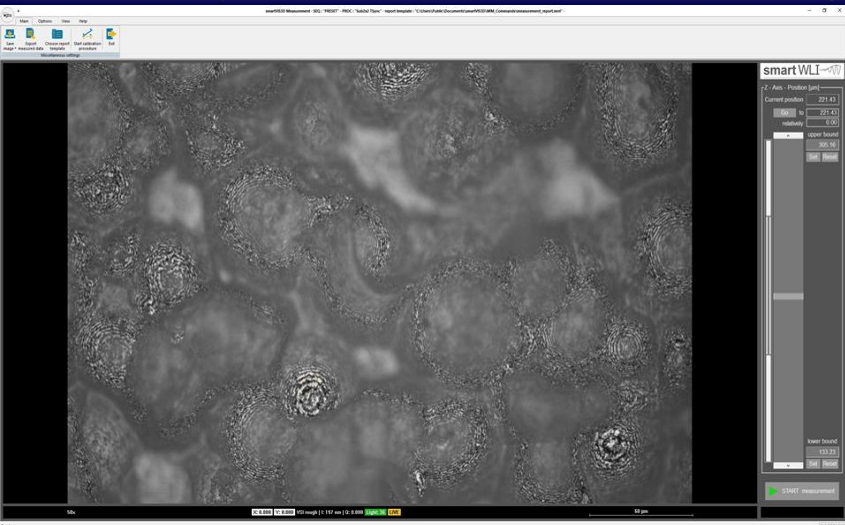


***universal package for
visualization and
data analysis
in surface
metrology***

contour analysis
statistical particle analysis
geometrical measurements
ISO conform roughness analysis
3d data alignment and comparison
interfaces for customized extensions

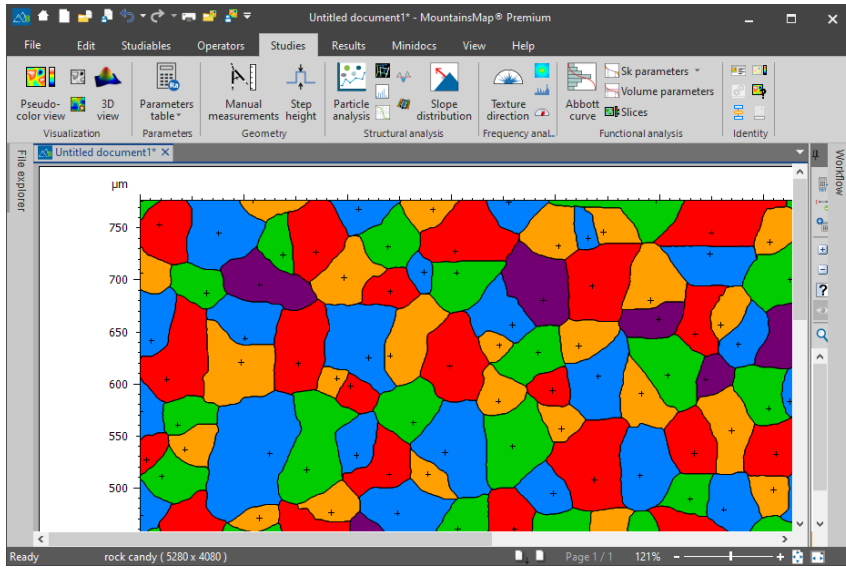
excellent team work



**smartVIS3D (scanning software)
definition of scanning volume,
application specific parameters and
measuring macro**



**full automated evaluation after “start”
of the scanning process
flexible and interactive extension of
the existing evaluation process**

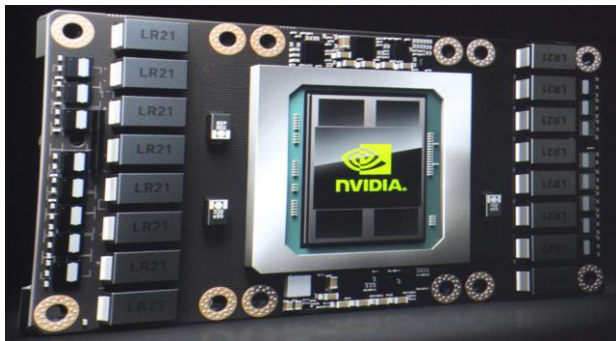


optimal use of resources...

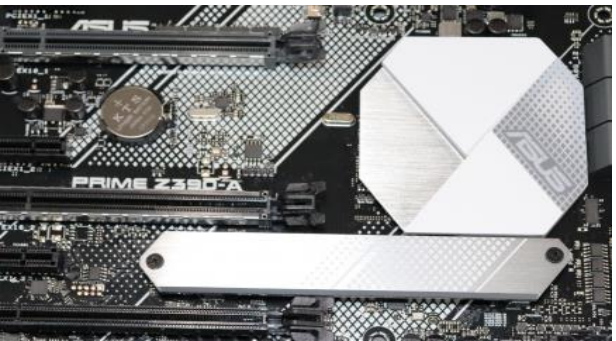
smartVIS3D – data processing on the GPGPU
(general purpose graphic processing unit):
image correction
contrast enhancement
real time 3d calculation



MountainsMap® – data processing on the CPU
(central processing unit):
visualization
filtering / stitching
parameter calculation
tolerance check
logging



split processes
split resources
double throughput



optimized for speed and extreme resolution

smartWLI Measurement report Page 1 / 1

ISO 4287 - Roughness (S-L)
F: None
As Filter: Gaussian, 2.500 μm
Ac Filter: Gaussian, 0.8000 mm
Calculated on: All Ac (1)

Amplitude parameters
Ra 25.16 nm

Ra - Amplitude parameters - Roughness profile - ISO 4287
25.16 nm

25.00 nm \pm 2.000 μm

μm [Z] nm

30 25 20 15 10 5 0

0 200 400 600 800 1000 1200 1400 1600 1800 μm

gbs Gesellschaft für Bild- und Signalverarbeitung mbH
For demonstration purposes only
Vormer-von-Siemens-Straße 10, 90690 Ilmenau
Tel.: +49(0)3677-6997663
Fax: +49(0)3677-6997682
www.gbs-ilmena.de, info@gbs-ilmena.de



frame rate: 3000 f/s
images: 15/ μm
objective: 10x
point spacing: 1 μm
cycle time: >>1s
EPSI: for sub-nanometer resolution

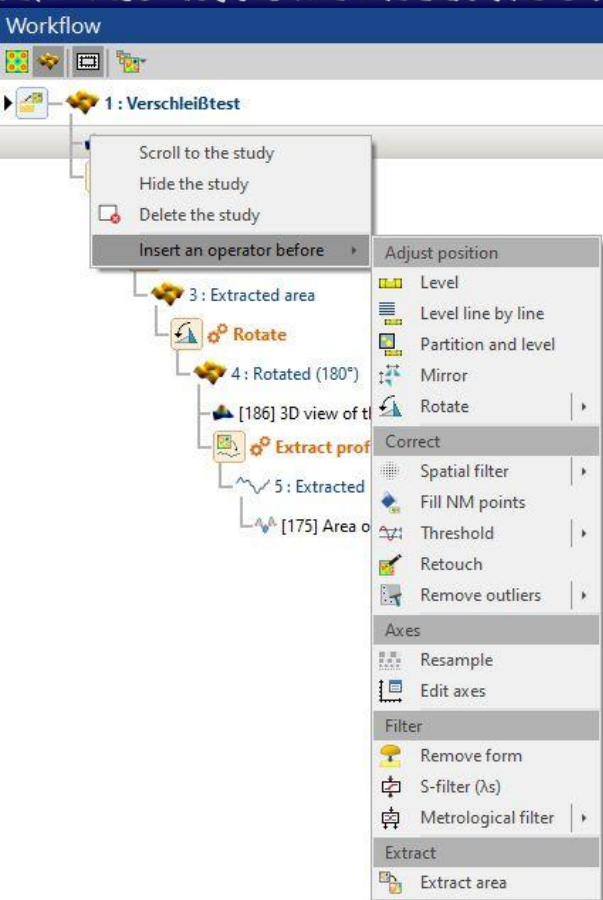
modular available evaluation functions

comparison between MountainsMap® Imaging Topography M8P and MountainsMap® Premium M8P

MountainsMap® Imaging Topography M8P / MM 1101	MountainsMap® Premium M8P / MM 1102
Automotive / MM 1103	Automotive
Advanced Profile / MM 1104	Advanced Profile
Contour / MM 1105	Contour
Advanced Contour / MM 1106	Advanced Contour / MM 1106
Advanced Topography / MM 1107	Advanced Topography
Fourier & Wavelets / MM 1108	Fourier & Wavelets
Colocalization / MM 1109	Colocalization
4D Series / MM1110	4D Series
Particle Analysis / MM 1111	Particle Analysis
Statistics / MM 1112	Statistics
GBS add on honing structures / AO 1001	GBS add on honing structures / AO 1001
GBS add on statistic evaluation of cavities / AO 1002	GBS add on statistic evaluation of cavities / AO 1002

yellow – optional available modules (extra charge)
 green – integrated modules in the premium version

Imaging Topography – basic functions



document orientation:

- all studies get arranged in document form for instant printing or *.pdf export

instant macros:

- each “workflow” can be modified or extended in a graphical tree with instant actualization of all graphical representations and calculated results
- used raw data are embedded in the workflow and remain intact
- exchange of the raw data is possible to test the workflow on various different data sets / measuring objects
- saving of a document make it to a macro, which can be choose inside of the scanning software for automated evaluation

simultaneously data processing – new in version 8:

- multiple raw data can be marked and processed parallel

batch processing:

- a saved document can be used as macro for the batch processing of unlimited raw data
- results of all raw can be saved automatically for processing in other programs (as Excel...)
- optional is the protocol printing and the export as *.pdf files possible

Imaging Topography – patching

Operator: Patch

Available studiabiles

	826 : x --- Mea Surface 164.3 μm X 102
	827 : x --- Mea Surface 164.3 μm X 102
	828 : x --- Mea Surface 164.3 μm X 102
	829 : x --- Mea Surface 164.3 μm X 102
	830 : x --- Mea Surface 164.3 μm X 102
	831 : x --- Mea Surface 164.3 μm X 102
	832 : x --- Mea Surface 164.3 μm X 102

Used studiabiles

	826 : x --- Mea Surface 164.3 μm X 102
	827 : x --- Mea Surface 164.3 μm X 102
	828 : x --- Mea Surface 164.3 μm X 102
	829 : x --- Mea Surface 164.3 μm X 102
	830 : x --- Mea Surface 164.3 μm X 102
	831 : x --- Mea Surface 164.3 μm X 102
	832 : x --- Mea Surface 164.3 μm X 102

Position of current studiabile

X-offset: -37484 μm (x 10)
 Use X-offset of source studiabile

Y-offset: 27026 μm (x 10)
 Use Y-offset of source studiabile

Z-offset: 231.1 μm (x 10)
 Use Z-offset of source studiabile

Calculation of offsets

Compute X/Y-offsets according to the best overlap

Size of the neighborhood: 5x5
The smaller, the faster.

Compute Z-offsets from common zones

Compute the Z-offsets using the mean heights of the surfaces' overlapping X/Y-zones

Result

View type

Top view 3D view

Preview size

Simplified preview Full size preview

Result properties

Size: 2396 x 1796 pixels
 Enable size edition

Apply the operator?

OK Cancel

Always use all compatible studiabiles (loaded from disk) available in the document.

More about this operator...

patching:

- merges the 832 single scans of a surface together
- patching use the coordinates of motorized xy stages
- the height error of the stage can be compensated
- patching of large areas with more than 8000 x 8000 measuring points require a high end PC with 32 GB Ram

Imaging Topography – stitching

stitching:

- merges the 9 single scans of a surface together
- stitching must be used for single scans after manual positioning
- it is necessary to import the files in the correct order to each other
- a significant overlapping area is required
- stitching use the microstructures in overlapping zones to calculate the best alignment of the single scans and merge them together

Operator: Stitch

X/Y-positioning

Automatic (using offsets)

Always use all compatible studiabiles (loaded from disk) available in the document.

Automatic positioning cannot be used when the studiabiles do not have any offset at all, or have the same offsets.

Manual

Grid size X x Y

Drag and drop a studiabile on a grid cell to use it in the stitching.

Fully automatic

Pre-processing

Apply the following operations on each studiabile prior to stitching:

LS-plane leveling

Line by line leveling

- on the full lines
- excluding structures above background
- excluding structures below background

Apply a gradient filter to images

Available studiabiles

- 34 : Created surface+image studiabile (23)
Surface+image (Size: 1.44 mm X 1.094 mm)
Offsets: -0.72 mm X -0.547 mm
- 35 : Created surface+image studiabile (25)
Surface+image (Size: 1.44 mm X 1.094 mm)
Offsets: -0.72 mm X -0.547 mm
- 36 : Created surface+image studiabile (27)
Surface+image (Size: 1.44 mm X 1.094 mm)
Offsets: -0.72 mm X -0.547 mm

Check / uncheck all

Overlapping

Search for the best overlap

Defines the size of the neighborhood for the search. The smaller, the faster.

