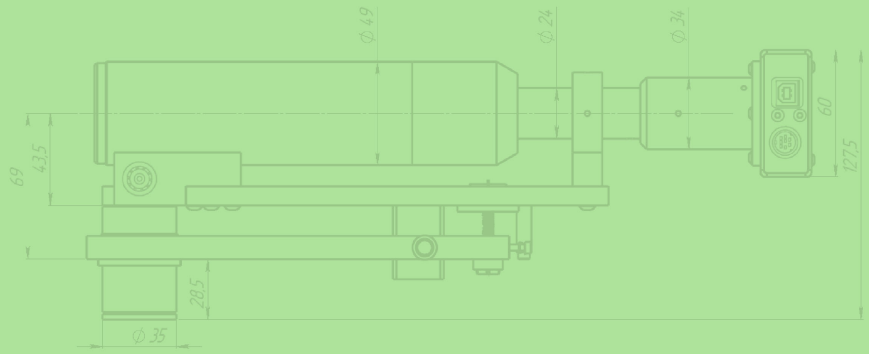
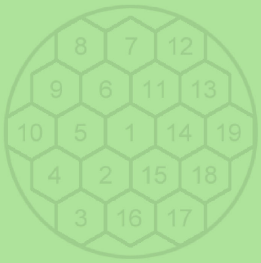
# VISIONICA

