The Remaining Nuclear Facilities at the Research Centre Jülich

Rudolf Printz

Forschungszentrum Jülich

➢ *Member of the Helmholtz Association*

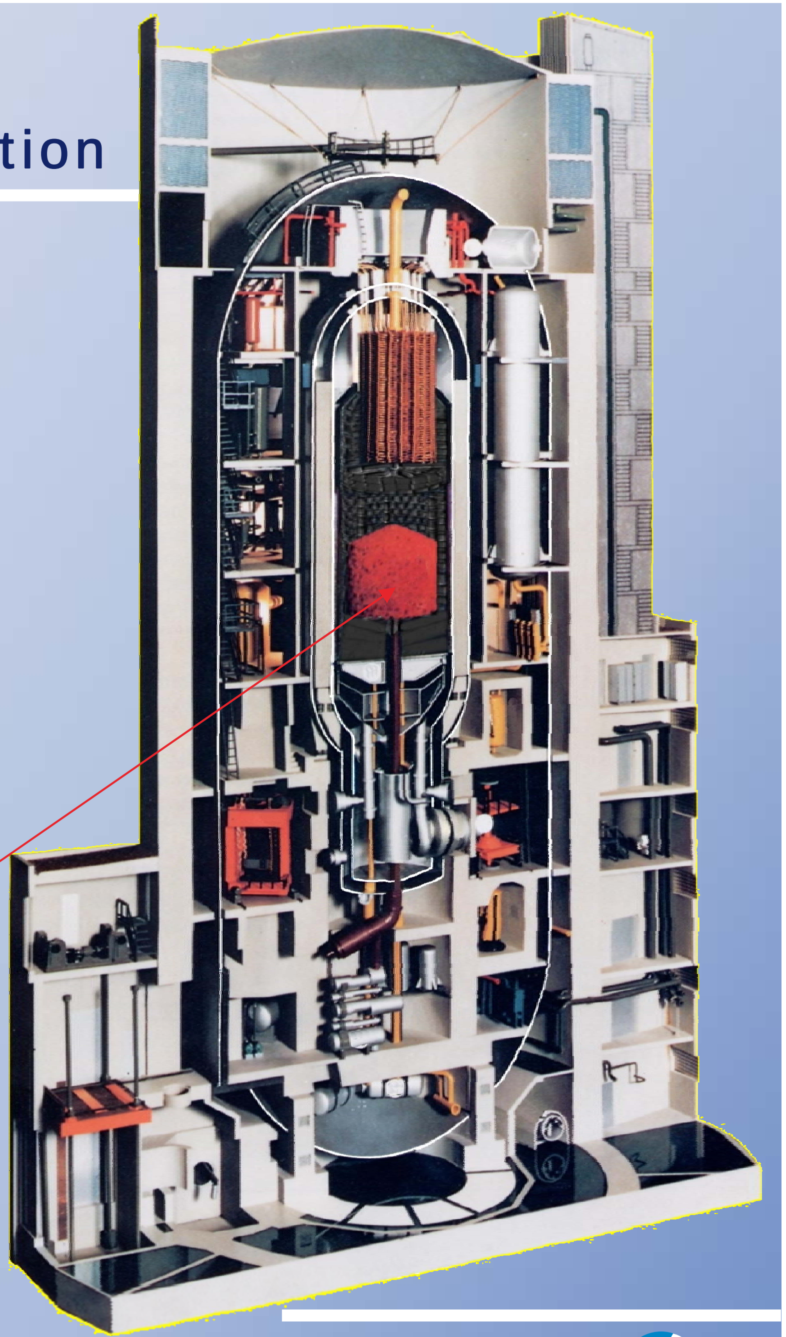
Outline

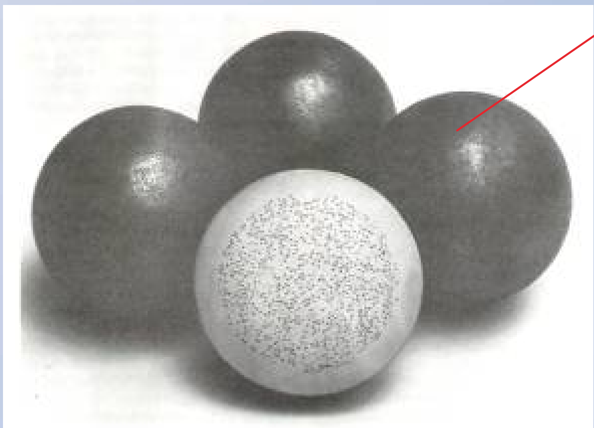
- Nuclear Research after Foundation
- Research and Development Today
- Status of the Nuclear Facilities
- Conclusions

