

The ASML logo is displayed in the top right corner in a bold, white, sans-serif font. The background of the slide features a large, detailed 3D rendering of an EUV lithography machine on the left, showing its complex mechanical structure and a red laser beam. In the center, there is a blue-tinted image of three white ASML storage cabinets. The bottom right corner shows a close-up of a server rack with blue cables.

ASML

EUV Industrialization

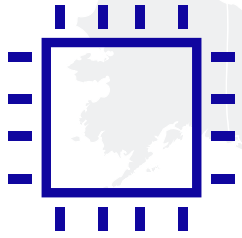
Presenter: Raymond Maas

Michael Lercel, Christophe Smeets, Stuart Young.

EUVL conference 2023

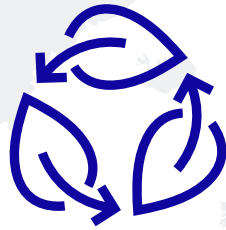
- Introduction
- NXE Installed Base performance
- EUV system roadmap
- NXE:3800E

The world is changing fast



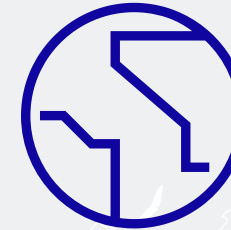
Connected world

- Smarter cities, factories, homes, cars
- Connecting billions of 'things'
- Unprecedented data volumes
- Privacy in a connected world
- Cybersecurity
- ...



Climate change and resource scarcity

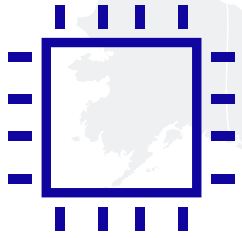
- Rising energy use
- Exploding energy costs
- Accelerating climate change
- More waste and pollution
- Fragile food chains
- Material shortages
- ...



Social and economic shifts

- Rising population
- Higher medical costs
- Faster urbanization
- Need for tech talent
- Deglobalization
- Technological sovereignty
- ...

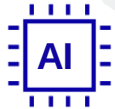
The world is changing fast, and technology can help unlock the potential



Connected world



Cloud infrastructure



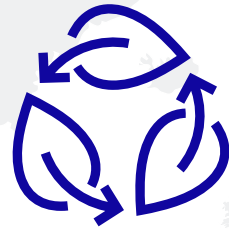
Artificial intelligence



Hyperconnectivity



Edge computing



Climate change and resource scarcity



Energy transition



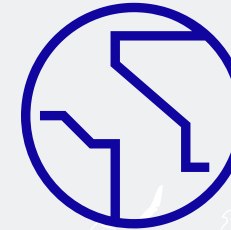
Agricultural innovation



Electrification, smart mobility



Smarter use of limited resources



Social and economic shifts



Working, learning remotely



Technological sovereignty



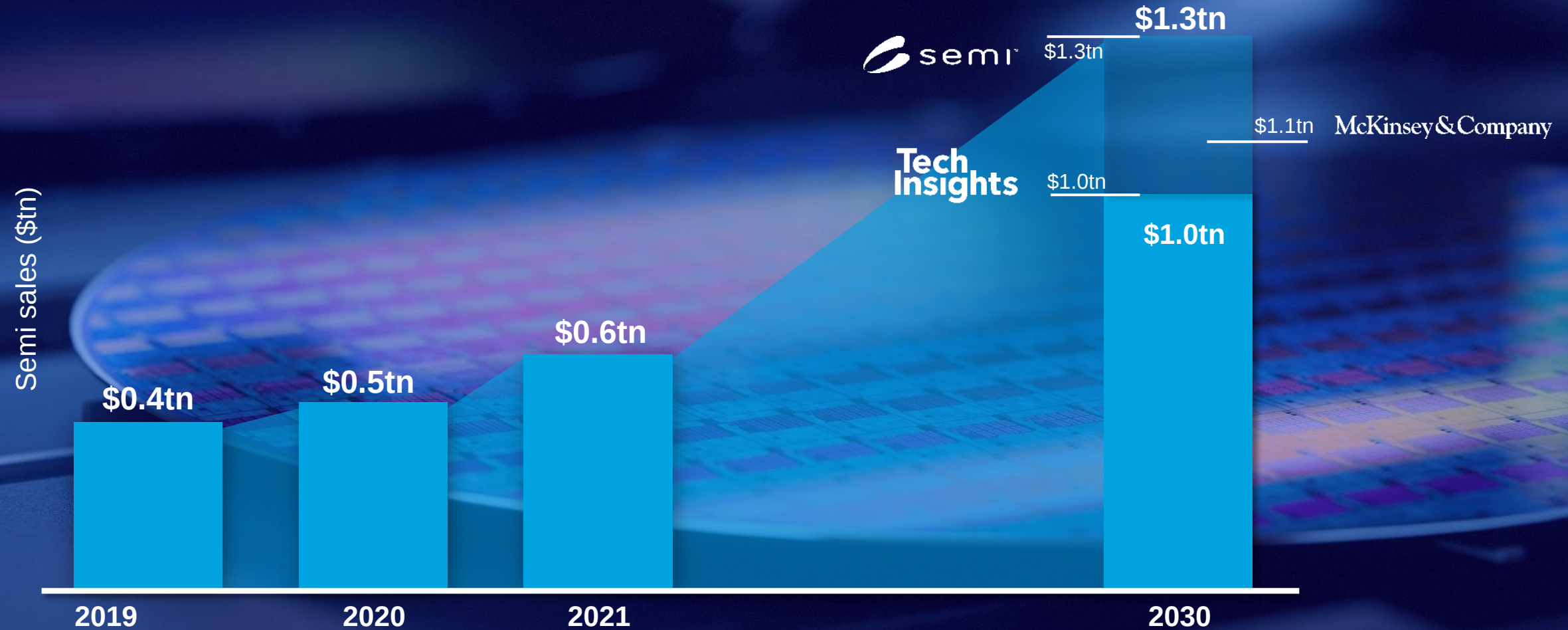
Healthcare, medical tech



Automation

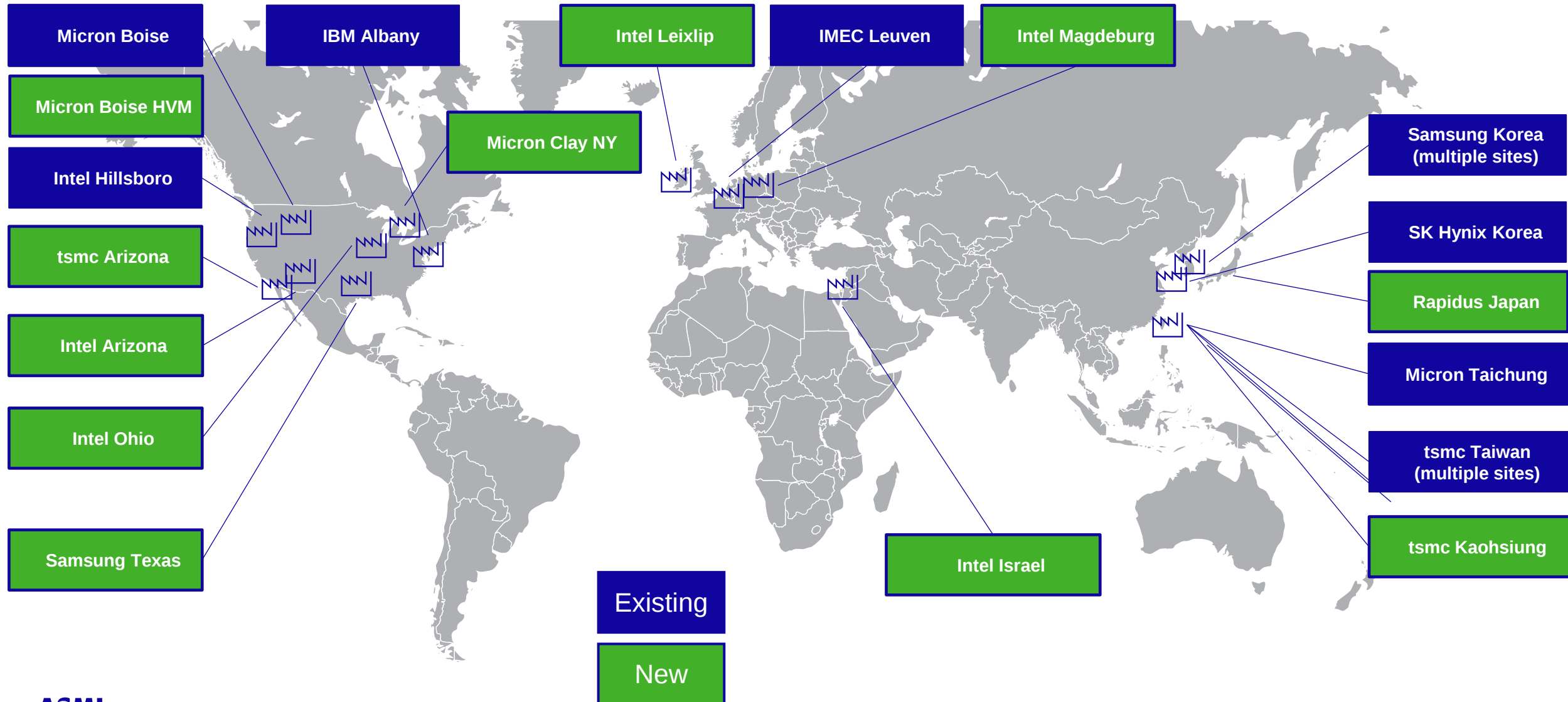
The semiconductor market is expected to double in 10 years

