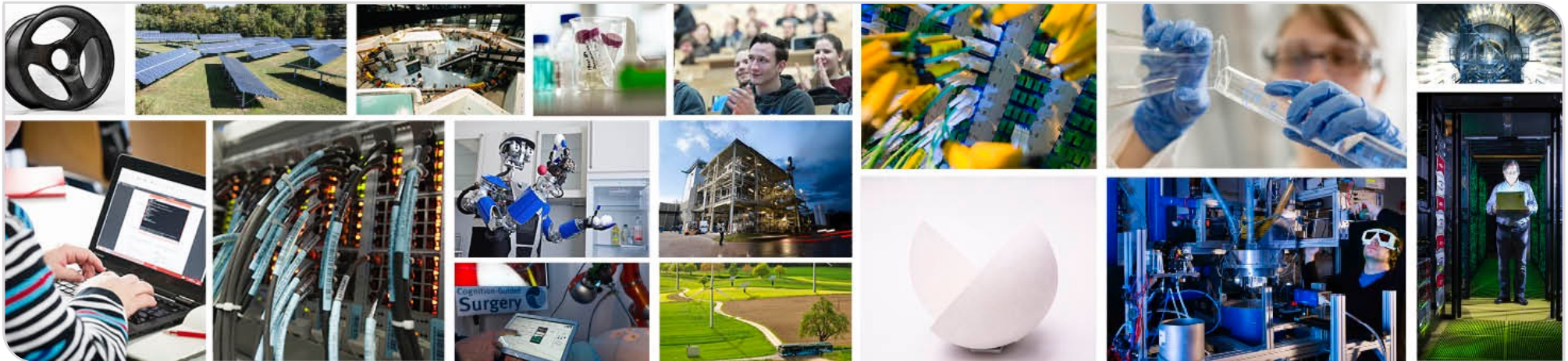


Karlsruhe Institute of Technology

The Research University in the Helmholtz Association

Presentation: Prof. Dr. Veronique Orian-Rousseau

Deputy Director: Institute of Biological and Chemical Systems- Functional Molecular Systems



Karlsruhe Institute of Technology

The Research University in the Helmholtz Association



Karlsruhe Institute of Technology (KIT)

Core tasks: Research, Teaching, Innovation

22,371 Students, 21% international

9,783 Employees

5,556 Researchers, 25% international

Researchers and students from 120 countries

Annual budget of € 1 090,7 million

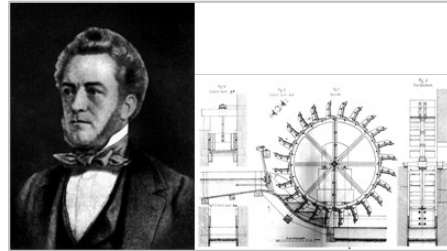


Welcome to Karlsruhe Institute of Technology (KIT)

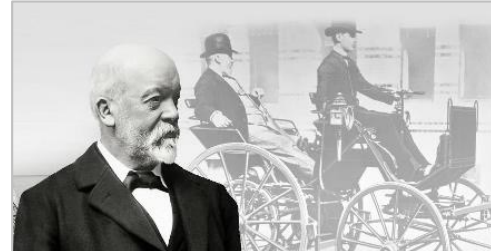
KIT Stands for Tradition and Vision



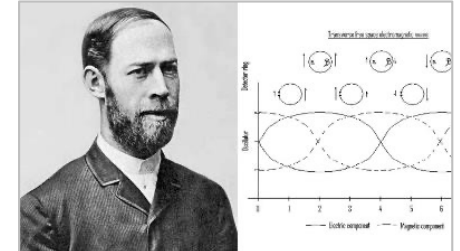
Ferdinand Braun



Ferdinand Redtenbacher



Carl Benz



Heinrich Hertz



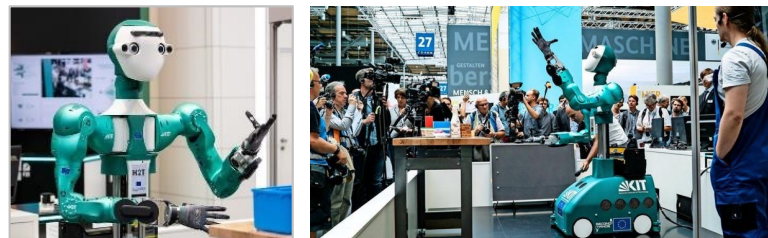
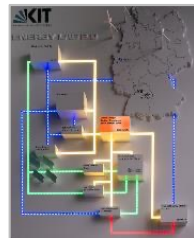
The first faculty of informatics in Germany



The first e-mail received in Germany



One of the largest energy research centers in Europe



Robotics and Artificial Intelligence



Mobility Systems and Autonomous Driving

Welcome to Karlsruhe Institute of Technology (KIT)

The Helmholtz Association of German Research Centers



- KIT is one of 18 Helmholtz Centers in Germany
- Helmholtz is Germany's largest scientific organisation
> 43.000 employees
annual budget of > € 5 billion
- Mission of Helmholtz: address the grand global challenges
- Helmholtz is promoting research in six research fields; KIT contributes to four of them:

ENERGY

EARTH and ENVIRONMENT

HEALTH

AERONAUTICS, SPACE AND TRANSPORT

MATTER

INFORMATION

Welcome to Karlsruhe Institute of Technology (KIT)

KIT – Research and Innovation at 6 Locations



Campus North



Campus South



Campus East



Campus West



Campus Alpine



Helmholtz Institute Ulm

Welcome to Karlsruhe Institute of Technology (KIT)

