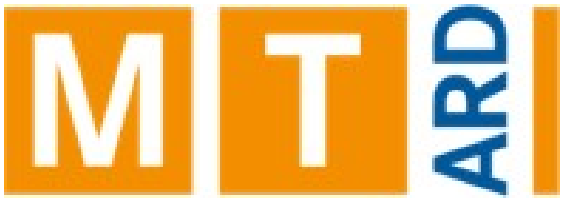
11th MT ARD ST3 Meeting 2023 in Dresden-Rossendorf



Report of Contributions

Contribution ID: **196** Type: **Oral presentation**

Beam Dynamic Simulations with an Additional Corrugated Structure Impedance at KARA

Thursday, 6 July 2023 14:55 (20 minutes)

In the KIT storage ring KARA (KArlsruhe Research Accelerator), two parallel plates with periodic rectangular corrugations are planned to be installed in a dedicated part of the vacuum chamber. These plates will be used for impedance manipulation to study and eventually control the beam dynamics and the emitted coherent synchrotron radiation (CSR). In this contribution, we present simulation results showing the influence of different corrugated structures on the longitudinal beam dynamics and how this influence depends on the machine setting in the low momentum compaction regime.

Co-authors: MOCHIHASHI, Akira (Karlsruhe Institute of Technology); MUELLER, Anke-Susanne (KIT); SCHWARZ, Markus (KIT); NASSE, Michael (Karlsruhe Institute of Technology); Dr BROSI, Miriam (KIT); SCHREIBER, Patrick (KIT)

Presenter: MAIER, Sebastian (KIT)

Session Classification: Session: Beam Dynamics

Track Classification: Beam dynamics

Contribution ID: **197** Type: **Oral presentation**

HZB facility talk

Wednesday, 5 July 2023 16:10 (20 minutes)

Update on accelerator R&D with relevance for ST3 at HZB

Primary author: KAMPS, Thorsten (Helmholtz-Zentrum Berlin / Humboldt-Universität Berlin)

Presenter: KAMPS, Thorsten (Helmholtz-Zentrum Berlin / Humboldt-Universität Berlin)

Session Classification: Session: Facility Status Talks

Track Classification: Facility overviews

Contribution ID: **198** Type: **Speed talk & Poster**

Electro-Optical Diagnostics at KARA: First Two-Bunch Measurements and Enhancing the Sensitivity

Friday, 7 July 2023 10:35 (3 minutes)

At the KIT storage ring KARA (Karlsruhe Research Accelerator), two electro-optical (EO) diagnostical setups are implemented: An EO near-field monitor within the beam pipe in vacuum as a tool for longitudinal bunch profile measurements and an EO far-field setup to measure the temporal profile of the coherent synchrotron radiation (CSR).
The EO near-field monitor performs very well in single-shot turn-by-turn measurements during single-bunch operation and over the years. The design has been optimized to be prepared for measurements in multi-bunch operation. This contribution provides first tests of the monitor during two-bunch operation with minimum 2 ns bunch spacing. Challenges like crystal heating due to an increased beam current are discussed and strategies for mitigation are presented.
For the EO far-field setup, to keep the crucial high signal-to-noise ratio, a setup based on balanced detection is under commission. Therefore, simulations are performed for an optimized beam path and the setup is characterized. In this contribution, the upgraded setup and first measurements are presented.

Primary author: NIEHUES, Gudrun (KIT)

Presenter: NIEHUES, Gudrun (KIT)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **199** Type: **Oral presentation**

Overview of Reinforcement Learning Development for Particle Accelerators

Thursday, 6 July 2023 09:40 (20 minutes)

In this talk, I will give an overview of the recent development of reinforcement learning-based controllers for particle accelerators, with a focus on the transverse beam tuning task at linear accelerators.

Primary author: XU, Chenran (KIT)

Presenter: XU, Chenran (KIT)

Session Classification: Session: Controls/Seeding/DAQ

Track Classification: Beam control

Contribution ID: **201** Type: **not specified**

HZDR facility talk

Wednesday, 5 July 2023 14:15 (20 minutes)

Primary author: EVTUSHENKO, Pavel (HZDR (ELBE))

Presenter: EVTUSHENKO, Pavel (HZDR (ELBE))

Session Classification: Session: Facility Status Talks

Contribution ID: **202** Type: **not specified**

DESY facility talk

Wednesday, 5 July 2023 14:35 (20 minutes)

Primary author: SCHLARB, Holger (MSK (Strahlkontrollen))

Presenter: SCHLARB, Holger (MSK (Strahlkontrollen))

Session Classification: Session: Facility Status Talks

Contribution ID: **203** Type: **not specified**

PITZ facility talk

Wednesday, 5 July 2023 14:55 (15 minutes)

Primary author: LI, Xiangkun (DESY Zeuthen)

Presenter: LI, Xiangkun (DESY Zeuthen)

Session Classification: Session: Facility Status Talks

Contribution ID: **204** Type: **not specified**

KIT facility talk

Wednesday, 5 July 2023 15:30 (20 minutes)

Primary author: SCHWARZ, Markus (KIT)

Presenter: SCHWARZ, Markus (KIT)

Session Classification: Session: Facility Status Talks

Contribution ID: **205** Type: **Oral presentation**

GSI facility talk

Wednesday, 5 July 2023 15:50 (20 minutes)

Overview on cooling and stacking methods at the GSI Experimental Storage Ring

Primary author: HESS, Regina (GSI)

Presenter: HESS, Regina (GSI)

Session Classification: Session: Facility Status Talks

Contribution ID: **207** Type: **not specified**

Organisation and Welcome to HZDR

Wednesday, 5 July 2023 14:00 (15 minutes)

Session Classification: Organisation and Welcome to HZDR

Contribution ID: **209** Type: **not specified**

Group photo

Wednesday, 5 July 2023 16:30 (10 minutes)

Presenter: EVTUSHENKO, Pavel (HZDR / ELBE)

Contribution ID: **210** Type: **Speed talk & Poster**

Controlling the transverse beam shape of the photoinjector laser via a spatial light modulator

Thursday, 6 July 2023 10:30 (3 minutes)

In order to achieve unprecedented control over the phase space of electron beams in linear accelerators, the laser pulse of the photoinjector can be shaped by spatial light modulators (SLMs). Here, we use a convolutional neural network (CNN) from a proof-of-principle test with a visible diode laser on the TiSa-800-nm photoinjector laser system of the Ferinfrarot Linac- und Test-Experiment (FLUTE) at KIT to compensate the effects of compression on the transverse laser profile.

