SYGLASS

Custom Photonics On-Demand

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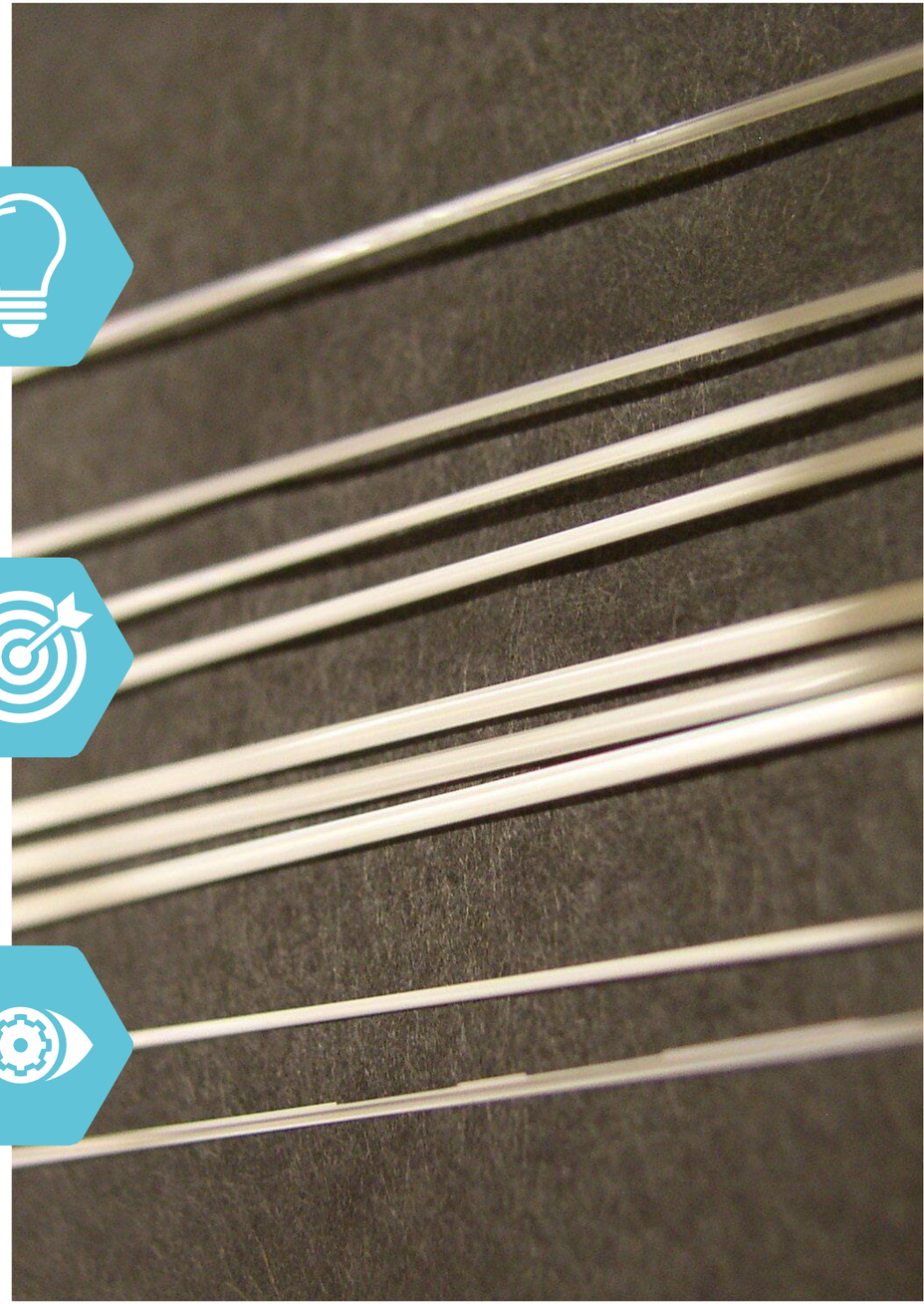
160 µm

Advancing Respiratory Diagnostics: Real-Time Ciliary Beat Frequency Analysis with the glass 3D printed imaging bundle



1. SYGLASS TECHNOLOGY

2. RESPIRATORY DIAGNOSTIC AND OTHER APPLICATIONS

3. GEN AI FOR DESIGN OPTIMISATION

About us

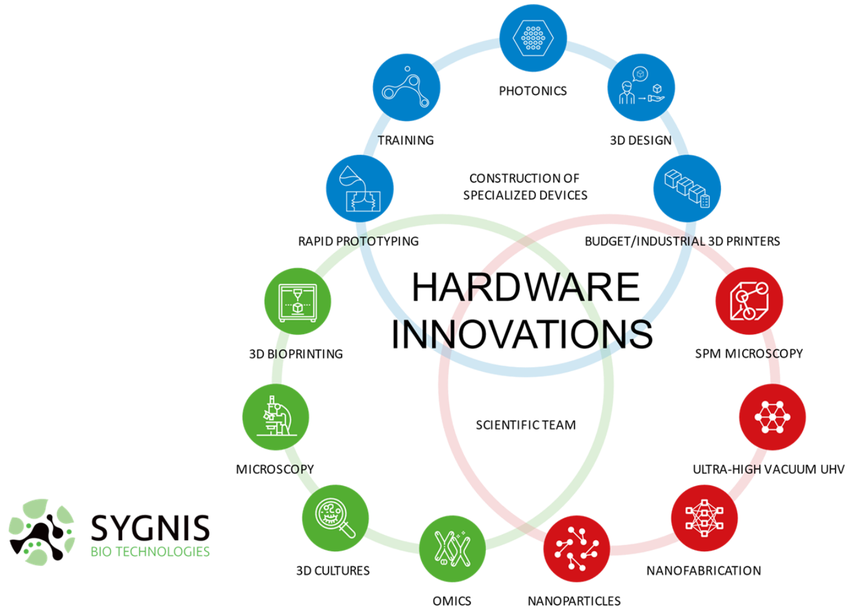
SYGLASS is a team of specialists in technological consulting, R&D projects, 3D printing, photonics, nanotechnology and implementation of short production series.

