

HASO X-EUV

Wavefront sensor at ultra-short wavelength



Imagine Optic is proud to present you the very first EUV to X-ray wavefront sensor. Fruit of the high expertise of Imagine Optic on wavefront sensing and of the collaboration with internationally recognised laboratories (CXRO, LOA, SOLEIL). Contactors such as DESY and SLS have already trusted us for the metrology of their beamlines.

PRINCIPLE

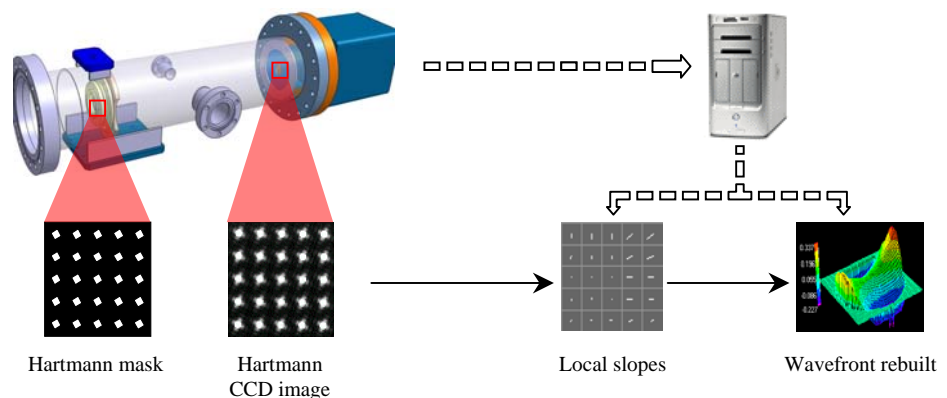
Direct Measure with X-EUV camera

Hartmann Technique

Imagine Optic Rotated Square Conception

➤ Optical wavefront sensor

Thanks to the use of a patented hole array, these sensors record the local slopes of the analysed wavefront, which is then computed and reconstructed.



Taking advantage of the “rotated-square” array conception patented by Imagine Optic, these sensors offer high spatial resolution and high measurement dynamic.

APPLICATION

Adjustment, Assembly Alignment

Adaptive Optic

Characterisation

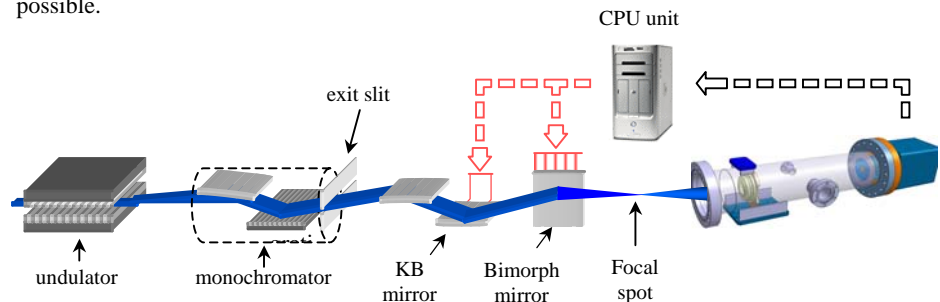
EUV Lithography

➤ Adjustment, assembly and alignment

Perfectly adapted for laboratories needs as well as in industrial processes.

➤ Adaptive optic

The close loop linking a HASO and a X-EUV deformable mirror allows to dynamically correct the wavefront. Very tight focusing, high Strehl ratio and control of the focal spot shape are possible.



➤ EUV lithography

Wavefront control seems more and more unavoidable to reach the severe specifications in term of wavefront quality for the future EUV lithography. With Imagine Optic HASO X-EUV, you are now ready for this challenge !

