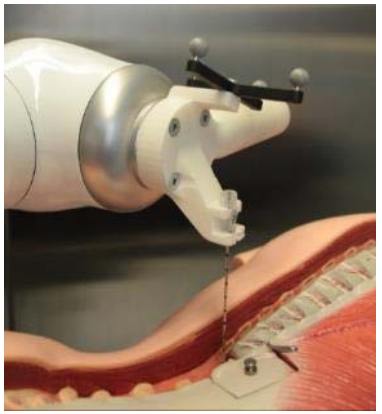
Personalized health and wellbeing

– R&D in medicine and rehabilitation facing the challenge of the demographic change

Business Unit Medical Engineering and Biotechnology




Dr.-Ing. Bernhard Budaker

Fraunhofer IPA

AGENDA

- Introduction – Fraunhofer IPA
- Societal Challenge –

The Demographic Change

- Medical Engineering and Bio-Technology at Fraunhofer IPA
- Project Examples – Medical Technology and AAL
- Pharma 4.0 / Clinics 4.0: Basis for personalized medicine
- Conclusion
- Outlook

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Fraunhofer IPA
as part of the Fraunhofer-Gesellschaft

- One of the largest institutes in the Fraunhofer-Gesellschaft
- More than 50 years of experience in manufacturing engineering and automation
- Expertise in implementing innovations in industrial environments
- International branches in Austria, Hungary and Japan

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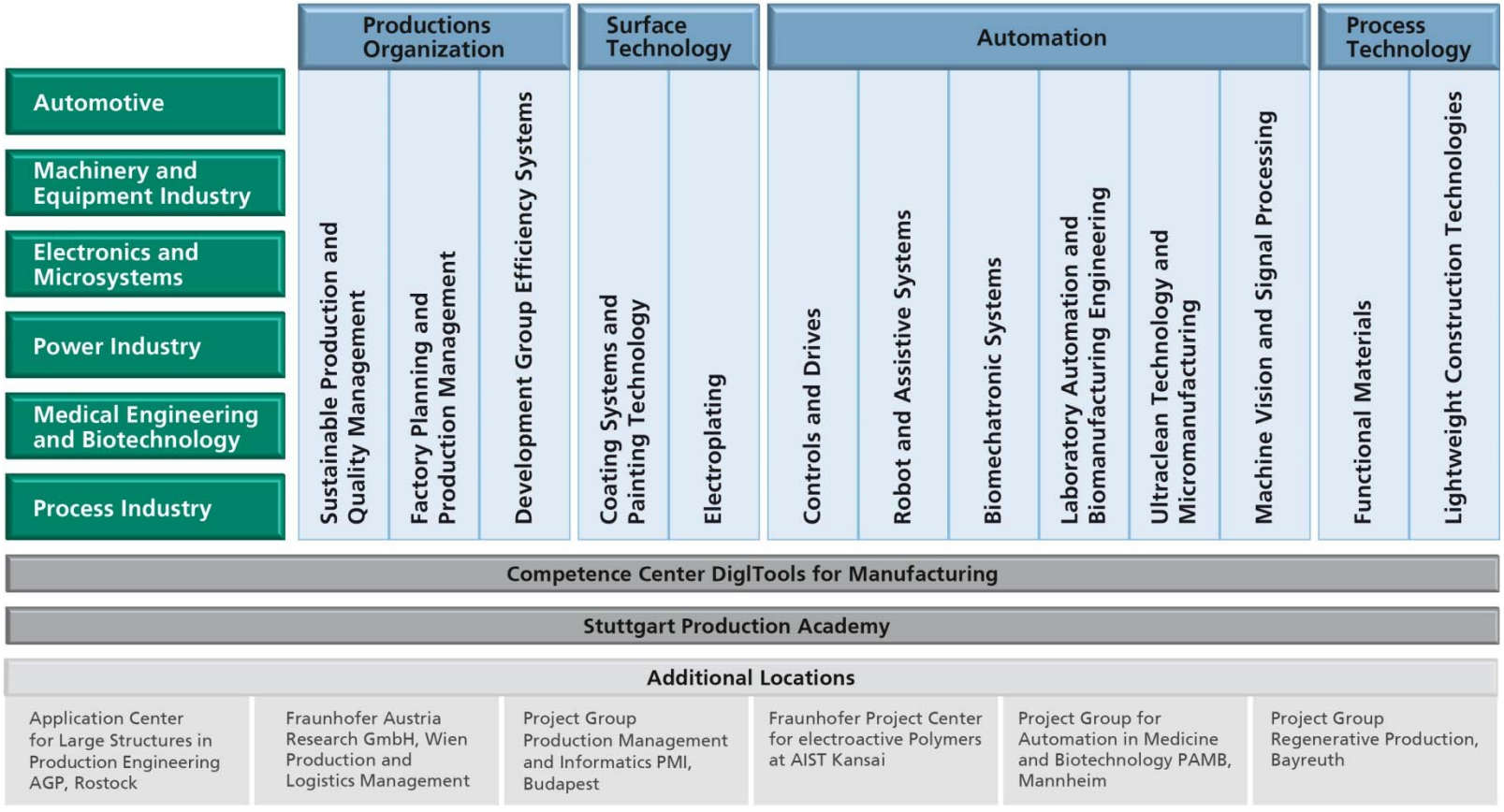
Business units and field of work

