NEWSLETTER

SurFace

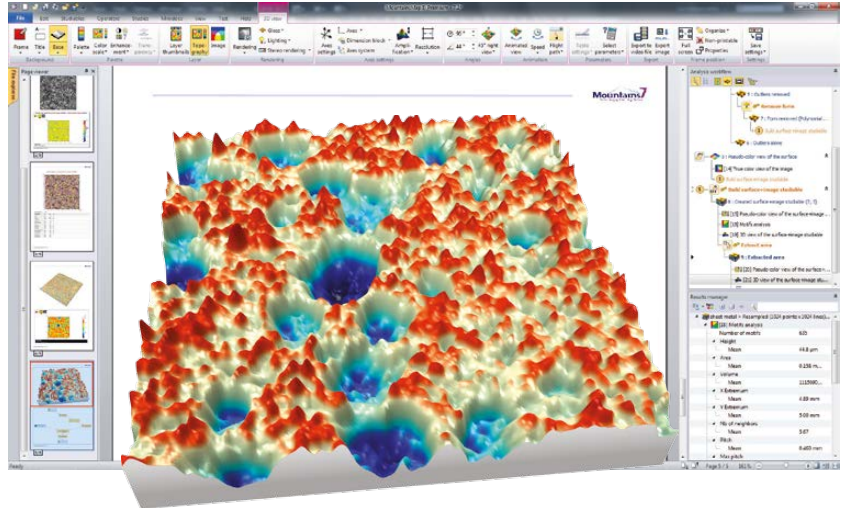## In this issue

Special 3D edition

Whenever you see this icon **Put on your 3D glasses and see surfaces in 3D!**

Join us on Facebook and LinkedIn!

What's new in Mountains® 7.2?

Mountains® 7.2, the latest version of Mountains® surface imaging, analysis and metrology software has just been released! A selection of new features is described below.

Users of Mountains® 7.0 and 7.1 can download an upgrade by visiting www.digitalsurf.com. Users of earlier versions of Mountains® can download a free trial version, read the Mountains® 7 data sheet and contact Digital Surf about an update.

Mountains® 7.2 will also be on show at Digital Surf's stand 3518 at the 29th Control international trade show for quality assurance in Stuttgart, Germany on May 5-8, 2015. We hope to see you there!

Superfast 3D reconstruction from 2 or 4 SEM images & metrology

3D reconstruction from 2 or 4 SEM images is now possible in a matter of seconds!
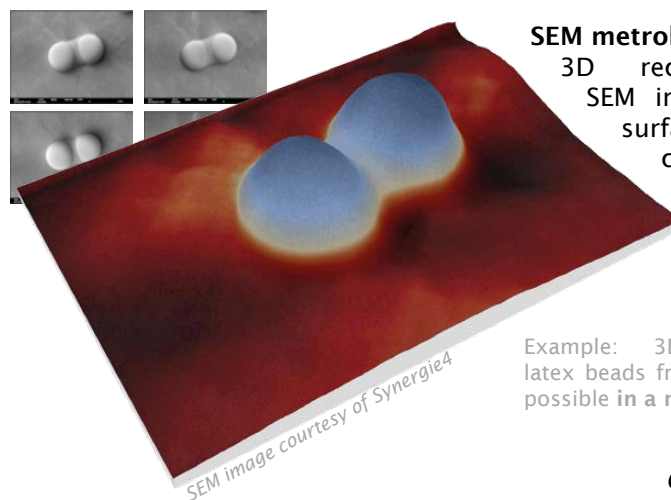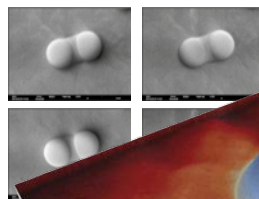
SEM metrology
3D reconstruction from SEM images provides 3D surface visualization in color and enables users to carry out studies of surface metrology.
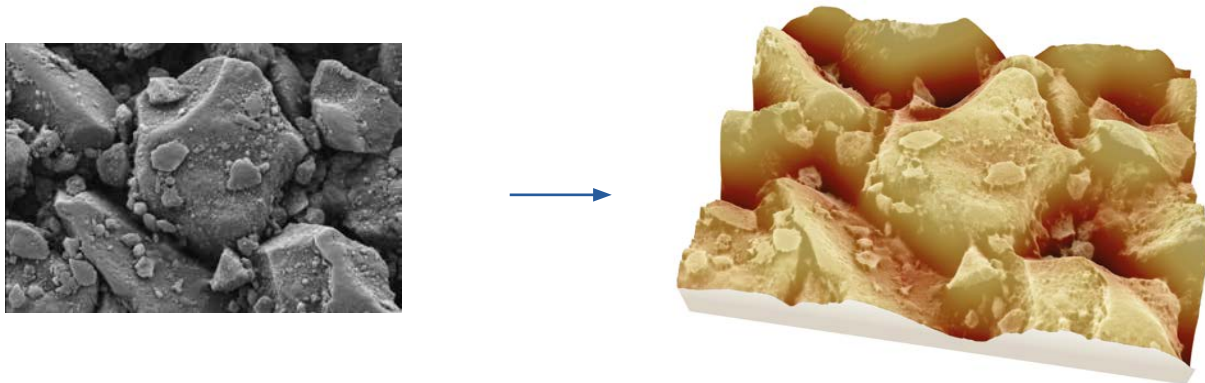
Example: 3D reconstruction of latex beads from 4 SEM images, now possible **in a matter of seconds!**
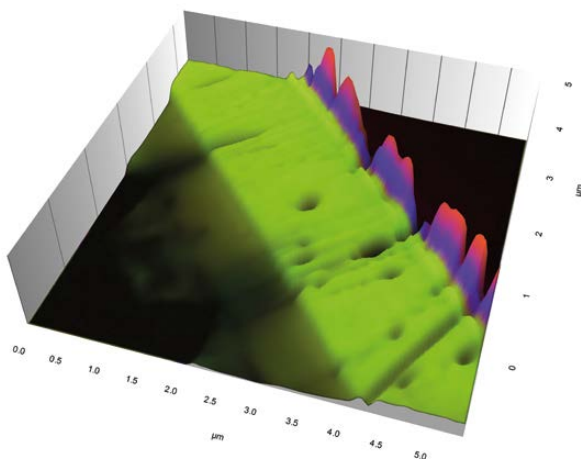
SEM image courtesy of Synergie4

Continued overleaf

3D color enhancement of single SEM images

3D enhancement of single SEM obtained using oblique electron beams.