We bring together engineers, scientists, designers and experts of Industry 4.0 & 5.0.

Knowledge has layers™

SYGNIS NEW TECHNOLOGIES

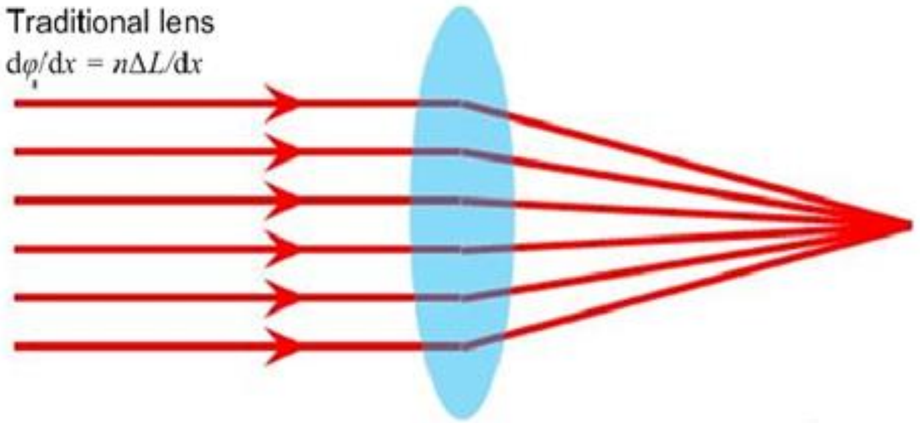
SYGNIS SPÓŁKA AKCYJNA

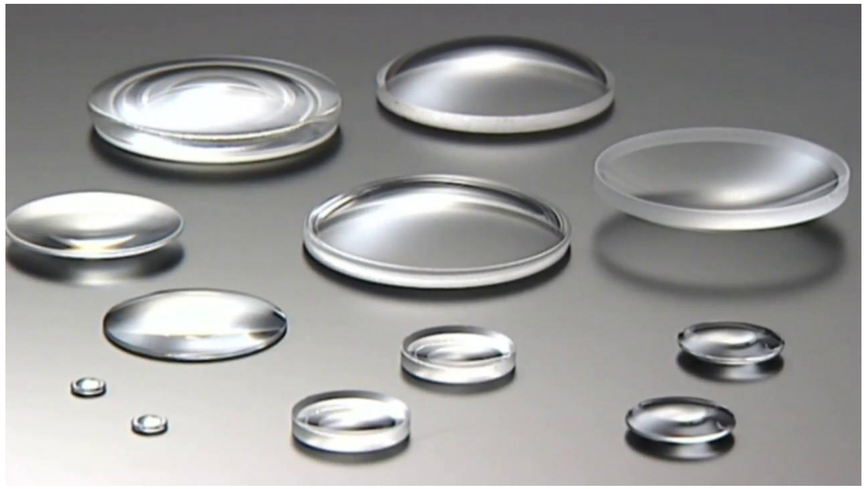


SYGNIS BIO TECHNOLOGIES

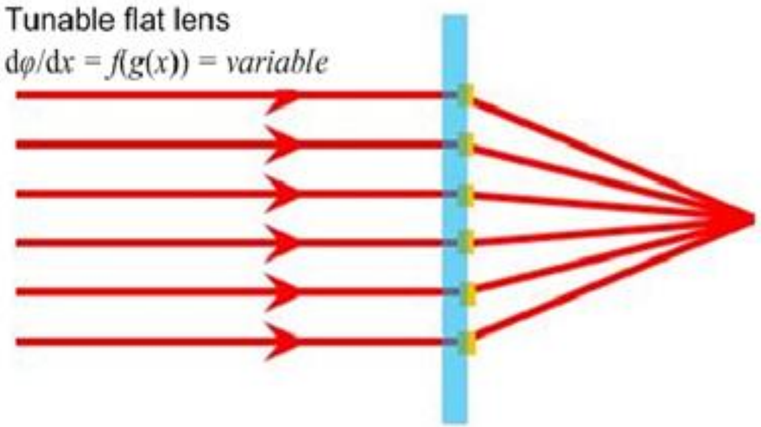
SYGNIS NANO TECHNOLOGIES

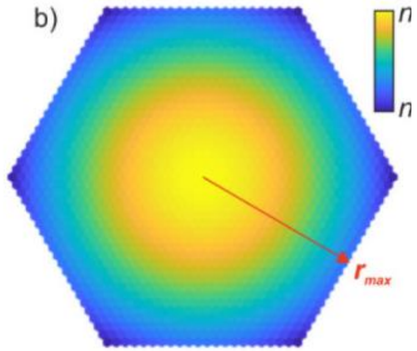
Gradient optics by nanostructurisation

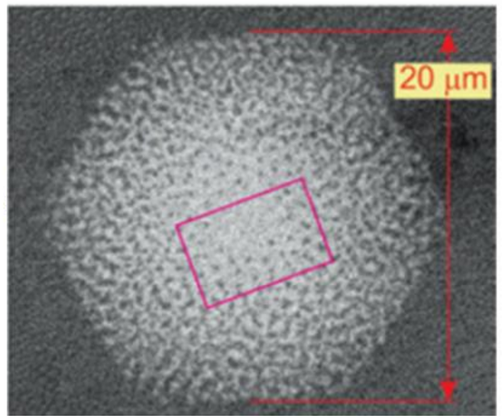




Conventional lenses



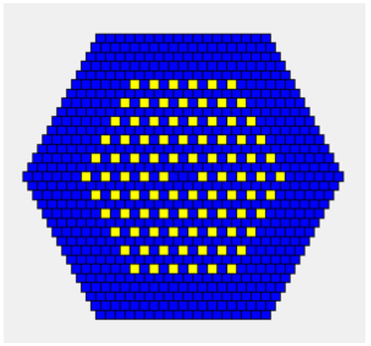




SYGLASS enabled flat lenses

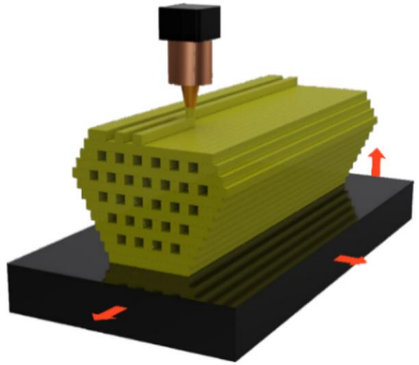
SYGLASS

SYGLASS is a direct ink writing glass 3D printing technology automating manufacturing of custom nanostructured fibres, lenses and matrixes of lenses.



