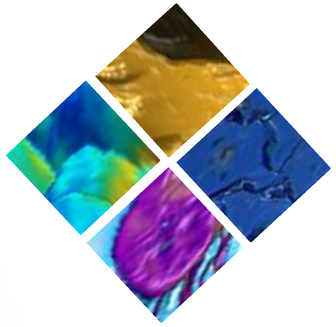


Digital Surf

Surface Intelligence

Surface Imaging & Metrology Software

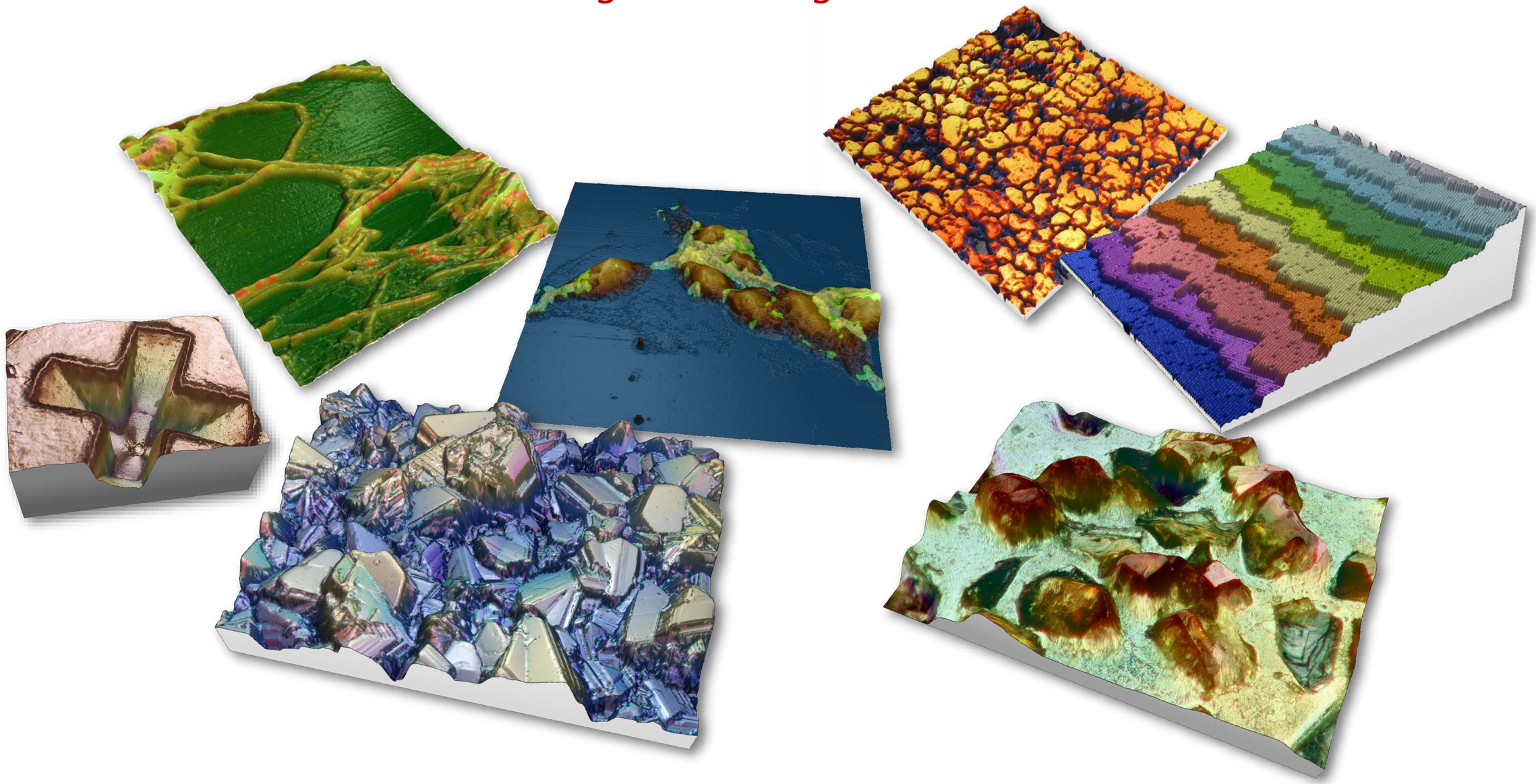
DIGITAL SURF / Arnaud VIOT / ANF, Paris June 2017

Analysis software

Key points

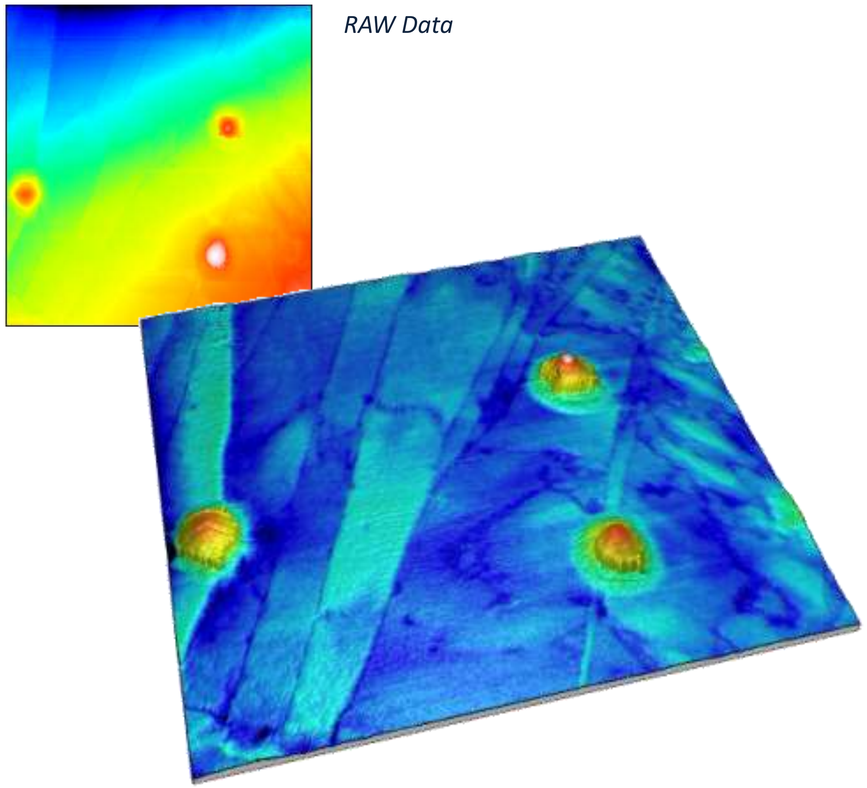
Cutting-edge 3D imaging

Seeing is believing!