Primary author: KOETTER, Stephan-Robert (KIT IBPT)

Co-authors: SANTAMARIA GARCIA, Andrea (KIT); MUELLER, Anke-Susanne (KIT); XU, Chenran (KIT); Dr BRUENDERMANN, Erik (KIT); NABINGER, Matthias (KIT)

Presenter: KOETTER, Stephan-Robert (KIT IBPT)

Session Classification: Speedtalks: Controls/Seeding/DAQ

Track Classification: ST - Beam control

Contribution ID: **211** Type: **not specified**

Introduction of LPA and its applications for light sources

Wednesday, 5 July 2023 17:00 (1 hour)

Primary author: IRMAN, Arie (HZDR)

Presenter: IRMAN, Arie (HZDR)

Session Classification: Tutorials

Contribution ID: **213** Type: **not specified**

Close out & PoF V

Friday, 7 July 2023 12:15 (1 hour)

2021-2027 PoF 4 (4th program-oriented funding period of the Helmholtz Association) => 2028-2035 PoF 5

Information material from the transition preparation from PoF 3 to PoF 4:
https://indico.desy.de/event/20689/contributions/40054/attachments/25682/32513/MT_ST3_POF4.pdf

The vision for MT ARD ST3 (PoF 4, 2021-2027):
https://indico.desy.de/event/36133/page/4250-vision

Description of ST3 for PoF 4:
https://www.helmholtz-ard.de/e42986/e43194/index_eng.html

Presenters: SCHLARB, Holger (MSK (Strahlkontrollen)); BRUENDERMANN, Erik (KIT)

Session Classification: Close out & PoF V

Contribution ID: **214** Type: **Speed talk & Poster**

Investigation on Microstrip based Pickup Monitor for Ultra Low charge Beam at 100 GHz

Friday, 7 July 2023 10:38 (3 minutes)

The microstrip based pickup monitor (MPM) suited for arrival time detection is carefully investigated and the voltage signal at the feedthrough exit has been studied to obtain the optimized symmetrical signal amplitude and reduced wakefields prior to and subsequent to the bunch. Due to the superior potential behavior of the microstrip line with ultra-low charge signals (1pC) at 100 GHz bandwidth, waveguide to microstrip transition concept could be used as a novel way of approach which can give more accuracy for future generation experiments at EuXFEL, ARES and also at FLASH. MPM design has two units which are all-metal waveguide rods where the signals are initially captured and transferred to the microstrip combiner. The microstrip combiner unit has been properly matched with 50-ohm impedance and transition techniques such as wedge shaped, stepped impedance, and block transitions has been simulated to observe the detailed signal flow characteristics. Also, the numerous pickup shapes are thoroughly taken into consideration for achieving maximum signal transfer and minimum radiation losses.

Primary author: Dr THEVARUPARAMBU ABDUL NAZER, Nisamol (MSK (Strahlkontrollen))

Co-authors: Dr PENIRSCHKE, ANDREAS; Dr SCHEIBLE, BERNHARD; SCHLARB, Holger (MSK (Strahlkontrollen)); Dr CZWALINNA, MARIE

Presenter: Dr THEVARUPARAMBU ABDUL NAZER, Nisamol (MSK (Strahlkontrollen))

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **215** Type: **Oral presentation**

Steady-State Microbunching and related activities at the Metrology Light Source

Thursday, 6 July 2023 15:15 (20 minutes)

Steady-State Microbunching (SSMB) has been proposed as a new mechanism to generate coherent synchrotron radiation at a storage ring facility with short wavelengths up to the EUV range. This promises a narrow band, high average power radiation source. A proof-of-principle experiment at the Metrology Light Source has shown the viability of the underlying mechanism. A summary of recent results from the ongoing experimental investigations is given, which includes the survival of microbunching for several revolutions. Relevant in the quasi-isochronous regime of SSMB, we also present work on nonlinear and local momentum compaction effects, limiting the shortest bunch lengths attainable.

Primary author: KRUSCHINSKI, Arnold (Helmholtz-Zentrum Berlin)

Co-authors: Mr HOEHL, Arne (Physikalisch-Technische Bundesanstalt (PTB)); LI, Ji (Helmholtz-Zentrum Berlin); FEIKES, Jörg (Helmholtz Zentrum Berlin); RIES, Markus (Helmholtz-Zentrum Berlin); KLEIN, Roman (Physikalisch-Technische Bundesanstalt (PTB))

Presenter: KRUSCHINSKI, Arnold (Helmholtz-Zentrum Berlin)

Session Classification: Session: Beam Dynamics

Track Classification: Beam dynamics

Contribution ID: **216** Type: **Speed talk & Poster**

Recent updates of the longitudinal diagnostics for beam-based feedbacks at FLASH

Friday, 7 July 2023 10:41 (3 minutes)

Within the FLASH 2020+ project, the injector and linac had undergone substantial upgrades and changes, bringing along also adaptations of longitudinal diagnostics. The main advances have been made on the electronics and automation side, with regard to the special burst-mode bunch pattern with individual tuning capabilities for FLASH1 and FLASH2 beamlines. Here we present the most recent changes in detection and feedback systems for arrival time and compression, as well as further THz-based diagnostics in far and near field applications.

Primary author: Dr CZWALINNA, Marie Kristin (DESY, MSK (Strahlkontrollen))

Co-authors: STEFFEN, Bernd (MSK (Strahlkontrollen)); LAUTENSCHLAGER, Bjoern (MSK (Strahlkontrollen)); ROTHE, Dietrich (MSK (Strahlkontrollen)); GEORG, Jens (MSK (Strahlkontrollen)); KRAL, Jiri (MSK (Strahlkontrollen)); BUECHLER, Michael (MSK (Strahlkontrollen)); LOCKMANN, Nils Maris (MSK (Strahlkontrollen))

Presenter: Dr CZWALINNA, Marie Kristin (DESY, MSK (Strahlkontrollen))

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **217** Type: **Speed talk & Poster**

Cryogenic Current Comparator (CCC): absolute beam current measurement in the order of nA

Friday, 7 July 2023 10:44 (3 minutes)

The Cryogenic Current Comparator (CCC) is able to provide a calibrated non-destructive measurement of beam currents with a resolution of 10 nA or better. The non-interceptive, absolute intensity measurement of weak ion beams (< 1 μA) is essential in heavy ion storage rings and in transfer lines, as the ones in FAIR. With standard diagnostics, this measurement is challenging for bunched beams and virtually impossible for coasting beams. The CCC provides reliable values for beam currents of this order of magnitude or lower, independent of ion species and without tedious calibration procedure.
The test in the heavy-ion storage ring CRYRING@ESR at GSI has confirmed its viability, and has also suggested several improvements to the detector hardware. Therefore, an upgrade of the CCC system was performed and tested in laboratory environment. A review of these improvements will be presented herein, with a detailed discussion of the most important measures and the next development steps for the final version of the CCC for FAIR.

Primary author: CRESCIMBENI, Lorenzo (Friederich schiller universität jena)

Co-authors: HAIDER, David (GSI Helmholtz Centre for Heavy Ion Research); SCHMIDL, Frank (Friedrich-Schiller-university Jena, Institute of Solid State Physics); Dr STOLTZ, Ronny (Leibniz IPHT, Jena); SIEBER, Thomas (GSI); STOEHLKER, Thomas (HI Jena and GSI-Darmstadt); Dr ZAKOSARENKO, Vladimir (Leibniz IPHT, Jena); TYMPEL, Volker (Helmholtz Institute Jena)

Presenter: CRESCIMBENI, Lorenzo (Friederich schiller universität jena)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **218** Type: **Oral presentation**

Impact of the Turkey/Syria Earthquake on the Synchronization Systems at EuXFEL and FLASH

Friday, 7 July 2023 10:00 (20 minutes)

During the last decades, the precision of the measurement of length variations has increased drastically to reach the nanometer scale, or a sub-femtosecond timescale, based on transit time-stabilized optical fibers using femtosecond laser pulses. Thanks to the high precision of the stabilization system, the influence of different perturbations can be investigated, such as environmental changes (temperature, relative humidity, and air pressure) or density modulation (acoustics, ground motion). We report here on the detection of the earthquake of magnitude 7.8 on the Richter scale happening at 1:17 am (UTC) on February 6, 2023, in Turkey and Syria using the optical synchronization systems of the EuXFEL and FLASH.

