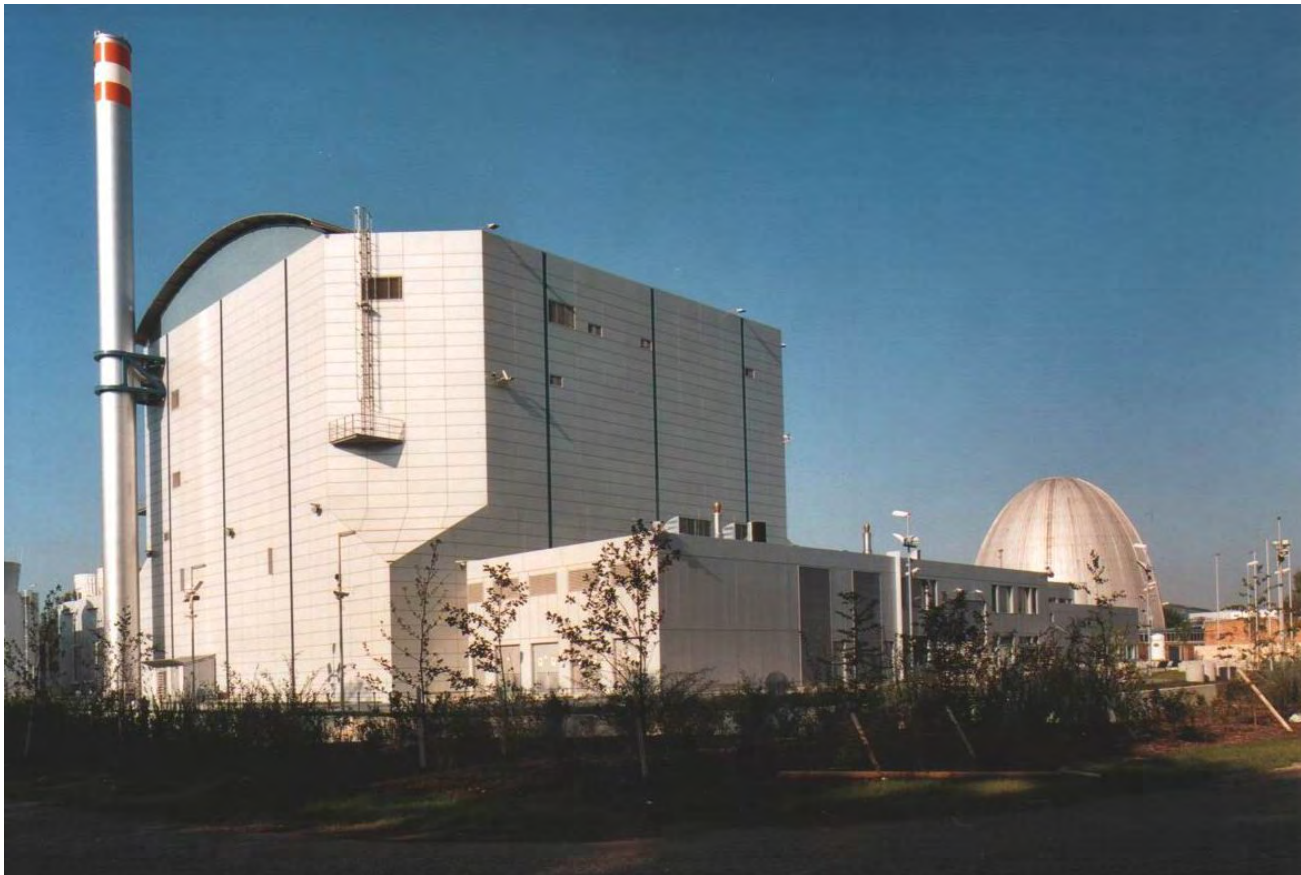




# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)



## Sample environment at FRM II





# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)



## Sample Environment at FRM II, Examples

- Cryogen-Free 7.5 T Magnet - Two Years of User Operation
- New FRM Closed Cycle Cryostat -  $\varnothing$  80 mm Sample Tube
- Shape Memory Alloy Switch
- Servohydraulic Press



# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)