Analysts' views on 2030 market are ranging from \$1.0tn to \$1.3tn



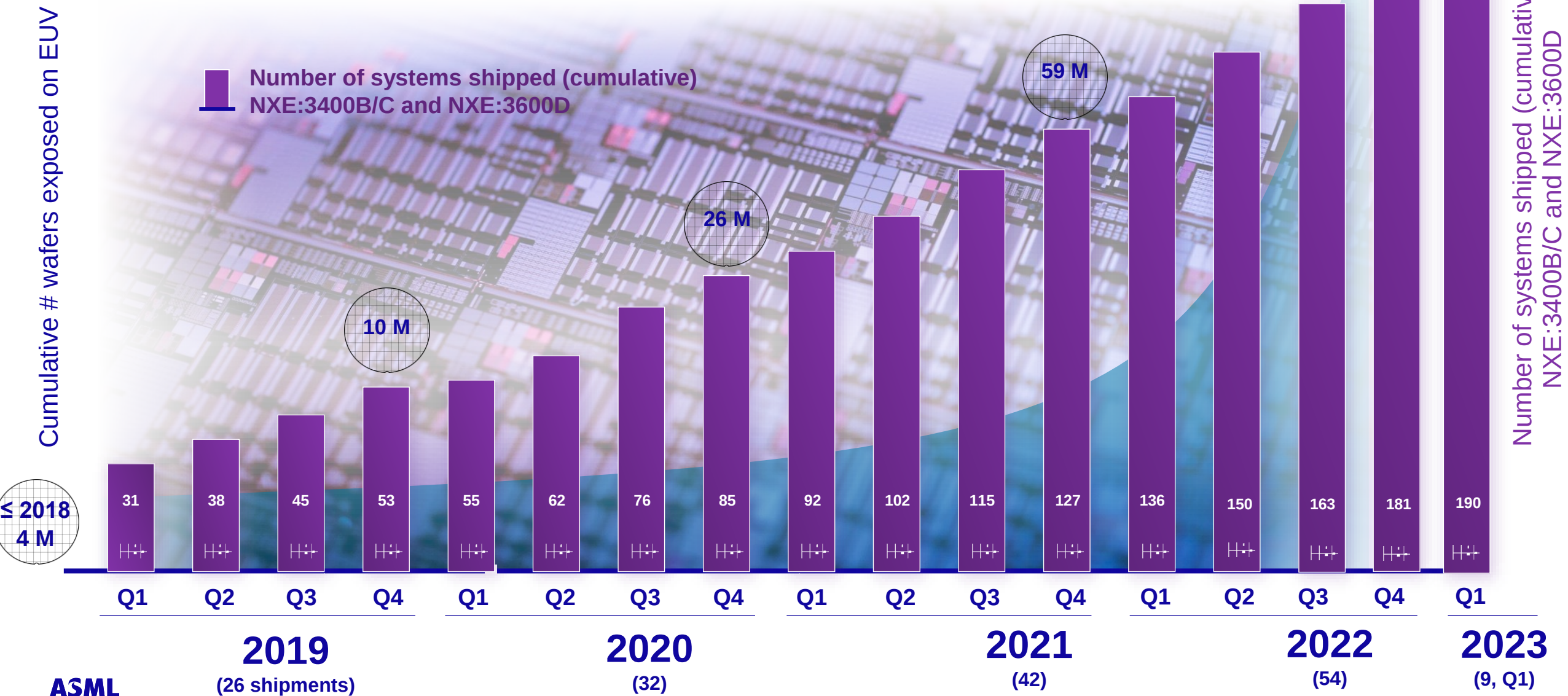
Sources: TechInsights, McKinsey, SEMI.org

Customers are opening and announcing new EUV fabs in US, Europe and Asia



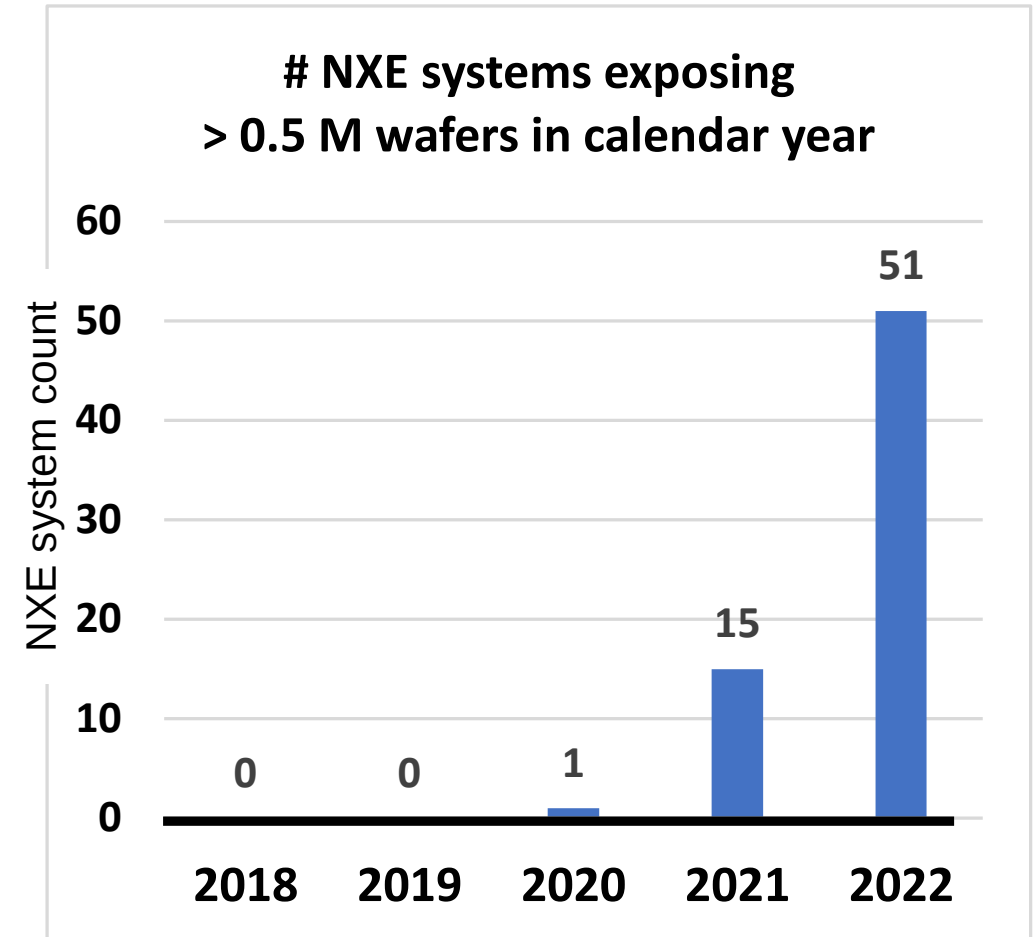
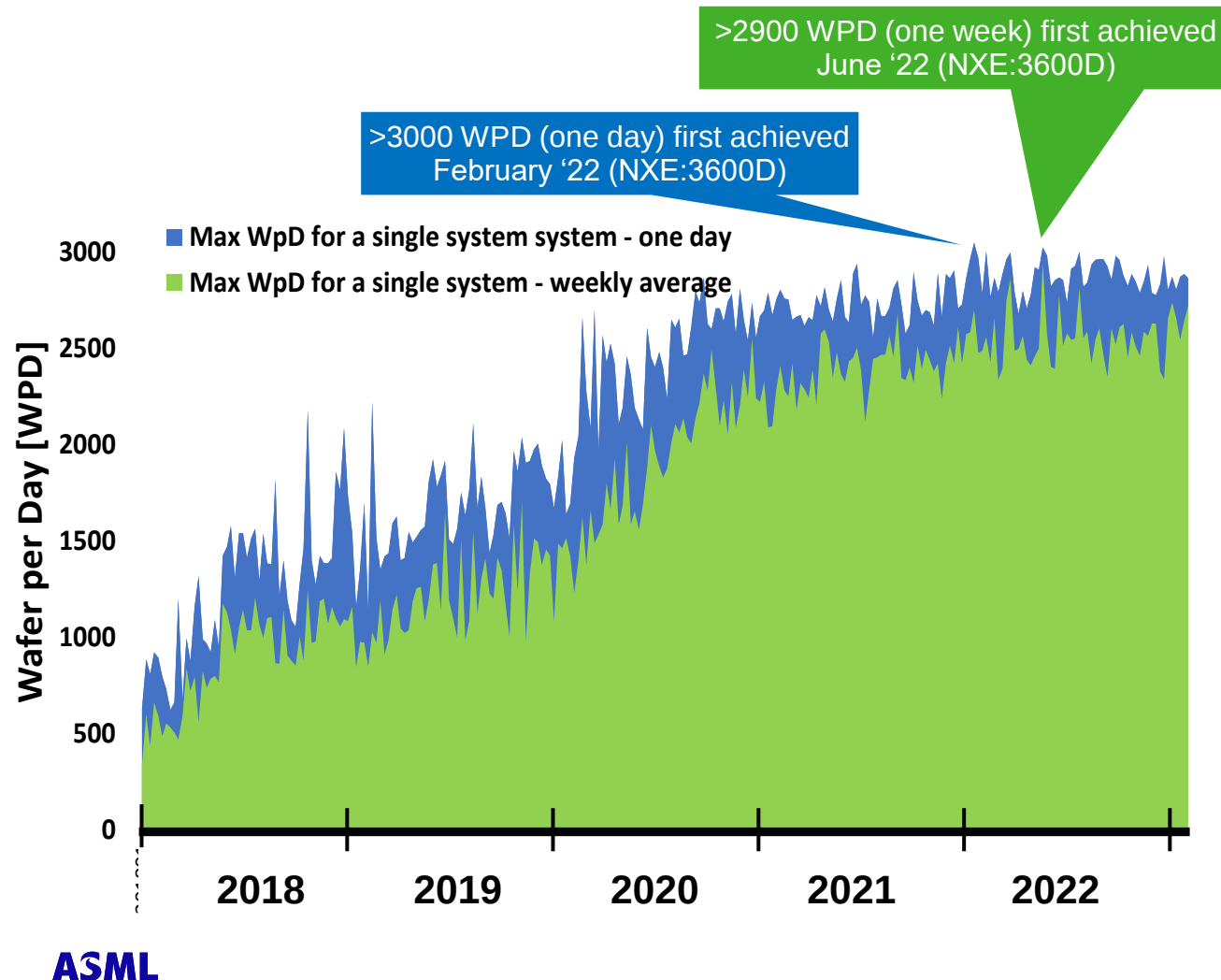
7th generation EUV (NXE:3600D) in production

