The intensive DT neutron generator of TU Dresden

Axel Klix[1], Toralf Döring[2], Dieter Leichtle[1], Marie Pichotta[3], Anton Wallner[2], Kai Zuber[3]

1 Karlsruhe Institute of Technology,
Institute for Neutron Physics and Reactor Technology
Eggenstein-Leopoldshafen, Germany

2 Helmholtz-Zentrum Dresden-Rossendorf
Accelerator Mass Spectroscopy and Isotope Research
Dresden, Germany

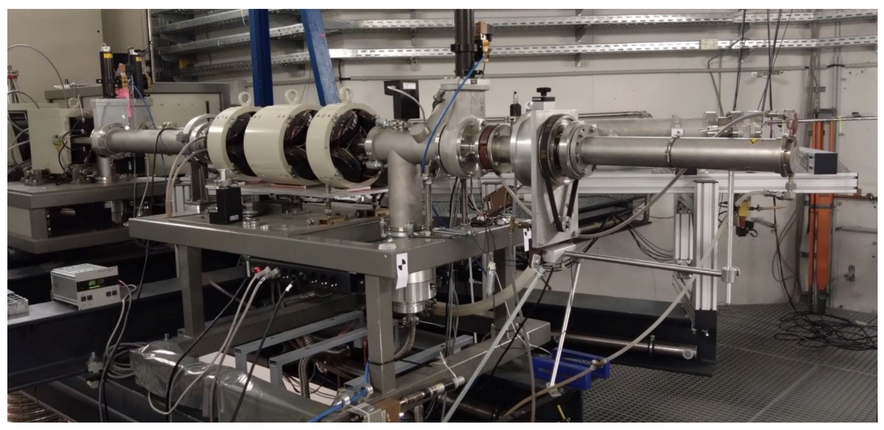
3 Technische Universität Dresden
Institute for Nuclear and Particle Physics
Dresden, Germany

