60 Years of Research at the Centre

Exhibition Booklet

JÜLICH
FORSCHUNGSZENTRUM

Foundation

In December 1956, the state parliament of North Rhine-Westphalia (NRW) decided to build an “atomic research establishment” – today’s Forschungszentrum Jülich was born. The founders’ main objective was the use of all nuclear research for peaceful purposes. While discussions were still proceeding as to how to equip the facility, the state of North Rhine-Westphalia was looking for a location that met the geographical criteria. A site with good transport links was needed that also offered safety for local people. After some debate, the state cabinet resolved in November 1957 to build the atomic research establishment in Stetternich Forest. The Christian Democratic district administrator of Jülich at the time, Wilhelm Johnen, played a key role in this decision. The establishment was the most important project realized by Leo Brandt, a Social Democratic policy-maker on science issues, who also became its first director. The plans included buildings for a materials testing reactor and a reactor for neutron research, ten institutes, and central institutions such the library. Respected scientists from the fields of physics and medicine oversaw the construction phase, while working groups at NRW’s universities prepared to establish the institutes.

New optimism and nuclear fervour

Atomic power would safeguard the Federal Republic's energy supply – of that the politicians, business leaders, and trade associations of the 1950s were sure: nuclear fervour was rife. As the economic miracle gained pace, the demand for energy was increasing, but domestic resources were scarce. Scientific knowledge was indispensable to harness nuclear energy for peaceful purposes. In 1955, the Federal Government set up a Ministry for Atomic Affairs, the forerunner of today's research ministry.

Nuclear research was not just going to benefit the energy supply, but was also intended to support medicine and biology. And for West German scientists, it promised the possibility of returning to the international fold. Young, dedicated researchers set to work, with backing for their endeavours from civil servants and politicians. Nuclear research was also carried out in Karlsruhe and at other West German sites, including West Berlin, while East Germany founded a similar establishment around the same time in Rossendorf near Dresden.

The founding father

"We must never make the mistake of doubting technology; those who do not believe that utopias can be realized by technical progress will not work towards this end and will get nowhere."

Leo Brandt (1908–1971), engineer, founder, and first director of the Research Centre

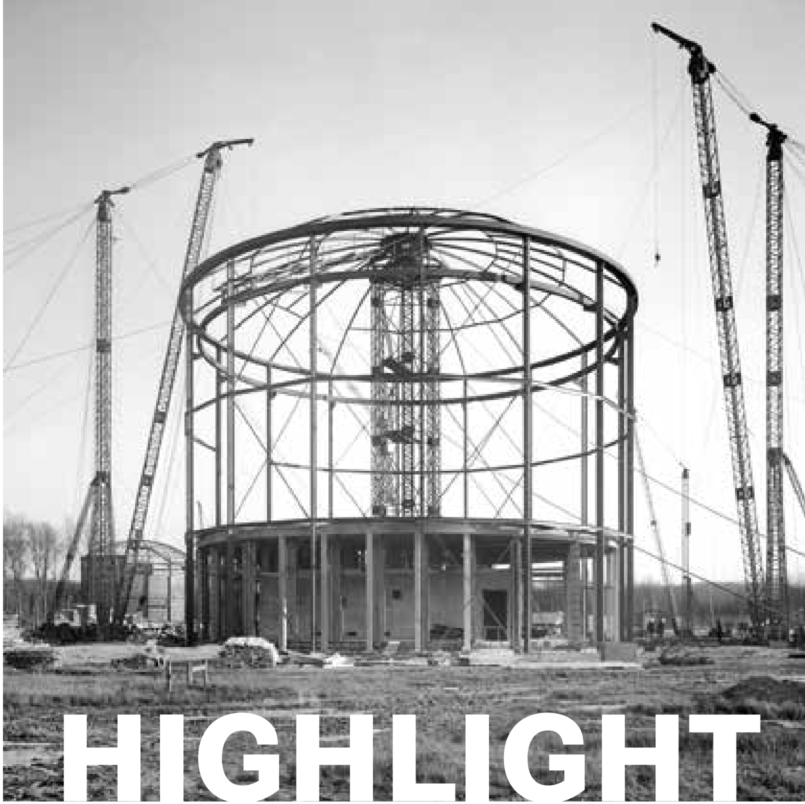
1956
The NRW state parliament decides to build an “atomic research establishment”

1957
Plans are drawn up for Institutes of Neutron Physics, Reactor Materials, Reactor Components, Nuclear Chemistry, Medicine, and Biology

1958
The foundation stone is laid for the MERLIN (FRJ-1) and DIDO (FRJ-2) research reactors

1960
The Institute of Plasma Physics, the nuclear research centre’s first institute, is formed from a working group at RWTH Aachen University

The “Gesellschaft zur Förderung der kernphysikalischen Forschung (GFKF)“ (Society for the Promotion of Nuclear Physics Research) is renamed “Kernforschungsanlage Jülich des Landes Nordrhein-Westfalen e. V.” (Jülich Nuclear Research Establishment of the State of North Rhine-Westphalia) (KFA)



The DIDO research reactor was installed in 1960. MERLIN is visible in the background, also still under construction. From 1962 onwards, the reactors played a pioneering role in materials science and basic physics research.

