

EPIC Technology Meeting: Photonics for AR | Milan | 13 Oct 2026

Image Quality, Start to Finish: From Waveguide to AR Glasses

Picometers in the grating. Pixels in the eye.

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Tiny drifts become image defects

1 μm

wafer thickness variation

2.8 pm

grating period error



66 arcsec

the same angular error

5x

shipments by 2030

WHERE

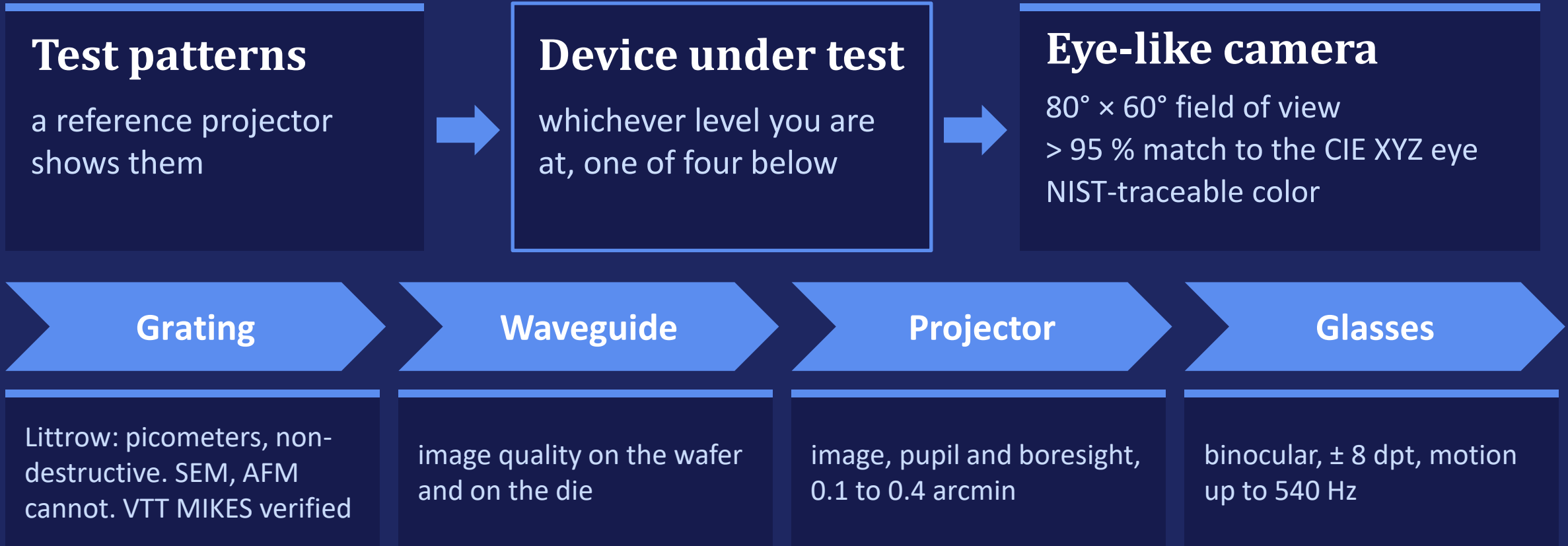
HOW BIG

WHAT THE WEARER SEES

Master fabrication	grating depth -5% to +4.5% of target	→	Efficiency, brightness vary
Grating lithography	15 pm period tolerance	→	Blur, brightness zones
Replication	6% shrinkage; layout shifts per imprint	→	Uneven luminance, lower MTF
Coating	color resolved to $\Delta E < 0.05$	→	Color shifts across field
Assembly, alignment	2.6 to 9.4 arcmin spread on remount	→	Distortion, double images
Wafer-level test	red contrast 26% to 37% from stray light	→	Contrast misread early

