FACTS AND FIGURES

Member of the Helmholtz Association

JÜLICH
Forschungszentrum

AT A GLANCE

Forschungszentrum Jülich focuses on benefit-inspired basic research, meeting the challenges of the present and conducting research for a future worth living in. As a member of the Helmholtz Association, it is one of the largest interdisciplinary research centres in Europe.

5,914
employees

Approx.
609.3
revenue total
in millions of euros

59
new patent applications

30
of which European/ international

10
years of JARA

2,442
publications

792
visiting scientists
from 75 countries

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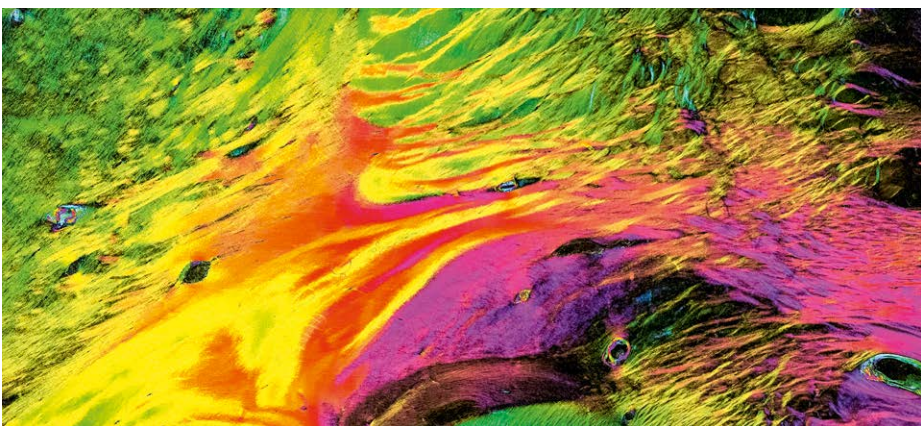
FOCUS OF RESEARCH

Forschungszentrum Jülich works across topics and disciplines and investigates the relationships between the research areas.

INFORMATION

Increasing digitalisation requires and enables innovations in high-performance computing, scientific simulation and big data as well as future technologies such as quantum computing and neuromorphic computing. The coding of information in molecular biology structures such as proteins or neuronal information processing in the human brain are also investigated by Jülich scientists. Understanding the complex processes in the brain is the prerequisite for better diagnosis and treatment of brain diseases.



FUTURE AREA BIOECONOMY

Structural change from an oil-based to a bio-based economy will gain in importance as a strategic topic of the future. For this reason, sustainable bioeconomy, that is, research into new value chains based on plant raw materials, is being expanded.

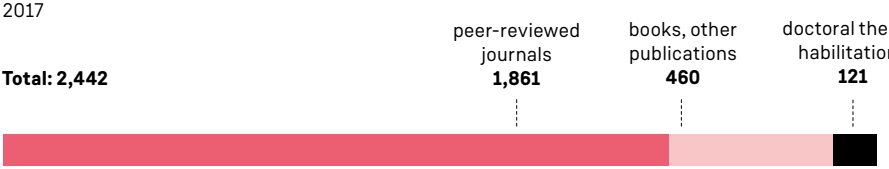
ENERGY

The aim of the energy transition is a secure, affordable and environmentally friendly energy supply. Research focuses on renewable energies, combined with questions of transformation and storage as well as the interactions of the energy system with the atmosphere and the climate. This requires a systemic linking of the value-added chains, for example from power generation using photovoltaics to storage and reconversion.

Jülich Publications

2017

Total: 2,442



INSTITUTES AND SECTIONS

1 Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons

- Physics of Nanoscale Systems
- Materials Science and Technology
- Structural Biology

2 Institute for Advanced Simulation

- Jülich Supercomputing Centre
- Quantum Theory of Materials
- Theoretical Soft Matter and Biophysics
- Theoretical Nanoelectronics
- Theory of the Strong Interactions
- Computational Biomedicine
- Theoretical Neuroscience
- Civil Safety Research
- Data Analytics and Machine Learning

3 Institute of Bio- and Geosciences

- Biotechnology
- Plant Sciences
- Agrosphere

4 Institute of Complex Systems

- Neutron Scattering
- Theoretical Soft Matter and Biophysics
- Soft Condensed Matter
- Cellular Biophysics
- Molecular Biophysics
- Structural Biochemistry
- Biomechanics
- Bioelectronics

