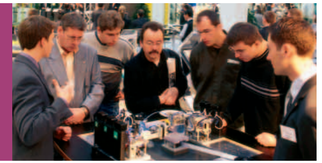
Contact persons:



3D MID laser systems:
Nils Heininger
LPKF Laser & Electronics AG
Osteriede 7, 30827 Garbsen, Germany
n.heininger@lpkf.de
- StencilLaser systems
- Laserdrilling and -cutting machines
- PCB prototyping equipment
- Microstructuring machines
- 3D MID

Nanorobotics system:
Dr. Volker Klocke
Klocke Nanotechnik
Pascalstr. 17, 52076 Aachen, Germany
info@nanomotor.de
- Nanomotors, Nano-Manipulators
- Nanorobotics, Microgrippers
- Microassembly stages
- Wafer Prober
- Systems for Electron Microscopy
- Micro Production System

Base stages for Nanorobotics system and 3D MID laser:
Dr. Gunther Blank
LPKF Motion & Control GmbH
Mittelbergstr. 17, 98527 Suhl, Germany
info@lpkf-mc.de
- Precision Drives
- Control systems/Software
- Measuring Equipment
- Special Systems

Micro Adhesive Bonding Technology:
Dr. Thomas Gesang
FHG-IFAM, Institut für Fertigungstechnik, Wiener Str. 12,
28359 Bremen, Germany
ge@ifam.fhg.de
- Design of adhesive joint
- Selection and modification of adhesives
- Development of production process
- Micro application of adhesives
- Precision joining
- Fast-, two step cure
- Micro quality control

Process Control Software:
Axel Schillo
SH-System
Brabantstr. 48, 52070 Aachen, Germany
schillo@sh-system.de

Metrology, Inline Inspection Systems:
Dr. Thomas Fries
FRT GmbH
Friedrich-Ebert-Straße,
51429 Bergisch Gladbach, Germany
info@frt-gmbh.com
- Instruments for surface measurements with optical technologies
- Different sensors and add-ons for measurement systems
- Image analysis software
- Surface analysis as subcontractor
- Training and education in fields related to surface measurements

The Customer of the shown application, Terahertz Detector Technology:
Dr. Karl Jacobs, Dr. Netty Honingh,
Michael Brandt
I. Phys. Inst./KOSMA, Universität zu Köln, Zülpicher Str. 77,
50937 Köln, Germany
jacobs@ph1.uni-koeln.de, honingh@ph1.uni-koeln.de,
brandt@ph1.uni-koeln.de
Mixer elements for
- KOSMA Telescope at Gornergrat/Switzerland
- Amundsen-Scott Telescope at South Pole
- ESA Herschel Space Telescope
- NASA/DLR SOFIA Airborne Telescope

Coordination:
Klaus Zimmer
VDMA, Lyoner Str. 18,
60528 Frankfurt/Main, Germany
klaus.zimmer@vdma.org
- Market informations
- Talk shops: Micro meets Macro
- Value Chains: Convert micro into money
- Technical networks in dialogue

MicroTechnology 2003 at a glance.

Hall 6:
- Microsystems technology
- Nanotechnology
- Sensors
- Optics
- Processes
- Plant and services
- Laser technology
- Photonics

www.microtechnology-hannover.de

Important information for your visit.

Duration: Monday, 7 April to Saturday, 12 April 2003
Opening hours: Monday to Friday, 9 a.m. to 6 p.m.
Saturday, 9 a.m. to 4 p.m.

Tickets/admission

One-day ticket	Advance sales	€ 18
	At the ticket office	€ 23
Six-day ticket	Advance sales	€ 42
	At the ticket office	€ 50

School pupils (at least 15 years old)/students/persons doing military service or compulsory community service

Day ticket	€ 10
Special ticket "GO FOR HIGH TECH"	€ 2

– Six-day tickets: not available
– Advance ticket sales: available for groups only (no reductions)
– Proof of status must be provided

Combined travel and admission tickets
Admission tickets will entitle you to free travel in the greater Hannover region.

Catalogue
€ 25 (excl. packaging & postage).
All prices include VAT. (If VAT rate changes, prices will be adjusted accordingly.)

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You can get full information on the HANNOVER FAIR 365 days a year on the Internet.
www.hannovermesse.de gives you a complete update on the range of exhibits, as well as opening hours, admission prices, accommodation, travel arrangements, conferences, congresses and cultural attractions in and around Hannover, etc.

