IRAI

SFET Optics Contamination Learning Update

Iwao Nishiyama

Semiconductor Leading Edge Technologies, Inc.

This work was supported by NEDO

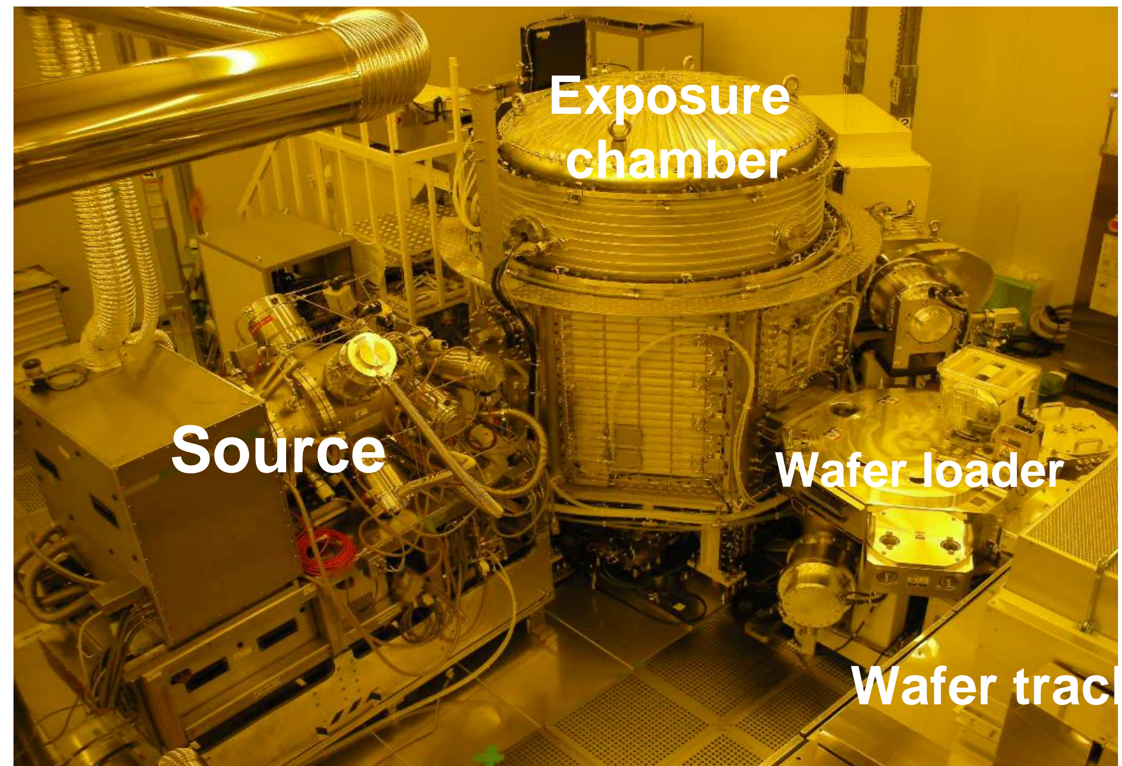
Oct. 2, 2008

Small Field Exposure Tool : SFET

