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V4: The Small Angle Scattering Instrument (SANS) at BER II

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Abstract: V4 is a small-angle neutron scatting instrument with an accessible range of scattering vector 0.01 nm^{-1} < Q < 8.5 nm^{-1}. Outstanding features of the instrument are the polarized neutron option and the list mode data acquisition, allowing for time-resolved measurements with μs time resolution.

1 Introduction

V4 allows for the measurement of density, composition and magnetization fluctuations in materials on a length scale from 0.5 nm to 400 nm. At short distance the 2D-detector can be moved vertically by 0.17 m, extending the Q range to even higher values. A large sample chamber is connected to the vacuum system with the detector and collimator tubes. Automatic sample changers (both T and B controlled) are available. Also, the large sample chamber allows for custom build samples, where for example *in situ* experiments can be performed.
A high transmission supermirror polarizer can be introduced by remote control in front of the 12 m collimation without any modification of the instrument alignment. The polarization direction can be reversed by a RF gradient spin-flipper behind the polarizer. The SANSPOL option is characterized by a high neutron flux of more than 30% of the non-polarized beam (wavelength dependent), a high degree of polarization (> 90%) and high efficiency of the spin-flipper (> 95%) for λ< 1.8 nm without any additional background.
Using the list mode data acquisition time-stamped measurements can be performed. Stroboscopic measurements by using a trigger signal allow for investigation of the kinetics of periodic processes. The chopper system based on TISANE technique allows for studies of microsecond dynamics.

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Figure 1: View of V4 model.

2 Instrument application

Typical applications are:

- Energy related materials
- Nanoscaled materials
- Phase separation in alloys and glasses
- Morphologies of superalloys
- Magnetic correlations
- Microporosity in ceramics
- Interfaces and surfaces of catalysts
- Biological macromolecules
- Polymers and membranes
- Fluxline lattices in superconductors

3 Instrument layout

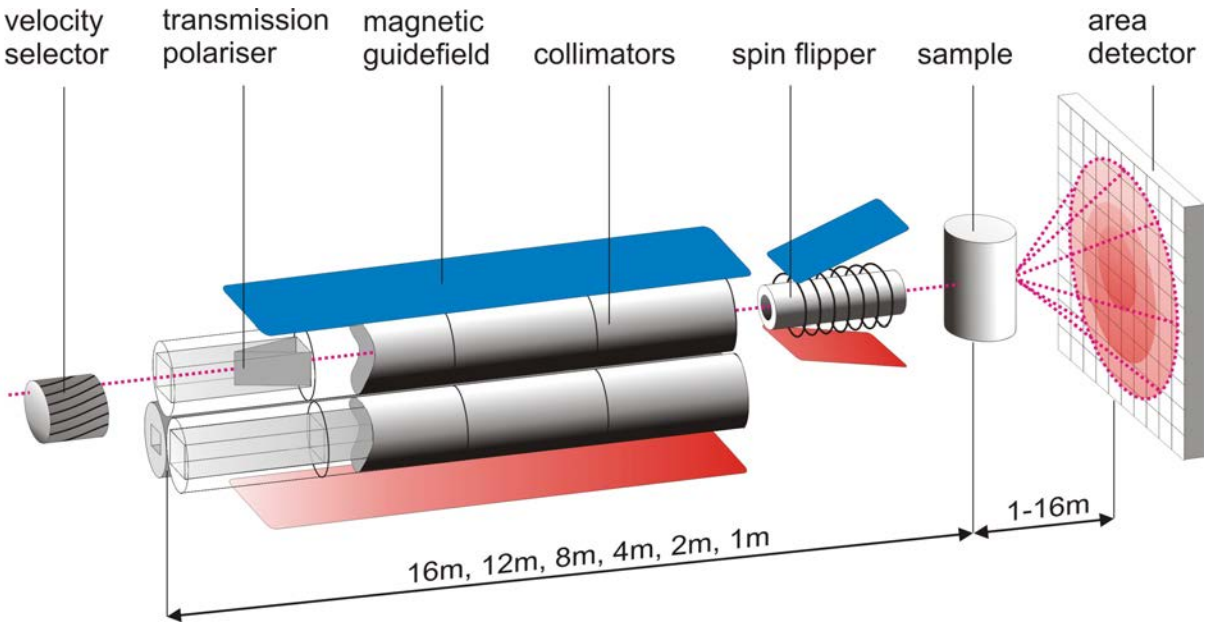

Figure 2: Schematic view of V4.

4 Technical Data

Neutron guide	NL 3A
Collimation	Entrance window: 50x30 mm^2 Collimator length: 2 m, 4 m, 8 m, 12 m (all also for SANSPOL), and 16 m
Monochromator	Mechanical velocity selector
Wavelength	$0.45 < \lambda < 2$ nm
Wavelength resolution	$8\% < \Delta\lambda/\lambda < 18\%$ FWHM
Flux	$1.0 \cdot 10^7$ n/cm^2 at λ=0.5 nm, $\Delta\lambda/\lambda$ = 10% and collimation 2 m
Q range	0.01 nm^{-1} < Q < 8.5 nm^{-1}
Detector	ca. 1 m diameter, 112 Reuter-Stokes tubes, 1000 mm / 850 mm / 600 mm
Sample-to-detector distance	Horizontal: 1 to 16 m continuously Vertical offset: 0.17 m at short distance
Polarized neutrons	Yes
Instrument options	• SANSPOL • Stroboscopic SANS • TISANE
Sample environment	• T-controlled automatic sample changer (5°C-70°C) • Automatic sample changer with magnetic field 1.5T
Software	BerSANS

Table 1: Technical parameters of V4.

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