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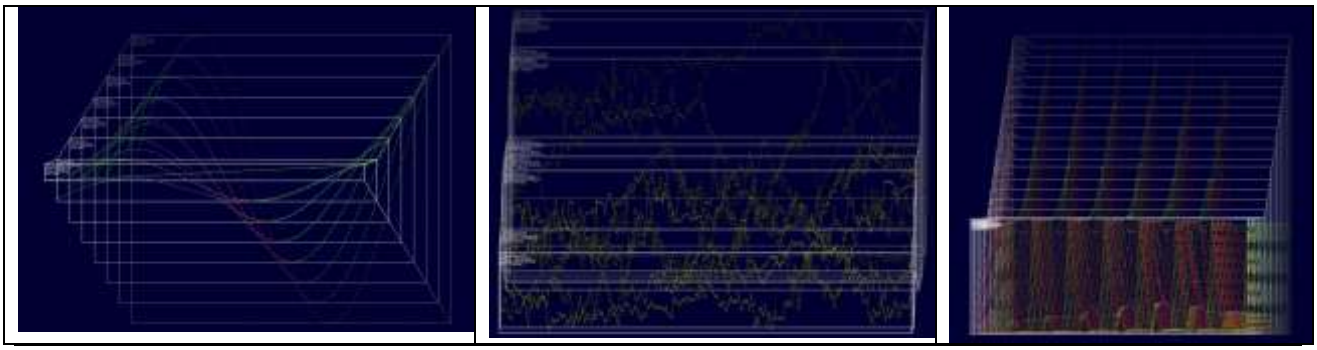
17.11.2009

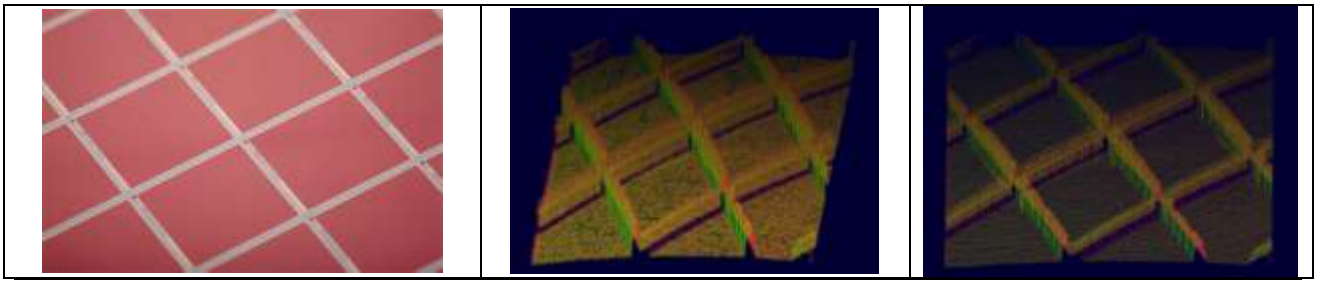
APPLICATION TO PRESENT AN INVESTIGATIVE SOFTWARE TOOL AT THE INNOVATION VILLAGE

The Prototype Software

"3d metric" software uses image analysis to measure on-screen. The *3d metric* approach to analysing and processing images is based on a powerful approach to visualizing multi-dimensional data in vertical layers. The three examples below show eight layers of sine waves, ten layers of Vostok related climate data and twenty-six layers of data that were recorded by a prototype sensor of the *London Metropolitan University.*



When applying this approach to digital images, new parameters become available for re-visualising an image and quantifying its elements. The following example is an image from the website of Aerius Photonics - re-visualized in two variations.



When visualizing data, correlations between different dimensions can be seen, and new functionalities become possible: e.g. sorting according to priorities and weighting factors.

When re-visualizing images, new visual depth becomes apparent through new perspectives. New metric details allow for quantifying images as a whole as well as regions of interest and image elements.

The next version of the prototype will demonstrate how these details serve to compare individual image elements, thus contributing to the recognition of patterns.

