

Development, design & technology of neutron scattering instruments by ZAT

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Overview

- FRM II Garching - Overview
- ZAT-Projects at the research reactor FRM II in Garching
 - Some current developments and new options for the neutron scattering instruments in Garching
- Neutron Spin Echo Spectrometer for SNS in Oak Ridge (USA)
- Summary

FRM II in Garching



Neutron Guide Hall
East

Reactor building
FRM II

Neutron Guide Hall
West

Reactor building
FRM I

ZAT projects at the research reactor FRM II in Garching

- Upgraded instruments moved from Dido reactor at FZJ to FRM II in Garching
- New instruments development and manufacture by ZAT
- New beam hole plug SR5

Moved and upgraded instruments

Neutron Guide Hall West



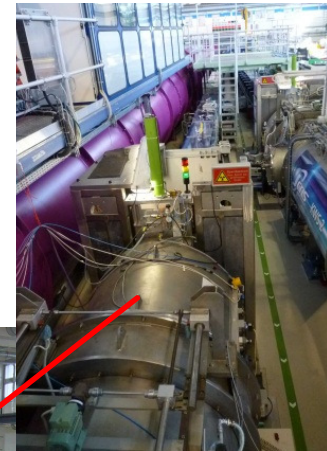
J-NSE



KWS 3



KWS 2



KWS 1

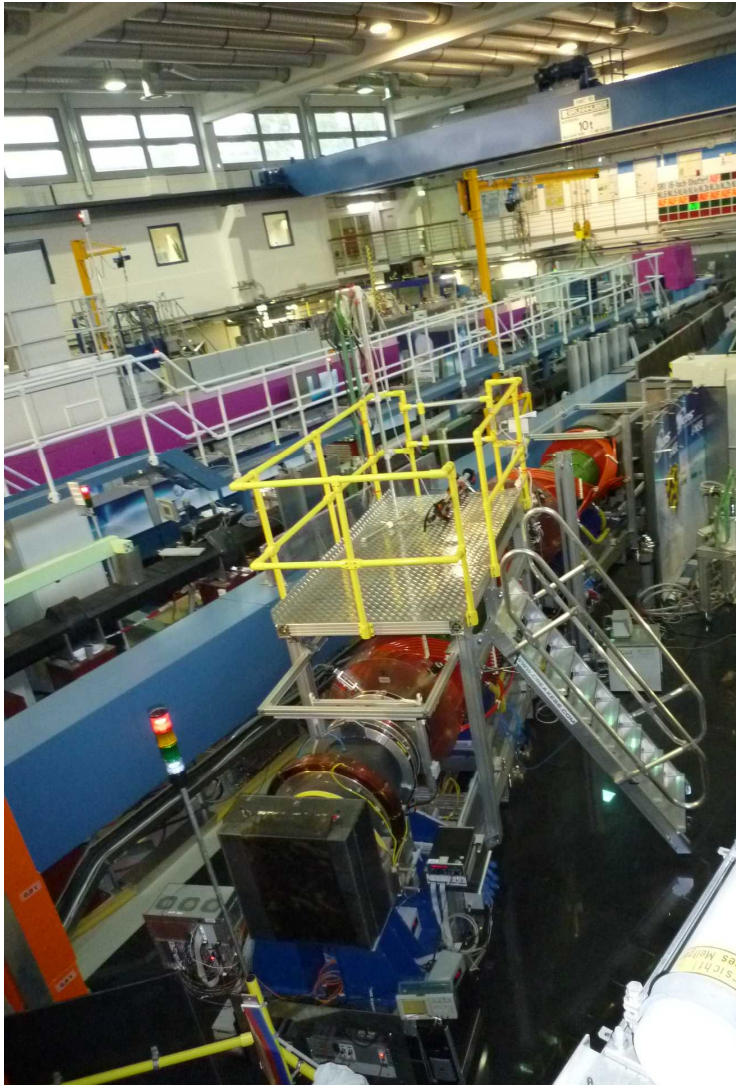


DNS

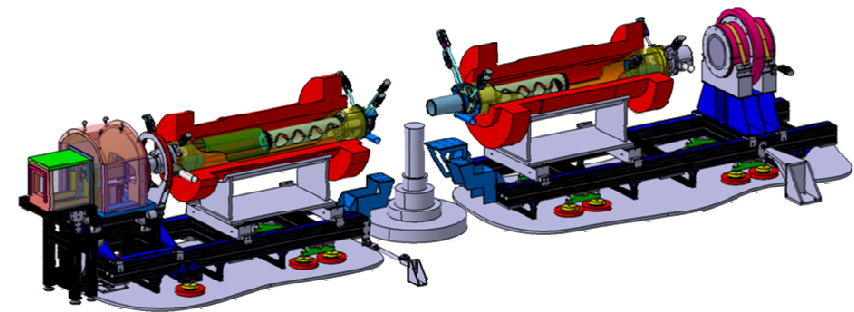


J-NSE

Juelich - Neutron Spin Echo Spectrometer

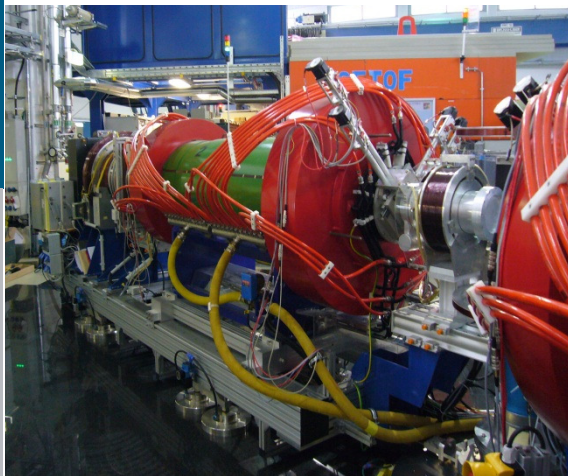


Tool to study slow dynamics in soft matter, glasses, magnetic materials, and biological systems at highest energy resolution

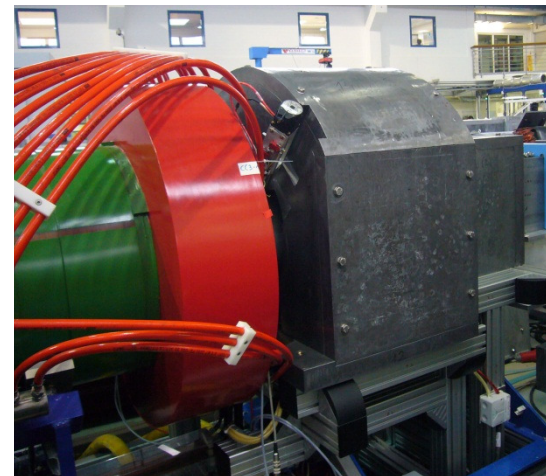


NSE

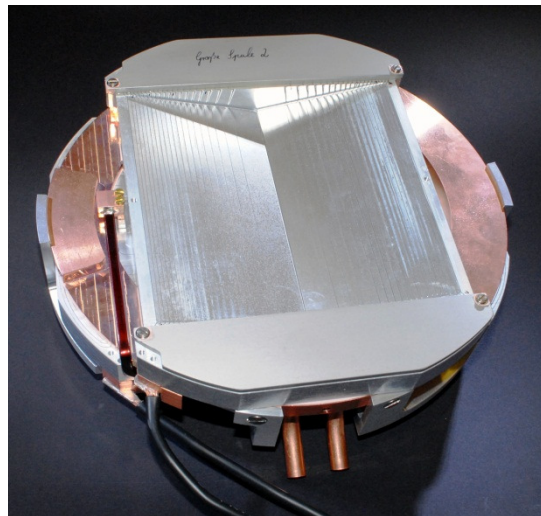
ZAT Developments und Modifications



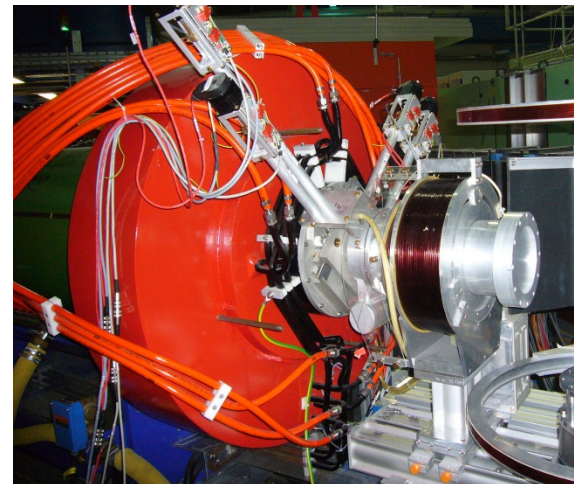
Adaptation of the support system to the new neutron beam height
(beam height at FRMII about 270mm lower than by DIDO)



Shielding for polarizer and drive polarizer adjustment



Development of correction coil



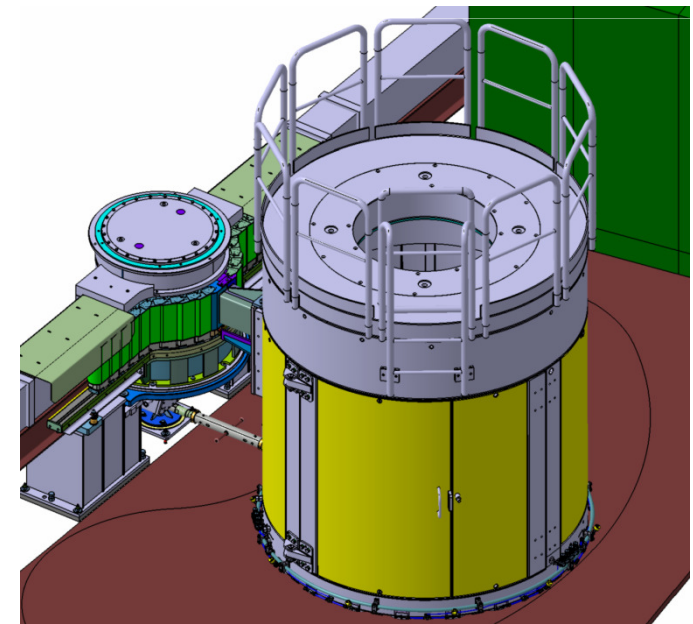
Double correction coil adjustment for two independent XY systems.

