

Positioning of Micro Optics in Optoelectromechanic Environments

JABIL

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Jabil Today: Built on a Solid Foundation

50+

YEARS OF CROSS-INDUSTRY
EXPERIENCE

140K+

DEDICATED
EMPLOYEES

400+

CUSTOMERS ACROSS
DIVERSE MARKETS

100+

SITES STRATEGICALLY LOCATED
AROUND THE WORLD

25+

COUNTRIES

36K+

SUPPLY CHAIN
PARTNERS



Have you ever heard

„this is the greatest design idea ever“?



Every design is worthless if you can't
manufacture it,
even if its the „greatest design idea ever“

Manufacturing means:



Product design fulfills necessary **standards** for materials and production



Product can be built on manufacturing **equipment**



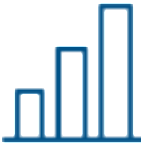
Product can be produced **cost-efficient**



Product can be **verified & tested** on available metrology equipment



Product can be built with available **technologies**



Product can be **scaled** at acceptable costs when demand is increasing



To enable production designers need to understand the entire system



Design must consider manufacturing capabilities

- Optical and mechanical
- Manufacturing and assembly
- Measurement systems and -data

Let's talk about projectors

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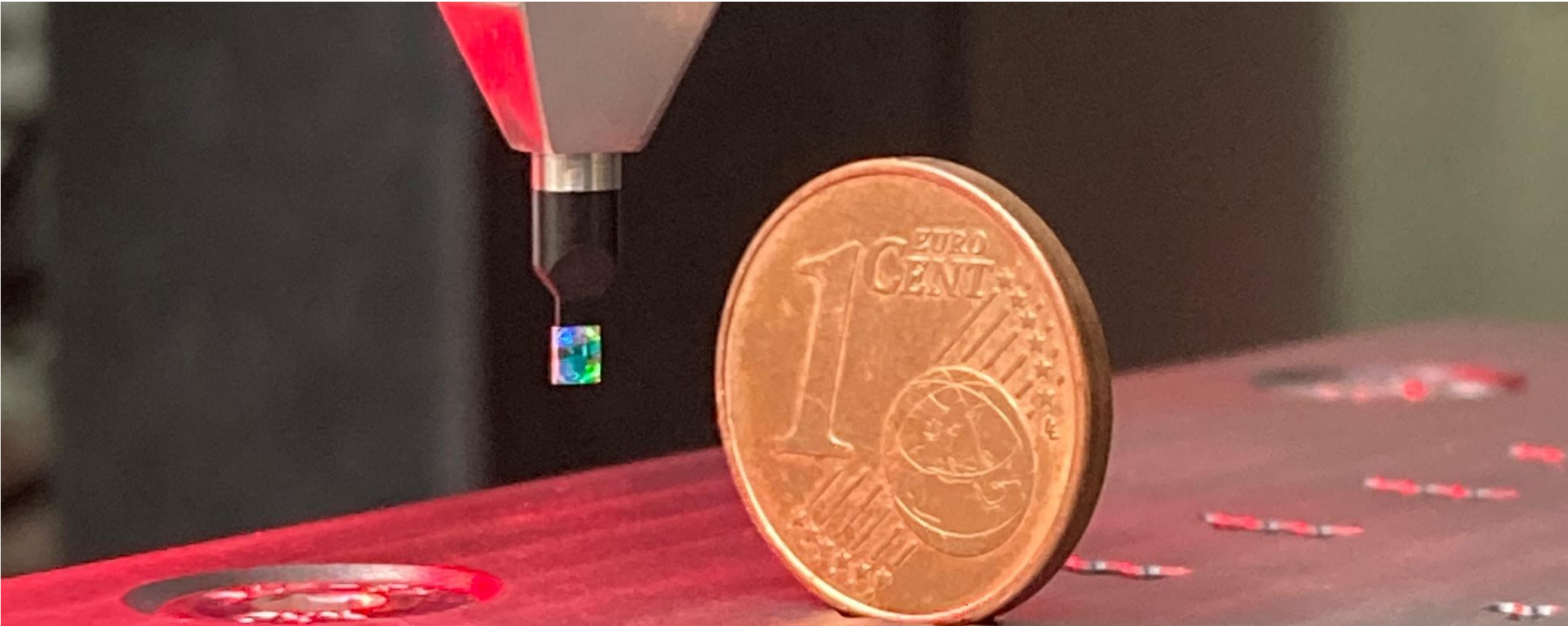
Projectors are simple!



