Koala Software
for efficient digital holographic microscopy

3D real time
optical topography
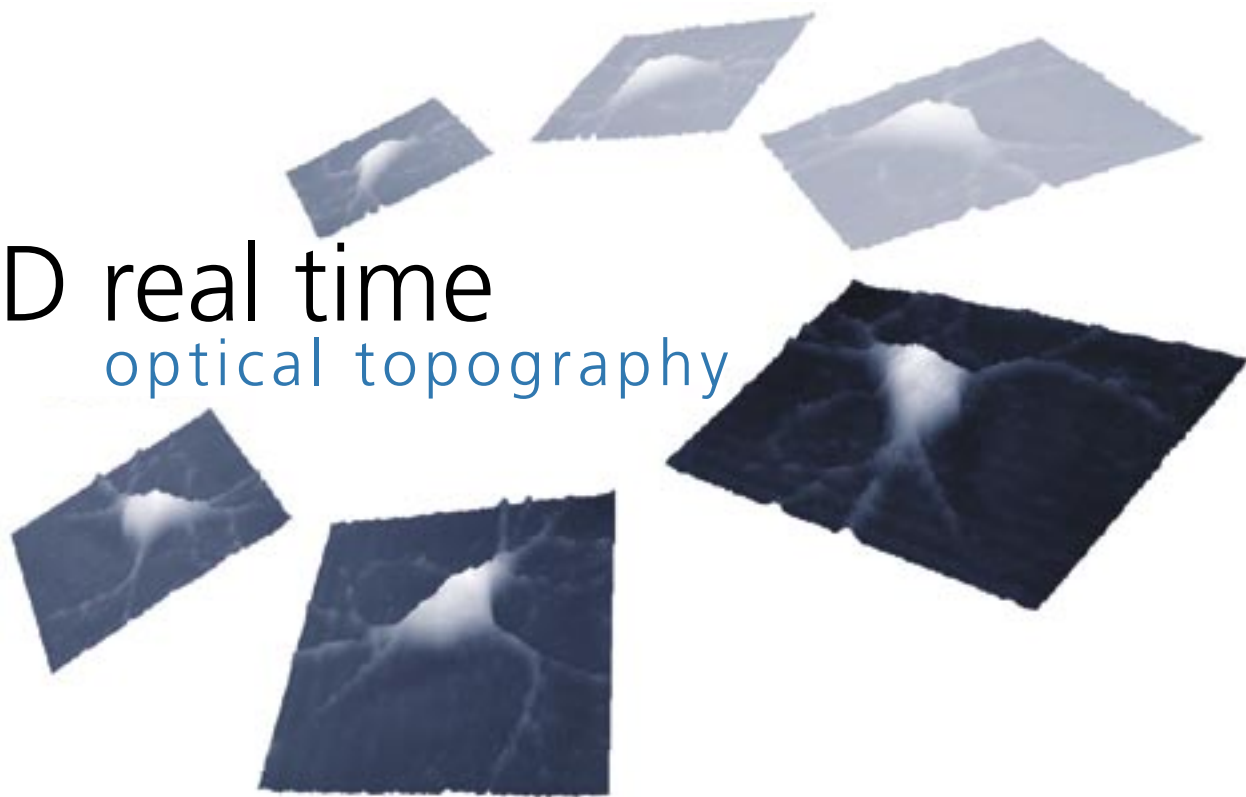
**Koala by Lyncée Tec is the indispensable proprietary software
to fully reveal the possibilities of digital holographic microscopes.**

Allows a complete analysis and 3D optical topography of the specimen under investigation.

↳ real-time and offline measurements
↳ short & long duration investigations
↳ stroboscopic and vertical scanning modes

Unique tools improve your efficiency by drastically reducing the measurement time:

↳ digital focusing
↳ single mouse-click tilt compensation
↳ shape factor, waviness and roughness

**These digital tools make digital holographic microscopy simpler
and faster than any interferometric technique has ever been!**

Working environment

It is composed of user-friendly windows refreshed in real-time. Each one is adjustable in size and contains icons for quick access to measurement tools. Every image includes digital zoom, lateral and vertical scale imprints and may be displayed using several color palettes. All axial scales can be displayed in degrees and nanometers. The interactive window layout gives a comfortable working environment.

Hologram
A single hologram contains both the intensity and phase information of the sample. Its digital processing, in live or offline mode, provides complete optical topographic information.

