

KIT Presentation Slides - Background Information

Contents and Explanations

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The set of slides presented here can be used to introduce KIT, The Research University in the Helmholtz Association, at a meeting, conference, or other event. The slides must not be given to third parties or external partners for presentation, but they may be published in pdf format in conference documents, if the date and source (see KIT imprint) are indicated correctly. The presentation is deliberately modular. It can be used as a whole, but it is also possible to select individual slides and highlight specific content before you present your own research field, thus ensuring target-group specific communication.

Slides 1-2: Title page - two alternatives with an identical statement: KIT - The Research University in the Helmholtz Association (using the keyword cloud or the images, special features of KIT may be highlighted)

Slide 3: Facts and figures - these are updated at regular intervals so that they always correspond to the official figures and the KIT website. Please make sure to also update your presentation regularly.

Slide 4: KIT locations

Slide 5: KIT stands for tradition and future; famous historical persons and highlights.

Slide 6: KIT excellent again!

Slide 7: KIT science organization - this slide will be updated as needed. Please make sure to also update your presentation regularly to ensure that the information on the slides matches the current structures at KIT.

Slide 8: Research profile of KIT - 5 discipline-focused Divisions, 9 interdisciplinary KIT Centers.

Slide 9 - 11: Topics sharpening the profile of KIT.

The current research profile has essentially evolved from the research profiles of the predecessor institutions. The KIT Departments reflect the disciplinary character of the research profile, while the Helmholtz programs and the KIT centers stand for the thematic orientation. On this basis, KIT is predestined for taking a leading national and highly visible international position in the three fields of societal demand of energy, mobility, and information.

Slide 12: Big research infrastructures (The individual facilities are explained below (from slide 35)).

Slide 13: Participation in the Helmholtz Association.

Helmholtz Association:

The Helmholtz Association's mission is to pursue long-term research goals of the Federation and society and to preserve and improve the basis of human life. To this end, it identifies and addresses major and pressing issues facing society, science, and industry through strategically and programmatically oriented cutting-edge research in six fields. The Association brings together 18 scientific-technical and medico-biological research centers. With more than 43,000 employees and an annual budget of 5 billion euros, the Helmholtz Association is the largest scientific organization in Germany.

KIT in the Helmholtz Association

In fulfilling its mission as a national research center, KIT makes first-class research contributions to solving major and urgent challenges facing the society, science, and industry. These research and development activities are embedded in the superordinate program structure of the six research areas of the Helmholtz Association. In the fourth phase of program-oriented funding (PoF IV), which runs from 2021 to 2027, KIT is involved in eleven research programs in four research fields. As a large-scale research facility, KIT operates the Grid Computing Centre Karlsruhe (GridKa), one of the Tier1 computing and data centers for data storage and data processing of the LHC experiments at the European Organization for Nuclear Research CERN.

Slide 14: Research-oriented teaching at KIT - 107 study programs, 11 KIT Departments.

Slide 15: Promotion of young scientists at KIT - HOC, KHYS, YIN.

Slide pool:

Slide 17: International Dimension - this is updated at regular intervals so that it always matches the official figures and the KIT website. Please be sure to also update your presentation regularly.

Slide 18: KIT Is Successful as University of Excellence and European University (EPICUR)

The European University Alliance EPICUR (European Partnership for an Innovative Campus Unifying Regions) aims to create an attractive, innovative European university for a new generation of students in Europe. EPICUR comprises the three projects EPICUR Education, EPICUR Research, and EPIDI (European Partnership for Innovation in Distant Internships). There is a particular focus on interaction with society.

Slide 19: Eucor - The European Campus

In the Upper Rhine region, the universities of Basel, Freiburg, Haute-Alsace, Strasbourg, and KIT form the trinational university confederation Eucor - The European Campus. The five member universities cooperate in the fields of teaching, research, innovation, and administration and promote cross-border mobility of students and employees of the partner universities in science and administration.

Slide 20: Rankings - Strong position in international competition - this is updated at regular intervals. Please make sure to also update your presentation regularly.

