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A split-and-delay unit for the European XFEL: Enabling hard x-ray pump/probe experiments at the HED instrument

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For the High Energy Density (HED) instrument at the SASE2 - Undulator at the European XFEL an x-ray split-and-delay unit (SDU) is built covering photon energies from $h\nu = 5$ keV up to $h\nu = 24$ keV. This SDU will enable time-resolved x-ray pump / x-ray probe experiments as well as sequential diffractive imaging on a femtosecond to picosecond time scale. Further, direct measurements of the temporal coherence properties will be possible by making use of a linear autocorrelation. The x-ray FEL pulses are split by a sharp edge of a silicon mirror (BS) coated with Mo/B₄C and W/B₄C multilayers. Both partial beams then pass variable delay lines. For different wavelengths the angle of incidence onto the multilayer mirrors will be adjusted in order to match the Bragg condition. Because of the different incidence angles, the path lengths of the beams will differ as a function of wavelength. Hence, maximum delays between ± 1.0 ps at $h\nu = 24$ keV and up to ± 23 ps at $h\nu = 5$ keV are possible.

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