AKBP 9: Diagnostics, Control and Instrumentation II

Zeit: Donnerstag 16:30–18:30 Raum: NW-Bau - HS4

AKBP 9.1 Do 16:30 NW-Bau - HS4

Phase-Space Diagnostis at LUX — •P. Winkler[1,3], N. Delbos[1], I. Dornmair[1], T. Eichner[1], B. Hubert[1], L. Hübner[1], S. Jalas[1], S. W. Jolly[1,2], M. Kirchen[1], V. Leroux[1,2], S. Mahncke[1], P. Messner[1], M. Schnepp[1], M. Trunk[1], C. Werle[1], P. A. Walker[1], J. Osterhoff[3], B. Schmidt[3], and A. R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]Institute of Physics of the ASCR, ELI-Beamlines project, Na Slovance 2, 18221 Prague, Czech Republic — [3]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany

The LUX beamline is a novel laser-plasma accelerator, built in close collaboration of the University of Hamburg and DESY, and dedicated for the generation of laser-plasma driven undulator radiation. After the laser-plasma target the electron beams are focused by a quadrupole doublet before entering the undulator to produce soft x-rays at few-nm wavelength. Due to shot-to-shot fluctuations of the electron beam propeties a single-shot diagnositc is required and further complicated by the 1 mrad level beam divergence and few percent level energy spread. We discuss our beam diagnostics concepts for LUX, including emittance and bunch length measurements.

AKBP 9.2 Do 16:45 NW-Bau - HS4

Beam-Based Alignment of the LUX Beam Optic — •Björn Hubert[1], Niels Delbos[1], Irene Dornmair[1], Timo Eichner[1], Lars Hübner[1], Sören Jalas[1], Spencer Jolly[1,2], Manuel Kirchen[1], Vincent Leroux[1,2], Sebastian Mahncke[1], Philipp Messner[1,3], Matthias Schnepp[1], Max Trunk[1], Christian Werle[1], Paul Walker[1], Paul Winkler[1,4], and Andreas Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]Institute of Physics of the ASCR, ELI-Beamlines project, Na Slovance 2, 18221 Prague, Czech Republic — [3]Max-Planck Institute for the Structure and Dynamics of Matter — [4]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany

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Due to the high quadrupole gradients of up to 150 T/m, smallest displacements of the quadrupoles lead to dispersive kicks of the bunch. We performed quadrupole scans to determine the offset in the transversal plane between the magnetic quadrupole centers and the beams center of mass to realign the magnets.

AKBP 9.3 Do 17:00 NW-Bau - HS4

Emittance Measurement at LUX — •Lars Hübner[1], Niels Delbos[1], Irene Dornmair[1], Timo Eichner[1], Björn Hubert[1], Sören Jalas[1], Spencer W. Jolly[1,2], Manuel Kirchen[1], Vincent Leroux[1,2], Sebastian Mahncke[1], Philipp Messner[1,3], Matthias Schnepp[1], Max Trunk[1], Paul Andreas Walker[1], Christian M. Werle[1], Paul Winkler[1,4], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany — [2]Institute of Physics of the ASCR, ELI-Beamlines project, Prague, Czech Republic — [3]Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — [4]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

The LUX beamline is a novel laser-plasma accelerator, built in close collaboration of the University of Hamburg and DESY, and dedicated for the generation of laser-plasma driven undulator radiation. For beam transport design, the beam properties after the plasma target are crucial. Here, we discuss first characterization of the electron beam optics at LUX and report on emittance reconstruction using measured beam profiles and electron spectra.

AKBP 9.4 Do 17:15 NW-Bau - HS4

Closed-Orbit Bilinear-Exponential Analysis — •Bernard Riemann, Stephan Koetter, Benjamin Isbarn, Shaukat Khan, and Thomas Weis — Center for Synchrotron Radiation, TU Dortmund University, Dortmund, Germany

Closed-Orbit Bilinear-Exponential Analysis (COBEA) is an algorithm to decompose monitor-corrector response matrices into (scaled) beta functions, phase advances, scaled dispersion, and betatron tunes. No explicit magnetic lattice model is required ("no lengths, no strengths"), but only the sequence of monitors and dipole correctors along the beam path. To get absolute beta functions, the length of one drift space can be provided as optional input.

Results of COBEA are shown while also relating the algorithm to other diagnostic algorithms. Improvements in the free Python implementation of COBEA are presented. Due to COBEA's low requirements on the amount of input data, it should be applicable to many existing storage rings.