Primary author: SCHULZ, Sebastian (Deutsches Elektronen-Synchrotron)

Co-authors: CALENDRON, Anne-Laure (MSK (Strahlkontrollen)); MUELLER, Jost (MSK (Strahlkontrollen)); SCHLARB, Holger (MSK (Strahlkontrollen))

Presenter: SCHULZ, Sebastian (Deutsches Elektronen-Synchrotron)

Session Classification: Session: Beam Diagnostics

Track Classification: Beam diagnostics

Contribution ID: **219** Type: **Speed talk & Poster**

Updates of the THz SASE FEL at PITZ

Thursday, 6 July 2023 10:51 (3 minutes)

Research and development of an accelerator-based THz source prototype for pump-probe experiments at the European XFEL are ongoing at the Photo Injector Test Facility at DESY in Zeuthen (PITZ). Proof-of-principle experiments have been performed to generate a high-gain THz Free-electron Laser (FEL) based on the Self-Amplified Spontaneous Emission scheme. The first lasing with a central wavelength of 100 μm (3 THz) was observed in the summer of 2022. This contribution presents updates of the THz SASE FEL at PITZ, including recent optimization of beam transport and matching resulting in a measured FEL pulse energy of more than 80 μJ, recent FEL gain curves measurements, and an upgrade plan of THz diagnostics.

Primary authors: BOONPORNPRASERT, Prach (Z_PITZ (Betrieb und Forschung)); KONGMON, Ekkachai (Z_PITZ (Beschleunigerphysik)); KRASILNIKOV, Mikhail (DESY Zeuthen); LI, Xiangkun (DESY Zeuthen)

Presenter: KONGMON, Ekkachai (Z_PITZ (Beschleunigerphysik))

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **220** Type: **Oral presentation**

Revealing the dynamics of ultrarelativistic non-equilibrium many-electron systems with phase space tomography

Friday, 7 July 2023 09:00 (20 minutes)

Perhaps one of the most crucial diagnostic targets in the operation of accelerator facilities is the phase space density (PSD) of the accelerated particle bunches. The knowledge of the PSD not only governs the emission spectrum of the bunches, but it also determines other fundamental properties such as bunch length, energy spread, and more sophisticated, intra-bunch interactions. Importantly, under ideal circumstances, the state of the PSD during a specific point in time completely determines the evolution of the PSD. In this talk, we introduce a non-destructive tomographic method for determining the PSD in a storage ring. Our approach utilizes electro-optic spectral decoding measurements of bunch profiles at MHz repetition rates. As an application, we demonstrate that the PSD microstructuring as well as the PSD evolution can be observed in detail during the micro-bunching instability. Our method may enhance the control of short electron bunches in circular accelerators, and potentially offer a new avenue for studying the physics of equilibrium and non-equilibrium ultrarelativistic thermodynamic systems.

Primary author: Dr FUNKNER, Stefan (KIT/IBPT)

Co-authors: MUELLER, Anke-Susanne (KIT); Dr KEHRER, Benjamin; Dr STEFFEN, Bernd (MSK (Strahlkontrollen)); Dr BRUENDERMANN, Erik (KIT); Dr NIEHUES, Gudrun (KIT); Dr STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT); Dr ROTA, Lorenzo (SLAC); Prof. WEBER, Marc; Dr SCHUH, Marcel (KIT - ANKA); Dr NASSE, Michael (Karlsruhe Institute of Technology); CASELLE, Michele (KIT); Dr SCHÖNFELDT, Patrik

Presenter: Dr FUNKNER, Stefan (KIT/IBPT)

Session Classification: Session: Beam Diagnostics

Track Classification: Beam diagnostics

Contribution ID: **221** Type: **Oral presentation**

First momentum modulation of a highly relativistic electron beam in a dielectric laser accelerator at ARES

Thursday, 6 July 2023 14:15 (20 minutes)

We present the preliminary experimental results of electron beam momentum modulation by a DLA at ARES. A fused silica micrometer scale grating was illuminated by a picosecond infrared laser. The timing was scanned to produce a crosscorrelation between the electron bunch and the laser pulse. The current limitations will be discussed and the planned improvement steps of the experiment. An outlook on the potential as beam manipulation and diagnostic device will conclude the presentation.

Primary authors: Dr MAYET, Frank (MPY1 (MPY Fachgruppe 1)); KUROPKA, Willi (MPY1 (MPY Fachgruppe 1))

Co-authors: CALENDRON, Anne-Laure (MSK (Strahlkontrollen)); STACEY, Blae (MPY1 (MPY Fachgruppe 1)); MOHR, Christian (FS-LA (Software Electronic)); MAHNKE, Christoph (FS-LA (Research Topics)); AMORIM GONCALVES GIESTEIRA, Filipe (MVS (Vakuum Systeme)); BURKART, Florian (MPY1 (MPY Fachgruppe 1)); LEMERY, Francois (MXL (XFEL)); KAERTNER, Franz (FS-CFEL-2 (Ultrafast X-rays Group)); DINTER, Hannes (MPY1 (MPY Fachgruppe 1)); DELSIM-HASHEMI, Hossein (MPY (Beschleunigerphysik)); CANKAYA, Hueseyin (FS-LA (FLASH 2020+ flexible pump probe lasers)); HARTL, Ingmar (FS-LA (Lasergruppe)); MUELLER, Jost (MSK (Strahlkontrollen)); GENOVESE, Luca (FS-CFEL-2 (Ultrafast X-rays Group)); KELLERMEIER, Max (MPY1 (MPY Fachgruppe 1)); ASSMANN, Ralph (MPY1 (MPY Fachgruppe 1)); SCHULZ, Sebastian (Deutsches Elektronen-Synchrotron); JASTER-MERZ, Sonja Meike (MPY1 (MPY Fachgruppe 1)); LEDERER, Sven (MVS (Vakuum Systeme)); VINATIER, Thomas (MPY1 (MPY Fachgruppe 1)); LAMB, Thorsten (MSK (Strahlkontrollen)); GROSSE-WORTMANN, Uwe (FS-LA (Software Electronic))

Presenter: KUROPKA, Willi (MPY1 (MPY Fachgruppe 1))

Session Classification: Session: Beam Dynamics

Track Classification: Beam dynamics

Contribution ID: **222** Type: **Oral presentation**

Finite Element Simulation of Fast Corrector Magnets for PETRA IV

Thursday, 6 July 2023 09:00 (20 minutes)

The new synchrotron light source PETRA IV at DESY will use a fast orbit feedback system with hundreds of fast corrector magnets to meet stringent orbit stability requirements. These magnets are operated at high frequencies, creating strong eddy currents that result in Joule losses and a time delay between applied voltage and aperture field. User experiments impose challenging requirements on beam operation to preserve the point of the radiation source. To meet the demanding feedback requirements, finite element simulations are needed to understand the characteristics of the corrector magnet. However, due to the small skin depths at high frequencies and the laminated structure of the yoke, these simulations need a very fine mesh and are thus
very costly. Therefore, we homogenize the laminated yoke which reduces the computational effort but captures the eddy current effects accurately. The reduction of simulation times from several hours to a few minutes allows us to conduct extensive studies of the eddy current losses, the multipole coefficients, and the transfer functions of the magnets.