## adaptive optics components

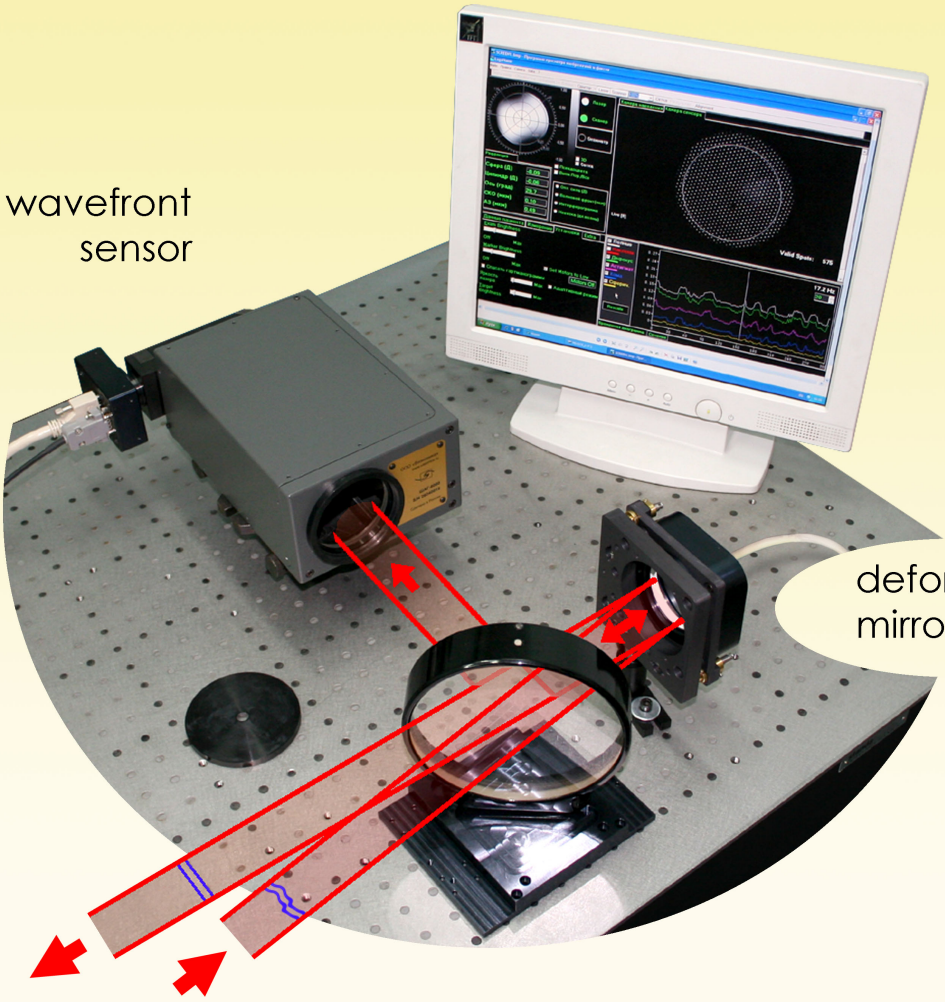



- wavefront sensors
- deformable mirrors
- mirror drivers
- calibration light sources

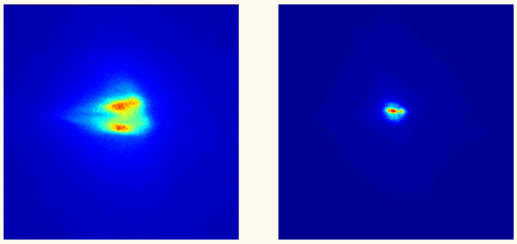


## ADAPTIVE OPTICAL SYSTEMS

Adaptive optics is widely used in ground-based telescopes, free space optical communication systems, industrial lasers, ophthalmology and scientific research, allowing one to reduce the effect of wavefront distortions caused by atmosphere, aberrations of optical systems, including ocular aberrations of the human eye.




Laser beam after 100-m propagation through the atmosphere




An adaptive optical system consists of a wavefront sensor, which measures wavefront distortions, a wavefront corrector, and a control system, which links the sensor and the corrector

## ShaH WAVEFRONT SENSORS, “Standard” series

The line of industrial Shack-Hartmann-based wavefront sensors **ShaH** is intended for applications in different areas, namely, fast and precise analysis of optical components, analysis of air streams, measurements of laser beams, etc. The design of the sensor can be easily optimized for a specific application.
C++ SDK provides the access to all functionality of the sensor and to develop any customized software according to the user’s needs.

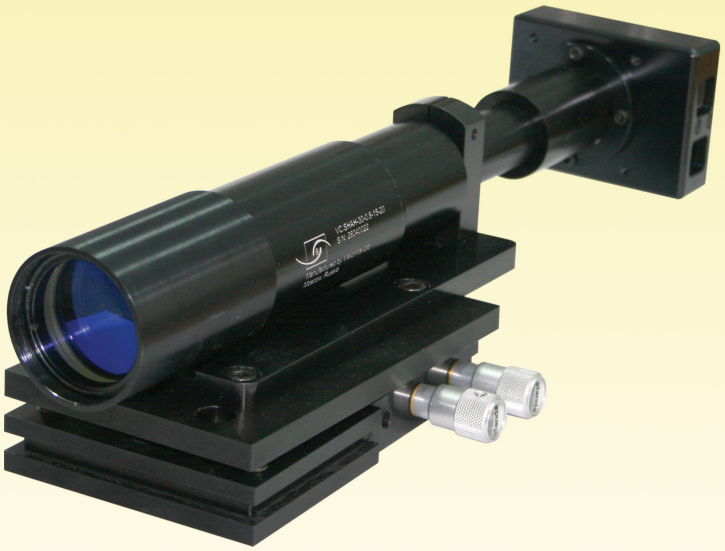
# ShaH-0660-A(B)

**aperture diameter - 6 mm**
**resolution - 150 (500) µm**
**frequency rate - 60 Hz**
**angular range - ±25 mrad (±50 mrad)**
**tilt measurment sensitivity - 0.3 µrad (0.5 µrad)**
**curvature radius min/max - ±12 cm / ±5.8 km (±6 cm / ±3 km)**
**interface - USB 2**
**weight - 250 g**
**size - 80×60×40 mm**

wavefront sensor
**ShaH-0660**

# ShaH-3060

**aperture diameter - 30 mm**
**resolution - 750 µm**
**frequency rate - 60 Hz**
**angular range - ±5 mrad**
**tilt measurment sensitivity - 0.05 µrad**
**curvature radius min/max - ±3 m / ±150 km**
**interface - USB 2**
**weight - 1.85 kg**
**size - 340×130×95 mm**