DNS

Diffuse Neutron Scattering Spectrometer

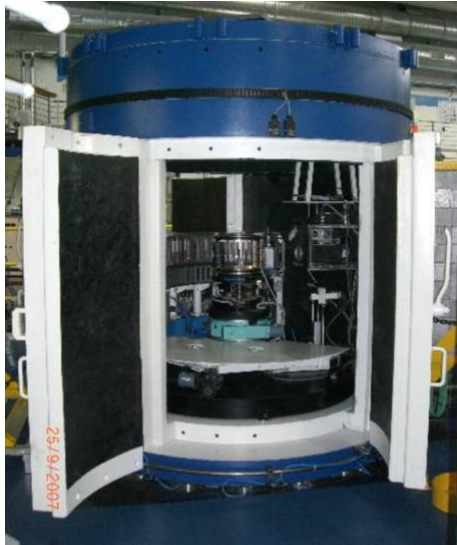


Tool to study magnetic structure,
superconductivity and
diffuse scattering



DNS

ZAT-Developments und Modifications



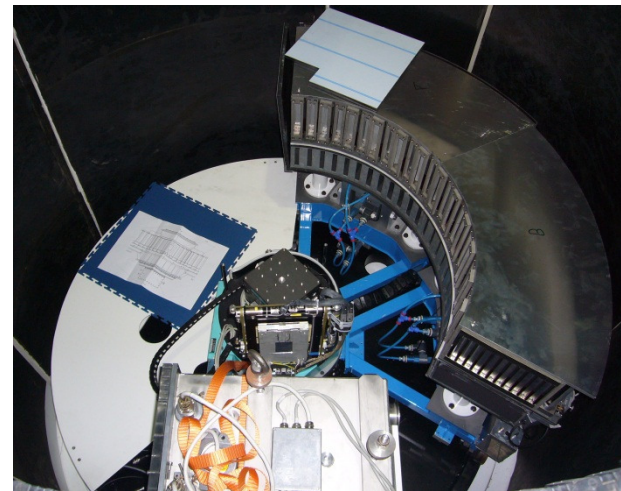
**Modification of
detector housing**



**Air cushion feet
for manual
movement of the
detector housing
12 t (weight)**



**Monochromator burg
with lead shielding
curtain and air flight
tube**



**Detector bank
fixture in the
detector housing**

KWS 1, KWS 2, and KWS3

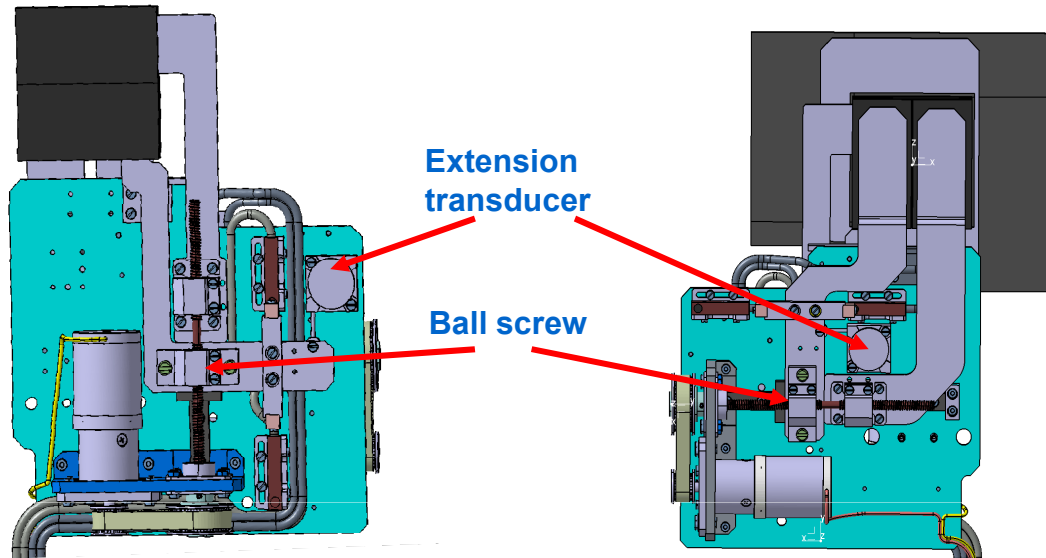
Klein-Winkel-Streuapparatur (Small-angle neutron scattering instrument)



Tool to study structures and particles in the nano- to micrometer range in soft matter, material sciences, and biology

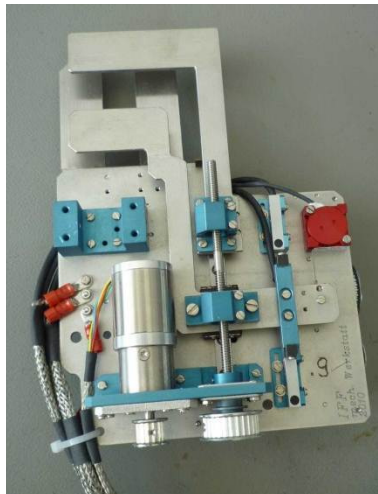
KWS 1 and KWS 2

ZAT Developments and Modifications

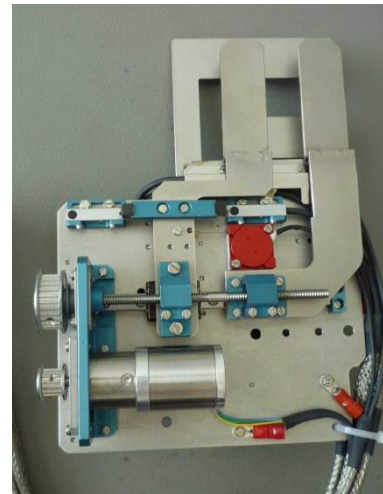


Development of a motor-adjustable aperture for use in vacuum (in close cooperation with JCNS workshop).

Opening of boron carbide blade
0 – 50 mm (continuous)



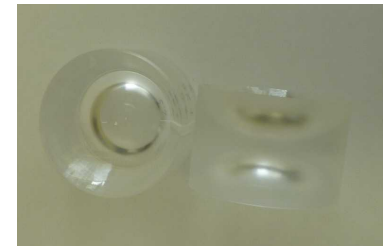
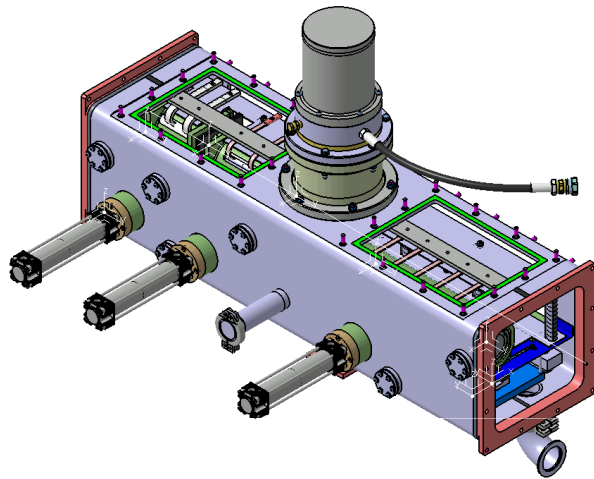
Front view



Back view

KWS 1 and KWS 2

ZAT Developments and Modifications



Development of lenses system

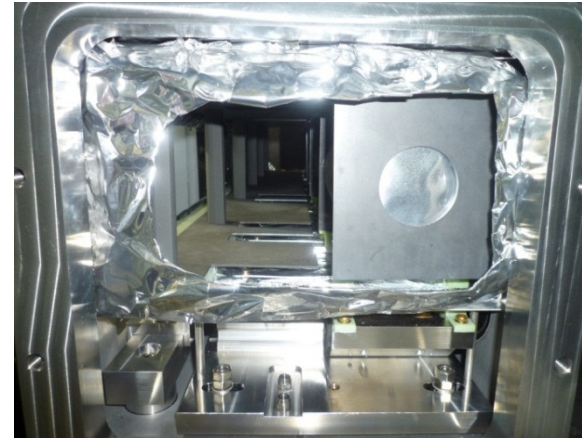
- 26 concave lenses from magnesium fluoride – single crystal (MgF_2)
divided into three units (with 4, 6, 16 lenses, respectively)
- Lenses cooled by a pulse tube cooler to about 70 K

