

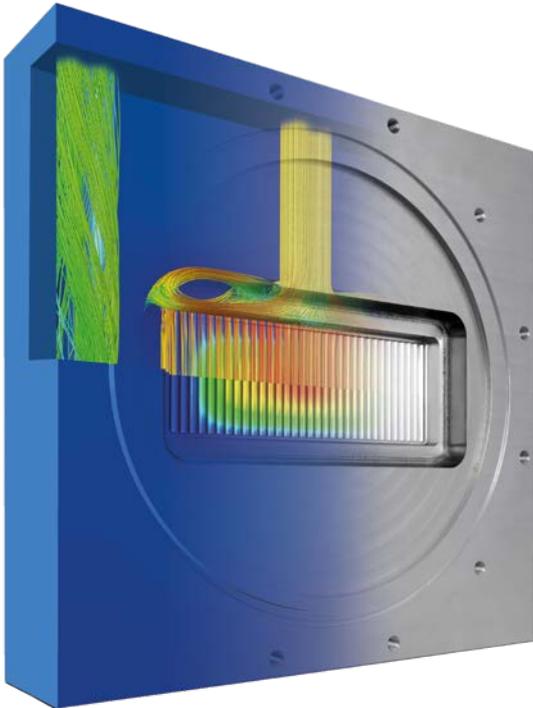


ZEA-1 ENGINEERING AND TECHNOLOGY

Technology for Excellent Science

Member of the Helmholtz Association

UNIQUE INSTRUMENTS AND PROCESSES FOR SCIENCE AND INDUSTRY



Are you a scientist or end user in industry? Are you looking for a process or high-tech instrument that is currently not available commercially?

Our experts at the Jülich Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1) offer tailor-made solutions. We design, develop, and produce unique instruments and equipment for world-class scientific research.

Whether you are looking to develop a completely new product, to modify existing equipment, or to take your product to the next level – help is at hand! Since 1974, our job has been to develop concepts and instruments in line with the expectations, ideas, and requirements of our clients. Our staff, now numbering more than 160 – half of whom are scientists and engineers – see themselves as consultants, partners, and pioneers.

Cover illustration: Stochastic cooling of a particle accelerator

Top image: Flow simulation and temperature field of a proton beam window

From market research, concept studies and simulations, through to prototypes, scientific trials and instrument construction – as your active partner, we are at your side through each phase of your project.

“With our broad knowledge and vast experience, we promote excellence in science by collaborating effectively with our partners. We are adept at combining the ideas and objectives of scientists with our own engineering perspectives to ensure a successful outcome.”

Prof. Dr. Ghaleb Natour

Director of the Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1)





OUR EXPERTISE – YOUR COMPETITIVE EDGE

Take advantage of our experience

Jülich brings together inspiration and vast engineering know-how from widely different fields – ranging from particle physics and energy and environmental research through to medicine and biology.

Often, it is possible to use technical instruments or a certain technique in a completely different context. Our expert knowledge ensures that you achieve your objectives faster, as we are not only familiar with the technologies and materials currently available but also with the wide range of potential fields of application.

For every project, we put together an interdisciplinary working group comprising engineers, physicists, material scientists, mathematicians, automation specialists, manufacturing experts, and technicians. By concentrating know-how from different fields in this way, we are able to create fresh, new ideas, which we then combine with the long-standing expertise of our staff to identify the best possible solution to scientific and technical questions.

Pioneering, excellent science today requires more than just pen and paper. We provide scientists with high-precision equipment and complex instruments, enabling them to make new discoveries and address the major challenges of our time.



ONE-STOP SHOP

For over forty years, we have successfully provided highly complex and innovative instruments and equipment for research. Additionally, we offer long-term service and maintenance support for the entire product life cycle. This is possible because we cover all aspects of a project – from planning, simulation, and feasibility studies right up to the development, production, installation and operation of the product.

We offer our partners advice and support both at the early and later phases of a project. Our most important asset in all of this is our staff, with their competence in applying in-house technologies and processes. Our experts know which processes and technology are commercially available, and what still needs to be developed. They calculate costs, are familiar with funding programmes, and are able to pinpoint the technical options available. Our clients and partners thus enjoy a high degree of reliable planning and comprehensive support as they turn their idea into an end product.

Equipped with state-of-the-art specialized machines and tools, we handle a broad spectrum of materials including special metals, ceramics, glass, plastics, and composite materials. Cutting-edge measurement and test procedures ensure that each instrument and system is produced and delivered with optimal specifications.

It goes without saying that we work according to the German standard DIN ISO 9001 and are certified by the TÜV Rheinland Group, undergoing regular quality assessments. Our instruments meet all existing guidelines and requirements – including extremely stringent regulations for nuclear facilities, aerospace instruments, and medical applications. All projects are fully documented. Moreover, we evaluate and optimize our workflows using our established quality management processes. Our investment in needs-based, ongoing professional development means that our staff are able to fulfil their role as innovators, to the complete satisfaction of our clients.

When commercially available measuring and test technologies fail to deliver, we step in and develop new methods to meet the high demands of cutting edge scientific research.

ENGINEERING AT ITS FINEST

From ultra-thin films comprising only a few atomic layers for nuclear research to installations weighing several tons for materials research: the ingenuity of our specialists knows no bounds.

Every project that our employees manage and implement is different. These constantly shifting challenges bring with them the advantage that knowledge can be transferred from one project to another. For over 40 years, we have succeeded in producing and operating highly complex, innovative instru-

ments and systems for excellent science. All project stages are closely coordinated with the client and partner, allowing any changes to be incorporated at short notice. Our strong network within Forschungszentrum Jülich and close ties with external partners in industry and science ensure that optimal solutions are found.

In this way, functional, technically sound, and highly reliable equipment, instruments, and materials result from what are often just the rough outlines of an idea.

At ZEA-1, sound engineering skills are complemented by structured and certified management processes. Our aim is to produce highly effective equipment, innovative processes, and novel materials, which help harness pioneering technologies and address the research issues at hand.

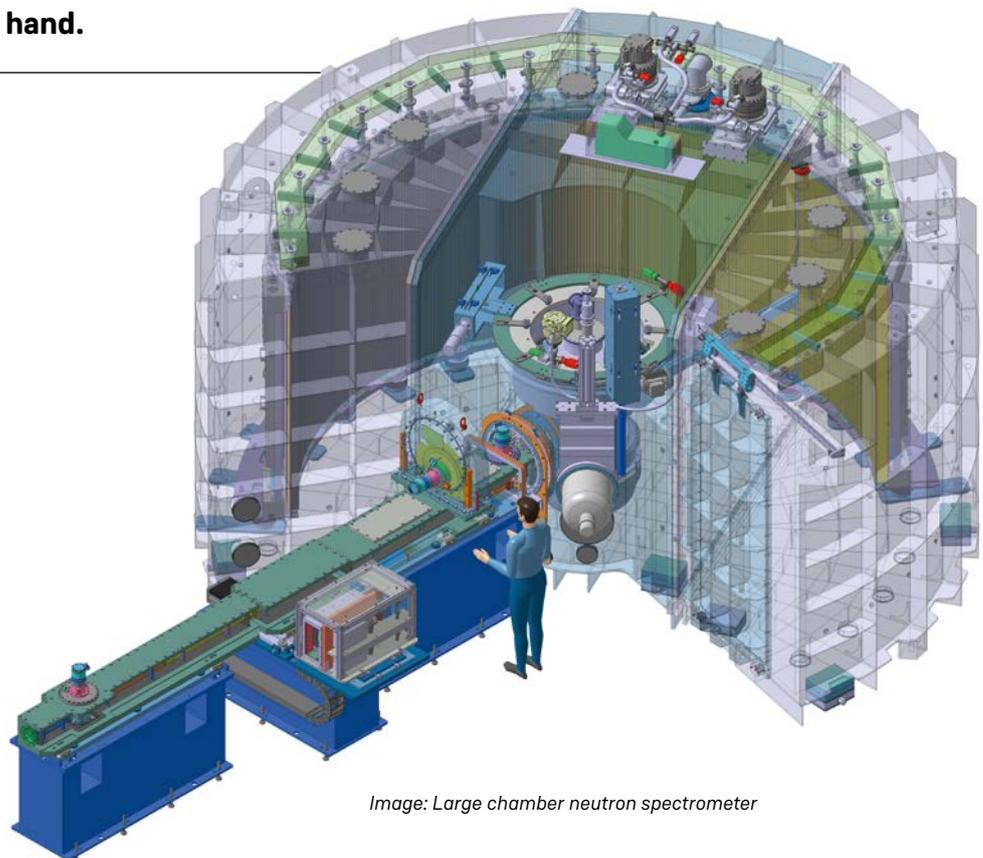


Image: Large chamber neutron spectrometer



COMPLEX PRODUCTION TECHNOLOGIES

For decades, we have dedicated our unique expertise in production and joining technologies to serving scientific research. As a result, we are able to join and shape almost any material.

Our experts are familiar with the characteristics of materials and the technical feasibility of optimally processing them. This huge wealth of experience and in-depth knowledge of material properties means that we can also process special metals such as niobium, tantalum, tungsten, and molybdenum.

We support researchers in developing new alloys, producing unique components, and performing comprehensive load tests.

For this, an extensive range of cutting-edge machinery and tools is at our disposal, capable of dealing with exceptional demands. The instruments, materials, and equipment in the world of science are usually far more complex than the industry standard, so we work on continuously refining existing technologies and processes.

For over forty years, ZEA-1 has stood for unique, innovative systems that are both reliable and effective: the right quality, delivered at the right time, to the right place.

RESEARCH PARTNER

Scientists from all over the world work with our unique instruments, systems, and processes in their quest to understand unknown or previously unexplained phenomena, and to use their research findings to acquire new, groundbreaking insights.

At all of the big national and international science centres – including CERN (Geneva), FRM II (Munich), SNS (Oak Ridge), ITER (Cadarache), FAIR (Darmstadt) and ESS (Lund) – researchers value the reliable, high-precision equipment and instruments produced by ZEA-1 engineers.

Materials scientists, physicists, biologists, and chemists use Jülich's outstanding chopper systems. These systems filter and split neutron, X-ray, and light beams. The rotating precision instruments achieve rotational speeds of up to 60,000 revolutions per minute. Thanks to the contactless magnetic bearing developed at Jülich and clever drive technology, our choppers run for years without requiring maintenance – and they do so with extreme precision. Our chopper systems are the best in the world, pushing back the limits of what is technologically feasible.

Energy researchers use our novel glass-ceramic sealants and innovative metal solders to considerably increase the operating times of state-of-the-art high-temperature fuel cells. At the same time, we are developing new components and fully automated processes to reduce future production costs for fuel and solar cells.

Our sophisticated and reliable vacuum expertise plays a key role here – not only in basic research but also in developing complex coating systems for information technology, novel material combinations for solar cells, and heat-stable alloys for energy production and storage technology.

The engineers and physicists at ZEA-1 work together with medical experts and industry representatives on combining various medical imaging techniques. This also benefits environmental and geological research as these imaging techniques can also be used, for example, to determine the root growth of plants, and thus reveal the potential impacts of climate change on crop yields. We plan, develop, and produce high-tech instruments that can detect the tiniest amounts of trace substances in the atmosphere or in groundwater.

A project often begins with an attempt to answer a scientific question. Even if the possible solution exists only in someone's head or as a rough outline on paper, a group of our experts will sit down with the scientists to design a concept which includes robust feasibility studies, detailed simulations, sound endorsements, and, where necessary, competent support in applying for funding. After all, a project proposal must be convincing, right down to the tiniest detail, if it is to be granted the necessary funding. With our comprehensive expert knowledge and years of experience, researchers can rely on us as an active partner at their side right from this crucial early phase.

If you are putting together a project proposal, please contact us. We can advise you on selecting the technology and materials best suited to your needs.



MILESTONES OF SUCCESS

The transformation of Forschungszentrum Jülich from a former nuclear research centre to one of the most important inter-disciplinary science institutions in the world is reflected in the history of the Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1).

In 1974, the “Central Institute for Reactor Experiments” became the “Central Technology Division”. The engineering expertise of staff capable of planning, constructing, and safely operating large and complex equipment was thus made available to all institutes on the Jülich campus and was soon open to external scientists as well as industry.

Another milestone was the amalgamation of the Central Technology Division with the central workshop in 1988. Engineers and scientists began working even more closely with master craftsmen and technicians, building teams capable of seeing projects through from the initial stages to the assembly and delivery of the final product.

The takeover of the Magnetic Bearing and Drive Technology group in 2002 meant that services offered expanded to include unique dynamic bearing technologies and high-precision chopper systems for all types of light, X-ray, and particle

radiation. In 2011, the pioneering move from service provider to stand-alone institute was made, as well as the mandate to conduct research to maintain and expand competence as a partner in research.

Groundbreaking national and international research projects that have benefited in the past and indeed continue to benefit today from the outstanding engineering services of Engineering and Technology (ZEA-1) include the fusion reactors TEXTOR and ITER, spallation sources SNQ, SNS, and ESS, particle accelerators COSY, LAHC, and HESR (FAIR), and neutron sources DIDO and FRM II.

In the area of environmental and climate research, Jülich instruments installed on research aircraft, Zeppelins, and satellites, or indeed on space probes, reliably provide important data – at times under extreme conditions – on climate change, plant growth, soil contamination, and planetary and atmospheric chemistry. Innumerable results from ZEA-1 projects are directly incorporated into medical or fuel cell technology by our national and international partners.

The founding of the Centre of Excellence in Joining Technologies in 2008 and the establishment of a chair in Measurement and Testing Methods in Joining Technology in 2015 at the Welding and Joining Institute Faculty for Mechanical Engineering at RWTH Aachen University, means that ZEA-1 now combines state-of-the-art competence in joining technology at both these renowned institutions to benefit the international science community as well as end users in industry.

AREAS OF EXPERTISE

Consultation services	<ul style="list-style-type: none">• A one-stop shop – from the idea to the finished product and systems
Feasibility studies	<ul style="list-style-type: none">• Design, development, and production of scientific equipment, instruments, and processes
Engineering Production	<ul style="list-style-type: none">• Technology development and Feasibility studies and experiments
Measurement and test technology	<ul style="list-style-type: none">• Project management, construction, design and installation
Prototype and instrument construction	<ul style="list-style-type: none">• Simulations and calculations (magnetic, thermal, mechanical,...)• Electron and laser beam, diffusion and friction joining technologies, including arc welding techniques
Certification	<ul style="list-style-type: none">• Vibration analysis, destructive and non-destructive testing procedures• Mechatronics, automation and drive technology• Magnetic bearings, choppers, and selectors• Glass apparatus engineering and ceramics processing• Surface engineering and precision machining• Vacuum technology, cryogenics, magnet design and measurement• Pressure vessel production, pickling and galvanic surface treatments• 3D rapid prototyping in metals and plastics• Special measurement and testing techniques such as x-ray computer tomography and thermography

FACTS AND FIGURES

Founded:	1974
Employees:	approx. 170
Production and assembly area:	approx. 6500 m ²
Simulation cluster:	1 large computer cluster (256 CPU cores; 2,304 GB RAM) 1 Xeon computer cluster (96 CPU cores; 768 GB RAM)
Partners:	all institutes of Forschungszentrum Jülich, national and international collaborations with industrial partners, universities, and scientific institutions

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