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The upgraded neutron grating interferometer at ANTARES –Design, Performance and Applications –

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Neutron grating interferometry (nGI) is a relatively new neutron imaging technique, which simultaneously delivers information about the transmission (TI), phase shift (DPC) and the scattering (DFI) inside a sample [1].
In particular the DFI has generated high interest, due to its ultra-small-angle neutron scattering (USANS) contrast mechanism, allowing to indirectly resolve structures not directly resolvable by an imaging instrument [2].
Recently there have been strong efforts to use nGI and particularly the DFI as tools for quantitative measurements of structures in materials.
A prerequisite for such measurements is a high signal-to-noise-ratio. For the DFI it has been shown that the main reasons for high noise are (i) low DFI signal and (ii) low visibility [3]. Hence a high visibility is needed for quantitative measurements.
We will present the upgraded nGI setup at the ANTARES beamline at FRM II, which has been heavily redesigned compared to its precursor [4]. The redesign allowed to optimize the source and analyzer gratings. With these changes we have achieved a visibility of 75% over the whole detector area (76mm x 76mm) at the design wavelength of 4 Å. This visibility is close to the theoretical limit imposed by the spatial coherence generated by the G0 grating.

[1] C. Grünzweig, PhD thesis (2009)
[2] M. Strobl et al., 101, 123902 (2008)
[3] R. Harti et al., Review of Scientific Instruments 88, 103704 (2017)
[4] T. Reimann et al., J. Appl. Cryst. 49, 1488-1500 (2016)

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