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The new time-compensated monochromator beamline FL23 at FLASH

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FLASH, the soft X-ray free-electron laser (FEL) in Hamburg provides high-brilliance ultrashort femtosecond pulses at MHz repetition rate for user experiments. For high resolution spectroscopic and dynamical studies in various research fields a narrow FEL energy bandwidth and ultrashort pulses are a prerequisite. While single grating monochromators provide high-energy resolution they introduce a pulse-front tilt which effectively elongates the longitudinal pulse profile, thus decreasing the time resolution. In order to preserve a short pulse duration and still monochromatize the FEL radiation, the new pulse-length preserving monochromator beamline FL23 at FLASH2 uses a double-grating design. A first grating disperses the radiation and an intermediate slit reduces the spectral bandwidth, a second grating operating in compensating configuration turns back the pulse front tilt, thereby preserving the ultrashort photon pulses.

The open port beamline covers the spectral range between 1.3 nm and 20 nm with a spectral resolving power of approximately 1500 [1]. The beamline can also be operated in a single grating configuration in order to maximize the transmission at the high energy end. A bendable Kirkpatrick-Baez mirror system –similar to the one used at the FL24 beamline at FLASH –provides flexible microfocusing at the experiment. A femtosecond optical laser synchronized to the FEL is provided for pump-probe experiments. The beamline concept and design has been developed using ray tracing simulations and confirmed by wavefront propagation simulations [2]. The commissioning phase was successfully completed and since 2024 the beamline is in FLASH user operation.

Here, results from the technical commissioning of the beamline and its components as well as of first user experiments will be presented.

I plan to submit also conference proceedings

Yes

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