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Low Energy Muon Ionization Cooling Channel Fermilab

Muon Ionisation Cooling Experiment MICE: Creating a muon beam Fermilab Finds Feeble Fifth Force (Maybe) Legitimate Cold Fusion Exists | Muon-Catalyzed Fusion What's the future for Muons? - Chris Rogers Let’s Collide Muons. 1517 Cold Fusion Is Real Cold Fusion is Back (there's just one problem) Muon Colliders ▸ KITP Blackboard Talk by Nima Arkani-Hamed (IAS) Using BEC to Slow Down Light Dense Matter and Neutrinos - Joe Carlson How the Higgs Boson was discovered Episode 48: Low Temperatures - The Mechanical Universe Magnetohydrodynamic (MHD) Propulsion - What Is It? #magnetohydrodynamics #mhd #aerospace #asteronx Muon Detecting □ Healthy Water: Which is BEST WATER to Drink □ Lab 9 muon physics Albert Einstein doing physics | very rare video footage #shorts CERN Muon Accelerator How to make a muon beam Should We Build A Muon Collider? Deep Dive Revisited How your water can help with brain fog and low energy (Feat. Dr. Daniel Pompa) Space Powered Cooling

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Electromagnetic Design of RF Cavities for Accelerating Low-Energy Muons

Handbook of Accelerator Physics and Engineering

Novel Linac Structures for Low-beta Ions and for Muons

RF ACCELERATING STRUCTURE FOR THE MUON COOLING EXPERIMENT.

'98 Electroweak Interactions and Unified Theories

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KEK International Workshop on High Intensity Muon Sources

News 99

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edited by

OBRIEN THORNTON

Lepton and Photon Interactions at High Energies
World Scientific
This is a major revision of a classic, best selling reference book. Originally published by the American Institute of Physics under the title "Physics Vade Mecum" in 1981, and then the second edition in 1989 with the new title "A Physicist's Desk Reference", this third edition has been completely updated and modernized to reflect current modern physics.The book is a concise compilation of the most frequently used physics data and formulae with their derivations. This revision

has six more chapters than the second edition, outdated chapters dropped, and new chapters added on atmospheric physics, electricity and magnetism, elementary particle physics, fluid dynamics, geophysics, nonlinear physics, particle accelerators, polymer physics, and quantum theory. There is a new last chapter on practical laboratory data. The references and bibliographies have been updated.This book is an indispensable tool for the researcher, professional and student in physics as well as other scientists who use physics data. The editors of this volume are Richard Cohen, author of the first two chapters of PDR and the "Physics Quick Reference Guide"; David Lide, one of the editors of the previous two editions and the editor of the "CRC Handbook of Physics and Chemistry"; and George Trigg, editor of the "Encyclopedia of Physics" and the "Encyclopedia of Applied Physics" (VCH). The market for this classic reference book includes the practicing scientist, including engineers, chemists, and biologists; and students.