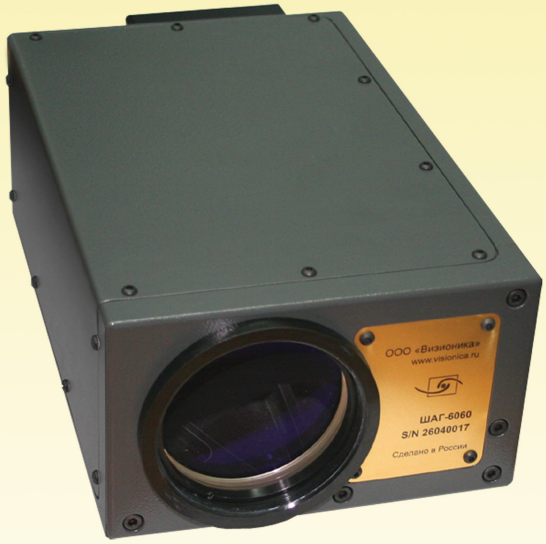


wavefront sensor
**ShaH-3060**

## ShaH WAVEFRONT SENSORS, "Standard" series

A unique feature of the **ShaH** wavefront sensors is the use of high-quality telescopes, which permits to perform measurements in a wide range of incidence angles without distorting the instrument function.
A specialized algorithm for precisely tracking the Hartmann spots provides high accuracy of the wavefront aberration measurements even under poor conditions of observation.

# ShaH-6060




**aperture diameter - 60 mm**
**resolution - 1.5 mm**
**frequency rate - 60 Hz**
**angular range - ±2.5 mrad**
**tilt measurment sensitivity - 0.025 µrad**
**curvature radius min/max - ±12 m / ±550 km**
**interface - USB 2**
**weight - 2.8 kg**
**size - 300×160×100 mm**

wavefront
sensor
**ShaH-6060**

# ShaH-601000

wavefront
sensor
**ShaH-601000**


**aperture diameter - 60 mm**
**resolution - 3 mm**
**frequency rate - 1076 Hz**
**angular range - ±2.5 mrad**
**tilt measurment sensitivity - 0.045 µrad**
**curvature radius min/max - ±12 m / ±350 km**
**interface - CameraLink**
**weight - 3.1 kg**
**size - 300×210×100 mm**

