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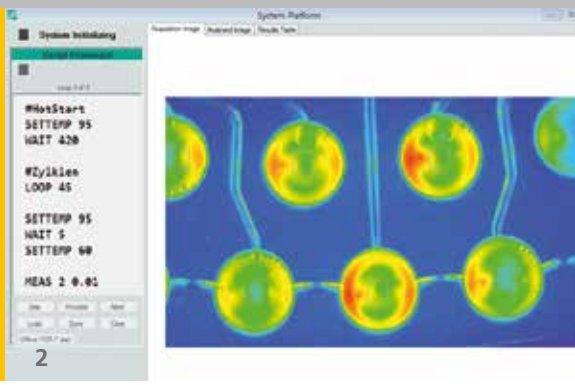

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1 *The GeneEngine platform is a compact series of devices for point-of-care-use. The cartridge illustrated was supplied by Hahn-Schickard/IMTEK, Freiburg.*
2 *The supplied software allows automatic evaluation of fluorescence in real-time, e.g. on the basis of camera images.*

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GeneEngine PLATFORM
FAST AND AUTOMATED PCR THERMOCYCLERS

Point-of-care PCR diagnostics

Fast, bedside diagnostics is becoming more and more important in modern medicine. This is the only way in which doctors can start direct and targeted treatment. Against this backdrop, Fraunhofer IPM has fully automated diagnostics of blood samples on the basis of polymerase chain reaction (PCR) in a compact point-of-care system. This was obtained by the use of microfluidic disposable cartridges developed by Hahn-Schickard/IMTEK, Freiburg. Precise pumping of the reagents in the cartridges is achieved by utilizing inertial forces by means of precisely controlled rotational movements. This allows the entire reaction to occur in purely passive, low-cost disposable products. However, this system advantage makes stringent demands on the processing equipment. The GeneEngine platform by Fraunhofer IPM can serve as a technological basis for tailor-made solutions for thermal, optical and mechanical handling of microfluidic cartridges – automatically and fast (Fig. 1).

Fast reaction process, sensitive detection

The GeneEngine platform is designed to conduct the entire reaction including real-time evaluation automatically. The system achieves maximum values for heating and cooling rates and also for sensitivity and speed of detection (see information box). Careful optimization of all modules allows fully automatic PCR diagnosis from the instant of sampling without intermediate manual steps with a high degree of multiplexing in under 45 minutes. New types of concept even lead us to anticipate a further halving of the diagnosis time.

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Individual adaptation

Fraunhofer IPM has many years of experience in designing PCR thermocyclers and handling microfluidic cartridges. The GeneEngine platform features a modular design in order to allow flexible adaptations to meet the requirements of the relevant microfluidic structures. Individual components of the optical, thermal or mechanical modules can be adapted and combined virtually at will. The main focus is always on optimization in order to achieve a fast and reliable overall reaction. Options already implemented are listed in the information box.

System integration

The devices of the GeneEngine series have been developed to meet the demands of medicine in practice. This includes complete integration of all components in a compact and reliable device which is simple to handle. Our expertise in this context has been proven in numerous successful joint ventures with industrial companies. For applications in research and development or for customer-specific laboratory tasks specific GeneEngines can be developed and manufactured as one-off devices. Series production with licensing by an OEM partner is also possible.

Options implemented

Fast fluorescence detection via laser excitation
Large-area fluorescence detection via camera
Parallel fluorescence excitation at various wavelengths
Complex rotation protocols for demanding microfluidics
Separate temperature regulation in various zones
Optimized tempering cycles by simulation

We can also supply customized adaptations or new developments at any time.

Performance features

Process duration	approx. 45 minutes with 40 cycles (including automatic sample pre-processing)
Speed of rotation with fluorescence detection	up to 50 Hz
Heating rate / cooling rate	8 K/s / -3 K/s
Temperature stability	± 1 K in the reaction chambers
Software	Fully automated

All specifications and features are subject to modification without notice.

3 Fraunhofer IPM develops optimized solutions for integration of microfluidic cartridges in the overall process.

4 Laser-based measurement of fluorescence allows evaluation of the test reactions while the cartridge rotates at up to 50 Hz.