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BARRERA COLLIER

Handbook Of Accelerator Physics And Engineering (3rd Printing) World Scientific Publishing Company

This book of proceedings is an up-to-date review of the advances made in the past two decades on the production, control and exploitation of bright electron and light beams for science — in particular, innovative manipulation and control, in linear and circular accelerators, of high brightness charged particle beams. In the conceptual, theoretical and experimental framework of nonlinear beam dynamics and collective cooperative effects, the book provides an update of the state-of-the-art theoretical formulations, techniques and technologies, innovative concepts and scientific results obtained at existing accelerator facilities. Challenges and solutions, proposed or implemented, for the operation of third and fourth generation storage rings as synchrotron radiation sources and circular colliders for high energy particle physics, as well as radiofrequency linear accelerators for Compton/Thomson scattering-based light sources and free electron lasers, are reviewed and discussed. The complementarity between single-pass and recirculating light sources in energy, timing and spectral operational modes also emerges.

Energy Research Abstracts Gulf Professional Publishing

The high scienti?c interest in coherent X-ray light sources has stimulated world-wide e?orts in developing X-ray lasers. In this book a particularly promising approach is described, the free-electron laser (FEL), which is p- sued worldwide and holds the promise to deliver ultra-bright X-ray pulses of femtosecond duration. Other types of X-ray lasers are not discussed nor do we try a comparison of the relative virtues and drawbacks of di?erent concepts. The book has an introductory character and is written in the style of a universitytextbookforthemanynewcomersto the?eldoffree-electronlasers, graduate students as well as accelerator physicists, engineers and technicians; it is not intended to be a scienti?c monograph for the experts in the ?eld. Building on lectures by one of us (J. R.) at the CERN Accelerator School, and motivated by the positive response to a series of seminars on “FEL t- ory for pedestrians”, given by P. S. within the framework of the Academic Training Program at DESY, we have aimed at presenting the theory of the low-gainandthehigh-gainFELinaclearandconcisemathematicallanguage. Particular emphasis is put on explaining and justifying the assumptions and approximations that are needed to obtain the di?erential equations descr- ing the FEL dynamics. Although we have tried our best to be “simple”, the mathematical derivations are certainly not always as simple as one would like them to be. However, we are not aware of any easier approach to the FEL theory. Some of the more involved calculations are put into the appendices.

Introduction to Physical Principles, Experimental Results, Technological Challenges World Scientific

The development of high energy accelerators began in 1911, when Rutherford discovered the atomic nuclei inside the atom. Since then, progress has been made in the following: (1) development of high voltage dc and rf accelerators, (2) achievement of high field magnets with excellent field quality, (3) discovery of transverse and longitudinal beam focusing principles, (4) invention of high power rf sources, (5) improvement of high vacuum technology, (6) attainment of high brightness (polarized/unpolarized) electron/ion sources, (7) advancement of beam dynamics and beam manipulation schemes, such as beam injection, accumulation, slow and fast extraction, beam damping and beam cooling, instability feedback, etc.The impacts of the accelerator development are evidenced by the many ground-breaking discoveries in particle and nuclear physics, atomic and molecular physics, condensed matter physics, biomedical physics, medicine, biology, and industrial processing.This book is intended to be used as a graduate or senior undergraduate textbook in accelerator physics and science. It can be used as preparatory course material for graduate accelerator physics students doing thesis research. The text covers historical accelerator development, transverse betatron motion, synchrotron motion, an introduction to linear accelerators, and synchrotron radiation phenomena in low emittance electron storage rings, introduction to special topics such as the free electron laser and the beam-beam interaction. Attention is paid to derivation of the action-angle variables of the phase space, because the transformation is important for understanding advanced topics such as the collective instability and nonlinear beam dynamics. Each section is followed by exercises, which are designed to reinforce the concept discussed and to solve a realistic accelerator design problem.

