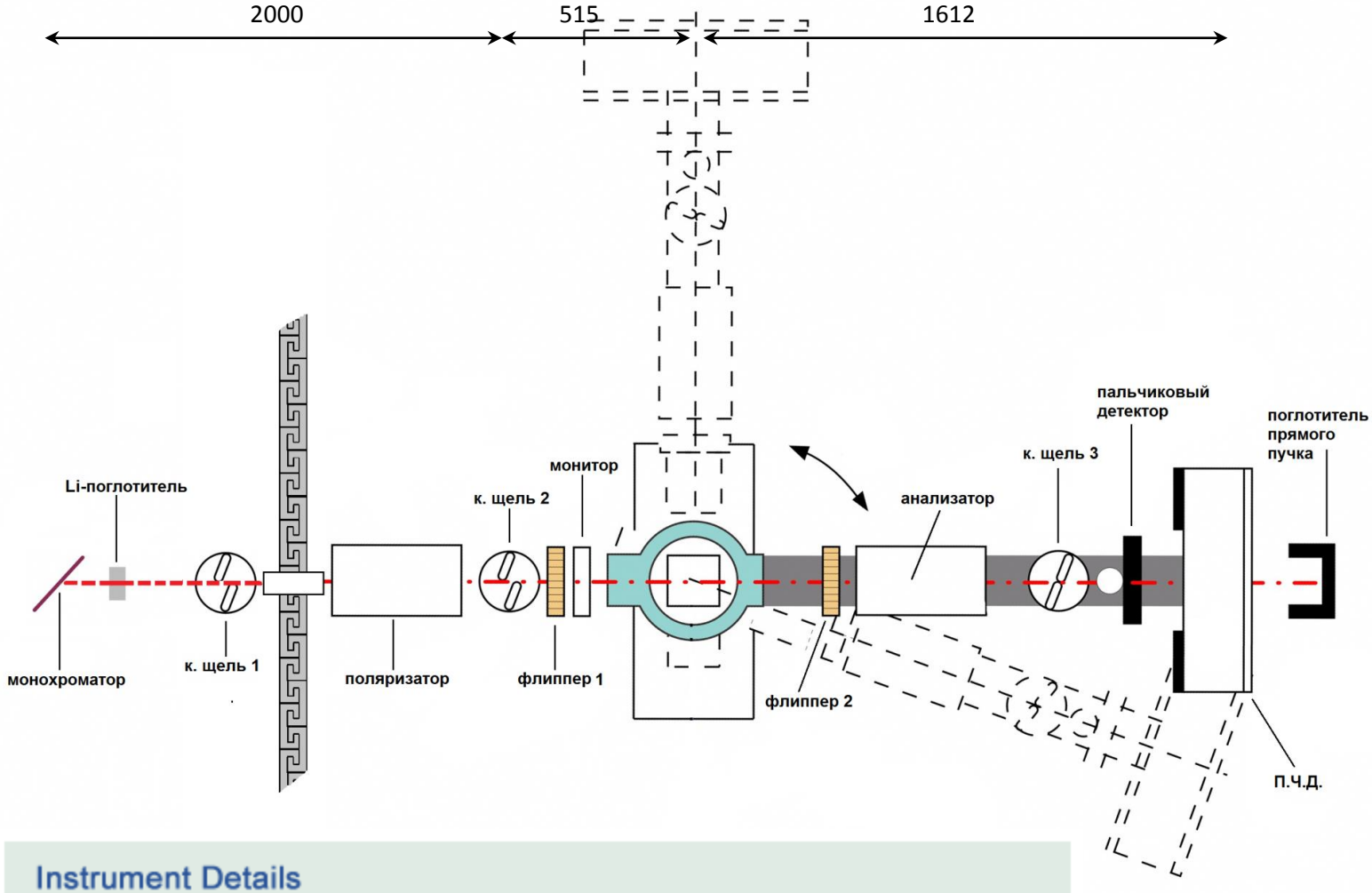
PNPI

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

Сборка рефлектометра NERO в нейтроноводном зале РК ПИК

Владислав Тарнавич

МУРОМЕЦ 2015

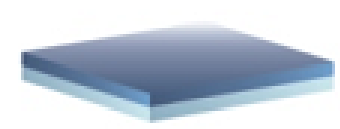


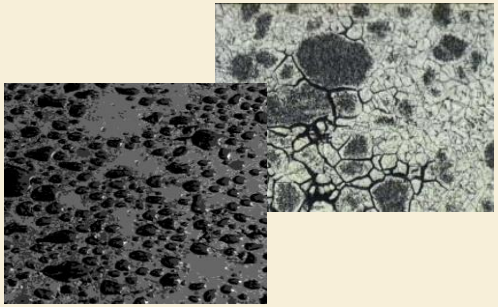
Instrument Details

Beamline:	*beamline 8 (NG-1)*
Wavelength:	*$\lambda = 0.435$ nm*
Wavelength resolution:	*$\Delta\lambda/\lambda \leq 0.02$*
Angular range:	*$-20° < 2\Theta < 100°$*
Flux at sample position:	*$\Phi = 5.10^4$ cm^{-2} s^{-1} (unpolarised, standard collimation)*
Detectors:	*2-dim position-sensitive ^{3}He counter;*
	^{3}He pencil counter
Ancillary equipment:	*refrigerator cryostat- temp.-range: 12-475 K;*
	electro magnet with field up to 0.9 T