Cryogen-Free 7.5 T Magnet -  
Two Years of User Operation



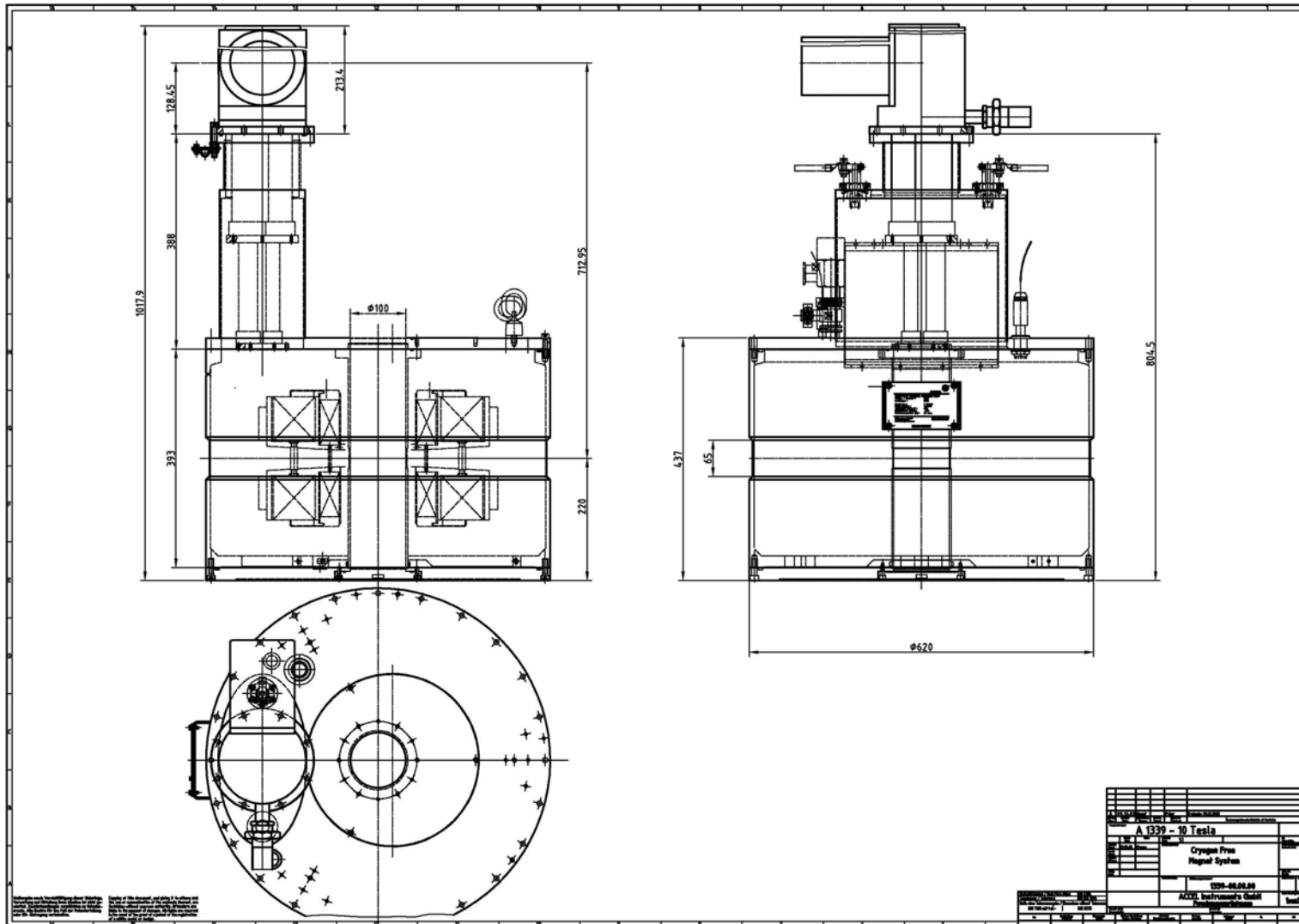


## Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)

