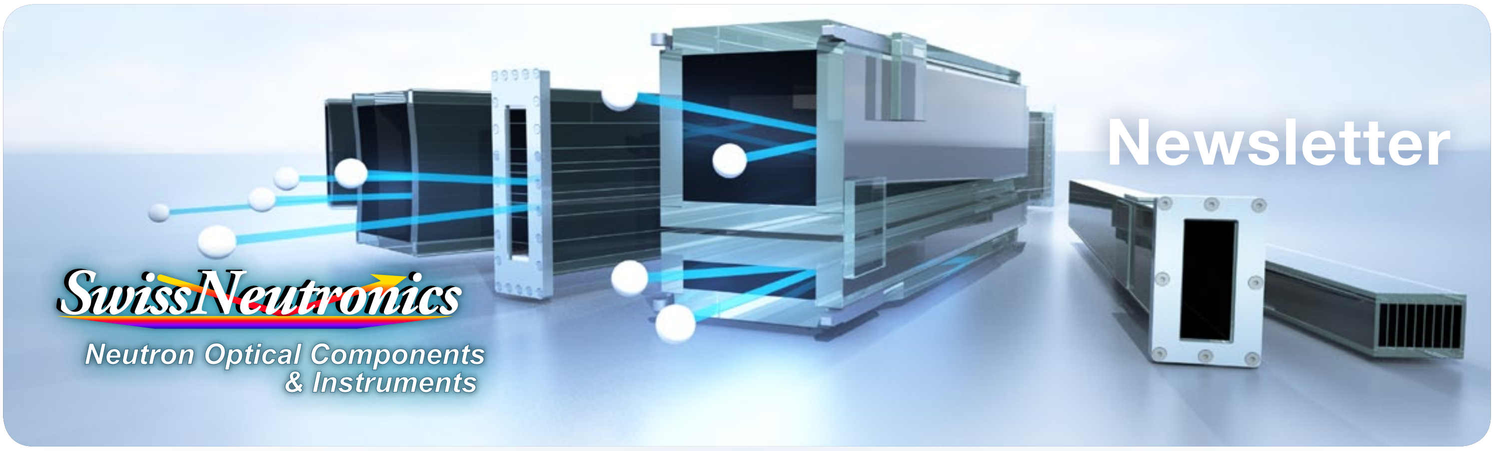

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issue 5 / december 2010

New level in performance of Fe/Si polarizing supermirror

In 2010 SwissNeutronics aimed to improve the performance of Fe/Si polarizing supermirror further. Therefore, various experiments were initiated and analysed in order to test the dependence of the properties of the supermirror on different sputter conditions. As a result, the recipe for the sputtering of Fe/Si supermirror could be refined providing increased reflectivity and polarization. The new generation of these mirrors was then applied to customer projects.

The instrument SuperADAM at the ILL requires a polarizing supermirror to analyze the polarization of the specularly reflected beam. The basic specifications are: i) Fe/Si supermirror with m = 3 and ii) area of mirror 100 mm × 300 mm (width × length). SwissNeutronics provided the complete device including a glass body as a holder of the mirror and a magnetic casing to saturate the supermirror. Fig. 1 shows the data from the neutron tests. The reflectivity at the supermirror edge is R = 0.91, which compares to the typical reflectivity of R = 0.86 obtained with the previous generation. The average polarisation in the regime of the supermirror is P = 0.994. This was so far P = 0.985.

A polarizing bandpass filter was required by the instrument MIRA at the FRM-II. The bandpass is specified with a bandwidth of 10% at an m-value of m = 4.2. Similar to the polarizer for SuperADAM, the bandpass mirror was mounted on a glass body and provided with an appropriate magnetic housing. Fig. 2 shows the results from the neutron measurements. The peak of the bandpass has an extraordinary high reflectivity of R = 0.97 and the polarization is P = 0.998.

In conclusion, SwissNeutronics established a new level for Fe/Si polarizing supermirror with excellent reflectivity and polarization. These mirrors are already available for polarizing devices.