An interdisciplinary organization

Director Prof. Dr.-Ing. Thomas Bauernhansl



Version as of: 06.2015

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Technical equipment and laboratories
In tune with the times


Application center Industry 4.0

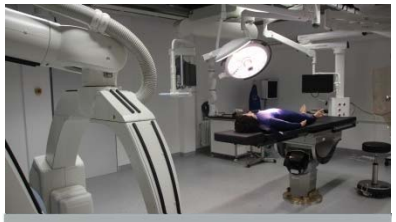

Motion laboratory


BioPoLis


Bio-production laboratory


Factory planning cockpit


Electroplating laboratory


Intervention room


Technical center for coating


Production laboratory


Clean and sterile rooms


Robotic experimentation area


Synthesis and reactor park

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Societal challenge: The demographic change

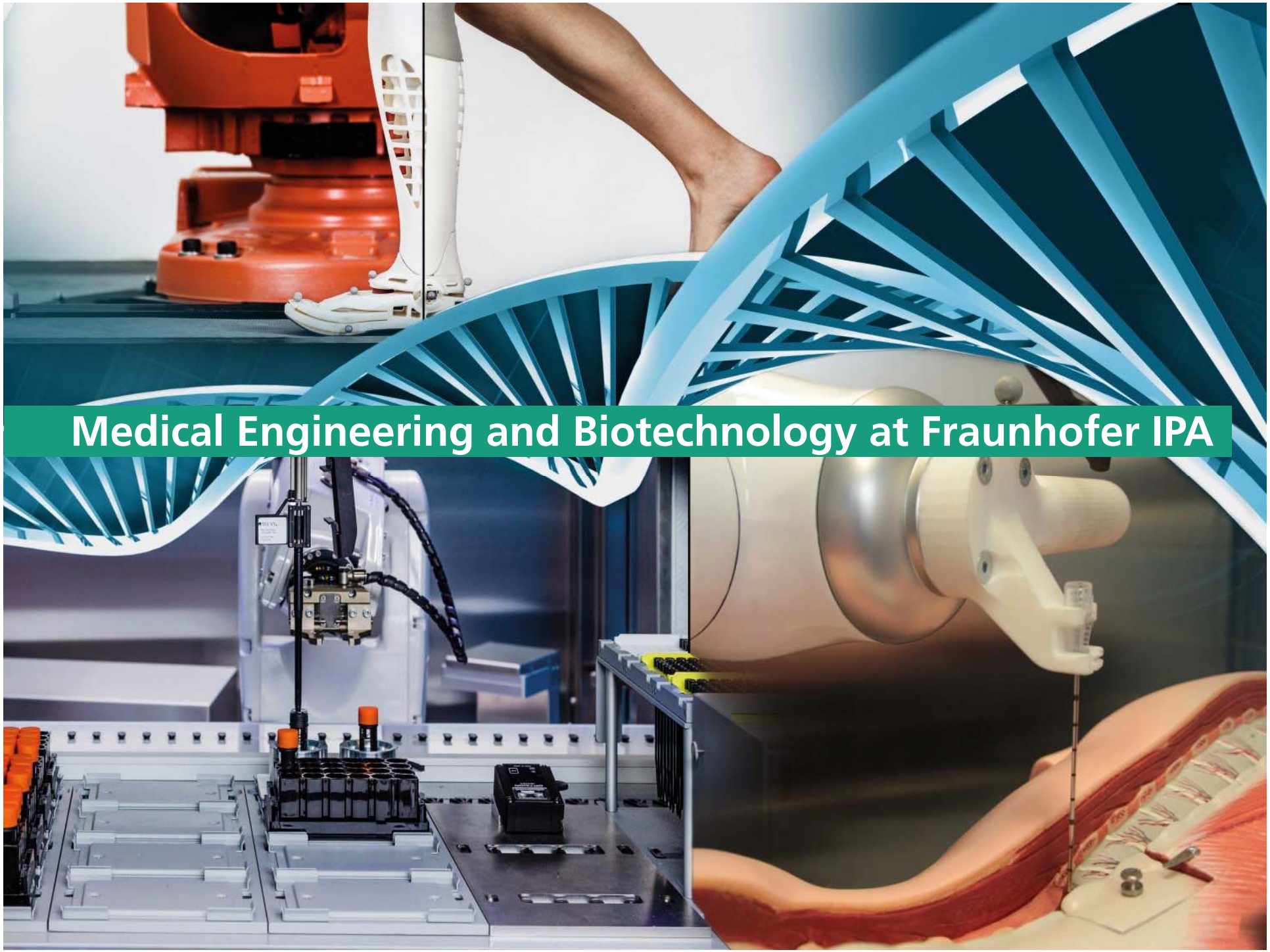
- German ministry of health:
  - To defend widespread diseases: musculoskeletal illness
  - Enable better rehabilitation
  - To enable a better quality control
  - build up telemedicine
  - Secure mobility up to high ages