Example of Nuclear Research

Gas-cooled high-temperature reactor technology:

Development of special components and several fuel-elements

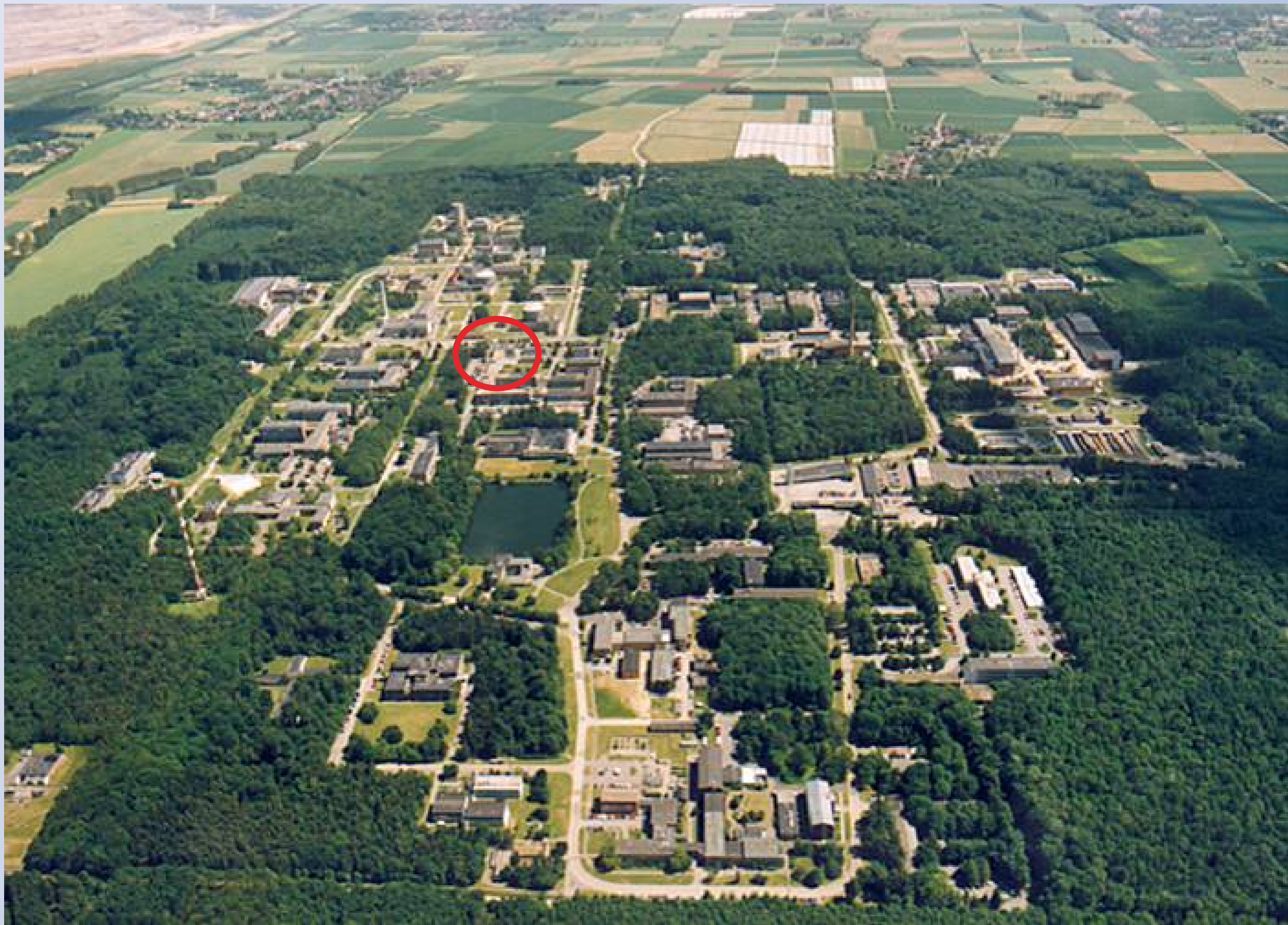




Nuclear Installations during the early years

- Institute of Reactor Materials
- Institute for Reactor Components
- Institute for Reactor Development
- Institute of Nuclear Chemistry
- Institute of Isotope Separation
- Research Reactor FRJ – 1 (MERLIN)
- Research Reactor FRJ – 2 (DIDO)
- Hot Cells

