

AKBP 5: Hadron and Electron Accelerators

Time: Wednesday 15:00–17:45

Location: MOL 213

AKBP 5.1 Wed 15:00 MOL 213

Beam Evolution during the 2016 Proton-Lead Run of the LHC — ●MARC JEBRAMCIK^{1,2}, JOHN JOWETT¹, TOM MERTENS¹, and MICHAELA SCHAUMANN¹ — ¹CERN, Geneva, Switzerland — ²Goethe University Frankfurt, Frankfurt, Germany

At the end of 2016, the second proton-lead run took place in the LHC. Enabling data taking in no less than 5 experiments resulted in demanding operational conditions due to the different requests of the experiments. These requests included a multiple change of beam directions, switches of the beam energies between 4 Z TeV and 6.5 Z TeV and different demands for luminosity and pile-up. In one month of heavy ion operation, the achieved integrated luminosity came close to the demanded and the measured peak luminosity exceeded several times the unofficial design value.

The different machine settings caused different evolutions of the beam properties, e.g., the beam lifetime and bunch size evolution, which had to be observed cautiously during operation. Simulations as well as first interpretations of the measured data are given.

AKBP 5.2 Wed 15:15 MOL 213

High-Temperature Superconductor Coating for the FCC Beam Screen — ●PATRICK KRKOTIĆ¹, UWE NIEDERMAYER¹, and OLIVER BOINE-FRANKENHEIM^{1,2} — ¹TU Darmstadt - TEMF — ²GSF Helmholtzzentrum für Schwerionenforschung Darmstadt

The international Future Circular Collider (FCC-hh) study develops a conceptual design for a post LHC particle accelerator with collision energies up to 100 TeV. To mitigate beam instabilities the coupling impedance of the beam screen has to be sufficiently low. So far, copper coatings are intended, but the resulting impedance might not be low enough to run without an active feedback. Therefore, High-Temperature Superconductors (HTS) in the operating beam screen temperature of 40K to 60K are studied to reduce the coupling impedance.

The main idea is to display HTS and copper in several selected positions in the beam screen in form of alternating stripes. This is combined with a very thin surface layer of amorphous carbon coating to reduce the electron cloud effect. The behaviour of HTS and change in impedance under the given temperatures, frequencies, magnetic fields and synchrotron radiation is examined. The results of coupling impedance simulations using the two-dimensional finite element solver BeamImpedance2D [1] are given.

[1] U. Niedermayer, O. Boine-Frankenheimer, and H. De Gersem, Phys. Rev. Special Topics * Accelerators and Beams 18, 032001, (2015)

AKBP 5.3 Wed 15:30 MOL 213

Spin tune mapping as a novel tool to probe magnetic imperfections of a storage ring — ●ARTEM SALEEV — Institut für kernphysik Forschungszentrum Jülich, Jülich, Deutschland

In precision searches for electric dipole moments of charged particles using storage rings, one needs to quantify background signals that stem from false rotations of the magnetic dipole moments in the radial and longitudinal magnetic fields of the storage ring. Mapping the spin tune response of a machine with artificially applied longitudinal magnetic fields allows one to probe the magnetic imperfection field content of the ring. The novel technique, called *spin tune mapping*, emerges as an extremely powerful probe of the spin dynamics in storage rings. The technique was experimentally tested by JEDI at COSY, and for the first time, the angular orientation of the stable spin axis at two different locations in the ring has been determined to an unprecedented accuracy of $\approx 10^{-6}$ μ rad.

Based on the obtained results, a roadmap toward further perfectioning of the technique is formulated, which fits the extensive program of upgrading COSY for a first direct measurement of the electric dipole moments of protons and deuterons using an RF Wien filter.

AKBP 5.4 Wed 15:45 MOL 213

Recent laser cooling and laser spectroscopy experiments at the ESR — ●MICHAEL BUSSMANN¹, OLIVER BOINE-FRANKENHEIM^{2,3}, AXEL BUSS⁴, LEWIN EIDAM^{2,3}, VOLKER HANNEN⁴, ZHONGKUI HUANG⁵, DANIEL KIEFER³, SEBASTIAN KLAMMES³, THOMAS KÜHL², MARKUS LÖSER^{1,6}, XINWEN MA⁵,

FRITZ NOLDEN², WILFRIED NÖRTERSHÄUSER³, RODOLFO MARCELO SANCHEZ ALARCON², ULRICH SCHRAMM^{1,6}, MATHIAS SIEBOLD¹, MARKUS STECK², THOMAS STÖHLKER^{2,7,8}, JOHANNES ULLMANN³, THOMAS WALTHER³, HANBING WANG⁵, WEIQIANG WEN⁵, CHRISTIAN WEINHEIMER⁴, DANYAL WINTERS², and DANIEL WINZEN⁴ — ¹Helmholtz-Zentrum Dresden - Rossendorf — ²GSF Darmstadt — ³TU Darmstadt — ⁴Uni Münster — ⁵IMP Lanzhou — ⁶TU Dresden — ⁷HI Jena — ⁸Uni Jena

Laser cooling is one of the most promising techniques for ion beam cooling at high energies. The fluorescence emitted during the cooling process can be used for both optical beam diagnostics and precision spectroscopy. We present results on experiments with 12C3+ beams (122 MeV/u) stored in the experimental storage ring (ESR) in Darmstadt, Germany. For the excitation of the cooling transition, a pulsed laser system with a high repetition rate and a wide-scanning cw laser system have been used simultaneously. For the fluorescence detection a novel XUV detector system installed inside the vacuum of the ESR. We will discuss the experimental setup and preliminary data on the interaction of the lasers with the beam and discuss them in the light of applications at future high energy storage rings at FAIR and HIAF.