Reviews of Accelerator Science and Technology

World

Scientific

We propose a novel scheme for final muon ionization cooling with quadrupole doublets followed by emittance exchange in vacuum to achieve the small beam sizes needed by a muon collider. A flat muon beam with a series of quadrupole doublet half cells appears to provide the strong focusing required for final cooling. Each quadrupole doublet has a low beta region occupied by a dense, low Z absorber. After final cooling, normalized transverse, longitudinal, and angular momentum emittances of 0.100, 2.5, and 0.200 mm-rad are exchanged into 0.025, 70, and 0.0 mm-rad. A skew quadrupole triplet transforms a round muon bunch with modest angular momentum into a flat bunch with no angular momentum. Thin electrostatic septa efficiently slice the flat bunch into 17 parts. The 17 bunches are interleaved into a 3.7 meter long train with RF deflector cavities. Snap bunch coalescence combines the muon bunch train longitudinally in a 21 GeV ring in 55 µs, one quarter of a synchrotron oscillation period. A linear long wavelength RF bucket gives each bunch a different energy causing the bunches to drift in the ring until they merge into one bunch and can be captured in a short wavelength RF bucket with a 13% muon decay loss and a packing fraction as high as 87 %. **Electromagnetic Design of RF Cavities for Accelerating Low-Energy Muons** World Scientific Development of two innovative linacs is discussed. (1) High-efficiency normal-conducting accelerating structures for ions with beam velocities in the range of a few percent of the speed of light. Two existing accelerator technologies - the H-mode resonator cavities and transverse beam focusing by permanent-magnet quadrupoles (PMQ) - are merged to create efficient structures for light-ion beams of considerable currents. The inter-digital H-mode accelerator with PMQ focusing (IH-PMQ) has the shunt impedance 10-20 times higher than the standard drift-tube linac. Results of the combined 3-D modeling for an IH-PMQ accelerator tank - electromagnetic computations, beam-dynamics simulations, and thermal-stress analysis - are presented. H-PMQ structures following a short RFQ accelerator can be used in the front end of ion linacs or in stand-alone applications like a compact mobile deuteron-beam accelerator up to a few MeV. (2) A large-acceptance high-gradient linac for accelerating low-energy muons in a strong solenoidal magnetic field. When a proton beam hits a target, many low-energy pions are produced almost isotropically, in addition to a small number of high-energy pions in the forward direction. We propose to collect and accelerate copious muons created as the low-energy pions decay. The acceleration should bring muons to a kinetic energy of ≈200 MeV in about 10 m, where both an ionization cooling of the muon beam and its further acceleration in a superconducting linac become feasible. One potential solution is a normal-conducting linac consisting of independently fed O-mode RF cavities with wide apertures closed by thin metal windows or grids. The guiding magnetic field is provided by external superconducting solenoids. The cavity choice, overall linac design considerations, and simulation results of muon acceleration are presented. Potential applications range from basic research to homeland defense to industry and medicine.

Handbook of Accelerator Physics and Engineering World Scientific

Abstract Low emittance muon beam lines and muon colliders are potentially a rich source of BSM physics for future experimenters. A muon beam normalized emittance of ax, y, z = (280, 280, 1570)æm has been achieved in simulation with short solenoids and a betatron function of 3 cm. Here we use ICOOL and MAD-X to explore using a 400 MeV/c muon beam and strong focusing quadrupoles to achieve a normalized transverse emittance of 100 æm and complete 6D cooling. The low beta regions, as low as 5 mm, produced by the quadrupoles are occupied by dense, low Z absorbers, such as lithium hydride or beryllium, that cool the beam transversely. Equilibrium transverse emittance is linearly proportional to the transverse betatron function. Reverse emittance exchange with septa and/or wedges is then used to decrease transverse emittance from 100 to 25 æm at the expense of longitudinal emittance for a high energy lepton collider. Cooling challenges include chromaticity correction, ssband overlap, quadrupole acceptance, and staying in phase with RF.

Novel Linac Structures for Low-beta Ions and for Muons

Cambridge University Press

We propose a high-gradient linear accelerator for accelerating low-energy muons and pions in a strong solenoidal magnetic field. The acceleration starts immediately after collection of pions from a target by solenoidal magnets and brings muons to a kinetic energy of about 200 MeV over a distance of the order of 10 m. At this energy, both an ionization cooling of the muon beam and its further acceleration in a superconducting linac become feasible. The project presents unique challenges - a very large energy spread in a highly divergent beam, as well as pion and muon decays - requiring large longitudinal and transverse acceptances. One potential solution incorporates a normal-conducting linac consisting of independently fed O-mode RF cavities with wide apertures closed by thin metal windows or grids. The guiding magnetic field is provided by external superconducting solenoids. The cavity choice, overall linac design considerations, and simulation results of muon acceleration are presented. While the primary applications of such a linac are for homeland defense and industry, it can provide muon fluxes high enough to be of interest for physics experiments. **RF ACCELERATING STRUCTURE FOR THE MUON COOLING EXPERIMENT.** World Scientific 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.

'98 Electroweak Interactions and Unified Theories CRC Press

This volume provides an overview of the state of the art in computational accelerator physics, based on papers presented at the seventh international conference at Michigan State University in October 2002. The major topics covered in this volume include particle tracking and ray tracing, transfer map methods, field computation for time dependent Maxwell's equations and static magnetic problems, as well as space charge and beam-beam effects. The book also discusses modern computational environments, including parallel clusters, visualization, and new programming paradigms. It is ideal for scientists and engineers working in beam or accelerator physics and related areas of applied math and computer science.

