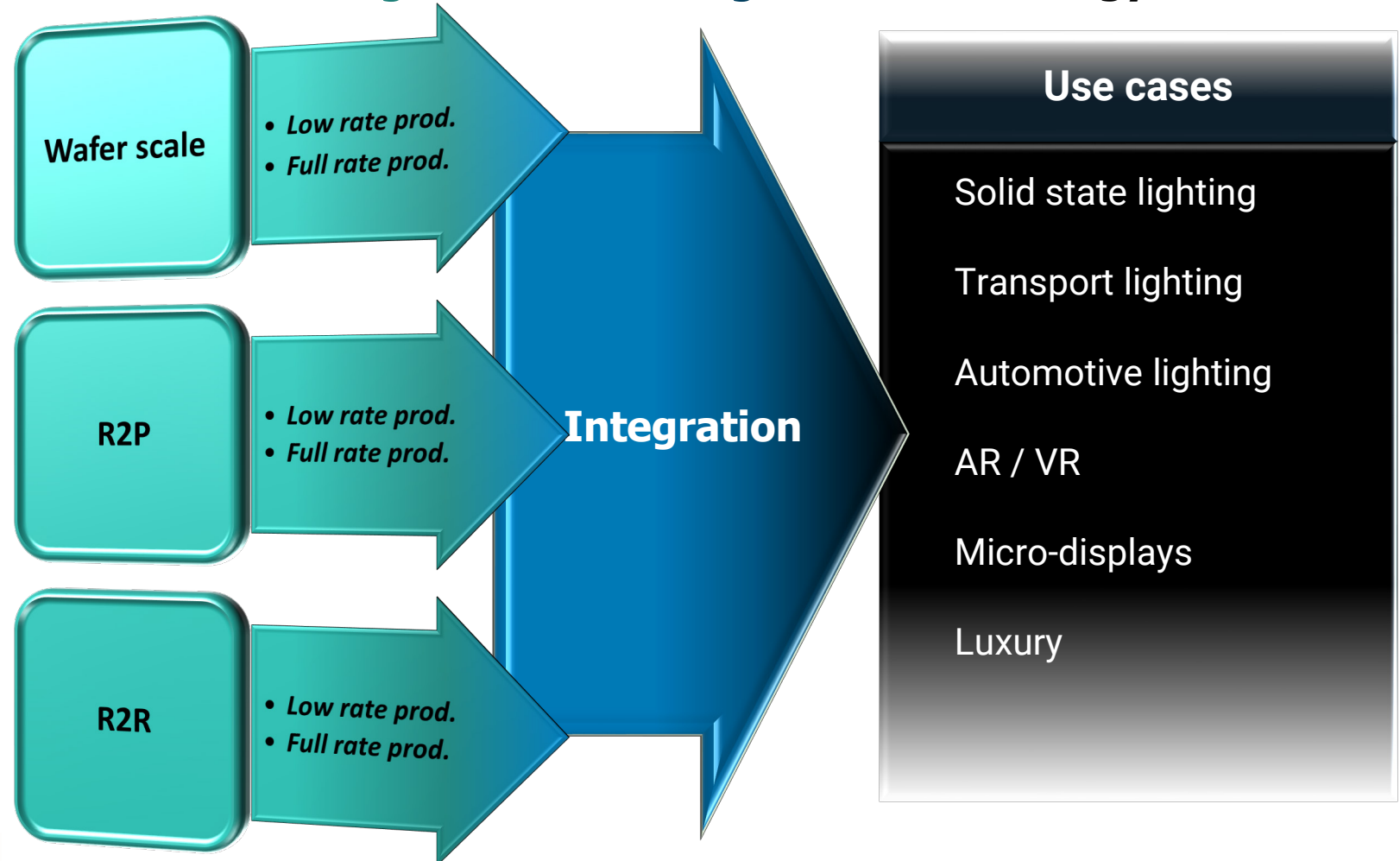


# Our Services

## Production Services & UV imprint manufacturing



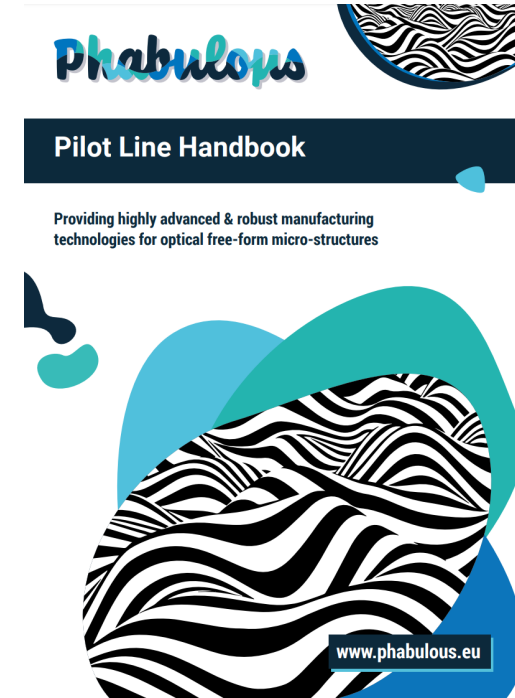
## Product integration Technology validation



# Advanced FMLAs for VR, AR & MR (use case)

- LIMBAK is one of the 6 use-case of PHABULOuS and is developing high-performance and innovative optics for AR/VR/MR.
- LIMBAK is licensing its high-performance, patented optics (ThinEyes®).
- TRENZA is one of the most advanced ThinEyes® concepts is based on free-form micro-optics.
- Find more information also in the PHABULOuS handbook:

[phabulous.eu/wp-content/uploads/2021/12/PHABULOuS-handbook\\_V3.pdf](http://phabulous.eu/wp-content/uploads/2021/12/PHABULOuS-handbook_V3.pdf)



# Micro-displays for AR (use case)

- Free-form microlens arrays (FMLAs) provide great advantages for improving pixel luminance of OLED micro-displays, especially for Augmented Reality (AR) applications with see-through glasses.
- MICROOLED designs, develops, and manufactures high performance micro-displays for near-to-eye applications, as well as complete connected glasses systems.

[phabulous.eu/downloads/](http://phabulous.eu/downloads/)