Quantifying images and their elements means classifying, comparing and sorting them. It means automating their processing and offering support for making decisions based on image content.

Photonics Related Images
The software is so generic and the algorithms so universal, that any image, produced by any technology, can be investigated in more detail. Photonics related images have been produced in two albums of images and their re-visualizations: Photonics and Photonics21, the *European Technology Platform* for photonics in Europe.

The Purpose of the Tool
The general purpose of this universal tool is to enhance knowledge and understanding photonics by comparing images, selecting 'odd ones out', formulating selection criteria and evaluating processes over time. More specifically, server installations for the purpose of the customer will allow for optimising automated processes, higher accuracy in determining measurements at nanoscale and below, and custom-building "smart systems". These systems benefit from the smartness of "software vision" combined with the parametrisation of "software lenses" and the expertise of humans based on analysing images all day long.

So far, the software exists only on my laptop and can only process individual images. The parametrisation is clumsy and incomplete. The next version will be a public web service that will allow users to re-visualize their own images and experiment with their own parameters sets. The ultimate installation will be on private servers to fulfil the needs of an organisation – where the "smart system" learns from image to image and aids in making decisions based on criteria relating to image contents and quantifications offered by the software.

When "seeing more" in their own images, it will become clear to image analysts how this generic tool can become useful within their respective field of knowledge:

- The recognition of patterns to distinguish materials or cells
    - The observation of differences between different states
    - The influence of chemical or physical ingredients
- The control of quality in industrial processes
- The observation of processes in life sciences.

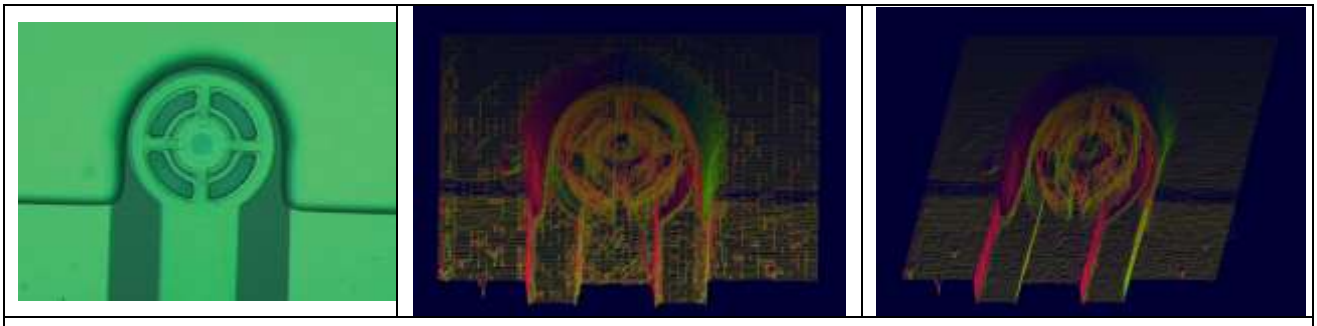
The Potential Market
Given the universality of the tool, the market is potentially huge. According to the *American Society for Clinical Pathology*, there were between 13,000 and 14,000 board-certified pathologists actively practising in the United States in 2006 and the worldwide number is significantly bigger. University researchers in pathology and cytology are also potential users of the future *3D Metrics* software. The combined U.S. anatomic pathology and cytology market was estimated by Washington G-2 Reports to be slightly over $12 billion in 2006.

The Funding
The work has been carried out in private and independent research since 1996, financed by family and friends.

