



<KOMATSU IR-DAY 2017>

GIGAPHOTON INTRODUCTION

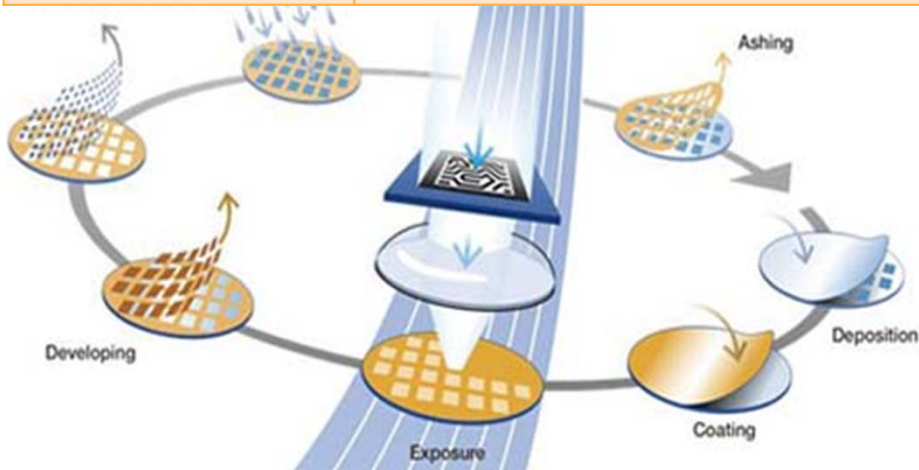
15th September 2017

Tatsuo Enami
Director and Senior Executive Officer
GIGAPHOTON

Outline of Gigaphoton Business

■ Light source business for semiconductor exposure

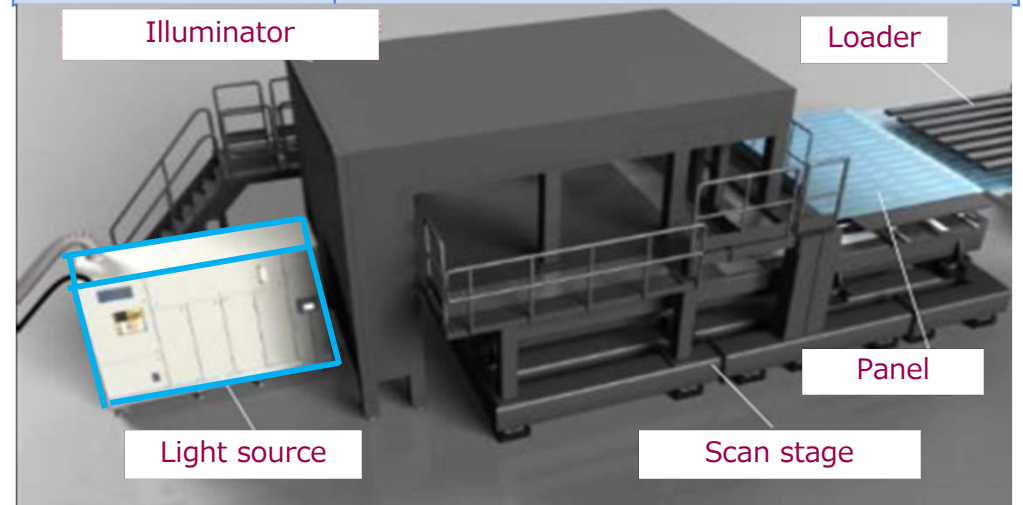
System sales destination	ASML , Nikon, Canon
Part sales destination	Semiconductor manufacturers, such as Intel, Toshiba, Samsung, TSMC



Source: <http://www.asml.com>

■ Light source business for Flat Panel Display(FPD) annealing

System sales destination	V-Technology
Part sales destination	Liquid crystal panel manufacturers, such as SDP, BOE