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- Free access to the exclusive **Visitors' Lounge,** where you can relax in a pleasant atmosphere
- New **online visitor guide** to the HANNOVER FAIR (can be downloaded to your PDA if required)
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World Fair for Applied Microsystems Technology and Nanotechnology

7–12 April 2003

MICRO PRODUCTION LINE

Hall 6 · Booth C31

Production in new dimensions

MICRO TECHNOLOGY
HANNOVER MESSE
7–12 April 2003

Miniature applications with great impact: Micro Production Line live.

On the HANNOVER FAIR 2003 a Micro Production Line will demonstrate extremely precise manufacturing steps and produce demonstrators of micro-systems at **the booth of VDMA (Hall 6, Booth C31)**. This Micro Production Line includes:

- Forming of mechanical and electrical microstructures,
- Handling and assembly with Nanometer precision,
- Micro adhesive bonding technology,
- Nanopositioning on large areas,
- Process Control Software by "drag and drop",
- Quality Control with nano-resolution.

This line on the booth of the VDMA in the MicroTechnology Hall 6 demonstrates that the increase of miniaturization needs new production technologies for production and assembly.

3D MID laser systems:

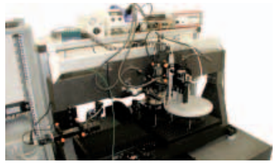
A product starts from basic material, forming of a housing, followed by cables for power supply and signals. The 3D-MID technology from **LPKF Laser & Electronics** offers these steps out of one hand. Injection moulded circuit carriers (MIDs) are produced from specially treated plastics (thermoplastics): the circuits are activated on the plastic by laser and then metallized in a chemical bath. LPKF made it possible for the first time to create a machine using this technology for the development of prototypes as well as for series production. Three-dimensional circuit carriers can be produced with this machine in a few highly efficient and environmentally-friendly steps. The secret lies in the multiply-functionalized MID plastics produced by LPKF. Laser light creates metallisation nuclei on the component surface at the same time as creating a surface structure which ensures excellent adhesion of the conductor lines created during subsequent metallisation. After passing through the metallisation bath, the modified plastic surface of the insulation zones lie cleanly adjacent to the metal surfaces of the circuit layout.

LPKF MicroLine Drill 160 3D (LPKF Laser & Electronics)

After producing these 3D-structures, that form e. g. a housing with conductor lines, microparts must be placed in high precision onto them. For fiber glass assembly the demand in reproducibility is 3 µm at the moment, a value that may be achievable with standard production technology.
Next generations will need 1 µm and a future-proof system should allow a reproducibility better than 1 µm. But thermal expansions in the classical design of meter sized robots and actuators will already avoid a precise positioning.

Nanorobotics System:

The reproducibility of nanorobotics by **Klocke Nanotechnik** is better than 50 nm. A complete Nanorobotics system recognizes microparts in bulk with Nanometer precision, handles them and assembles these parts to small systems.



Nanorobotics System (Klocke Nanotechnik)

The modular design of this Nanorobotics System allows plenty of configurations to grow with the production demands of a new micro-product. It can start from a simple microassembly stage moving with 1 Nanometer resolution, formed by a small manipulator and a microgripper. This stage can grow step by step up to a system with about 16 degrees of freedom in movement, integrated quality control and up to 6 video microscopes, attached to a vision system for pattern recognition.

- Integrated Wafer Prober can measure currents on smallest chip structures.
- "Nanofinger" determine the position of microparts without touching them.
- Alignment units adjust the final orientation of microparts with down to 1 nm resolution, e. g. to find the maximum intensity of a glass fiber.

Process Control Software:

The modular design of a production system should be supported by a software, that allows easy programming by "drag-and-drop" or teaching. Besides plenty of different sensors and actuators the vision system can be remote controlled with this software, developed by our partner **SH-System**.

Base stages for Nanorobotics system and 3D MID laser:

The 3D MID laser as well as the Nanorobotics system needs a very precise base stage for positioning of quite large samples without reducing the precision of the system. **LPKF Motion & Control** is responsible for this part.