3D color mapping of spectroscopy information

3D color mapping of spectroscopy information is now available for a wide range of applications.
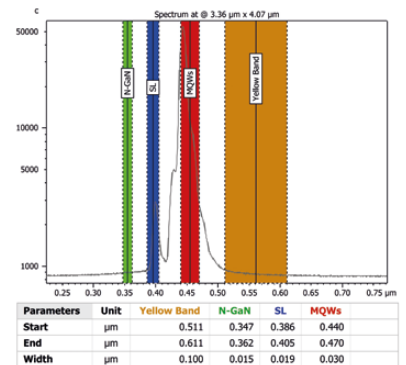
Visualize surfaces in real 3D with glasses

Activate the new stereo rendering option and view surfaces in real 3D through polarized 3D glasses or anaglyph glasses (red-cyan, yellow-blue).

Example: red-cyan anaglyph.

SEM image courtesy of www.semimaging.eu

More versatile surface stitching for 3D optical profilers, SPMs, SEMs and other instruments

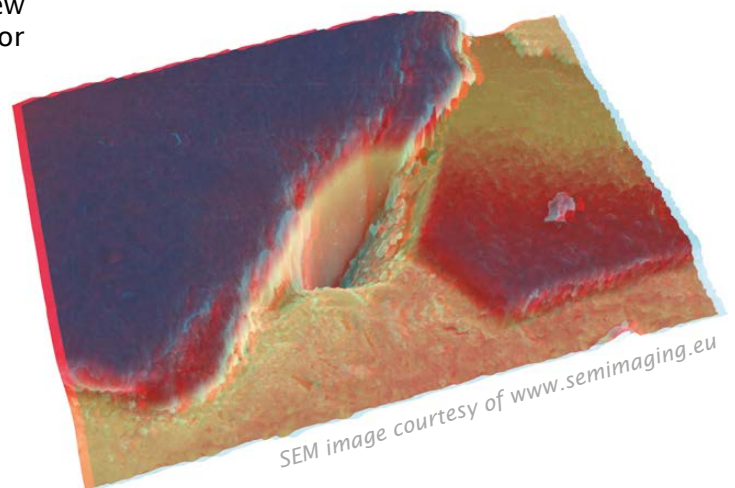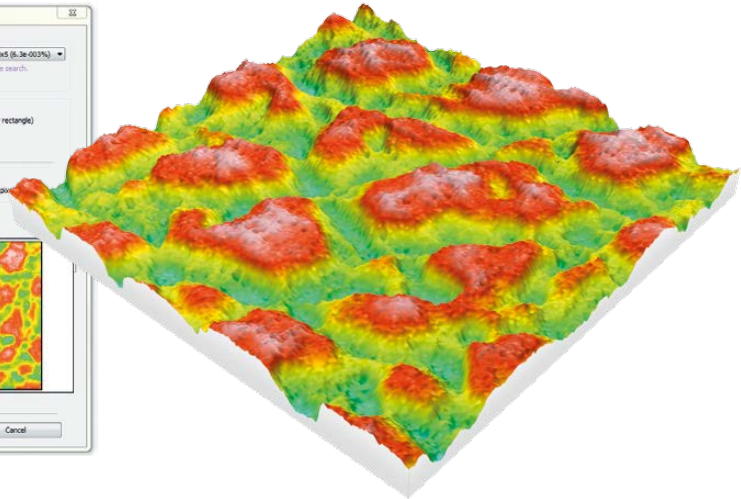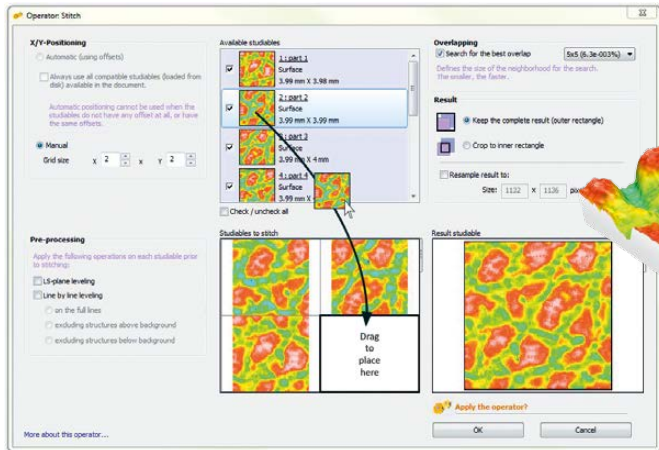Stitch together surfaces even if data on x,y offsets is not available.
Example: stitching of four surfaces without offsets + 3D view of the surface

Customize Operators and Studies ribbons

Personalize ribbons the way that you want them!

For example:

· Keep icons you use everyday on the ribbons and make them full size.

· Transfer other icons to the "Other" menu where they are still active.

· Gradually introduce icons/functions for new users during training.

Example: customization of Filter group in the Operators ribbon.
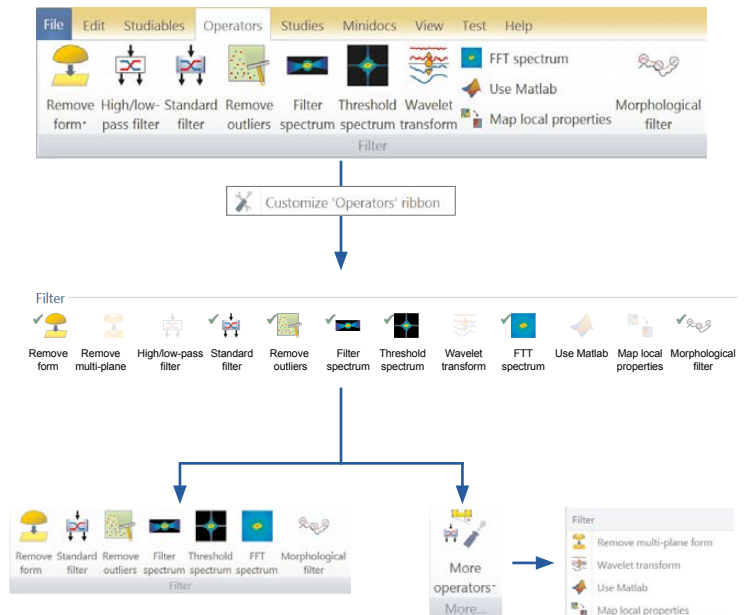
And much more!