Focus on productivity Wafers per Day (WPD)



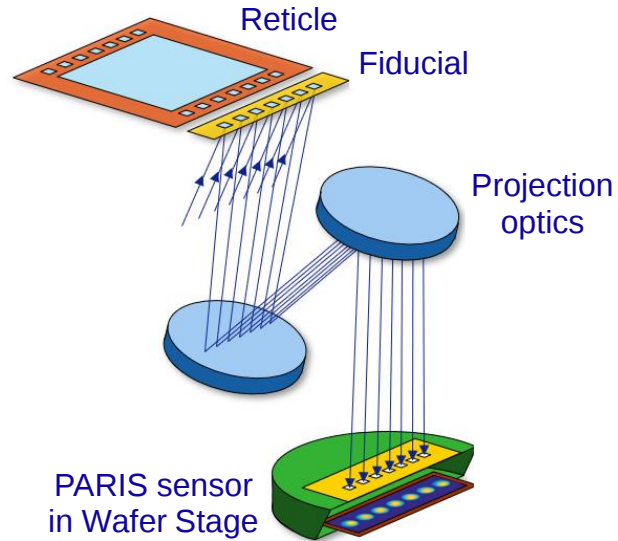
NXE productivity keeps increasing, supporting Cost of Technology targets

Contributing factors: higher scanner throughput, next level system maturity, optimization of process and operations by customers



NXE:3600D

Enabling 1.7nm On Product Overlay at increased productivity of 160 WPH (30 mJ/cm²)



PARIS Sensor

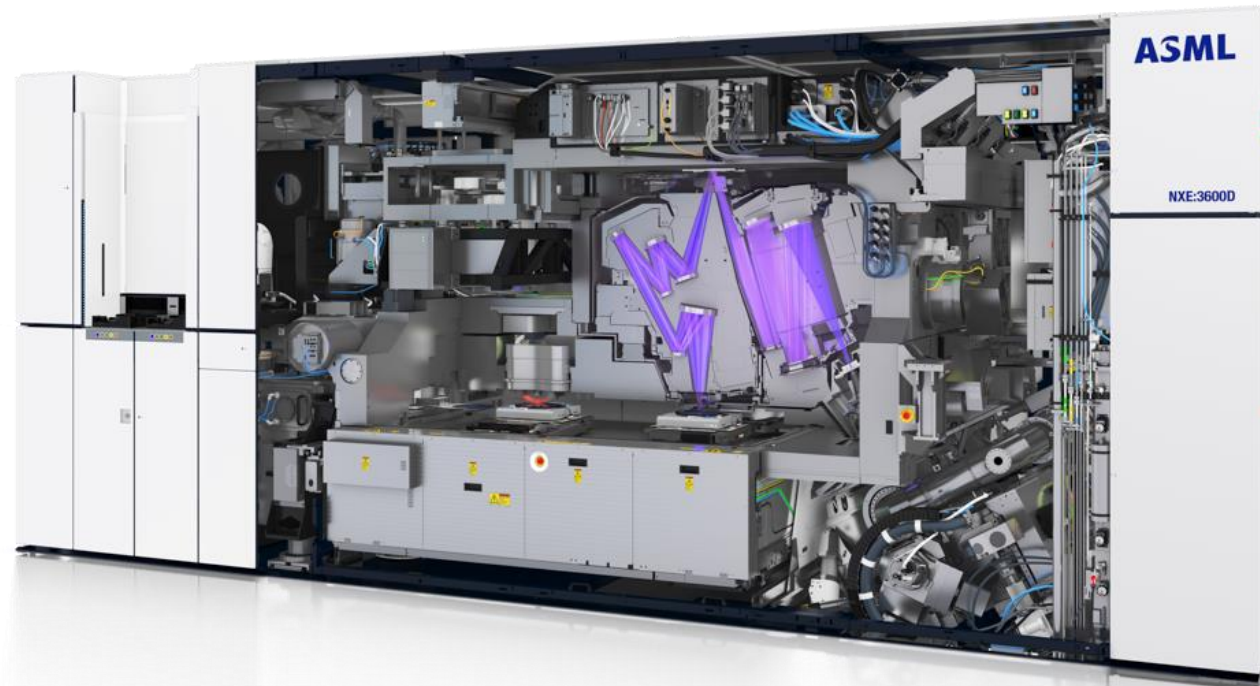
Faster aberration measurement and control by measuring multiple slit points in one scan