Source: V-Technology brochure

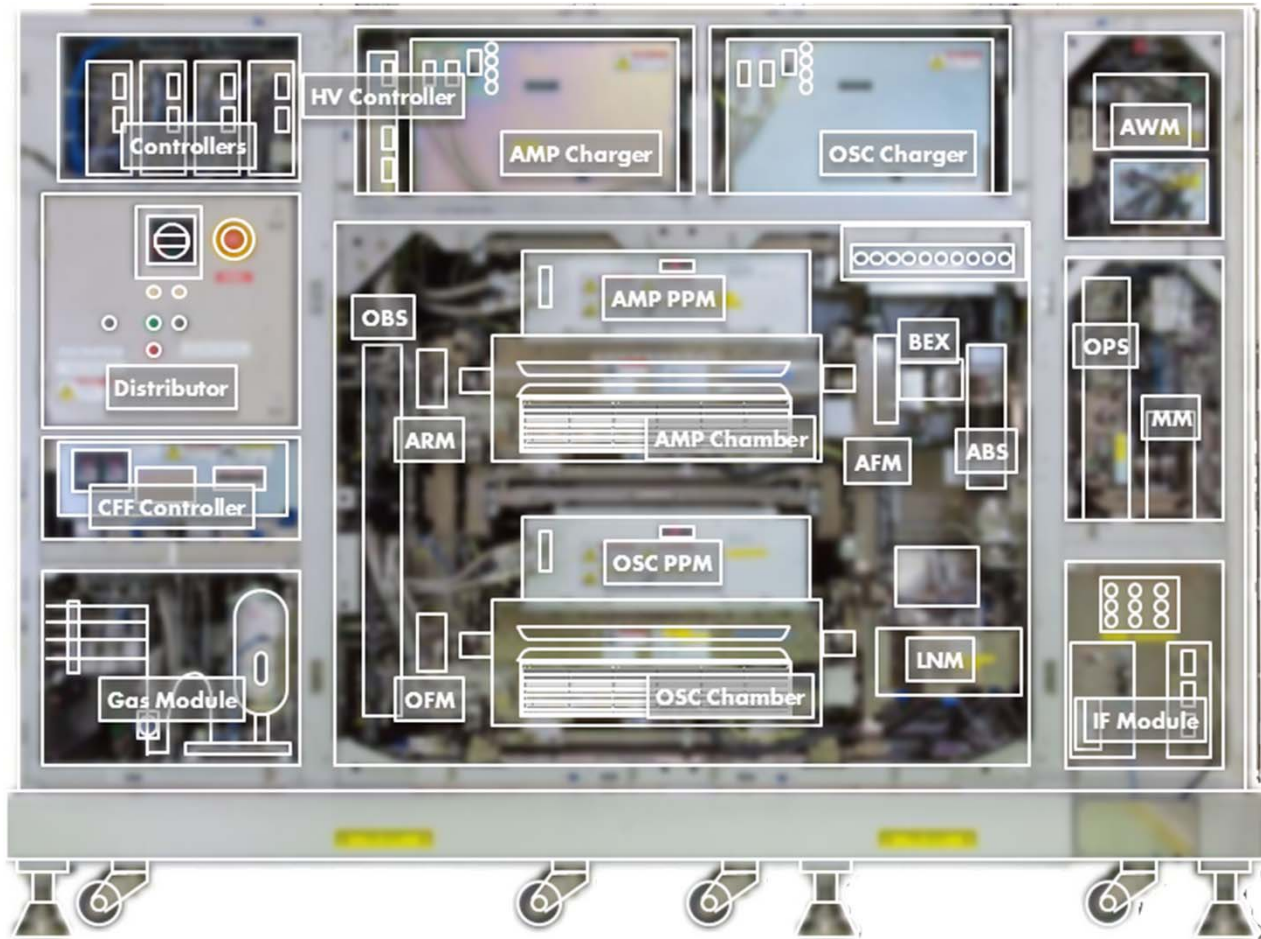
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Light Source for Semiconductor Exposure



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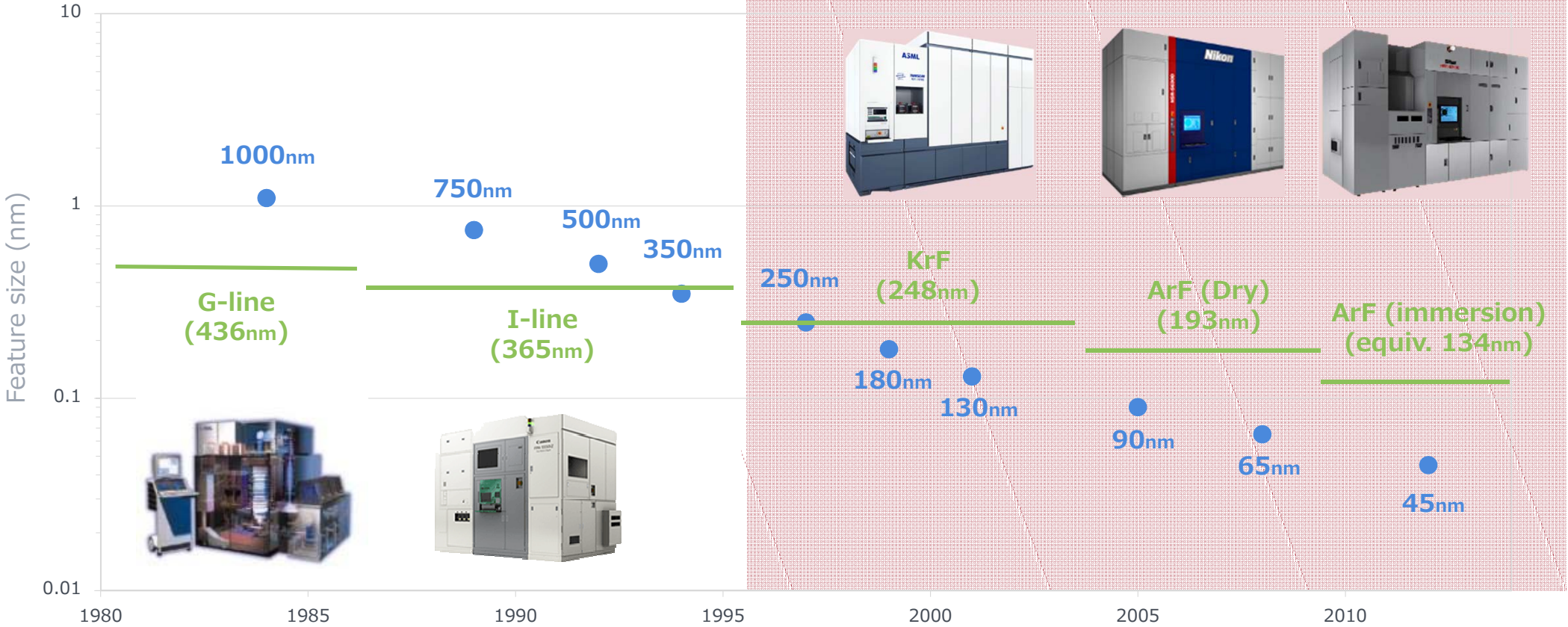
Cutting-Edge Product Structure and Performance