Slide 21: KIT in the TU9 Association

Slide 22: Organizational structure of KIT - this slide will be updated as needed. Please make sure to also update your presentation regularly so that the information on the slides matches the current structures at KIT.

Slides 23-25: KIT Departments, Helmholtz Programs, and KIT Centers

Teaching is organized in the KIT Departments, program-oriented research in the Helmholtz programs; nine KIT Centers coordinate cross-domain research and innovation and promote interdisciplinary collaboration at KIT.

Slides 26-27: Summary

Two alternatives with the identical statement: KIT - The Research University in the Helmholtz Association (by means of the keyword cloud or the images, the special features of KIT can be highlighted again)

Slides 28-33: KIT Divisions

KIT is divided into five Divisions: "1: Biology, Chemistry, and Process Engineering", "2: Informatics, Economics, and Society", "3: Mechanical and Electrical Engineering", "4: Natural and Built Environment", and "5: Physics and Mathematics". The Divisions combine research, teaching, and innovation of the institutes assigned to them. Each Division is under the responsibility of a Division Head who is supported by a Division Council. Teaching is organized in the KIT Departments, which are assigned to the Vice President Higher Education and Academic Affairs. Program-oriented research is organized in the Helmholtz programs, which are assigned to the respective Division Heads.

Slides 34-48: Big research infrastructures

Acoustic all-wheel roller dynamometer

- Holistic examination of vehicles under precisely defined and reproducible conditions
- "Road in the lab": Testing novel prototypes in a shielded and secured environment
- Apex roller test rig with a roller diameter of 2,000 mm and a roller width of 1,350 mm
- Synchronous motors with a rated power of 300 kW each
- Applications: Holistic and precise evaluation of energy consumption of vehicles, power measurements, acoustic investigations.
- Use for a wide range of vehicles: From small cars to SUVs to trucks and buses as well as earthmoving equipment and agricultural vehicles

AIDA cloud chamber

- Inaugurated in 1997 as an atmospheric simulation chamber for aerosol processes in the environment and the climate system
- 1999 to 2002: Expansion to aerosol and cloud chamber.

Special features:

- Simulation of atmospheric conditions from the ground up to heights of 50 km (troposphere and stratosphere)
- Precise and very homogeneous temperature control down to -90°C
- Controlled generation of droplet and ice clouds by adiabatic expansion control
- Extensive instrumentation for trace gases, aerosols, and clouds
- Very high international reputation: "Gold Standard" for ice nucleation research
- Used by numerous national and international research groups; used in cooperative measurement campaigns with up to 20 external participants
- Planned for the next years: Expansion to the "World Calibration Center for Cloud Physics"
- 2020: Expansion to include cloud chamber AIDA
- Main research goals: Ice nucleation in tropospheric clouds and its influence on precipitation formation; climate-relevant optical properties of aerosols and ice particles in cirrus clouds; chemical aerosol processes and their influence on air quality, clouds, and climate.

Carbon Cycle Lab (CCLab)

- Research and development platform for the carbon cycle of the future
- CCLab maps a complete process chain of the carbon cycle of the future: From feedstocks, such as residual and waste materials, to the chemical feedstocks derived from them for reuse in the chemical industry, to substitute fossil raw materials
- In the first step of the process chain, the feedstocks are pretreated mechanically and thermochemically in material-specific pyrolysis processes
- Liquid and solid intermediate products, pyrolysis oil and pyrolysis coke, are produced, which are then, in a high-pressure entrained-flow gasifier, converted into the basic

chemical building blocks hydrogen and carbon monoxide, which together form the synthesis gas

- Downstream synthesis processes then produce important chemical feedstocks for industrial production, such as methanol

Energy Lab 2.0

Research focus:

- Intelligent energy system
- Flexibility in power generation from chemical energy sources
- Energy system services based on decentralized components
- Parallel energy information network
- Network topologies for a scenario with largely decentralized supply of electrical energy from renewable sources

Core: Smart Energy System Simulation and Control Center (SEnSSiCC)

Function: Systems interconnection between participating research institutions at KIT and outside

