Dr. Axel Klix
Institute of Neutron Physics and Reactor Technology
Karlsruhe Institute of Technology
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen
Germany

Neutronics experiments in support of the European fusion development program

Since many years the EU is conducting a dedicated R&D effort to provide the basis for the design of tests and experiments to be performed with the so called Test Blanket Modules (TBM) in the fusion reactor ITER (The Way) as well as for further development towards fusion power plants.
The talk presents an overview of neutronics experiments at Karlsruhe Institute of Technology, formerly Forschungszentrum Karlsruhe (FZK). Most of the experiments are done in collaboration with other leading European fusion research centers such as ENEA Frascati utilizing intense neutron generators. The neutron generators are based on the deuterium-tritium and deuterium-deuterium fusion reactions and produce neutron fields which are well characterized. Experiments focus on the radiation transport in mock-ups of the two design lines of the European TBM for ITER. Mock-ups of the Helium-Cooled Pebble Bed (HCPB) TBM and the Helium-Cooled Lithium-Lead (HCLL) TBM were irradiated with 14 MeV neutrons and tritium production rates in the tritium breeding layers, neutron and gamma-ray spectra were measured. The results of the experiments serve to check radiation transport codes and nuclear data libraries for their prediction accuracy of nuclear responses. The qualification of these codes and data is needed for the technical design of fusion reactors as well as for their licensing procedure.
The progress of the construction of ITER in Cadarache in southern France led to grown interest in neutronics instrumentation for the extremely harsh environment in the ITER TBMs. A considerable part of our current activity is devoted to the development and testing of suitable measurement methods and detectors for neutron flux, tritium production rate and others in the TBM. Particular R&D focus is on a neutron activation system, diamond and silicon carbide detectors, and self-powered neutron detectors. The current status of the work will be presented.