# Advanced free-form micro-optics

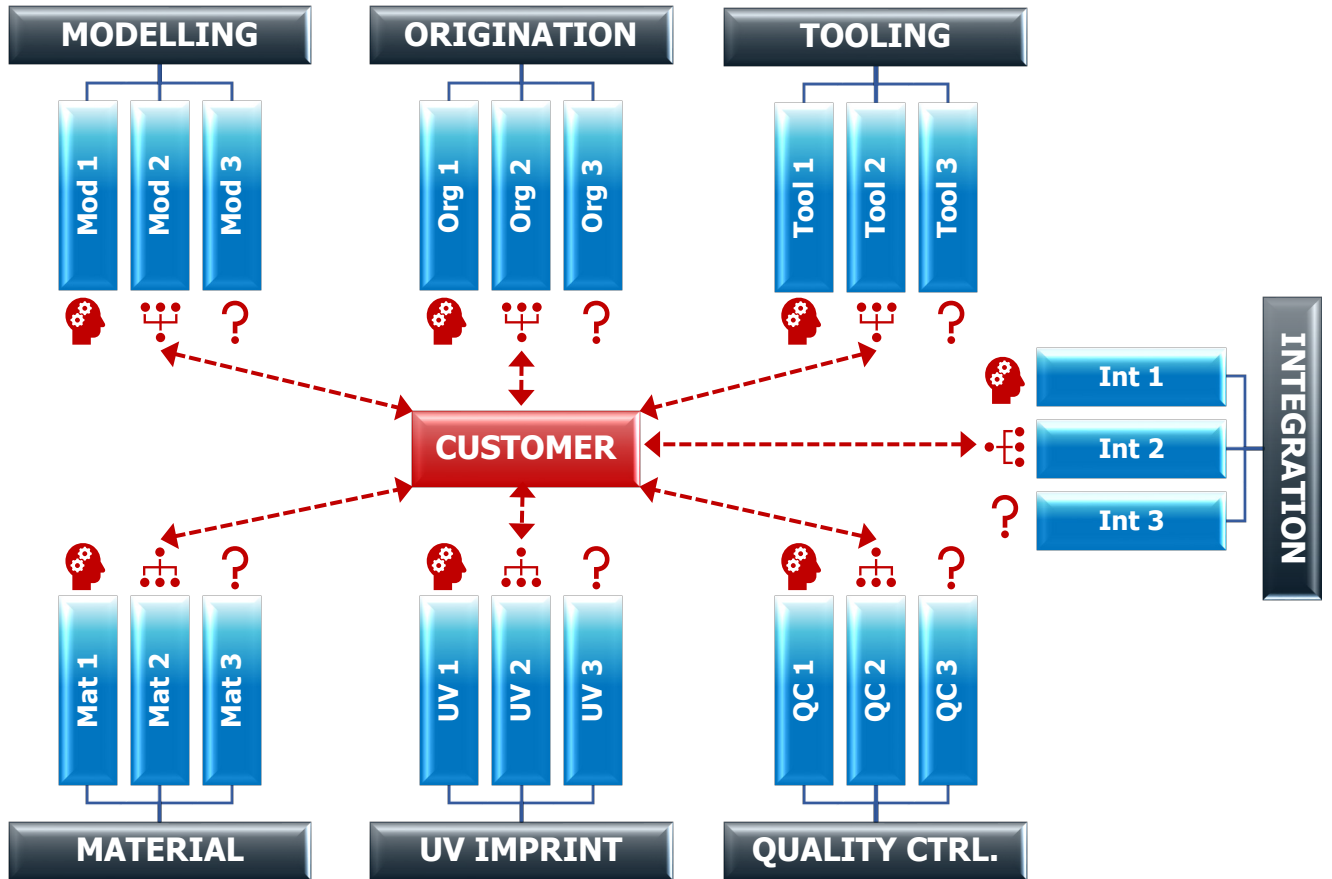
- Support for all phases of development, from design and prototyping, to replication and integration
- Through a single entry point

[www.phabulous.eu](http://www.phabulous.eu)

