

REFLECTOMETERS

Beam tube	Cold neutron guide G2
Monochromator	Multilayer monochromator
Type of instrument	Two-axis.
Typical flux at specimen ($Dq = 0.03^\circ$)	3×10^5 n/cm ² /s
Max. beam size at specimen	Width : 1.5 mm Height : 15 mm
Incident wavelength	0.43 nm
Angular resolution (horizontal)	0.01° to 06° (typical 0.04°)
Vertical divergence	2°
Angular range	$0 \leq 2\theta \leq 120^\circ$
Minimum step size scan	$\Delta\theta = 0.01^\circ$
Detectors	³ He tube or microstrip PSD
Ancillary equipment	<ul style="list-style-type: none"> ★ Cryomagnet : $2.5 \text{ K} \leq T \leq 300 \text{ K}$ B = 7 T in the sample plane ★ Continuous flow cryostat : $80 \text{ K} \leq T \leq 300 \text{ K}$ B = 1.2 T in the sample plane or Perpendicular to the sample plane ★ Furnace : 800°C in 10 mT

This spectrometer is suited for the study of magnetic thin films and multilayers with polarisation analysis but can also be used for high resolution large angle diffraction.

We use movements with a precision of 0.01°. Slits are made of single crystal Gallium Gadolinium Garnet to reduce small angle neutron scattering.

The incident beam is produced by a multilayer monochromator mounted in the guide G 2. The wavelength is fixed at 0.43 nm. The wavelength spectrum width $d\lambda/\lambda$ is 5%.

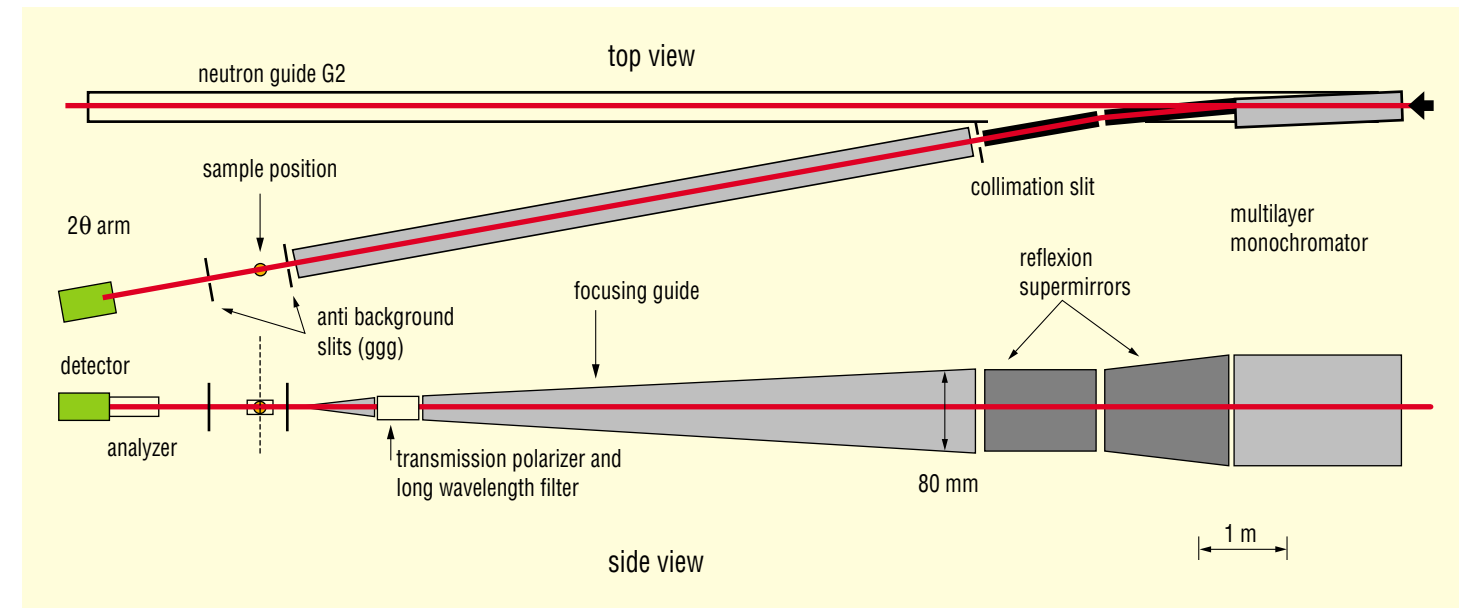
The scattering angle 2θ can be varied up to 120°. The sample table can sustain 350 kg and the beam center is at 270 mm from the top goniometer.

Experiment interface allows complex batching for sweeping field, currents, temperatures, etc... while scanning angles.

The spectrometer can be equipped with a cryomagnet for low temperature measurements or high field measurements (up to 7 T in the sample plane). It can also be equipped with a more flexible nitrogen continuous flow cryostat that can be fitted into a 1.2 T magnet. In this latter case, the field can be applied in any direction relative to the sample plane.

Neutrons are polarised with transmission FeCo/Si supermirrors. The polarisation is analysed by reflection supermirrors. The flipping ratio is of the order of 35.

In reflectivity, this spectrometer allows to measure reflectivity curves with a dynamic range of $10^5 - 10^6$ on a 1 cm² sample in 12 hours for all spin states (non spin-flip and spin-flip).