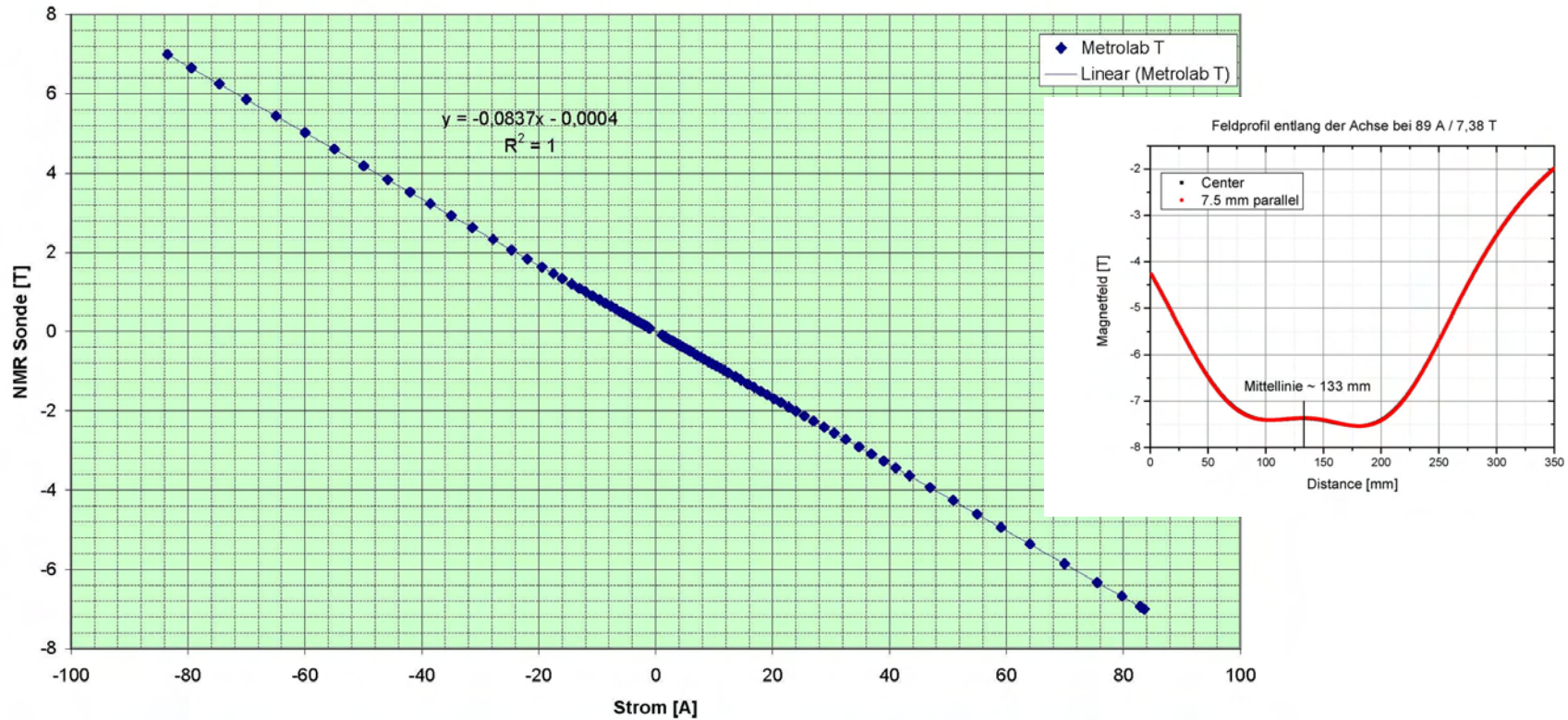


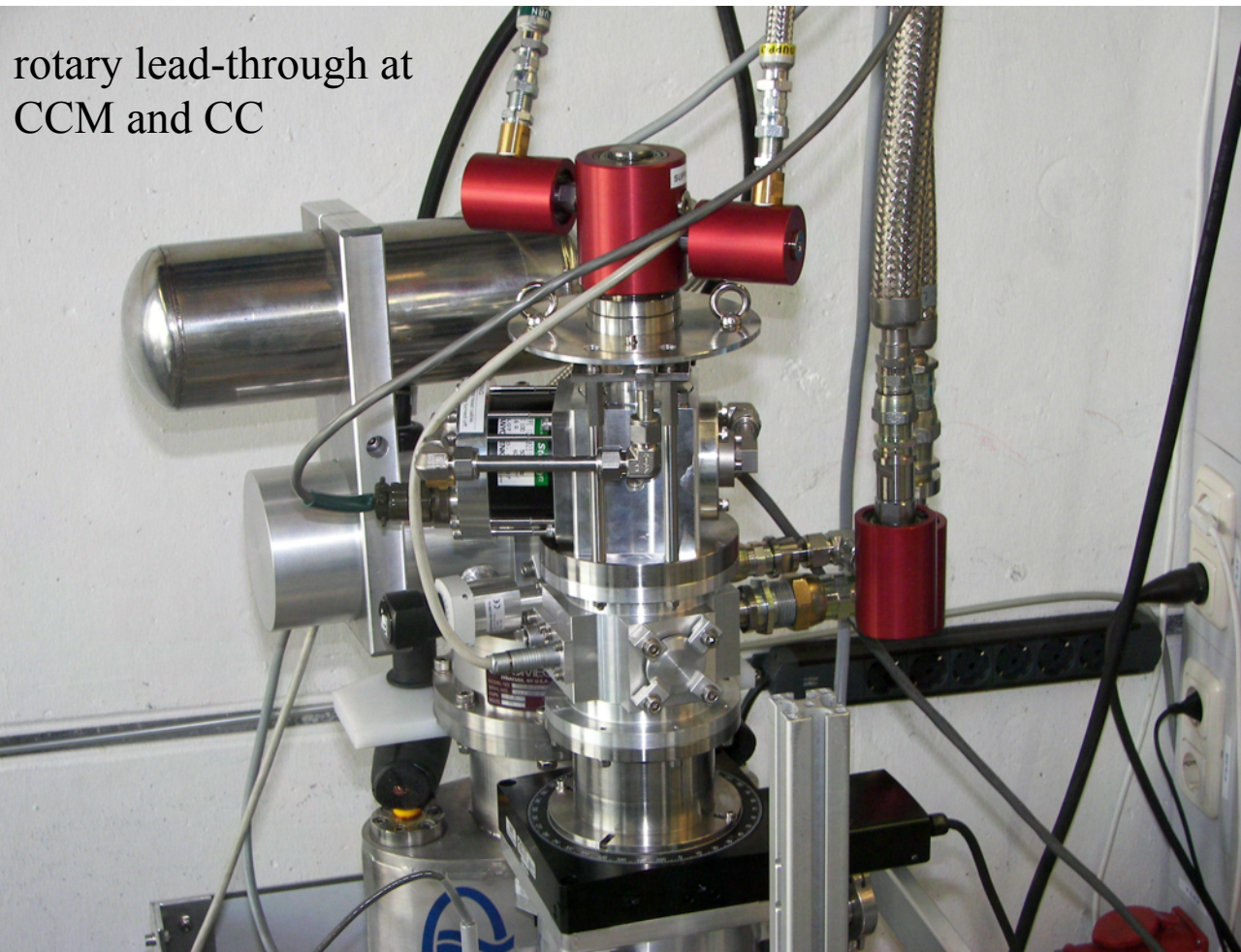
- manufacturer: ACCEL Instruments GmbH, Germany
- cold head: Cryomech, PT410, 1W at 4K
- type: vertical split coil (NbTi, Nb<sub>3</sub>Sn PIT)
- B-field: 7.5T
- homogeneity: 0.15% at  $\varnothing$  15 mm sphere
- B-stability:  $1.343 \times 10^{-5}$
- RTB:  $\varnothing$  100 mm
- split: 30 mm
- aperture angle:  $\pm 3^\circ$
- tipping angle:  $\pm 15^\circ$
- window: 30 x 30 mm
- cool down time: initial 52 h
- ramp time (7.5T): 45 min
- stray field (beam): 0.0018T radial (0,012T axial) in 1m distance
- weight: 300 Kg

# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)

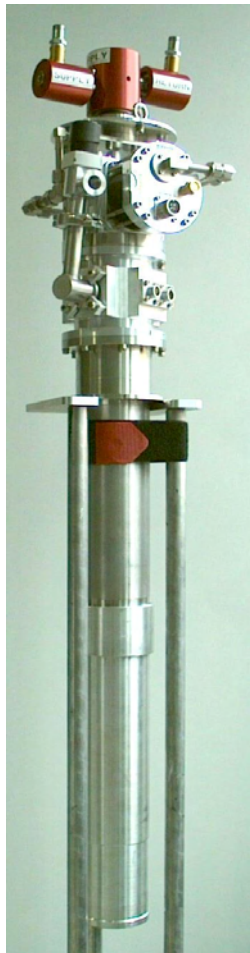


Messung des Magnetfeldes im Zentrum des Magnetsystems mit Hilfe von NMR Sonden





CCM +  
CC



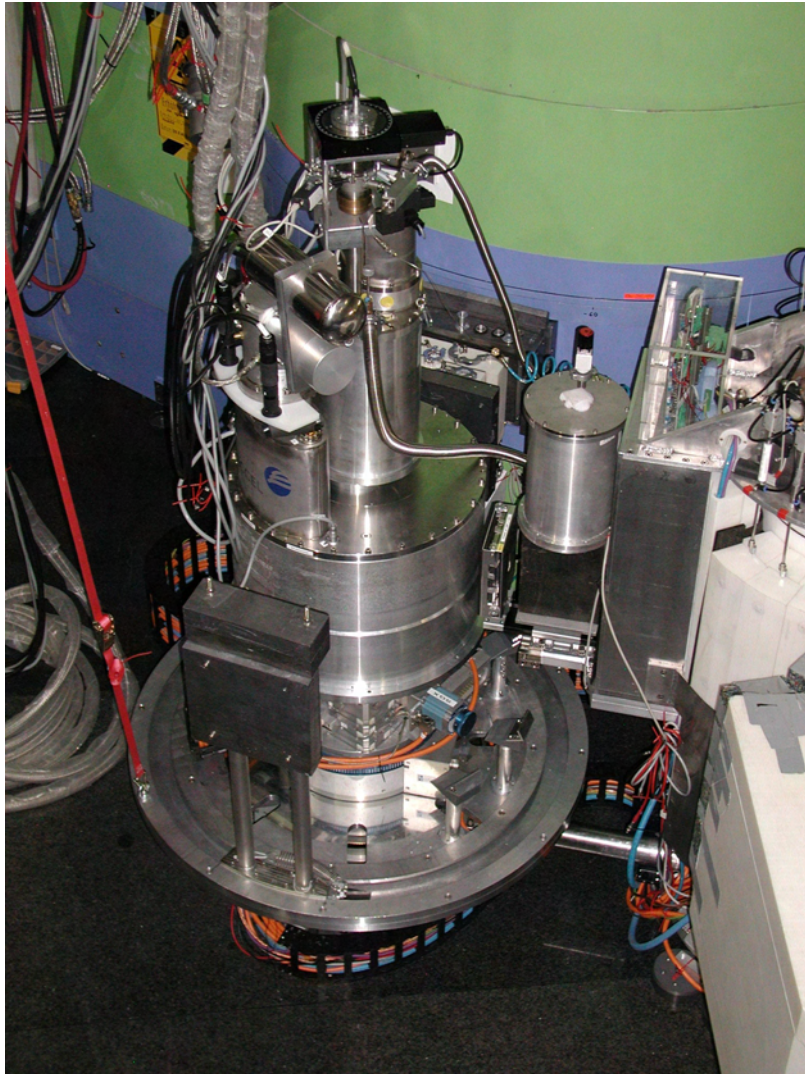
CCR + insert



rotary table







## 7.5 Tesla Magnet on Cold Three Axes Spectrometer **PANDA**

Technische Universität Dresden, IFP

magnetic excitations in thin layers (Dy, Y)

