AKBP 3: RF, Resonators and Applications

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

AKBP 3.1 Mo 16:45 BZ.08.06 (HS 1)

Implementation of a high level phase controller for the superconducting injector of the S-DALINAC — •Thore Bahlo, Christoph Burandt, Florian Hug, and Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt

The Superconducting DArmstadt LINear Accelerator S-DALINAC is a recirculating electron accelerator with a design energy of 130 MeV. It operates in cw-mode at a radio frequency of 3 GHz and provides either unpolarized or polarized electron beams. Before entering the main accelerator the electron beam passes both, a normal-conducting injector beamline for beam preparation and a superconducting 10 MeV injector beamline for preacceleration. The phase of the beam which is injected into the 40 MeV main accelerator is crucial for the efficiency of the acceleration process and the minimization of the energy spread. Due to thermal drifts of the normal-conducting injector cavities this injection phase varies by about 0.2 degree over a timescale of an hour. In order to compensate these drifts, a high level phase controller has been implemented. It adjusts the phase measured at an rf-monitor at the exit of the superconducting injector by changing the phase of a prebuncher in the normal-conducting injector beamline. We will present the used hardware, the control algorithm as well as measurements showing the phase stabilization achieved by this controller.

This work has been supported by the DFG through CRC 634

AKBP 3.2 Mo 17:00 BZ.08.06 (HS 1)

Systematic beam studies with the bunch-by-bunch feedback system at the ANKA storage ring — •Edmund Hertle[1], Benjamin Kehrer[2], Nicole Hiller[1], Erhard Huttel[3], Nigel Smale[3], Alexander Papasch[3], Anke-Susanne Müller[1,2,3], and Dmitry Teytelman[4] — [1]IPS, KIT, Karlsruhe — [2]LAS, KIT, Karlsruhe — [3]ANKA, KIT, Karlsruhe — [4]Dimtel, Inc.

The bunch-by-bunch feedback system installed at the ANKA storage ring of the Karlsruhe Institute of Technology (KIT) has now been used to counteract transverse beam instabilities for more than one year. In addition, improvements of beam lifetime were observed. The system has been instrumental in systematic studies of the different operation modes of ANKA (e.g. at different beam energies and optics). Recently, the feedback system was complemented by the installation of a longitudinal kicker cavity. This presentation gives an overview of the systematic studies with the bunch-by-bunch feedback system at ANKA and reports possible first results of its operation in all three planes.

AKBP 3.3 Mo 17:15 BZ.08.06 (HS 1)

Performance of the RF Phase Modulation System at DELTA — •Marcel Bursy[1], Jonathan Fürsch[2], Peter Hartmann[1], Benjamin Isbarn[1], Malte Sommer[1], and Thomas Weis[1] — [1]Center for Synchrotron Radiation (DELTA) TU Dortmund University, 44227 Dortmund, Germany — [2]Affiliation changed meanwhile

At DELTA, a third generation 1.5 GeV synchrotron radiation facility, we use common schemes to damp longitudinal coupled bunch mode instabilities, including a bunch-by-bunch feedback system. We also utilize an RF-phase modulation of the master-RF at two times the synchrotron frequency, providing strong additional damping capabilities and a significant increase in beam lifetime of approximately 20%, due to bunch lengthening and reduced Touschek effect. Despite the apparent influence on beam lifetime and longitudinal beam stability the actual correlation between the phase modulation of the master-RF and its influence on the time dependent accelerating gradient has not been studied sufficiently yet. The presentation will give an overview on the existing modulation scheme together with first studies to provide a better understanding of the RF phase modulation impact on the small bandwidth accelerating cavity.

AKBP 3.4 Mo 17:30 BZ.08.06 (HS 1)

Field emission investigations on flat Cu samples before and after surface cleaning — •Stefan Lagotzky[1], Pavel Serbun[1], Günter Müller[1], Tomoko Muranaka[2], and Sergio Calatroni[2] — [1]University of Wuppertal, D-42097 Wuppertal, Germany — [2]CERN, Geneva, Switzerland

Enhanced field emission (EFE) resulting in electric breakdowns (BD) is one of the main field limitations of the accelerating structures for the Compact Linear Collider (E_{acc} = 100 MV/m, E_{pk}/E_{acc}=2.43). Deep and quantitative understanding of the origin of EFE is therefore important to reduce the conditioning time as well as the final BD rate of these structures. Systematic EFE investigations on Cu samples manufactured in a similar way as the CLIC accelerating structures have revealed an emitter number density up to N= 372 cm^{-2} at E = 243 MV/m. SEM investigations around the emission sites revealed mainly particulate contaminations as origin of EFE. Removal of such contaminations by cleaning with ionized N_2 led to N = 124 cm^{-2}, and a further reduction of N was achieved by applying dry ice cleaning (DIC) in a class 10 cleanroom resulting in N = 29 cm^{-2}. The emission sites that could not be removed by DIC showed onset fields down to E_{on} = 30 MV/m and field enhancement factors up to β = 360, and SEM investigations revealed mainly accidental scratches and etching pits. Moreover, a strong activation effect of emitters was observed on all samples. A possible breakdown mechanism based on this emitter activation will be discussed.

The work is funded by BMBF project 05H12PX6.

