Fraunhofer
IMM

FRAUNHOFER INSTITUTE FOR MICROENGINEERING AND MICROSYSTEMS IMM

MICROSTRUCTURE-BASED ANALYTICS AND SENSOR TECHNOLOGY

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1 *CTCelect: Isolation of single CTCs*
2 *Diagnostic fluidic chip*
3 *Fluidic chip for cell isolation*
4 *Helium detector*
5 *MEMS micro densitometer*

APPLICATION PORTFOLIO

Isolation of circulating tumor cells (CTC) from blood
- isolation of CTCs from 7,5 ml blood to single wells in µl-droplets
- extreme purity – almost no cells
- unprecedented CTC recovery, magnetic separation of CTCs
- comprehensive process, fully automated system
- disposable microfluidic chips for cost savings

Oil monitoring on-line in machines/motors
- smart and compact IR-detection system for lubricants
- simultaneous in-line detection of water, soot, TAN, oxidants
- small footprint and robust methods
- in-line monitoring supports cost-effective maintenance on demand

High-precision double slit for earth observation
- optical component for high performance spectrometer in earth observation satellite
- assembly of components with 5 µm precision
- manufacturing and space qualification of interface parts
- space approved – robust and durable components enduring rocket launch and harsh space conditions

Microelectrodes for neural recording and stimulation
- enable locally resolved signal recording & stimulation
- rigid, unbreakable probes with up to 32 electrode sites
- customer defined length to fit stereotaxic frames
- flexible, chronically implantable multi-site electrode arrays
- sterilizable by autoclaving, ETO or chemical sterilization
- custom-designed to meet specific patient conditions

Micro flow cytometry
- counting bacteria and detecting cells in microfluidic systems
- single-sided optical access
- self-aligning disposable flow cells
- robust and calibration free detection
- easy-to-integrate for laboratory automation

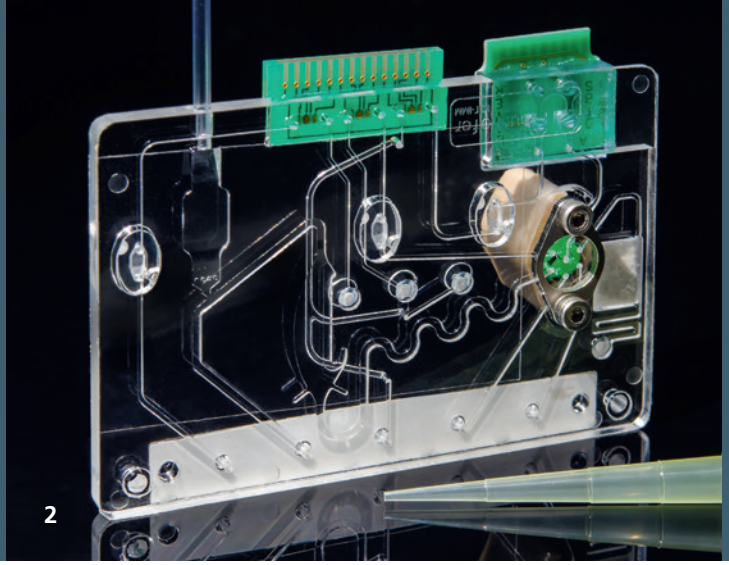
Mobile platform for versatile Point-of-Care testing
- complete and compact system for pandemic surveys
- fully automated – sample preparation, PCR amplification and assay incorporated, integrated analysis software
- easy to use: loading samples and exchanging fluidic chips
- flexible and customizable system for other applications

Radiation measurement in Fusion Experiments
- bolometer for measurement of high radiation fluxes
- radiation resistant selection of materials
- highly reproducible and precise manufacturing
- fulfilling high QA demands

Lab-on-chip for rapid liver monitoring
- µ-fluidic chip incorporating sampling, sample preparation and analytical methods for liver function tests
- separation of coagulated blood and plasma on-cartridge
- fully integrated liquid storages and lyophilized reagents as well as µ-sensors and mixing chambers
- easy to use: loading samples and exchanging fluidic chips

Simultaneous and continuous µ-titration on a chip
- microfluidic titration for stand-alone measurements or on-line process monitoring
- continuous determination of equivalent point
- substantial reduction of reagent consumption even in continuous operation – down to 5 l/month
- space saving design with small footprint