Overall AIM:

To live a long, healthy and mobile life!

Strategy and Roadmap – Future Technologies

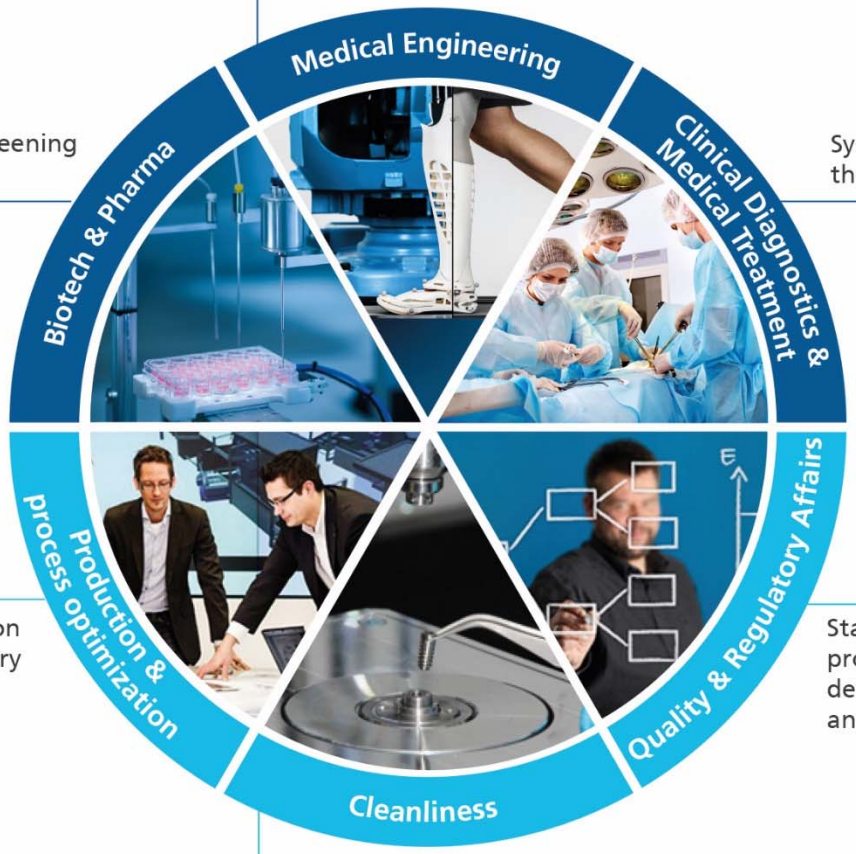
- Strategy paper of the German Government:
  - Development of systems (rehabilitation system, bio-production systems) in interdisciplinary teams
  - Bridge the GAP between applied research and product.
- Build up international collaborations
- Create technologies and products in international and interdisciplinary teams.