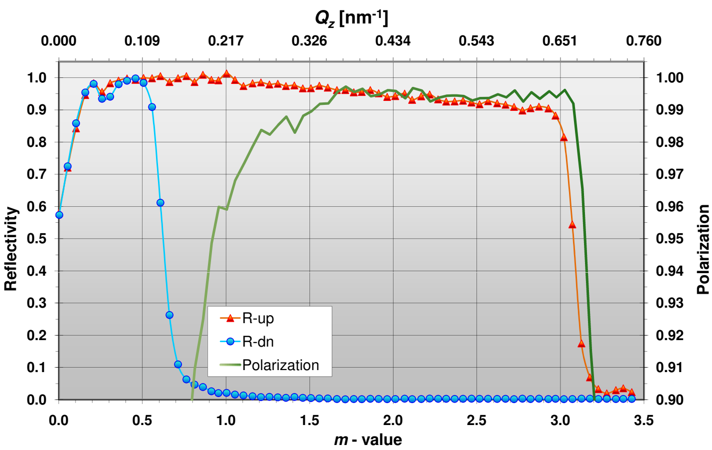

Fig. 1: *Reflectivity and polarization data of an Fe/Si polarizing supermirror with m = 3. (polarization scale expanded)*

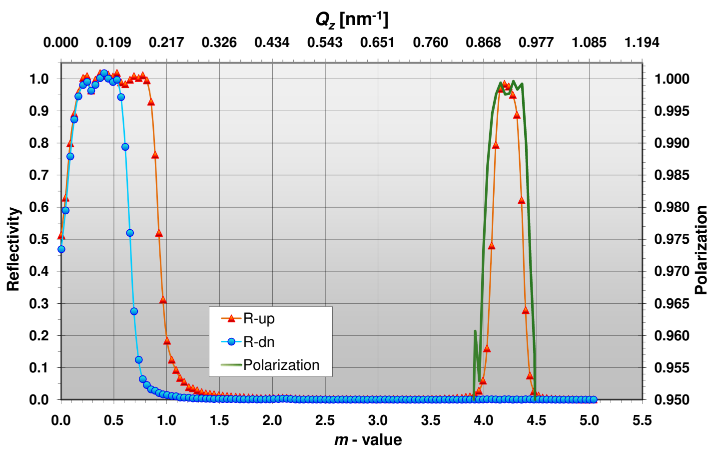

Fig. 2: *Reflectivity and polarization data of an Fe/Si polarizing bandpass mirror ($\Delta\lambda/\lambda$ = 10%) at m = 4.2. (polarization scale expanded)*

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High m supermirror on metallic substrates

As a continuation of our research and development in the field of metallic substrates for neutron supermirror SwissNeutronics tested mirrors with $m = 4$ on super-polished aluminum and steel substrates. Fig. 3 shows reflectivity profiles for the two types of substrates. Both have an excellent reflectivity reaching $R = 0.73$ at the critical edge of the supermirror. For comparison, on polished borkron glass SwissNeutronics achieves in average $R = 0.78$.

These metallic substrates offer an alternative to glass for dedicated applications, when glass is not suitable because of its fragility and/or its limited stability against irradiation and thermal load. As an example, Fig. 4 shows metallic neutron guides, which were provided to FRM II in 2010. The guides are installed inside the biological shield of the reactor (beamport NL4b), i.e. close to the core of the reactor.

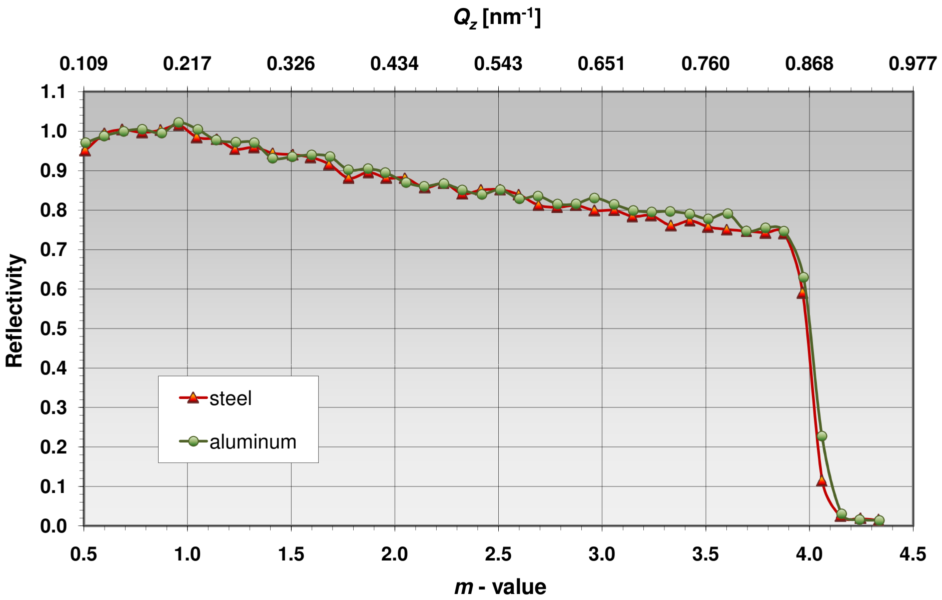

Fig. 3: *Reflectivity of supermirror with $m = 4$ on aluminum and steel substrates.*