But when you start to make them smaller???



With size it might become challenging



To make things smaller

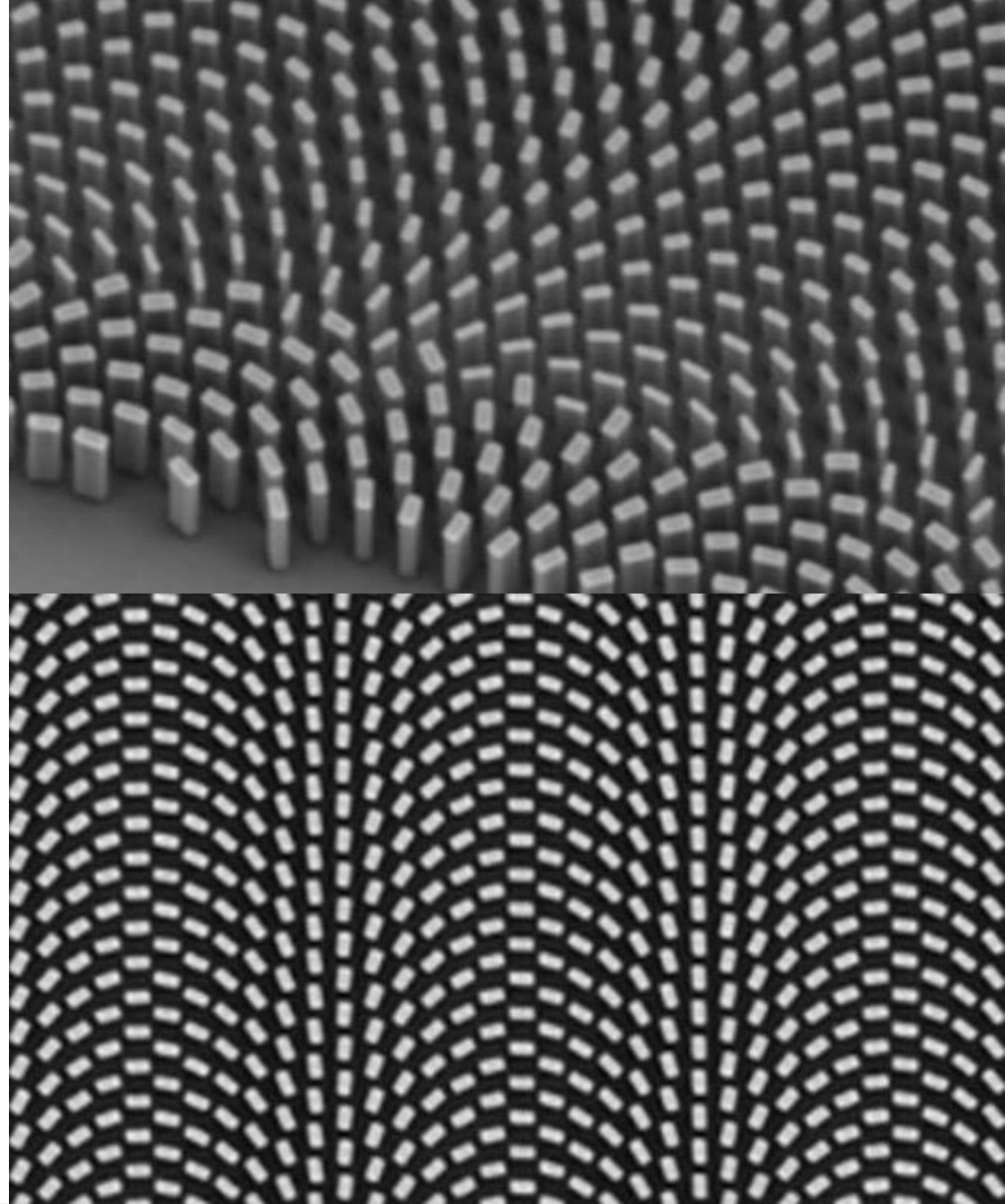
let's use new materials

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Meta Optical Elements

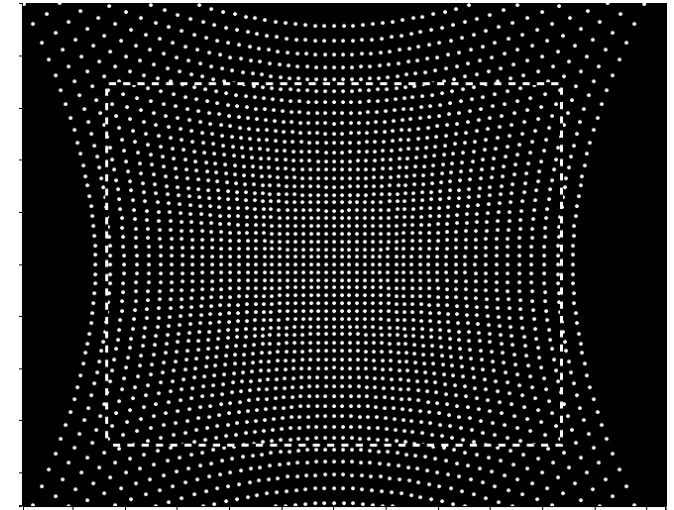
- New light modulation based on sub-wavelength patterned layers - nanopillars.
- Flat, thin, light optical elements
- Wavefront control
- Polarization control
- Combine multiple optical functions into a single element