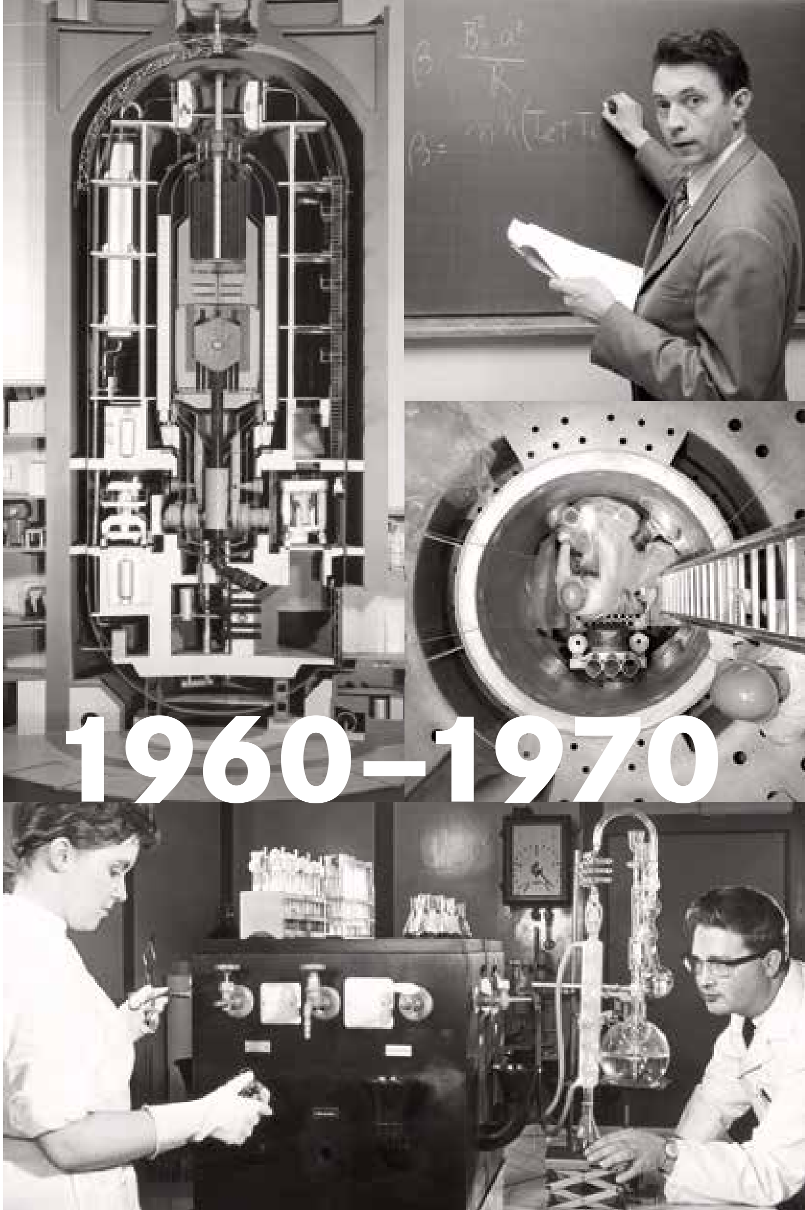
Up and running

The research reactors started operation in 1962. With a library, lecture theatre, and the Central Institute for Applied Mathematics, a scientific infrastructure was taking shape. Jülich established links with EURATOM (the European Atomic Energy Community) and German industry.

When North Rhine-Westphalia's state finances were stretched to the limit in the 1960s, the establishment's future was threatened. In 1968 the federal government stepped in, with a 50 percent share to start with that was later increased to 90 percent.

Arbeitsgemeinschaft Versuchsreaktor GmbH (AVR), a joint venture involving 15 energy companies, built a high-temperature reactor next to the KFA site. Once this experimental reactor began to produce electricity in 1967, interest grew in projects with spherical fuel elements. The AVR reactor was the starting point for subsequent research and development work on high-temperature reactor technology at Jülich.