Reticle Stage

Improved temperature control by local chiller

Projection optics

Improved aberrations



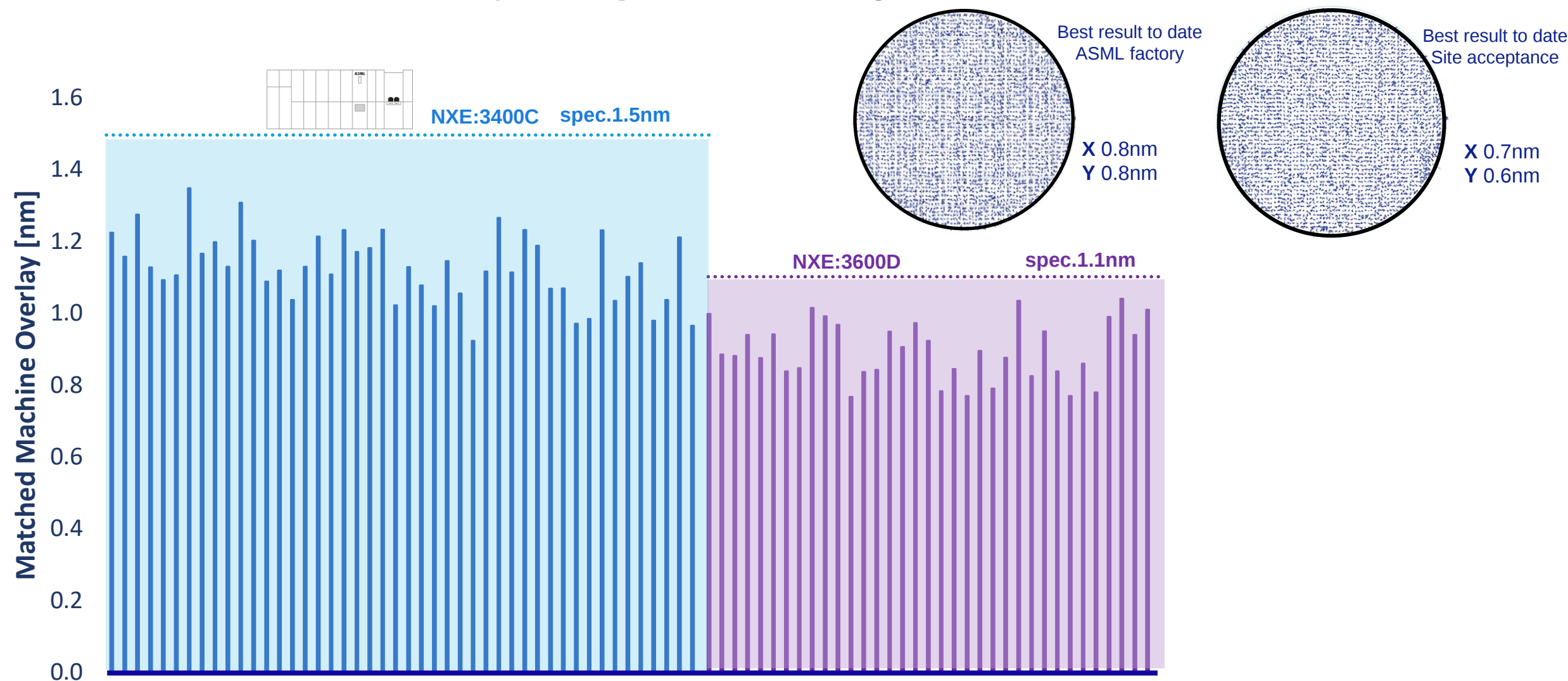
Wafer Stage

Faster chuck exchange
Improved flatness wafer clamps

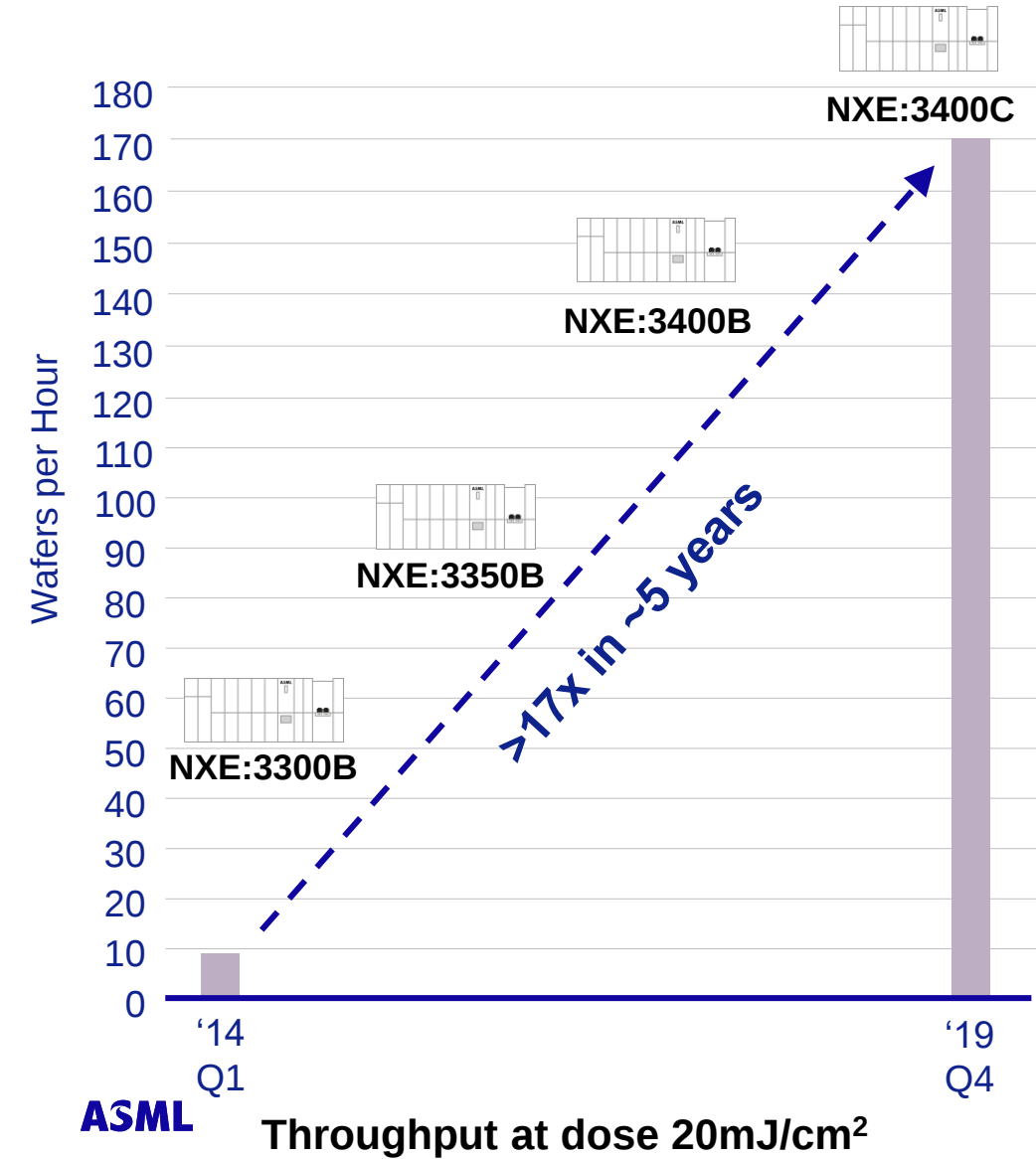
EUV Source

Higher CO₂ Drive Laser power
Optimization of source plasma control

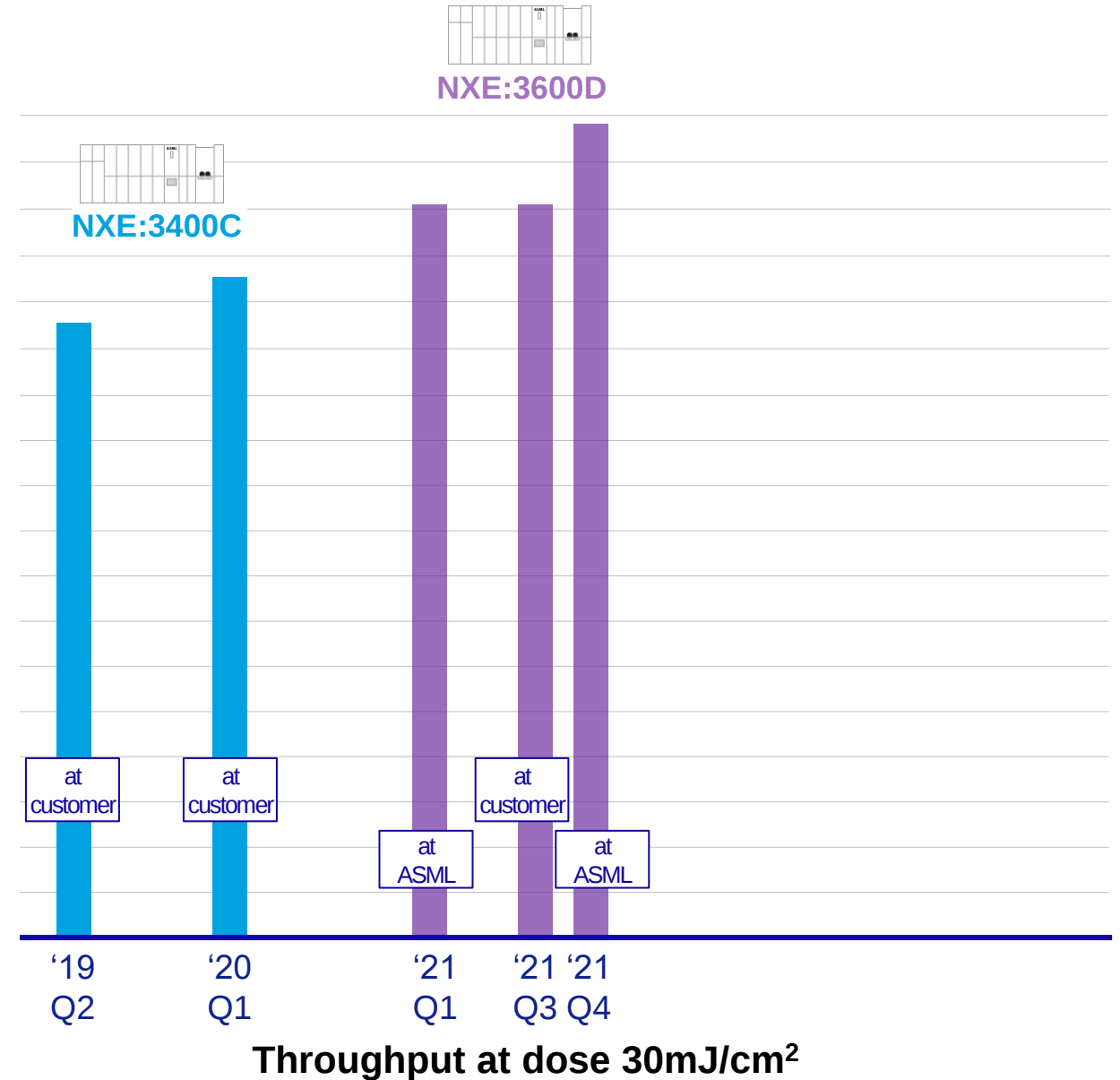
