MT ARD ST3 Meeting 2021 in Hamburg

Report of Contributions

https://indico.desy.de/e/28823

Contribution ID: **60** Type: **not specified**

Introduction to the MicroTCA Systems

Wednesday, September 29, 2021 4:00 PM (1 hour)

Presenter: GUEMUES, Cagil (MSK (Strahlkontrollen))

Session Classification: Tutorials

Contribution ID: **63** Type: **Speed talk**

ARES - status update

Thursday, September 30, 2021 4:00 PM (5 minutes)

Status update of the ARES construction works and results from beam commissioning.

Summary

Primary author: BURKART, Florian (MPY1 (MPY Fachgruppe 1))

Presenter: BURKART, Florian (MPY1 (MPY Fachgruppe 1))

Session Classification: Session Beam Dynamics

Contribution ID: **64** Type: **Speed talk**

Impedance studies of a corrugated pipe at KARA

Thursday, September 30, 2021 4:35 PM (5 minutes)

At the KIT storage ring KARA (KArlsruhe Research Accelerator) it is
planned to install an impedance manipulation structure in a versatile chamber
to study and eventually control the in
uence of an additional impedance on
the beam dynamics and the emitted coherent synchrotron radiation. For this
purpose the impedance of a corrugated pipe is under investigation. In this contribution,
we present results of simulations showing the impact of different
structure parameters on its impedance.
This work is supported by the DFG project 431704792 in the ANR-DFG
collaboration project ULTRASYNC.
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Summary

Primary author: MAIER, Sebastian (KIT)

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

Presenter: MAIER, Sebastian (KIT)

Session Classification: Session Beam Dynamics

Contribution ID: **66** Type: **Speed talk**

Slice energy spread measurements at PITZ

Thursday, September 30, 2021 4:10 PM (5 minutes)

Slice energy spread is one of the key parameters of beam brightness for free electron laser optimizations, but its measurement is not straightforward. Two recent studies at high energy (>100 MeV) photoinjectors at SwissFEL and European XFEL have measured much higher slice energy spread than simulations, leading to the debate of necessity of laser heaters. In this report, we will show a new method of measuring slice energy spread in the low energy (~20 MeV) photoinjector at PITZ, and the results are much closer to simulations.

Summary

Primary author: KRASILNIKOV, Mikhail (Z_PITZ (Betrieb und Forschung))

Presenters: KRASILNIKOV, Mikhail (Z_PITZ (Betrieb und Forschung)); Mr QIAN, Houjun

Session Classification: Session Beam Dynamics

Contribution ID: **67** Type: **Oral presentation**

Welcome

Wednesday, September 29, 2021 1:00 PM (20 minutes)

Presenter: LEEMANS, Wim

Session Classification: Welcome

Contribution ID: **68** Type: **Oral presentation**

Photocathode laser pulse shaping results

Thursday, September 30, 2021 2:25 PM (25 minutes)

Presenter: KOSCHITZKI, Christian (Z_PITZ (Technologie))

Session Classification: Session Beam Dynamics

Contribution ID: **70** Type: **Oral presentation**

Facility status DESY

Wednesday, September 29, 2021 1:20 PM (25 minutes)

Summary

Presenter: Dr SCHLARB, Holger

Session Classification: Session Facility Talks

Contribution ID: **71** Type: **Oral presentation**

Facility status HZDR

Wednesday, September 29, 2021 1:45 PM (25 minutes)

Presenter: Dr EVTUSHENKO, Pavel (HZDR / ELBE)

Session Classification: Session Facility Talks

Contribution ID: **72** Type: **Oral presentation**

Facility status HZB

Wednesday, September 29, 2021 2:10 PM (25 minutes)

Summary

Presenter: KAMPS, Thorsten (HZB)

Session Classification: Session Facility Talks

Contribution ID: **73** Type: **Oral presentation**

Facility status GSI

Wednesday, September 29, 2021 2:45 PM (25 minutes)

Summary

Presenter: WEINRICH, Udo (GSI)

Session Classification: Session Facility Talks

Contribution ID: **74** Type: **Oral presentation**

Facility status KIT

Wednesday, September 29, 2021 3:10 PM (25 minutes)

Summary

Presenter: Dr SCHUH, Marcel

Session Classification: Session Facility Talks

Contribution ID: **75** Type: **Oral presentation**

PITZ facility overview and plans

Wednesday, September 29, 2021 3:35 PM (20 minutes)

Presenter: Dr WEILBACH, Tobias (Z_PITZ (Technologie))

Session Classification: Session Facility Talks

Contribution ID: **76** Type: **Oral presentation**

Attosecond Field Receiver Technology

Thursday, September 30, 2021 9:00 AM (25 minutes)

Presenter: Dr LUDWIG, Frank

Session Classification: Session Beam Controls

Contribution ID: **77** Type: **Oral presentation**

Towards autonomous tuning and control of accelerators

Thursday, September 30, 2021 9:50 AM (25 minutes)

Presenter: XU, Chenran (KIT)

Session Classification: Session Beam Controls

Contribution ID: **78** Type: **Oral presentation**

Longitudinal beam dynamics cSTART

Thursday, September 30, 2021 2:00 PM (25 minutes)

To serve the diverse community at the ARD-ST 3 workshop, this presentation first introduces some key concepts of longitudinal beam dynamics before discussing the longitudinal beam dynamics at cSTART.

The compact STorage ring for Accelerator Research and Technology (cSTART) project aims to store electron bunches of laser-wakefield accelerator-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-wakefield accelerator-like beams. In a second stage a laser-plasma accelerator will be used as an 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. Furthermore, the critical frequency of synchrotron radiation is 53 THz and in the same order as the bunch spectrum, which implies that the entire bunch radiates coherently. We perform longitudinal particle tracking simulations to investigate the evolution of the bunch length and spectrum as well as the emitted coherent synchrotron radiation.