GridKa

- German center for analysis and archiving of data from various particle physics and astroparticle physics experiments
- Support of the experiments at the Large Hadron Collider (LHC, CERN) and the Belle II experiment in Japan
- One of only four Tier1 centers of the Worldwide LHC Computing Grid (WLCG), providing computing power and storage for all four of the major LHC experiments
- About 16 petabytes (PB) of data in the online storage systems, more than 18 PB on tape
- More than 11000 CPU cores with a 100 gigabits/s fast connection to the German research network

High-performance computer for research (HoreKA)

- Research areas can work on very complex application problems of new orders of magnitude
- Operator: Scientific Computing Center (SCC) of KIT
- New computing center building on Campus North with innovative cooling technology
- Almost 35,000 computing cores with a total performance of more than one petaflops per second (one quadrillion floating point arithmetic operations)
- Fiber-optics link with a throughput of 320 gigabits per second

KARA Karlsruhe Research Accelerator

- 1998: Start of construction of the particle accelerator
- 2003: Start of the synchrotron radiation facility for scientific and industrial experiments focusing on soft X-rays, terahertz and infrared radiation
- The ring-shaped electron storage ring has a diameter of 35 m and a circumference of 110 m
- The electrons in the storage ring are accelerated to 2.5 GeV (nearly the speed of light)
- The synchrotron radiation (brilliant radiation of high intensity) generated by acceleration and deflection of the electrons is used in the 19 beamlines for various analytical methods of investigation
- The investigation methods (imaging and spectroscopic investigation methods) are used in life sciences, energy research, material sciences, actinide research, catalysis, micro- and nanotechnology, and technology developments, such as lithography
- Use as:
 - Test facility for accelerator research
 - Synchrotron radiation source for KIT's research in the above fields

Karlsruhe Nano Micro Facility (KNMFi)

- Established by KIT
- Associated with the Helmholtz program "Science and Technology of Nanosystems" (STN)
- Accessible to industry and universities
- Free access, if results are/will be published
- Paid access for proprietary use (if used alone without publication of results)
- Many technologies: Micro- and nanostructuring, microscopy and spectroscopy, characterization (whole bundle of physico-chemical characterization techniques, e.g. topology, structure, chemical composition, and other properties)
- Close cooperation and solution-oriented approach

Karlsruhe Research Factory

- Karlsruhe Research Factory for AI-integrated production
- Founded and jointly operated by the wbk Institute of Production Science of KIT together with Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB) and Fraunhofer Institute of Chemical Technology (ICT)
- Unique opportunity to study "Intelligent Production" using real processes
- Supported by the latest methods of digitalization and artificial intelligence. Science and industry jointly transfer innovative, challenging manufacturing processes from the idea to operational practice within the shortest possible time
- The aim is enabling manufacturing companies and machine and plant manufacturers to serve the market with the new products much earlier
- In addition, established processes are further improved through the use of smart production technology methods and the pooling of the research partners' expertise
- Application domains: Electric mobility, lightweight construction, and Industry 4.0

Karlsruhe Tritium Neutrino Experiment (KATRIN)

- International collaboration: 150 scientists, engineers, technicians, and students from 4 countries (D, US, UK, Czech Republic) and 12 institutions
- 70 m long experiment with a large number of high-technology components
- Scientific goal: Measurement of the mass of neutrinos. These elementary particles are of fundamental interest to particle physics and cosmology (see Nobel Prize for Physics 2015 on neutrinos)
- Significantly improved experimental sensitivity
- Technical commissioning in October 2016, first measurements with tritium performed in 2019
- Total measurement time: Five calendar years
- Spectrometer is the world's largest ultra-high vacuum vessel
- Ideal international and interdisciplinary high-tech environment for young students at KIT and worldwide to enhance their skills and knowledge