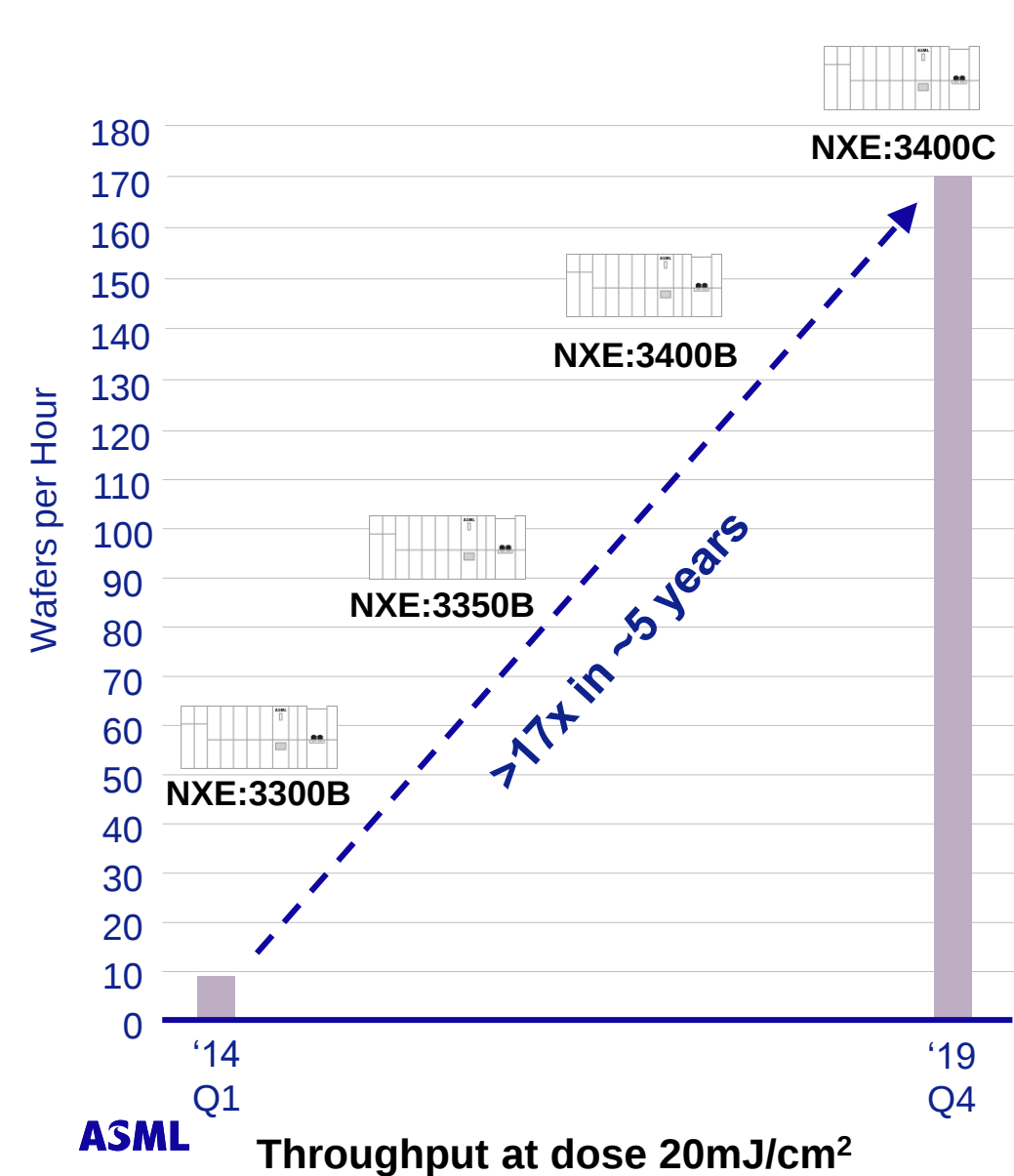
NXE:3600D Matched Machine Overlay improvement confirmed in ASML factory acceptance testing



Throughput of NXE platform continues to increase



Throughput of NXE platform continues to increase

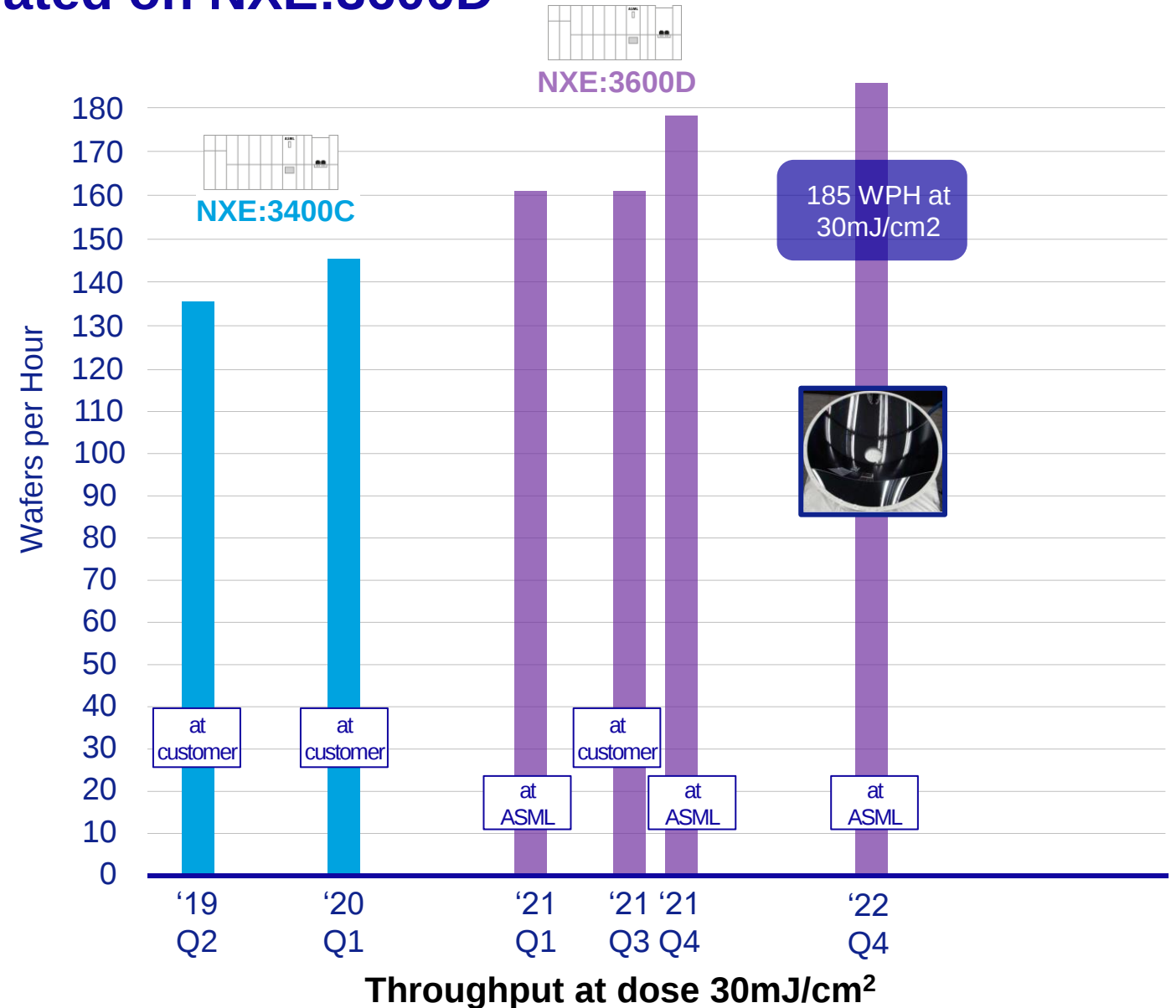


Throughput of NXE platform continues to increase 185 WPH at 30mJ/cm² demonstrated on NXE:3600D