Source: Scientific Reports: "High-efficiency chiral meta-lens" 08 May 2018



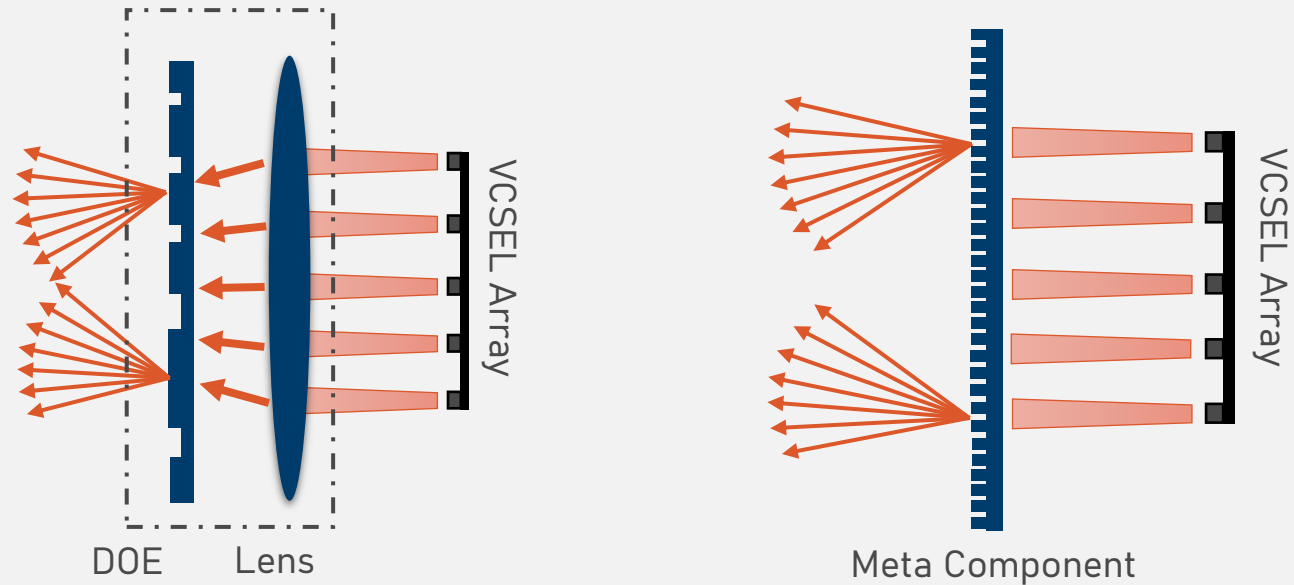
Pattern Generator

- Conventional pattern is generated by a smart combination of the VCSEL, the lens and the DOE
- The larger the FOV, the more challenging the design and fabrication of the DOE
- The size of the dots are driven by the lens performance, whereas the pattern quality is dependent on the lens distortion and the DOE design
- the DOE stitches the afocal image of the VCSEL array together to generate a dot pattern