Summary

Presenter: SCHWARZ, Markus (KIT)

Session Classification: Session Beam Dynamics

Contribution ID: **79** Type: **Oral presentation**

Measurement of temporal distribution using accelerating radio frequency cavity in low-emittance injector

Thursday, September 30, 2021 2:50 PM (25 minutes)

Summary

Presenter: HWANG, Ji-Gwang (HZB)

Session Classification: Session Beam Dynamics

Contribution ID: **80** Type: **Speed talk**

Investigation of novel radiation hard fast scintillators for heavy ion beam diagnostics

Friday, October 1, 2021 12:35 PM (5 minutes)

At GSI ion beams of many elements, from H up to U, are produced with energy as high as 4.5 GeV/u with the SIS-18 synchrotron. For absolute beam intensity and micro-spill structure measurements a BC400 organic scintillator is used. Due to the low radiation hardness of this material, alternative inorganic scintillators like ZnO:Ga and ZnO:In are investigated. The properties and possible application of these novel radiation hard fast scintillators will be discussed.

Summary

Primary author: SAIFULIN, M.

Co-authors: BOUTACHKOV, P. (GSI); GOROKHOVA, E. (Vavilov State Optical Institute); RODNYI, P. (Polytechnic University Peter the Great); VENEVTSEV, I. (Polytechnic University Peter the Great); WALASEK-HÖHNE, B. (GSI)

Presenter: SAIFULIN, M.

Session Classification: Session Beam Diagnostics

Contribution ID: **81** Type: **Speed talk**

Decentralized Control Approach for the Optical Synchronization System at the European XFEL

Thursday, September 30, 2021 10:35 AM (5 minutes)

Like many other subsystems in particle accelerators, the optical synchronization system at the European XFEL implements a joint high-performance control task over individual stations along the spatial extend of the facility. In the case of the optical synchronization system, this ensures a stable timing reference in the region of a few femtoseconds over more than 3.5km distance. Using numerical simulations, we show that the performance can be improved even further by considering all individual control loops in the subsystem as part of a distributed complex system rather than tuning each loop individually. The resulting distributed optimization problem is in general rendered NP-hard because of the information constraints between the spatially separated systems and ways of obtaining a tractable program are discussed prior.

Summary

Primary author: Mr SCHÜTTE, Maximilian (MSK (Strahlkontrollen))

Co-authors: Dr EICHLER, Annika (MSK (Strahlkontrollen)); Mr MUELLER, Jost; Mr KOZAK, Tomasz; Mr KSCHUEV, Nick; Mr ZUMMACK, Falco; Mr LAMB, Thorsten; Ms CALENDRON, Anne-Laure; Dr SCHULZ, Sebastian; Mr FELBER, Matthias; Dr SCHLARB, Holger

Presenter: Mr SCHÜTTE, Maximilian (MSK (Strahlkontrollen))

Session Classification: Session Beam Controls

Contribution ID: **82** Type: **Speed talk**

First bunch duration measurement on the ARES linac at DESY

Thursday, September 30, 2021 11:10 AM (5 minutes)

The ARES linac at DESY aims at producing and characterizing ultrashort electron bunches for cutting-edge applications (e.g. advanced and compact longitudinal diagnostics development, advanced and compact accelerating structures test, FLASH radiotherapy, etc.). The targeted properties (100-150 MeV, down to sub-pC charge and sub-fs duration) make the characterization of the bunch duration a challenge on its own. A first measurement of the bunch duration on ARES, based on a traveling wave structure phase scan, was performed in spring 2021. Resolution-limited durations down to 50 fs rms for bunches compressed by velocity bunching were recorded. Two X-band transverse deflecting structures with variable streaking direction (PolariX type) will be commissioned end 2021 or beginning 2022 and will enable fully characterizing the ARES bunches with down to sub-fs resolution.

Summary

Primary author: VINATIER, Thomas (MPY1 (MPY Fachgruppe 1))

Co-authors: ASSMANN, Ralph; Dr BURKART, Florian; DINTER, Hannes (MPY1 (MPY Fachgruppe 1)); JASTER-MERZ, Sonja; KUROPKA, Willi (MPY1 (MPY Fachgruppe 1)); Dr MAYET, Frank (MPY1 (MPY Fachgruppe 1))

Presenter: VINATIER, Thomas (MPY1 (MPY Fachgruppe 1))

Session Classification: Session Beam Controls

Contribution ID: **83** Type: **Oral presentation**

Seeding concept and challenges for FLASH2020+

Thursday, September 30, 2021 9:25 AM (25 minutes)

Summary

Presenter: Dr NIKNEJADI, Pardis (MPY (Beschleunigerphysik))

Session Classification: Session Beam Controls

Contribution ID: **84** Type: **Oral presentation**

Time stretch EO measurements of bunch length at ELBE

Friday, October 1, 2021 10:25 AM (25 minutes)