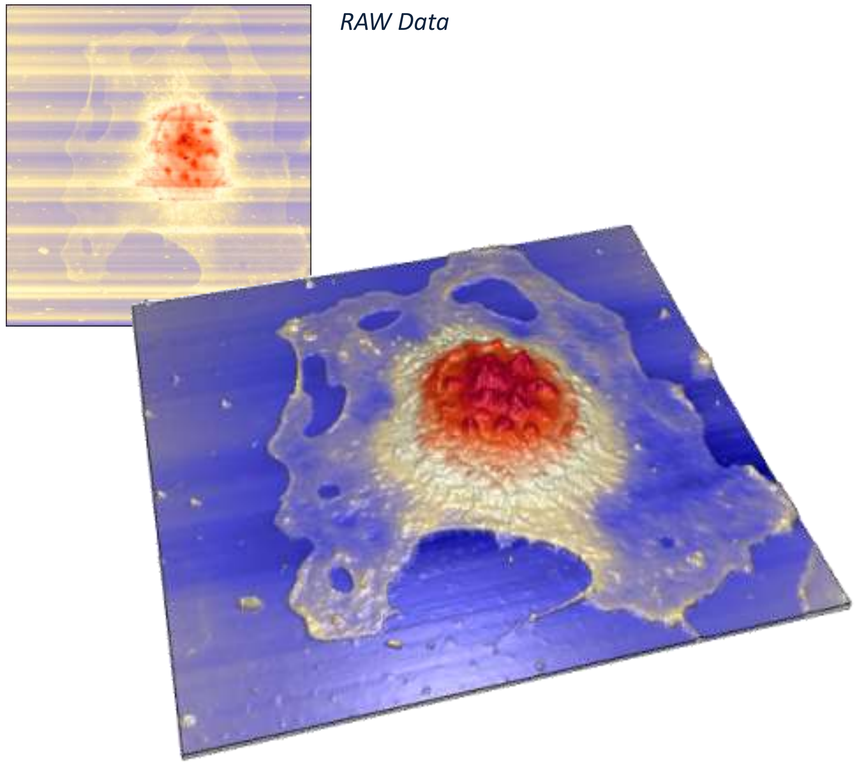


Powerful filters for dataset enhancement

Getting your data ready for analysis



Plane correction & flattening



Line correction and isolated artefacts removal

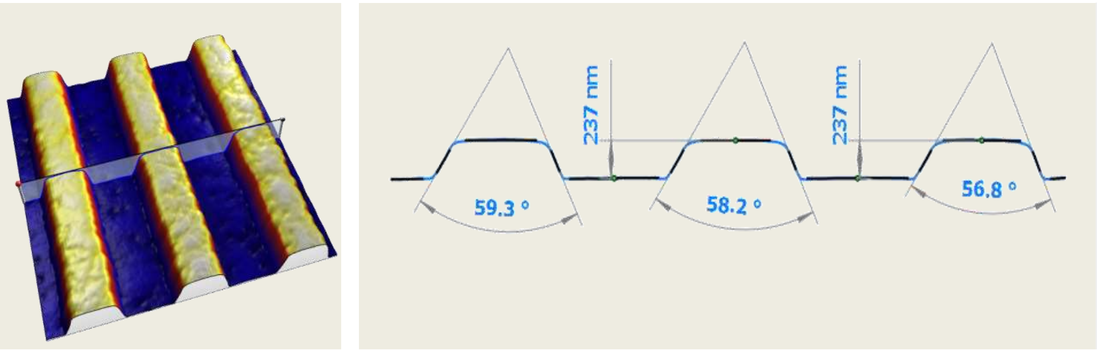
Surface imaging and analysis

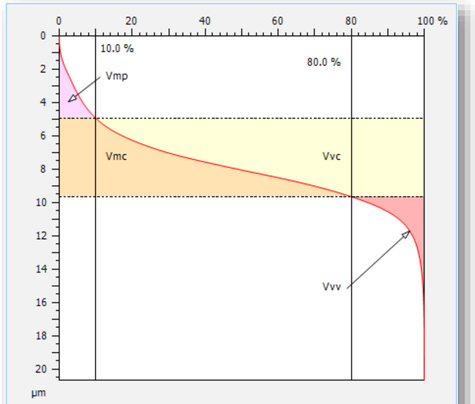
Full set of areal surface texture parameters, volume, height, dimensional analysis etc.

ISO 25178				[8]
Height Parameters				
Sa	1.75	µm		*Arithmetic mean height*
Sq	2.34	µm		*Root-mean-square height*
Ssk	0.246			*Skewness*
Sku	4.03			*Kurtosis*
Sp	7.91	µm		*Maximum peak height*
Sv	12.7	µm		*Maximum pit height*
Sz	20.7	µm		*Maximum height*
Functional Parameters				
Smr	0.00223	%	*c = 0.1 µm under the highest peak*	*Areal material ratio*
Smc	2.98	µm	*p = 10%*	*Inverse areal material ratio*
Sxp	4.29	µm	*p = 50%, q = 97.5%*	*Extreme peak height*

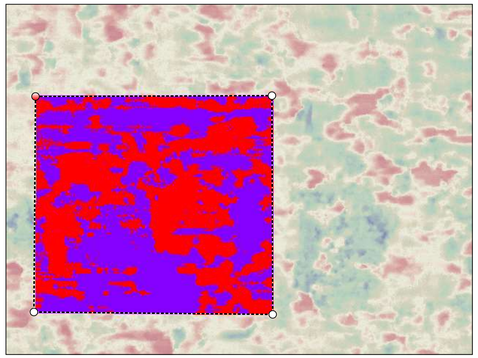
Calculate areal surface texture parameters

Extract vertical (x,z) or horizontal (x,y) nano-contours from a surface





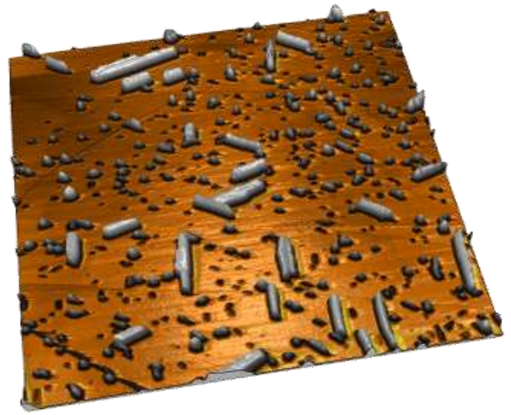
Parameters	Value	Unit
Vmp	0.164	ml/m2
Vmc	1.83	ml/m2
Vvc	2.88	ml/m2
Vvv	0.264	ml/m2

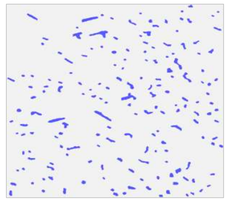


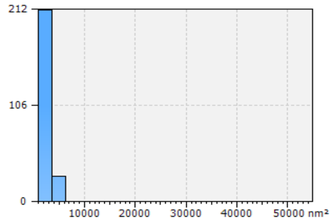
Parameters	Unit	Hole	Peak
Surface	mm²	0.896	0.783
Volume	µm³	1551800	1415776
Max. depth/height	µm	13.6	8.25
Mean depth/height	µm	1.73	1.81

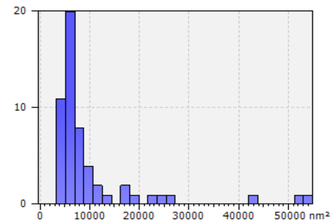
Studies: height, bearing, volume etc.

Study surface features, automatically detect particles by height or shape





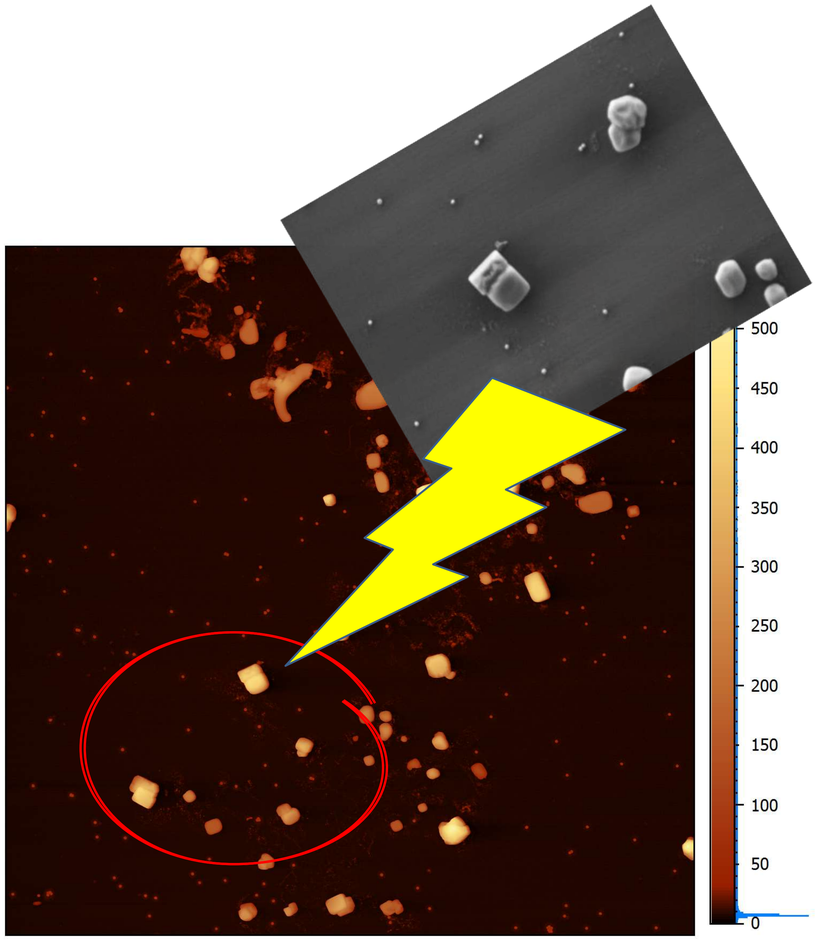




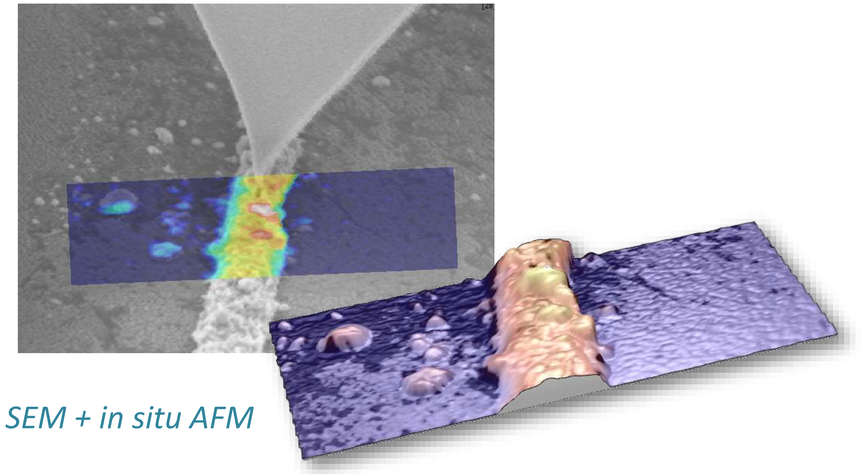
Calculate morphological parameters on particles and generate statistics