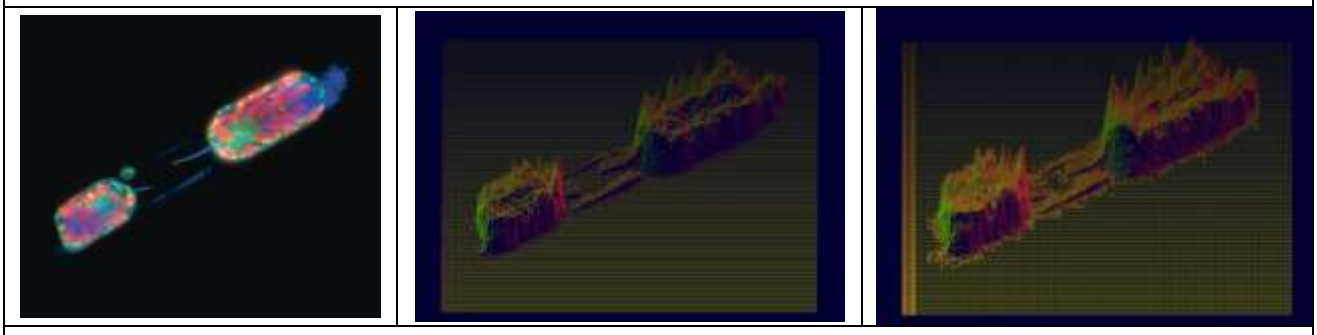
The Team
The inventor is Sabine K McNeill, a German mathematician and software designer who started her career as system analyst at CERN, the *European Centre for Nuclear Research* in Geneva. A number of different programmers were involved to advance commercial exploitations of the prototype in London. See The Team. In Berlin, a work experience programme for three programmers took place from May till August 2009, in collaboration with EDV Hofmann.

It resulted in an English and German gallery of images and their re-visualizations. They illustrate potential applications and markets in terms of imaging technologies as well as science and research. The current project manager is **Wolfram Eifler**, a system architect with over twenty years of professional experience in science and industry.

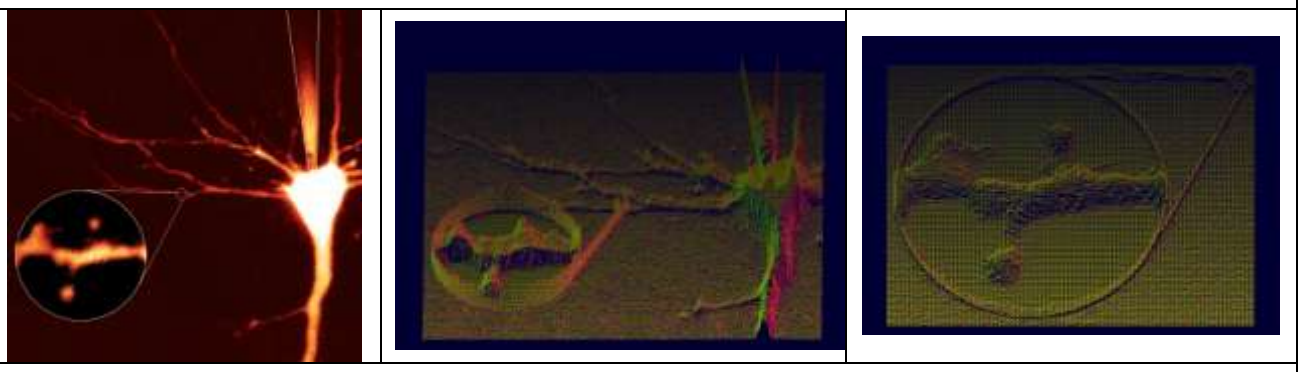
The following samples have been taken from Towards a Bright Future for Europe the *Photonics*[21] *Strategic Research Agenda*:



A high speed VCSEL for data communication applications: Chalmers University of Technology



Life marker in a living cell: Dr. J. W. Rijstenbil, Netherlands Institute of Ecology



Measuring dynamic process in living cells: Dr. Koester, MPI for Medical Research

"3d metric" Software Lenses: a New Instrument of Observation

"Humboldt had 'a horror of the single fact', believing that ' in order to explore any one thing, one needs to approach it from all sides'... Every discovery opens up the imagination further, stimulating more discovery: it 'enlarges the sphere of ideas', excites a taste for investigation, while the creation of new instruments of observation increases the intelligence."

Theodore Zeldin, *An Intimate History of Humanity*, London 1994