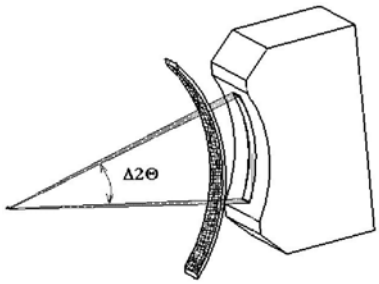
High-Performance Registration Unit for Diffracted X-rays



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Power Supply & Data Registration Electronic Unit

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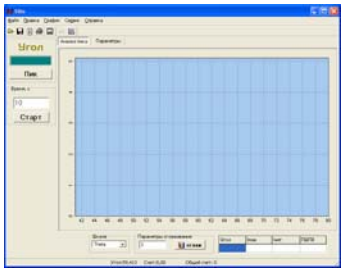


The Registration Unit consists of the detection unit PSD-C, developed filtration unit, power supply & data registration electronic unit interfaced with this detector and spectrum capture software

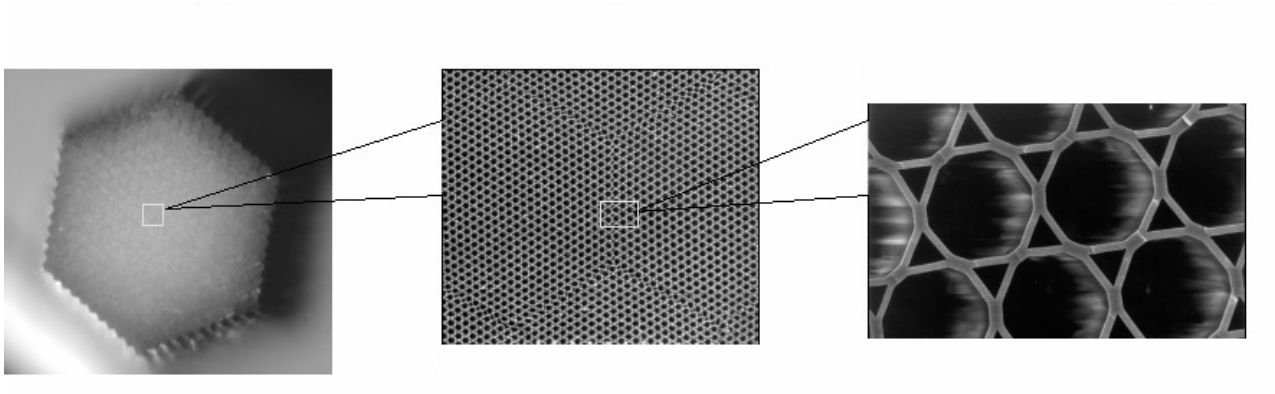
The equipment is designed for registering x-rays (within the range of 3 to 20 KeV) together with concurrent identification of the coordinates whereto x-ray quanta hit the output work window of the detector in a wide angular range. Radiation resistant wire anode ensures high reliability of detectors. The detectors are sealed and gas filled (with Xe-based mix).

Technical Characteristics of Detectors

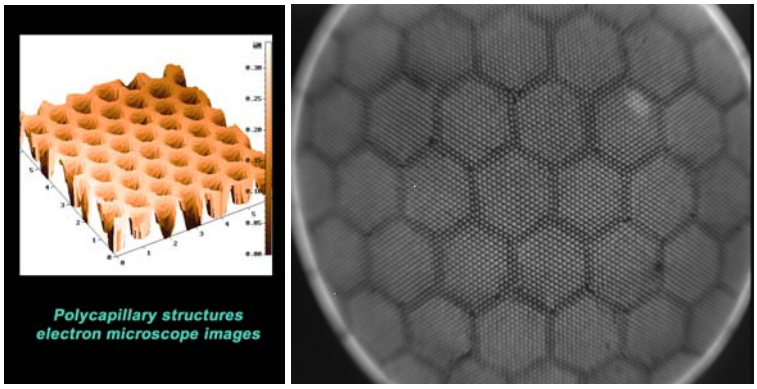
	Linear-Coordinate Detectors	Bent Coordinate Detectors
Work window size	20x10 mm	
Range of simultaneous registration (2Θ)		55˚
Spatial resolution, CuKα	90 μm	280 μm
Energy resolution, CuKα	20 %	22 %
Maximum count rate	$5x10^4 sec^{-1}$	$5x10^4 sec^{-1}$
Work window thickness (Be)	200 μm	200μm
Window height	10 mm	10.mm
Overall dimensions	118x82x50 mm	164x120x42 mm
Weight	0.8 kg	1.1 kg

Position-sensitive detectors are used in apparatuses designed for x-ray structural analysis for the purposes of express determining the phase composition of substances at high pressures and temperature, in order to speed up exposure in case of weak low-angular diffractograms, in simple goniometer-free phase analysis sensors.

