T 126: Beschleunigerphysik XIII (Synchrotronstrahlung/THz)

Zeit: Donnerstag 14:00–16:15 Raum: WIL-C207

T 126.1 Do 14:00 WIL-C207

Current Activities at the DELTA THz Beamline* — •Peter Ungelenk, Markus Höner, Holger Huck, Shaukat Khan, Robert Molo, Andreas Schick, and Maryam Zeinalzadeh — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

In addition to an InSb Bolometer, which detects laser-induced coherent THz pulses at the synchrotron light source DELTA since June 2011, a Fourier transform infrared spectrometer is currently being commissioned. Furthermore, a fast hot-electron bolometer has been used in cooperation with the Karlsruhe Institute of Technology to study the evolution of the laser-induced electron density modulation over several revolutions in the storage ring.

* Work supported by DFG, BMBF, and by the Federal State NRW.

T 126.2 Do 14:15 WIL-C207

Single Particle Tracking for Simultaneous Long and Short Electron Bunches in the BESSY II Storage Ring — •Martin Ruprecht[1], Axel Neumann[1], Markus Ries[1], Godehard Wuestefeld[1], and Thomas Weis[2] — [1]Helmholtz-Zentrum Berlin, Germany — [2]Technische Universität Dortmund, Germany

A scheme where 1.5 ps and 15 ps long bunches (rms) can be stored simultaneously in the BESSY II storage ring has recently been proposed (BESSY^{VSR}[1]). Based on that scheme, this talk presents simulations of single particle beam dynamics influenced by superconducting cavities used for the strong longitudinal beam focusing. The effect of perturbations to the ideal system of cavities, such as jitter and offsets in amplitude, frequency and phase is investigated and results are discussed. The primary goal is to reveal preliminary design specifications on the operating parameters of the sc-cavities and the LLRF system in the BESSY II storage ring.

[1] G. Wüstefeld, A. Jankowiak, J. Knobloch, M. Ries, Simultaneous Long and Short Electron Bunches in the BESSY II Storage Ring, Proceedings of IPAC2011, San Sebastián, Spain

T 126.3 Do 14:30 WIL-C207

Beamline for THz beam diagnostics at the ANKA storage ring — •Jan Christoph Heip, Vitali Judin, Michael J. Nasse, Marcel Schuh, Yves-Laurent Mathis, and Anke-Susanne Müller — KIT, Karlsruhe

A new dedicated beamline for THz radiation at ANKA, the electron storage ring at the Karlsruhe Institute of Technology, will allow measurements of the electron bunch characteristics. Since the wavelength of THz radiation is in the mm range, the wave nature of the radiation has to be taken into account when planning the beamline.This presentation discusses possible designs for this beamline.

T 126.4 Do 14:45 WIL-C207

HF-Bunchkompressionsstudien für FLUTE — •Marcel Schuh für die FLUTE-Kollaboration — KIT, Karlsruhe, Deutschland

FLUTE ist eine geplante 40 bis 50 MeV Beschleunigertestanlage, bestehend aus einem Elektronenlinearbeschleuniger und einer Magnetschikane zur Bunchkompression. In der Anlage soll die Bunchkompression und Erzeugungsmechanismen von koheränter Synchrotron-, Übergangs- und Kantenstrahlung im THz-Bereich für einen großen Ladungsbereich von Pikocoulomb bis zu mehreren Nanocoulomb untersucht werden. In diesem Beitrag wird der Einfluss einer Buncher-Kavität zwischen Elektronenkanone und Linearbeschleuniger untersucht, um Bunchlängen von Femtosekunden im pC Bereich zu erzeugen. Die Kavität wird um etwa 90 Grad phasenverschoben betrieben und in der anschliessenden Driftstrecke setzt ballistische Bunchkompression ein. Durch Wahl der geeigneten Amplitude, Phase im Buncher und der Driftstreckenlänge kann der Bunch vorkomprimiert und die Bunchlänge im Linac weiter reduziert werden.

T 126.5 Do 15:00 WIL-C207

Studies of bunch length and charge for the planned THz source, FLUTE — •Somprasong Naknaimueang for the FLUTE-Collaboration — Karlsruhe Institute of Technology, Karlsruhe, Germany

FLUTE is a THz source consisting of a 7 MeV photon gun, a 40 to 50 MeV linac, and a bunch compressor. The gun can produce up to 3 nC electron bunches which are several picoseconds long. At high charges, the transverse and longitudinal beam sizes are limited by space charge effects. In addition, coherent synchrotron radiation effects in the compressor limit the minimum obtainable bunch length in this case. The relationship between bunch charge and obtainable bunch length for a FLUTE-type accelerator is discussed.