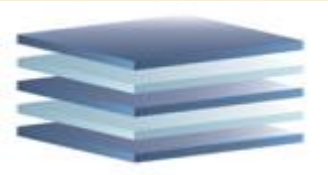
Для чего он (рефлектометр) нужен:

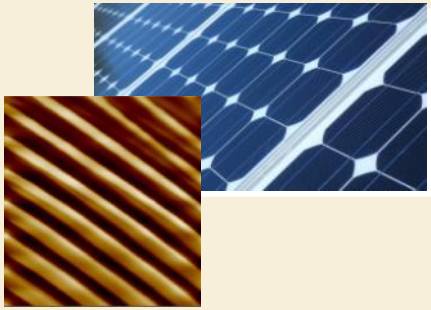
процессы поверхностного агрегирования
поглощение, диффузия, коррозия;



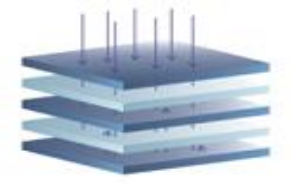


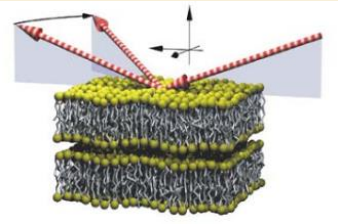
атомная и магнитная структура тонких слоёв
нанокристаллы, поверхностный магнетизм,
магнитная сверхструктура, тонкие плёнки;

