Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, April 22, 2008

(16:00 in Room 459/30b)

Fiber Laser Master Oscillators
for Optical Synchronization Systems
(DISPUTATION)

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Abstract

New X–ray free electron lasers (e.g. the European XFEL) require a new generation of synchronization system to achieve a stability of the FEL pulse, such that pump–probe experiments can fully utilize the ultra-short pulse duration (50 fs). An optical synchronization system has been developed based on the distribution of sub–ps optical pulses in length–stabilized fiber links. The synchronization information is contained in the precise repetition frequency of the optical pulses. In this thesis, the design and characterization of the laser serving as laser master oscillator is presented. An erbium–doped mode–locked fiber laser was chosen. Amplitude and phase noise were measured and record–low values of 0.03% and 10 fs for the frequency range of 1 kHz to the Nyquist frequency were obtained. Furthermore, an initial proof–of–principle experiment for the optical synchronization system was performed in an accelerator environment. In this experiment, the fiber laser wase phase–locked to a microwave reference oscillator and a 500 meter long fiber link was stabilized to 12 fs rms over a range of 0.1 Hz to 20 kHz. RF signals were obtained from a photodetector without significant degradation at the end of the link. Furthermore, the laser master oscillator for FLASH was designed and is presently in fabrication and the initial infrastructure for the optical synchronization system was setup.

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