Nanoparticle characterization in-line
- monitoring of particle sizes during production processes of particle Ø 5 to 300 nm
- tolerant to flow variations at flow rates up to 200 ml/min
- based on dynamic light scattering
- low cost design due to standard electronic components



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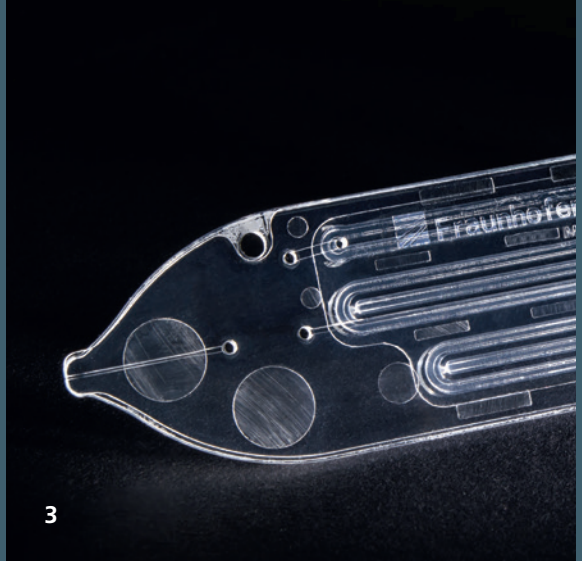

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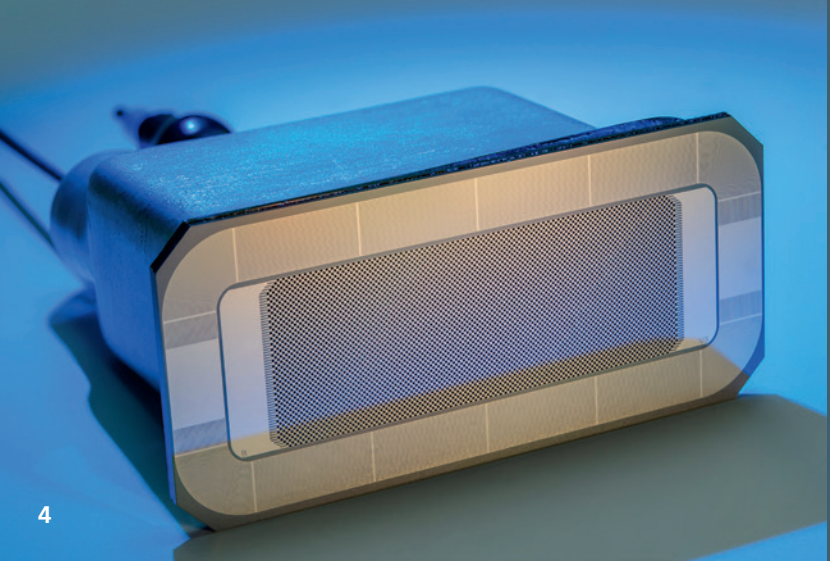
GETTING IDEAS TO LIFE

Fraunhofer IMM strives to support the main trends like Industry 4.0 focussing on projects for Process Analytical Technology (PAT), lab automation and patient-side diagnostics. The increasing demand for smart/intelligent sensors, analytical systems for process monitoring and point-of-care systems as well as for instruments for pandemic studies is the stimulation for our daily work.

- We have more than 25 years of experience in miniaturization of chemical and life science applications utilizing microfluidic technologies and chips.
- We provide access to a specific range of patents.
- Interdisciplinary teams of physists, chemists, biochemists, molecular biologists and engineers work together closely.
- Our capabilities cover all steps of applications from sampling, sample preparation to result.
- For our customers we close scientific and technological gaps to enable new or improved products.
- Numerous machines and the extensive know-how of fabrication technologies support the realization of the ideas and rapid prototyping.