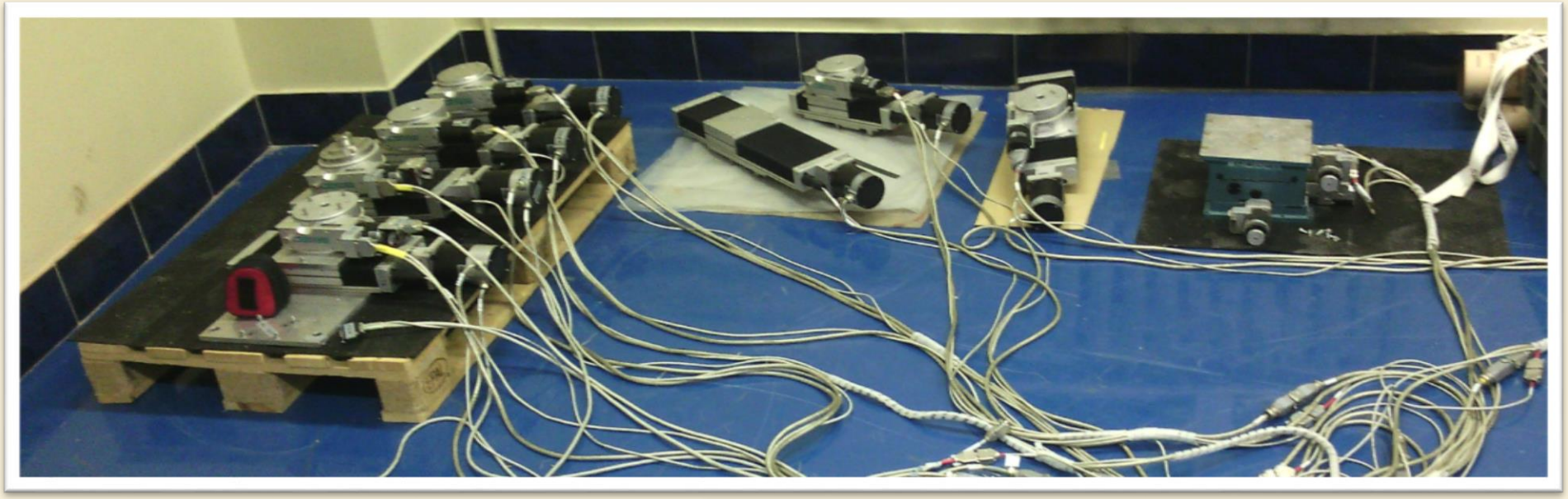




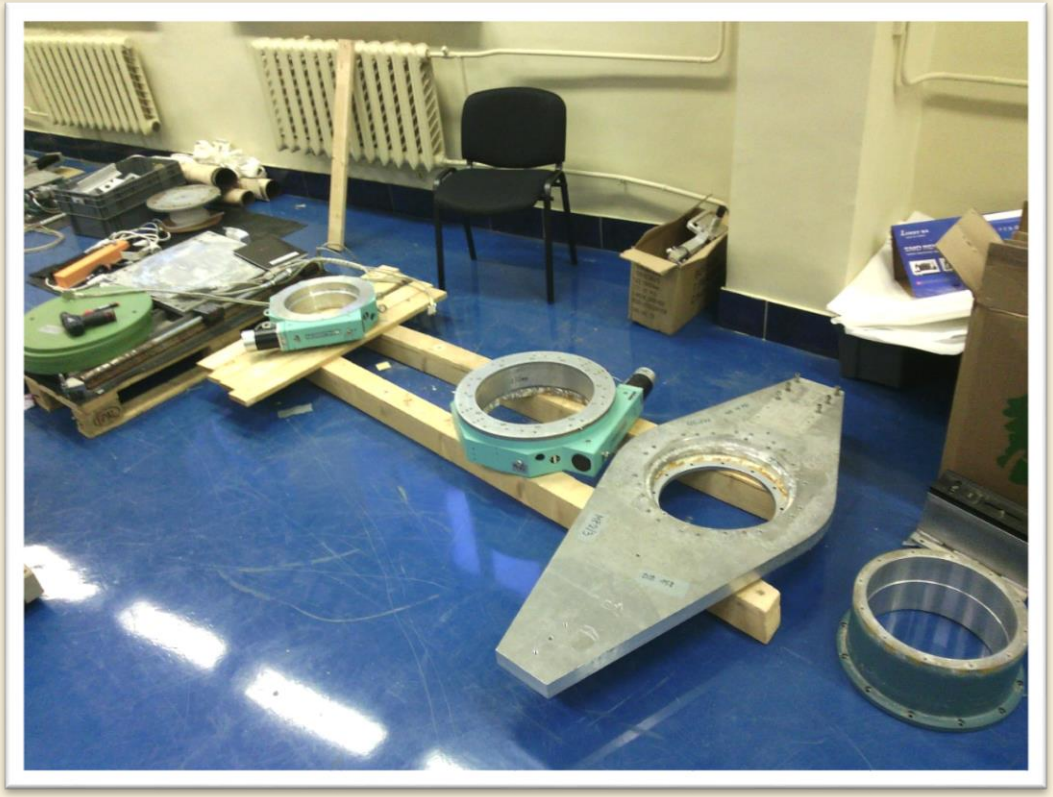
мембраны и органика
биологические мембраны, искусственные мембраны,
мембранный транспорт, полимерные плёнки.