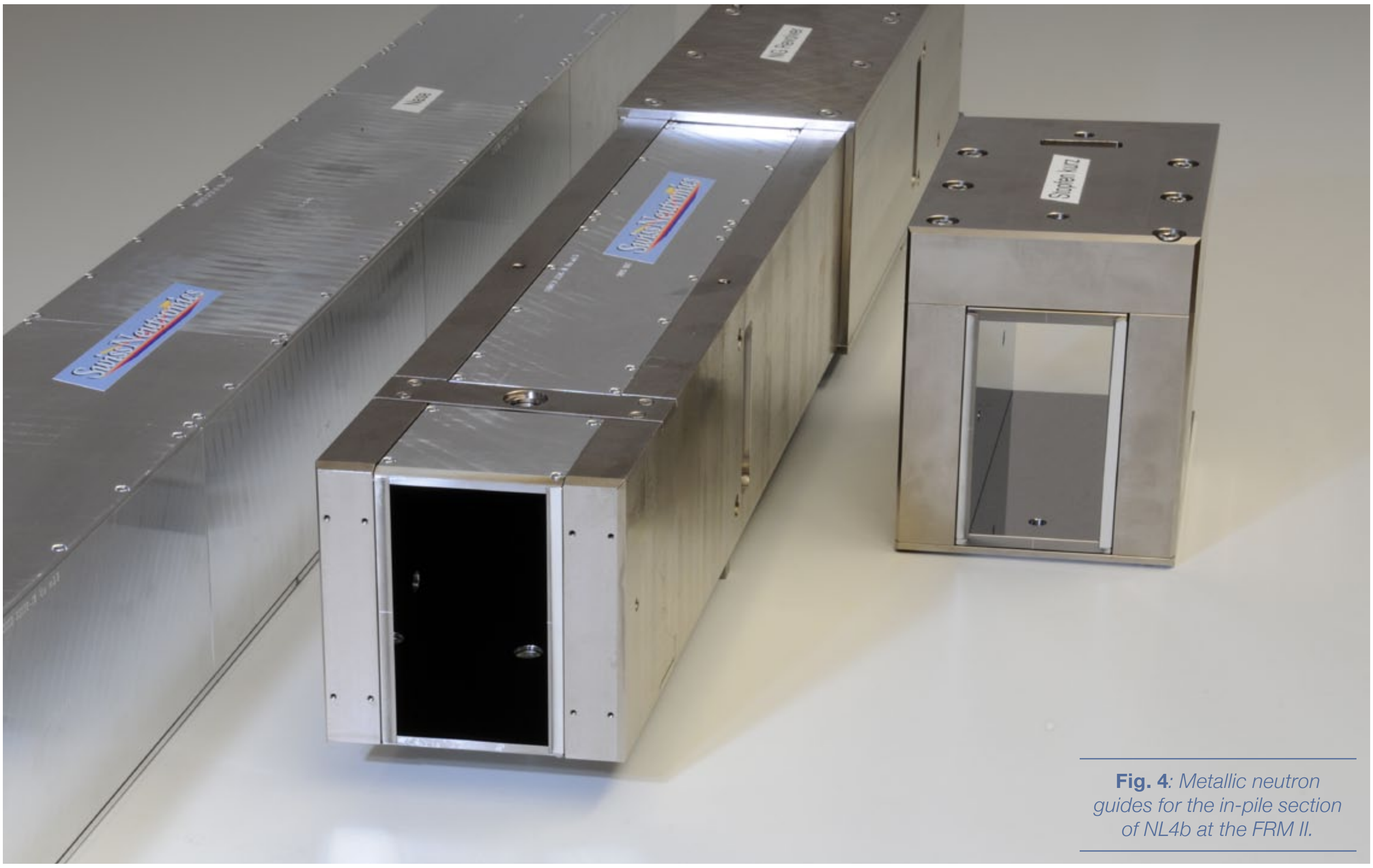

Fig. 4: *Metallic neutron guides for the in-pile section of NL4b at the FRM II.*

Monochromator stage for beamline HYSPEC @ SNS

The instrument HYSPEC at SNS uses crystal arrays to focus and direct the neutron beam onto the sample. Provision is made for arrays of Highly Orientated Pyrolytic Graphite (HOPG) and Heusler crystals to perform experiments with an unpolarized and a polarized neutron beam, respectively. Both monochromators have a variable vertical focus so that the optimum vertical focusing can be chosen for different neutron energies. In order to switch between these two types of focusing crystal arrays a vertical translation mechanism is used to position the relevant monochromator in the neutron beam. The complete system including the monochromator mechanism, goniometer stages for each monochromator, the vertical translation mechanism and all cabling was designed, fabricated, assembled and tested by SwissNeutronics. The details of the monochromators are shown in Fig. 6 and the complete stage is depicted in Fig. 7.

