




The Future of Personalized Treatment

Overview

- ▶ BOSCH in Healthcare
- ▶ Vivatmo: Breath Analysis for improved Asthma Therapy
- ▶ Vivalytic: Open Modular Platform for Automation of Molecular Diagnostics Assays
- ▶ Detection of Infectious Diseases
- ▶ Potentials in Oncology: Patient Stratification and Monitoring of Targeted Therapies
- ▶ Summary



BOSCH

400,500
associates

78 bn
in sales


€

Bosch is one of the world's leading international providers of technology and services and over the past five years, has invested more than **20 billion euros** in research and development.


~60%

~40%


4 BUSINESS SECTORS




MOBILITY SOLUTIONS



INDUSTRIAL TECHNOLOGY



ENERGY AND BUILDING TECHNOLOGY



CONSUMER GOODS

BOSCH HEALTHCARE SOLUTIONS


SINCE 2015

100 employees

5 PRODUCT AREAS FOR INNOVATIVE SOLUTIONS

Our Vision:
With innovative solutions „Invented for life“, we improve quality of life and help to optimize global healthcare.

Therapy Management
Laboratory Diagnostics
Connected Life
Hightech Components
Medical Screening




Our Mission:
Thanks to our high technology competence we are a preferred partner in the international market. Our connected products and services solely and consistently draw on the Bosch group's core competencies.

A NETWORK OF STRONG PARTNERS


EXPERTISE ON TECHNOLOGY

CORPORATE RESEARCH AND ADVANCED ENGINEERING



Access to the complete know-how of RB portfolio


ROBERT-BOSCH-HOSPITAL



Research, development, and validation of innovative solutions in the healthcare sector

INNOVATIVE HEALTHCARE SOLUTIONS AND BUSINESS IDEAS

BOSCH BKK HEALTH AND NURSING CARE INSURANCE




Health insurance fund with expertise in healthcare provides the capacity to validate innovative business ideas

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The Future of Personalized Treatment

Citation from Robert Bosch



1941

“ It is inherent to the nature of medicine that its greatest concern is to cure the suffering and, where this is not possible, to alleviate pain.”

ROBERT BOSCH

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The Future of Personalized Treatment

History of the Robert-Bosch-Hospital

1915



Entrepreneurial foundation Initiative
 Founding of the "Stuttgarter Homöopathie Krankenhaus GmbH" by the industrial entrepreneur Robert Bosch.

1936



The Foundation of the Robert-Bosch-Krankenhaus
 Robert Bosch's 75th birthday and the 50th anniversary of his company, the Robert Bosch GmbH, presented the occasion for realising the plans to build a hospital as a foundation.

2006



Acquisitions of Klinik Schillerhöhe and Klinik Charlottenhaus
 Klinik Schillerhöhe in Gerlingen is a specialised healthcare centre for the treatment of lung diseases. The Klinik Charlottenhaus in Stuttgart's east districts is specialized in gynecology, obstetrics and plastic surgery.

2008



Perspectives – Building for the future
 The comprehensive modernisation and extension of the hospital was completed after six years.

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Bosch Healthcare Solutions

Our vision

With innovative solutions "Invented for life", we improve quality of life and help to optimize global healthcare.

Therapy Management

Our vision

We help young and older asthma patients feel more confident – for a life without breathing difficulties.

The Future of Personalized Treatment

NEED

- ▶ Non-invasive breath analysis with a patient device for measurement at home.

MARKET

- ▶ With Vivatmo *me* approximately 13 m patients can be reached in 2023.¹⁾
- ▶ More than 330 m people worldwide suffer from asthma.²⁾
- ▶ The number of fatal casualties caused by asthma worldwide is around 383,000 annually.³⁾

PRODUCTS

Vivatmo *pro* for physicians

Vivatmo *me* for patients

Vivatmo *app* for patients

USE CASES

Diagnostic support

Asthma therapy management

Asthma self-monitoring

CORE COMPETENCIES

- Sensors
- Miniaturization
- Interconnectivity

With the Vivatmo system, we support the best possible patient therapy and help to significantly improve asthma patients' quality of life.

¹⁾ Internal market assessment ²⁾ The Global Asthma Network 2014 ³⁾ WHO Mortality Database 2016

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The Future of Personalized Treatment

NEED


vivalytic

- ▶ Universal laboratory platform for complex DNA tests, also for use directly at the point-of-care.