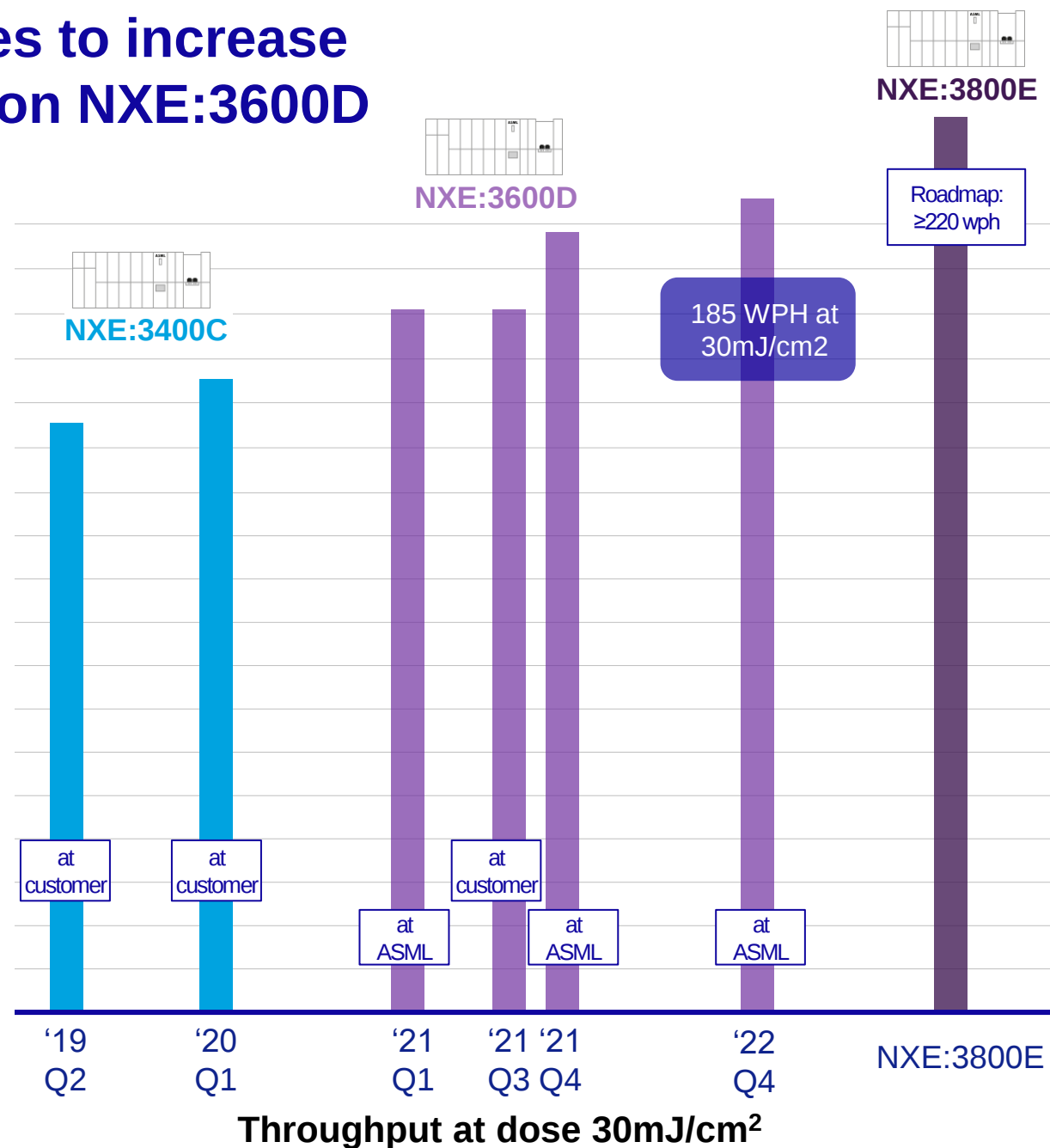
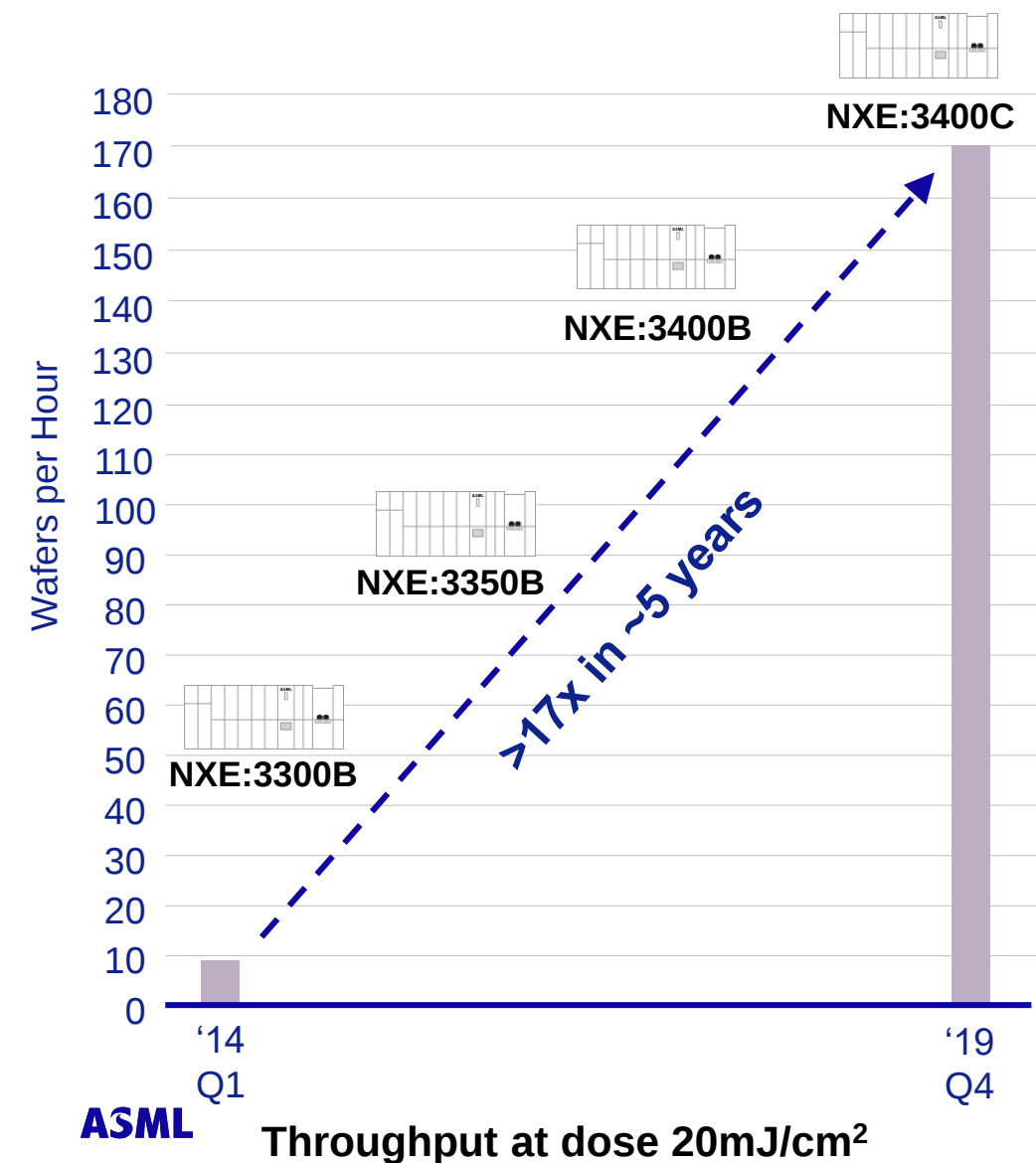


Higher reflectivity collector: NGCM
(Next Generation Collector Module)

Collector Mirror: collects the EUV light
generated by the tin plasma and directs it
to the scanner illuminator

