AKBP 1: Particle Sources and Electron Accelerators

Zeit: Montag 16:00–18:00 Raum: NW-Bau - HS4

AKBP 1.1 Mo 16:00 NW-Bau - HS4

Overview of the Photo Injector Test Facility at DESY, Zeithen site (PITZ) — •Ye Chen, Prach Boonpornprasert, James Good, Matthias Gross, Holger Huck, Igor Isaev, Christian Koschitzki, Mikhail Krasilnikov, Xin Li, Osip Lishilin, Gregor Loisch, Raffael Niemczyk, Anne Oppelt, Houjun Qian, Yves Renier, Frank Stephan, and Quantang Zhao — DESY, 15738 Zeuthen, Germany

The photo injector test facility at DESY, Zeuthen site (PITZ), was built to test, develop and experimentally optimize high brightness photoelectron sources for superconducting linac driven SASE FELs, such as the Free electron LASer in Hamburg (FLASH) and the European X-ray Free Electron Laser (European XFEL). Extremely low beam emittance beyond the original European XFEL requirements has been demonstrated at PITZ in 2011. Further improvements of the transverse projected beam emittance are in good progress by generating 3D ellipsoidal electron beams on the basis of photocathode laser pulse shaping. In this talk, an overview of the PITZ facility is given. New progress on emittance optimization will be presented.

AKBP 1.2 Mo 16:15 NW-Bau - HS4

Accelerator R&D at the Photo Injector Test Facility at DESY, Zeuthen site (PITZ) — •Ye Chen, Prach Boonpornprasert, James Good, Matthias Gross, Holger Huck, Igor Isaev, Christian Koschitzki, Mikhail Krasilnikov, Xin Li, Osip Lishilin, Gregor Loisch, Raffael Niemczyk, Anne Oppelt, Houjun Qian, Yves Renier, Frank Stephan, and Quantang Zhao — DESY, 15738 Zeuthen, Germany

The photo injector test facility at DESY, Zeuthen site (PITZ), was built to test, develop and experimentally optimize high brightness photoelectron sources for coherent light sources. The produced high quality electron beam and a large variety of advanced beam diagnostics at PITZ also provide excellent oppotunities for a wide field of research activities. This includes experiments of particle beam driven plasma wakefield acceleration, experiments towards a prototype IR/THz source for pump-probe experiments at the European XFEL, experimental demonstration of ballistic bunching with dielectric-lined waveguides, electron diffraction experiments and many others. In this talk, an overview of recent research activities at PITZ is given. Corresponding results will be presented.

AKBP 1.3 Mo 16:30 NW-Bau - HS4

Erster ERL Betrieb des S-DALINAC* — •Michaela Arnold[1], Florian Hug[2], Jonas Pforr[1], Norbert Pietralla[1] und Manuel Steinhorst[1] — [1]IKP, TU Darmstadt — [2]KPH, JGU Mainz

Der S-DALINAC wird seit 1991 an der TU Darmstadt als rezirkulierender Linearbeschleuniger betrieben. In den Jahren 2015/2016 wurde eine dritte Rezirkulationsstrahlführung eingebaut. Dabei wurde ein Weglängensystem realisiert, das die Gesamtlänge der Rezirkulationsstrahlführung um einen Gesamthub von insgesamt 10 cm verändern kann. Bei der am S-DALINAC verwendeten Betriebsfrequenz von 3 GHz erlaubt diese Strahlführung eine Anpassung der Strahlphase um bis zu 360° der HF Phase. Dadurch erlaubt diese neue Strahlführung sowohl den normalen, beschleunigenden Betrieb (einfacher Durchschuss, einfach- oder dreifach-rezirkulierend auf beschleunigender Phase) als auch den Betrieb als Energy-Recovery LINAC (ERL; einfach oder zweifach auf abbremsender Phase von 180°). Das Weglängensystem wurde nach Installation und Justage mit Strahl in Betrieb genommen und die Änderung der Strahlphase in Abhängigkeit von der Position des Weglängensystems bestimmt. Die Nutzung der neuen Strahlführung für den normalen, beschleunigenden Betrieb sowie der Betrieb als einfach-rezirkulierender ERL konnten im Herbst 2017 erfolgreich gezeigt werden. Dieser Beitrag wird die Inbetriebnahme des Weglängensystems sowie den ersten Betrieb des S-DALINAC als einfach-rezirkulierenden ERL präsentieren.

*Gefördert durch die DFG im Rahmen des GRK 2128 und INST163/383-1/FUGG

AKBP 1.4 Mo 16:45 NW-Bau - HS4

Current Commissioning status of FLUTE Phase I — •Thiemo Schmelzer[1], Axel Bernhard[2], Andreas Böhm[3], Erik Bründermann[2], Stefan Funkner[1], Anton Malygin[1], Sebastian Marsching[1], Wolfgang Mexner[2], Michael J. Nasse[2], Gudrun Niehues[1], Robert Rubrecht[2], Marcel Schuh[2], Markus Schwarz[1], Nigel Smale[2], Pawel Wesolowski[2], Minjie Yan[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe, Germany — [2]IBPT, KIT, Karlsruhe, Germany — [3]IPS, KIT, Karlsruhe, Germany

FLUTE (Ferninfrarot Linac- Und Test-Experiment) is a new compact versatile linear accelerator currently being constructed at KIT. Its primary goal is to serve as a platform for a variety of accelerator studies as well as to generate strong ultra-short THz pulses for photon science. The phase I of the project, which includes the RF photo injector providing electrons at beam energy of 7 MeV and a corresponding diagnostics section, is currently being commissioned. Here, we report on the latest progress of the commissioning phase. The status of the gun conditioning will be given, followed by an overview of the RF system and the laser system as well as the progress of the diagnostics section.