CCM + CCR + rotary sample stick

Courtesy P. Link, FRM II



## 7.5 Tesla Magnet on Structure Powder Diffractometer **SPODI (I)**

Technische Universität Darmstadt, LMU, FRM

tasks:

- magnetic phase transitions
- magnetic moment per atom  
→ as function of B, T
- magnetic - crystal structure relations
- magnetoelastic effects

samples:

- magnetic shape memory alloys
- molecular magnets
- frustrated magnetic systems

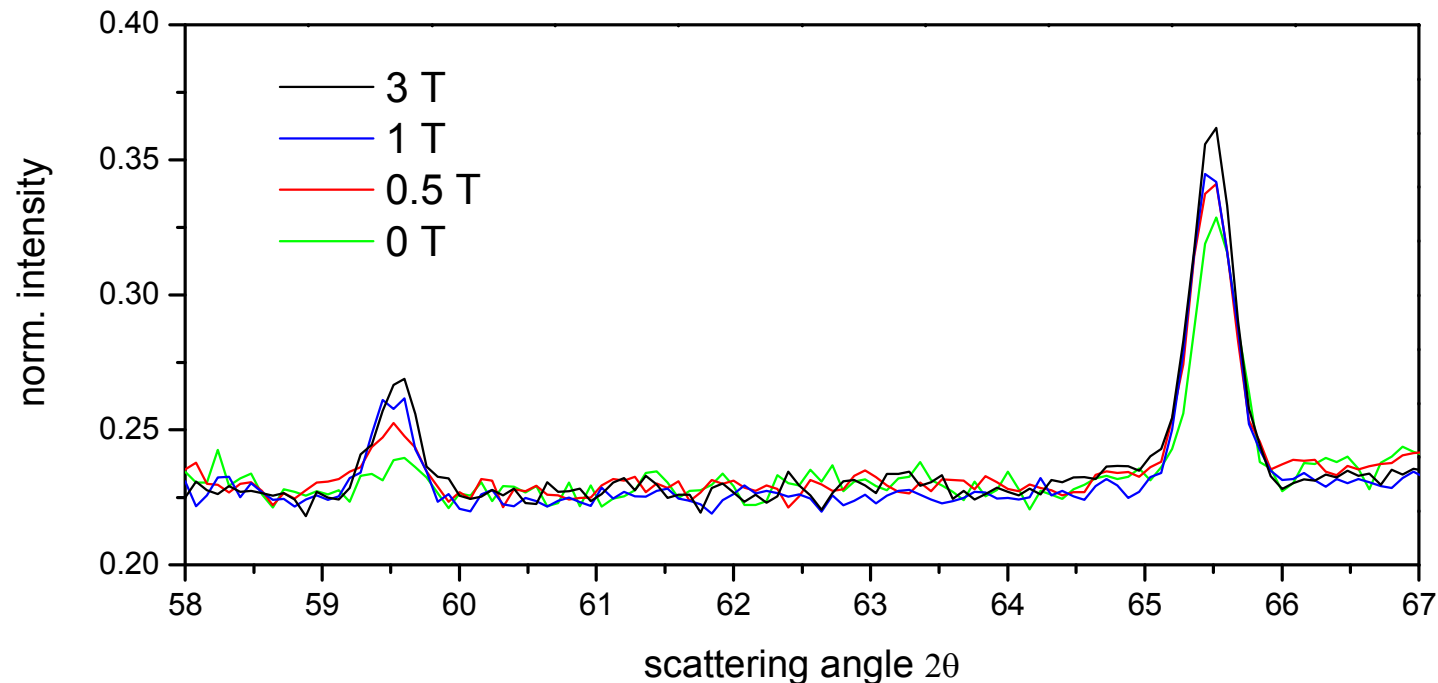
Courtesy M. Hölzel, FRM II

## 7.5 Tesla Magnet on Structure Powder Diffractometer SPODI (II)

example: magnetic contributions to Bragg reflections at different magnetic fields

→ *Revealing magnetic ordering in addition to crystal structure*

→ *Revealing magnetic and crystal structure relations*



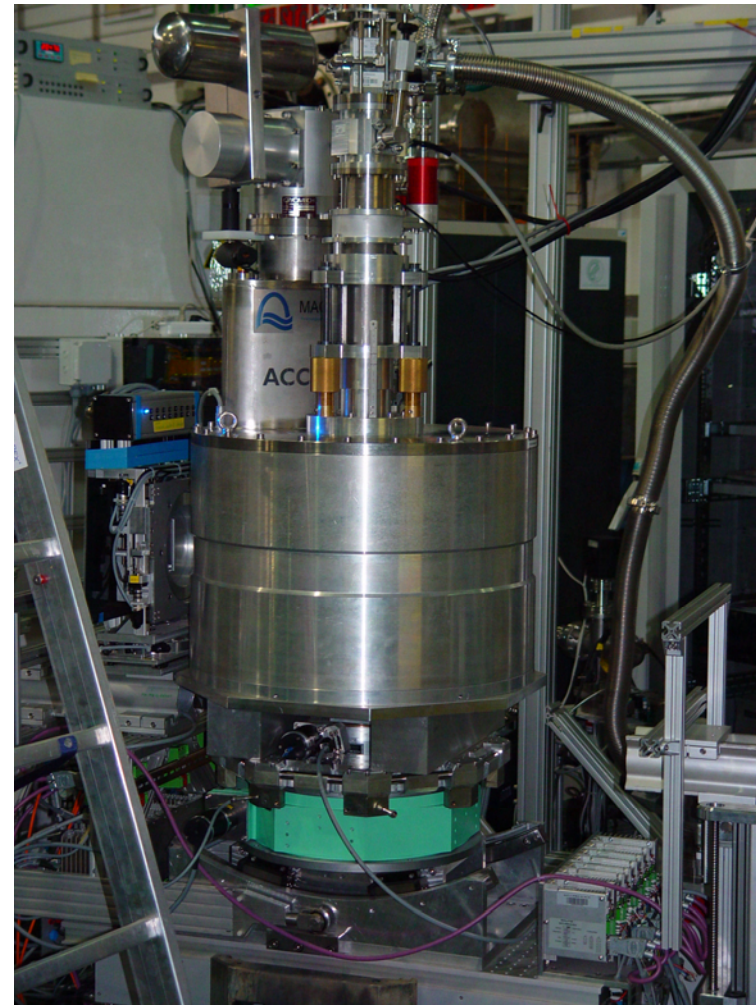
## Neutron / X-ray Contrast Reflectometer *N-REX<sup>+</sup>*

Max Planck Institut für Metallforschung (MPI MF)

experimental parameters:

- cold head (CC): 2 - 300 K
- vertical magnet (CCM): 0 - 6 T
- neutron beam polarization: 80% at 4 T  
78% at 1 T

Courtesy A.Rühm



## ***N-REX*<sup>+</sup> user project:**

University of Houston (Wolfgang Donner)

Superconducting magnetic multilayers

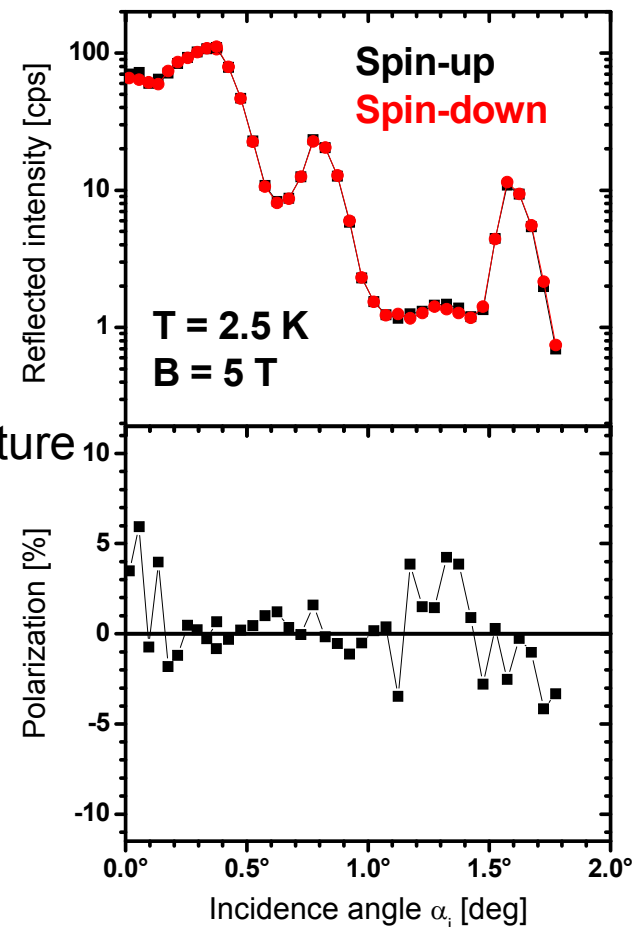
– July 2007

Experiment:

-Polarized neutron reflectivity at low temperature

as a function of magnetic field.

-Extract magnetic scattering length profiles.



Courtesy A.Rühm

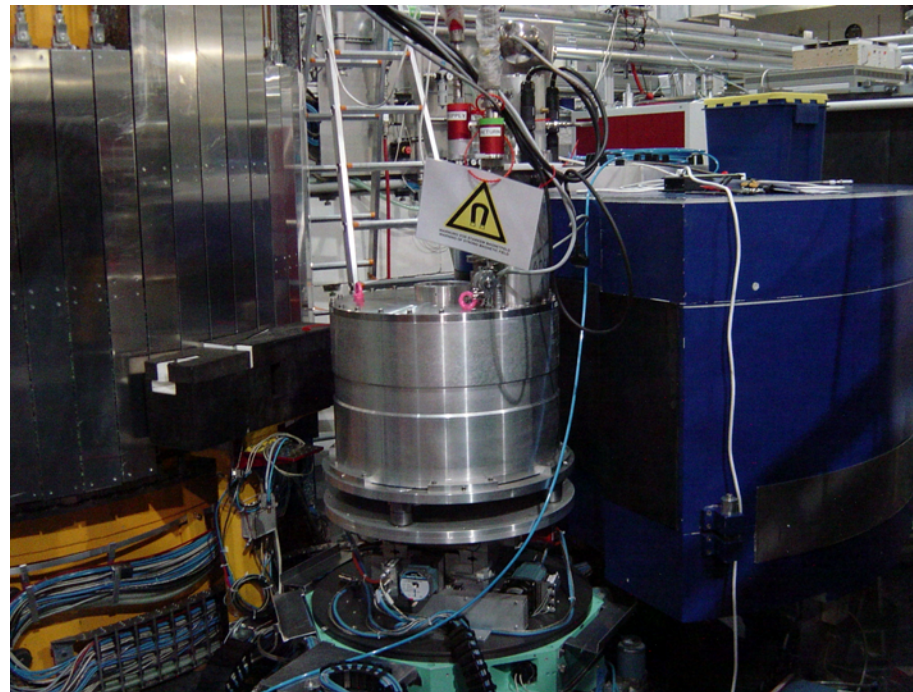
## Thermal Triple Axis Spectrometer with Multianalyser-Detector Option **PUMA;**