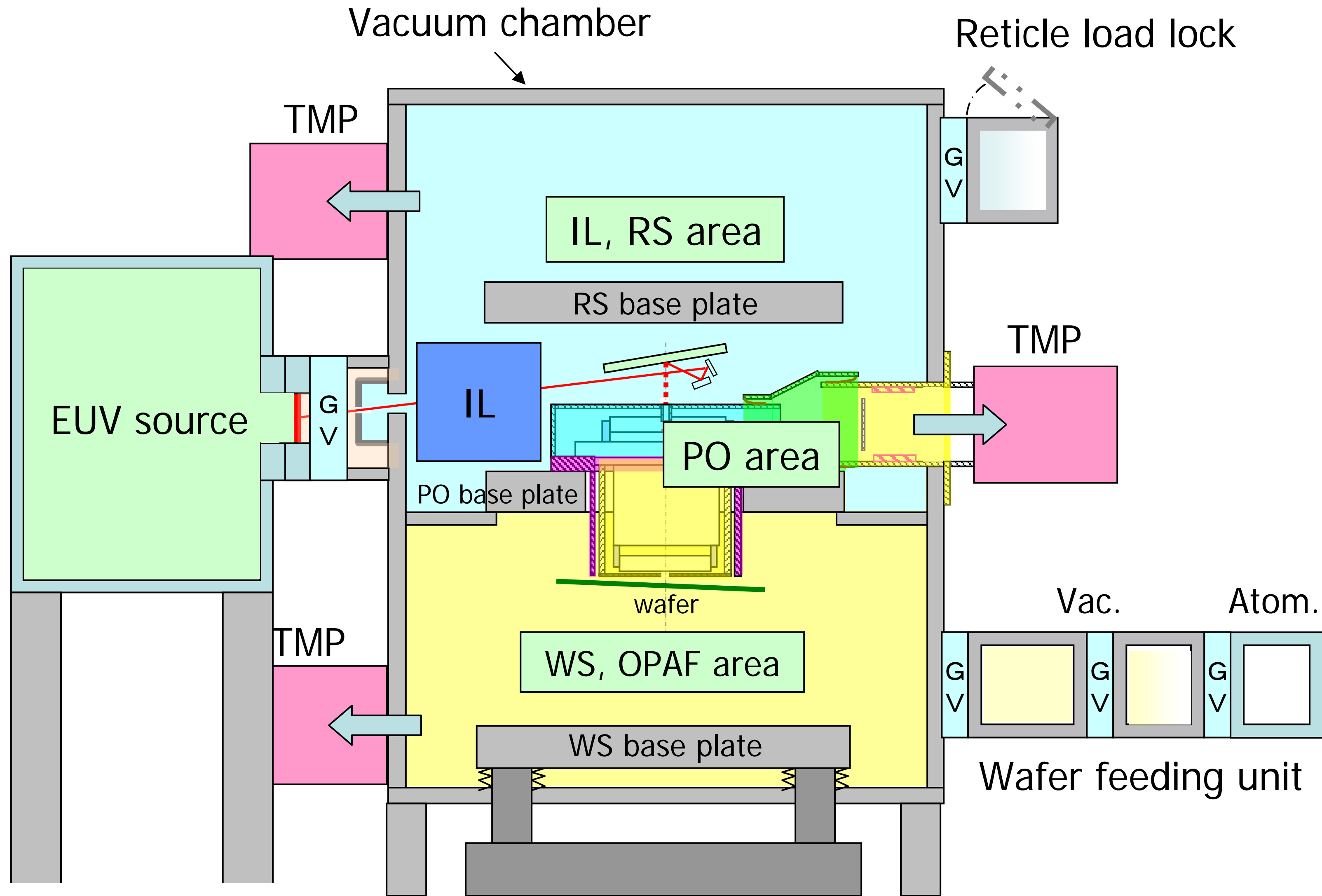
Purposes

- Optimize mask structure
- Develop resist materials
- Evaluate optics & source lifetime

Items	Specification
NA	0.3
Field size	0.2 x 0.6 mm
Magnification	1/5
Wafer size	300mm



