RECENT DEVELOPMENTS IN X-RAY GRATING INTERFEROMETRY AT ESRF

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X-ray grating interferometry (XGI) is a coherent imaging technique that provides high sensitivity differential phase and dark-field (small angle X-ray scattering) images of the investigated sample and in this way gives access to features, such as details with tiny density differences, cracks and regions with nanoporosity, that cannot be revealed with absorption contrast. XGI bears tremendous potential for two- and three-dimensional imaging in many application areas including biomedical imaging, paleontology and materials sciences. Moreover, since it yields refraction angle measurements with a precision on the order of 10 nrad, XGI has received considerable attention also for metrology and wave front sensing applications. A grating interferometer, which in its standard implementation consists in two line gratings placed between sample and detector, has been installed and made available to external users at the beamline ID19 of the ESRF. We present the characteristics of this instrument and recent results obtained with this device. The grating interferometer at ID19 has been used to study a large variety of ex-vivo soft tissue biological samples (e.g. Ref. [1]); its performance has been compared with the results obtained with other soft tissue imaging methods, i.e. holotomography, magnetic resonance imaging and histology. Exploiting the instrument at ID19 and the conditions offered by this beamline, the technique itself has been significantly improved under the methodological and instrumental aspects. In particular, we developed a two-dimensional XGI [2,3] and we introduced advanced phase-stepping acquisition schemes in grating-based tomography [4].

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