AKBP 1: Synchrotron Radiation

Zeit: Montag 14:00–15:15 Raum: BZ.08.06 (HS 1)

AKBP 1.1 Mo 14:00 BZ.08.06 (HS 1)

Optics compensation for variable-gap undulator systems at FLASH — •Philipp Amstutz[1], Sven Ackermann[2], Jörn Bödewadt[2], Christoph Lechner[1], Tim Plath[1], and Mathias Vogt[2] — [1]Universität Hamburg, Hamburg — [2]Deutsches Elektronen-Synchrotron (DESY), Hamburg

Variable-gap undulator systems are widely used in storage rings and linear accelerators to generate soft- and hard X-ray radiation for the photon science community. By closing the undulator its focussing effect gains in strength, which needs to be corrected, in order for the optical functions in downstream parts of the accelerator to be constant.

At the free-electron laser (FEL) facility FLASH at DESY two undulator systems share one common electron beamline. The first undulator is a variable-gap system used for seeding experiments, the second undulator is a fixed-gap system, which serves the user facility with FEL radiation. Variaton of the gap in the first undulator results in altered beam optics, which deteriorates the FEL process in the second undulator. This gives rise to the need for a method to calculate a steady correction function for quadrupole currents depending on the current gap size, effectively making the disturbance transparent for subsequent sections. The approach presented here applies the implicit function theorem to an analytical model of the beamline section and can be used for any pertubation of the beam optics. In this contribution we present the method and its implementation as well as measurements performed at FLASH.

AKBP 1.2 Mo 14:15 BZ.08.06 (HS 1)

Calculation of Coherent Radiation — •Markus Schwarz — ANKA, KIT

Electromagnetic radiation emitted by electron bunches in accelerators is usually incoherent. However, when the bunch length becomes shorter than the wavelength of the emitted radiation, the waves of the individual electrons interfere constructively. As a result, the intensity of this coherent radiation is enhanced by several orders of magnitude at this wavelength. On one hand, this allows for intense radiation. On the other hand, coherent radiation can act as a "magnifying glass", which allows one to study the electron bunch structure.

I give a brief derivation of the basic equation for coherent radiation and discuss its properties for a simple Gaussian bunch as well as more complex bunches.

AKBP 1.3 Mo 14:30 BZ.08.06 (HS 1)

Studies of THz-radiation in the Bursting Regime at ANKA in Multi-Bunch Operation — •Miriam Brosi[1], Michelle Caselle[4], Johannes Steinmann[1], Patrik Schönfeldt[3], Edmund Hertle[3], Nicole Hiller[3], Anke-Susanne Müller[1,2,3], Marc Weber[4], and Andreas Kopmann[4] — [1]LAS, KIT, Karlsruhe — [2]ANKA, KIT, Karlsruhe — [3]IPS, KIT, Karlsruhe — [4]IPE, KIT, Karlsruhe

The ANKA storage ring of the Karlsruhe Institute of Technology (KIT) operates in the energy range from 0.5 to 2.5 GeV and can generate brilliant coherent synchrotron radiation in the THz range with a dedicated bunch length-reducing optic. The high degree of longitudinal compression in this so-called low-alpha optics leads to complex longitudinal dynamics of the electron bunches. The resulting micro-bunching instability leads to time dependent fluctuations and strong bursts in the radiated THz power. The study of these fluctuations in the emitted THz radiation provides insight into the longitudinal beam dynamics. Fast THz detectors combined with KAPTURE, the dedicated KArlsruhe Pulstaking and Ultrafast Readout Electronics system developed at KIT, allow the simultaneous measurement of the radiated THz intensity for each bunch individually in a multi-bunch environment.

AKBP 1.4 Mo 14:45 BZ.08.06 (HS 1)

Narrow-Band THz Radiation at the Synchrotron Light Source DELTA — •Peter Ungelenk[1], Fin Hendrik Bahnsen[1], Max Bolsinger[1], Svenja Hilbrich[1], Markus Höner[1], Holger Huck[1], Maryam Huck[1], Shaukat Khan[1], Carsten Mai[1], Arne Meyer auf der Heide[1], Robert Molo[1], Helge Rast[1], Gholamreza Shayeganrad[1], Serge Bielawski[2], Clement Evain[2], Marc Le Parquier[2], Eléonore Roussel[2], Christophe Szwaj[2], Matthias Arndt[3], Konstantin Ilin[3], Artem Kuzmin[3], Juliane Raasch[3], and Michael Siegel[3] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Germany — [2]PhLAM/CERLA, Université Lille 1, France — [3]Institute of Micro- and Nanoelectronic Systems, Karlsruhe Institute of Technology, Germany

Based on the interaction of 40-fs laser pulses with electron bunches at the 1.5-GeV synchrotron light source DELTA operated by the TU Dortmund University, coherent broad-band THz pulses are routinely generated since 2011. Recently, 11-ps laser pulses with a periodic intensity modulation have been employed in cooperation with PhLAM/CERLA, Lille, in order to generate THz pulses with a narrow bandwidth of down to 300 GHz and a tunable central frequency between 0.7 and 5.5 THz. As a first application, the frequency dependence of $YBa_2Cu_3O_{7-x}$-based (YBCO) THz detectors developed at the Institute of Micro- and Nanoelectronic Systems (IMS) at KIT, Karlsruhe, has been studied. In order to investigate a tuning range of the narrow-band pulses at lower central frequencies, a new spectrometer is under development.

AKBP 1.5 Mo 15:00 BZ.08.06 (HS 1)

Non-interferometric spectral analysis of synchrotron radiation in the THz regime at ANKA — •Johannes Steinmann[1], Erik Bründermann[2], Michele Caselle[3], Benjamin Kehrer[1], Paul Schütze[1], Patrik Schönfeldt[1], Marcel Schuh[1], Edmund Hertle[2], Nicole Hiller[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IPS, KIT, Karlsruhe — [3]IPE, KIT, Karlsruhe

The ANKA storage ring of the Karlsruhe Institute of Technology (KIT) can be operated in a low-alpha mode in order to compress bunches down to the picosecond range. Pico-second electron bunches radiate coherently in the observed THz range. The spectral information in this range can give valuable information about the bunch length and on bunch form and substructures created by micro-bunching instabilities We present the current activities at ANKA to explore this spectral range to address the instabilities arising from collective effects resulting in micro-bunching.