Primary author: CHRISTMANN, Jan-Magnus (Technische Universität Darmstadt)

Co-authors: ALOEV, Alexander (MEA1 (Technische Projektierung)); Prof. DE GERSEM, Herbert (Technische Universität Darmstadt); SCHLARB, Holger (MSK (Strahlkontrollen)); Mr VON TRESCKOW, Moritz (Technische Universität Darmstadt); MIRZA, Sajjad Hussain (MSK (Strahlkontrollen)); PFEIFFER, Sven (MSK (Strahlkontrollen))

Presenter: CHRISTMANN, Jan-Magnus (Technische Universität Darmstadt)

Session Classification: Session: Controls/Seeding/DAQ

Track Classification: Beam control

Contribution ID: **223** Type: **Speed talk & Poster**

Enhanced quench detection at the EuXFEL through a machine learning-powered approach

Thursday, 6 July 2023 10:33 (3 minutes)

The European X-Ray Free-Electron Laser is the largest particle accelerator for X-ray laser generation worldwide. The facility utilizes hundreds of superconducting radio-frequency cavities (SRFCs) for the acceleration of electron bunches to very high energies, reaching up to 17.5 GeV. This enables the generation of extremely intense laser flashes for an important number of users every year. However, the accelerator's smooth operation can be disrupted by various anomalous events, with quenches being particularly severe, as they result in the loss of superconductivity and down-times that can last for several hours. Hence, quench detection plays a vital role in ensuring the safe and optimal operation of the accelerator.
In this context, we undertake an analysis of signals that reflect the behavior of the SRFCs using a two-stage approach. The initial stage involves employing analytical redundancy, specifically the parity space method, to process the data and generate a residual. By evaluating this residual using the generalized likelihood ratio, we can identify faulty behaviors. In the subsequent stage, we focus on distinguishing quenching events from other anomalies. For this purpose, we employ a semi-supervised machine learning model based on the k-medoids algorithm, which explores various similarity measures such as lock-step and elastic measures. Evaluation results obtained during the second half of 2022, in comparison to the currently deployed quench detection server, demonstrate the effectiveness of our approach.

Primary author: BOUKELA, Lynda (DESY)

Co-authors: JOMHARI, Nur Zulaiha (DESY); EICHLER, Annika (DESY); BRANLARD, Julien (DESY)

Presenter: BOUKELA, Lynda (DESY)

Session Classification: Speedtalks: Controls/Seeding/DAQ

Track Classification: ST - Beam control

Contribution ID: **224** Type: **Speed talk & Poster**

Learning to Do or Learning While Doing: Reinforcement Learning and Bayesian Optimisation for Online Continuous Tuning

Thursday, 6 July 2023 10:36 (3 minutes)

Online tuning of real-world plants is a complex optimisation problem that continues to require manual intervention by experienced human operators. Autonomous tuning is a rapidly expanding field of research, where learning-based methods, such as Reinforcement Learning-trained Optimisation (RLO) and Bayesian optimisation (BO), hold great promise for achieving outstanding plant performance and reducing tuning times. Which algorithm to choose in different scenarios, however, remains an open question. Here we present a comparative study using a routine task in a real particle accelerator as an example, showing that RLO generally outperforms BO, but is not always the best choice. Based on the study's results, we provide a clear set of criteria to guide the choice of algorithm for a given tuning task. These can ease the adoption of learning-based autonomous tuning solutions to the operation of complex real-world plants, ultimately improving the availability and pushing the limits of operability of these facilities, thereby enabling scientific and engineering advancements.

Primary author: KAISER, Jan (DESY)

Co-authors: SANTAMARIA GARCIA, Andrea (KIT); EICHLER, Annika (MSK (Strahlkontrollen)); XU, Chenran (KIT); Dr BRUENDERMANN, Erik (KIT); BURKART, Florian (MPY1 (MPY Fachgruppe 1)); Dr MAYET, Frank (MPY1 (MPY Fachgruppe 1)); DINTER, Hannes (MPY1 (MPY Fachgruppe 1)); SCHLARB, Holger (MSK (Strahlkontrollen)); STEIN, Oliver (D3 (Strahlenschutz)); VINATIER, Thomas (MPY1 (MPY Fachgruppe 1)); KUROPKA, Willi (MPY1 (MPY Fachgruppe 1))

Presenter: KAISER, Jan (DESY)

Session Classification: Speedtalks: Controls/Seeding/DAQ

Track Classification: ST - Beam control

Contribution ID: **225** Type: **Speed talk & Poster**

Improvements in Longitudinal Phase Space Tomography at PITZ

Friday, 7 July 2023 10:47 (3 minutes)

At the Photo Injector Test facility at DESY in Zeuthen, Longitudinal Phase Space (LPS) tomography is done to reconstruct the LPS before the booster. In order to improve the existing technique, methodical studies were done where some core concerns were addressed e.g. booster phase scan range, momentum resolution and space-charge effects. An analytical model was developed to quantify RMS energy spread, bunch length and phase advance. Phase advance analysis determined the booster phase range and step size to be used for obtaining momentum projections. The signal resolution of these projections was improved by careful beta function control at the reference screen of the momentum measurements. The reconstruction method was updated from algebraic reconstruction technique to image space reconstruction algorithm and an initial scientific presumption of LPS from low energy section momentum measurements was established. The aforementioned reforms resulted in reduced noise-like artefacts, better convergence speed and accurate longitudinal emittance. The method was tested on simulations as well as on experimental data. It can diagnose not only linear chirp in LPS but also higher order effects. Experiment with modulated laser beam was also designed to demonstrate the diagnostic capability.

Primary authors: HOFFMANN, Andreas (Z_PITZ (Technologie)); OPPELT, Anne (DESY); RICHARD, Christopher James (Z_PITZ (Betrieb und Forschung)); STEPHAN, Frank (DESY); GEORGIEV, Georgi (Z_PITZ (Betrieb und Forschung)); VASHCHENKO, Grygorii (Z_DV (Datenverarbeitung)); Dr QIAN, Houjun (DESY); Mr DAVID GOOD, James (DESY); GROSS, Matthias (Z_PITZ (Technologie)); KRASILNIKOV, Mikhail (DESY Zeuthen); AFTAB, Namra (Z_PITZ (Betrieb und Forschung)); BOONPORNPRASERT, Prach (Z_PITZ (Betrieb und Forschung)); NIEMCZYK, Raffael (Helmholtz-Zentrum Dresden-Rossendorf); Dr WEILBACH, Tobias (Z_PITZ (Technologie)); LI, Xiangkun (DESY Zeuthen)

Presenter: AFTAB, Namra (Z_PITZ (Betrieb und Forschung))

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **226** Type: **Speed talk & Poster**

Simulation Optimisation of the 3.5-cell 1.3 GHz SRF Gun for DALI

Friday, 7 July 2023 10:50 (3 minutes)

At HZDR, the development of the Dresden Advanced Light Infrastructure (DALI) - a successor of the existing ELBE user facility, is ongoing. The new user facility will operate several SRF linac-based MIR-THz sources. The main motivation for the new facility is the user community request to increase the photon pulse energy from a few µJ, available now, to a few hundred µJ and even a mJ, in the frequency range from 0.1 to 30 THz. The new facility will operate in CW mode, as supported by ELBE SRF linac technology, with a high pulse repetition rate ranging from 10 kHz through 1 MHz. Achieving the very high photon pulse energy required operation with a high bunch charge of about 1 nC. In this contribution, we present a study on the possibility of supplying the accelerators with a 1 nC beam by the SRF gun, similar to the one successfully operating at ELBE. Genetic optimizers were used to find the optimum injector settings for minimal transverse and longitudinal emittance of the electron beam.
Our contribution shows the baseline layout of the planned accelerator complex at DALI and a sketch of the considered SRF gun for DALI. We present the Pareto front of optimal beam properties achieved in ASTRA simulations, as well as the development of beam properties in the beamline and the phase spaces for one injector's possible working point as an example.