Introduction

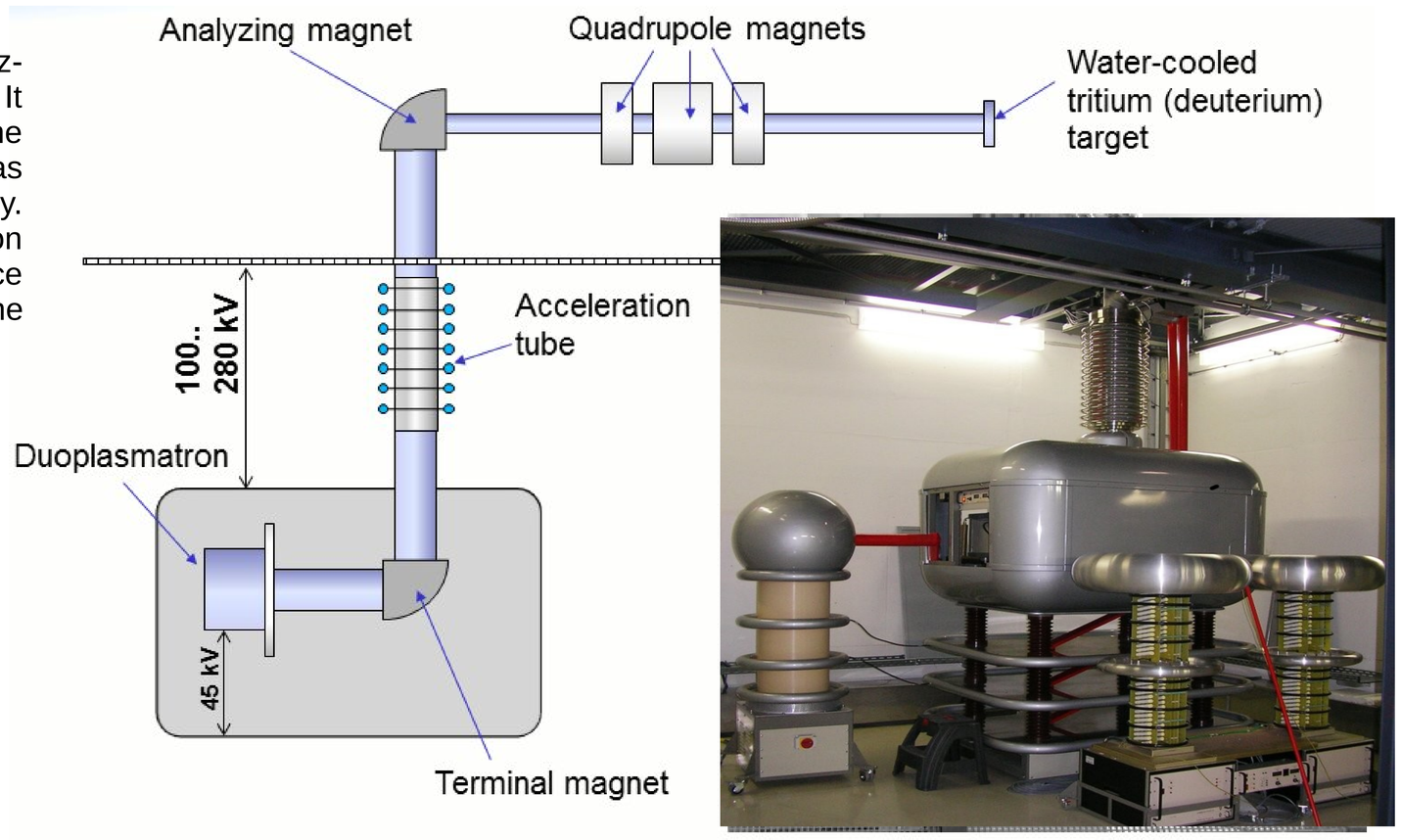
The neutron laboratory of TU Dresden, located at Helmholtz-Zentrum Dresden-Rossendorf, went into full operation in 2005. It was primarily designed for experiments in the frame of the European fusion technology program, however, work was expanded to other areas related to nuclear physics and technology. The heart of the laboratory is an accelerator based neutron generator with tritium and deuterium targets. An AmBe source (1.7×10^{11} Bq) and a ^{252}Cf source (5.0×10^{7} Bq) complement the available neutron fields.

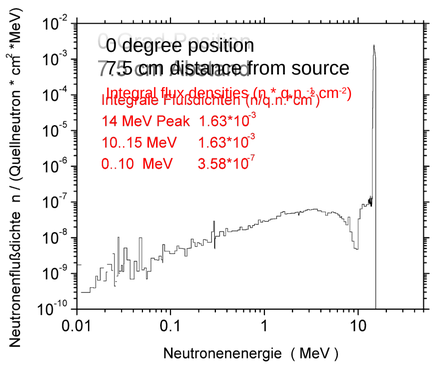
Neutron generator

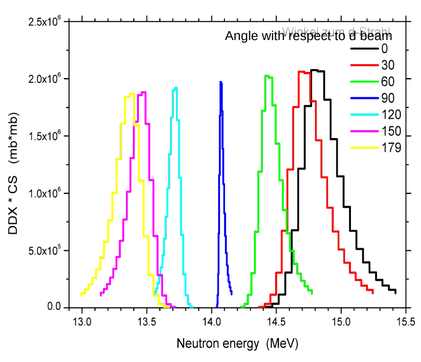
- Accelerator with Greinacher multiplier (Cockroft-Walton)
- Continuous and pulsed mode (µs available, ns upgradeable)
- Maximum d-beam current 8...10 mA, energy up to 345 keV
- Target in center of room, distance to walls more than 4 m



- Neutron energy ≈14.1 and 2.5 MeV
- Licensed up to 10^{12} s^{-1} (DT neutrons)
- Typical operation 10^{9} -10^{11} s^{-1}
- Nearly isotropic