Different causes, one result: only the image adds it all up

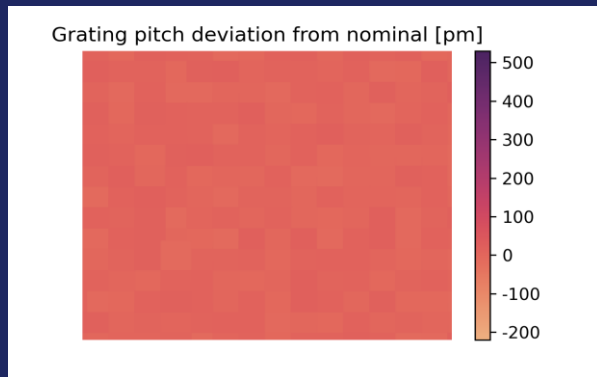
Measure it the way the eye sees it



One method, four levels: results compare from grating to glasses

Grating and image: you need both

GRATING PITCH MAP

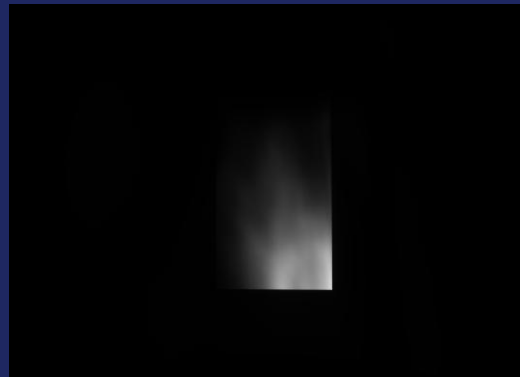
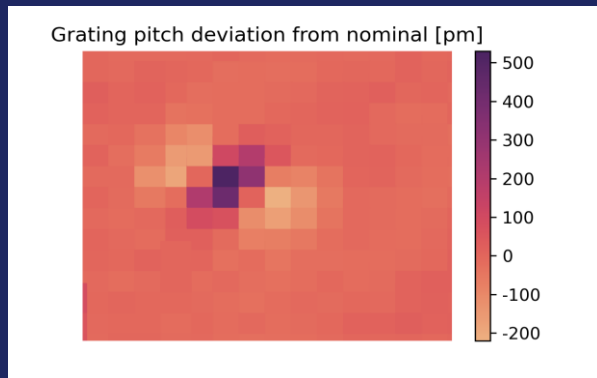


IMAGE



Uniform grating

uniform pitch, clean image



500 pm pitch defect

electron microscopy cannot see it

On-target gratings can still lose 70% contrast: measure both

Proof at scale: 270 per imprint cycle



9 wafers × 30 waveguides

270

waveguides per imprint cycle

101

imprints with one stamp, image quality stable

< 10 pm

period deviation, expander grating

< 0.4 μm

residual layer (was 4.5 μm): clearly higher MTF

Tight from one waveguide to hundreds, imprint after imprint

From lab to line, same core



R&D: flexible, both sides



Production: faster

$< 100 \mu\text{m}$
 $< 0.15^\circ$

active alignment on
fiducials

48 to ~ 400
UPH

four stations, full vs
reduced sequence
(estimate)