The SRF linac-based Radiation Source ELBE operates with picosecond and sub-picosecond bunch length. The accelerator system provides beam in CW mode for two (FIR and MIR) FEL oscillators or for two THz sources comprising a superradiant undulator and coherent diffraction radiation (CDR) source. Performances of these sources depend critically on the bunch length. Single shot bunch length measurements made for every bunch at the repetition rate between 50 and 250 kHz is necessary for complete analysis of the THz sources stability. Electro-optical spectral decoding could fulfill these requirements. One drawback of the spectral decoding is the THz wavelength-dependance of the response function. This wavelength dependance can be very strong and can display zeros within wavelength ranges relevant for measurements. This has dramatic consequences on the temporal resolution, and typically leads to measurements that are strongly deformed versions of the actual THz pulse shapes. For solving this problem, It was suggested recently that THz EO spectral decoding can be upgraded [1] by borrowing a strategy from RF communications and time-stretch, known as the phase-diversity technique [2,3]. In this talk we report about first test of the EO spectral decoding measurements at ELBE which includes the phase-diversity detection scheme. The measurements are performed in single-shot on the THz CDR source. Moreover, the readout was made using the so-called photonic time-stretch technique [4], which allows the THz pulses to be recorded at high repetition rates. The EO system was used to record CDR pulses emitted at 50 KHz repetition rates. However the present measurement system was actually operating at 26 MHz acquisition rate.
[1] Phase Diversity Electro-optic Sampling: A new approach to single-shot terahertz waveform recording, https://arxiv.org/abs/2002.03782 [2] Kahn, L. R. Ratio squarer. Proceedings of the Institute of Radio Engineers 42, 1704 (1954) [3] Han, Y., Boyraz, O. & Jalali, B. Ultrawide-Band Photonic Time-Stretch A/D Converter Employing Phase Diversity. IEEE Trans. on Microwave Theory and Techniques 53, 1404 (2005). [4] Observing microscopic structures of a relativistic object using a time-stretch strategy, 5, 10330 (2015)

Summary

Primary author: HANOUN , Christelle (Lab. PhLAM, Lille University, France)

Presenters: RYZHOV, Anton (Helmolz-Zentrum Dresden-Rossendorf); SZWAJ, C. (Lab. PhLAM, Lille University, France); SCHNEIDER, Ch. (Helmholtz-Zentrum Dresden-Rossendorf); HANOUN , Christelle (Lab. PhLAM, Lille University, France); ROUSSEL, E. (Lab. PhLAM, Lille University, France); Dr KUNTZSCH, Michael; Dr EVTUSHENKO, Pavel (HZDR / ELBE); BIELAWSKI, S. (Lab. PhLAM, Lille University, France)

Session Classification: Session Beam Diagnostics

Contribution ID: **85** Type: **Oral presentation**

Inverse modeling of quadrupole gradients using orbit response measurement

Friday, October 1, 2021 10:50 AM (25 minutes)

During accelerator operation, quadrupole gradients can be different from the set values for a variety of reasons.
Precise knowledge of quadrupole gradient errors is desirable in order to improve the optics with respect to the model.
The measured orbit matrix response encodes the optics of the lattice and hence can be used for inverse modeling of quadrupole gradients. The thus derived parameter estimates are subject to measurement uncertainty of the
orbit response and hence a detailed study of the uncertainty propagation must be performed in order to build confidence in the thus derived results.
This contribution reports on the studies for the SIS18 synchrotron at GSI and investigates the feasibility of inverse modeling of quadrupole gradients.

Summary

Presenter: VILSMEIER, Dominik (PhD Student @ Goethe University Frankfurt)

Session Classification: Session Beam Diagnostics

Contribution ID: **86** Type: **Speed talk**

Room Temperature Broadband Terahertz Detectors for Particle Accelerator Beam Characterization and Diagnostic

Friday, October 1, 2021 11:40 AM (5 minutes)

Ultra-short pulses in the picosecond range, combined with the high repetition rate, high power and high brilliance at accelerator facilities opens a wide range possibilities for both fundamental as well as application-oriented research. Radiation generated at Free Electron Lasers (FELs) and Coherent Synchrotron Radiation (CSR) can be used for atomic and sub-atomic level studies. A frequent technique is the optical pump-THz probe method that is used traditionally for the study of matter and materials. The laser and THz pulses are not naturally phase-locked. Thus, time jitter is an obvious obstacle that must be monitored. It further aggravates the use of electro-optical sampling which is otherwise frequently used for table-top phase-locked pump-probe setups. However, room temperature based Schottky diode and Field Effect Transistor (FETs) broadband Terahertz (THz) direct detectors are well suited for monitoring time jitter. They are fast, highly sensitive, robust and easy to use, less expensive (compared to other counterparts such as Bolometers) and does not need cryogenic conditions for operation. FETs can be used much beyond their cut-off frequencies for the rectification of the detected THz radiation. Both type of THz detectors can be suited for aligning the experimental setup at accelerator facility during beam time as well as the diagnostic of THz beam during the maintenance of the beam line. The current limitation to these detectors is the post detection electronics, High frequency passive IF circuitry, packaging methods and system integration with other devices for data processing. In the talk, we will demonstrate the basic working principle of these detectors, state-of-the-art achieved by our group until now and current status.

Summary

Primary authors: Mr YADAV, Rahul (Terahertz Devices and Systems, IMP , TU Darmstadt); Prof. PENIRSCHKE, Andreas; Prof. PREU, Sascha (Terahertz Devices and Systems, IMP, TU Darmstadt)

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

Session Classification: Session Beam Diagnostics

Contribution ID: **87** Type: **Speed talk**

Transverse Electron Beam Emittance Measurements at FLUTE

Thursday, September 30, 2021 11:00 AM (5 minutes)

FLUTE (Ferninfrarot Linac- und Test-Experiment) is a compact linac-based test facility for accelerator R&D and source of intense THz radiation for photon science. In preparation for the next experiments, the electron beam of the injector section of FLUTE has been characterized. In systematic studies the electron beam parameters, e.g., beam charge and emittance, are measured with several diagnostic systems. This knowledge allows the establishment of different operation settings and the optimization of electron beam parameters for future experiments. This work is supported by the DFG-funded Doctoral School „Karlsruhe School of Elementary and Astroparticle Physics: Science and Technology (KSETA)“

