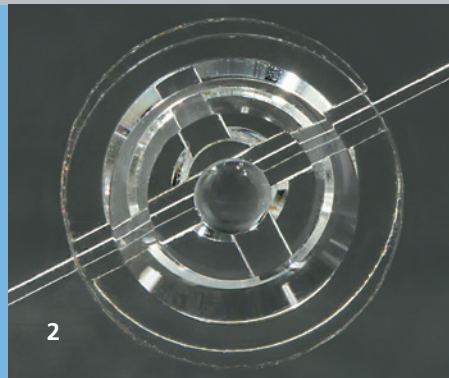
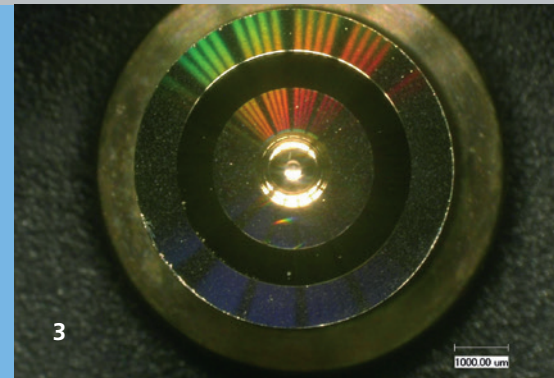




1



2



3

- 1 *E. coli* bacteria
- 2 Injection moulded flow cytometry optics
- 3 Mould insert

MICRO FLOW CYTOMETRY MODULES AND COMPONENTS

Fraunhofer Institute for Microengineering and Microsystems IMM

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55129 Mainz | Germany

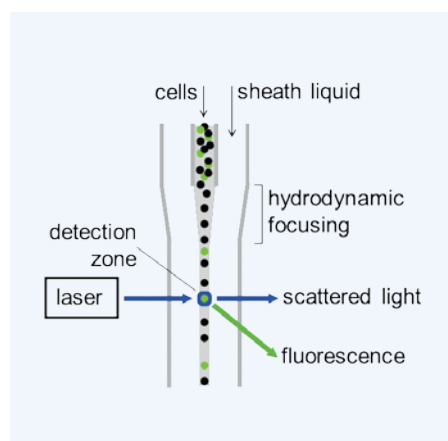
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Conventional laboratory flow cytometry

Flow cytometry is a technology to characterize cells in suspensions based on fluorescent markers and light scattering. Cells continuously flow one by one through a laser focus. For each cell the fluorescent intensity at various wavelengths and side, as well as forward scatter signals are recorded. The technique is widely used in medicine and biology to identify and count cell populations.



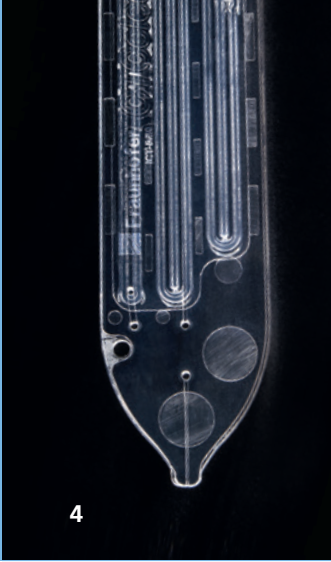
Flow cytometry for lab automation and point-of-care

Flow cells in conventional flow cytometer require optical access from three sides. The delicate optical components and the tense requirement for precise alignment restrict the systems' use to laboratory settings. Consequently, calibration, cleaning and maintenance is required in regular intervals.

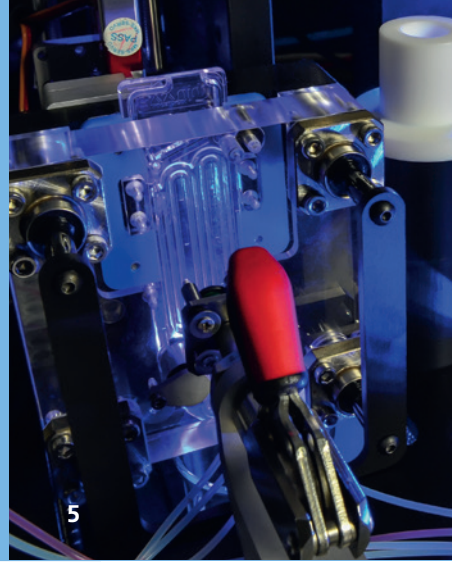
Due to the unique features of the miniaturized optical modules, the use of microfluidic flow cells developed at IMM renders calibration, cleaning and alignment unnecessary. Thus, flow cytometry becomes easy-to-integrate in lab automation and point-of-care devices.

Our components and modules feature:

- single-sided optical access
- self-aligning disposable flow cells
- small footprint
- robust and calibration-free optics
- integrated electronics and real-time data processing



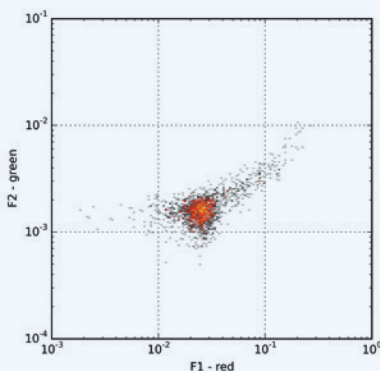
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Flow cells in microfluidic cartridges for new applications

By providing flow cytometry as a new function in disposable microfluidic cartridges, new fully integrated and automated applications become possible. Even the sample preparation, which requires manual user interaction for standard cytometers, can be transferred to disposable cartridges. Due to the automation, cell based analytical and diagnostic processes become reliable and reproducible and no longer experts are required to run the assays.

Today, state-of-the-art injection moulding can provide cartridges with the required optical precision and microfluidic channel dimensions at low cost. After running a test the cartridge is disposed and tedious and time consuming cleaning steps are rendered unnecessary.

Real-time electronics

Key for easy system integration is appropriate embedded electronics. Based on embedded computers, free programmable gate arrays (FPGAs) and controllers we have a range of electronic modules available for real-time data processing and communication with master systems. Be it a stand-alone instrument or an automated laboratory, we have know-how and modules at hand for rapid system integration.

Applications

We have demonstrated the sensitivity and robustness of miniaturized flow cytometry in a range of applications

- counting various bacteria such as *Legionella*, *E. coli*, *Lactobacillus brevis* in microfluidic cartridges
- detecting tumor cells in human blood and isolating them selectively into the well of a micro titer plate

Besides medicine and biological research, the technology has a broad potential of not yet addressed applications for finding bacterial or fungal contamination in various liquids and industrial media for example such as:

- cosmetics
- beverages
- process water
- oil, etc.

- 4 Disposable microfluidic cartridge (injection moulded)
- 5 Self-aligning manifold for cartridge
- 6 Compact microfluidic cell counting module