Mountains® 7.2 contains many more features including new math functions, color/intensity inversion operator for images, easier application of axes settings, streamlined contour analysis and fast navigation in long 4D series of surfaces and lateral shift. Contact us for more information.

New perspectives in leveling and form removal

As well as general form removal, Mountains® 7 software offers innovative leveling and form removal tools tailored to the specific needs of certain applications.

Form removal using manual area exclusion

When using the "Level" and "Remove form" operators tools in Mountains®, it is possible to include or exclude areas from form calculation.

In the following example, taken from research into wound healing assessment, silicone imprints of wounds were scanned using a laser profilometer and analyzed in order to measure wound volume.

Wound volume is calculated after removing form from the area surrounding the wound but not from the area of the wound itself, thus taking into account body shape.

The "Remove form" operator in Mountains® makes it possible to specify the form to be removed using a polynomial:

The area of the wound itself (in gray) is excluded from calculation of the form.

This operation allows very precise calculation of volume.

It is accessible via the "Remove form" operator but is also included as an option in the "Volume of a hole" study.

Surface before form removal

Surface after form removal
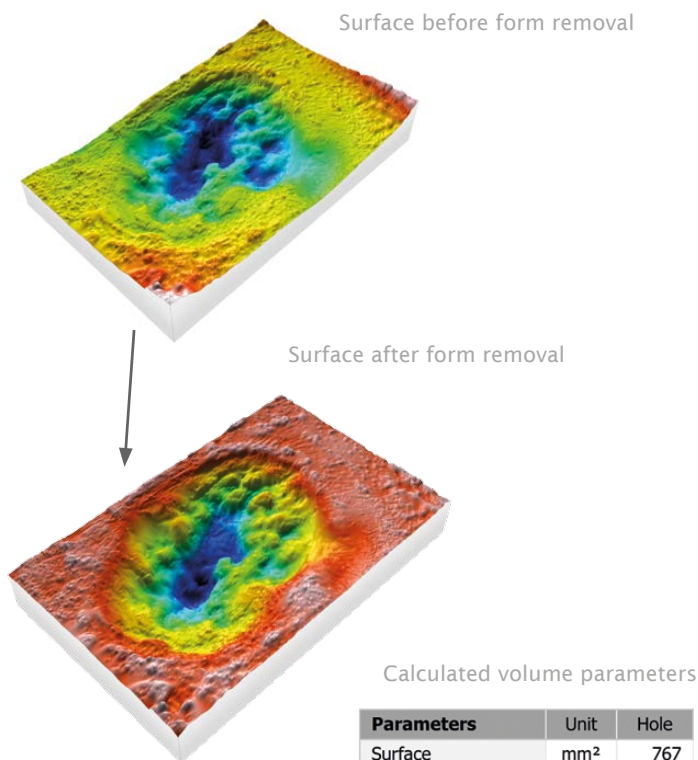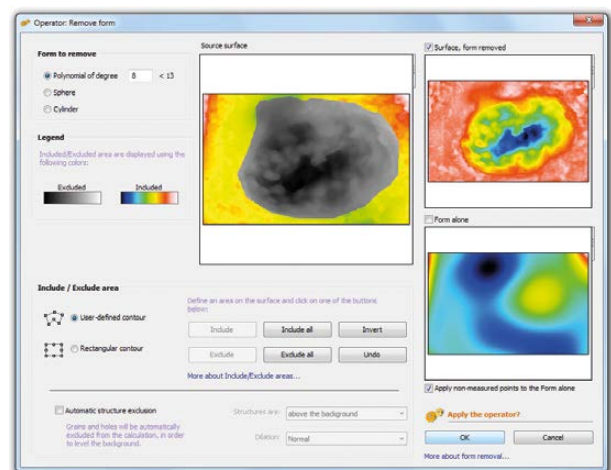
Calculated volume parameters

Parameters	Unit	Hole
Surface	mm²	767
Volume	mm³	682
Max. depth/height	mm	2.49
Mean depth/height	mm	0.890

Automatic structure exclusion

From Mountains® 7.0 onwards, grains and holes can be automatically excluded from form calculation. This option makes it quick and easy to level the background and prepare the surface for further analysis (motifs analysis, structural analysis - peak and hole volume etc.)

New "terrace" form removal

The new **"Remove multi-plane form"** operator allows leveling or removal of the general form of a surface, even if form is only visible through the deformation of multiple terraces situated at different altitudes.

The algorithm used ignores transitional zones, or steps, and only takes general deformation into account.

Hence, when the new operator is applied, terraces and steps are leveled and their heights and morphology are preserved.

In this particular case, Mountains® not only levels the surface and horizontally aligns the atomic planes of the crystal, but also corrects any distortions due, for example, to scanning system imperfections (thermal drift etc.)

