Accelerator Physics
Beschleunigerphysik (BE)

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Overview of Invited Talks and Sessions

(Lecture rooms: MOL 213 and ZEU 255; Posters: P4)

Invited Talks

BE 3.1	Tue	9:30–10:00	MOL 213	**Laser-Plasma Acceleration in Hamburg** — •Andreas R. Maier
BE 3.6	Tue	11:15–11:45	MOL 213	**Laser acceleration of electrons at a dielectric grating structure** — •Peter Hommelhoff
BE 9.1	Wed	15:00–15:30	MOL 213	**Short-Pulse Operation of Synchrotron Radiation Sources** — •Anke-Susanne Müller
BE 9.2	Wed	15:30–16:00	MOL 213	**Progress in White Beam Diffraction Imaging** — •Andreas Danilewsky
BE 9.3	Wed	16:00–16:30	MOL 213	**Short pulses @ SOLEIL: Femto-Slicing and Low-Alpha** — •Marie Labat
BE 9.4	Wed	16:30–17:00	MOL 213	**Nanomagnets and artificial multiferroics studied with X-ray photoemission electron microscopy** — •Frithjof Nolting

Sessions

BE 1.1–1.8	Mon	15:00–18:00	MOL 213	**Hadron Accelerators and Colliders**
BE 2.1–2.9	Mon	15:00–17:45	ZEU 255	**Diagnostics and Instrumentation I**
BE 3.1–3.9	Tue	9:30–12:30	MOL 213	**New Accelerator Concepts**
BE 4.1–4.10	Tue	9:30–12:30	ZEU 255	**Diagnostics and Instrumentation II**
BE 5	Tue	13:00–14:00	HSZ 105	**Sitzung des Komitees für Beschleunigerphysik (KfB)**
BE 6	Tue	15:00–16:00	BAR Schön	**Vollversammlung des Forums Beschleunigerphysik**
BE 7.1–7.9	Wed	9:30–12:30	MOL 213	**Synchrotron Radiation I**
BE 8.1–8.10	Wed	9:30–12:15	ZEU 255	**Diagnostics and Instrumentation III**
BE 9.1–9.5	Wed	15:00–17:15	MOL 213	**Synchrotron Radiation II (Focus Session with MI)**
BE 10.1–10.9	Wed	15:00–17:15	ZEU 255	**Beam Dynamics and Fields I**
BE 11.1–11.15	Wed	17:00–19:30	P4	**Accelerator Physics Poster Session**
BE 12.1–12.9	Thu	9:30–12:30	MOL 213	**Free-Electron Lasers**
BE 13.1–13.11	Thu	9:30–12:30	ZEU 255	**Beam Dynamics and Fields II**
BE 14.1–14.8	Thu	15:00–17:00	MOL 213	**Particle Sources**
BE 15.1–15.9	Thu	15:00–18:00	ZEU 255	**Beam Dynamics and Fields III**

Sitzung des Komitees für Beschleunigerphysik (KfB)

Tue 13:00–14:00 HSZ 105

Vollversammlung des Forums Beschleunigerphysik

Tue 15:00–16:00 BAR Schön

BE 1: Hadron Accelerators and Colliders

Time: Monday 15:00–18:00 Location: MOL 213

Group Report BE 1.1 Mon 15:00 MOL 213

Laser Cooling of Relativistic Ion Beams with Large Momentum Spreads — •Michael Bussmann[1], Danyal Winters[2], Weiqiang Wen[3], Christina Dimopoulou[2], Tino Giacomini[2], Christophor Kozhuharov[2], Thomas Kühl[2,4,5], Yuri Litvinov[2], Matthias Lochmann[2,4], Wilfried Nörtershäuser[2,6], Fritz Nolden[2], Rodolfo Sánchez[2,6], Shahab Sanjari[2], Markus Steck[2], Thomas Stöhlker[2,5,7], Johannes Ullmann[2,6], Tobias Beck[6], Gerhard Birkl[6], Benjamin Rein[6], Sascha Tichelmann[6], Thomas Walther[6], Xinwen Ma[3], Dacheng Zhang[3], Markus Löser[1], Michael Seltmann[1], Mathias Siebold[1], and Ulrich Schramm[1,8] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]GSI Darmstadt — [3]Institute of Modern Physics, Chinese Academy of Science, Lanzhou — [4]Uni Mainz — [5]HI Jena — [6]TU Darmstadt — [7]Uni Jena — [8]TU Dresden

We present new results from a recent experiment on laser cooling of relativistic bunched ion beams at the Experimental Storage Ring at GSI. Our results show laser cooling with a single solid-state cw laser system with a laser frequency scanning range larger than the bucket acceptance. This technique is of great importance for future storage ring facilities such as FAIR and HIRFL, as it allows for all-optical beam cooling of initially hot ion beams without the need for pre-electron cooling.

BE 1.2 Mon 15:30 MOL 213

Polarisation Lifetime Studies for EDM Measurements at COSY — •Marcel Rosenthal — Institut für Kernphysik, Forschungszentrum Jülich

The annihilation of matter and antimatter during the evolution of the universe requires further sources of CP violation to explain the matter-antimatter asymmetry in our galaxy. According to the CPT theorem, permanent Electric Dipole Moments (EDMs) are CP violating.

Up to now no direct EDM measurements for charged hadrons have been performed yet. The JEDI collaboration investigates the feasibility of such measurements in dedicated storage rings. The conventional storage ring in Jülich, the Cooler Synchrotron COSY, is used to first explore methods and crucial parameters of these measurements and do a first direct measurement of the proton and deuteron EDM afterwards.

Tracking simulations are a crucial part of feasibility studies of the planned experiments. The software COSY INFINITY is utilized to analyze the motion-correlated spin dynamics and create one turn transfer maps. This allows for less computational power consuming tracking in comparison to integration codes. For long-term tracking this is absolutely mandatory.

One crucial parameter for EDM measurements is the polarisation lifetime. During the last beam times a huge dataset of polarisation lifetimes utilizing different accelerator settings were recorded. These polarisation measurements at COSY are used to benchmark accelerator models and validate further predictions for EDM measurement methods.

BE 1.3 Mon 15:45 MOL 213

A RF-E-B-Dipole for Spin Manipulation at COSY — •Sebastian Mey[1], Ronald Brings[1], Ralf Gebel[1], Andreas Lehrach[2], Rudolf Maier[1], Frank Rathmann[1], and Jörg Pretz[2] — [1]Institut für Kernphysik, Forschungszentrum Jülich GmbH, Deutschland — [2]III. Physikalisches Institut B, RWTH Aachen, Deutschland

The JEDI Collaboration investigates the feasibility of EDM (Electric Dipole Moment) experiments with charged hadrons in storage rings. These incorporate measurements with horizontally polarized particles. To maximize the lifetime of the horizontal polarization, systematic studies of unwanted spin rotations utilizing a vertical RF-B field are required. To avoid simultaneously kicking the beam in the horizontal plane, the resulting Lorentz force needs to be compensated by the force of an orthogonal electric field, leading to a Wien-Filter configuration. For preliminary studies, the Cooler Synchrotron COSY is currently being supplemented with a new RF-E-B-Dipole.

The talk will incorporate the setup of the new system from the RF-Supply to the electrode and coil configuration providing the electromagnetic fields, as well as the commissioning and first measurements taken at COSY.

Group Report BE 1.4 Mon 16:00 MOL 213

Reacceleration of Ion Beams for Higher Performance in Tumor-Therapy — •Christian Schömers, Andreas Peters, and Thomas Haberer — Heidelberger Ionenstrahl-Therapiezentrum

At the Heidelberg Ion-Beam Therapy Centre (HIT) cancer patients are treated using the raster-scanning method. A synchrotron provides pencil beams in therapy quality for 255 energy steps per ion type allowing to vary the penetration depth and thus to irradiate tumors slice-by-slice. So far, changing the beam energy necessitates a new synchrotron cycle, including all phases without beam extraction.

The no. of ions that can be accelerated in the synchrotron usually exceeds the required no. of ions for one energy slice. An intensity upgrade of the injector system will be investigated, to increase the no. of accelerated particles even more. The treatment time could be significantly reduced by reaccelerating or decelerating the remaining ions to the next energy level. By alternating acceleration and extraction phases several slices could be irradiated with only short interruptions.

Therefore the reacceleration of a transversally blown up beam * due to RF-knockout extraction * must be investigated, beam losses have to be minimized. To estimate the benefit of this operation mode, treatment time has been simulated and compared to the time achieved in the past. A reduction of up to 65 percent is possible and more patients can be treated! Simulations and first tests of a reaccelerated and extracted beam are presented.

15 min. break

Group Report BE 1.5 Mon 16:45 MOL 213

Challenges and current status of the TLEP lattice design — •Bastian Härer[1,2], Bernhard Holzer[1], and Anke-Susanne Müller[2,3,4] — [1]CERN, Geneva — [2]LAS, KIT, Karlsruhe — [3]ANKA, KIT, Karlsruhe — [4]IPS, KIT, Karlsruhe

Following the recommendations of the European Strategy Group for High Energy Physics, several new projects are studied as possible future accelerators for the high energy physics research at CERN. One of these accelerators is TLEP, a new 80 km e+/e- storage ring collider with an energy up to 175 GeV per beam. TLEP will have at least two mini beta insertions to house high energy detectors and several straight sections dedicated for rf installation, injection/extraction, machine safety and beam collimation.

This talk will point out the current status of the TLEP lattice design, which is challenging, because the beam emittance is depending on energy squared and experiments in the energy range from 45 GeV to 175 GeV are foreseen.

BE 1.6 Mon 17:15 MOL 213

Origins of Transverse Emittance Blow-up during the LHC Energy Ramp — •Maria Kuhn[1,2], Gianluigi Arduini[1], Verena Kain[1], Andy Langner[1,2], Yannis Papaphilippou[1], Michaela Schaumann[1], and Rogelio Tomas[1] — [1]CERN, Geneva, Switzerland — [2]University of Hamburg, Hamburg, Germany

During LHC Run 1 about 30 % of the potential peak performance was lost due to transverse emittance blow-up through the LHC cycle. Measurements indicated that the majority of the blow-up occurred during the energy ramp. Until the end of LHC Run 1 this emittance blow-up could not be eliminated. In this presentation the measurements and observations of emittance growth through the ramp are summarized. Simulation results for growth due to Intra Beam Scattering will be shown and compared to measurements. A summary of investigations of other possible sources will be given and backed up with simulations where possible. Requirements for commissioning the LHC with beam in 2015 after Long Shutdown 1 to understand and control emittance blow-up will be listed.

BE 1.7 Mon 17:30 MOL 213

Impact of Quadrupolar Errors (b2) on the Optics Measurement Resolution in the LHC — •Andy Langner[1,2], Per Hagen[2], Ewen Hamish Maclean[2], Viktor Maier[2], and Rogelio Tomás[2] — [1]Universitaet Hamburg — [2]CERN

With respect to the operation of the LHC in 2015 with an increased

collision energy, an accurate measurement and correction of the optics will be crucial. The algorithm to determine LHC beta-functions uses the measured turn-by-turn data at the beam position monitors (BPMs) from an excited betatron oscillation. From the phase advances between three adjacent BPMs the beta functions are computed. An important prerequisite for this method is the precise knowledge of the optics model. It was studied whether introducing measured values of the systematic quadrupolar errors (b2) to the model will further increase the measurement resolution.

BE 1.8 Mon 17:45 MOL 213

A hydrodynamic tunneling experiment in CERN's HiRadMat facility - Comparison of experimental results and simulations. — •Florian Burkart[1,2], Daniel Wollmann[1], Rüdiger Schmidt[1], and Naeem Tahir[3] — [1]CERN, Genf, Schweiz — [2]Goethe Universität, Frankfurt, Deutschland — [3]GSI, Darmstadt, Deutschland

In 2012, a novel experiment has been performed at the CERN HiRadMat facility to study the impact of a 440 GeV proton beam generated by CERN's Super Proton Synchrotron (SPS), on extended solid copper cylindrical targets. Substantial hydrodynamic tunneling of the protons in the target material has been observed. In this contribution a comparison of the experimental results to predictions, achieved with iterative FLUKA and BIG2 simulations will be presented. Furthermore, the plan and status of simulations for future upgrades of the LHC their implication on the machine protection design will be discussed.

BE 2: Diagnostics and Instrumentation I

Time: Monday 15:00–17:45 Location: ZEU 255

Group Report BE 2.1 Mon 15:00 ZEU 255

Status of Single-Shot EOSD Measurements at ANKA — •Nicole Hiller[1], Andrii Borysenko[1], Edmund Hertle[1], Anke-Susanne Müller[1], Michael J. Nasse[1], Patrik Schönfeldt[1], Marcel Schuh[1], Nigel Smale[1], Peter Peier[2], Bernd Steffen[2], Volker Schlott[3], Benjamin Kehrer[1], and Vitali Judin[1] — [1]LAS/IPS/ANKA Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Deutsches Elektronen Synchrotron (DESY), Hamburg, Germany — [3]Paul-Scherrer Institut (PSI), Villigen, Switzerland

ANKA is the first storage ring in the world with a near-field single-shot electro-optical (EO) bunch profile monitor. The method of electro-optical spectral decoding (EOSD) uses the Pockels effect to modulate the longitudinal electron bunch profile onto a long, chirped laser pulse passing through an EO crystal. The laser pulse is then analyzed with a single-shot spectrometer and from the spectral modulation, the temporal modulation can be extracted. The setup has a sub-ps resolution (granularity) and can measure down to bunch lengths of 1.5 ps RMS for bunch charges as low as 30 pC. With this setup it is possible to study longitudinal beam dynamics (e. g. microbunching) occurring during ANKA's low-alpha-operation, an operation mode with compressed bunches to generate coherent synchrotron radiation in the THz range. In addition to measuring the longitudinal bunch profile, long-ranging wake-fields trailing the electron bunch can also be studied, revealing bunch-bunch interactions. The talk will give an overview over beam dynamics studies performed with the system. This work is funded by the BMBF contract numbers: 05K10VKC, 05K13VKA.

BE 2.2 Mon 15:30 ZEU 255

Emulated balanced detection of fast pulses by using a single detector — •Johannes Steinmann[1], Erik Bründermann[2], and Anke-Susanne Müller[1] — [1]Karlsruhe Institute of Technology (KIT), Laboratory for Applications of Synchrotron radiation (LAS), Karlsruhe, Germany — [2]Ruhr-Universität Bochum, Physikalische Chemie II, Bochum, Germany

Shot to shot signal variations in intensity and spectral properties as they occur during bursts in the THz emission of storage ring light sources like ANKA at KIT operated in low alpha mode have to be compensated for time resolved measruements. A solution can be provided by balanced detection where the incoming radiation is split into a reference beam, providing calibration, and a beam passing through the experiment. If only the intensity varied, any two detectors could be used for the detection of the reference and sample beam. Since our THz source also varies in spectral properties, two detectors with the exact same spectral response would be needed. Ultra fast THz-Detectors are in their characteristics so far not sufficiently reproducible, hard to manufacture, and very expensive. This study demonstrates that near-simultaneous recording of signal and reference pulse via time-shifted detection can emulate the advantages of balanced detection exploited by using only a single detector, thus having exactly the same detector behavior.

BE 2.3 Mon 15:45 ZEU 255

Online Burst Analysis of Coherent THz Radiation at ANKA — •Miriam Brosi[1], Michele Caselle[4], Edmund Hertle[3], Vitali Judin[2], Anke-Susanne Müller[1,2,3], Nigel Smale[2], and Johannes Steinmann[1] — [1]LAS, KIT, Karlsruhe — [2]ANKA, KIT, Karlsruhe — [3]IPS, KIT, Karlsruhe — [4]IPE, KIT, Karlsruhe

ANKA, the synchrotron light source in Karlsruhe, provides a low-alpha operation mode for users. In this mode, coherent synchrotron radiation (CSR), which is emitted by short bunches, can be provided up to a frequency of several THz. Bursts in the CSR intensity, driven by instabilities in the longitudinal phase space and bunch length fluctuations, have been measured for single and, recently, multi bunch operation. Providing coherent THz radiation for users on a reliable and controlled basis requires better understanding of these time dependent fluctuations. Therefore, ultra fast THz detectors together with an FPGA-based DAQ system are developed in collaboration with IPE and IMS at KIT.

Tools are being developed and optimized to characterize and further understand the bursting behavior for different storage ring parameters and to investigate phase, correlations and interaction between the bursting of different bunches. In this contribution the first results are presented and an outlook towards an online data analysis system is given.

BE 2.4 Mon 16:00 ZEU 255

First Results of the new bunch-by-bunch feedback system at ANKA — •Edmund Hertle[1], Markus Höner[4], Erhard Huttel[2], Anke-Susanne Müller[1,2], Nigel Smale[2], and Dmitry Teytelman[3] — [1]Karlsruhe Institute of Technology (KIT) Institute for Photon Science and Synchrotron Radiation (IPS/ANKA) — [2]Karlsruhe Institute of Technology (KIT) ANKA Synchrotron Radiation Facility — [3]Dimtel, Inc. (Dimtel) — [4]Dortmund University (DELTA) Center for Synchrotron Radiation

A new digital three dimensional fast bunch by bunch feedback system has been installed and commissioned at ANKA. Immediate improvements to stored current and lifetime were achieved for normal user operation. For this, the feedback has to be running during the injection and the energy ramp to 2.5 GeV. Additionally, the feedback system was also incorporated into the diagnostic tool-set at ANKA and opened up new possibilities of automated and continuous measurements of certain beam parameters. The system can operate in different modes such as the low alpha operation mode, which has different requirements on the feedback system compared to normal user operation. Results on the various aspects will be presented as well as future improvements.