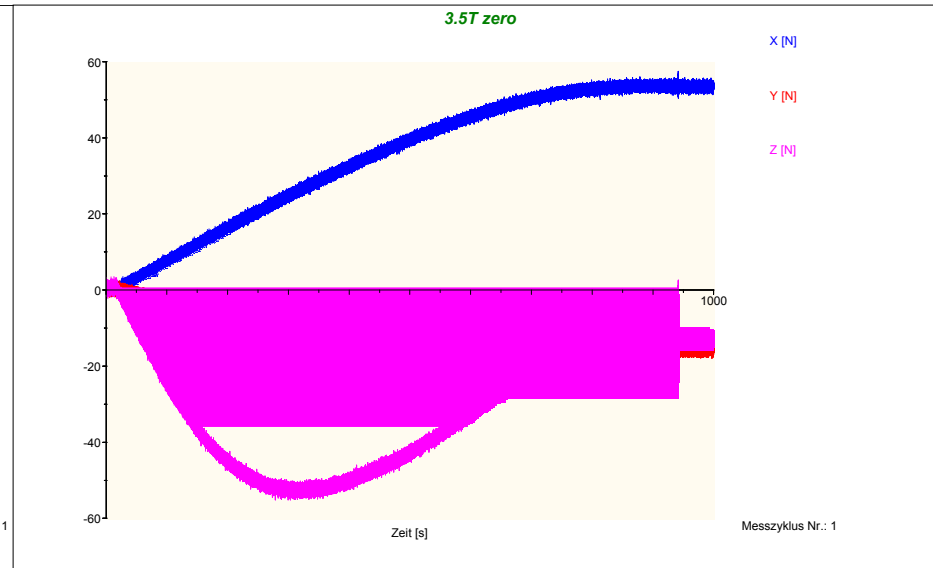
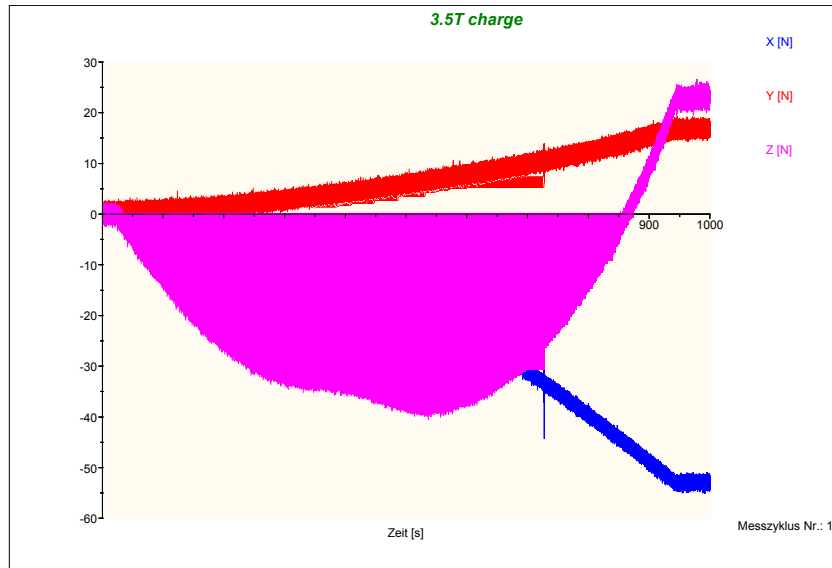
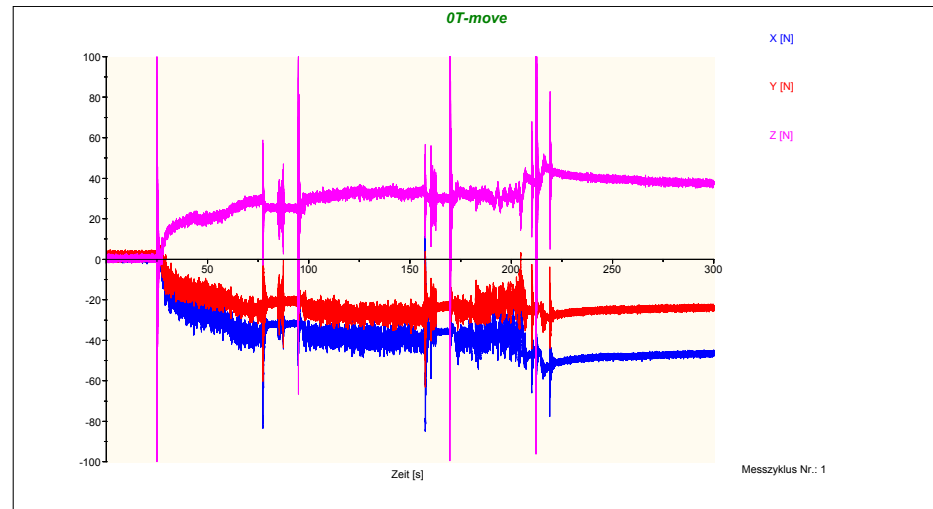
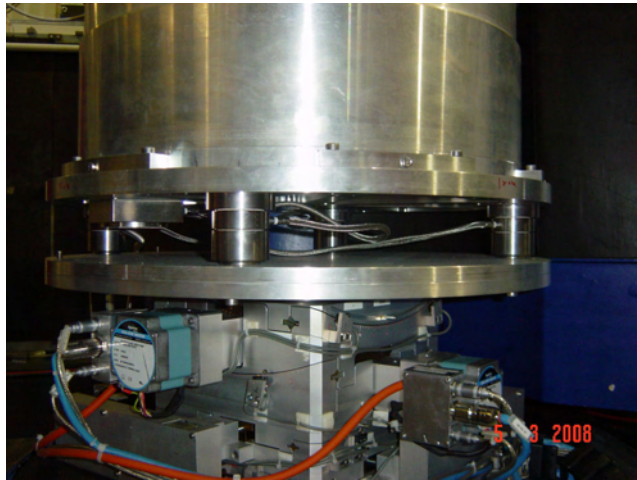
Georg-August-Universität Göttingen

force measurement:

- no nonmagnetic instrument setup
- no constraints up to 7.5 T

Courtesy R. Mole (FRM II)







## Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)



Cryogen-free 7.5 T magnet - two years of user operation

positive

- operation reliable and save
- easy to use (push button)
- compact design
- wide range of application, different additional environment possible
- no constraints (up to now)

negative

- cool down time
- Cryomech coldhead  
(leaky flex lines, leaky compressor, no reverse polarity check, reluctant support)



# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)