Example: leveling a surface containing multiple planes, featuring both slope and distortion, using the "Remove multi-plane form" operator.
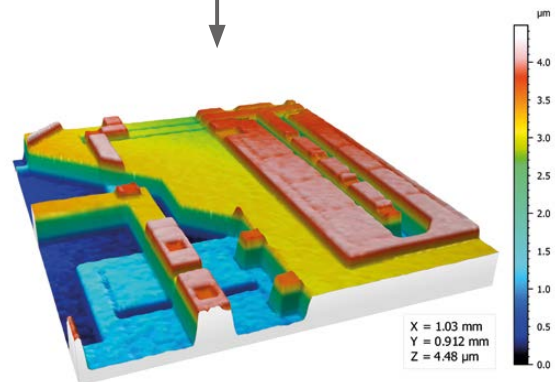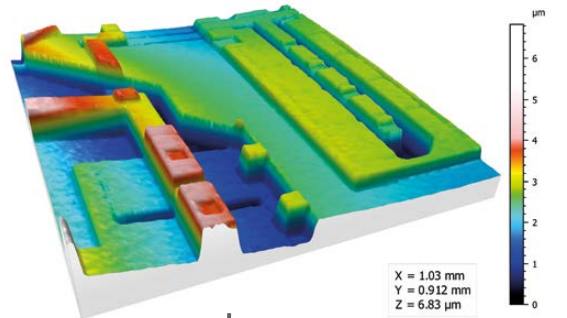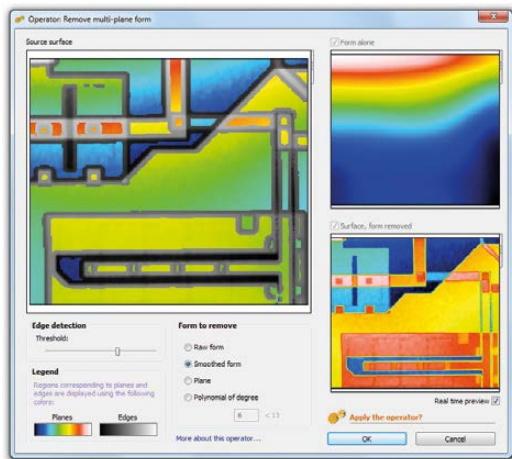
The new operator can separate slopes with respect to a threshold set by the user. Slopes below the threshold, interpreted as undesirable distortion, are removed in order to level the surface, while steps (in gray in the image above) are retained.

This feature proves particularly useful when analyzing silicon etchings (electronic components, MEMS), where several etching layers co-exist.

Similarly, in AFM or STM microscopy, surfaces with several atomic terraces can be leveled automatically.

Example showing the removal of multi-plane form from an artificial test surface consisting of numerous terraces and vertical cross-sections.

Original surface

Result using new "Remove multi-plane form" operator

*Surface profiles before and after multi-plane form removal*
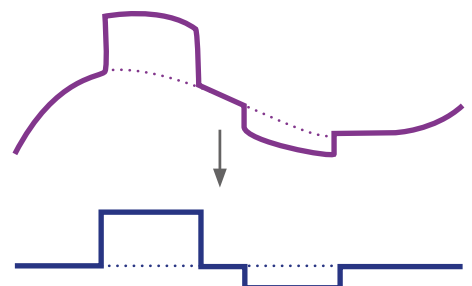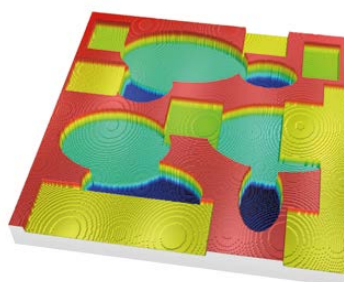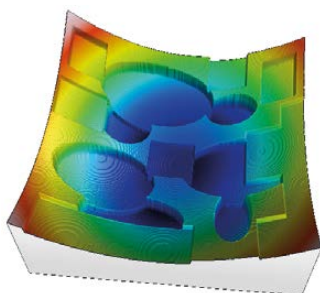
Powerful filters enable surface visualization and analysis

Surfaces measured by 3D profilers often contain measurement artifacts. These must be removed in order to visualize a surface and analyze it. Additional filters are needed for analyzing surface features including defects. Mountains® 7 provides all of the tools that you need. Here are three case studies:

Textured metal – making it possible to calculate bump parameters

The initial textured metal surface below (in black and white) contains outliers. Mountains® tools make it easy to remove these artifacts. The form of the surface is also removed and the image layer is overlaid on the 3D surface topography.

Structural analysis (motifs analysis) can then be performed on the resulting surface.

Remove outliers

Remove form

Build surface+image studiable
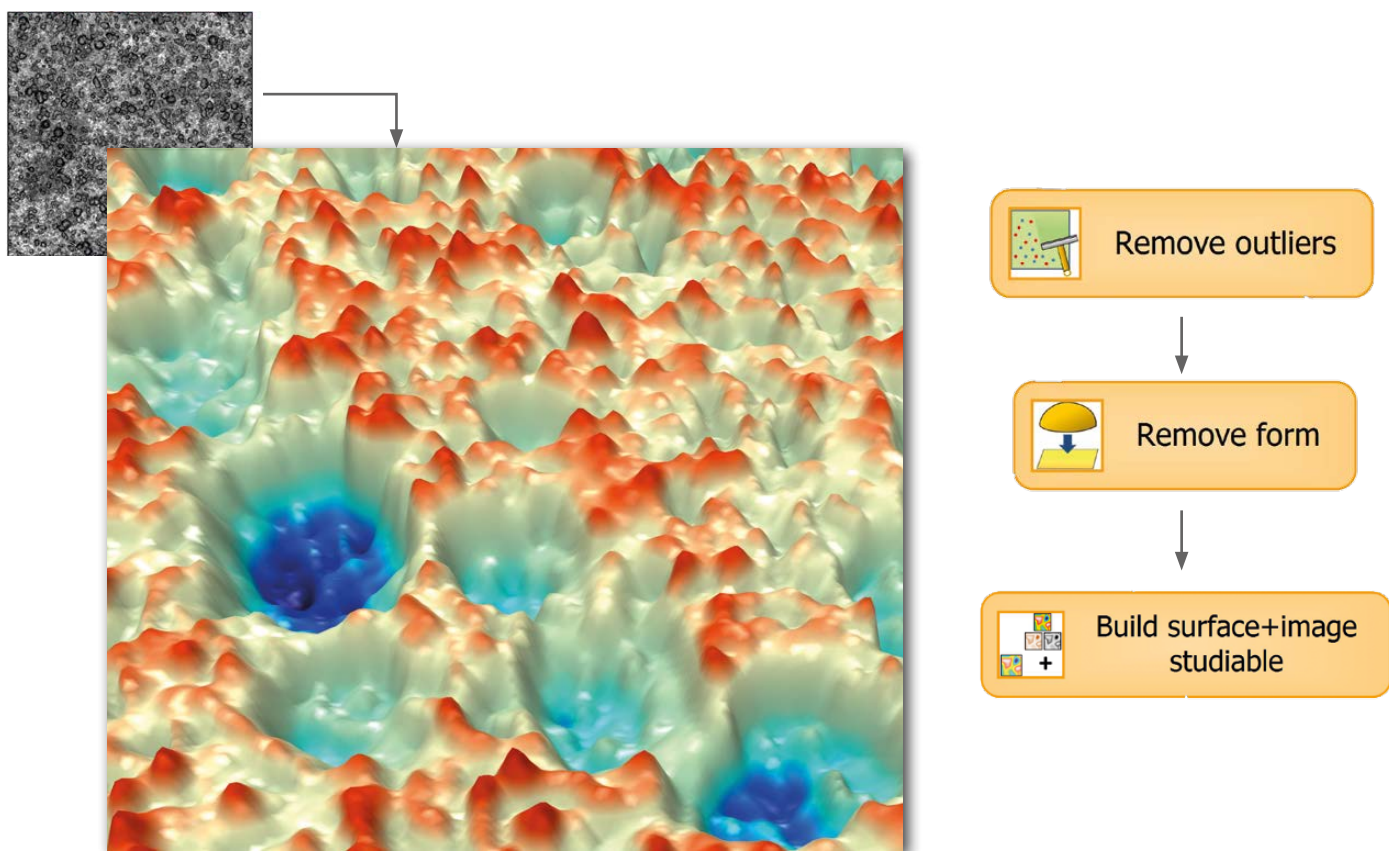
Motifs analysis