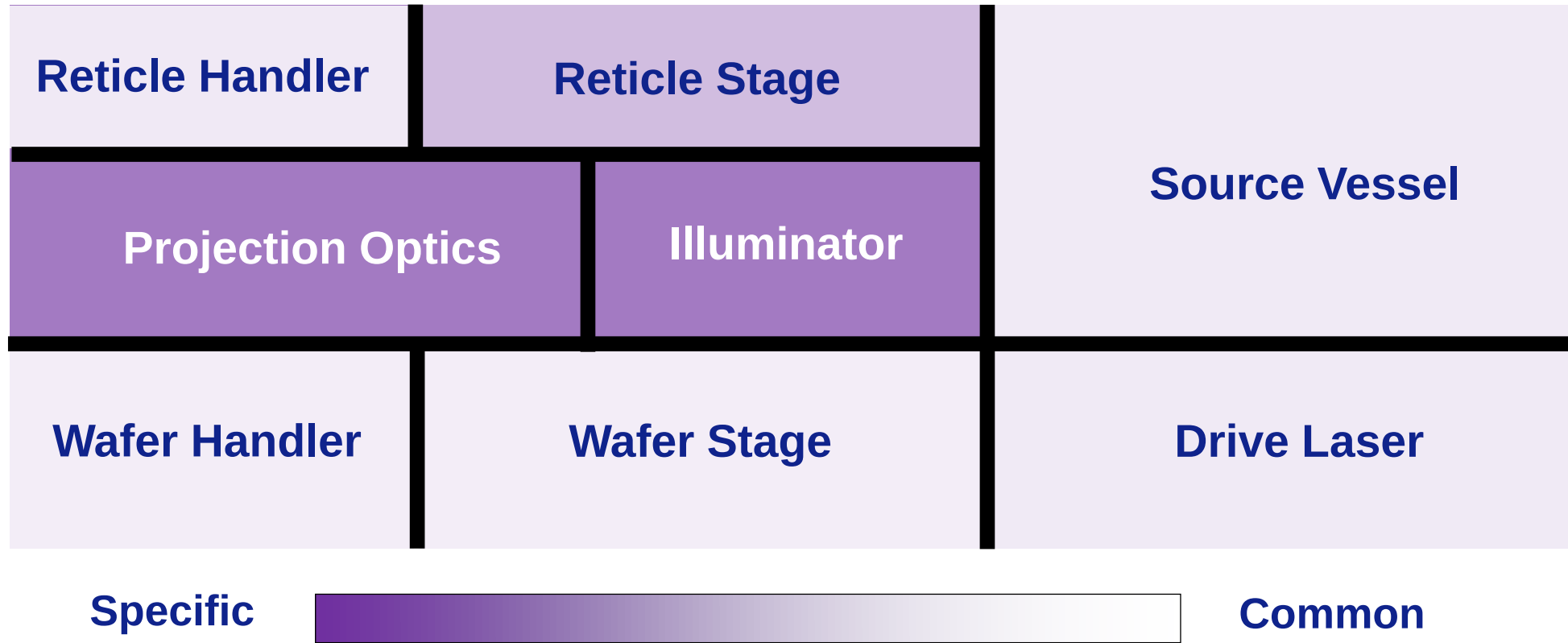


Throughput of NXE platform continues to increase 185 WPH at 30mJ/cm² demonstrated on NXE:3600D



EUV 0.33 NA and 0.55 NA platform commonality is maximized

To reduce introduction risk and improve platform maturity



NXE:3800E throughput ≥ 220 wph at 0.9 nm Matched Machine Overlay (*)

Reticle Stage

Higher acceleration supporting ≥ 220 wph

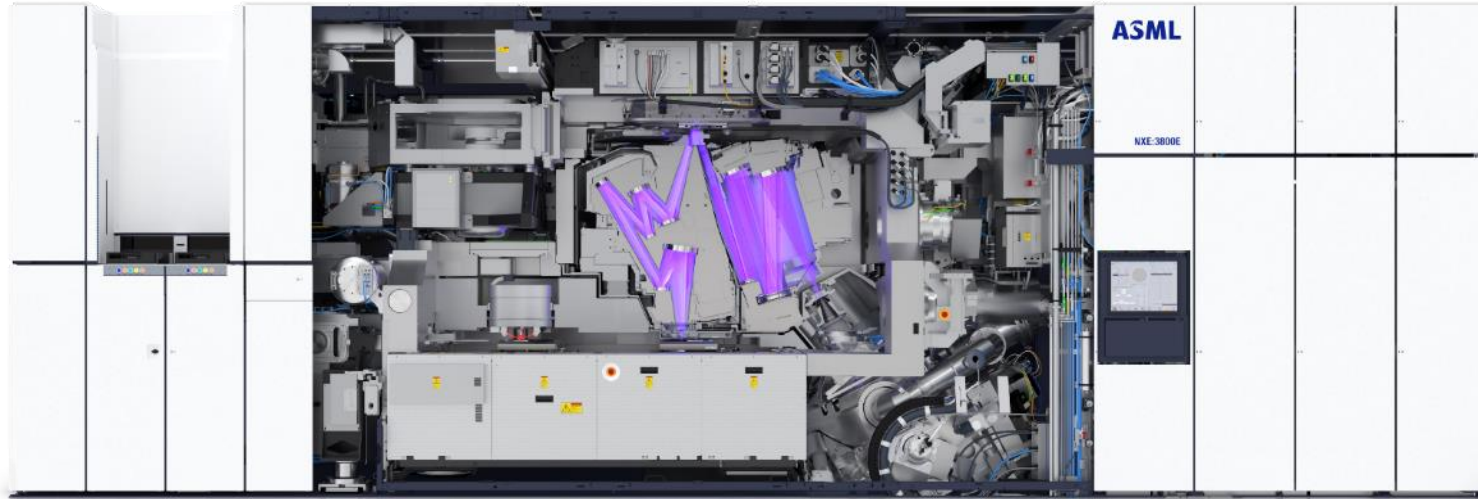
Reticle Clamp

Improved thermal stability

Projection Optics

Lower aberrations

Increased stability at higher power
Manipulators to mitigate mirror heating



Wafer Handler

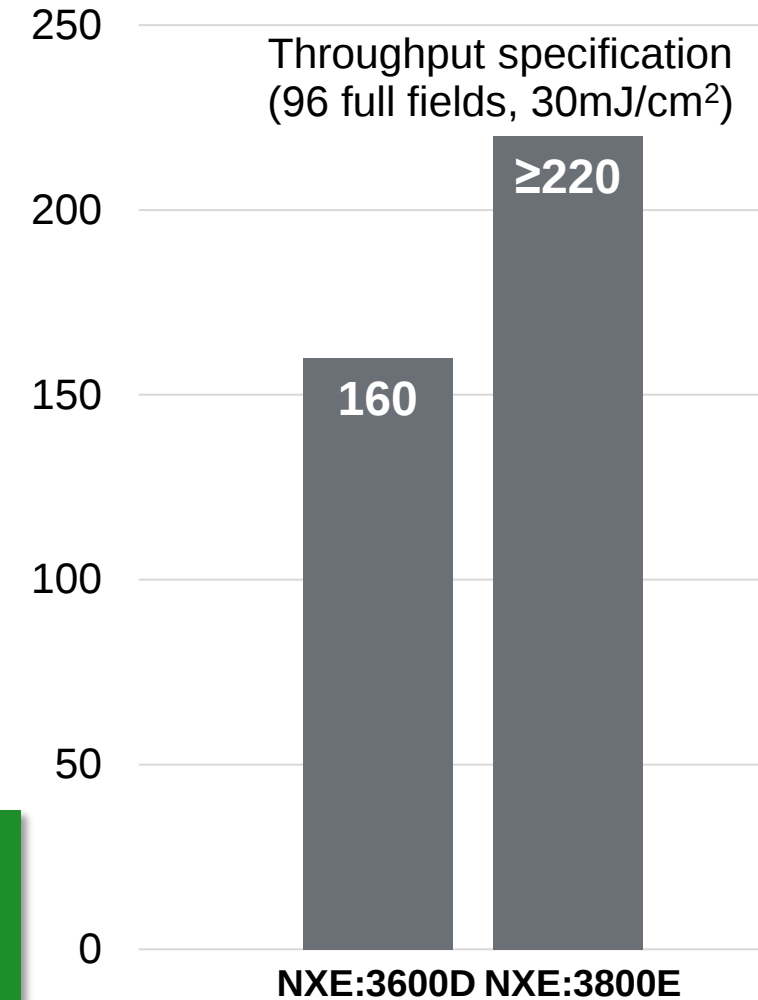
Faster wafer handler supporting ≥ 220 wph

Wafer Stage

Faster wafer stages with increased step & scan speeds
Improved dynamic performance

EUV Source

Higher power CO₂ drive laser
Higher tin droplet frequency
New tin management system (Cold Flow Module)



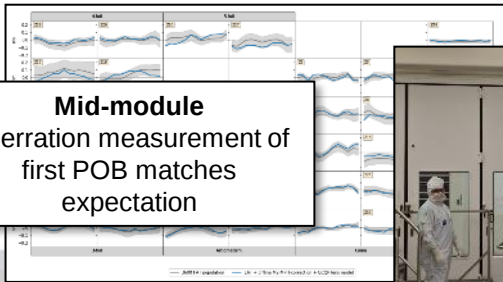
NXE:3800E ≥ 220 wph (30 mJcm^{-2}) supporting 1.4 nm OPO ($m+3\sigma$)

First full NXE:3800E build completed and in integration phase



Top Module

- >50M reliability cycles at higher acceleration completed without issue



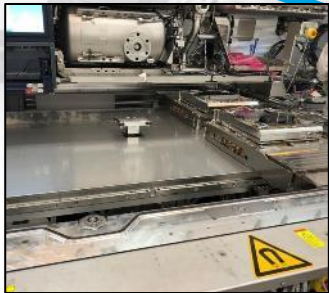
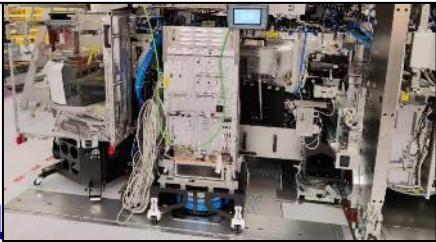
Mid-module
Aberration measurement of first POB matches expectation