Combine data from different instrument types

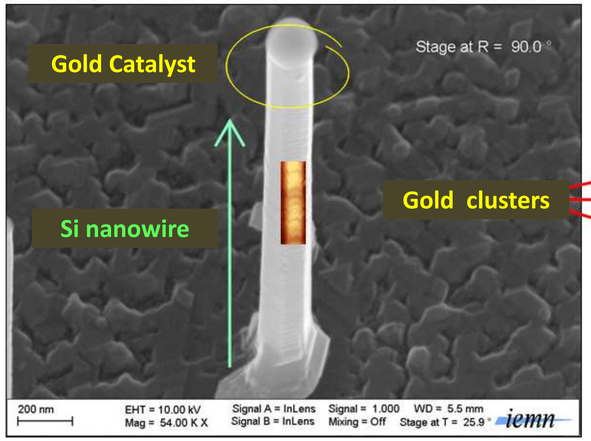
Colocalization: SEM image + 3D AFM topography

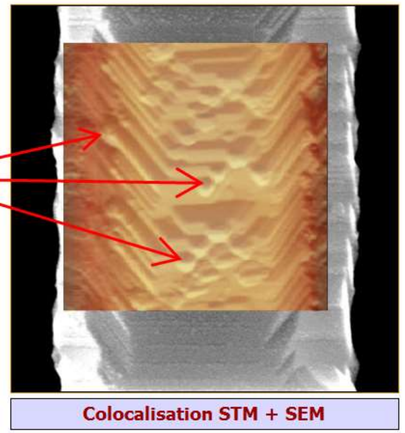


Combine data from different instrument types: examples

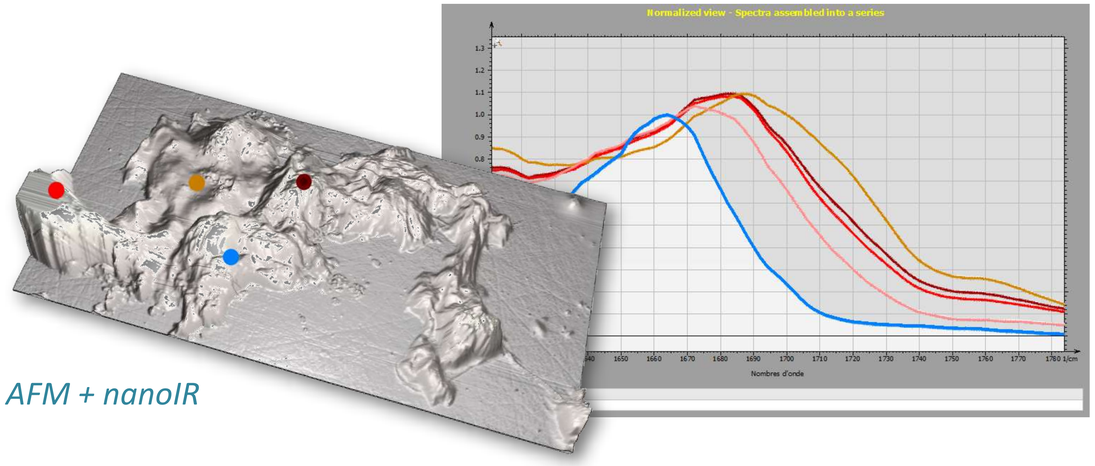


SEM + in situ AFM

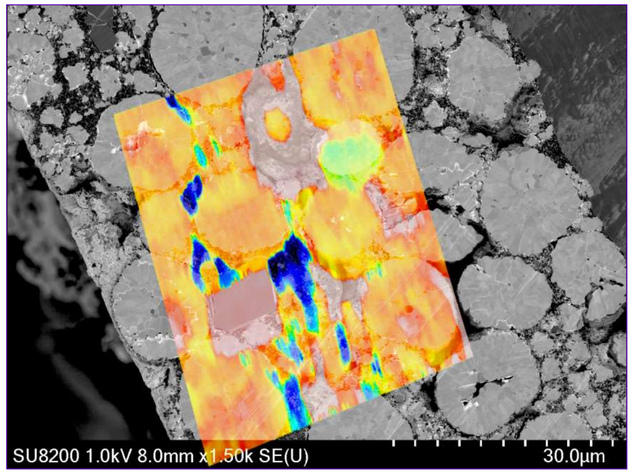




SEM + STM



AFM + nanoIR



SEM + RFM

A wide range of applications

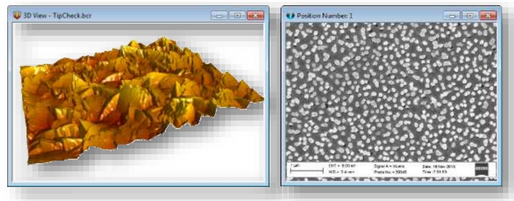
Image Metrology

SPIP™

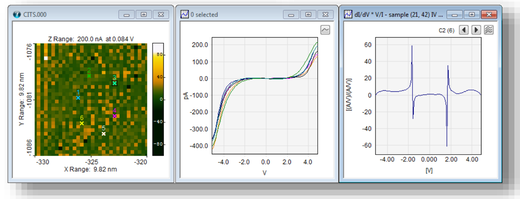
Renowned analysis software designed exclusively for SPM users

More than 100 data formats from:

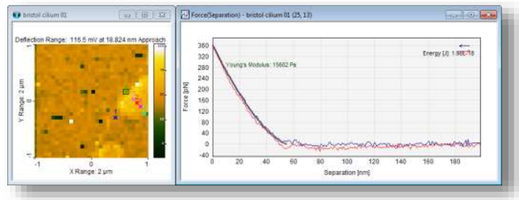
- scanning probe microscopes (AFM, STM…)
- other digital imaging devices



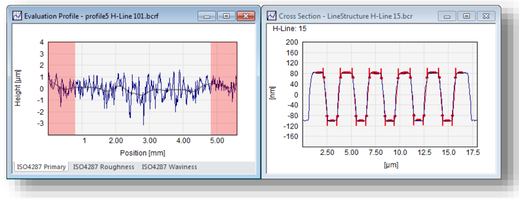
Images
Topographic images, multichannel images, grayscale images



Force curves
Force volume images, single force curves, collections of force curves