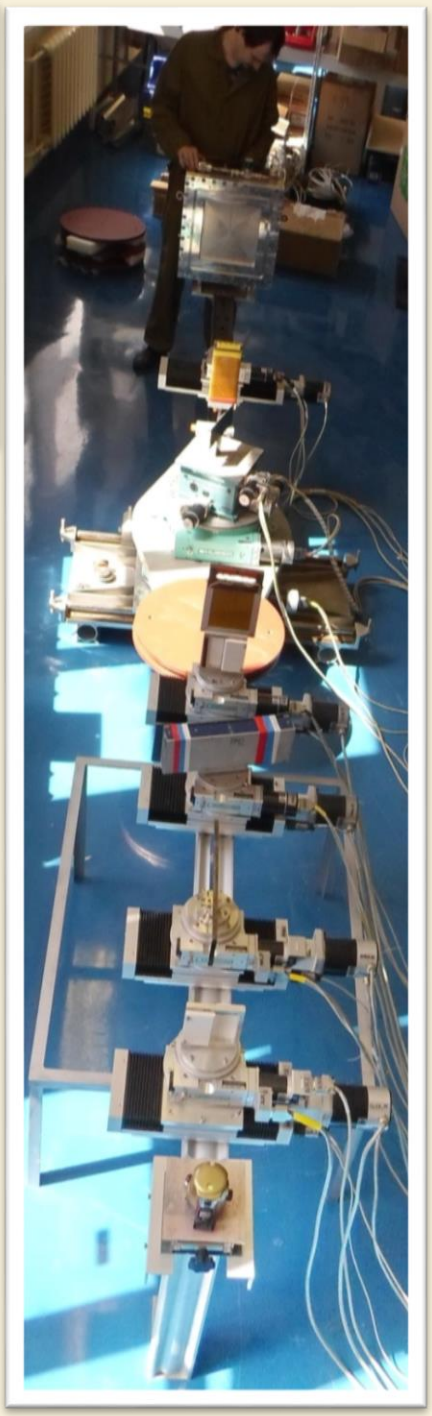




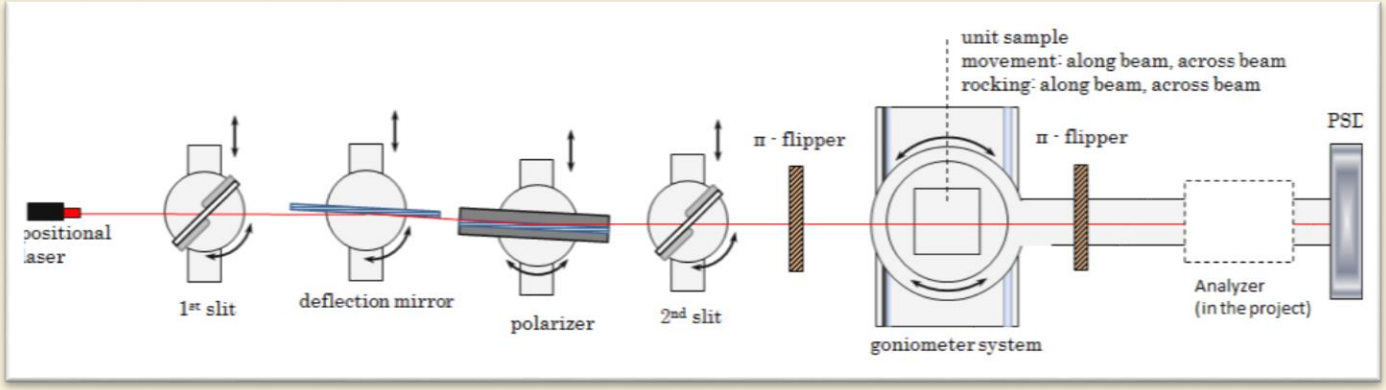


декабрь 2014





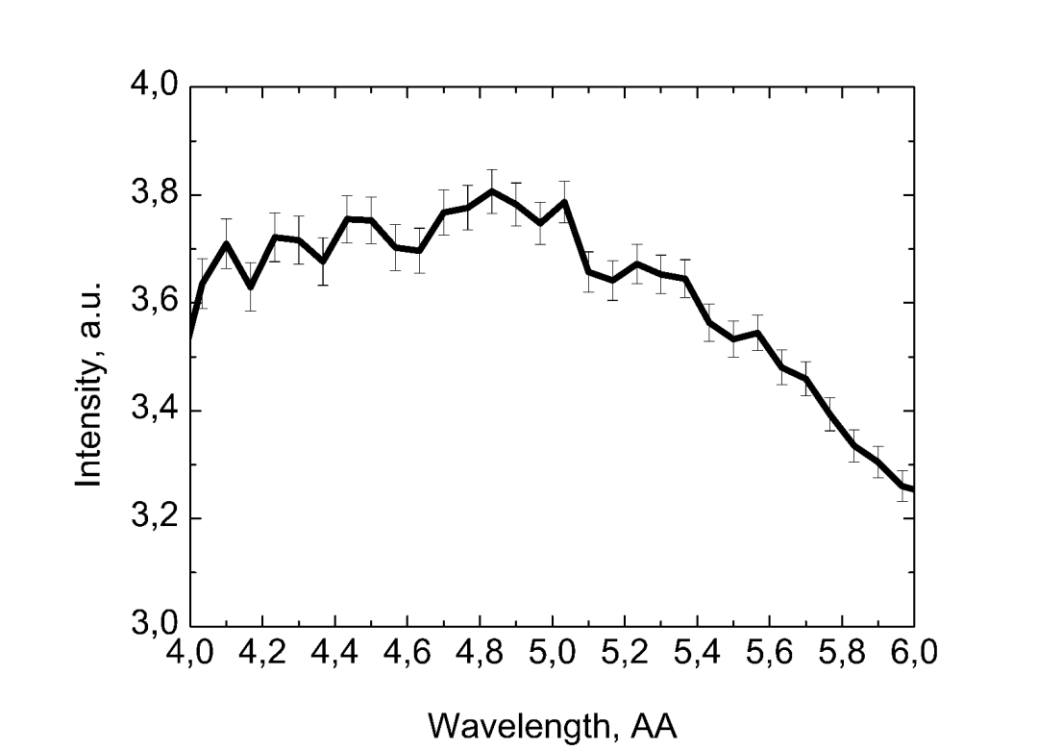
сейчас


unit sample
movement: along beam, across beam
rocking: along beam, across beam
PSD
π - flipper
π - flipper
positional
laser
1st slit
deflection mirror
polarizer
2nd slit
goniometer system
Analyzer
(in the project)