Result

Keep the complete result (outer rectangle)

Crop to inner rectangle

Resample result to:

Size: x pixels

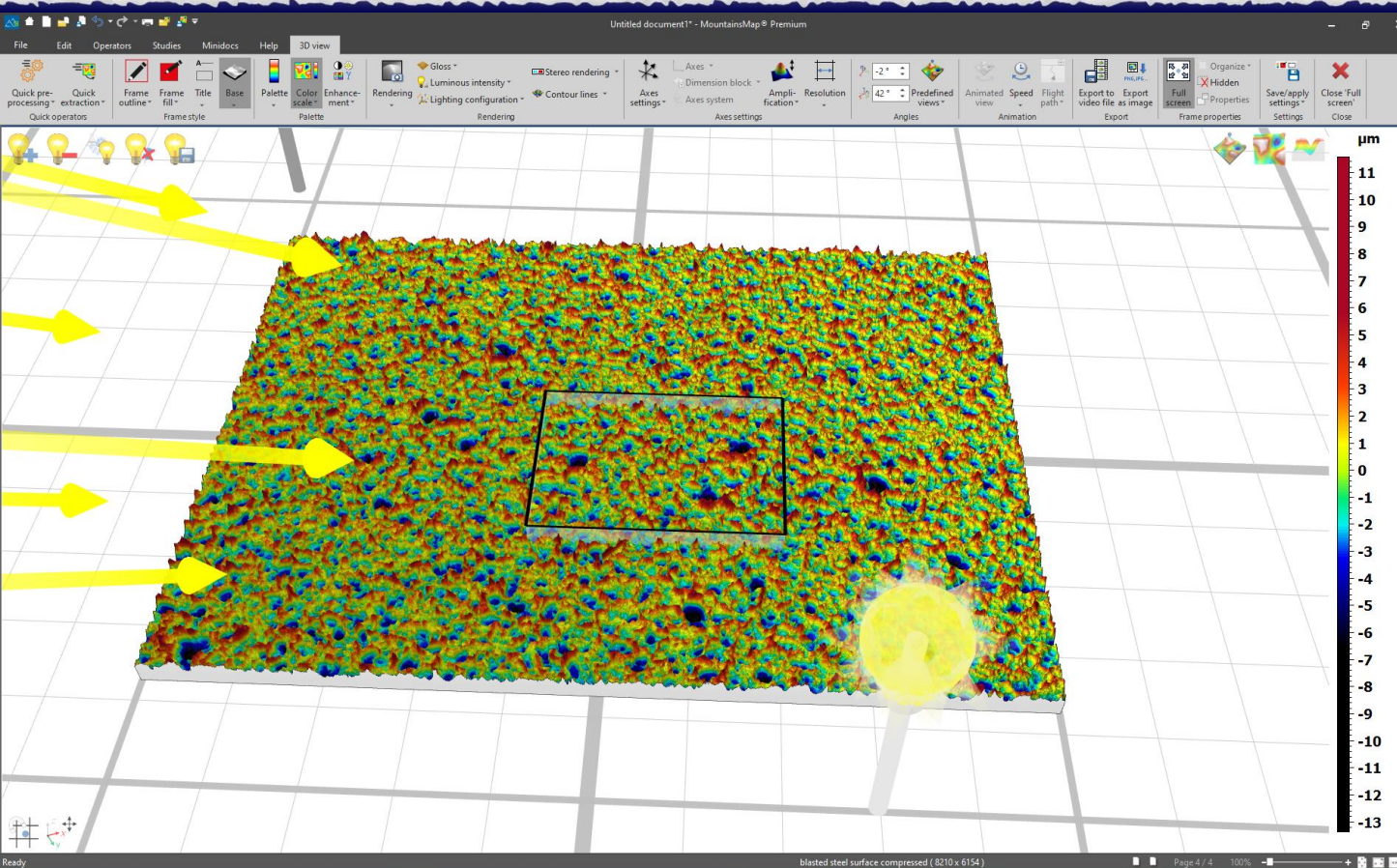
Grid view of studiabiles to stitch

Result studiabile

Apply the operator?

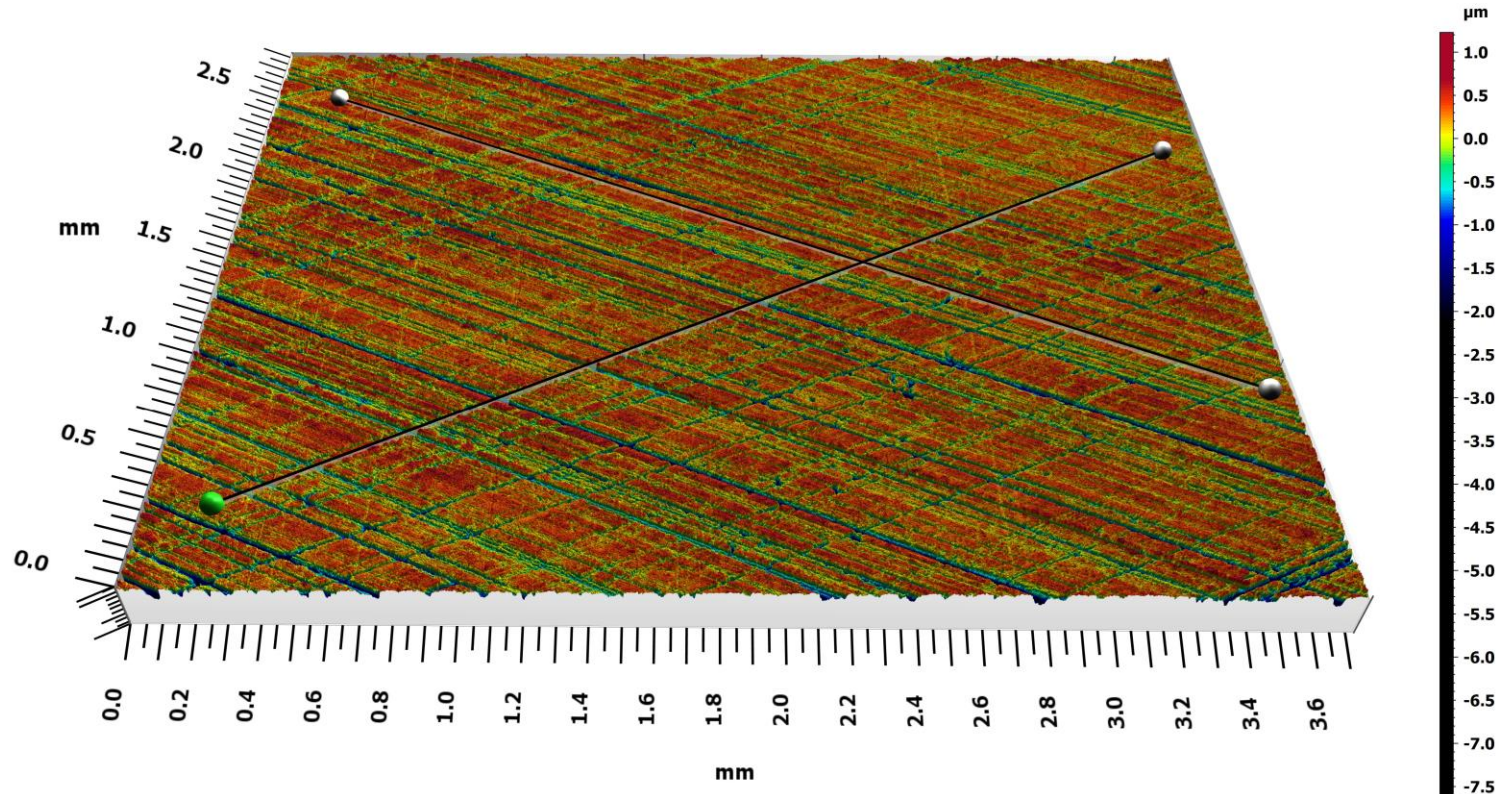
OK Cancel

Imaging Topography - visualization



- 2d plots*
- 3d plots*
- various color palettes*
- wire plots*
- contour lines*
- illumination models*
- variable gloss*
- stereo rendering*
- flying movies*
- movie export*
- ...*

Imaging Topography – profile extraction



*interactive selection of
one or several profile
with automated
actualization of
subsequent
evaluations*



Imaging Topography – 3d surface parameters

Selection of parameters

List configuration



ISO 25178

ISO 25178
EUR 15178N
Other areal parameters
ASME B46.1
EUR 16145 EN

Roughness surface (S-L)

Available in the Workflow.

Radius: mm

S-filter (As)

L-filter (Ac)

Gaussian (ISO 16610-61)*

0.8 mm

Manage end effects

Calculate parameters on:

More...

* Default settings

Parameters

- Sku
- Sp
- Sv
- Sz
- Sa
- Functional parameters
 - Smr
 - Smc
 - Sxp
- Spatial parameters
 - Sal
 - Str
 - Std
- Hybrid parameters
 - Sdq
 - Sdr
- Functional parameters (Volume)
 - Vm
 - Vv
 - Vmp
 - Vmc
 - Vvc
 - Vvv
- Functional parameters (Stratified...)
 - Sk
 - Spk

Parameter configuration

No configuration

Parameter description

Symbol:

Standard: ISO 25178

Family: Height parameters

Full name:

Context:

[More about this standard or family of parameters...](#)

[More about selecting and configuring parameters...](#)

Open this dialog when creating a 'Parameters table' study

OK

Cancel

**Sa; Sal; Sbi;
Sci; Sdar;
Sdc; Sdq;
Sdr; Sds;
Sfd; Sk; Sku;
Smc; Smean;
Smq; Smr;
Smr1; Smr2;
Sp; Spar; Spk;
Spq; Sr1; Sr2;
Ssc; Ssk; St;
Std; Stdi; Str;
Sv; Svi; Svk;
Svq; Swt; Sxp;
Sz; Vm; Vmc;
Vmp; Vv; Vvc;
Vvv**

Imaging Topography – 2d surface parameters

Selection of parameters

List configuration

ISO 4287
ISO 12780
ISO 12181
Other profile parameters
ASME B46.1
VDA 2006
SEP 1941

Roughness profile (S-L)

Radius: mm

S-filter (As) **'S-filter (As)' operator detected in the workflow.**

L-filter (Ac)

Gaussian (ISO 16610-21)* 0.8 mm

Remove 1/2 cut-off at each end

Calculate parameters on:
Total profile length (no averaging) More...

* Default settings

Parameters

- Amplitude parameters
 - Rp
 - Rv
 - Rz
 - Rc
 - Rt
 - Ra
 - Rq
 - Rsk
 - Rku
 - Rp1max
 - Rv1max
 - Rz1max
 - Rz(n)
- Spacing parameters
 - RSm
 - Rdq
- Material ratio parameters
 - Rmr
 - Rdc
 - Rmr (Rz/4)
- Peak parameters
 - R Pc

Parameter configuration

No configuration

Parameter description

Symbol: **Htp; LSRad; P3z; Pa; Pc; PD; Pda; Pdc; Pdq; Pfd; PH; PHSC; PHTp; Pku; PLa; PLo; PLq; Pmax; Pmr; Pp; PPc; Ppm; Psk; PSm; Pt; Ptm; PTP; Pv; PVo; Py; Pz; PzJIS; R3z; Ra; Rc; RD; Rda; Rdc; Rdq; Rfq; RH; RHSC; RHTp; Rku; RLa; RLo; RLq; Rmax; Rmr; RONp; RONq; RONT; RONv; Rp; Rp1max; RPC; Rpm; Rq; Rrms; RS; Rsk; RSm; Rt; Rtm; RTP; Rv; RV1max; RVo; Ry; Rz; Rz(n); Rz1max; RzJIS; STRp; STRq; STRt; STRv; tp; W3z; Wa; Wc; WD; Wda; Wdc; Wdq; Wfd; WH; WHSC; WHTp; Wku; WLa; WLo; WLq; Wmax; Wmr; Wp; WPC; Wpm; Wq; Wrms; WS; Wsa; Wsk; WSm; Wt; Wtm; WTP; Wy; WVo; Wy; Wz; WzJIS**

Standard: ISO 4287

Family: Amplitude parameters

Full name:

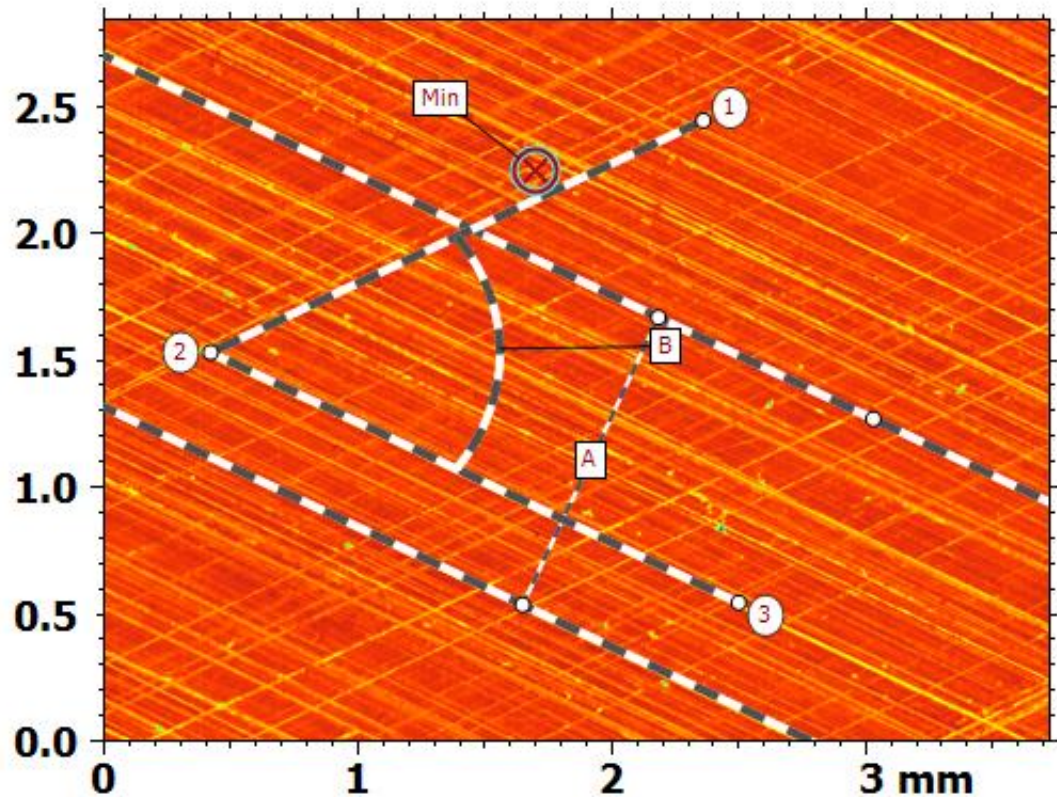
Context:

Open this dialog when creating a 'Parameters table' study

OK Cancel

Imaging Topography – area measurements

mm

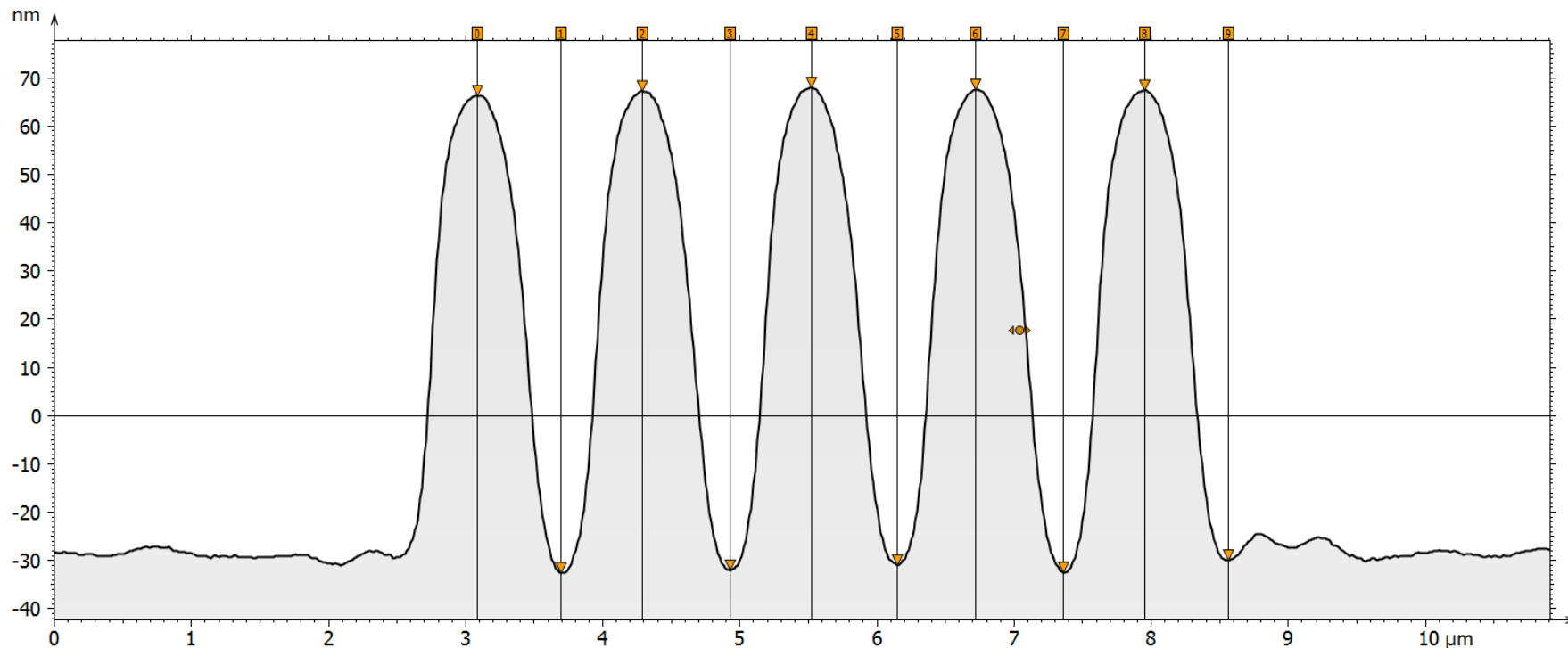


z d θ d Rectangle Ellipse Custom shape Min Max Shape settings Select parameters

Parallel lines		
Distance	A	Unit
	1.252	mm
Angles		
Angle	B	Unit
	50.56	°
Points		
X	Min	Unit
	1.698	mm
Y		
	2.247	mm
Z		
	-7.605	μm



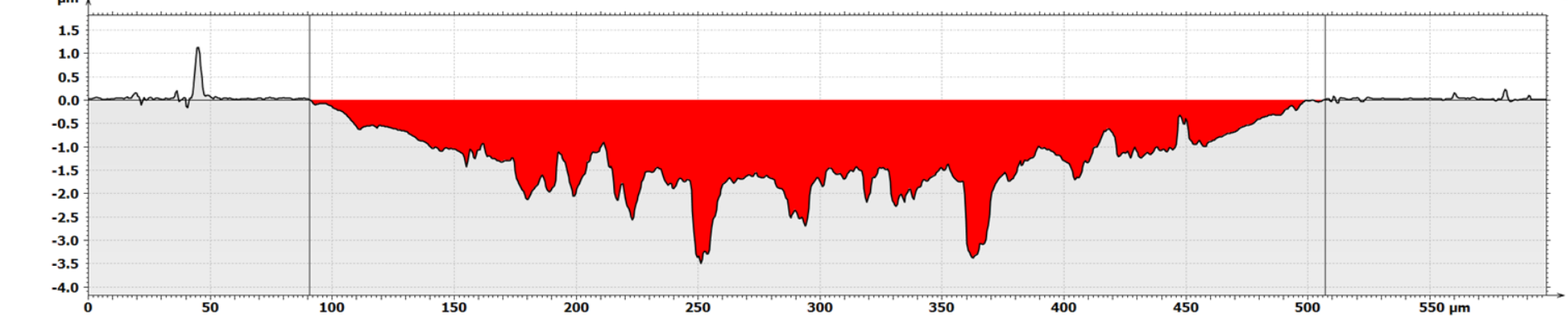
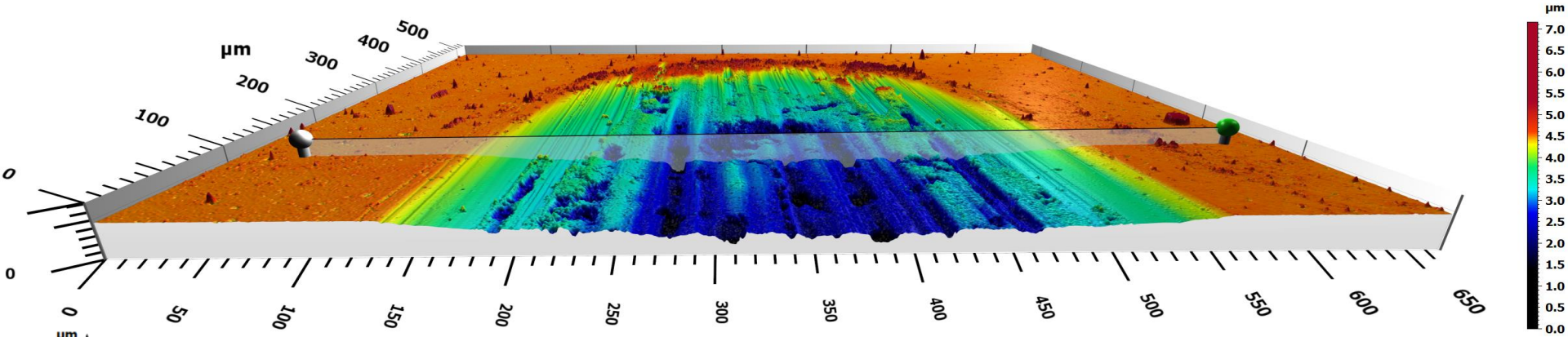
Imaging Topography – profile measurements



Parameters	Unit	0-1	2-3	4-5	6-7	8-9
Horizontal distance	μm	0.6101	0.6412	0.6279	0.6412	0.6101
Height difference	nm	-98.82	-99.25	-98.9	-100	-97.29



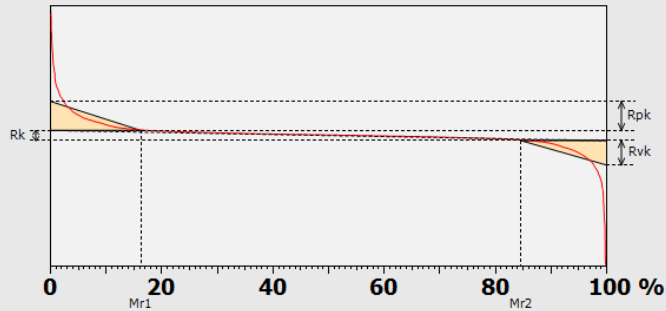
Imaging Topography – wear measurement



Parameters	Value	Unit
Maximum depth	3.512	μm
Area of the hole	561.9	μm^2
Maximum height	0.000	μm
Area of the peak	0.000	μm^2



Automotive – plots and R&W motifs ISO 12085

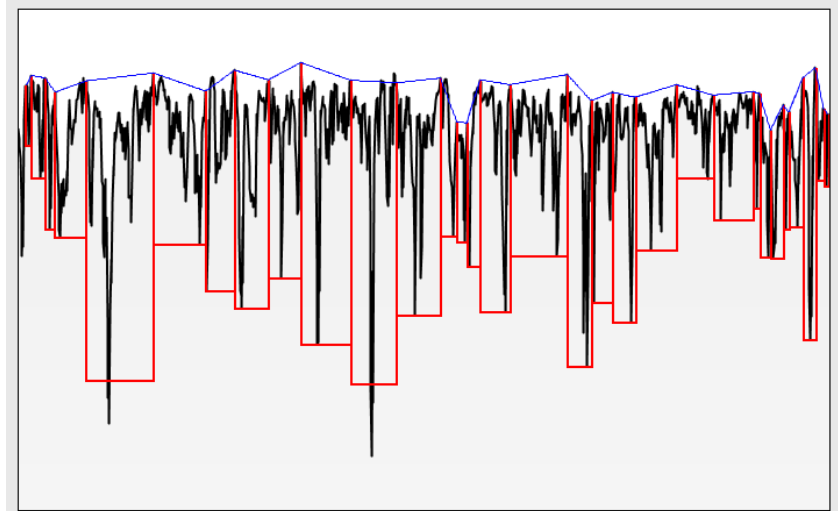


Information

Filter settings Robust Gaussian filter, 0.0080 mm, Manage end effects.

Parameters

Parameters	Value	Unit
Rk	0.07525	μm
Rpk	0.2151	μm
Rvk	0.1813	μm
Mr1	16.23	%
Mr2	84.55	%
A1	17.45	$\mu\text{m}^2/\text{mm}$
A2	14.00	$\mu\text{m}^2/\text{mm}$
Rpk*	0.9226	μm
Rvk*	0.9303	μm



Information

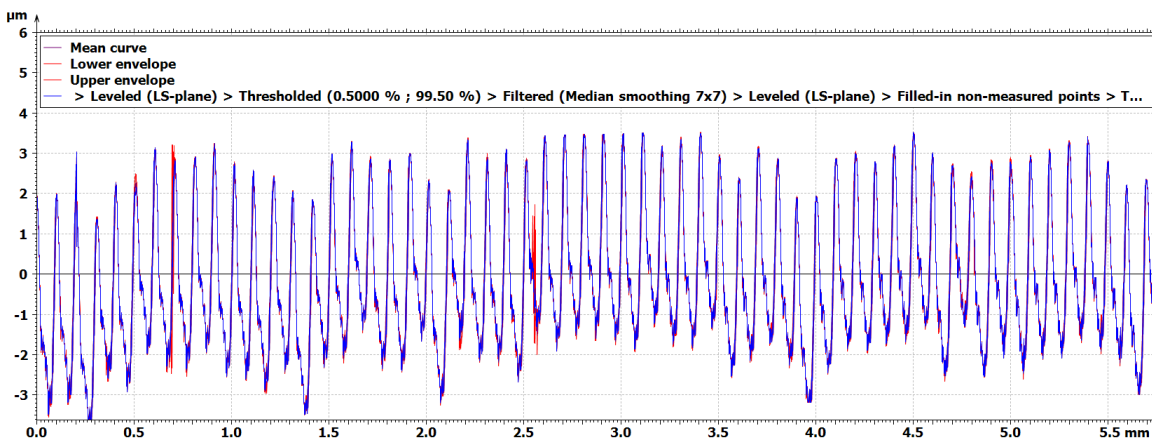
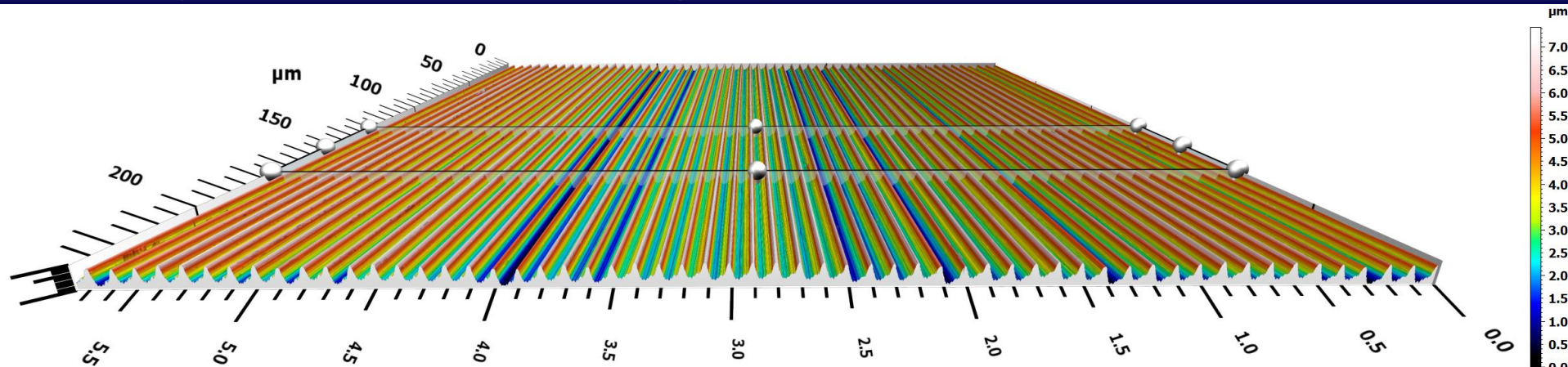
Roughness limit A 0.5 mm