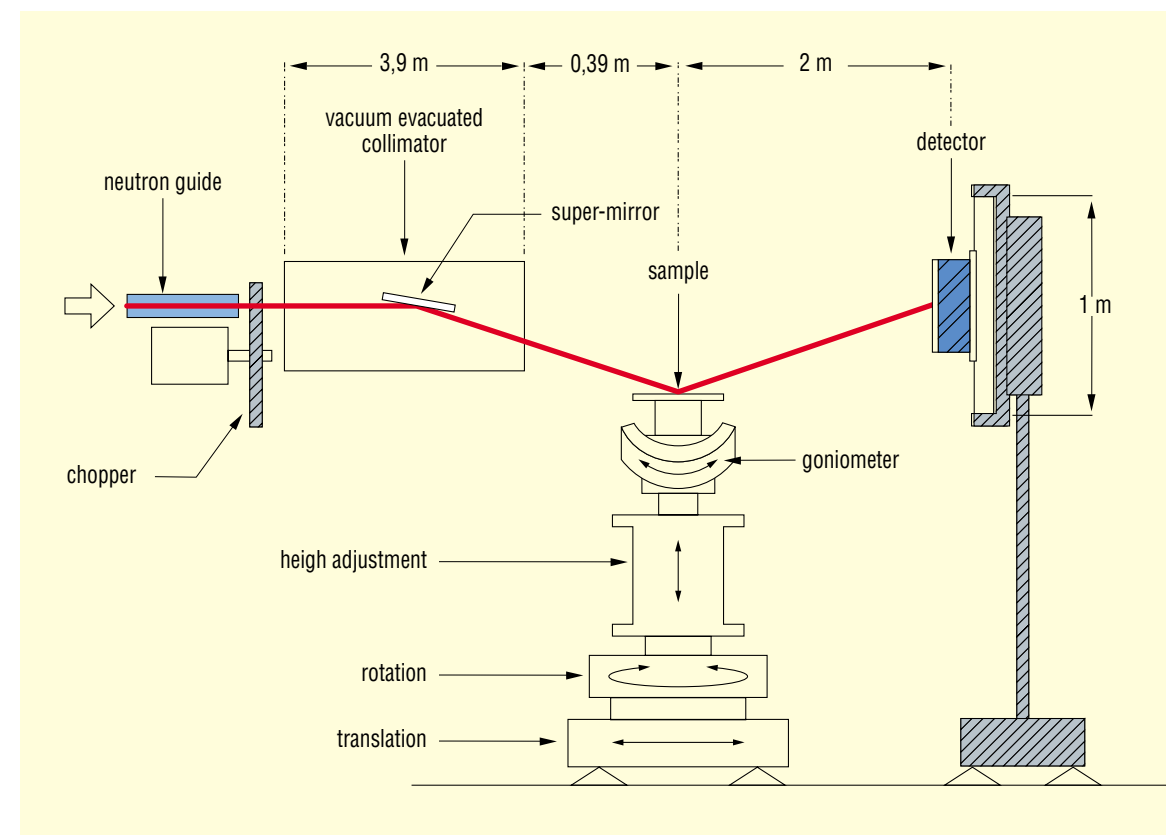
General view of the G 2-4 spectrometer.

Distance chopper to detector	6.25 m
Distance sample to detector	2 m
Wavelength range	3 Å to 25 Å
Wavelength resolution	fixed $\Delta\lambda$ from 0.1 Å to 1 Å
Angular range	0.1° to 6°
Angular resolution	0.007° to 0.15°
Position of the surface	horizontal
Horizontal beam size at the sample	25 mm
Vertical beam size at the sample	0.5 mm to 10 mm
Detection	^3He
Maximum intensity	1000 count.sec ⁻¹ Å ⁻¹ at 3.5 Å
Background	1 count.hour ⁻¹ Å ⁻¹
Minimum measurable reflectivity	5.10 ⁻⁶
Typical acquisition time :	4 h - 8 h (soft matter)
Ancillary equipment	<ul style="list-style-type: none"> ★ Multireflections system for samples of 10 cm to 50 cm long ★ Furnace (60°C, 200°C) ★ Magnets with horizontal or vertical field between 0.001 T and 1 Tesla ★ Controlled temperature cells (from -40°C to 60°C) for liquid surface measurements ★ Polarizer and flipper for polarized neutron measurements

This reflectometer is dedicated to the study of interfaces by neutron reflection. The reflected intensity at grazing angle of a non polarized white neutron beam is measured as a function of wavelength. The variation of this reflection coefficient (reflectivity) with the wavevector is linked to the concentration profile perpendicular to the interface. If this profile is represented by a succession of different layers, the thickness, composition and roughness of each layer may be determined within the range from 2 to 500 nm for thickness and 1 to 20 nm for roughness. All type of interfaces might be studied, including air/liquid interfaces.

The reflectometer is installed at the end of the neutron guide G 3 bis. It is composed first of a chopper that produced the neutron bursts. Then, a 3.9 m evacuated collimator defined a very narrow neutron beam. Inside the collimator, a neutron supermirror enables the deviation of the beam towards liquid surfaces. The samples are installed on a goniometric head for alignment purpose. The reflected intensity is measured at a 2 to 4 m distance by single ^3He counter.

A polarizer and a flipper can be installed in order to perform polarized neutron measurements. A multireflections measurement system providing a better precision on the reflection coefficient when this one is close to one is available.



General layout of the spectrometer G 3 BIS.

Responsible : A. Menelle

e-mail : menl@llb.saclay.cea.fr