



HASO NIR

New wavefront sensor for telecom applications

PRINCIPLE

More Performant

Low Cost Solution!

APPLICATIONS

*Beam Analysis
Phase and Intensity*

MTF

Characterization

Fiber Coupling

ADVANTAGES

Real Time

High Dynamic

Interactivity

➤ **Optical wavefront sensor**

These wavefront sensors (Shack-Hartmann type) allow to obtain a map of local slopes of the analysed wavefront with the help of a microlenses array. This principle used for a long time in astronomy was amply improved as well on hardware as on software. But the CCD technology does not allow measurement in the telecom range, and especially around 1,5 μm . The InGaAs photodiodes technology is extremely expensive and does not answer to quality criteria to guaranty a good Shack-Hartmann metrology (reliability, dead pixels, etc...)

Some detectors (based on a phosphor coating technology on a CCD) reached the maturity and the necessary quality/price ratio to certify an irreproachable metrology with moderate prices; the fabrication of microlenses arrays has become reliable. The software innovations of Imagine Optic allow to use trough optimal way this simple and direct measurement.

➤ **Beams analysis in phase and intensity**

1500 nm laser source: the HASO allows to measure optical quality, divergence, position and size of the waist, M^2 parameter, Strehl ratio, astigmatism values, ...

➤ **Components and systems characterization**

Especially adjusted to middle size components (aperture of 5 mm), the HASO dynamic allows also the characterization of small and large components with divergent or convergent beam.

➤ **Adjustment, mounting, alignment**

The operator visualizes in real time the wavefront and some measured parameters, which show adjustments quality and allow to improve them (tilts and curvature values, space source position, third order aberrations which can move during an adjustment). When the user ends operation, he can get the optical quality (and especially the MTF).

➤ **Point spread function**

The phase and intensity measurement lead to the PSF (shape and location of the focus spot). Then it is possible to know accurately the fiber coupling efficiency and to understand some bad performances.

➤ **Achromatic and non sensitive to the coherence**

Particularly, monochromatic wavefront analysis.

➤ **Display and calculation in real time**

Adjustment and on-line control..

➤ **High spatial resolution**

Up to 1200 points measured in a standard configuration on the pupil.

➤ **Strong divergent and convergent beams analysis**

Compatible with fiber and laser source.

➤ **Wavefront measurement in absolute or relative mode**

The HASO is factory calibrated. The measure is absolute except if a reference wavefront is specified.

SPECIFICATIONS

	HASO NIR 40
Aperture dimension	3.6 x 4.8 mm ²
Number of sub-apertures dedicated for analysis	30 x 40
Tilt dynamic range	till ± 3°
Focus dynamic range (1)	± 0,012 m to ± ∞
Maximum operating aperture (half angle sinα)	0,17 (max)
Repetability (rms)	~ λ/70
Wavefront measurement accuracy in absolute mode RMS (2)	~ λ/35
Wavefront measurement accuracy in relative mode RMS (3)	~ λ/50
Tilt measurement accuracy	15 μrad
Focus measurement accuracy	15.10 ⁻³ m ⁻¹
Spatial resolution	~ 115 μm
Acquisition frequency / processing frequency	~20 Hz / ~ 4 Hz
Wavelength	1500 – 1600nm
Working temperature	15 – 30° C/ 5 – 45° C

*: all specifications given with an average operating mode of 10 acquisitions.

Note 1: Central wavelengths: 120 λ for HASO NIR 32, 180 λ for HASO NIR 40.

Note 2: Wavefront directly measurement by the wavefront sensor (no added lens).

Note 3: Difference between a referenced wavefront and the measured wavefront, in a range < 10 λ.

SOFTWARE

Wavefront acquisition (standard software)

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 (standard software)

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 with or 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.

Wavefront : other tools (standard software)

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 coef. – 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.

Point Spread Function measurement (PSF software)

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).

MTF measurement (MTF software)

MTF display: 2D, x profile (user choice) – parameters: best focus plane, user specified plane, focal plane of ideal lens – zoom (1 to 8) – historic function: display of the time change of a specified frequency - save and load functions (text or excel format, comments).

Laser characterisation (M² software)

Beam location, dimension and position of the waist – display of the beam shape – M² calculation – calculation of intensity shape in any plane - save and load functions (text or excel format, comments).

Coupling efficiency (Preliminary)

Beam location, dimension and position of the waist – display of the beam shape – calculation of intensity shape in any plane, and comparison with dimension and aperture of the fibre - save and load functions (text or excel format, comments).

Dynamic library

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