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Towards time-resolved RIXS@FLASH at the PG1 monochromator end-station

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The XUV double stage Raman spectrometer is a permanent experimental end-station at the PG1 monochromator beamline at the free-electron laser FLASH at DESY in Hamburg, Germany [1,2]. This unique instrument is designed to cover the photon energy range from 20 to 200 eV with high energy resolution of about 2 – 20 meV (design values in additive mode) and to suppress the elastic line and stray light.

Currently, the transport line for the FLASH1 optical pump-probe laser is being installed at the Raman spectrometer end-station. This upgrade will soon allow time-resolved RIXS experiments at the transition metal M-edges (20 - 210 eV) with an energy resolution ≤ 20 meV (double monochromator) and a time resolution of ≤ 250 fs (FWHM). With such a resolution the double stage Raman spectrometer will provide information about dynamic properties of solid matter approaching the Heisenberg limit. The FLASH1 Pump-Probe laser has a fundamental wavelength of 800 nm. By non-linear optical frequency conversion, the wavelengths 400 nm and 267 nm can be generated for optical pump - XUV probe measurements. The first monochromator stage SP1 with an energy resolution < 60 meV (FWHM) will be available for experiments by end of 2018.

Here, we discuss the implementation of the optical laser in-coupling scheme into the sample chamber, present the controls and diagnostics available for pump-probe RIXS studies, and give an overview of the expected performance parameters.

Contact: Siarhei Dziarzhyski (siarhei.dziarzhyski@desy.de)

[1] Rusydi et al. Phys. Rev. Lett. 113, 067001 (2014)

[2] Dziarzhyski et al. J. Synchr. Rad. 23, 123-131 (2016)

Primary authors: DZIARZHYSKI, Siarhei (DESY Hamburg); REDLIN, Harald (DESY Hamburg); Dr MANSCHWETUS, Bastian (DESY Hamburg); BEYE, Martin (DESY); WEIGELT, Holger (DESY Hamburg); TEMME, Marc (DESY Hamburg); BRENNER, Günter (DESY Hamburg)

Presenter: BRENNER, Günter (DESY Hamburg)

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