Micro adhesive bonding:

For the assembly of microparts screws are quite useless, in particular when they are 10 times bigger than the microsystem. Micro adhesive bonding is in most cases the only possible solution. But the properties of adhesives in small dimension can be totally different to those in classical macroscopic dimensions: In microscopic dimensions. Adhesives suitable for a similar macroscopic task, can be completely unsuitable on the microscopic scale.
In the same way the handling of adhesive materials is different: smallest amounts are necessary, they have to be placed very precisely and may be swallowed by capillarity into the microstructure. The transport of a single drop with defined size must be provided, as well as the fast inline curing of adhesives with a high precision of the bond or two stage cure processes.

All this special knowledge on micro adhesive bonding is provided by the **Fraunhofer institute IFAM**.

Micro adhesive bonding modules are also part of the Nanorobotics System from Klocke Nanotechnik.

Quality Control:

The quality control of microparts cannot be done with classical instruments: the analysis of structures and surface roughness should have Nanometer resolution. Such ultra precise quality control systems are offered by our partner **FRT**, supporting 3D-data of roughness, contour/shape, and topography from surface structures.

Microprof (FRT)

The optical sensors of these instruments allow the non-contact and non-destructive acquisition of surface topography with rapid data acquisition and a large working distance.

Atomic force sensors, magnetic sensors or sensors to measure a film thickness are available for these instruments to collect 3D-data with high resolution. The data of all sensors can be saved as profiles (2D) or as 3D-data. The data acquisition is metrological and traceable.

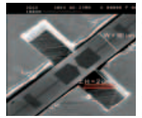
The FRT sensors are also part of the Nanorobotics Systems from Klocke Nanotechnik, e.g. to determine a 3-dimensional path on the surface of a micropart. This path can then be covered with an adhesive. Using a conductive adhesive leads to "wires" on microstructures, placed without heat treatment directly during the assembly process.

Applications:

These ultra precise manufacturing technologies allow the production of devices that were impossible to make until now, for example:

High Frequency Technology:

The radio astronomy group KOSMA at the University of Cologne/Germany uses a Nanorobotic System from Klocke Nanotechnik to assemble their 800 GHz mixers with a substrate width and thickness below 100 µm – less then a human hair – into a waveguide structure. The SEM picture shows the precise centering and alignment inside the waveguide channel before the micro adhesive bonding. These detectors are used in cryogenic receivers for astrophysical and atmospheric research in extreme environments, such as Gornergrat (3100 m) in Switzerland or at the Amundsen-Scott South Pole Station. Presently, these detectors are implemented into the ESA Herschel Space Telescope and the NASA-DLR SOFIA Airborne Telescope. Researchers from the NASA Jet Propulsion Laboratory evaluated the Nanorobotic System at KOSMA for the assembly of their Terahertz oscillators.
To our own surprise, even 2 µm thick GaAs membranes, 20 times thinner than a human hair, could be handled with the gripper.



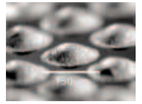
Sharpen a hair...

... or bring a tip onto the end of a glass fiber and focus it! This microassembly example of a detection element in Scanning Nearfield Optical Microscopes (SNOM) needs a resolution better 20 nm². A microtip is glued onto the end of a glass fiber by active alignment in closed loop.

a) Cantilever with microtip, b) Glass fiber, c) Shear force sensor "Gap"= area that has to be filled with adhesive: Have fun!

3D adhesive structures:

An FRT sensor attached to the Nanorobotics Systems from Klocke Nanotechnik is used to determine a 3-dimensional path on the surface of a micropart. This path can then be covered with an adhesive. Using a conductive adhesive leads to wires on micro-structures that are placed without heat treatment directly during the assembly process. The left picture shows how small structures of conductive adhesives can be |IFAM|.

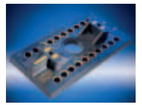


VCSEL-Diode, adhesively bonded after active alignment (Spinner)

Endoscope objective with micro lenses (Richard-Wolf)

3D Circuit carriers:

The shown three-dimensional circuit carrier was produced by injection-moulding of the 3D structure, Laser structuring of those areas that shall have a metallic coating later and by a selective metallisation step. The Micro Production Line shows these new machines and techniques working together to form new products. The cooperation of these machines is only made possible by a close network of partners, who are able to deliver common solutions. This network is established in the German Microtechnology area since some years and forms the power of a strong virtual company.



MICRO TECHNOLOGY
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Deutsche Messe AG
Messegelände
D-30521 Hannover
Tel. +49-511/89-0
Fax +49-511/89-3 26 26
hannovermesse@messe.de
www.hannovermesse.de

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