dimensions	Width	2800mm
	Depth	845mm
	Height	2120mm
Weight		3410kg
Specifications	Wavelength	193nm
	Average Output	60 - 120W
	Pulse Energy	10 - 20mJ
	Repetition Frequency	6000Hz
	Spectrum Width (E95)	0.25pm

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Technology Transition

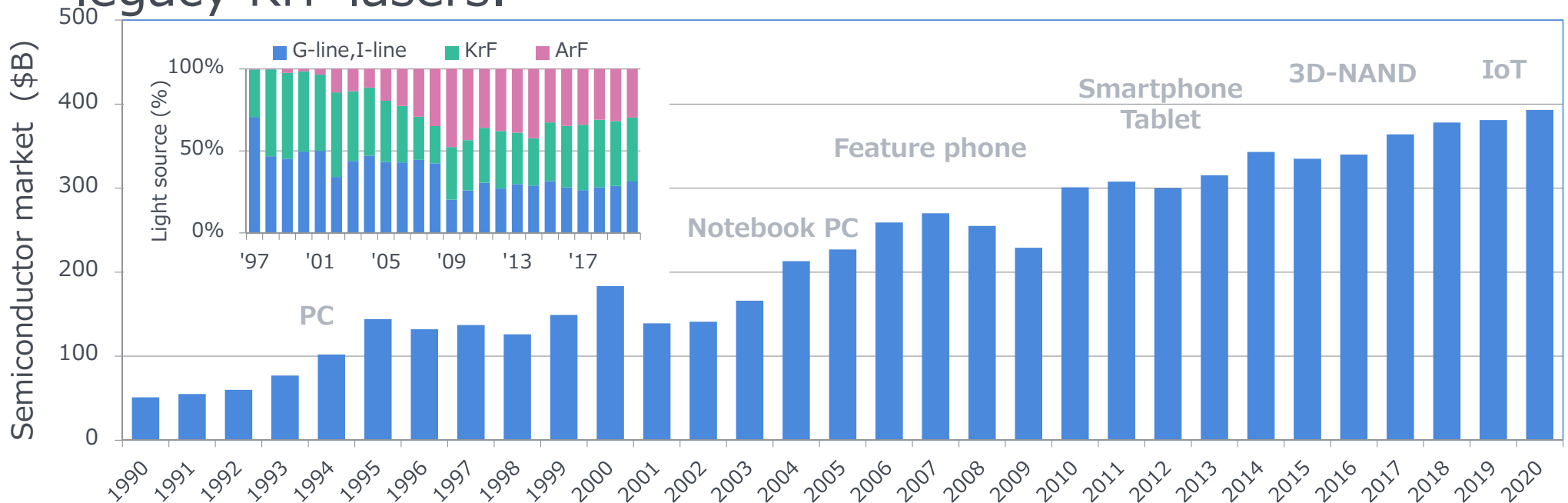


Source: ASML, Canon, Nikon



Semiconductor Market

- Semiconductor market size is 330 \$B and will grow at +3% /year.
- 3D NAND and IoT application will sustain a demand for legacy KrF lasers.



History of Excimer Lasers Development at Komatsu



1980 - The first Excimer LASER was developed at Komatsu for the Coherent Anti-Stokes Raman Spectroscopy (a.k.a. CARS) system

1980



1987

1987 - Komatsu shipped the world's first KrF excimer laser KLE-630S for lithography ... 2 full Watts output !!!



1989

1989 - Cymer enters market of Excimer lasers for lithography tools. The rivalry begins ...!!!



1999

1999 - Our first KrF laser for semiconductor manufacturing, KLES-G10K was shipped to overseas

2000 - Komatsu and Ushio developed joint venture company... Gigaphoton Inc. is founded !!!



In 2000
Gigaphoton was born!