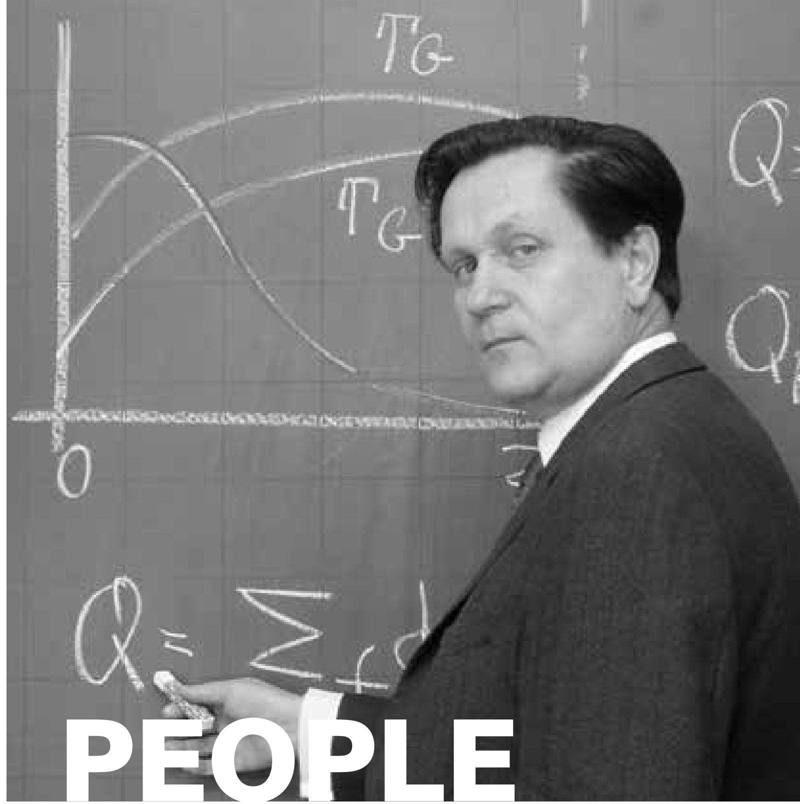
While the early focus of research was on "the atom" and on power generation, soon the scientists were also working on environmental research and agriculture. Nuclear medicine was a particular area of interest right from the start.



Pressures and mergers

While the expectations of research were high, public funding became limited as the economic miracle came to an end. Following years of seemingly boundless growth, West Germany experienced a slight recession for the first time in 1967. Justifying high expenditure on research became difficult in North Rhine-Westphalia as the coal crisis took its toll and the boom years in the Ruhr region ended. In 1963 alone, 13 pits were closed; 10,000 people lost their jobs.

The now renamed Federal Ministry of Scientific Research sought to centralize control of the activities it funded; the research centres joined forces to protect their interests. In 1970, the informal group of all the administrative managing directors of West Germany's nuclear research centres – nicknamed the "reactor fraternity" – formed the Arbeitsgemeinschaft der Großforschungseinrichtungen (Association of National Research Centres) (AGF), from which the Helmholtz Association evolved in 1995.



PEOPLE

The visionary

"The high-temperature reactor will come!"

Prof. Rudolf Schulten (1923–1996), physicist, developed the pebble-bed reactor at Jülich and had a lifelong belief in this technology's future.

1961

The nuclear research establishment is officially opened by the Prime Minister of North Rhine-Westphalia, Franz Meyers, in the presence of the Nobel prizewinner Otto Hahn