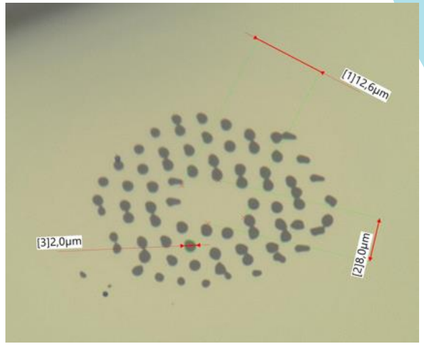
Design

Proprietary AI-assisted algorithms for nanostructured optical elements design



Production

Automated manufacturing with Syglass

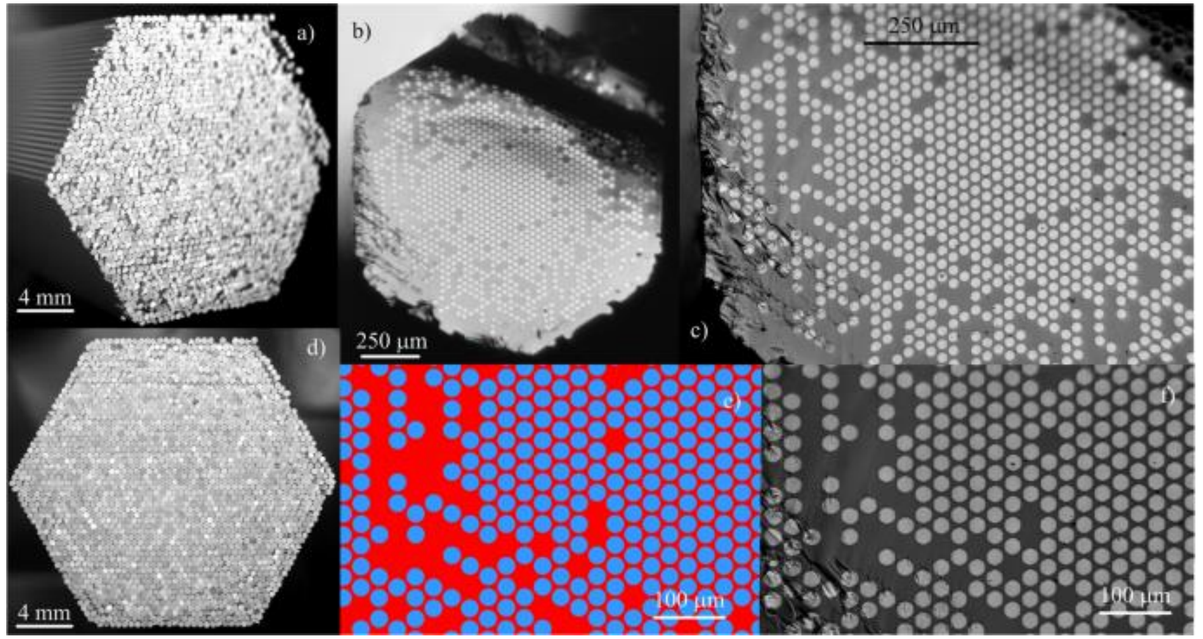


Postprocess

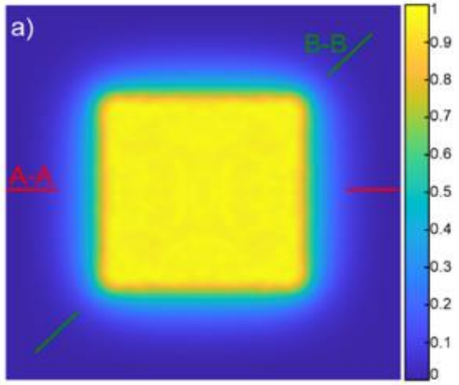
Final postprocessing resulting in custom fibre, lens or matrix of lenses

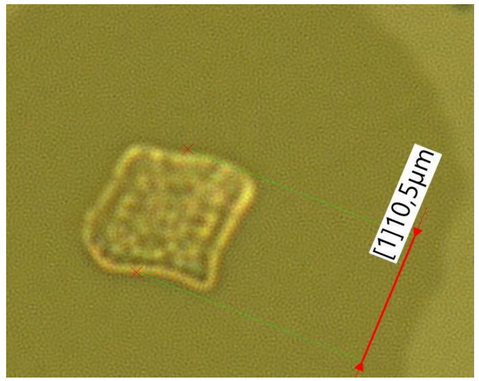
Nanostructured core special fibres

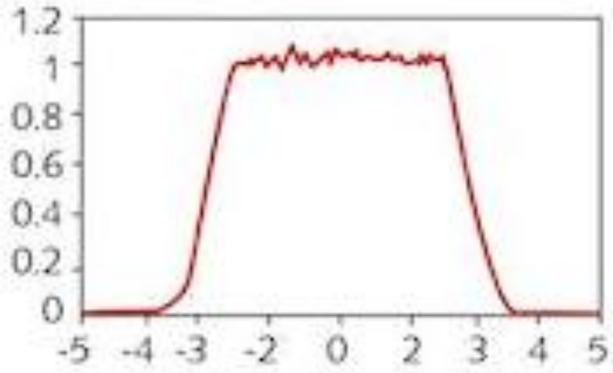
- Designable core shape,
- Designable power distribution,
- Possibility to use custom glasses selected for the expected transmission window,
- All-fiber systems.