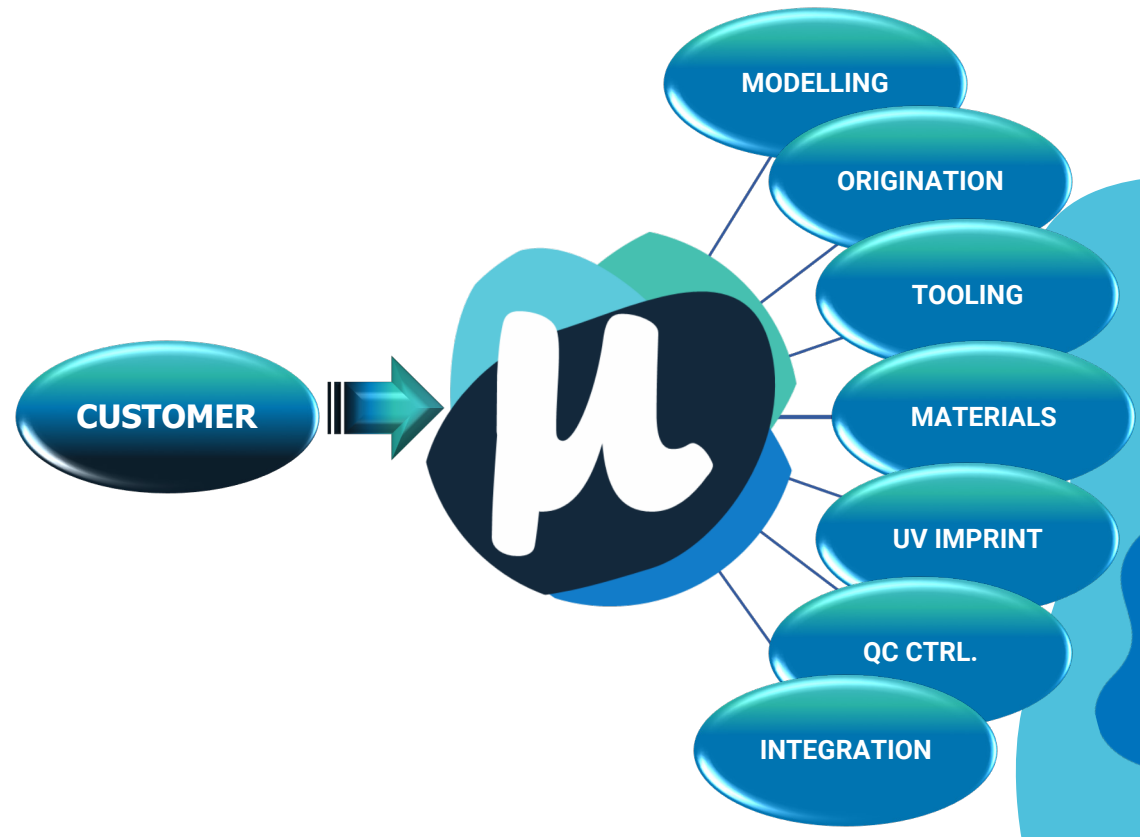


# Single Entry Point

Without PHABULOuS



With PHABULOuS



# Open Call

Funding opportunity to implement  
free-form micro-optical components

... is open to all European companies (+ more)

... fundings up to 90%

... continuous open call with cut-off dates:  
end of March, **June**, November **2022** +2023

[www.phabulous.eu/open-call](http://www.phabulous.eu/open-call)









# We are PHABULOuS

- **Single entry point** to access design and manufacturing services for free-form micro-optical components.
- Access to **Europe's leading Companies** and Research & Technology Organizations that cover the full value chain.
- **Promotion of the capabilities** and advantages of integrating free-form micro-optics.



# Ecosystem & Marketplace

- ... launched in November 2021
- ... showcases extensive product offerings for free-form micro-optics
- ... is open to all suppliers and companies active in the field of micro-optics
- ... aim is to become the main source for orientation towards implementation of free-form micro-optics

Register at [ecosystem.phabulous.eu/](https://ecosystem.phabulous.eu/)



# Organisation Registry

 <p>3D AG</p>	 <p>AMIRES S.R.O.</p>	 <p>AXETRIS AG</p>	 <p>CEA</p>	 <p>CORNING LASER TECHNOLOGIES GMBH</p>	 <p>CSEM SA</p>	 <p>EPIC - EUROPEAN PHOTONICS INDUSTRY CONSORTIUM</p>
 <p>FEMTOPRINT</p>	 <p>FOLEX AG</p>	 <p>FRAUNHOFER FEP</p>	 <p>HELLA GMBH &amp; CO. KGAA</p>	 <p>JOANNEUM RESEARCH FORSCHUNGSGESELLSCHAFT MBH</p>	 <p>JOYA TEAM</p>	 <p>LASEA</p>
 <p>LIMBAK</p>	 <p>MICRORELLEUS, S.L.</p>	 <p>MORPHOTONICS B.V.</p>	 <p>NANOCOMP OY LTD</p>	 <p>NANOSCRIBE GMBH &amp; CO. KG</p>	 <p>PHABULOUS PILOT LINE ASSOCIATION</p>	 <p>POWERPHOTONIC LTD</p>
 <p>STANDEX INTERNATIONAL</p>	 <p>SUSS MICROOPTICS</p>	 <p>VTT TECHNICAL RESEARCH CENTRE OF FINLAND LTD</p>	 <p>WIELANDTS UPMT</p>			

