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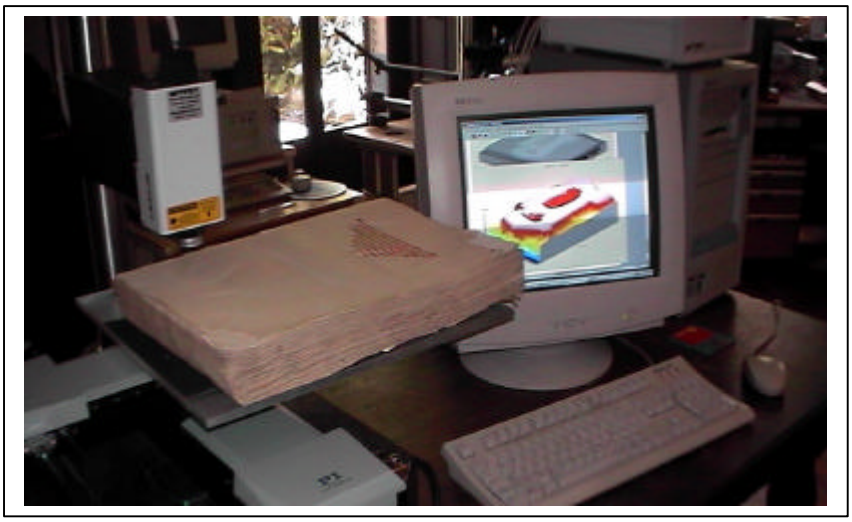
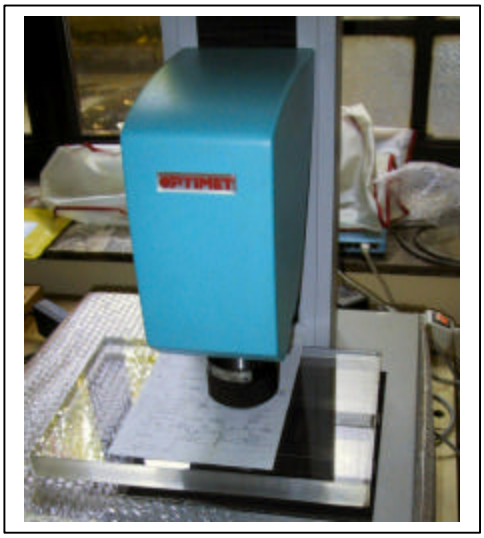
Evaluation of the "Superposed Strokes" for Forensic Analysis of Handwriting

Through a non-invasive and non-destructive analysis system the GRAFISCAN 3D - based on Conoscopic Holography technology – is able to produce three-dimensional scans with non-contact solutions at sub-micron resolution.





The GRAFISCAN 3D System

Pertel s.r.l. have experience of over twenty years of activity in non-contact dimensional/superficial measurements for the research and industrial markets. The main purpose of the “Grafiscan 3D” is to offer the graphic expert, in coupling with traditional instrumentation and his professional experience in graphology analysis, an innovative measurement system, which enables determining the order of "overlap of the strokes". The “Grafiscan 3D” employs a non-contact sensor which is based on Conoscopic Holography technology (protected by eleven patents). This enables a 3-dimensional scan of samples for profile and absolute distance measurements at sub-micron resolutions.

The scan produces a compound file sampled by the cartesian coordinates X-Y-Z of every single point. In cases where an area is limited to a several millimeter square (as in the zone where two strokes overlap), tens of thousands of points are measured. Because the system recognizes the topographic map of the sample, the ink or paper colour have no importance, the same goes for the hand which has traced the strokes. Furrows which have been marked and then cancelled are also traceable.

The Grafiscan 3D, in relation to traditional techniques, such as observing strokes through optic microscope, IR, UV and cold light through optic fibres, allows producing depth measurements of the furrows and width at every point sampled on almost any kind of material.

The system enables observing the "dynamics" by which the strokes produced the furrows due to the pressure of the tip of the pen, this includes felt-tip pens and typewritten characters.

The following is a description of the procedure for identifying the sequence of the strokes:

The three-dimensional scan in the area where the strokes cross each other allows observing in minute detail how these were impressed on the paper. Particular attention is given to how the second stroke is presented. In the instant in which the second stroke arrives in narrow closeness to the first stroke and crosses it, this second stroke further compresses the weft of the paper forming a light protrusion of the second stroke in relation to the first furrow. The second stroke continues further leaving behind the first stroke, which really created the furrow.