Motifs (or texture cells) detection and analysis according to ISO 25178 detection algorithms (segmentation by watersheds). Different display modes (colored motifs, overlay...), or interactive selection of one motif.

Parameters	Stat.	Value	Unit
Height	Mean	44.8	µm
Area	Mean	0.158	mm²
Volume	Mean	1115090	µm³
Equivalent diameter	Mean	0.418	mm
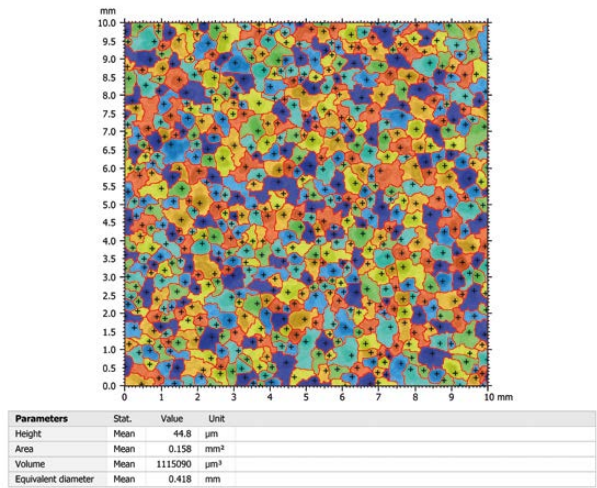
Engraved metal - improving visualization of defects

Engraved metal surfaces are checked to make sure that they are free of defects, for example burrs.

This initial engraved metal surface (to the right) contains outlier artifacts.

Outliers and noise are removed and the surface is leveled.

X = 150 µm
Y = 126 µm
Z = 33 µm

Remove outliers

Level

☑ Automatic structure exclusion
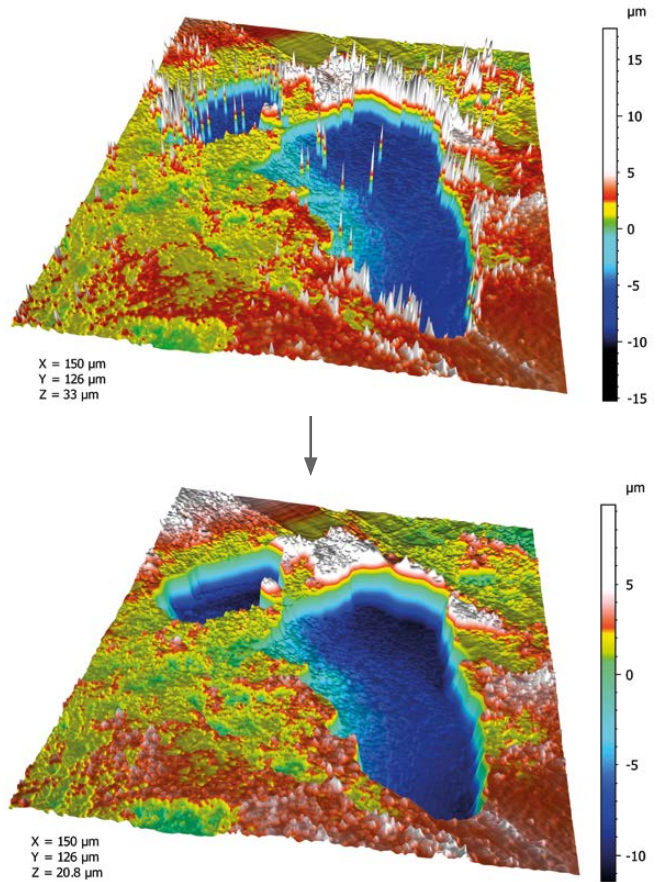
It is now ready for further analysis (volume of holes and peaks etc.)

X = 150 µm
Y = 126 µm
Z = 20.8 µm

Quality control of car body panels

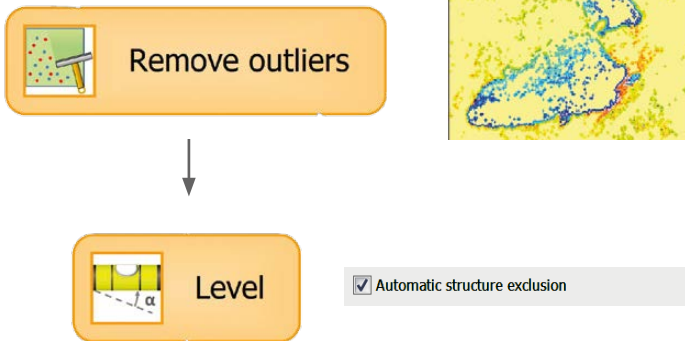The detection of local surface form defects is a major step in the quality control of car body parts during the manufacturing process.

For example, tiny dents can often appear on relatively flat panels with some kind of embossment, e.g. in the area around door handles. Here is how the advanced filters in Mountains® can detect them.