2000

Business Model of DUV Light Source

■ Composite business of System sales(Light source unit sales) and Part sales (Maintenance business)

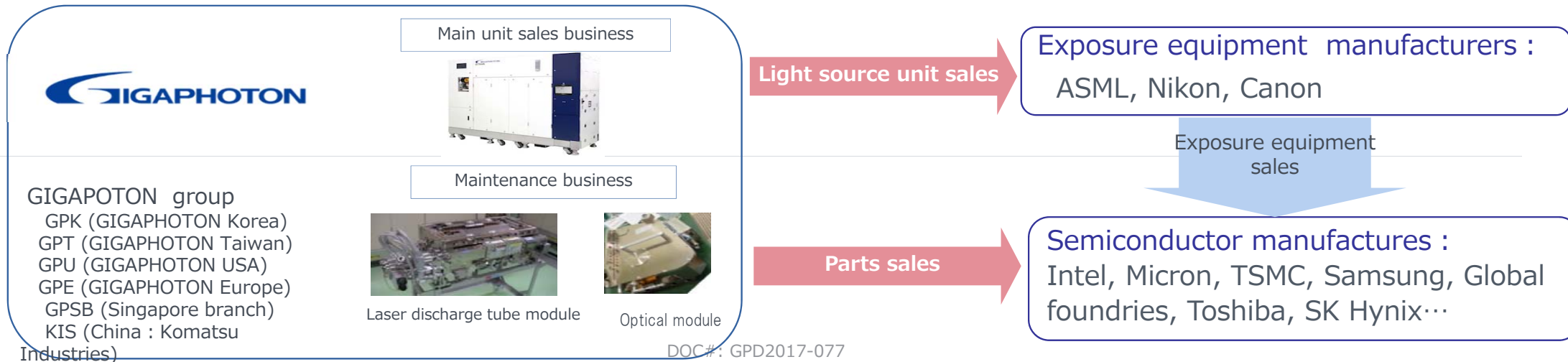
- Systems are sold to exposure equipment manufacturers.
- Upon system sales, Gigaphoton (GPI) receives a maintenance contract, called Pay-per-pulse, from semiconductor manufacturers.

* Pay-per-pulse: Charging system paid on the basis of the Laser usage (Pulse usage × Pulse unit price)
 (GPI benefits) Secure stable revenue stream

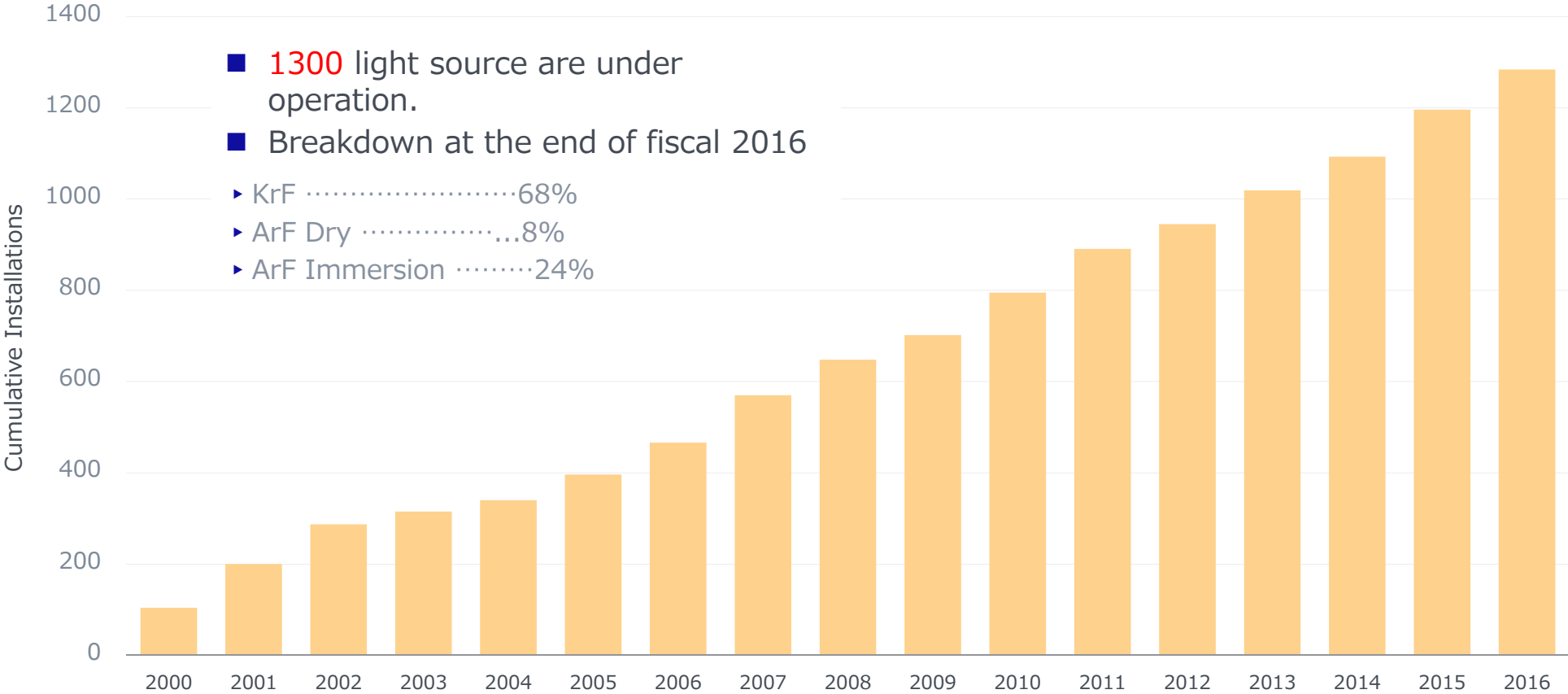
Part lifetime extension enables cost reduction