BE 2.5 Mon 16:15 ZEU 255

Design of a compact setup to determine beam energy by detection of Compton backscattered photons at ANKA — •Cheng Chang[1], David Batchelor[2], Edmund Hertle[1], Erhard Huttel[2], Vitali Judin[2], Anke-Susanne Müller[1,2,3], Michael Nasse[3], Marcel Schuh[3], and Johannes Steinmann[3] — [1]IPS, KIT, Karlsruhe — [2]ANKA, KIT, Karlsruhe — [3]LAS, KIT, Karlsruhe

One of most important parameters of accelerators is their electron beam energy. So far, the method of resonant depolarization was used to accurately determine the energy at ˜2.5GeV of the ANKA storage ring, which, however, becomes cumbersome for lower energies. A good alternative is the detection of Compton backscattered photons, generated by laser light scattered off the relativistic electron beam. To achieve compactness and integration into the storage ring, the setup of transverse scattering is proposed instead of conventional head-on

collision. The feasibility has been studied by comparison between simulations of Compton backscattered photons by AT and CAIN 2.35 and actual measurement of background radiation with an HPGe (High Purity Germanium) spectrometer. The configuration of the setup is also presented.

This work is funded by the European Union under contract PITN-GA-2011-289191

15 min. break

BE 2.6 Mon 16:45 ZEU 255

Status of bunch-by-bunch feedback systems at the DELTA storage ring used for electron beam diagnostics* — •Markus Höner, Svenja Hilbrich, Holger Huck, Maryam Huck, Shaukat Khan, Arne Meyer auf der Heide, Carsten Mai, Robert Molo, Helge Rast, Andreas Schick, Malte Sommer, and Peter Ungelenk — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

At the 1.5-GeV electron storage ring DELTA (TU Dortmund), bunch-by-bunch feedback systems are in use to analyze and counteract transverse and longitudinal multi-bunch instabilities. An automatic readout of bunch position data allows a real-time mode analysis during machine operation, which is available in the control room. In dedicated machine shifts an excitation of particular multi-bunch modes allows further investigation of beam stability and determination of natural damping times of all modes even below the instability threshold.

Besides that, a chromaticity-dependent single-bunch instability will be discussed and first bunch-by-bunch data taken from the synchrotron (BoDo) will be shown.

* Work supported by the BMBF.

BE 2.7 Mon 17:00 ZEU 255

First Considerations on a Broadband TM11-RF-Kicker for Transverse Bunch-By-Bunch-Feedback in Comparison with a Standard Stripline Kicker* — •Malte Sommer, Thomas Weis, Bernard Riemann, and Markus Höner — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

Longitudinal and transverse bunch-by-bunch-feedback-systems are well established in high intensity beam accelerators such as synchrotron light sources. Modern accelerator concepts like energy recovery linacs (ERL) and/or the use of high acceleration gradients in storage rings however require superconducting multicell resonators with a high probability of residual impedances and therefore fast feedback systems with increased strength and efficiency of the kicker structures. Based on the properties of a broadband longitudinal kicker we have investigated the possibility of operating a similar RF-structure in the TM11 dipole mode as a transverse kicker without any striplines. First attempts have been made to optimize the system concerning operation frequency, bandwidth and efficiency by numerical simulations with CST Microwave Studio. The layout of the transverse kicker structure is presented and compared with numerical studies of a transverse stripline-kicker operated at the DELTA storage ring.

*Work supported by the BMBF under contract no. 05K13PEB

BE 2.8 Mon 17:15 ZEU 255

Cone-shaped pickups upgrade for the 40 GHz Bunch Arrival-time Monitors at FLASH and European XFEL — •Aleksandar Angelovski[1], Andreas Penirschke[1], Marie Kristin Czwalinna[2], Cezary Sydlo[2], Christopher Gerth[2], Holger Schlarb[2], Silke Vilcins-Czvitkovits[2], Thomas Weiland[3], and Rolf Jakoby[1] — [1]Institut für Mikrowellentechnik und Photonik, TU Darmstadt, Germany — [2]DESY, Hamburg, Germany — [3]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, Germany

For sub-10 fs measurement resolution of the arrival time for electron bunches higher than 200 pC, an electro-optical detection scheme was developed and implemented at FLASH. The Bunch Arrival-time Monitors (BAMs) comprise pickup electrodes, an RF and electro-optical frontend and read out electronics. In order to measure the arrival time for charges as low as 20 pC the bandwidth of the BAMs was increased up to 40 GHz. First measurements show reduced signal strength due to high losses in the RF signal path. An analysis towards increasing the pickup signal level through modifying the pickup design is presented. A non-hermetic demonstrator is build to compare RF measurements with CST STUDIO SUITE simulations.

BE 2.9 Mon 17:30 ZEU 255

Status des neuen Ankunftszeitmonitorsystem bei 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 M. Schnepp[3] und Thomas Weiland[4] — [1]Universität Hamburg, Hamburg, Deutschland — [2]DESY, Hamburg, Deutschland — [3]Laboratory for Electromagnetic Fields and Microwave Electronics (IFH), Zürich, Schweiz — [4]TEMF, Technische Universität Darmstadt, Darmstadt, Deutschland

Im Freie-Elektronen-Laser Hamburg (FLASH) werden Ankunftszeitmonitore betrieben, die eine Zeitauflösung von etwa 10 fs bei Bunchladungen über 500 pC ermöglichen. Für den FEL Betrieb mit single-spike Pulsen werden niedrigere Bunchladungen von etwa 20 pC benötigt. Um die geforderte Zeitauflösung für solch kleine Ladungen zu ermöglichen, wurde ein neuer Pickup mit einer deutlich größeren Bandbreite von 40 GHz entwickelt und in FLASH eingebaut. Dazu passend wurde ein neues Frontend entwickelt. Hierbei stellte die höhe Bandbreite die größte Herausforderung dar. Im Vortrag werden der aktuelle Stand der Entwicklung und erste Testmessungen vorgestellt.

BE 3: New Accelerator Concepts

Time: Tuesday 9:30–12:30 Location: MOL 213

Invited Talk BE 3.1 Tue 9:30 MOL 213

Laser-Plasma Acceleration in Hamburg — •Andreas R. Maier — CFEL, Center for Free-Electron Laser Science

Laser-plasma accelerators promise ultra-compact sources of highly relativistic electron beams, especially suited for driving novel x-ray light sources. The stability and reproducibility of laser-plasma generated beams however, is still not comparable to conventional machines. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together towards stable plasma-driven electron beams. In my talk, I will report on the recently commissioned 200 TW laser ANGUS and new beamlines currently being set up in Hamburg, and will review experimental activities, including external injection, and plasma-driven undulators.

BE 3.2 Tue 10:00 MOL 213

Diagnostik-Beamline mit Transversal-Gradient-Undulator am Laser-Wakefield-Beschleuniger in Jena — •Christina Widmann[1], Veronica Afonso Rodriguez[1], Axel Bernhard[1], Robert Rossmanith[1], Walter Werner[1], Anke-Susanne Müller[1], Maria Nicolai[2], Alexander Sävert[2], Malte Kaluza[2,3] und Maria Reuter[3] — [1]Karlsruher Institut für Technologie (KIT) — [2]Friedrich-Schiller-Universität Jena — [3]Helmholtz-Institut Jena

Zur Erzeugung von monochromatischer Undulatorstrahlung an Laser-Wakefield-Beschleunigern (LWFA) können Transversal-Gradient-Undualtoren (TGU) eingesetzt werden. Am LWFA in Jena wird auf Basis eines supraleitenden, zylindrischen TGU eine Diagnostik-Beamline aufgebaut: In einer dispersiven Schikane aus normalleitenden Strahlführungsmagneten werden die Bunche des LWFA energetisch aufgespalten und auf das Feld des Undulators abgestimmt.

In diesem Vortrag wird der aktuelle Stand des Projekts mit ersten Tests der verschiedenen Komponenten vorgestellt.

Gefördert durch das BMBF unter Fördernummer 05K10VK2 und 05K10SJ2.

BE 3.3 Tue 10:15 MOL 213

Simulation der Strahlung von Elektronen in einem zylindrischen TG-Undulator — •Nils Braun[1], Verónica Afonso Rodríguez[1], Axel Bernhard[1], Peter Peiffer[1], Robert Rossmanith[1], Christina Widmann[1], Tilo Baumbach[1] und Michael Scheer[2] — [1]Karlsruher Institut für Technologie (KIT) — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH

Die Laser-Wakefield-Beschleunigung (LWFA) bietet die Möglichkeit,

innerhalb kurzer Strecken eine hohe Beschleunigung der Elektronen zu erreichen bei zugleich sehr kurzer Impulslänge. Gerade für die zukünftige Verwendung in Freie-Elektronen-Lasern (FEL) ist jedoch die große Energiebandbreite des Elektronenstrahls problematisch.

In einem Transversal-Gradient-Undulator kann ein energetisch aufgespaltener Elektronenstrahl monochromatische Strahlung produzieren. Die grundsätzliche Funktionsweise dieses Prinzips wurde nun erstmals durch die Simulation des Spektrums der spontanen Undulatorstrahlung bestätigt.

Projekt teilgefördert durch das BMBF unter Förderkennz. 05K10VK2

BE 3.4 Tue 10:30 MOL 213

Synthetic Diagnostics of Radiation Phenomena in the Particle-in-Cell Code PIConGPU — •Richard Pausch, Michael Bussmann, Heiko Burau, Alexander Debus, Axel Huebl, Arie Irman, Ulrich Schramm, and René Widera — Helmholtz-Zentrum Dresden-Rossendorf

Synthetic diagnostics in particle-in-cell codes provide physical quantities to the scientist that can be directly compared to experiment. We present simulations of laser-wakefield acceleration of electrons and on the dynamics of the relativistic Kelvin-Helmholtz Instability using the code PIConGPU. With PIConGPU it is possible to compute the radiation of every single electron in the simulation caused by acceleration by computing the Lienard-Wiechert Potentials, including both coherent and incoherent radiation. With GPU-accelerated codes Petaflop performance has become possible.

BE 3.5 Tue 10:45 MOL 213

On the plasma lens effect in a hybrid plasma accelerator — •Thomas Heinemann[1], Oliver Karger[1], Constantin Aniculaesei[1], Bernhard Hidding[1,2], and Stephan Kuschel[3] — [1]Universität Hamburg, Germany — [2]University of Strathclyde, United Kingdom — [3]Universität Jena, Germany

An electron bunch propagating into and through a plasma is influenced by various incarnations of the plasma lens effect. Such a plasma lens can operate as a focusing, as well as a deflecting device and is of significant relevance for plasma accelerators. Therefore, experiments at FLAME (Frascati Laser for Acceleration and Multidisciplinary Experiments) and JETI (Jena-Titan-Saphir-Laser) are introduced, measuring the influence of a plasma lens on an electron beam created using the laser wakefield acceleration technique. Those experiments include a hybrid plasma accelerator scheme with two consecutive plasma stages. The first stage generates an electron beam, whereas the second stage operates as a plasma lens.

15 min. break

Invited Talk BE 3.6 Tue 11:15 MOL 213

Laser acceleration of electrons at a dielectric grating structure — •Peter Hommelhoff — Physikdepartment, Friedrich-Alexander-Universität Erlangen-Nürnberg und MPI f. Quantenoptik, Garching

In free space acceleration of charged massive particles with alternating (optical) fields works only over distances as small as the driving wavelength, or is inefficient (higher order effects). However, with proper boundary conditions the acceleration with alternating fields can become efficient, over infinite distances. We will present results on the acceleration of electrons with the optical electric field of 800-nm 100-fs laser pulses at a dielectric grating structure. We employ the third spatial harmonic (grating period of 750nm) to accelerate non-relativistic 30-keV electrons and observe an acceleration gradient of up to 25 MeV/m, already matching the gradient of nowadays large-scale accelerators. With similar laser parameters and relativistic electrons the acceleration becomes more efficient and translates into a gradient of 1 GeV/m. We will present experimental and simulation results as well as an extended outlook on dielectric laser acceleration and manipulation of charged particles, including a discussion of the required ultra-low emittance electron beam properties.

BE 3.7 Tue 11:45 MOL 213

HiPACE simulations of self-modulation of the PITZ electron beam — •Gaurav Pathak[1,2], Matthias Gross[2], Mikhail Krasilinikov[2], Timon Mehrling[2], Jens Osterhoff[1,2], and Frank Stephan[2] — [1]Universität Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron , Germany

In a proposed experiment a plasma oven will be setup in the Photo Injector Test Facility at DESY, Zeuthen Site (PITZ), beam line to study the self-modulation of electron beams when they pass through a laser generated plasma.

For better understanding of the physical process, a set of numerical simulations with the Quasi-Static Particle-in-Cell code, HiPACE, has been carried out. The simulations also help to optimize the beam and plasma parameters that suits best for the experiment. The particular interest is to observe the energy modulation induced into the beam itself by means of the generated wakefields in the plasma. It will reflect the key properties of the accelerating electric fields such as their magnitude and phase velocity, both of significant importance in the design of experiments relying on the underlying physics processes.

BE 3.8 Tue 12:00 MOL 213

Towards high transformer ratios for plasma wakefield acceleration at PITZ — •Galina Asova[1], Anne Oppelt[2], Frank Stephan[2], and Thomas Vinatier[3] — [1]INRNE-BAS, Sofia, Bulgaria — [2]DESY, Zeuthen, Germany — [3]LAL, Orsay, France

In the middle of 2014 the Photo-Injector Test facility at DESY, Zeuthen site, will be extended with a plasma chamber that will be used to study plasma wakefield acceleration, starting with the self-modulation of the electron beam in the plasma. Later on, an electron bunch constituted out of four Gaussian sub-pulses with ramped charge structure will be used to resonantly drive the plasma wave accelerating a trailing probe pulse within the same bunch. The stacked pulse structure with increasing charge gives the possibility to reach high transformer ratios for the energy transfer to the probe pulse.

In order to achieve high-density plasma waves those pulses need to be longitudinally compressed before entering the plasma which imposes stringent requirements towards the longitudinal parameters of the electron bunch. This work concentrates on the possibilities to preserve the ramped charge structure from the photocathode until the bunch compressor while satisfying in the best manner the requirements of the bunch compressor.

BE 3.9 Tue 12:15 MOL 213

Controlled injection of plasma electrons into a beam-driven wakefield using the density down-ramp technique at Facility for Advanced Accelerator Experimental Tests (FACET) — •Olena Kononenko, Christopher Behrens, John Dale, Julia Grebenyuk, Vladyslav Libov, Timon Mehrling, Alberto Martinez de la Ossa, Halil Olgun, Charlotte Palmer, Lucas Schaper, and Jens Osterhoff — DESY, Hamburg, Germany

Plasma wakefields can sustain high field gradients ($>$ 10 GV/m) allowing particle acceleration to ultrarelativistic energies over small distances (few mm). Control over the electron bunch phase-space during the process of injection into the accelerating wakefield is of crucial importance for the production of electron beams in plasma-based schemes. Shaping of the longitudinal plasma-density profile has been proposed as a method of achieving controlled injection. In this report, we describe the study of density down-ramp injection into a beam-driven plasma wakefield which will be explored at the FACET facility.

For the planned experiments at FACET, suitable target density profiles with a low-density plateau region, preceded by a high-density peak are required. The basic target is designed as a capillary tube with inlets along its length. The peak region is achieved by an external gas jet. This gas jet must be operated in pulsed mode to reduce the gas load into the main vacuum of FACET.

Here the goals and preparation for the experiment are presented, including particle-in-cell and hydrodynamic simulations of the tailored target.

BE 4: Diagnostics and Instrumentation II

Time: Tuesday 9:30–12:30 Location: ZEU 255

Group Report BE 4.1 Tue 9:30 ZEU 255

Development and Status Quo of the Optical Beam Diagnostics System at ELSA* — •Michael Switka, Sven Zander, Manuel Schedler, Philipp Hänisch, Tobias Schiffer, Dennis Proft, Frank Frommberger, and Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut der Universität Bonn

The pulse stretcher ring ELSA delivers polarized and non-polarized electrons with an adjustable beam energy of 0.5 - 3.5 GeV to external experimental stations. Extraction currents available are up to 1 nA with a maximum duty factor of 80%. To meet the growing demands of the user community regarding beam intensity and quality, the upgrade of vital accelerator components is an ongoing process. This includes the improvement of the beam diagnostics in order to resolve and monitor intensity and quality limiting effects. An optical diagnosis system utilizes the available synchrotron radiation at strategic locations. The system includes a streak camera, a fast photo diode and multiple CCD cameras in order to obtain transverse and longitudinal beam images. The streak camera's maximum resolution of 1 ps provides an equivalent observation bandwidth of up to 1 THz, thus being able to capture fast longitudinal and transverse beam dynamics. Its operation has recently started. The fiber coupled fast photo diode is set-up to provide an on-line filling pattern information. The overall performance of the optical diagnostics and machine relevant measurements are presented.
* Work funded by the DFG within SFB/TRR16.

