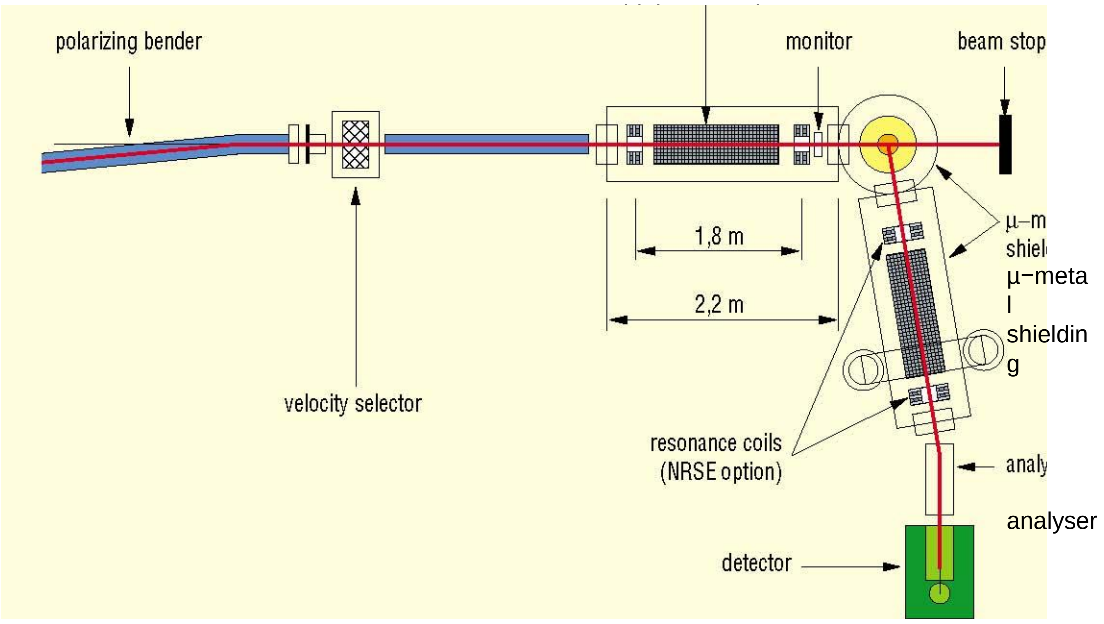
G 1 BIS Neutron resonance spin-echo Spectrometer MUSES

Beam tube	Cold G 1 bis. Neutron guide 2.5 x 5 cm^2, polarizing bender	
Incident wavelength	$3.5 < \lambda < 14$ Å	
Range of incident energies	$0.4 < E < 6.7$ meV	
Monochromator = Dornier velocity selector	max speed 28 000 RPM $\frac{\Delta\lambda}{\lambda} = 0.1 - 0.15$	
Beam area at sample position	4 x 4 cm^2	
Flux at sample position (polarized)	10^7 n/cm^2/sec at 5.0 Å.	
Divergence	± 0.1° per Å on the sample	
Distance sample - Detector	3100 mm	
Field path integral with NSE Option	0.5 - 50 G.m	
Frequency range of the RF coils	40 - 640 kHz	
Distance between RF coils	1800 mm	
Time range	$\lambda = 3.5$ Å	1.2 ps ... 1.1 ns
	$\lambda = 6.0$ Å	6 ps ... 5.0 ns
	$\lambda = 10$ Å	29 ps ... 22.0 ns
Energy range	$\lambda = 3.5$ Å	$6.0\ 10^{-4}$ ... 0.55 mev
	$\lambda = 6.0$ Å	$1.3\ 10^{-4}$ ... 0.11 mev
	$\lambda = 10$ Å	$3.0\ 10^{-5}$ ... 0.02 mev
Angular range	4 - 110°	
Polarizing/analysing devices	★ Polarizing bender R = 76 m, FeCo/TiNi supermirrors m = 2.5 on the concave side and m = 2 on the convex side, the 25 mm beam is divide into 3 channels of 8 mm ★ Analysing device : supermirrors R = 17 m, 5 x 5.6 x 500 mm^3	
Ancillary equipments available	★ 10 K < 800 K ★ 4 K < 600 K ★ 200°C < 1800 °C	

MUSES is a mixed resonance-conventional neutron spin echo spectrometer installed on the guide G 1 bis. The aim of this spectrometer is to study high resolution quasielastic scattering in the medium wavevector range (0.05 Å$^{-1} < Q < 2.75$ Å^{-1}) bridging the gap between Time-of-flight spectroscopy and SANS Neutron Spin-Echo at the LLB.
The spectrometer is divided into two distinct parts, a conventional NSE spectrometer for measurements at small Fourier times (typically $\tau < 200$ ps for λ~10 Å) and an NRSE option for measurements at longer times. In resonance spin-echo spectrometry, the two high magnetic precession coils are replaced by four radio-frequency coils ; two in the first arm and two in the second. Only within these coils the spins are submitted to magnetic field and consequently the remaining neutron path has to be shielded from any magnetic contamination (earth magnetic field...). The field geometry in the coils is very similar to the one used in nuclear magnetic resonance : a static high field in the vertical direction B_0, and a horizontal radio



General set-up of the spin-echo spectrometer G 1 BIS.

frequency field $B_1(t)$ rotating in the horizontal plane. Such a configuration allows measurements at high Fourier times without the need of high magnetic fields. It is particulary interesting for measurements at high angles, because of the difficulty of keeping the field line path in the sample position with conventional NSE option (needs of tunning devices). It allows a very high flexibility with respect to wavevector changes : the resolution function is negligibly angle dependent for a given wavelength.

The neutron beam is polarized by a bender of 4 m length and 76 m radius made out with NiTi super mirrors. A velocity selector roughly monochromizes the incident flux with a wavelength band of $\delta\lambda/\lambda \sim 0.1 - 0.15$. The polarized flux intensity at the wavelength maximum and at the sample position of the spectrometer MUSES is 10^7 n.cm^{-2} s^{-1} for $\lambda \sim 5$ Å, this total integrated flux of the 40 x 40 mm^2 beam at the sample position is $\sim 1.6\ 10^8$ n.s^{-1}. Due to the presence of µ-metal shielding, very small Fourier times can be measured (at low current) with NSE option because the depolarization of the beam due to the earth magnetic field or any environmental fields is absent.

Typical studies performed on the instrument are dynamics in liquids and supercooled liquids (in bulk or confined geometries), dynamical studies of soft condensed matter (polymers, colloids...), Biologically relevant systems, critical phenomena, molecular motions in crystals...

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