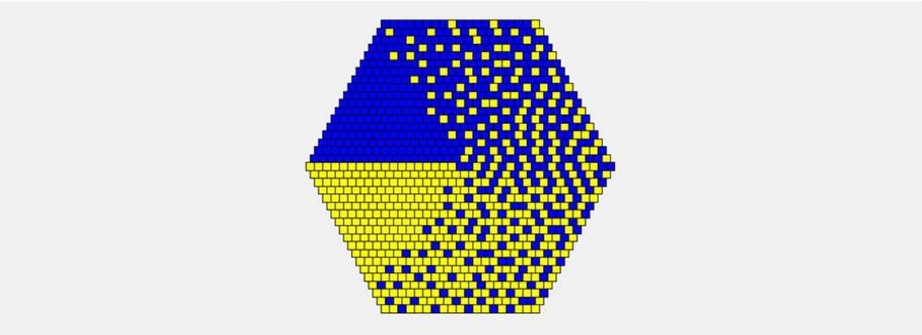
Ref: Anuszkiewicz, A., Kasztelanic, R., Filipkowski, A. et al. "Fused silica optical fibers with graded index nanostructured core." Nature, Sci Rep ***8****,*



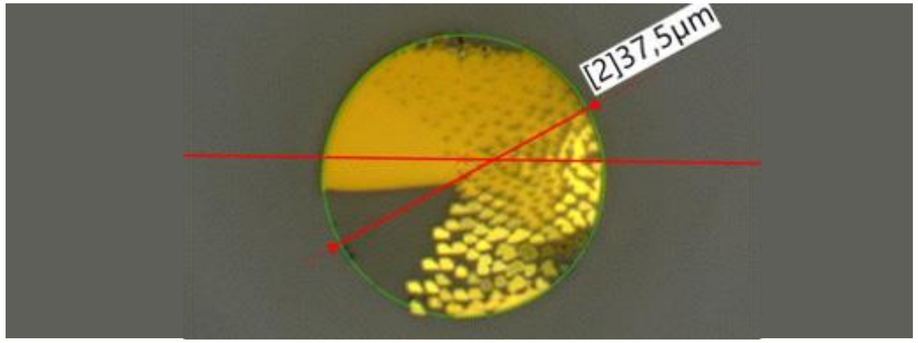




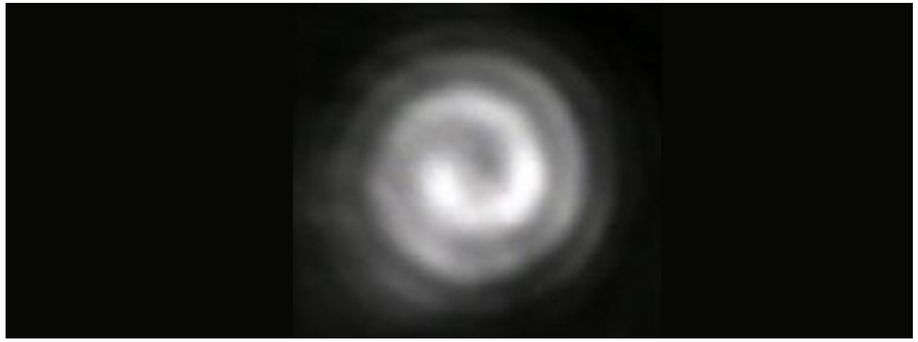
Nanostructured gradient lenses



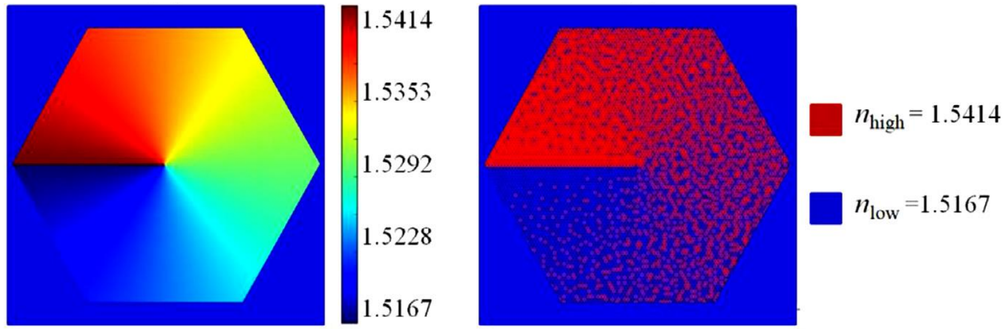
Design of the Vortex core fibre

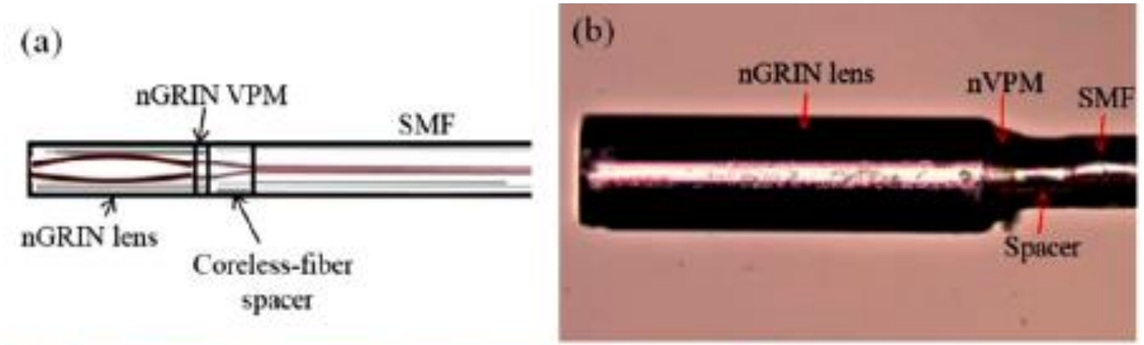