KWS 1 and KWS 2

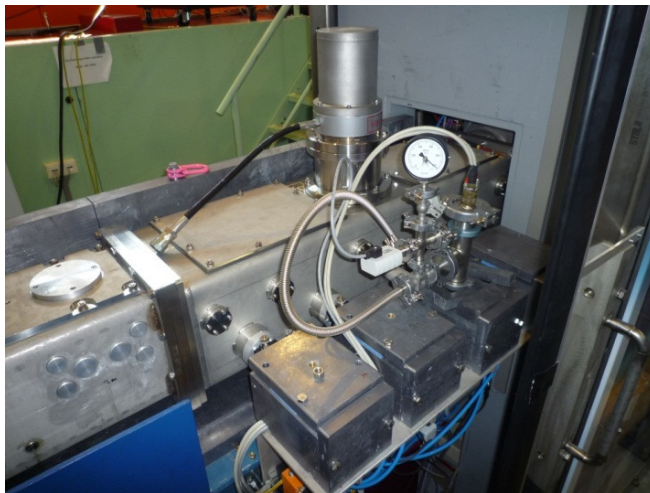
ZAT Developments and Modifications



**Construction of lenses unit in
der NG-Hall west**



Construction of insulation

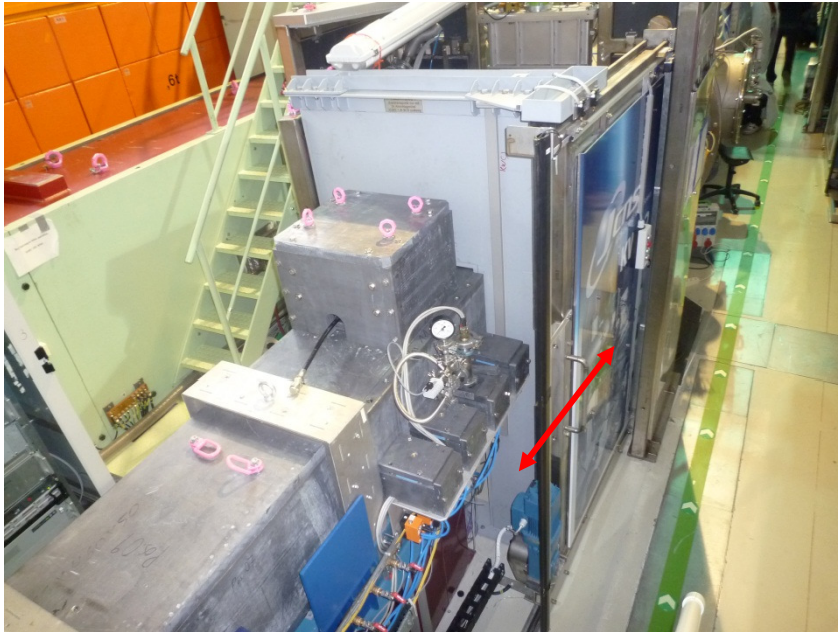


Lenses unit built in NG-Hall west



KWS 1 and KWS 2

ZAT Developments and Modifications



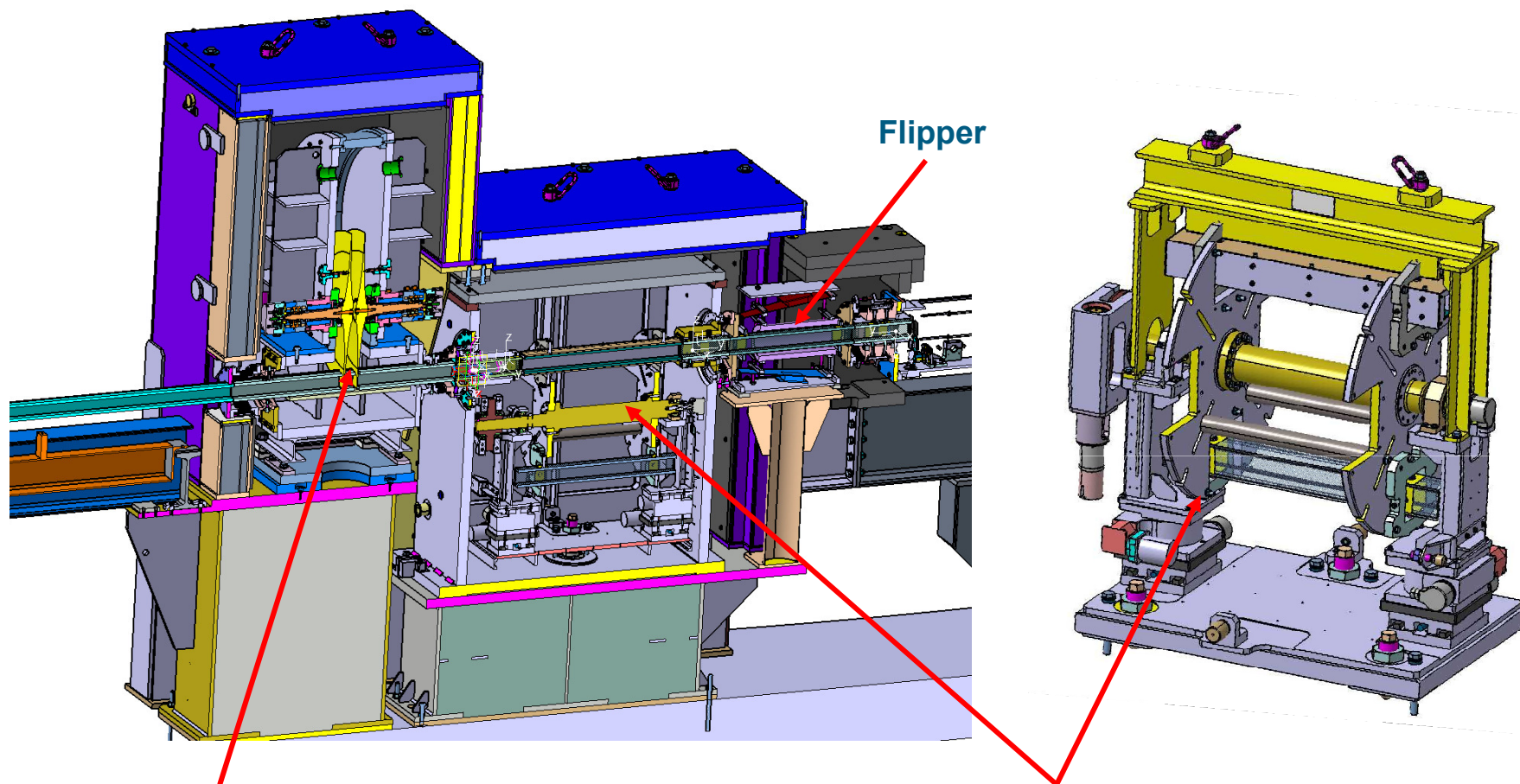
Mobile shielding at the sample position
(The shielding door can be moved by drive)



New double-disk Chopper
12,000 rpm, Disk diameter 620 mm

KWS 1

ZAT Developments and Modifications



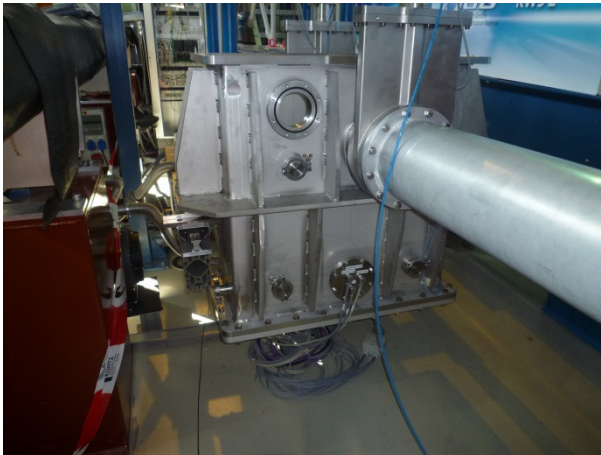
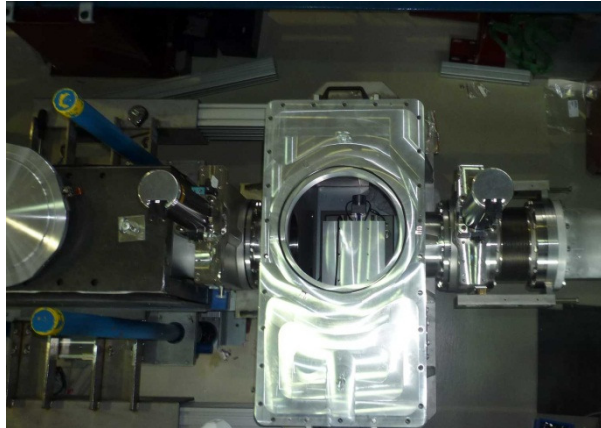
Double-disk chopper