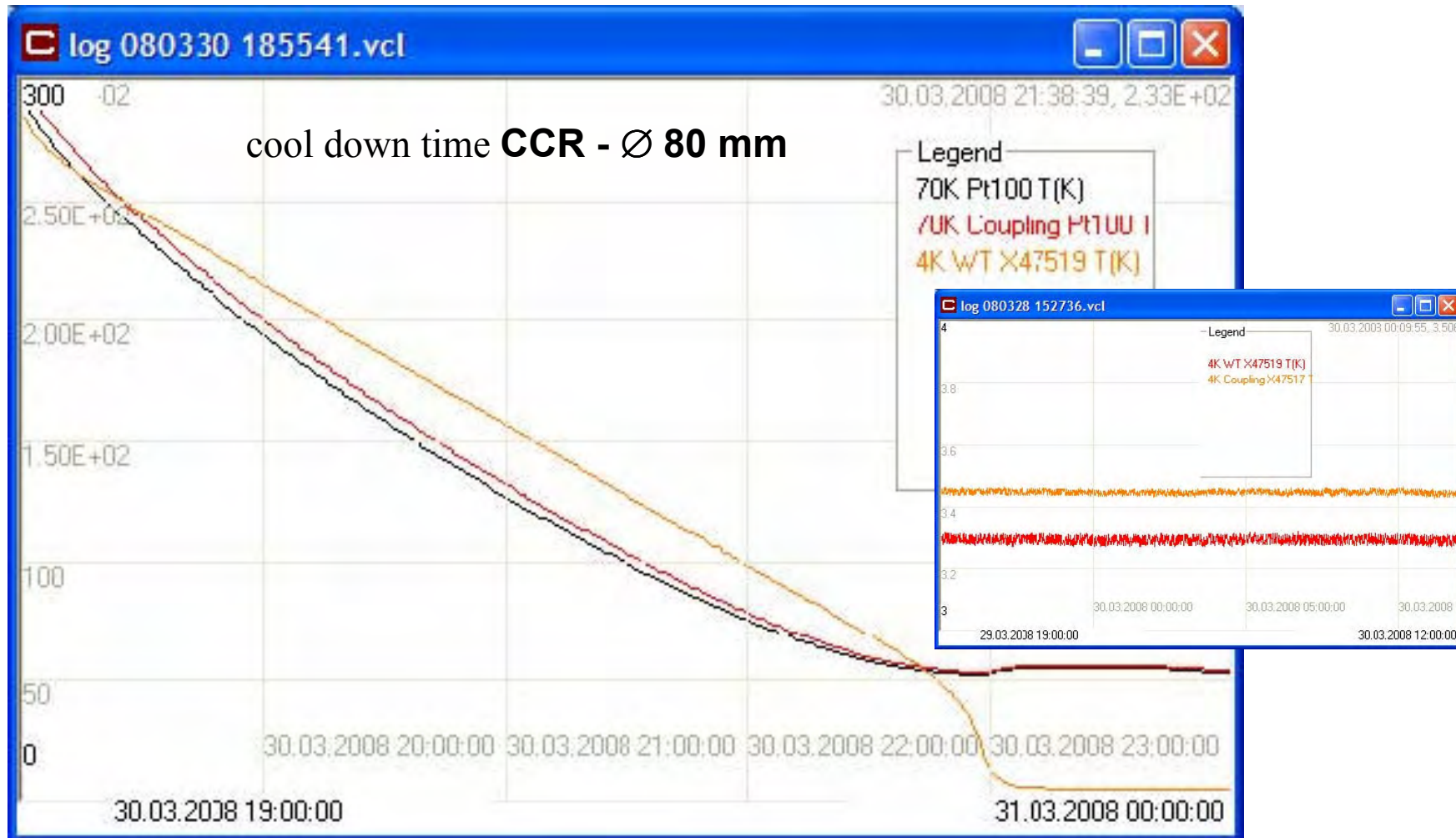


## Closed cycle cryostat CCR - $\varnothing$ 80 mm sample tube

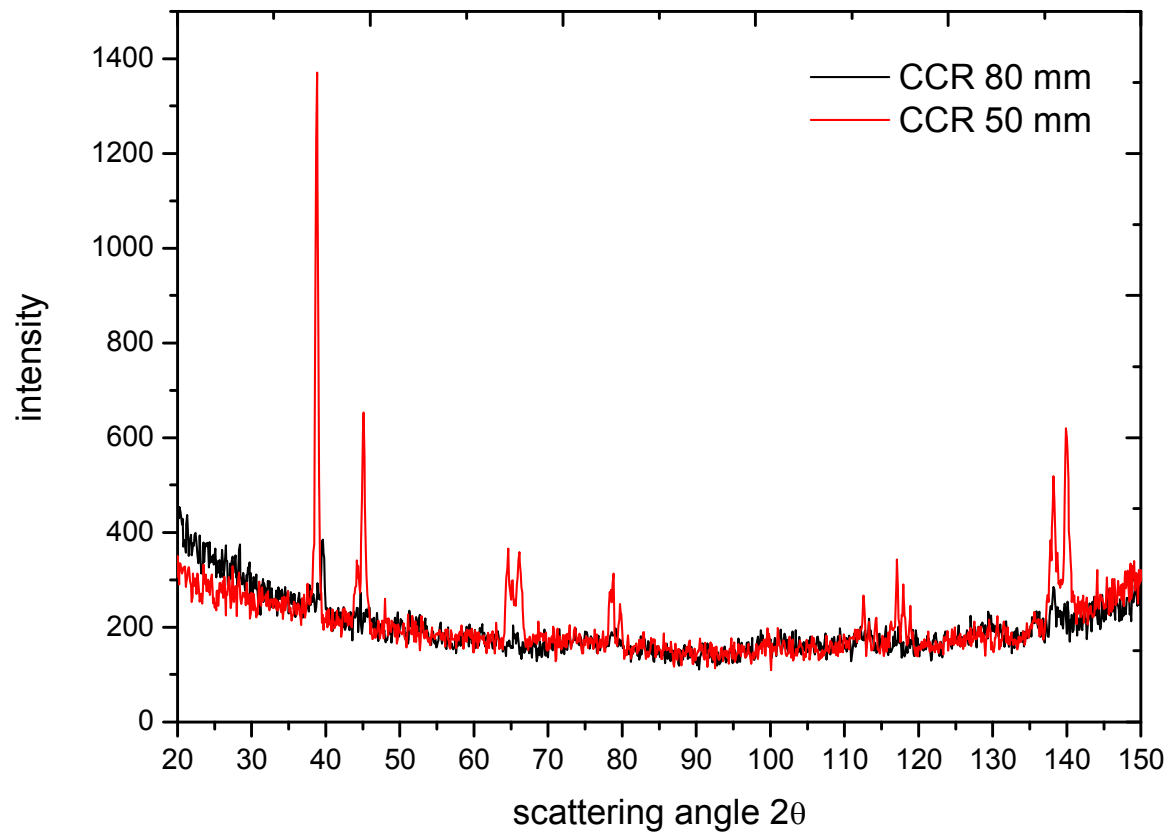


- cold Head : PF1, 400 mW at 4 K, VeriCold
- compressor: Coolpack 6000, Oerlikon
- sample tube:  $\varnothing$  80mm



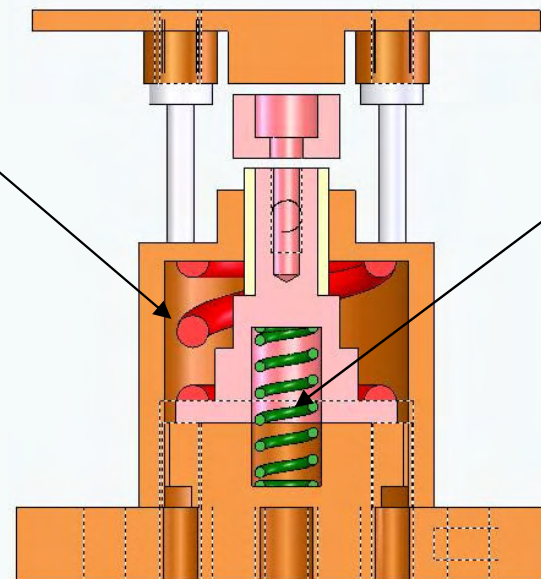
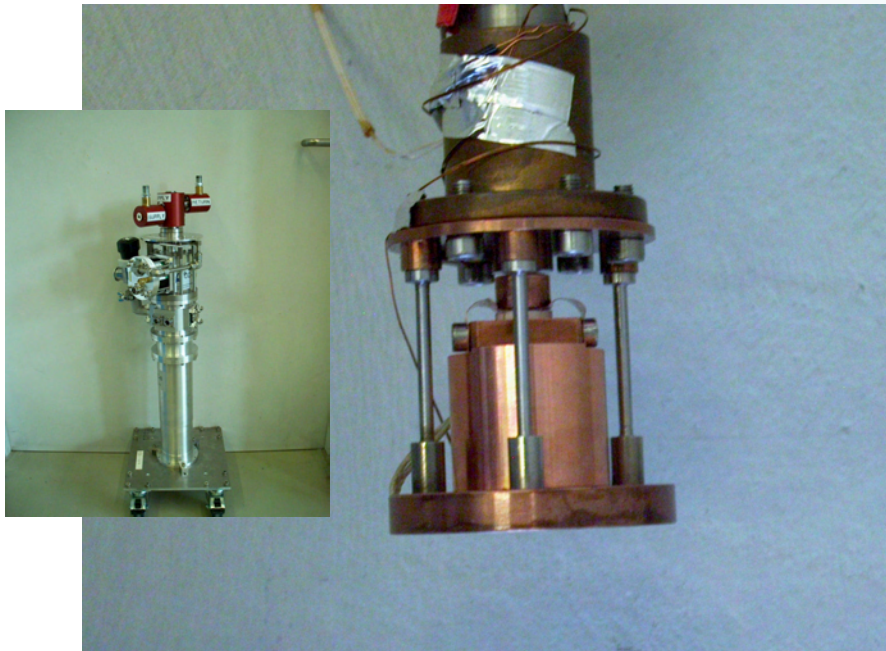