Waviness limit B 2.5 mm

Parameters

Parameters	Value	Unit
R	1.736	μm
AR	0.1407	mm
Rx	3.758	μm
Pt	4.073	μm

Advanced Profile – profile series and statistics

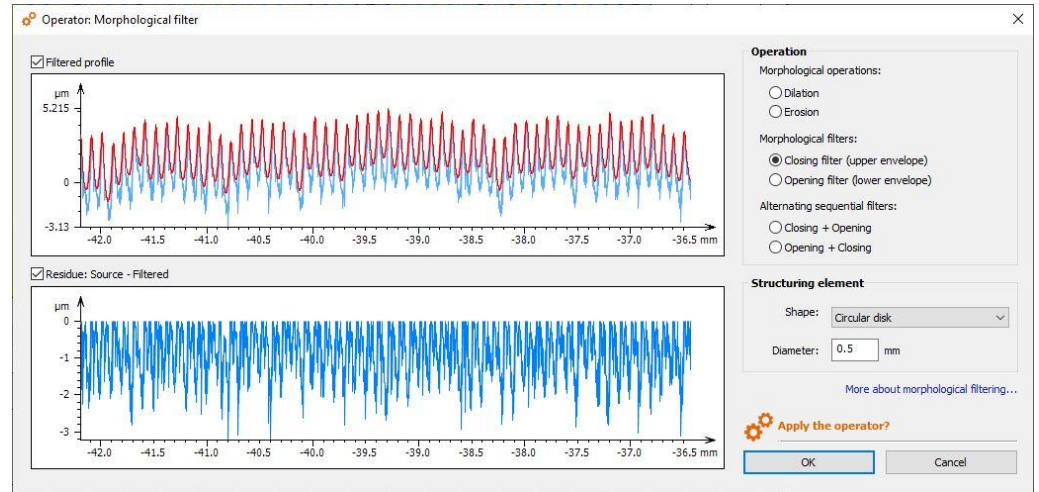
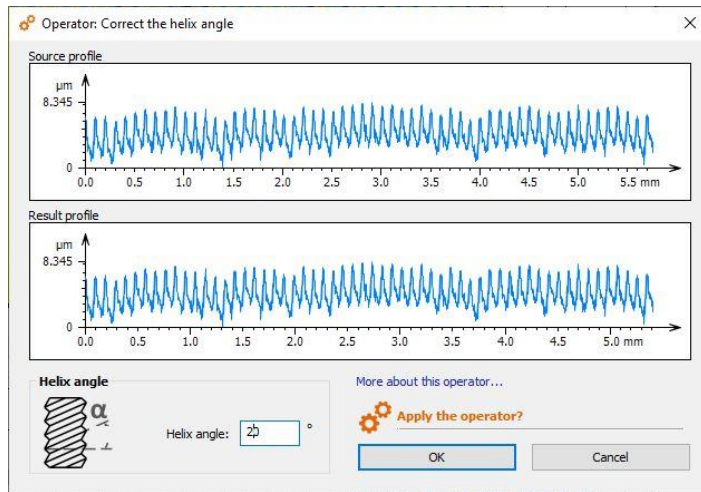
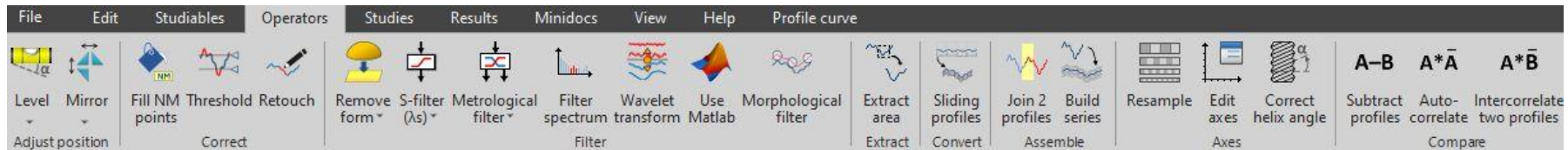


	Context	Mean	Std dev	Min	Max
ISO 4287 - Roughness (S-L)					
<i>F: None</i>					
<i>S-filter (λ_s): Gaussian, 2.500 μm</i>					
<i>L-filter (λ_c): Gaussian, 0.8000 mm</i>					
<i>Calculated on: All $\lambda_c(7)$</i>					
Amplitude parameters					
Rz	μm	6.041	0.02604	6.017	6.088
Ra	μm	1.332	0.002641	1.328	1.335

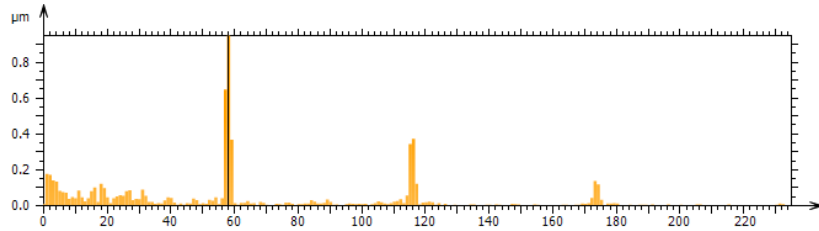
thousands of profiles can be evaluated at the same time



Advanced Profile – filter functions for profiles

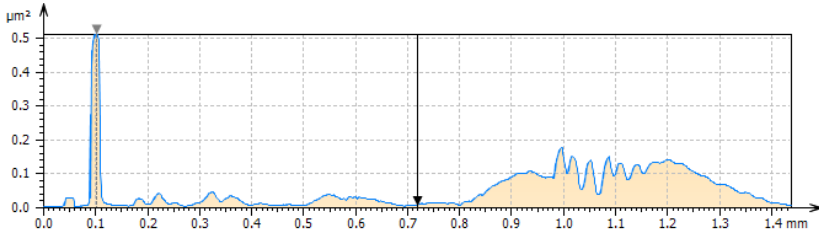


Advanced Profile – frequency analysis



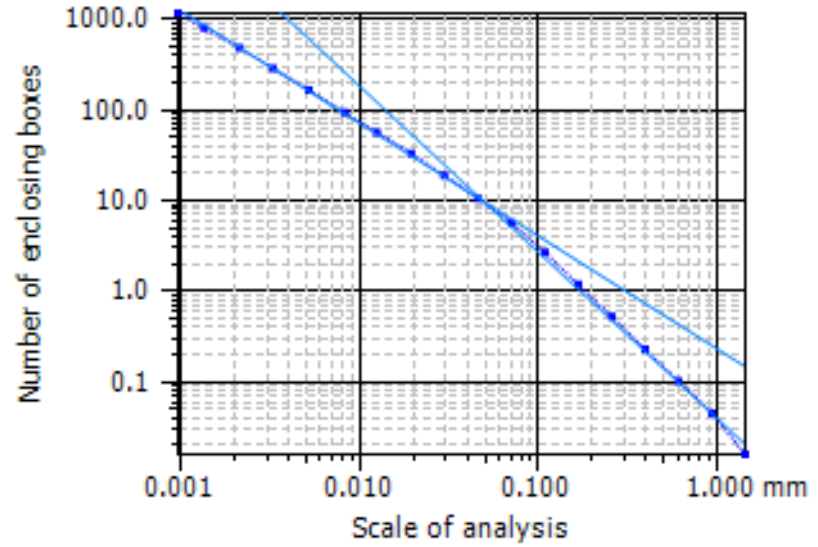
Information		
Zoom factor	x64	
Windows function	Hanning	

Parameters	Value	Unit
Wavelength # 58	99.22	µm
Magnitude	0.9485	µm
Phase	133.3	°



Information		
Zoom factor	x4	
Nb iterations	32	
Smoothing	17	
Windows function	None	

Parameters	Value	Unit
Wavelength	0.7191	mm
Amplitude	0.07774	µm
Dominant wavelength	0.1020	mm
Maximum amplitude	0.7158	µm

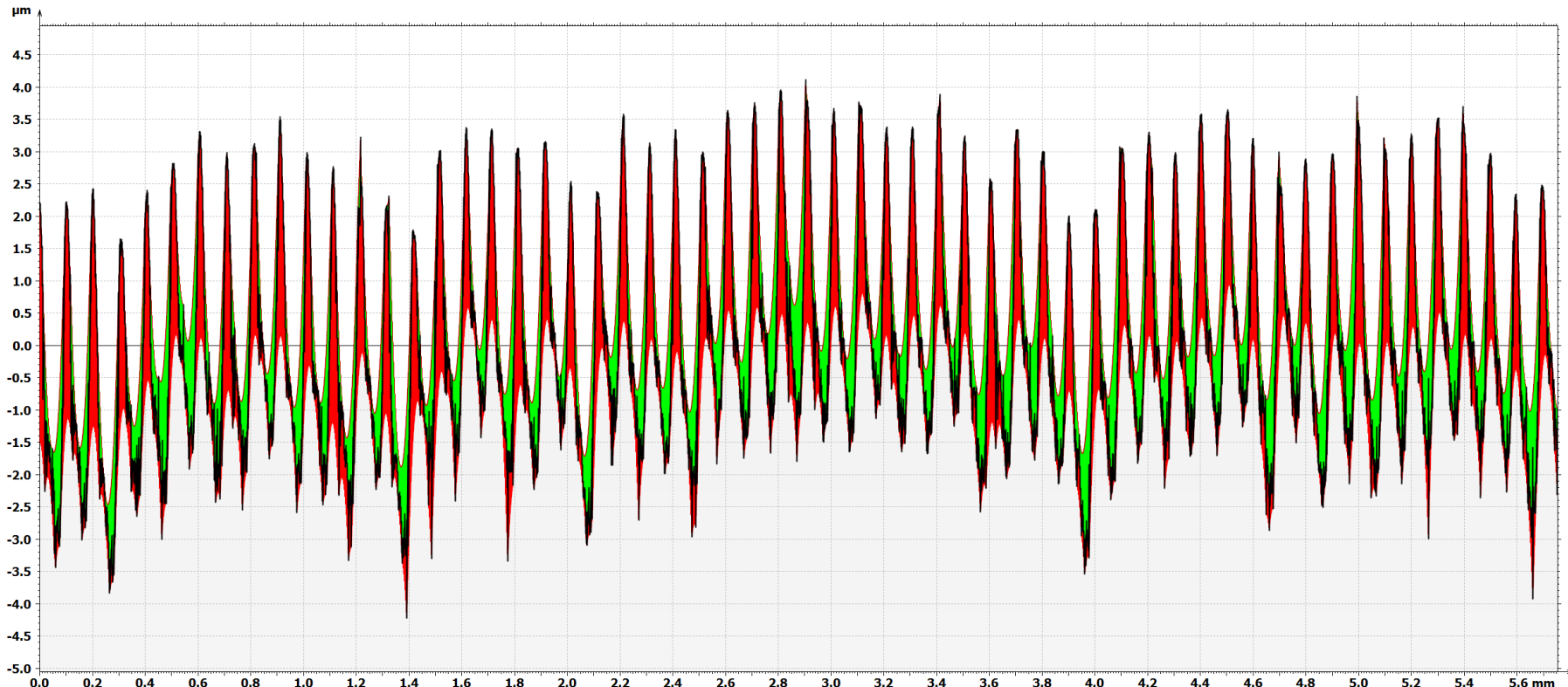


Information	
Method	Enclosing boxes

Parameters	Value
Fractal dimension	1.243



Advanced Profile – morphological envelopes



Information

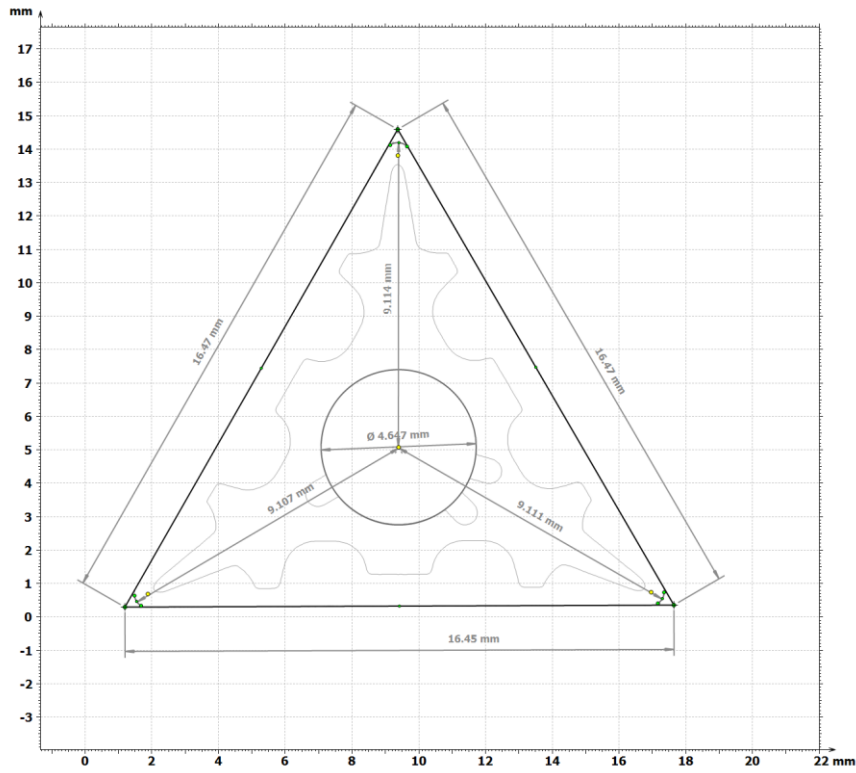
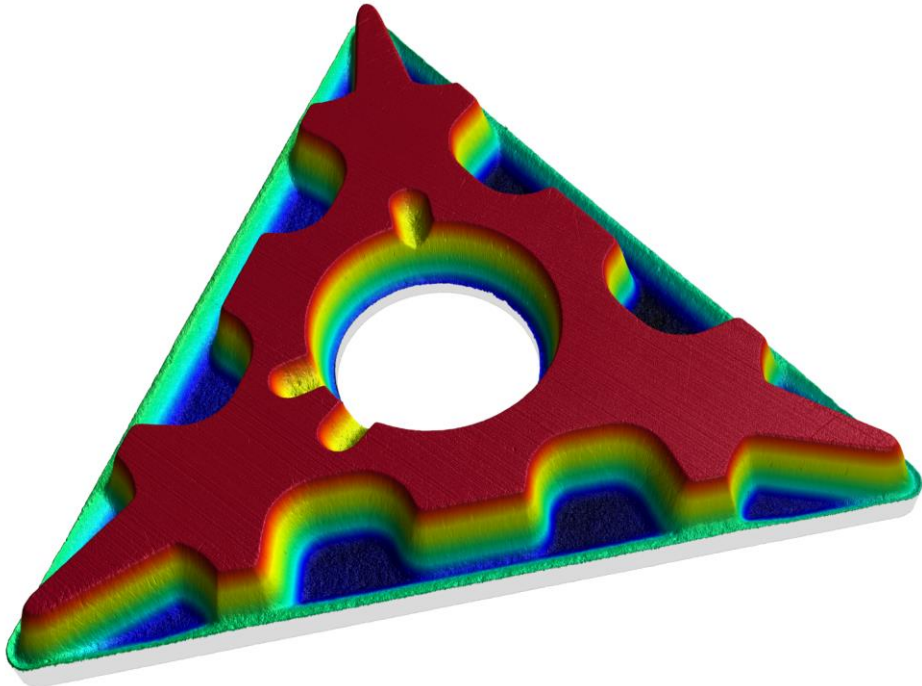
Element Circle of diameter: 0.5 mm