Summary

Primary author: SCHMELZER, Thiemo (Karlsruhe Intitute of Technology (KIT))

Presenter: SCHMELZER, Thiemo (Karlsruhe Intitute of Technology (KIT))

Session Classification: Session Beam Controls

Contribution ID: **88** Type: **Speed talk**

Multi-alkali antimonides photocathodes for high-brightness RF photoinjectors

Thursday, September 30, 2021 11:05 AM (5 minutes)

Multi-alkali antimonide-based photocathodes are suitable candidates for the electron sources of next-generation high brightness RF photoinjectors due to their excellent photoemissive properties, especially low thermal emittances, and high sensitivity to visible light. The utilization of these photocathodes is so far successfully demonstrated in low field DC gun-based photoinjectors. However, their performance in a high field RF gun is still challenging due to their sensitivity towards vacuum conditions. Based on the previous R&D development, a batch of three KCsSb photocathodes of different thicknesses have been developed in a new production system at INFN LASA. Afterwards, these photocathodes are successfully tested and characterized for the first time in a normal conducting CW system at the photo injector test facility at DESY in Zeuthen (PITZ). This talk reports an overview of cathode preparation recipe with its test results like QE map evolution, thermal emittance, response time, and cathode lifetime.

Summary

Primary authors: MOHANTY, Sandeep (DESY Zeuthen); Mr QIAN, Houjun

Co-authors: KRASILNIKOV, Mikhail; Mr OPPELT, A. (DESY); Dr STEPHAN, F. (Desy); Mr SERTORE, D. (INFN LASA); Mrs MONACO , L. (INFN LASA); Mr MICHELATO, P. (INFN LASA); Mr ROCCO, G. Guerini (INFN LASA and Università degli Studi di Milano, Italy); Mr PAGANI, C. (INFN LASA and Università degli Studi di Milano, Italy); Dr HILLERT, W. (University of Hamburg, Germany)

Presenter: MOHANTY, Sandeep (DESY Zeuthen)

Session Classification: Session Beam Controls

Contribution ID: **90** Type: **Speed talk**

Time resolved UED with the SRF Photoinjector in Sealab

Thursday, September 30, 2021 4:05 PM (5 minutes)

Ultrafast Electron Diffraction (UED) is a technique used to observe dynamical changes in the structure of materials. It consists of a pump-probe scheme in which a laser pulse excites the target structure and a subsequent electron bunch scatters in the sample producing a diffraction pattern. The time resolution of MeV UED experiments is mainly governed by the electron bunch length and the time of flight jitter between the laser and electron pulses at the target. Hence, high brilliance and stable electron beams are needed. The SRF Photoinjector test facility in Sealab is a high brilliance and high current electron source being currently commissioned at Helmholtz-Zentrum Berlin (HZB). It offers unique possibilities to perform UED experiments since the original design composed by a L-band SRF electron gun followed by three L-band SRF booster cavities provides several knobs to manipulate the longitudinal phase space and time of flight fluctuations of the electron bunches. In order to accomplish the high brilliance beam, the longitudinal phase space of the bunch is linearized at the target while the time of flight jitter is kept as low as possible. In summary, we discuss the basic requirements for such experiment, the strategy to improve the time resolution and the outlook of the UED project in HZB.

Summary

Primary author: ALBERDI ESUAIN, Beñat (Helmholtz-Zentrum Berlin)

Co-authors: KAMPS, Thorsten (HZB); HWANG, Ji-Gwang (HZB); NEUMANN, Axel (Scientist, SRF); Mr VOELKER, Jens (Helmholtz-Zentrum Berlin)

Presenter: ALBERDI ESUAIN, Beñat (Helmholtz-Zentrum Berlin)

Session Classification: Session Beam Dynamics

Contribution ID: **91** Type: **Speed talk**

Bunch arrival stability at the European XFEL

Thursday, September 30, 2021 10:40 AM (5 minutes)

For pump-probe experiments at free electron lasers, like the European XFEL, a femtosecond precise bunch arrival time stability is mandatory. The longitudinal intra bunch-train feedback (L-IBFB) system regulates the arrival time, measured by a bunch arrival time monitor (BAM), with femtosecond resolution. Due to the energy dependent path length of the electron bunches through a magnetic bunch compression chicane, the energy prior to the chicane is modulated by the superconducting radiofrequency (SRF) cavities to compensate fast arrival time fluctuations of the bunches in a train. Measurement results show arrival time stabilities of the electron bunches below 10 fs (rms), if the longitudinal intra bunch-train feedback is activated.

Summary

Primary authors: LAUTENSCHLAGER, Bjoern (MSK (Strahlkontrollen)); BRANLARD, Julien; Dr CZWALINNA, Marie Kristin; KRAL, Jiri (MSK (Strahlkontrollen)); PFEIFFER, Sven (MSK (Strahlkontrollen)); Dr SCHLARB, Holger; SCHMIDT, Christian (MSK (Strahlkontrollen)); STEFFEN, Bernd (MSK (Strahlkontrollen))

Presenter: LAUTENSCHLAGER, Bjoern (MSK (Strahlkontrollen))

Session Classification: Session Beam Controls

Contribution ID: **92** Type: **Speed talk**

Influence of Different Beam Energies on the Micro-bunching Instability

Thursday, September 30, 2021 3:30 PM (5 minutes)

During the operation of an electron synchrotron with short electron bunches the beam dynamics are influenced by the occurrence of the micro-bunching instability. This collective instability is caused by the self-interaction of a short electron bunch with its own emitted coherent synchrotron radiation (CSR). Above a certain threshold bunch current dynamic micro-structures start to occur on the longitudinal phase space density. The resulting dynamics depend on various parameters and were previously investigated in relation to amongst others the momentum compaction factor and the acceleration voltage. In this contribution, the influence of the energy of the electrons on the dynamics of the micro- bunching instability is studied based on measurements at the KIT storage ring KARA (Karlsruhe Research Accelerator).