AKBP 5.5 Wed 16:00 MOL 213

Aufbau und Status des dreifach rezirkulierenden S-DALINAC* — ●MICHAELA ARNOLD¹, CORNELIA ESCHELBACH², RUBEN GREWE¹, FLORIAN HUG³, THORSTEN KÜRZEDER¹, MICHAEL LÖSLER², JONAS PFORR¹ und NORBERT PIETRALLA¹ — ¹IKP, TU Darmstadt, Darmstadt, Germany — ²LIM, Frankfurt UAS, Frankfurt, Germany — ³KPH, JGU Mainz, Mainz, Germany

Von 1991 bis 2015 konnte der Elektronenlinearbeschleuniger S-DALINAC mit zwei Rezirkulationen betrieben werden. Da die Güten der supraleitenden Kavitäten nicht ihre angestrebten Werte erreichten, blieb die maximale Strahlenergie im cw-Betrieb deutlich unterhalb der ursprünglich geplanten 130 MeV. Aus diesem Grund wurde in 2015/2016 eine weitere Rezirkulation installiert, wodurch es in Zukunft möglich sein wird, den Hauptbeschleuniger viermal anstatt dreimal zu nutzen. Somit können die Beschleunigungsstrukturen bei reduzierten Feldgradienten betrieben werden, womit nun die ursprünglich geplanten Strahlenergien von bis zu 130 MeV erreicht werden. Die Erweiterung um eine zusätzliche Rezirkulation resultierte in einem erneuten Aufbau von weiten Teilen der bestehenden Strahlführung sowie einem erstmaligen Aufbau der neuen Sektion. Des Weiteren mussten alle Magnete hinsichtlich ihrer Position und Orientierung geodätisch erfasst und justiert werden. Der Vortrag beschäftigt sich mit dem Aufbau und wird die verwendeten Methoden zur Justage vorstellen. Des Weiteren wird der aktuelle Status der Inbetriebnahme thematisiert.

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AKBP 5.6 Wed 16:15 MOL 213

Absolute charge calibration and degeration studies of various scintillation screens used in laser Wakefield acceleration — ●THOMAS KURZ^{1,2}, JURJEN COUPERUS^{2,7}, JAKOB KRÄMER^{2,7}, HAO DING^{1,6}, STEPHAN KUSCHEL^{3,4}, DOMINIK HOLLATZ^{3,4}, ALEXANDER KÖHLER^{2,7}, OMID ZARINI^{2,7}, RICHARD D'ARCY⁵, DAVID SCHINKEL^{3,4}, JAN-PATRICK SCHWINKENDORF^{5,8}, MATT ZEPF^{3,9}, JENS OSTERHOFF^{5,8}, ARIE IRMAN², ULRICH SCHRAMM^{2,7}, and STEFAN KARSCH^{1,6} — ¹Ludwig-Maximilians-Universität, München — ²Helmholtz-Zentrum Dresden-Rossendorf, Dresden — ³Helmholtz Institut, Jena — ⁴Friedrich-Schiller-Universität Jena, Jena — ⁵Deutsches Elektronen-Synchrotron, Hamburg — ⁶Max-Planck-Institut für Quantenoptik, Garching — ⁷Technische Universität Dresden, Dresden — ⁸Universität Hamburg, Hamburg — ⁹Queen's University, Belfast

Scintillation screens are generally used as the electron beam diagnostics in Laser Wakefield Accelerators. We present an absolute charge calibration of the electron detector i.e. a scintillating screen with a layer of powdered rare earth phosphor (Gd₂O₂S:TB). The calibration was designed to investigate the absolute light/charge-ratio and saturation effects of various screens used in current laser-electron accelerators. The scintillation screens show a linear photon response to the applied charge up to an upper boundary caused by saturation effects. We also report about degeneration studies of some of these screens which were excited with a similar condition compared to Wakefield experiments.