Nuclear Fusion - Tritium Laboratory Karlsruhe

- Nuclear fusion is an energy-producing process that has been going on in the Sun and in stars for billions of years: At extreme pressure conditions and about 15 million degrees, atomic nuclei fuse and form the so-called plasma
- Since the pressure conditions of the Sun are not feasible on Earth, the operating temperature in the reactor must exceed 100 million degrees to reach the plasma state. To protect the surrounding reactor wall from the hot plasma, the plasma is confined by a very high magnetic field
- In future fusion power reactors, deuterium and tritium will be used as fusion fuels
- As a competent know-how provider, KIT is significantly involved in numerous large-scale international projects and designs, such as key technologies and components for the experimental reactors ITER, JT-60SA, and Wendelstein 7-X
- The Karlsruhe Tritium Laboratory (TLK) founded in the early 1990s is a semi-technical center for the handling and safe containment of the radioactive hydrogen isotope tritium

Real-world Labs

- District Future-Urban Lab works together with people living in the Karlsruhe Oststadt district and studies and tests how an urban neighborhood can be made more sustainable and compatible with the environment
- The Center for Digital Accessibility and Assistive Technologies explores new approaches to shaping society so that people with disabilities can participate without barriers
- KARLA makes society more aware of climate protection and studies selected climate protection measures in Karlsruhe in five areas: Climate-friendly business trips, sustainable climate protection in construction, skilled workers for climate protection, climate-friendly canteens and automobile-free mobility, and quality of life
- The goal of the Robotics and Artificial Intelligence Real-world Lab is to test artificial intelligence in a variety of experiments and in different real-life environments, such as daycare centers, schools, museums, libraries, and hospitals
- The goal of the ERNIE real-world laboratory is to predict and analyze the effects of short-term extreme events and slow climate changes on society, economy, and environment in urban areas
- At TAF BW, companies and research institutions can test future-oriented technologies and services relating to connected and automated driving in road traffic
- Smart East aims to transform an existing residential and commercial area in Karlsruhe's Oststadt district into a smart, energy-optimized, and climate-friendly neighborhood
- The goal of RABus is to study the use of fully automated, electric buses and to test them in real life in Mannheim and Friedrichshafen. With this technology, an attractive, affordable, and environmentally friendly door-to-door bus shuttle service can be offered around the clock

Theodor Rehbock River Engineering Laboratory

- Foundation of the "Theodor-Rehbock-Wasserbaulaboratorium" (TRL) in Karlsruhe in 1901
- Hydraulic engineering experiments were established in Karlsruhe and transferred from there to the rest of the world
- 2,500 m² of permanently installed laboratory water channels for basic research as well as areas for the construction of temporary experimental models for contract research
- Pump system with elevated tank and a pumping capacity of up to 820 l/s
- Automated and computer-aided measurement and control technology of the models
- Main fields of work: Analysis and simulation of flow processes in flowing waters, planning and operating strategies of hydraulic engineering facilities and concepts

Vehicle Efficiency Laboratory

Advantages over conventional roller dynamometers:

- Direct flange mounting of the load units to the vehicle's wheel hubs: Changing properties of the tires do not falsify measurement results
- Steerability of front wheels: Steering system included in the energy balance of the vehicles tested

Primary research objectives:

- Holistic and precise evaluation of the energy consumption of vehicles with conventional or alternative drive systems during straight and curved driving
- Development and optimization of energy management systems for complete vehicles or for individual components
- Development of future test methods with which vehicles with alternative drives can be evaluated with regard to their energy efficiency

Features:

- Drives, brakes, and steering can be represented
- Simulation of tires with clearly defined characteristics
- Simulation of road characteristics, track, and traffic situation in real time
- Real or virtual driver
- Wide range of vehicles testable (small cars to light trucks)
- Innovative wheel recording (unique selling point)

Slide 49: Research and innovation at KIT - Main topics of the German/English lookKIT magazine.

Slides 50-53: Development to KIT and KIT 2.0

Slide 51: The way to KIT

In 2009, the KIT idea, which had emerged in the context of the first Excellence Initiative in 2006, became reality: Merging Universität Karlsruhe (TH) as a state university with Forschungszentrum Karlsruhe as a national large-scale research center of the Helmholtz Association in a unique national scientific institution. The aim was to become more than the sum of the two parts and to leverage the scientific potential that had become apparent over many years of close cooperation.

