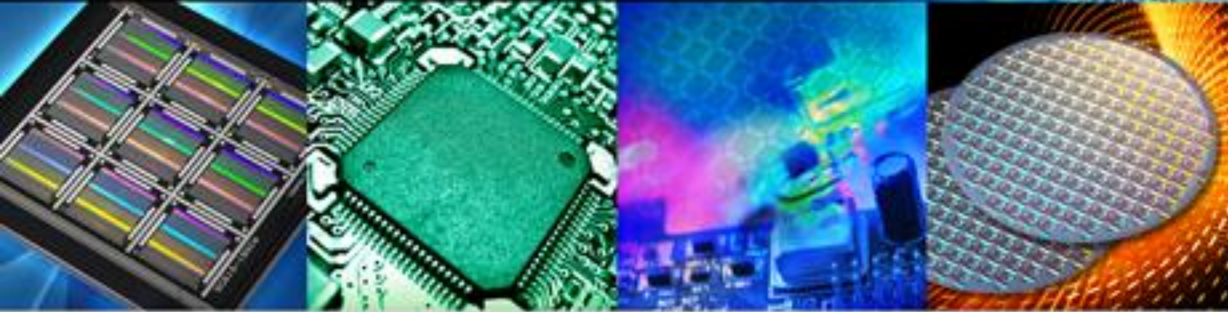
Lasertec

EUVL Symposium 2013



High Magnification Review Function for defect location accuracy improvement with EUV Actinic Blank Inspection Tool

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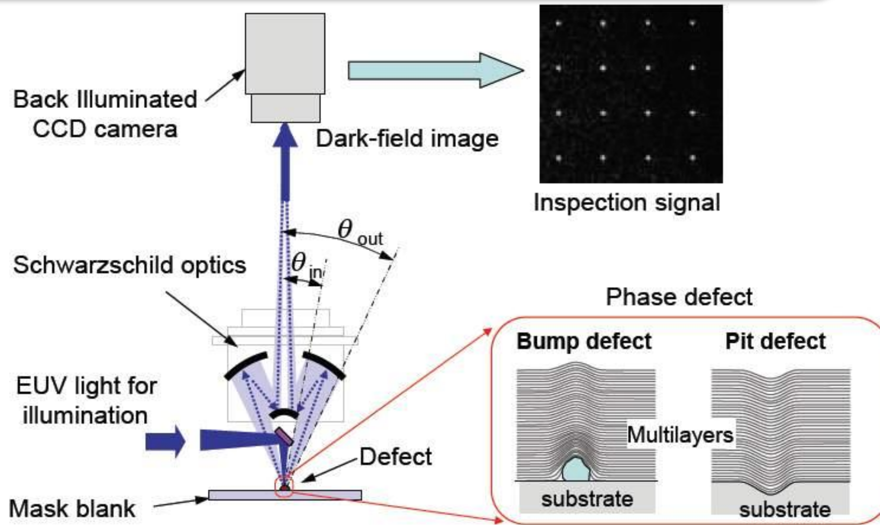
Contents

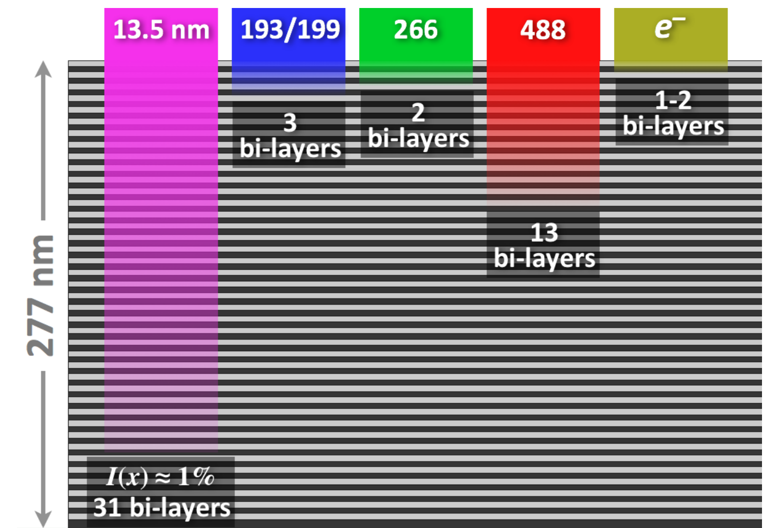
1. Introduction
2. EIDEC/ Lasertec ABI Program
3. Inspection status
4. ABI signal and Surface topography
5. Location accuracy (High mag. optics)
6. Summary

Dark Field Actinic Blank Inspection

Dark field inspection:
Inherently high throughput
and high sensitivity

Actinic inspection:
The only way to find all defects
regardless of surface topography



