T 87: Beschleunigerphysik X

Convenor: Wolfgang Hillert

Zeit: Freitag 14:00–15:30 Raum: HG ÜR 8

T 87.1 Fr 14:00 HG ÜR 8

Erste Magnetmessungen am supraleitenden Dämpfungswiggler für die CLIC Dämpfungsringe — Daniel Schoerling[1], Remo Maccaferri[1], Mikko Karppinen[1], •Axel Bernhard[2], Peter Peiffer[2], Robert Rossmanith[2] und Alfons Ams[3] — [1]European Organization for Nuclear Research (CERN), CH-1211 Genève 23, Switzerland — [2]Karlsruher Institut für Technologie, Kaiserstraße 12, 76131 Karlsruhe — [3]Technische Universität Bergakademie Freiberg, 09596 Freiberg

Die Emittanz des Positronen- und Elektronenstrahles in CLIC, einem Kompakt-Linearbeschleuniger, der momentan am CERN entwickelt wird, muss um zwei Größenordnungen verringert werden, bevor der Strahl in den 3 TeV Linearbeschleuniger injiziert werden kann. Die Reduktion der Emittanz wird in Dämpfungsringen erreicht. Die Teilchenstrahlen werden kurzzeitig in den Dämpfungsringen gespeichert, wo ihre Emittanz durch massive Abstrahlung von Synchrotronstrahlung minimiert wird. Das aktuelle Design der Dämpfungsringe sieht eine Teilchenenergie von 2.86 GeV und eine Ausstattung mit supraleitenden Wigglern mit einer Gesamtlänge von 152 m vor. Die Wiggler sind umso effizienter, je stärker ihr Feld und je kürzer ihre Periodenlänge ist. In einer Kollaboration des CERN mit der TU Bergakademie Freiberg und dem Karlsruhe Institut für Technologie wurde ein Niob-Titan- (NbTi) -Wiggler entwickelt, gebaut und erfolgreich getestet. Das Zweiperiodenmodell zeigt, dass die CLIC-Wigglerspezifikationen mit NbTi erreichbar sind. Die hier vorgestellte Arbeit diskutiert das technische Konzept und Simulations- und Messergebnisse.

T 87.2 Fr 14:15 HG ÜR 8

Development of a Cryogenic Permanent Magnet Undulator — •Florian Holy[1,2], Raphael Weingartner[1,2], Finn O'Shea[3], Johannes Bahrdt[4], Andreas Gaupp[4], Hans-Jürgen Bäcker[4], and Florian Grüner[1,2] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — [2]Department für Physik, Ludwig-Maximilians-Universität, Am Coulombwall 1, 85748 Garching, Germany — [3]Department of Physics, University of California, Los Angeles, CA 90095, USA — [4]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH Glienicker Straße 100, 14109 Berlin, Germany

Analysis of matter on an atomic scale requires brilliant light sources with keV photon energies. Undulator-based light source facilities are invaluable tools for producing such photon beams. To improve their performance at even higher photon energies, it is essential to decrease the undulator period while still maintaining a high magnetic field strength. We present measurements of a new permanent magnet material, (NdPr)FeB, which shows significantly higher remanent magnetic fields of 1.69 T and a better coercivity of 70 kOe at cryogenic temperatures. A 20 period prototype is being constructed for use at the laser-wakefield experiment in Munich.

T 87.3 Fr 14:30 HG ÜR 8

Design and assembly of a strong focusing undulator — •Carlo Frevert[1,2], Sebastian Raith[1,2], Andreas R. Maier[1,2], Stefan Becker[1,2], and Florian Grüner[1,2] — [1]Department for Physik, Ludwig-Maximilians-Universität, Am Coulombwall 1, 85748 Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

Highly-tuned permanent magnetic quadrupoles (TPMQs) can be used for an intrinsically strong-focusing undulator. Alternating focusing / defocusing TPMQs impose an overall focusing effect on the electron beam. By tranversally shifting the individual TPMQs, a dipole field component exerts a force upon the whole beam, leading to an undulating motion. The focusing effect keeps the electron beam size stable for an arbitrary length of the undulator.