(Customer benefits) Ease of cost management

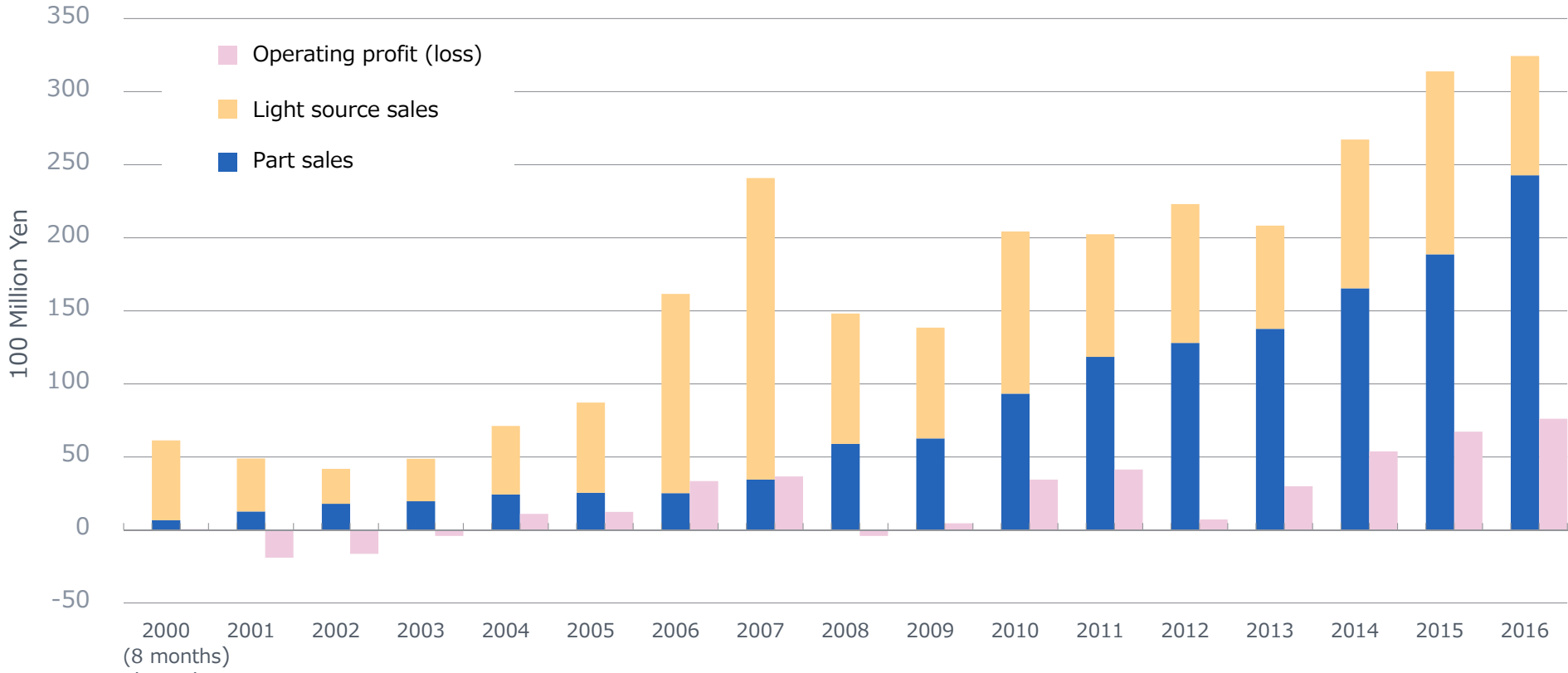
Maintenance plan can be optimized to maximize utilization



Cumulative Light Source Installations



Sales and Profit Trend(Non-consolidated)



Priority for Exposure Light Source

■ Support for expanding Chinese market

- ▶ In June 2014, the State Council of China issued the "National Guideline for the Development and Promotion of the IC Industry," to support the development of the domestic semiconductor industry.
 - ▶ Semiconductor sales in 2015 will be increased by 40% compared with 2013, and in 2030 a number of world-class companies will be nurtured.
 - ▶ Established "China IC Industry Fund" of 2 trillion yen

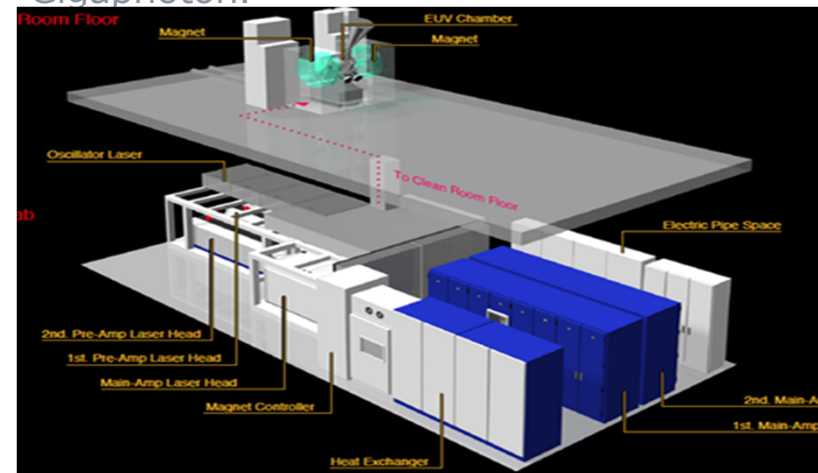


Notes:
1. The Revenue number is the sum of China IC companies' sales, including IC Fables, Foundry, IDM & OSAT;
2. Revenue Target (2015): >\$57.5 Billion (RMB 350Billion);
3. Y2015~Y2020 CAGR Target: >20%

Source: CSIA, SEMI

■ Introduction of EUV light source into the market

- ▶ Major semiconductor manufactures are planning aggressive investment to apply EUV for 7nm to 5 nm process.
- ▶ Highest level of durability and reliability are required for mass production.
- ▶ Two suppliers only. ASML(Cymer) and Gigaphoton.