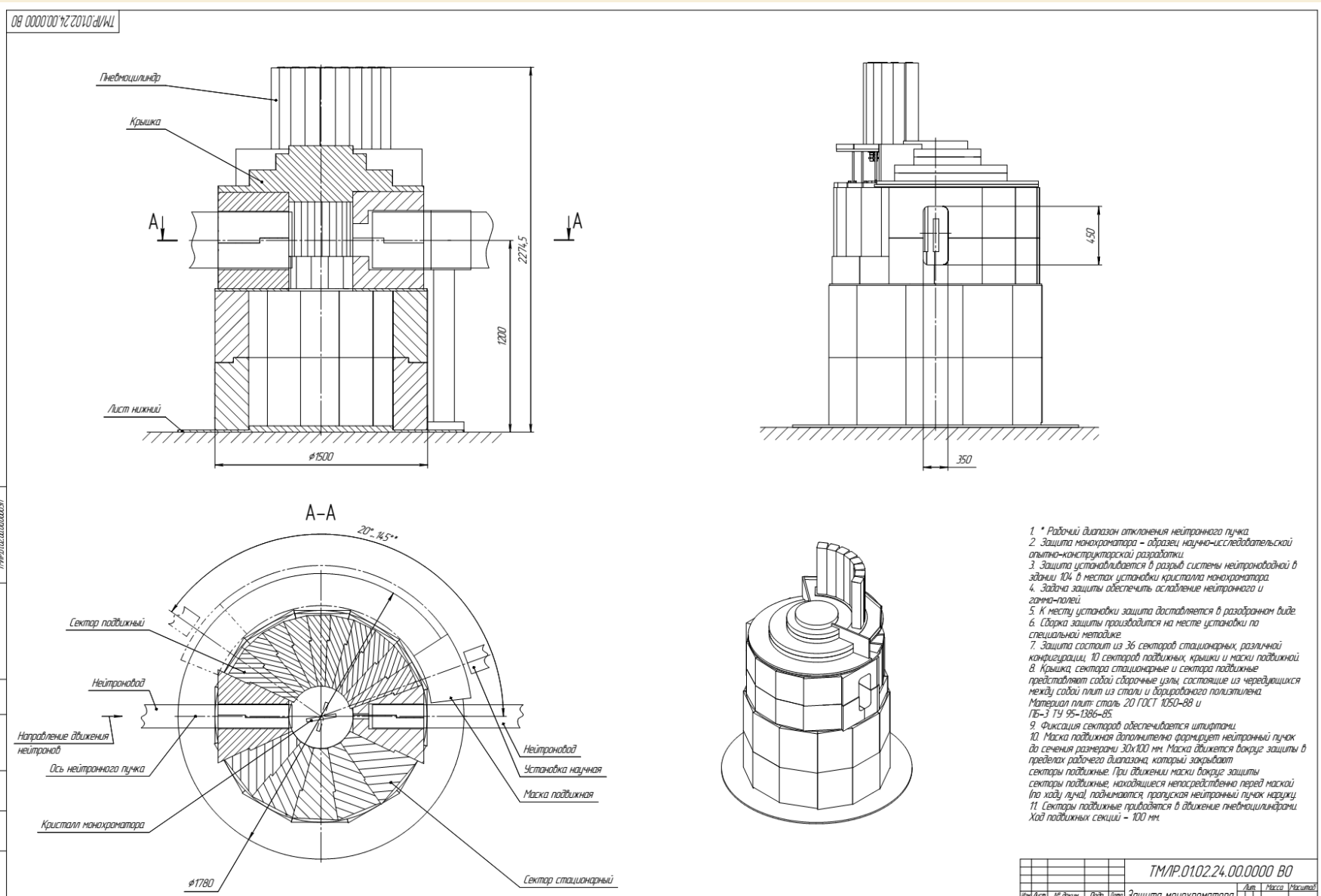
Монохроматор	HOPG (002), $\Delta\lambda/\lambda = 0.02$
Диапазон углов сканирования	$-20^{o}<2\theta<100^{o}$
Горизонтальная коллимация	0.01° - 0.05°
Точность измерения угла	0.001°
детектор	^{3}He PSD with res. 256×256

Рефлектометр работал на $\lambda = 4.35$ Å при $\Delta\lambda/\lambda = 0.02$.