Schematics of SFET



Supported by NEDO

SFET Illumination Optics

IRAI

Selete

SA1, SA2

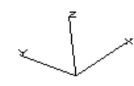
SG1

PO

SG2

IF

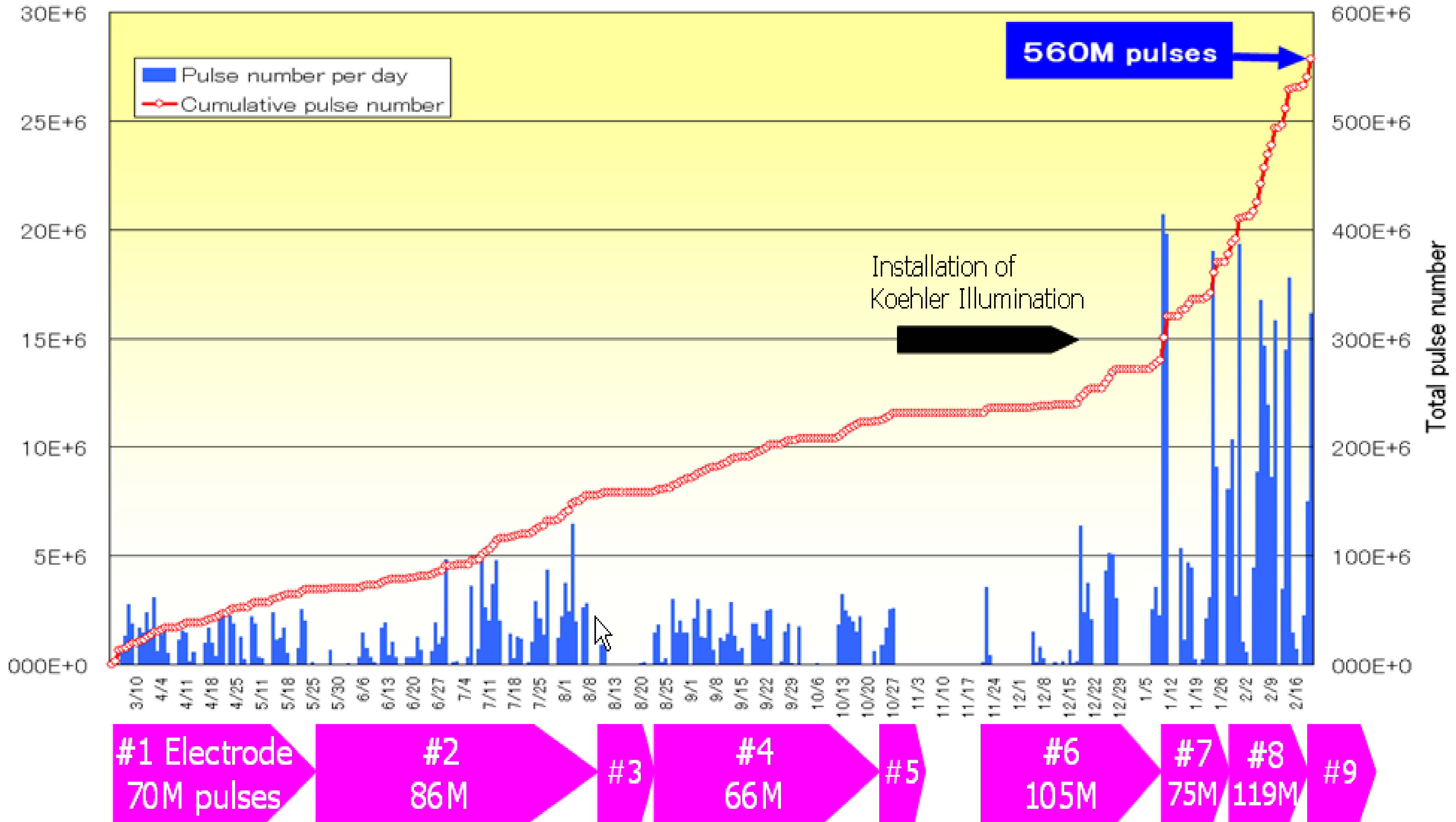
EUV Source



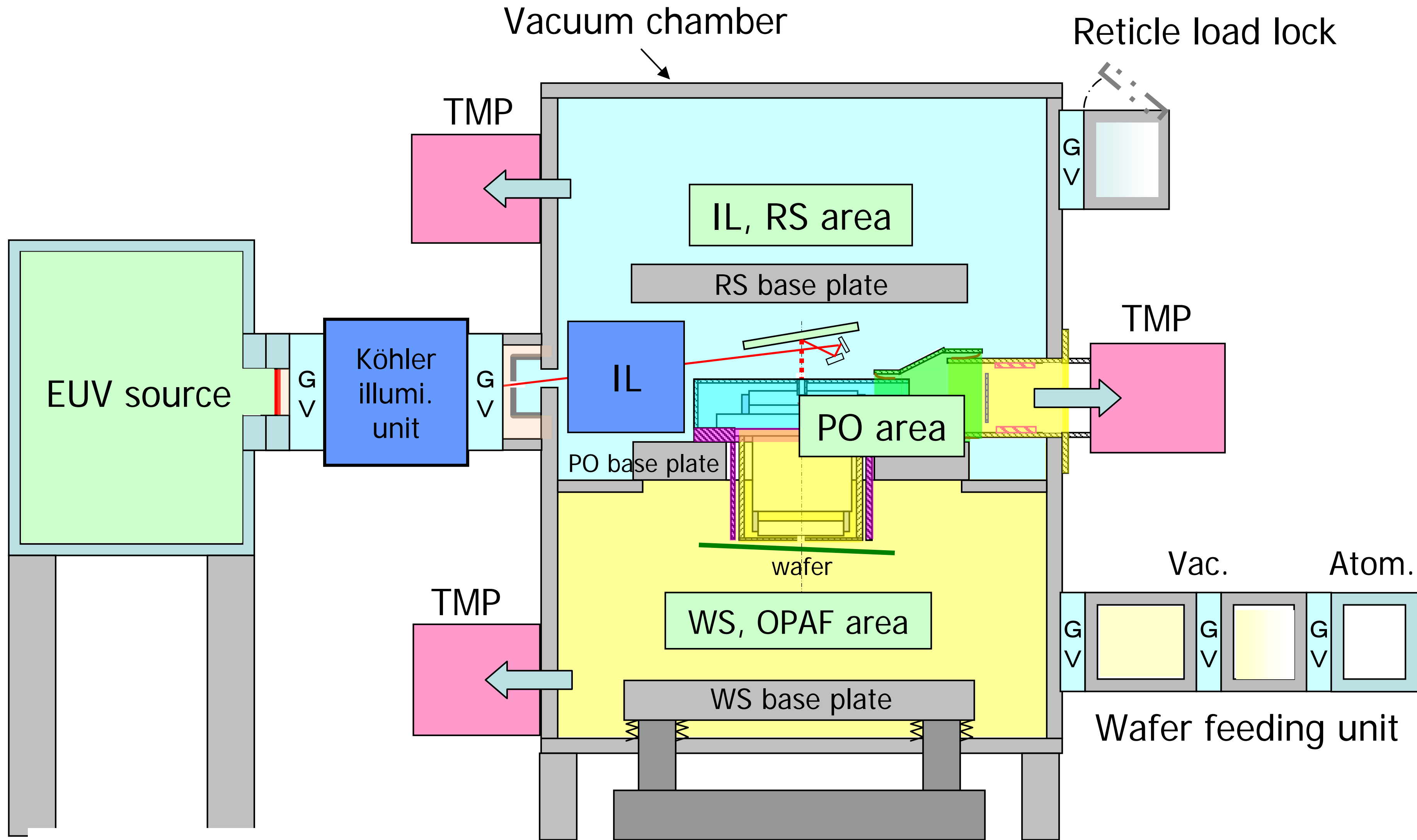
EUVA

Supported by NEDO

SFET Operating Results



Schematics of SFET



EUVA Selete