Summary

Primary author: Dr BROSI, Miriam (KIT)

Co-authors: Mr SCHREIBER, Patrick; Dr SCHUH, Marcel; MUELLER, Anke-Susanne (KIT)

Presenter: Dr BROSI, Miriam (KIT)

Session Classification: Session Beam Dynamics

Contribution ID: **93** Type: **Speed talk**

Latest developments in the split-ring resonator experiment

Friday, October 1, 2021 12:05 PM (5 minutes)

A compact, longitudinal diagnostics for fs-scale electron bunches using a THz electric-field transient in a split-ring resonator (SRR) for streaking will be tested at the Far Infrared Linac and Test Experiment (FLUTE). We present the most important measures that have been carried out in the course of the preparations for the experiment: These include, first, the redesign of the laser optics at FLUTE as well as the successful installation of a module for efficient generation of intense THz radiation and its characterization. On the other hand, further steps to ensure temporal and spatial overlap between electron bunch and THz pulse were initiated.

Summary

Primary author: NABINGER, Matthias (KIT)

Co-authors: Dr NASSE, Michael; Dr BRUENDERMANN, Erik; FUNKNER, Stefan (KIT); Dr HAERER, Bastian; MUELLER, Anke-Susanne; NIEHUES, Gudrun (KIT); RUPRECHT, Robert; SCHÄFER, Jens (KIT IBPT); Mr SCHMELZER, Thiemo; Dr SMALE, Nigel

Presenter: NABINGER, Matthias (KIT)

Session Classification: Session Beam Diagnostics

Contribution ID: **94** Type: **Speed talk**

Studies of Scintillators Nonproportionality

Friday, October 1, 2021 12:40 PM (5 minutes)

For the European XFEL it was decided to use scintillator screens, as the standard diagnostics based on optical transition radiation (OTR) would undergo coherent effects at the machine. LYSO:Ce was chosen as scintillator material. However significantly larger emittances have been measured during the comissioning of the XFEL. Moreover there were measured “smoke-ring” distributions [*] at high bunch charges.The effect is related to the material. Hence several other materials have been chosen for further tests. At first there were number of tests made at the XFEL. Later it was proposed to do the tests at PITZ as one can reach even higher charges. So the talk summs up and demonstrates the main results of the measurements.

- G. Kube et al., *Indentification and Mitigation of Smoke-Ring Effects in Scintillator Based Electron Beam Images at the European XFEL*, in Proc. FEL19, Hamburg, 2019, pp. 301-306.

Summary

Primary authors: NOVOKSHONOV, Artem (DESY); KUBE, Gero (MDI (Diagnose & Instrumentierung)); STEPHAN, Frank; OPPELT, Anne; MUELLER, Frieder (DESY); KRASILNIKOV, Mikhail (DESY); Dr GOOD, James; Mr QIAN, Houjun; Dr GROSS, Matthias

Presenter: NOVOKSHONOV, Artem (DESY)

Session Classification: Session Beam Diagnostics

Contribution ID: **95** Type: **Speed talk**

Effect of Negative Momentum Compaction Operation on the Current-Dependent Bunch Length

Thursday, September 30, 2021 3:35 PM (5 minutes)

New operation modes are often considered during the development of new synchrotron light sources. An understanding of the effects involved is inevitable for a successful operation of these schemes. At the KIT storage ring KARA (Karlsruhe Research Accelerator), new mode scan be implemented and tested at various energies, employing a variety of performant beam diagnostics devices. Negative momentum compaction optics at various energies have been established. Also,the influence of a negative momentum compaction factor on different effects has been investigated. This contribution comprises a short report on the status of the implementation of a negative momentum compaction optics at KARA. Additionally, first measurements of the changes to the current-dependent bunch length will be presented.

Summary

Primary author: SCHREIBER, Patrick (KIT)

Co-authors: BOLTZ, Tobias (KIT); Dr BROSI, Miriam (KIT); Dr HAERER, Bastian; MOCHIHASHI, Akira (Karlsruhe Institute of Technology); Dr PAPASH, Alexander; RUPRECHT, Robert; SCHUH, Marcel (KIT - ANKA); MUELLER, Anke-Susanne (KIT)

Presenter: SCHREIBER, Patrick (KIT)

Session Classification: Session Beam Dynamics

Contribution ID: **96** Type: **Speed talk**

Beam intensity measurement with secondary electron emission foil in comparison to fast current transformer.

Friday, October 1, 2021 12:30 PM (5 minutes)

The task of the Particle Detector Combination detectors is to measure the beam intensity of slowly extracted ion beams. The complete range of possible beam intensities at FAIR cannot be covered by single detector type. At GSI this task is accomplished by a combination of three detectors, a plastic SCintillator (SC), an Ionization Chamber (IC) and a Secondary Electron Monitor (SEM).
The SEM detector measures the amount of secondary electrons excited during the passage of charged particles through matter. The secondary electron yield for a single beam ion is experimentally determined by first calibrating the IC detector relative to the SC. In a second measurement the SC detector is removed and the beam current is increased. The SEM secondary electron current is measured as a function of the beam intensity, determined by the IC.
In this contribution we present an alternative approach for calibration of the SEM detector with fast extracted ion beam. The secondary electron yield is experimentally determined by comparison of the SEM and Fast Current Transformer signals.