Studies of Proton Driven Plasma Wakefield Acceleration World Scientific

This is the second book to RF Superconducting, written by one of the leading experts. The book provides fast and up-to-date access to the latest advances in the key technology for future accelerators. Experts as well as newcomers to the field will benefit from the discussion of progress in the basic science, technology as well as recent and

forthcoming applications. Researchers in accelerator physics will also find much that is relevant to their discipline.
Proceedings of the Workshop on Applications of High Intensity Proton Accelerators World Scientific
A comprehensive survey of recent theoretical and experimental progress in the area of electron-photon interaction and dense media. A state-of-the-art discussion of radiation production, with descriptions of new ideas and technologies that enhance the production of X-rays in the form of channelling, transition and parametric X-ray production. Progress in electron beam physics to produce sub-picosecond electron bunches from low-energy linear accelerators make it possible to produce coherent, high brightness, submillimeter radiation and sub-picosecond X-ray pulses. Micro-undulators in the form of bent crystalline structures hold great promise as future X-ray sources.
RF Superconductivity Nova Publishers
X-Ray Lasers 1996 provides not only an overview and progress report on this fast moving field, but also important reference material on which future work can be built. Topics covered include collisional x-ray lasers, table-top x-ray lasers, beam optics, x-ray optics, OFI and photo-pumped schemes, capillary schemes, international laser facilities, XUV nonlinear mixing, alternative soft x-ray sources, diagnostics, and applications. The volume is an essential addition to the libraries of researchers in the field.
Physical Principles, Experimental Results, Technical Realization CRC Press
Magnetic bunch compressors are designed to increase the peak current while maintaining the transverse and longitudinal emittances in order to drive a short-wavelength free electron laser (FEL). Recently, several linac-based FEL experiments observe self-developing micro-structures in the longitudinal phase space of electron bunches undergoing strong compression [1-3]. In the mean time, computer simulations of coherent synchrotron radiation (CSR) effects in bunch compressors illustrate that a CSR-driven microbunching instability may significantly amplify small longitudinal density and energy modulations and hence degrade the beam quality [4]. Various theoretical models have since been developed to describe this instability [5-8]. It is also pointed out that the microbunching instability may be driven strongly by the longitudinal space charge (LSC) field [9,10] and by the linac wakefield [11] in the accelerator, leading to a very large overall gain of a two-stage compression system such as found in the Linac Coherent Light Source (LCLS) [12]. This paper reviews theory and simulations of microbunching instability due to bunch compression, the proposed method to suppress its effects for short-wavelength FELs, and experimental characterizations of beam modulations in linear accelerators. A related topic of interests is microbunching instability in storage rings, which has been reported in the previous ICFA beam dynamics newsletter No. 35 (http://wwwbd.fnal.gov/icfabd/Newsletter35.pdf).
A Fast Longitudinal Phase Space Tracking Code with Graphical User Interface Springer Nature
An energetic charged particle beam introduced to an rf cavity excites a wakefield therein. This wakefield can be decomposed into a series of higher order modes and multipoles, which for sufficiently small beam offsets are dominated by the dipole component. This work focuses on using these dipole modes to detect the beam position in third harmonic superconducting S-band cavities for light source applications. A rigorous examination of several means of analysing the beam position based on signals radiated to higher order modes ports is presented. Experimental results indicate a position resolution, based on this technique, of 20 microns over a complete module of 4 cavities. Methods are also indicated for improving the resolution and for applying this method to other cavity configurations. This work is distinguished by its clarity and potential for application to several other international facilities. The material is presented in a didactic style and is recommended both for students new to the field, and for scientists well-versed in the field of rf diagnostics.
Measurement and Control of Charged Particle Beams World Scientific
In this study, we calculate the effects of Coherent Synchrotron Radiation (CSR) in the LCLS bunch compression section BC2[3] on the resulting FEL performance, considering a realistic, strongly non-gaussian longitudinal charge distribution. The longitudinal chirping required for the bunch compression process leads to a non-linear, non-monotonous [delta](z) functional dependence (Fig. 1 shows the current distribution and the energy offset along the bunch). We model this functional dependence by matching it to a cubic polynomial [delta] ≈ c0 + c1z + c2z2 + c3z3. During compression, the charge distribution in the z-[delta] plane will ''fold over'', as shown in fig. 2. This leads to a cusp at each end of the current distribution I(z), as shown in figure 3. High
Self Focusing of Relativistic Electron Bunches in Plasma Springer
This publication covers topics in the area of applied electromagnetics and mechanics. Since starting in Japan in 1988, the ISEM has become a well-known international forum on applied electromagnetics.
Geneva, Switzerland, July 7–11, 1980 Birkhäuser
Research and development of high energy accelerators began in 1911. Since then, progresses achieved are:The impacts of the accelerator development are evidenced by the many ground-breaking discoveries in particle and nuclear physics, atomic and molecular physics, condensed matter physics, biology, biomedical physics, nuclear medicine, medical therapy, and industrial processing. This book is intended to be used as a graduate or senior undergraduate textbook in accelerator physics and science. It can be used as preparatory course material in graduate accelerator physics thesis research. The text covers historical accelerator development, transverse betatron motion, synchrotron motion, an introduction to linear accelerators, and synchrotron radiation phenomena in low emittance electron storage rings, introduction to special topics such as the free electron laser and the beam-beam interaction. Hamiltonian dynamics is used to understand beam manipulation, instability and nonlinearity. Each section is followed by exercises, which are designed to reinforce the concept discussed and to solve a realistic accelerator design problem.
Handbook of Accelerator Physics and Engineering Springer
This volume presents the non-linear theory of electrostatic focusing of an electron beam split into bunches under conditions when the plasma permittivity at the modulation frequency is negative and the effective Coulomb force acting on the electron bunches is reversed. Conditions for the spatial equilibrium between the bunch and plasma emission, as well as the dynamics of the formation of focussed bunches, are confirmed by solving (both analytically and numerically) the self-consistent set of equations.
Proceedings of the 25th International Free Electron Laser Conference and the 10th FEL Users Workshop, Tsukuba, Ibaraki, Japan, 8-12 September 2003 World Scientific Publishing
This volume, consisting of articles written by experts with international repute and long experience, reviews the state of the art of accelerator physics and technologies

