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The U125-2 NIM beamline at BESSY II

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Abstract: Optical design and technical data of the high-resolution normal incidence monochromator (NIM) beamline U125-2 NIM are presented.

1 Introduction

Normal incidence monochromators (NIM) are typically used in synchrotron beamlines which are dedicated to experiments operating in an energy range of about 4 to 35 eV only. The decisive advantages of this type of monochromator design are that only small aberration errors occur and highest resolution can be easily achieved.
The 10m-NIM beamline (Reichardt et al., 2001) was designed for the quasi-periodic undulator U125-2 (Bahrdt et al., 2001). In this special kind of undulator source the period of the magnets is structured in a way that higher orders are suppressed. The design of the beamline's monochromator is based on the so called off-Rowland circle mounting design (Samson, 1967). This implies that the grating has to be rotated and slightly translated in order to get the highest resolution and a small spot size in the experiment.

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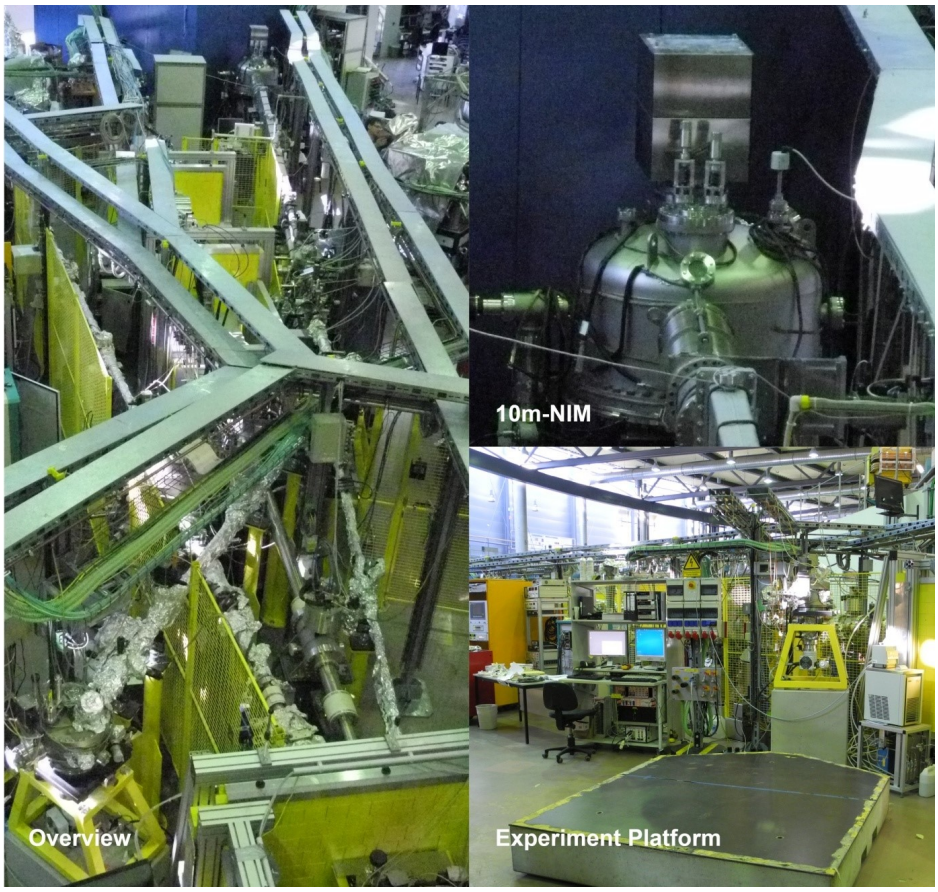

Figure 1: Views of beamline U125-2 NIM.

2 Instrument application

At this beamline the users care for their own experimental setup which fits to their application. Typical user's applications and experimental methods are:

- absorption spectroscopy
- fluorescence spectroscopy
- photoelectron spectroscopy
- photoionization of molecules and clusters
- spectroscopic ellipsometry

3 Source

The insertion device is the undulator U125-2 with the following parameters:

Type	planar hybrid, quasi-periodic
Location	H03
Periode length	125 mm
Periods/Pols	32 n
Minimal Energy at 1.7 GeV	2.53 eV
Minimal Gap	15.7 mm
Polarisation	linear horizontal

Table 1: Parameters of the undulator U125-2.