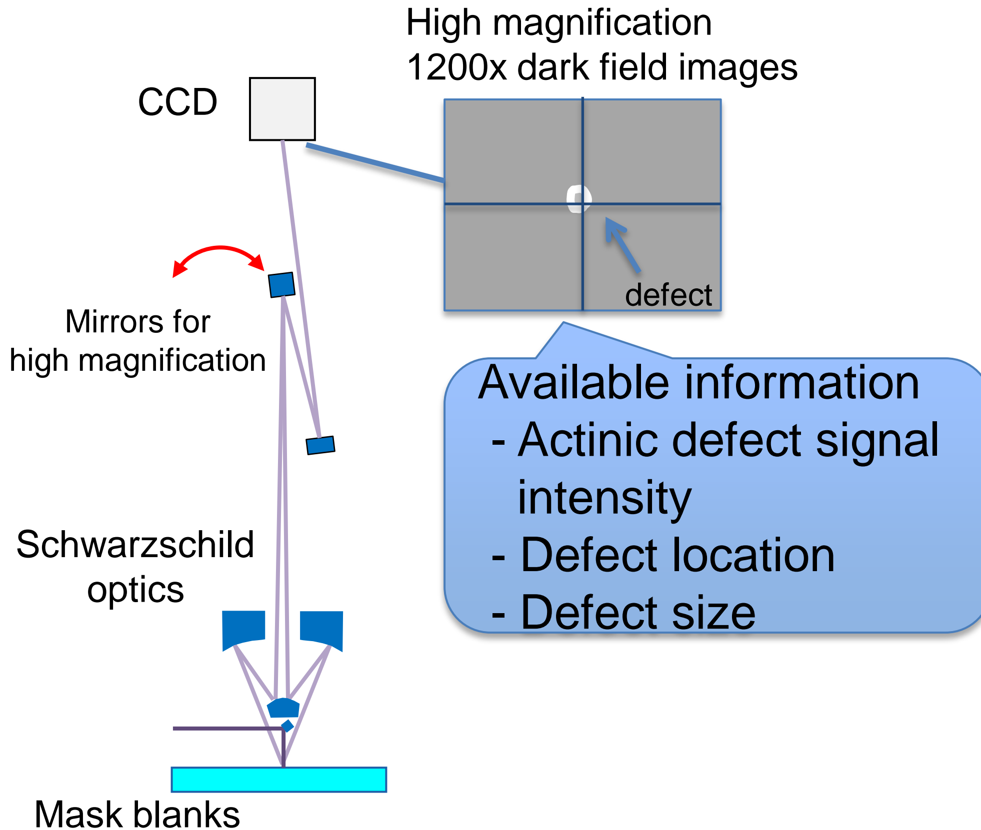


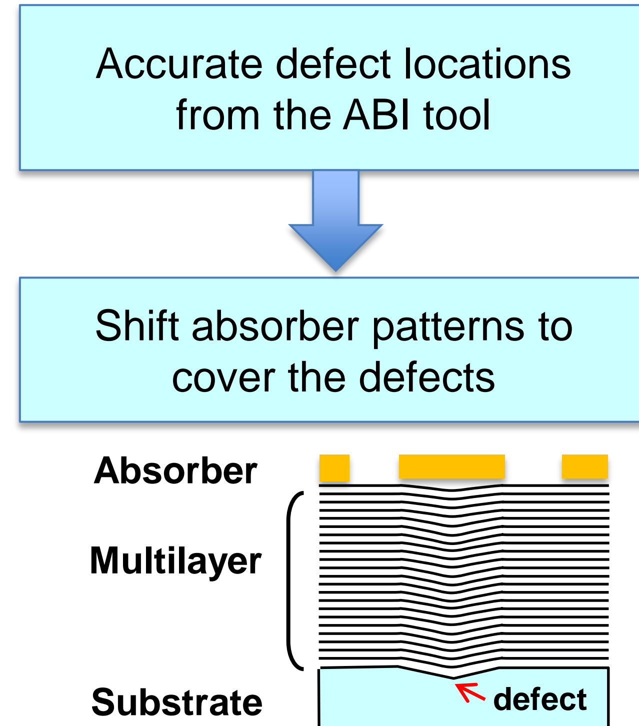
Tsuneo Terasawa et al., Development of actinic full-field EUV mask blank inspection tool at MIRAI-Selete, Proc. of SPIE vol. 7271 (2009)

K. Goldberg et al., “Defect detection and inspection unmasked”, IWEUVL, 2010

Dark field actinic blank inspection is crucial for phase defect management

High Magnification Review

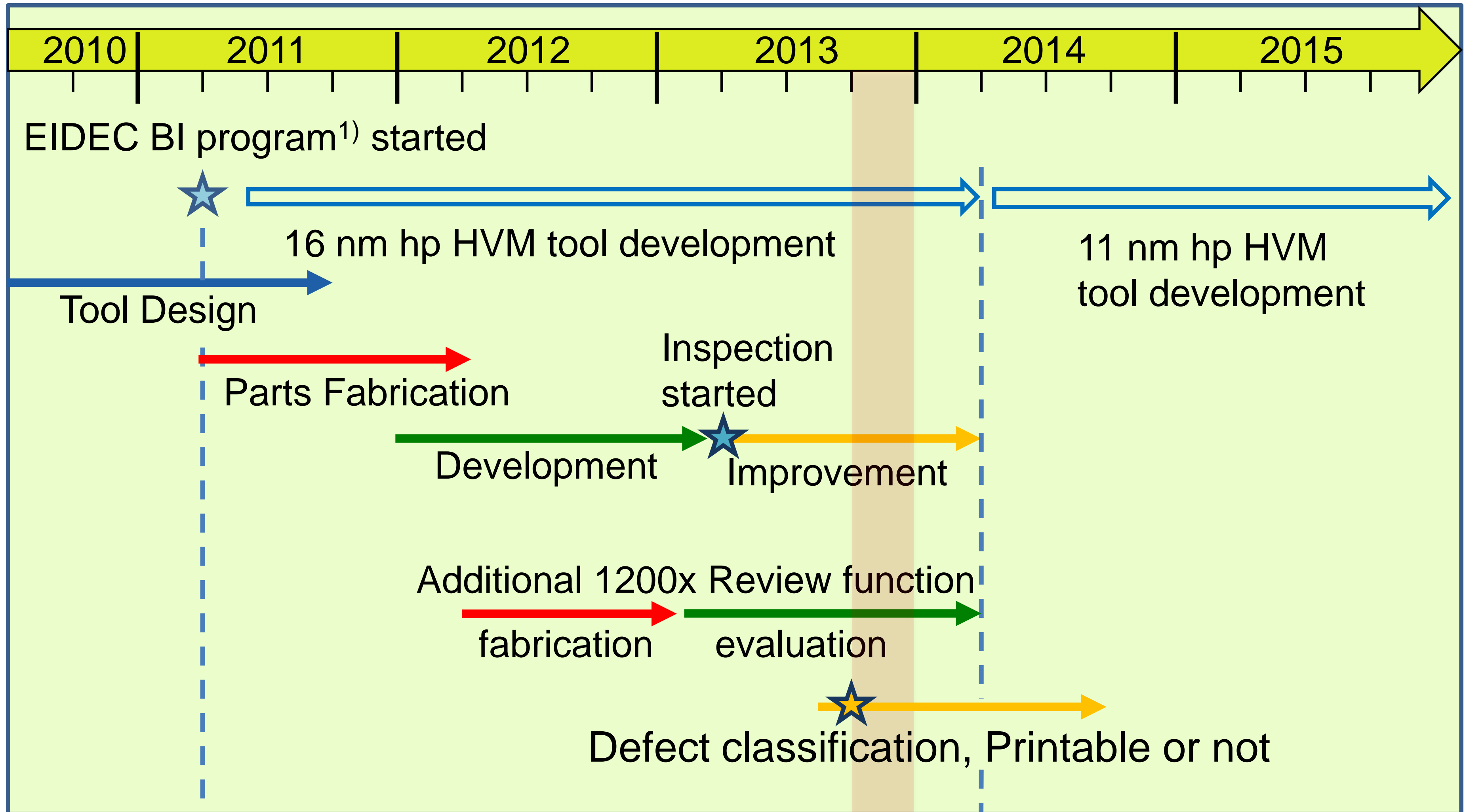




ABI high magnification review provides valuable information for the defect mitigation strategy