MARKET

- ▶ The global market volume of molecular diagnostics is estimated to EUR 9,5 bn in 2021.¹⁾
- ▶ Infectious diseases are the largest market segment in molecular diagnostics.²⁾

PRODUCTS




Vivalytic one




Vivalytic cartridge


USE CASES



Laboratory







Hospital





Doctor's practice

CORE COMPETENCIES

-  Miniaturization
-  Automation
-  Sensors
-  Interconnectivity


VIDEO



 The wide range of applications and the quick and easy performance of the tests enable physicians to diagnose and treat patients faster.

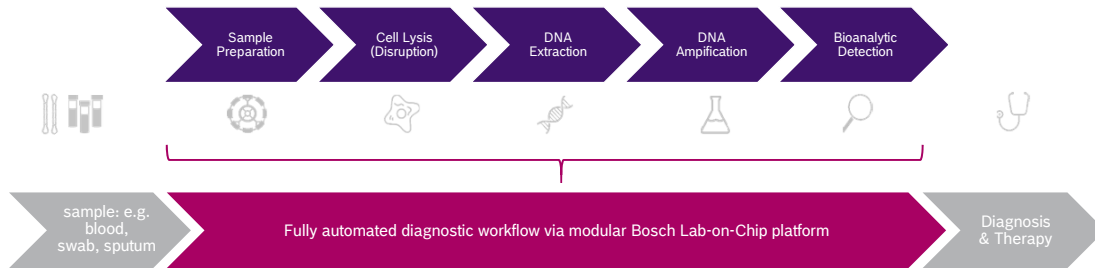
¹⁾ Markets and Markets: Molecular Diagnostics Market by Application – Forecast to 2021
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²⁾ Markets and Markets: IVD Market by Product Technology by Application – Forecast to 2021

 **BOSCH**

The Future of Personalized Treatment Automation of complex Molecular Diagnostic Workflows

Conventional: complex **manual** workflow in diagnostics labs



Lab-on-Chip: Integrated microfluidic System for **Automation** of Diagnostics

Depending on the application, test results can be available within 30 minutes.

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The Future of Personalized Treatment Flexible Modular Platform

Universal Processing Station:
Valytic Analyser



Application-specific
Disposable Cartridges



Key Benefits

- Cartridge as closed system (avoids contamination)
- All reagents stored on cartridge, only sample loading needed
- Storage of cartridge @ room temperature
- High degree of Multiplex diagnostics (up to ~100 characteristics/sample)
- Independent multiple PCR- and detection-chains
- Standard detection methods (μ Array, PCR, qPCR, melting curve)
- Random access device

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The Future of Personalized Treatment Vivalytic Analyser

Optics and camera

Electronics
power supply, hardware control, image acquisition

Pneumatics
pumps, valves, manifold

Thermal management
heaters, ventilators

Man-machine-interface
touch-display, scanner

Mechanics
cartridge feeder, clamping, reagent release

Scanner

Ultrasonics
universal sample lysing

Software
incl. clinical information system

Connected and combinable
The Bosch Analyser supports HL7, GDT, and POCT-1A out-of-the-box. Connectivity options include Ethernet, WLAN, Bluetooth, and GSM.

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BOSCH

The Future of Personalized Treatment Vivalytic Cartridge

Cover

Fluidic layer

Reagent bars

Elastic Membrane (carrier film)

Pneumatic layer

PC seal film (carrier film)

Lab-on-Chip cartridge

Reagent bars

Exploded view of cartridge components

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BOSCH

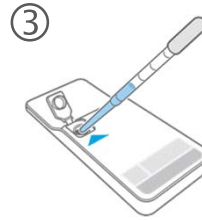
The Future of Personalized Treatment Operation of Vivalytic



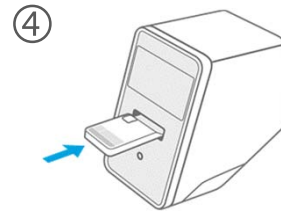
Scan Sample Code



Scan Cartridge Code



Load Sample and close Lid



Enter Cartridge and push START

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The Future of Personalized Treatment Business model

*“So, you are like Apple.
The analyser is your iPhone,
and others can develop their apps for it.
That’s genius!”*