5 Institute of Energy and Climate Research

- Materials Synthesis and Processing
- Microstructure and Properties
- Electrochemical Process Engineering
- Plasma Physics
- Photovoltaics
- Nuclear Waste Management and Reactor Safety
- Stratosphere
- Troposphere
- Fundamental Electrochemistry
- Systems Analysis and Technology Evaluation
- Helmholtz Institute Erlangen-Nürnberg for Renewable Energy
- Helmholtz Institute Münster: Ionics in Energy Storage

6 Nuclear Physics Institute

- Experimental Hadron Structure
- Experimental Hadron Dynamics
- Theory of the Strong Interactions
- Large-Scale Nuclear Physics Equipment

7 Institute of Neurosciences and Medicine

- Structural and Functional Organisation of the Brain
- Molecular Organization of the Brain
- Cognitive Neuroscience
- Medical Imaging Physics
- Nuclear Chemistry
- Computational and Systems Neuroscience
- Brain and Behaviour
- Ethics in den Neurosciences
- Computational Biomedicine

8 Jülich Centre for Neutron Science

- Neutron Scattering and Soft Matter
- Quantum Materials and Collective Phenomena

9 Peter Grünberg Institute

- Quantum Theory of Materials
- Theoretical Nanoelectronics
- Functional Nanostructures at Surfaces
- Quantum Materials and Collective Phenomena
- Microstructure Research and Nanoscale Systems
- Electronic Properties
- Electronic Materials
- Semiconductor Nanoelectronics
- JARA-Institute Green IT
- JARA-Institute Quantum Information

10 Central Institute for Engineering, Electronics and Analytics

- Engineering and Technology
- Electronic Systems
- Analytics

RESEARCH INFRASTRUCTURES

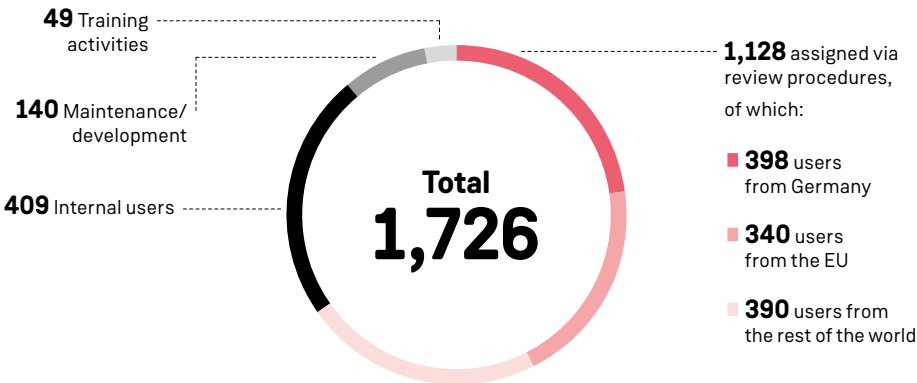
Scientists at Forschungszentrum Jülich have access to extensive, highly specialised research infrastructures. Some of them, such as the supercomputers or neutron scattering instruments, are used by teams of scientists from all over the world – Jülich experts are there to assist them.

JÜLICH CENTRE FOR NEUTRON SCIENCE (JCNS)

The Jülich Centre for Neutron Science operates instruments for research with neutrons at top locations in Germany, Europe and all over the world: at Heinz Maier-Leibnitz Zentrum (MLZ) in Garching, Germany, at the ILL High-Flux Reactor in Grenoble, France, and the first megawatt spallation neutron source SNS in Oak Ridge, USA. These instruments are also available to external scientists. In addition, JCNS and international partners are developing several instruments for the future European Spallation Source ESS in Lund, Sweden.

Beam time assigned by JCNS

Days, rounded, 2017



HELMHOLTZ NANO FACILITY (HNF)

The Helmholtz Nano Facility at Forschungszentrum Jülich is the Helmholtz Association's central technology platform for nanostructures. It serves the research, production and characterisation of nanostructures for information technology. The HNF, which was transferred to an independent division at the beginning of 2017, provides universities, research institutions and those from the industry with free access to know-how and offers resources for the manufacture of structures, devices and circuits through to complex systems. The focus of the work is on resource-friendly "green information technology".