BE 4.2 Tue 10:00 ZEU 255

Using a non-relational database for long term data storage in an accelerator control system — •Dennis Proft, Frank Frommberger, and Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

The electron stretcher facility ELSA serves external hadron physics experiments with a beam of unpolarized and polarized electrons of up to 3.2 GeV energy. Its in house developed control system is able to provide real time beam diagnostics as well as steering tasks in one homogeneous environment.

To surveil the long term evolution of beam properties and machine states access to all parameters values at any given time is needed. This yields a huge amount of data the storage system has to cope with. In order to read back the data to user applications with low latency fast random access to the data in specific time ranges is required. *Hypertable*, a non-relational database system, meets these requirements and is used as the storage engine.

This talk will give details on the setup of the history storage engine on top of hypertable together with a presentation of a newly developed, powerful and easy to use graphical data browser.

BE 4.3 Tue 10:15 ZEU 255

Beam Heat Load Measurements with COLDDIAG at the Diamond Light Source — •Robert Voutta[1], Sara Casalbuoni[1], Stefan Gerstl[1], Andreas Wolfgang Grau[1], David Saez de Jauregui[1], Tomas Holubek[1], Riccardo Bartolini[2], Matthew Peter Cox[2], Emily Carya Longhi[2], Günther Rehm[2], Jos Chris Schouten[2], Richard Walker[2], Mauro Migliorati[3], and Bruno Spataro[3] — [1]Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]Diamond Light Source, Oxfordshire, England — [3]INFN/LNF, Frascati, Italy

Understanding the heat load from an electron beam to the cold beam tube (liner) is an open issue of great interest for the cryogenic layout of superconducting insertion devices. COLDDIAG, a cold vacuum chamber for diagnostics was designed and built especially for this purpose. The instrumentation comprises temperature sensors, pressure gauges, mass spectrometers as well as retarding field analyzers with which it is possible to measure the beam heat load, total pressure, and gas content as well as the flux of particles hitting the chamber walls. COLDDIAG was installed in November 2011 in the Diamond light source (DLS). Due to a mechanical failure at one thermal transition, it was removed after only one week of operation. A redesign of the faulty transition in COLDDIAG allowed reinstallation in August 2012. In this presentation, we report on the measurements and results obtained during the first months since reinstallation in the DLS.

BE 4.4 Tue 10:30 ZEU 255

Laser-induced fluorescence as neutral gas density diagnostic for an hybrid plasma accelerator — •Johannes Wein[1], Constantin Aniculaesei[1], Gregor Fuhs[1], Oliver Karger[1], and Bernhard Hidding[1,2] — [1]Universität Hamburg, Germany — [2]University of Strathclyde, Glasgow, United Kingdom

Relativistic electron beams with small emittance and size are needed for advanced applications such as free electron lasers (FEL) and other coherent light sources in the x-ray regime. The concept of underdense plasma photocathode acceleration uses a beam-driven plasma wave in a two component gas mixture consisting of a low ionisation threshold medium (LIT) a high ionisation threshold medium (HIT) and a low-energy laser pulse. Electron bunches with sub-fs-length and unprecedented normalized emittance down to 10^{-9} m rad can be produced. To achieve a controlled injection a homogenous plasma density is very important. Therefore a plasma oven for rubidium as both HIT and LIT medium is developed. The presentation discusses laser-induced fluorescence (LIF) as a method to measure the neutral gas density profile in this oven. LIF is a widely used technique for the detection of atomic species in gaseous environments. It excites present atoms with a laser and measures the intensity of transversally emitted relaxation photons. This method is capable to measure the gas density with high accuracy over a wide range of values.

BE 4.5 Tue 10:45 ZEU 255

Emittance Measurement of the Laser-Accelerated REGAE Beam — •Max Hachmann — DESY, Hamburg, Germany

The linear accelerator REGAE at DESY produces short and low charged electron bunches in order to investigate principal mechanisms of external injection inside a laser-plasma wakefield. This is only feasible with a high quality electron beam with a small beam emittance. The conservation of the beam quality while the acceleration is crucial for every further experiment. Results and simulations of the characterization of the injected as well as the accelerated electron beam will be presented and discussed.

15 min. break

BE 4.6 Tue 11:15 ZEU 255

Electro-Optical bunch length monitor for FLUTE: layout and simulations — •Andrii Borysenko[1], Edmund Hertle[1], Nicole Hiller[1], Vitali Judin[1], Sebastian Marsching[1], Anke-Susanne Müller[1], Michael Johannes Nasse[1], Markus Schwarz[1], and Bernd Steffen[2] — [1]KIT, Karlsruhe, Germany — [2]DESY, Hamburg, Germany

A new compact linear accelerator FLUTE is currently under construction at Karlsruhe Institute of Technology (KIT) in collaboration with DESY and PSI. It aims at obtaining femtosecond electron bunches (˜1fs - 300 fs) with a wide charge range (1 pC - 3 nC) and requires a precise bunch length diagnostic system. Here we present the layout of a bunch length monitor based on the electro-optic technique of spectral decoding using an Yb-doped fiber laser system (central wavelength 1030 nm) and a GaP crystal. Simulations of the electro-optic signal for different operation modes of FLUTE were performed and main challenges are discussed in this talk. This work is funded by the European Union under contract PITN-GA-2011-289191

BE 4.7 Tue 11:30 ZEU 255

Closed Orbit Control for Acceleration of Polarized Electrons in a Fast Ramping Accelerator — •Jens-Peter Thiry, Frank Frommberger, Andreas Dieckmann, and Wolfgang Hillert — Elektronen-Stretcher-Accelerator ELSA, Physics Institute, University Bonn

ELSA is a fast ramping stretcher ring supplying polarized electrons with energies up to 3.2 GeV. The acceleration is performed within 300 ms, with a fast energy ramp of 6 GeV/s. In order to preserve the initial degree of polarization during the ramping phase, various procedures are applied. These call for a high bandwidth of the orbit corrector system.

A fast energy ramp and a precise and stable control of the vertical orbit are crucial for polarization conservation. Additional harmonic field distributions have to be applied at certain energies, leading to

extra requirements of the system.

Recently the vertical corrector system was upgraded to fulfill the required maximum field strength and high bandwidth. In this talk an overview of the performance of our closed orbit control system and an outlook of possible future plans will be given.

BE 4.8 Tue 11:45 ZEU 255

Aufbau eines Synchrotronlichtmonitors am 2,5 GeV Booster-Synchrotron von ELSA — •Tobias Schiffer, Philipp Hänisch, Michael Switka und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut der Universität Bonn

Das 2,5 GeV Synchrotron ist seit 1967 an der Universität Bonn in Betrieb und wird zur Zeit als Vorbeschleuniger des ELSA-Stretcherrings genutzt. Es handelt sich um ein schnell rampendes combined function Synchrotron mit einer Zyklusdauer von 20 ms. Typischerweise werden Strahlströme von 10 mA auf eine Extraktionsenergie von 1,2 GeV beschleunigt.

Im Zuge der Aufrüstung der Beschleunigeranlage zur Erhöhung des Strahlstroms soll am Booster-Synchrotron eine nicht-destruktive Strahldiagnose aufgebaut werden. Diese basiert auf der Detektion des vom Strahl emittierten Synchrotronlichts zur Bestimmung der transversalen Position und Intensitätsverteilung des umlaufenden Strahls. Im Vordergrund steht hier insbesondere ein Studium der dynamischen Effekte auf der schnellen Energierampe. Bei dieser wird die Strahlenergie innerhalb von 8,6 ms von 20 MeV auf 1,2 GeV erhöht, wobei das Magnetfeld mit maximal 85 T/s geändert wird. Der momentane Stand der Planung und Installation wird präsentiert.

BE 4.9 Tue 12:00 ZEU 255

GunLab - Eine kompakte Diagnoseeinrichtung zur Untersuchung von Elektronenstrahlen aus SHF-Photoelektronen-Injektoren — •Jens Völker[1], Roman Barday[1], Thorsten Kamps[1], Jeniffa Rudolph[1], Susanne Schubert[1], Stephan Wesch[1], Alessandro Ferrarotto[2], Thomas Weis[2], Vasiliy Ivanovich Shvedunov[3] und Ivan Yu Vladimirov[3] — [1]Helmholtz Zentrum Berlin — [2]DELTA, Dortmund — [3]MSU SINP, Moscow

Supraleitende Hochfrequenz (SHF)- Photoelektronen Injektoren sind für zukünftige ERLs und FELs mit kleinen Emittanzen, hohen mittleren Strahlströmen und kurzen Pulslängen die ideale Lösung. Im Rahmen von **B*ERL*inPro** werden verschiedenen SHF Injektorkonzepte und Photokathoden entworfen und sollen in **GunLab** getestet werden. Mit **GunLab** wird es möglich sein den kompletten 6d-Phasenraum der extrahierten Bunche zu charakterisieren. Des Weiteren sollen Halo- und Dunkelströme parallel zum Photoelektronenstrahl im Detail untersucht werden. In dieser Arbeit präsentieren wir Aufbau und erwartete Messgenauigkeiten von **GunLab**.

BE 4.10 Tue 12:15 ZEU 255

Strahlenschutzkonzepte für die Strahlführung für Detektortests an ELSA — •Nikolas Heurich, Philipp Hänisch, Frank Frommberger und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Gegenwärtig wird am Elektronenbeschleuniger ELSA eine neue externe Strahlführung aufgebaut, deren Aufgabe es ist, einen primären Elektronenstrahl für Detektortests zur Verfügung zu stellen. Damit soll die Beschleunigeranlage nicht nur für die momentan durchgeführten Photoproduktionsexperimente der Hadronenphysik zur Verfügung stehen, sondern auch eine Plattform für das „Forschungs- und Technologiezentrum Detektorphysik“ zur Entwicklung von Detektoren für die Teilchen- und Astroteilchenphysik bieten.

Zur Vernichtung und gleichzeitigen Strommessung des Elektronenstrahls hinter den Detektorkomponenten wird ein Faraday-Cup, bestehend aus abgereichertem Uran, eingesetzt. Die Reststrahlung, die den Cup verlässt, wird in einer Betonummantelung absorbiert. Das Strahlenschutzkonzept für den gesamten Bereich der neuen Strahlführung wurde mit Hilfe des Monte-Carlo-Simulationsprogramms *Fluka* entworfen. Dabei wurden neben der Dimensionierung der Betonummantelung auch Strahlenschutzmauern berücksichtigt, um ein gefahrloses Arbeiten im dadurch geschaffenen Nebenraum zu ermöglichen.

In diesem Vortrag werden verschiedene Konzepte für den Strahlenschutz vorgestellt. Außerdem wird über Fortschritte an der Strahlführung berichtet.

BE 5: Sitzung des Komitees für Beschleunigerphysik (KfB)

Time: Tuesday 13:00–14:00 Location: HSZ 105

BE 6: Vollversammlung des Forums Beschleunigerphysik

Time: Tuesday 15:00–16:00 Location: BAR Schön

BE 7: Synchrotron Radiation I

Time: Wednesday 9:30–12:30 Location: MOL 213

Group Report BE 7.1 Wed 9:30 MOL 213

BESSY_VSR: Upgrade einer Synchrotronstrahlungsquelle zum gleichzeitigen Betrieb mit langen und kurzen Bunchen — •Andreas Jankowiak, Godehard Wüstefeld, Martin Ruprecht, Paul Goslawski, Markus Ries, Jens Knobloch, Peter Kuske und Axel Neumann — Helmholtz-Zentrum Berlin

Am HZB werden für das Energy Recovery Linac Projekt BERLinPro modengedämpfte, supraleitende Kavitäten für den cw Betrieb bei hohen mittleren Strömen entwickelt. Werden solche Kavitäten in einen Speicherring integriert, dann erlaubt deren starke longitudinale Fokussierung die Erzeugung von kurzen Buckets, in denen intensive Elektronenpakte gespeichert werden können. Zwei Kavitätensysteme, die bei der 3-fachen und 3.5-fachen der Grundfrequenz von 500MHz betrieben werden, erzeugen eine Modulation (Schwebung) der Hochfrequenzspannung die zu einer Bucketstruktur führt, die alternierend lange und kurze Elektronepakete erlaubt. Der Einbau eines solchen Systems in eine der geraden Strecken von BESSY II ermöglicht Pulslängen von 15ps und 1.5ps (rms) bei gleicher Bunchladung pro Bucket in der Standard Nutzeroptik des Speicherrings. Der Betrieb mit wenigen intensiven, kurzen Einzelpulsen, zusammen mit einem Batch langer Elektronenpulse, erfüllt dann gleichzeitig die Forderung der Nutzer nach hoher mittlerer Brillanz, für z.B. Strukturuntersuchungen, als auch intensiven Einzelpulsen für dynamische Untersuchungen. Das dem BESSY_VSR Upgrade zugrunde liegende Konzept wird beschrieben und die Herausforderungen bei der Realisierung werden diskutiert.

BE 7.2 Wed 10:00 MOL 213

Analysis of Coupled Bunch Instabilities in BESSY$^{\mathrm{VSR}}$ — •Martin Ruprecht[1], Paul Goslawski[1], Andreas Jankowiak[1], Markus Ries[1], Godehard Wüstefeld[1], and Thomas Weis[2] — [1]Helmholtz-Zentrum Berlin, Germany — [2]Technische Universität Dortmund, Germany

BESSY$^{\mathrm{VSR}}$, a scheme where 1.5 ps and 15 ps long bunches (rms) can be stored simultaneously in the BESSY II storage ring has recently been proposed [1]. The strong longitudinal bunch focusing is achieved by superconducting high gradient RF cavities. This paper presents investigations of coupled bunch instabilities driven by higher order modes (HOMs) of superconducting multi cell cavities in BESSY$^{\mathrm{VSR}}$. Analytical calculations and tracking simulations in time domain are performed in the longitudinal and the transverse planes and factors that influence the threshold currents are being discussed. Possible candidates of suitable cavity designs are investigated.

[1] G. Wüstefeld, A. Jankowiak, J. Knobloch, M. Ries, Simultaneous Long and Short Electron Bunches in the BESSY II Storage Ring, Pro-

ceedings of IPAC2011, San Sebastián, Spain

BE 7.3 Wed 10:15 MOL 213

The Low-α Lattice and Bunch Length Limits at BESSY^{VSR} — •Paul Goslawski, Markus Ries, Martin Ruprecht, and Gode Wüstefeld — Helmholtz-Zentrum Berlin, D-12489 Berlin, Germany

An upgrade of the BESSY II ring to a **V**ariable bunch length **S**torage **R**ing (BESSY^{VSR}) has been recently proposed [1], by introducing strongly focusing superconducting cavities. This will allow to store simultaneously long and short bunches. In the regular user optics, bunch lengths of 15 ps (rms) and down to 1.5 ps (rms) are expected. Bunches as short as 300 fs (rms), close to the bunch length limit, and a ring current of 3.5 mA at the bunch bursting threshold can be provided by using a modified low-α optics. This presentation will discuss the properties of the low-α optics and intrinsic bunch length limits, given by coupling effects of the longitudinal and horizontal plane.

[1] G. Wüstefeld, A. Jankowiak, J. Knobloch, M.Ries, "Simultaneous Long and Short Electron Bunches in the BESSYII Storage Ring", Proceedings of IPAC2011, San Sebastian, Spain.

BE 7.4 Wed 10:30 MOL 213

A Robinson Wiggler Proposal for the Metrology Light Source — •Tobias Goetsch, Jörg Feikes, Markus Ries, and Godehard Wüstefeld — Helmholtz-Zentrum Berlin

The Metrology Light Source (MLS) of the Physikalisch-Technische Bundesanstalt, situated in Berlin (Germany) is an electron storage ring operating from 105 MeV to 630 MeV. The MLS serves as the national primary source standard from the near infrared to the extreme ultraviolet spectral region [1]. Due to the low operating energy of 630 MeV, Touschek scattering dominates the lifetime at the MLS. By installing a Robinson Wiggler, damping effects can be transferred from the longitudinal to the horizontal plane [2,3], thereby increasing the energy spread while reducing the horizontal emittance. By varying the energy spread, the bunch length can be increased and thus the scattering rate decreased, resulting in an increased lifetime. According to preliminary estimations an increase in lifetime of more than 60 % seems achievable. First results of a feasibility study of such a scheme will be presented.

[1] R. Klein et al., Phys. Rev. ST-AB 11, 110701, 2008

[2] K. W. Robinson, Radiation effects in circular electron accelerators, physical review, vol. 111, number 2, 1958.

[3] H. Abualrob et al., SOLEIL Emittance Reduction using a Robinson Wiggler, MOPPP062 in Proceedings of IPAC2012, New Orleans (USA), 2012

BE 7.5 Wed 10:45 MOL 213

First measurement results of the CLIC damping wiggler prototype to be installed at the ANKA synchrotron — •Steffen Hillenbrand[1], Axel Bernhard[1], Erhard Huttel[1], Robert Rossmanith[1], Paolo Ferracin[2], Daniel Schörling[2], Alexey Bragin[3], Nikolay Mezentsev[3], Vasily Syrovatin[3], Konstatin Zolotarev[3], and Laura Garcia Fajardo[2] — [1]Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]CERN, Geneva, Switzerland — [3]Budker Institute of Nuclear Physics (BINP), Novosibirsk, Russia

For the proposed linear collider CLIC, damping rings operating at 2.86 GeV are foreseen. In these rings, an array of superconductive wigglers will reduce the emittance.

In order to test a wiggler element for the CLIC damping rings, a wiggler with comparable specifications has been developed and produced by BINP. This wiggler will be installed at the ANKA synchrotron, where it will serve both as a test device in collaboration with CERN, and as a radiation source for a new beamline.