ADVANTAGES

Real Time

High Accuracy

All Coherence

Large λ Bandwidth

- **Display and calculus in real time**
- **High accuracy**
From $\lambda/30$ (3 μrad) up to $\lambda/130$ (0.7 μrad) at $\lambda = 13 \text{ nm}$.
- **No needs on coherence requirement**
Adapted to slightly or to highly coherent beams
- **Friendly software interface**

	$\lambda/30$	$\lambda/100$
Aperture dimension	27.6 x 27.6 mm ²	27.6 x 27.6 mm ²
Number of sub-apertures dedicated for analysis	75 x 75	75 x 75
Tilt dynamic range	Up to 0.25°	Up to 0.25°
Focus dynamic range	$\pm 0.8\text{m}$ to $\pm \infty$	$\pm 0.8\text{m}$ to $\pm \infty$
Repeatability rms / local slope	$\sim \lambda/60 / 1.2 \mu\text{rad}$	$\sim \lambda/200 / 0.37 \mu\text{rad}$
Wavefront measurement accuracy in absolute mode rms / local slope	$\lambda/30 / 2.5 \mu\text{rad}$	$\lambda/100 / 0.75 \mu\text{rad}$
Wavefront measurement accuracy in relative mode rms / local slope	$\lambda/20 / 3.7 \mu\text{rad}$	$\lambda/60 / 1.2 \mu\text{rad}$
Tilt measurement sensitivity	/	/
Focus measurement sensitivity	/	/
Spatial beam sampling step	$\sim 135\mu\text{m}$	$\sim 135\mu\text{m}$
Min. readout time	$\sim 1\text{sec}$ (@1MHz digitization)	$\sim 1\text{sec}$ (@1MHz digitization)
Processing time	/	/
Working photon energy (wavelength)	30 eV – 10 keV (40nm – 0.125nm)	30 eV – 10 keV (40nm – 0.125nm)
Storage temperature / Operating environment	$< 55^\circ\text{C} / 5^\circ\text{C} - 30^\circ\text{C}$	$< 55^\circ\text{C} / 5^\circ\text{C} - 30^\circ\text{C}$
Compliant vacuum (<u>hydrocarbon free</u> compatible with clean vacuum)	10^{-6} mbar	10^{-6} mbar
Power supply	Via controller (100-110-220 or 240V AC)	Via controller (100-110-220 or 240V AC)

These data are given for the wavelength 10nm

Site implementation analysis (optional)

Create the solution you really need by taking advantage of the high expertise of Imagine Optic. Imagine Optic proposes you to analyze your specifications and site implementation to adapt the HASO X-EUV to your experiment type. Contact Imagine Optic for more details.

SOFTWARE

Wavefront acquisition

Continuous or ext. trigger mode – absolute (factory calibration) or referenced (user calibration) mode – one-shot or flying acquisition – camera signal – background signal : save and subtract in real time – for the sensor adjustment : tilt visualization ; manual adjustment of integration time.

Wavefront reconstruction

Wavefront display (unit in microns or lambda) : 3D, 2D projection, fringes mode, xy profile, save function (text or excel format, comments) – display in real time without tilt and/or focus and/or 3rd order aberrations – intensity display : 3D, 2D projection, xy profile, save function (text or excel format, comments) – reconstruction : zonal or modal (Zernike or Legendre) – pupil shape : with or without central occultation – location (x y z) of the focus point – polynom coefficient display (unit in microns or lambda), historic function : display of the time changes of 4 coeff. – local slopes display : with or without tilt and focus, zoom, rms and pv of the slopes - pupil calculation : automatic or manual (save and load functions) – spot diagram in real time for various observation positions.

Extended wavefront reconstruction (optional)

Zernike polynom coefficient processing in real time for any pupil shape – display of the calculated wavefront surface and display of the residual – manual or automatic choice of the pupil - save functions: text or excel format, comments

Point Spread Function measurement (optional)

PSF display : 3D, 2D projection, xy profile – parameters : best focus plane, user specified plane, focal plane of ideal lens – zoom (1 to 8) – Strehl ratio – numerical value in table - save and load functions (text or excel format, comments).

Dynamic library (optional)

dll in C or VI for Labview : all the software functions to build specific soft applications.