and the use of accelerators in research, industry and medicine. It covers a wide range of topics, from basic problems concerning the performance of circular and linear accelerators to technical issues and related fields. Also discussed are recent achievements that are of particular interest (such as RF quadrupole acceleration, ion sources and storage rings) and new technologies (such as superconductivity for magnets and RF cavities). The book will interest not only researchers and engineers in the field of accelerator development but also users of accelerators in research and industry. Moreover, teachers giving courses on accelerators and their applications will profit by learning about the most recent achievements and future possibilities. Contents:Introduction:What Can We Learn from Experiments with Accelerators and Storage Rings (C Jarlskog)Circular Accelerators and Storage Rings:Beam Optics and Lattice Design (P J Bryant)Collective Phenomena and Instabilities (J Gareyte)The Relativistic Heavy Ion Collider, RHIC (H Foelsche et al.)Beauty- and Tau-Charm Factories (Y Baconnier)Linear Accelerators:General Aspects of Linear Accelerators (P Lapostolle)RF Quadrupoles as Accelerators (A Schempp)Accelerator Physics of the Stanford Linear Collider and SLC Accelerator Experiments Towards the Next Linear Collider (J T Seeman)The Road to TeV Electron-Positron Colliders (Y Kimura)New Methods and Technologies:Superconducting Magnets for Accelerators (G Brianti & T Tortschanoff)Superconducting Cavities for High Energy Accelerators and Storage Rings (H Lengeler)Cooling of Particle Beams (D Möhl)Acceleration of Polarized Particles (J Buon)Ion Sources (H Haseroth & H Hora)A Good Idea at the Time (B W Montague)Geodesy for Particle Acceleratos (J Gervais & M Mayoud)Applications:Synchrotron Radiation Sources (S Tazzari)The Impact of Pulsed Spallation Neutron Sources on Condensed Matter Research (J L Finney)Inertial Fusion with Heavy Ions (I Hofmann)High Energy Accelerators in Medicine (P Mandrillon)Industrial Applications of Accelerators (K H W Bethge) Readership: High energy physicists, nuclear physicists and engineers. Reviews: “... essential reading for the accelerator specialist ... Bravo to the editor, Herwig Schopper, for making a success out of a timely compilation.” CERN Courier