This presentation gives the status of the project, in particular the results of the factory acceptance test of the wiggler. An overview over the planned experiments at ANKA is given.

Work supported by the German Federal Ministry of Education and Research (BmBF) under contract no. 05K12VK1.

Gruppenvortrag

15 min. break

Group Report BE 7.6 Wed 11:15 MOL 213

Coherent Harmonic Generation at DELTA — •Arne Meyer auf der Heide, Svenja Hilbrich, Markus Höner, Holger Huck, Maryam Huck, Shaukat Khan, Carsten Mai, Robert Molo, Helge Rast, Andreas Schick, and Peter Ungelenk — Center for Synchrotron Radiation (DELTA), TU Dortmund, 44227 Dortmund, Germany

At DELTA, a 1.5-GeV synchrotron light source at the TU Dortmund University, Coherent Harmonic Generation (CHG) is under commissioning and shall soon be used for pump-probe experiments. CHG is based on the interaction of ultrashort laser pulses from state-of-the-art laser systems with electron bunches in an undulator to generate short and coherent pulses at harmonics of the laser wavelength. The CHG pulses are characterized by different methods, e.g. studying the transverse and longitudinal coherence with a classical double-slit experiment and a Michelson interferometer, respectively. The first pump-probe applications will be devoted to the study of ultrafast magnetic phenomena with sub-picosecond time resolution.

BE 7.7 Wed 11:45 MOL 213

Ultrashort THz Pulses at DELTA* — •Carsten Mai[1], Lukas-Georg Böttger[1], Svenja Hilbrich[1], Markus Höner[1], Holger Huck[1], Maryam Huck[1], Shaukat Khan[1], Arne Meyer auf der Heide[1], Robert Molo[1], Helge Rast[1], Andreas Schick[1], Peter Ungelenk[1], Nicole Hiller[2], Vitali Judin[2], Juliane Raasch[2], and Petra Thoma[2] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany — [2]Karlsruhe Institute of Technology (KIT), 76021 Karlsruhe, Germany

DELTA is a 1.5-GeV electron storage ring operated by the Center for Synchrotron Radiation at TU Dortmund University. Following a laser-electron interaction in an electromagnetic undulator, a sub-picosecond modulation of the electron density leads to coherent ultrashort THz pulses, which are extracted by a dedicated THz beamline. Studies of the turn-by-turn evolution of the density modulation and the spectrum of the THz pulses have been continued experimentally and with simulations. For diagnostic purposes a set-up consisting of a spectrometer and different types of ultrafast detectors was used in cooperation with KIT in Karlsruhe.

*Work supported by DFG, BMBF, and by the Federal State NRW.

BE 7.8 Wed 12:00 MOL 213

Fluctuation of Bunch Length in Bursting Regime: Measurement and Simulation — •Patrik Schönfeldt[1], Markus Schwarz[1], Nicole Hiller[2], and Anke-Susanne Müller[1,2,3] — [1]LAS, KIT, Karlsruhe — [2]IPS, KIT, Karlsruhe — [3]ANKA, KIT, Karlsruhe

This talk is based on bunch length measurements taken in low-alpha-operation at the ANKA synchrotron light source (KIT, Germany). Above the bursting threshold not only bursting of coherent synchrotron radiations occurs but also a continuous fluctuation of the bunch's length. In particular, it has been observed that the growth of bunch length with increasing current is not strictly monotonic. The measurements were carried out using concurrent multi turn (using a streak camera) as well as single shot (using electro-optical spectral decoding) methods. Furthermore, we compare information obtained on the fluctuation to simulations.

This work is funded by the BMBF contract numbers: 05K10VKC, 05K13VKA

BE 7.9 Wed 12:15 MOL 213

Application of High-Temperature Superconducting Tapes to Insertion Devices — •Christina Meuter[1], Sara Casalbuoni[1], Stefan Gerstl[1], Andreas Grau[1], David Saez de Jauregui[1], Tomas Holubek[1], Wilfried Goldacker[2], and Rainer Nast[2] — [1]ANKA, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]ITeP, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

A promising alternative to the conventional NbTi wires that are currently used for the construction of SCUs, are high temperature superconducting (HTS) tapes. The engineering current density of commertial HTS tapes is rapidly increasing in performance. HTS tapes can be operated at higher temperatures than NbTi allowing to sustain higher beam heat loads. Here we present examples of the application of HTS technology to planar or stacked superconducting undulators.

BE 8: Diagnostics and Instrumentation III

Time: Wednesday 9:30–12:15 Location: ZEU 255

BE 8.1 Wed 9:30 ZEU 255

Commissioning of the low-energy electron scraper system for the S-DALINAC injector* — •Lars Jürgensen, Christoph Burandt, Florian Hug, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The S-DALINAC is the superconducting linear accelerator of the Institut für Kernphysik at Technische Universität Darmstadt. It delivers an electron beam with energies up to 130 MeV. In order to improve the energy spread and the energy stability of the beam for further acceleration a new scrapersystem has been developed and installed between the 10 MeV injector and the main linac. The system was designed to ensure an energy spread of $\Delta E/\mathrm{E} \leq 10^{-3}$. After installation several tests have taken place, the results will be presented in this talk.

*Work supported by DFG through SFB 634

BE 8.2 Wed 9:45 ZEU 255

Installation and test of a beam monitor for non-destructive phase and amplitude measurements at the S-DALINAC* — •Maximilian Herbert, Thore Bahlo, Christoph Burandt, Patrick Nonn, Florian Hug, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The S-DALINAC is a superconducting linear electron accelerator providing electron beams with kinetic energies of up to 130 MeV. For nondestructive measurements of phase and amplitude of the beam, a beam monitor has been developed. The underlying model for the design of the monitor is a pillbox cavity. Its geometric dimensions have been configured to match the accelerator frequency of 3 GHz using CST Particle Studio and additional mechanical adjustments after construction. In the course of developing the beam monitor, a testing setup has been designed and constructed in order to simulate an electron beam with a desired frequency and beam current. This makes it possible to perform tests of a beam monitor before its installation. We will present the parameters of the monitor, the results of the test setup and first measurements with beam.

*Work supported by DFG through SFB 634

BE 8.3 Wed 10:00 ZEU 255

Set up of a beam diagnostic system for the S-DALINAC based on rf monitors* — •Jan Hauke Hanten, Thore Bahlo, Christoph Burandt, Maximilian Herbert, Florian Hug, Patrick Nonn, Norbert Pietralla, and Thomas Schösser — Institut für Kernphysik, TU-Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt

At the superconducting electron accelerator S-DALINAC a system of rf monitors is used for beam current, phase and longitudinal dispersion measurements as well as for stabilization of the beam through feedback to the rf control system. In this work we will present the setup of a newly developed electronic read out system based on FPGA boards, which allows to perform measurements on all monitors simultanously. In addition we will present the integration in the EPICS based control system of the S-DALINAC and first results from measurements on electron beam.

*funded by the DFG through SFB 634

BE 8.4 Wed 10:15 ZEU 255

In-situ quality factor measurement of the S-DALINAC* superconducting cavities — •Ruben Grewe, Christoph Burandt, Florian Hug, Thorsten Kürzeder, Patrick Nonn, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The S-DALINAC is a recirculating superconducting linear electron accelerator designed for beam energies of up to 130 MeV. For the main acceleration it uses ten 20-cell niobium cavities which are cooled in a liquid helium bath at 2 K. While operational experience showed that the design electric field gradient of 5 MV/m can be reached and exceeded, it was found that the quality factor is three or more times worse than the design value of $3 \cdot 10^9$. This results in more power being dissipated into the liquid helium bath which limits the electric field gradient for CW operation.

For a better analysis it is necessary to observe the long term change of the quality factor of the cavities in the accelerator cryostats. The system presented is going to use the rf control system developed at the S-DALINAC to obtain the quality factors with decay time measurements.

*Work supported by DFG through SFB 634

BE 8.5 Wed 10:30 ZEU 255

Development of a 130 MeV Møller-Polarimeter at the S-DALINAC* — •Thore Bahlo[1], Christian Eckardt[1], Joachim Enders[1], Florian Hug[1], Norbert Pietralla[1], and Oliver Haas[2] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The Superconducting Darmstadt Linear Accelerator (S-DALINAC) can be used to accelerate polarized electron beams which are produced by the S-DALINAC Polarized injector (SPIN). In order to measure the polarisation of the electrons several devices along the beamline, like a low-energy Mott polarimeter and a Compton transmission polarimeter have already been installed and successfully tested.

For kinetic energies of more than 50 MeV these types of polarimeters are not applicable. Therefore a new high energy Møller-Polarimeter has been developed. In this talk we will present the design of the used dipole magnet and the layout of the polarimeter with respect to the strongly limited available space.

*Work supported by DFG through SFB 634 and by the state of Hesse through the LOEWE center HIC for FAIR.

BE 8.6 Wed 10:45 ZEU 255

Non-Invasive Beam Diagnostics for High-Intensity Electron Beams — •Timo Stengler — Helmholtz-Institut Mainz

For high intensity electron machines e.g. magnetized electron cooling devices or energy recovering linacs non-invasive beam diagnostic devices are needed. Therefore a system based on beam induced ?uorescence (BIF) and a system on Thomson scattering was installed at the 100keV electron source test setup at the Mainzer Mikrotron (MAMI). A major concern in these devices is the signal to noise ratio. To improve this ratio dedicated studies on the background are in progress.

15 min. break

BE 8.7 Wed 11:15 ZEU 255

A highly sensitive cavity-based Schottky sensor for the Collector Ring at FAIR — •Matthias Hansli[1], Andreas Penirschke[1], Rolf Jakoby[1], Peter Hülsmann[2], and Wolfgang Kaufmann[2] — [1]IMP, TU Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

A Schottky Cavity Sensor is poposed for the Collector Ring at FAIR, a dedicated storage ring for secondary particles, rare isotopes, and antiprotons. The Sensor consists of a pillbox cavity with attached waveguide filters utilizing the TM_{010}-mode at 200 MHz for longitudinal and the TM_{110}-mode at 330 MHz for transversal Schottky measurements. Separated coupling structures are used for mode-selective coupling to measure longitudinal and transversal Schottky spectra independently. To allow for non-hermetic adjustable coupling and tuning devices as well as waveguide structures, a ceramic vacuum shielding inside the pillbox is introduced. Simulation investigating the influence of the ceramic and the coupling are shown. Measurements of a scaled demonstrator are compared to the simulations.

BE 8.8 Wed 11:30 ZEU 255

Digitizing video signals for the EPICS-based accelerator control system of the S-DALINAC* — •Thomas Schösser, Jonny Birkhahn, Christoph Burandt, Florian Hug, Patrick Nonn, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The Superconducting Darmstadt Linear electron Accelerator S-DALINAC provides electron beams for experiments in the field of nuclear structure physics.

Beam diagnostics is mainly based on beryllium oxide targets which are observed by analog CCD cameras. A video multiplexer allows to send up to eight video signals to the control room. To gain further flexibility, digitizing of the video signals and integration into the EPICS based accelerator control system is being worked on. This will also allow for automatic image processing which is crucial for future plans for computer supported beam commissioning procedures.

*Work supported by DFG through SFB 634

BE 8.9 Wed 11:45 ZEU 255

The Accelerator Control System of the S-DALINAC* — Michaela Arnold, Thore Bahlo, •Jonny Birkhan, Uwe Bonnes, Christoph Burandt, Florian Hug, Thorsten Kuerzeder, Patrick Nonn, Thomas Schoesser und Norbert Pietralla — Institut fuer Kernphysik, TU Darmstadt

The Superconducting Darmstadt Linear electron Accelerator (S-DALINAC) provides beam energies between 2 MeV and 130 MeV and beam currents up to 20 μA. About 5 years ago the low-level radio frequency control system was replaced by a new digital one, which could be supported best by an EPICS-based control system [1]. This has been the origin for a complete migration to EPICS, which is still in progress. A custom Controller Area Network (CAN) bus device support has been developed for in-house made hardware, which is compatible with EPICS. Also the EPICS stream device support is used for commercial serial communication interfaces. Graphical User Interfaces (GUI) are created with CSS [2], which allows to develop a S-DALINAC specific GUI. Current projects are focused on rotary knob boards for controlling magnet power supplies, digitalization of analog video signals for beam monitoring, alarm handling, and optimization of the data archiver. These projects will be introduced in this talk.

[1] Experimental Physics and Industrial Control System, http://www.aps.anl.gov/epcis/
[2] Control System Studio, http://controlsystemstudio.github.io/
*Work supported by DFG through SFB 634

BE 8.10 Wed 12:00 ZEU 255

Experimental results from the characterization of diamond particle detectors with a high intensity electron beam. — •Oliver Stein[1], Florian Burkart[1], Daniel Wollmann[1], and Erich Griesmayer[2] — [1]CERN, Geneva, Switzerland — [2]CIVIDEC Instrumentation, Wien, Austria

The detection of ultra-fast beam losses and the understanding of the underlying loss mechanisms is essential for improving the protection routines of the LHC and its pre-accelerator complex for future running periods.

With the diamond particle detectors, which are already installed in the LHC tunnel, it has been shown that these detectors can resolve beam losses bunch-by-bunch with a wide dynamic range. The recorded data lead to a better understanding of different fast particle loss mechanisms.

To fully exploit the potential of the diamond detectors, they were characterized with electron beams of different particle multiplicities with intensities up to 10^{10} electrons per shot. The goal of these measurements was to determine the efficiency and the detectors response function.

In this talk the actual status of the measurements and the results of the detector characterization will be presented.

BE 9: Synchrotron Radiation II (Focus Session with MI)

Time: Wednesday 15:00–17:15 Location: MOL 213

Invited Talk BE 9.1 Wed 15:00 MOL 213

Short-Pulse Operation of Synchrotron Radiation Sources — •Anke-Susanne Müller — Karlsruhe Institute of Technology

Short-pulse operation of synchrotron light source storage rings can be useful for both the production of IR and (coherent) THz-band radiation and high repetition rate pump-probe science in the X-ray regime. Amongst the different approaches to short-pulse generation, in particular the use of dedicated magnet optics for short (ps) electron bunches and the technique of Coherent Harmonic Generation for the production of coherent THz and UV radiation, respectively, will be discussed in this talk.

Invited Talk BE 9.2 Wed 15:30 MOL 213

Progress in White Beam Diffraction Imaging — •Andreas Danilewsky — Kristallographie, Universität Freiburg, Freiburg

Monochromatic X-ray diffraction imaging (topography) has been used for over half a century for the characterization of extended defects such as dislocations, slip bands, stacking faults, etc. in single crystals and devices fabricated thereupon. The advantage of using the synchrotron white beam is a Laue pattern of reflections on X-ray sensitive film, each containing a topograph from the same sample volume. It allows a fast Burgers vector analysis, even in case of high dislocation densities and in high absorbing crystals. The actual development of fast and high resolving indirect digital detector systems supports a tremendous reduction of the exposure time for a single diffraction image. Integration times of less than 0.2 s allow e.g. the real-time metrology of 450 mm Si wafers in less than 4 hours or the in-situ topography at high temperatures to analyse dislocation dynamics in Si or GaAs. A very promising new development is the 3-dimensional diffraction imaging. It results from the 3-dimensional rendering of a high number of section transmission topographs across the sample with the beam collimated to 15 μm and a step size of 15 μm. This new approach allows the measurement of the absolute strain value around defects.

Invited Talk BE 9.3 Wed 16:00 MOL 213

Short pulses @ SOLEIL: Femto-Slicing and Low-Alpha — •Marie Labat — SYnchrotron SOLEIL - Saint-Aubin - FRANCE

In order to produce shorter pulses of synchrotron radiation, two setups have been studied at SOLEIL. Operation in low-alpha mode now enables to deliver few ps pulses to users on several beamlines. And a femto-slicing experiment is presently under commissioning. In the magnetic field of a wiggler, the electron bunch interacts with a Ti:Sa laser of 50 fs-fwhm pulse duration. The energy modulation over this short slice is used to separate it spatially from the core beam in different undulators downstream, allowing the delivery of about 100 fs-fwhm pulses to at least two beamlines. We will report on the commissioning of this femto-slicing experiment and on the operation in low-alpha mode.

Invited Talk BE 9.4 Wed 16:30 MOL 213

Nanomagnets and artificial multiferroics studied with X-ray photoemission electron microscopy — •Frithjof Nolting — Paul Scherrer Institut, Switzerland

Bringing different materials in contact at the nanoscale opens the door to improving or creating new functionalities by tuning the properties of the resulting interfaces. Employing photoemission electron microscopy (PEEM) and X-ray magnetic circular dichroism (XMCD) their magnetic properties can be studied. Using recent results I will explain the technique and its possibilities. One example is the study of the magnetic properties and scaling laws of nanoparticles, were we discovered a size-dependent transition from a single domain state to a non-collinear spin structure in isotropic nanoparticles with sizes ranging from 25 down to 5 nm [1]. A second example will be the demonstration of in situ 90 degree electric field-induced uniform magnetization rotation in single domain submicron ferromagnetic islands grown on a ferroelectric single crystal [2]. Further examples will be about patterned magnetic nanostructures and how the magnetization of ferromagnetic systems can be manipulated by ultrashort laser pulses studied with time resolved measurements [3].

[1]A. Fraile-Rodríguez et al. Phys. Rev. Lett. 104, 127201 (2010).
[2]M. Buzzi et al. Phys Rev. Lett. 111, 027204 (2013).
[3]L. Le Guyader et al. App Phys. Lett. 101, 022410 (2012).

