KONICA MINOLTA

(Some applications in 3D Digitizing)

3D Digitizing – KONICA MINOLTA 3D Laserscanner

We are pleased to present this brochure introducing the Konica Minolta Non-Contact 3D Digitizer as the ideal scanning tool for applications in medical sciences.

Actively engaged in 3D imaging technology internationally since 1997, Konica Minolta works in close partnership with leading universities, research institutes and software partners. This global activity puts the company in an ideal position to offer successful product solutions for a wide range of 3D applications. The design and manufacture of 3D imaging systems is a logical next step in the development of Konica Minolta's core strengths based on its expertise in colour and light-measurement technology.

Fig. 1: Konica Minolta VI 910 3D Laserscanner.

The 3D product range is comprised of hardware and complementary processing software for a wide range of applications where both the shape and the colour are to be analysed. Konica Minolta non-contact 3D Digitizers (see figure 1) are used in the industrial sector (reverse engineering, rapid prototyping), in restoration and conservation of art objects and cultural heritage materials (three-dimensional documentation and archiving, virtual museums and non-contact moulding replication) and in web design and animation (3D character animation for film and cartoons). Many medical researchers and practitioners have derived a variety of useful research applications and diagnostics in the medical sector. In the field of 3D measurement in medical science there are numerous applications. For example, the scanning method is used in orthodontics to measure, reproduce and archive teeth and to fabricate appliances and plan treatments.

The VI-3D Digitizer is used in forensic medicine to digitize and archive corpses for criminological purposes such as analysing evidence and determining the likely sequence of events. Another application is in reconstructive surgery in which faces, breasts or entire bodies are scanned for surgical planning and prosthetic design. Breast cancer treatment via radiation therapy is improved by use of a correct 3D model for creation of the compensating mask. Another typical application is the comparison of pre- and postoperative 3D models with the aim to optimize symmetry and volume.

Specific reasons to use the versatile Konica Minolta 3D Digitizers in medical sciences:

- Fast - with up to 0.3 seconds per scan, there is no inconvenience to patients;
- Accurate - with up to ± 0.10 mm accuracy it accommodates even the most demanding requirements for pre and post-surgical measurement;
- Colour-mapping - captures 3D shape and colour with only one scan;
- Portable - with only 11 kg easy to carry;
- Flexible - no calibration required prior to scanning;
- Stand-alone - no computer required while measuring;
- Easy to use - operating is just as easy as photographing with a digital camera;
- Non-contact - measuring without touching the patient.

Konica Minolta's 3D laser technology could be the perfect solution for you too.

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Product Information

Konica Minolta 3D laserscanner
For use in medical sciences, the non-contact 30 Digitizers combine all the advantages of a non-contact optical measurement in a single system. They are portable and compact, giving maximum mobility during patient treatment. Konica Minolta non-contact 30 Digitizers are based on the principle of laser triangulation. Objects are scanned using a laser light stripe. The light reflecting from the object then enters the CCD camera of the VI-910. The distance to the object can be obtained by the angle of reflection of the laser, the angle of incidence of the reflected light from the object into the CCD and the fixed distance between Laser and CCD camera.

Fig. 2: inter-changeable lenses of the VIVID-910.

Using a eco with a resolution of 640x480 pixels and four rotary filters (for R, G, Band 30 measurement) you can produce 30 data and colour images in high quality in which every single colour data pixel corresponds to a point in the 30 data. With dimensions of some 20x40x30 cm and a weight of around 11 kg, the 30 Digitizers are handy to use, may be operated from a tripod or a desk top and do not need to be calibrated. This means you can bring the scanner to the patient instead of the patient coming to the scanner.

Konica Minolta VI-910 3D laser scanner
The VI-910 (called VIVID-910 outside of Europe) has three inter- changeable lenses (see figure 2) giving an exceptionally flexible scanning area. A scan area from 11 x8 cm at a subject distance of 60 cm up to 120x90 cm at a subject distance of 2.5 m can be covered with each scan. Measuring time in fine mode (307,000 points) can be reached in 2.5 seconds and in fast mode (76,800 points) in 0.3 seconds.

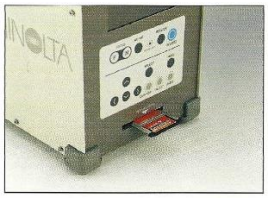

Fig. 3: flash memory card to save file during scanning process.

The system achieves a resolution 0.008 mm in the z coordinate. The VI-910 can be also operated in stand-alone mode (i.e., without a host computer) by using an LCD and a compact flash memory card (see figure 3). The 3D Digitizer has received ISO 9001 and ISO 14001 certification and has an FOA Laser Class 1 certification (IEC Class 2). This means it is eye-safe, not hazardous to humans even with prolonged exposure

Konica Minolta's software Polygon Editing Tool (PET)
With the Konica Minolta standard software it is then simple matter to merge several individual scans and edit and export the data. The 3D Digitizer can also be operated with a turntable allowing fast and automatic 360˚ acquisition of models. The object data can then be processed with a variety of third party software packages.