Primary authors: ARNOLD, André (HZDR); EVTUSHENKO, Pavel (HZDR (ELBE)); NIEMCZYK, Raffael (Helmholtz-Zentrum Dresden-Rossendorf); LEHNERT, Ulf (Helmholtz-Zentrum DResden-Rossendorf)

Presenter: NIEMCZYK, Raffael (Helmholtz-Zentrum Dresden-Rossendorf)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **227** Type: **Speed talk & Poster**

First Online Reinforcement Learning on Hardware at a Particle Accelerator

Thursday, 6 July 2023 10:39 (3 minutes)

Future particle accelerators will challenge the capabilities of current control systems. One of the possible solutions is the use of Machine Learning techniques. While several algorithms have already been implemented and are in current operation, some specific problems will require novel hardware systems in order to satisfy throughput and latency constraints.
In this study, we employ the KINGFISHER platform developed at IPE, which is based on the innovative Xilinx Versal ACAP, to effectively control horizontal betatron oscillations caused by a kicker at KARA. This control is achieved through the turn-by-turn action of a Reinforcement Learning agent. Notably, this is the first instance of online agent training implemented on hardware at a particle accelerator.

Primary author: SCOMPARIN, Luca (KIT IPE)

Presenter: SCOMPARIN, Luca (KIT IPE)

Session Classification: Speedtalks: Controls/Seeding/DAQ

Track Classification: ST - Beam control

Contribution ID: **228** Type: **Oral presentation**

First EEHG Seeding at FLASH

Thursday, 6 July 2023 09:20 (20 minutes)

FLASH demonstrated recently for the first time seeded operation with the echo-enabled harmonic generation (EEHG) scheme. Additionally, the second FEL beamline was simultaneously operated in self-amplified spontaneous emission (SASE). This is a significant milestone towards the successful implementation of the FLASH2020+ project, aiming at the parallel operation of high repetition rate seeding and SASE after the upgrade of FLASH.

Primary author: PARASKAKI, Georgia (MFL (FLASH))

Presenter: PARASKAKI, Georgia (MFL (FLASH))

Session Classification: Session: Controls/Seeding/DAQ

Track Classification: Beam control

Contribution ID: **229** Type: **Speed talk & Poster**

Test Bench for the PETRA IV FOFB System Identification

Thursday, 6 July 2023 10:42 (3 minutes)

A fast orbit feedback system is currently being developed for the upcoming fourth generation of the PETRA IV light source at DESY Hamburg. The performance of the FOFB system depends mainly on the frequency response of the subsystems, i.e. the corrector magnets, power supplies, cables, and vacuum chamber. A test bench is being developed for measuring the field quality of FOFB corrector magnets and system identification of all subsystems in the kHz range. The requirements for the test bench and the initial ideas for the different types of measurement techniques are presented.

Primary author: AMJAD, Adeel (MSK (Strahlkontrollen))

Co-authors: BARKER, Anthony (MSK (Strahlkontrollen)); DURSUN, Burak (MSK (Strahlkontrollen)); Dr SCHLARB, Holger (MSK (Strahlkontrollen)); MIRZA, Sajjad Hussain (MSK (Strahlkontrollen)); PFEIFFER, Sven (MSK (Strahlkontrollen))

Presenter: AMJAD, Adeel (MSK (Strahlkontrollen))

Session Classification: Speedtalks: Controls/Seeding/DAQ

Track Classification: ST - Beam control

Contribution ID: **230** Type: **Speed talk & Poster**

Design and Test of Beam Diagnostics Equipment for the FAIR Proton Linac

Friday, 7 July 2023 10:53 (3 minutes)

The future proton injector Linac (pLinac) for the Facility of Antiproton and Ion Research (FAIR) at GSI, Darmstadt, will provide a 68 MeV, up to 70 mA proton beam at a duty cycle of max. 35µs / 2.7 Hz for the SIS18/SIS100 synchrotrons, using the existing UNILAC transfer beamline. The Linac will operate at 325 MHz and consists of a novel so called 'Ladder'RFQ, followed by a chain of CH-cavities, partially coupled by rf-coupling cells. In this contribution we present the beam diagnostics system for the pLinac with special emphasis on the Secondary Electron Emission (SEM) Grids and the Beam Position Monitor (BPM) system. We also describe design and status of our diagnostics testbench for stepwise Linac commissioning, which includes an energy spectrometer with associated optical system.

Primary authors: SIEBER, Thomas (GSI Helmholtzzentrum für Schwerionenforschung); FORCK, Peter (GSI Helmholtzzentrum für Schwerionenforschung); Dr KLEFFNER, Carl (GSI Helmholtzzentrum für Schwerionenforschung); UDREA, Serban (GSI Helmholtzzentrum für Schwerionenforschung); Dr HERRANZ, Juan (PROACTIVE R&D); Dr BUSTINDUY, Ibon (ESS Bilbao); Dr RODRIGUEZ PARAMO, Angel (ESS Bilbao); Dr NAVARRO FERNANDEZ, Araceli (CERN)

Presenter: UDREA, Serban (GSI Helmholtzzentrum für Schwerionenforschung)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **231** Type: **Oral presentation**

New Picosecond Timing System for ELBE

Thursday, 6 July 2023 10:00 (20 minutes)

The ELBE timing system has been patched several times in order to meet changing requirements. In 2019 the development of a new timing system based on Micro Research Finland Hardware has been started which is designed to unify the heterogeneous structure and to replace obsolete components. The system generates complex beam patterns from single pulse, to macro pulse and 26 MHz cw operation including special triggers for diagnostics and machine subsystems. In spring 2023 the software and firmware development of the software has been accomplished, which included the mapping of operation mode and different complex beam patterns onto the capabilities of the commercial platform. It is planned to do the transition to the new timing system in the course of 2023.