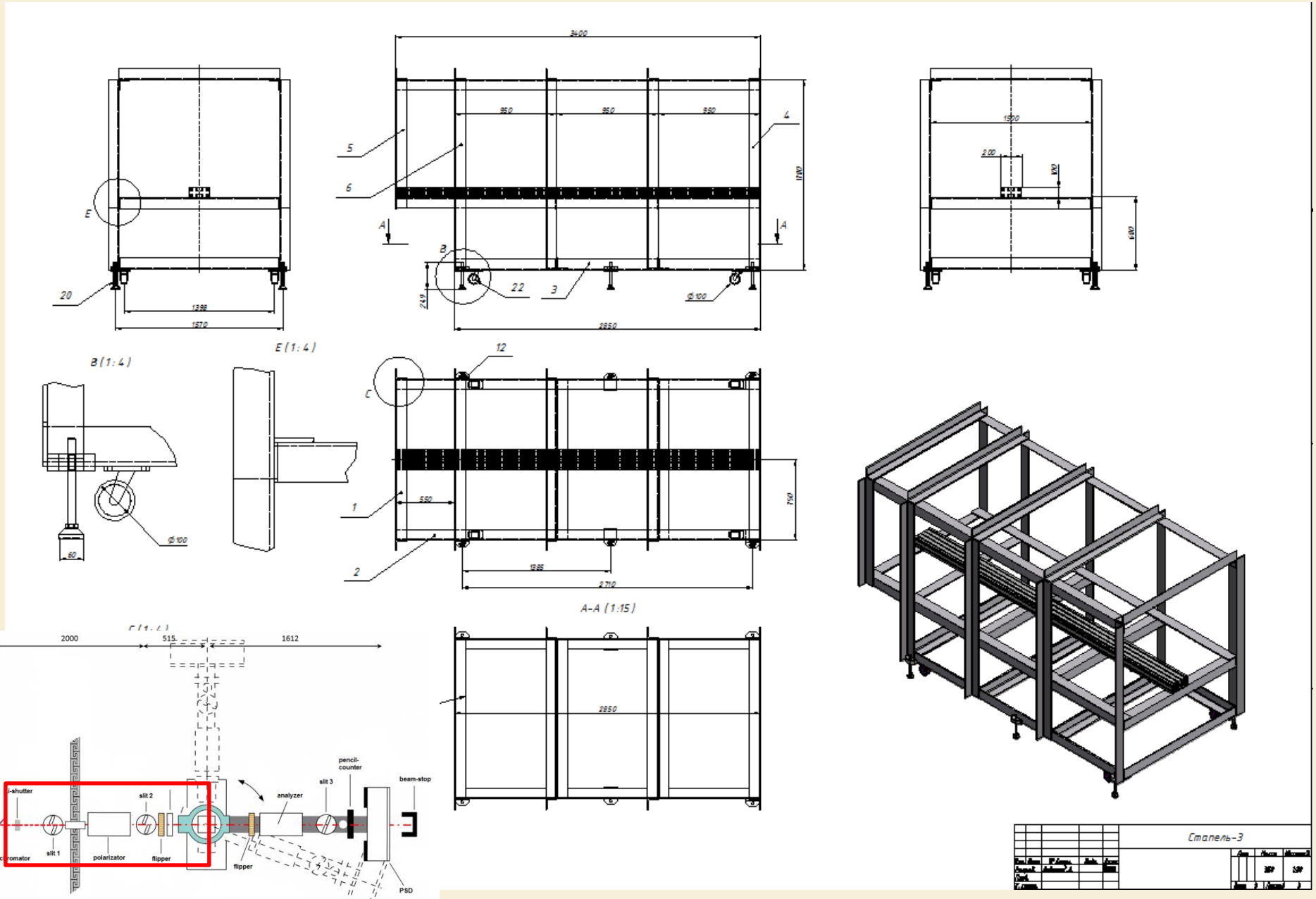
Зависимость потока на образце от длины волны с учётом монохроматичности



Защита монохроматора

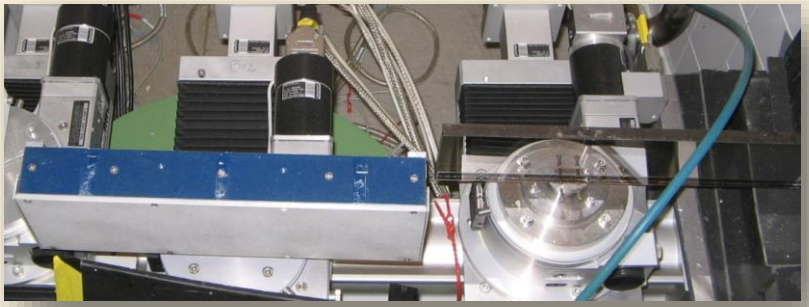


Платформа

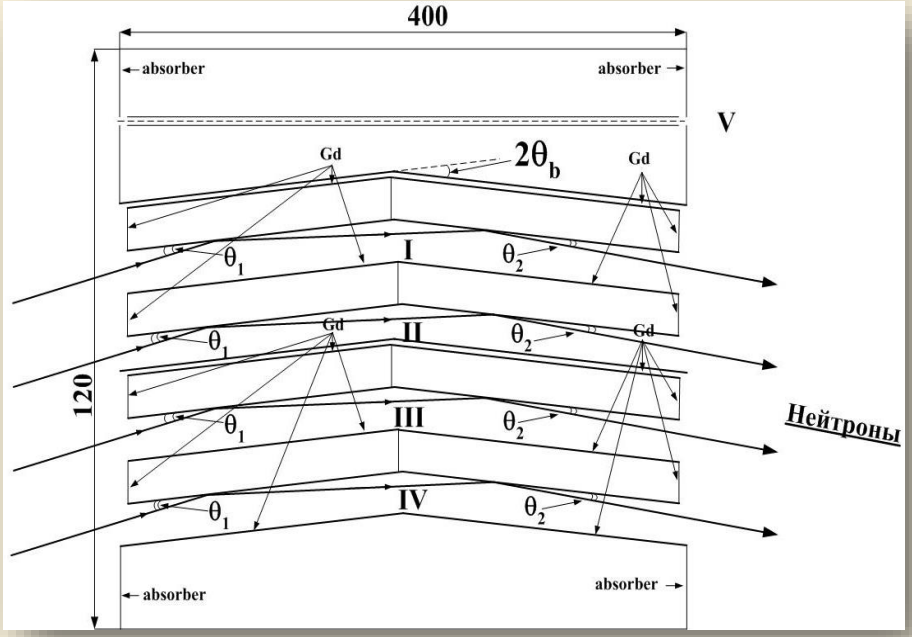

E (1:4)
B (1:4)
A–A (1:15)
2000
515
1612
monochromator
slit 1
polarizator
flipper
slit 2
analyzer
slit 3
pencil-counter
beam-stop
PSD
Стапель-3