The basic specifications of the monochromators are given in table 1 and 2. General features of the system are:

- Both monochromators are individually equipped with rotation, tilt and translation stages.
- All axis are equipped with stepper motors, position encoders, limit and home switches.

After complete assembly of the monochromators the orientation of the individual crystals was tested with neutrons (see Fig. 5). Table 3 summarizes the alignment of the crystal assemblies.

Table 1: specifications of the HOPG monochromator

type	vertical focusing monochromator mechanism
focusing range	600 mm ≤ R ≤ ∞
crystals	HOPG – 78 crystals
size of crystals	12 × 50 mm²
thickness of crystals	3 mm
area of monochromator	300mm (w) × 170mm (h)
number of focusing rows	13

Table 2: specifications of the Heusler monochromator

type	vertical focusing monochromator mechanism
focusing range	600 mm ≤ R ≤ ∞
crystals	Heusler – 33 crystals
size of crystals	15 × 50 mm²
thickness of crystals	≈5 mm
area of monochromator	150mm (w) × 170mm (h)
number of focusing rows	11
miscellaneous	ensemble of magnets/magnetic yoke per row

Table 3: Distribution of crystal orientations as measured with neutrons (RMS values)

	HOPG	Heusler
vertical	0.12°	0.09°
horizontal	0.08°	0.09°

Fig. 5: *Setup for the characterization of the monochromators at the instrument MORPHEUS @ PSI.*

Fig. 6: *Details of the Heusler monochromator (top) and the HOPG monochromator (bottom).*

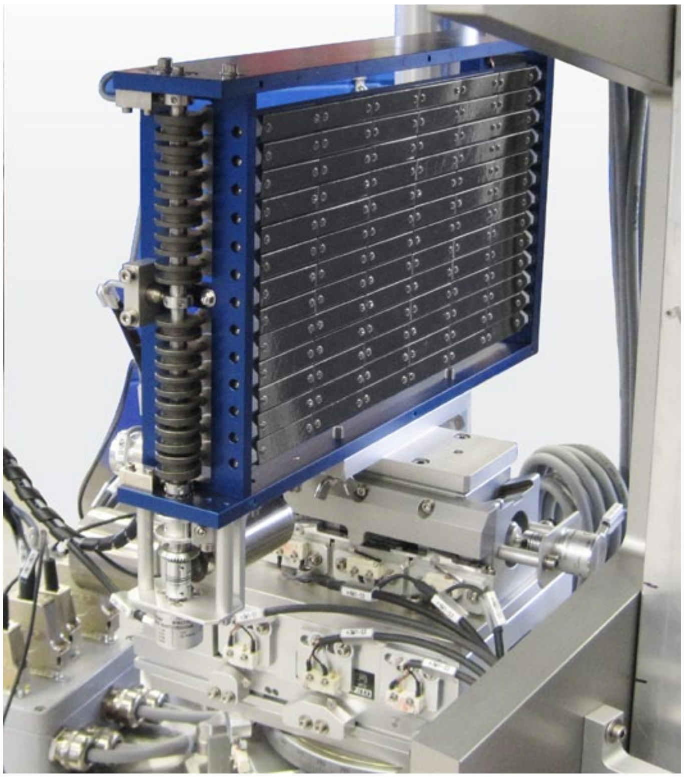

Fig. 7: *Monochromator stage for HYSPEC @ SNS. The top and bottom platforms carry the Heusler and the HOPG monochromator, respectively. The stages can be vertically translated in order to move the desired monochromator into the beam.*

SwissNeutronics goes future

Early this year SwissNeutronics decided to renovate its corporate building. At this occasion the building is expanded to accommodate additional fabrication facilities and make SwissNeutronics ready for the future tasks. In addition, care is taken concerning energy-efficient construction by using an upgraded insulation, triple glazing and other provisions.

Fig. 8: *Picture of the new annex (Dec-2010). The cladding is still covered with a protective foil. Towards the left (into the picture) the original building extends.*

At present the new annex building (Fig. 8) has been completed. The renovation of the original building is supposed to be finished in Jan-2011. Fig. 9 illustrates the final result of the renovation.

Fig. 9: *Illustration of the renovated corporate building. In the front is the original building. In the background, at the right side is the new annex. In between is the existing fabrication wing.*