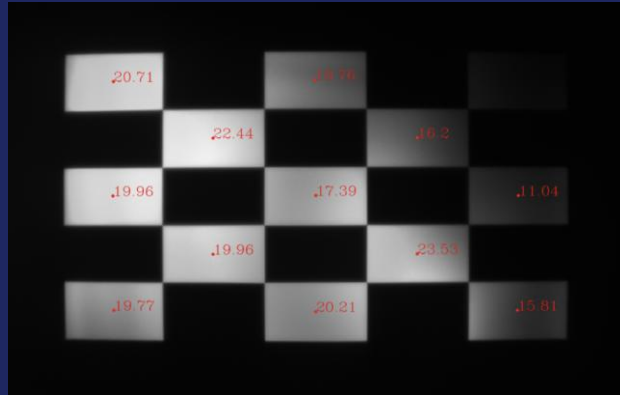
Wafer level

test before dicing:
manage stray light and
crosstalk

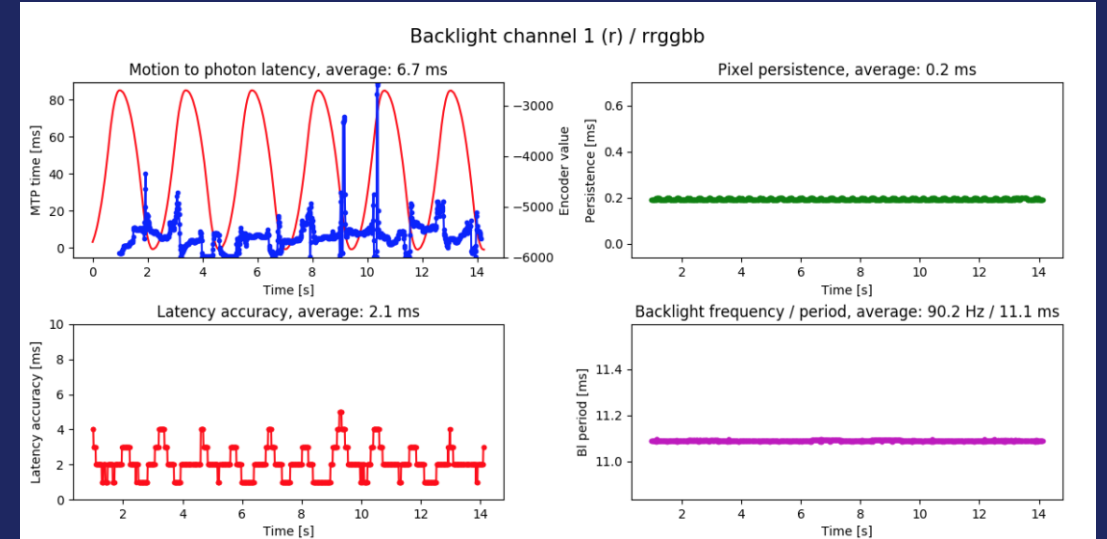
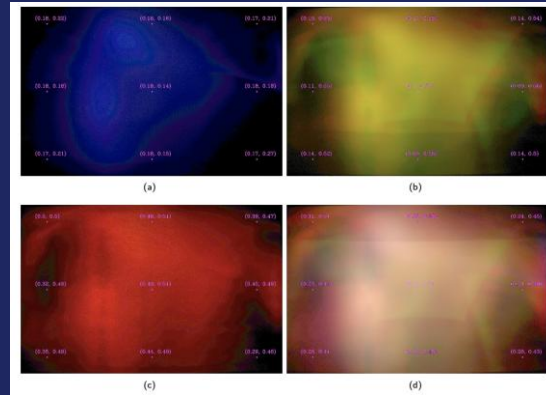
Alignment is about 40% of the cycle: optimize it, run stations in parallel.

Same core components: results compare from R&D to mass production

Glasses level: static and in motion



Checkerboard contrast and color uniformity, on the glasses



Motion-to-photon, example run

Binocular disparity

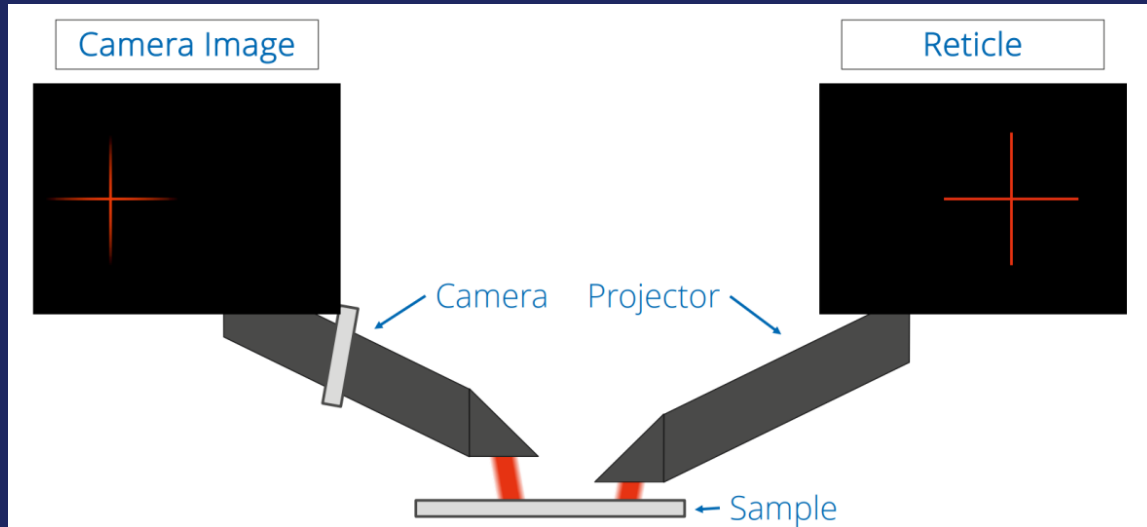
8 static metrics

100 kHz sensor sampling

0.1 ms frame timing

Delay above 20 ms disorients. Under 5 ms is the goal for AR.

Measured the way the wearer sees



Left and right eye by reticle offset

Sphere / cylinder

-10 to +4 dpt, motorized

Cylinder axis

0 to 360°

Pupil

1 to 5 mm, motorized

Catch image quality problems at the right level.

Same approach for AI glasses: camera, IMU and LED. See it live at our table.

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master fabrication

Morphotonics

large-area imprinting

Pixelligent

high-index resins

3D-Micromac

laser singulation

Dispelix

wafer-level study

Coretronic

projector collaboration

Eulitha

grating wafer measurements

VTT MIKES

metrology verification

Thank you for the data, the samples and the years of collaboration.