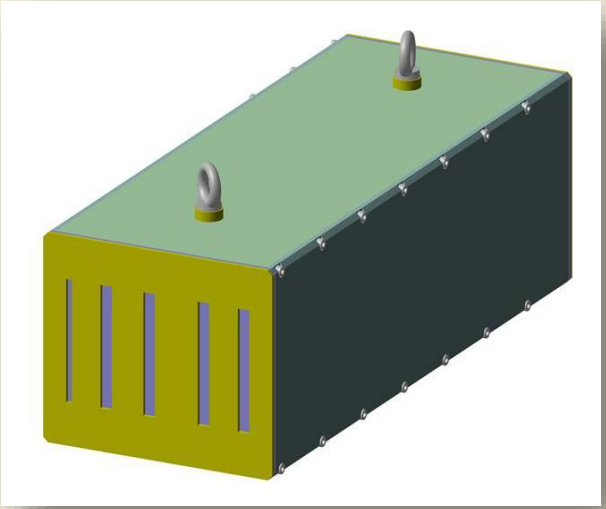
Поляризатор+суперзеркало

FeCo/Si суперзеркало
пропускание 60%
поляризация 96%



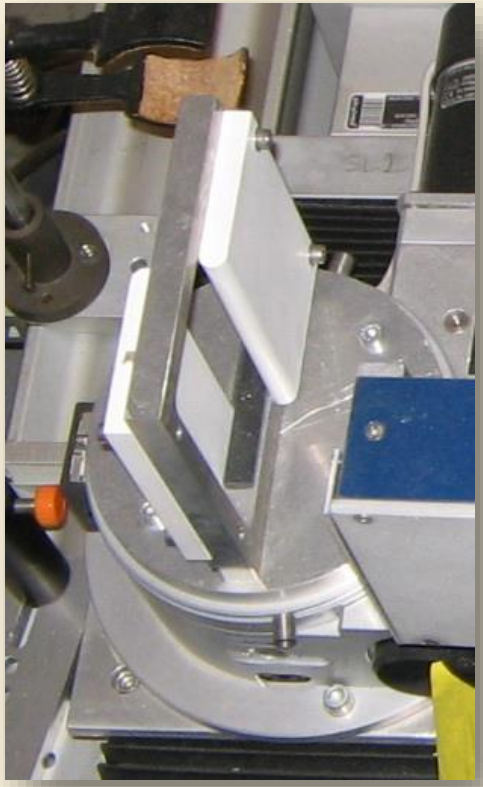
Формирователь пучка



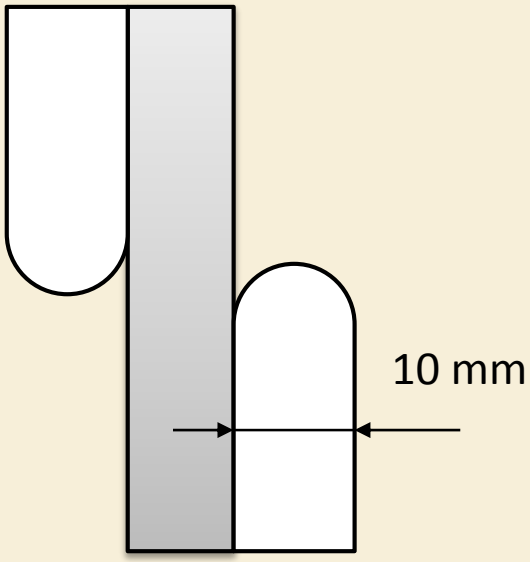


5 каналов: настроечный, 2 канала для высокого и 2 для низкого разрешения
периодическая структура:
60x[Ni(90Å)/Ti(90Å)] (неполяризованный)
60x[CoFe(90Å)/TiZr(90Å)] (поляризованный)
суперзеркало:
Ni/Ti with *m* = 2.5 (неполяризованный)
CoFe/TiZr with *m* = 2.5 (поляризованный)