Developing comprehensive systems requires a broad range of scientific and technological disciplines, methods and experiences



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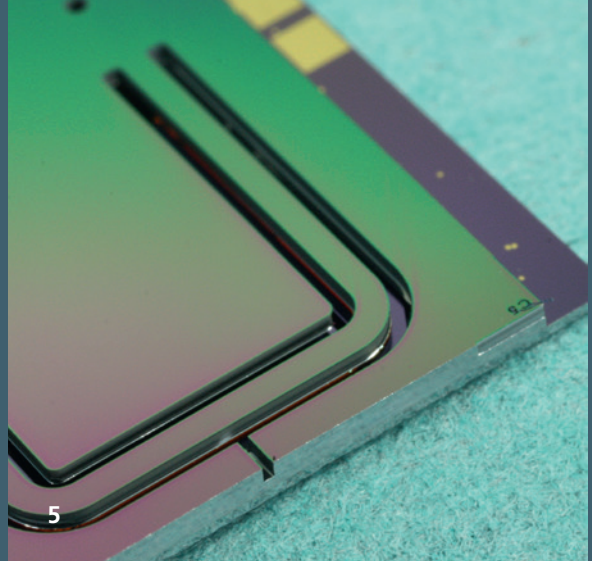

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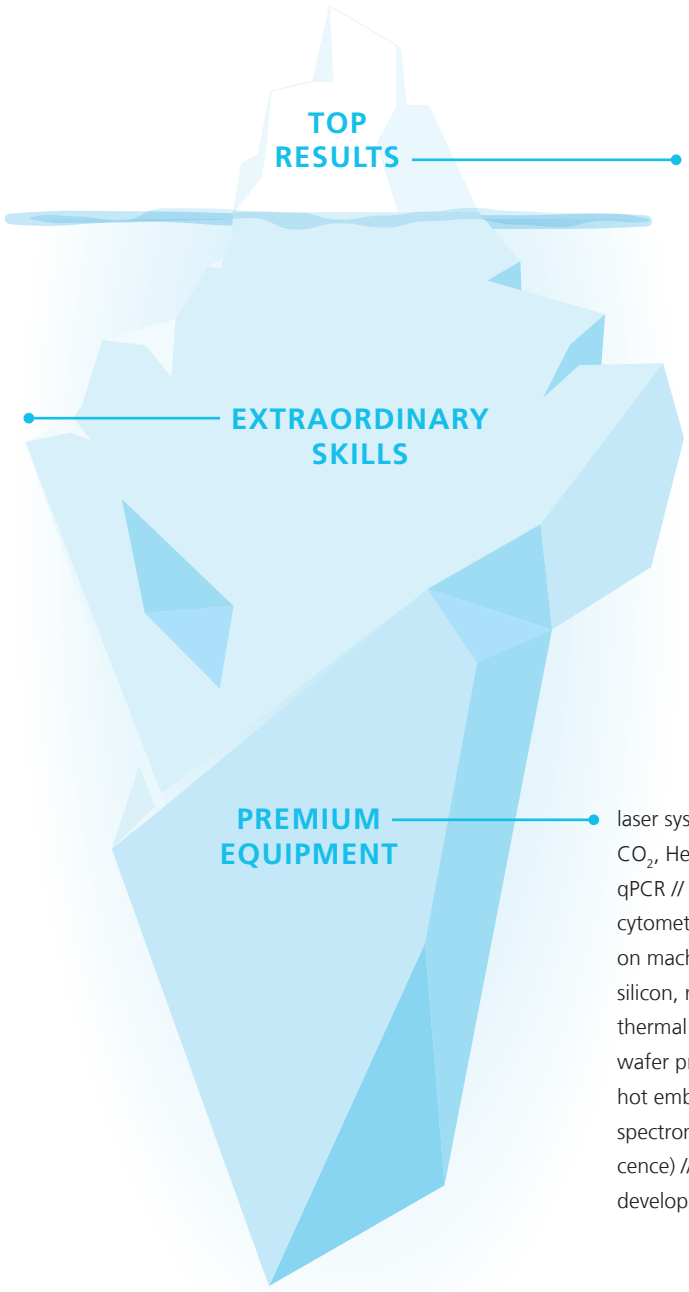
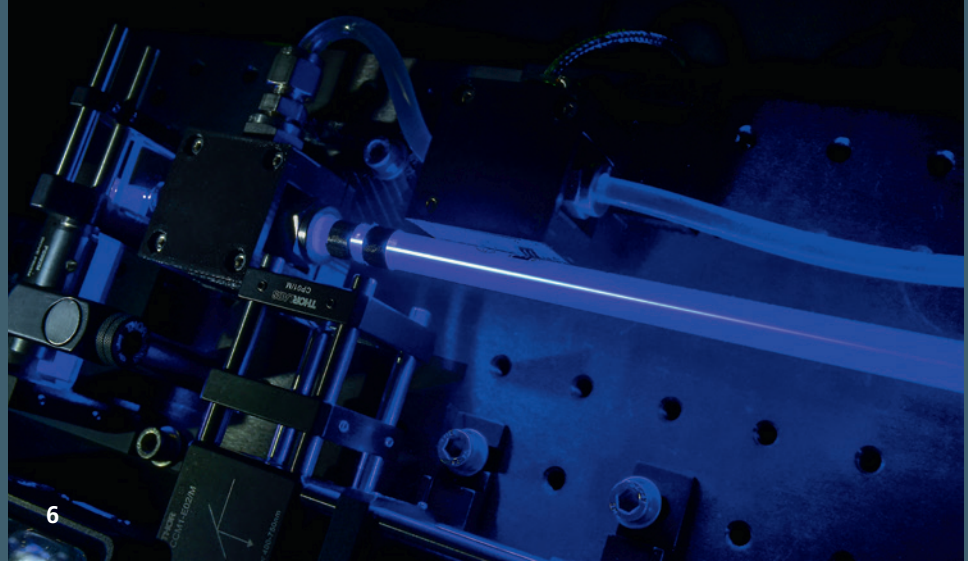