Organization structure of KIT

Discipline-focussed – Division

Division I

Biology, Chemistry, and
Process Engineering

Division II

Informatics, Economics
and Society

Division III

Mechanical and Electrical
Engineering

Division IV

Natural and Built
Environment

Division V

Physics and Mathematics

Interdisciplinary – KIT Centers

Energy



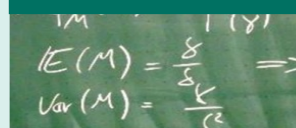
Mobility Systems



Materials



Mathematics in Sciences, Engineering, and Economics



Health Technologies



Humans and Technology



Mathematics in Sciences, Engineering, and Economics



Elementary Particle and Astroparticle Physics

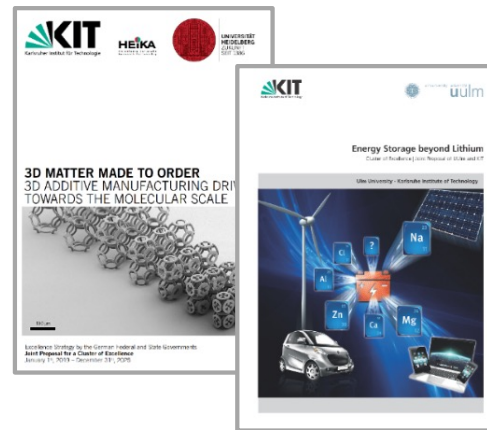
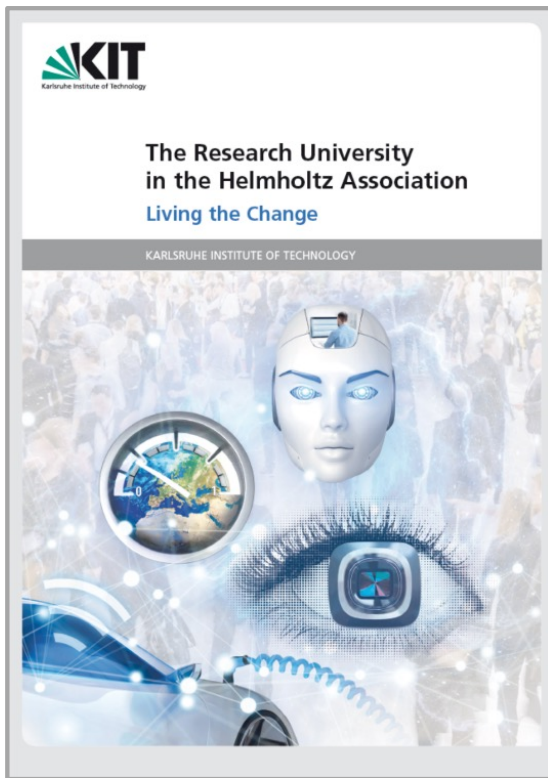


Information · Systems · Technologies



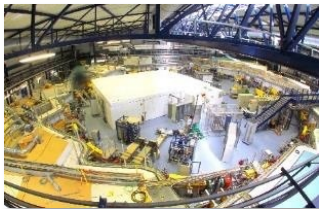
Welcome to Karlsruhe Institute of Technology (KIT)

KIT is successful as Excellence University and European University



Welcome to Karlsruhe Institute of Technology (KIT)

Large-Scale Research Infrastructure at KIT



Karlsruhe Research Accelerator (KARA)



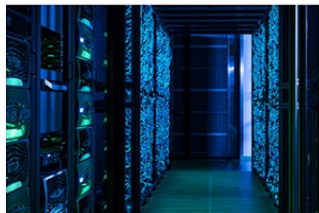
Fusion Materials Laboratory (FML)



Biomass to Liquid (bioliq®)



Electronics Interconnect and Packaging Center



High-performance research computer



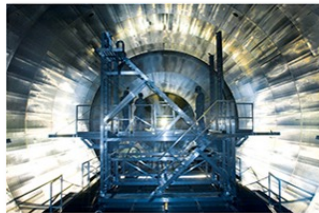
Energy Lab 2.0



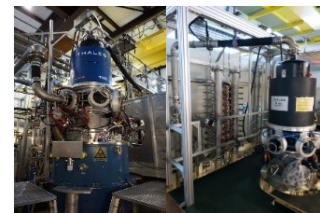
Pierre Auger Observatory in Argentina



Karlsruhe Nano Micro Facility (KNMF)



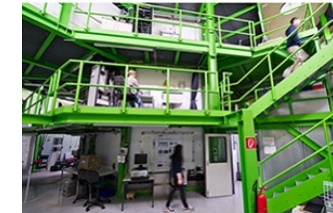
Karlsruhe Tritium Neutrino Experiment (KATRIN)



Electron Cyclotron Resonance Heater for Fusion



Grid Computing Centre Karlsruhe (GridKa)



Claud Chamber AIDA

Large-Scale Research Infrastructure at KIT



**Cryogenic Material Test
Karlsruhe (CryoMAK)**



KALLA Laboratory



**Biomass to Liquid
(bioliq®)**



**Modular Low Temperature Cycle
Karlsruhe (MoNiKa)**



**PtL-Plant with Direct Air
Capture (Kopernikus Project)**



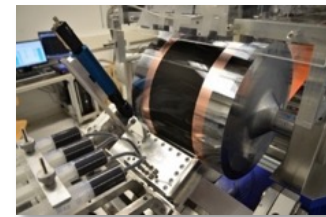
INE Laboratories



**European Zebrafish Resource
Center (EZRC)**



3-Phase-Methanation Plant



**Energy Materials Foundry
(HEMF)**



**CAT-ACT Beamline at
Karlsruhe Research
Accelerator KARA**



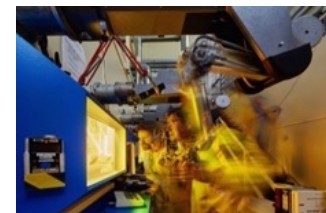
SEnSSiCC Laboratory



**CHF on Smooth and Modified
Surfaces (COSMOS)**



Engine Test Benches (IFKM)



**Fusion Materials Laboratory
(FML)**



**Power Hardware in the Loop
(PHIL)**

Welcome to Karlsruhe Institute of Technology (KIT)