The Institute of Biology is founded

The first open day attracts 2,706 visitors

1962

Start-up of the MERLIN and DIDO reactors

The Central Electronics Laboratory is founded

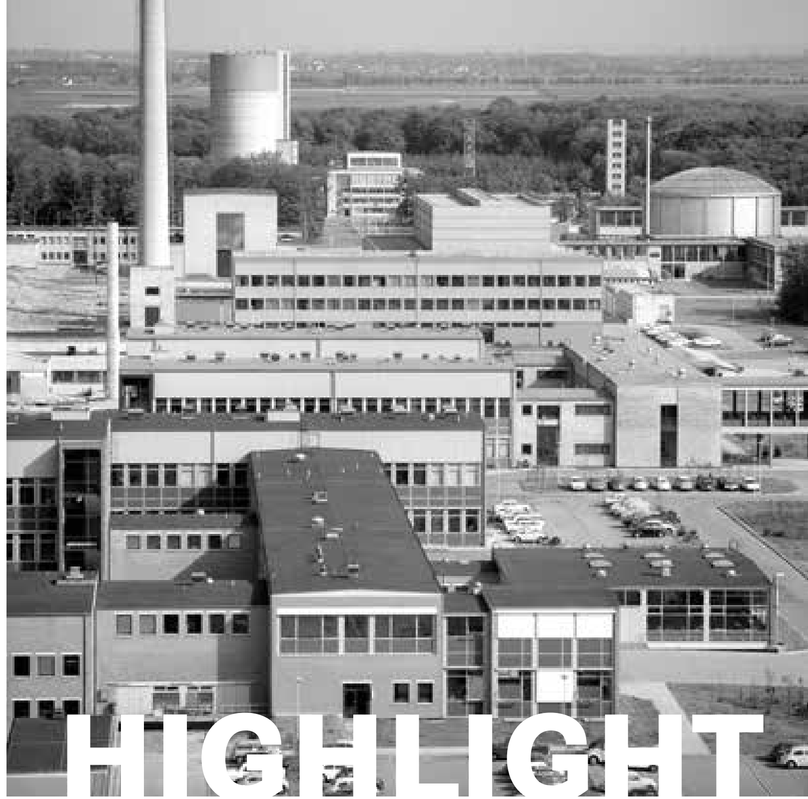
1964

The Institutes of Reactor Materials, Neutron Physics, and Medicine are founded

1967

Conversion to a limited company (GmbH)

The Nuclear Physics Institute is founded, and the isochronous cyclotron JULIC is built to investigate elementary constituents of matter using accelerated particles



HIGHLIGHT

The research establishment and its infrastructure were up and running – after years of planning and intensive construction activities, a research facility with numerous institutes and auxiliary institutions was created on the Jülich site.

Diversity and openness

The institutes grouped around nuclear research used their expertise and infrastructure in a cross-disciplinary approach and established new focal points. Solid state research emerged as a particular success story. An understanding of solids allowed the properties of materials to be changed, by exposing them to radiation for example. This permitted materials to be modified in a controlled manner or new ones to be created.

In the 1970s, structures at Jülich became more open and more democratic. The Scientific Council (WR) created in 1958, which later became the Scientific and Technical Council (WTR), for instance institutionalized participation in institutes and projects.

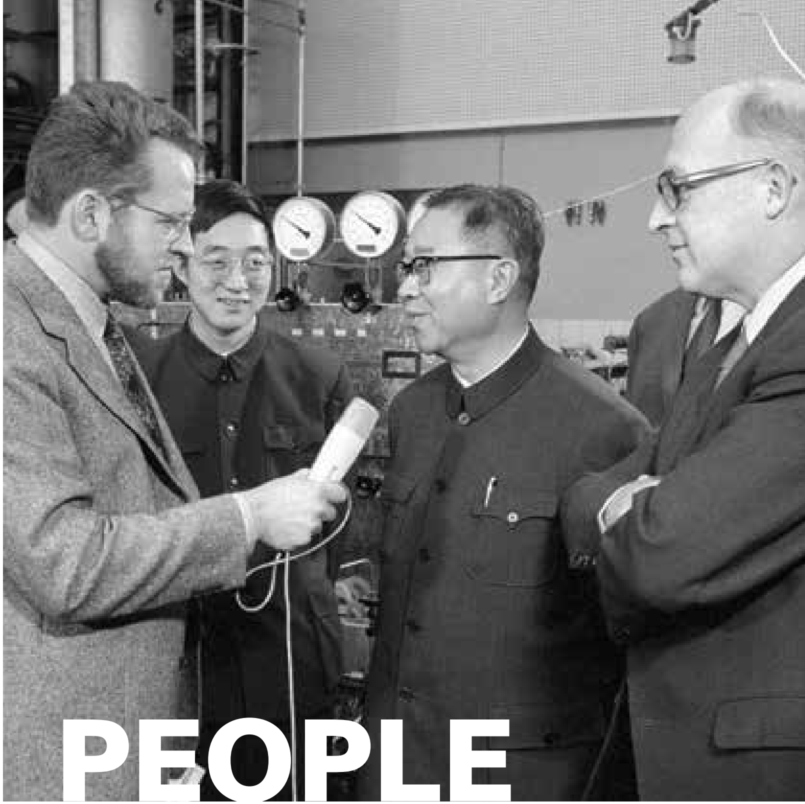
In 1978, 27 cubic metres of water entered the AVR experimental reactor as the result of a leak in the steam generator. AVR GmbH reported the incident straight away to the supervisory authorities at the regional and national level. After investigating the incident, it took the reactor out of service for 15 months to carry out repairs.

In response to a growing awareness of environmental protection and the risks of nuclear energy, new programme groups were set up to study the interactions between humans, the environment, technology, and society.