2. EIDEC/ Lasertec ABI Program

EIDEC/Lasertec BI Program Schedule



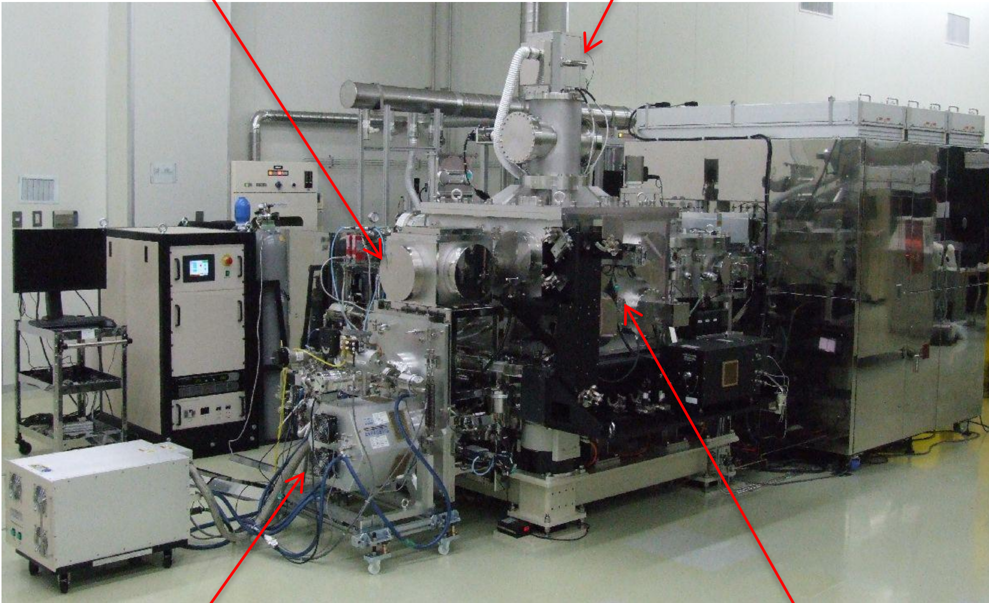
1) BI Program: Blank Inspection program

Defects classification study on going

ABI HVM tool

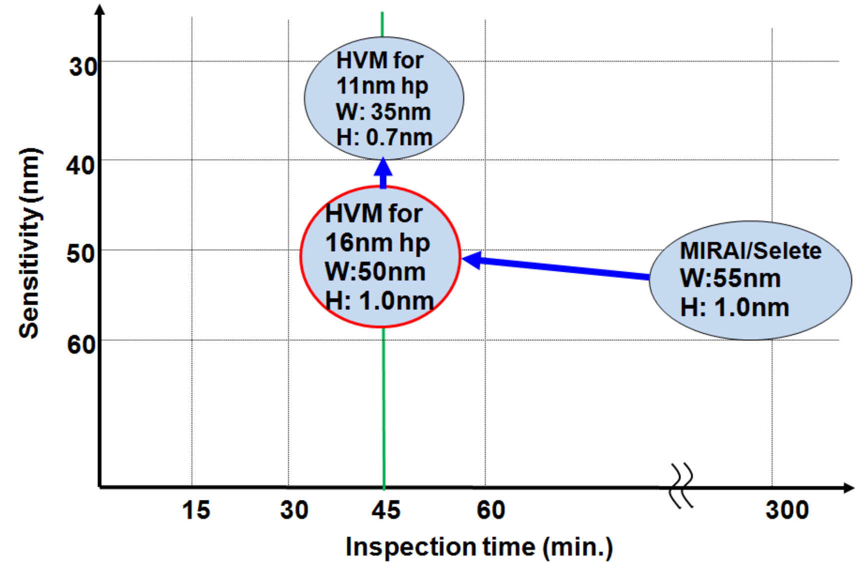
Illumination optics

CCD camera



EUV DPP source

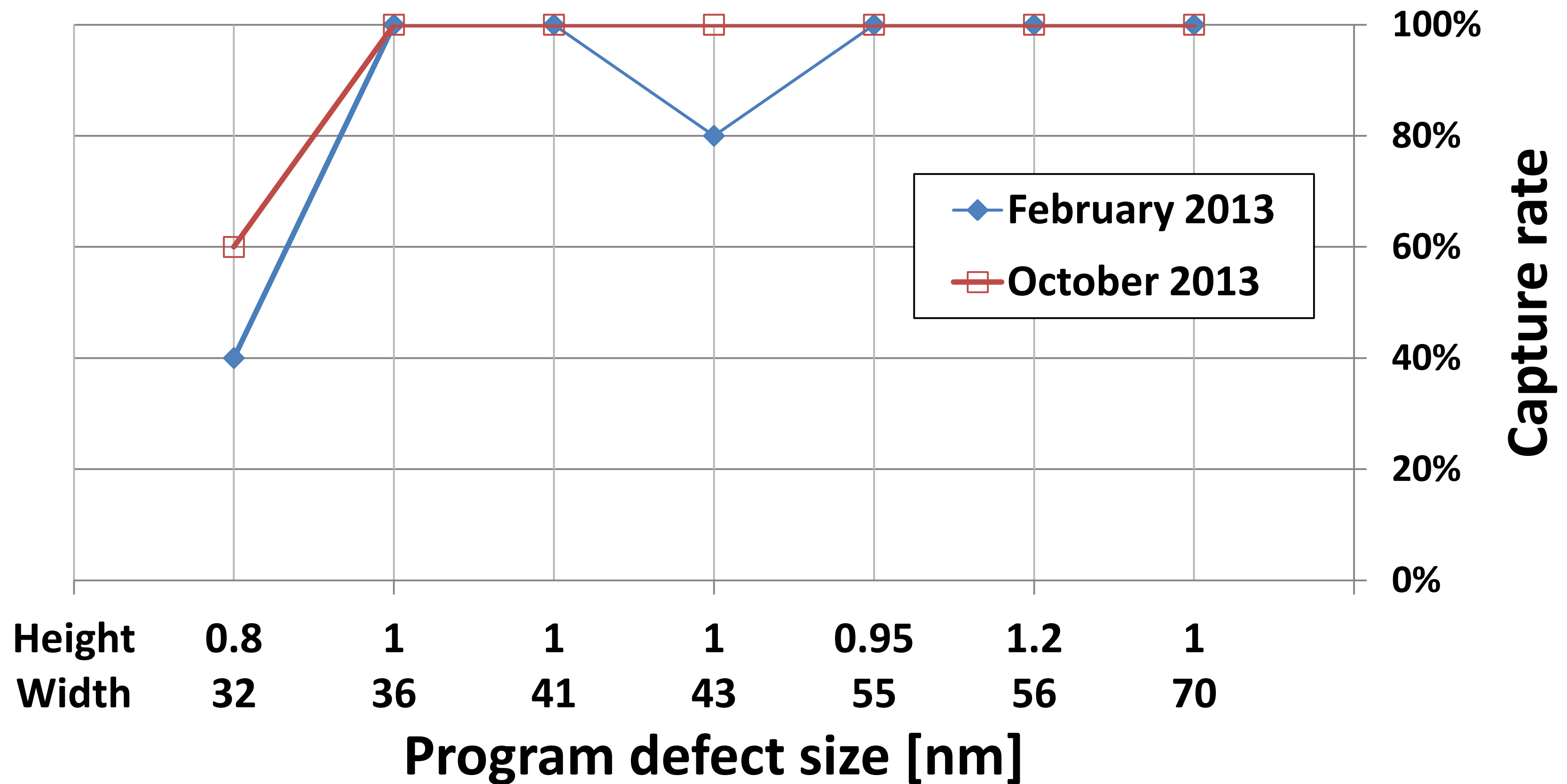
Vacuum chamber



ABI HVM Tool meets the 16nm hp specification

3. Inspection status