Parameters Value Unit

Enclosed area 0.01058 mm²



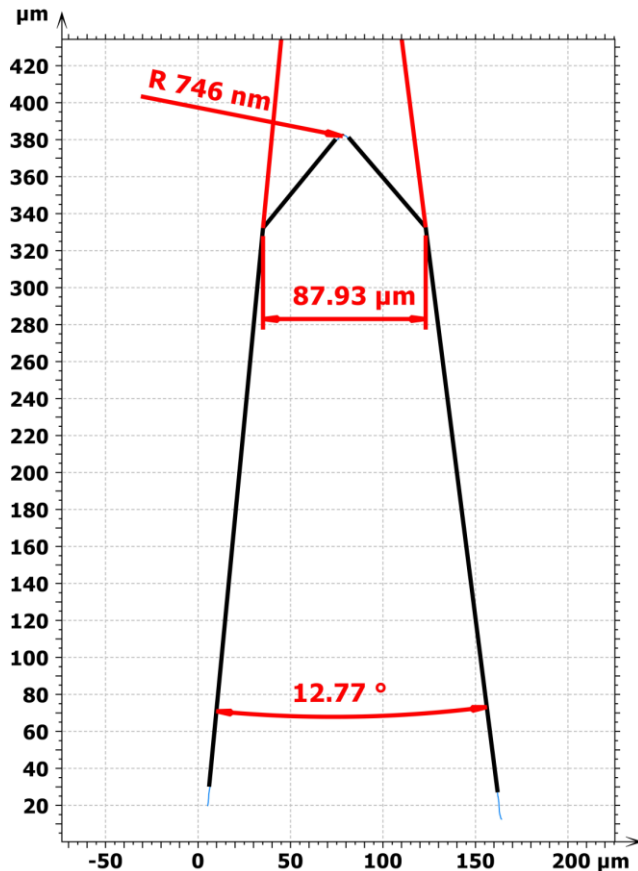
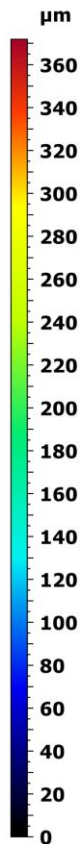
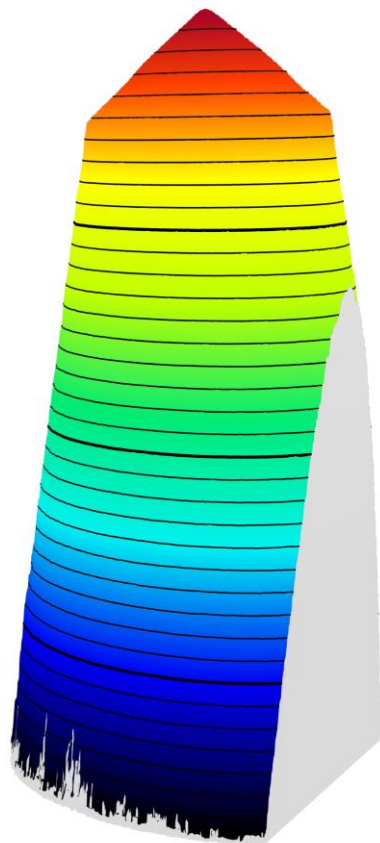
Contour – planar contour evaluation of an insert



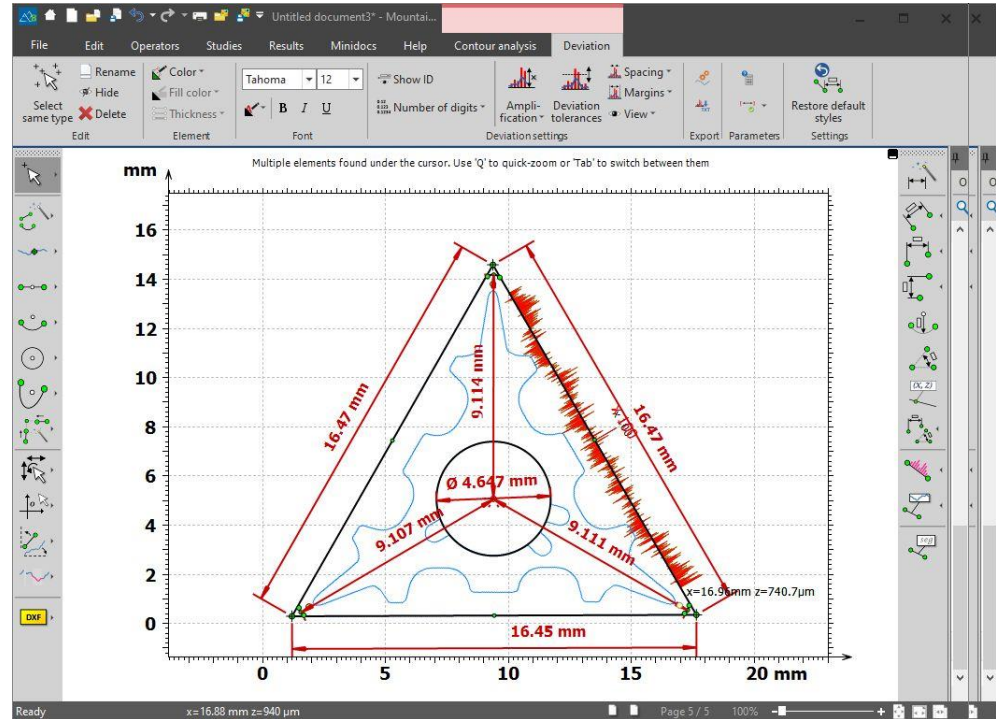
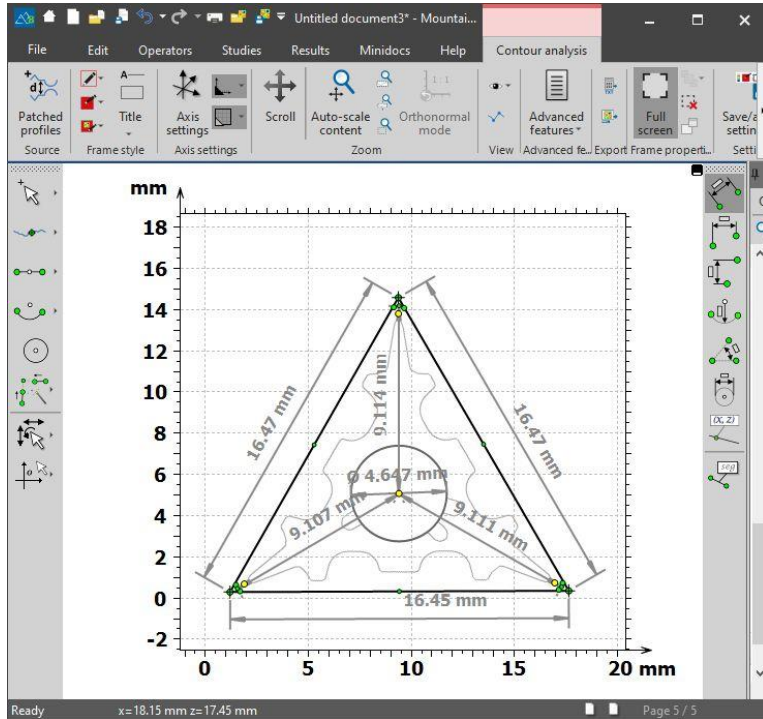
2 contour lines was selected at different height levels and combined



Contour – profile evaluation of an needle tip

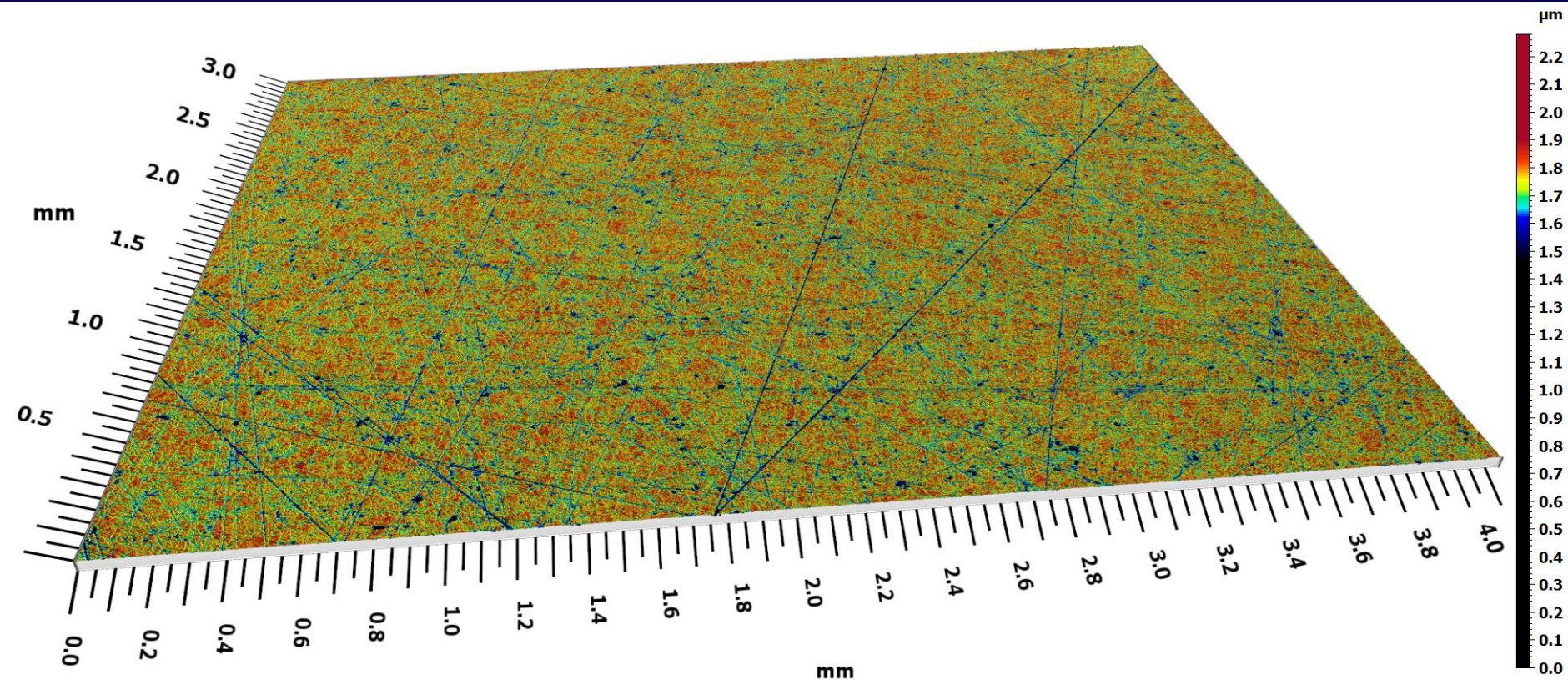


Advanced Contour – additional functions



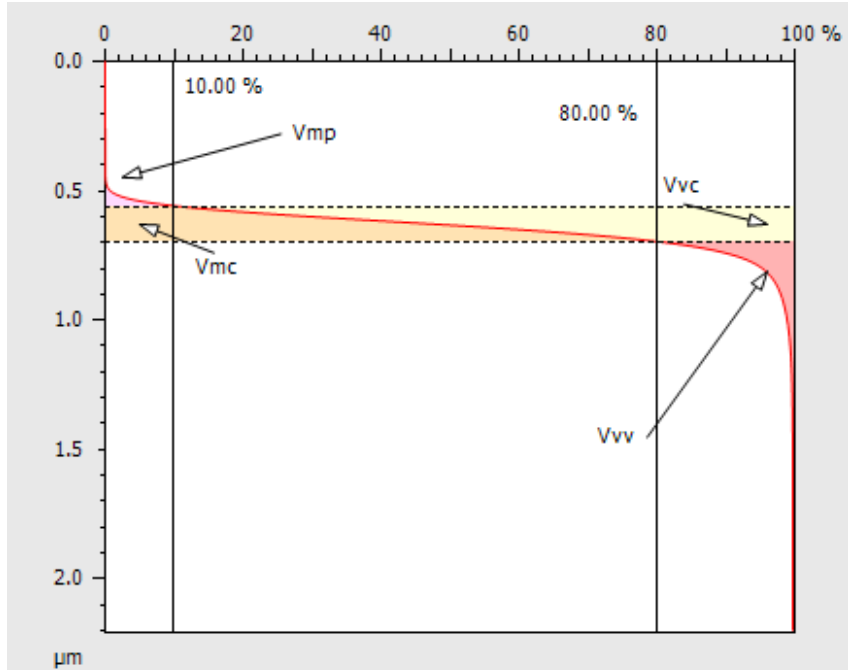
**CAD data import and comparison
deviation to form elements
advanced alignment and measuring functions**

Advanced Topography

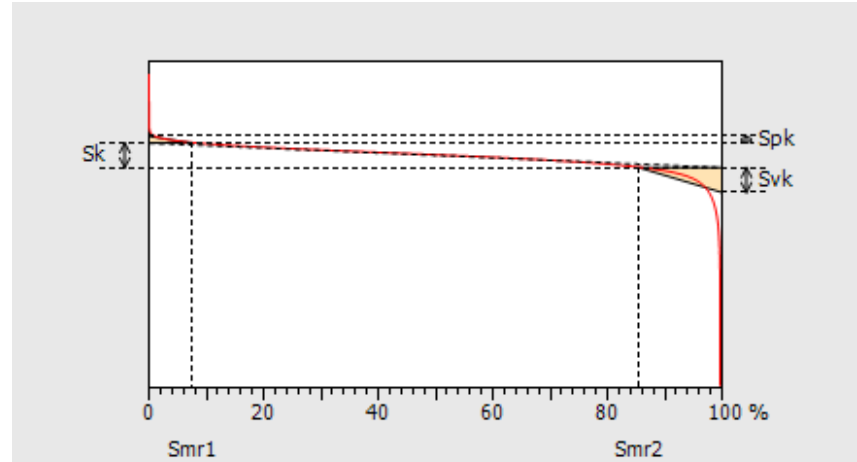


sample – polished surface

Advanced Topography – Sk/volume parameters



Parameters	Value	Unit
V_{mp}	2.431e-06	mm^3/mm^2
V_{mc}	6.307e-05	mm^3/mm^2
V_{vc}	7.463e-05	mm^3/mm^2
V_{vv}	1.563e-05	mm^3/mm^2

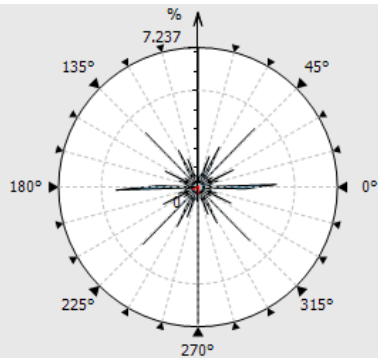


Information

Filter settings Unfiltered.