Social change

"The limits to growth" – a Club of Rome study published in 1972 – raised awareness of the consequences of technical and industrial progress. Damage to the environment, shortages of resources, and social conflicts called for a realignment of scientific and technical research. Reactor safety – a concern for nuclear research from the very beginning – rose to prominence as nuclear power came increasingly under fire. In Wyhl, a small town in the southern German state of Baden-Württemberg, local residents protested against a proposed nuclear power station in 1975. Close on 30,000 opponents of nuclear power occupied the site for nine months and stopped the plant being built. The anti-nuclear campaign attracted large numbers of supporters in the following years and, alongside environmental and peace organizations, became one of the most influential social movements in the country.

Public spending became tighter, and the desire for central planning and control grew. Research institutions came under stronger performance monitoring. With a view to targeting energy research, from 1974 onwards the Federal Ministry for Research and Technology set up project management agencies to oversee funding programmes and based them in major research centres such as Jülich.



An international guest

First official visitor from the People's Republic of China: The engineering scientist Prof. Zhang Wei from Tsinghua University, Beijing, visited Jülich in 1972.

1970
The Institute of Solid State Research (IFF) is founded

1971
Plasma with a temperature of 100 million degrees is generated for the first time at Jülich: it is a prerequisite for achieving nuclear fusion

1973
The Central Technology Division is founded

1974
The Jülich project management agency (PtJ) implements the German Federal Government's first energy research programme

1975
The Institute of Medicine obtains its own ward for patients

1977
The Institute of Biotechnology (IBT) is formed from the Institutes of Botany and Microbiology

1978
The world's lowest ever temperature of 50 microkelvin is recorded at the IFF's cryo-facility, allowing previously unknown physical effects of materials to be investigated, e.g. superconductivity

The "nuclear power and the environment" programme group is set up

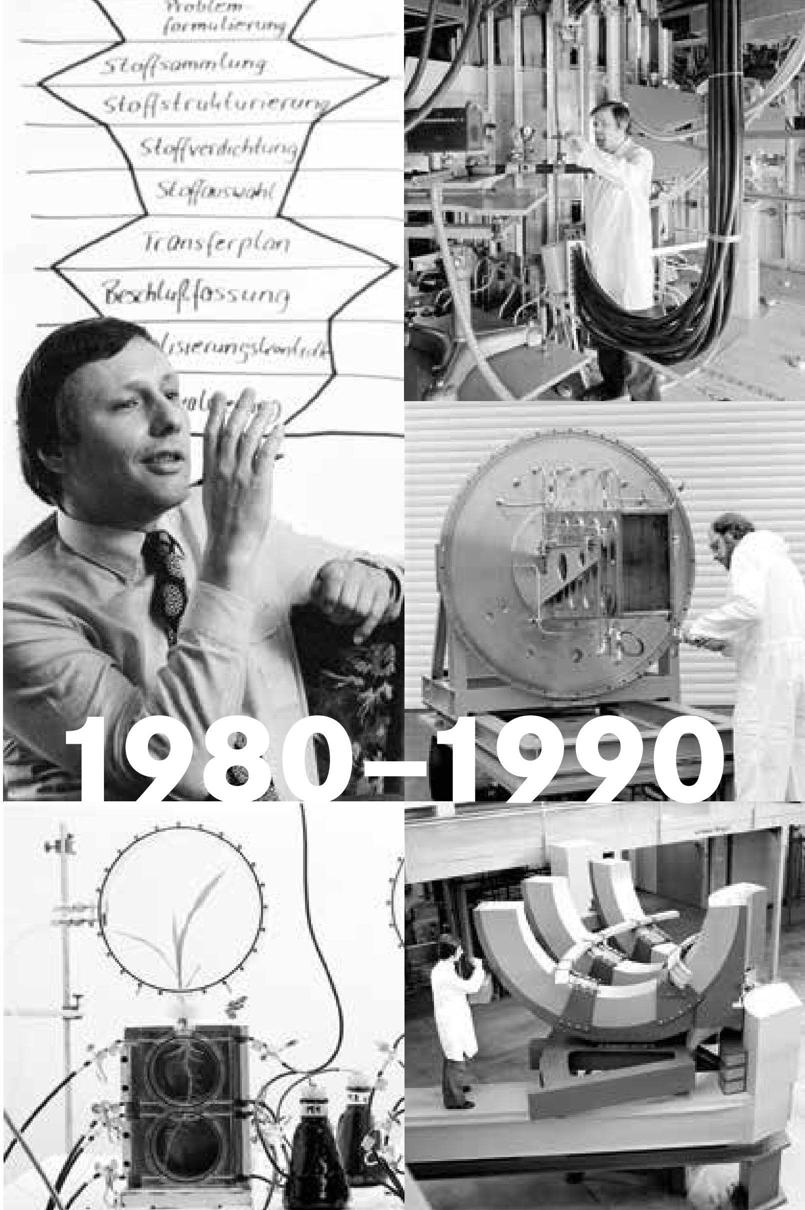
In an algal research facility, Jülich scientists investigated how waste water could be purified with the help of micro-algae and bacteria and the resultant, protein-rich biomass, consisting of algae and bacteria, processed as animal feed.