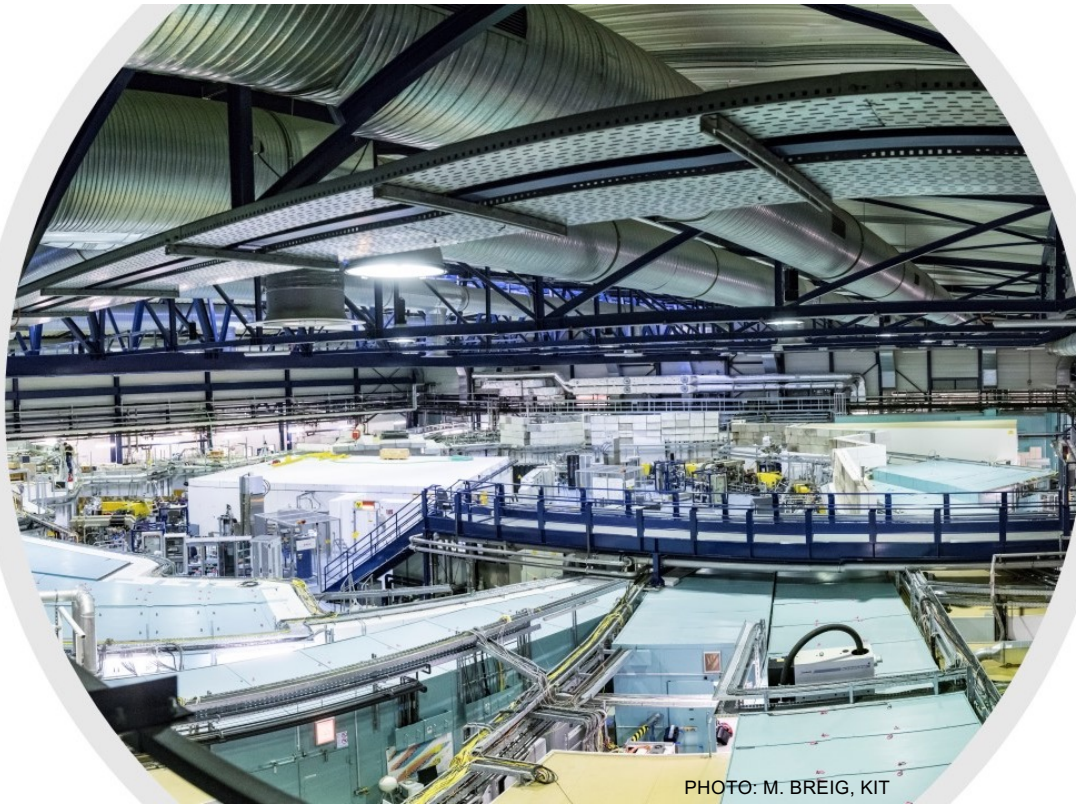


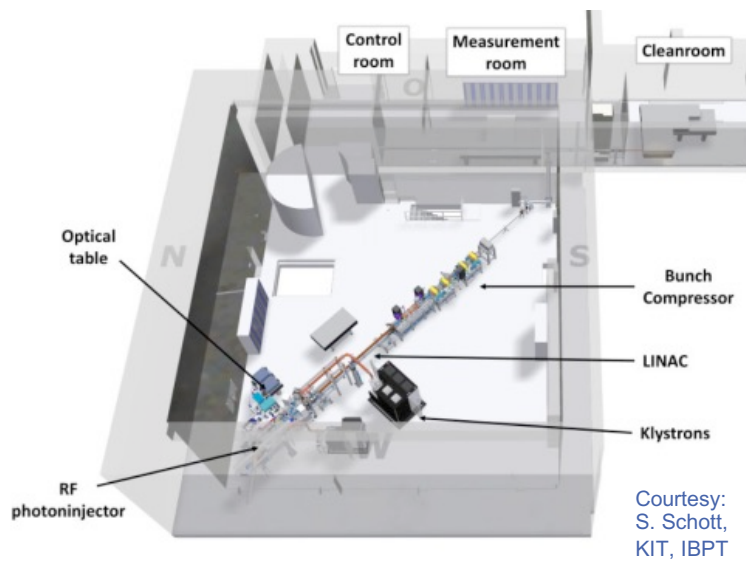
PHOTO: M. BRÉIG, KIT

KIT's prioritized infrastructure Karlsruhe Research Accelerator

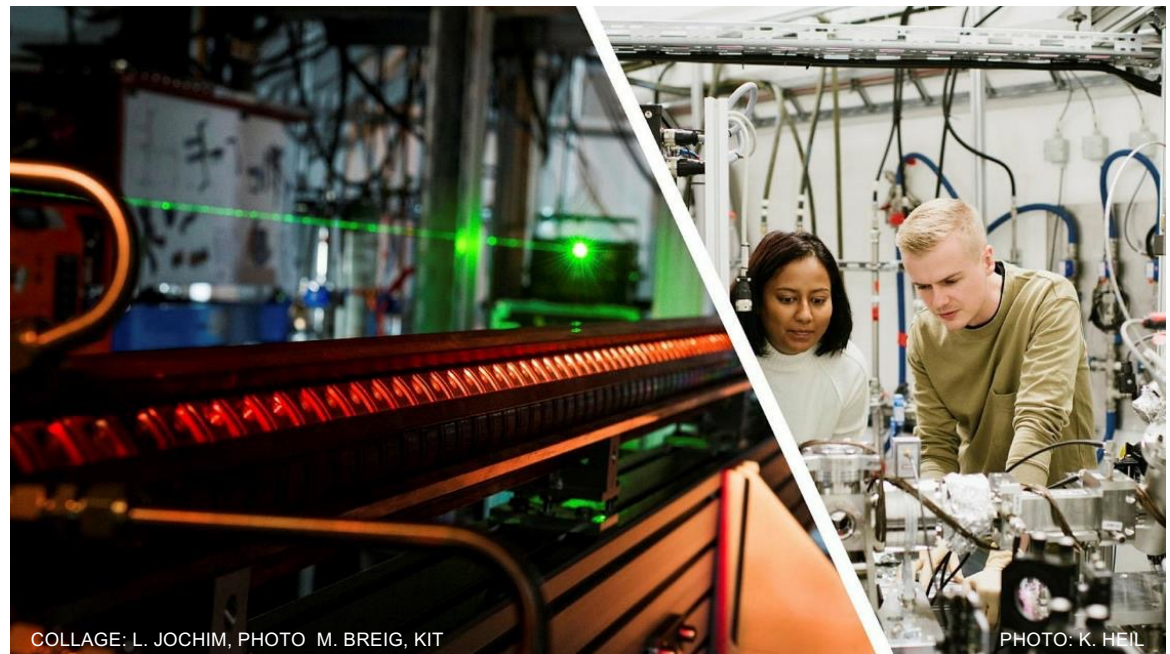
Parameter	Values
Circumference	110.4 m
Energy range	0.5 – 2.5 GeV
RF frequency / period	500 MHz / 2 ns
Revolution frequency / period	2.715 MHz / 368 ns
Beam current up to	200 mA
RMS bunch length	45 ps (2.5 GeV) a few ps (1.3 GeV)

Welcome to Karlsruhe Institute of Technology (KIT)

Ferninfrarot Linac- Und Test-Experiment Accelerator Test Facility at KIT



Courtesy:
S. Schott,
KIT, IBPT

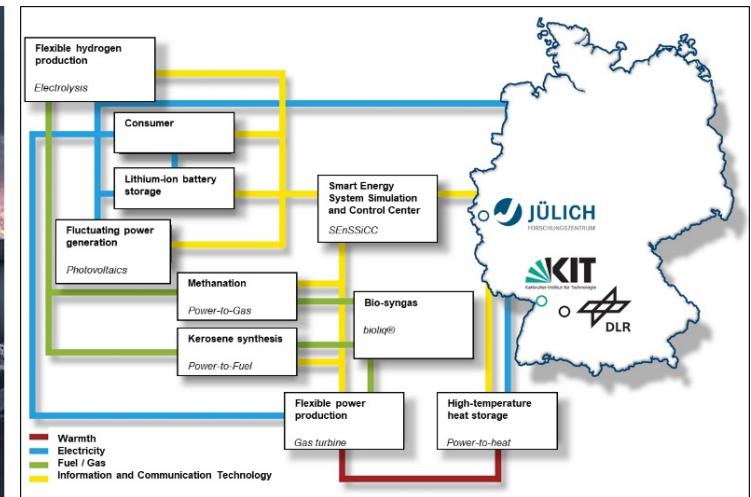


COLLAGE: L. JOCHIM, PHOTO M. BREIG, KIT

PHOTO: K. HEIL

Welcome to Karlsruhe Institute of Technology (KIT)

Energy Lab 2.0



The **Energy Lab 2.0** investigates the integration of renewable energies in power generation and enables realistic testing of new approaches to stabilizing energy networks and the linking of electrical, thermal and chemical energy flows as well as new information and communication technologies.