ShaH WAVEFRONT SENSORS, “Standard” series

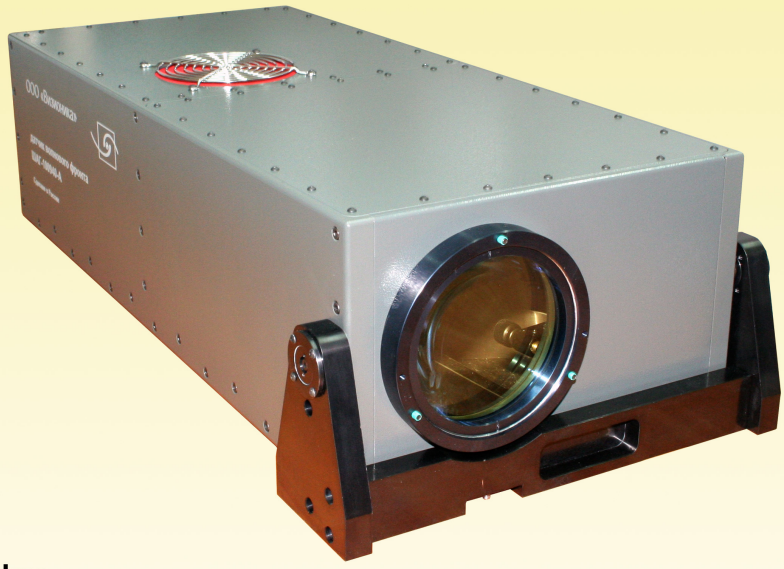
# ShaH-10060

aperture diameter - 100 mm
resolution - 2.5 mm
frequency rate - 60 Hz
angular range - ±1.5 mrad
tilt measurment sensitivity - 0.25 µrad
curvature radius min/max - ±33 m / ±1600 km
interface - USB 2
weight - 12 kg
size - 400×170×255 mm


wavefront
sensor
ShaH-10060

# ShaH-1001000

wavefront
sensor
ShaH-1001000



aperture diameter - 100 mm
resolution - 5 mm
frequency rate - 1076 Hz
angular range - ±1.5 mrad
tilt measurment sensitivity - 0.45 µrad
curvature radius min/max - ±33 m / ±1000 km
interface - CameraLink
weight - 20 kg
size - 700×170×255 mm

ShaH WAVEFRONT SENSORS for specialized applications

# ShaH-03500


aperture diameter - 3 mm
resolution - 150 µm
frequency rate - 515 Hz
angular range - ±25 mrad
tilt measurment sensitivity - 0.6 µrad
curvature radius min/max - ±6 cm / ±1.1 km
interface - PCI
weight - 2.9 kg
size - 250×140×175 mm
quantum efficiency
of Peltier-cooled CCD - 93 %

wavefront
sensor
**ShaH-03500**

for low-light conditions

# ShaH-6060-UV

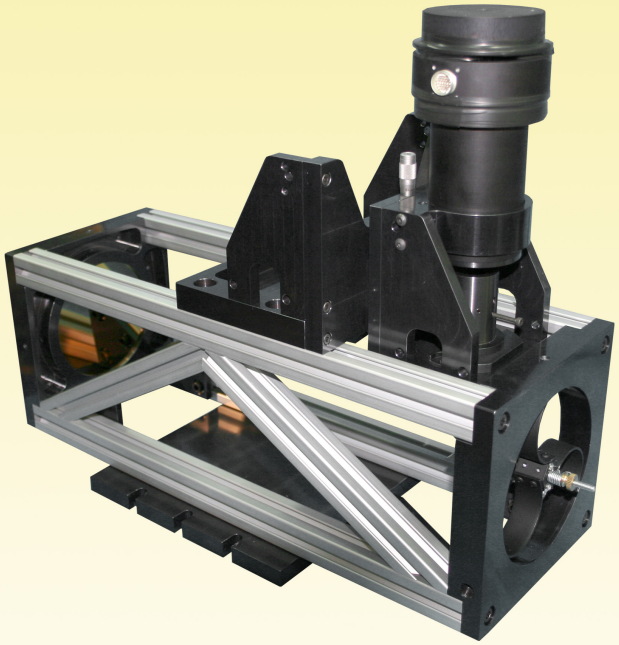
wavefront
sensor
**ShaH-6060-UV**

aperture diameter - 60 mm
resolution - 3 mm
frequency rate - 60 Hz
angular range - ±3 mrad
tilt measurment sensitivity - 0.04 µrad
curvature radius min/max - ±10 m / ±450 km
interface - USB-2
weight - 3.3 kg
size - 400×160×100 mm

for 200-450 nm wavelength range

ShaH WAVEFRONT SENSORS for specialized applications

# ShaH-10025-IR



aperture diameter - 100 mm
resolution - 6.5 mm
frequency rate - 50 Hz
angular range - ±5 mrad
tilt measurment sensitivity - 0.2 µrad
curvature radius min/max - ±10 m / ±110 km
interface - RS-170
weight - 6.3 kg
size - 600×450×175 mm

wavefront
sensor
**ShaH-10025-IR**

for 5-10 µm wavelength range

* The thermal sensor requires cryogenic cooling to -170°C

# TTS-041500

**tip-tilt sensor**

sensor type - PSD
aperture diameter - 30 mm
max. angle - 10 mrad
tilt measurment sensitivity - 15 µrad
radiation power (min/max) - 2 µW / 1 mW
frequency band - 1.5 kHz (-3 dB)
sampling rate - 44 kHz
weight - 1.75 kg
size - 340×130×100 mm