AKBP 9.5 Do 17:30 NW-Bau - HS4

Preparations for electro-optical measurement at DELTA — •Boris Sawadski, Shaukat Khan, Nils Lockmann, Carsten Mai, Arne Meyer auf der Heide, and Raffael Niemczyk — TU Dortmund University, Dortmund, Germany

At the DELTA electron storage ring, operated by the TU Dortmund University, THz radiation is routinely produced by the interaction between the electron bunches and a femtosecond laser pulse. Due to a laser-induced energy modulation, a dip in the longitudinal electron distribution forms after passing a dispersive magnet structure. At a dedicated THz beamline, an Ytterbium-fiber-laser system has been installed which allows for an electro-optical detection of the THz far field. The setup currently being commissioned for the measurement of the longitudinal charge distribution is described and a characterization of the fiber laser system is presented.

AKBP 9.6 Do 17:45 NW-Bau - HS4

Online diagnostics for the ANGUS 200 TW laser — •Matthias Schnepp[1], Niels M. Delbos[1], Timo Eichner[1], Sören Jalas[1], Spencer Jolly[1,3], Manuel Kirchen[1], Vincent Leroux[1,3], Philipp Messner[1,4], Maximilian Trunk[1], Christian M. Werle[1], Paul Winkler[2], and Andreas R. Maier[1] — [1]Center for Free- Electron Laser Science and Department of Physics,University of Hamburg, 22761 Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]ELI Beamlines, Dolní Brežany, Czech Republic — [4]International Max Planck Research School for Ultrafast Imaging and Structural Dynamics, Hamburg, Germany

Laser-plasma based acceleration has matured into a technique providing high-energy electron beams able to drive undulator-based x-ray light sources. The LUX beamline, recently built up in a collaboration between University of Hamburg and DESY is designed to be such a light source. The plasma acceleration stage is driven by the 5 Hz 200 TW laser system ANGUS, and recently demonstrated first x-ray from a plasma-driven undulator. Here, we will introduce the ANGUS laser system as the main driver of the facility and describe the implementation of the online diagnostics with a data acquisition system at the laser repetition rate. We show long-term stability measurements and discuss reliability and reproducibility of the laser as a driver for laser-plasma acceleration.

AKBP 9.7 Do 18:00 NW-Bau - HS4

In-situ synthetic radiation diagnostics for laser wakefield acceleration — •Richard Pausch[1,2], Alexander Debus[1], Axel Huebl[1,2], Ulrich Schramm[1,2], Klaus Steiniger[1,2], René Widera[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]TU Dresden

We present recent results of LWFA simulations including in-situ radiation diagnostics performed with the particle-in-cell code PIConGPU. Our results demonstrate the power provided by synthetic radiation diagnostics to determine the laser-plasma dynamics with regard to applications in experiments.

PIConGPU is currently one of the fastest 3D3V particle-in-cell codes and provides an in-situ radiation diagnostic based on Liénard-Wiechert potentials. This synthetic diagnostic is capable of quantitatively predicting the spectrally and directionally resolved far-field radiation of billions of macro-particles by an in-situ implementation in the PIC cycle. Among other things, the code enables resolving the spatial origin and temporal evolution of the radiation, determine the polarization, quantifying both coherent and incoherent radiation simultaneously and

covering a frequency range from infrared to x-rays.

The talk briefly introduces the technical background of computing the radiation in-situ on GPUs. Its main focus, however, is the characteristic radiation of LWFA that allows identifying the various stages of the laser-plasma dynamics. Possible applications of these radiation signatures in laboratory experiments will be discussed.

AKBP 9.8 Do 18:15 NW-Bau - HS4

Applications of the Double Slit Interferometer for Transverse Beam Size Measurements at BESSY II — •Marten Koopmans[1,2], Ji-Gwang Hwang[1], Andreas Jankowiak[1,2], Peter Kuske[1], Markus Ries[1], Andreas Schälicke[1], and Gregor Schiwietz[1] — [1]Helmholtz-Zentrum Berlin, Deutschland — [2]Humboldt-Universität zu Berlin, Deutschland

For the upgrade of the BESSY II storage ring to BESSY VSR * an interferometric beam size monitor was designed and set up. Since this system uses visible light it can be upgraded efficiently to provide bunch resolved measurements. These are required for machine commissioning, development and to ensure long term quality and stability of user operation of BESSY VSR. Various applications of the system are outlined and measurements are presented. A detailed estimation of possible error contributions is given and the upgrade of the present system with an ICCD will be discussed.

* A. Jankowiak et al., eds., BESSY VSR Technical Design Study, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany, June 2015. DOI: 10.5442/R0001