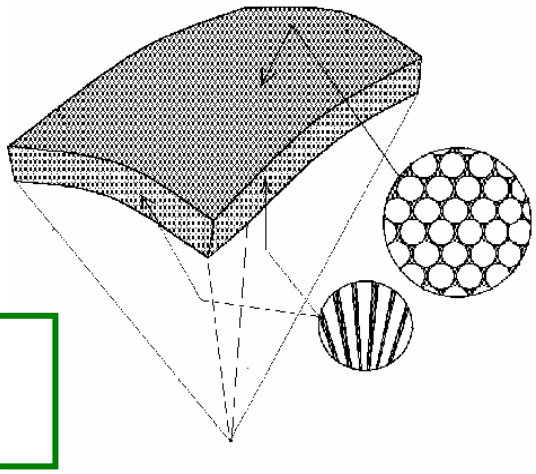
To improve the resolving power of the detector, a polycapillary raster system has been suggested providing diffracted x-rays filtration.



The polycapillary system has a honeycomb-like appearance

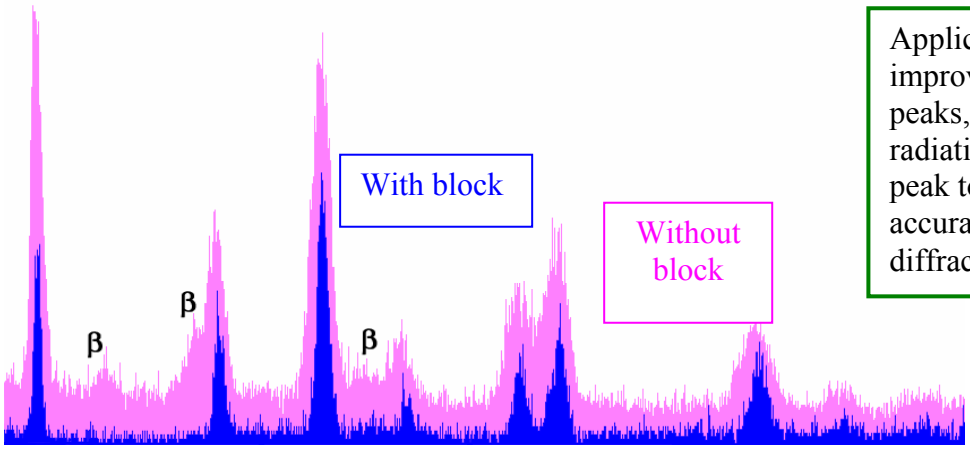


Glass polycapillary collimating system is shaped as sphere while tubular channels are directed along the radii of this spherical surface. This allows maximum utilization of diffracted x-rays. The radius of curvature of the raster system matches the radius of goniometer in the diffractometer used, and manufactured, as necessary, with s radius of 114.7, 180, or и 240 mm.



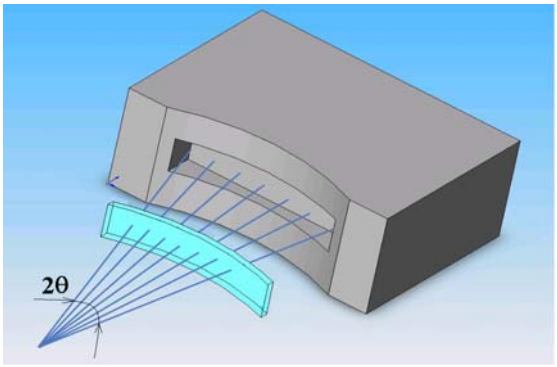
The collimating system has a honeycomb structure comprising multiple tubular channels for transportation of diffracted x-rays. Walls of neighboring tubular channels are fused.

Spherical design of the polycapillary raster provides spatial collimation of diffracted x-rays and concurrently filters stray x-ray radiation (such as fluorescent, Compton, elastic etc.) creating substantial background.
Spatial collimation enables minimizing the instrument width of the diffraction maximum. At that, the FWHH values of monochromatic x-rays are achieved.
Combined application of a polycapillary system and a respective β-filter allows their efficient use in diffractometers for express analysis of polycrystalline materials featuring complex composition.



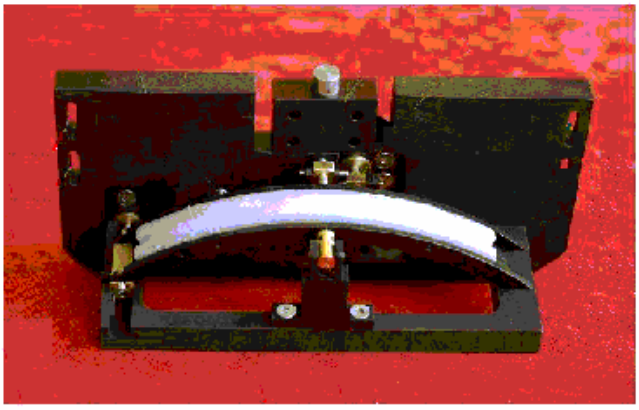
Application of the filtering unit improves resolution of adjacent peaks, provides filtration of K_β radiation, 4 times improves the peak to noise ratio, raises the accuracy of determining the diffraction peak's angular position.

Polycapillary raster system is mounted directly in front of the window of the position-sensitive detector, is fitted with a β-ϕfilter corresponding to the anode of the x-ray tube, and does not need additional alignment in the parallel-beam method.



The raster system is equipped with an additional alignment device to obtain the intensities ratios corresponding to:

1. the Debye-Sherrer method
2. the Θ-2Θ method
3. the parallel beam method at the best resolution.



The detection unit for x-ray diffraction measurements comprising a position-sensitive detector and a polycapillary collimating system is patented (patent RU 2242748 C1)