Intensity image
- information identical to classical optical microscopy
- line profile extraction

Phase contrast image
- topographic view
- histogram
- phase unwrapping
- phase offset
- line profile extraction
- adjustable phase scale
- phase monitoring
- single click tilt adjustment
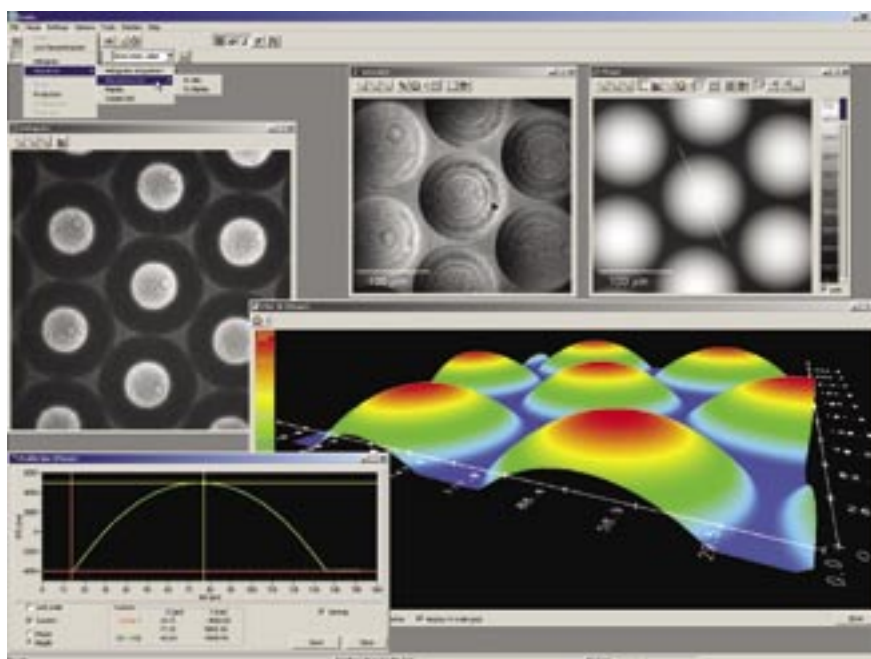
User friendly Koala Software interface

Line profile
- quantitative axial measurements
- quantitative lateral measurements
- cursors for precise alignment
- slope measurements

3D plot
- 3D surface topography
- easy and interactive view of the sample
- saveable and recallable viewing positions
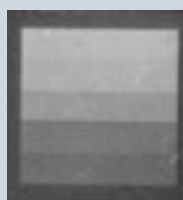- lateral scale

Unique tools

↘ Digital tilt adjustment
Digital phase compensation of the tilt of the sample with respect to the optical axis. Correction with a single mouse-click.
- no need of time consuming precision alignment of the sample under the microscope objective!
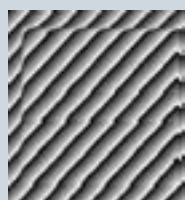

Phase image without tilt correction

Phase image with digital tilt correction

↘ Digital focusing
The numerical propagation of the reconstructed light wavefront enables focusing and precise measurements at any user defined depth of the sample without moving it. In particular, different planes can be focused from a single hologram.
- depth of field extension up to 50x
- efficient and fast image focusing for high magnification objectives
- a posteriori focus correction
- track of samples moving along the vertical axis without mechanical translation
- no loss of valuable information and time!

Hologram (d=0)

Digital propagation

$d=3\,cm$ $d=4.5\,cm$ $d=6\,cm$

Reconstructed images
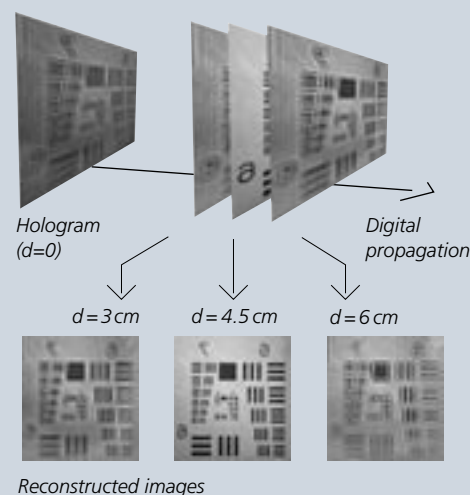
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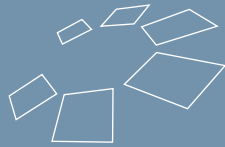
Operating modes

⤳ Live reconstruction mode

Reconstruction of holograms in real-time giving live 3D optical topography of the specimen with powerful tools for precise measurements.

⤳ Offline reconstruction mode

Reconstruction of stored holograms. Allows the same analysis as in live mode but, with possibilities of a posteriori image processing and optimization (focusing, tilt, aberration compensation, form removal,...)

⤳ Sequence mode

Acquisition, reconstruction and replay of time sequences of holograms. Allows fast acquisition or long term investigations. Creation of movies included (avi)

⤳ Stroboscopic mode*

Synchronization of the hologram acquisition with external hardware or software. Allows high frequency phenomena observations. Analog and digital input for external event recording included.

⤳ Scanning mode*

Extension of the vertical measurement range. Similar to vertical scanning in white light interferometry.

⤳ Production mode*

The evolutive software enables interactions with external hardware and software. Customized interface for specific applications (quality control, automated analysis,...)