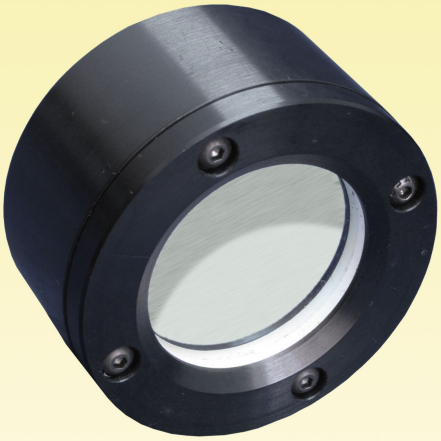
tip-tilt sensor
**TTS-041500**

* sensor interface unit provides outputs for both PC connection and direct control of a tip-tilt connector

## U-Flex DEFORMABLE MIRRORS

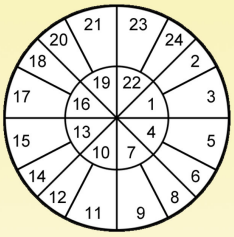
**U-Flex** deformable mirrors are intended for the use in industrial lasers, medicine, optical communication systems, astronomy and other applications, where the optical radiation wavefront shape must be controlled.

# U-Flex-36

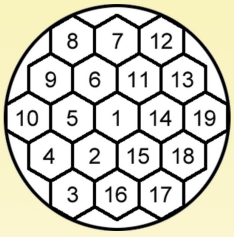


deformable mirror
**U-Flex-36**

standard configuration
of electrodes




MDL-24

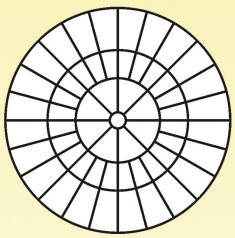



HEX-19

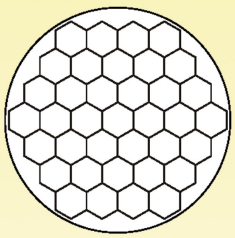
**aperture diameter - 36 mm**
**substrate - glass**
**stroke - 18 µm**
**number of control electrodes - 19/24**
**scratch-dig - 60-40**
**weight - 100 g**
**size - 60×60×32 mm**

# U-Flex-56

standard configuration
of electrodes

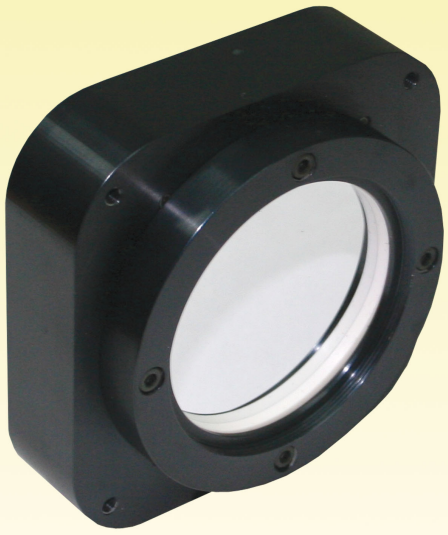


MDL-57



HEX-37

deformable mirror
**U-Flex-56**



**aperture diameter - 56 mm**
**substrate - glass**
**stroke - 23 µm**
**number of control electrodes - 37/57**
**scratch-dig - 60-40**
**weight - 150 g**
**size - 90×90×32 mm**