Once the presence of the heightening in one of the two furrows is identified, then automatically the first stroke is identified as well. However identifying this heightening, especially in light strokes, requires thickness measurement of even several microns, and this is not perceptible with two-dimensional information alone, which is what an optical microscope can provide. In image no. 1 the red arrow points to the "heightening" of the paper pressed by the second stroke. It is visible that the thinner stroke has been placed first on the paper. The example refers to two engraved strokes with a common ballpoint pen. Image no.1 enables a better understanding of the procedure of recognizing the overlaps. In image no. 2 we can observe the two raised areas highlighted in the two zones in red.

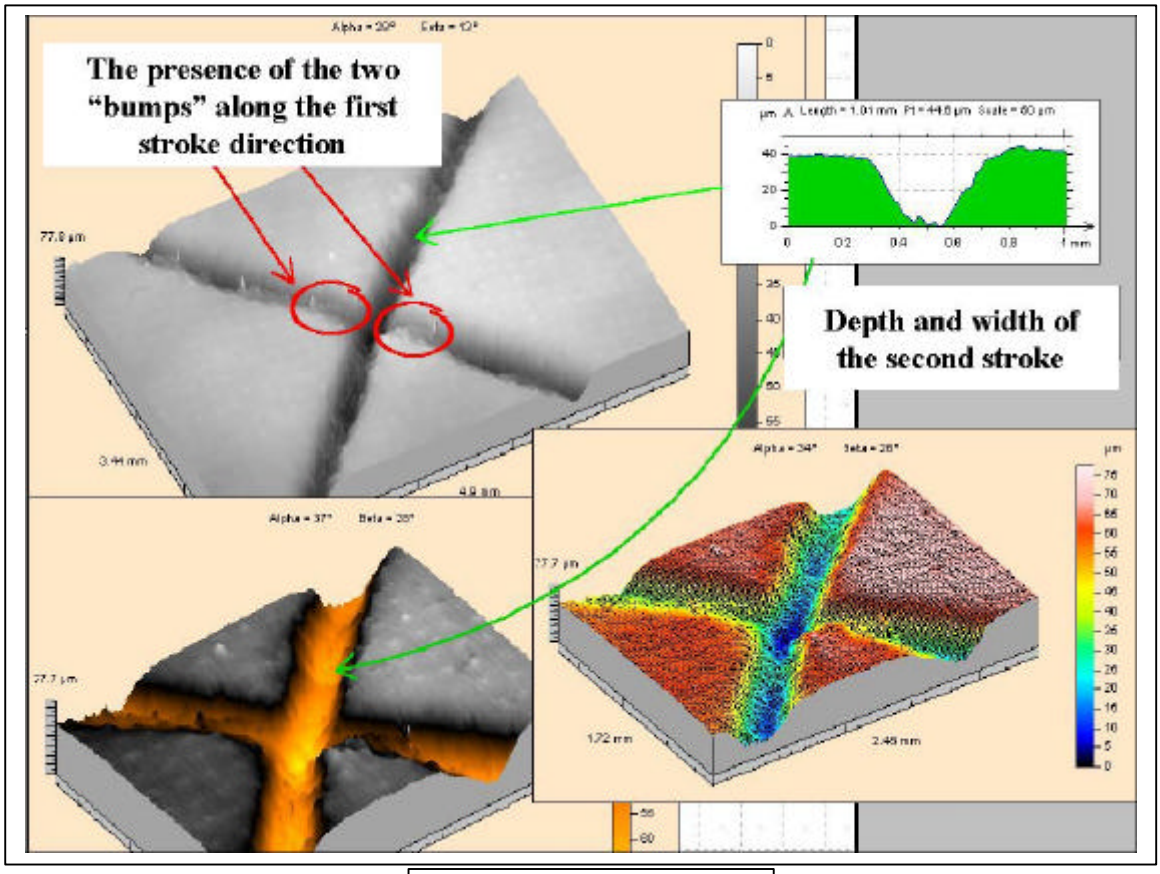


Image n.1

To obtain the results in image no. 2 we have carved two strokes on a veil of plaster, which is most suitable for preserving under-stroke impressed modifications. This is a simulation of what happens on paper, however even if in the three-dimensional image we see two underlined raised areas, these actually measure a thickness of only 150 microns.