- Cost intensive aspherical molded glass lens as beam delivery optics (collimation + Fourier lens)
- **ASSEMBLY PROCESS**
 - Active alignment VCSEL to lens necessary
 - Active alignment DOE to VCSEL + lens necessary



Large FoV pattern projected to screen

Pattern Generator



Replacement by a Single Meta Optical Component

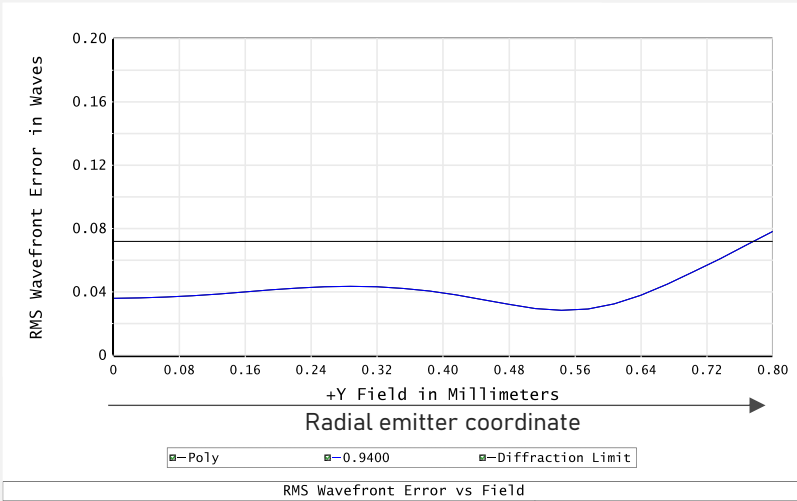
- DOE and lens can be replaced by a single meta component
- Complexity of system can be reduced

ASSEMBLY

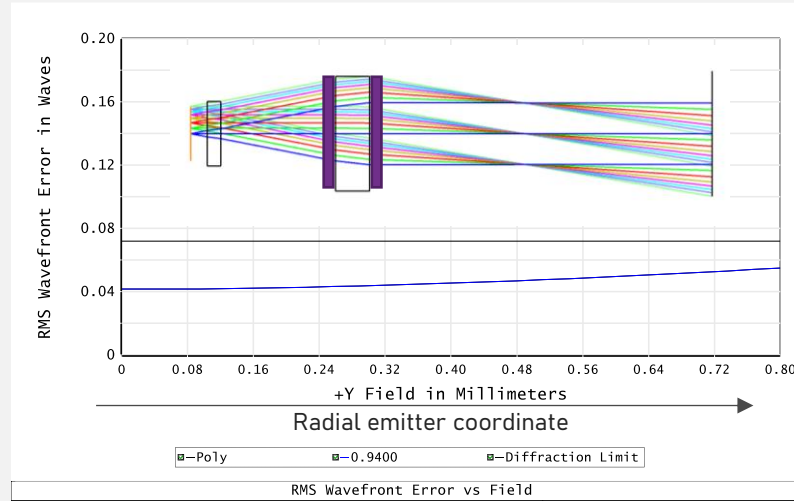
- Reduction to single active alignment step
- VCSEL to meta component