BE 9.5 Wed 17:00 MOL 213

Plans for EEHG and Femtoslicing at DELTA — •Robert Molo, Svenja Hilbrich, Markus Höner, Holger Huck, Maryam Huck, Shaukat Khan, Arne Meyer auf der Heide, Carsten Mai, Helge Rast, Andreas Schick, and Peter Ungelenk — Center for Synchrotron Radiation (DELTA), TU Dortmund University, D-44221 Dortmund, Germany

In order to reach shorter wavelengths, the short-pulse facility based on the Coherent Harmonic Generation (CHG) technique at DELTA, a 1.5-GeV synchrotron light source operated by the TU Dortmund University, will be upgraded using Echo-Enabled Harmonic Generation (EEHG). Both the CHG and the EEHG scheme employ a laser-induced energy modulation, which additionally can be used to generate ultrashort pulses of incoherent radiation at arbitrary wavelengths by transversely displacing the off-energy electrons (femtoslicing). A new storage ring lattice will be presented that not only offers enough space

for an EEHG and femtoslicing setup, but also allows to operate both radiation sources simultaneously.

BE 10: Beam Dynamics and Fields I

Time: Wednesday 15:00–17:15 Location: ZEU 255

BE 10.1 Wed 15:00 ZEU 255

Ein neues LLRF-System für ELSA — •Manuel Schedler, Dennis Sauerland, Wolfgang Hillert und Frank Frommberger — ELSA, Bonn, Germany

Im Zuge der Erhöhung des extrahierten Strahlstromes an den Experimentierplätzen der Elektronen-Stretcher-Anlage ELSA muss auch der interne Strom des ELSA-Rings auf bis zu 200 mA erhöht werden. Der interne Strahlstrom wird nach einer schnellen Energierampe über mehrere Sekunden zu den Hadronenphysikexperimenten extrahiert.

Die strahlstromlimitierenden Effekte sind Multibunchinstabilitäten, die durch ein aktives Bunch-by-Bunch Feedback-System gedämpft werden. Um eine optimale Dämpfung zu erzielen, muss die Phase der Elektronenbunche relativ zum Referenzsignal sowie die Synchrotronfrequenz über den gesamten Beschleunigungszyklus, insbesondere auf der schnellen Energierampe von 6 GeV/s, konstant bleiben. Hierfür wurde eine neue digitale Low-Level-RF-Steuerung in Betrieb genommen, die eine umfassende Kontrolle und Stabilisierung der Amplitude und Phase der beschleunigenden Hochfrequenzfelder ermöglicht. Das FPGA-basierte System der Firma Dimtel überimmt hierbei auch die Steuerung der Abstimmstempel der Beschleunigungsresonatoren, die zur Regelung der Resonanzfrequenz eingesetzt werden.

BE 10.2 Wed 15:15 ZEU 255

Synchrotron radiation models for spin tracking in circular accelerators — •Jan Schmidt, Oliver Boldt, and Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Polarized beams are useful for high-energy physics and hadron physics experiments. The polarization of leptons in circular accelerators is affected significantly by synchrotron radiation. The implementation of these radiation effects in a spin tracking algorithm considerably increases computing times. This is due to the statistical nature of synchrotron radiation and the need to track many particles to compute beam polarization.

Thus, simplified models of the influence of radiation on the particle motion in longitudinal phase space are crucial for efficient spin dynamics studies. In this talk different models are discussed concerning their effect on spin dynamics. These investigations have been made possible by the new spin dynamics simulation suite POLE - and elegant, a 6D accelerator simulation code including synchrotron radiation.

BE 10.3 Wed 15:30 ZEU 255

Erste Untersuchungen der Ioneneffekte am Beschleuniger ELSA* — •Dennis Sauerland und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Im Stretcherring der Beschleunigeranlage ELSA werden Elektronen durch eine schnelle Energierampe mit einer Rampgeschwindigkeit von bis zu 6 GeV/s auf 3,2 GeV beschleunigt. Hierbei ionisieren Elektronen die vorhandenen Restgasmoleküle. Die so produzierten Ionen akkumulieren im Strahlpotential und sind unter anderem Ursache für Arbeitspunktverschiebungen, Emittanzvergrößerungen sowie Strahlinstabilitäten.
Im Rahmen einer Kollaboration, bei der unter anderem auch numerische Simulationen dieser Problemstellung durchführt werden, sollen an ELSA Untersuchungen vorgenommen werden, mit dem Ziel den Einfluss von Ionen in Elektronenbeschleunigern systematisch zu analysieren und diesen quantisieren zu können.
In diesem Vortrag werden erste Untersuchungen der auftretenden Ioneneffekte an ELSA vorgestellt.

*Gefördert vom Bundesministerium für Bildung und Forschung unter Fördernummer 05K13PDA

BE 10.4 Wed 15:45 ZEU 255

Erweiterung des ELSA Hochfrequenz-Systems — •Moritz Wiesner, Andreas Dieckmann, Wolfgang Hillert, Dennis Sauerland und Manuel Schedler — ELSA, Bonn, Germany

Für die Experimente an der Elektronen-Stretcher-Anlage (ELSA) wird zur Zeit ein interner Strahlstrom von 20 mA benötigt. In Zukunft soll der Strahlstrom auf bis zu 200 mA erhöht werden. Die hierfür erforderliche HF-Leistung soll durch ein zusätzliches HF-System bereitgestellt werden. Dieses besteht aus einem siebenzelligen PETRA-Resonator, einem HF-Sender und entsprechender Infrastruktur. Für den späteren Strahlbetrieb muss das neue System mit dem bestehenden phasenstarr gekoppelt werden. Die vom Strahlstrom abhängigen Beamloading-Effekte können über eine Anpassung der Koppelschleifen in den einzelnen Resonatoren kompensiert werden. Im Vortrag wird über den aktuellen Stand der HF-Aufrüstung berichtet.

BE 10.5 Wed 16:00 ZEU 255

Pulsed rf control of CH-Cavities at p-Linac test stand of FAIR* — •Patrick Nonn[1], Uwe Bonnes[1], Christoph Burandt[1], Harald Klingbeil[2,3], Norbert Pietralla[1], Gerald Schreiber[3], and Wolfgang Vinzenz[3] — [1]IKP, Darmstadt — [2]TEMF, Darmstadt — [3]GSI, Darmstadt

The p-Linac is a crucial part of FAIR. It will use normal conducting CH-cavities to accelerate pulsed proton beams with high intensities, as needed for the production of antiprotons. These cavities need to be tested. To do so, a test stand is under construction at GSI.

The 3 GHz, cw rf control of the S-DALINAC has been adapted at the needs of the p-Linac's pulsed 325 MHz rf. Final measurements and results will be presented in this talk.

*This project was supported by the BMBF under grant No. 05P09RDRB5 and by the Helmholtz International Center for FAIR (HIC for FAIR) funded by the State of Hesse within its initiative LOEWE.

BE 10.6 Wed 16:15 ZEU 255

Collector efficiency measurement at a linear electron beam guiding system using a wien-filter — •Simon Friederich — Institut für Kernphysik, Johannes-Gutenberg Universität Mainz, Deutschland

A testbench for the electron cooler which is planned for the facility for antiproton and ion reasearch (FAIR) has been set up at Helmholtzinstitut Mainz (HIM). It consists of a thermionic electron gun, an energy recuperating collector and a longitudinal magnetic guiding system. Electrons hitting the collector surface may be scattered (in-)elastically or may liberate secondary electrons from the collector wall. A safe running of the electron cooler is only ensured if less than one out of one hundred thousand incoming electrons may leave the collector again. This is equivalent to a collector efficiency of >99.999%. In order to measure this quantity one has to break the symmetry between the incoming primary electron beam and the secondary beam leaving the collector. A Wien-filter is used for this purpose and further simulations were used to estimate the efficiency.

BE 10.7 Wed 16:30 ZEU 255

Strahldynamikrechnungen für den MESA Rezirkulator — •Daniel Simon — Institut für Kernphysik Johannes Gutenberg-Universität Mainz

Gegenstand der Präsentation ist der aktuelle Stand des Strahlführungsdesigns für den multiturn-energierückgewinnenden supraleitenden Dauerstrich-Beschleuniger MESA (Mainz Energy-Recovering Superconducting Accelerator). Dieser soll primär zur genaueren Vermessung des Weinbergwinkels und zusätzlich zur Suche nach dem dunklen Photon dienen.

BE 10.8 Wed 16:45 ZEU 255

A Deflecting Cavity for MESA — •Victor Bechthold — Inst. f. Kernphysik, JGU Mainz, 55128 Mainz, D

Within the framework of the Cluster of Excellence "Precision Physics, Fundamental Interactions and Structure of Matter"(PRISMA) a superconducting energy-recovering accelerator (MESA) will be built at the Institute for Nuclear Physics at the Johannes Gutenberg-University Mainz. The Energy-Recovery-Linac (ERL) accelerator technology allows very high electron-beam luminosities on internal targets at low

energies (150 MeV) and provides experiments in particle physics, e.g. the search of the dark photon.

To produce electron bunches that are short enough for further acceleration, electrons emitted by a photocathode have to be cut to a small bunch length. A chopper system likewise the one of the Mainz Microton (MAMI), consisting of two circular deflecting rf-cavities, a slit-collimator with adjustable slith-widh and a solenoid-pair, yields a bunch length of $\pm 20°$ or less. Further reduces are provided by a following buncher-system.

The circular deflection is realized by a TM_{110}-Cavity operating at MESA frequency 1.3 GHz. In this talk the simulation and optimization of the scaled MAMI chopper-cavity design, calculated with CST Microwave Studio, will be presented, as well as two prototypes build on the improved simulated design. To verify the circular deflection a beam test with the deflector cavity was done.

BE 10.9 Wed 17:00 ZEU 255

Quick reversal of helicity for the P2 experiment at MESA — •Christoph Matejcek — Institut für Kernphysik, Mainz, Deutschland

The P2 Collaboration is proposing a precise measurement of the electroweak mixing angle (θ_w). Therefore the parity violating scattering asymmetrie A_{PV} should be determined with an accuracy of $\frac{\Delta A_{PV}}{A_{PV}} = 1.6\,\%$. It is reasonable to use high frequency to switch between the helicity states. In this case the frequency should be increased from 50 Hz at MAMI to 1000 Hz at MESA, the planned accelerator. Compared to KD*P used so far RTP offers higher switching frequency and also a higher degree of circular polarisation. Slow drift of the circular polarisation which appears with KD*P has not been observed. As a disadvantage, a drift of the optical phase shift due to d.c. electric fields has been observed.

BE 11: Accelerator Physics Poster Session

Time: Wednesday 17:00–19:30 Location: P4

BE 11.1 Wed 17:00 P4

Corrugated and Dielectrically Lined Tubes as Dechirpers for ELBE — •Franziska Reimann[1], Ursula van Rienen[1], Peter Michel[2], and Ulf Lehnert[2] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik — [2]Helmholtz-Zentrum Dresden-Rossendorf

The generation of pulses in the range of sub-picoseconds at radiation sources, like the ELBE free electron laser in Dresden-Rossendorf, requires an efficient reduction of the electron beam's pulse length and energy width.

We show that both corrugated and dielectrically lined cylindrical tubes are suited to serve a passive beam dechirper, using the wakefields generated in these structures when they are passed by an electron beam ([1],[2]). The generated wakefields are dependent on the structural parameters of the dechirper, and we provide optimisations of these parameters for the dechirping requirements of the ELBE beam and demonstrate their dechirping effects on the beam using numerical simulations.

[1] Bane, Stupakov, SLAC-PUB-14925 (2012)

[2] Mosnier, Novokhatski, in: Proceedings of PAC97, Vancouver, Canada, 1997

BE 11.2 Wed 17:00 P4

Towards a high-field THz source operating at few 100 kHz repetition rates — •Michael Gensch[1], Sergey Kovalev[1], Bert Green[1], Christian Bauer[2], Michael Kuntzsch[1], Torsten Golz[3], Ala Al-Shemmary[3], Jens Hauser[1], Joerg Voigtlaender[1], Bernd Wustmann[1], Isabel Koesterke[1], Vivek Asgekar[1,3], Michael Freitag[1], Ulf Lehnert[1], Jochen Teichert[1], Matthias Justus[1], Wolfgang Seidel[1], Christoph Ilgner[1], Stephan Winnerl[1], Harald Schneider[1], Gianluca Geloni[4], Ilie Radu[5], Tobias Kampfrath[6], Simon Wall[7], Andrea Cavalleri[8], Joachim Heberle[2], Peter Michel[1], Alan Fisher[9], Anke-Susanne Mueller[10], Nikola Stojanovic[3], Manfred Helm[1], Ulrich Schramm[1], and Tom Cowan[1] — [1]HZDR, Bautzner Landstr. 400, 01328 Dresden — [2]FUB, Arnimallee 14, 14195, Berlin — [3]DESY, Notkestr. 85, 22607 Hamburg — [4]XFEL GmbH, Albert-Einstein Ring 19, ,22761 Hamburg — [5]HZB, Albert Einstein Str.15, 12489 Berlin — [6]FHI, Faradayweg 4-6, 14195 Berlin — [7]ICFO, Av. Carl Friedrich Gauss 3, 08860 Castelldefels (Barcelona), Spain — [8]MPSD-CFEL, Notkestr. 85, 22607 Hamburg — [9]SLAC, 2575 Sand Hill Rd, Menlo Park, CA 94025, USA — [10]KIT, Kaiserstr. 12, 76131 Karlsruhe

At the ELBE accelerator a unique super-radiant THz source is currently under developement. It aims at delivering fourier-limited THz pulses with pulse energies of up to 100 microJ at reprates of up to 500 kHz (cw). This corresponds to transient electric fields in the GV/m regime or transient magnetic fields in the few T regime. First results from the commissioning are discussed.

BE 11.3 Wed 17:00 P4

THz-based femtosecond-level arrival time monitor for quasi-cw electron accelerators — •Sergey Kovalev, Bert Green, and Michael Gensch — HZDR, Bautzner Landstr. 400, 01328 Dresden

In this contribution we present an electro-optic arrival time monitor for coherent THz pulses. The monitor operates robustly at high repetitionrates and extremely low THz pulse energies. It thereby has the potential to provide few femtosecond-level synchronization on next generation large scale X-ray photon sources based on high repetition rate electron accelerators such as X-ray FELs or energy recovery linacs.

BE 11.4 Wed 17:00 P4

THz-based electron bunch length monitoring at the quasi-cw SRF accelerator ELBE — •Bertram Green[1], Sergey Kovalev[1], Alan Fisher[2], Christian Bauer[1], Michael Kuntzsch[1], Ulf Lehnert[1], Rico Schurig[1], Torsten Golz[3], Peter Michel[1], Nikola Stojanovic[3], and Michael Gensch[1] — [1]HZDR, Bautzener Landstrasse 400, 01328 Dresden — [2]SLAC, 2575 Sand Hill Rd, Menlo Park, CA 94025, USA — [3]DESY, Notkestrasse 85, 22607 Hamburg

In the past few years the quasi-cw SRF electron accelerator ELBE has been upgraded so that it now allows compression of electron bunches to the sub-picosecond regime. The actual optimization and control of the electron bunch form represents one of the largest challenges of the coming years, in particular with respect to the midterm goal to utilize the ultra-short electron bunches for Laser-Thomson scattering experiments or high field THz experiments. Current developments of THz based longitudinal electron bunch diagnostic are discussed and an outlook into future developments is given.

BE 11.5 Wed 17:00 P4

Development of a compact, integrated on-chip THz spectrometer for the use in electron bunch compression monitors at SRF accelerators — Bert Green[1], Niels Neumann[2], Martin Laabs[2], Michael Schiselski[2], Sergey Kovalev[1], Dirk Plettemeier[2], and •Michael Gensch[1] — [1]HZDR, Bautzner Landstr. 400, 01328 Dresden — [2]Chair for RF engineering, TU Dresden, Georg-Schumann Str.9, 01062 Dresden

In a collaborative effort between the TU Dresden and the HZDR within the frame of the BMBF Project InSEl, a compact on-chip THz spectrometer shall be developed which allows detecting the intensity distribution at up to 20 different THz frequencies between 0.1 and 1.5 THz simultaneously. The intended use of the spectrometer which shall not exceed 5 mm diameter in size is to replace current single element THz detectors in the bunch compression monitors in the ELBE accelerator at the HZDR. If successful the device could also be of interest for the longitudinal electron bunch diagnostic at other electron linacs such as FLUTE, BERlinPro, FLASH or the European X-FEL.

BE 11.6 Wed 17:00 P4

Transverse Emittance Compensation for a Superconducting Photo Injector – One Year later — •H. Vennekate[1,3], A. Arnold[1], T. Kamps[2], P. Kneisel[4], P. Lu[1,3], P. Mucek[1], J. Teichert[1], and R. Xiang[1] — [1]HZDR — [2]HZB — [3]TU Dresden — [4]JLab

The Helmholtz-Zentrum Dresden Rossendorf is one of the leading institutes in the development of superconducting electron photo injectors for particle accelerators of all kind. The local facility provides its own 40 MeV linear accelerator which can operate various beamlines such as a free electron laser. Recently, a new gun cavity has been prepared at JLab and transferred to Dresden to be put in use in the coming sum-

mer. This project includes an updated cryostat design, introducing a superconducting solenoid to enhance the emittance compensation of the final injector. The poster is going to present the commissioning of these systems, the results of several tests of subsystems, and the current status of the new injector.