## PAD-300 PIEZO ACTUATOR DRIVERS

These electronic units are intended for controlling piezoceramic deformable mirrors, linear piezo actuators, and other devices that use the inverse piezoelectric effect.
The unit is computer-controlled through the USB 2 interface and allows forming the required time profile of operating voltage in each channel independently.

piezo actuator
control unit
**PAD-300**

**output voltage range - ±300 V**
**voltage setting step - 0.15 V**
**operation frequency - 1 kHz**
**number of channels - 16-64**
**power consumption - 50 W**
**interface - USB 2**
**weight - 8 kg**
**size - 440×400×140 mm**

## LS-FC-1 CALIBRATION LASER SOURCES

**LS-FC-1** laser sources provided with a single mode fiber output are intended for calibrating wavefront sensors and also can be used when building adaptive optical systems.

calibration
laser sources
**LS-FC-1**

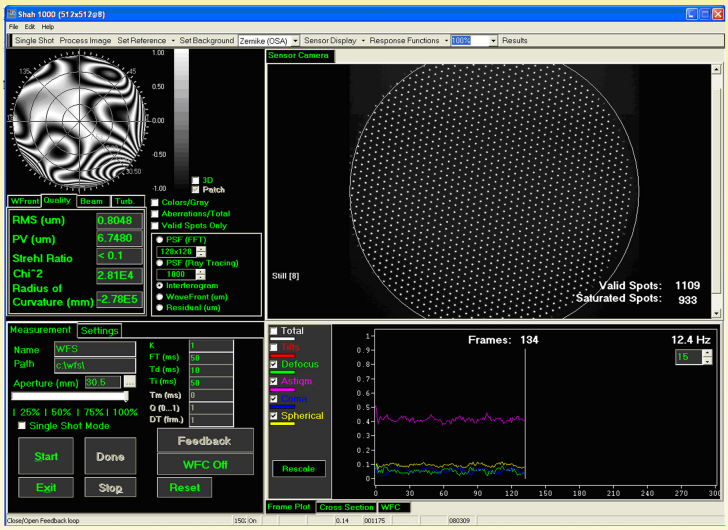

**wavelength - 655 nm**
**spectral bandwidth - 1 µm**
**max. power - 4 mW**
**fiber - SM**
**connector - FC**
**interface - USB 2**
**(PC control)**
**weight - 900 g**
**size - 200×170×40 mm**

# ShaH SOFTWARE PACKAGE

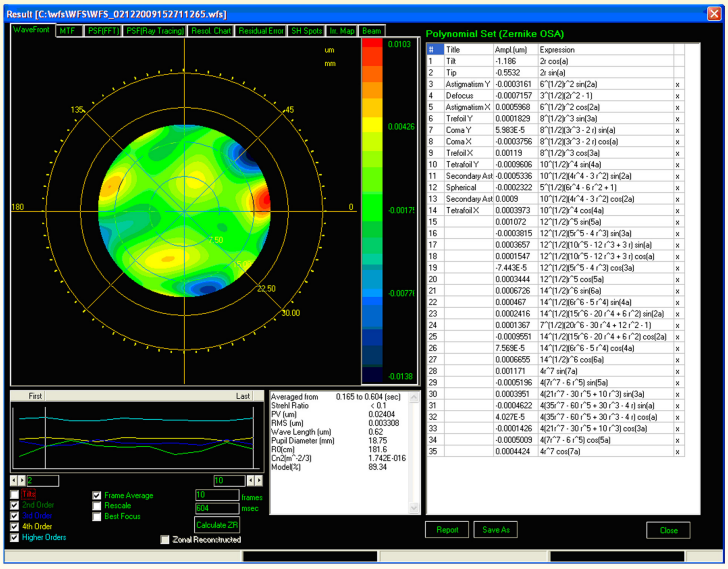
**ShaH** program package is intended for measuring a wavefront by means of ShaH wavefront sensors. Measurement data are both represented in a realtime and stored for further post-processing and analysis.