Reviews Of Accelerator Science And Technology - Volume 9: Technology And Applications Of Advanced Accelerator Concepts World Scientific

Linac-based light sources and linear colliders typically apply longitudinal phase space manipulations in their design, including electron bunch compression and wakefield-induced energy spread control. Several computer codes handle such issues, but most also require detailed information on the transverse focusing lattice. In fact, in most linear accelerators, the transverse distributions do not significantly affect the longitudinal, and can be ignored initially. This allows the use of a fast 2D code to study longitudinal aspects without time-consuming considerations of the transverse focusing. LiTrack is based on a 15-year old code (same name) originally written by one of us (KB), which is now a Matlab [1] code with additional features, such as graphical user interface, prompt output plotting, and functional call within a script. This single-bunch tracking code includes RF acceleration, bunch compression to 3rd order, geometric and resistive short-range wakefields, aperture limits, synchrotron radiation, and flexible output plotting. The code was used to design both the LCLS [2] and the SPPS [3] projects at SLAC and typically runs 105 particles in

Accelerator Physics (Fourth Edition) Newnes

Edited by internationally recognized authorities in the field, this expanded and updated new edition of the bestselling Handbook, containing more than 100 new articles, is aimed at the design and operation of modern particle accelerators. It is intended as a vade mecum for professional engineers and physicists engaged in these subjects. With a collection of more than 2000 equations, 300 illustrations and 500 graphs and tables, here one will find, in addition to the common formulae of previous compilations, hard-to-find, specialized formulae, recipes and material data pooled from the lifetime experience of many of the world's most able practitioners of the art and science of accelerators.The eight chapters include both theoretical and practical matters as well as an extensive glossary of accelerator types. Chapters on beam dynamics and electromagnetic and nuclear interactions deal with linear and nonlinear single particle and collective effects including spin motion, beam-environment, beam-beam, beam-electron, beam-ion and intrabeam interactions. The impedance concept and related calculations are dealt with at length as are the instabilities associated with the various interactions mentioned. A chapter on operational considerations includes discussions on the assessment and correction of orbit and optics errors, real-time feedbacks, generation of short photon pulses, bunch compression, tuning of normal and superconducting linacs, energy recovery linacs, free electron lasers, cooling, space-charge compensation, brightness of light sources, collider luminosity optimization and collision schemes. Chapters on mechanical and electrical considerations present material data and important aspects of component design including heat transfer and refrigeration. Hardware systems for particle sources, feedback systems, confinement and acceleration (both normal conducting and superconducting) receive detailed treatment in a subsystems chapter, beam measurement techniques and apparatus being treated therein as well. The closing chapter gives data and methods for radiation protection computations as well as much data on radiation damage to various materials and devices.A detailed name and subject index is provided together with reliable references to the literature where the most detailed information available on all subjects treated can be found.

Accelerator Physics Atlantica Séguier Frontières

This volume captures the contents of the talks given at the Workshop on Applications of High Intensity Proton Accelerators held at Fermilab Oct 19ndash;21, 2009. This workshop brought together experts from a variety of disciplines to explore new and profound ways proton accelerators can be used in the future. The workshop explored uses of such a proton source for producing intense muon, kaon and neutrino beams as well as using the intense protons for new forms of nuclear reactors that go by the name Accelerator Driven Sub-critical systems that promise to increase our available nuclear fuel supply by orders of magnitude while at the same time solving the nuclear waste problem. Intense proton beams can also be used to produce short-lived nuclear isotopes that are important in the medical industry.