- ▶ Open Platform Solution
- ▶ Bosch Technology for Automation of any Molecular Diagnostics Workflow
- ▶ Broad Test Portfolio
- ▶ Fast Market Access for new Tests



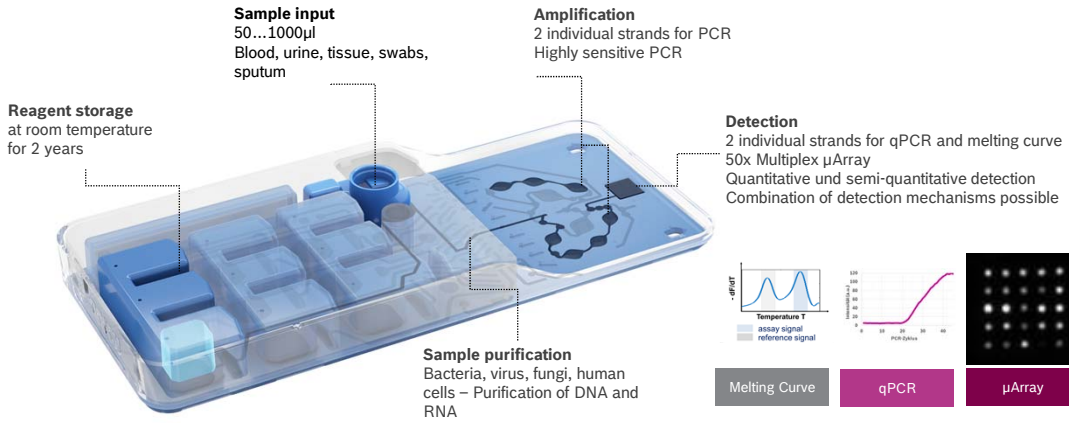
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The Future of Personalized Treatment Processing of Infectious Disease Assay



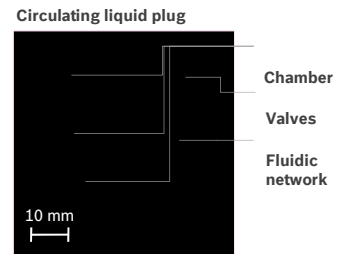
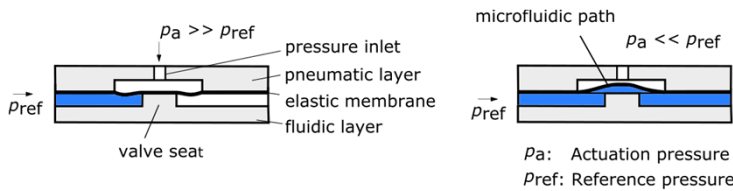
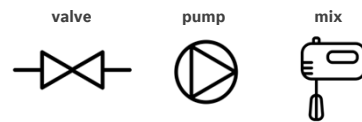
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The Future of Personalized Treatment Cartridge pneumatic actuation principle

- ▶ Automation of complex test protocols
- ▶ Small volumes
- ▶ Precisely controlled conditions



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The Future of Personalized Treatment Cartridge Assembly Line

- ▶ Automated Manufacturing Line
- ▶ Reliable assembly and laser welding processes
- ▶ Scalable to high-volume manufacturing
- ▶ Economy-of-Scales Effects with increasing Production Volumes



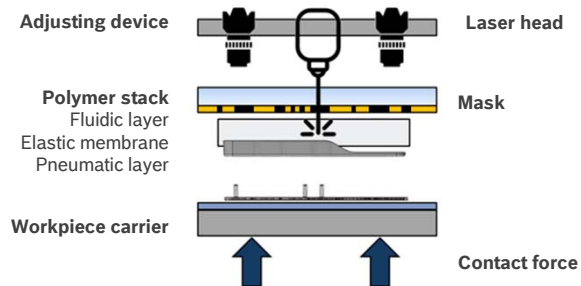
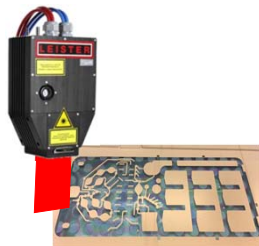
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The Future of Personalized Treatment Laser welding process

- ▶ Cost efficient materials
- ▶ Line beam and mask
- ▶ Unique material combination