Summary

Primary authors: BOUTACHKOV, Plamen (GSI); REITER, Andreas (GSI); SAIFULIN, Maxim; WALASEK-HÖHNE, Beata (GSI); ZIMMERMANN, Danilo (GSI)

Presenter: BOUTACHKOV, Plamen (GSI)

Session Classification: Session Beam Diagnostics

Contribution ID: **97** Type: **Speed talk**

An Efficient Vlasov Solver for Microbunching Simulations

Thursday, September 30, 2021 3:40 PM (5 minutes)

Due to the exotic shape of the longitudinal phase space of electron bunches in free-electron lasers, it is challenging to efficiently simulate their dynamics using Vlasov methods. We present SeLaV1D, a semi-lagrangian Vlasov solver which addresses this challenge by employing tree-based domain decomposition, and its application to the analysis of the microbunching instability in free-electron laser injectors.

Summary

Primary authors: AMSTUTZ, Philipp (MFL (FLASH)); VOGT, Mathias (MFL (FLASH))

Presenter: AMSTUTZ, Philipp (MFL (FLASH))

Session Classification: Session Beam Dynamics

Contribution ID: **98** Type: **Speed talk**

CSR instability in EEHG simulation

Echo-Enabled Harmonic Generation (EEHG) is an external seeding technique for Free Electron Lasers (FEL). The technique implies complex transformations of the electron beam phase space. The transformations include laser-induced energy modulations and subsequent shearing of the modulations with dispersive chicanes. The goal of the transformations is to have the electron beam pre-bunched at a high harmonic of the seed laser. FEL seeded with such pre-bunched beam allows coherent emission at down to few nm wavelength. The design of EEHG requires one of the chicanes to be quite strong. Unfortunately, strong chicanes can induce or enhance detrimental collective effects. One of the effects - Coherent Synchrotron Radiation (CSR) - is known to be able to disturb the fine phase space manipulations required for EEHG. Here, we use particle-tracking code `elegant` to estimate CSR influence on performance of EEHG. With simulations we show that CSR in the strong chicane induces energy modulation along the electron beam, which causes notable changes in the bunching spectrum.

Summary

Primary authors: SAMOILENKO, Dmitrii (MPY (Beschleunigerphysik)); NIKNEJADI, Pardis (MPY (Beschleunigerphysik)); Mr PANNEK, Fabian (DESY); PARASKAKI, Georgia (FS-FLASH (FLASH)); SCHAPER, Lucas (DESY)

Presenter: SAMOILENKO, Dmitrii (MPY (Beschleunigerphysik))

Session Classification: Session Beam Dynamics

Contribution ID: **99** Type: **Speed talk**

Single-Shot analysis of short radiation pulses with fast detectors and an 80 GHz Oscilloscope

Friday, October 1, 2021 11:35 AM (5 minutes)

Fundamentally, synchrotron radiation contains information about the particle distribution in the bunch. From this, among other things, the charge, length, shape and arrival time of the bunch can be determined. However, bunch lengths in the lower picosecond range were too short for conventional, commercial electronics in the past. In this talk, we will provide a glimpse of our recent experiments and limitations with fast detectors and an 80 GHz real-time oscilloscope.

Summary

Primary author: STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT)

Co-authors: MUELLER, Anke-Susanne; Dr BRUENDERMANN, Erik; BROSI, Miriam

Presenter: STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT)

Session Classification: Session Beam Diagnostics

Contribution ID: **100** Type: **Speed talk**

Ultra-fast line-camera KALYPSO for fs-laser based electron beam diagnostics

Friday, October 1, 2021 11:30 AM (5 minutes)

A very common bottleneck to study short electron bunch dynamics in accelerators is a detection scheme that can deal with high repetition rates in the MHz range. The KIT electron storage ring KARA (Karlsruhe Research Accelerator) is the first storage ring with a near-field single-shot electro-optical (EO) bunch profile monitor installed for the measurement of electron bunch dynamics in the longitudinal phase-space. Using electro-optical spectral decoding (EOSD) it is possible to imprint the bunch profile on chirped laser pulses subsequently read out by a spectrometer and a camera. However, commercially available cameras have a drawback in their acquisition rate, which is limited to a few hundred kHz. Hence, we have developed KALYPSO, an ultra-fast line camera capable of operating in the MHz regime. Its modular approach allows the installation of several sensors e.g. Si, InGaAs, PbS, PbSe to cover a wide range of spectral sensitivities. In this contribution, an overview of the EOSD experimental setup and the detector system installed for longitudinal bunch studies will be presented.

Summary

Primary author: PATIL, Meghana Mahaveer (KIT)

Co-authors: CASELLE, Michele (KIT); MUELLER, Anke-Susanne (KIT); Dr BRUENDERMANN, Erik (KIT); FUNKNER, Stefan (KIT); Dr NASSE, Michael; STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT); EBERSOLDT, Andreas (KIT); KOPMANN, Andreas (Karlsruhe Institute of Technology (KIT)); DRITSCHLER, Timo (Karlsruhe Institue of Technology); WIDMANN, Christina (KIT); REISSIG, Micha (Karlsruher Institut für Technologie (KIT)); NIEHUES, Gudrun (KIT); CHILINGARYAN, Suren (KIT); WEBER, Marc (KIT)

Presenter: NIEHUES, Gudrun (KIT)

Session Classification: Session Beam Diagnostics

Contribution ID: **101** Type: **Speed talk**

Photonic-integrated electro-optical modulator for high-resolution bunch arrival time monitor