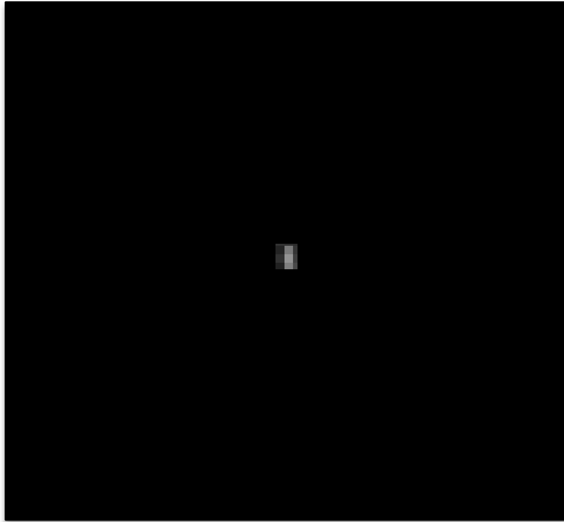
Inspection status



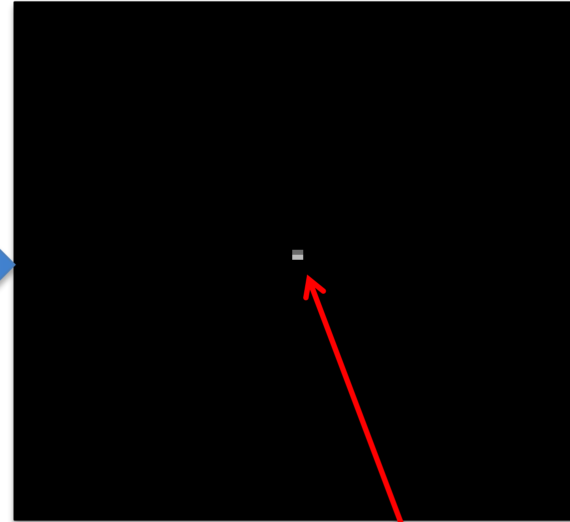
ABI HVM Tool is improving

Reducing the stage vibration

February 2013
Without stage reinforcement



Today
With stage reinforcement



Signal intensity is higher

Higher defect signal intensity improves SBR

SBR: Signal to Background ratio

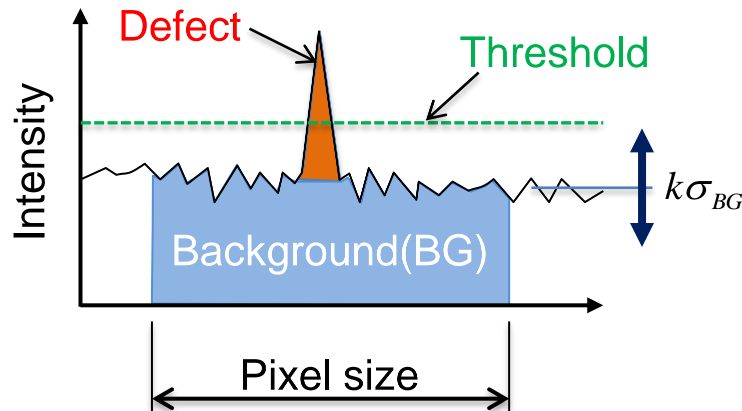
Signal to Background ratio(SBR)