development // design and manufacturing of compact, robust, reliable and intelligent sensor modules and analysis systems for on-line/in-line applications or stand-alone systems // electrodes for neuro research

downsizing of macro applications to fit to µ-fluidic requirements // lab-on-a-chip, design of µ-modules: channels, mixers, valves, storages, pumps, sensors,actuators, others // assay development/modification // development of chemical analysis methods // optical systems, system engineering/integration // automation // design/engineering of systems-electronics-firmware/software // precise mechanical processing // laser machining // MEMS silicon/thin-film technology

laser systems (excimer, Nd:YAG, diode, CO_2, HeCd, Ti:Sapphire, excimer) // qPCR // fluorescence microscopes // flow cytometers // CNC/milling/ultra precision machines // etching (wet, advanced silicon, reactive ion) // CVD // PVD // thermal oxidation // electroplating // SOI wafer processing // injection molding // hot embossing // 3D printer // spotter // spectrometers (UV-VIS, NIR, FTIR, fluorescence) // simulation // 3D CAD // software development // C/C++

6 *Flow cell for nanoparticle size measurement*



PERFORMANCE CAPABILITIES

CORE DEVELOPMENTS

	LIFE SCIENCE	CHEMICAL ANALYSIS ONLINE / STAND ALONE	SENSORS AND DETECTION
METHODS	sample preparation // assay development // lyophilization of reagents // surface treatment // liquid biopsy // amplification // immuno-magnetic cell separation // DNA isolation // extraction	density // flow rate // pH value // conductivity // potentiometry // ion-selective detetction // voltammetry // refraction // viscosity // photometry // light scattering // capillary electrophoresis	diffusion // vibration // deflection // radiation absorbance // gravity // light scattering // molecule or ion sensitive
COMPONENTS	µ-fluidic chips, components (membranes, sensors, valves, pumps, optics, flow cells, mixers and more) // MEMS-based components // polymer waveguides // mini spectrometer // electronics // firmware // software	linked	µ-glucose sensor // viscosity sensor // helium, hydrogen detectors // bolometer // tri-axial force sensor // multiparameter oil sensor // on-line viscosity sensor // MEMS-based density sensor // precision slits // ISE // enzyme sensors
SYSTEMS	lab-on-a-chip platform for point-of-care systems: pandemic tests, diseases // µ-flow cytometer // cell counting // isolation of circulating tumor cells // exposure studies // ultrafast PCR	lab-on-a-chip systems // CBRN detection // food and feed contamination // monitoring of process solutions // stand alone systems	read-out electronics // A/D converter // integrated analysis // computing // automated on-site monitoring // data processing and transfer // self calibration
	POINT-OF-CARE DIAGNOSTIC	ANALYTICAL SYSTEMS ONLINE / STAND ALONE	SMART SENSORS

BUSINESS FIELDS

diagnostics and life science, pharmaceutical, chemistry, food and beverage, power plants, semiconductors, environmental test companies, instruments and process control, water and waste water treatment, aerospace

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