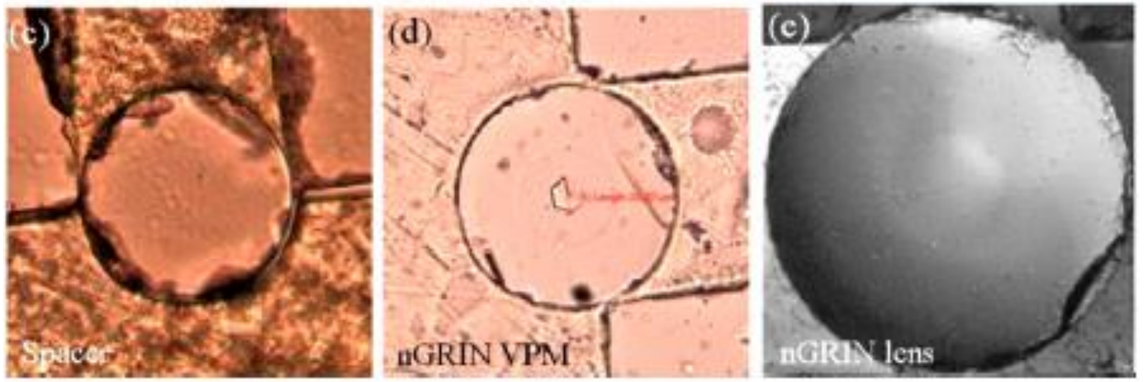
Microscope image of the manufactured Vortex core fibre



Signal transmitted through our Vortex core fibre





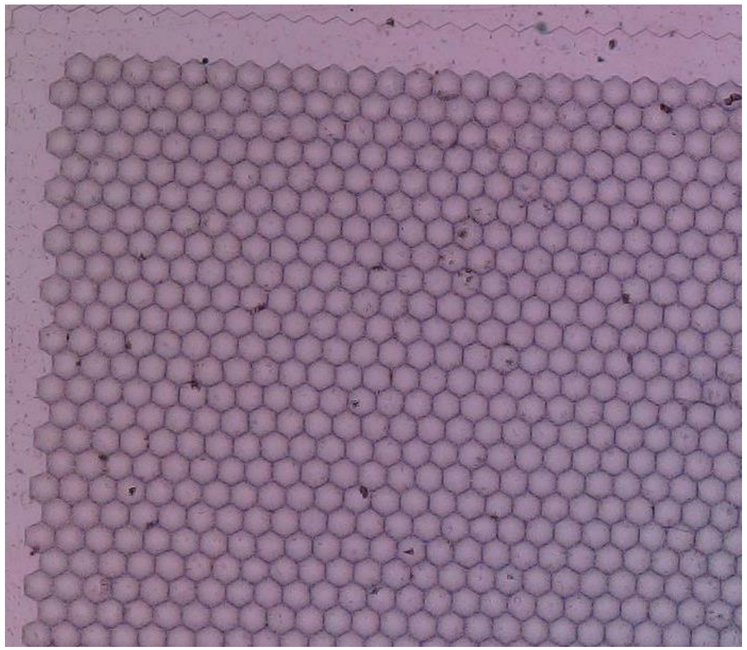


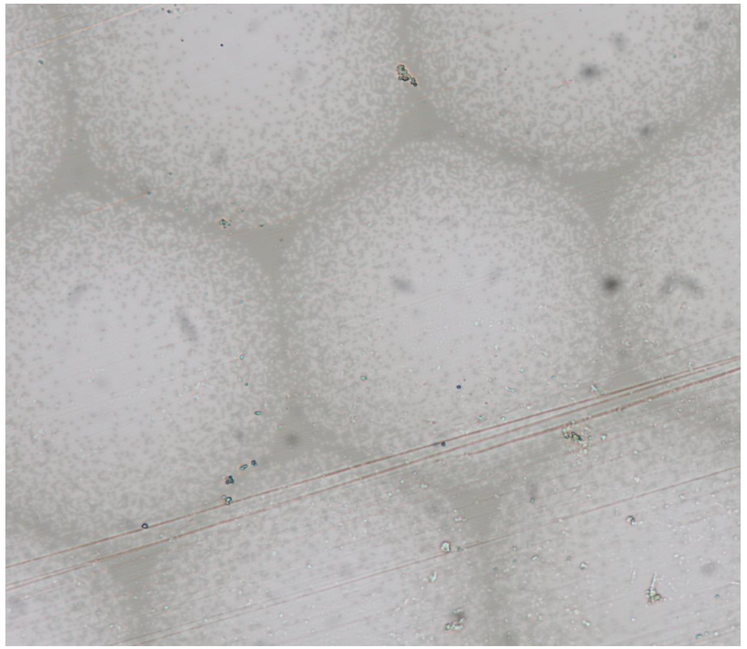
Ref.: Hue Thi Nguyen, Krzysztof Switkowski, Rafal Kasztelanic, et. al. „Optical characterization of single nanostructured gradient index vortex phase masks fabricated by the modified stack-and-draw technique", Optics Communications.