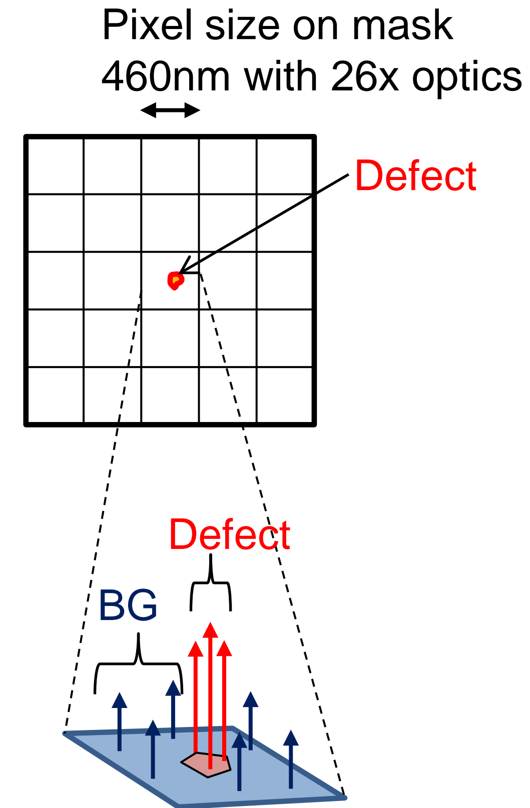
Pixel size >> Defect size

$$Signal = Background + Defect$$

$$\sigma_{Signal} = \sqrt{\sigma_{BG}{}^2 + \sigma_{Defect}{}^2}$$

$$\sigma_{BG}{}^2 \propto (Pixel\ size)^2$$

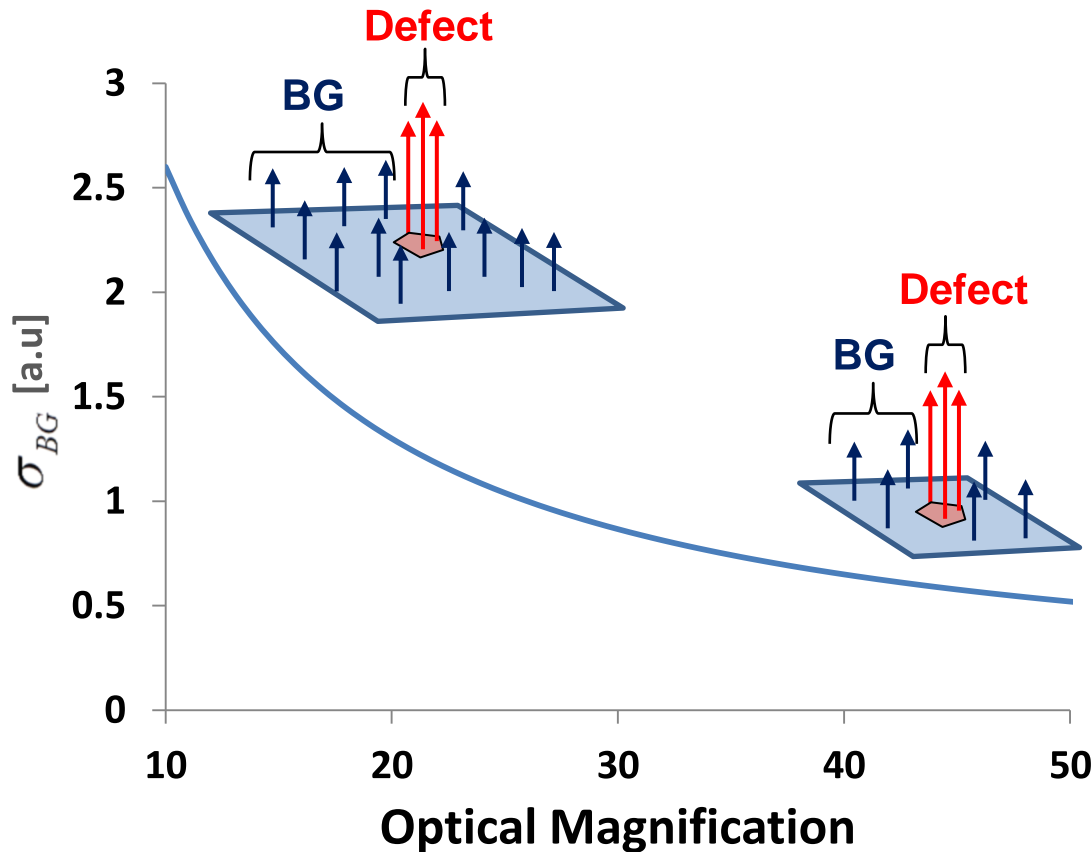


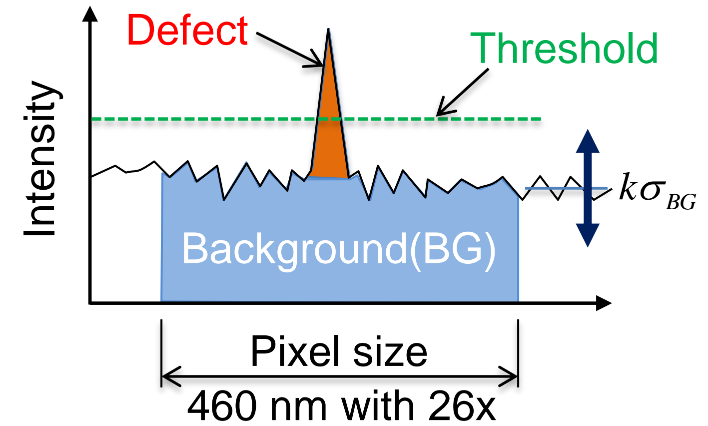


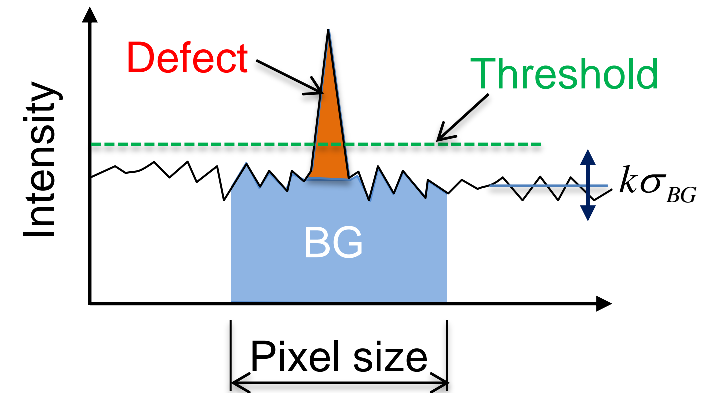
SNR improves together with SBR

ABI platform extendability for future nodes