IV curve analysis
Collections of IV curves, STS images, CITS images

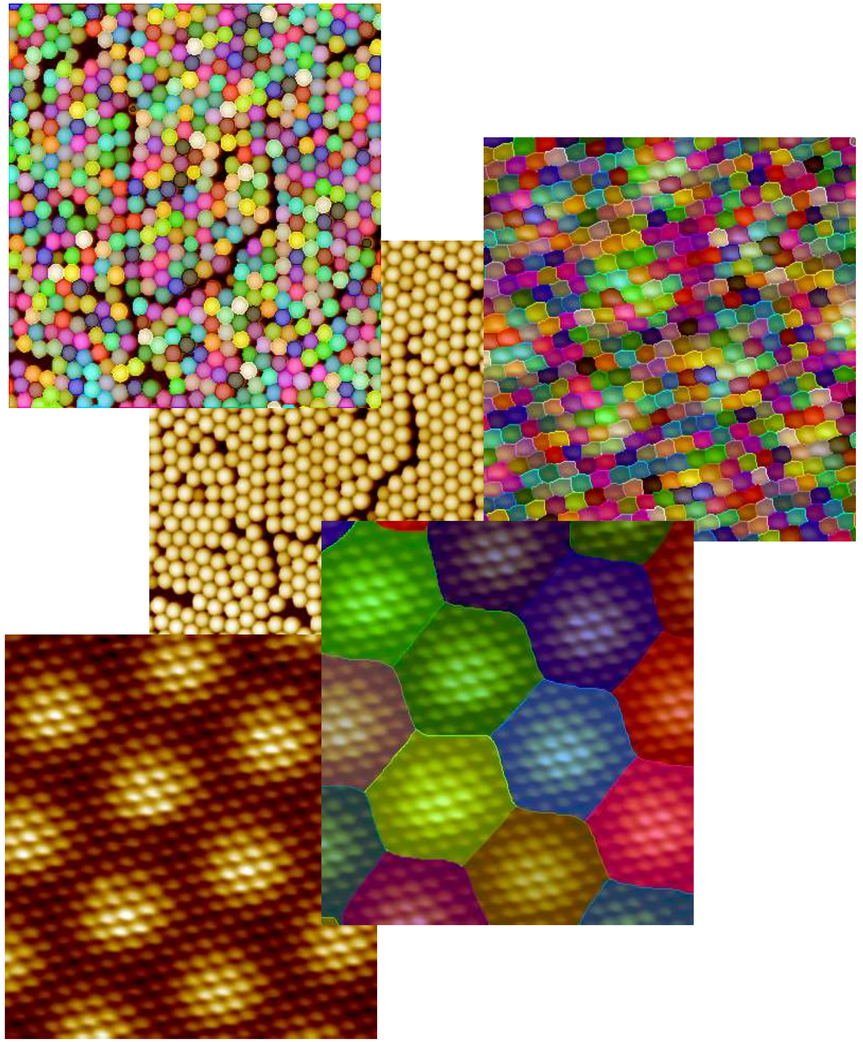


Profiles and other curve data
Single profiles or curves, collections of profiles

Digital Surf Surface Intelligence

SPIP™ information

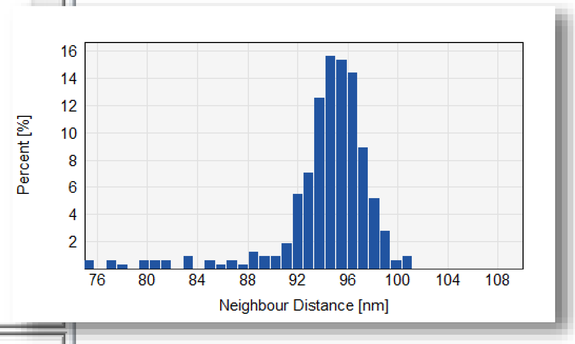
Particle & pore analysis

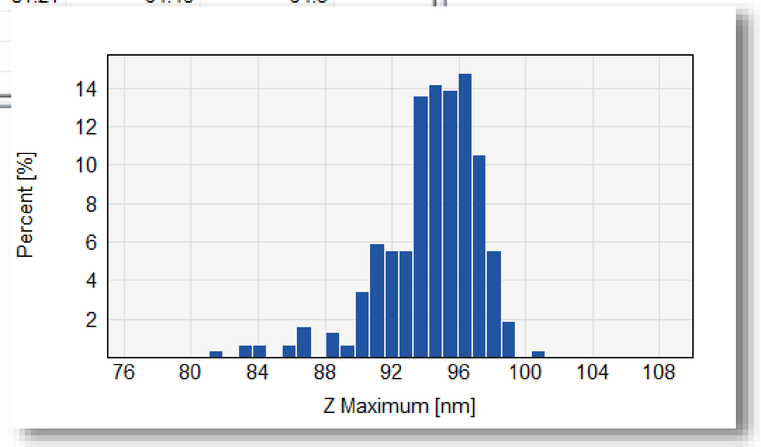


Shape Measurements: PS particles.bcrf

Image | Collection | Automatic

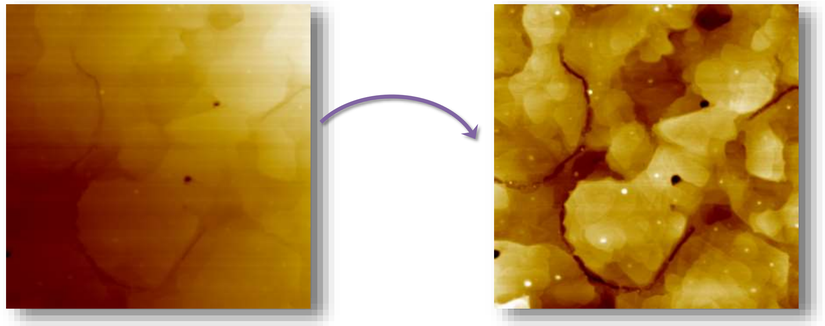
ID	Area [nm²]	Z Minimum [nm]	Z Maximum [nm]	Neighbour Distance [nm]
240	4308.3	81.19	94.80	96.2
241	3805.7	81.20	92.80	91.8
242	5170.0	81.28	98.06	96.7
243	4811.0	81.18	95.67	93.6
244	4858.9	81.17	96.14	96.2
245	1244.6	81.18	84.54	89.2
246	4475.9	81.19	95.24	93.2
247	167.5	81.16	81.77	86.9
248	3733.9	81.21	93.02	93.0
249	4882.8	81.18	96.09	94.8
250	4475.9	81.30	94.16	96.4
Minimum	167.5	81.11	81.77	75.7
Maximum	6295.0	81.60	100.88	100.6
Mean	4245.9	81.21	94.46	94.3
Std. Dev.	1012.7			
Count	326			