12,000 rpm, Disk diameter 620 mm

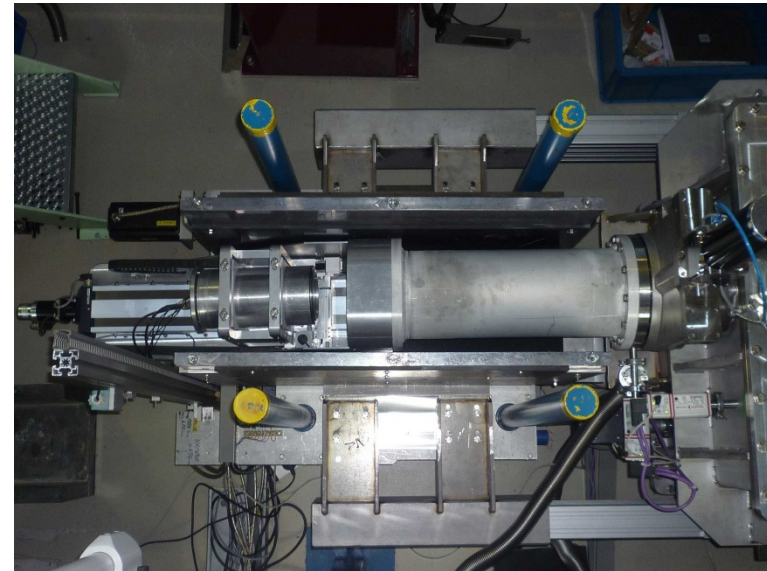
Polarizer Revolver

KWS 3

ZAT Developments and Modifications

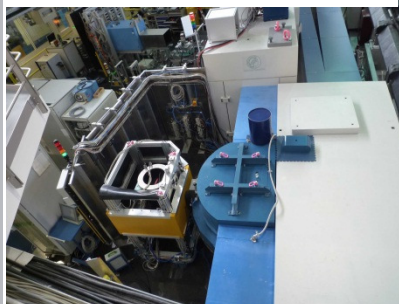


Second sample chamber



Mobile holding frame for Detector

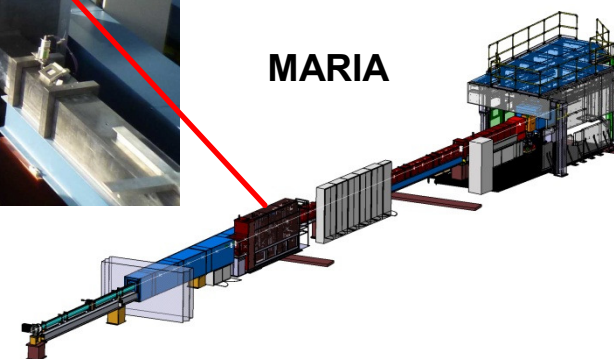
New Instruments Neutron Guide Hall West



Bio-Diff



Spheres



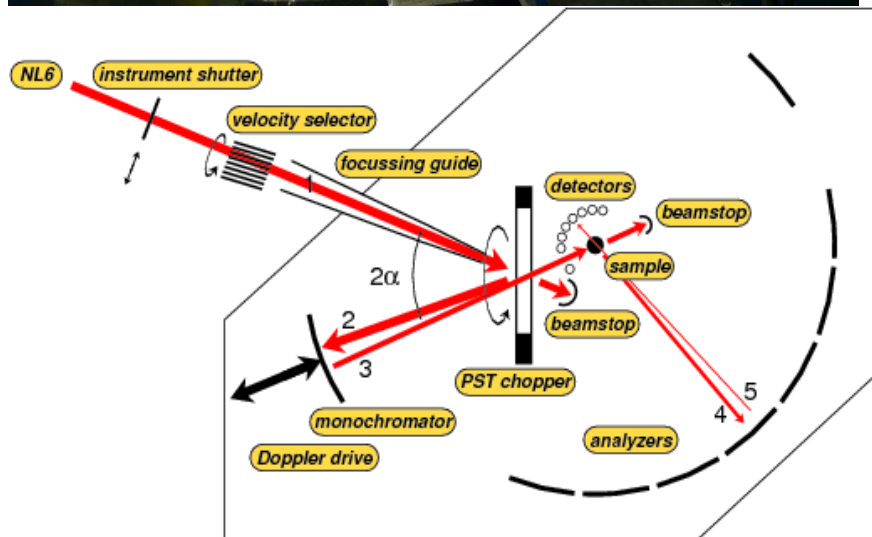
MARIA

SPHERES

Spectrometer for High Energy Resolution

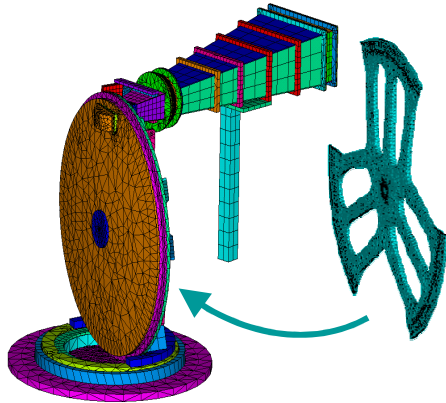


The neutron backscattering spectrometer for the study of dynamics in soft matter, glasses, magnetic materials, and biological systems at high energy resolution



SPHERES

ZAT Developments



PST Chopper (Phase-Space-Transformation chopper)

Development and calculation of chopper disk

Vibration analysis



PST Chopper

Accelerate or brake of neutron flux through reflection from graphite crystals

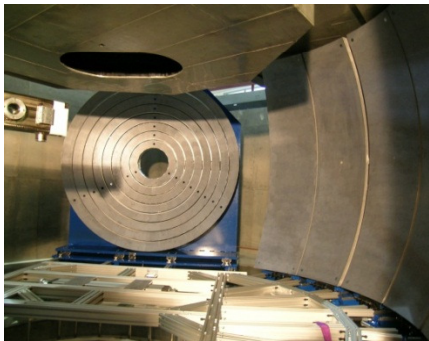
Disk diameter 1280 mm

Revolutions per minute 1600

Speed of graphite crystals 100 m/s

Cooperation ZAT, JCNS, EAAT Chemnitz,

Cerobear Herzogenrath

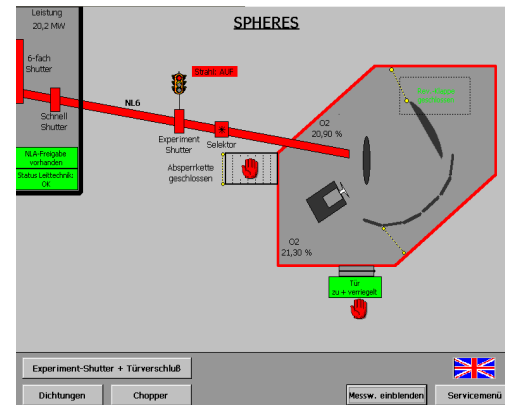


Analyzer ring and analyzer shell



Doppler drive

Cooperation ZAT and AeroLas Unterhaching



Monitoring and control using a fail-safe programmable logic controller

MARIA

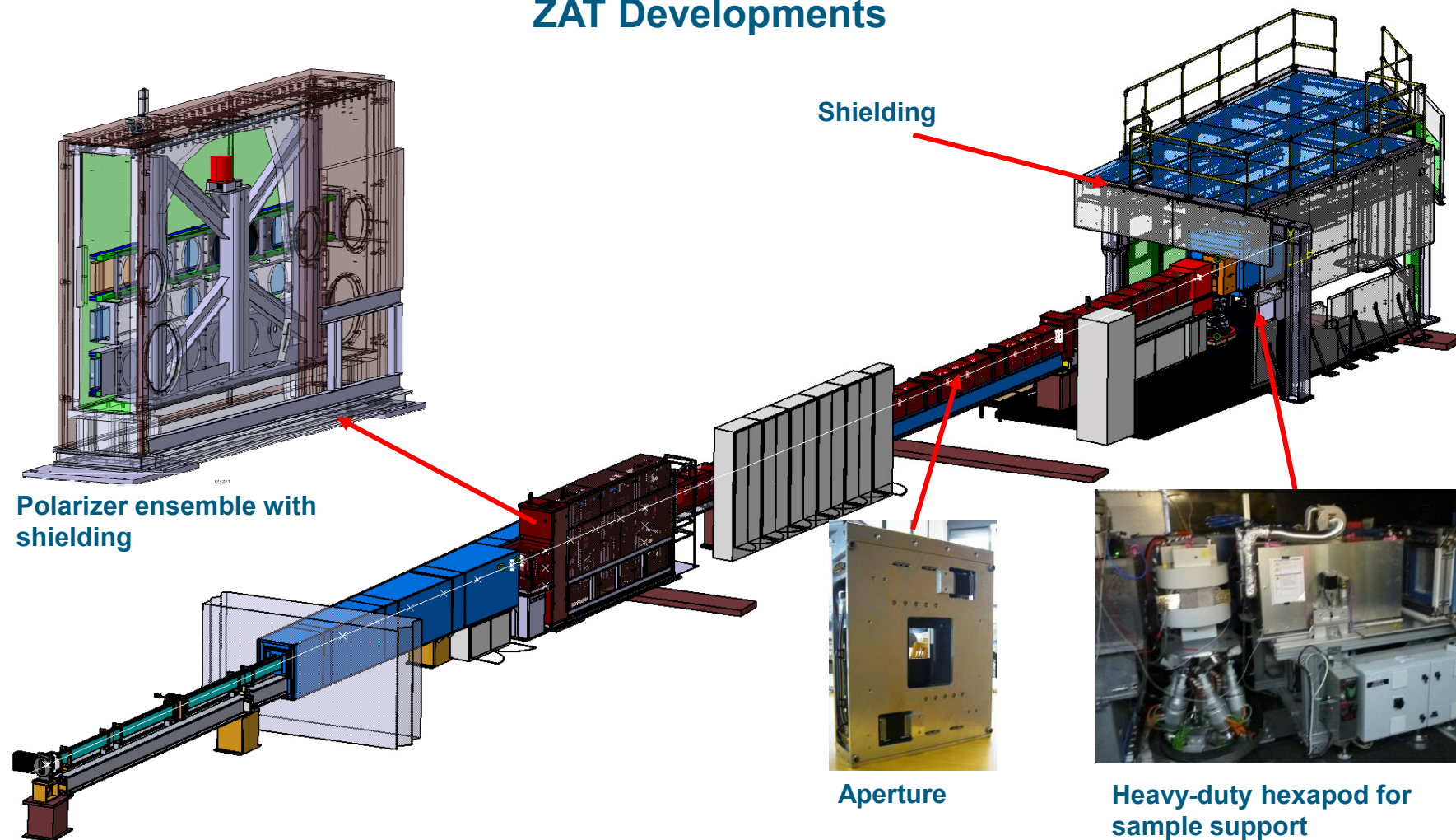
Magnetism Reflectometer with Incident Angle