A systematic approach

A new buzzword heralded a fresh approach: “systems analysis” involved bringing together results from projects and working groups so that findings could be classified, understood, and evaluated in complex contexts. A pioneer in this field was the Systems Analysis and Technological Evaluation programme group. Environmental and climate research in particular required energy, climate, technology, and society to be considered in terms of their interrelationships and interactions.

Results from nuclear research became the starting point for new technologies. Thus, Jülich’s radiochemistry department specialized in pharmaceutical applications and developed tracers that made metabolic processes in the brain visible. The Institute of Reactor Materials, which came into existence in the 1960s, worked on ultra-high-temperature ceramic materials of substantial interest to industry.

With large-scale facilities such as TEXTOR and supercomputers, Jülich underlined its status as a major research centre: large scientific and technical infrastructures were developed and built for a variety of research areas, and methods for their operation were created and made available to the community.



New horizons

The anti-nuclear and environmental movements gave rise to many questions in the 1980s. While nuclear energy attracted increasing criticism, in particular following the Chernobyl disaster in 1986, getting to grips with environmental problems became more and more important. Research responded to the new questions coming from society and taken up by politicians, and investigated a large number of new fields. These included information technology, materials research, and biotechnology. At the same time, the major research institutions also regarded themselves as partners in terms of scientific policy and started to play a more active role in determining the strategic direction of research.

An agreement on scientific and technical cooperation between West and East Germany in 1987 encouraged relations between their respective research institutions. So when the inner-German border was opened in 1989, these contacts soon grew into straightforward cooperations; Project Management Jülich (PtJ) became active in the former East Germany as soon as the Wall came down, placing and coordinating a number of environmental projects in particular. It therefore became indirectly involved in reshaping science in what had been East Germany.

Technicians

Alongside scientific expertise, developing and commissioning large-scale facilities such as TEXTOR or COSY called for technical know-how and skilled craftsmanship. These were provided by the Central Technology Division and its various manufacturing workshops.

1981
TEXTOR, the large-scale fusion experiment based in Jülich, comes on stream

1982
Molecular beam epitaxy plant for investigating semiconductor and magnetic film structures

1984
Inauguration of supercomputer CRAY X-MP, one of the world’s fastest computers

1985
The MERLIN (FRJ-1) research reactor is decommissioned

1987
The High Performance Computing Centre (Höchstleistungsrechenzentrum, HLRZ) is founded

1988
Official opening of the pilot-scale bioengineering facility for obtaining enzymes from micro-organisms

The AVR reactor is shut down

Peter Grünberg discovers the GMR effect, for which he is awarded the Nobel Prize in 2007

1989
New European record: a high-temperature superconductor developed in Jülich conducts electric current at 130 kelvin

1990
Change of name to Forschungszentrum Jülich

HIGHLIGHT

The CRAY X-MP/22 supercomputer was installed in Jülich in 1983. Its 16 megabytes of memory made the computer a sensation.

New structure (MEILE)

Forschungszentrum Jülich adopted a new structure focusing on five key research areas: matter, energy, information, life, environment (known by the acronym MEILE). From 1995 onwards, Jülich became a beacon of supercomputing. Powerful supercomputers fundamentally changed science, as simulation began to establish itself as a third methodological pillar alongside experiment and theory.

Soil and environmental research evolved with the addition of climate research and now embraced the entire spectrum, from sedimentary systems in the soil to plants and also the troposphere and stratosphere layers of the atmosphere. Investigations in this field were further advanced by key research installations such as the SAPHIR atmosphere simulation chamber (inaugurated in 2001) and the Phytec experimental greenhouse facility (from 2004). Energy research was boosted when the Institute of Photovoltaics was founded in 2000.

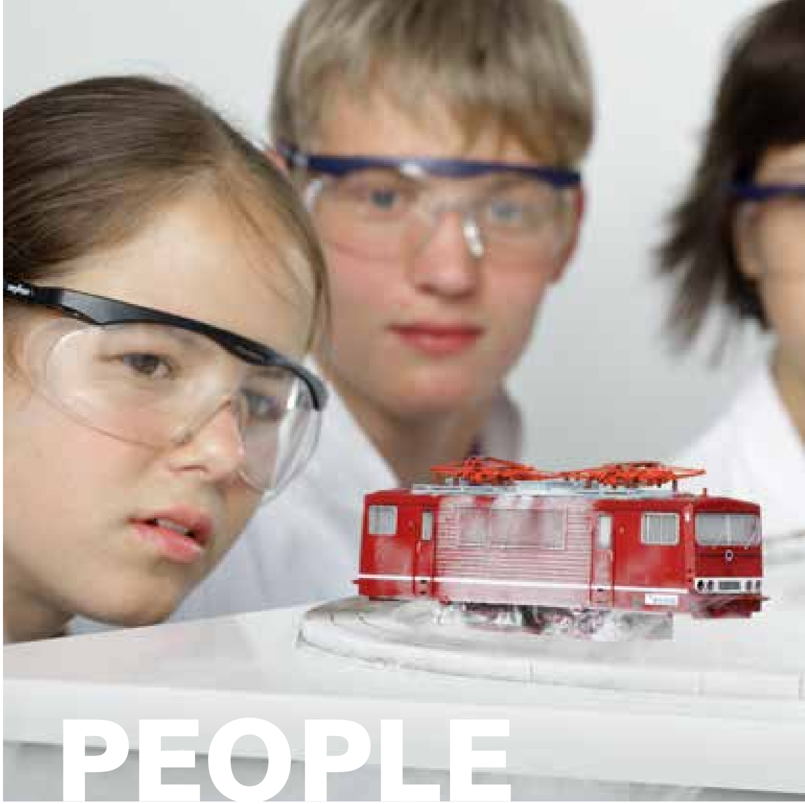
In 1999 radioactive contamination of the soil and groundwater was discovered close to the AVR reactor building – a consequence of the 1978 incident. Regular water and soil testing was introduced immediately. In the course of its work, the TÜV technical inspectorate entrusted with carrying out the tests was able to rule out both past and present threats to human life and the environment.

Challenges and strategies

Research dealing with the pressing issues of the future became a national responsibility and required a well-planned approach – on this premise, several ministries drew up a joint high-tech strategy, which the Federal Government presented in 2006. The strategy called for networking of science with industry and provided clear guidelines for research funding. In future, research was to concentrate on “innovative fields” such as energy, health, and biotechnology.

In the meantime, scientific methods were changing fundamentally, in particular as a result of the greater possibilities afforded by information technology. At ever shorter intervals, new generations of computers offered ever faster computing speeds. Supercomputers with such prodigious capacities were essential for climate modelling, for example, or when attempting to simulate the human brain.

The expectations made of research ranged widely: as well as injecting impetus in areas of basic research, it had also to collaborate on developing innovative products in partnership with industry.



Programme for schools

Children and young people have been having fun with science at their own special laboratory since 2005. By 2015, some 40,000 school students had visited the JULAB schools laboratory and been fascinated, for example, by the levitating train that demonstrates the phenomenon of superconductivity.

1993
The COSY particular accelerator, a cooler synchrotron, commences operation

The PHOEBUS photovoltaic plant on campus produces electricity for the first time

1994
The magneto-encephalograph makes brain functions visible

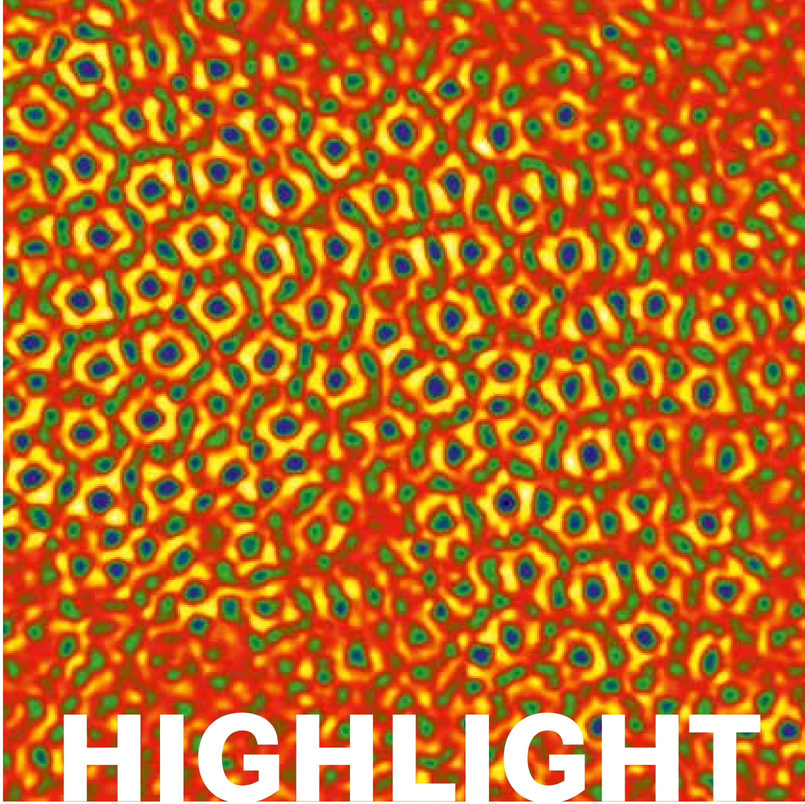
1997
Water molecules become visible for the first time by scanning tunnelling microscopy