HNF in figures

2017

Internal users	180
External users	76
Total usage time of all devices in hours	36,960

Full protective clothing is mandatory in the cleanroom of the Helmholtz Nano Facility.

ERNST RUSKA-CENTRUM (ER-C)

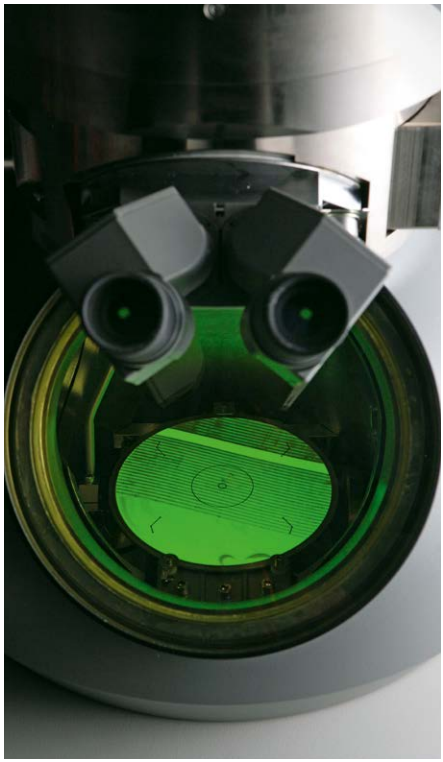
With the ER-C, Forschungszentrum Jülich and RWTH Aachen University operate a facility for atomic resolution microscopy and spectroscopy with electrons. It is also the first national user centre for high-resolution electron microscopy. It was newly founded as an independent institute at the beginning of 2017. The ER-C houses some of the world's most advanced electron microscopes and tools for nano-scale characterisation. Universities, research institutes and industry are provided with about 50 per cent of the acquisition time at the ER-C's five microscopes of the titanium class (CREWLEY, HOLO, PICO, STEM and TEM). This time is allocated by a panel of experts appointed by the German Research Foundation.

99

individual user projects in 2017

Allocated acquisition time in days:

2,035



Methods of ultra-high resolution transmission electron microscopy make it possible today to measure atomic distances with accuracy down to a few picometres.

JÜLICH SUPERCOMPUTING CENTRE (JSC)

The Jülich Supercomputing Centre provides scientists and engineers at Forschungszentrum Jülich and at universities and research institutions in Germany and Europe as well as the industry with computing capacity on supercomputers for solving highly complex problems with simulation calculations. The scientific assessment is carried out by the John von Neumann Institute for Computing.

With the JURECA supercomputer, the JSC had already been operating its first supercomputer consisting of several modules since last year. JUWELS is another, even more powerful modular system that will now replace the Jülich supercomputer JUQUEEN, which was once the fastest supercomputer in Europe.

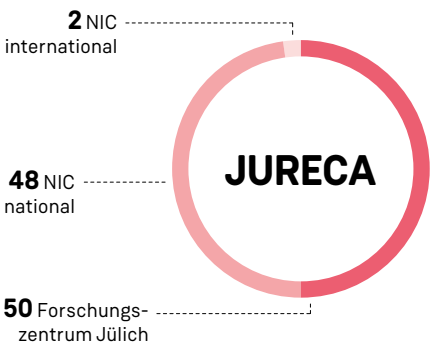
Some

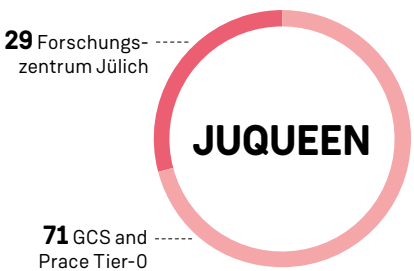
250

publications in peer review journals from the projects running on the HPC systems at the JCS.

Relative numbers according to users

in percent, 2017[1)]





1) Based on the GCS appropriation periods 11/2016-10/2017 and 5/2017-4/2018

IMAGING CORE FACILITY (ICF)

The imaging procedures at the Institute of Neuroscience and Medicine (INM) are bundled at the Imaging Core Facility. These include various high-quality instruments that provide insights into the brain.

COOLER SYNCHROTRON (COSY)

The COSY cooler synchrotron at the Institute of Nuclear Physics provides proton and deuteron beams with a magnetic stiffness between 1 and 11 Tm for internal and external experiments for basic research purposes.

JÜLICH SYNCHROTRON RADIATION LABORATORY (JSRL)

The Jülich Synchrotron Radiation Laboratory offers access to advanced photon-based spectroscopy and microscopy techniques. To this end, the JSRL operates dedicated instruments and beamlines at various synchrotron radiation sources. It provides the framework and expertise for the development of new beamlines and experimental concepts, and is a partner for synchrotron laboratories worldwide.

JSRL as photon platform

2017

Instrumentations	Use for own research	Use for cooperations with external groups
Delta (Dortmund)	90%	10%
BESSY (Berlin)	80%	20%
Elettra (Trieste)	33%	67%[1)]

1) via proposal system, i.e. > 50% external users

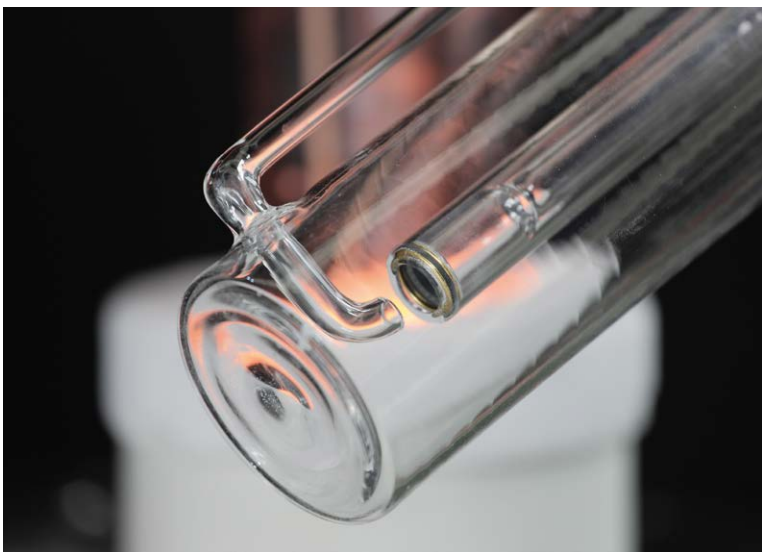
HELMHOLTZ ENERGY MATERIALS CHARACTERIZATION PLATFORM (HEMCP)

The Helmholtz Energy Materials Characterization Platform is a decentralised research infrastructure funded by the Helmholtz Association. Under one virtual roof, it combines instruments and analytical methods from seven research institutions for the purpose of materials research specifically for energy technologies.

MEMBRANE CENTRE

The Membrane Centre with a floor space of around 1,550 square metres contains a modern, spatially close research infrastructure for the development of membrane systems.

With this apparatus it is possible to measure how well a ceramic membrane allows oxygen to pass through.



SAPHIR AND SAPHIR-PLUS

The atmospheric simulation chamber SAPHIR allows for the reproducible analysis of precisely defined atmospheric-chemical mechanisms. Processes in the atmosphere can thus be simulated and analysed. If required, the SAPHIR-PLUS plant chamber supplies a natural mixture of biogenic hydrocarbons for experiments.

Experiment days at SAPHIR chambers

2017

Internal experiments	12%
Experiments involving external cooperation partners	88%
Total number of experiment days	43 [1)]

1) The maximum number of experiment days is approx. 60. It was somewhat lower in 2017 due to a longer conversion phase and the weather dependency.

The dynamic plant climate chamber SAPHIR-PLUS is used for the investigation of biogenic hydrocarbon emissions and their influence on atmospheric chemical processes.

The Biomolecular NMR Centre combines a number of high-quality NMRs such as a 900 MHz NMR spectrometer.

BIOMOLECULAR NMR CENTRE

Together with Heinrich Heine University Düsseldorf, Forschungszentrum Jülich operates a research platform for biomolecular ultra high-field spectroscopy. The Biomolecular NMR Centre combines a number of high-quality NMRs such as a 900 MHz NMR spectrometer.

NMR Centre in figures

2017

Internal users	32
External users	27
Total usage time of all devices in hours	63,800

JÜLICH MULTI-METHOD PLATFORM

It is the purpose of the multi-method platform to make the extensive and highly diversified methodological expertise in Jülich available to scientists. In particular, the appropriate combination of different methods for scientific analysis should be made simpler in the process.

JUELICH_HORIZONS: PROMOTING YOUNG TALENT

The promotion of young talent is of particular importance at Forschungszentrum Jülich. These activities, ranging from the school laboratory and promising training courses to career advancement for doctoral and junior scientists, are coordinated under the umbrella of juelich_horizons.

JUELICH_IMPULSE

More than 5,000 participants took advantage of the offers from Jülich's JuLab Schools Laboratory in 2017 – including experimental days on 14 different topics. Forschungszentrum Jülich is the new coordinator for the activities of the "Haus der kleinen Forscher", a non-profit foundation in the district of Düren. It is committed to good early education in the STEM disciplines and to sustainable development. The coordinating office at Forschungszentrum Jülich is headed by the Equal Opportunities Bureau; JuLab is responsible for the didactic management of the training courses.

JUELICH_TRACKS

105 young men and women successfully completed their training in 18 professions. 18 of them received the top grade "sehr gut" and 54 the second-best grade "gut". 24 trainees were able to shorten their training by six months due to their outstanding performance. In 2017, Forschungszentrum Jülich supervised a total of 477 interns.

Vocational training positions

New trainees 2017

Occupations		of which including a dual study programme
Laboratory technicians	27	6
Electricians	7	–
Metalworkers	12	2
Office stuff	12	3
Mathmatical-technical software developers	28	28
Other	11	–
Total	97	39

JUELICH_CHANCES

In Jülich, students and doctoral candidates are given excellent opportunities to participate in interesting research projects already at an early stage. In 2017, a total of 1,048 doctoral researchers were supervised at Forschungszentrum Jülich. Three young scientists were awarded a special prize: for their outstanding dissertations, they received the Jülich Excellence Prize, each worth 5,000 euros.

Awarded for their outstanding dissertations: Dr. Christoph Bäumer, Dr. Félix Urbain and Dr. Catalin Voiniciuc (left to right).

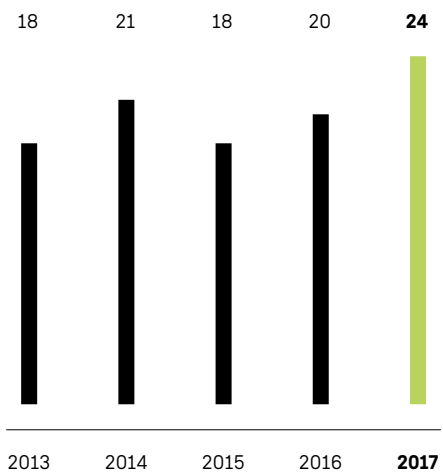
JUELICH_HEADS

The Jülich Career Center has been providing comprehensive advice for postdocs since the beginning of 2018. In the summer of 2017, the Helmholtz Association selected Forschungszentrum Jülich as one of three centres which it supports with 150,000 euros per year in the establishment of a Helmholtz Career Development Center for Researchers.

Three young scientists from Jülich received renowned EU Starting Grants: Jun.-Prof. Dörte Rother, Jun.-Prof. Julia Frunzke and Dr. Christian Wagner (left to right).

Young investigator groups in Jülich

Helmholtz Young Investigator Groups, young investigator groups in Jülich and young investigator groups funded by third parties, 2013–2017



PERSONNEL

Proportion of women

in per cent, FTE (full-time equivalent)

	♀	♂
2013	33.7	
2017	**37.2**	

Total employees

2013	27.6
2017	**29.5**

Salary grades E 12 to E15Ü as well as those paid according to groups AT, B, C and W

2013	20.7
2017	**22.2**

Scientific personnel

2013	17.4
2017	**22.3**

Total senior positions

2013	28.8
2017	**34.0**

Total early-career scientists

Overview personnel

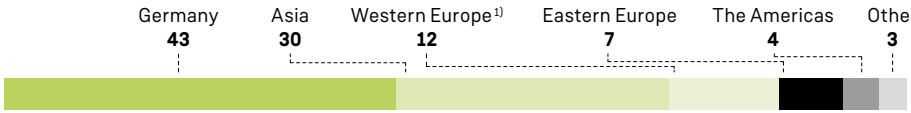
As of: 31.12.2017

Area	Number[1]
Scientists and technical personnel	3,687
of which scientists incl. persons in scientific training	2,165
· of which doctoral researchers	536
· of which scholarship holders	33
· of which student assistents	109
· of which joint appointments with universities[2]	142
· of which W3 professors	60
· of which W2 professors	67
· of which W1 professors	15
of which technical personnel	1,522
Project management organisations	1,181
Administration	723
Trainees and students on placement	323
Total	5,914

1) only employees with a contract paid by Jülich are included
2) excl. members of the Board of Directors

Visiting scientists 2017

2017: a total of 792 from 75 countries (broken down by percentage)



1) excl. Germany

PROFESSORIAL APPOINTMENTS

Scientists of Forschungszentrum Jülich are appointed to a professorship at a partner university in a joint appointment procedure. In accordance with the Jülich model, those in the professions are released from the university for work at Forschungszentrum Jülich. In the Jülich reverse model, the professors work full-time at the university and part-time in Jülich. There are 68 common vocations with JARA alone.

Joint professorial appointments with universities *

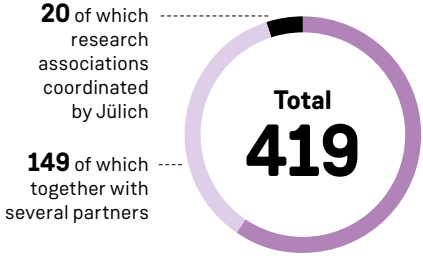
As of: 31.12.2017

University	Jülich model	of which new appointments 2017	Reverse model	of which new appointments 2017	Total
Aachen University of Applied Sciences	**8**	1			**8**
Heinrich Heine University Düsseldorf	**11**	1	**7**		**18**
RWTH Aachen University	**52**	4	**16**	4	**68**
Bielefeld University	**1**	1			**1**
Ruhr-Universität Bochum	**6**	1			**6**
University of Bonn	**9**		**3**		**12**
University of Duisburg-Essen	**5**	1			**5**
FAU Erlangen-Nürnberg	**2**		**1**		**3**
University of Cologne	**9**	1	**2**		**11**
KU Leuven	**1**				**1**
UCL Louvain	**1**				**1**
University of Münster	**1**				**1**
University of Regensburg	**1**				**1**
University of Stuttgart	**1**				**1**
University of Wuppertal	**5**				**5**
Total	**113**	**10**	**29**	**4**	**142**

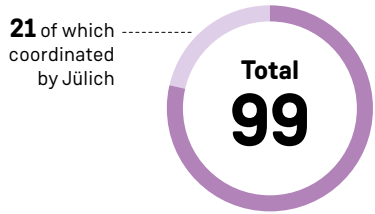
* excl. members of the Board of Directors

COOPERATIONS

Nationally funded projects



Horizon 2020



1 ENERGY

Power-to-X

Carbon dioxide becomes raw material (Kopernikus project)
Total volume: € 30 million
Funded by: Federal Ministry of Education and Research

2 ENERGY

MOSES

Mobile system for extreme events (heavy rain, heat waves etc.)
Volume: € 3.8 million
Funded by: Helmholtz Association

3 ENERGY

NanoBat

Nanostructured battery materials for lithium-ion batteries
Total volume: € 3 million
Funded by: Federal Ministry for Economic Affairs and Energy

4 INFORMATION

Helmholtz Analytics Framework

Processes and tools for big data
Total volume: € 3 million
Funded by: Helmholtz Association

5 INFORMATION

Computational Connectomics

Simulation of neural network model of the visual cortex
Total volume: € 600,000
Funded by: DFG

6 INFORMATION

Dual2PET

Development of new active ingredients against chronic pain
Total volume: € 2 million
Funded by: EU

7 BIOECONOMY

FocusLabs

5 labs pool together competencies for a sustainable bioeconomy in North Rhine-Westphalia
Total volume: € 11 million
Funded by: North Rhine Westphalian Ministry of Culture and Science

8 BIOECONOMY

AlgNutrient-UrBioSol

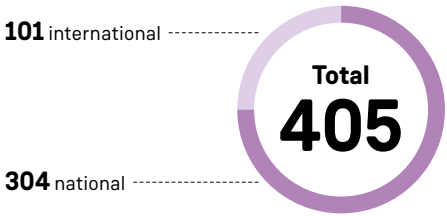
Biomass from microalgae
Total volume: € 1.2 million
Funded by: Federal Ministry of Education and Research

Total volume: contract volume over several years

In 2017, Forschungszentrum Jülich and the European IT company Atos agreed to install the first module of a new supercomputer. The third partner is the Munich-based software company ParTec. The supercomputer is developed in a co-design approach by the industry partners and Forschungszentrum Jülich. The new system follows JUQUEEN, once the fastest computer in Europe, and was the No. 1 in Germany when it went into operation in June 2018. It is to be operated within the scope of the Gauss Centre for Supercomputing (GCS), to which the three national high-performance computer centres of Forschungszentrum Jülich (JSC), of the Bavarian Academy of Sciences and Humanities (LRZ) and of the University of Stuttgart (HLRS) belong.

Number of projects carried out as contract research

2017



Supercomputer JUWELS in the JSC computer hall

JARA – 10 YEARS OF COOPERATION

The Jülich Aachen Research Alliance (JARA) – a nationally unique cooperation model between RWTH Aachen University and Forschungszentrum Jülich in Germany – was established in 2007. The anniversary was celebrated on 3 July 2017 under the motto “Pooling together competencies, shaping the future”.

The cooperation started with three sections in 2007; since 2014, there have been six sections that combine “cores of excellence” from universities and large research institutions and offer outstanding opportunities for young scientists.

The JARA sections

Sustainable Energy Research
JARA-ENERGY

Soft Matter Science
JARA-SOFT

Forces and Matter Experiments
JARA-FAME

Fundamentals of Future Information Technology
JARA-FIT

Translational Brain Medicine
JARA-BRAIN

High-Performance Computing
JARA-HPC

JARA in figures

Budget	in millions of euros
Total	500
Amount invested	60
Funds from the Excellence Initiative [1]	13.6

Professorial appointments	since 2006
Joint professorial appointments [2]	68 [3]

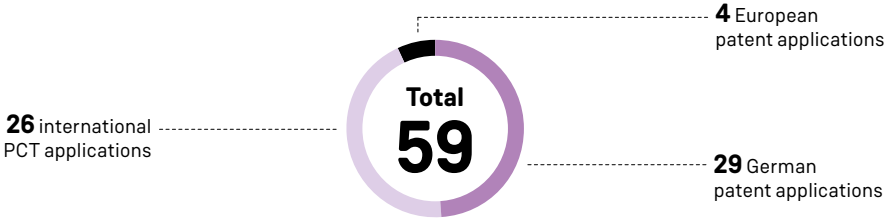
Publications	2017
Publications of all institutions involved in JARA [4]	1,753
Joint publications	953

1) for the period 2012–2017
2) as of: 31.12.2017
3) excl. members of the Board of Directors
4) peer-reviewed publications, as of: 31.12.2017

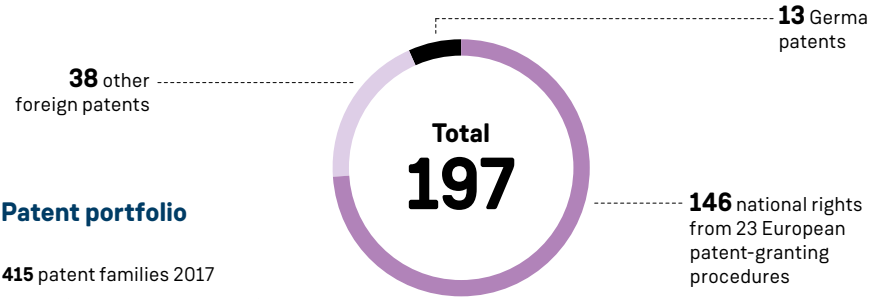
PATENTS AND LICENCES

Research in Jülich focuses on fundamental issues, creating innovations which benefit both business and society and which result in intellectual property rights and licensing agreements. Intellectual property rights include inventions for which patent applications have been filed as well as patents granted on inventions.

New patent applications



Patents granted

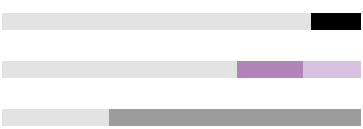


Patent portfolio

415 patent families 2017

15,063 intellectual property rights 2017

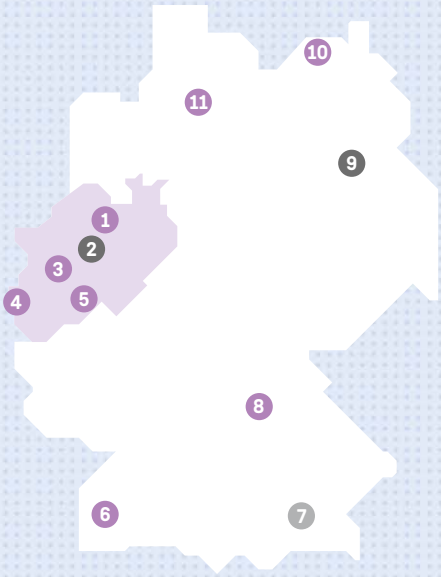
Total number of licences: 87



Revenues from licensing and know-how agreements amounted to **€ 307,000**.