Tool to study surfaces and interfaces in soft matter, magnetism, material sciences, and biology

MARIA

ZAT Developments



Polarizer ensemble with shielding

Shielding



Aperture

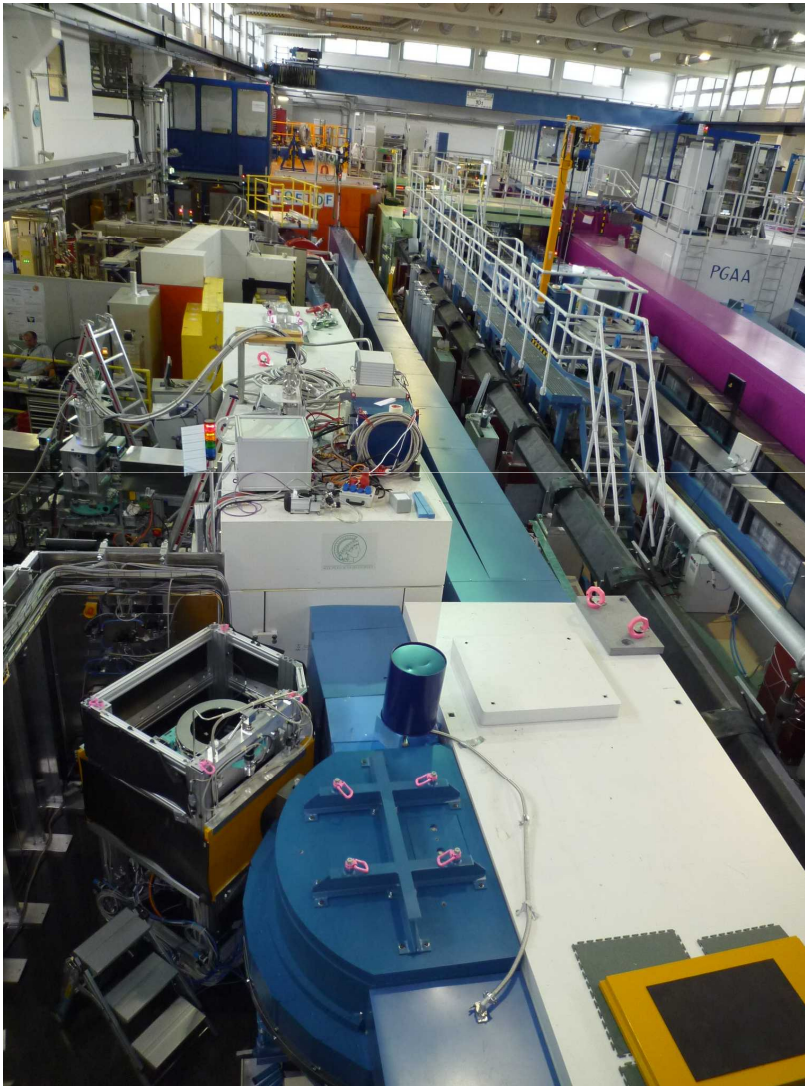


Heavy-duty hexapod for sample support

In cooperation with
OHE Hagenbuch (CH) company

Bio-Diff

Bio-Diffractometer

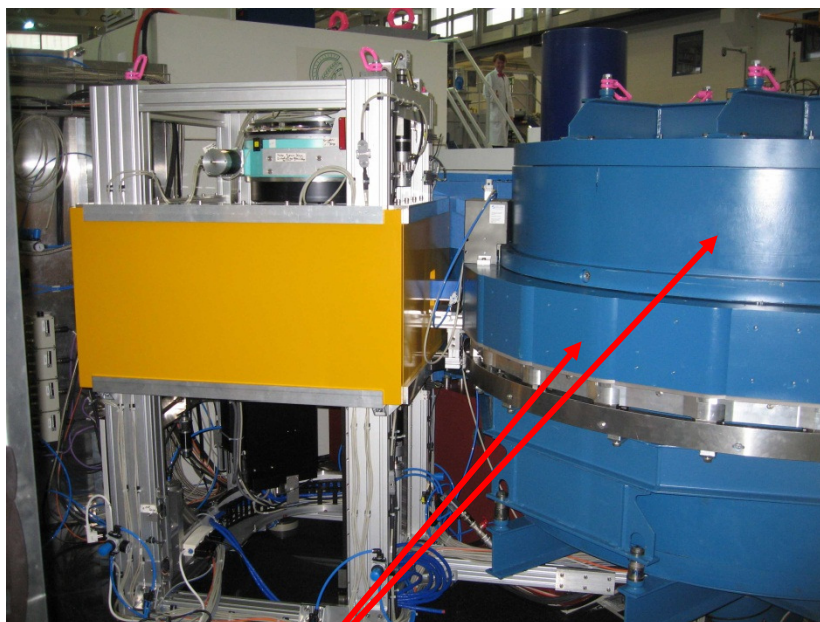


The single crystal diffractometer for structural analysis of proteins - especially the determination of hydrogen atom positions

The instrument is a joint project of the FRM II and the FZJ

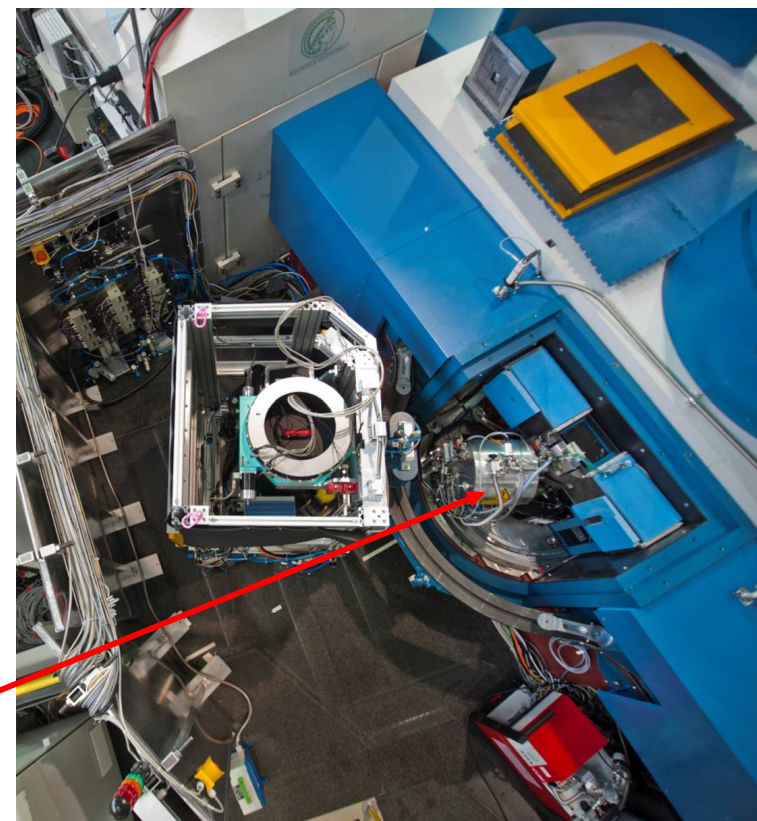
Bio-Diff

ZAT Developments



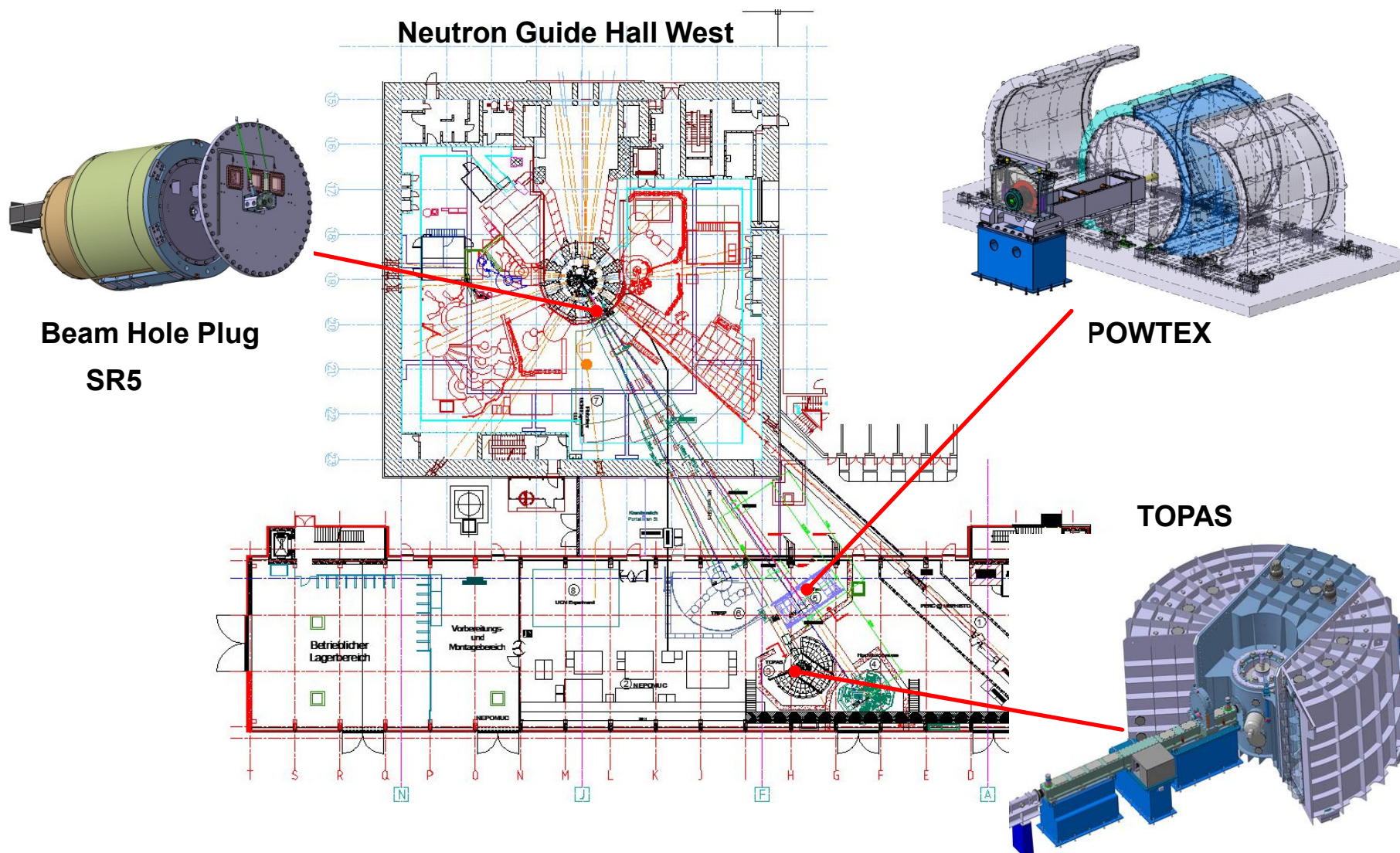
**Monochromator burg
with lead shielding
curtain**