Research and Development Today



Forschungszentrum Jülich at a glance

Company	**Founded in: December 1956** **Legal form: limited liability company** **Area: 2.2 km^2**
Company partners	**Federal Republic of Germany (90%)** **Federal State of North Rhine-Westphalia (10%)**
structure	**12 departments (36 institutes)** **6 central departments**
budget	**365 million euros** (according to the 2005)

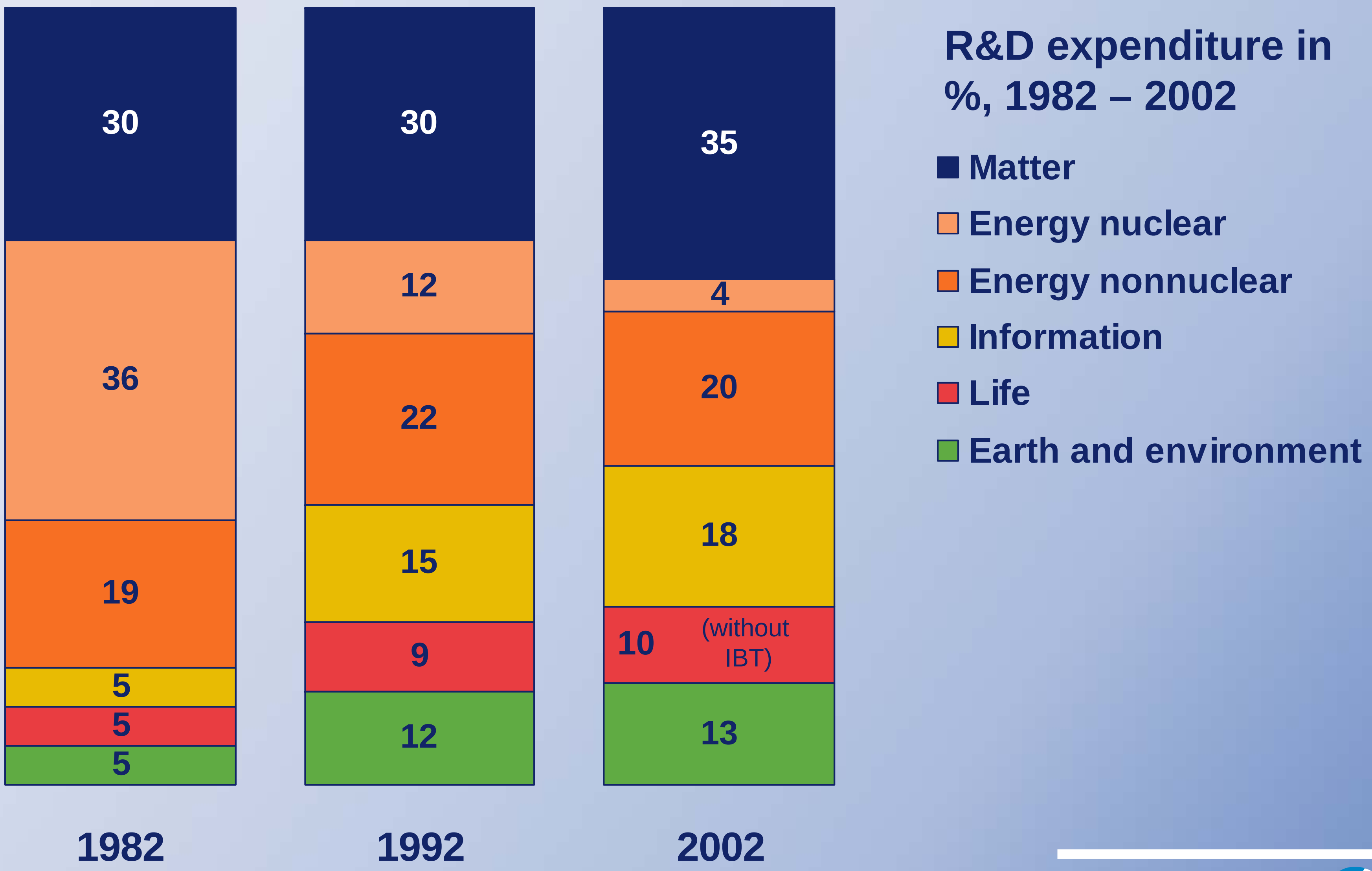
Forschungszentrum Jülich
at a glance




- **staff members total 4285**
  including
  - approx. 1200 scientists
  - 400 Ph.D. students (doctoral students)
  - 150 undergraduates
  - 370 trainees

- **visiting scientists**
  - more than 700 p.a. from 50 countries

Development of the Areas of Research



Present research areas (1)

- **Health** (bio- and neurosciences)

