EUV Actinic Blank Inspection Tool Development

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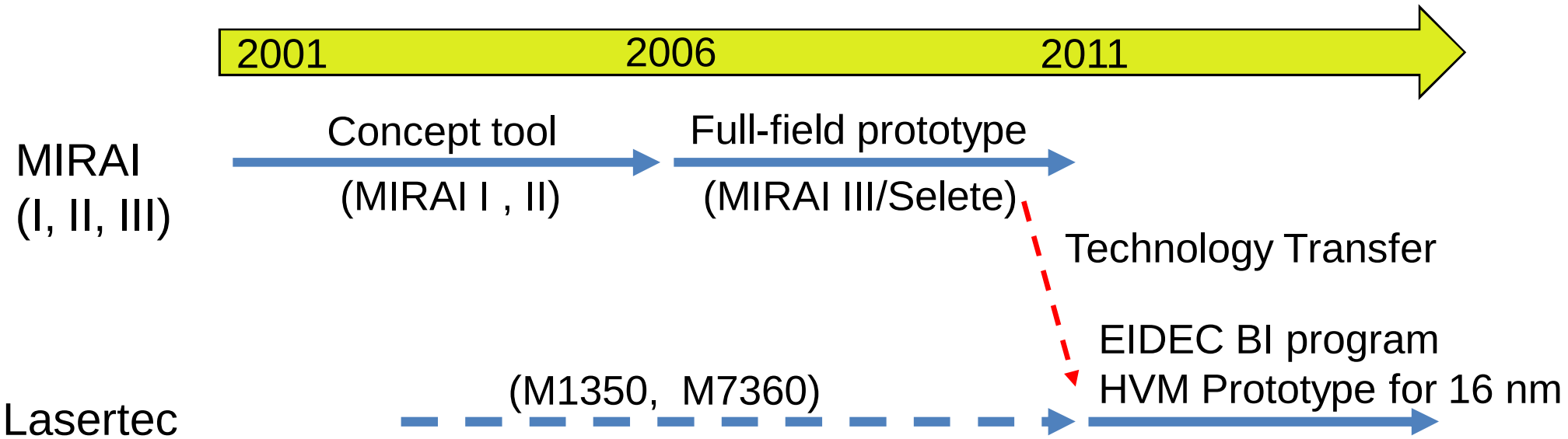
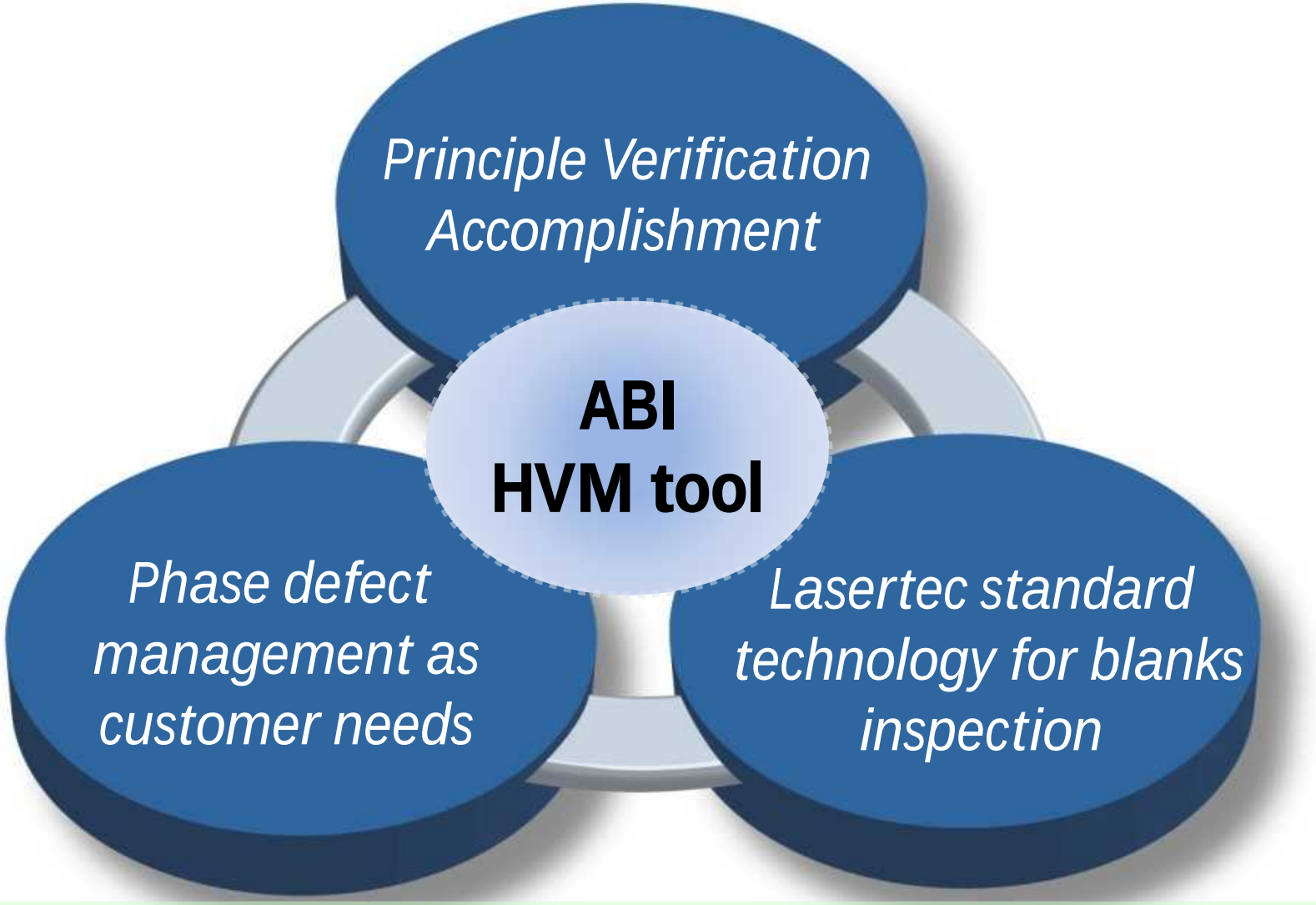
Contents