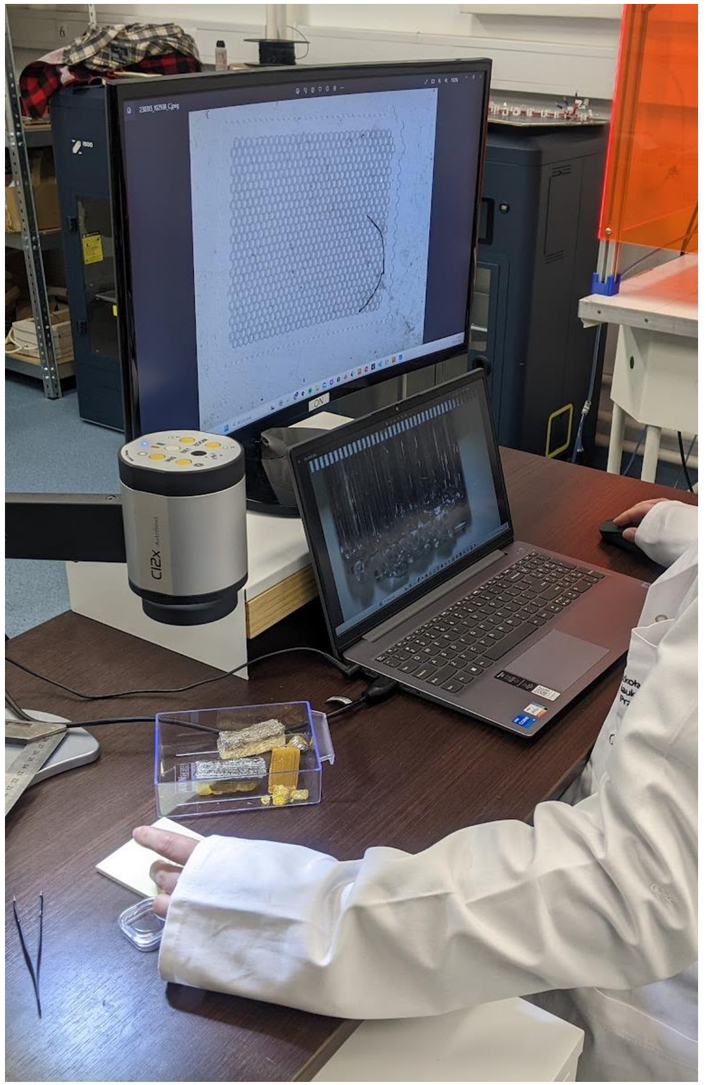
Nanostructured core special fibres

Elements effective in difficult conditions:

- wide bandwidth,
- high operating temperature,
- resistance to E/M interference,
- long service life,
- Lightweight.





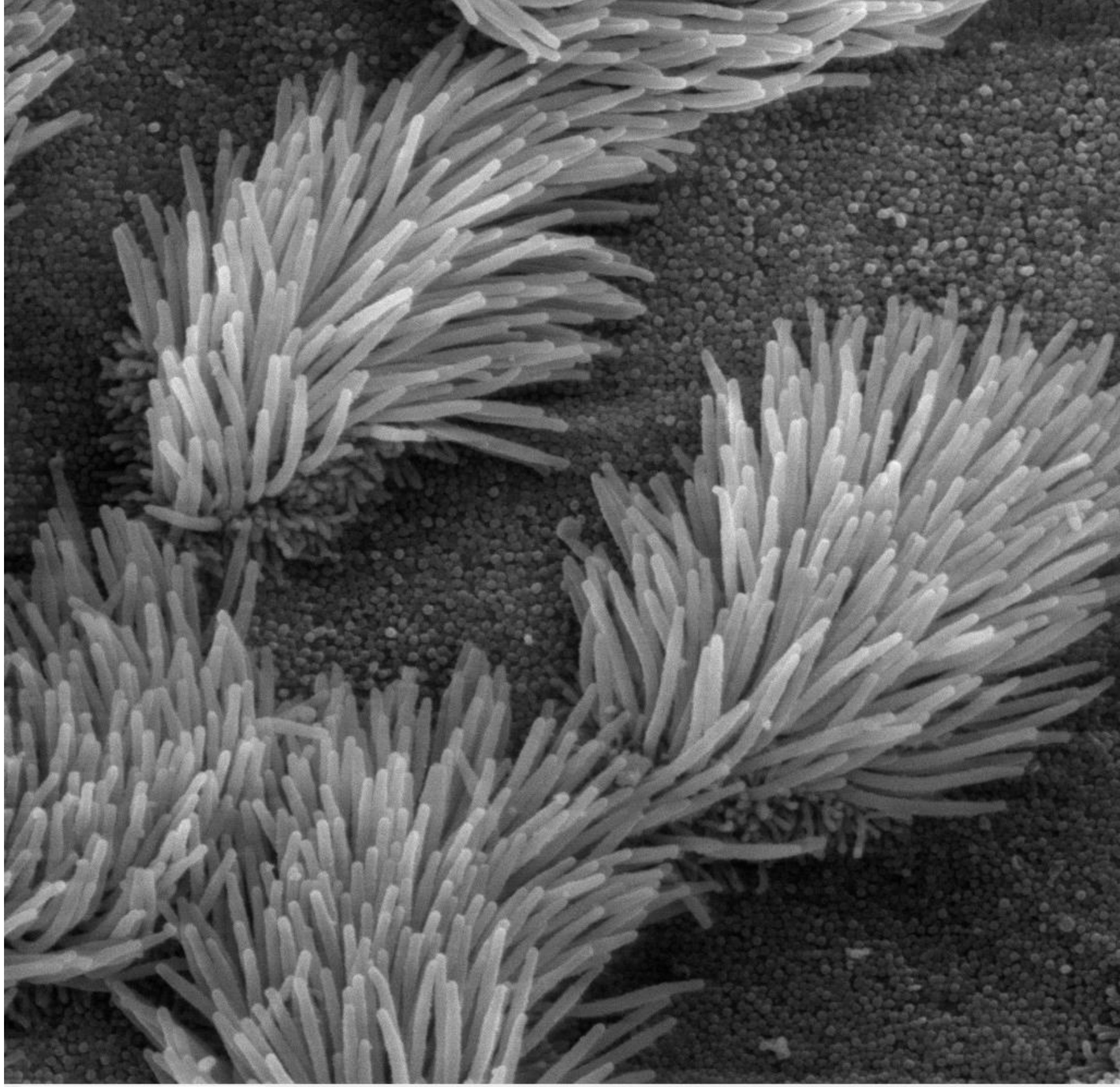


APPLICATIONS

Advancing Respiratory Diagnostics

Objectives for the Real-Time Ciliary Beat Frequency Analysis with the Glass 3D Printed Imaging Bundle:

