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SANS Instrumentation / Components

Multibeam collimation implemented for the ICCAS / CARR SANS instrument

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Abstract

The multibeam focusing collimation system, experimentally proved at the Budapest Research Reactor, is included into the 15 m long Collimator unit of the CARR ICCAS SANS instrument. This option might yield a gain factor of 2 - 6 in the detected intensity in most cases of experiments. The instrument characteristics (resolution, sample size and illumination) are evaluated for several aperture sizes of the multibeam collimator as well as for various available configurations of the Collimator.

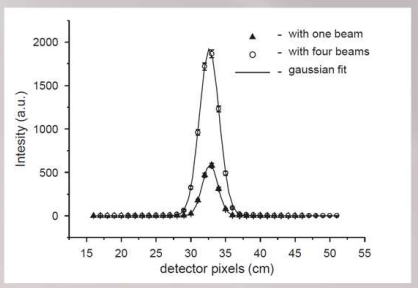
Installed collimator unit of the CARR ICCAS SANS instrument

Collimator system:

-Total length: 15 m
-Scattering vector q range: 1.0×10^{-2} nm^{-1} ~ 5.0 nm^{-1}
-Wavelength range: λ: 0.25nm ~ 2.0nm
-Incident wavelength resolution Δλ/λ: 8 % ~ 25 %
-Horizontal movement in evacuated housing with vacuum 10 Pa
-Guide-multibeam positioning rail system precision ±0.05 mm

Technical parameters:

-Multibeam collimator option might yield a gain factor of 2 – 6 in the detected intensity in most cases of experiments.
-The Collimator vacuum housing could be connected to the sample station via gate valve with 100mm ID standard flange.
-The SANS instrument is controlled by a PC via an electronic control and driving system.
-The supplied software will control the beam stop mechanism, selector parameters, monitor counting and collimator configuration.
-Maximum collimation length of 15 m as well as 9 m and 3 m collimation lengths inserting 2 m long neutron guide segments 3 and 6 pieces, respectively. At the three collimation lengths i.e. at 15 m, 9 m and 3 m distance from the sample position are positioned the identical aperture plates with changeable diaphragms of 50 mm or 25 mm diameter while the aperture plate with diaphragms of correspondingly smaller diameter of 25 mm or 12.5 mm is close to the sample position.



Gaussian fit of the direct beam measurement with 1 and 4 beams at 4 Å at the BNC SANS instrument

Multibeam focusing collimator unit parameter at Budapest Neutron Center

The beam is formed by 4.5m long, 40 mm diameter collimator, the intensity is recorded by a 64x64 cm^2 area, 1x1 cm^2 pixel size BF_3 filed 2D position sensitive detector. The collimator system consist a 4m aluminum collimator tube coated with boron carbide. The beam separator is a cross shaped 2m long aluminum section with 1mm wall thickness coated with boron carbide too.
At the collimator entrance a Cd with four 16x16 mm2 windows, 8mm between windows, at the sample end a second aperture with 8x8 mm2 windows and 4 mm between them. Sample to detector distance is equal the collimator distance of 4,7 m.

Source: A. Len et al. / Physica B 350 (2004) e771–e773

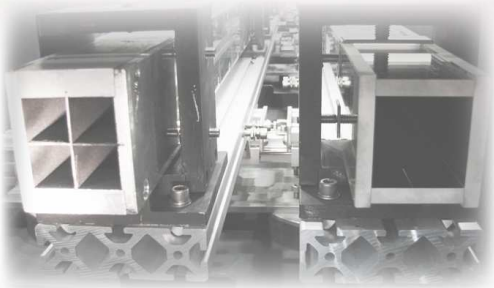
λ (Å)	Counts	FWHM (cm)
3.43	40 296	2.56
4.91	61 582	2.58
9.76	4699	2.15

Table 1. Data of direct beam measurements without beam separator. The column counts represent the sum over the central part of the detector, FWHM is the width of the 2D gaussian surface.

λ (Å)	Counts	FWHM (cm)
3.43	269 694	3.62
4.91	277 807	3.57
12.20	22 854	4.42

Table 2. Data of direct beam measurements with beam separator. The column counts represent the sum over the central part of the detector, FWHM is the width of the 2D gaussian surface.

Diaphragm with variable aperture and positioning rail system (below)



High accuracy guide-multibeam positioning rail system

Diaphragm with variable aperture.