ABI HVM tool development

- An ABI HVM (Actinic Blank Inspection for High Volume Manufacturing) tool will be developed, by taking over the concept of principle verification for the dark field ABI tool accomplished by MIRAI Project(I,II,III).
- The development of the ABI HVM tool will be implemented under the Blank Inspection Technology Program of EIDEC.
  - Co-development of Lasertec and EIDEC
  - Commercialization of a HVM tool for 16 nm in 2013



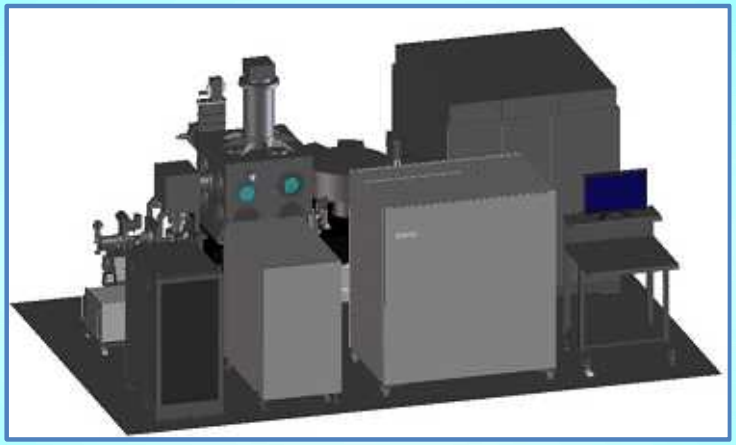
Actinic blank inspection for HVM



Lasertec, under the support of EIDEC, transforms the actinic blanks inspection concept verified by the MIRAI project to a commercial tool. The tool will enable the phase defect management.

Lasertec EUV tools

The Actinic Blank Inspection tool will be newly added to the Lasertec product line for EUVL technology