We present a design study of an undulator with a matched beam size of $20\mu m$ and report on the progress of a first prototype currently being built.

T 87.4 Fr 14:45 HG ÜR 8

Characterization and Tuning of High-Gradient Miniature Quadrupoles — •Sebastian Raith[1,2], Stefan Becker[1,2], Carlo Frevert[1,2], and Florian Grüner[1,2] — [1]Department für Physik, Ludwig-Maximilians-Universität, Am Coulombwall 1, 85748 Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

To guide and shape laser-wakefield-accelerated electron bunches while maintaining the intrinsically ultra-short pulse lengths, we use segmented Halbach quadrupole lenses. They consist of 12 segments made of permanent magnet material with a remanence of 1.3 T. Together with an aperture of 6 mm, large gradients of about 500 T/m can be achieved. However, a small aperture increases the effect of disturbing higher order multipoles which destroys the beam quality. To preserve the beam quality, it is mandatory to reduce them. This is achieved by precisely shifting the individual segments and hence introducing additional higher orders, but with a phase opposing the one of the present multipoles. Being of iterative nature, this process requires a fast determination of the higher-order field components. We have developed a measurement technique relying on a Fourier expansion of the field which dramatically reduces the measurement effort.

T 87.5 Fr 15:00 HG ÜR 8

Theoretical Description and Numerical Calculations of significant three-dimensional Magnetic Field Configurations — •Anna Mierau[1], Pierre Schnizer[2], Egbert Fischer[2], Pavel Akishin[3], and Thomas Weiland[1] — [1]Technische Universität Darmstadt, Institut für Theorie Elektromagnetischer Felder (TEMF), Schlossgartenstrasse 8, D-64289 Darmstadt, Germany — [2]GSI Helmholzzentrum für Schwerionenforschung GmbH, Planckstraße 1, D-64291 Darmstadt, Germany — [3]JINR, Joliot-Curie 6, 141980 Dubna, Moscow region, Russia

The heavy ion synchrotron SIS100, the core component of the Facility of Antiproton and Ion Research will accelerate high current ion beams of up to U27+.

For operating such a machine the static and transient magnetic field quality must be fully understood. This is also necessary to keep the beam losses well below acceptable limits and to prepare a sound strategy for high resolution magnetic measurements and data analysis. Challenging preconditions to perform such work are to find a proper description for the non. Cartesian symmetry of the magnets, most important for curved dipoles with elliptical apertures.

We describe the parameterisation methods using elliptic and toroidal multipoles and summarise comparing the calculated to the measured field quality.

T 87.6 Fr 15:15 HG ÜR 8

A new Generation of fast cycling superconducting Magnets for the Accelerator System of FAIR - R&D Process and present Test Status — •Egbert Fischer[1], Pierre Schnizer[1], and Anna Mierau[2] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, D-64291 Darmstadt — [2]Technische Universitaet Darmstadt, Institut fuer Theorie Elektromagnetischer Felder (TEMF) Schlossgartenstrasse 8 / D-64289 Darmstadt

The SIS100 is the core component of the FAIR accelerator complex. It will be the largest fast ramped synchrotron for heavy ion research using superconducting magnets.

Starting from the design of its ancestor the Nuclotron in JINR Dubna we accomplished an intensive R&D process to develop magnets fulfilling the ambitious requirements for SIS100 operation concerning field quality, cycling frequency, cryogenic losses and reliability. In addition the beam pipe has to operate as a cryopump to reach extremely low vacuum pressures.

We describe the different design modifications required to minimise the AC losses as well as to get a better field quality. We show the current vacuum chamber design and present the measurements result obtained for the first prototype dipole.