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Single-crystal diffraction instrument TriCS at SINQ

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Abstract

The single-crystal diffractometer TriCS at the Swiss Continuous Spallation Source (SINQ) is presently in the commissioning phase. A two-dimensional wire detector produced by EMBL was delivered in March 1999. The instrument is presently tested with a single detector. First measurements on magnetic structures have been performed. The instrument is remotely controlled using JAVA-based software and a UNIX DEC-α host computer.

Keywords: Neutron instruments; Detectors; Monochromators; Single-crystal neutron

The single-crystal neutron diffractometer TriCS has been designed for nuclear and magnetic structure determinations of samples with small-to-medium size unit cells (lattice parameter $< 20\,\text{Å}$ depending on symmetry of the system) and is presently in the commissioning phase. The layout of the instrument is shown in Fig. 1.

First flux measurements with the high resolution Ge_{311}-monochromator [1] using gold foils yielded 5.7×10^5 n/cm^2/s/mA by focusing the beam to a height of 40 mm. As SINQ is running at 850–940 μA presently, this is comparable to DMC at Saphir ($Ge_{311}/\lambda = 1.7\,\text{Å}$: 5×10^5 n/cm^2/s [2]) and DMC at SINQ ($C_{002}/\lambda = 2.56\,\text{Å}$: 5.3×10^5 n/cm^2/s). We successfully reduced the focus using the TOPSI spectrometer for a final and perfect alignment of the individual slabs, both for TriCS and powder diffractometer HRPT. The results of these tests are shown in Fig. 2. A second C_{002} monochromator with fixed focusing and a limited height of 50 mm has been installed for measurements of magnetic Bragg peaks with higher flux but lower resolution. The interesting *q*-range for magnetic measurements will be well covered with this set-up. The C_{002} monochromator can be moved into scattering position using an elevator system.

Two main problems caused a delay of the start-up: The microstrip detectors could not be completed within time, as major problems have to be solved (cf. D20). We therefore decided to run first with a wire chamber detector from EMBL [3]. A first detector arrived in March 1999.

The auxiliary equipment for temperature control has been completed with a four-circle cryostat (1.5–300 K), which is available with a three months prior notice in order to complete all the test and to order the helium dewar. Standard equipment will cover 12–450 K in four-circle mode. Any other equipment is available in

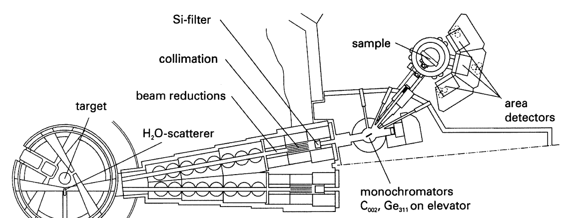

Fig. 1. Layout of the single-crystal diffractometer TriCS at SINQ.

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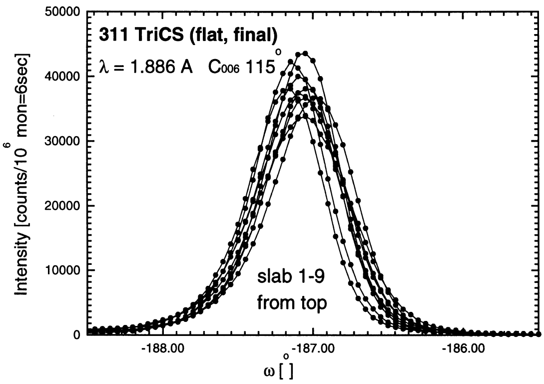

Fig. 2. Rocking curve of the nine Ge_{311}-slabs measured at TOPSI/SINQ using a C_{006}-monochromator.

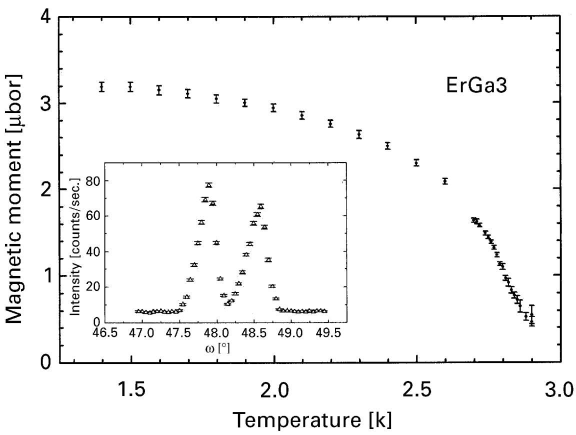

Fig. 3. Magnetic moment of $ErGa_3$ measured in a helium flow cryostat using the tilting option of TriCS. The inset shows the omega scan at 1.5 K.

out-of-plane measurements (tilting mode), of course with a certain loss in resolution. As one of the first results we show in Fig. 3 the magnetisation curve measured for the cubic ($a = 4.2\,\text{Å}$) rare-earth metallic compound $ErGa_3$.

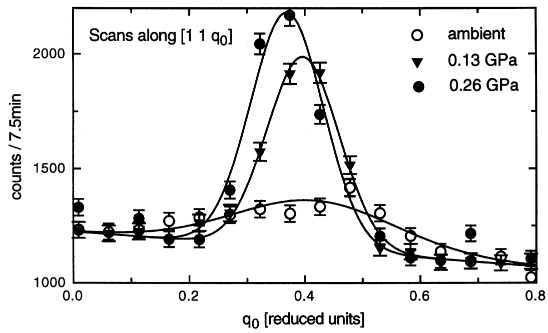

Fig. 4. Pressure-dependence of q-scans along [11q] in $Ce_{0.85}(La_{0.95}Y_{0.05})_{0.15}Sb$ at $T = 2\,K$.

As a second example we show in Fig. 4 q-scans along [11q] in $Ce_{0.85}(La_{0.95}Y_{0.05})_{0.15}Sb$, where increasing uni-axial pressure along [001] yields a higher T_N. The crystal for this measurement was approximately $3\,mm^3$.

TriCS is controlled by a Unix DEC-α host-computer. JAVA-based software is used to interact from outside terminals such as PCs or MACs using PPP-protocol. Motor controllers and temperature controller are serviced by RS232 interfaces. Additional auxiliary equipment with RS232 connections can be controlled by writing small scripts.

Acknowledgements

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