BE 11.7 Wed 17:00 P4

Simulation of the Rossendorf SRF photo injector with a new cavity — •Pengnan Lu[1,2], Andre Arnold[1], Ulf Lehnert[1], Petr Murcek[1], Jochen Teichert[1], Hannes Vennekate[1,2], and Rong Xiang[1] — [1]HZDR, Dresden, Germany — [2]TUD, Dresden, Germany

In Rossendorf, a new 3*-cell cavity is under preparation and will be installed to the SRF photo injector in April 2014. This cavity is constructed and tested in Jefferson Lab, with the designed final energy up to 7.5 MeV.

The simulation presented in this contribution includes the particle tracking in the new cavity itself with ASTRA, and also the bunch transport in ELBE with elegant. On the cathode, the profile and time structure of the UV laser are utilized to specify the electron bunch parameters. Then a single bunch of electrons are tracked in the cavity field that calculated by Superfish. From the exit of the cavity, we apply the elegant matrix calculations for magnet elements and accelerator modules.

The main purpose of this simulation is to find the optimized parameters of different beam transport tasks. For a more convenient operation among different codes, a Labview program is introduced which executives all codes automatically from settings of parameters to the final results.

BE 11.8 Wed 17:00 P4

Development status of Photo-CATCH facility at the S-DALINAC — •Neeraj Kurichiyanil, Christian Eckardt, Joachim Enders, Markus Wagner, Martin Espig, and Yuliya Fritzsche — Institut für Kernphysik, TU Darmstadt

We report on the development status of a photocathode activation, test and cleaning using atomic hydrogen (Photo-CATCH) facility for semiconductor photocathodes used at the polarized electron source at the Darmstadt superconducting accelerator S-DALINAC. Three ultra-high vacuum (UHV) chamber design has dedicated chambers for 1) atomic hydrogen cleaning 2) single- or multi-alkali negative electron affinity (NEA) activation and quantum efficiency (QE) as well as lifetime studies and 3) test of the activated cathodes at high-voltage. A polarized electron beam of up to 60 keV will be available for operational QE and charge lifetime measurements and other experiments. The research is aimed at improving vacuum conditions, cathode dark and charge lifetimes, and exploring superior activation procedures. Supported by DFG through SFB 634 and by the state of Hesse within the LOEWE centre HIC for FAIR.

BE 11.9 Wed 17:00 P4

A Method for Measuring the r.m.s Beam Dimension $\sigma_x^2 - \sigma_y^2$ — •Joel Alain Tsemo Kamga, Wolfgang F. O. Müller, and Thomas Weiland — Institut für Theorie Elektromagnetischer Felder, 64289 Darmstadt, Germany

Quadrupole pickups are of particular importance in the accelerator physics because they allow the measurement of some parameters like the beam emittance. However, the emittance can be obtained by measuring the quadrupole moment of the beam by means of a quadrupole pickup consisting of four electrodes placed at 0° (Right), 90° (Top), 180° (Left) and 270° (Bottom). Usually, the difference over sum method is used to pick up the quadrupole moment. However, we use another method starting from the log-ratio method. The analysis and comparing of all these methods will be presented in this work.

BE 11.10 Wed 17:00 P4

Numerical Calculation of Electromagnetic Fields in Acceleration Cavities Under Precise Consideration of Coupler Structures — •Cong Liu, Wolfgang Ackermann, Wolfgang F.O. Müller, and Thomas Weiland — Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt, Germany

During the design phase of superconducting radio frequency (RF) accelerating cavities a challenging and difficult task is to determine the electromagnetic field distribution inside the structure with the help of proper computer simulations. In reality, because energy transfer occurs in the dissipative superconducting cavities, the numerical eigenmode analysis based on real-valued variables is no longer suitable to describe the dissipative acceleration structure. Dissipation can occur with the help of dedicated higher order mode (HOM) couplers, the power coupler as well as the beam tube once the resonance frequency is above the cutoff frequency of the corresponding waveguide. At the Computational Electromagnetics Laboratory (TEMF) a robust parallel eigenmode solver based on complex-valued finite element analysis is available. The eigenmode solver has been applied to the TESLA 1.3 GHz cavity and the third harmonic nine-cell cavity (3.9 GHz) to determine the resonance frequency, the quality factor and the corresponding field distribution of eigenmodes.

BE 11.11 Wed 17:00 P4

Bunch Emission Study of the PITZ Electron Gun by Use of the CST Particle Studio — •Ye Chen, Erion Gjonaj, Wolfgang Müller, and Thomas Weiland — Institut für Theorie Elektromagnetischer Felder,Technische Universität Darmstadt,Schloßgartenstr. 8, 64289 Darmstadt

The Photo Injector Test Facility at DESY Zeuthen (PITZ) is dedicated to test and to optimize sources of high brightness electron beams for future free electron lasers and linear colliders. The main task of PITZ is to produce an intense electron beam with very small transverse emittance. Bunch emission process contributes significantly to the emittance of a charged electron beam. In order to investigate the emittance manipulation, we have the possibility to perform Particle-in-Cell (PIC) simulations by use of the Computer Simulation Technology (CST) [1] code.

Depending on an extremely fine mesh resolution of 10 micrometers, CST simulations have shown convergent results on beam quality parameters for a bunch charge of 1nC. Cross-checking the results with A Space Charge Tracking Algorithm (ASTRA) [2] simulations showed good agreements on convergent trends of the beam parameters, while a discrepancy of 15% on transverse emittance can be found. Due to memory limitations and a long processing timescale, current simulation scheme give its way to further improvements.

[1] CST Computer Simulation Technology AG, CST Particle Studio, http://www.cst.de. [2] K. Flöttmann, ASTRA particle tracking code, http://www.desy.de/~mpyflo/.

BE 11.12 Wed 17:00 P4

A Poisson solver with various boundary conditions for simulation in particle accelerators — •Dawei Zheng, Gisela Pöplau, and Ursula van Rienen — Institut für Allgemeine Elektrotechnik, Fakultät für Informatik und Elektrotechnik, Universität Rostock, Rostock, Germany

Future technologies for particle acceleration need more precise numerical simulation tools to meet the tight requirements for beam quality. Therefore, beam dynamics studies play an important role in all phases of establishing new machines. The investigation of space charge fields of charged particle bunches and their interaction with electron or ions clouds poses an important task within these numerical simulations. Possible approaches to determine space charge fields are the particle-mesh method and the particle-particle method. Our software package MOEVE (MOEVE: Multigrid Poisson Solver for Non-Equidistant Tensor Product Meshes) uses multigrid algorithms for the computation of 3D space charge fields. Now, an additional fast 3D solver based on spectral decomposition of matrix will be integrated into MOEVE in order to meet recent facilities' demands. The solver is designed for various mixed boundary conditions, such as Dirichlet, Neumann, and Periodic. The implementation is based on fast Fourier transform and related fast trigonometric transforms, and it uses the state-of-the-art framework FFTW [*].

[*] M. Frigo and S.G. Johnson, FFTW, C program library, www.fftw.org

BE 11.13 Wed 17:00 P4

Suppression Methods of Multipacting in a Superconducting RF Gun — •Eden Tafa Tulu[1], Tomasz Galek[1], André Arnold[2], and Ursula van Rienen[1] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, 18051 Rostock, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf, Germany

Superconducting radio frequency (SRF) structures may be subjected to electron multipacting (MP). This phenomenon is a problem that limits the accelerating gradient in the cavity. Moreover, it might cause an impair of RF components and distortion of the RF signal. Therefore, there should be an efficient countermeasure to suppress multipacting in order to boost the performance of SRF gun. Three techniques of suppression of the electron cloud from the vicinity of the cathode,

such as DC-bias, simple geometric modification of the cathode and microstructure of the cathode's surface, in the Rossendorf SRF gun are presented in this work.

BE 11.14 Wed 17:00 P4

Quantification of Geometric Uncertainties in Single-Cell Cavities for BESSY VSR using Monte-Carlo Simulation — •Johann Heller, Thomas Flisgen, Christian Schmidt, and Ursula van Rienen — Institute for General Electrical Engineering, University of Rostock, Germany

The electromagnetic properties of SRF cavities are mostly determined by their shape. Due to fabrication tolerances, tuning and limited resolution of measurement systems, the exact shape remains uncertain. In order to make assessments for the real life behaviour it is important to quantify how these geometrical uncertainties propagate through the mathematical system and influence certain electromagnetic properties, like the resonant frequencies of the structure's eigenmodes. Since the deterministic problem is relatively fast to compute, this can be done by using non-intrusive straightforward methods like Monte-Carlo (MC) simulations. Using this technique we investigate the propagation of geometric uncertainties on a single cell cavity from BESSY VSR regarding certain RF properties. In the future we plan on the application of the gained knowledge on a higher order mode beam position monitoring system as well as using different techniques for uncertainty quantification like polynomial chaos expansion in order to reduce the computational time.

BE 11.15 Wed 17:00 P4

HOM Couplers for CERN SPL Cavities — •Kai Papke[1,2], Frank Gerigk[1], and Ursula van Rienen[2] — [1]CERN — [2]University of Rostock

The CERN SPL (Superconducting Proton Linac) is a R&D project with the focus on neutrino or radioactive beam facilities. The linac is composed of two types of cavities operating at 704.4 MHz in pulsed mode and with geometrical beta of 0.65 and 1. In order to limit beam induced Higher-Order-Modes (HOM) effects, CERN considers the use of HOM couplers on the cut-off tubes of the 5-cell superconducting cavities. We present the design process taking into account the RF characteristics, mechanical aspects, heat loss as well as multipacting sensitivity. A comparison is made between various design options for the medium and high-beta SPL cavities. Two options are presented, tested as warm prototypes on 5-cell high-beta copper cavity models.

BE 12: Free-Electron Lasers

Time: Thursday 9:30–12:30 Location: MOL 213

Group Report BE 12.1 Thu 9:30 MOL 213

FLASH1 Seeding Plans — •Christoph Lechner — University of Hamburg, Hamburg, Germany

Many free-electron lasers (FELs) producing light in the UV and extreme ultraviolet (XUV) wavelength ranges start up from noise and operate in the self-amplified spontaneous emission (SASE) mode. Therefore they have typically poor longitudinal coherence. It has recently been demonstrated that when starting with an external laser beam (the so-called 'seed'), it is possible to generate photon pulses with greatly improved longitudinal coherence and higher shot-to-shot stability of the pulse spectra and energy.

For the investigation of FEL seeding, an experiment was built at the FLASH FEL user facility in Hamburg. This beamline can be used with seeds generated by high-harmonic generation (HHG), as originally planned, but also to test more sophisticated concepts. The results from these tests of high-gain harmonic generation (HGHG) and echo-enabled harmonic generation (EEHG) will be considered in the design process of the seeding option at the currently being constructed FEL beamline FLASH2. The baseline design of this upgrade foresees delivery of seeded radiation down to 20nm.

In this contribution, we present the FLASH1 seeding beamline including the diagnostics needed to establish six-dimensional overlap of electron bunches and seed pulses and give an overview of the FLASH1 seeding plans.

BE 12.2 Thu 10:00 MOL 213

Modal Analysis of a Seeded Free-Electron Laser — •Sven Ackermann[1,2], Bart Faatz[1], and Velizar Miltchev[2] — [1]Deutsches Elektronen-Synchrotron (DESY), Hamburg — [2]Universität Hamburg, Hamburg

The free-electron lasers (FEL) are bright photon sources which emit light in a broad wavelength range down to some tenth of an Angstrom. The FELs became an indispensable tool for the scientific research in many fields like physics, biology, chemistry and medicine. Some FELs can amplify the radiation from an external laser field ("seed") which is a promising option to improve the coherence and temporal stability of the FEL radiation. In this contribution, we study the impact of the quality of the seed beam on the power of the output FEL radiation. By the means of numerical simulations the authors investigate the power of the radiation from an FEL seeded using a laser beam of different quality. The obtained results are then compared to experimental results from a directly seeded FEL operated in the XUV range. In addition, a method to measure the beam quality factor from single transverse intensity profiles is discussed and applied.

[1] S. Ackermann, B. Faatz, and V. Miltchev, Phys. Rev. ST Accel. Beams 16, 100702 (2013)

BE 12.3 Thu 10:15 MOL 213

Sub-Femtosecond Single-Spike X-Ray Pulses from Electron Bunches with very low Charge — •Violetta Wacker[1], Juliane Rönsch-Schulenburg[1], Yuantao Ding[2], Zhirong Huang[2], and Alberto Lutman[2] — [1]Universität Hamburg, Edmund-Siemers-Allee 1, 20146 Hamburg — [2]SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, CA 94025

The Linac Coherent Light Source (LCLS) is an x-ray free-electron laser (FEL) at SLAC National Accelerator Laboratory, supporting a wide range of scientific research with an x-ray pulse length varying from a few to several hundred femtoseconds. There is also a large interest in even shorter x-ray pulses consisting of a single spike only, which will allow the investigation of matter at the atomic length (Å) and time scale (fs). Based on start-to-end simulations we investigate the FEL performance of LCLS at 4.3 GeV and 13.6 GeV using 5 pC, 10 pC and 20 pC electron bunches. With an optimization of the machine set up, simulations show that single spike, sub-fs, hard x-ray pulses are achievable at such a low charge.

BE 12.4 Thu 10:30 MOL 213

Commissioning and Characterization of an Optical Compressor for the Ultrashort-Pulse Laser System at FLASH — •Nils Lockmann[1], Tim Plath[1], Juliane Rönsch-Schulenburg[1], Bernd Steffen[2], and Jörg Rossbach[1] — [1]Universität Hamburg — [2]Deutsches Elektronen Synchrotron, Hamburg

It is of high scientific interest to generate stable ultrashort FEL pulses in the few fs range for e.g. a better time-resolved imaging of nanoparticles. In order to extend the parameter range of FLASH towards short pulses, a new photo-injector laser system is introduced to provide a much shorter laser pulse on the photo-cathode than is regularly possible at FLASH. In this way, the longitudinal compression factor needed is reduced way below then the standard operation compression factor which eases beam dynamics issues and relaxes RF stability requirements. The new laser system includes an optical compressor, which in this case is used to stretch the originally very short injector laser pulse to the exactly required value thus providing the optimum length of the electron bunch directly at the injector.

The compressor consists of two diffracting transmission gratings, which introduce dispersion counteracting the chirp of the incoming laser pulse. The strength of the dispersion is controlled by the distance of the gratings, which allows to vary the pulse length from the original length up to a value determined by the beam dynamics requirement.

In this contribution the principle, layout and the characteristics of the optical compressor as well as its influence on the electron bunch will be presented.

BE 12.5 Thu 10:45 MOL 213

Comparison of transverse beam profile measurement techniques — •Jan-Niclas Gruse[1], Sven Ackermann[1,2], Christoph Lechner[1], Jörg Rossbach[1], and Markus Drescher[1] — [1]University

of Hamburg, Hamburg, Germany — [2]Desy, Hamburg, Germany

Free-electron lasers in the UV and extreme ultraviolet are typically operated in self-amplified spontaneous emission (SASE) mode. Starting up from shot-noise, there are typically multiple longitudinal modes present, resulting in poor longitudinal coherence. Using so-called 'seeding' techniques it is possible to produce photon pulses with greatly improved longitudinal coherence. For successful direct FEL-seeding the energy coupling of the electron bunch and the seed pulse inside the undulator is critical. This requires low divergence photon beams which can be characterized by the beam quality factor M^2. One standard technique to determine the M^2 is to measure the photon beam size at different longitudinal positions. Due to space constraints such a measurement would be challenging in the undulator. Therefore the seed beam characterization is performed with a dedicated setup. The drawback of using two separated beamlines is that error sources (i.e. deformed mirrors) in one of those branches will result in unpredictable seeding performance. In a recent publication a different approach using modal decomposition of a single image was proposed, holding the promise of a M^2 estimation in the undulator beamline.

In this contribution we present studies comparing the results obtained with the longitudinal scanning technique and the modal decomposition method.

15 min. break

Group Report BE 12.6 Thu 11:15 MOL 213

Status of FLUTE — •Marcel Schuh[1], Andrii Borysenko[2], Nicole Hiller[2], Erhard Huttel[3], Vitali Judin[3], Sebastian Marsching[1], Anke-Susanne Müller[1,2,3], Somprasong Naknaimueang[3], Michael Johannes Nasse[1], Robert Rossmanith[3], Robert Ruprecht[3], Markus Schwarz[1], Manuel Weber[1], and Pawel Pawel Wesolowski[3] — [1]LAS, KIT, Karlsruhe — [2]IPS, KIT, Karlsruhe — [3]ANKA, KIT, Karlsruhe

FLUTE, a new linac based test facility and THz source is currently being built at the Karlsruhe Institute of Technology (KIT) in collaboration with DESY and PSI. It consist of an RF Photo Gun and a traveling wave linac accelerating electrons in the charge range from pC up to 3nC up to 40-50 MeV. The electron bunch will then be compressed in a magnetic chicane down to 1-300fs depending on the charge in order to produce coherent THz emission. An overview of the hardware and the construction status will be given.