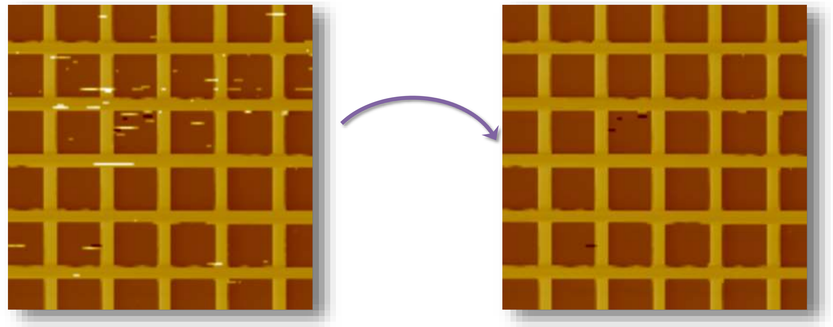


Correction and noise reduction

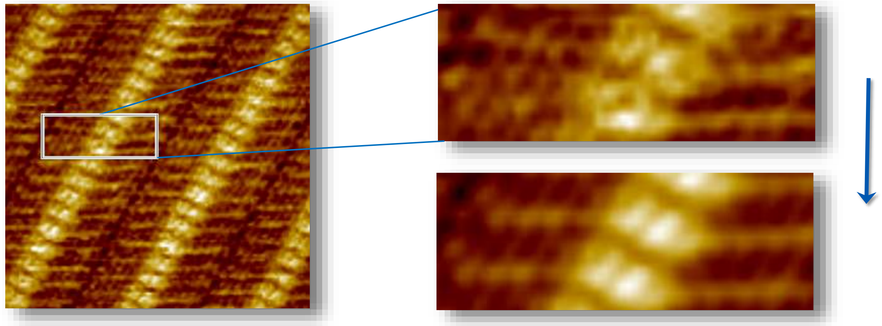
Plane correction



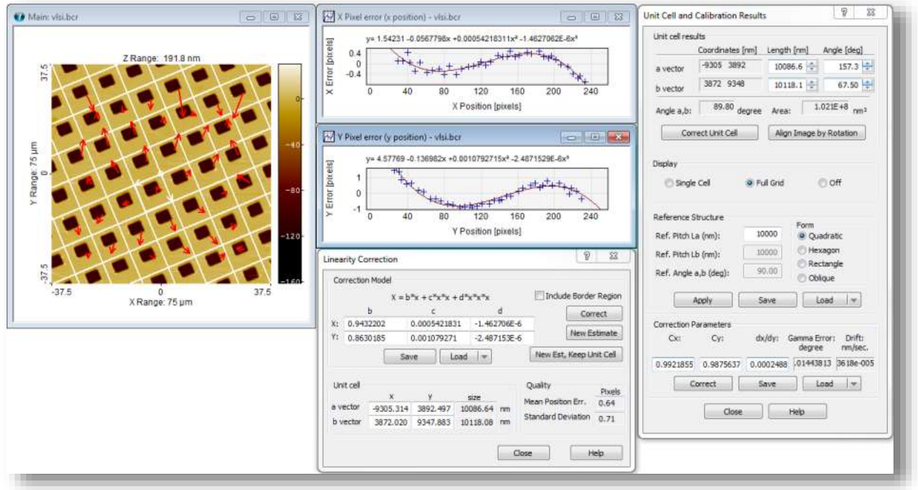
Filtering



Correlation averaging



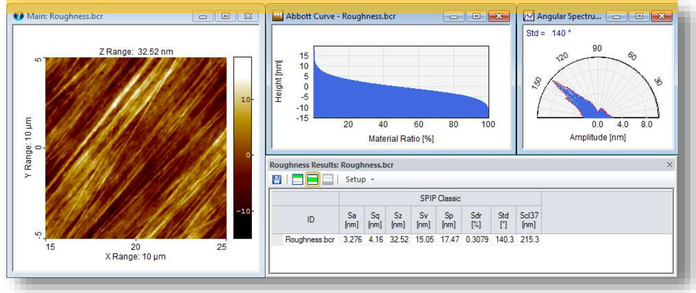
Calibration



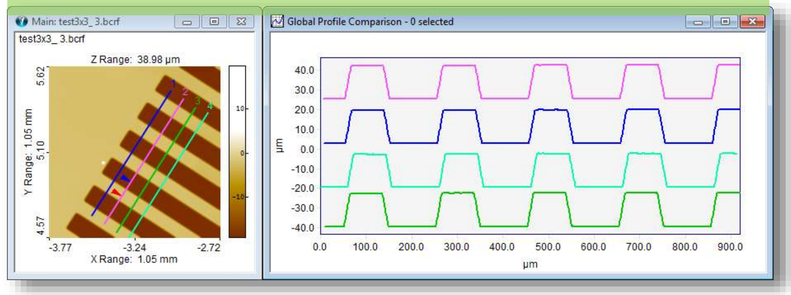
Analysis & Inspection

SPIP™

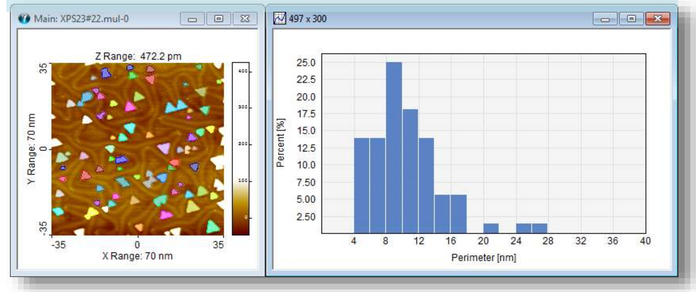
Roughness



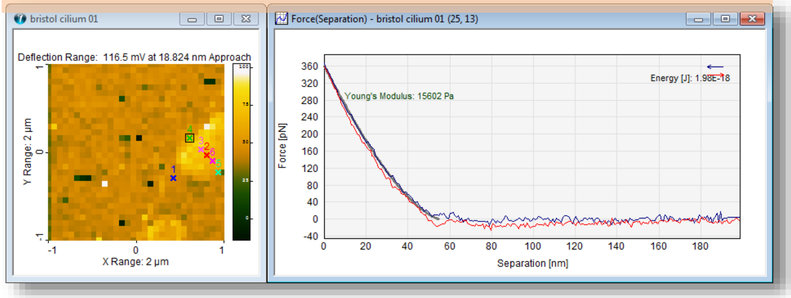
Interactive tools



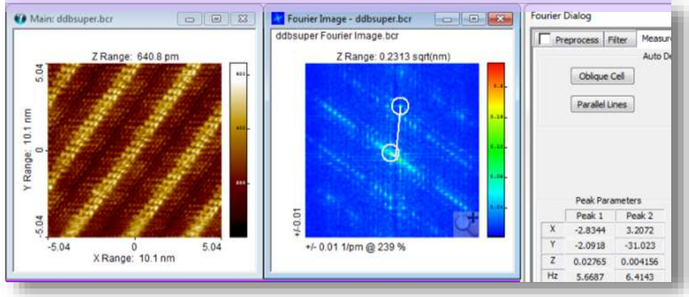
Particle & pore



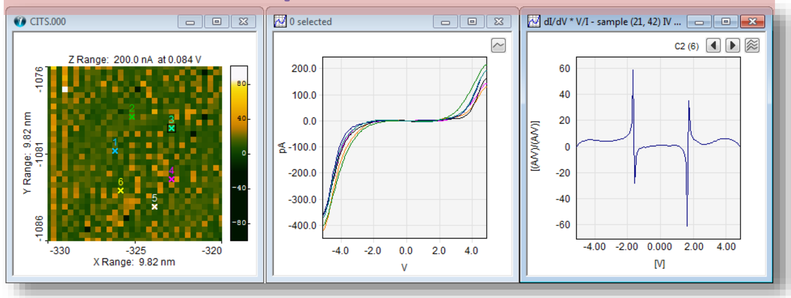
Force curves & maps



Fourier



IV curves & maps

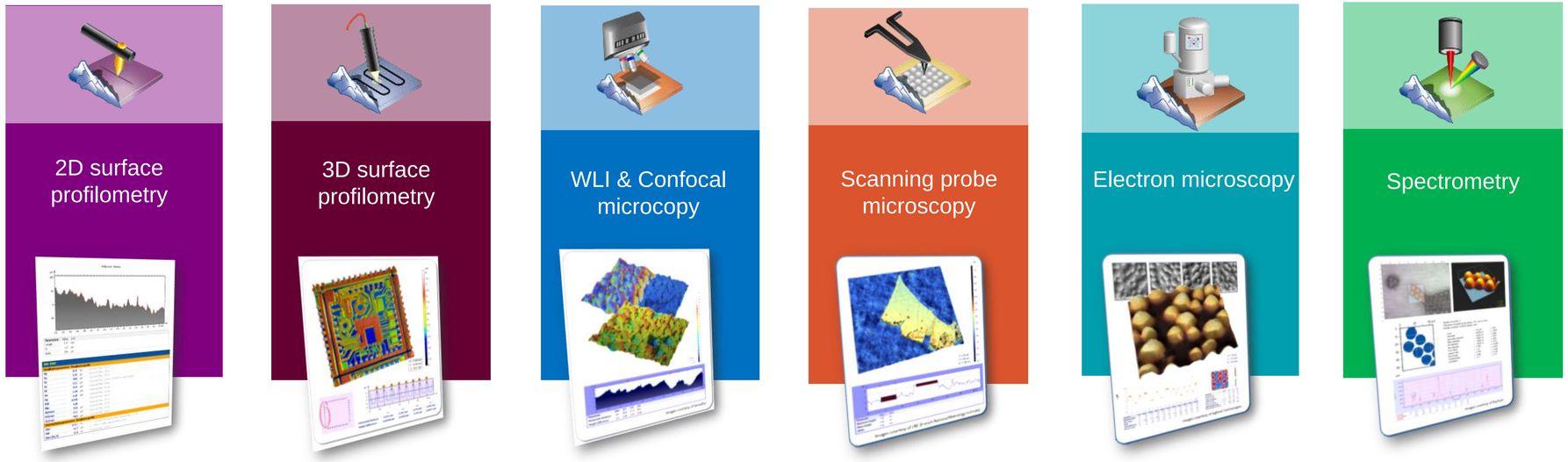


Digital Surf
Surface Intelligence

Applications & markets

Mountains
Surface Imaging & Metrology Software

Instrument-oriented solutions



Surface imaging & metrology software – powered by Mountains technology®

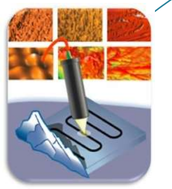
Digital Surf
Surface Intelligence

IMPORTANT

Mountains® software ONE technology for any instrument

3D Optical Profilers

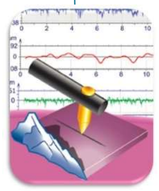
Confocal microscopes, interferometric microscopes, structured light systems, etc.



3D Scanning Profilometers

Contact and non-contact: stylus profilers etc.

SEM



2D Profilometers

Mountains
Surface Imaging & Metrology Software

Scanning probe microscopes

AFM, STM, CSAFM, KPFM, MFM, NSOM, etc.

Light Microscopes

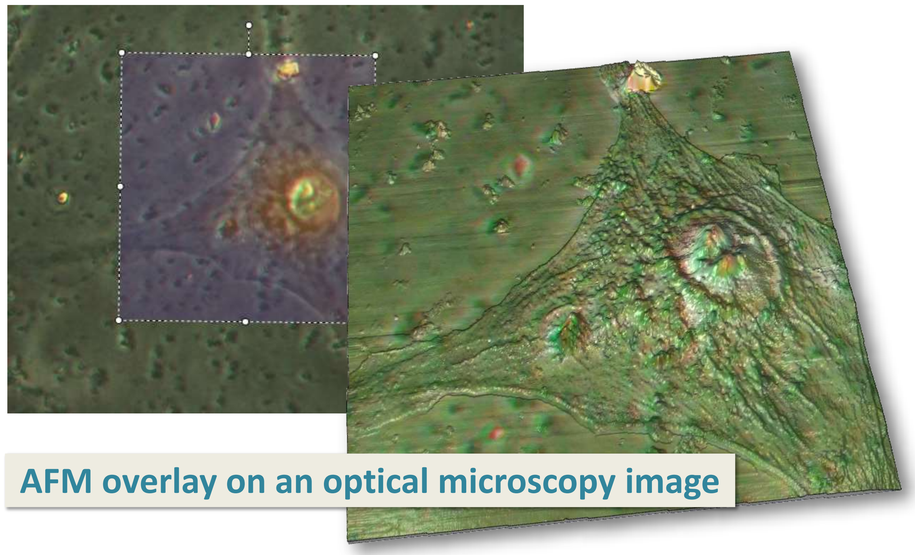
Hyperspectral instruments

Raman, FTIR Spectrometers, cathodoluminescence (CL) etc.