Supported by:

Energy Lab 2.0 @ KIT



Photo: M. Breig und A. Bramsiepe, KIT

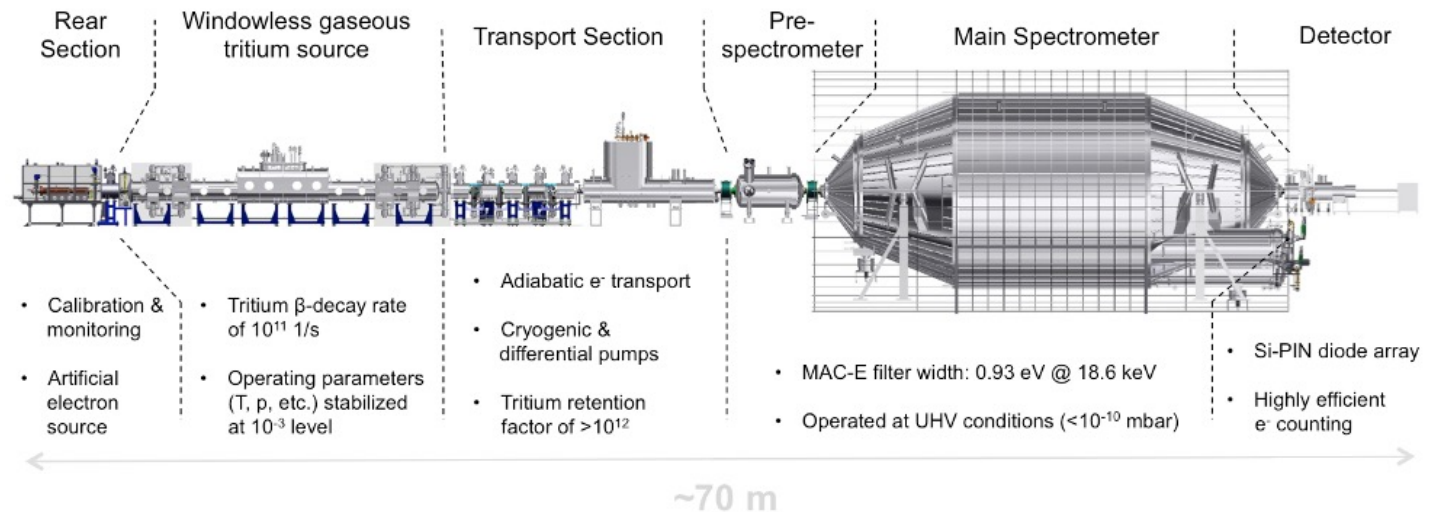
Welcome to Karlsruhe Institute of Technology (KIT)

Karlsruhe Tritium Neutrino Experiment (KATRIN)



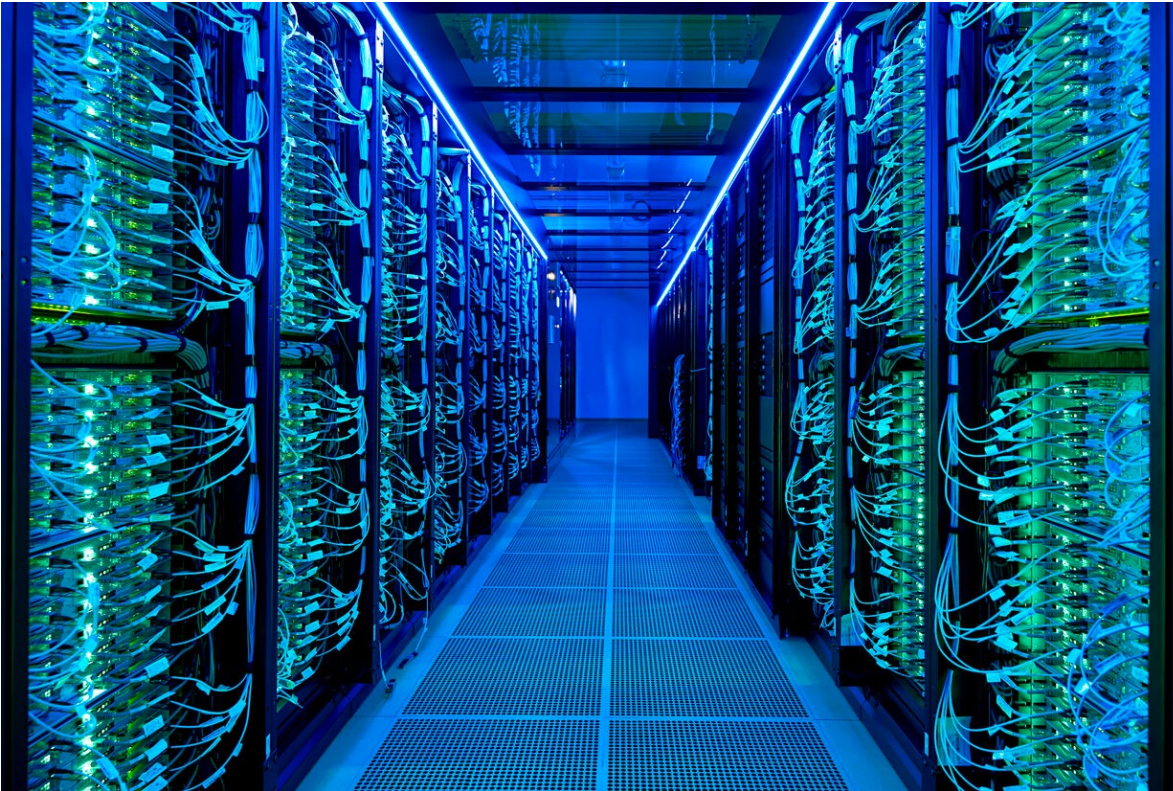
Direct neutrino-mass measurement
with sub-electronvolt sensitivity

• [The KATRIN Collaboration](#)
[Nature Physics](#) (2022)



Welcome to Karlsruhe Institute of Technology (KIT)

HoreKa



Among 15 most powerful computers in Europe: mid 2021

Ranked 13th: International supercomputer ranking in term of energy efficiency

Computer power more than 17 Petaflops /17 quadrillion computing operations/sec

Performance of more than 150 000 laptops

<https://www.nhr.kit.edu/userdocs/horeka/>

60000 Intel Xeon "Ice Lake" Scalable Processor cores, 220 Terabytes main memory
668 NVIDIA A100 Tensor systems

Welcome to Karlsruhe Institute of Technology (KIT)

Karlsruhe Nano Micro Facility (KNMFi)

KNMFi was founded in 2008 as an open access technology platform/research infrastructure for structuring and characterizing of functional materials at the micro- and nanoscale.

