HK 82: Beschleunigerphysik XIV (Strahldiagnose II)

Zeit: Donnerstag 16:45–19:00 Raum: WIL-C203

HK 82.1 Do 16:45 WIL-C203

Spectral methods for measuring ultrashort electron bunch durations from Laser-wakefield accelerators — •Alexander Debus, Omid Zarini, Michael Bussmann, Jurjen Couperous, Arie Irman, Wolfgang Seidel, and Ulrich Schramm — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

Laser-wakefield accelerators (LWFA) feature electron bunch durations ranging from several fs to tens of fs. Knowledge and control of the electron bunch duration is vital to the design of future table-top, X-ray light-sources for laser-synchronized pump-probe experiments, ranging from betatron radiation, Thomson scattering to FELs. Due to the nonlinear nature of the laser-wakefield electron injection and small changes in initial experimental conditions the electron bunch properties are often subject to large shot-to-shot variations, which requires diagnostics working not only at ultrashort time-scales but also at single-shot.

We aim for measurements of the LWFA electron bunch duration and bunch substructure at single-shot by analysing the coherent and incoherent transition radiation spectrum. Our ultra-broadband spectrometer ranges from the UV (200 nm) to the mid-IR (12 μm), which allows to resolve time-scales from 0.7 to 40 fs. The prims and grating-based spectrometer divides and maps the spectrum onto three detector systems (UV/VIS;NIR;MIR) of staggered, increasing resolution towards lower wavelengths. Here we present the experimental approach, scope and current status of our spectrometer project.

HK 82.2 Do 17:00 WIL-C203

Electro-optical bunch shape measurements - possible temporal resolution limits — •Andrii Borysenko, Nicole Hiller, Benjamin Kehrer, Michael J. Nasse, Edmund Hertle, Marcel Schuch, Sebastian Marsching, and Anke-Susanne Müller — Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Coherent synchrotron radiation arises when the longitudinal electron bunch length is smaller than the wavelength. In storage rings, substructures on the electron bunches (micro-bunching) can lead to strong "bursting" of coherent radiation and investigation of such effects requires a measurement of the electron bunch length with sufficient temporal resolution. In linear accelerators, the bunch lengths themselves can be extremely short. This report considers the main electro-optical techniques for bunch length measurements and discusses systematic limitations of the method. Special emphasis is put on possible ways to increase the temporal resolution.

HK 82.3 Do 17:15 WIL-C203

Transverse emittance measurement at REGAE via a solenoid scan — •Max Hachmann[1], Frank Mayet[1], Klaus Flöttmann[2], and Florian Grüner[1] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, Hamburg

The linear accelerator REGAE at DESY produces short and low charged electron bunches, on the one hand to resolve the excitation transitions of atoms temporally by pump probe electron diffraction experiments and on the other hand to investigate principal mechanisms of laser plasma acceleration. For both cases a high quality electron beam is required which can be identified with a small beam emittance. The current method to measure the transverse beam emittance at REGAE and results will be presented.

HK 82.4 Do 17:30 WIL-C203

Digital Beam Position and Phase Monitor for P-LINAC for FAIR — •Mohammed almalki — Planckstrasse 1, 64291 Darmstadt,

For the planned P-LINAC for the FAIR facility, Beam Position Monitors (BPM) will be installed at 14 locations along the LINAC. The digital signal processing to derive the transverse beam position and the beam phase will be implemented by "Libera Single Pass H". The specification for position measurement is 0.1 mm spatial resolution and phase accuracy is 1 degree with respect to 325 MHz acceleration frequency. The results from the Libera digital signal processing were compared with the time-domain approach and the FFT analytic calculations. The first test was performed at the GSI UNILAC with a Ne4+ beam at 1.4 MeV / u with a beam current of ~ 80 *A. A single BPM was used to act as a "Bunch arrival monitor" to characterize the dependence of beam arrival time on bunch shape. The signals were sampled at 117.440 MHz with a 16-bit ADC to produce I and Q data streams. The first experimental results will be reported.

HK 82.5 Do 17:45 WIL-C203

Electro-optical bunch length measurements at the ANKA storage ring - First lessons learned — •Nicole Hiller, Andrii Borysenko, Edmund Hertle, Erhard Huttel, Vitali Judin, Sebastian Marsching, Anke-Susanne Müller, Michael J. Nasse, and Marcel Schuh — Karlsruher Institut für Technologie, Kaiserstraße 12, 76131 Karlsruhe

A set up for near-field electro optical bunch length measurements has recently been installed into the UHV system of the ANKA storage ring. For electro-optical bunch length measurements during ANKA's low alpha operation a laser pulse is used to probe the field induced birefringence in an electro-optical crystal (GaP in our case). The setup allows for both, electro-optical sampling (EOS, multi-shot) and spectral decoding (EOSD, single- and multi-shot) measurements. This talk presents first results and discusses challenges that needed to be overcome in order for this method to work at storage rings.