AKBP 3.5 Mo 17:45 BZ.08.06 (HS 1)

Yacs - A New 2.5D FEM Eigenmode Solver for Axisymmetric RF-Structures* — •Benjamin Isbarn, Bernard Riemann, Malte Sommer, and Thomas Weis — Center for Synchrotron Radiation (DELTA) TU Dortmund University, 44227 Dortmund, Germany

Most feasibility studies for modern accelerator concepts, including superconducting multicell RF-cavity-resonators in circular accelerators, depend on computing a large number of eigenmode frequencies and field patterns to obtain typical figures of merit. This task includes computational intensive numerical studies. To obtain the full eigenfrequency spectra most of these studies are performed in 3D, require a great amount of computation resources and thus are limited to a few hundred or thousand eigenmodes. To overcome this issue, some codes make use of the axisymmetric geometry of most of the RF-cavity-resonator structures and solve the problem in 2D. Solving in 2D however reduces the eigenmode spectra to eigenmodes with no azimuthal dependencies (so called monopole-modes). Due to the lack of freely available and easy to use 2.5D eigenmode solvers which are able to solve for the full 3D field in a reduced 2.5 dimensional problem, we developed yet another cavity solver (Yacs), a simple FEM based solver capable of solving for the full 3D eigenmodes of axisymmetric problems while only requiring a fraction of the computation resources required by most modern 3D codes.

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

AKBP 3.6 Mo 18:00 BZ.08.06 (HS 1)

Status of the Robinson Wiggler Project at the Metrology Light Source — •Tobias Goetsch, Jörg Feikes, Markus Ries, and Godehard Wüstefeld — Helmholtz-Zentrum Berlin, Berlin, Germany

The Metrology Light Source (MLS), situated in Berlin (Germany) is owned by Physikalisch-Technische Bundesanstalt and was built / is operated by Helmholtz-Zentrum Berlin. It is an electron storage ring operating from 105 MeV to 630 MeV and serves as the national primary source standard from the near infrared to the extreme ultraviolet spectral region. The lifetime at the MLS is dominated by the Touschek effect. By installing a Robinson Wiggler, the bunches can be lengthend, as damping is transferred from the longitudinal to the horizontal plane. A considerable increase in lifetime seems achievable, while preserving the source size. The current status of this project will be presented.

AKBP 3.7 Mo 18:15 BZ.08.06 (HS 1)

Status of Instability Damping-Rate Analysis Using Bunch-by-Bunch Feedback Systems at the DELTA Storage Ring* — Markus Höner, Shaukat Khan, Malte Sommer, •Christian Waldera, and Thomas Weis — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At the 1.5-GeV electron storage ring DELTA (TU Dortmund), bunch-by-bunch feedback systems are in use to analyze and counteract transverse and longitudinal multi-bunch instabilities. Synchronous phase measurements for different filling patterns will be presented. Furthermore, a feedback-based method to measure the damping times of stable and unstable multi-bunch modes will be compared with images from a streak camera. The dependence of growth rates and instability thresh-

olds on the beam energy will be discussed. *Work supported by the BMBF.

AKBP 3.8 Mo 18:30 BZ.08.06 (HS 1)

Chopper/Buncher System für MESA — •Victor Bechthold — Inst.f. Kernphysik, JGU Mainz, 55128 Mainz, D

Im Rahmen des Exzellenzclusters "Precision Physics, Fundamental Interactions and Structure of Matter (PRISMA)"wird am Institut für Kernphysik an der Johannes Gutenberg-Universität Mainz der neue 1,3 GHz Teilchenbeschleuniger MESA (Mainz Energy Recovering Superconducting Accelerator) gebaut. Er wird im ERL Modus betrieben werden und Elektronen auf Energien von 150 MeV beschleunigen können um Experimente wie die Suche nach dem Dunklen Photon und der Vermessung des Weinbergwinkels zu ermöglichen. Um Elektronen mit falscher Phasenlage in den Beschleunigungssektionen abzutrennen wird direkt nach der Quelle und vor dem Injektor ein vom MAMI Chopper/Buncher abgeleitetes System verwendet. Der kontinuierliche Elektronenstrahl aus der Quelle wird hierbei vom Chopper in Bunche einer Länge von bis zu 20 Grad „*zerhackt*“ und im darauffolgenden Bunchersystem weiterhin im longitudinalen Phasenraum auf bis ±2 Grad fokussiert. Es wird eine bereits entwickelte und erfolgreich getestete Deflektor-Kavität des Choppers, sowie eine neue Buncher-Kavität präsentiert. Weiterhin ist es geplant dazu im Jahr 2015 einen Teststand aufzubauen.

AKBP 3.9 Mo 18:45 BZ.08.06 (HS 1)

RF field asymmetry simulations for the PITZ RF Photo Gun. — •Igor Isaev and Mikhail Krasilnikov — DESY, Platanenallee 6, 15738, Zeuthen

The photoinjector test facility at DESY, Zeuthen site (PITZ) has been built for the development, testing and optimization of high brightness electron sources for Free Electron Lasers (FELs). A radio frequency (RF) photo gun is one of the key components for the successful operation of modern FELs. The PITZ RF gun consists of a 1.6 cell copper cavity with a Cs2Te photocathode. It is surrounded by two solenoids for generation a constant external magnetic field for beam focusing. The gun is operated at an RF field resonance frequency of 1.3 GHz with an electric field strength of 60 MV/m at the cathode. The RF cavity is fed through a coaxial coupler.

An electron beam asymmetry has been observed at PITZ experimentally which could not be explained by imperfections of the photocathode laser transverse profile. An RF field asymmetry in the coupler section of the cavity generates a transverse RF field in the cavity which can deteriorate the transverse phase space of generated beams, therefore it is being considered as one of possible reasons of the observed electron beam distortions.

The influence of the transverse fields on the beam dynamics was studied using CST Particle Studio simulation code. Several coupler concepts were suggested and their field asymmetry was studied. The results of simulations are presented in this work.