Medical Engineering and Biotechnology at Fraunhofer IPA

Medical Engineering and Biotechnology Fraunhofer IPA

Portfolio



Innovative solutions for quality-assured and efficient medicine

Laboratory Automation and development of innovative screening and production technologies

Systems and processes for the future of medicine

Planning, design and realization of value stream-oriented factory planning and organization

Standard-compliant product and process development for medical devices (CE, CE-ivD, DIN EN ISO 14971 and 13485, G(A)MP, ROHS, REACH)

Planning and optimization of measures to develop a successful cleanliness concept

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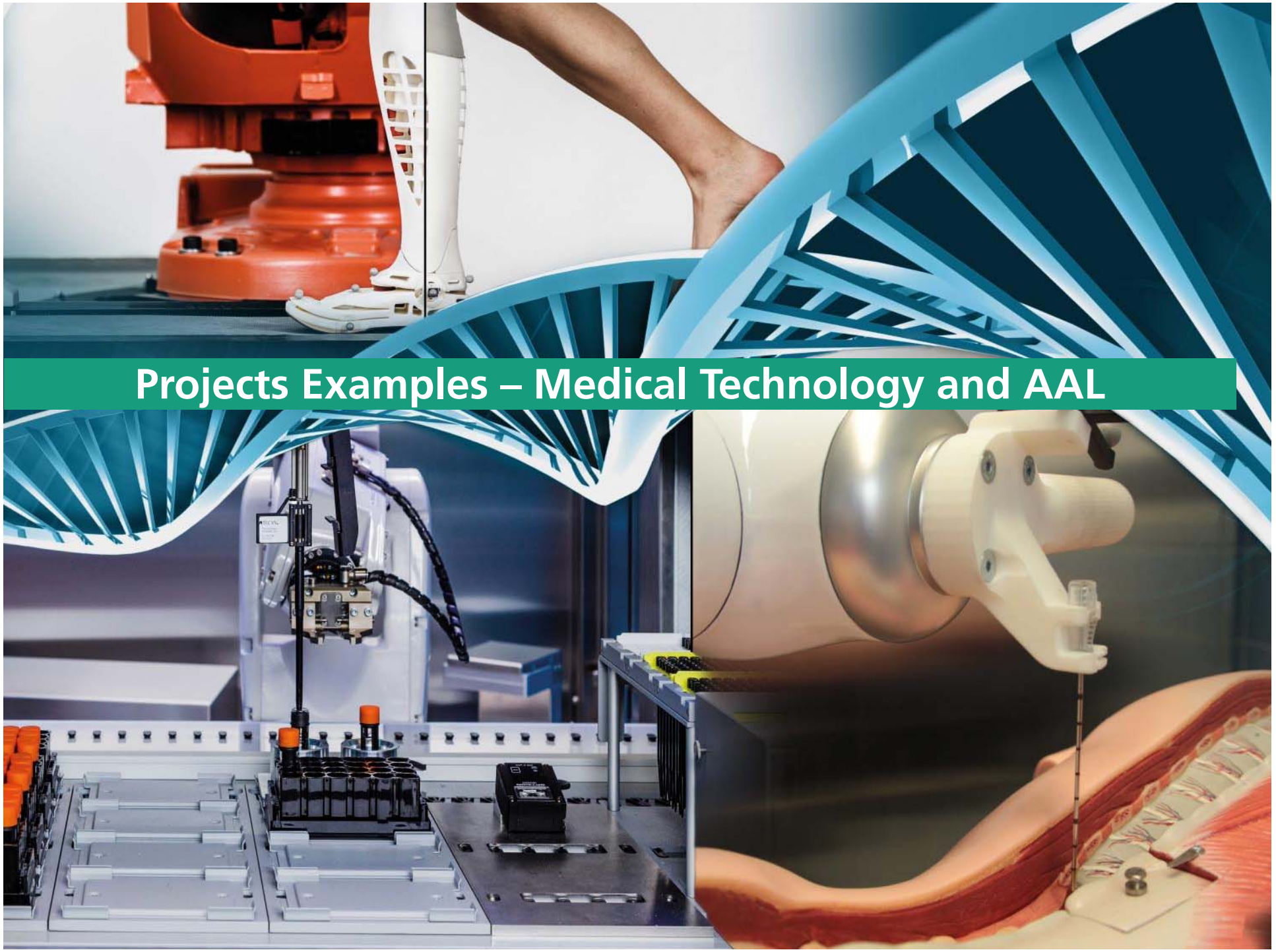
Projects Examples – Medical Technology and AAL



