DIFFUSE SCATTERING INSTRUMENTS

Beam tube	7 C - Hot source
Monochromators	Ge (111) , Cu (111) , Ge (311)
Type of instrument	Two-axis (for diffraction from disordered systems).
Max. flux at specimen	10^6 - 2.10^7 n cm^{-2} sec^{-1}
Max. beam size at specimen	5 x 2 cm^2
Incident wavelength	λ = 1.11 Å - 0,7 Å - 0.58 Å
Angular ranges	1.25° < 2θ < 128°
Q range	0.3 $Å^{-1}$ < Q < 20 $Å^{-1}$
Distance sample - detector	1.5 m
Collimation	Vertical : 2°
	Horizontal : 0.6° (0.2° possible)
Detectors	640 cell PSD (height : 70 mm, width 5.2 mm)
	covering 128° (2θ)
	radius of curvature 1.50 m
Data collection and Instrument Control System	PC computer
Ancillary equipment	★ Furnace 320 K < T < 1700 K
	★ Cryostat 1.5 K < T < 300 K
	★ Vacuum tight

The two-axis diffractometer 7 C2 is located on the hot source of the reactor Orphée. It is dedicated to structural investigations of liquids, glasses and amorphous materials.

The characteristics of 7 C2 are detailed in “Position sensitive detection of thermal neutrons” Ed. P. Convert - B. Forsythe, Academic Press - London 1983.

The high energy neutrons provide a wide range of momentum transfer and reduced inelastic scattering. The detector is a curved multidetector filled with $^{10}BF_3$. The 640 cells cover a scattering angle 2θ = 128° (step 0.2°). The sample to detector distance is 1.5 m. Three monochromator crystals (Ge(111), Cu(111) and Ge(311)) allow for the three incident wavelengths : 1.1 Å, 0.7 Å and 0.58 Å. (computerised change of wavelength).

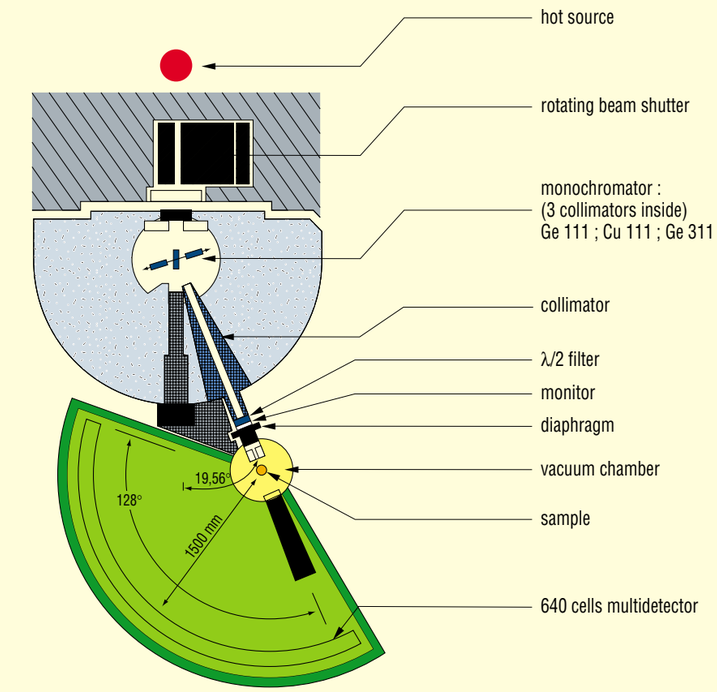
The beam is collimated between the hot source and the monochromator (3 types of collimation), and between the monochromator and the sample (4 types).

The sample is placed in a 600 mm diameter vacuum vessel. In this vessel can be added :

- a sample changer (5 positions) for room temperature experiments
- a furnace with a vanadium or niobium heater, covering a temperature range 300 K - 1700 K
- a similar furnace that can be put upside down (manually), in order to mix liquids
- a thermal bath with a temperature range 200 K - 350 K.

A cryostat is also available for temperatures from 1.5 K to 300 K. The cryostat tail in the beam is made from vanadium.

Hot Neutron Two-Axis Diffractometer 7 C2



General layout of the diffractometer 7 C2.

The 7 C2 spectrometer is controlled via a PC type computer which drives the temperature (furnace, cryostat) and the sample changer at room temperature.

Standard programs for data reduction are available on the computers of the group. Guides are available for these analysis programs (in french and in english) as well as for the driving programme of 7 C2.

Projects :
The BF_3 detector will be replaced by a detection ensemble composed of 12 2D-microstrip detectors filled with 10 bars ^3He. This will result in an increase of the efficiency by a factor 4 at least. Each detector will have its own collimation, which will greatly improve the signal-to-background ratio.
A new thermal bath working from 200 K to 500 K will be available soon.