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Reconstructive Surgery - Breast Cancer Treatment

In the planning of radiation treatment for breast cancer it is important to have a detailed knowledge of the patient outline in order to correctly calculate the dose distribution that can be expected within the patient (see figure 4). The information of the patient outline is obtained from an extensive Computer Tomography (CT) scan of the patient. CT data provides the best level of detail because both external patient shape and internal anatomical information is collected. In some cases however, it is not practical for either economical or physical reasons to use CT scans.

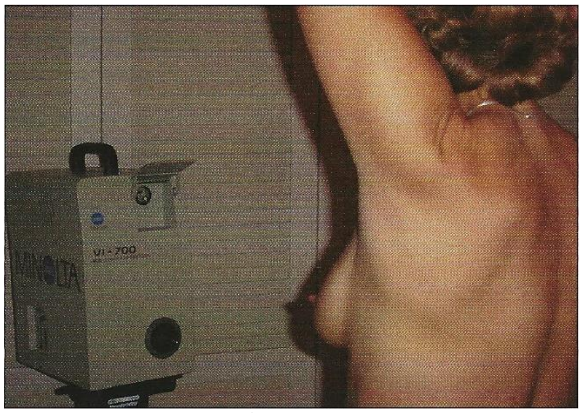
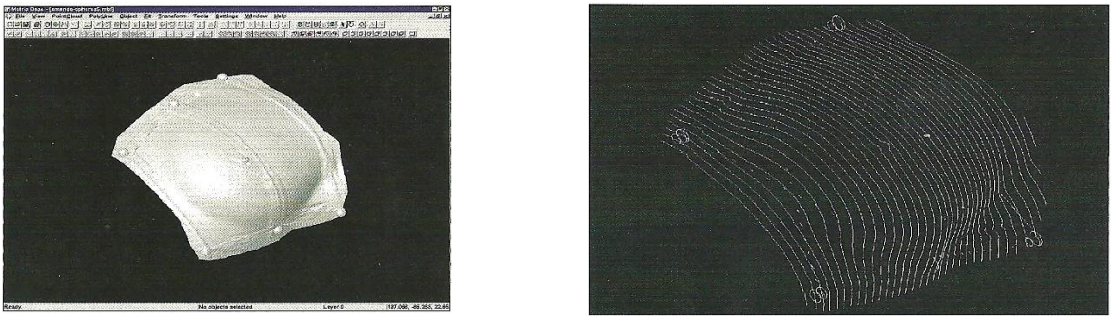


Fig. 4: Scanning a breast to reduce the calculated maximum dose of the irradiation.

For instance, for breast irradiation the normal patient position is an upright posture. According to the patient's breast which is deformed when lying horizontally in the CT scanner the acquired 3D data does not suit to the irradiation treatment and its dose distribution.

Assumed that the patient fits into the bore of the CT scanner the limited resources of expensive CT scanners for such a large patient population is also significant. These limitations can be overcome by employing the Konica Minolta 3D laser scanning method. Addenbrooke's Hospital in Cambridge, England measured a breast in the treatment position with the Konica Minolta VI-3D Digitizer. The scan merely takes 0.6 seconds, and since there is no patient contact, the tissue is not deformed. The acquired 3D data (see figure 5a, b) gives a set of outlines that can be used in conjunction with the radiotherapy system.



a) b)

Fig. 5: a digital breast in a) shaded view; b) in slice.

This technique enables the treatment teams to evaluate the true three dimensional dose distribution with the irradiation of patients. The result showed that the dose distribution was significantly reduced. Calculated maximum doses for the volunteer were reduced from 113% to 106%. Konica Minolta's 3D laser technique has no radiation overhead associated with it and is proving to be a quick, accurate and cost effective tool.

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Forensic Medicine - Three-dimensional crime scene investigation
An imprecise inspection of the crime scene can negatively affect the outcome of trials and tribunals. Temporal evidence can be lost forever. With the introduction of Konica Minolta VI-910 3D Digitizer highly-accurate accurate 3D models are provided for a detailed reconstruction of a crime scene (see figure 6).

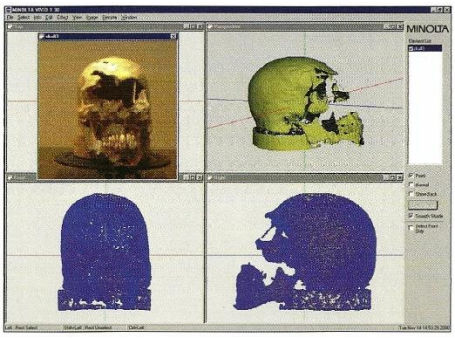

Fig. 6: highly accurate 3D models from a crime scene.