Primary author: KUNTZSCH, Michael (MSK (Strahlkontrollen))

Co-authors: OVEN, Ziga (COSYLAB); JUSTUS, Matthias (Helmholtz-Zentrum Dresden-Rossendorf); ZENKER, Klaus (Helmholtz-Zentrum Dresden-Rossendorf); SCHWARZ, Andreas (Helmholtz-Zentrum Dresden-Rossendorf, radiation source ELBE); KRMPOTIC, Luka (COSYLAB); PERUSKO, Luka (COSYLAB); ROJEC, Ursa (COSYLAB); LEGAT, Uros (COSYLAB)

Presenter: KUNTZSCH, Michael (MSK (Strahlkontrollen))

Session Classification: Session: Controls/Seeding/DAQ

Track Classification: Beam control

Contribution ID: **232** Type: **not specified**

Study on spill quality and transit times for tune sweep slow extraction from SIS18

Thursday, 6 July 2023 10:54 (3 minutes)

The temporal quality on the 100 micro-second scale of the slowly extracted spill from GSI SIS18 is crucial for fixed-target experiments, which is influenced by the power supply ripples that act on the quadrupole magnets, causing temporal fluctuations, the so-called spill micro structure. Extensive simulations regarding the dependency of spill quality and transit time on the power supply ripples and beam parameters are executed. These results are compared to detailed beam-based measurements.

Primary authors: YANG, Jiangyan (GSI); FORCK, Peter (GSI); SINGH, Rahul (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); SORGE, Stefan (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Presenter: YANG, Jiangyan (GSI)

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **233** Type: **Oral presentation**

Improving Beam-Based Regulation with Disturbance Model-Based Design for Continuous-Wave Linear Accelerators

Friday, 7 July 2023 09:40 (20 minutes)

Regulating the arrival time of electron bunches is a crucial step to improve the temporal resolution of accelerator-based time-resolved experiments. Nowadays, a regulation method, called beam-based feedback, has been shown to work well for stabilizing the arrival time on pulsed accelerator machines. Essentially, this method resembles a typical design of a simple proportional regulator, where the plant is represented by an electron beam response matrix, and where the inversion of such matrix produces the regulator.

In recent years, however, linear accelerators that operate in a continuous-wave mode have received increasing attention. One of the key features of such machines is the improved statistics of measured data, which enables a high-resolution spectral analysis of the noise acting on the electron beam. This new insight allows to reinterpret the electron beam regulation as a disturbance rejection goal, where the disturbance is based on measured frequency data.

In this contribution, we show that the proportional beam-based feedback method has a principal performance limitation that becomes apparent by analyzing continuous-wave data. To improve this situation, we propose a regulator design that incorporates a dynamical disturbance model formulated in the context of a so-called H2 mixed-sensitivity problem. With the help of measurement data, we demonstrate that a single regulation stage, which is installed in a continuous-wave linear accelerator and features a disturbance model-based beam-based regulator, has a potential to outperform the commonly used proportional regulator, without compromising the plant stability.

Primary author: MAALBERG, Andrei (Helmholtz-Zentrum Dresden-Rossendorf)

Co-authors: KUNTZSCH, Michael (HZDR); ZENKER, Klaus (Helmholtz-Zentrum Dresden-Rossendorf); Prof. PETLENKOV, Eduard (Tallinn University of Technology)

Presenter: MAALBERG, Andrei (Helmholtz-Zentrum Dresden-Rossendorf)

Session Classification: Session: Beam Diagnostics

Track Classification: Beam diagnostics

Contribution ID: **234** Type: **Speed talk & Poster**

Simulations for an XUV High-Gain FEL Oscillator at FLASH

Thursday, 6 July 2023 10:57 (3 minutes)

Externally seeded high-gain FELs provide fully coherent radiation with high shot-to-shot stability at wavelengths tunable down to the soft X-ray range (applying harmonic conversion). However, the lack of suitable seed laser sources has been limiting the generation of such short-wavelength FEL radiation to low repetition rates. So, such setups have been unable to make use of the full repetition rate of superconducting machines.
Cavity-based FELs have been proposed as a possible way to overcome these limitations, combining short wavelengths and high repetition rates, while preserving full coherence.
We present simulations for such a high-gain FEL oscillator, currently under implementation at FLASH, which is aimed at the operation at the wavelength of 13.5 nm and the repetition rate of 3 MHz.
Achieving bunching on that wavelength would open the possibility of generating fully coherent radiation at much shorter wavelengths with the use of harmonic conversion schemes.

Primary authors: FERRARI, Eugenio (MPY (Beschleunigerphysik)); PARASKAKI, Georgia (MFL (FLASH)); ASATRIAN, Margarit (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); Dr MILTCHEV, Velizar (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); HILLERT, Wolfgang (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Presenter: ASATRIAN, Margarit (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik))

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **235** Type: **Speed talk & Poster**

Preparatory measurements for the comparison of scientific camera systems to be used for beam diagnostics purposes

Friday, 7 July 2023 10:56 (3 minutes)

In beam diagnostics cameras are used for beam characterization by imaging beam induced fluorescence (BIF). This way the transverse profile of the beam can be determined. The amount of light generated through BIF is in many cases very low. Under such conditions extremely sensitive camera systems have to be used. The final aim of the work presented here is to compare three different such systems: emCCD, ICCD and sCMOS. As light sources for this comparison LEDs at different wavelenghts will be used. The present contribution gives an overview of the work done to characterize these LEDs and of the experimental setup prepared for performing the comparison.

Primary author: BAUER, Leonie (GSI)

Co-authors: Dr HÄHNEL, Hendrik (Goethe Universität Frankfurt); FORCK, Peter (GSI); UDREA, Serban (GSI Helmholtzzentrum für Schwerionenforschung)

Presenter: BAUER, Leonie (GSI)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **236** Type: **Speed talk & Poster**

Overview of Terahertz detectors technologies for particle accelerator application

Friday, 7 July 2023 10:59 (3 minutes)

Accelerator-Based Terahertz (THz) radiation sources[1] open new domains for both physical matter as well as application based research in the Terahertz domain. The generated THz Spectrum as well as its pulse shape is of importance for both, beam line scientists in order to study the beam dynamics[2] as well as for the experimental scientists in order to use THz signals for numerous studies.
Various cryogenic and room-temperature based detection technologies for THz signals are available for medium and high power THz signals. The detectors can be subdivided into heterodyne (mixing) and homodyne (direct detection). For several applications, broadband room-temperature Terahertz detectors are well suitable for beam diagnosis and alignment at accelerator facilities due to easy handling, compact size, direct detection and robustness [3,4]. Zero-Bias Schottky Diode (ZBSD) based detectors are highly sensitive and extremely fast, enabling detection of picosecond scale THz pulses.
In this work, we present a brief overview of various types of THz detector technologies available for beam diagnostic and beam dynamic studies. Along with that we will show the latest results of THz detectors developed by our research group. Future development prospects of the detector will be discussed in the outlook section.
The work is supported by the German Federal Ministry of Education and Research (BMBF) under contract no. 05K22RO1..
References:
[1] Müller, Anke-Susanne, and Markus Schwarz. “Accelerator-based THz radiation sources.” Synchrotron Light Sources and Free-Electron Lasers: Accelerator Physics, Instrumentation and Science Applications (2020): 83-117.
[2] Steinmann, Johannes Leonhard. Diagnostics of short electron bunches with THz detectors in particle accelerators. KIT Scientific Publishing, 2019.
[3] Yadav, Rahul, et al. “State-of-the-Art Room Temperature Operable Zero-Bias Schottky Diode-Based Terahertz Detector Up to 5.56 THz.” Sensors 23.7 (2023): 3469.
[4] Preu, Sascha, et al. “THz autocorrelators for ps pulse characterization based on Schottky diodes and rectifying field-effect transistors.” IEEE Transactions on Terahertz Science and Technology 5.6 (2015): 922-929.