BE 12.7 Thu 11:45 MOL 213

Simulations of Radiation Production in the Undulator for the THz Source Project at PITZ — •Prach Boonpornprasert, Barbara Marchetti, Mikhail Krasilnikov, and Frank Stephan — Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY, Zeuthen site, (PITZ) develops high brightness electron sources for modern linac based Free Electron Lasers (FELs). A normal conducting L-band PITZ linac delivers electron bunches of various bunch charge with low emittance and unique pulse train structure. As one possible application of such beams, this generation of IR/THz radiation is under consideration now. Based on the PITZ linac Terahertz light sources using synchrotron radiation, transition radiation and undulator radiation can provide remarkable properties. Due to its infrastructure PITZ can be considered as a proper site for the development of a THz source prototype that could be placed at the European XFEL site, allowing pump and probe experiments with X-rays and THz radiation with a time structure that is identical to that of the XFEL. On the other hand the THz/IR radiation can be used for the electron beam characterization. This work presents GENESIS1.3 simulations of the radiation produced in the undulator. The simulations were performed by considering the PITZ facility as the accelerator and adding an APPLE-II type undulator as the radiator. In this presentation the simulations setup, procedure and results will be described.

BE 12.8 Thu 12:00 MOL 213

Compact Optical Free Electron Laser with Traveling-Wave Thomson Scattering — •Klaus Steiniger, Michael Bussmann, Alexander Debus, Arie Irman, Axel Jochmann, Richard Pausch, Ulrich Schramm, and René Widera — Helmholtz-Zentrum Dresden-Rossendorf

We present a fully analytical description of the field and the electrons in an optical free electron laser in the Travelling-Wave Thomson Scattering (TWTS) configuration. This scheme allows for long interaction lengths of an ultra-short, high-intensity pulsed laser with an electron bunch. The latter can be either provided by laser-accelerated electrons or by a conventional accelerator. TWTS provides for high peak brightness, high brilliance pulses from the EUV to the gamma spectrum with high flexibility in the wavelength and bandwidth of the emitted radiation.

BE 12.9 Thu 12:15 MOL 213

Resonant coherent X-ray diffractive imaging in ultra intense laser interactin with matter — •Thomas Kluge[1], Christian Gutt[2], Lingen Huang[1], Malte Zachias[1], Thomas Cowan[1,3], Ulrich Schramm[1,3], and Michael Bussmann[1] — [1]Helmholtzzentrum Dresden-Rossendorf — [2]Universität Siegen — [3]Technische Universität Dresden

We describe a novel proposed experimental method for X-ray diagnostics of terawatt class laser - solid interaction. Here resonant bound-bound electron transitions in ions give rise to a diffraction pattern that can be used to derive the distribution of ions. The transition energy of a specific transition (e.g. K alpha) is sensible to the degree of ionization, so that an intense mono energetic X-ray beam (XFEL) can be used to select a given in species. The feasibility is studied using quantitative simulations and the great potentials and unique possibilities of this method are highlighted.

BE 13: Beam Dynamics and Fields II

Time: Thursday 9:30–12:30 Location: ZEU 255

BE 13.1 Thu 9:30 ZEU 255

Progress in Eigenmode Computation Using Perturbative Methods — •Korinna Brackebusch and Ursula van Rienen — Institute of General Electrical Engineering,University of Rostock

Parametric studies of geometric variations are an essential part of the performance optimization and error estimation in the design of accelerator cavities. Using common eigenmode solvers the analysis of intentional and undesired geometric perturbations tend to be very extensive since any geometric variation involves an entire recomputation. Perturbative methods constitute an efficient alternative for the computation of a multitude of moderately varying geometries. Their practicability was proven by means of simple cavity geometries.

We present the progress in eigenmode computation using perturbative methods, showing improvements of the algorithm and latest results for single and multi cell cavities subject to cylindrically symmetric and nonuniform perturbations.

BE 13.2 Thu 9:45 ZEU 255

Numerical Modeling of Superconducting Radio Frequency Cavities — •Tomasz Galek and Ursula van Rienen — Universität Rostock, Institut für Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, 18051 Rostock

Design of modern superconducting radio frequency cavities for acceleration of charged particle bunches require intensive numerical simulations. Wide variety of parameters vital to the proper operation of accelerating cavities must be optimized. The aim of this talk is to present currently existing simulation and modeling methods applied in the field of accelerator physics. General considerations and more specific problems of B*ERL*inPro and BESSY$^{\mathrm{VSR}}$ cavity design and optimization will be discussed.

BE 13.3 Thu 10:00 ZEU 255

Parameter Studies and Geometry Optimization on Superconducting Multicell RF-Cavity-Resonators* — •Benjamin Isbarn, Bernard Riemann, and Thomas Weis — Center for Synchrotron Radiation (DELTA) TU Dortmund University, 44227 Dortmund, Germany

Modern accelerator concepts for high intensity electron beams often re-

quire superconducting multicell RF-cavity-resonators in circular accelerators (e.g. storage rings). Various numerical studies were performed to numerically calculate the dependence of different figures of merit with respect to the geometry parameters of the RF-structure. To ease the numerical effort an optimization routine has been developed which automatically optimizes the geometry based on goal functions. In this context it turned out that cell geometries defined by spline functions have advantages compared to the standard elliptical parametrization regularly used. The number of free parameters is substantially reduced which facilitates the search for optimum solutions.

* Work partly supported by the BMBF under contract No. 05K13PEB.

BE 13.4 Thu 10:15 ZEU 255

Simulation of electron beam - ion interactions — •Aleksandar Markovik and Ursula van Rienen — Universität Rostock, Institut für Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, D-18059 Rostock

Parasitic ions generated by synchrotron radiation and collisions of the electron beam and the rest gas in the vacuum chamber of a particle accelerators could harm the quality of the beam. Therefore numerical simulations of their behavior in the field of the electron beam and/or beam guiding magnets are indispensable to achieve an understanding of the phenomena and to possibly model their influence on the beam. Here we present results of a tracking simulation of the ion distribution over a relatively long period of time. During that time the ions interact up to thousand times with the passing bunches.

BE 13.5 Thu 10:30 ZEU 255

Prediction of severe electron loading of high-gradient accelerating structures based on field emission sample measurements — •Stefan Lagotzky and Günter Müller — University of Wuppertal, D-42097 Wuppertal, Germany

Enhanced field emission (EFE) limits the performance of both superconducting and normal conducting high-gradient accelerating structures. Systematic field emission scanning microscopy and correlated SEM/EDX measurements of relevant Nb and Cu samples have revealed particulates and surface irregularities with field enhancement factors β = 10 - 90 as origin of EFE. Based on sufficient emitter statistics, an exponential increase of the emitter number density N with increasing surface field (E) was found. This allows a prediction of the EFE loading of future ILC and CLIC accelerating structures by scaling of N to relevant E and using a weighted integration over the high-field cavity surface. Accordingly, an electropolished (Ra < 300 nm) and dry-ice cleaned (DIC) TESLA-shape 9-cell 1.3 GHz Nb cavity [1] will still suffer from EFE at E_{acc} = 35 MV/m (N = 0.3 cm^{-2} at E_{peak} = 70 MV/m). Moreover, a diamond-turned, chemically etched and DIC 11.2 GHz Cu structure [2] will breakdown at E_{acc} = 100 MV/m (N = 20 cm^{-2} at E_{peak} = 243 MV/m). Possible improvements, i.e. by emitter processing will be discussed.

The work is funded by BMBF project 05H12PX6.

[1] ILC Technical Design Report (2013)
[2] A. Grudiev and W. Wuensch, LINAC2010, pp. 211 - 213

Gruppenbericht

BE 13.6 Thu 10:45 ZEU 255

Optimierung des Förstersondenprinzips für die Anwendung im SRF-Bereich — •Matthias Wegen — Helmholtz-Zentrum Berlin, Berlin, Deutschland

Die Güte supraleitender Kavitäten ist umgekehrt proportional zum Hochfrequenz-Oberflächenwiderstand des supraleitenden Materials, welcher aus dem BSC-Widerstand und dem Restwiderstand besteht. Für SRF Kavitäten mit hohen Güten kann eingefrorener magnetischer Fluss letzteren leicht dominieren. Messungen am Helmholtz-Zentrum Berlin ergaben, dass bis zu 100 % des angelegten Magnetfeldes während des Phasenüberganges eingefroren werden, was den Restwiderstand und die Güte der Kavitäten deutlich verschlechtert.

Um die Magnetfeldverteilung an der Kavität im Betrieb vermessen zu können, wurde eine Sonde entwickelt, die eine hochauflösende Messung der DC-Magnetfelder im sub-μT-Bereich ermöglicht und somit die genaue Bestimmung des Magnetfeldes während des Phasenüberganges und auch des eingefrorenen Flusses zulässt. Dazu wurde das bestehende Prinzip der Förster-Sonde auf kleinere Raumabmessungen von ca. 20mm übertragen und dabei Kryotauglichkeit gewährleistet. In diesem Beitrag werden die Messungen der selbstgefertigten Sonde präsentiert und mit denen von kommerziell erhältlichen Produkten verglichen und anschließend diskutiert.

Eine Anordnung mehrere Sonden könnte helfen, eine 3-Dimensionale Aufnahme magnetischer Felder zu erstellen und somit die genaue Abhängigkeit zwischen Temperatur-Gradient und eingefrorenen Fluss zu erforschen, um signifikant höhere Kavitäten-Güten zu ermöglichen.

15 min. break

BE 13.7 Thu 11:15 ZEU 255

Recalculation of the dispersion tracks of the recirculations at the S-DALINAC* — •Jonas Pforr, Michaela Arnold, Florian Hug, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The S-DALINAC is a twofold recirculating superconducting electron linear accelerator operated at Darmstadt. The design-energy of 130 MeV could however not be reached in cw operation so far due to a lower quality factor of the superconducting cavities than originally expected.

In order to increase the possible beam energy in future the construction of a third recirculation is planned. Since this modification slightly changes the layout of the excisting recirculations as well, the beam dynamics in all recirculations had to be revised by simulations. In this context, the relation between the longitudinal disperison and the quadrupole gradients was studied, which is important for the non-isochronous operation of the S-DALINAC.

We present the latest simulations of the beam dynamics, where the results of the new recirculation are of particular interest.

*Work supported by DFG through SFB 634

BE 13.8 Thu 11:30 ZEU 255

Future experiments on beam break up at the S-DALINAC* — •Thorsten Kürzeder, Florian Hug, Lars Jürgensen, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The superconducting accelerator S-DALINAC provides electron beams of up to 130 MeV for nuclear physics experiments at the Technische Universität Darmstadt. It consists of a 10 MeV injector and a 40 MeV main linac cryostat, where 20-cell SRF cavities are operated at 3 GHz in 2 K liquid helium. Two recirculation paths provide the possibility to use the main linac up to three times. Due to transverse beam break up (BBU) the design beam current of 20 μA could not be reached in recirculating operation mode yet, the highest stable beam current obtained so far accounts for 5 μA, which is sufficient for the nuclear physics experiments carried out at Darmstadt. On the other hand the very low threshold current for the occurance of beam break up gives a unique opportunity for testing different strategies of avoiding BBU in a recirculating linear SRF accelerator. We report on upcoming experiments which will be carried out at the S-DALINAC for that purpose.

*Work suported by BMBF through 05K13RDA.

BE 13.9 Thu 11:45 ZEU 255

Sextupole magnets for beam break up measurements at the S-DALINAC* — •Marcel Schilling, Michaela Arnold, Mirco Gros, Florian Hug, Lars Jürgensen, Thorsten Kürzeder, and Norbert Pietralla — TU Darmstadt, Darmstadt, Germany

Energy recovery linacs (ERLs) are an emerging type of electron accelerators which can provide very high beam currents at low investment and running costs compared to conventional linacs. The high current densities generate strong fields that on the one hand act back on the beam (space charge forces) and on the other hand excite higher order modes (HOM) inside the accelerator structures. Those HOMs interact with the beam and excite beam oscillations that deteriorate beam quality and can lead to beam break up (BBU) in the worst case limiting the maximum achievable beam current in cw operation .

Avoiding BBU is investigated theoretically within simulations by several groups world-wide resulting in different strategies. In this talk we will focus on the idea of using the natural chromaticity in the beam transport system to delete the correlation of HOMs and electrons within the bunch in order to increase BBU threshold currents [1]. For that purpose test experiments at the superconducting recirculating electron accelerator S-DALINAC will be performed. As the natural chromaticity of the S-DALINAC beam transport system is rather low, new sextupoles had to be designed for this project. We will report on the properties of these sextupoles and the upcoming experiment.

[1] V. Litvinenko, Proc. LINAC'12, Tel Aviv, Israel (2012) 249.

*Work supported by BMBF through 05K13RDA

BE 13.10 Thu 12:00 ZEU 255

Kompakte Combined-Function-Quadrupol-Sextupol-Magnete für die Elektronstrahlführung an einem Laser-Wakefield-Beschleuniger — •Walter Werner, Veronica Afonso Rodriguez, Tilo Baumbach, Robert Rossmanith und Christina Widmann — Karlsruher Institut für Technologie (KIT)

Ein Laser-Wakefield-Beschleuniger (LWFA) erzeugt kurze Elektronenpakete mit einer relativ großen Energiebandbreite und Divergenz. Der Transport von Elektronenpaketen mit diesen Eigenschaften erfordert stark fokussierende Magnete mit chromatischer Korrektur. Für die Realisierung einer kompakten Strahlführung am LWFA in Jena sind Combined-Function-Magnete (CF-Magnete) mit Quadrupol- und Sextupolkomponenten vorgesehen.

Die Realisierung der hohen Quadrupol- und Sextupol-Stärken erfordert kleine magnetische Aperturen. Deshalb werden die Magnete im Vakuum aufgebaut, woraus sich besondere Anforderungen an die Kühlung der Spulen ergeben.

In diesem Vortrag werden Ergebnisse der magnetischen und thermischen Modellierung und Optimierung der CF-Magnete vorgestellt. Zusätzlich werden Tracking-Simulationen zur Untersuchung der Randfeldeffekte sowie der aktuelle Status der Realisierung der Magnete präsentiert.

Gefördert durch das BMBF unter Fördernummer 05K10VK2.

BE 13.11 Thu 12:15 ZEU 255

Test und Feldmessung eines vollständigen Kurzmodells eines Transversal-Gradient-Undulators — •Andreas Will, Peter Peiffer, Veronica Afonso Rodriguez, Axel Bernhard, Andreas Grau, Robert Rossmanith, Christina Widmann und Anke-Susanne Müller — Karlsruher Institut für Technologie (KIT)

Mit einem Transversalgradient-Undulator (TGU) ist es möglich, auch mit Elektronenpaketen mit einer relativ breiten Energieverteilung monochromatische Strahlung zu erzeugen. Dabei müssen die Elektronen entlang einer Magnetfeld-Gradientenachse nach ihrer Energie aufgefächert in den Undulator eintreten. Ein zylindrischer Undulator liefert entlang der Symmetrieachse einen passenden Feldgradienten.

Derzeit wird am KIT für den Laser-Wakefield-Beschleuniger am Jenaer Ti:Sa-Laser (JETI) ein zylindrischer TGU entwickelt. Dieser Beitrag zeigt die Ergebnisse der magnetischen Charakterisierung eines vollständigen Kurzmodells (2 Perioden) des zylindrischen, supraleitenden TGU.

Das Projekt wurde teilgefördert durch das BMBF unter Förderkennz. 05K10VK2.

BE 14: Particle Sources

Time: Thursday 15:00–17:00 Location: MOL 213

BE 14.1 Thu 15:00 MOL 213

Aufrüstung des ersten Linearbeschleunigers an ELSA — •Jens Zappai, Philipp Hänisch, Wolfgang Hillert und Manuel Schedler — ELSA, Bonn, Germany

Im Zuge der geplanten Erhöhung des internen Strahlstroms von 20 mA auf 200 mA an der Elektronen-Stretcher-Anlage ELSA findet eine Aufrüstung des ersten Linearbeschleunigers statt. Dieser soll zukünftig sowohl als Langpuls- als auch Single-Bunch-Injektor dienen.

Während der Langpuls-Modus einen Strahl mit hohem Strom und hoher Energieschärfe erfordert, ist für den Single-Bunch-Betrieb eine geringe Pulslänge und präzises Timing notwendig. Um beiden Anforderungen gerecht zu werden, wurde die thermische Elektronenquelle mit je einer Steuerplatine für beide Betriebsmodi sowie mit einem Triggersystem mit einer Präzision im Picosekunden-Bereich ausgestattet. Die erforderliche Pulslänge wird durch ein zweistufiges Bunchingsystem bestehend aus Prebuncher und Traveling Wave Buncher erreicht. Ein an die eigentliche Beschleunigerstruktur folgendes Energie-Kompressor-System erhöht die Energieschärfe für eine maximale Injektionseffizienz in das anschließende Synchrotron. Bis auf den Prebuncher werden alle Komponenten über ein Hohlleitersystem mit hybridbasierten Amplituden- und Phasenstellern von einer gemeinsamen HF-Quelle gespeist.

In meinem Vortrag werde ich den aktuellen Stand der Aufrüstung vorstellen.

BE 14.2 Thu 15:15 MOL 213

Commissioning of the New Injector Laser System for the Short-Pulse Project at FLASH — •Tim Plath[1], Juliane Rönsch-Schulenburg[1], and Bernd Steffen[2] — [1]Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg — [2]DESY, Notkestraße 85, 22607 Hamburg

In order to extend the parameter range of FLASH towards shorter electron pulses down to a few femto-second self-amplified spontaneous emission (SASE) pulses, shorter bunches with very small charges of a few tens of picocoulombs directly at the photo injector are necessary. To achieve so short bunches at FLASH, a new injector laser delivering pulses of 1 to 5 ps duration has been installed and commissioned. The influence of the laser parameters on the electron beam was studied theoretically.