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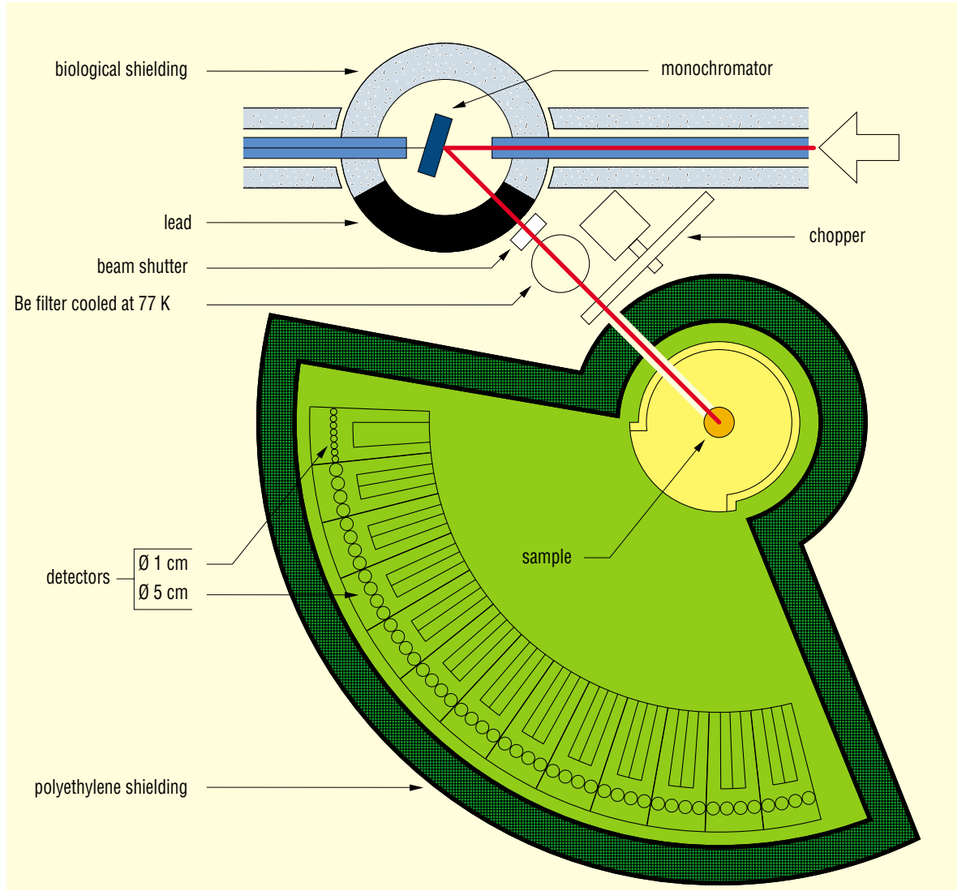
G 4-4 Two-Axis Diffractometer for Elastic Diffuse Scattering

Beam tube	Cold neutron Guide G 4
Monochromators	Graphite, 5 slabs (80 x 30 x 2 mm), vertical focusing Mosaicity 0.8°
Type of instrument	Diffractometer.
Max. flux at specimen (n/cm2.s)	1.3 x 10^6 (λ = 5.6 Å)
Max. beam size at specimen	25 x 50 mm^2
Incident wavelength	2.4 < λ (Å) < 6 $\Delta\lambda/\lambda = 4.10^{-2}$
Incident energy	12 > E (meV) > 2.2
Energy resolution	8 to 0.5 meV
Angular resolution	2.5° or 0.625°
Angular ranges	-5° < 2θ < 140°
Scattering vector ranges	0.1 < Q ($Å^{-1}$) < 5
Collimation	Monochromator-sample distance : 1.8 m (λ = 5.6 Å) Sample-detector distance : 1.5 m
Detectors	64 ^{3}He detectors (48 + 16)
Background	1 c/min detector
Data Collection and Instrument Control System	PC
Ancillary equipment	★ Furnace (T < 1300°C) ★ Cryostat (1.5 < T < 300 K)

This instrument is dedicated to the study of disorder in solids, in particular in metallic alloys : short range order, size effects, impurity effects. The sample is a polycrystal or a single crystal oriented outside the instrument.
The incoming beam is monochromatic (2.4 < λ < 6 Å). The focusing monochromator, made of 5 graphite blades, concentrates the beam on about 6 cm at the sample level, with a flux increase by a factor of 2 or 3. A nitrogen cooled beryllium filter (λ > 3.96 Å) eliminates $\lambda/2$ harmonic of the incident beam.

A vacuum vessel around the sample, 80 cm diameter, minimizes the background due to air scattering and includes a furnace for in situ high temperature experiments. An automatic sample translator enables to compare various samples, including a vanadium standard and a background without sample. For single crystal studies, an automatic rotation of the sample is provided, in order to explore the diffuse scattering in a whole plane of the reciprocal space.
The measuring system is made of 48 ^{3}He detectors, 50 mm in diameter, and a block of 16 (10 mm in diameter), which can be rotated by ± 5° around the sample axis.



General layout of the diffractometer G 4-4.

The experiment is equipped with a PC which enables to position the instrument, collect the data, and to perform some pre-treatments of the spectra while new data are collected.

A time of flight system (with chopper) enables, for each detector, to select the elastically scattered neutrons, which correspond to static disorder. The analysis of the inelastic part of the time of flight spectra yields interesting information about localized excitations (crystal field, optical phonons …).

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