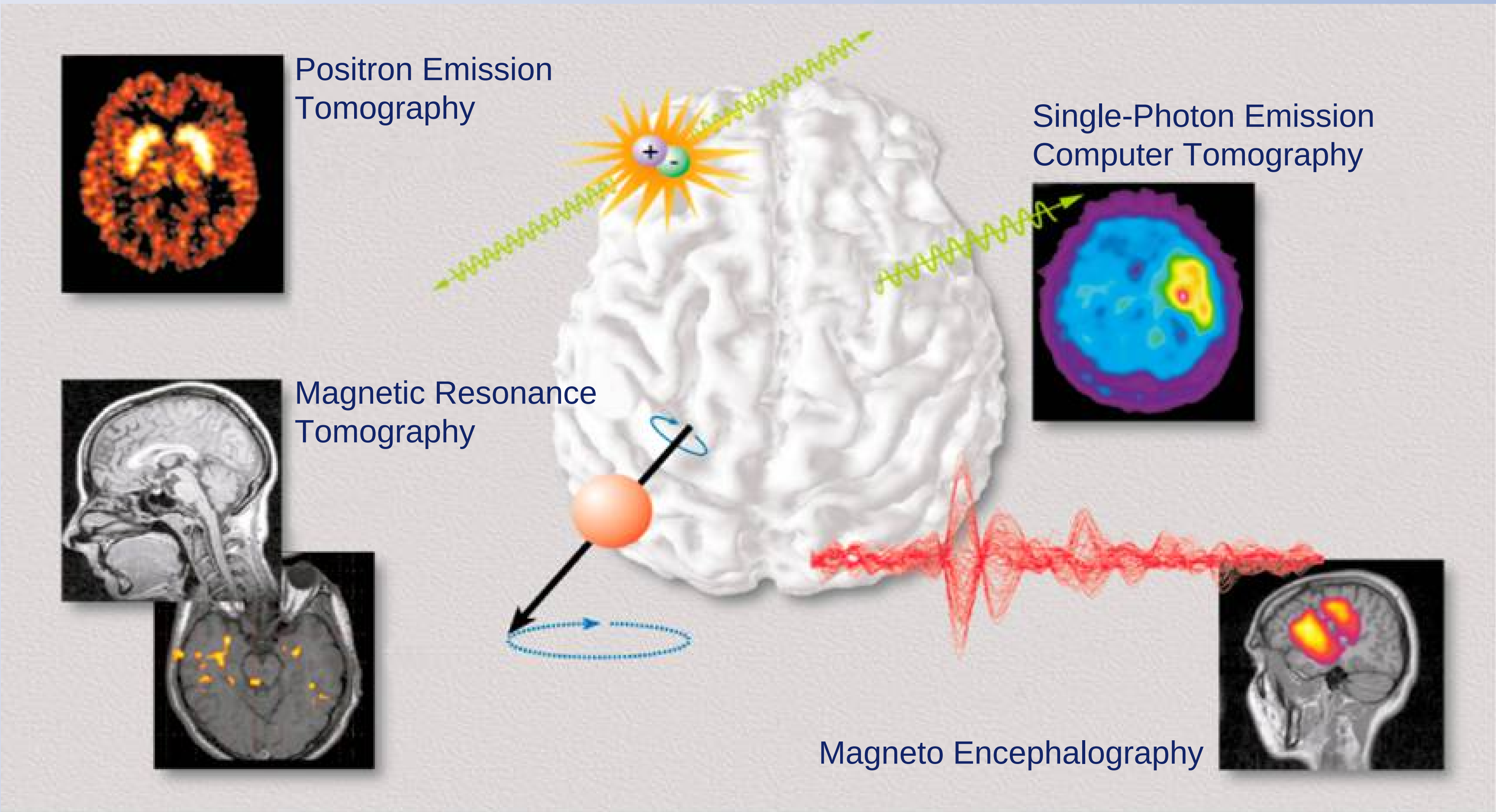
HGF* research field

Health

Neurosciences

Biotechnology

Large-Scale Equipment for Brain Research



Present research areas (2)

- **Environment** (atmospheric and geospheric research)

HGF* research field

Earth and Environment

Chemistry and Dynamics of the Geosphere

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Tour through the Geosphere Research

SAPHIR – Atmosphere Simulation Chamber

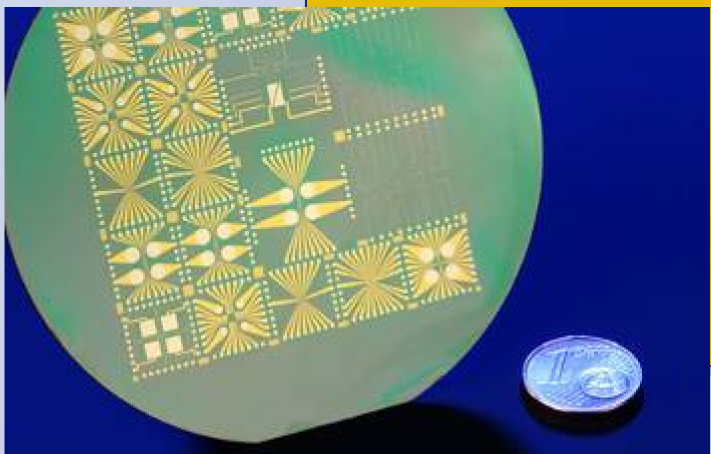
PhyTec – Experimental Plant Facility

Present research areas (3)

➢ **Information** (nanoelectric elements and systems)

HGF* research field

Information



Scientific Computing

Information Technology and Nanoelectronics

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- **Giant Magneto Resistance Effect**

results:
170 million magnetic sensors;
sales worth US$ 31 billion in 2000

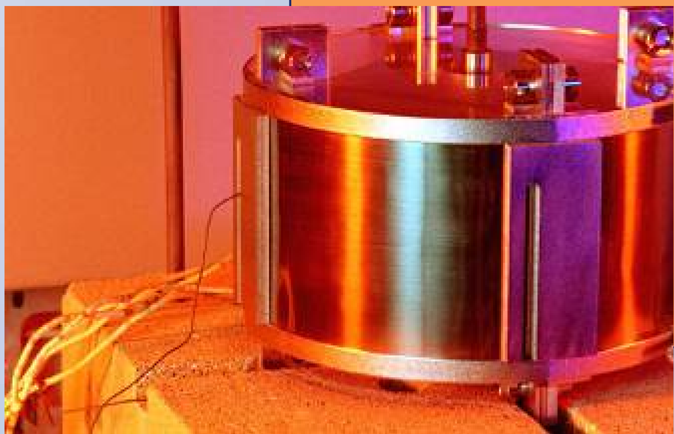
Present research areas (4)

- **Energy** (energy generation of the future, e. g. photovoltaics, fuel cells and nuclear fusion)

HGF* research field

Energy

- Photovoltaics
- Fuel Cells
- Power Plant Technologies
- Plasma Physics
- Nuclear Safety Research



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Nuclear institutes and facilities today

- Institute for Safety Research and Reactor Technology
- FRJ-1 Research Reactor (MERLIN)
- FRJ-2 Research Reactor (DIDO)
- Large Hot Cells (GHZ)
- Hot Materials Testing Laboratory (HML)
- Decontamination Department (DE)
- Radionuclide Laboratories






Institute for Safety Research and Reactor Technology

Major fields of work

- Nuclear safety research
  - ✓ Safety analysis of nuclear facilities
  - ✓ Safety experiments with components of nuclear facilities

- Nuclear waste management
  - ✓ Characterization of radioactive waste
  - ✓ Treatment and storage of radioactive substances
  - ✓ Radiochemical analysis of isotope mutation