Primary author: YADAV, Rahul (Terahertz Devices and Systems, IMP , TU Darmstadt)

Co-authors: PENIRSCHKE, ANDREAS; Dr PREU, Sascha (Terahertz Devices and Systems, IMP , TU Darmstadt)

Presenter: YADAV, Rahul (Terahertz Devices and Systems, IMP , TU Darmstadt)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **237** Type: **Speed talk & Poster**

Arrival time measurement reliability

Friday, 7 July 2023 11:02 (3 minutes)

Reliability and reproducibility of the measurement is what separates proof of principle or experimental diagnostics from systems used for day to day accelerator operation. The poster describes the steps that were taken to bring the Bunch Arrival Time Monitors of EuXFEL and FLASH to steady operation.

Primary author: KRAL, Jiri (MSK (Strahlkontrollen))

Co-authors: ROEVER, Jan (MSK (Strahlkontrollen)); GEORG, Jens (MSK (Strahlkontrollen)); BUECHLER, Michael (MSK (Strahlkontrollen)); Dr CZWALINNA, Marie Kristin (DESY, MSK (Strahlkontrollen))

Presenter: KRAL, Jiri (MSK (Strahlkontrollen))

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **238** Type: **Speed talk & Poster**

Present status of the magnetic bunch compressor at PITZ

Thursday, 6 July 2023 11:00 (3 minutes)

THz free electron laser (FEL) prototype has been developed at the Photo Injector Test Facility at DESY in Zeuthen (PITZ) for obtaining high intensity radiation for THz-pump and X-ray-probe experiments at the European XFEL. In this development, a magnetic bunch compressor (BC) was recently installed in the facility to manipulate the longitudinal properties of the electron bunch, resulting in the enhancement of the THz free-electron laser (FEL) performance. The objective of this study is to explore the electron beam dynamics throughout the magnetic BC using simulated software in order to determine the methodology employed for electron beam commissioning in the experiments. The simulated results have provided a practical method to minimize electron beam dispersion after the BC in the experiment. The method for minimizing dispersion and the commissioning results of the energy measurement of coherent transition radiation (CTR) obtained by applying this method to the magnetic bunch compressor (BC) during the commissioning process are presented in this contribution.

Primary author: KONGMON, Ekkachai (Z_PITZ (Beschleunigerphysik))

Presenter: KONGMON, Ekkachai (Z_PITZ (Beschleunigerphysik))

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **239** Type: **Speed talk & Poster**

Towards Fiber Optics-Guided Synchrotron Radiation-Based Longitudinal Beam Diagnostics at the KARA Booster Synchrotron

Friday, 7 July 2023 11:05 (3 minutes)

Before injection into the Karlsruhe Research Accelerator (KARA), the electron storage ring of the KIT Light Source, the beam energy is ramped up from 53 MeV to 500 MeV by a booster synchrotron. The whole booster is located in a concrete enclosure inside the storage ring and thus not accessible during operation. For the study of longitudinal beam dynamics, a cost-effective solution to leverage the synchrotron radiation emitted at the booster bending magnets is desired. To ensure durability of the setup and to not obstruct the removable concrete ceiling of the booster enclosure, it is required to place the radiation-sensitive readout electronics outside of the booster enclosure and outside of the storage ring. In this contribution, a fiber-optic setup consisting of commercially available optical components, such as collimators, optical fibers and high bandwidth photodetectors are used. As a proof-of-concept, we present experimental results of different components characterized at the visual light diagnostics port of the storage ring KARA. In addition, we report on further improvements of the setup along with planned future experiments.

Primary author: NOLL, Marvin (KIT)

Co-authors: MUELLER, Anke-Susanne (KIT); Mr GOFFING, Christian (KIT); WIDMANN, Christina (KIT); EL KHECHEN, Dima (KIT, Karlsruhe Institute of Technology); Dr BRUENDERMANN, Erik (KIT); STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT)

Presenter: NOLL, Marvin (KIT)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **240** Type: **Speed talk & Poster**

Design and Unused Potentials of the 67-GHz Electro-Optical PCB-BAM Prototype for ELBE

Friday, 7 July 2023 11:08 (3 minutes)

In most accelerator facilities the machine synchronization is crucial. It depends on bunch arrival-time measurements with high precision, which can be achieved either by RF synchronization or by an electro-optical detection scheme. For very low bunch charges down to a few pC, a single-digit fs resolution cannot not be reached with the state-of-the-art bunch arrival-time monitors (BAM). A new generation of pickups was proposed and gave promising simulation results. A theoretical jitter charge product in the order of 9 fs pC has been estimated for a system with updated pickups in combination with a new electro-optical modulator. As a proof-of-concept a dedicated vacuum sealed prototype was designed for measurements at ELBE. In this contribution the design of the prototype is presented, with focus on the mechanical layout and the unutilized potential for an optimized design.

Primary author: SCHEIBLE, Bernhard Erich Juergen (Technische Hochschule Mittelhessen)

Co-authors: Prof. PENIRSCHKE, Andreas (Technische Hochschule Mittelhessen); Prof. DE GERSEM, Herbert (Technische Universität Darmstadt); Dr SCHLARB, Holger (DESY); Dr CZWALINNA, Marie Kristin (DESY, MSK (Strahlkontrollen)); KUNTZSCH, Michael (HZDR); THEVARUPARAMBU ABDUL NAZER, Nisamol (MSK (Strahlkontrollen)); Dr ACKERMANN, Wolfgang (Technische Universität Darmstadt)

Presenter: SCHEIBLE, Bernhard Erich Juergen (Technische Hochschule Mittelhessen)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **241** Type: **Oral presentation**

Bunch Shape at GSI ion LINAC using coherent transition radiation in the GHz range and comparison to FAST Faraday Cups

Friday, 7 July 2023 09:20 (20 minutes)

Besides the classical Feschenko monitor also Fast Faraday Cups (FFC) and GHz Transition Radiation monitors (GTR) are able to measure the longitudinal bunch shape. While the Feschenko monitor observes an averaged bunch shape, both latter devices can measure the shape bunch by bunch within a bunch train. In this contribution we want to show the current research at GSI ion LINAC on FFCs and GTRs and highlight the advantages and disadvantages of both devices.

Primary author: KLAPROTH, Stephan (THM / TU Darmstadt / GSI (BSI))

Co-authors: PENIRSCHKE, ANDREAS; DE GERSEM, Herbert (Technische Universität Darmstadt); SINGH, Rahul (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Presenter: KLAPROTH, Stephan (THM / TU Darmstadt / GSI (BSI))

Session Classification: Session: Beam Diagnostics

Track Classification: Beam diagnostics

Contribution ID: **242** Type: **Speed talk & Poster**

Longitudinal beam dynamics for different initial distributions at cSTART

Thursday, 6 July 2023 11:03 (3 minutes)

The compact STorage ring for Accelerator Research and Technology (cSTART) project aims to store electron bunches of LPA-like beams in a very large momentum acceptance storage ring. The project will be realized at the Karlsruhe Institute of Technology (KIT, Germany).
Initially, the Ferninfrarot Linac- Und Test-Experiment (FLUTE), a source of ultra-short bunches, will serve as an injector for cSTART to benchmark and emulate laser-plasma accelerator-like beams. In a second stage, a laser-plasma accelerator will be used as an additional injector, which is being developed as part of the ATHENA project in collaboration with DESY and Helmholtz Institute Jena (HIJ).
With an energy of 50 MeV and damping times of several seconds, the electron beam does not reach equilibrium emittance within the storage time of about 100 milliseconds.
Therefore, the initial phase space distribution influences the later dynamics and beam properties. We perform longitudinal particle tracking simulations to investigate the evolution of the bunch lengths and phase space densities for different initial beam distributions.