BCI activated and motorized finger gripping function

U. Schneider et al.: Approaches to powered upper limb orthotics

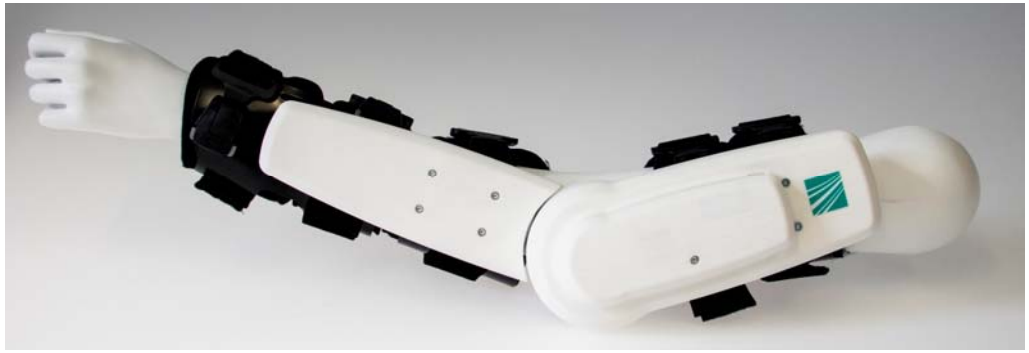
Concept

- feedback to the sensory cortex Brain Computer Interfaces (BCI) can detect "open hand“ versus „close hand“ motor cortex signals with above 90% repeatability (here Tuebingen BCI model).
- These signals may be used to activate a powered glove.
- Afferent generated from hand function.

EMG activated and motorized elbow flexion function

U. Schneider et al.: Approaches to powered upper limb orthotics

- Compact
- High Power Density
- Integration of Battery System and Motion Controller
- Position, Speed and Torque Control
- Modular Design
- Flexible safety features



Research by D. Minzenmay, A. Ebrahimi, B. Budaker, U. Schneider

In collaboration with Thomas More Campus Geel

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User activated power assist approach for elbow and shoulder actuation

U. Schneider et al.: Approaches to powered upper limb orthotics

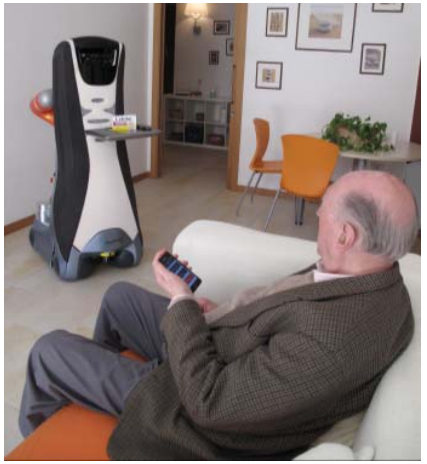
Research by D. Minzenmay, J. Lefint, J. Breuninger, A. Ebrahimi, T. Feiler, B. Budaker, U. Schneider

Care-O-bot® 3

- Product vision of a robotic home assistant to assist people in their daily life
- Abilities:
  - Navigates safely even in dynamic everyday environments
  - Learns, detects and grasps different objects automatically
  - Safely exchanges objects with persons using its tray
- Interactive butler: Take orders, deliver snacks and drinks
- Emergency assistance: robot used to communicate with emergency centre, support diagnosis with local sensors, support additional measures

➔ Field tests in elderlies' private homes and care homes

Video link: http://www.youtube.com/watch?v=ABpOtvLzh2U



MobiNa

Mobile emergency assistant for elderly people

Designed to support communication in emergencies, e. g. after a person's fall.

