Journal of large-scale research facilities

Journal of large-scale research facilities, 1, A3 (2015) http://dx.doi.org/10.17815/jlsrf-1-21

Published: 18.08.2015

MIRA: Dual wavelength band instrument

Heinz Maier-Leibnitz Zentrum
Technische Universität München

Instrument Scientists:
- Robert Georgii, Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universität München, Garching, Germany, phone: +49(0) 89 289 14986, email: robert.georgii@frm2.tum.de
- Klaus Seemann, Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universität München, Garching, Germany, phone: +49(0) 89 289 14668, email: klaus.seemann@frm2.tum.de

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 Å $< \lambda <$ 20 Å 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 Å^{-1} with an q-resolution of 0.01 Å^{-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 magentic 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 mm^2 (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)
- $6\ \text{Å} < \lambda < 20\ \text{Å}$

3.1.3 Max. differential neutron flux at sample

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

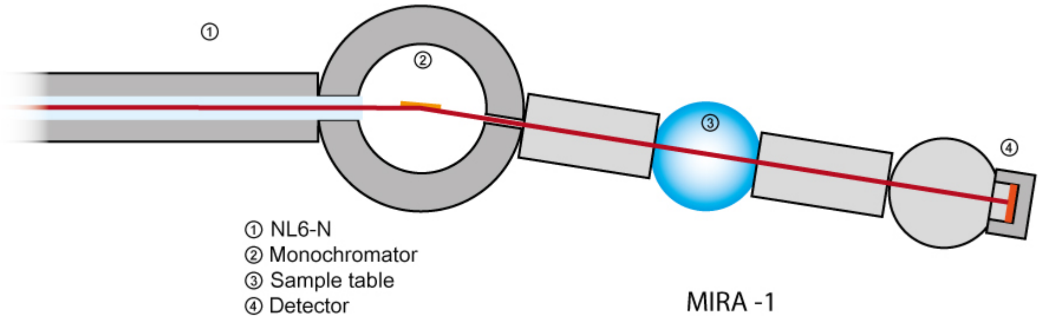

Figure 2: Schematic drawing of MIRA-1.

3.1.4 Analyzer

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

3.1.5 Detector

- 20 x 20 cm^2 2-D PSD with 1 x 2 mm^2 resolution
- 1 inch ^{3}He finger detector
- 20 x 20 cm^2 2-D PSD, time resolution < 1 ps

3.2 MIRA-2

3.2.1 Primary beam

- Neutron guide: NL6-S
- Dimensions: 60 x 120 mm^2 (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 Å $< \lambda <$ 6 Å

3.2.3 Max. differential neutron flux at sample

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

3.2.4 Analyzer

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

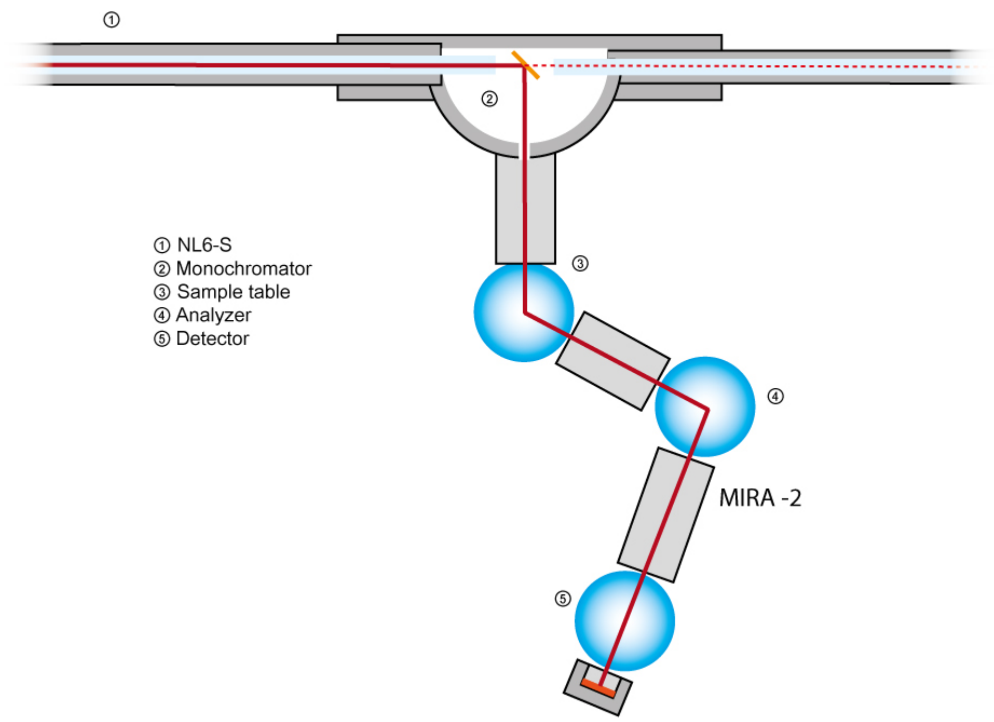

Figure 3: Schematic drawing of MIRA-2.

3.2.5 Detector

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