15 min. break

AKBP 5.7 Wed 16:45 MOL 213

KIT-IBPT accelerator test facilities status report — •MARCEL SCHUH¹, AXEL BERNHARD², EDMUND BLOMLEY², TOBIAS BOLTZ¹, MIRIAM BROSI¹, ERIK BRÜNDERMANN², SARA CASALBUONI², STEFAN FUNKNER¹, JULIAN GETHMANN¹, ANDREAS GRAU², ERHARD HUTTEL², BENJAMIN KEHRER¹, SEBASTIAN MARSCHING¹, YVES-LAURENT MATHIS², WOLFGANG MEXNER², MICHAEL J. NASSE², GUDRUN NIEHUES¹, ALEXANDER PAPASH², FLORIAN RÄHMISCH¹, ROBERT RUPRECHT², DAVID SAEZ DE JAUREGUI², MANUEL SCHEDLER¹, THIEMO SCHMELZER¹, PATRIK SCHÖNFELDT², MARKUS SCHWARZ¹, NIGEL J. SMALE², JOHANNES L. STEINMANN¹, BETTINA STÖHR¹, PAWEŁ WESOŁOWSKI², MINJIE YAN², and ANKE-SUSANNE MÜLLER^{1,2} — ¹LAS, KIT, Karlsruhe, Germany — ²IBPT, KIT, Karlsruhe, Germany

The Institute for Beam Physics and Technology (IBPT) at the KIT operates the accelerator test facility and synchrotron light source ANKA and the Ferninfrarot Linac and Test Experiment (FLUTE) which is presently under construction. An overview over the accelerator physics research performed at these two facilities will be given.

AKBP 5.8 Wed 17:00 MOL 213

Characterisation of the photo-injector laser and laser transport for the production of short electron bunches at FLUTE — •THIEMO SCHMELZER¹, STEFAN FUNKNER¹, MINJI YAN², MICHAEL NASSE², MARCEL SCHUH¹, ERIK BRÜNDERMANN², and ANKE-SUSANNE MÜLLER^{1,2} — ¹LAS, KIT, Karlsruhe, Germany — ²IBPT, KIT, Karlsruhe, Germany

At the Ferninfrarot Linac and Test Experiment (FLUTE), which is currently under construction at KIT, a photo-injector gun system is used to generate electron bunches with different charges. The pulses from the gun laser have to be transported over a distance of around 35 m from the laser lab to the electron gun via image relay. For an optimized laser transport the transversal and longitudinal size of the laser pulses are important. In this contribution we present the characteristics of the photo injector laser and the planned laser transport.

AKBP 5.9 Wed 17:15 MOL 213

Experimental Optimization of Electron Beams for Generating THz Coherent Transition and Diffraction Radiations with PITZ — •PRACH BOONPORNPRASERT¹, GALINA ASOVA^{1,2}, YE CHEN¹, JAMES GOOD¹, HOLGER HUCK¹, IGOR ISAEV¹, DAVIT

KALANTARYAN¹, MIKHAIL KRASILNIKOV¹, XIN LI¹, OSIP LISHILIN¹, GREGOR LOISCH¹, DAVID MELKUMYAN¹, ANNE OPPELT¹, HOUJUN QIAN¹, YVES RENIER¹, TINO RUBBLACK¹, CHAIPATTANA SAISARD^{1,3}, FRANK STEPHAN¹, and QUANTANG ZHAO^{1,4} — ¹DESY, Zeuthen, Germany — ²INRNE, Sofia, Bulgaria — ³CMU, Chiangmai, Thailand — ⁴IMP/CAS, Lanzhou, China

The Photo Injector Test facility at DESY, Zeuthen site (PITZ), develops high brightness electron sources for modern linac-based Free Electron Lasers (FELs). The PITZ accelerator can also be considered as a suitable machine for the development of an IR/THz source prototype for pump-probe experiments at the European XFEL. Interesting options for the IR/THz generation with PITZ are to generate the radiation by means of a Coherent Transition Radiation (CTR) and a Coherent Diffraction Radiation (CDR). Experimental optimizations of electron beams for such means were done with two types of longitudinal profiles; short Gaussian and comb-like profiles. In this contribution, results of the optimizations are presented and discussed together with corresponding calculations of the CTR and CDR. Progress on the design and installation of a CTR/CDR station is also reported.

AKBP 5.10 Wed 17:30 MOL 213

Preliminary On-table and Photoelectron Results from the PITZ Quasi Ellipsoidal Photocathode Laser — •JAMES GOOD¹, ALEX ANDRIANOV², EKATERINA GACHEVA², EFIM KHAZANOV², MIKHAIL KRASILNIKOV¹, SERGEY MIRONOV², ANATOLY POTEOMKIN², TINO RUBBLACK¹, FRANK STEPHAN¹, EUGENIY SYRESIN², and VIKTOR ZELENOGORSKY² — ¹DESY, Zeuthen — ²IAP RAS, Nizhny Novgorod, Russia

The optimization of photoinjectors is crucial for the successful operation of linac-based free electron lasers, and beam dynamics simulations have shown that ellipsoidal photocathode laser pulses result in significantly lower electron beam emittance than that of conventional cylindrical pulses. Therefore, in collaboration with the Institute of Applied Physics (Nizhny Novgorod, Russia) and the Joint Institute of Nuclear Research (Dubna, Russia), a Laser system capable of generating quasi 3-D ellipsoidal laser pulses has been developed and installed at the Photo Injector Test facility at DESY, Zeuthen (PITZ).

The pulse shaping has been realized using the spatial light modulator technique, characterized by cross-correlation and spectrographic measurements, and is demonstrated with electron beam measurements. In this contribution the overall setup, operating principles, and initial results of the new photocathode laser system at PITZ will be reported.