In 2021, the scope of KNMFi was widened with the addition of digitalization and research data management. Operating with a collaborative approach to user access, KNMFi is currently organized in three laboratories hosting 23 technologies.

KNMFi is open to users from KIT, Helmholtz Centers as well as to worldwide users from industry and academia.



14 years
USER OPERATION

≈ 55000 h/a
USER TIME

55
COUNTRIES

≈ 1400
USERS

> 3000
SUBMITTED PROPOSALS

3
LABORATORIES

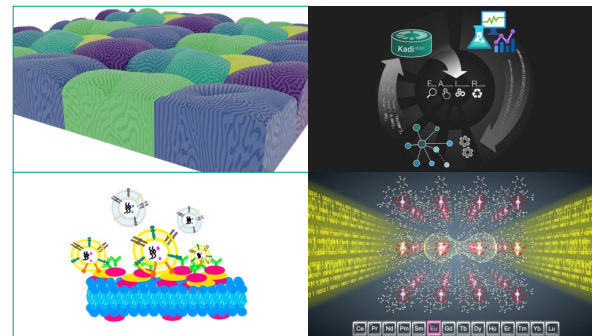
23+
TECHNOLOGIES

> 1.5 million €/a
STRATEGIC INVESTMENTS

11
HOST INSTITUTES

≈ 54 FTE
STAFF

≈ 2000
JOURNAL ARTICLES



Technologies & Expertise



- 23 technologies: structuring, characterization, data & information
- Collaboration-oriented and solution-oriented approach
- 50+ experts provide expertise at all stages of your project
- Combine technologies (e.g. process chains, characterization clusters)
- Training Courses
- User Meetings

Technologies



Laboratory for Micro- and Nanostructuring

3D Direct Laser Writing (3D-DLW)
3D Printing (3DP)
Atomic Layer Deposition (ALD)
Deep X-ray Lithography (XRL)
Dip-Pen Nanolithography (DPN)
& Polymer Pen Lithography
Direct Laser Writing (DLW)
Dry Etching Cluster (DRIE)
Electron Beam Lithography (EBL)
Focused Ion Beam (FIB)
Hot Embossing (HE)

Laboratory for Microscopy and Spectroscopy

3D Atom Probe Tomography (APT)
Atomic Force Microscopy (AFM)
Auger Electron Spectroscopy (AES)
Helium Ion Microscope (HIM)
Nano Tomography (nanoCT)
Nuclear Magnetic Resonance (NMR)
Single Crystal X-ray Diffraction (SCXD)
Soft X-ray Spectroscopy, Microscopy, and
Spectromicroscopy (WERA)
Time-of-Flight Secondary Ion Mass
Spectrometry (ToF-SIMS)
Transmission Electron Microscopy (TEM)
X-Ray Photoelectron Spectroscopy (XPS)

Laboratory for Simulation and Data Management

Electronic Lab Notebook (ELN)
Karlsruhe Data Infrastructure for Materials
Science (Kadi4Mat)

Profile & Access

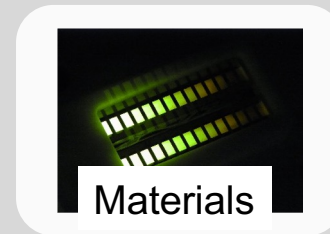
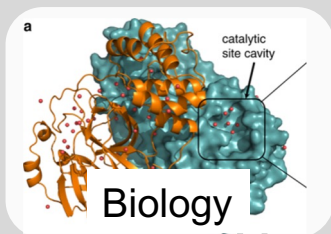


The Karlsruhe Nano Micro Facility (KNMFi) offers a dedicated set of state-of-the-art technologies for structuring and characterizing a multitude of functional materials at the micro- and nanoscale.

- Open innovation user facility since October 2008
- Open to industry and academia
- Free access if results are published
- Easy access via online proposal submission
- Two annual deadlines: January 15 and June 15
- Visit us at www.knmf.kit.edu

Activities of the Compound Platform

Stefan Bräse, Nicole Jung (IBCS-FMS)