BE 14.3 Thu 15:30 MOL 213

Conditioning status of the second XFEL gun at PITZ. — •Igor Isaev — DESY, Zeuthen, Germany

An RF photo gun is one of the key issues for the successful operation of modern linac based free electron lasers (FELs). The photo injector test facility at DESY, Zeuthen site (PITZ) develops high brightness electron sources for the European XFEL as well as for FLASH facility at DESY, Hamburg site. After the first gun for the European XFEL was conditioned at PITZ and installed for first RF tests at the European XFEL photo injector the second XFEL gun has been installed in October 2013 at PITZ for conditioning and characterization. An L-band 1.6- cell copper cavity is required to be conditioned up to 6.5 MW peak power at 650 us RF pulse length and 10 Hz repetition rate. This assumes stable gun run keeping ultra-high vacuum conditions needed for efficient operation of Cs2Te cathode and supporting low dark current level required for further usage of the gun in the superconducting linac environment. With established conditioning procedure has been applied in order to achieve the specifications. The results of the second XFEL gun conditioning will be reported in comparison with corresponding data obtained for the first gun. This includes conditioning rate comparison, RF signals and dark current measurements.

BE 14.4 Thu 15:45 MOL 213

Vorbereitungen zur Spektroskopie von laser-gepulsten Elektronen aus Feldemissionskathoden — •Vitali Porshyn, Stephan Mingels, Benjamin Bornmann, Dirk Lützenkirchen-Hecht und Günter Müller — Bergische Universität Wuppertal (BUW), Gaußstr. 20, 42119

Zur Entwicklung hochbrillanter gepulster Elektronenquellen auf Basis der photoinduzierten Feldemission (PFE), welche die Vorteile der Photo- und Feldemission (FE) kombiniert, wurde an der BUW ein neuartiges Messsystem aufgebaut [1]. Die Elektronen werden im UHV-System aus kalten Kathoden mit einer Gitterelektrode unter gepulster Laserstrahlung (3,5 ns; 10 Hz; $0,5 - 5,9$ eV; $> 0,3$ mJ) extrahiert und bisher mit einem CW-Spektrometer analysiert. Quanteneffizienz-Untersuchungen an flachen Metall- (Au, Ag verschiedener Orientierung) und Halbleiterkristallen (n- und p-Si, GaN) ergaben die erwartete Austrittsarbeit und zeigten erste Hinweise auf Bandstrukturabhängige PFE-Effekte. Dabei konnte aber die Energieverteilung der Elektronenpulse mit dem CW-Spektrometer nicht gemessen werden. Außerdem wurde die erreichbare Feldstärke (< 20 MV/m) durch parasitäre FE begrenzt. Deshalb wird das System derzeit mit einem für den Pulsbetrieb ausgelegten Spektrometer (Auflösung < 3 meV) erweitert und eine staubreduzierte Umgebung an der Probenschleuse installiert. Erste Messergebnisse an PFE-Kathoden mit der so erweiterten Apparatur sollen vorgestellt werden.

[1] B. Bornmann et al., Rev. Sci. Instrum. 83, 013302 (2012)

BE 14.5 Thu 16:00 MOL 213

Laserdiagnose-System mit großem Dynamikbereich für einen Dauerstrich-SRF-Photoinjektor — •Eva Panofski, Andreas Jankowiak, Thorsten Kamps und Guido Klemz — Helmholtz-Zentrum Berlin für Materialien und Energie

Die enge Verknüpfung zwischen Laserpulsen und Elektronenbunchen in

einem SRF Photoinjektor erfordert eine kontinuierliche Überwachung einiger Laserpuls-Parameter während des Betriebs. Bei der Kontrolle der Laserstabilität spielt die sogenannte virtuelle Kathode, ein Laserdiagnose-System, eine entscheidende Rolle. Hier stellt insbesondere der große Dynamikbereich des Photokathoden-Lasers mit Wiederholraten zwischen 120 Hz und 1.3 GHz bei konstanten Laserpuls-Parametern eine hohe Anforderung an die verwendeten Messysteme. Es sollen der Aufbau der virtuellen Kathode sowie erste Messungen mit dem Photokathoden-Laser des Teststandes "GunLab" von BERLinPro präsentiert werden.

BE 14.6 Thu 16:15 MOL 213

In-situ Charakterisierung von K_2CsSb-Photokathoden — •Martin Schmeisser[1], Susanne Schubert[1,2], Thorsten Kamps[1] und Andreas Jankowiak[1] — [1]Helmholtz-Zentrum Berlin für Materialien und Energie — [2]Brookhaven National Lab, Upton, NY, USA

Photokathoden aus Alkali-Antimoniden versprechen Elektronenstrahlen mit hoher Quanteneffizienz und niedriger intrinsischer Emittanz zu erzeugen und eignen sich daher für den Einsatz in Photoinjektoren mit hoher Brillianz. Ein Drift-Spektrometer wurde entwickelt, gebaut und schließlich an ein Präparationssystem für Photokathoden angeschlossen. Das Gerät erlaubt eine in-situ Charakterisierung der radialen Energieverteilung der Photokathoden um Korrelationen zwischen Wachstumsprozess und intrinsischer Emittanz zu untersuchen. Das Design und erste Messungen der transversalen Energieverteilung von K_2CsSb Kathoden werden vorgestellt.

BE 14.7 Thu 16:30 MOL 213

Untersuchung zur Photoemission von Photoinjektoren mit hoher Brillanz und hohem mittleren Strom an der Johannes Gutenberg-Universität Mainz — •Monika Dehn, Kurt Aulenbacher, Victor Bechthold, Simon Friederich, Eike Kirsch und Valery Tioukine — Institut für Kernphysik, JGU Mainz

An der JGU Mainz werden in verschiedenen Experimenten diverse Aspekte des Emissionsverhaltens aus Photokathoden untersucht. Ein Aspekt ist die zeitaufgelöste Messung der Impulsantworten, die routinemäßig mit Hilfe einer Deflektor-Kavität und eines durchstimmbaren Femtosekunden-Lasersystems zur Erzeugung kurzer Elektronenpulse durchgeführt werden können. Das Verhalten von GaAs-Photokathoden ist bei 800 nm Laserwellenlänge in Bezug auf Pulslänge/-form, Spin-Polarisation und QE gut bekannt. In einem unserer Experimente wird die Laserwellenlänge auf 400 nm halbiert, um die Impulsantworten bei verschiedenen Laserwellenlängen miteinander zu vergleichen. Erste Messungen zeigen eine deutliche Verkürzung des longitudinalen Strahlprofils bei 400 nm ohne den bei 800 nm typisch beobachteten nachlaufenden Elektronen. Diese Messungen werden mit einem anderen Typ von Photokathoden (K_2CsSb) wiederholt. Für weiterführende Messungen soll eine neue Elektronenquelle mit variablem Feldgradienten auf der Kathode bei 100 keV zum Einsatz kommen. Darüber hinaus wird eine weitere Elektronenquelle konzipiert, um Elektronenpakete mit etwa 50 ps Pulslänge und einer normierten transversalen Emittanz $< 1\,\mu$m bei einer Pulsladung von 8 pC zu erreichen.

BE 14.8 Thu 16:45 MOL 213

Commissioning of the FLUTE gun — •Stephan Höninger[1], Anke-Susanne Müller[1], Michael Nasse[1], Vitali Judin[2], Anke-Susanne Müller[2], and Robert Ruprecht[2] — [1]LAS, KIT, Karlsruhe — [2]ANKA, KIT, Karlsruhe

FLUTE, a new linac based test facility and THz source is currently being built at the Karlsruhe Institute of Technology (KIT) in collaboration with DESY and PSI. The electron source is an 2.5 cell S-band rf photo gun. It was design for high current applications and operated as CTF II gun at CERN. The status of the gun's rf commissioning will be presented.

BE 15: Beam Dynamics and Fields III

Time: Thursday 15:00–18:00 Location: ZEU 255

Group Report BE 15.1 Thu 15:00 ZEU 255

Hochstrom Energy-Recovery-Linac B*ERLin*Pro - Statusbericht — •Stephan Wesch, Michael Abo-Bakr, Wolfgang Anders, Roman Barday, Alexey Bondarenko, Klaus Bürkmann-Gehrlein, Andrew Burrill, Volker Dürr, Andreas Jankowiak, Thorsten Kamps, Vasim Khan, Guido Klemz, Jens Knobloch, Oliver Kugeler, Bettina Kuske, Peter Kuske, Aleksandr Matveenko, Atoosa Meseck, Gerd Meyer, Roland Müller, Axel Neumann, Klaus Ott, Eva Panofski, Yuriy Petenev, Joachim Rahn, Jeniffa Rudolph, Martin Schmeisser, Susanne Schubert, Oliver Schüler, Julia Vogt und Jens Völker — Helmholtz-Zentrum Berlin HZB, Deutschland

Die im Aufbau befindliche Beschleunigertestanlage B*ERL*inPro am HZB ist ein 50 MeV supraleitender energy-recovery-linac (ERL), der von einem supraleitenden Photokathoden-Injektor gespeist wird. In Hinblick auf den Einsatz von ERLs als künftige hoch-brillante Strahlungsquellen ist das Hauptziel von B*ERL*inPro einen maximalen Strahlstrom von 100 mA cw zu demonstrieren. Gleichzeitig sollen Elektronenpakete mit einer normierten, transversalen Emittanz unter 1 mm mrad und mit Längen von einer Pikosekunde und kürzer erzeugt werden. Viele aktuelle physikalische und technologische Herausforderungen wie z.B. Emittanzerhaltung bei Rezirkulation, stabiler Hochstrombetrieb bei geringen Strahlverlusten und flexible Elektronpaketmanipulation werden mit diesen Projekt adressiert. In diesem Übersichtsvortrag wird B*ERL*inPro kurz vorgestellt und über dessen momentanen Status berichtet.

BE 15.2 Thu 15:30 ZEU 255

Modelling of the short-bunch optics for B*ERL*inPro — •Andreas Ginter and Alexander Matveenko — Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Elektronenspeicherring BESSY II, Albert-Einstein-Str. 15, 12489 Berlin, Germany

BERLinPro is designed as an Energy Recovery Linac (ERL) test facility to develop and to demonstrate the technology and expertise required to drive next-generation lights sources that are based on ERL principle.

Compared to storage rings, ERLs can achieve bunch lengths that are at least two orders of magnitude shorter. As part of the technology demonstration the minimal obtainable bunch length in BERLinPro has to be determined. Lattice parameters are optimized in simulations. Limiting factors like coherent synchrotron radiation and space charge effects are discussed. Results for different bunch charges are presented.

BE 15.3 Thu 15:45 ZEU 255

Investigation of microbunching instability in energy recovery linacs - utilizing BERLinPro as an example — •Rädel Stephanie and Meseck Atoosa — Helmholtz Zentrum Berlin für Materialien und Energie GmbH, Berlin, Germany

In an Energy Recovery Linac (ERL), an electron bunch is accelerated during the first passage through a linac. After the usage (radiation generation or collider-experiments) the spent electron beam passes the linac a second time with a phase shift of 180 degree and is decelerated. This way the energy can be recovered. In an ERL the preservation of the low emittance and small energy spread is of major importance. Therefore, deep understanding and control of effects, which can degrade the emittance and energy spread such as space charge effects are of interest. The microbunching caused by the longitudinal space charge forces can lead to, on the one hand to an increase in emittance and energy spread in the arcs of the loop. On the other hand it can be used to generate coherent high brightness radiation. In this contribution, utilizing BerlinPro as an example, the impacts of the microbunching instability on the beam quality and its implication for an ERL are discussed.

BE 15.4 Thu 16:00 ZEU 255

Magnetic Optics of the Femto-Science-Factory Multi-Turn ERL Project — •Terry Atkinson — Helmholtz Zentrum Berlin

The heavy demands on the beam quality for future light sources: diffraction limited emittance, femto-second pulses and low energy spread require advanced magnetic optic designs. This talk highlights the magnetic optic that is presently being investigated in the ERL-simulation group at HZB. Start-to-End beam dynamic simulations are presented. The effect from higher order chromatic aberration terms

have been minimized using multipole magnets and biased off-crest acceleration. Optic based on horizontal phase advance manipulation to suppress emittance growth due to coherent synchrotron radiation has been investigated.

BE 15.5 Thu 16:15 ZEU 255

Auswirkungen des CLIC-Dämpfungswiggler-Prototypen auf die Strahldynamik an ANKA — •Julian Gethmann[1], Axel Bernhard[1], Edmund Hertle[1], Steffen Hillenbrand[1], Nigel Smale[1], Konstantin Zolotarev[2] und Anke-Susanne Müller[1] — [1]Karlsruher Institut für Technologie (KIT) — [2]Budker Institute of Nuclear Physics

Für hohe Luminositäten am Lepton-Collider CLIC werden Strahlen mit geringer transversaler Emittanz benötigt, die man durch Dämpfungsringe mit supraleitenden Wigglern erreichen will. Zu Testzwecken wird an ANKA ein Dämpfungswiggler-Prototyp installiert. Als vorbereitende Untersuchung wurden die Auswirkungen des Wigglers auf die Strahldynamik simuliert und das Modell mit an ANKA existierenden Permanentmagnet-Wigglern experimentell getestet.

15 min. break

Group Report BE 15.6 Thu 16:45 ZEU 255

Short-pulse studies at FLASH — •Marie Rehders — Universität Hamburg, for the short bunches project at FLASH

Many users at FLASH work on pump-probe experiments, where time resolution is determined by the FEL pulse duration. Therefore they have expressed a keen interest in being provided with shorter XUV pulses. The shortest possible SASE pulse is a single longitudinal optical mode of the FEL radiation, resulting in radiation pulses of some 3 fs.

The most direct way to realize this at FLASH would be to reduce the electron bunch length to only a few μm at the entrance of the undulator section. The maximum tolerable bunch compression from the cathode to the FEL is limited to a factor of approximately 300 due to beam dynamics issues and RF tolerances. Thus, the bunch duration at the injector has to be as short as approximately 1ps, which in turn calls for low bunch charges to make space charge effects tolerable. A new photo-injector laser with adjustable pulse duration is thus used to optimize the initial bunch length at the cathode.

Beam dynamic studies are performed to optimize the injection and compression of low charge electron bunches, starting with the pulse parameters of the injector laser. Also, first experimental results with several injector laser settings are compared with beam dynamic simulations and presented in this contribution.

BE 15.7 Thu 17:15 ZEU 255

Determination of a working point for double-bunch electron-beam generation and transport in the FLASH accelerator at DESY — •Carlos Manuel Entrena Utrilla and Steffen Wunderlich — Deutsches Elektronen-Synchrotron, Hamburg, Germany

The future studies on particle-beam driven plasma-acceleration in the FLASHForward project at the FLASH accelerator facility at DESY in Hamburg, as well as other projects like the two-color FEL, require the production and transport of two electron bunches with a spacing of hundreds of femtoseconds within one RF bucket. The bunches are generated at the cathode by dividing the injector laser pulses with a split-and-delay optic system. They are then accelerated and compressed using the FLASH linear accelerator and its two bunch compressors. A method for the determination of the machine's working point, the voltages and phases of the accelerating modules, is presented. The determination is done with a three step optimization process: an initial analytical approach, a subsequent numerical optimization with one dimensional tracking procedure including collective effects and the full three dimensional simulation with the ASTRA and CSRtrack tracking codes.

BE 15.8 Thu 17:30 ZEU 255

Start-to-end error study for FLUTE — •Manuel Weber[1], Anke-Susanne Müller[1,2,3], Somprasong Naknaimueang[2], Marcel Schuh[1], Markus Schwarz[1], and Pawel Wesolowski[2] — [1]LAS, KIT, Karlsruhe — [2]ANKA, KIT, Karlsruhe — [3]IPS, KIT, Karlsruhe

FLUTE, a new linac based test facility and THz source is currently being built at the Karlsruhe Institute of Technology (KIT) in collaboration with DESY and PSI. In this machine single electron bunches with charges from 1pC to 3nC will be accelerated to 40-50 MeV. Afterwards the bunches will be compressed longitudinally in a magnetic chicane to generate intense coherent THz radiation. The stability and repeatability of longitudinal bunch profiles are essential for optimum compression and THz emission.

Start to end beam dynamics error studies have been performed using ASTRA to determine the influence of various machine elements on the beam. Afterwards critical parameters are identified and tolerances are defined for those. In this contribution a summary of this error study will be given.

BE 15.9 Thu 17:45 ZEU 255

SALOME: An accelerator for the practical university course in accelerator physics — •Daniel Riebesehl[1], Velizar Miltchev[1], Jörg Rossbach[1], Oliver Stein[2] und Maximilian Trunk[1] — [1]Universität Hamburg — [2]CERN

SALOME (Simple Accelerator for Learning Optics and the Manipulation of Electrons) is a short low energy linear accelerator for electrons built by the University of Hamburg. The goal of this project is to give the students the possibility to obtain hands-on experience with the basics of accelerator physics. The SALOME accelerator project offers a great bandwidth of learning the theoretical aspects of accelerator technologies and the realization of technical setups. In this contribution the layout of the device will be presented. The most important components of the accelerator will be discussed and experimental results characterising the beam energy and transverse phase space will be presented.