AKBP 1.5 Mo 17:00 NW-Bau - HS4

Segmented Terahertz Electron Accelerator and Manipulator (STEAM) — •Dongfang Zhang[1,2], Arya Fallahi[1], Michael Hemmer[1], Xiaojun Wu[1], Moein Fakhari[1,2], Yi Hua[1], Huseyin Cankaya[1], Anne-Laure Calendron[1], Luis E. Zapata[1], Nicholas H. Matlis[1], and Franz X. Kärtner[1,2,3] — [1]Center for Free-Electron Laser Science, Deutsches Elektronen Synchrotron, Notkestrasse 85, 22607 Hamburg, Germany. — [2]Department of Physics and The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany. — [3]Research Laboratory of Electronics, MIT, Cambridge, 02139 Massachusetts, USA.

We present a segmented THz based device (STEAM) capable of performing multiple high-field operations on the 6D-phase-space of ultrashort electron bunches. With this single device, using only a few microjoules of single-cycle THz radiation, we have shown record THz-based acceleration of more than 30 keV, with a peak acceleration field gradient of around 70 MV/m. At the same time, the STEAM device can also manipulate the electrons that show high focusing gradient (2 kT/m), compression of electron bunches down to 100 fs and streaking gradient of 140 urad/fs, which offers temporal profile characterizations with resolution below 10 fs. The STEAM device can be fabricated with regular mechanical machining tools and supports real-time switching between different modes of operation. It paves the way for the development of THz-based compact electron guns, accelerators, ultrafast electron diffractometers and Free-Electron Lasers.

AKBP 1.6 Mo 17:15 NW-Bau - HS4

Inverted Geometry Photo-electron Gun Research and Development at TU Darmstadt* — •Maximilian Herbert, Joachim Enders, Yuliya Fritzsche, Neeraj Kurichiyanil, and Vincent Wende — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The Institute for nuclear physics at TU Darmstadt houses the Superconducting Darmstadt Linear Accelerator S-DALINAC. A photoelectron gun using GaAs photocathodes to provide pulsed and/or polarized electron beams, the S-DALINAC Polarized Injector SPIn, has been installed [1] for future nuclear-structure investigations [2]. In order to conduct research and development for this source, a test facility for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) has been constructed [3]. This setup provides several chambers for photocathode handling and a 60 keV beamline for photo-gun design studies [4]. Currently, an upgraded inverted insulator geometry is under investigation for Photo-CATCH that is supposed to be implemented at SPIn. This talk will present the current developments at Photo-CATCH and future measurements.

*Work supported by the Deutsche Forschungsgemeinschaft through GRK 2128 'AccelencE'

[1] Y. Poltoratska et al., J. Phys.: Conf. Series 298, 012002 (2011)
[2] J. Enders, AIP Conf. Proc. 1563, 223 (2013)
[3] M. Espig, Dissertation, TU Darmstadt (2016)
[4] N. Kurichiyanil, Dissertation, TU Darmstadt (2016)

AKBP 1.7 Mo 17:30 NW-Bau - HS4

Simulations on a spin-polarized photo-electron gun for the superconducting Darmstadt electron linear accelerator S-

DALINAC* — •Vincent Wende, Joachim Enders, Yuliya Fritzsche, Maximlian Herbert, and Neeraj Kurichiyanil — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The S-DALINAC Polarized-electron Injector SPIn [1] provides pulsed and/or polarized electron beams with an electron energy up to 125 keV. To improve the injection into the accelerator, an upgrade of the SPIn photo gun to an operational voltage of 200 kV is planned. For this upgrade it is envisaged to use the inverted insulator geometry, which was previously examined at the Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) test facility [2] with an operational voltage of 60 kV. In this talk simulation results, obtained with CST, concerning the adaptability of this gun geometry to 200 kV and observed challenges will be presented.

[1] Y. Poltoratska et al., J.Phys.: Conf. Series 298, 012002 (2011)
[2] M.Espig, Dissertation, TU Darmstadt (2016)

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AKBP 1.8 Mo 17:45 NW-Bau - HS4

Conceptual Design and Simulation Studies of an Electron Source for Ultrafast Electron Diffraction at DELTA — •Daniel Krieg[1], Shaukat Khan[1], and Klaus Sokolowski-Tinten[2] — [1]Center for Synchrotron Radiation, TU Dortmund University, Dortmund, Germany — [2]University Duisburg-Essen, Duisburg, Germany

Ultrafast electron diffraction (UED) is a technique to study the structural dynamics of matter, combining a femtosecond time resolution with the diffraction of electrons with sub-angstrom De-Broglie wavelength. The method is an alternative approach to X-ray scattering at free-electron lasers. UED pump-probe experiments require ultrashort laser pulses to pump a sample, electron bunches with small emittance and ultrashort length, typically with charges well below 1 pC, to analyze the state of the sample by diffraction, and an excellent control of the delay between laser and electron bunch. Most UED setups use electrostatic electron sources in the keV regime but electrons accelerated to a few MeV in a radiofrequency photocathode gun offer significant advantages concerning bunch length and emittance due to the reduction of space charge effects. Furthermore, the longer mean free path of MeV electrons allows for thicker samples and therefore a wider range of possible materials. In this talk, a first conceptual design and simulation results for a university-based UED facility with ultrashort and low-emittance MeV electron bunches are presented.