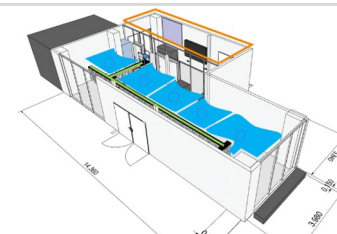
Chemical Synthesis



Molecule Archive



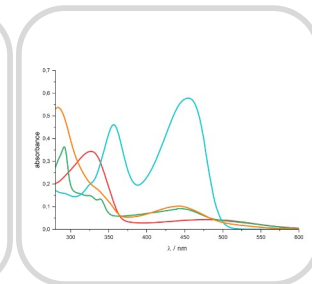
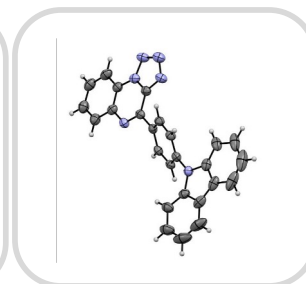
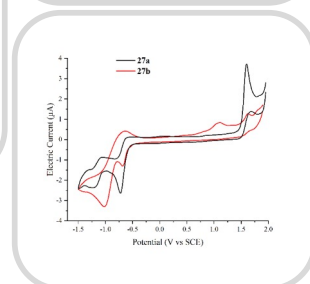
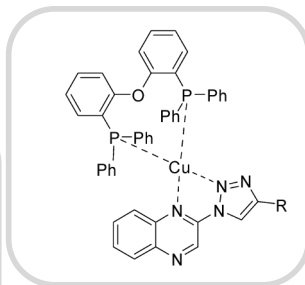
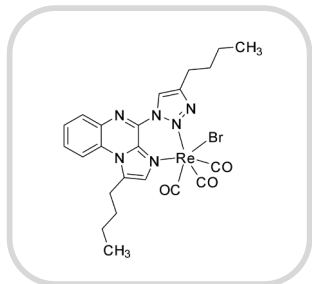
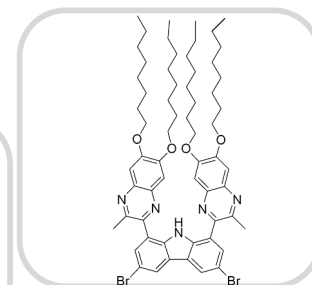
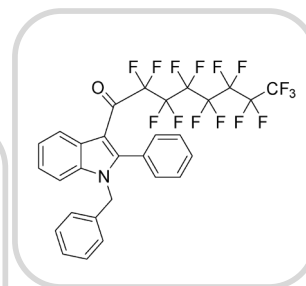
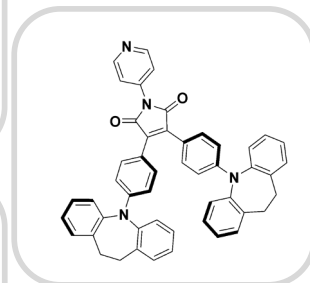
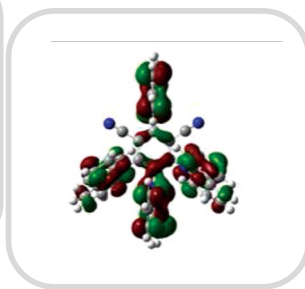
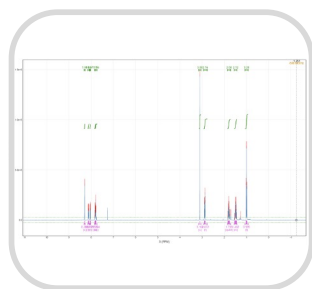
Digitalization



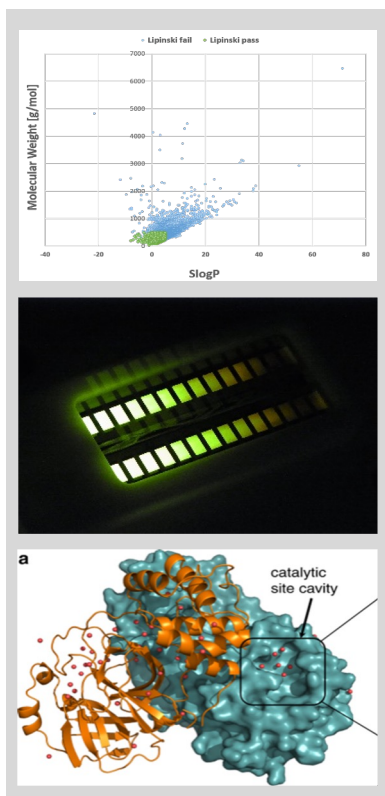
Automation - Robotics

Activities of the Compound Platform

Chemical Synthesis and Analytical Characterization



Activities of the Compound Platform





Molecule Archive – Store and share materials to enable science

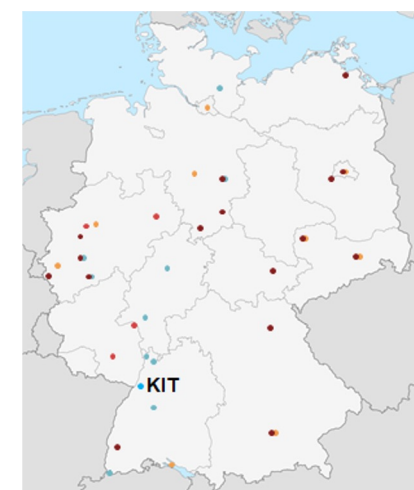
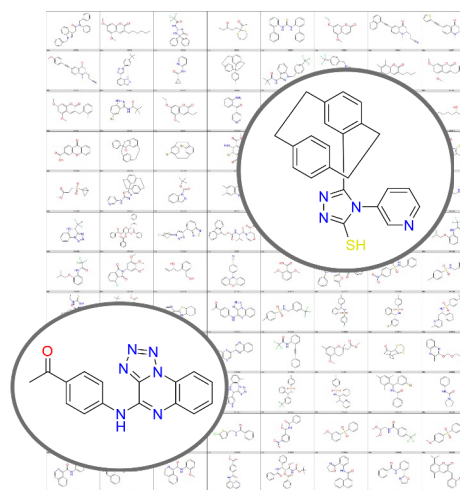
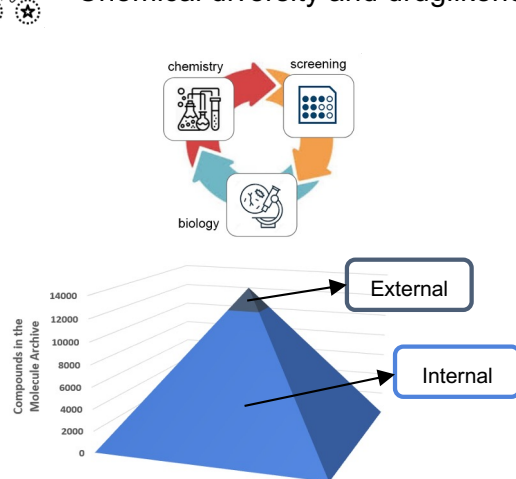
 ~16,000 total entries, 14,000 samples

 Student projects AK Bräse or external collaborators (~14%)

 Chemical diversity and druglikeness

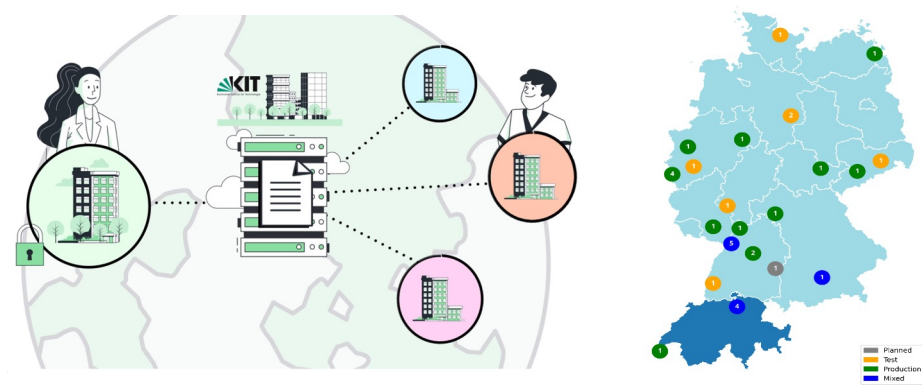
 Free of charge, only academia

 Majority not available to the market

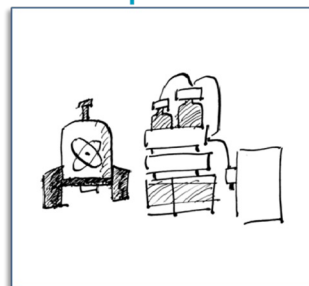


Activities of the Compound Platform

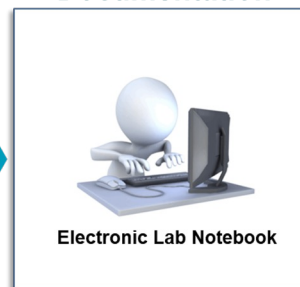
Chemotion – LabIMotion – Digitalization strategies for chemists