Remove form

☑ Automatic structure exclusion

Threshold

Standard filter

Waviness (Spline filter, 8000 µm)
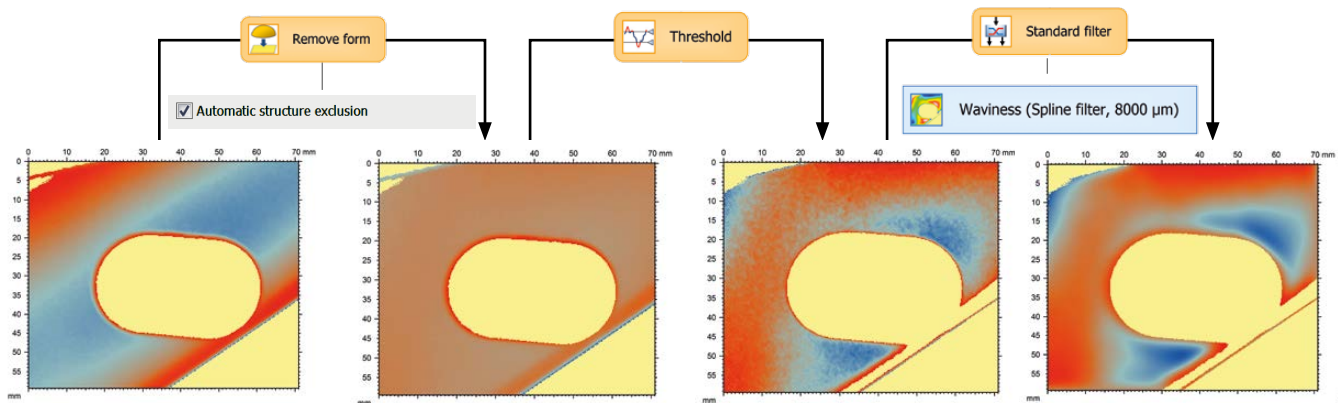
What does the term "default" mean in international standards ?

In this section of the Surface Newsletter, François Blateyron, COO at Digital Surf and ISO expert sheds light on an important aspect of surface metrology.

In this issue, he demonstrates the meaning of the term "default" which, as far as international standards are concerned, is not exactly what it may seem to be...

In international standards, the term "default" figures significantly ("default filter", "default cut-off" etc.) Many standards define default values or default rules. ISO 4287 defines the "default relationship between λc and λs" cut-offs. It also mentions the "default height and spacing discriminations" to be used for Rc and RSm parameters; ISO 4288 describes a "default rule for selection of cut-off wavelength".

However, it seems that users often misinterpret "default" as meaning "recommended".

Drawing specifications

In ISO vocabulary, the term "default" actually means "if not otherwise stated on the drawing".

When a roughness specification is given on a technical drawing (see figure), many default specifications are implied and do not actually appear.

The value of the parameter given in this specification represents an upper limit because it is the default limit and therefore the symbol U (for upper) is omitted.

turned

Rz 3,1

If a lower value is to be given, then the symbol L (for lower) should be explicitly written in the specification. The value must be interpreted in micrometers as they are the default unit for parameter specifications. The filter and cut-off are also implicit as the default filter is the Gaussian filter and the default cut-off is 0.8 mm.
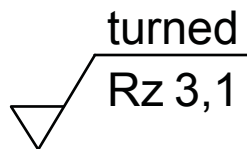
All these default values are given in ISO 1302 that describes how to indicate surface texture specifications on technical drawings.

Applications in industry

Most ISO Geometrical Product Specifications (GPS) have been published over the last thirty years by and for mechanical engineers with the aim of clearly specifying tolerances on drawings and validating them by measuring the manufactured parts.

Surface texture of mechanical parts depends on the type of machining involved. Several decades of experience in industry have allowed mechanical engineers to correlate parameter values and filtering conditions with mechanical functions, such as sealing, sliding, resistance to wear, lubrication etc. Part of this knowledge is reflected in the default choices used in standards.

Non-default values

However, users and designers are free to use other values for filters, cut-offs, parameters etc. as long as a functional correlation proving the link between the specification and the expected function has been carried out. In all such cases, they should explicitly specify all context parameters.

For example, small metal parts used in mechanical watches may be specified with shorter evaluation lengths, while larger cut-off values may be specified for diesel engines used in cargo ships. Similarly, users working in different fields that are not covered by these ISO standards (such as the paper industry, the food industry, archaeology etc.) may establish their own specifications.

Key points

> Specifications on technical drawings contain implied default conditions

> Non-default values must be written explicitly in specifications

> Fields that are not subject to specifications or are outside the scope of standards may use any other conditions that have been proven useful to control their functions or phenomena

> In the context of standards, "default" does not mean "recommended" or "mandatory"

> Read Digital Surf's surface metrology guide : www.digitalsurf.com/guide

Met & Props 2015

The prestigious 15th International Conference on Metrology and Properties of Engineering Surfaces (Met & Props) took place on March 2-5, 2015 in Charlotte, North Carolina, USA.

As a sponsor, Digital Surf, represented by François Blateyron, COO and Anne Berger, head of end-user sales, was proud to take part in this event bringing together surface metrology specialists from around the world.

The organizing committee, chaired by Prof. Christopher J. Evans, welcomed over 100 delegates representing the industry and research sectors of 13 different countries.

The technical program including 55 papers covered a wide variety of topics and featured technical talks, panel discussions, poster presentations, tabletop exhibits and lab tours as well as opportunities for discovering Charlotte's main attractions.

Conference proceedings will shortly be published in a special issue of the IoP Journal "Surface Topography: Metrology and Properties" (STMP).

During the conference, François Blateyron announced that Digital Surf will sponsor the next Met & Props conference to be organized in Gothenburg, Sweden in June 2017 by Prof. B-G. Rosén.

Visit Digital Surf's Applications gallery

Why not take a look at our recently updated on-line applications gallery?

Discover a whole range of surface imaging & metrology applications from numerous sectors: automotive industry, metallurgy, semiconductors, biotechnology, MEMS, nanotechnology, archaeology and more...