- Design study
- CAD / Digital Prototyping
- Rapid Prototyping
- Assembly







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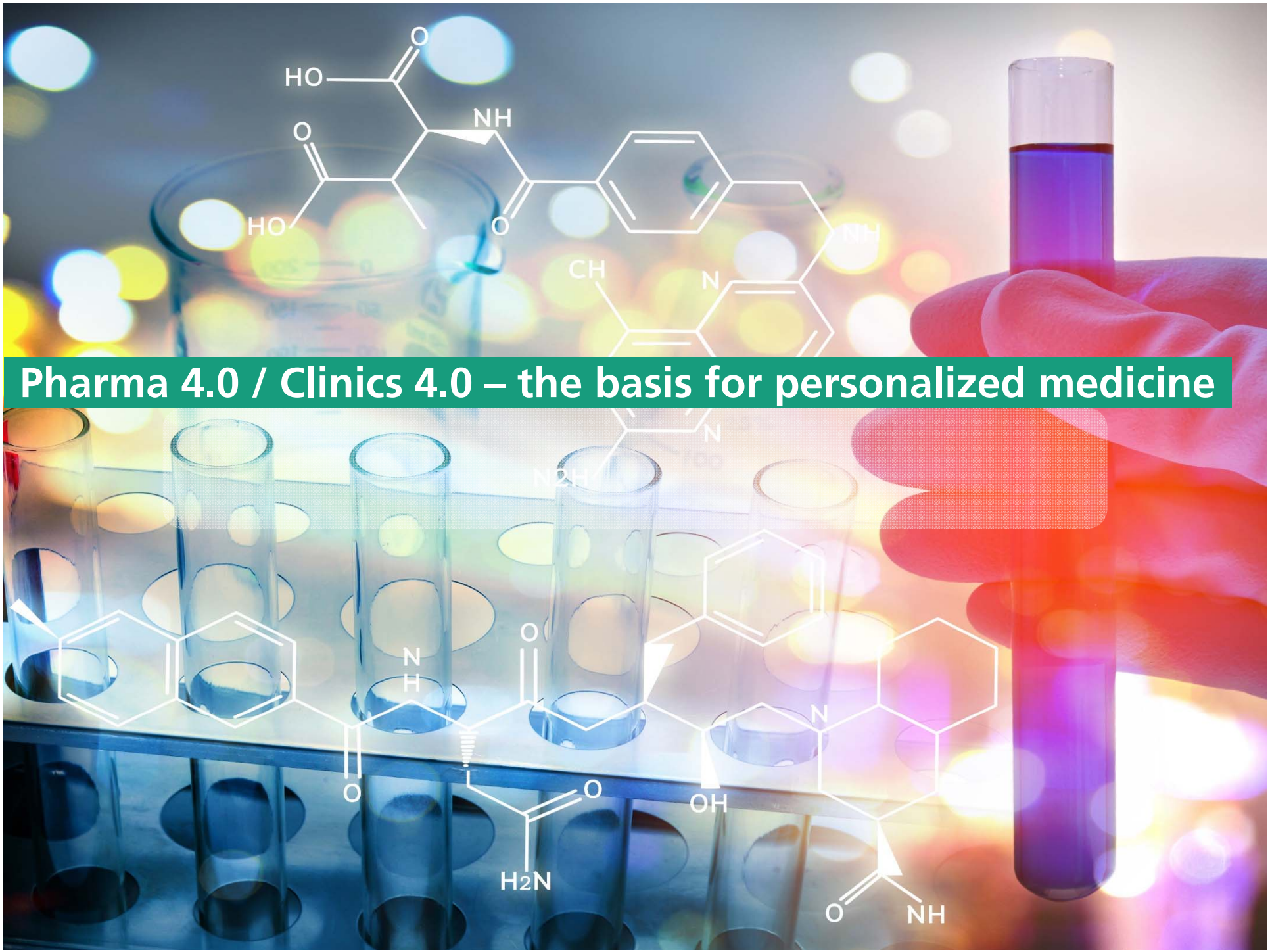
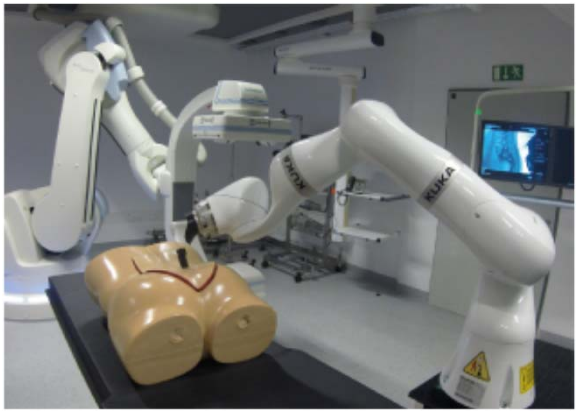
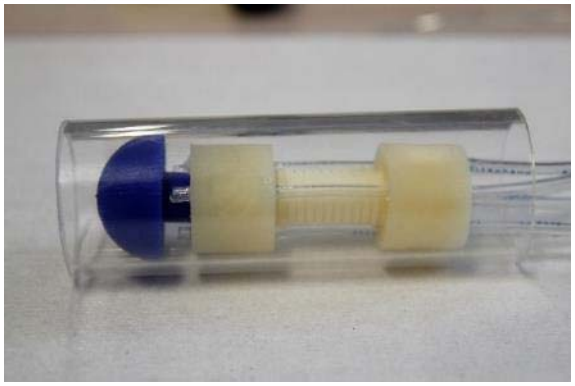