Acquisition



Documentation

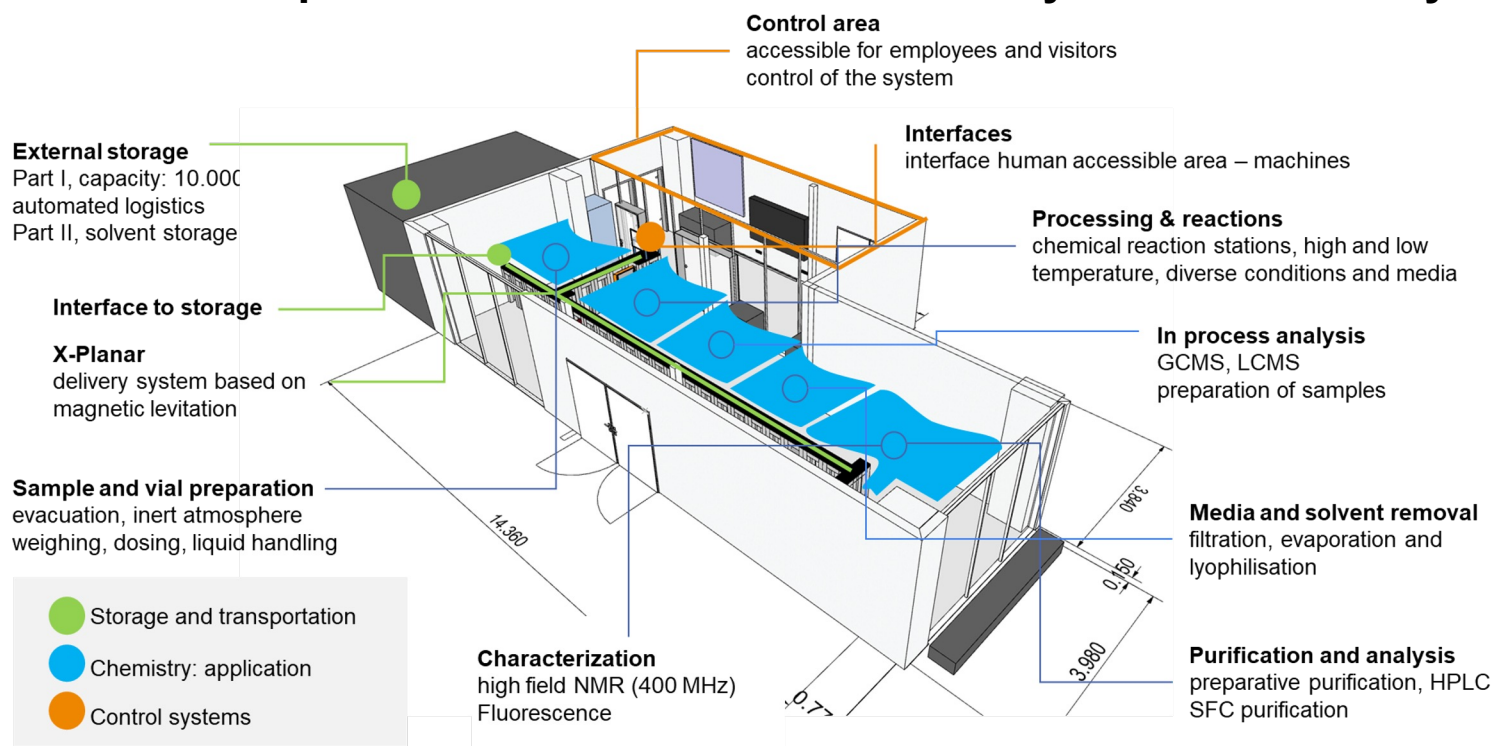
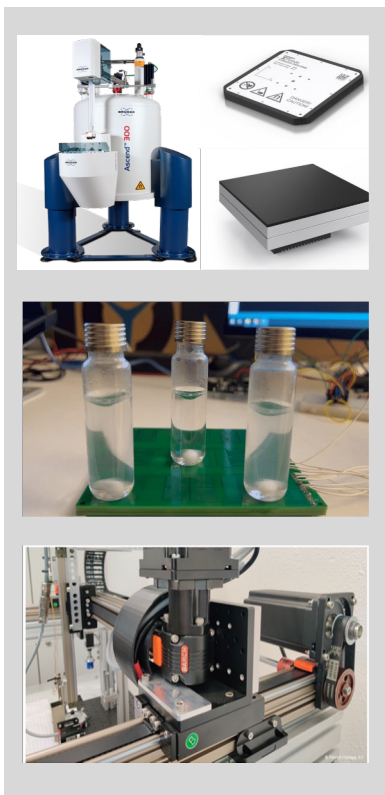