ATP targets	NXE:3800E
Full Wafer CDU	$\leq 0.7 \text{ nm}$
DCO	$\leq 0.8 \text{ nm}$
MMO	$\leq 0.9 \text{ nm}$
Throughput at 30 mJcm^{-2} (clean collector)	$\geq 220 \text{ WPH}$

Bottom Module

- Higher acceleration wafer stages running under interferometer and lot operation software control. Full acceleration demonstrated. Performance and reliability runs started

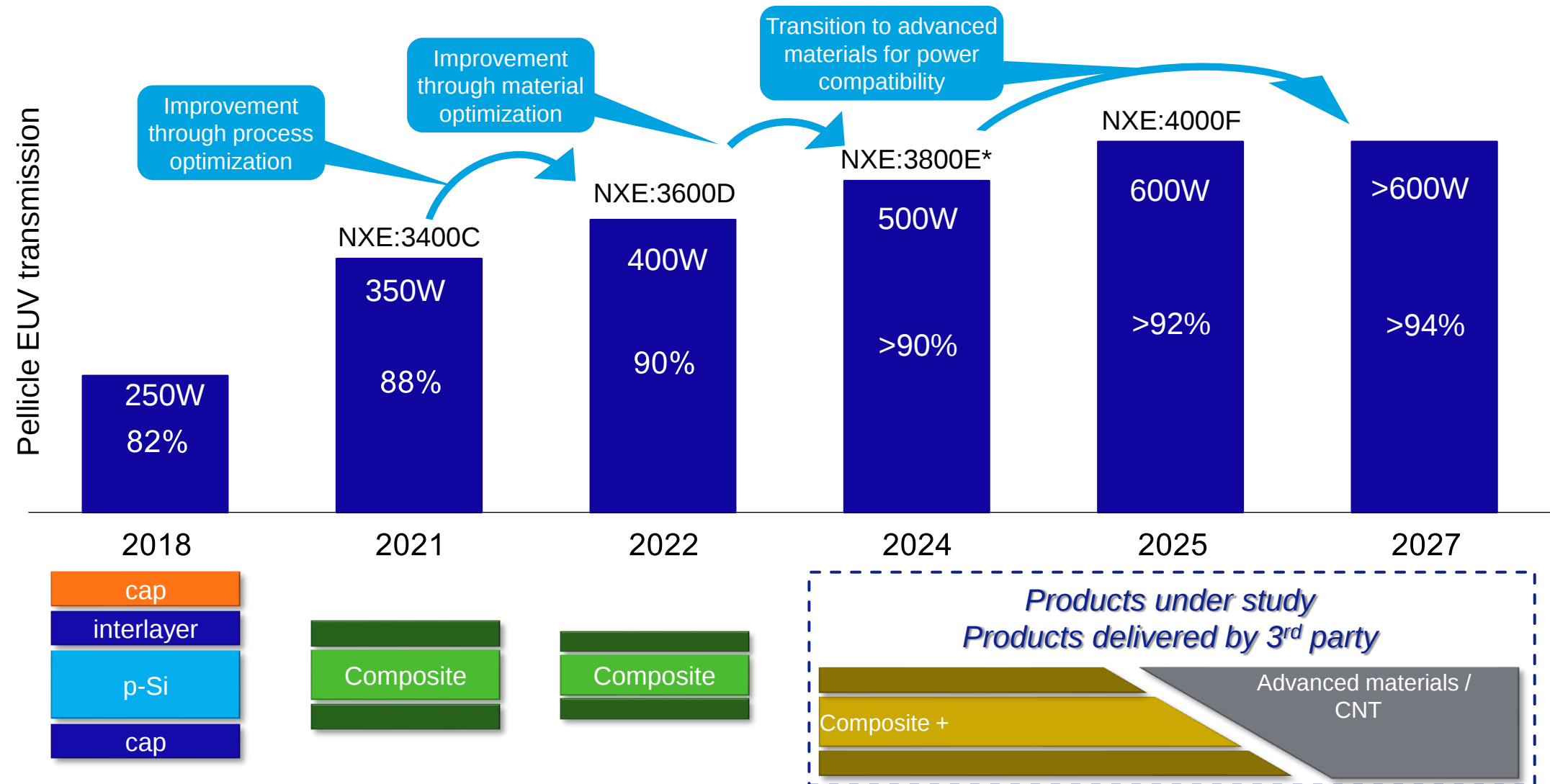


Source

- Increased Sn droplet velocity and repetition rate show 10% increased CE and >500W EUV power at IF. Thousands of hours of reliability runs already executed on drive laser, droplet generator, vessel and will continue in order to secure source reliability at shipment

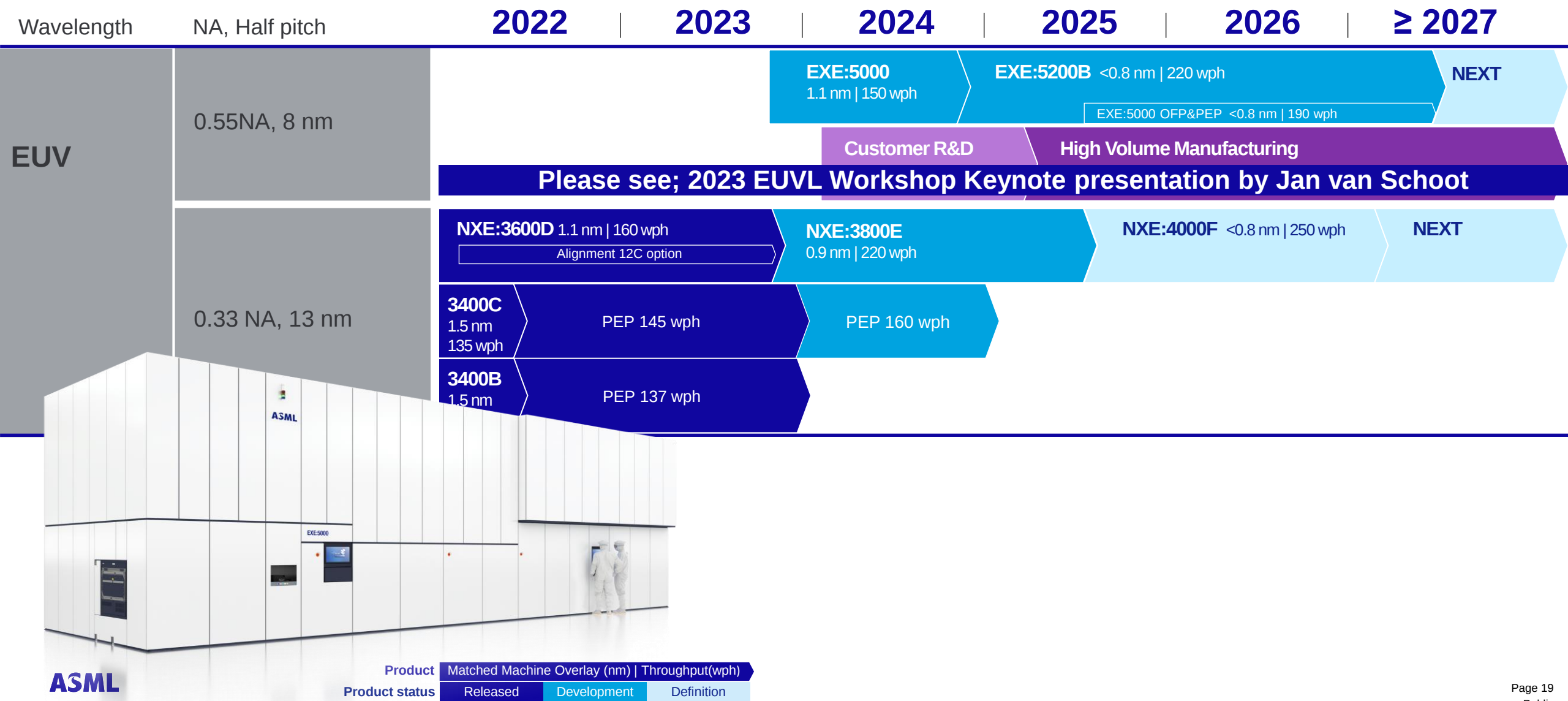
EUV pellicle productivity roadmap

Pellicle roadmap ensures compatibility with new scanners



Power levels indicate order of magnitude
* NXE:3800E introduction timing end 2023 in 400W configuration

EUV product roadmap



NXE is successfully used in High Volume Manufacturing

ASML's EUV platforms provide affordable shrink roadmaps to customers



- Our customers are using EUV lithography in HVM on Logic $\geq 3\text{nm}$ and 10nm-class DRAM nodes. Next technology nodes are under preparation.
- The NXE installed base is growing fast. 190 systems were shipped by the end of Q1'23. By 2025-2026, we plan to ship 90 NXE systems per year.
- The ASML NXE roadmap continues to provide systems with improved imaging, overlay and productivity
- NXE (0.33 NA) and EXE (0.55 NA) roadmaps are complementary, enabling our customers to continue their affordable shrink roadmaps.

Special thanks goes to:

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