AKBP 14: Injectors, Lasers

Zeit: Donnerstag 16:45–19:00 Raum: BZ.08.06 (HS 1)

AKBP 14.1 Do 16:45 BZ.08.06 (HS 1)

Preliminary Results from the Laser System generating Quasi 3-D Ellipsoidal Photocathode Laser Pulses at PITZ — •James Good[1], Alex Andrianov[2], Ekaterina Gacheva[2], Efim Khazanov[2], Martin Khojoyan[1], Mikhail Krasilnikov[1], Sergey Mironov[2], Tino Rublack[1], Frank Stephan[1], Eugeniy Syresin[3], and Victor Zelenogorsky[2] — [1]DESY, Zeuthen, Germany — [2]IAP, Nizhny Novgorod, Russia — [3]JINR, Dubna, Russia

The optimization of photoinjectors is crucial for the successful operation of linac-based free electron lasers, and beam dynamics simulations have shown that 3D ellipsoidal photocathode laser pulses result in significantly lower electron beam emittance than that of conventional cylindrical pulses. Therefore, in collaboration with the Institute of Applied Physics (Nizhny Novgorod, Russia) and the Joint Institute of Nuclear Research (Dubna, Russia), a Laser system capable of generating quasi 3-D ellipsoidal laser pulses has been developed and installed at the Photo Injector Test facility at DESY, Zeuthen (PITZ).

The pulse shaping has been realized using the spatial light modulator technique, characterized by cross-correlation measurements, and is going to be demonstrated by electron beam measurements. In this contribution the overall setup, operating principles, and initial results of the new photocathode laser system at PITZ will be reported.

AKBP 14.2 Do 17:00 BZ.08.06 (HS 1)

Diagnostics for stable operation of a 200 TW laser system for laser-plasma acceleration — •Spencer Windhorst Jolly[1,2,3], Dominik Trosien[1,2], Byunghoon Kim[1,2,3], Matthias Schnepp[1,2], Vincent Leroux[1,2,3], and Andreas Richard Maier[1,2] — [1]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg, Germany — [2]University of Hamburg, Institute of Experimental Physics, 22761 Hamburg, Germany — [3]ELI Beamlines, 18221 Prague 8, Czech Republic

Laser-plasma based acceleration has matured into a technique providing comparable electron energies and secondary source characteristics to conventional accelerators. The missing piece is stability and repetition rate, which are, among other aspects, severely limited by the driver laser performance. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together to combine university research in the field of laser-plasma acceleration with the expertise of a large and well-established accelerator facility. We present in this talk a summary of hardware, software, and operation based changes to the 200 TW laser system (ANGUS) to increase ease of operation and stability. We concentrate on camera-based alignment and diagnostics, implemented within the DESY accelerator controls system. These improvements to the laser system will greatly help the operation of LUX and REGAE, the two dedicated experiments in Hamburg which study laser-plasma acceleration.

AKBP 14.3 Do 17:15 BZ.08.06 (HS 1)

Diagnostics of the FLUTE Gun Laser and Design of a Beam Transport System — •Sophie Walther, Erik Bründermann, Nicole Hiller, Anke-Susanne Müller, and Michael Nasse — KIT, Karlsruhe, Germany

FLUTE (Ferninfrarot Linac Und Test Experiment) is a new linear accelerator currently under comissioning at the Karlsruhe Institute of Technology (KIT). It is aimed at accelerator physics and THz radiation research. The electrons are generated with a photo-injector gun using picosecond long UV laser pulses. A Ti:Sapphire laser system with a consecutive third harmonic generation unit is used to generate the electrons. We present the design of a stabilized laser beam transport system to guide the laser to the cathode, including crucial diagnostic devices such as a 'virtual cathode' to monitor the laser beam. Additionally, first test results with the laser system will be presented.

AKBP 14.4 Do 17:30 BZ.08.06 (HS 1)

Photocathode development and spectral response measurements at HZB — •Martin A. H. Schmeisser, Julius Kühn, Thorsten Kamps, and Andreas Jankowiak — Helmholtz-Zentrum Berlin

Photocathodes of the Alkali Antimonide group are promising candidates for the generation of electron beams with high brightness and high average current in photoinjectors. A preparation and analysis system for these cathodes was commissioned at HZB and first results are presented. The system supports the in-situ characterization of cathodes regarding their spectral response, and depth-profiled chemical composition using XPS and LEIS.

