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The PM3 beamline at BESSY II

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Abstract: PM3 merges the developments of the former BESSY I SX700 III monochromator for elliptically polarized VUV radiation and of BESSY II collimated plane grating monochromators. This way it is possible to achieve circular polarization from a BESSY II dipole in the range 20 - 2000 eV with high photon flux, high energy resolution and high stability.

1 Introduction

PM3 is designed to deliver synchrotron radiation of variable polarization (linear and left- or right-handed elliptical), easily tuneable over a wide range of photon energies. Operating in the soft X-ray range, the major part of beamtime is dedicated to the investigation of magnetic materials using magnetic circular dichroism (XMCD) techniques. It is an "open port" beamline meaning that it is not equipped with a permanent experimental station. Rather, varying user experiments are connected to the PM3 beamline according to the beamtime schedule. At BESSY II PM3 has been installed in 2001. The accessible photon energies range from about 30 to 2000 eV. The energy resolution of 33,000 @ 64 eV is the best reported for any SX700 type monochromator so far. A signal-to-noise ratio close to the shot noise level, fast "on-the- fly" scanning and horizontal beam position control make PM3 one of the most productive dipole beamlines at BESSY II. The high performance of the beamline is reflected by selected publications: Antoniak et al. (2011); Luo et al. (2012); Manzke et al. (2012); Radu et al. (2012); Sanyal et al. (2010); Valencia et al. (2011).

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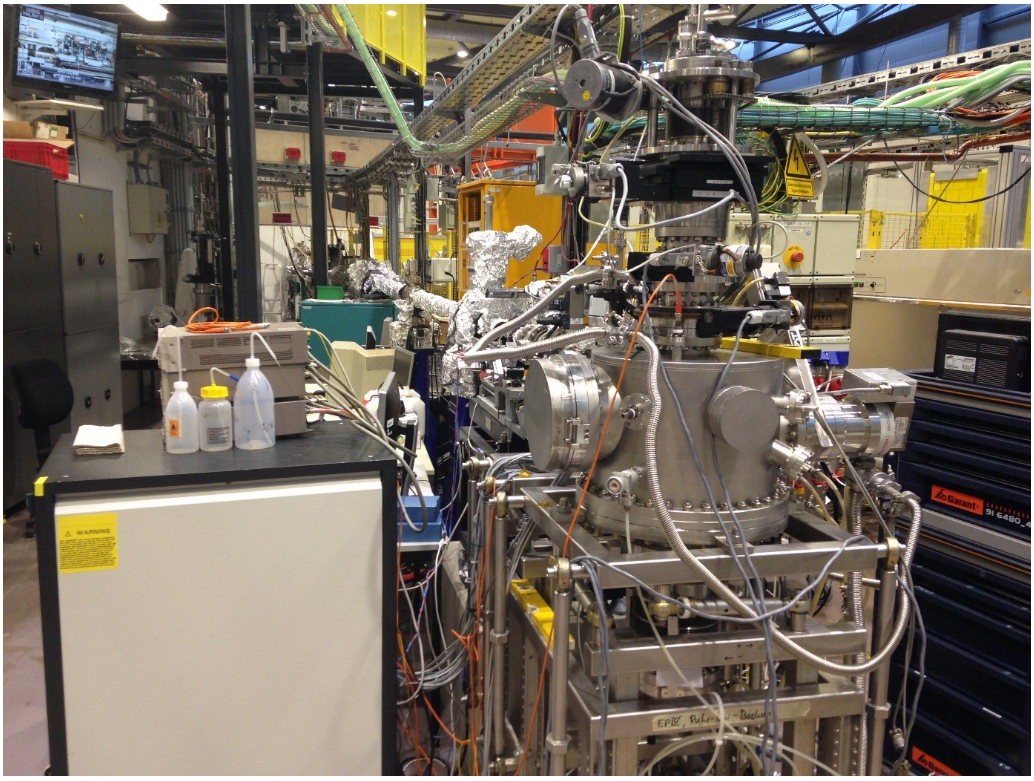

Figure 1: View of beamline PM3 (with user experiment chamber ALICE).

2 Instrument application

Typical applications are:

- Sub-Monolayers to Multilayers (inorganic or organic)
- Liquids
- Ferrimagnets
- Exchange Bias systems
- Multiferoics
- Magnetic Nanoparticles

3 Source

The source is the dipole D111.

4 Optical design

From the layout it is seen that the design is close to the one of a standard BESSY PGM. A refocusing mirror is not implemented. The focusing is astigmatic. The vertical focus is located in the exit slit plane at 25500 mm. The horizontal focus lies at 26000 mm. The smallest spot size is observed at 25850 mm. The beam divergences are 2.68 mrad (hor.) and 1.17 mrad (vert. @ $\beta = 4°$). The applicability of elliptical polarization is mainly given and determined by the rotation of M1 around the light axis. This principle is described in detail in Kachel et al. (2015).

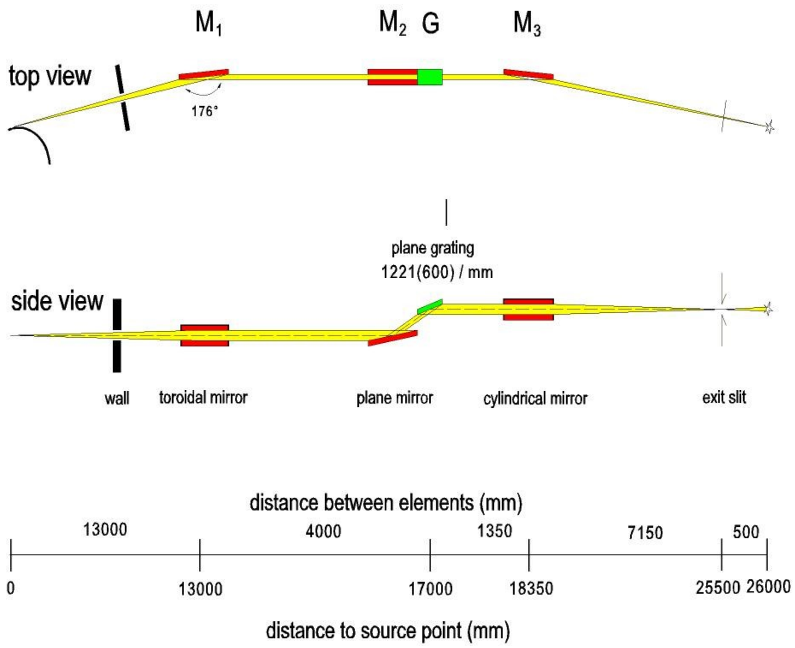

Figure 2: Optical layout of beamline PM3.

5 Technical data

Location	12.2
Source	D111
Monochromator	PM3
Energy range	20 - 1900 eV
Energy resolution	32000 at 64 eV
Flux	10^9 - 10^{10} ph/s
Polarization	• Horizontal • Circular
Divergence horizontal	1.5 mrad
Divergence vertical	1 mrad
Focus size (hor. x vert.)	180 µm x 100 µm
Distance focus/last valve	350 mm
Height focus/floor level	1432 mm
Free photon beam available	Yes
Fixed end station	No

Table 1: Technical parameters of beamline PM3.

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