Structure Powder Diffractometer SPODI: Al signals from cryostat walls



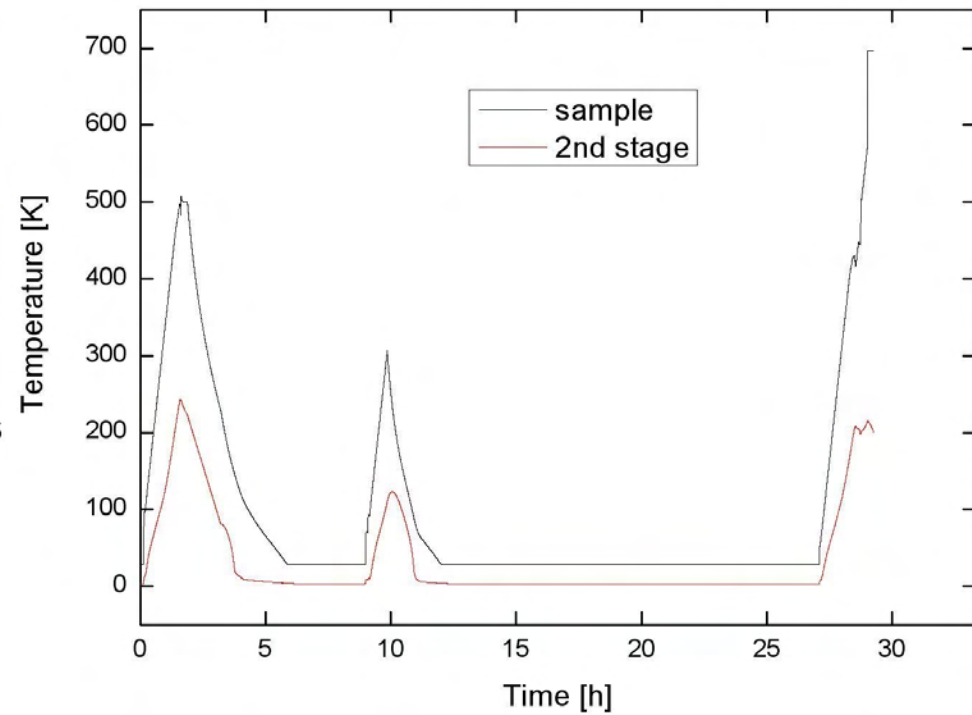
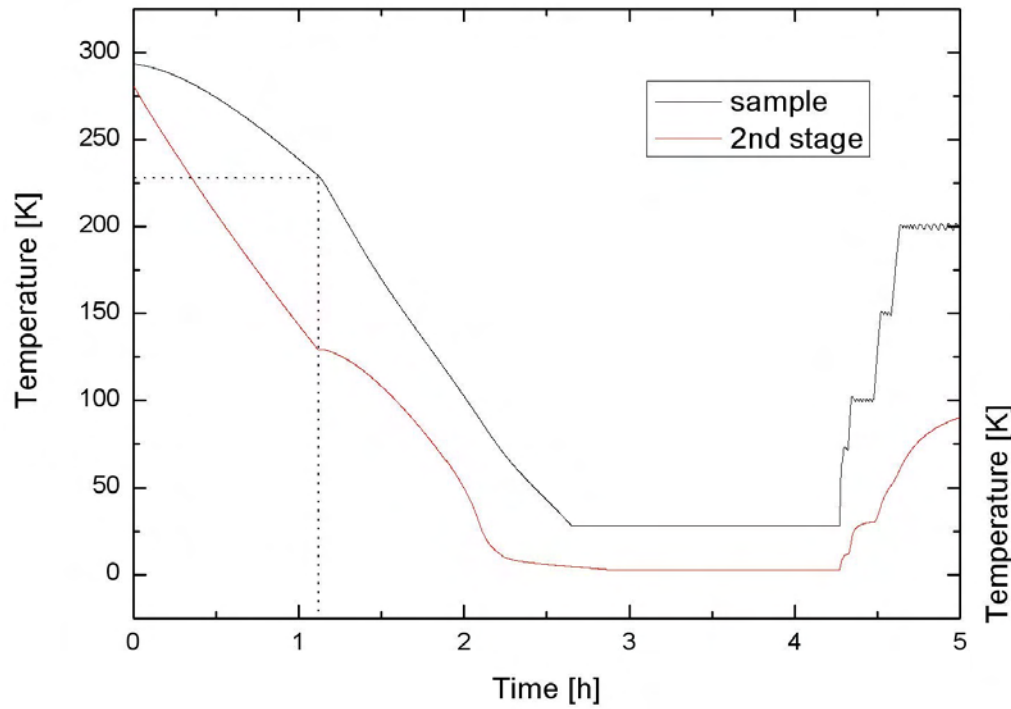
## Shape Memory Alloy Switch

NiTi: 99,39N at 2 °C, min. restoring force 50N, Ø 20,76mm,  
length 13,21 mm



EN 10270-3-1.4310  
F<sub>max</sub> 91,36 N

## Shape Memory Alloy Switch



## Servohydraulic Press

- double action cylinder
- press capacity           450kN
- tensile force            220kN
- stroke                    100mm
- working height        300mm
- force sensor            500kN

### control

- static
- dynamic: range        10 Hz
- force/displacement sensor



# Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II)



Servo-hydraulic Press:  
Cryostat / furnace

hydraulic cylinder

cold head /  
pump

ZrO piston