Actinic Blank Inspection

MAGICS

Mask blank inspection tool

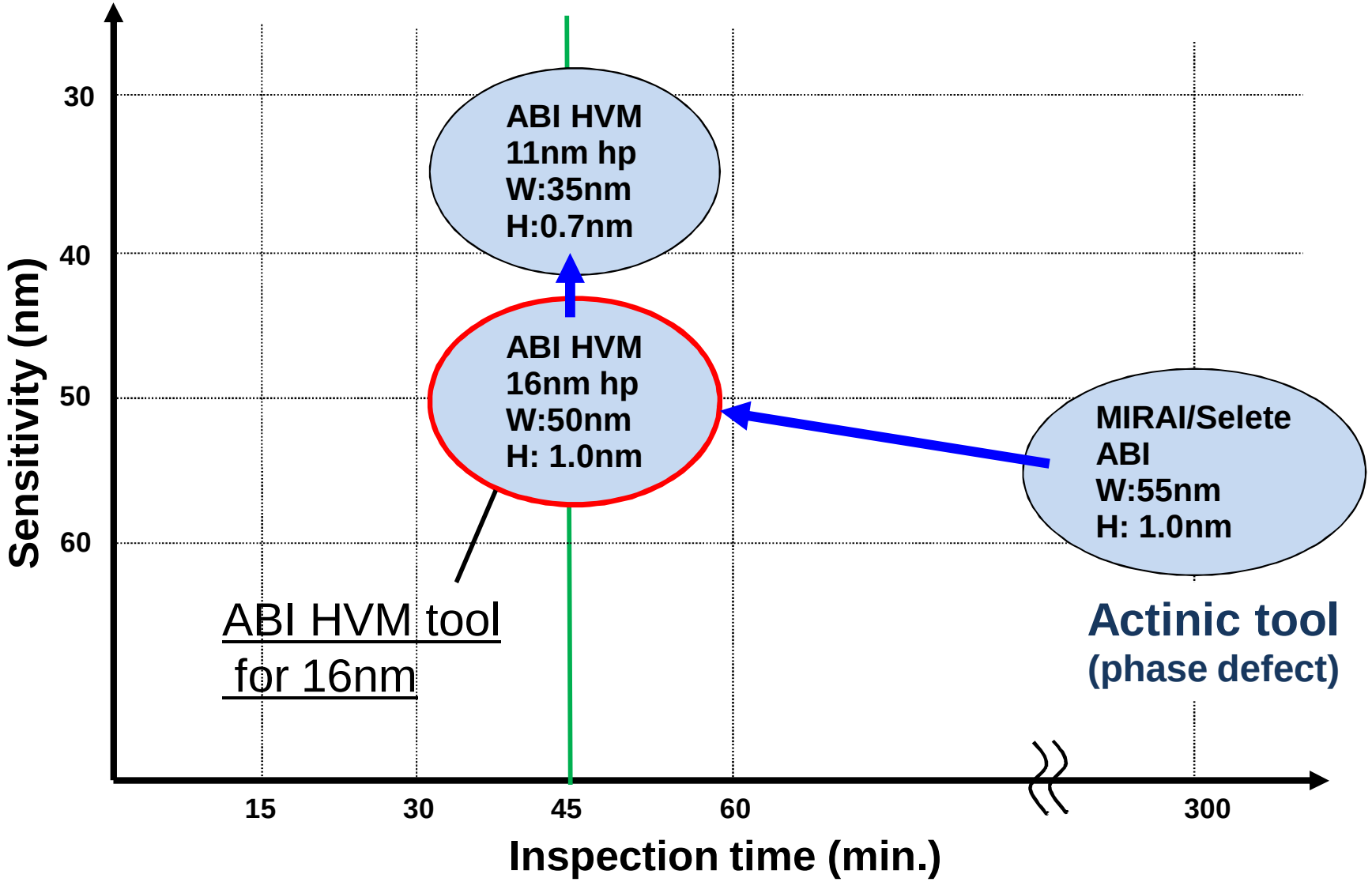
MATRICS

Mask pattern inspection tool

DP200

Dual Pod Handling tool

Mask blank inspection target performance



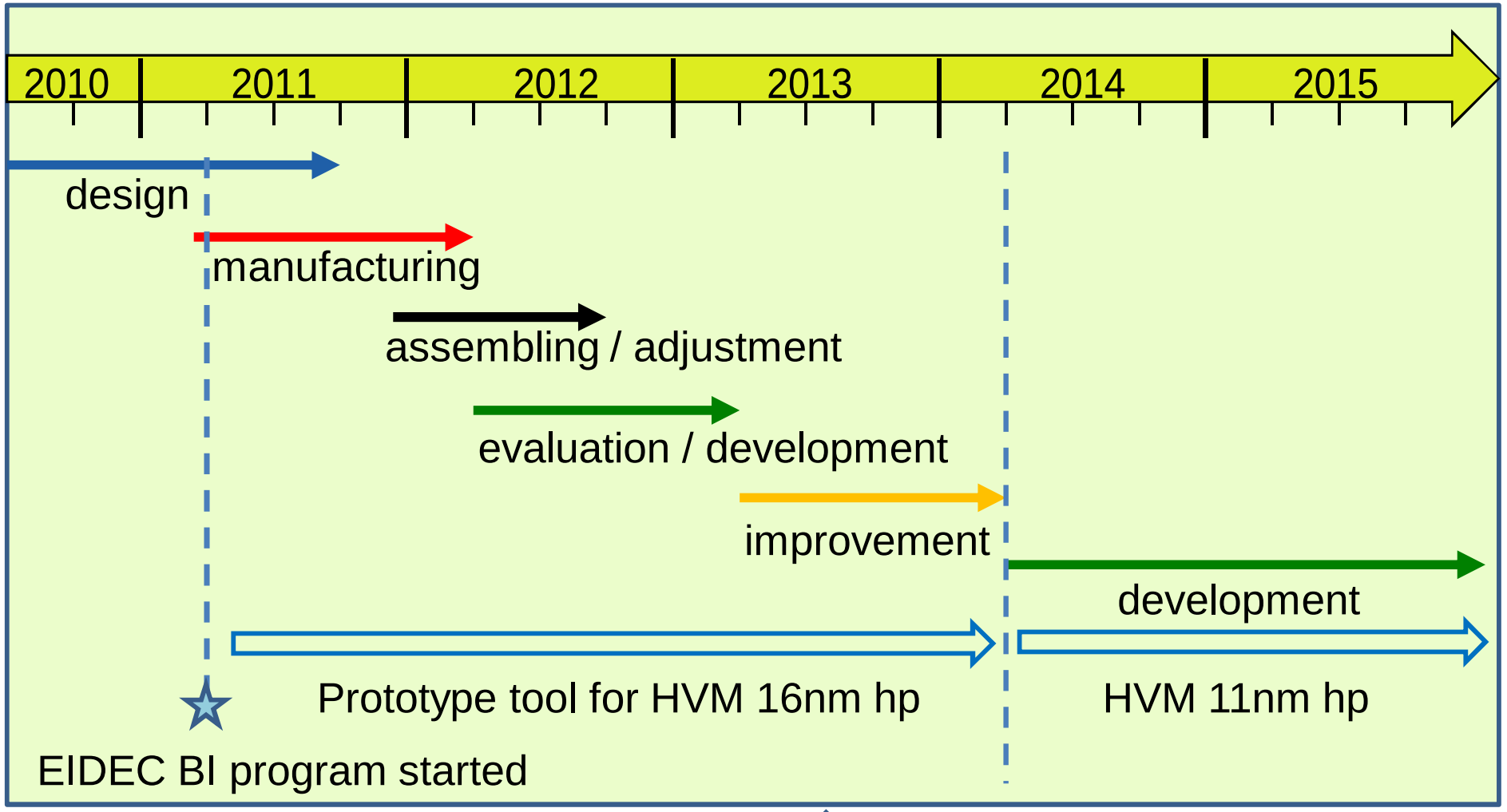
1. Introduction
2. ABI program status
3. ABI tool Design
4. Defect coordinate accuracy
5. Summary

ABI HVM 16nm specification

Attribute Item	Specification
Mask inspection	6 inch EUVL mask Inspection area : 142mm X 142mm
Inspection time	<= 45 minutes
Defect Sensitivity - Phase Defects	Minimum detectable defect on top of ML. Height 1 nm; Width 50nm (FWHM)
Defect location accuracy by compensation using the fiducial mark position	Target < ±1μm ※ An optional review optics targeting the location accuracy of 20 nm will be developed.
Defect observation (Review)	Available
Optical Magnification	Inspection : 26X Review mode : >600X (at the planning phase)
Cleanliness The number of particles:>=50 nm	10 cycle with 0 adder