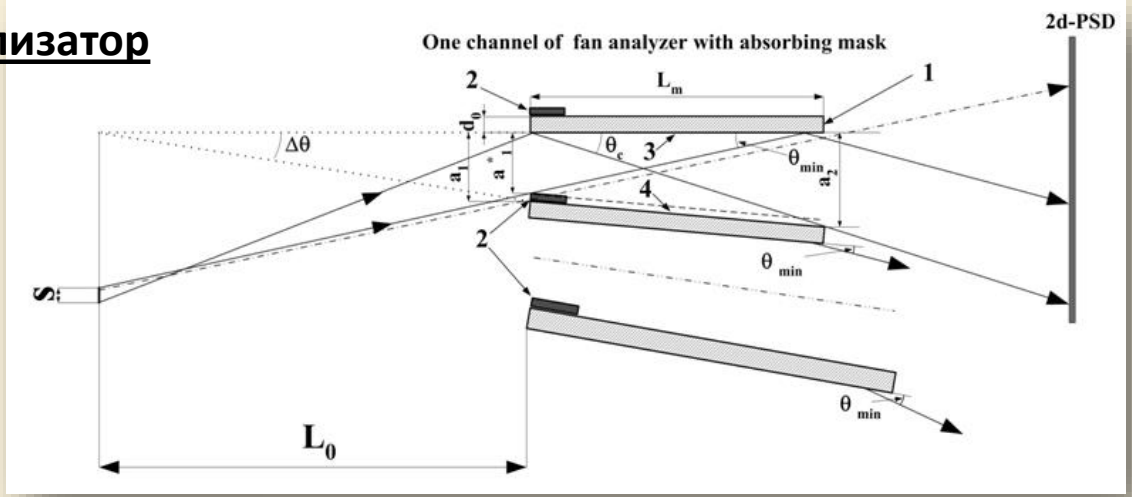
Диафрагма

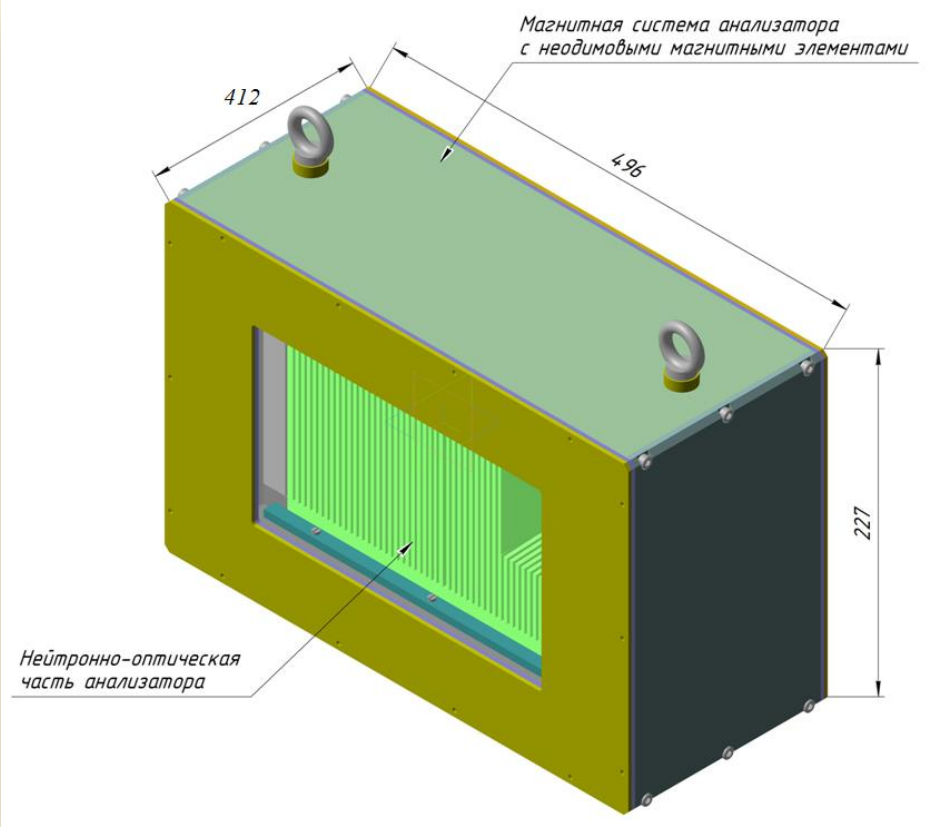


BN
beam divergence $\Delta\theta/\theta \sim 0.05°$
beam wide 0.1 ÷10 мм



Мультиканальный веерный анализатор





Length of supermirrors	***Lm* = 400 mm**
Height of supermirrors	*h0* =110 mm
Height of the analyzer channel	*h* = 90 mm
Strength of a magnetizing field	*H* = 650 G
Number of supermirrors in the analyzer	***N* = 77**
Polarizing Co*Fe/TiZr* supermirror coating: Faceside (3) Backside (4)	***m 1* = 2.0** ***m 2* = 0**
Distance from a sample to an entrance of the analyzer	*L0* = 1400 mm
Maximal glancing angle in the channel	*θc* = 14.4 mrad
	***Lm2* = 180 mm**
Thickness of a glass substrate of supermirror	*d0* = 0.4 mm
Width of the beam blocked by sample	*s* = 2 mm
Channel width at entrance with spacer	***a1* = 2.47 mm**
Actual width of channel at entrance including mask	***a*1* = 2.07 mm**
Channel width at the exit	***a2* = 2.88 mm**
Sensitive width of 2d-PSD	*b* = 250 mm
Acceptance angle for the beam reflected from a sample	*Ω = 6.36°*
Entrance cross-section of the analyzer	(90 x 221) mm^2
Geometrical transmission	**0.72**

Адиабатический радиочастотный флиппер

Мезеевский π - флиппер

Эффективность 96%

Эффективность 99.9%

He^3 ПЧД

Рабочая область окна детектора 25x25 $см^2$ с разрешением 2×2.5 мм.