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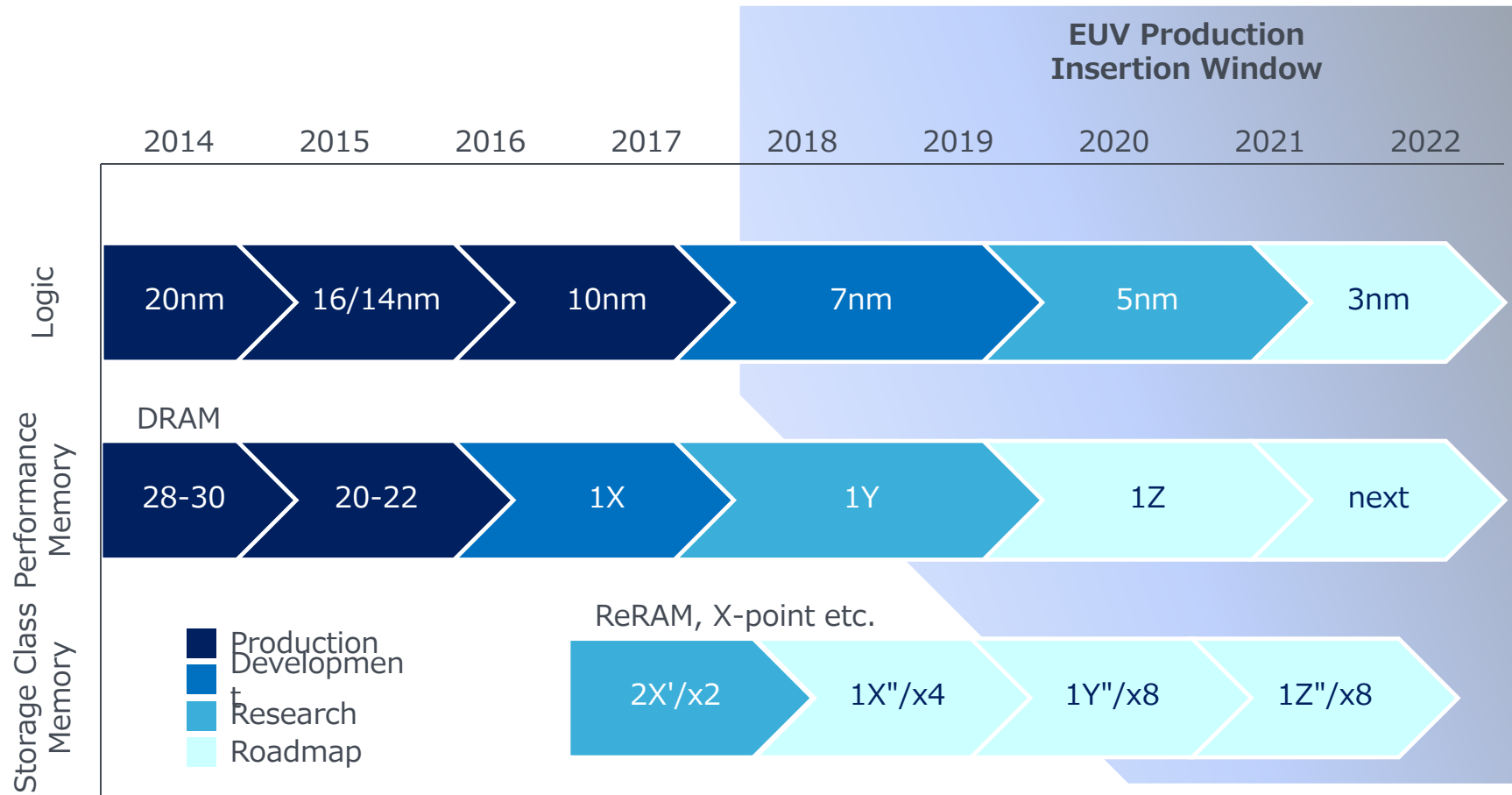
Gigaphoton's Strategy for China Market

■ One Gigaphoton Support

- ▶ Gigaphoton group is organizing a cross-sectional project centered on Optical division of Komatsu Industrial Shanghai(KIS) with HQ and oversea subsidiaries in order to quickly strengthen the China business.
 - ▶ Strengthen local sales force
 - Support form Gigaphoton HQ, Taiwan(GPT) and Korea(GPK)
 - ▶ Opening of new support offices
 - 6 offices (Today) → 11 offices (End of FY2017)
 - ▶ Opening of Training Center
 - August 2017, Gigaphoton opened a training center in order to train new service engineers at Komatsu China in Changzhou City.