Visit www.digitalsurf.com/en/applications.php
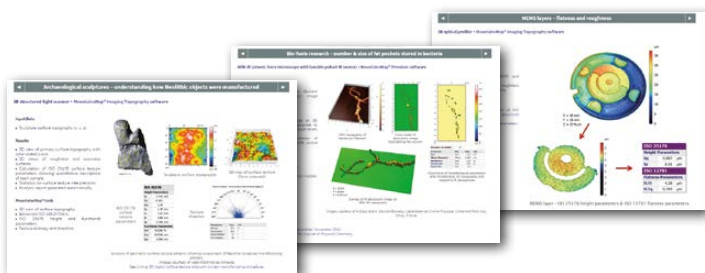
New information on Mountains® products

You may also be interested in consulting two of our recently published information documents:

> Surface Analysis Brochure on Mountains® surface metrology software.

> New brochure on Mountains® software for scanning electron microscopes (SEMs) including Mountains® 7.2 features.

Both are available for download now at **www.digitalsurf.com**

Putting our solar system under the microscope

In the "Mountains… and beyond!" section of the Surface Newsletter, the Digital Surf team let creativity take over to bring you some rather more offbeat examples of Mountains® applications.

With so much news from the solar system over these last few weeks, we simply cannot fight the urge to publish some amazing photos from the Dawn and Rosetta missions and let our imagination take hold: what if comet 67P and the Vesta asteroid could be put under a microscope? How could Mountains® help reveal their deepest secrets?

3D color enhancement of single images

NASA's Dawn spacecraft has recently become the first mission to achieve orbit around a dwarf planet. So over the next few months, we can look forward to some close-ups of the surface of Ceres which lies between Mars and Jupiter.

In the meantime, let's backtrack to the previous part of the Dawn mission, the study of the asteroid Vesta. In January 2012, Dawn's camera captured this image (see right) of a dark-rayed impact crater and several dark spots on Vesta's surface, possibly the remnants of a meteor collision.
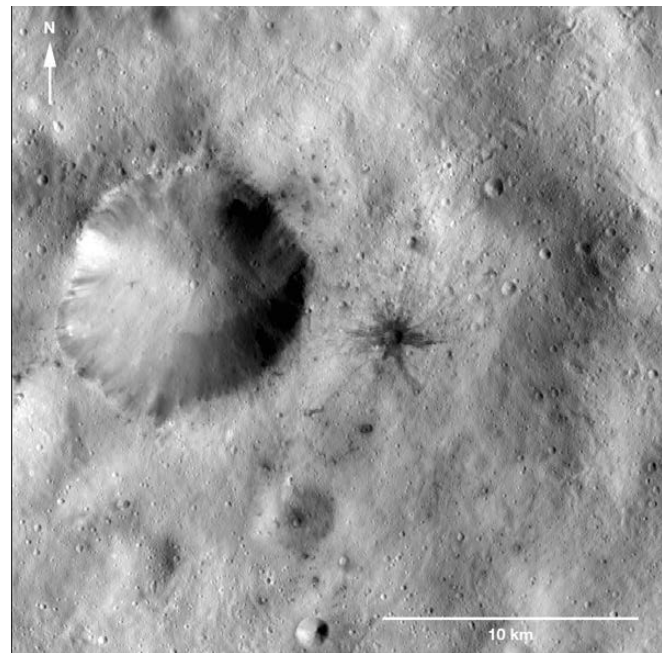
Mountains® magical new 3D enhancement tool for single images, used in particular for the analysis of SEM images, makes it possible to explore the rocky terrain of the asteroid's surface without leaving your desk!
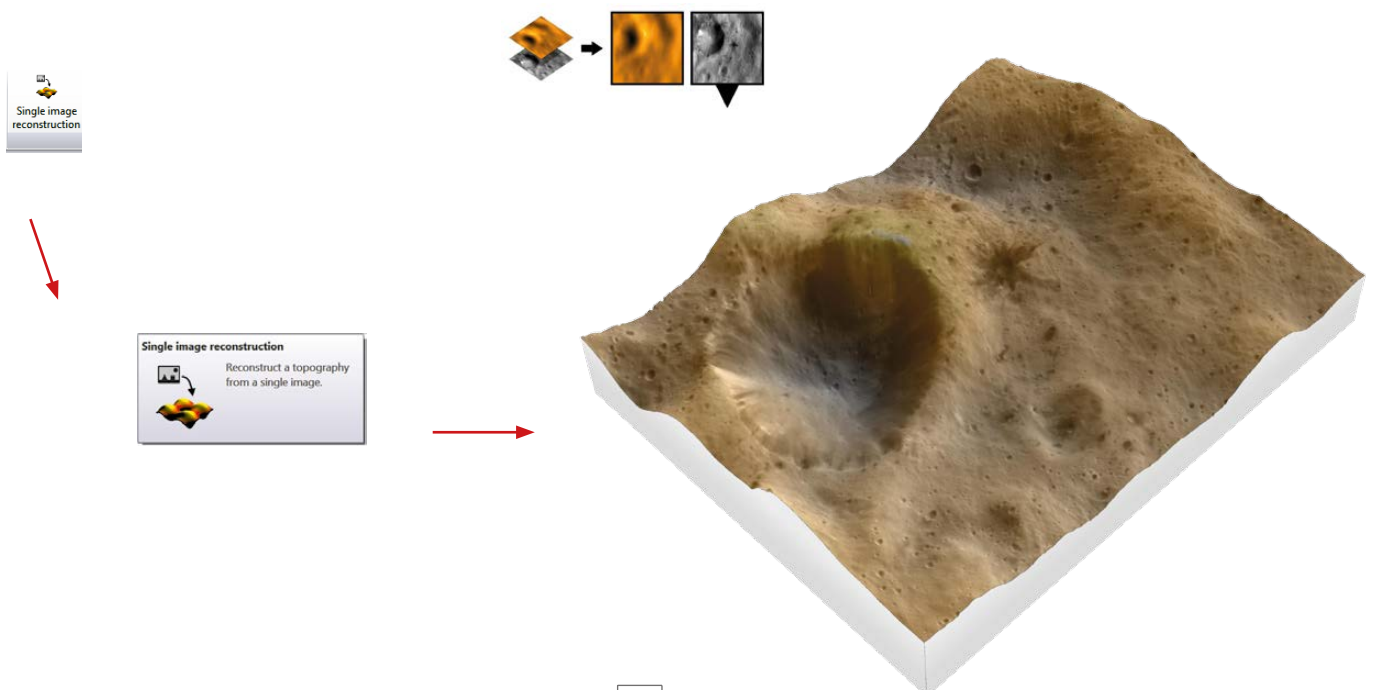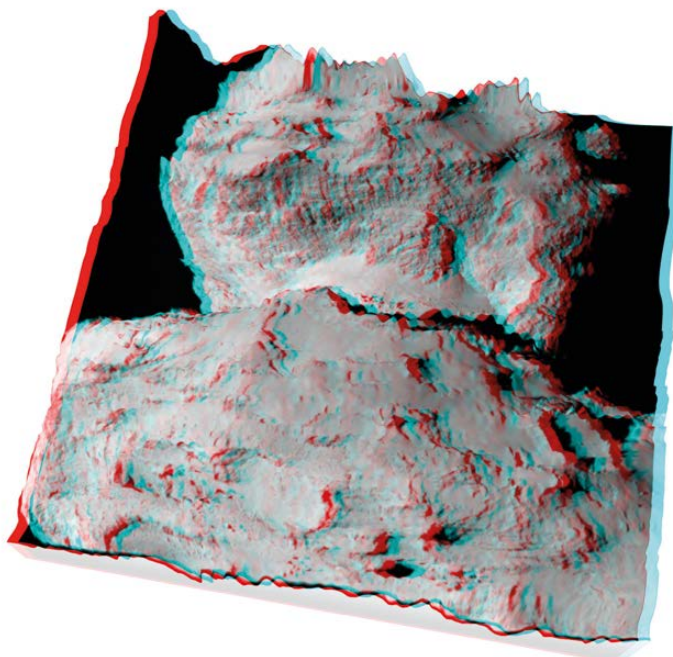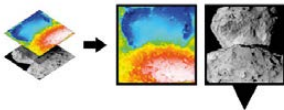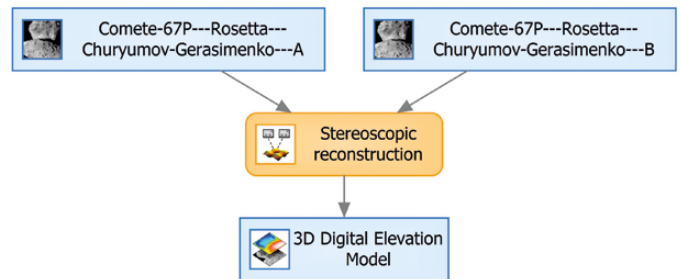
3D reconstruction from a stereoscopic pair