HK 82.6 Do 18:00 WIL-C203

Inbetriebnahme eines neuen hochempfindlichen Bunch-Ankunftszeitmonitors am FLASH — •Alexander Kuhl[1], Juliane Rönsch-Schulenburg[1], Jörg Rossbach[1], Michael Bousonville[2], Marie Kristin Czwalinna[2], Holger Schlarb[2], Cezary Sydlo[2], Sascha Schnepp[3] und Thomas Weiland[4] — [1]Universität Hamburg, Hamburg, Deutschland — [2]DESY, Hamburg, Deutschland — [3]Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zurich, Schweiz — [4]TEMF, Technische Universität Darmstadt, Darmstadt, Deutschland

Der Freie-Elektronen-Laser FLASH in Hamburg verfügt derzeit über vier Bunch-Ankunftszeitmonitore (BAMs) welche eine Zeitauflösung von weniger als 10 fs bei Bunchladungen von mehr als 500 pC ermöglichen. Für den FEL-Betrieb bei FLASH mit sogenannten "Single-Spike-Pulsen" werden niedrigere Bunchladungen von 20 pC benötigt. Die aktuellen BAMs sind mit einer Bandbreite von 10 GHz limitiert und erreichen daher für solch eine kleine Ladungen nicht mehr die geforderte Zeitauflösung von 10 fs. Um diese neuen Anforderungen erfüllen zu können, wurde ein neuer breitbandiger Ankunftszeitmonitor mit einem Frequenzbereich bis 40 GHz entwickelt und an einer fünften Position bei FLASH installiert. In dem Vortrag werden der Aufbau sowie die Inbetriebnahme des Systems als auch die ersten Messungen mit diesem BAM und deren Analyse vorgestellt.

HK 82.7 Do 18:15 WIL-C203

Bunch arrival time monitors; Concepts towards improving the sensitivity for low charge operation for FLASH II and XFEL — •Andreas Penirschke[1], Aleksandar Angelovski[1], Cesary Sydlo[2], Michael Bousonville[2], Alexander Kuhl[3], Marie Kristin Czwalinna[2], Holger Schlarb[2], Thomas Weiland[4], and Rolf Jakoby[1] — [1]TU Darmstadt, Institut für Mikrowellentechnik und Photonik, Merckstr. 25, 64283 Darmstadt — [2]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg — [3]University of Hamburg, Physics Department, Accelerator physics group — [4]TU Darmstadt, Institut Theorie Elektromagnetischer Felder, Schlossgartenstr. 8, 64289 Darmstadt

High gain Free-Electron Lasers can generate ultra short X-ray pulses in the femtosecond range. For a stable operation of the FEL, the precise knowledge of the bunch arrival time is crucial. A novel high bandwidth Bunch Arrival time Monitor was recently installed at FLASH to allow a low charge operation mode with a sub-10fs resolution for bunch charges of 20pC or more. The BAM is equipped with cone shaped pickups for the precise measurement of both, the high and low bunch charge operation mode. For the extension of FLASH facility to FLASH II new pickups for the high bandwidth BAMs need to be developed. The new BAM needs to maximize the voltage level of the beam induced signal for low charge operation mode in order to provide sufficient signal strength for the subsequent electronics. In this talk, we will present concepts to improve the signal strength at the electro-optic modulators for low charge operation at FLASH II and XFEL.

HK 82.8 Do 18:30 WIL-C203

Overview of the Beam Instrumentation of the European Spal-

lation Source — •Christian Böhme — European Spallation Source, Lund, Schweden

With the transition to high-power accelerators the need for new methods in beam instrumentation has risen. An overview of the planned beam instrumentation of the European Spallation Source will be given. As main focus the planned beam profile measurements will be presented, as these have to be measured in different environments: From low ultra-high vacuum regions in between cryogenic cavities to atmospheric pressure helium in a highly radiated area close to the beam target.

HK 82.9 Do 18:45 WIL-C203

High resolution synchrotron light analysis at ELSA — •Michael Switka, Sven Zander, and Wolfgang Hillert — Electron stretcher facility ELSA, Physics Institute of Bonn University

The pulse stretcher ring ELSA provides polarized electrons with energies up to 3.5 GeV for external hadron experiments. In order to suffice the need of stored beam intensities towards 200 mA, advanced beam instability studies need to be carried out. An external diagnostic beamline for synchrotron light analysis has been set up and provides the space for multiple diagnostic tools including a streak camera with time resolution of < 1 ps. Beam profile measurements are expected to identify instabilities and reveal their thresholds. The effect of adequate countermeasures is subject to analysis. The current status of the beamline development will be presented.