Parameters	Value	Unit
Sk	0.1658	μm
Spk	0.04619	μm
Svk	0.1681	μm
$Smr1$	7.555	%
$Smr2$	85.46	%
$Sa1$	1745	$\mu\text{m}^3/\text{mm}^2$
$Sa2$	12220	$\mu\text{m}^3/\text{mm}^2$

Advanced Topography – texture direction

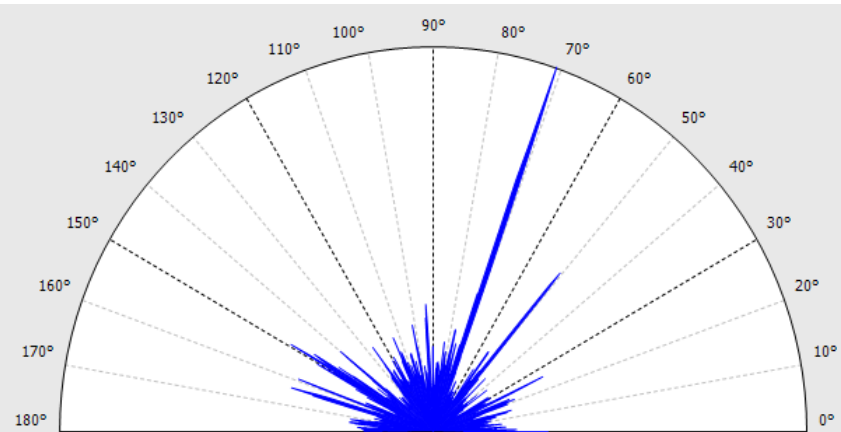


Information

Angle	beta
Number of bins	90
Width of each bin	4.000000 °

Parameters

	Value	Unit
Circular mean	56.94	°
Mean resultant length	0.006972	
Max	180.0	°

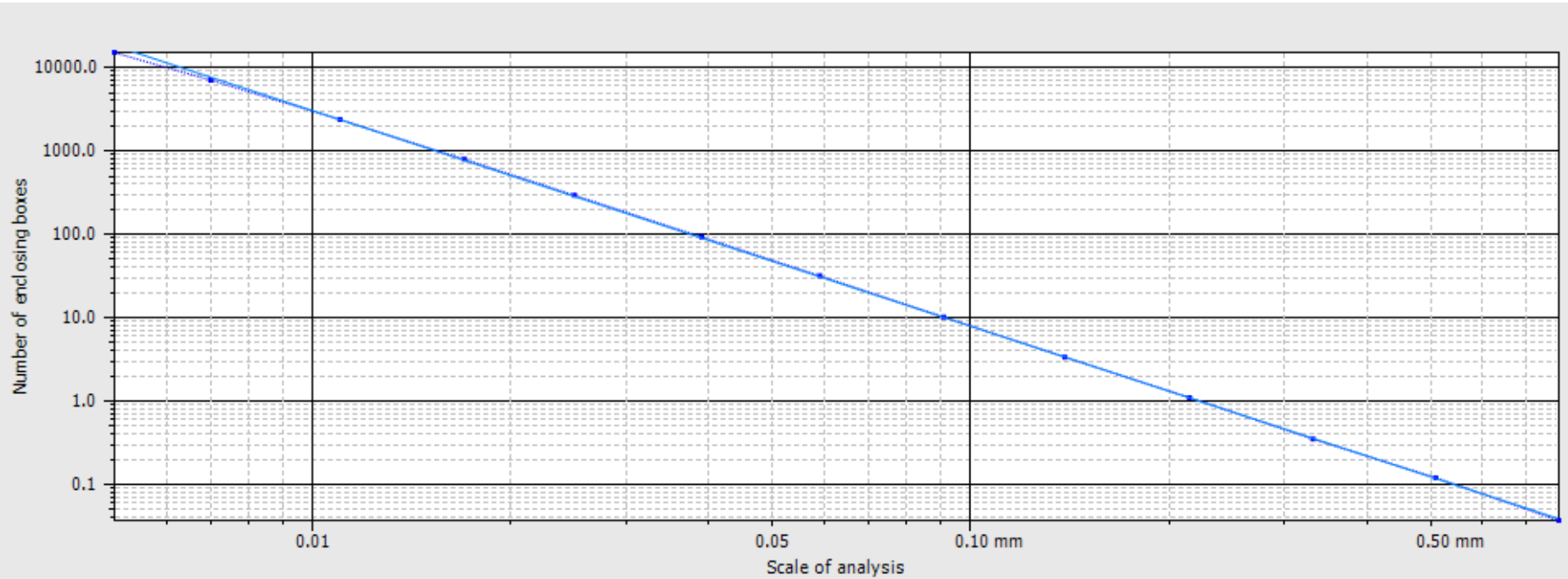


Parameters

	Value	Unit
Isotropy	78.91	%
First direction	70.74	°
Second direction	50.51	°
Third direction	149.2	°



Advanced Topography – fractal analysis



Information

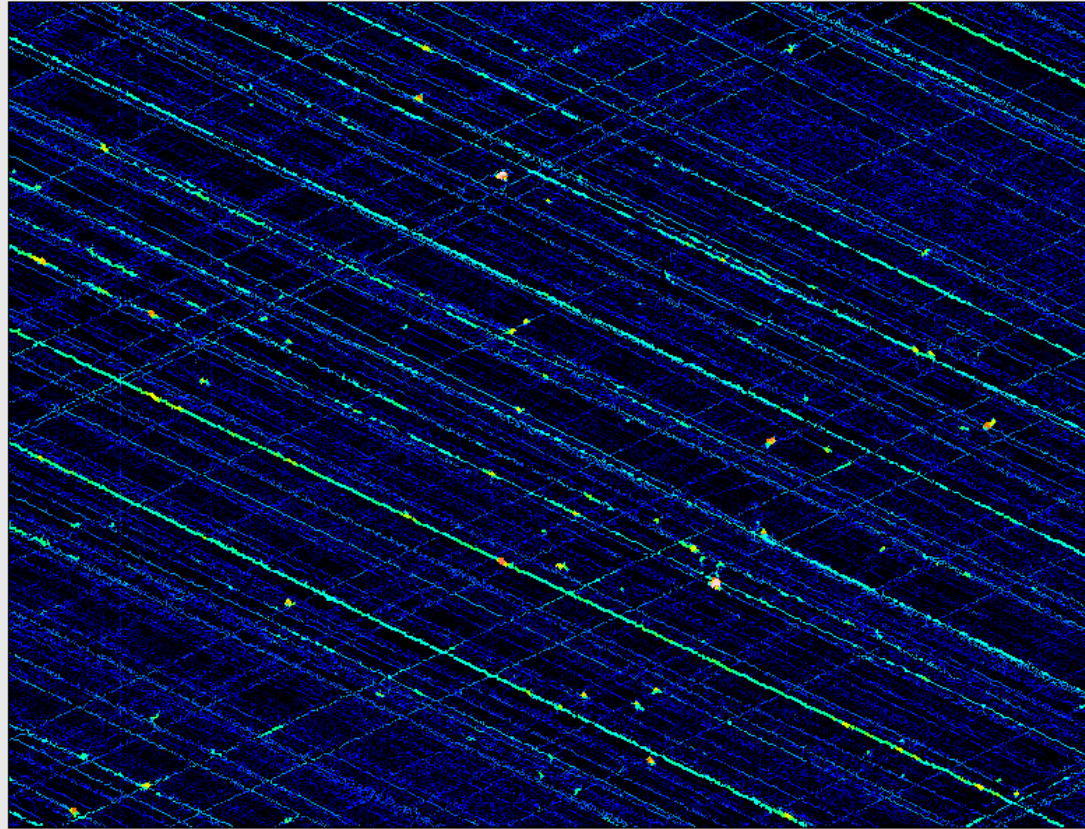
Method: Enclosing boxes

Parameters

Fractal dimension: 2.583

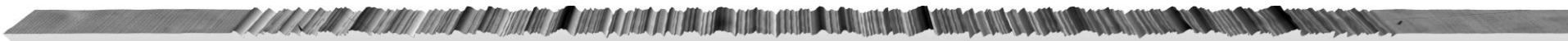
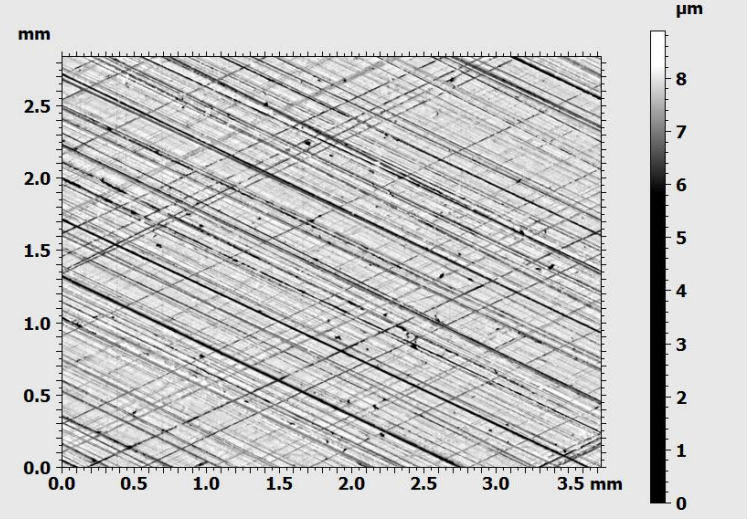


Advanced Topography – furrow analysis

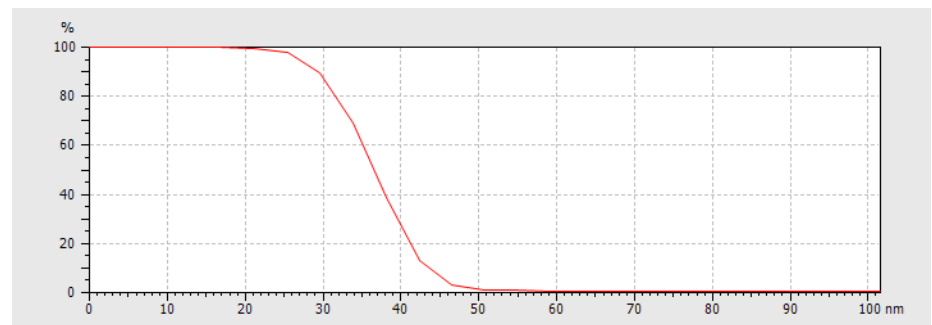
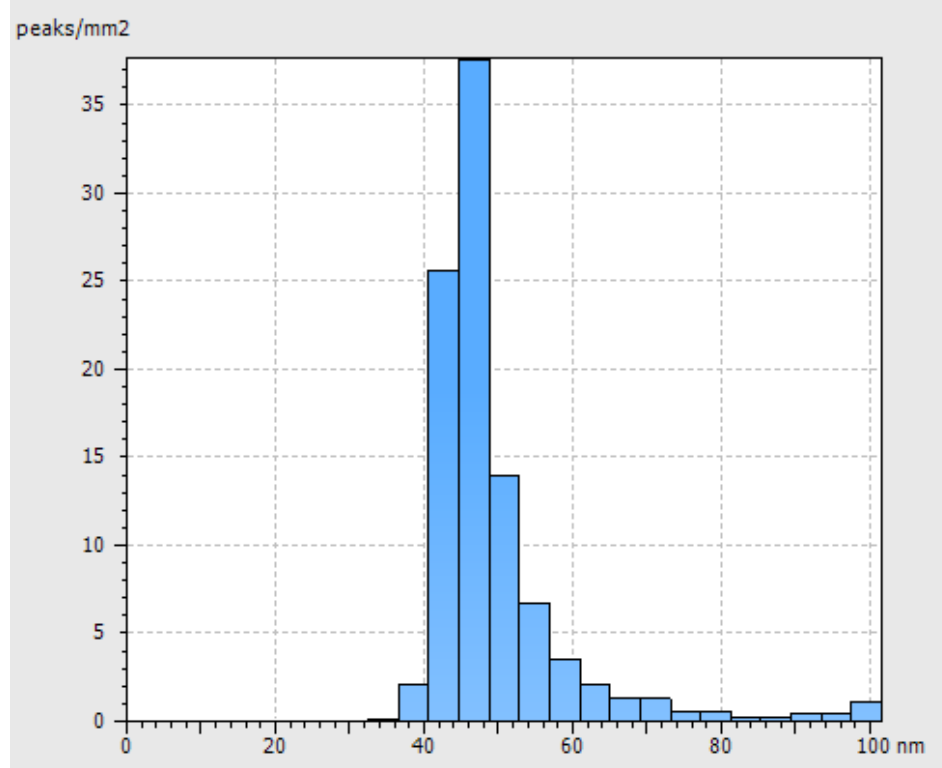
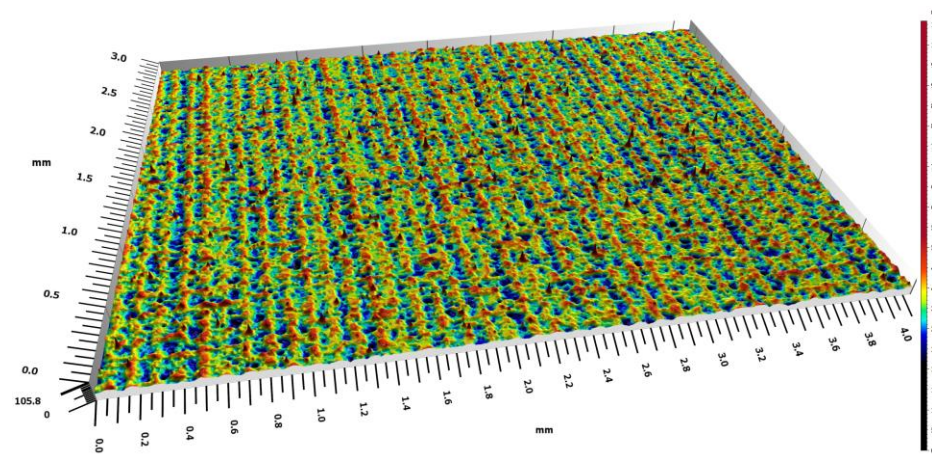


All furrows are shown.