AKBP 14.5 Do 17:45 BZ.08.06 (HS 1)

Laser wavefront optimisation for laser-plasma acceleration — •Vincent Leroux[1,2,3], Matthias Schnepp[1,2], Spencer Jolly[1,2,3], Buynghoon Kim[1,2,3], Ji-Ping Zou[4], and Andreas R. Maier[1,2] — [1]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg — [2]University of Hamburg, Institute of Experimental Physics, 22761 Hamburg — [3]ELI Beamlines, 18221 Praha 8, Czech Republic — [4]Laboratoire pour l'Utilisation des Lasers Intenses, CNRS, Ecole Polytechnique, Palaiseau, France

Laser-Plasma Wakefield Accelerators showed promising results in the past few years, generating high-energy electron beam over cm-distances. Nevertheless, the quality and shot-to-shot stability of such beams have not yet reached the level of conventional accelerators. One of the crucial factors is the driver laser beam quality, which need to be focused close to the diffraction limit. To achieve the highest electron beam quality, the laser wavefront has to be controlled via a closed loop including a deformable mirror and a wavefront sensor. Within the LAOLA collaboration between the University of Hamburg and DESY, the LUX beamline is developed to generate and study plasma-driven undulator radiation. It is driven by the commercial 200 TW ANGUS laser system which includes such adaptive optics. In this talk, I will present considerations on closed-loop wavefront control for enhanced beam quality in laser-plasma acceleration.

AKBP 14.6 Do 18:00 BZ.08.06 (HS 1)

Laser transport for the LUX laser plasma beamline — •Paul Andreas Walker[1,2], Niels Matthias Delbos[1,2], Darek Kocon[3], Vincent Leroux[1,2,3], Nils Plambeck[1,2], Matthias Schnepp[1,2], Christian Markus Werle[1,2], Benno Zeitler[1,2], and Andreas R. Maier[1,2] — [1]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg — [2]University of Hamburg, Institute of Experimental Physics, 22761 Hamburg — [3]ELI Beamlines, 18221 Praha 8, Czech Republic

Within the LAOLA collaboration the university of Hamburg and DESY work closely together within the field of Laser Wakefield Acceleration. We report on the new laser transport beamlines which will feed two laser plasma experiments, LUX and REGAE. We outline the technical challenges and their solutions the first laser beamline within the accelerator UHV environment posed. The in-house design of the 7 inch diameter mirror mounts and the design process of their vacuum chambers are discussed alongside vibration studies, vacuum force analysis, and material selections.

AKBP 14.7 Do 18:15 BZ.08.06 (HS 1)

ANGUS Laser System for Laser-Plasma Acceleration — •Matthias Schnepp[1,2], Spencer Windhorst Jolly[1,2,3], Byounghoon Kim[1,2,3], Vincent Alain Gilles Leroux[1,2,3], Claus Domink Trosien[1,2], Julian Zeyn[1,2], and Andreas R. Maier[1,2] — [1]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg — [2]University of Hamburg, Institute of Experimental Physics, 22761 Hamburg — [3]ELI Beamlines, 18221 Praha 8, Czech Republic

Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together to combine university research with the expertise of a large and well-established accelerator facility. In this talk we will introduce the recently commissioned 200 TW laser system ANGUS. We will report on the integration of the laser system into the accelerator infrastructure, in particular about requirements for the air conditioning and demands for the vacuum system. Important characteristic laser parameters will be discussed as well as the progress towards stable operation. We will present results on measured energy stability, pulse duration and temporal intensity contrast as well as wave front distortion and pointing stability.

AKBP 14.8 Do 18:30 BZ.08.06 (HS 1)

Compton Polarimetry at ELSA - Properties of the Laser System — •Florian Hinterkeuser, Wolfgang C.A. Hillert, Rebecca Koop, and Michael T. Switka — Elektronen-Stretcher-

Anlage ELSA, Physikalisches Institut, Universität Bonn

For double polarization experiments, the Electron Stretcher Facility ELSA provides a spin polarized electron beam with energies ranging from 0.5 to 3.5 GeV. Since the initial polarization is not preserved during the acceleration and storage process, it is crucial to monitor the electron polarization in the stretcher ring. Hence the installation of a Compton polarimeter, consisting of a laser and a silicon microstrip detector system, is in progress. The laser system provides two polarized photon beams, which are scattered off the stored electrons. After recent inevitable repairs, the final laser properties have been measured in order to obtain a stable system with optimized performance. The laser properties and the expected performance are presented.

AKBP 14.9 Do 18:45 BZ.08.06 (HS 1)

Time domain characterization of the cone-shaped pick-ups at FLASH, ELBE and SwissFEL Injector Test Facility — •Aleksandar Angelovski[1], Andreas Penirschke[1], Michael Kuntzsch[4], Marie Kristin Czwalinna[2], Cezary Sydlo[2], Vladimir Arsov[3], Stefan Hunziker[3], Holger Schlarb[2], Michael Gensch[4], Volker Schlott[3], Thomas Weiland[1], and Rolf Jakoby[1] — [1]TU Darmstadt, Darmstadt, Germany — [2]DESY, Hamburg, Germany — [3]PSI, Villigen, Switzerland — [4]HZDR, Dresden-Rossendorf, Germany

As a part of the 40 GHz Bunch Arrival-time Monitors (BAMs) for low charge operation mode at the European XFEL, the cone-shaped pick-ups were introduced. The pickups are installed at FLASH (DESY), ELBE (HZDR) and SwissFEL Injector Test Facility (PSI). Time domain measurements with real time and sampling oscilloscopes are conducted at the three accelerators. The pickup signal is recorded for different machine and bunch settings. For validation the measurement results are compared to the simulations.