ABI tool schedule

EIDEC – Lasertec Blank Inspection project



ABI HVM for 16nm will be released in 2013

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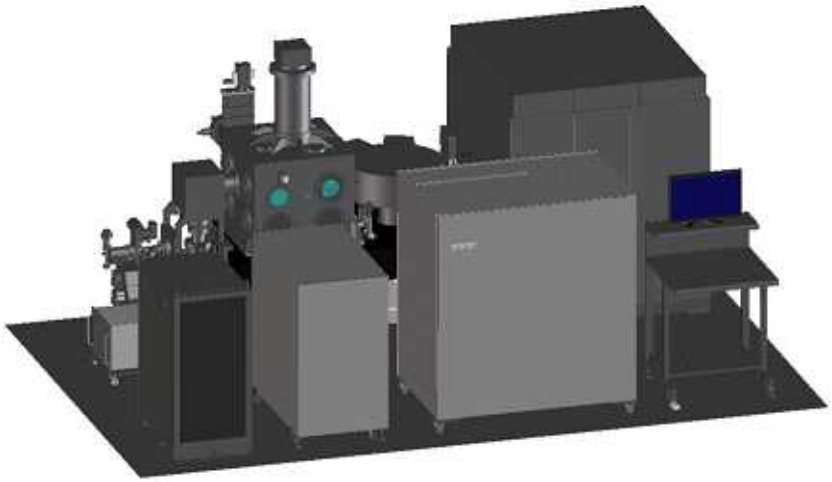
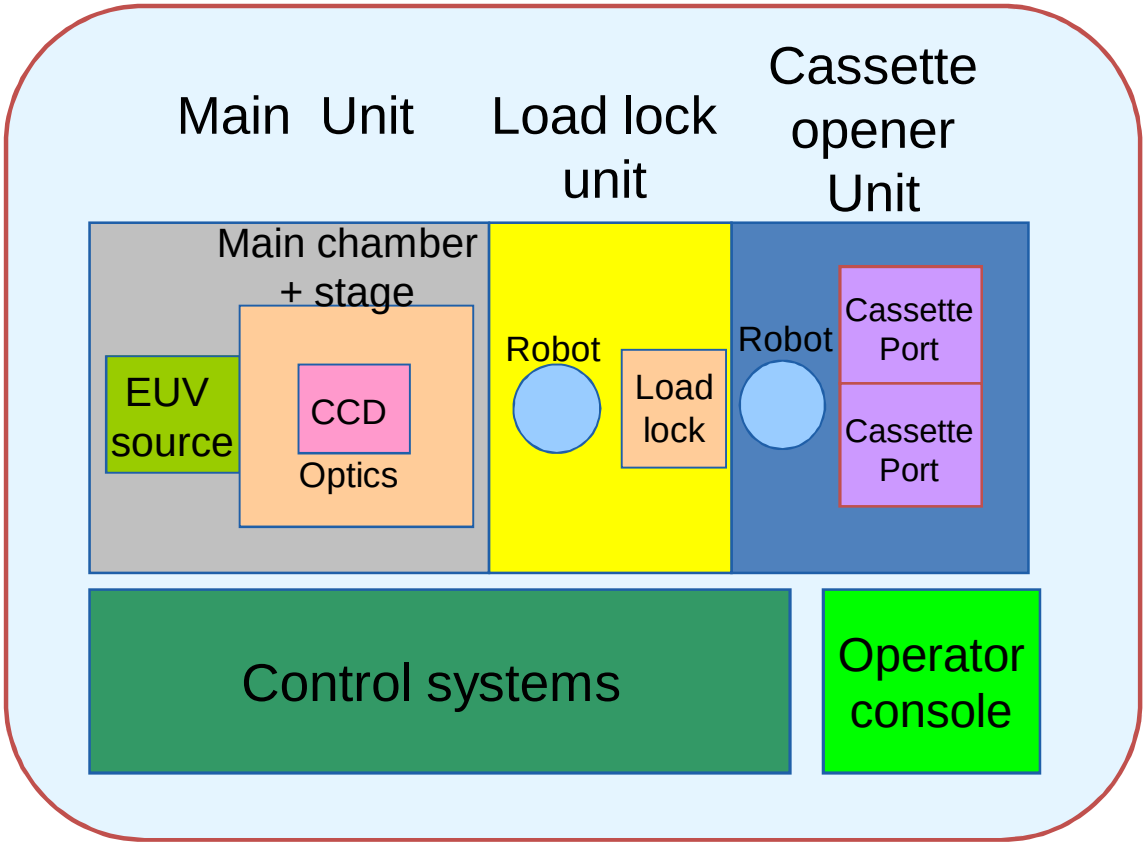
ABI Tool Design