4 Optical Design

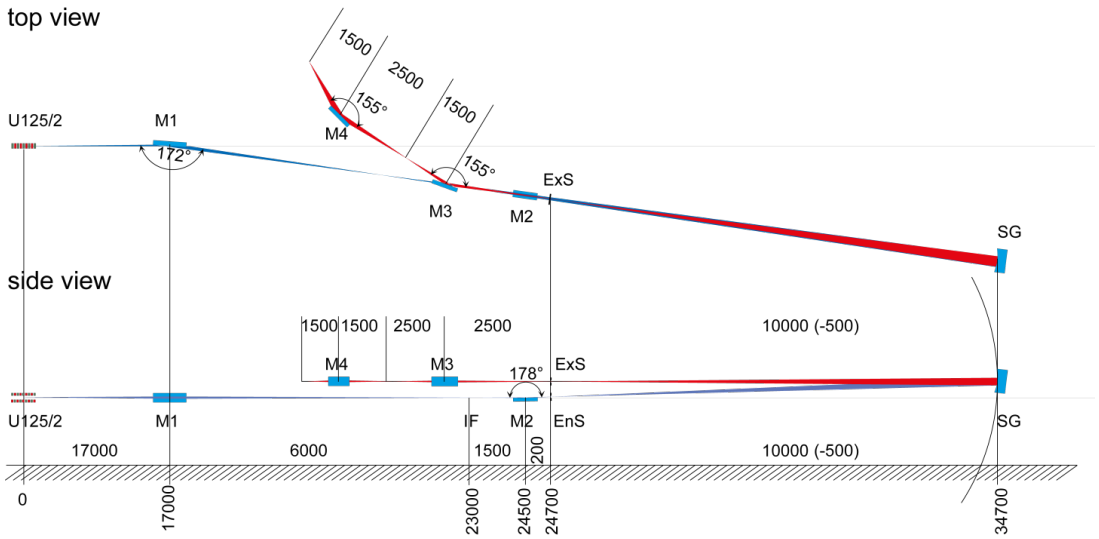

Figure 2: Optical design of beamline U125-2 NIM. All distances are given in mm. The optical elements are described in Table 2.

premonochromator optics	M1: toroidal mirror, horizontal deflection, 2Θ=172°, platinum coated, water cooled, horizontal and vertica demagnification 17:6 IF: Intermediate focus M2: plane-elliptical mirror, vertical focussing on entrance slit (15:2), vertical deflection 2Θ=178°					
entrance slit (EnS)	slit setting: 0-2000 µm, water cooled, rotatable by ±2°, prepared for online laser diffraction slitwidth monitor					
Monochromator	off-Rowland circle mounting G1-3: spherical gratings, vertical deflection, 2Θ= 2°, water cooled					
		E [eV]	profile	d[l/mm]	R [mm]	coating
	G1	3 - 40	blaze angle: 0.8°(max: 12 eV)	300	10041	Au
	G2	5 - 40	laminar	1200	10044	Pt
	G3	5 - 40	laminar	4800	9991	W
Exit slit (ExS)	slit setting: 0-2000 µm, rotatable by ±2°, prepared for online laser diffraction slit width monitor					
postmonochromator optics	M3: toroidal mirror, horizontal deflection, 2Θ= 155°, Ruthenium coated, vertical demagnification (1:1) of exit slit, horizontal demagnification 5:3 M4: toroidal mirror, horizontal deflection, 2Θ= 155°, Ruthenium coated, vertical demagnification (1:1) of intermediate focus, horizontal demagnification 5:3					

Table 2: Description of the optical elements.

5 Technical Data

Location	5.1
Source	U125-2
Monochromator	10m-NIM
Energy range	6(4) - 40 eV
Energy resolution	E/dE = 85000 @ d = 1200l/mm, 2nd order, 10 μm slits
Flux	10^{12} @ 21.75 eV [photons/s/0.1A/0.1%BW]
Polarization	horizontal
Divergence horizontal	5.5 mrad
Divergence vertical	12 mrad
Focus size (hor. x vert.)	200 x 350 μm^2
Distance Focus/last valve	1190 mm
Height Focus/floor level	1760 mm with concrete experiment platform without feet: 1450 mm (30, 50 and 100 mm feet are available)
Free photon beam available	yes
Fixed end station	no

Table 3: Technical data for U125-2 NIM beamline.

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