Semiconductor Roadmap & EUV Insertion

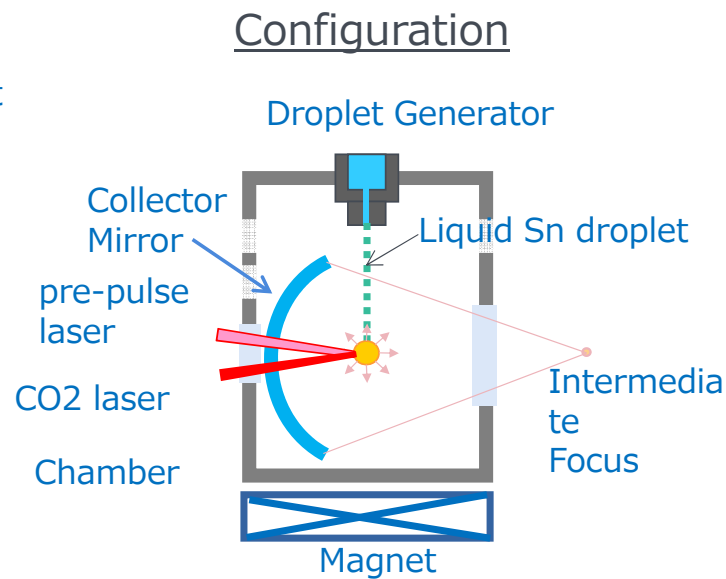
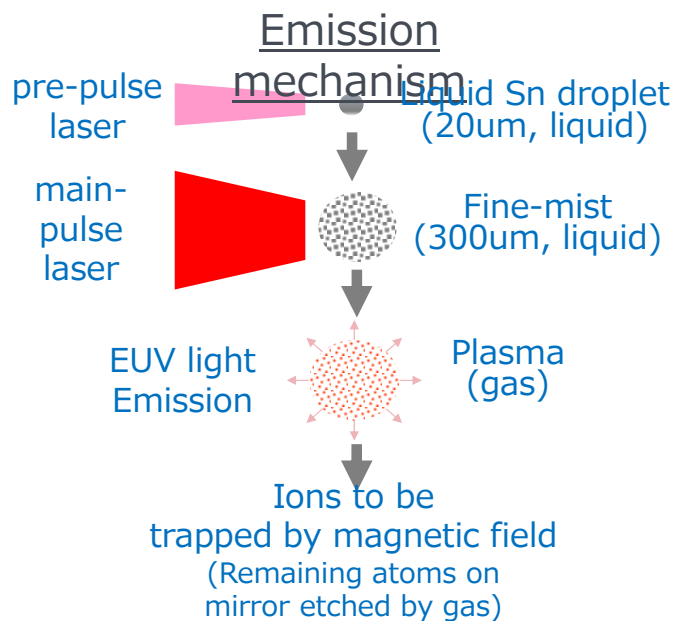


* Source: ASML Materials

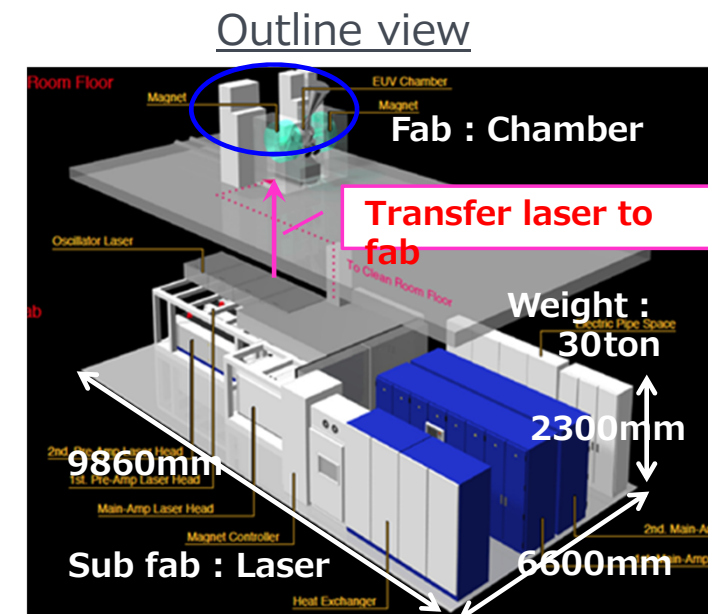


Technology Concept of EUV Light Source

- High efficiency (x1/2 energy saving)
 - ▶ High conversion efficiency by Pre-Pulse Technology (picosecond YAG laser)
 - ▶ High power CO2 laser co-developed with Mitsubishi Electric
- High durability, High reliability
 - ▶ Tin(Sn) debris mitigation with a super conductive magnetic field