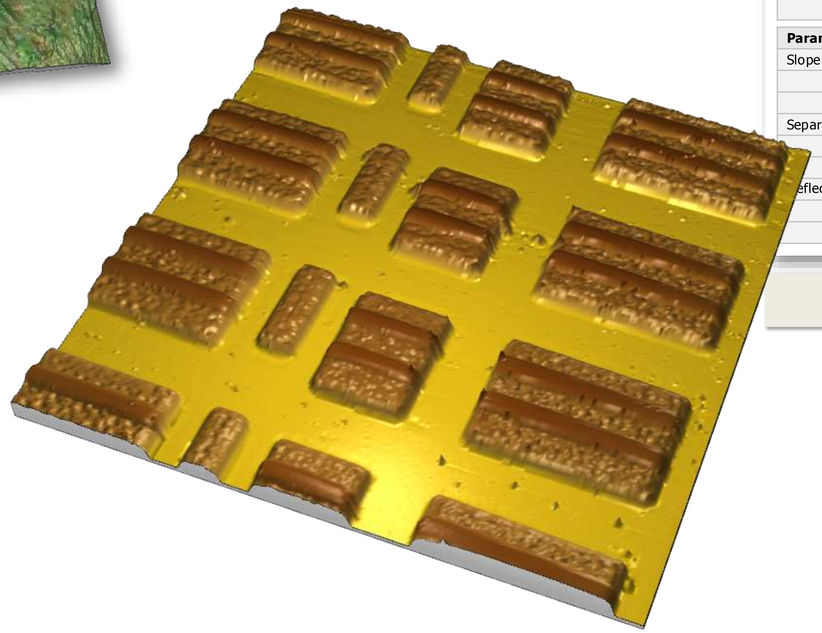
Premium software
Superset for all types of surface imaging and measuring instruments

Digital Surf
Surface Intelligence

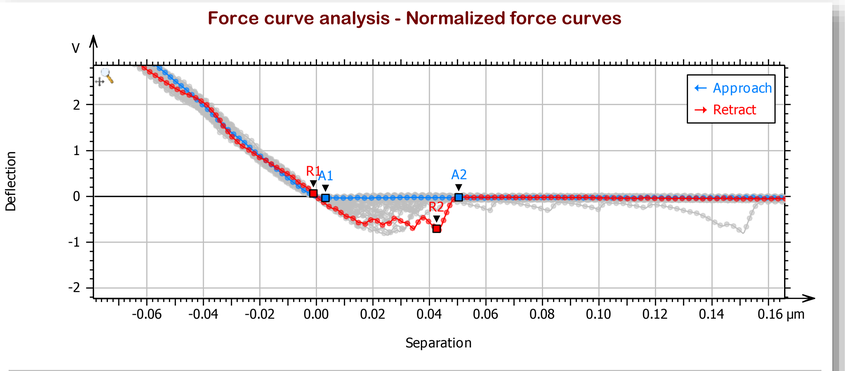
Mountains® software applications: further examples



AFM overlay on an optical microscopy image



Advanced flattening operation on SDRAM



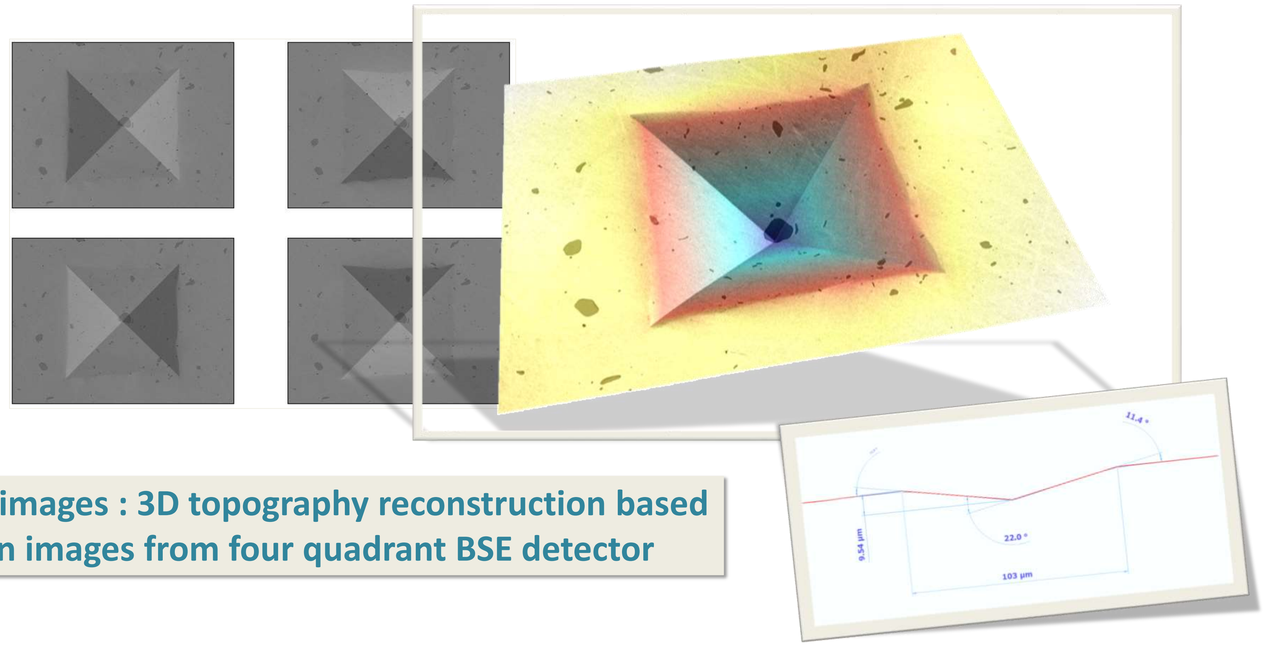
Information						
Force curve	7 / 17					
T-axis	T = 6					

Parameters for individual cursors	Stat.	Unit	A1	A2	R1	R2
Separation	Mean	µm	0.00323	0.0504	0.00986	0.0503
	Min	µm	0.00323	0.0504	-0.00107	0.0426
	Max	µm	0.00323	0.0504	0.0208	0.0581
Deflection	Mean	V	-0.0338	-0.0219	-0.165	-0.338
	Min	V	-0.0338	-0.0219	-0.394	-0.706
	Max	V	-0.0338	-0.0219	0.0635	0.030

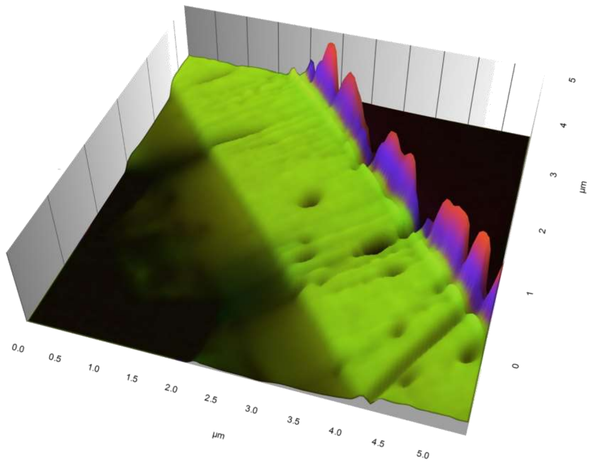
Parameters for cursor pairs	Stat.	Unit	A1-A2	R1-R2
Slope	Mean	V/µm	0.253	-3.14
	Min	V/µm	0.253	-17.6
	Max	V/µm	0.253	11.4
Separation difference	Mean	µm	0.0472	0.0405
	Min	µm	0.0472	0.0373
	Max	µm	0.0472	0.0436
eflection difference	Mean	V	0.0119	-0.173
	Min	V	0.0119	-0.77
	Max	V	0.0119	0.424

Series of force curves for WLC analysis

Mountains® software applications: further examples

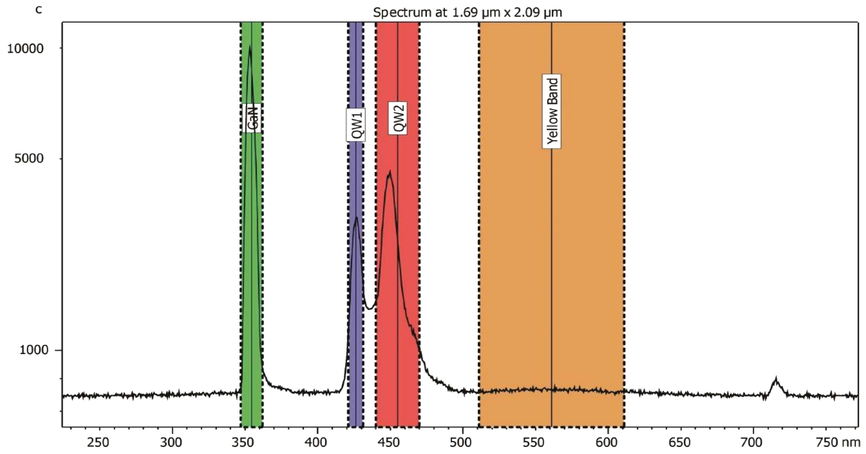


SEM images : 3D topography reconstruction based on images from four quadrant BSE detector