# Marketplace for AR/VR

## MARKETS

☒ AR/VR (19)

Member

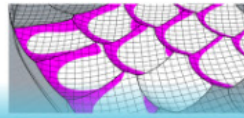


ADVANCED DESIGN OF  
FREE-FORM OPTICS



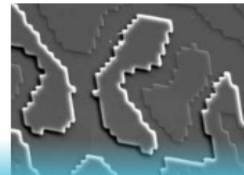
ASPHERICAL  
MICROLENS AND MLA  
ON SILICON AND GLASS  
WAFER

Member



DESIGN & DESIGN FOR  
MANUFACTURING

Member

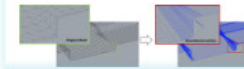


DIFFRACTIVE OPTICS  
(DOES)



ELECTROFORMING  
NICKEL SHIMS MOLDS  
FOR REPLICATION

Member



CHARACTERIZATION &  
QUALITY CONTROL



LASER DICING OF GLASS  
BASED WAFER LEVEL  
MANUFACTURED  
PRODUCTS

Member

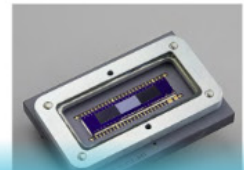


LENS ARRAYS & LENS  
ARRAY MASTERS



MICRO- AND NANO  
LASER STRUCTURING

Member



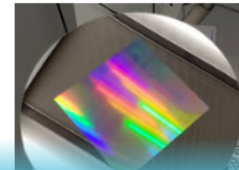
MICRO-LENSES &  
MICRO-LENS ARRAYS

Member



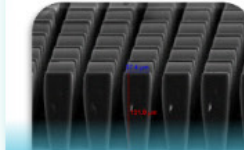
NANOIMPRINT  
(REPLICATION OF  
NANO/MICRON  
TEXTURES)

Member



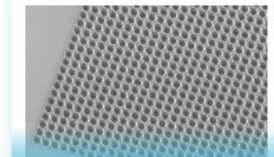
NANOIMPRINT AT  
WAFER-SCALE

Member



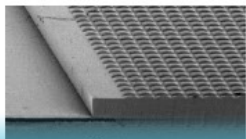
ORIGINATION

Member



ORIGINATION -  
MICROLENS ARRAY

Member



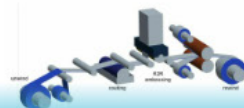
100  $\mu$ m  
REPLICATION AT  
WAFER-SCALE

Member



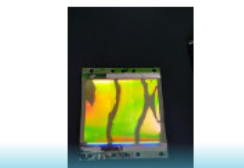
REPLICATION BY R2P

Member

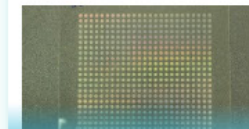


ROLL-TO-ROLL UV  
IMPRINT REPLICATION

Member



TOOLING (ELECTRO-  
FORMING)



TOOLING (STEP &  
REPEAT)



# Pilot Line Front Office

- Apply for our services
- Join the ecosystem
- Contact us
- Follow us

[info@phabulous.eu](mailto:info@phabulous.eu)

[www.phabulous.eu](http://www.phabulous.eu)



@PHABULOU\_S\_eu



PHABULOU\_S Pilot Line



PHABULOU\_S EU



MICRO-OPTICS IS...

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MICRO-OPTICS IS...

Phabulous

csem

JOANNEUM  
RESEARCH

VTT

Fraunhofer  
FEP

SUSS  
MicroOptics

leti  
C23tech



morphotonics

NANOCOMP

Wielandts  
upmt

LASEA

limbak



PowerPhotonic

microoLED



SEISENBACHER

SWAROVSKI



ZUMTOBEL

EPIC  
European Photonics  
Industry Consortium

AMIRÉS

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MICRO-OPTICS IS...

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Thank You



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