

MIRA: Dual wavelength band instrument

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Abstract: MIRA is a dual wavelength band instrument operated by Technische Universität München TUM, which provides neutrons over a wide range of wavelengths $3.5 \text{ \AA} < \lambda < 20 \text{ \AA}$ combining the two beam ports of MIRA-1 and MIRA-2. The instruments setup is modular and allows for various different cold neutron experiments such as diffraction, spectroscopy or reflectometry.

1 Introduction

The instrument can easily be moved from one port to the other without changing the sample environment. A variety of different setup options can be combined allowing for a fast and flexible realisation of neutron experiments using the options available:

- Cold neutron diffraction
- Cold neutron three axes spectroscopy for extreme environments in pressure and temperature
- Small angle neutron scattering (SANS)
- Reflectometry
- MIEZE spin echo
- 3D-Polarimetry

Polarised neutrons are optional for all experimental setups at MIRA. Using the finger detector, the instrument has a very low background of less than 0.1 cps. For MIRA-2 a q-range up to 2.5 \AA^{-1} with an q-resolution of 0.01 \AA^{-1} can be reached. Vertical and horizontal B-fields up to 2.2 T and vertical B-fields up to 7.5 T are available. Temperatures from 50 mK to 1500 K can be applied using the standard sample environment at MLZ.



Figure 1: Instrument MIRA-2 in three axes mode (Copyright by W. Schürmann, TUM).

2 Typical Applications

- Dynamics of magnetic excitations
- Determination of magnetic structures, especially large scale structures, i.e. helical spin density waves or magnetic lattices
- Quasi-elastic measurements in magnetic fields with high resolution
- Determination of structures and dynamics in extreme environments, like pressure
- Determination of layer thickness of films, for instance in polymer physics
- Reflectometry from magnetic multilayers
- Polarisation analysis

3 Technical Data

3.1 MIRA-1

3.1.1 Primary beam

- Neutron guide: NL6-N
- Dimensions: 10 x 120 mm² (width x height)
- Curvature: 84 m
- Coating: sides m = 2.0, top/bottom m = 2

3.1.2 Monochromator

- Intercalated HPGO $\Delta\lambda/\lambda = 2\%$
- Multilayer $\Delta\lambda/\lambda \approx 3\%$ (5% polarised)
- $6 \text{ \AA} < \lambda < 20 \text{ \AA}$

3.1.3 Max. differential neutron flux at sample

- $5 \cdot 10^5 \text{ n cm}^{-2}\text{s}^{-1}$ at 10 \AA
- $2 \cdot 10^5 \text{ n cm}^{-2}\text{s}^{-1}$ polarised

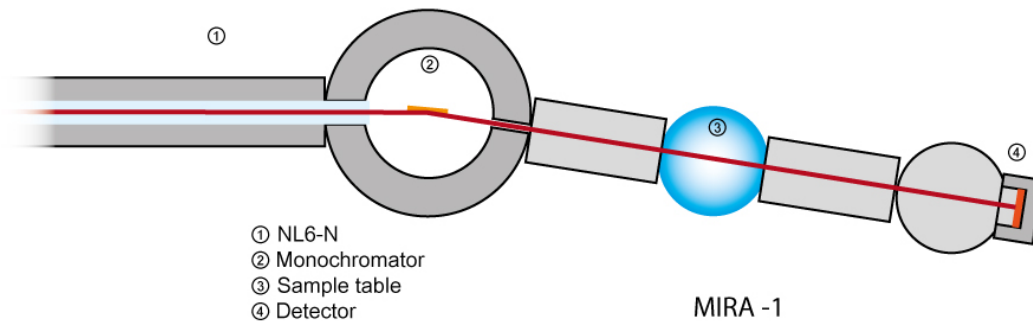


Figure 2: Schematic drawing of MIRA-1.

3.1.4 Analyzer

- 2 cavities
- 2 bender
- ^3He -spin filter

3.1.5 Detector

- 20 x 20 cm² 2-D PSD with 1 x 2 mm² resolution
- 1 inch ^3He finger detector
- 20 x 20 cm² 2-D PSD, time resolution < 1 ps

3.2 MIRA-2

3.2.1 Primary beam

- Neutron guide: NL6-S
- Dimensions: 60 x 120 mm² (width x height)
- Coating: sides $m = 2.0$, top/bottom $m = 2$

3.2.2 Monochromator

- Horizontal focussing HOPG $\Delta\lambda/\lambda \approx 2\%$
- $3.5 \text{ \AA} < \lambda < 6 \text{ \AA}$

3.2.3 Max. differential neutron flux at sample

- $1 \cdot 10^7 \text{ n cm}^{-2}\text{s}^{-1}$ at 4.7 \AA (2015)
- $1 \cdot 10^6 \text{ n cm}^{-2}\text{s}^{-1}$ polarised

3.2.4 Analyzer

- 2 cavities
- S-bender, transmission polariser
- ^3He -spin filter

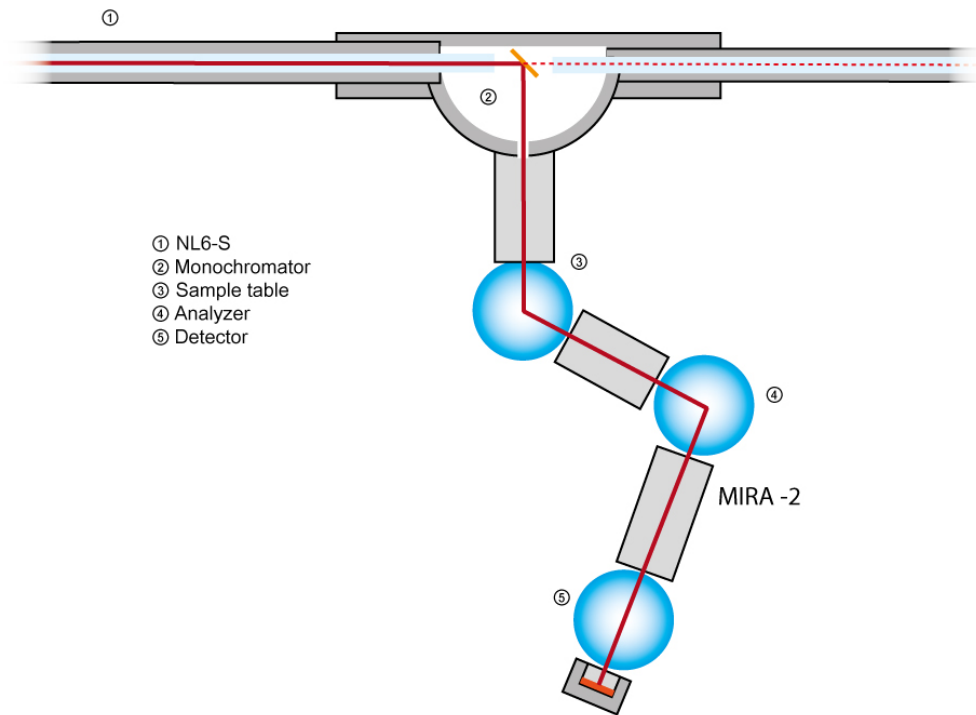


Figure 3: Schematic drawing of MIRA-2.

3.2.5 Detector

- 20 x 20 cm² 2-D PSD with 1 x 2 mm² resolution
- 1 inch ³He finger detector
- 20 x 20 cm² 2-D PSD, time resolution < 1 ps
- with low background < 0.1 cps