The merger of "Universität Karlsruhe (TH)" and "Forschungszentrum Karlsruhe GmbH (FZK)" in 2009 resulted a legal corporation with two missions and three legally established core tasks: Research, Teaching, and Innovation. However, the university and large-scale research areas remained legally and financially separate.

In 2012, KIT's autonomy was strengthened compared to the other state universities and Helmholtz centers by the (first) KIT Further Development Act: It brought KIT the right of appointment, the employer's capacity for the staff, as well as building ownership for Campus East (otherwise a state matter) on a trial basis.

Since the beginning of his term of office in fall 2013, President Holger Hanselka worked together with the entire Executive Board to further deepen the merger. The objective was a unified mission for the entire KIT: "KIT - The Research University in the Helmholtz Association".

Finally, in order to remove existing internal barriers, the next decisive step in the further development of KIT took place in February 2021 with the signing of an administrative agreement between the federal and state governments and the adoption of the 2nd KIT Further Development Act (2nd KIT-WG) by the Baden-Württemberg state parliament.

Slide 52: Development to KIT 2.0

The visit of Theresia Bauer, Minister of Science of the State, and Anja Karliczek, Federal Minister of Research, to KIT in July 2018 preceded the next big step: The political will and the guiding principles for "KIT 2.0" were laid down in a key points paper. In February 2021, the new administrative agreement was signed and the 2nd KIT Further Development Act was adopted by the Baden-Württemberg state parliament. Implementation at KIT started.

Slide 53: 2nd KIT Further Development Act abolishes existing separations.

Since the 2nd KIT Further Development Act, the Large-scale Research and University Sectors have ceased to exist. KIT now fulfills two responsibilities, the "Large-scale Research Responsibilities" and the "University Responsibilities". This also means that university professors and all scientists at KIT can assume both university and large-scale research responsibilities.

- State law now represents the common overarching legal framework. The separation of the personnel bodies of the university sector and large-scale research sector has been abolished and uniform personnel categories exist
- Internal decision-making processes in bodies and committees (such as KIT Senate) have been standardized. This ensures that the large-scale research and university responsibilities are adequately represented and taken into account.
- However: Cash flows continue to be separate

Slides 54-56: KIT in the Helmholtz Association

Research Field Energy

In the research field energy, KIT focuses on the energy transition by participating in the two new PoF- IV programs "Energy System Design" and "Materials and Technologies for the Energy Transition". In addition, the "Fusion" program covers essential challenges for the realization of fusion as a primary energy source. The program "Nuclear Waste Management, Safety and Radiation Research" provides expertise for nuclear safety research and safe waste management.

Research Field Earth and Environment

Climate research in the Earth and Environment research field is strengthened by big data analysis through involvement in the Digital Earth and Earth System Modeling projects. Since 2021, KIT has participated in two topics of the Helmholtz program "Changing Earth - Sustaining our Future" and has been granted 29 million euros per year. KIT is in charge of the topic "The Atmosphere in Global Change" and to a small extent also represented in the topic "Sustainable Bioeconomy - Harnessing Natural Potentials".

Research Field Information

In the research field of information, KIT focuses, among other things, on the topic of cybersecurity. Other important topics for KIT are quantum technologies, with a focus on quantum computing, and information-based materials science.

Research Field Matter

In the matter research field, KIT focuses on elementary particle physics, including the GridKa large-scale research facility, astroparticle physics with neutrino physics, the search for dark matter and cosmic ray research, studies of how complex forms and materials are created from the smallest building blocks, and the development of detector and accelerator technologies.

Slide 57-65: KIT 2025 Strategy

Slide 58: Ten areas of action

Slide 59: Mission

Slides 60-67: Measures Derived from the KIT 2025 Strategy

The KIT 2025 Strategy outlines the path for the coming years. KIT intends to fully exploit its synergy potential. In the coming years, the large-scale research and university responsibilities will be brought together even more closely. The slides list major measures in some areas of action.