**Selector pivoting
device**



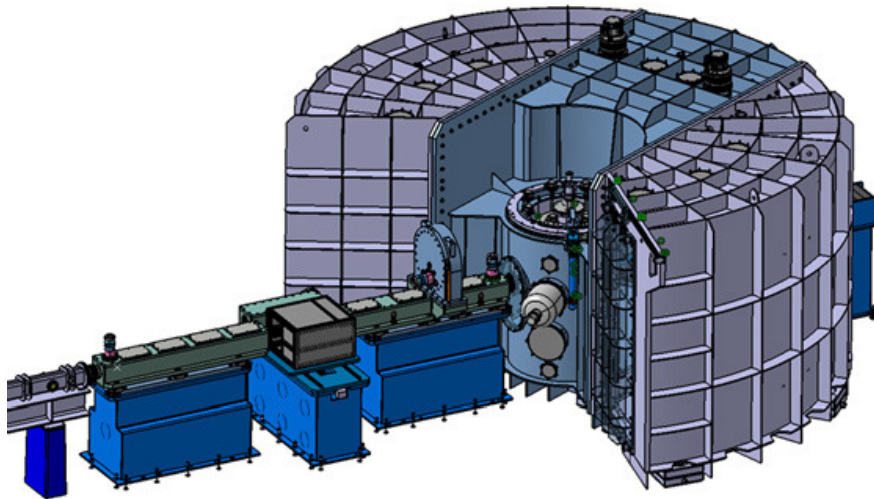
New Projects

Neutron Guide Hall East

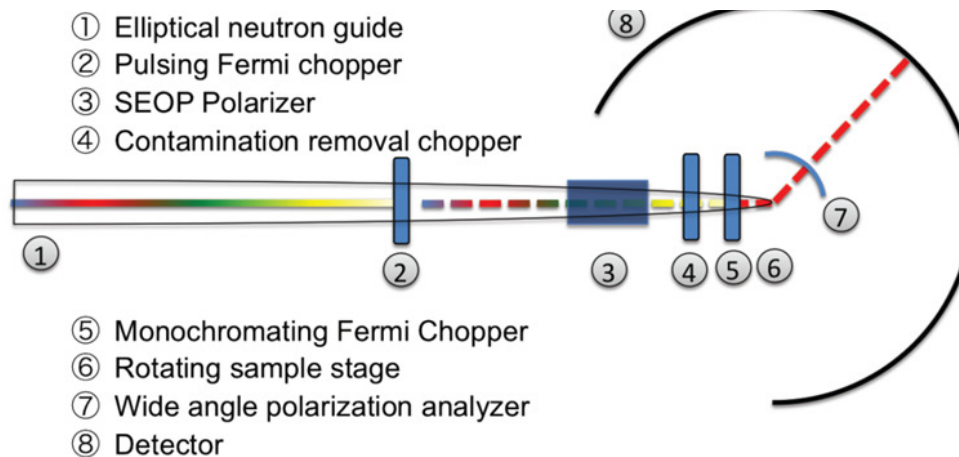


TOPAS

Thermal Time-of-Flight with Polarization Analysis Spectrometer

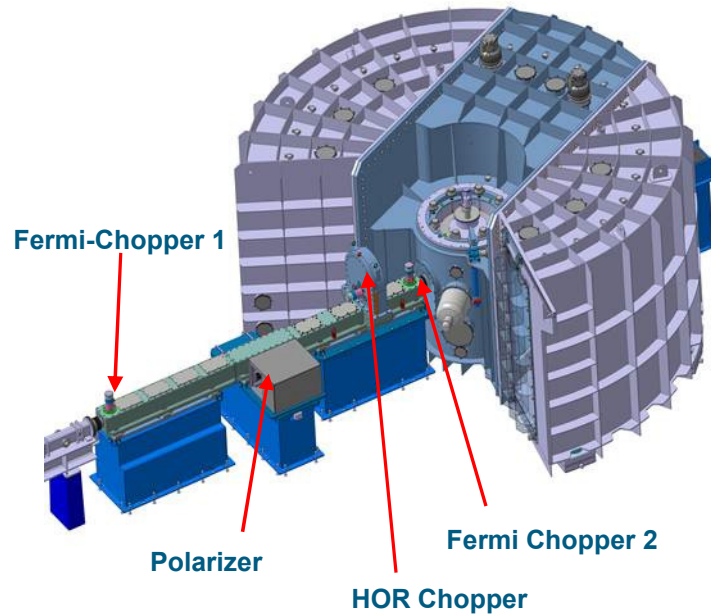


The scientific scope of the instrument includes the determination of coherent and localized excitations in novel materials.



TOPAS

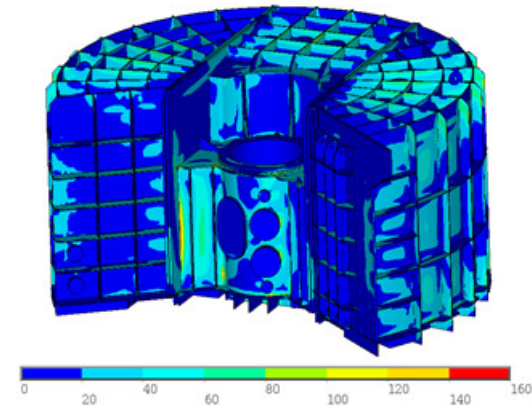
Time-of-Flight Spectrometer with Polarization Analysis



Spectrometer housing:

Vacuum housing

Pressure	$< 10^{-5}$ mbar
Material	1.4571 (1.4429)
Diameter	6.5 m
Height	3 m
Volume	75 m ³

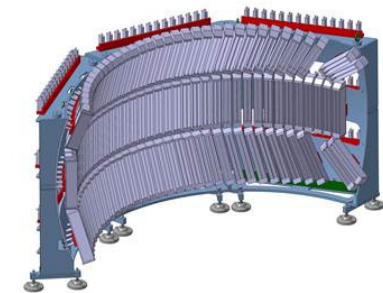
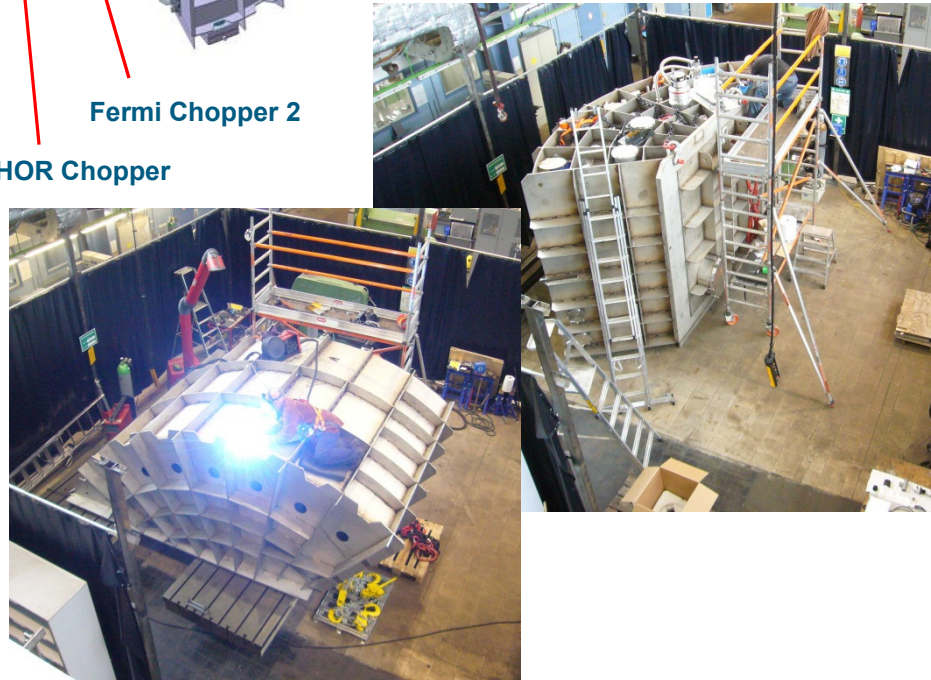


FE - calculation of the vacuum housing

Equivalent stress in N/mm²

Chopper systems:

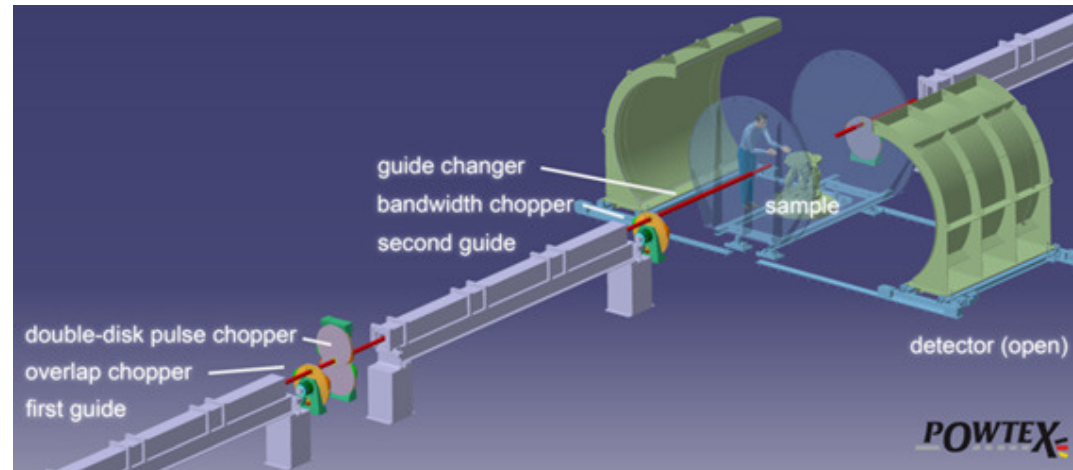
Fermi Chopper 1: < 450 Hz
Fermi Chopper 2: < 600 Hz
HOR Chopper: < 225 Hz



Detector system with ³He-Detectors

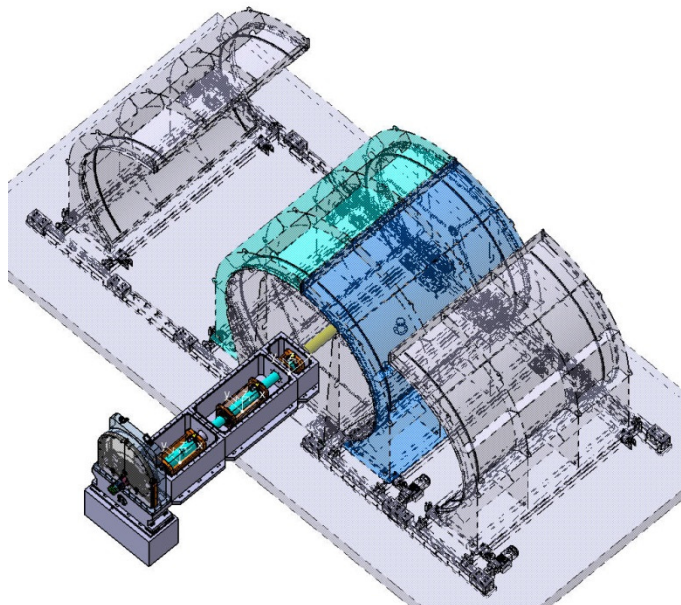
POWTEX

POWder diffraction and TEXture analysis



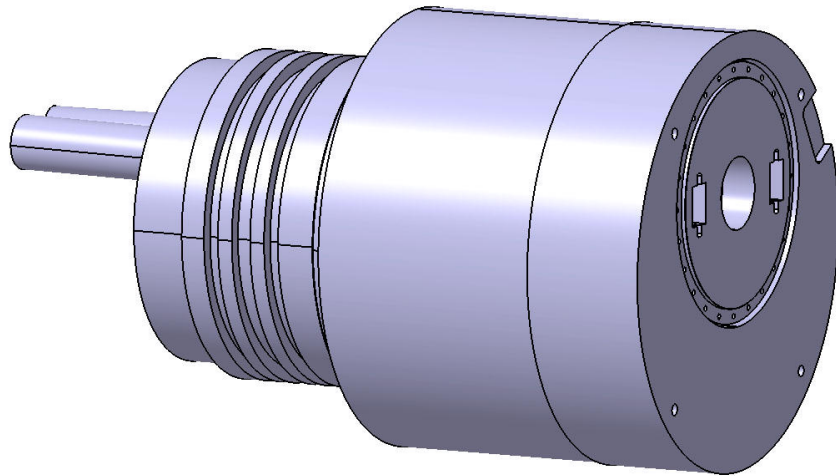
Tool for standard applications from chemistry and physics as well as geo- and materials sciences related to texture measurements.

The instrument is a joint project between RWTH Aachen, University of Göttingen, and Forschungszentrum Jülich GmbH and is funded by BMBF.



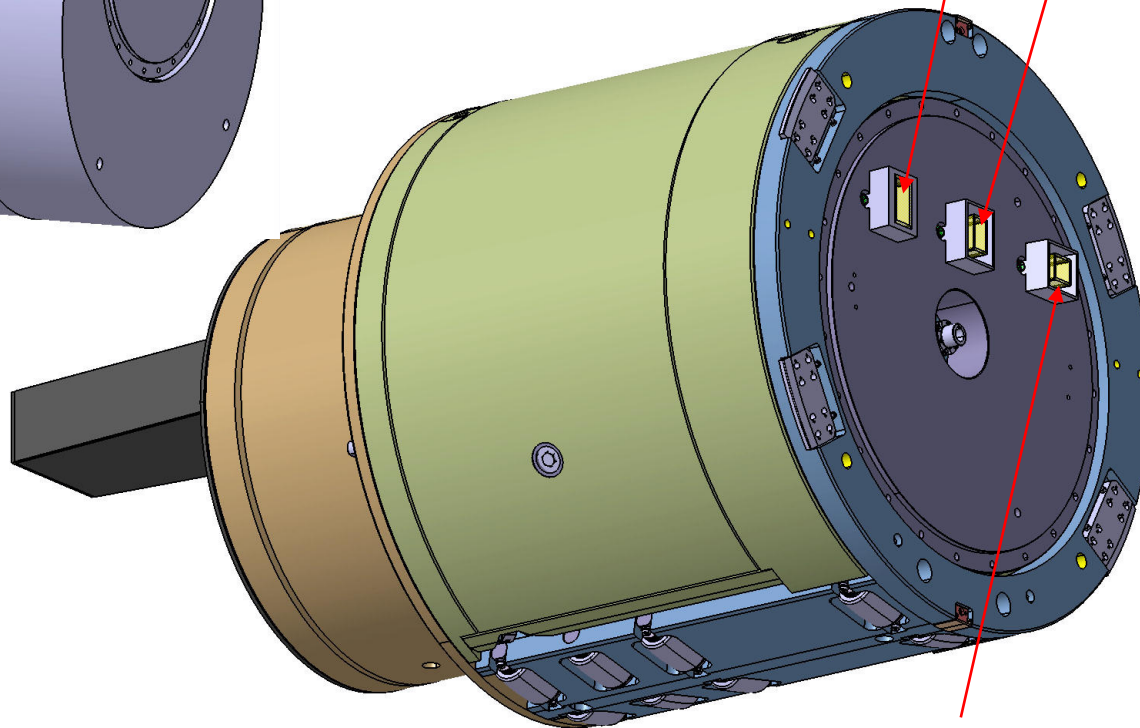
Now POWTEX is in the development and design phase by ZAT.