T 126.6 Do 15:15 WIL-C207

A Transmittive Photon Flux Detector for Laser-Plasma-Driven Soft X-Ray Undulator Radiation — •Niels Delbos, Christian Werle, Benno Zeitler, Andreas Richard Maier, and Florian Grüner — University of Hamburg, Center for Free-Electron Laser Science

In recent experiments early 2012 our group demonstrated the energy tunability of a laser-plasma driven undulator source, emitting ultrashort soft x-ray (SXR) pulses of only a few femtoseconds with energies up to the water window.

Based on these results, the next step is to use the generated SXR pulses in pump-probe experiments. The photon flux of the undulator, however, is subject to fluctuations, as the electron beam parameters vary from shot to shot. Hence a diagnostic, measuring the photon flux on-line with high transmission, efficiency and sensitivity is needed to bedeveloped for future experiments.

Since SXR radiation shows a characteristically high degree of absorption in matter,the development of a detector that meets the particularly high requirements posed a considerable challenge. This talk discusses the development and calibration of a detector, which is easy to use and shows high and adjustable transmission for a broad photon energy range, based on the photoionization of noble gases.

T 126.7 Do 15:30 WIL-C207

Design of a transmission grating hard X-ray spectrometer for laser-driven undulator sources — •Christian Werle[1], Nathaniel Kajumba[2], Anfdreas Maier[1], Benno Zeitler[1], Niels Delbos[1], and Florian Grüner[1] — [1]University of Hamburg / CFEL, Hamburg, Germany — [2]Ludwig Maximilian University, Munich, Germany

State-of-the-art laser-driven undulator sources are already becoming very versatile and powerful light sources, especially due to their wavelength tunability and ultra-short pulses. However, being still in development, they suffer from instabilities, which can make the spectral characterization of their radiation rather challenging, especially in the few-nm range. The hard X-ray transmission grating spectrometer, presented in this talk, was specifically optimized to tackle these difficulties. Its simple base design and its fully motorized optical components grant a high degree of flexibility during operation, fitting nicely to the nature of this radiation source. During calibration the device has been proven to measure wavelengths from 18 nm to 5 nm, but was in general also designed to address the sub-nm range. Following these test runs, the spectrometer was installed during a undulator campaign and was successfully used to measure laser-driven undulator radiation from 100 eV up to 300 eV, being the highest energy photons ever demonstrated with such a source.

T 126.8 Do 15:45 WIL-C207

EEHG at FLASH and DELTA* — •Robert Molo[1], Markus Höner[1], Holger Huck[1], Kirsten Hacker[1], Shaukat Khan[1], Andreas Schick[1], Peter Ungelenk[1], Maryam Zeinalzadeh[1], Peter Van der Meulen[2], Peter Salen[2], Gergana Angelova Hamberg[3], and Volker Ziemann[3] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Germany — [2]Stockholm University, Sweden — [3]Uppsala University, Sweden

The echo-enabled harmonic generation (EEHG) scheme utilizes two modulators with two magnetic chicanes in order to generate an electron density modulation with high harmonic content. In contrast to free-electron lasers (FEL) based on self-amplified spontaneous emission (SASE), the radiation of an EEHG FEL has better longitudinal coherence and is naturally synchronized with an external laser, which is advantageous for pump-probe applications. At the free-electron laser in Hamburg (FLASH), an EEHG experiment is currently under preparation. The short-pulse facility at DELTA (a 1.5-GeV synchrotron light source operated by the TU Dortmund University) based on coherent

harmonic generation (CHG) will be upgraded using the EEHG technique in order to reach shorter wavelengths.

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T 126.9 Do 16:00 WIL-C207

sFLASH: Seeding at 38nm — •Christoph Lechner for the sFLASH-Collaboration — University of Hamburg, Hamburg, Germany

Many free-electron lasers (FEL) producing light in the UV and extreme ultraviolet (XUV) wavelength ranges start up from noise, operating in the self-amplified spontaneous emission (SASE) mode and therefore have poor longitudinal coherence. It has recently been demonstrated that using so-called 'seeding' techniques, it is possible to generate almost fully coherent photon pulses.

The sFLASH experiment at DESY has been built to study seeding using a source based on a high-harmonic generation (HHG) process. In contrast to SASE, the seeded FEL is operated as an amplifier of the HHG seed. Critical for successful seeding is the precise 6D overlap between the electron bunch and the HHG radiation in the undulator. As a result, one expects greatly improved longitudinal coherence and higher shot-to-shot stability of the pulse spectra and energy. In addition, the output of the seeded FEL is intrinsically synchronized to the HHG drive laser, thus enabling pump-probe experiments with a resolution in the order of 10 fs. In this contribution, the sFLASH layout as well as recent experimental results are presented.