$$\sigma_{BG}{}^2 \propto (Pixel\ size)^2$$



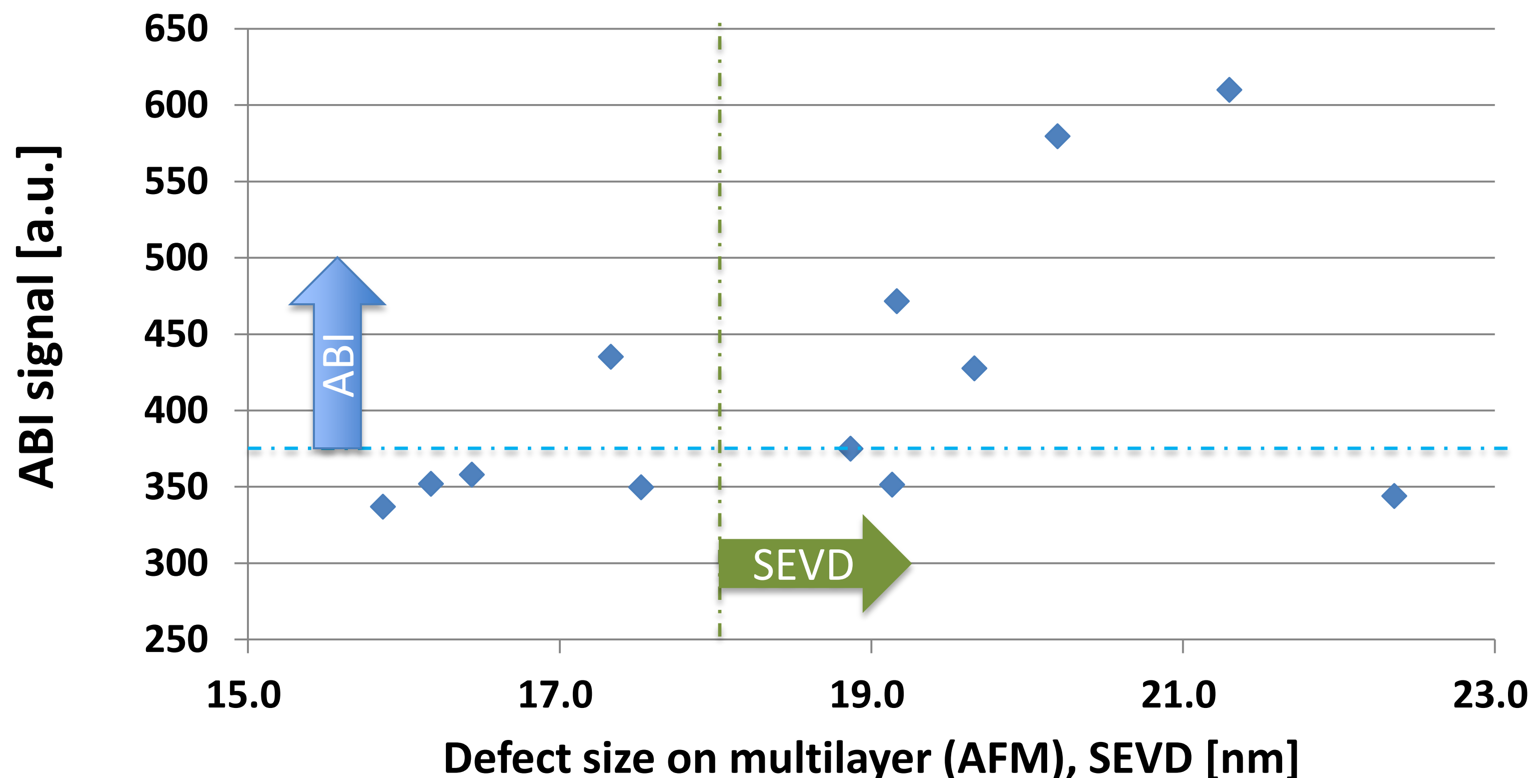




Higher Mag will enable sensitivity increase

4. ABI signal and Surface topography

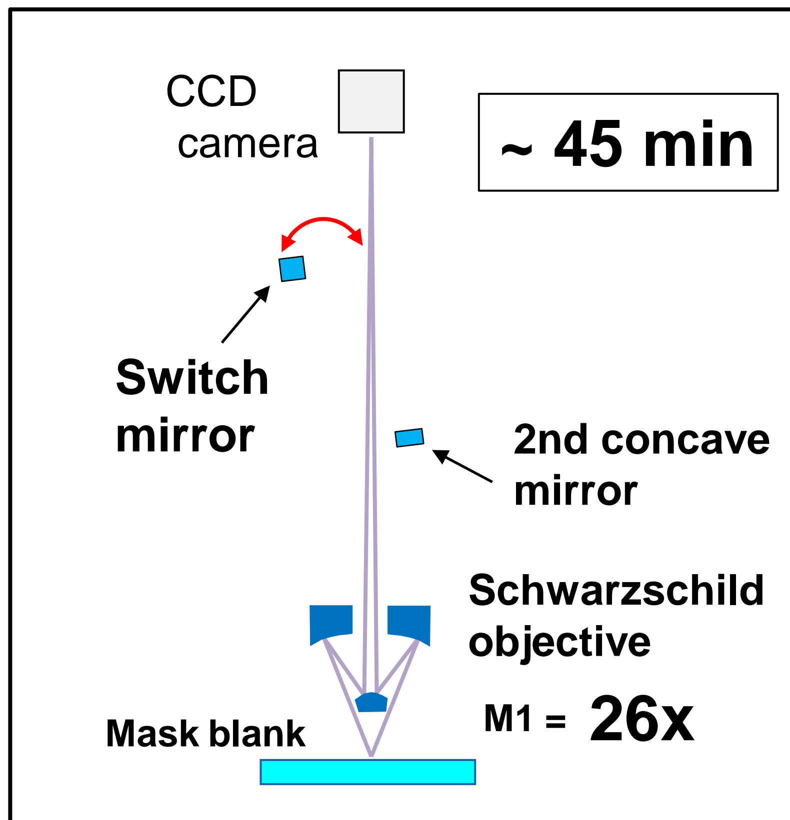
ABI signal and Surface topography

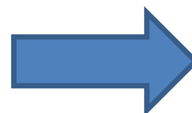


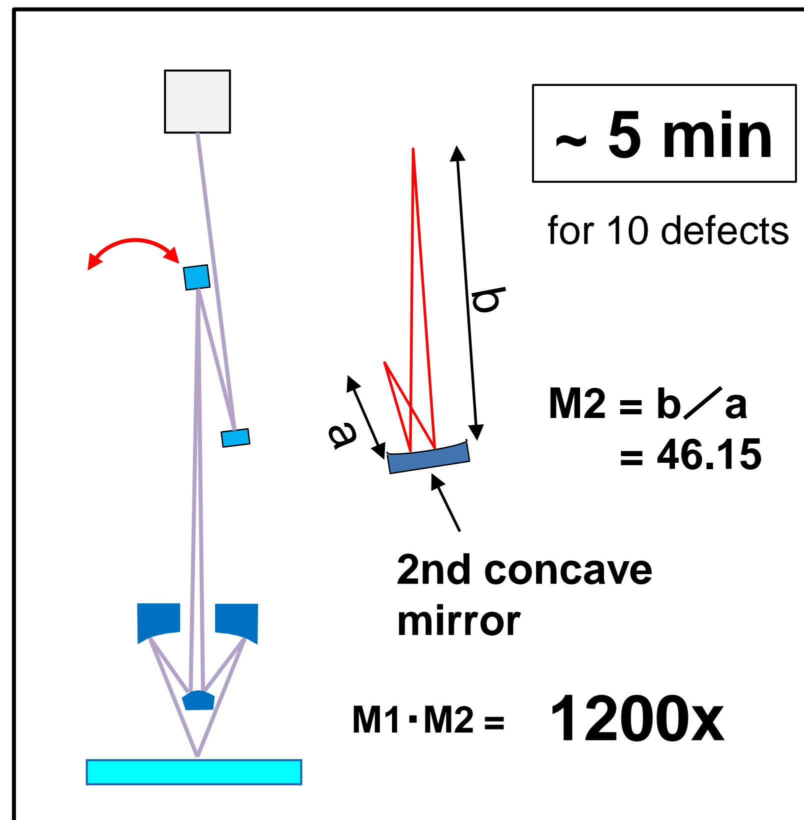
Discrepancy of
ABI signal and surface topography