Friday, October 1, 2021 12:00 PM (5 minutes)

Emerging applications of X-ray free-electron lasers would benefit from femtosecond (fs) pulse durations and fs timing accuracies. The latter requires synchronization that can simultaneously lock all components with a precision better than the accelerator pulse duration. Large-scale facilities are usually synchronized using an RF reference clock and electronic phase-locking techniques. With this approach, it is only possible to synchronize pulses with about 100 fs resolution. To improve long-range synchronization the all-optical links with pulsed optical signals are used. Recently, bunch arrival-time monitors (BAM) with optical synchronization demonstrated resolution in the range of 10 – 40 fs for bunch charges above 50 pC. For even lower bunch charges and, thus for only few-fs long accelerator pulses, the sensitivity of BAMs need to be further improved. One of the key components of any optically-synchronized BAM is a high-speed electro-optical modulator (EOM) that imprints the electrical pulse from a pick-up structure onto the optical synchronization signal. Here we present the status of the development of a wideband photonic-integrated EOM with low drive voltages which could potentially enable BAMs with sub-10 fs timing accuracy for bunch charges down to 1 pC.

Summary

Primary authors: Dr KUZMIN, Artem (LAS KIT); NIEHUES, Gudrun (KIT); KOTZ, Alexander (IPQ KIT); WIDMANN, Christina (KIT); Dr BRUENDERMANN, Erik; Prof. KOOS, Christian (IPQ KIT); MUELLER, Anke-Susanne

Presenter: Dr KUZMIN, Artem (LAS KIT)

Session Classification: Session Beam Diagnostics

Contribution ID: **102** Type: **Speed talk**

Experimental tests in KARA booster in favor of cSTART

Friday, October 1, 2021 12:10 PM (5 minutes)

cSTART (compact Storage ring for Accelerator Research and technology) is a future project at KIT to demonstrate and examine the injection of ultra-short electron bunches and the storage of a laser wakefield accelerated (LWFA) like beam in a very large acceptance compact storage ring (VLA-cSR). Several parameters of the machine and the beam impose some challenges on the beam diagnostics at cSTART. Due to some similarities between the VLA-cSR and the (KArlsruhe Research Accelerator) KARA booster, we also plan to perform some experimental tests in the booster, including measurements of beam position, lifetime, longitudinal profile, and beam losses. In this talk, we would like to briefly report on the plans and preparations for such tests.

Summary

Primary author: Dr EL KHECHEN, Dima

Co-authors: BLOMLEY, Edmund (KIT); Dr BRUENDERMANN, Erik; Mr HOTEIT, Houssameddine (KIT/IBPT); Dr MOCHIHASHI, Akira (KIT/IBPT); NIEHUES, Gudrun (KIT); RUPRECHT, Robert; Dr SCHUH, Marcel; STEINMANN, Johannes (Karlsruhe Institute of Technology (KIT), IBPT); WIDMANN, Christina (KIT); MUELLER, Anke-Susanne

Presenter: Dr EL KHECHEN, Dima

Session Classification: Session Beam Diagnostics

Contribution ID: **103** Type: **Speed talk**

Intra-train bunch charge leveling at FLASH

Thursday, September 30, 2021 4:30 PM (5 minutes)

Intra-train bunch charge at FLASH shows an RMS of approx. 2 pC at 0.4 nC, with periodic oscillation that originates from within an injection laser cavity. Noticeable adverse effects on the final SASE were reported recently. The implementation of a slow and fast intra-train charge feedback is discussed. The measurement results show sub-pC charge flatness with the feed-back activated.

Summary

Primary authors: KRAL, Jiri (MSK (Strahlkontrollen)); STEFFEN, Bernd (MSK (Strahlkontrollen))

Presenter: KRAL, Jiri (MSK (Strahlkontrollen))

Session Classification: Session Beam Dynamics

Contribution ID: **104** Type: **Speed talk**

Control of bunch oscillations using Bunch-by-Bunch capable systems at KARA

Thursday, September 30, 2021 10:30 AM (5 minutes)

At the KIT Synchrotron KARA several systems are in place to measure and interact with individual electron bunches. A Bunch-by-Bunch (BBB) feedback system provides capabilities to control individual bunch motion whereas KAPTURE allows to readout multiple synchrotron radiation detector channels on the bunch-by-bunch level. This allows to closely study coherent radiation effects in our short bunch operation mode much more effectively. It also allows to create a feedback channel based on the detector signals processed with machine learning algorithms, in which the BBB feedback system is used to manipulate bunch motion to optimize the radiation characteristics. This contribution will give an overview of how these two systems can interact with each other to achieve this goal.

Summary

Primary author: BLOMLEY, Edmund (KIT)

Co-authors: BROSI, Miriam; Mr BOLTZ, Tobias; CASELLE, Michele (KIT)

Presenter: BLOMLEY, Edmund (KIT)

Session Classification: Session Beam Controls

Contribution ID: **105** Type: **Speed talk**

New SoC-based MicroTCA Hardware Developments

Thursday, September 30, 2021 11:40 AM (5 minutes)

For future installations, new and powerful hardware components are required. In this talk, an 8-channel low-latency RF-digitizer, a distributed motion controller card and a RTM Class D1.3 digital processing board targeting serial JESD204 ADCs will be presented. All these boards are designed on the basis of ARM-based MPSoCs, which allow convenient board bring-up, configuration and maintenance.

Summary:

A low-latency RF-digitizer, a distributed motion controller card and a RTM Class D1.3 AMC board will be presented.