Pattern Generator

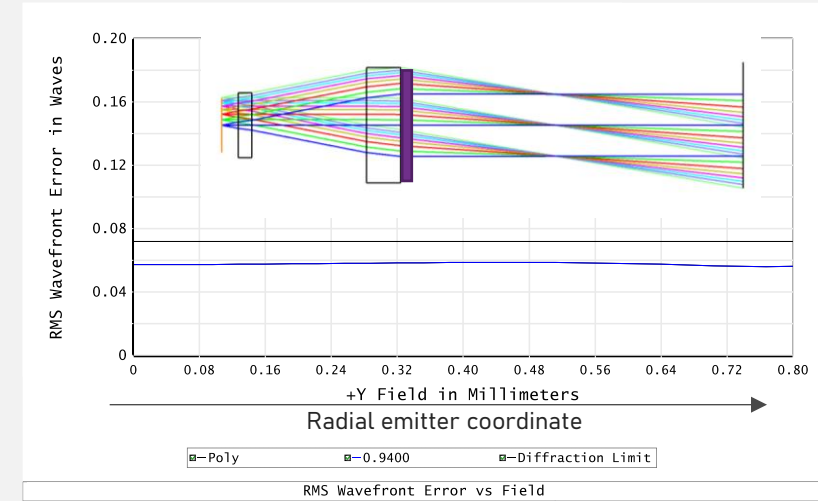
RMS WAVEFRONT ERROR CONVENTIONAL OPTIC DESIGN



RMS WAVEFRONT ERROR **DOUBLE SIDED** META OPTIC



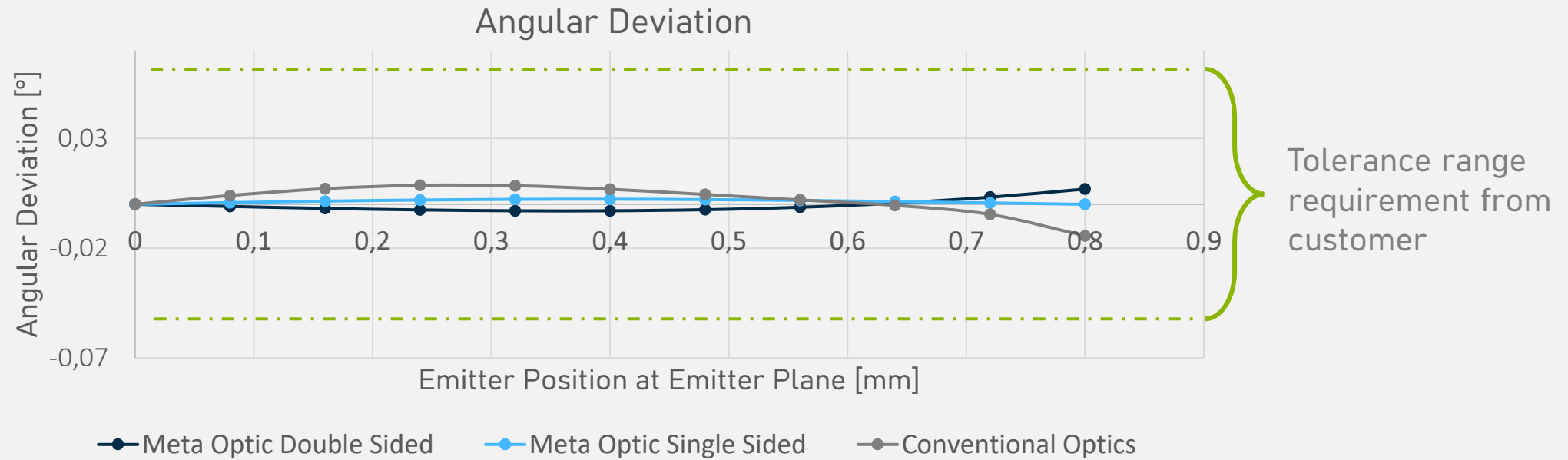
RMS WAVEFRONT ERROR **SINGLE SIDED** META OPTIC



