BE 7: Synchrotron Radiation I

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

Group Report BE 7.1 Wed 9:30 MOL 213

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

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

BE 7.2 Wed 10:00 MOL 213

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

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

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

BE 7.3 Wed 10:15 MOL 213

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

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

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

BE 7.4 Wed 10:30 MOL 213

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

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

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

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

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

BE 7.5 Wed 10:45 MOL 213

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

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

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

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

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

Gruppenvortrag

15 min. break

Group Report BE 7.6 Wed 11:15 MOL 213

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

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

BE 7.7 Wed 11:45 MOL 213

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

stitute of Technology (KIT), 76021 Karlsruhe, Germany

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

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

BE 7.8 Wed 12:00 MOL 213

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

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

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

BE 7.9 Wed 12:15 MOL 213

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

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