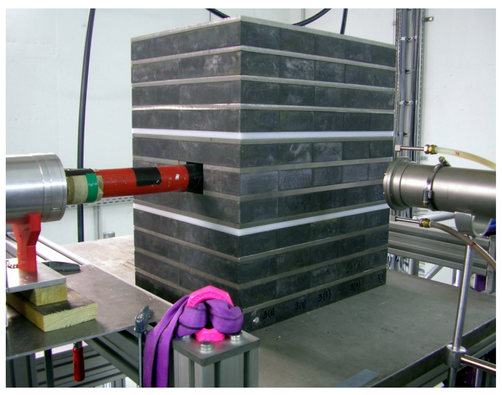


- Calculated spectrum of the DT neutron
- Assuming thick target and 320 keV deuteron energy
- Neglegible fraction of room-returned neutrons near the target
- reaction cross section measurement around 14 MeV

Applications to the development of nuclear fusion reactors

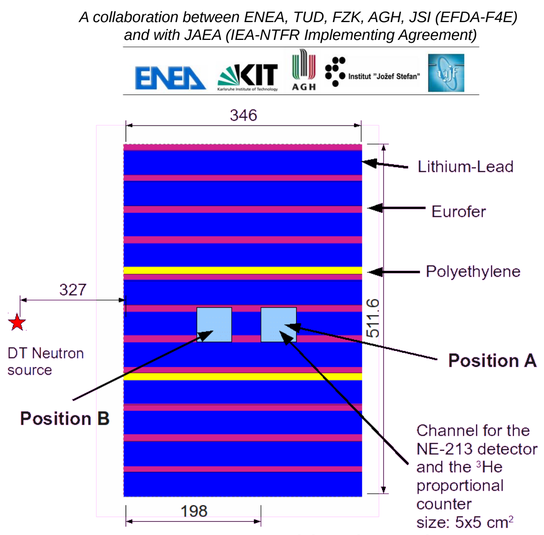
Breeding blanket mockup experiments

Helium-Cooled Lithium-Lead Test Blanket Module mockup



Left: NE-213 detector (1.5"x1.5 ")
Right: Ti-T target of neutron generator
Middle: Mock-up

A collaboration between ENEA, TUD, FZK, AGH, JSI (EFDA-F4E) and with JAEA (IEA-NTFR Implementing Agreement)



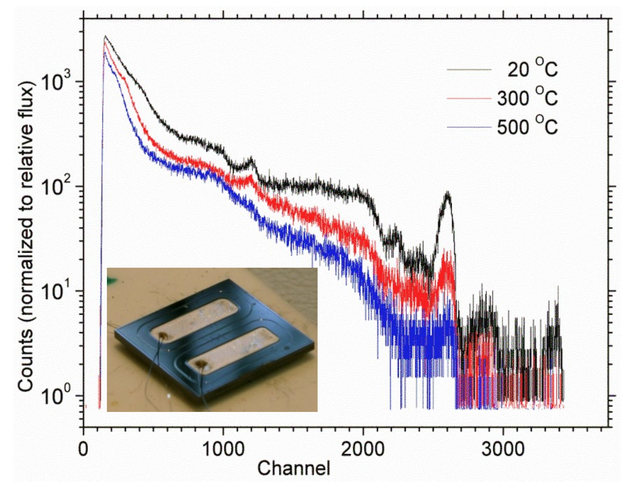
Two measurement position have been used. Only one channel was present at a time.

Detector development for ITER Test Blanket Modules and beyond

Silicon carbide detector

- I_SMART: Detectors for fast neutrons (plain SiC) and thermal neutrons (boron conversion layer) developed
- Funded by KIC InnoEnergy with the aim to develope a detector system
- Signal processing electronics based on SiC investigated

I_SMART
Collaboration between CEA, KIT, SCK*CEN, AMU, Univ. of Oslo, KTH, AGH



SiC detector without neutron converter at temperatures up to 500 °C.

Near-term experimental plans and facility development

- Further experiments with self-powered detectors at elevated temperatures
- Cross section measurements (for example ^{39}K(n,p)^{39}Ar), in particular for long-living products
- Investigation into feasibilty of radiochemical measurements with ESR
- Improvements on the tritium target assembly
  - higher fluence at 14 MeV
  - Reduction of influence of cooling water on neutron spectrum and flux
- Upgrade of neutron generator control system

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