2004
The Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons is inaugurated

2005
Official opening of the Biomolecular NMR Centre

Brain tumour diagnostics with an FET tracer improve the accuracy of tumour detection from 50 to 97 percent

2006
The DIDO (FRJ-2) reactor is decommissioned; the Jülich Centre for Neutron Science is founded and from now on operates its instruments at the FRM-II research reactor in Garching



HIGHLIGHT

Ultra-high-resolution electron microscopes at the Ernst Ruska-Centre provided unique and fascinating insights into the world of atoms. This microscopic image dating from 2004 shows the metal tantalum with a resolution of 127 picometres. Tantalum is used for metallization in semiconductor electronics.

The key to the future

Jülich defines energy and the environment, information technology, and neurosciences as its core fields and is guided by the principle of researching key technologies for the future. The understanding of materials remains crucial both for supplying energy and for information systems. Fundamental to this is expertise in physics and especially in nanotechnology and information technology. Supercomputers continue to play a central role, since simulation today forms a bridge between theory and experiment.

Among the strategic partnerships with industry and with universities and research institutions, the “Jülich Aachen Research Alliance” (JARA), formed in 2007 with RWTH University Aachen, is perhaps the most innovative. Starting in 2013, Jülich has set up Helmholtz Institutes at universities.

In 2011, Forschungszentrum Jülich was hit by the “fuel spheres scandal”. Media reports that spherical fuel elements from the former AVR reactor had disappeared attracted major public attention, but were later revealed as untrue. The German nuclear regulatory authorities confirmed that the nuclear fuel was being safely held in the interim storage facility at Jülich.

German energy transition and challenges posed by demographic change

After the Fukushima disaster in 2011, the Federal Government decided to transform the energy system. For nuclear power to be fully phased out, renewable energies must be used. This major task can only be achieved by innovations in energy research.

In addition to environmental and energy issues, problems arising from demographic change are also growing in importance. Ageing societies are increasingly confronted with brain diseases like Alzheimer's. Intensive research is required in order to improve how we diagnose and treat such conditions. A deeper understanding of how information is processed in the human brain could also provide ideas for modern information technology. Information processing forms a field of research that is of great significance for overcoming various future challenges.

Research institutions are now expected to think beyond the boundaries of their own institutes and to organize themselves in overarching research programmes. Funding is directed at research projects that look for solutions in cooperation with universities or partners from industry.

Up-and-coming scientists

More than 100 young scientists complete their doctorate at Jülich each year. Since 2009, Forschungszentrum Jülich has awarded its Excellence Prize to internationally successful young scientists from Jülich whose ideas have provided decisive stimulus in their respective areas of research.

2009
Inauguration of “9komma4”, a 9.4-tesla MR-PET hybrid tomograph that can simultaneously examine structure, function, and molecular processes in the brain

Inauguration of the Jülich neutron spin echo spectrometer at the strongest spallation source in the world at Oak Ridge, Tennessee

2011
The Bioeconomy Science Center (BioSc) is founded as a centre of scientific excellence for a sustainable bioeconomy with the universities of Aachen, Bonn, and Düsseldorf

2012
The electron microscope PICO enables atomic structures to be studied with the highest precision

2013
Inauguration of the Helmholtz Nanoelectronic Facility with a clean-room laboratory covering a floor space of 1,200 square metres

The “Big Brain” 3D digital atlas of the brain with a resolution of 20 micrometres becomes available to those active in the fields of science and medicine

2014
Discovery of the dibaryon, a complex particle consisting of six quarks, on the COSY particle accelerator

2015
Separation of Jülich’s nuclear activities in JEN, an entity incorporated in the EWN group of companies

World record: Jülich fuel cell clocks up more than 70,000 hours of continuous operation

HIGHLIGHT

Peter Grünberg (together with Albert Fert) received the Nobel Prize in Physics on 10 December 2007 in Stockholm. At the Jülich Institute of Solid State Research he discovered the GMR effect in 1988, which radically increased the storage capacities of computer hard drives.

Contents

For further information, films, photos and items of interest marking 60 years of Forschungszentrum Jülich, go to http://historie.fz-juelich.de/english

Interested in taking a tour of Forschungszentrum Jülich and the Anniversary Exhibition?

Contact our Visitor Service
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