- Target diseases: PCD, CF, COPD, and sinusitis.
- Simplify procedure reducing diagnostics from days to minutes.
- Scalable integration in healthcare.



https://biologaygeologia.blogspot.com/2013/02/cilios-y-flagelos-halina-mytsan.html

Funded by the European Union

NCBR Narodowe Centrum Badań i Rozwoju

E!6,436 ENDOBEAT "Development and Validation of an Endoscope for the Real-Time In Situ"

Current diagnostic capabilities

- High false positives/negatives due to external factors
- Indirect measurement
- Long time with multiple steps and specialists involved

In vivo direct single-cell CBF validation after brushing

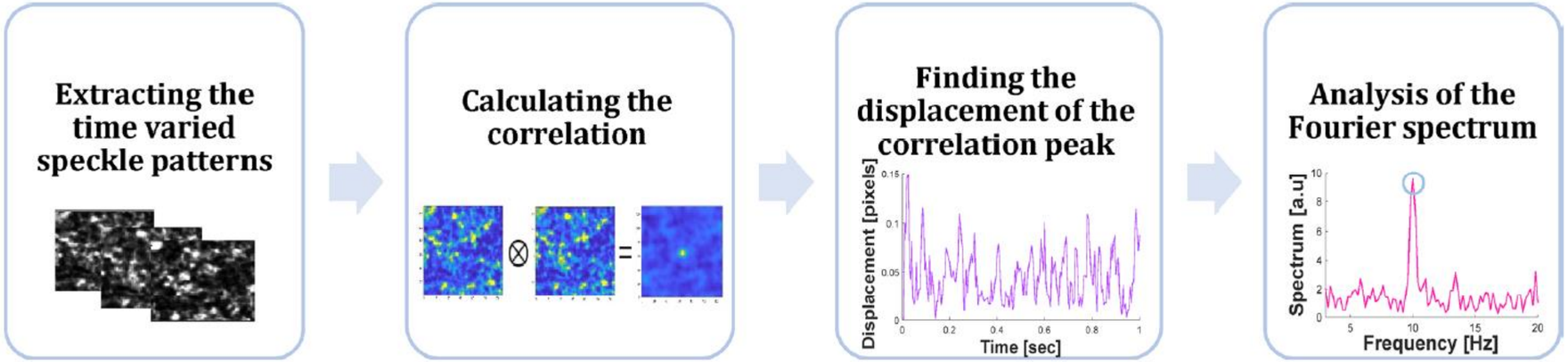
Nasal epithelial cell isolation via Nasal Brushing and their 2D culture

In vitro CBF validation after 2D culture

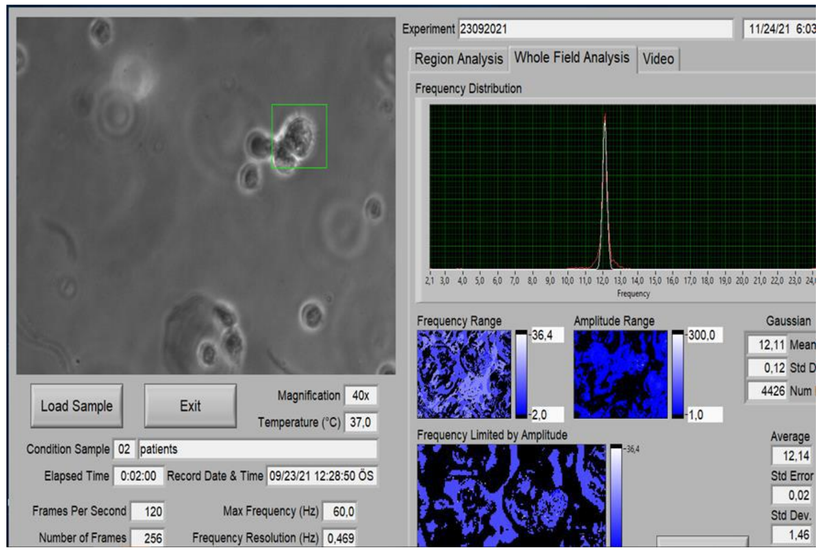
In vitro CBF measurement with HSVM

Duadi, D., Shabairou, N., Primov-Fever, A. et al. Non-contact optical in-vivo sensing of cilia motion by analyzing speckle patterns. Sci Rep 12, 16614 (2022).

Nanostructured endoscope solution



- Dual-channel endoscopic setup
- ±0.5 Hz accuracy in real time
- Reliable and reproducible results



Duadi, D., Shabairou, N., Primov-Fever, A. et al. Non-contact optical in-vivo sensing of cilia motion by analyzing speckle patterns. Sci Rep 12, 16614 (2022).

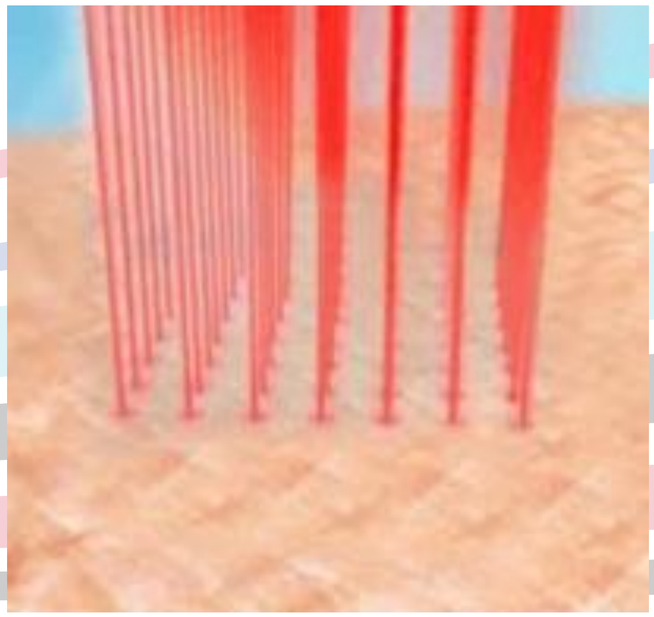
Other Syglass applications

Space communication

Generation of optical vortexes with flat, passive lenses, integrable with existing laser sources.