Publication



Activities of the Compound Platform

ChemASAP - platform for automated chemical synthesis and analysis



KITHealthTech

KIT Zentrum „Health Technologies“

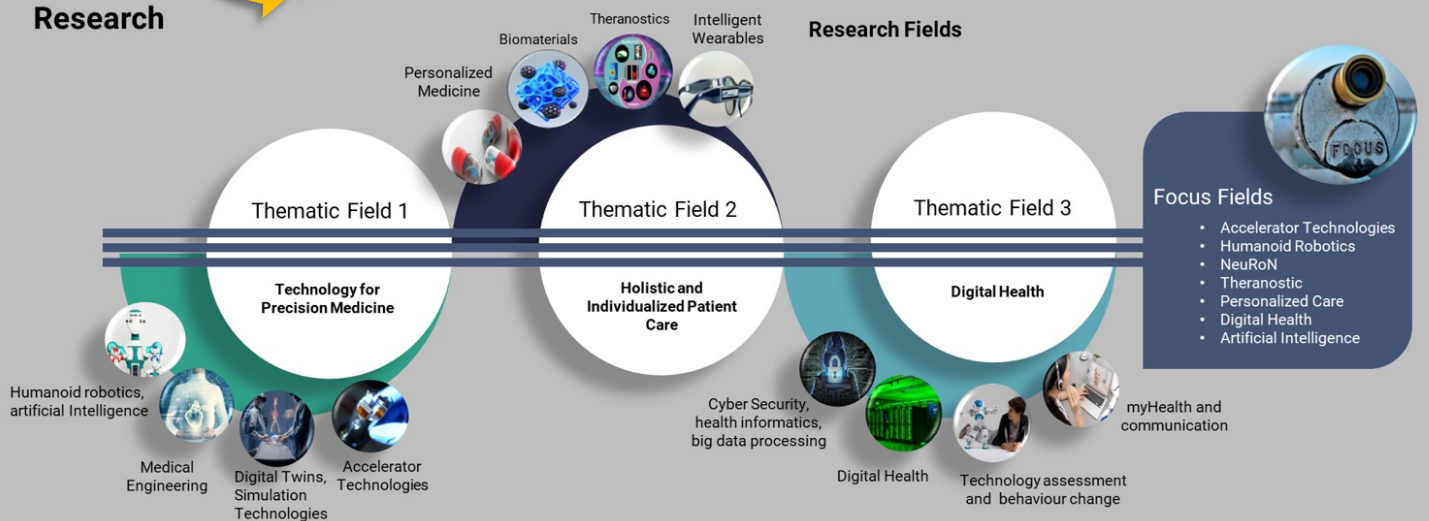
New! City Health

Food,
Climate & Environment
Urban Living
Mobility



Karlsruhe Region of Health Technologies

Research



Transfer & Innovation

- Engagement with society
- Engagement with healthcare providers
- IP generation
- Industrial collaboration
- Industrial partnerships
- Spin-offs

Teaching

Studiengang
Medizintechnik

- Dedicated Bachelor and Master Programs
- Speziation in general study programs
- Graduate schools
- upCAT accelerator

Ref.: Beigl, Loewe, Schepers (KIT)

Welcome to Karlsruhe Institute of Technology (KIT)

New KIT Center of Health Technologies



Personalized Medicine/ Theranostics

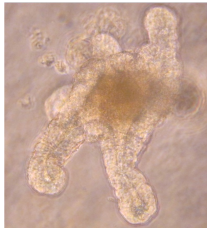
V. Orian-Rousseau



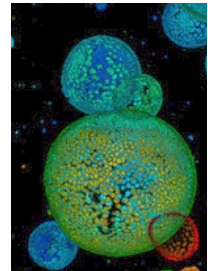
S. Bräse

New KIT Center of Health Technologies

3RockIT Core Units



Intestinal organoids
Walter et al., Cell Death and Disease 2022



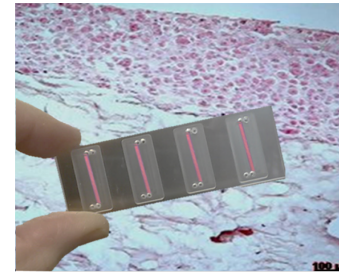
Colorectal Cancer Organoids
/Patient derived organoids
Sonnentag et al., in preparation



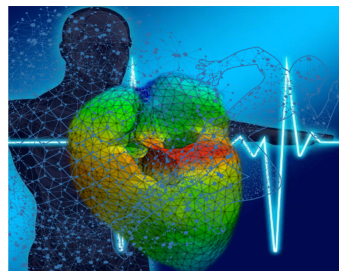
Preclinical Research Center



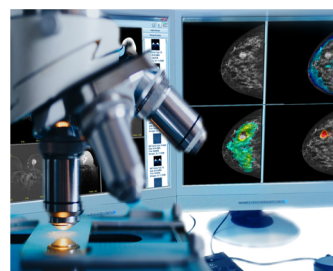
BioBank



Tissue Engineering Center



Center of Computational Tissues



Tissue Imaging Core



3D-Printing Center

KITHealthTech

KIT Zentrum „Health Technologies“

New! City Health

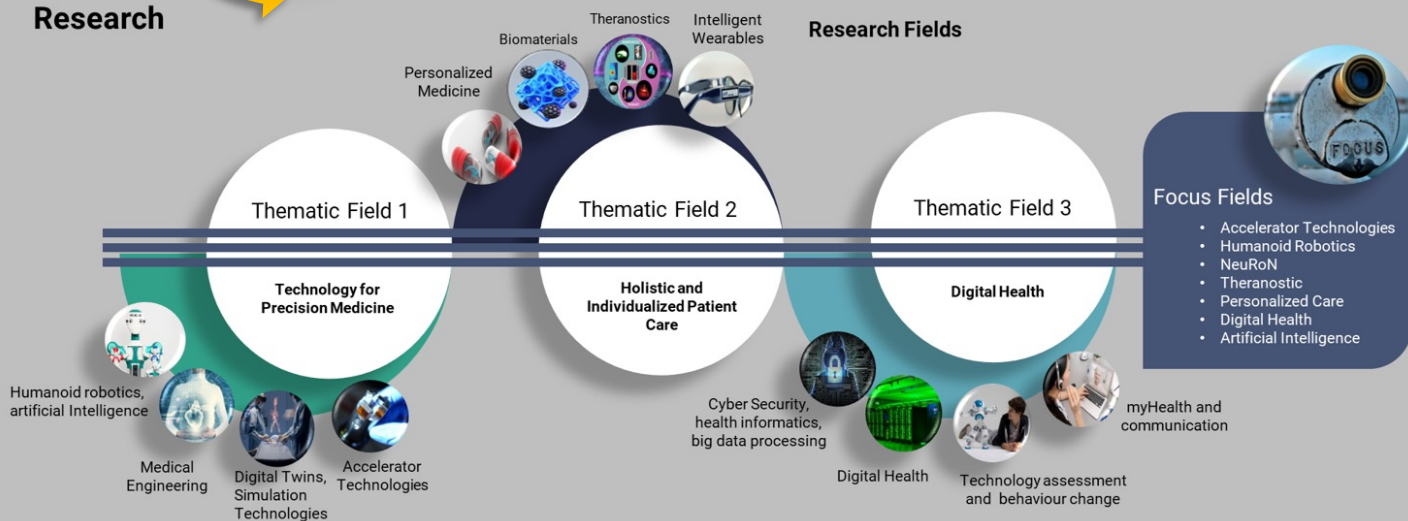
Food,
Climate & Environment
Urban Living
Mobility



Karlsruhe Region of Health Technologies

New Centre
SynGen
Synthetic
Genomics: writing
the code of life

Research



Transfer & Innovation

- Engagement with society
- Engagement with healthcare providers
- IP generation
- Industrial collaboration
- Industrial partnerships
- Spin-offs

Teaching

Studiengang
Medizintechnik

- Dedicated Bachelor and Master Programs
- Speziation in general study programs
- Graduate schools
- upCAT accelerator

Ref.: Beigl, Loewe, Schepers (KIT)