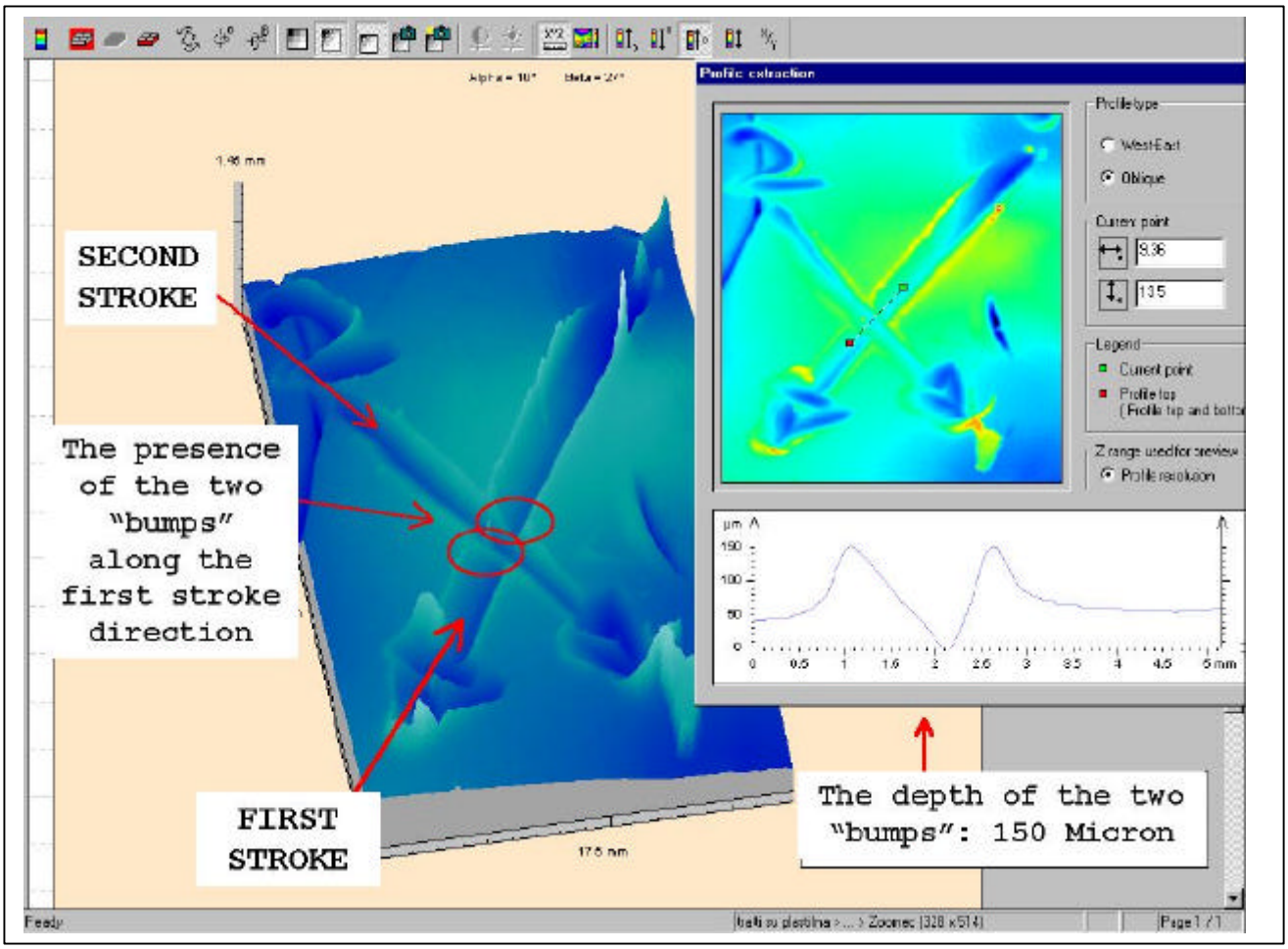


Image n.2

Conclusions

Mr. Francesco Dellavalle (responsible for Marketing Quality at Pertel) is confident that this equipment will open new job perspectives. Above all he believes this technology can be especially beneficent in Scientific Laboratories of the Judicial Police and for Technical Consultants of the Courts. Criminologists can verify banknote forgeries, coin forgeries, forgeries of documents, ballistic finds analysis and more.

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3D SCANNING EXAMPLES: