Institutes Profile

INR performs experimental investigations, develops and applies simulation tools to the research field Energy of the HGF. This work is embedded in research domains such as fusion technology, nuclear safety for LWR and innovative reactors, energy storage and direct energy conversion. Key aspects concern

- Modeling of material and heat transport in thermally highly loaded components,
- Development of methods, models, numerical tools, and data libraries for reactor physics and safety studies, including uncertainty and sensitivity evaluation
- Multi-physics and /-scale methodologies involving reactor physics, thermal-hydraulics, thermo-mechanics, and fluid-structure interaction,
- Computation methodologies for analysing hypothetical severe accidents and radiological impact on the environment
- Design, fabrication, and analysis of nuclear components,
- Experiments and instrumentation for gas and liquid metal flows relevant for direct energy conversion and high-temperature heat storage for solar and other systems.

Besides the application-oriented investigations in the framework of national and international co-operations, fundamental research is performed at the INR, in which in particular, students and Ph.D. candidates are integrated. They are supervised individually by dedicated in-house experts. Additionally, the INR is active in academic and vocational education. The INR also organizes and contributes to university lectures and international events like summer schools on reactor physics and fusion technologies.

Finance, Human Resources and Infrastructure

- Economic consulting tailored to the needs of R&D programs.
- Strategic workforce planning for the medium and long term.
- Ensuring the framework conditions for the implementation of research projects at INR.

Contact: D.Tahir, I. Brinkhoff

Continuous optimization of comprehensive processes

Contact

Karlsruhe Institute of Technology (KIT)

Institute for Neutron Physics and Reactor Technology (INR)

Prof. Dr.-Ing. John Jelonnek
Acting Director

Campus Nord
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen

Telefon: +49 721 608-22551
Fax: +49 721 608-22378

E-Mail: john.jelonnek@kit.edu

www.inr.kit.edu

Karlsruhe Institute of Technology (KIT)
Kaiserstraße 12 | 76131 Karlsruhe
Germany

Status: March 2025

www.kit.edu

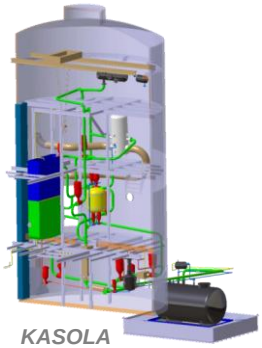
Karlsruhe Institute of Technology

Institute for Neutron Physics and Reactor Technology

Research for Energy Technology of tomorrow

INSTITUTE FOR NEUTRON PHYSICS AND REACTOR TECHNOLOGY

Thermal and Fluid dynamic System Design (TFS)



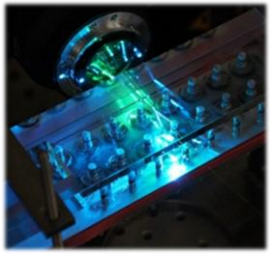
KASOLA

Experiments (up to prototypical size) and numerical simulations in thermal hydraulics and convection processes of liquid metal, molten salt and gas flows in energy and thermal engineering components under high-temperature conditions; dynamic simulation, modelling of balance of plant as well as safety analyses of nuclear systems including the enhancement and qualification of computer codes.

Contact: Dr. S. Ruck, Dr. E. Bubelis

Measurement Technology and Experimental Methods (MET)

Development of experiments and measurement techniques integrated with analysis methods and uncertainty control. Our fields of application cover thermal-hydraulics for irradiation setups and plasma facing components, hydrogen transport in components at high temperature such as the blanket breeder zone, and development of irradiation experiments for IFMIF.

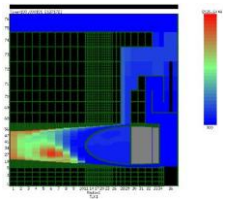


Laser-optical flow measurement technique in a mini-channel

Contact: Dr. F. Arbeiter,
Dr. D. Klimenko

Analysis of Beyond Design Nuclear Events (ADE)

Safety studies of advanced reactors, accident prevention and mitigation strategies, fast reactor physics and fuel cycle, transmutation of heavy nuclei, multi-phase and /-component flows, development and application of related codes, such as SIMMER.

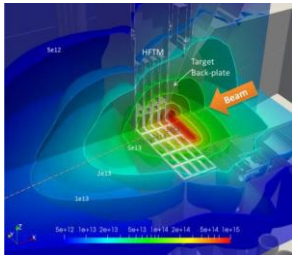


SIMMER: MSR Temperature Distribution

Contact: Dr. A. Rineiski

Neutronics and Nuclear Data (NK)

Nuclear analysis for design and safety of fusion facilities and accelerator driven neutron sources for energy and medical applications. Development of methods and codes for nuclear physics and neutronics calculations. Simulation support to radiological protection design. Evaluation, processing and validation of nuclear data including benchmark experiments and detector development. Development of dosimetry methodologies for innovative radiotherapy approaches.

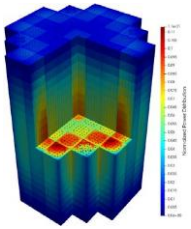


Neutron flux mapping in IFMIF-DONES

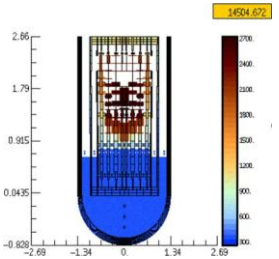
Contact: Dr. D. Leichtle, Dr. Y. Qiu

Reactor Physics and Dynamics (RPD)

Multi-physics/-scale calculation tools for the core and plant of LWR and SMRs under stationary and transient conditions. Development and validation of thermal hydraulic and neutronic codes for improved analysis of core transients.
Development and application of severe accident codes combined with tools for the estimation of the radiological impact of LWR, SMRs.
Uncertainty quantification methods.
Validation using test data from QUENCH, COSMOS, etc.



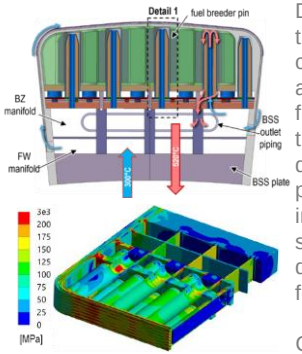
KANECS: 3D Pin power of NuScale-like core at Steady steate conditions



ASTEC: iPWR Design 1 Core behavior under Severe Accident

Contact: Dr. V. Sanchez,
Dr. F. Gabrielli

Design and Analyses of Nuclear Components, Manufacturing and Qualification (DAF)

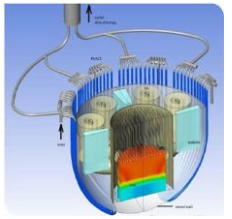


DEMO HCPB Breeding Blanket

Design and assessment of thermally highly loaded components for nuclear applications, with a focus on fusion. Core activities include thermal and structural analysis, qualification of fabrication processes in compliance with international design codes and standards, and the development of system codes for fusion power plants.

Contact: Dr. F. Hernandez,
Dr. I. Maione

Thermal-Hydraulic Simulations and Optimization (TSO)



Flow simulation of a lead cooled fission reactor

Development of models and three-dimensional simulation of local thermal-hydraulic processes in nuclear systems; multi-scale methods for innovative nuclear systems; validation and qualification of numerical simulation programs, e.g. for two- phase flow; analyses of complex experiments in circuits with gas, water or liquid metal as a coolant.

Contact: Prof. X. Cheng,
Dr. X. Jin

Complex Experiments, Experimental Design (KEK)

HELOKA facility with breeding blanket mockup

Experimental investigation of components for nuclear fusion applications subject to high heat flux loading. The HELOKA facility, that is operated by our group, can accommodate both helium- as well as water-cooled mock-ups providing unique testing possibilities.

Contact: Dr. B.-E. Ghidersa,
Dr. R. Krüßmann