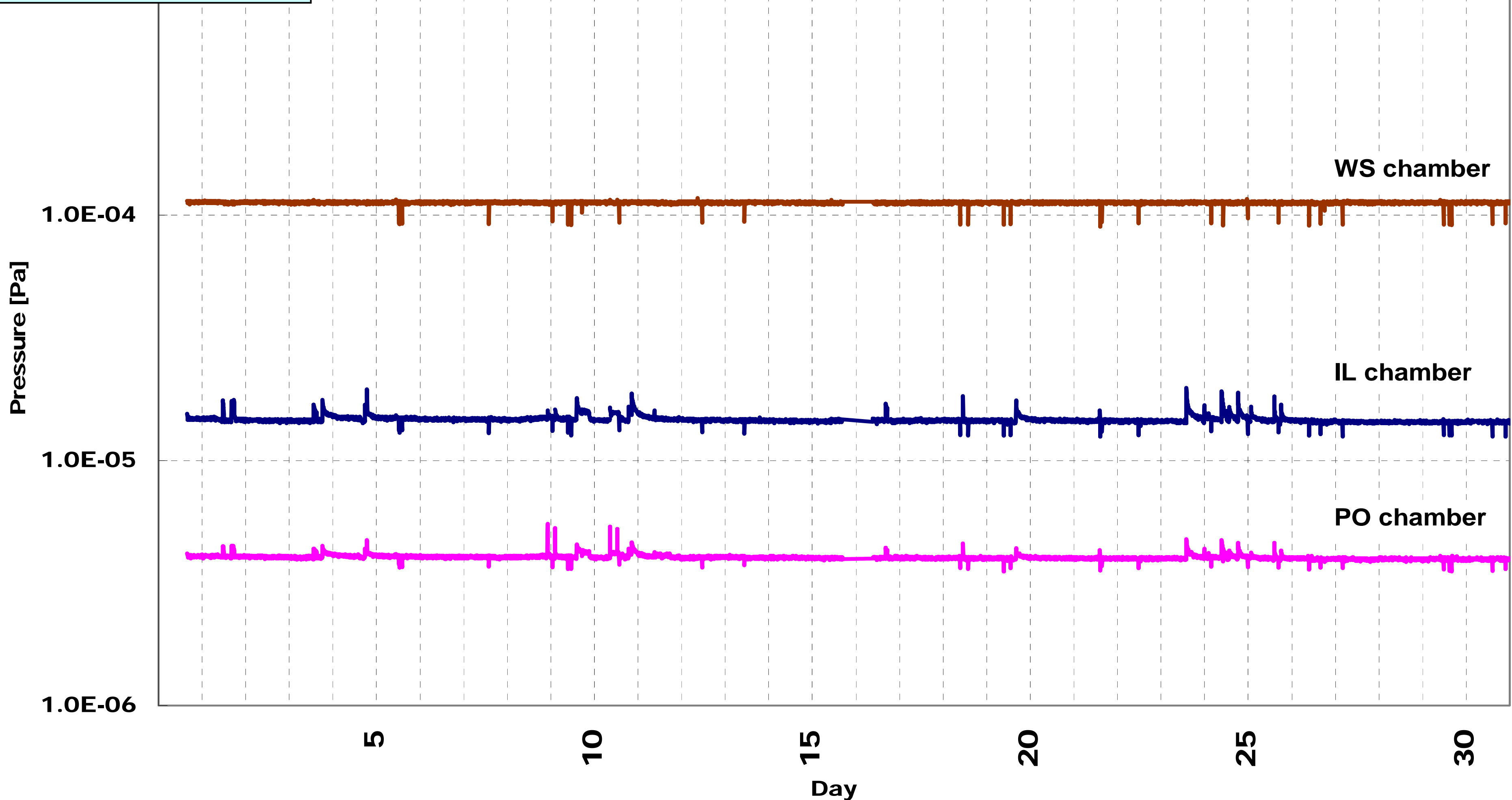
Supported by NEDO

IRAI

Chamber pressure stability

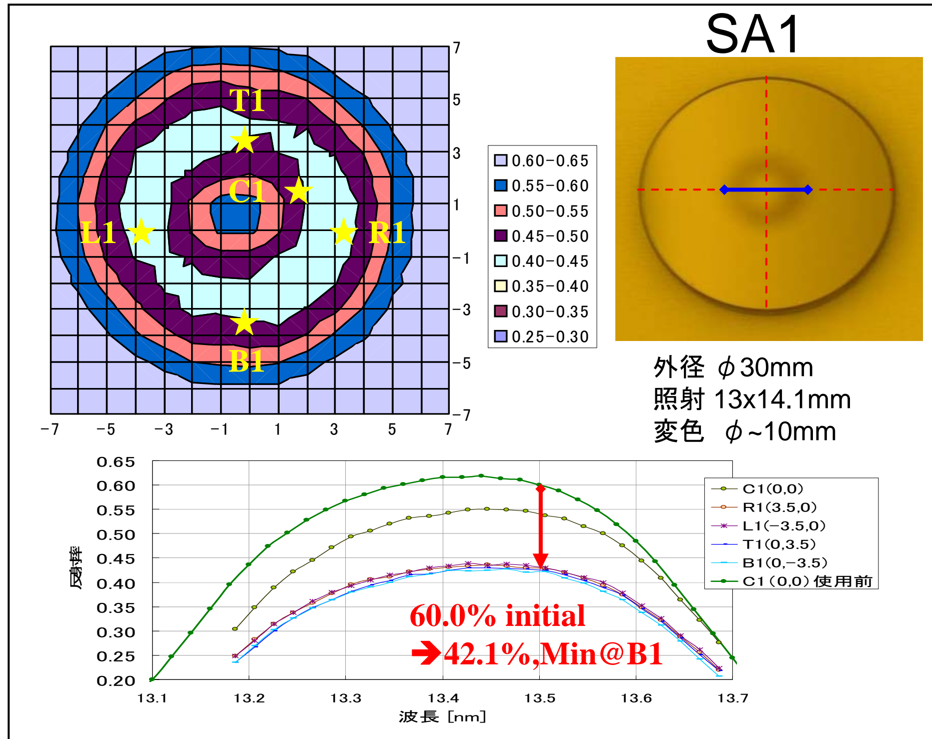
Selete

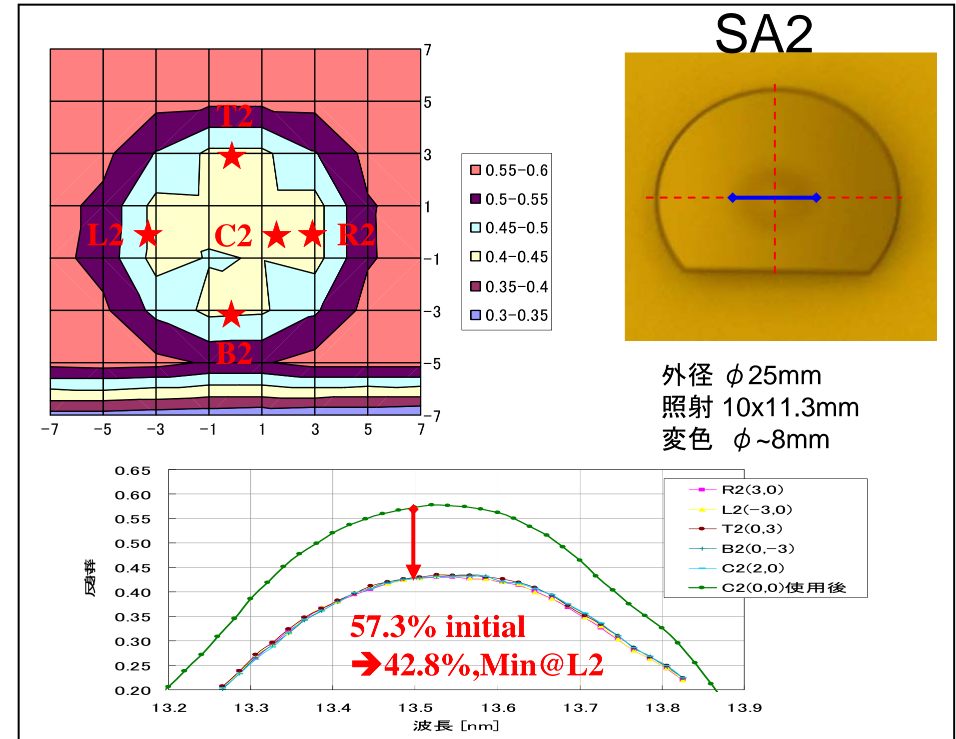
30-days stability



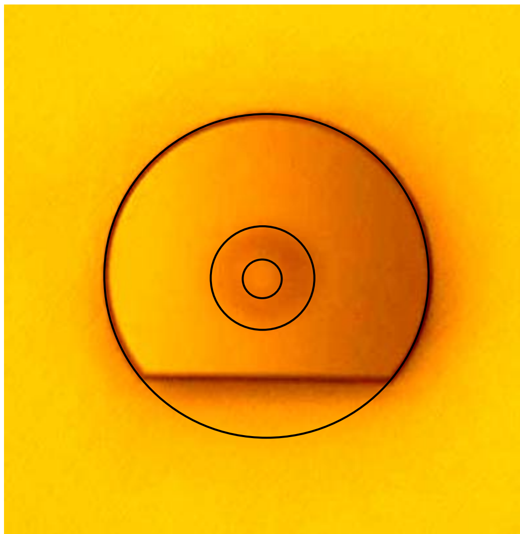
Chamber pressure is well keeping during tool running eventhough wafer & mask in/out .