Institute for Safety Research and Reactor Technology

Laboratory Building ISR

Hot Cells Building ISR

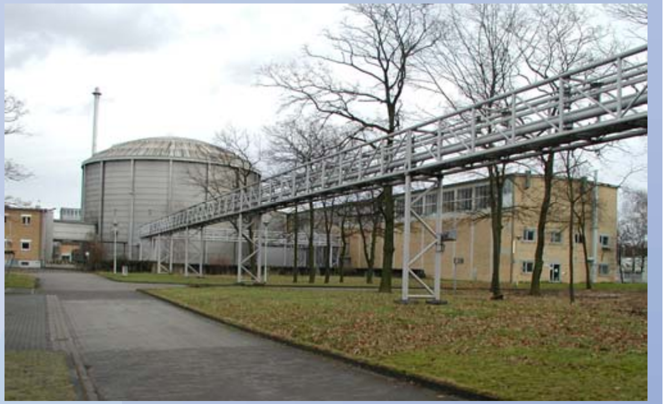
Research Reactors FRJ-1 (MERLIN)

Thermal Power :	10 MW
Reactor Type:	Pool reactor
Moderator:	H_2O
Thermal Neutron Flux (max.):	$1.1*10^{14}$ n/(cm² s)
Purpose (Function):	Neutron source for basic and applied research
Operation:	1962 – 1985
Finally shut down:	22 March 1985

(following transformation into safe enclosure and discharge of the fuel elements)

Safe enclosure:	1988 - 1996
Decommissioning:	since 1996
End of Decommissioning:	July 2007 (expected)

Research Reactors FRJ-2 (DIDO)



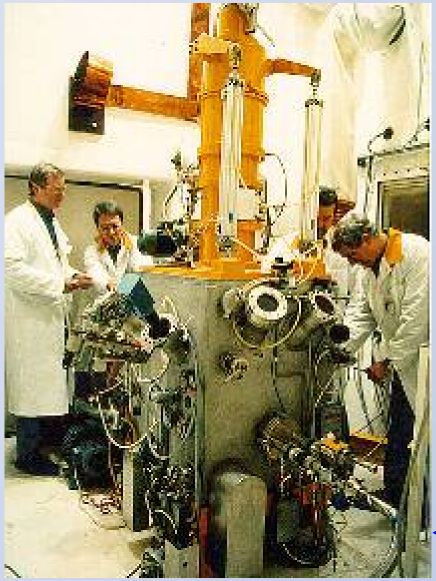
Thermal Power :	23 MW
Reactor Type:	Tank reactor
Moderator:	D_2O
Thermal Neutron Flux (max.):	$2.5 \cdot 10^{14}$ n/(cm² s)
Purpose (Function):	Neutron Source for basic and applied research
Operation:	11/1962 – 05/2006
Finally shut down:	2 May 2006
Post-operational phase:	05/2006 – 12/2008
Decommissioning (plan):	2009 - 2015

Large Hot Cells (GHZ)

Main task:

- **Disposal of about 200 experimental inserts from FRJ-2**
  (dismantling, cutting and packaging)
- **Material investigations with the JUDITH-1 facility**

GHZ building



JUDITH 1

Hot Materials Testing Laboratory (HML)

Main task:

- **Material investigations on irradiated and unirradiated specimens**
  (especially for future fusion plants)

Decontamination Department

Main tasks:

- **Treatment of radioactive waste**
- **Interim storage of radioactive waste**

Decontamination Department

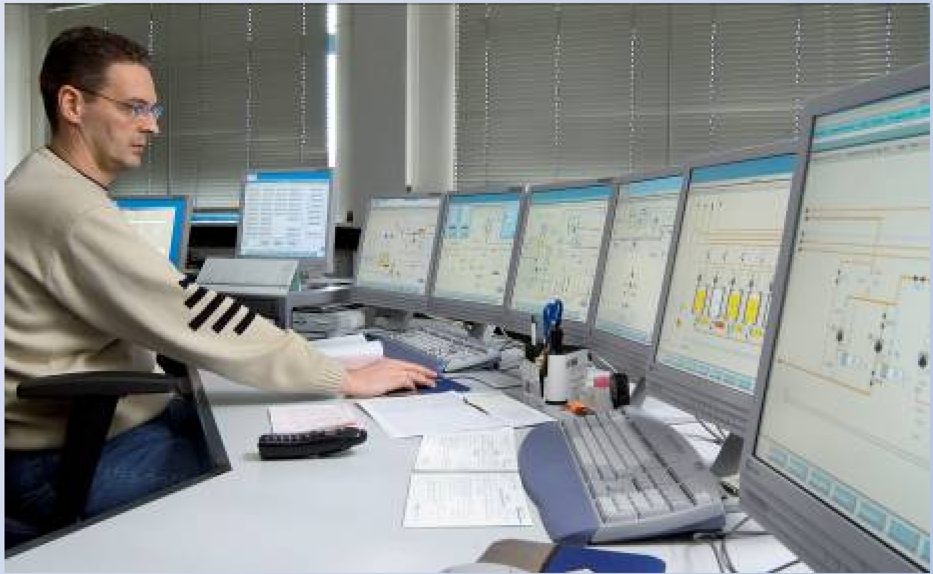
➢ Treatment facilities (1)

- ✓ Tank farm **and** evaporator unit **for low level radioactive waste water**

Decontamination Department

➢ Treatment facilities (2)

✓ Drier unit **for low-level radioactive concentrates/sludges**



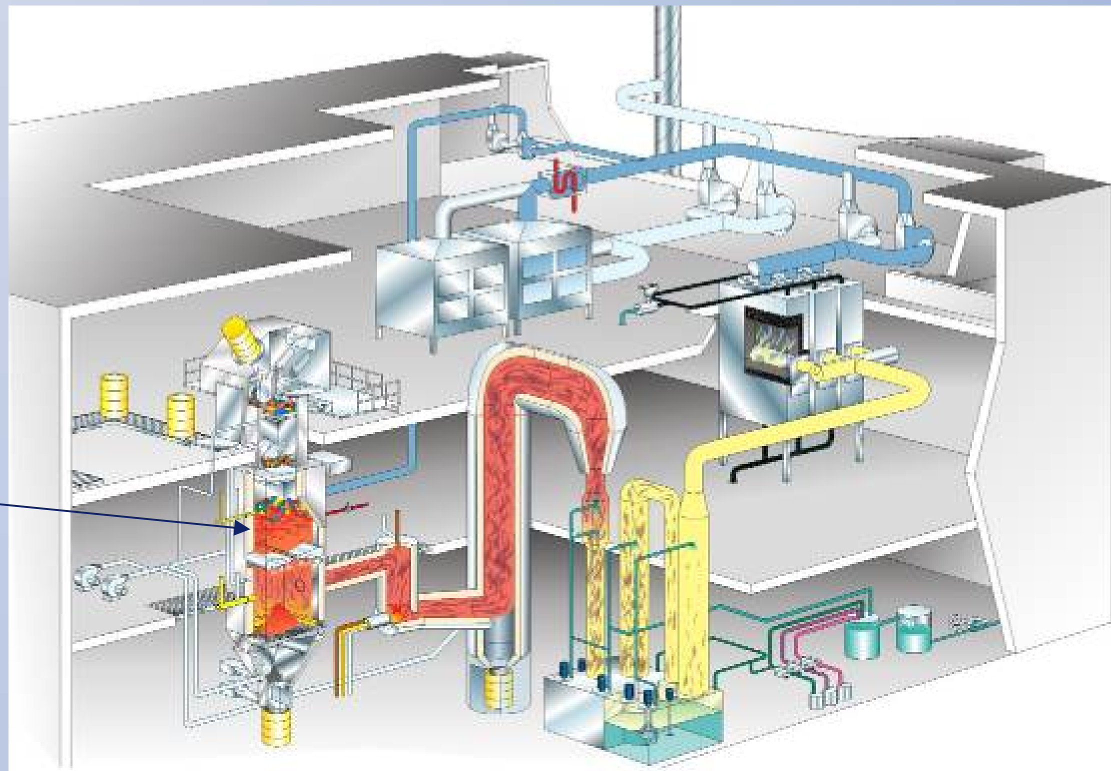
Control room of the evaporator and drier unit

Fluidized bed drier

Decontamination Department

➢ Treatment facilities (3)