Beam Hole Plug SR5



Beam hole Plug SR5-Current
with 2 channels

Beam hole Plug SR5-New
with 3 channels

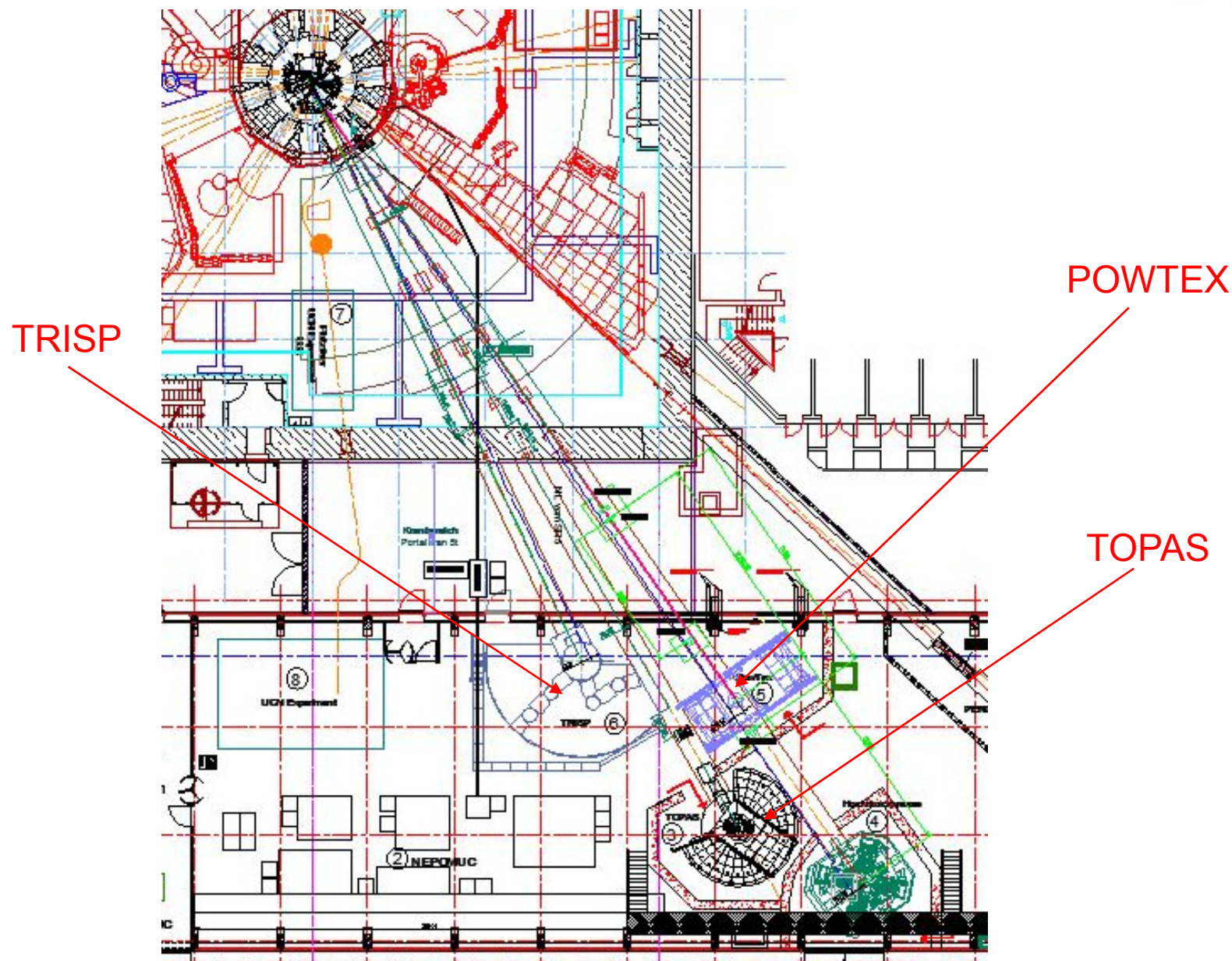


POWTEX

TRISP

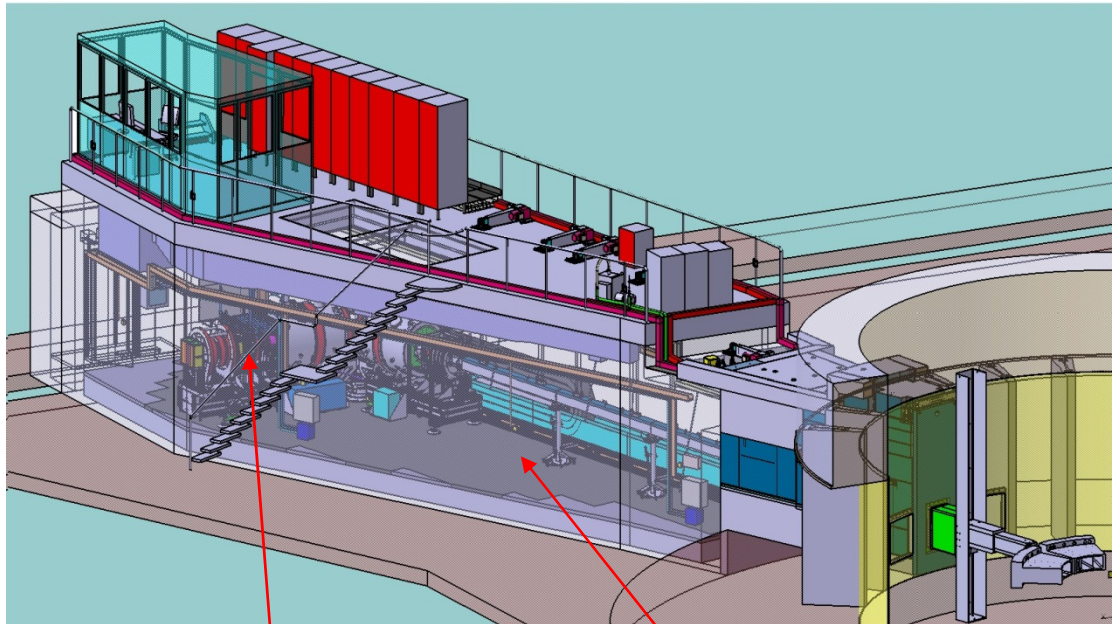
TOPAS

Beam Hole Plug SR5



NSE

Neutron Spin Echo Spectrometer



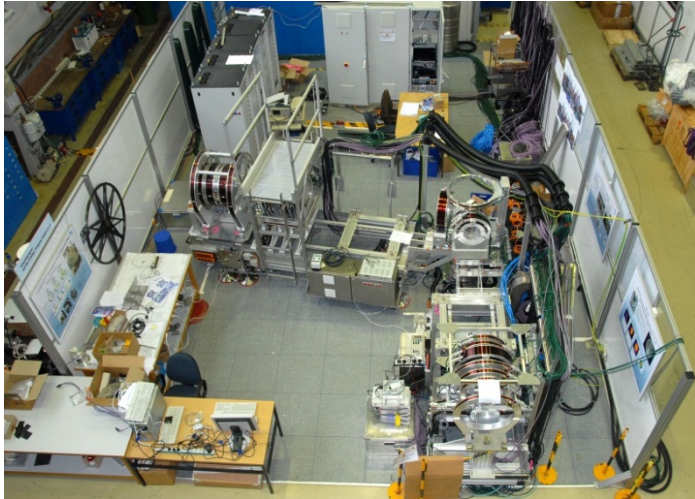
NSE-Instrument

Magnetically shielded room

Tool for the analysis of slow motions on large and intermediate length scales.

This instrument was built and commissioned at SNS in Oak Ridge, Tennessee, USA

NSE for SNS



Test setup in ZAT



Concrete work for the magnetically shielded room
at SNS

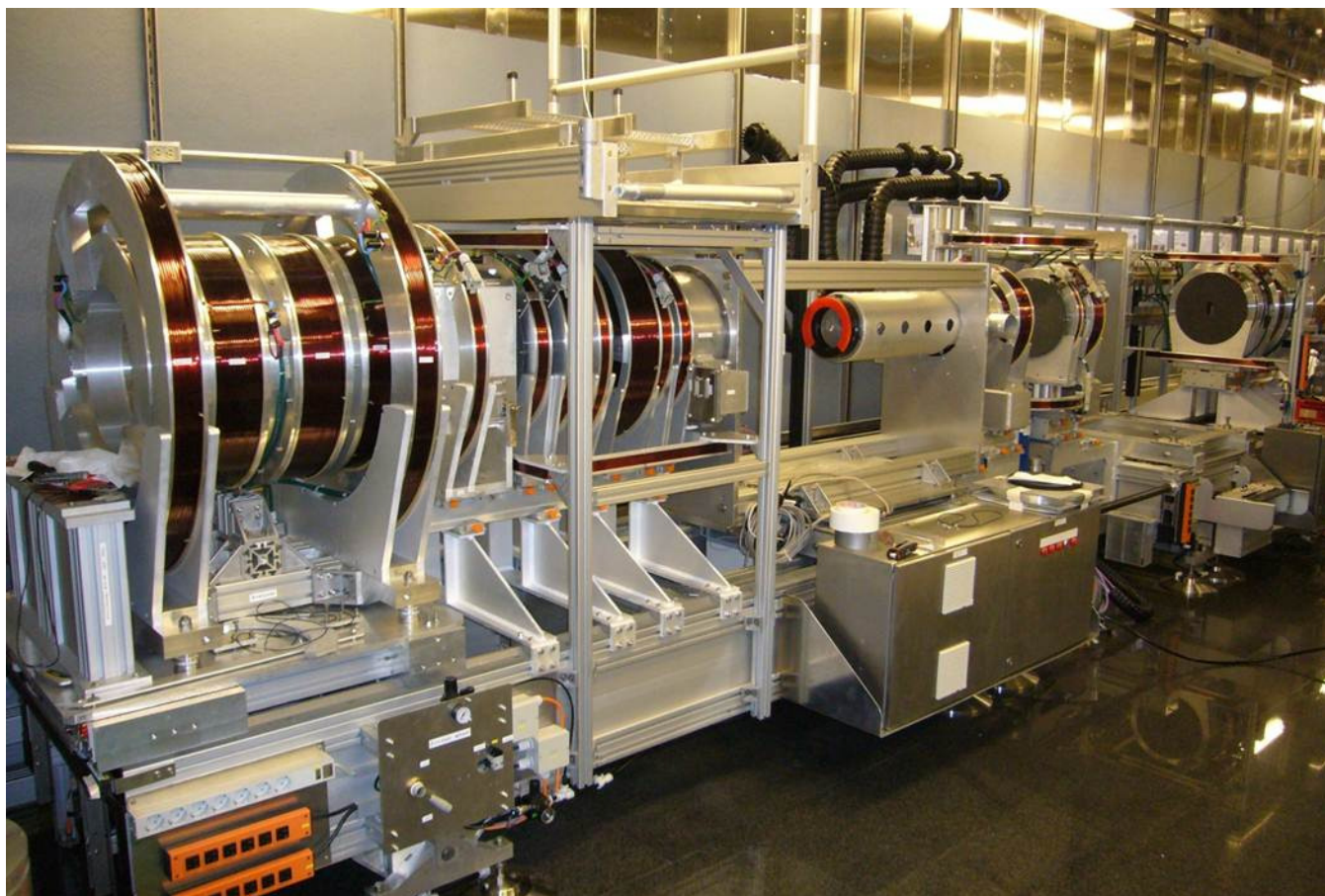


Construction of the magnetically shielded room with mu-metal



Installation of NSE

NSE for SNS



NSE in the magnetically shielded room

Summary

- ZAT designs, constructs, and manufactures complex equipment - particularly neutron scattering instruments.
- Specially feature of ZAT is his competence in delivering complete solutions for the instruments sector, from development, design, automation, construction to the commissioning at the customer site.

Thank you for your attention!

Einbau Polarisator/Chopper KWS1