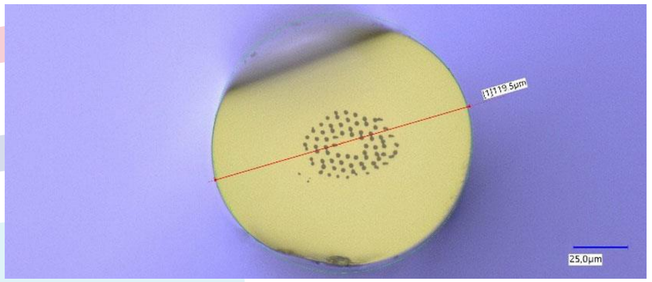
Skin treatement

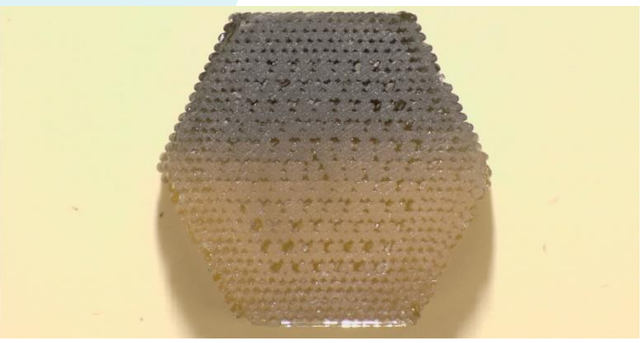
Our technology allows to shape the individual beams and multiplex numerous treatment light frequencies in a single procedure and device.



Research

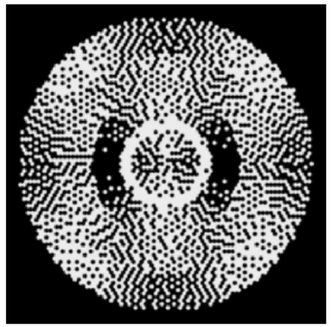
Sale of elements. Entering consortia to develop and commercialise SYGLASS-based devices.





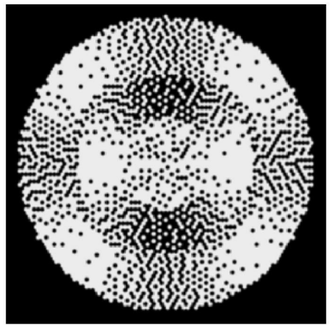
Generative AI in Design

- AI-enhanced design generation using GANs and VAEs.
- Optimized structural configurations and material arrangements.
- Faster iteration cycles and reduced costs.



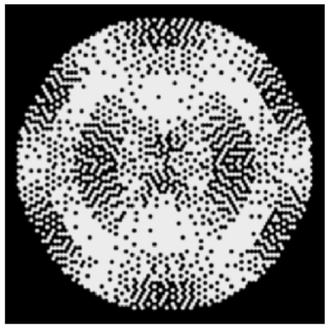
$\mathrm{Min}|\Delta n_{eff}| = 0.81\times10^{-3}$

$\mathrm{Min}|A_{eff}| = 130\ \mu\mathrm{m}^2$



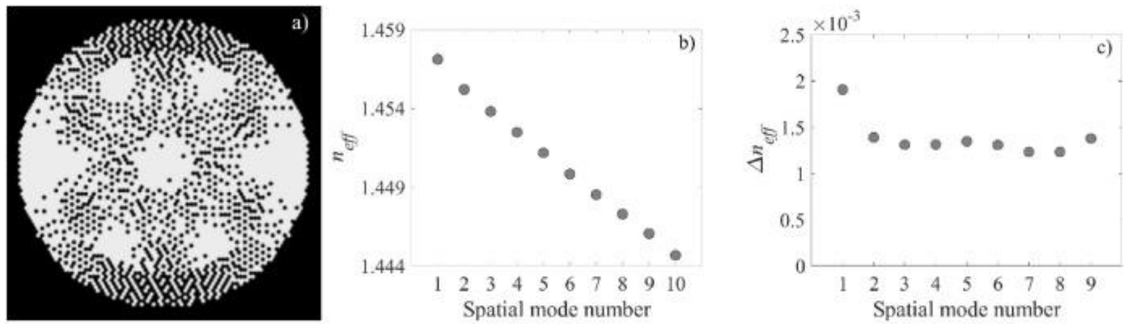
$\mathrm{Min}|\Delta n_{eff}| = 1.15\times10^{-3}$

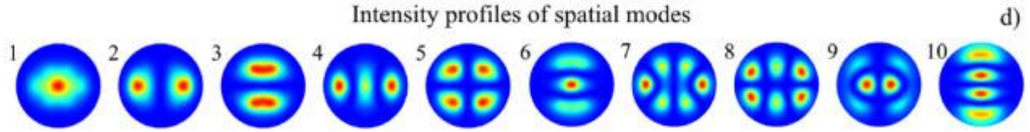
$\mathrm{Min}|A_{eff}| = 107\ \mu\mathrm{m}^2$



$\mathrm{Min}|\Delta n_{eff}| = 1.04\times10^{-3}$

$\mathrm{Min}|A_{eff}| = 97\ \mu\mathrm{m}^2$





Ref.: Maciej Napiorkowski, Rafal Kasztelanic, Ryszard Buczynski, „Optimization of spatial mode separation in few-mode nanostructured fibers with generative inverse design networks, Engineering Applications of Artificial Intelligence,”

Thank You !

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