X-Ray Lasers 1996 World Scientific

The 22nd International Free Electron Laser Conference and 7th FEL User Workshop were held August 13-18, 2000 at Washington Duke Inn and Golf Club in Durham, North Carolina, USA. The conference and the workshop were hosted by Duke University's Free Electron laser (FEL) Laboratory. Following tradition, the FEL prize award was announced at the banquet. The year 2000 FEL prize was awarded to three scientists propelling the limits of high power FELs: Steven Benson,

Eisuke Minehara and George Neill. The conference program was comprised of traditional oral sessions on First Lasing, FEL theory, storage ring FELs, linac and high power FELs, long wavelength FELs, SASE FELs, accelerator and FEL physics and technology, and new developments and proposals. Two sessions on accelerator and FEL physics and technology reflected the emphasis on the high quality of accelerators and components for modern FELs. The breadth of the applications was presented in the workshop oral sessions on materials processing, biomedical and surgical applications, physics and chemistry as well as on instrumentation and methods for FEL applications. A special oral session was dedicated to FEL center status reports for users to learn more about the opportunities with FELs. As usual, the oral sessions were supplemented by poster sessions with in-depth discussions and communications. The FEL physicists and FEL users had excellent opportunities to interact throughout the duration of the event, culminating a Joint Sessions. The year 2000 was very successful being marked by lasing with two SASE and one storage ring short-wavelength FELs, and by the first human surgery with the use of FEL, to mention but a few. The International Program Committee and chairs of the sessions had the challenging and exciting problem of selecting invived and contributed talks for the conferences and the workshop from the influx of abstracts mentioning new results and ideas. The success of the conference was determined by these contributions. Scientists from 15 countries gave 70 talks, presented 176 posters and submitted 146 papers, which are published in the present volume of proceedings.

Free Electron Lasers 2002 Springer Science & Business Media
Since its invention in the 1920s, particle accelerators have made tremendous progress in accelerator science, technology and applications. However, the fundamental acceleration principle, namely, to apply an external radiofrequency (RF) electric field to accelerate charged particles, remains unchanged. As this method (either room temperature RF or superconducting RF) is approaching its intrinsic limitation in acceleration gradient (measured in MeV/m), it becomes apparent that new methods with much higher acceleration gradient (measured in GeV/m) must be found for future very high energy accelerators as well as future compact (table-top or room-size) accelerators. This volume introduces a number of advanced accelerator concepts (AAC) — their principles, technologies and potential applications. For the time being, none of them stands out as a definitive direction in which to go. But these novel ideas are in hot pursuit and look promising. Furthermore, some AAC requires a high power laser system. This has the implication of bringing two different communities — accelerator and laser — to join forces and work together. It will have profound impact on the future of our field. Also included are two special articles, one on "Particle Accelerators in China' which gives a comprehensive overview of the rapidly growing accelerator community in China. The other features the person-of-the-issue who was well-known nuclear physicist Jerome Lewis Duggan, a pioneer and founder of a huge community of industrial and medical accelerators in the US.

Proceedings of the Fifth International Conference on X-Ray Lasers held in Lund, Sweden, 10-14 June, 1996 Springer Science & Business Media
Edited by internationally recognized authorities in the field, this handbook focuses on Linacs, Synchrotrons and Storage Rings and is intended as a vade mecum for professional engineers and physicists engaged in these subjects. Here one will find, in addition to the common formulae of previous compilations, hard to find specialized formulae, recipes and material data pooled from the lifetime experiences of many of the world's most able practitioners of the art and science of accelerator building and operation.

A Bunch Compression Method for Free Electron Lasers that Avoids Parasitic Compressions John Wiley & Sons
The Linac Coherent Light Source (LCLS) [1] is an x-ray FEL project with a 1-nC electron bunch compressed to an rms length of 20 microns at 4.5 GeV, accelerated in 500 meters of SLAC linac to 15 GeV, and then injected into an undulator to generate SASE radiation. The longitudinal wakefield generated by the short bunch in the (S-band) linac is very strong, and is relied upon to cancel the energy chirp left in the beam after bunch compression. Up to now, both the average [2] and the shape [3] of the longitudinal wake of the SLAC linac have been measured and confirmed using bunches ranging down to an rms 500-microns in length. The recent installation of a chicane in the SLAC linac for the Sub-Picosecond Photon Source (SPPS) [4, 5, 6], however, allows compression of a 3.4-nC bunch down to 50 [mu]m rms length. We present measurements of the average wakefield, for bunch lengths down to this, LCLS-type scale, and compare with theory.