-- tool size : ~ 4m x 5m

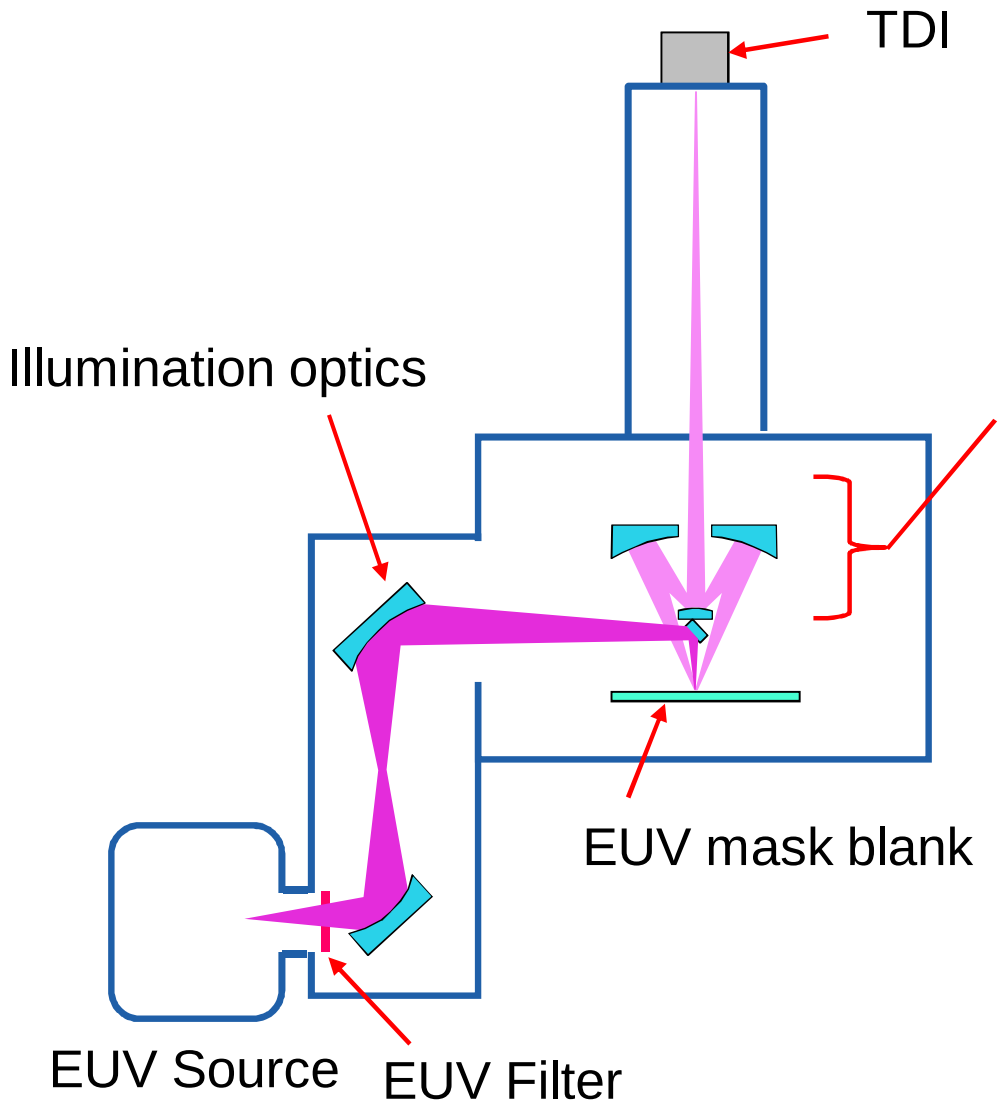


ABI tool image



ABI tool configuration

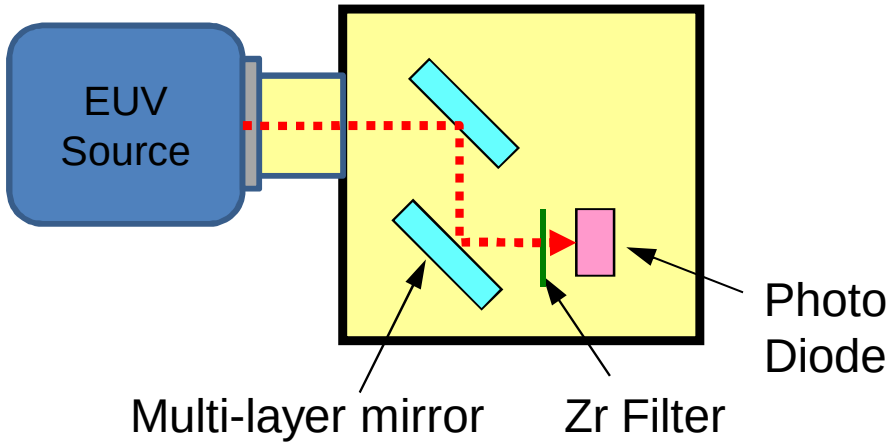
ABI inspection optics



1. Dark field inspection
   --- High throughput
   --- High sensitivity
2. Actinic inspection
   --- Detect printable phase defect

Realization of high brightness at mask surface

1. Employment of a new EUV source
   Actual measurement evaluation test was performed with a EUV power measurement system.



EUV power measurement system

EUV source performance comparison

	MIRAI/Selete	ABI HVM 16nm
EUV power	**1**	**2 ~ 4**
Etendue	**1**	**1**
Brightness	**1**	**2 ~ 4**
Fluctuation	**1**	**0.1 ~ 0.3**

2. Application of a new illumination optics
   ~ 2X higher EUV transmission is expected.

4 - 8 X higher Brightness at mask surface is expected.