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The Future of Personalized Treatment

Potential Use Cases in Oncology

Screening Methods:

- ▶ High-risk HPV Infections
- ▶ Precancer forms

Companion Diagnostics:

- ▶ Patient stratification for targeted Tumor Therapies (MAB's, Kinase- and Checkpoint-inhibitors)
- ▶ Monitoring of targeted Tumor Therapies (eg. early detection of "escape mutations")
- ▶ Periodic reiteration of Automated Tests based on "Liquid Biopsy Samples" at the Point-of-Care

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Companion diagnostics:

▶ Chronic Myeloid Leukemia (CML)

- ▶ Monitoring of targeted cKiT-Therapy and Status of **Chronical Disease**

▶ Non-Small-Cell Lung Carcinoma (NSCLC)

- ▶ Monitoring of targeted EGFR-Tki Therapy (Mutations in EGFR: L858R, DEL19, T790M, ALK)

▶ Colon Cancer

- ▶ Monitoring of targeted EGFR-MAB Therapy (Mutations in KRAS, BRAF)

▶ Breast Cancer

- ▶ Monitoring of targeted Therapies (Mutations in HER2, HER3, ER, BRAF...)

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The Future of Personalized Treatment Biopsies in Oncology

Today

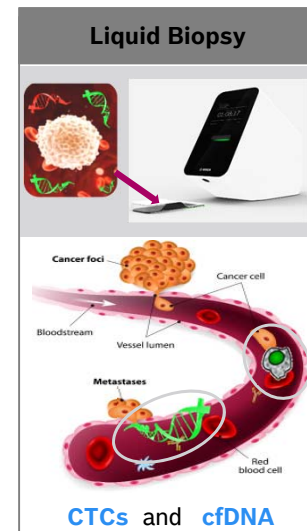


- ▶ Tissue Samples (FFPE*) from Surgery or „Solid Biopsy“
- ▶ Patient Stratification: Decision on initial Personalized Treatment from genetic information of Tumor Sample
- ▶ Repetitive Biopsies for Therapy Monitoring (if done at all)

Tomorrow



- ▶ Therapy Monitoring by minimally invasive repetitive „Liquid Biopsies“
- ▶ Genetic information on Tumor from CTC's and/or cfDNA harvested from the blood-stream



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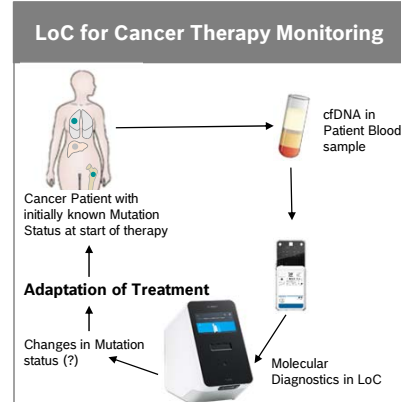
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* FFPE = Formalin Fixation Paraffin embedded Tissue

The Future of Personalized Treatment Tracking of Therapy-relevant Mutations by Liquid Biopsies

The Game-changer: Lab-on-Chip (LoC)

- ▶ Input to LoC: Patient Blood sample (< 1ml)
- ▶ Isolation of cfDNA (reduction of background-DNA)
- ▶ Amplification of target-cfDNA (PCR)
- ▶ Analyse specific genetic information from the Tumor for changes in therapy-relevant Mutations (?)
- ▶ Reiteration at regular time-intervals easily possible: low burden to the patient, fully automated, fast, low-cost
- ▶ Adaptation of Treatment whenever necessary



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The Future of Personalized Treatment

Summary and Outlook

- ▶ We developed a flexible Open Platform for the Automation of Complex Diagnostic Workflows
- ▶ Integration of a large variety of Molecular Diagnostics assays on disposable Chips
- ▶ Driven by the same universal Processing Station, the Vivalytic Analyser
- ▶ Offering short time-to-result, low hands-on-time, high multiplex degree, usability at the Point-of-Care
- ▶ Scope of Applications: Infectious diseases, Monitoring of Personalized Therapies in Oncology
- ▶ Combined with “Liquid Biopsies”: CTC’s and/or cfDNA harvested from the blood-stream
- ▶ From central laboratories to the Point-of-Care

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THANK
YOU
FOR YOUR
ATTENTION