Optical Design Performance – Spot Quality

- The RMS wavefront error indicates the spot performance
- As a goal, the RMS wavefront error should be equal or less the diffraction limit for all emitters on the VCSEL array

Pattern Generator



Optical Design Performance – Pattern Quality (Lens Distortion)

- The tailored lens distortion is an indication for pattern quality (avoiding stitching errors and pattern distortion)
- The distortion must be in a range of $\pm 0.06^\circ$ absolute deviation for all dots to ensure accurate decoding of the 3D sensing module

Jabil as System Integrator

Systemic Approach

Considering the interplay of all functions, i.e. optics, software, manufacturing engineering, test engineering from the beginning, we design the best possible product

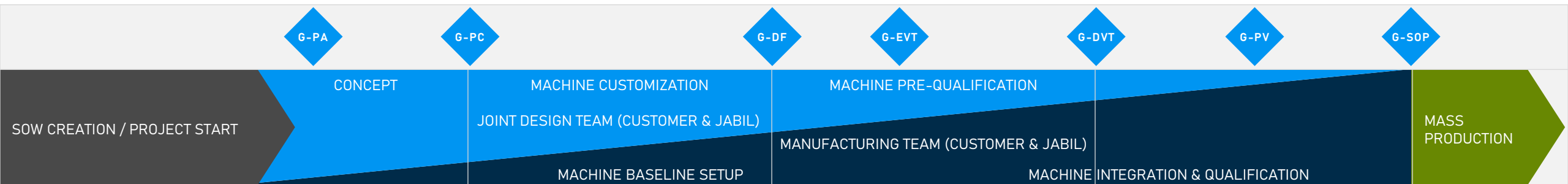
Design and Production Projects

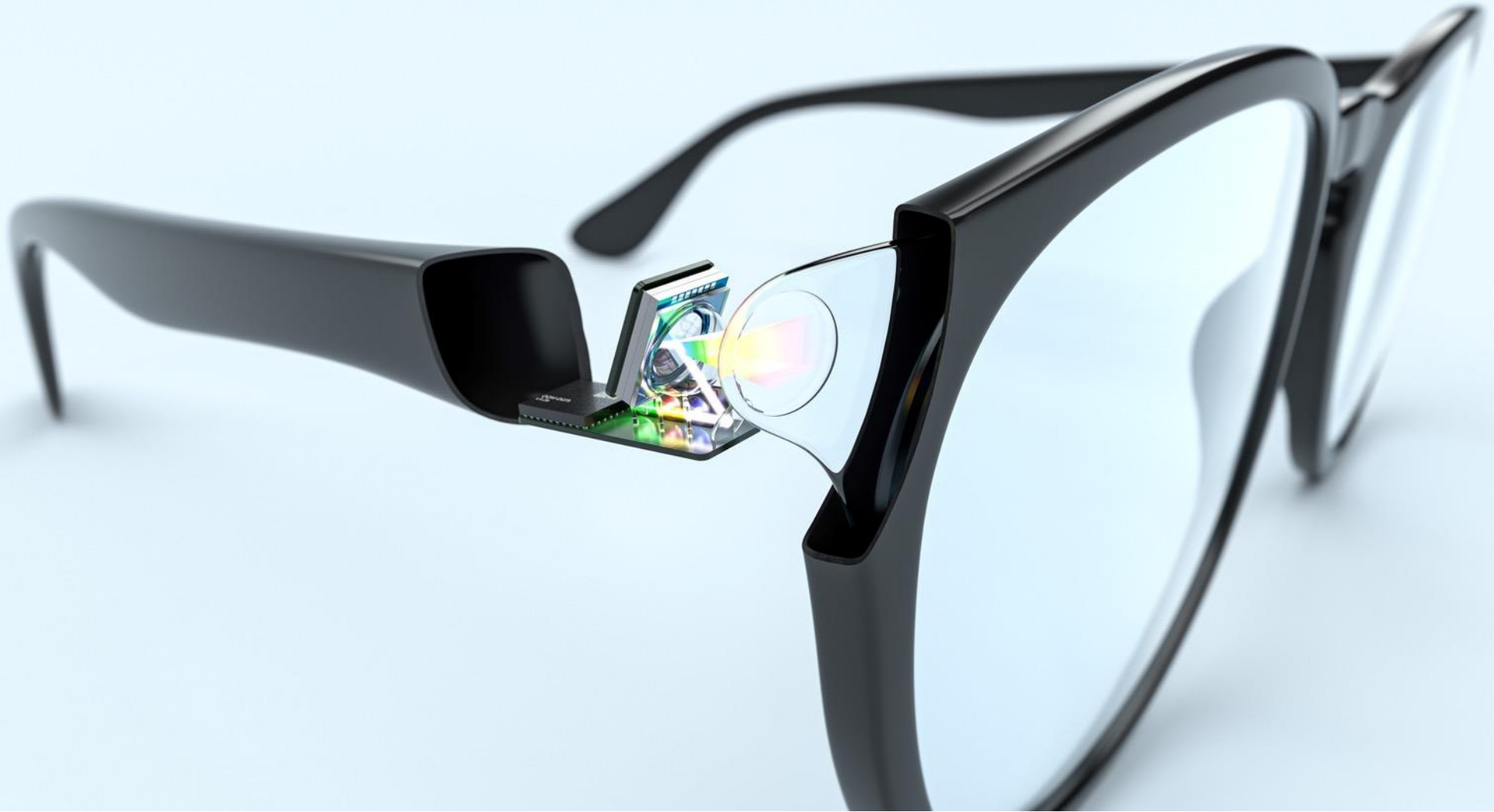
- Customized feasibility studies for comparison to assess the benefits
- Cost effective designs
- Less alignment steps
- Consideration of system tolerances
- Yield estimation
- Specification definition
- System level tests
- Validation

Successful Management of Product Maturity

Collaboration

- **One Team** approach (Design & Manufacturing) for best effectivity
 - Joint design team solves design and DfM topics together
- NPI to MP **transition phase** instead of fix handover date for best efficiency
- Both together ensure best **knowledge transfer**





Revolutionizing AR Light Engines Manufacturing

Meeting the Demands of High-Precision MEMS with Jabil's Expertise



Challenge

- OQmented was looking for a suitable partner which is able to realize their manufacturing needs
- Size: 1.2 ccm; Brightness: 19 lm



Unique Features

- Ultra-compact MEMS-based light engines utilize laser beam scanning technology
- Advanced optical design and manufacturing capabilities
- Assembly of the optics with carriers in an active alignment process



Your Benefit For Your Product

- Accelerated time-to-market for new products
- Enhanced product quality and performance
- Cost-effective and scalable manufacturing solutions