5. Location accuracy

Review mode integration

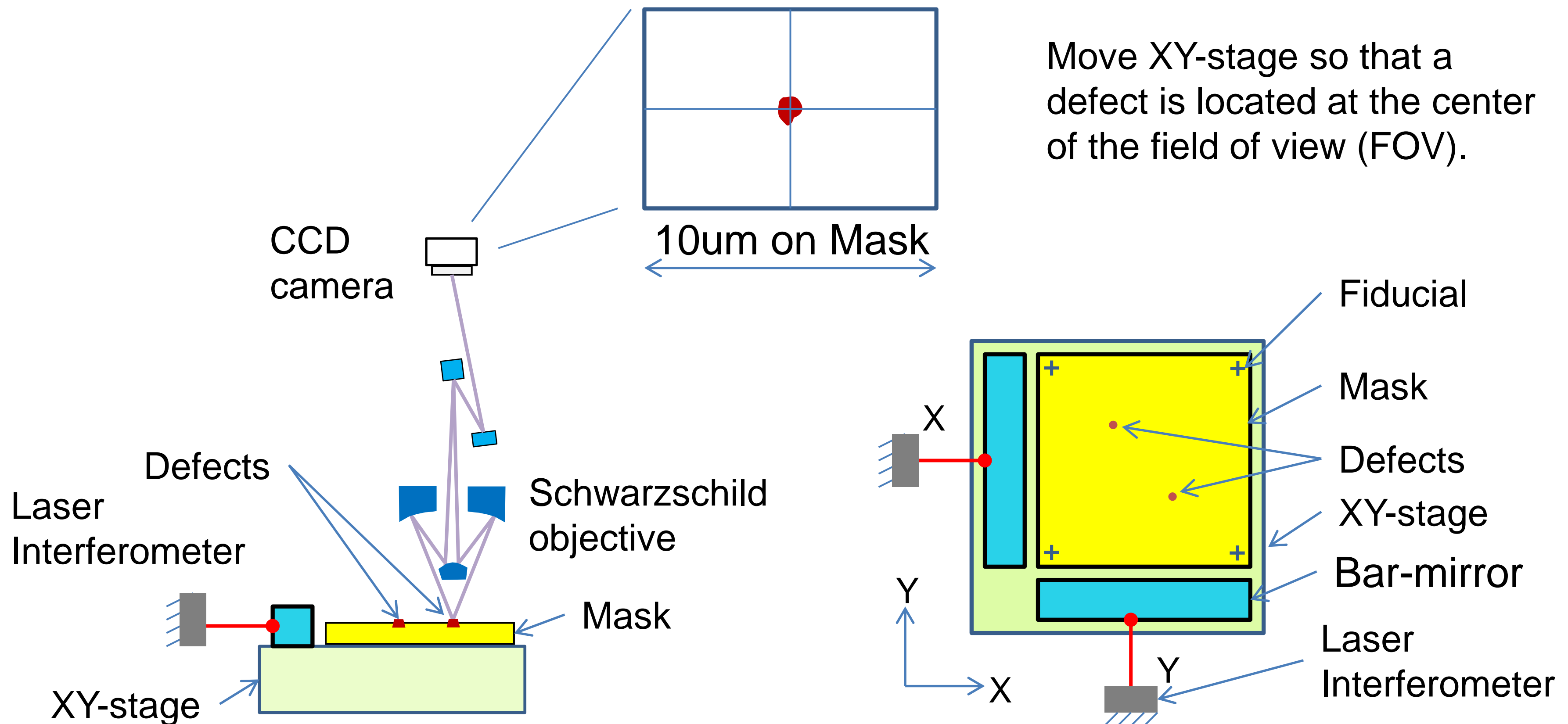






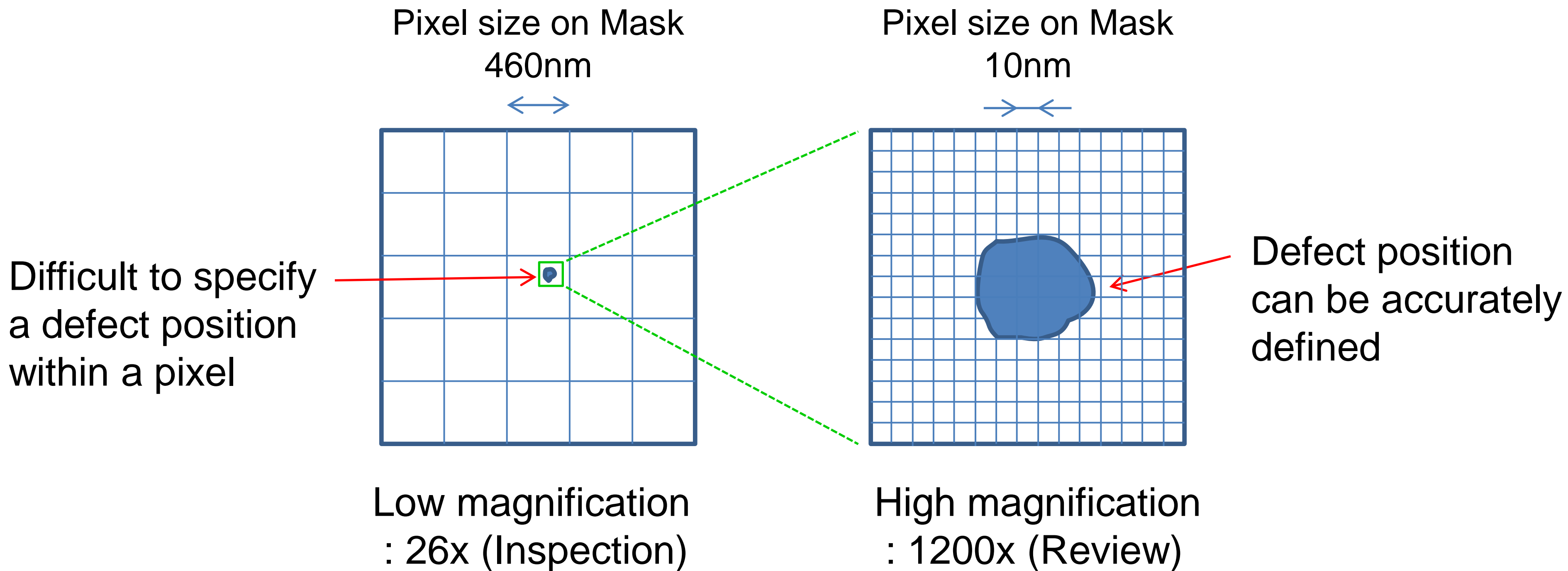
High-Speed Inspection & High Resolution Review implemented in one system

Coordinate accuracy (1)



XY-stage position reading by laser interferometer with defect or fiducial centered in the FOV to minimize aberration and field distortion error

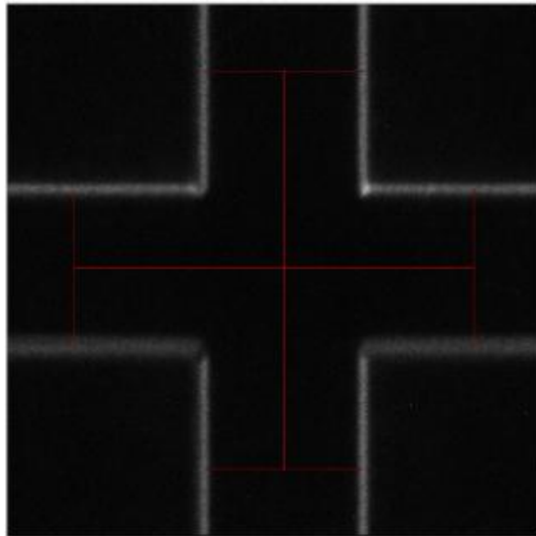
Coordinate accuracy (2)