Parameters	Value	Unit
Maximum depth of furrows	6.893	μm
Mean depth of furrows	0.4727	μm
Mean density of furrows	965.0	cm/cm ²



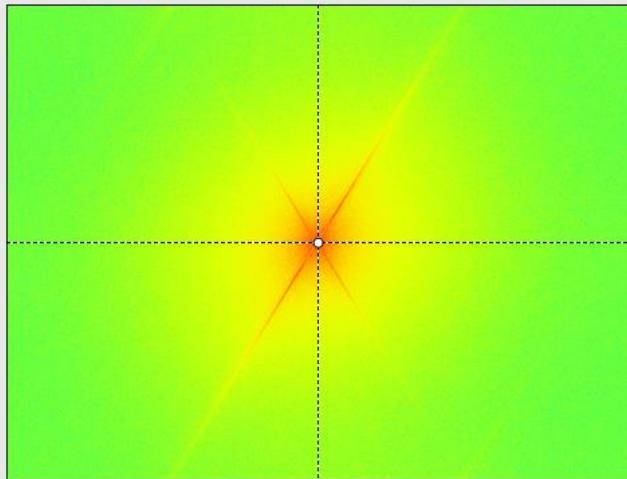
Advanced Topography – peak count



Information
Curve (display mode) Peak count histogram



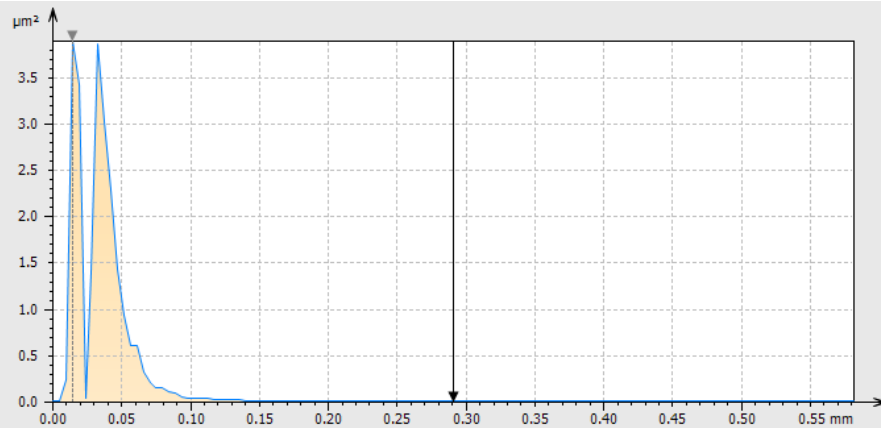
Fourier and Wavelets



Parameters	Value	Unit
X	*****	μm
Y	*****	μm
Wavelength	0.000	μm
Angle	0.000	$^\circ$
Magnitude	-48.83	dBc
Phase	2.444	$^\circ$



Fourier spectrum



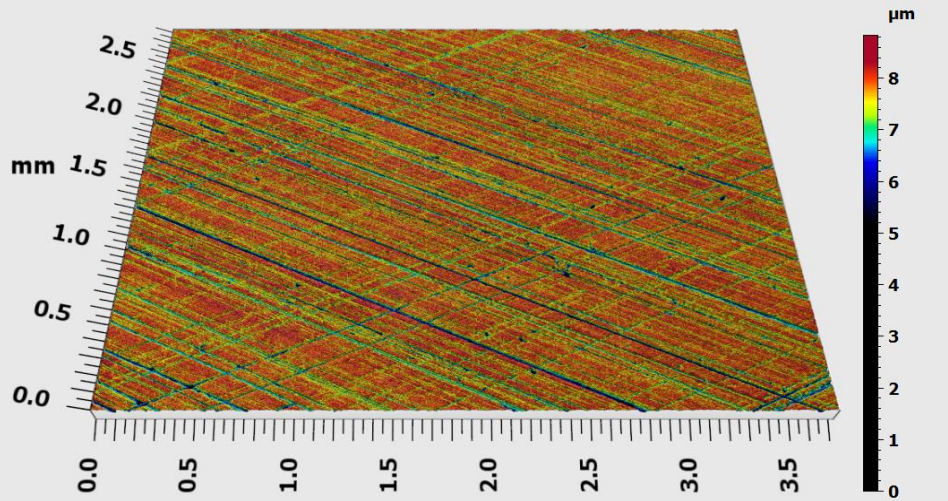
Information

Zoom factor	x8
Smoothing	None
Windows function	Hanning

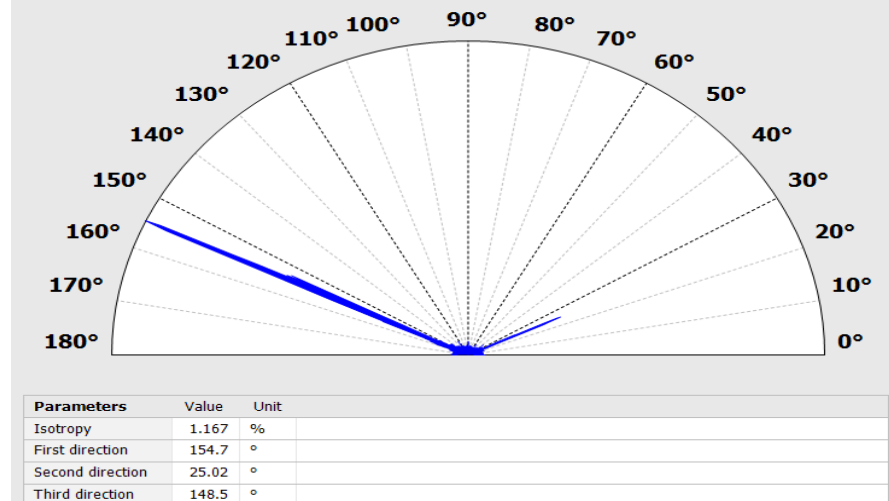
Parameters	Value	Unit
Wavelength	0.2908	mm
Amplitude	0.008591	μm
Dominant wavelength	0.01407	mm
Maximum amplitude	1.974	μm

Power spectrum density, radial

Fourier and Wavelets



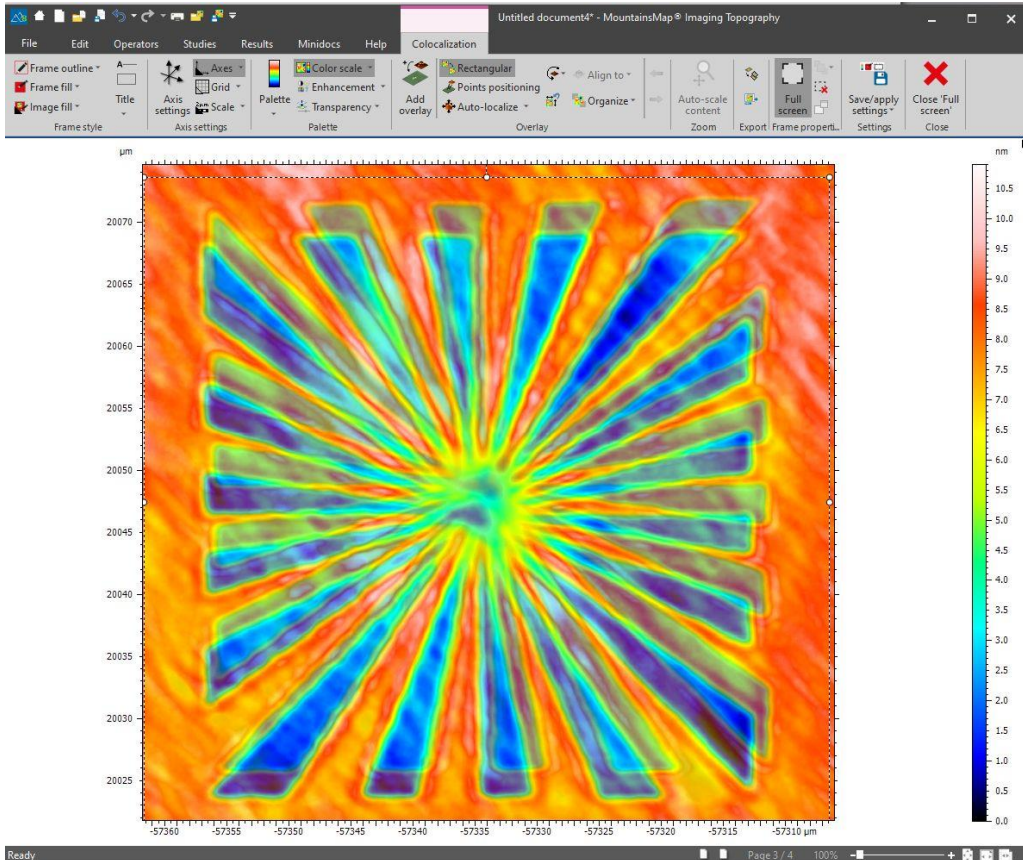
honing structure



texture direction



Colocalization



Data alignment for comparison

- data out of different sources get important and can be aligned based on similar micro structures automatically
- shown is the comparison of a siemens star measured with a 20x objective and super resolution against reference data of a 100x objective for difference analysis and optimization of algorithms
- similar comparisons are possible to analyze:
 - wear processes with scans from a stress test
 - comparison of a part against data from a CAD model
 - ...

4D Series

Operator: Build series of surfaces

Available studables

- 8 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 9 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 10 : y --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 11 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 12 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 13 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 14 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 15 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm

Operation

Copy after
 Copy before

X/Y-positioning

Use X/Y-offsets

T-axis

Use the T-axis

The T-axis can be used to describe the relation between the studables of the series.

Spacings: 1
Axis unit:

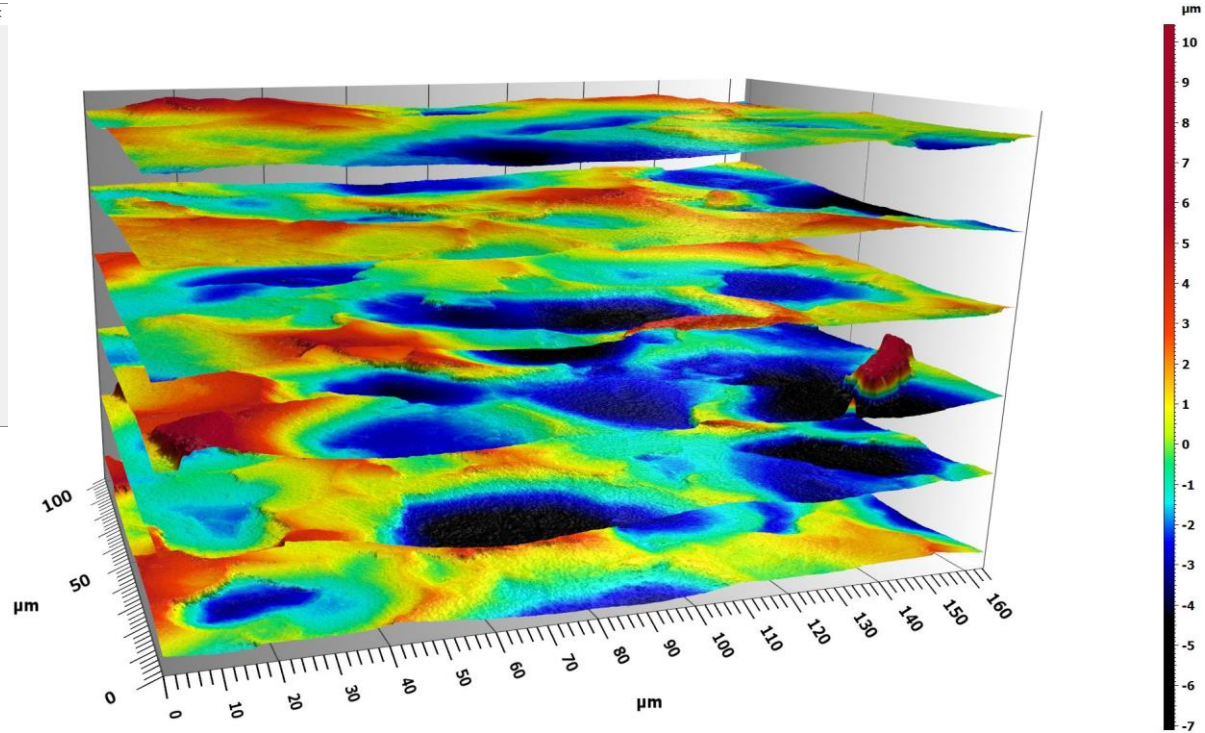
More about the T-axis...