* options

⤳ Phase Monitoring

Time monitoring of phase mean values on different user defined areas. Operating in live, sequence and stroboscopic modes. Recording of external events, automatic phase unwrap of the time profiles, saveable profiles and log file.
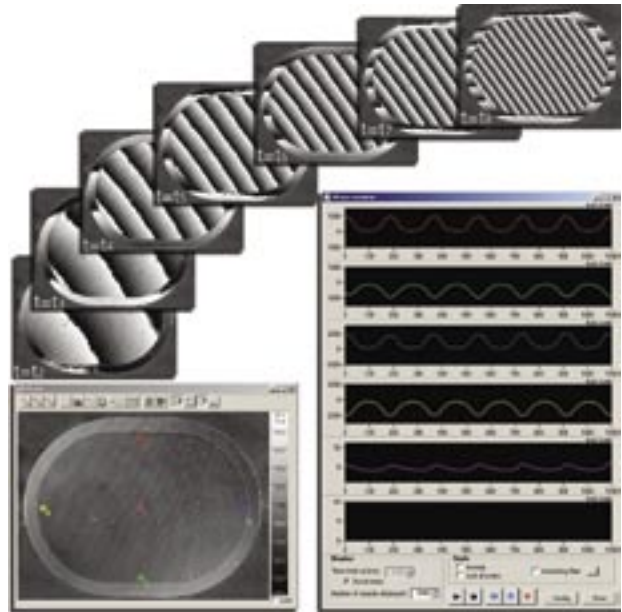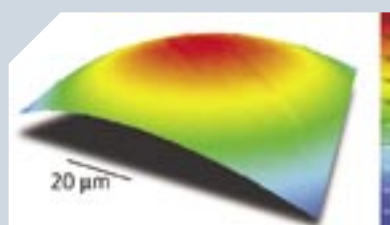

Live micro mirror motion in stroboscopic mode with corresponding phase monitoring (sample courtesy of Colibrys)

⤳ Surface fitting

Fit of the topographic surface. Different models included (polynomial, Zernike, spherical, cylindrical,...)
• direct access to quantitative shape information
  (slope, radius, step height, sphericity,...)

⤳ Form factor suppression

Uses fit to suppress the form factor and digitally flatten the sample surface.
• increased visibility of defects
• quantified deviation of the surface in comparison to a perfect shape
• real-time roughness parameters calculation of any shaped form

Form factor suppression

3D representation of a micro-ball surface for sample characterization
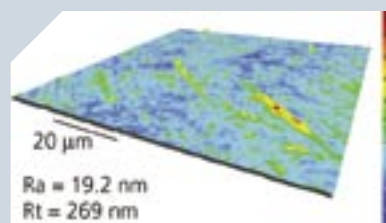
3D representation of a digitally flattened micro-ball surface for roughness measurements

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Represented by

Koala Software specifications

Technology:	based on C++ and .NET	
Environment:	Microsoft Windows XP	
Administration:	multi-user configurations with individual passwords and restriction levels	
Personalization:	factory configuration for user selected objectives	
	possibility to save and recall personalized configurations in database	
	possibility to import / export configurations	
Operating modes:	live reconstruction	reconstruction rate: 15 fps (512 x 512 pixels hologram)
		4 fps (1024 x 1024 pixels hologram) ~3.0 GHz processor
	offline reconstruction	reconstruction of stored hologram :
		- recovery of all sample information
		- enables modification of all reconstruction parameters
	sequence	acquisition and replay of sequences
		rate up to 15 fps, higher with optional camera
	stroboscopic (option)	output for external synchronization:
		- 1 analog up to 1 MHz - 10 V_{rms} (20 V peak to peak)
		- 1 high voltage analog up to 1 MHz - 200 V_{rms} (400 V peak to peak)
		- user-defined signal shape, amplitude and frequency
		input for event synchronization:
		- 1 analog 2 digital
	vertical scanning (option)	objective and hardware dependent specifications
	production (option)	customized integrated interface for specific applications
Unique tools:	digital focusing	vertical focusing range up to 50x depth of field (objective dependent)
	digital sample tilt compensation	on simple mouse-click
	phase monitoring	time monitoring of the topography in user defined image areas
		operating in live, sequence and stroboscopic mode
		unwrapping of the time profile
	roughness measurements	coefficient determination over user defined line or image area
	surface fit	different fit models available (polynomial, Zernike, spherical, cylindrical,...)
	form factor suppression	surface flattening for increased visibility of surface details and deformation
	adjustable phase offset	user defined zero referencing
	profiles	precise axial and lateral measurements using cursors
Data compatibility:	recorded and reconstructed images exportable in .tif format or .txt array	
	measurement and log data exportable in .txt format	
Camera configuration:	image size: 1024 x 1024 or 512 x 512 pixels, regions of interest selection tool included	
	software controlled camera shutter, brightness and gain	
Reference path:	enables compensation for immersion liquids, glass covers,...	
	automatic detection of the optimal reference arm optical path length	
Intensity:	automatic adjustment of the reference arm intensity for optimal hologram contrast	
Polarization (option):	automatic adjustment of the reference arm polarization for optimal interference in case of birefringent samples	