Primary author: SCHWARZ, Markus (KIT)

Co-authors: MUELLER, Anke-Susanne (KIT); HAERER, Bastian (Karlsruhe Institute of Technology (KIT)); SCHÄFER, Jens (KIT IBPT); Mr BRANER, Simon (KIT)

Presenter: SCHWARZ, Markus (KIT)

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **244** Type: **Speed talk & Poster**

Characterization and optimization of laser-generated THz beam for THz based streaking

Friday, 7 July 2023 11:11 (3 minutes)

In preparation of future streaking experiments at the FLUTE linear accelerator using a split-ring resonator (SRR) structure we present measurements of the laser-based THz generation setup. We also show some efforts to improve the THz pulse strength using a different lens material and a dry air box to reduce the impact of water vapor.

Primary authors: NABINGER, Matthias (KIT); NASSE, Michael (Karlsruhe Institute of Technology)

Co-authors: Mr SCHMIDT, André (Karlsruher Institute of Technology (KIT)); MUELLER, Anke-Susanne (KIT); XU, Chenran (KIT); WIDMANN, Christina (KIT); Dr BRUENDERMANN, Erik (KIT); SCHÄFER, Jens (KIT IBPT); STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT); Dr OLLMANN, Zoltan (University of Bern, Switzerland)

Presenter: NASSE, Michael (Karlsruhe Institute of Technology)

Session Classification: Speedtalks: Beam Diagnostics

Track Classification: ST - Diagnostics

Contribution ID: **245** Type: **Oral presentation**

Diagnostics for plasma-based electron accelerator e-beams

Thursday, 6 July 2023 12:15 (1 hour)

Plasma-based accelerators that impart energy gain as high as several GeV to electrons or positrons within a few centimeters have engendered a new class of diagnostic techniques very different from those used in connection with conventional radio-frequency (rf) accelerators [1]. The need for new diagnostics stems from the micrometer scale and transient structure of plasma accelerators, and from the micrometer source size, small normalized transverse emittance (εn < 0.1 mm mrad) and ultrashort duration (τb ~ 1 fs) of plasma-accelerated e-bunches, compared to those from RF linacs. Prof. Downer will first review single-shot diagnostics that the plasma accelerator community has developed to determine such small εn and τb noninvasively from measuring electromagnetic radiation from THz to X-rays that the electrons emit. Dr. LaBerge will then feature recent experimental results [2, 3] that measure the internal coherent nanostructure of plasma-accelerated e-bunches in a single shot by analyzing their coherent optical transition radiation over a wide spectral range.

[1] M. C. Downer, R. Zgadzaj, A. Debus, U. Schramm, and M. C. Kaluza, "Diagnostics for plasma-based electron accelerators,"Rev. Mod. Phys. 90, (2018).
[2] A. H. Lumpkin, M. LaBerge, et al., "Coherent optical emittance evaluations of microbunched electron beamlets from laser-driven plasma accelerators,"Phys. Rev. Lett. 125, 014801 (2020).
[3] M. LaBerge et al., "Coherent 3D microstructure of plasma-wakefield-accelerated e-bunches," in preparation (2023).

Presenters: Dr LABERGE, Max (HZDR); Prof. DOWNER, Mike (Department of Physics, University of Texas at Austin, USA)

Session Classification: Tutorials

Track Classification: Tutorial

Contribution ID: **246** Type: **Oral presentation**

Attosecond Pulse Generation Projects at EuXFEL

Thursday, 6 July 2023 14:35 (20 minutes)

Attosecond pulses generation and delivery are a major area of research at all FEL facilities. EuXFEL currently employs a few methods to generate atto-second pulses in both the hard and soft x-ray regime. The short-pulse capabilities are expanded by the ASPECT project to achieve a better control on the lasing window. All of those projects depend strongly on both diagnostic to both setup and characterize those pulses.

Primary author: GUETG, Marc (MXL (XFEL))

Presenter: GUETG, Marc (MXL (XFEL))

Session Classification: Session: Beam Dynamics

Track Classification: Beam dynamics

Contribution ID: **247** Type: **Speed talk & Poster**

Update on Laser Pulse Arrival Time Measurements for XFEL Experiments

Thursday, 6 July 2023 10:45 (3 minutes)

While the time arrival stability of the electron bunches in an FEL can be as good as 5-10 fs rms, the arrival time of the optical laser pulses is on the order of 10 fs rms or worse. Here will be presented the update on a laser pulse arrival time monitor: the arrival time of the optical pulses will be measured against a reference from the laser-based optical synchronization system. With a measurement as close as possible to the interaction point, instabilities due to laser beam transport can be evaluated and corrected either by time-sorting experimental data or actively in a feedback loop.

Primary author: KSCHUEV, Nick (MSK (Strahlkontrollen))

Presenter: KSCHUEV, Nick (MSK (Strahlkontrollen))

Session Classification: Speedtalks: Controls/Seeding/DAQ

Contribution ID: **248** Type: **Speed talk & Poster**

A compact S-band photocathode gun for single-shot ultrafast electron diffraction with femtosecond resolution

Thursday, 6 July 2023 11:06 (3 minutes)

R. Bazrafshan(1,4), G.H. Kassier(1), M. Fakhari(1), H. Delsim-Hashemi(2), T. Rohwer(1), K. Flöttmann(2), N.H. Matlis(1) and F. X. Kärtner(1,3,4)
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(2) Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
(3) The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Germany
(4) Physics Department, Universität Hamburg, Germany

We present a compact electron source for a high-temporal-resolution ultrafast electron diffraction (UED) instrument. The source, which employs field-enhancement at a pin-shaped photocathode to produce an extraction field strength of about 100 MV/m driven by a solid-state rack-mountable 10-W-average power, 10-kW-peak power S-band RF amplifier, can generate 180 keV electron bunches of 100 fC charge that compress via velocity bunching down to 30 fs with a radius of 220 μm, and spatial emittance of 0.1 mm-mrad at a distance of 8 cm from the photocathode. The impact of laser spot size and duration, as well as their spatial distribution, on the temporal bunch length of electrons on the specimen was investigated. Following the successful completion of the conditioning phase of the RF gun and multipacting suppression, photo-triggered electrons using a UV laser on the photocathode were observed.

Primary author: BAZRAFSHAN DELIJANI, Reza (FS-CFEL-2 (Ultrafast X-rays Group))

Presenter: BAZRAFSHAN DELIJANI, Reza (FS-CFEL-2 (Ultrafast X-rays Group))

Session Classification: Speedtalks: Beam Dynamics

Track Classification: ST - Beam dynamics

Contribution ID: **249** Type: **Speed talk & Poster**

All PDF of session control and dynamics

Thursday, 6 July 2023 11:09 (1 minute)

Presenters: BRUENDERMANN, Erik (KIT); Dr SCHLARB, Holger (DESY)

Session Classification: Speedtalks: Beam Dynamics