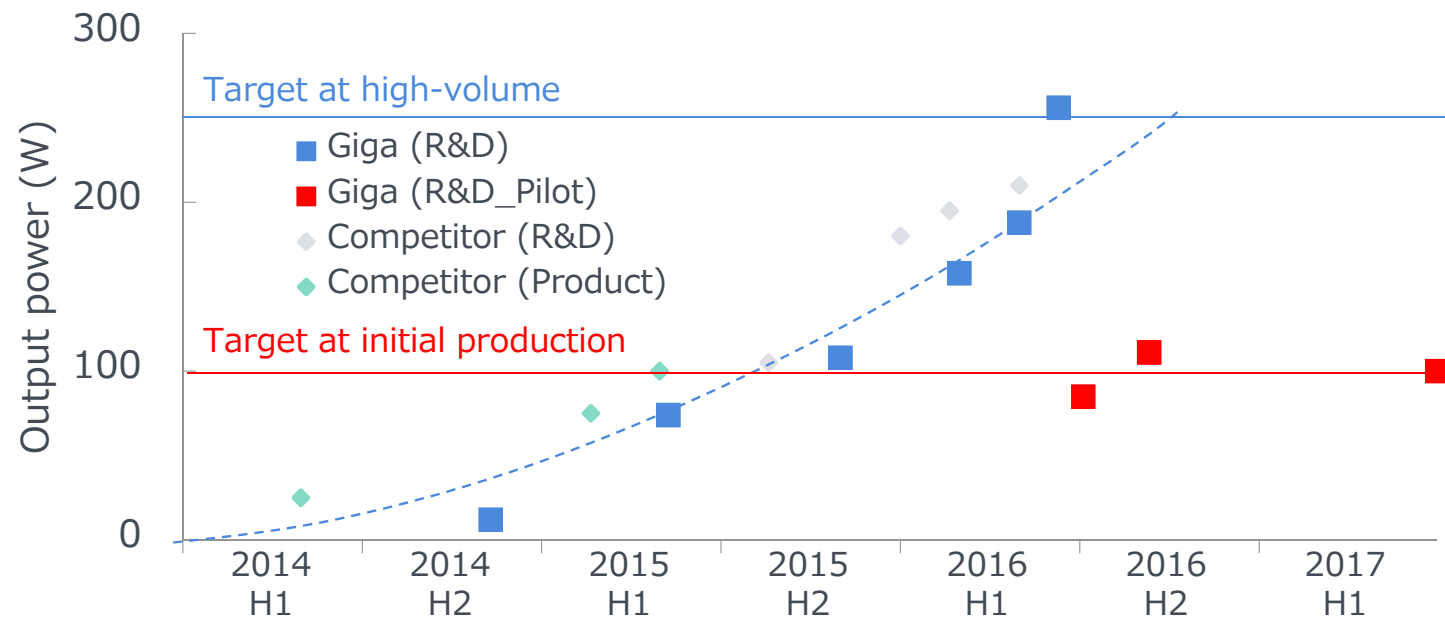


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EUV Light Source Development Progress

- Achieved 250W output power, matching with the competitor under laboratory environment
- Current focus is on reliability improvement at the 100 W level (target at initial mass production) with pilot type EUV light source.



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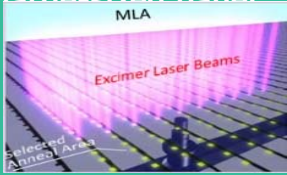
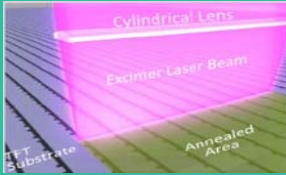
Light Source for FPD Annealing



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Support Large-sized Glass Substrate

- Glass substrate has become larger along with upsizing TV screen.
- Our competitor cannot support beyond G6 due to their annealing optical system design.
- Glass substrate larger than G6 size is currently under development by a novel method by our partner, V-Technology company.

Size of glass substrate※1	V-Technology's annealing method (PLAS※2) for large-sized panel	Competitor's annealing method (ELA) for small to mid-sized panel
		
G6 X1500mm Y1850mm	○ Capable	○ Capable
G8 X2200mm Y2400mm	○ Capable	(No track record) ※3
G10 SDP X2880mm Y3130mm	○ Capable	(No track record)
G10.5 BOE X2940mm Y3370mm	○ Capable	(No track record)

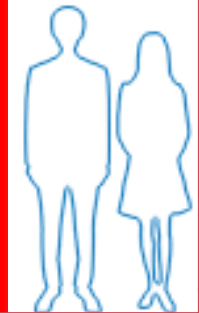
G10.5 2940mm × 3400mm

G8 2160mm × 2400mm

G7 1870mm × 2200mm

G6 1500mm × 1800mm

G5 1100mm × 1250mm





※1 Size of glass substrate (Above figure)

※2 PLAS : Partial Laser Anneal Silicon

※3 Our competitor's line beam method has no track record for glass substrate larger than G6 due to the size limitation of the irradiation optical system



Features of Light Source for FPD Annealing

Application	FPD annealing	Semiconductor exposure
Type	GT600K	GT64A
Appearance ※FPD annealing laser has a new and different panel color.		
Specifications		
Wavelength	248nm	193nm
Repetition Rate	6000Hz	6000Hz
Pulse Energy	100mJ	10mJ
Output Power	600W	60W

New Head Office Building Completed

- Manufacturing capacity expansion (x1.4) to support increasing light source demand
- Improvement of office environment





THANK YOU