

Concept of a novel high-bandwidth arrival time monitor for very low charges as a part of the all-optical synchronization systems at XFEL and FLASH

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Numerous advanced applications of X-ray free-electron lasers require pulse durations and time resolutions in the order of only a few femtoseconds or better. The generation of these pulses to be used in time-resolved experiments require synchronization techniques that can simultaneously lock all necessary components to a precision in the range of 1fs only. To improve the experimental conditions at existing facilities and enable future development of seeded FELs, a new all-optical synchronization system at FLASH and XFEL was implemented, which is based on pulsed optical signals rather than electronic RF signals. In collaboration with DESY, Hamburg the all-optical synchronization system is used to ensure a timing stability on the 10fs scale at XFEL.

For a future ultra-low charge operation mode down to 1pC at XFEL an overall synchronization of (5+1)fs r.m.s. or better is necessary.

This contribution presents a new concept for a ultra-wideband pickup structure for beampipe-diameters down to 10mm for frequencies up to 100GHz or higher and at the same time providing sufficient output signal for the attached EOMs.

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