Successful Management of Uncertainty

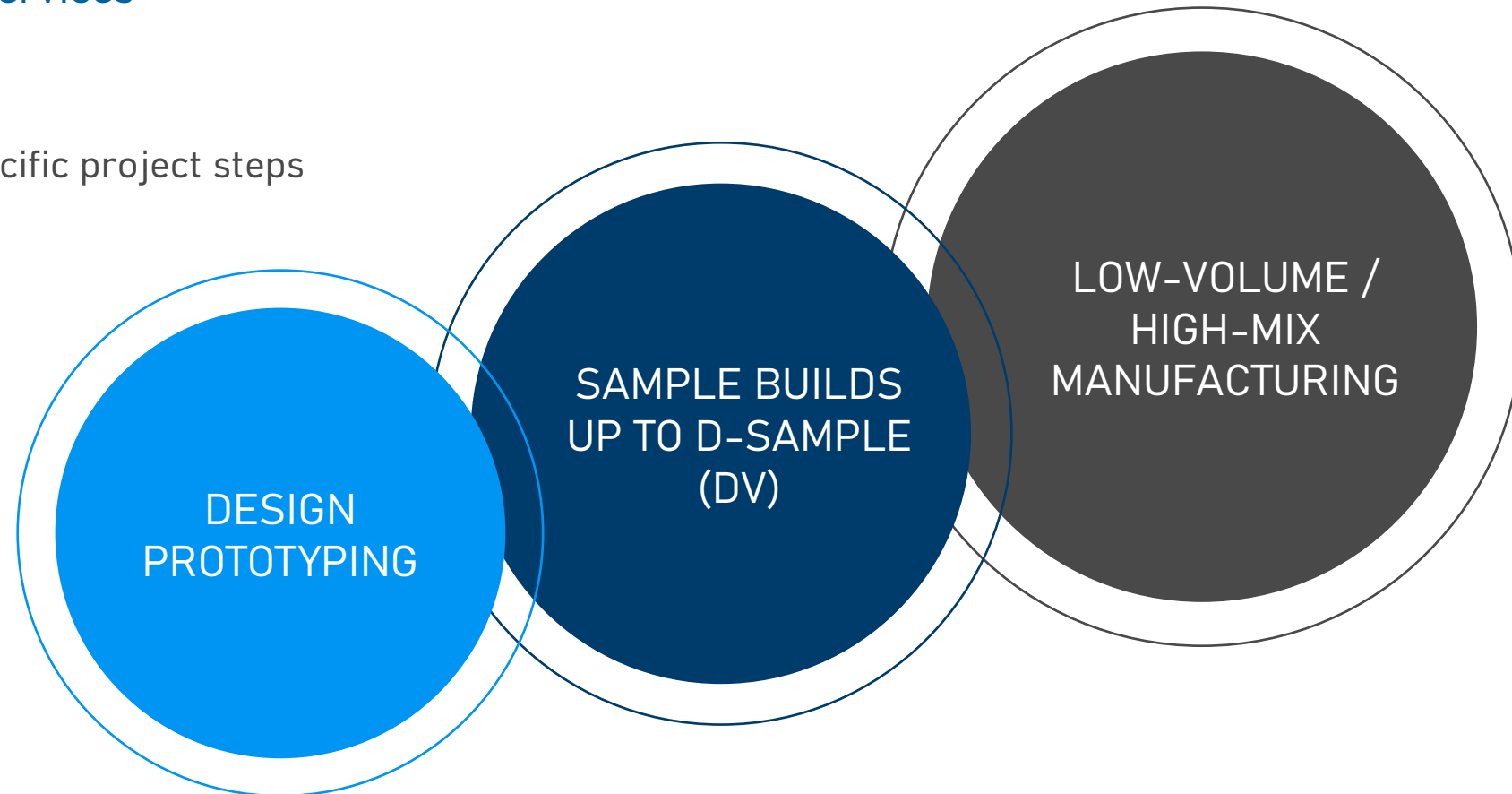
Combination of Two Worlds

(Contract) Design / Engineering Services

- PoC / sample builds
- Changes are welcome
- Budgets can be tailored to specific project steps

Contract Manufacturing

- High-volume / BTP
- Changes are not possible
- “Everything is fixed”





We solve problems
that nobody else
solves.

1

We combine **start-up mentality** with the **one of the world's largest** manufacturing service provider in the world.

2

We **focus** on your **design needs** without insisting on a mass production guarantee.

3

We provide worldwide **access to engineering** and **manufacturing experts** in all technological fields.

Together with you. As one team.

Take the next step & start your project with us.

Contact me via sven_sassning@jabil.com for shaping the future together!

JABIL

Thank You

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**MADE POSSIBLE.
MADE BETTER.**