✓ Incinerator **for low-level solid and liquid radioactive waste**



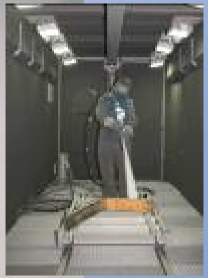
decontamination bath

Decontamination Department

- **Treatment facilities (4)**
  - ✓ Disassembly systems **for radioactive components**
  - ✓ Decontaminations units **for radioactively contaminated components**

Working cabin

Shot blasting cabin



Status of the Nuclear Facilities

Decontamination Department

- **Storage facilities:**
  - **Interim storage for radioactive low-level waste**
  - **Interim storage for radioactive intermediate-level waste**
  - **Interim storage for spent fuel elements** (AVR fuel elements)




Conclusions

- **The research areas of the research centre have changed considerably since their foundation**
- **Non-nuclear projects dominate research today**
- **The Institute for Safety Research and Reactor Technology is the only remaining nuclear scientifically oriented department**
- **Most of the formerly nuclear facilities are out of order and partly decommissioned or will be dismantled**
- **Only some nuclear infrastructure facilities are in operation**

Thank you for your attention

Summary of Session 1 -Infrastructure, Refurbishment, Decommissioning

chaired by
Håkon Jenssen (IFE, Norway) and Lars Roobol (NRG, Petten, Netherland)

In this session six presentations were given, describing infrastructure, refurbishment and decommissioning of old hot cells with the aim to meet new demands.

B.C.Oberländer gave the first presentation. She described fire technical and health physics improvements in the fuel production facilities at the IFE hot laboratory. To meet new demands the building and facilities had underwent a fire technical and health physics upgrading due to enhanced requirements of facility safety, preparation for a new licensing period and demands on experimental fuel for testing in the HBWR.

The fire technical improvements were related to installation of water mist sprinkler system, fire resistant walls, fire resistant insulation of pipes and cable trays penetrating compartment walls and fire resistant HEPA filter in the cells. A new radiation monitoring system is now installed at the facility. The RaMona system includes both stationary and portable monitors connected both to the hot laboratory and the radiation protection/health physics department.

C.Montandon gave the second presentation. He described a virtual reality environment simulation system utilised in relation to hazardous working sites. The French Nuclear Agency (CEA-LIST) started a few years ago the CHAVIR program in order to develop a software tool for simulation of invention in nuclear working sites. One important use of the system is for operator training in a safe virtual world, before achieving the real interventions within hazardous facilities.

The third presentation given by L.Roobol dealt with semi-long-term storage of uranium containing waste from molybdenum production. In Petten, molybdenum is produced in HFR by irradiation of highly enriched uranium. The fission products are freed from uranium, and molybdenum is extracted. The uranium/waste are transported to the HABOG facility for political reasons. The presentation described the engineering and licensing steps in order to get the waste into HABOG.

K.Dylst gave the fourth presentation about refurbishment of the tritium laboratories at the SCK•CEN. The tritium laboratories were first commissioned in 1975 for a maximum inventory of 37 TBq. With the aim to improve the infrastructure, capabilities and the safety, it was decided to refurbish the laboratories. The paper described the ongoing refurbishment of two tritium laboratories. The new layout provides more and better work areas. Also, the decommissioning required a strategy for disposal or free release.

The fifth presentation given by J.P.Grandjean was about the LECA (Cadarache) refurbishment project. The presentation described two different methods for improving contamination confinement when refurbishing hot cells. During the refurbishment it was necessary to improve contamination confinement inside hot cells to comply with new safety rules. For the largest cells in the facility, work was concentrated on tracking down any leaks, e.g. between different parts of the cell roof and of all shielded plugs in the walls. New equipments (e.g. filters, manipulators, crane units) were designed to minimize leakage. For the second method, a leak-proof stainless steel box was installed inside the smallest cells for improving the containment and allowing an easier decontamination later on. The general conclusion is that refurbishment strategy should take several parameters into account, e.g. initial contamination level, future experiment to be carried out in the cell and installation of new equipment set-up.

D.Delnooz gave the last presentation. He described a system for software control of hot cells for mechanical operations and sample preparation at the SCK•CEN. The technology is based on PLC in combination with LCD windows touch screens. The system should be applicable on every hot cell in the future. The system is reliable and quick and easy to operate. The utilisation of the system is both automatic and manual.