Contamination of SFET illumination Optics

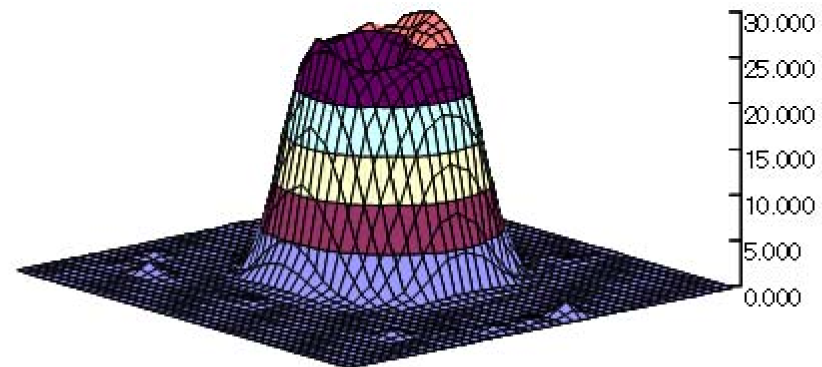




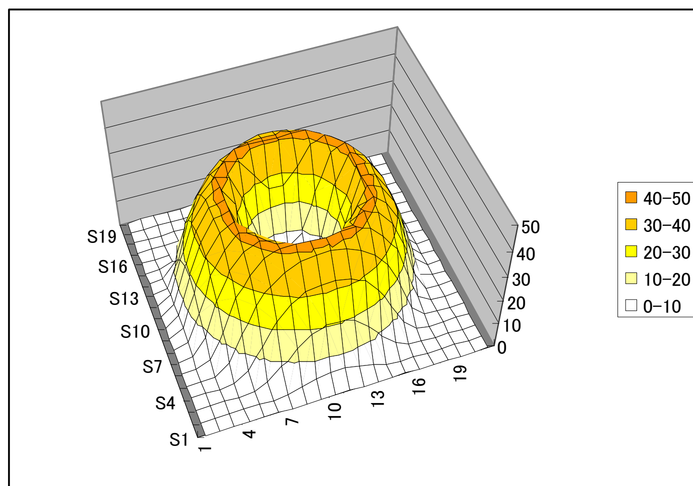
Contaminated SA2 Mirror



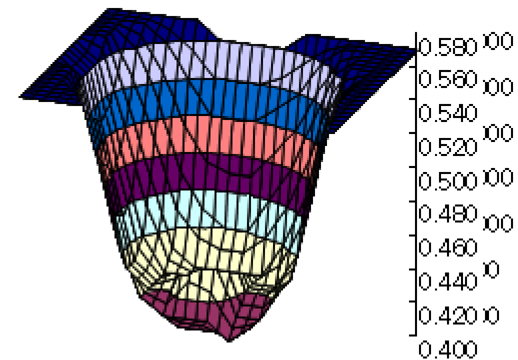
Film thickness



Estimated intensity



Reflectivity loss



Selete Confidential

IRAI

Analysis of SFET optics contamination

Selete

- Ellipsometry
- TEM (transmission electron microscopy)
- Micro beam GIXR (Grazing Incidence X-ray Reflectometry)
- XPS (X ray photoelectron spectroscopy)
- Raman spectroscopy
- EELS (electron energy-loss spectroscopy)
- RBS (Rutherford backscattering spectroscopy)
- ERDA (Elastic Recoil Detection Analysis)
- TOF-SIMS (Secondary ion-microprobe mass spectroscopy)
- ATR-FTIR (attenuated total reflectance Fourier transform infrared spectroscopy)

Summary

- SFET SA2 mirror contamination was analyzed with many surface analysis methods. Major species are carbon. Details will be reported elsewhere.
- Contamination growth rate was estimated.
- If scaled linearly to EUV intensity on HVM PO mirror, very short life time is expected. Precise estimation should count the non linear dependence on intensity and pressure.
- Modeling for carbon contamination growth is necessary for precise lifetime scaling.

Acknowledgements

This work was supported by New Energy and Industrial Technology Development Organization (NEDO).