WORK AT OTHER LOCATIONS

Forschungszentrum Jülich operates unique large-scale facilities – not only on its own campus, but also at other locations in Germany and abroad.



1 **Münster**
Jülich Institute of Energy and Climate Research, Helmholtz-Institut Münster: Ionics and Energy Storage
jointly operated by RWTH Aachen University and the University of Münster (WWU), WWU/CeNTech GmbH/Münster Electrochemical Energy Technology

2 **Dortmund**
Peter Grünberg Institute
Synchrotron radiation source DELTA of TU Dortmund University

3 **Düsseldorf**
Technology Transfer, branch office of the biotechnology cluster BIO.NRW

4 **Aachen**
Jülich Institute of Energy and Climate Research – Helmholtz-Institut Münster
RWTH Aachen University

5 **Bonn**
Project Management Jülich

6 **Freiburg**
Institute of Neuroscience and Medicine, Coordination Site of the Bernstein Network on the elucidation of fundamental neuralprocessing
Albert-Ludwigs-Universität Freiburg

7 **Garching**
Jülich Centre for Neutron Science (JCNS)
Heinz Maier-Leibnitz Zentrum: operation of the research reactor together with the Technical University of Munich and Helmholtz-Zentrum Geesthacht

8 **Erlangen/Nuremberg**
Helmholtz-Institut Erlangen-Nürnberg (HI ERN) for Renewable Energy
in cooperation with Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) and Helmholtz Zentrum Berlin (HZB)

9 **Berlin**
Project Management Jülich

Peter Grünberg Institut and Central Institute of Engineering
Electron storage ring BESSY II

10 **Rostock**
Project Management Jülich

11 Hamburg
Institute of Complex Systems
Center of Structural Systems Biology (CSSB) with the X-ray source "European XFEL" (X-Ray Free Electron Laser), operated together with research groups from nine partner institutions

12 Argonne (USA)
Peter Grünberg Institute
Argonne National Laboratory

13 Oak Ridge (USA)
Jülich Centre for Neutron Science (JCNS)
Spallation Neutron Source SNS at the Oak Ridge National Laboratory (ORNL)

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Shareholder of the high-flux reactors of the Institut Laue-Langevin (ILL), together with the Commissariat à l'Energie Atomique (CEA, France), the Centre National de la Recherche Scientifique (CNRS, France) and the Science and Technology Facilities Council (STFC, UK)

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Peter Grünberg Institute
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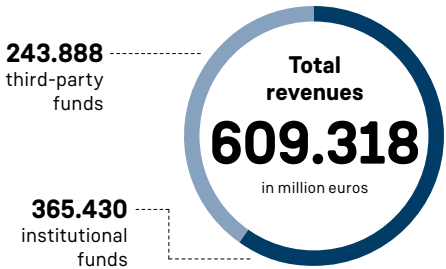
The activities of the Peter Grünberg Institute in the area of synchrotron radiation in Dortmund, Berlin, Trieste and Argonne are coordinated by the Jülich Synchrotron Radiation Laboratory (JSRL).

The JCNS operates neutron scattering instruments at the neutron sources FRM II, ILL and SNS under one roof sharing a common strategy.

REVENUES

In 2017, Forschungszentrum Jülich generated € 243.9 million in third-party funding. The majority of the third-party funding resulted from research and development activities for the industry, the acquisition of grants and from project management organisations on behalf of the Federal Republic of Germany and the State of North Rhine-Westphalia. In addition, Forschungszentrum Jülich received institutional support from the federal and state governments in the amount of € 365.4 million in 2017 to cover operating expenses and to implement investment measures.



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Forschungszentrum Jülich has since 2010 been certified as part of the "audit berufundfamilie" initiative. The third successful re-audit took place on 15 March 2016.

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