These two images were taken last August by ESA's Rosetta probe and show the "core" of the comet 67P/Churyumov-Gerasimenko.
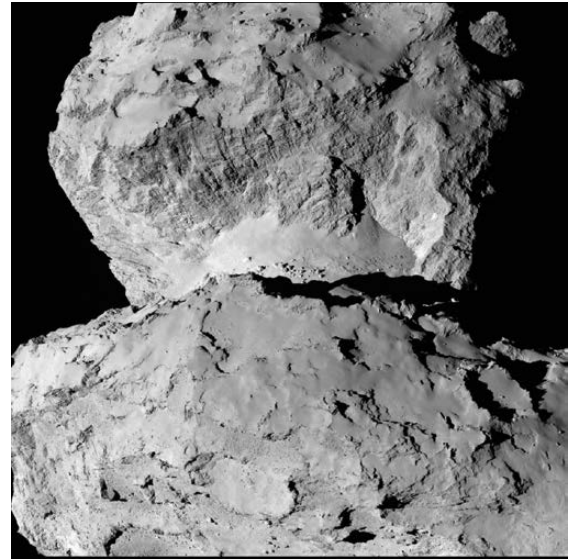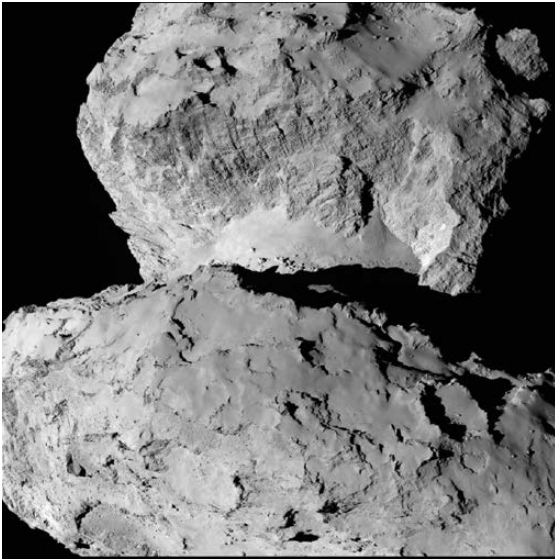
As with two SEM images, Mountains® can reconstruct a 3D model from this stereoscopic pair in seconds. The resulting image can then be viewed in real 3D using anaglyph glasses.

Comete-67P---Rosetta---Churyumov-Gerasimenko---A

Comete-67P---Rosetta---Churyumov-Gerasimenko---B

Stereoscopic reconstruction

3D Digital Elevation Model

Mountains® Tip:

Easily create an animated view of any 3D image and simulate flying over the surface using a predefined flight path.

Animated view

Simulate a flight over the surface, using a predefined or a customized flight path.

Click to start the animation, and click again to stop it.

Try MountainsMap®

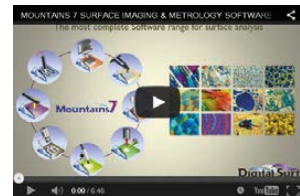**MountainsMap® Premium Software with all options, free for 30 days!**

Contact us for an update

Contact us for information about updating MountainsMap® 6 or earlier software to the latest version of MountainsMap® 7

Watch the Mountains® 7 video

**Mountains® 7 Software
The most complete range for surface analysis**

Download our brochures

**Learn more about Mountains® 7 Software
- download a Mountains® 7 brochure in English or Japanese**

Meet Digital Surf

**29th Control international trade show for quality assurance, Stuttgart, Germany - Stand 3518
May 5-8, 2015**

Digital Surf
Surface Intelligence

Solutions for surface metrology, designed for instrument manufacturers, research laboratories and industry

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