Pharma 4.0 / Clinics 4.0 – the basis for personalized medicine

Clinics 4.0 - AUTOMATION FOR INTERVENTION ROOMS

- CLOSED-LOOP APPLICATIONS
- (MICRO-) ROBOTS AND MANIPULATORS
- INSTRUMENTS AND APPLICATORS
- PROCESS- AND RESSOURCE-MANAGEMENT SYSTEMS
- DATA-ACQUISITION AND NETWORK SYSTEMS
- APPLICATION DEVELOPMENT FOR (HYBRID) INTERVENTIONS SYSTEMS





Pharma 4.0 – Enabling personalized biopharmaceuticals

Personalization is a major trend in healthcare, which leads to new challenges in drug development and production

- Producing small batches in many variant forms, in highly regulated environments
- Handling biologicals with their highly sensitive and sensitive materials
- Managing interaction between humans and automated platforms
- Mastering costly and error-prone documentation efforts
- Training staff to fulfill regulatory requirements
- Enabling Big Data despite heterogenic software infrastructure

Managing complexity will become a decisive competitive factor and forms one of the core proficiencies of elite companies in pharma and bio production.

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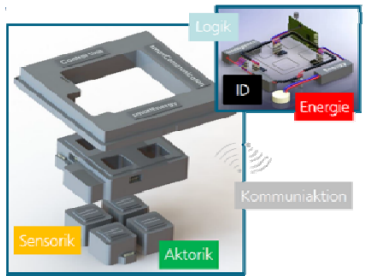
Pharma 4.0 – Piloting a new generation of health care

The human operator as integral part of the overall process chain

Holistic process analysis is guiding us **from connecting manual and robotic laboratory** to **personalized biopharmaceutical production** by applying **cyber physical assistant systems**.



Smart Workpiece carrier

- active system with own logic, sensor and actuator technology
- Complete traceability (sampling, laboratory, supply)
- Decentralized, connected control system

Empower stuff by CPS

- helps managing regulated processes
- Correct recorded process sequence
- Identification of operator or level of qualification and authorization

Managing complexity

- Consistent, transparent data base for everyone
- Real time operating demand management
- Reduction of coordination processes

AR in process & maintenance

- Context based information
- Decentralized, real time process information
- Support by regulated process steps
- training on the job

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Our Services

How we can help you to handle industry 4.0 in your company

Future is our product

Sustainable. Personalized. Smart

Pharma 4.0 assessment

- ❑ Process analysis
- ❑ workshops
- ❑ referencing, training

Conception projects

How to integrate pharma 4.0 in your company

- ❑ roadmap development
- ❑ technology evaluation
- ❑ partner assessment

Implementation

- ❑ technology development
- ❑ scale-out strategies
- ❑ business model development for lot size 1
- ❑ Application Center I4.0 as a unique testbed

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