Summary

A low-latency RF-digitizer, a distributed motion controller card and a RTM Class D1.3 AMC board will be presented.

Primary authors: Mr FENNER, Michael; ZINK, Johannes (DESY); Mr MARJANOVIC, Jan

Presenter: Mr FENNER, Michael

Session Classification: Session Beam Controls

Contribution ID: **106** Type: **Speed talk**

Reconstruction of the longitudinal phase space for short electron bunches

Thursday, September 30, 2021 4:40 PM (5 minutes)

The Split Ring Resonator is a novel tool for longitudinal beam diagnostics of short bunches. The small metal device is a THz-driven resonator which creates a strong, vertical oscillating electromagnetic field. This allows a time dependent streaking of an electron bunch with a frequency of around 300 GHz. The device is being installed and tested in FLUTE at KIT. The vertical streaking combined with the dispersive effect of a spectrometer leads to looped screen images. These screen images allow the reconstruction of the longitudinal phase space of the bunch. This talk presents the working principle of the reconstruction of the longitudinal phase space of short bunches based on this diagnostic device, the experimental setup at FLUTE and the current challenges in the application.

Summary

Primary author: SCHÄFER, Jens (KIT IBPT)

Co-authors: Dr SMALE, Nigel; MUELLER, Anke-Susanne; RUPRECHT, Robert; Dr HAERER, Bastian; Dr NASSE, Michael; NABINGER, Matthias (KIT)

Presenter: SCHÄFER, Jens (KIT IBPT)

Session Classification: Session Beam Dynamics

Contribution ID: **107** Type: **Speed talk**

Studies on Using Reinforcement Learning Methods for Controlling the Transverse Beam Parameters at the ARES Accelerator

Thursday, September 30, 2021 11:35 AM (5 minutes)

Within the scope of the Helmholtz AI Autonomous Accelerator Project machine learning methods for automating the accelerator operation are investigated. The recurrent task of manipulating the transverse beam parameters in the ARES experimental area poses as a test bed for studying reinforcement learning applications helping to automate complex tasks during accelerator operation. In this talk the current status and preliminary results of these studies will be presented.

Summary

Primary author: STEIN, Oliver (MSK (Strahlkontrollen))

Co-authors: EICHLER, Annika; KAISER, Jan (DESY)

Presenter: STEIN, Oliver (MSK (Strahlkontrollen))

Session Classification: Session Beam Controls

Contribution ID: **108** Type: **Speed talk**

High-fidelity Prediction of Megapixel Longitudinal Phase Space images at the European XFEL Photoinjector

Thursday, September 30, 2021 11:30 AM (5 minutes)

Modeling of large-scale research facilities is extremely challenging due to complex physical processes and engineering problems. We adopt a data-driven approach to model the longitudinal phase-space diagnostic beamline at the photoinector of the European XFEL with an encoder-decoder
neural network model. We demonstrate that the model trained only with experimental data can make
high-fidelity predictions of megapixel images for the longitudinal phase-space measurement without
any prior knowledge of photoinjectors and electron beams. The prediction significantly outperforms
existing methods. We also show the scalability and interpretability of the model and propose a pragmatic way to model a facility with various diagnostics and working points. This opens the door
to a new way of accurately modeling a photoinjector using neural networks and experimental data.

Summary

Primary author: ZHU, Jun (MSK (Strahlkontrollen))

Presenter: ZHU, Jun (MSK (Strahlkontrollen))

Session Classification: Session Beam Controls

Contribution ID: **109** Type: **Oral presentation**

Longitudinal tomography at HELIAC

Friday, October 1, 2021 10:00 AM (25 minutes)

At the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt, Germany, a prototype cryomodule (Advanced Demonstrator) for the superconducting (SC) continuous wave (CW) Helmholtz Linear Accelerator (HELIAC) is under construction.
A transport line, comprising quadrupole lenses, rebuncher cavities, beam steerers and sufficient beam instrumentation has been built to deliver the beam from the GSI 1.4 MeV/u High Charge Injector (HLI) to the Advanced Demonstrator,
which offers a test environment for SC CW multigap cavities.
In order to achieve proper phase space matching, the beam from the HLI must be characterized in detail.
In a dedicated machine experiment the bunch shape has been been measured with a non destructive bunch shape monitor (BSM).
The BSM offers a sufficient spatial resolution to use it for reconstruction of the energy spread.
Therefore, different bunch projections were obtained by altering the voltage of two rebunchers.
These measurements were combined with dedicated beam dynamics simulations using the particle tracking code Dynamion.
The longitudinal bunch shape and density distribution at the beginning of the matching line could be fully characterized.
Independent measurements of the beam profile at the reconstrution location are available for confirmation of the reconstruction results.

Summary

Primary authors: LAUBER, Simon (HIM Mainz, GSI Darmstadt); Prof. AULENBACHER, Kurt (HIM, JGU); BARTH, Winfried (GSI); Dr FORCK, Peter; Dr HEILMANN, Manuel (GSI); Dr MISKI-OGLU, Maksym (GSI); Mr SIEBER, Thomas (GSI); Dr YARAMYSHEV, Stepan (GSI)

Presenter: LAUBER, Simon (HIM Mainz, GSI Darmstadt)

Session Classification: Session Beam Diagnostics

Contribution ID: **110** Type: **not specified**

SpeedTalks (BC, BDyn, BDiag)

Summary

Presenter: AYVAZYAN, Gohar (DESY)

Contribution ID: **111** Type: **Oral presentation**

Machine Learning for Accelerator Physics and Engineering

Thursday, September 30, 2021 12:00 PM (1 hour)

Presenter: STEINBACH, Peter (HZDR)

Session Classification: Tutorials