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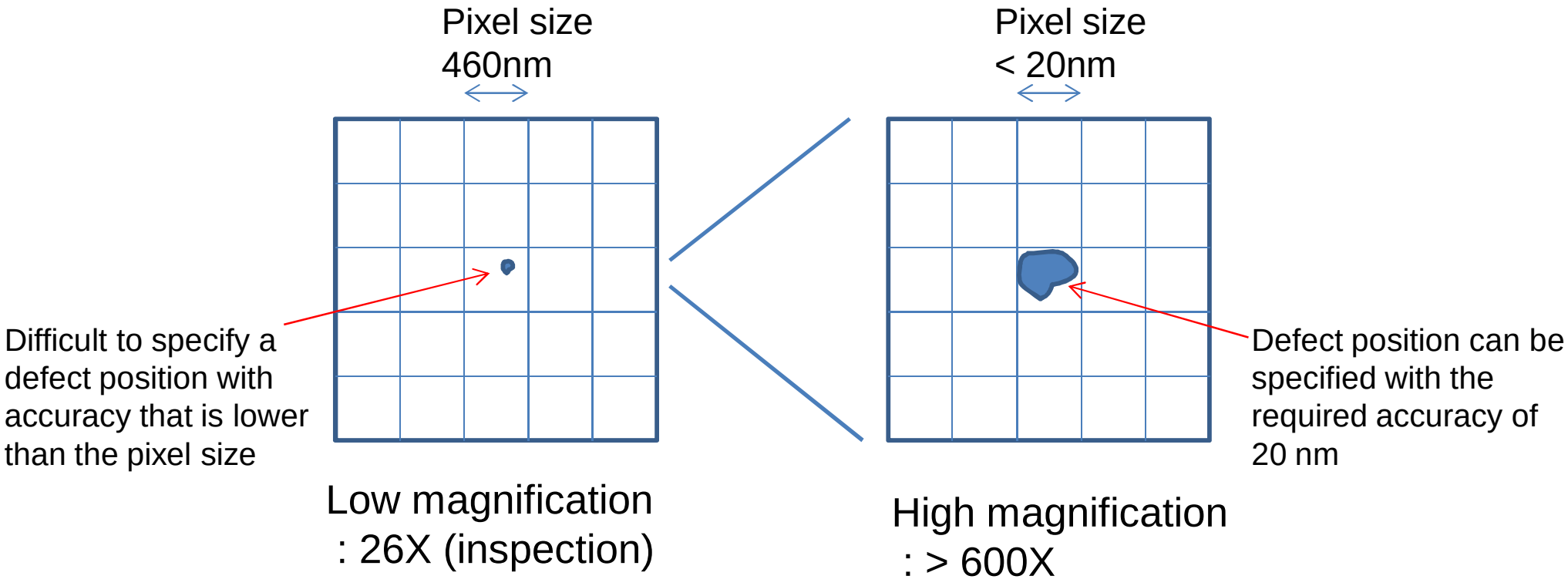
Specification of the defect coordinate accuracy

- The ABI tool requires the defect coordinate accuracy of 20 nm for the defect mitigation of blanks.

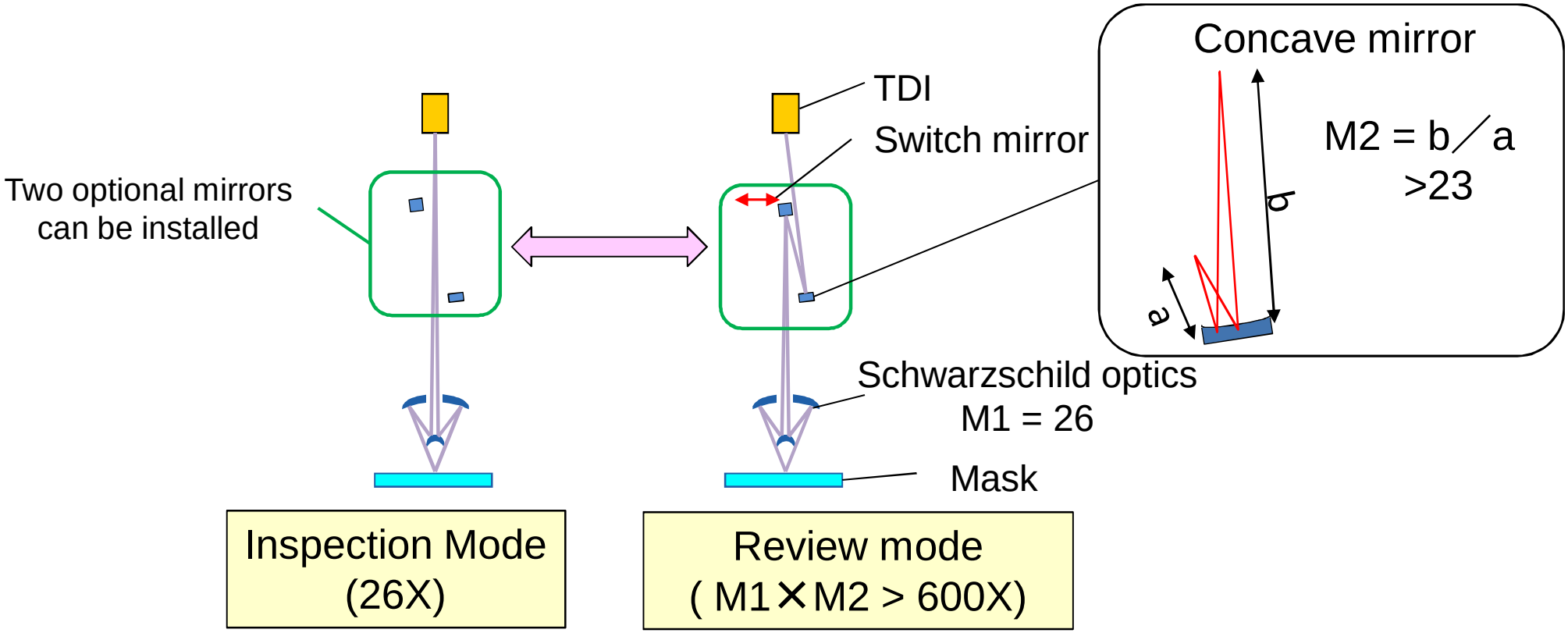
  → The resolution limit needs to be smaller than the pixel size.



