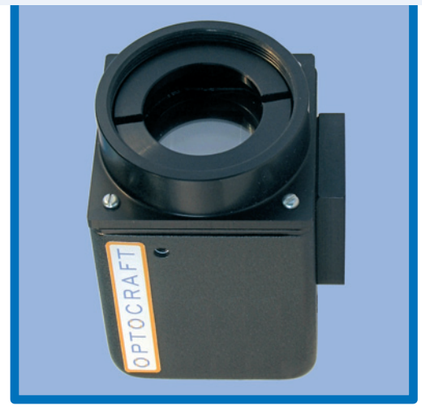
OPTOCRAFT
OPTICAL METROLOGY

SHSLab
Product Information



SHSLab - Product Versions

Category		SHSLab VIS				SHSLab special		
Version		**BR**	**HR**	**SHR**	**UHR**	**UV193**	**IR1550**	**IR1700**
Sensorhead								
sensor area	mm^2	6.3x4.65	8.25x6.3	11.7x8.85	15.15x15.15	6.3x4.65	6.3x4.65	9.6x7.68
number of lenses[1]		42x31	55x42	78x59	101x101	45x34	42x31	20x16
bus system[2]		FW or CL	FW or CL	CL	CL	FW	analog	USB or CL
Performance								
wavelength range[3]	nm	375 ... 1064	375 ... 1064	375 ... 1064	375 ... 1064	193 ... 400	1545...1580	900 ... 1700nm
repeatability[4] (rms)	nm	<3	<3	<3	<3	<2	<8	<8
basic accuracy[4,5] (pv)	nm	<40	<40	<60	<80	<30	<150	<150
min. wave-front curvature[6]	mm	~15	~15	~15	~15	~20	~15	~40
measurement frequency[7]	Hz	~15	~15	~10	~4	~8	~15	~20

All systems include standard PC, TFT 17" monitor, pre-installed software SHSLab (WinXP) and dongle.
Systems with Firewire or USB bus system can alternatively be delivered with laptop.

Optocraft also delivers **customized SHSLab** systems with up to 150 x 150 microlenses; CCD, CMOS, backthinned (optional cooled) camera systems with up to 16 bit; FW, CL or USB bus system; total wavelength range[3] 157nm ... 1700nm. The performance parameters are related in a complex manner. Please ask for your specification.

(1) Other lens designs available.
(2) FW = FireWire IEEE1394, CL = CameraLink, USB = Universal Serial Bus 2.0.
(3) Principally possible range. Wavelength has to be specified at time of order.
(4) Value for circular evaluation area with maximum diameter on sensor area.
(5) Wave-front accuracy of uncalibrated sensor head. The accuracy can be obviously increased by appropriate calibration methods.
(6) Local radius of wave-front curvature. Sampling-theorem has to be fulfilled.
(7) Maximum measuring frequency including simple evaluation; depends on bus system and chosen evaluation parameters.

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SHSLab - The Wave-front Sensor

The universal measurement tool for industry and research

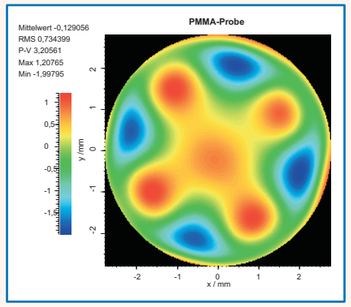
The Shack-Hartmann sensor SHSLab measures the wave-front and intensity distribution of light beams with high precision and speed - also in a turbulent environment. It is irrelevant whether the measured wave-front shape is caused by refraction, diffraction, reflection or other effects. Therefore, both the fundamental transfer functions of optical elements and systems such as wave-front aberrations, pointspread function or modulation transfer function and simple classification figures such as focal length, Strehl-ratio or the beam propagation factor M^2 can be measured.

Flexibility for the areas of application

SSHSLab is available in different versions. For simple applications such as the collimation of an optical system a small number of lateral supporting points is sufficient. However, a version with high lateral resolution is necessary, if the MTF is to be measured with high resolution regarding the spatial frequency spectrum or if SHSLab is to be used for the measurement of the shape of optical surfaces. Furthermore, SHSLab is available for different wavelength ranges from DUV to IR. This ideally qualifies SHSLab for the quality assurance of optics and lasers..

Typical test samples

- optics for mobile phones (high numerical aperture)
- optics for automotive applications
- optics for optical data storage (DVD, BlueRay)
- intraocular lenses (spherical, aspherical, toric)
- optical components
- aspheres
- laser beam characterization (DUV to IR)
- laser diodes, gas-lasers, solid-state lasers
- systems for laser material processing
- laser systems for digital photography
- laser pick ups for optical storage (CD, DVD, BlueRay)



Measurement and testing applications

Measurement in transmission		wave-front aberrations PSF, MTF focal length centering system alignment
Measurement in reflection		surface deviation radius of curvature series tests (high speed)
Lasers		wave-front intensity distribution M^2 collimation

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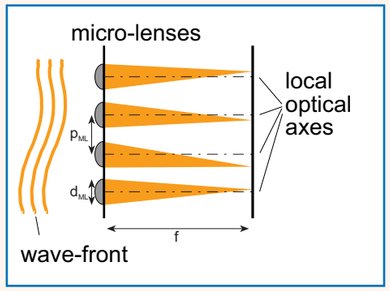
SHSLab - From Principle to Measurement System

Basic principle

The Shack-Hartmann wave-front sensor uses a microlens array to focus a wave-front to a number of spots, which are detected by a camera. For the evaluation the lateral positions of the spots are calculated relative to the local optical axes of the microlenses. As theses lateral shifts are proportional to the mean local slope of the wave-front, the latter can be reconstructed by numerical integration.



By additional evaluation of the spot intensities, the propagation characteristics of coherent laser beams can be calculated. The advantage of the Shack-Hartmann sensor is its ability to determine the beam propagation factor M^2 with a single measurement.

Outstanding properties

- Extreme wave-front dynamics:

  Due to a unique technique the smallest measurable local radii of curvature of the wave-front can be as small as 10mm. These are regions which cannot be reached offhand with an interferometer. Compared to the largest measurable radius of curvature of above 100m, the dynamics is larger than 10^4.

- High accuracy:

  The high uncalibrated accuracy is ensured by a thorough selection of the components and high standards during fabrication. Thus, an uncalibrated accuracy of $\lambda/15$ (PV) is obtained and the repeatability without averaging is better than $\lambda/300$ (rms). By performing a suitable calibration, the accuracy can be considerably increased.

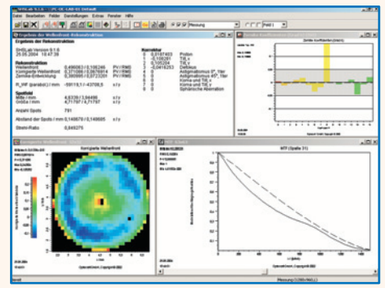
- Speed and stability:

  Due to a measurement frequency of up to 30Hz and the high stability, SHSLab is excellently suitable both for research and industrial applications.

Comprehensive software

The various functions of the SHSLab software regarding evaluation, calibration and reporting fullfil nearly all user´s demands. If the user likes to post-process the measured data by himself, an interface to the SHSLab results is available.

In day-to-day work with SHSLab, the following features are especially helpful:



SHSLab with Zernike plo,t wave-font and MTF

- automatic functions for reporting and archiving
- sophisticated functions for calibration
- comprehensive analysis (Zernike, PSF, MTF, M^2) and display options
- automatic functions for easy data acquisition
- configurable pass-fail analysis
- administrator und user mode (password protected)

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