Used studables

- 11 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 12 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 13 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 14 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 15 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 16 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm
- 17 : x --- Measurement: Tl Surface
164.3 μm X 102.6 μm

18 studable(s) in the series
Stunable size: 960 x 600 points
164.3 x 102.6 μm

More about this operator...

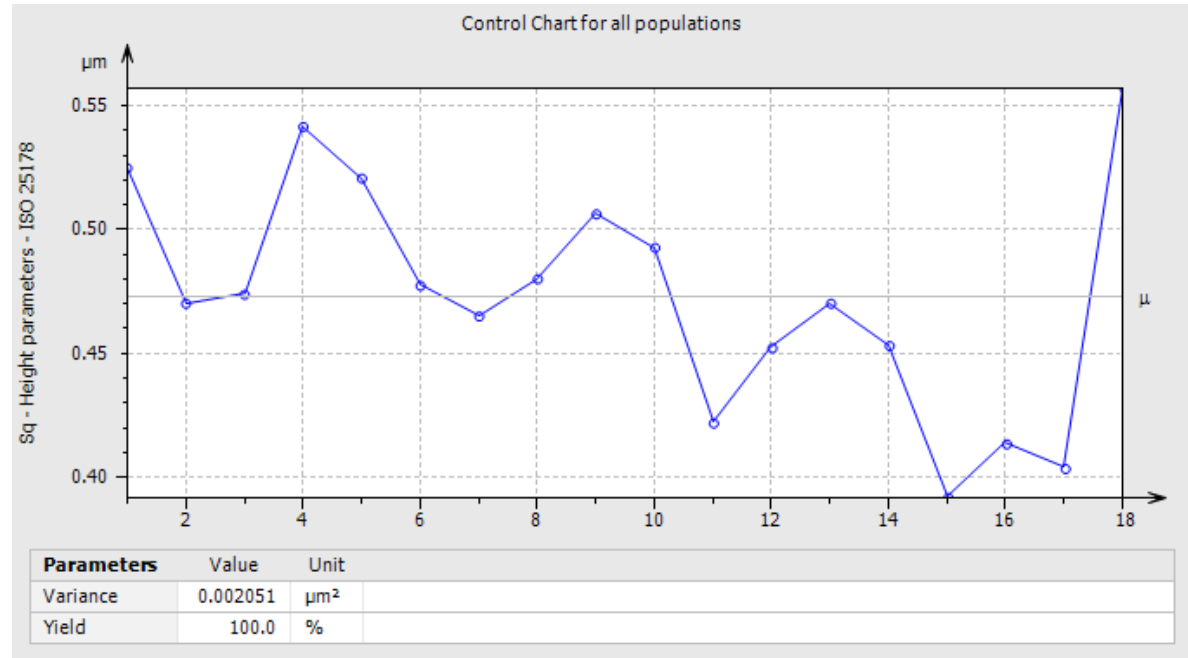
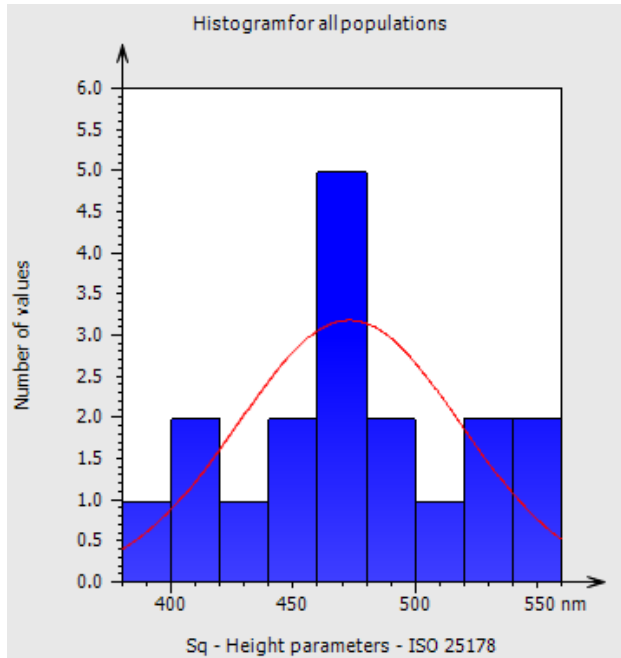


	Mean	Std dev	Min	Max
ISO 25178 - Primary				
<i>F: None</i>				
<i>S-filter (λs): None</i>				
Height parameters				
Sq μm	2.218	0.4282	1.790	3.056
Ssk	0.1254	0.3059	-0.3801	0.5159
Sku	3.209	0.6952	2.447	4.496
Sp μm	7.554	1.741	5.330	10.43
Sv μm	5.881	0.9130	4.730	7.099
Sz μm	13.43	2.253	11.08	17.53
Sa μm	1.759	0.3849	1.415	2.568

simplifies the evaluation of multiple data with statistical analysis



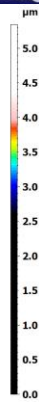
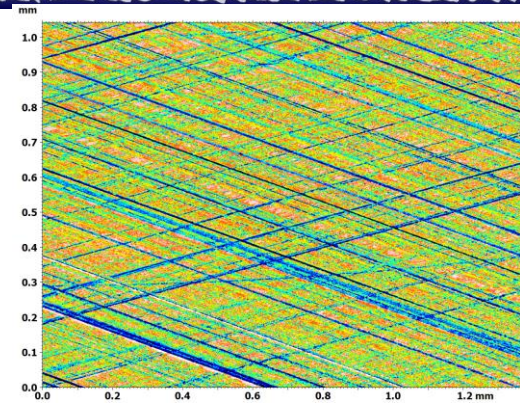
Statistics



allows the statistically analysis of measuring data as well as the process monitoring for continuously measurements

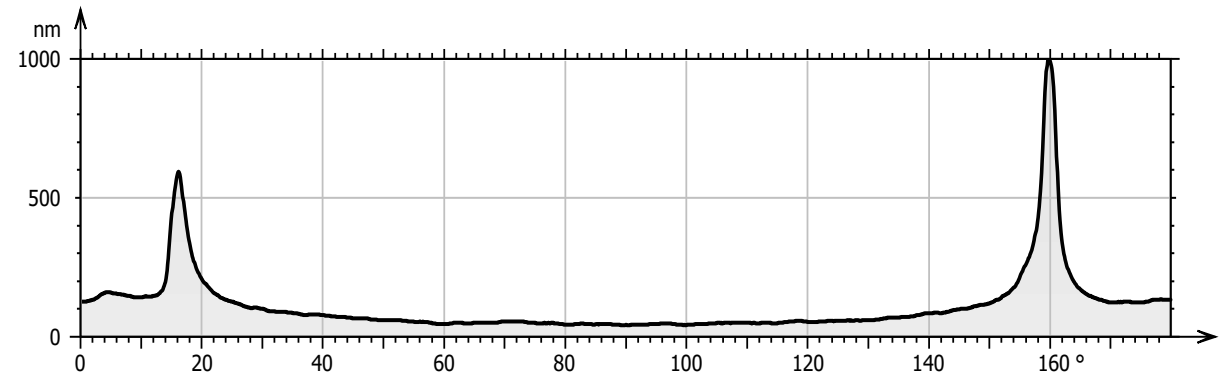


GBS add on honing structures



Parameters	Value	Unit
Honing Angle - Honing Structure FFT Analysis	18	°
Rising Grooves - Honing Structure FFT Analysis	16	°
Falling Grooves - Honing Structure FFT Analysis	20	°
Rising Structures - Honing Structure FFT Analysis	26	%
Falling Structures - Honing Structure FFT Analysis	35	%
Cross Structures - Honing Structure FFT Analysis	2.0	%
Closed Structures - Honing Structure FFT Analysis	37	%

- structures get analyzed integral
- “rising” and “falling” structures get analyzed separate from each other
- additional is it possible to classify cross structures – important for functional behavior and oil transport



Parameters	Value	Unit
Length	180	°



free trial and test



SOFTWARE & SOLUTIONS

STORIES

LEARNING

SUPPORT

ABOUT

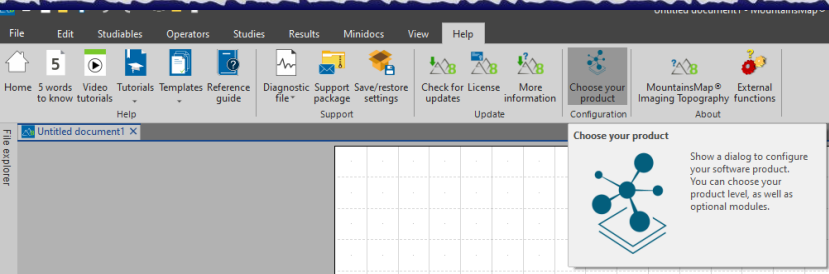
English ▾

 FREE TRIAL

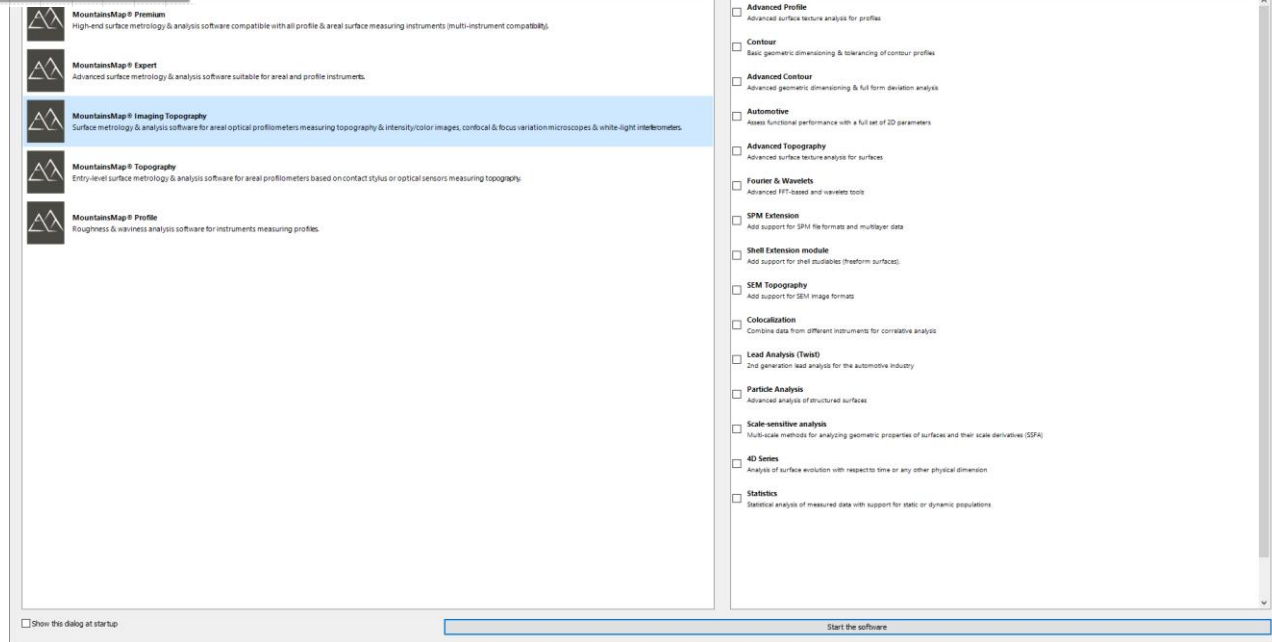


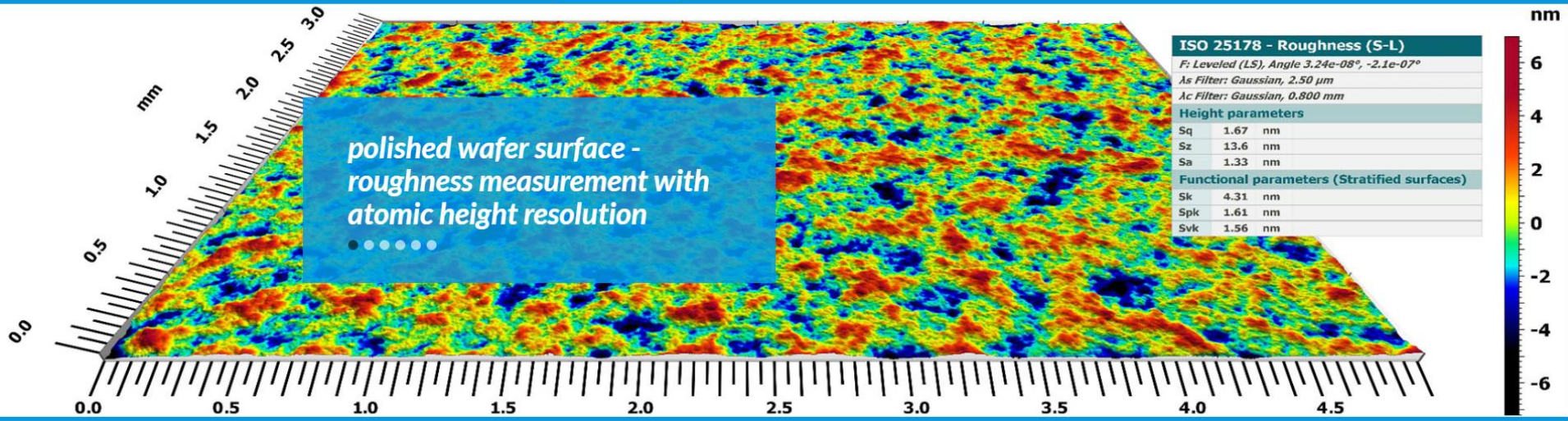
MountainsMap 8 can be downloaded from the homepage www.digitalsurf.com for 30 days free trial period
GBS: as a general policy first sample test are free of charge
You can test MountainsMap using data from your own samples!

configuration of the trial version



Test your configuration to choose the necessary optional evaluation modules! The trial version can be configured with and without optional modules to avoid unnecessary payments. Trial periods are possible any time – even after you bought a basic package and in front of a possible software extension.





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