The relationship between the pixel size and the defect size.

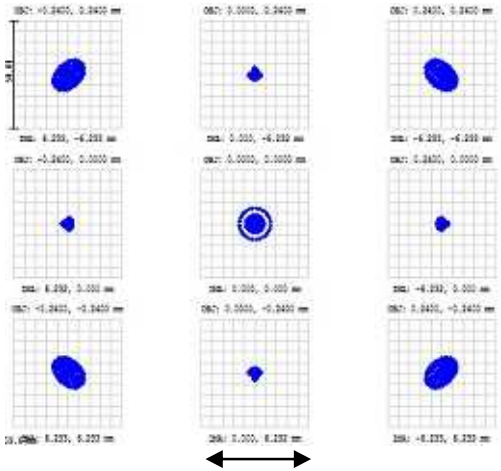
High magnification review optics

- The ABI tool will perform defect position measurement of 20 nm.
  - -- For inspection, the 26X Schwarzschild optics is used prioritizing the throughput.
  - -- For review, a switch mirror is inserted into the optical path and observation is performed under the high magnification of > 600X.
  - -- Defect position is accurately measured by referencing the fiducial mark.



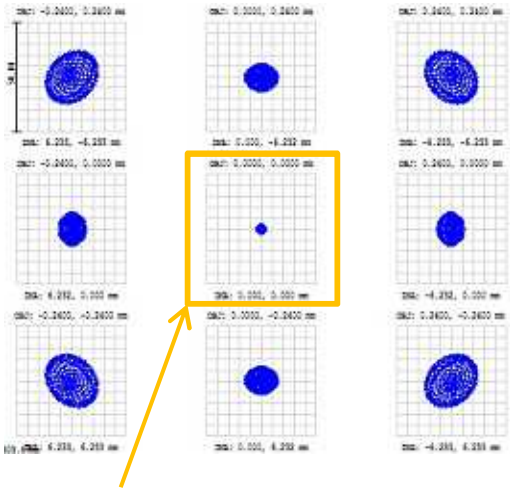
Simulation of the review optics

Simulated spot diagrams of the 26X Schwarzschild optics (0.48x0.48mm)



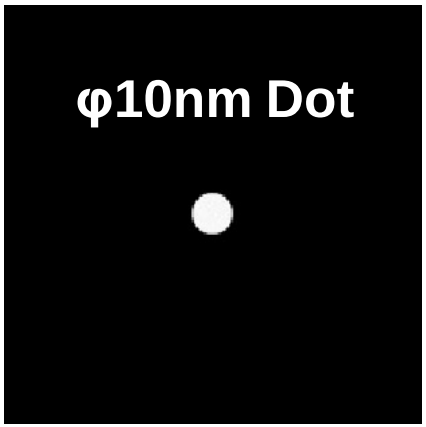
50um at TDI

Focus adjust at field center



Center of the field is used for review

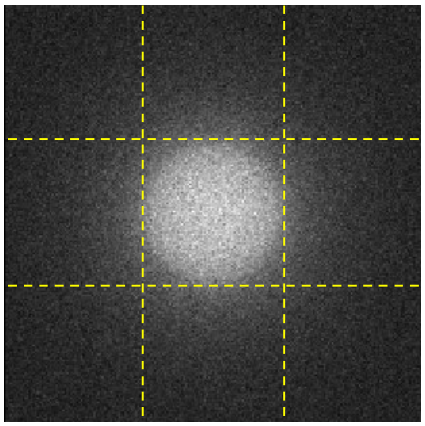
A simulation image of the review optics at the magnification of 1200X



On mask

1200X

10nm at mask



On TDI

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Summary

1. Lasertec develops an ABI HVM tool under the Blank Inspection Technology Program of EIDEC.

2. The ABI tool development status:
   -- The basic design of the ABI tool has been completed
   -- The tool is currently under fabrication.
   -- Assembly of the unit will start in December 2011.

3. Higher throughput and sensitivity are accomplished by brighter illumination.

4. A high magnification review optics realizes the required defect location accuracy.

Acknowledgement

We would like to thank:

-- all the members of the EIDEC BI program

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