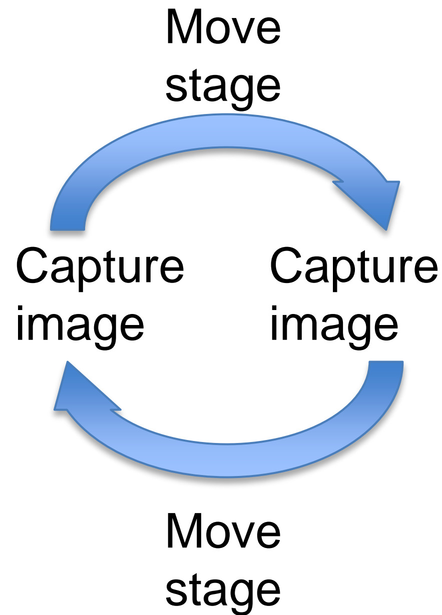


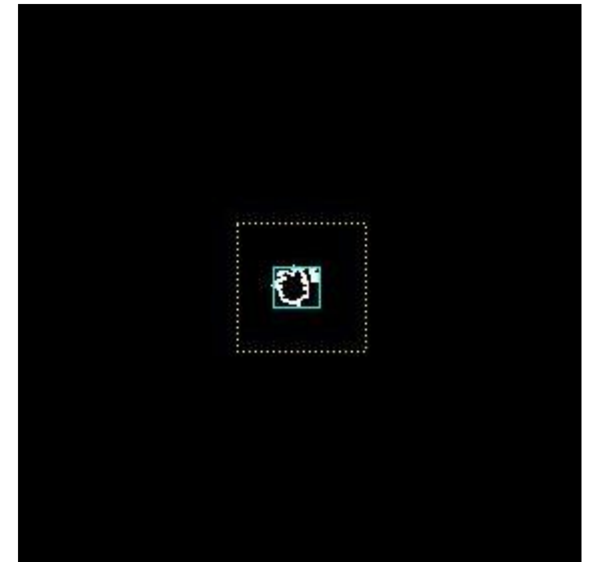
1200x magnification - a basis for the accurate defect positioning

Location accuracy (1)

Experimental procedure

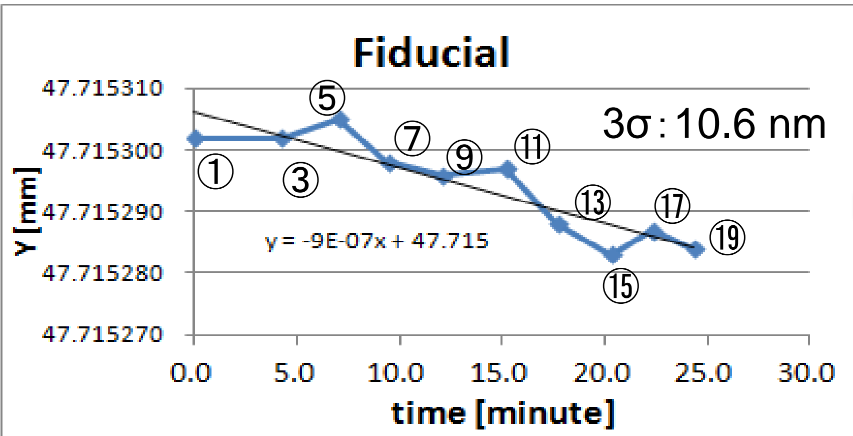

Fiducial mark

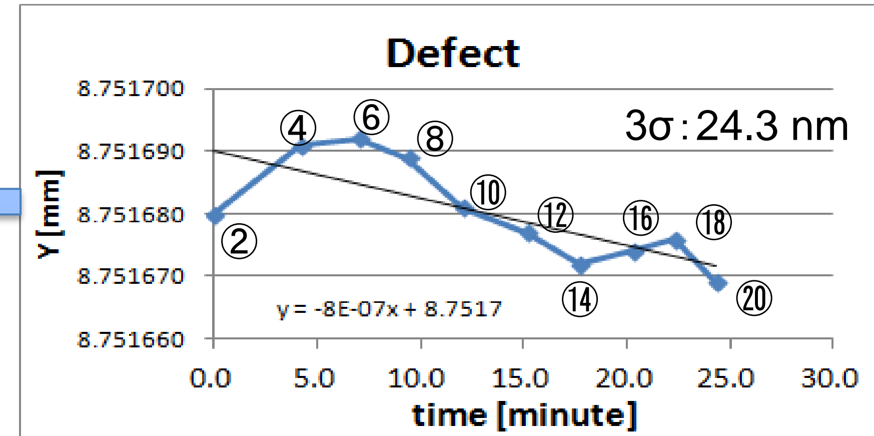


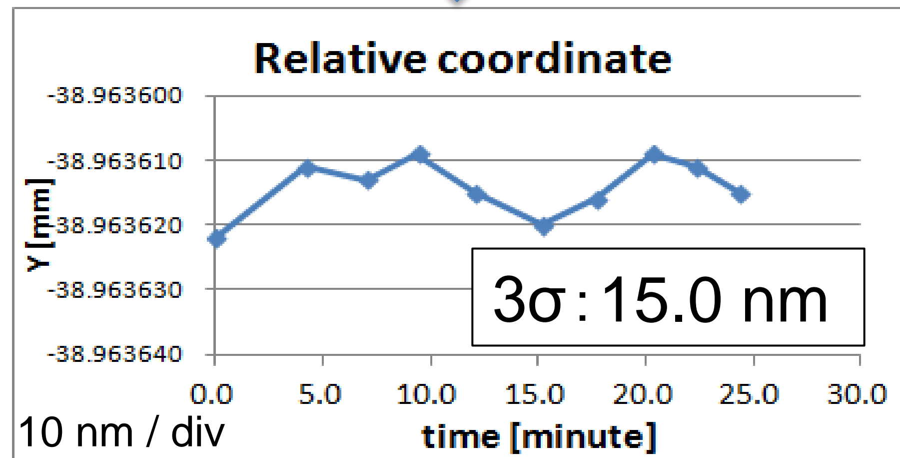

Defect

Repeated 10 times to evaluate the location stability

Location accuracy (2)







Starting to see the promising results for the targeting accuracy of 20nm

Summary

- ABI HVM tool has a capability of detecting 16nm node size defects.
- ABI platform is extendable for the future nodes inspection by reducing the pixel size.
- In many cases, ABI signal intensity does not match the AFM measured defect size on multilayer. Printability study is required.
- ABI HVM with high magnification review provides valuable information for a defect characterization and printability studies.
- Fluctuation of defect location relative to fiducial was 15nm(3σ). Location accuracy improvement is on track for the target of 20nm.

Acknowledgements

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