Output
- Raw Hartmann images
- Spot shift map
- Wavefront aberration map (3D plot, 2D projection, synthesized interferogram, up to 66 Zernike polynomials)
- Measurement error map
- PSF (point spread function)
- MTF (modulation transfer function)
- Strehl ratio, M2 factor, Gauss-Hermite modes
- Turbulence parameter estimation (for free space measurements)

Statistical analysis can be carried out during post-processing.
If the system is equipped with a wavefront corrector, the **ShaH** software allows calculating control signals for the corrector in the closed-loop mode.




Main window



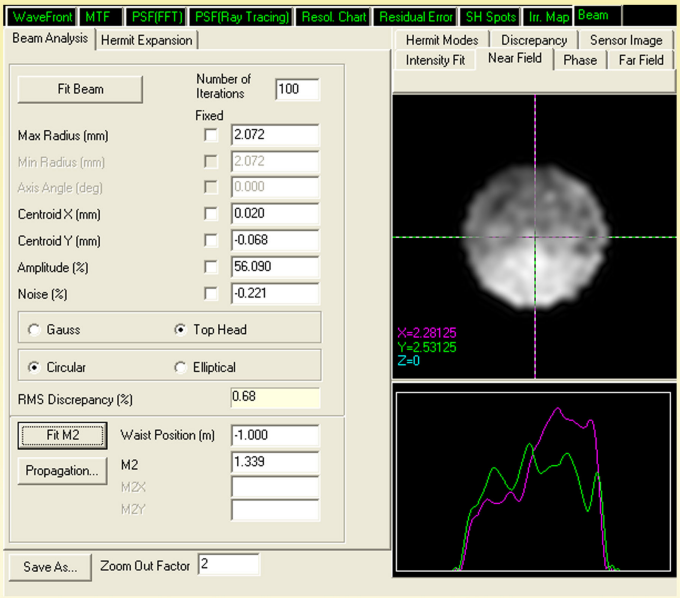

Result window

# ShaH SOFTWARE PACKAGE

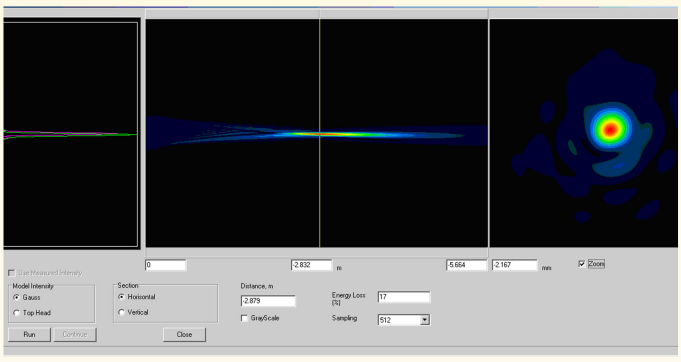
The optional program module “M2-sensor” is intended both for measurements of intensity and phase profiles and for estimation of the M2 factor of a single-mode laser beam on the basis of the wavefront measurement data.
M2 calculations are carried on according to ISO 11146-2 standard.
The module also permits expansion of the multimode beam into Gauss-Hermite modes in both automatic and manual regimes.

The optional program module “Beam propagation” is intended for simulation of the beam propagation starting from the wavefront sensor input plane to the plane located at a doubled distance to the plane of the beam waist.

The program package Shah is distributed as a self-installing executable file and/or a C++ SDK, which grants access to all functionality of the sensor and allows complete customization useful to the user’s software.




“M2-sensor” window



“Beam propagation” window

VISIONICA

adaptive optics components

# Visionica Ltd.


+7 (499) 256-73-35
+7 (499) 259-27-84
+7 (495) 792-79-76

www.visionica.biz
visio@optics.ru

Office 31, 10/2 Anatoliya Zhivova Str.,
Moscow 123100, Russian Federation