A new dimension is opened for investigators
Modern 3D data representation techniques allow them to reconstruct the original crime scene three-dimensionally (see figure 7). Adding 3D animation techniques investigators are able to show suspicious persons and even their alleged actions at the scene.

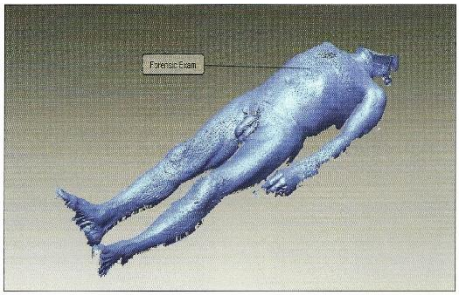

Fig. 7: 3D data used to reconstruct the original crime scene three-dimensionally.

If investigators own some film of the scene where they had doubts about the recognition of something suspicious in particular they could scan those in 3D and simulate the same scene with highly accurate 3D animation videos. Investigators could overlap either scenes, original camera and simulated flying camera, and compare both using photorealistic corresponding real models. The possibility of travelling around the scene helps the jurors to envision the crime and to make better judgement about actual events.

The possibilities in criminal investigation of the new developments in forensic anthropology allow the human identification from any type of human remain being with a high reliability. In addition the conservation of such evidence as well as any physical evidence can be obtained and archived as synthetic images on scale 1/1 (see figure 8) and with real textures and colours with the Konica Minolta VI-910 3D Digitizer.

Fig. 8: 3D acquisition of a face in addition to the information of criminals for criminological purposes.

A further great benefit of capturing evidence digitally is the fact that it allows the images to travel through the network in real time. The uncomplicated and fast creation of a 3D model by the VI-91 0 makes it possible to ask different professionals around the world to collaborate about a particular evidence on line. The police investigations, the review by the police as well as inquisitions in court will undergo substantial changes from these technological innovations.

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Orthopedics – Prostheses – Improved fitting and patient comfort

The company Mignard SARL, France, specializes in the development of software and hardware technologies primarily related to fitting artificial limbs and medical braces (see figure 9). Mignard SARL use their own proprietary medical software which integrates the Konica Minolta VI-910 3D Digitizer into a complete 3D digital process chain. This includes capturing, processing and using 3D data for prostheses production by CNC-milling. Difficulties arise when applying the traditional plaster method to obtain data from burn patients. Applying and removing of the plaster is a painful and slow procedure. The Konica Minolta VI-910 adopts a non-contact approach which is faster and offers more comfort and thus can be used for patients with open wounds, says Jean-Christoph Mignard, owner and manager of Mignard SARL.

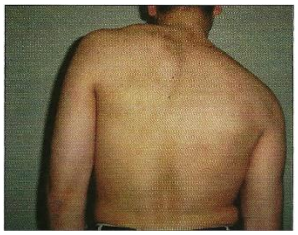

Fig. 9: morphological aspect of the human body.

The surface data of the patient's body generated by CAT scanners tend to be unreliable as the body shape changes when lying in the bore of the CAT scanner. By using the VI-3D Digitizer Mignard SARL could reduce the average production and fitting time per patient from three days down to a half a day, and this even with increasing the accuracy of prostheses (see figure 10).

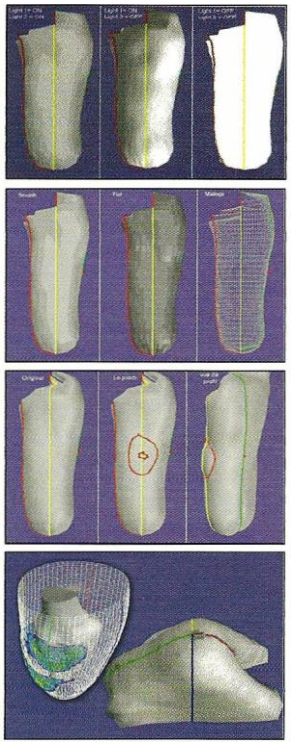

Fig. 10: 3D scanning processes from human body.

The VI-700 3D Digitizer can be applied even in a hospital environment. The VI-700 does not generate a magnetic field and requires just a power source. The scanning speed, memory card, LC Display and touch panel allow convenient on-site data acquisition and storage for a variety of prosthetics. The Mignard proprietary software "Sockets" allows reshaping the output data of the VI-700 by manipulating the 3D shape of the soft tissue with respect to the patient's bone structure. After the necessary corrective measures have been taken, the milling module is launched. Hard-foam is the preferable milling material due to its relatively low cost and speed of milling. By applying these techniques any part of the human body can be acquired and successfully treated.

Individual adjustment of shoes

Concerning the adjustment of shoes an optimized 3D model can be created on the basis of the 3D models of the feet. A CNC milling machine is able to produce a physical master of the optimized 3D model which will be used to produce the actual shoe. Another option is an orthotic foot bed which can be milled with the 3D data set of the optimized 3D models as well.

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