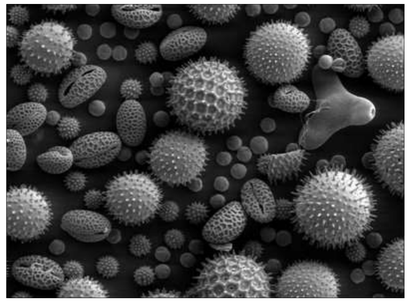


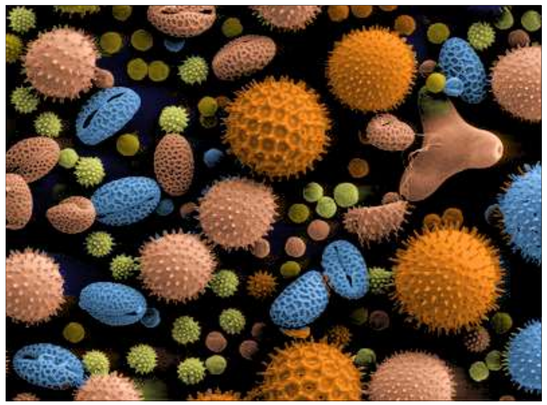
Cathodoluminescence : Gallium Nitride LED

Courtesy of Attolight



Parameters	Unit	Yellow Band	GaN	QW1	QW2
Start	nm	511	347	421	440
End	nm	611	362	431	470
Width	nm	100	15	10	30

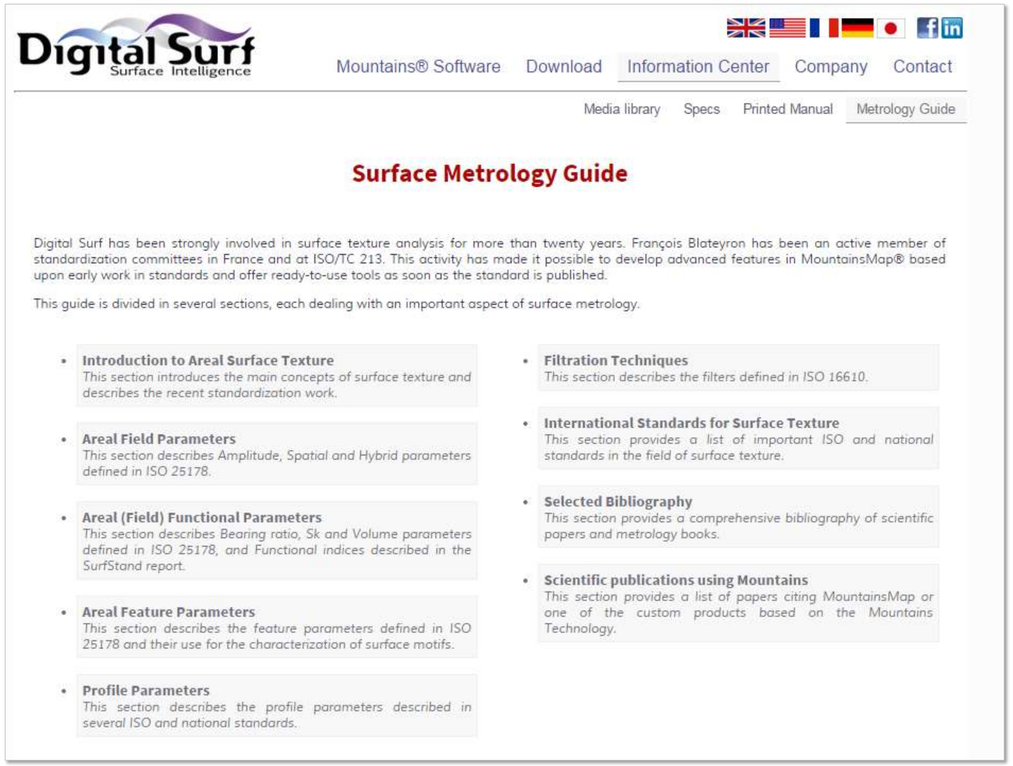




SEM image enhancement : colorization, contrast, W balance

Metrology & expertise

Free online Surface Metrology guide:
www.digitalsurf.com/guide



Created by François Blateyron, Digital Surf COO

› Expert on ISO/TC 213, responsible for defining standards in surface texture metrology (since 2003)

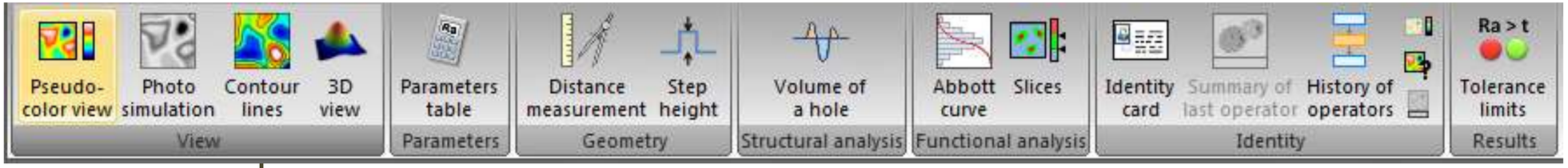
› President of CEN (European Committee for Standardization)/TC90

› Author of numerous articles on surface metrology

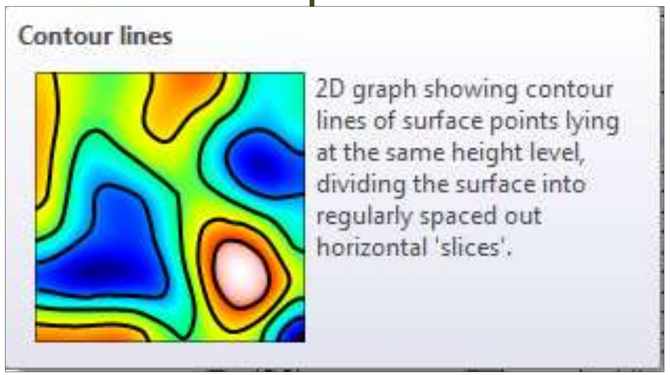
Key features of Mountains® software

Smart user environment

Top-down object-oriented ribbons



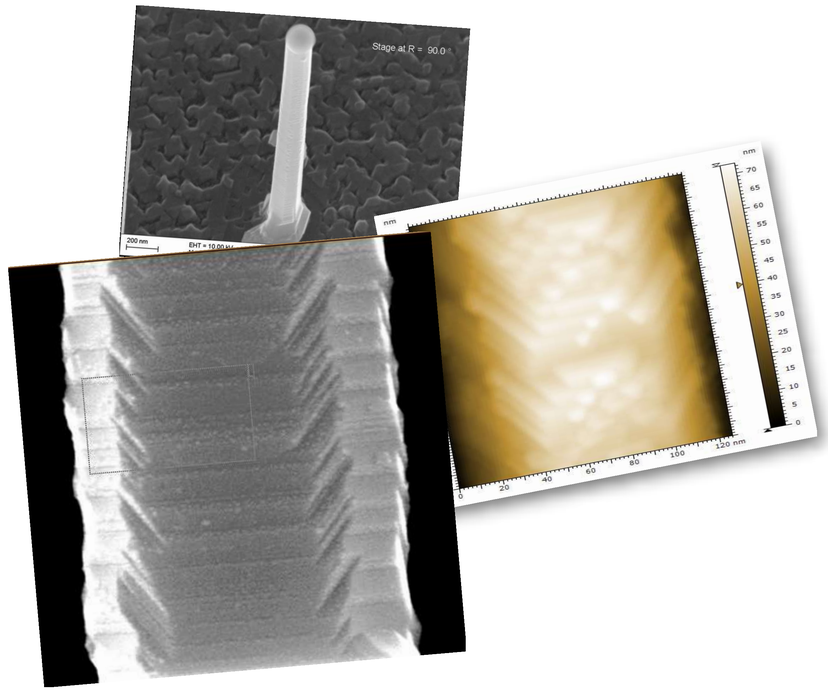
Expandable tooltips

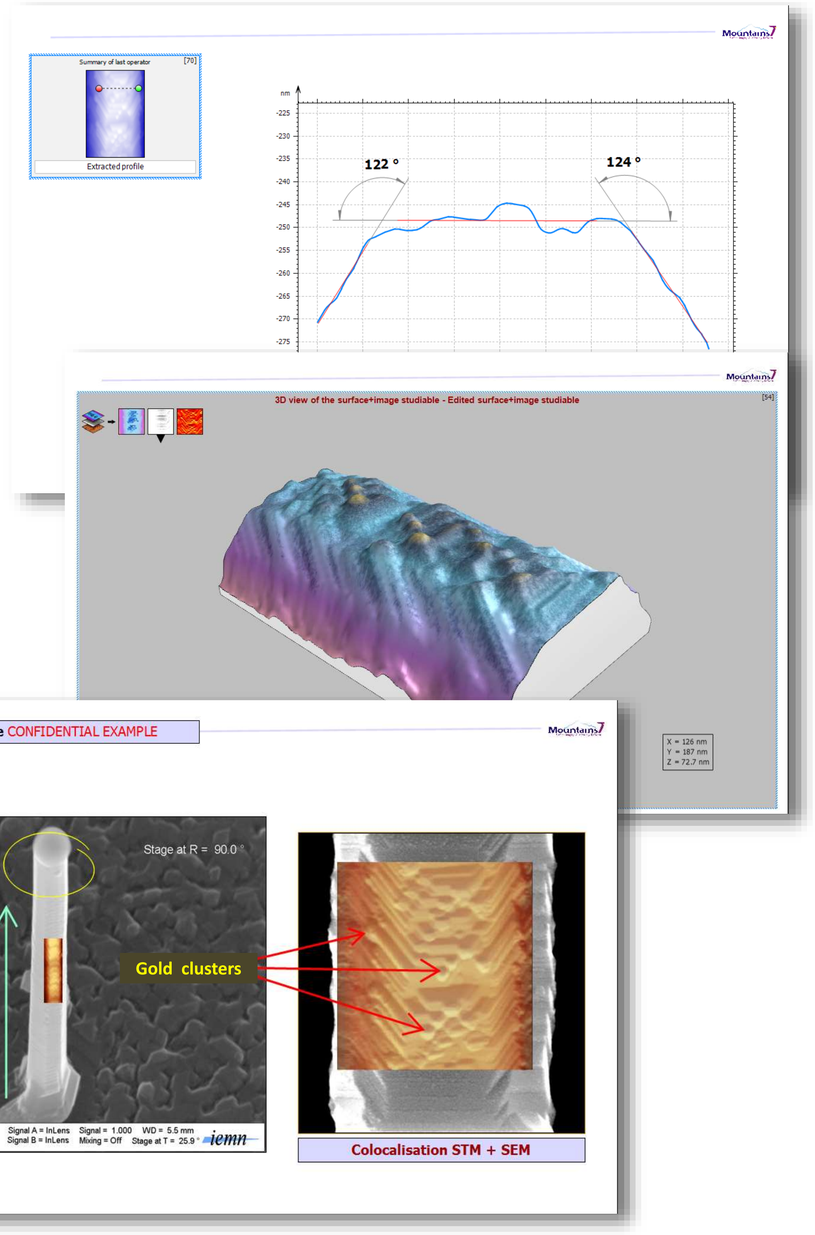


In 11 languages!

IMPORTANT

Organize datasets as visual analysis documents

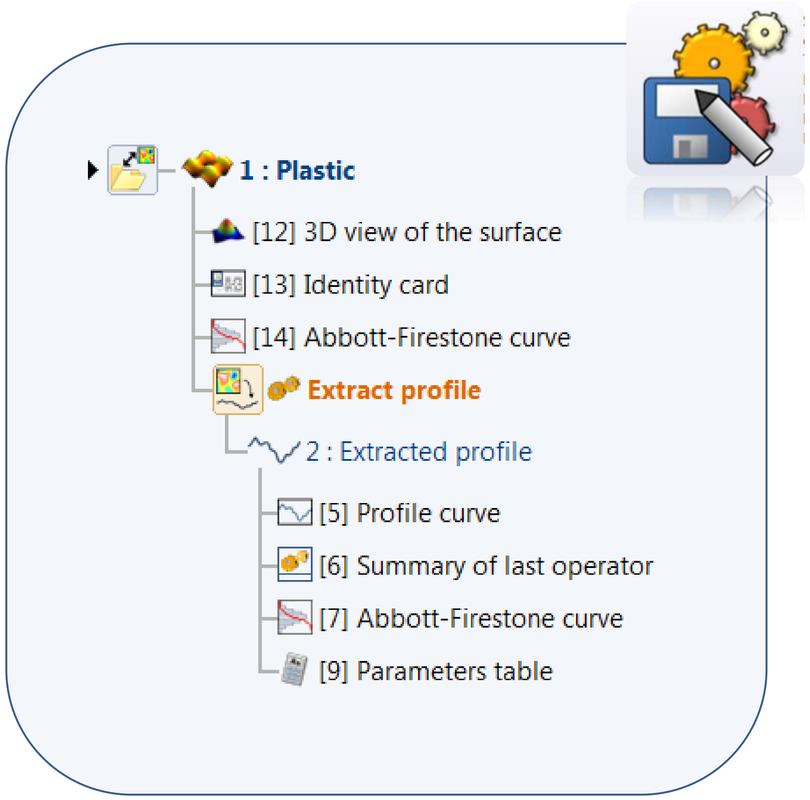




Visualize, analyze, report!

IMPORTANT

Stay in control thanks to the analysis workflow



All Mountains® documents integrate *an* **analysis workflow**

- Step by step overview
- Full metrological traceability
- Update any step at any time…
  … dependent steps are recalculated automatically

Traceability, flexibility & automation GUARANTEED!

IMPORTANT

Speed up analysis with Templates and Minidocs®

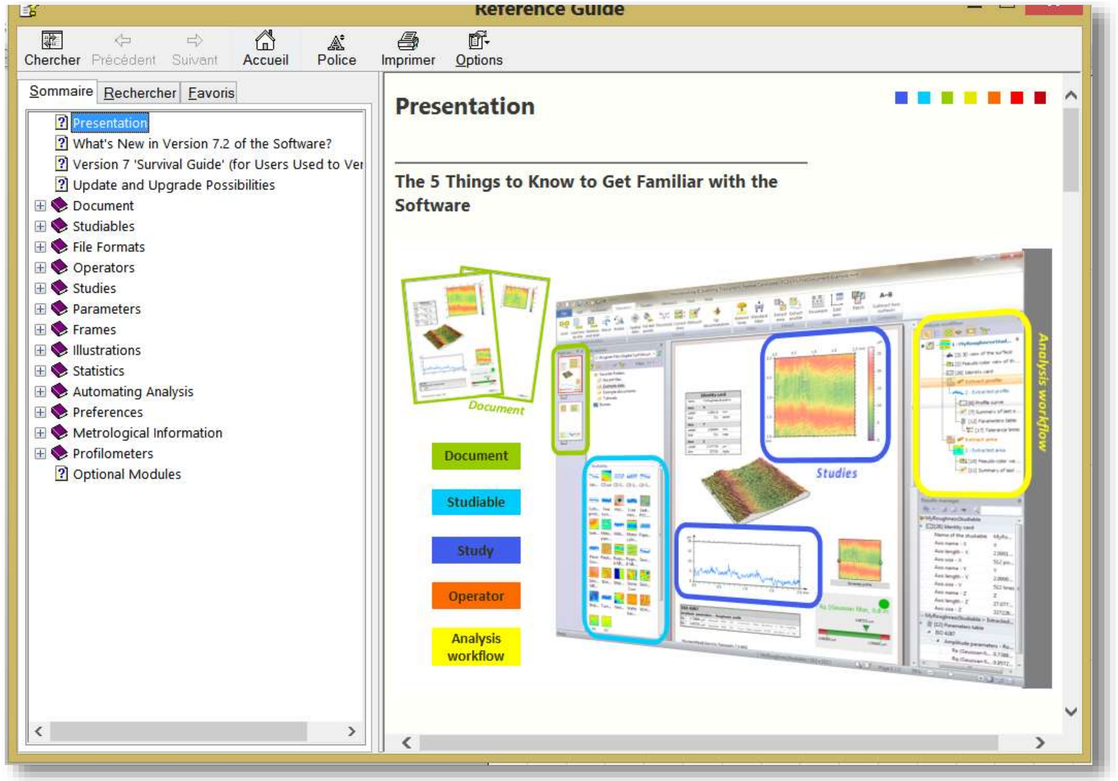
Use any document as a template for automation

IMPORTANT

Please help me!

Press **F1**

.... and get comprehensive multi-lingual on-line help



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