INTERACTION OF MUON BEAM WITH PLASMA DEVELOPED DURING IONIZATION COOLING.

Springer Science & Business Media

This volume presents the possibility of high intensity muon sources whose intensity would be at least 104 higher than that available now. Scientific opportunities anticipated with such sources are search for muon lepton flavor violation, measurements of the muon anomalous magnetic moment and the electric dipole moment, neutrino factories based on a muon storage ring, muon collider and muon applied science such as muon catalyzed fusion and biology. In addition to physics opportunities, the necessary technology for such sources is discussed.

KEK International Workshop on High Intensity Muon Sources

World Scientific

A high-gradient linear accelerator for accelerating low-energy muons and pions in a strong solenoidal magnetic field has been proposed for homeland defense and industrial applications. The acceleration starts immediately after collection of pions from a target in a solenoidal magnetic field and brings decay muons, which initially have kinetic energies mostly around 15-20 MeV, to 200 MeV over a distance of ≈10 m. At this energy, both ionization cooling and further, more conventional acceleration of the muon beam become feasible. A normal-conducting linac with external-solenoid focusing can provide the required large beam acceptances. The linac consists of independently fed zero-mode (TM010) RF cavities with wide beam apertures closed by thin conducting edge-cooled windows. Electromagnetic design of the cavity, including its RF coupler, tuning and vacuum elements, and field probes, has been developed with the CST MicroWave Studio, and is presented. *News 99* World Scientific The international Muon Ionization Cooling Experiment (MICE) will perform a systematic investigation of ionization cooling with muon beams of momentum between 140 and 240\, MeV/c at the Rutherford Appleton Laboratory ISIS facility. The measurement of ionization cooling in MICE relies on the selection of a pure sample of muons that traverse the experiment. To make this selection, the MICE Muon Beam is designed to deliver a beam of muons with less than $\sim$1\% contamination. To make the final muon selection, MICE employs a particle-identification (PID) system upstream and downstream of the cooling cell. The PID system includes time-of-flight hodoscopes, threshold-Cherenkov counters and calorimetry. The upper limit for the pion contamination measured in this paper is $f_\pi

Final 6D Muon Ionization Colling Using Strong Focusing Quadrupoles

Atlantica Séguier Frontières

The area of physics involving muons and neutrinos has become exciting in particle physics. Using their high intensity sources, physicists undertake, in various ways, extensive searches for new physics beyond the Standard Model, such as tests of supersymmetric grand unification (SUSY-GUT) and precision measurements of the muon and neutrino properties, which will in future extend to ambitious studies such as determination of the three-generation neutrino mixing matrix elements and CP violation in the lepton sector. The physics of this field is advancing, with potential improvements of the sources. Many R & D projects, such as those concerning high intensity, low energy muon sources or a neutrino factory, are being carried out or planned at various places. Some of those topics are included in this book.

Lampf Users Group Inc. (Lugi) Symposium: 20 Years Of Meson Factory Physics: Accomplishments And Prosp

World Scientific Ionization cooling requires low-Z energy absorbers immersed in a strong magnetic field and high-gradient, large-aperture RF cavities to be able to cool a muon beam as quickly as the short muon lifetime requires. RF cavities that operate in vacuum are vulnerable to dark-current-generated breakdown, which is exacerbated by strong magnetic fields, and they require extra safety windows that degrade cooling, to separate RF regions from hydrogen energy absorbers. RF cavities pressurized with dense hydrogen gas will be developed that use the same gas volume to provide the energy absorber and the RF acceleration needed for ionization cooling. The breakdown suppression by the dense gas will allow the cavities to operate in strong magnetic fields. Measurements of the operation of such a cavity will be made as functions of external magnetic field and charged particle beam intensity and compared with models to understand the characteristics of this technology and to develop mitigating strategies if necessary.

The Proceedings of the International Symposium on Nuclear Electro-Weak Spectroscopy for Symmetries in Electro-Weak Nuclear-Processes

World Scientific Addressing the need for an up-to-date reference on silicon devices and heterostructures, Beyond the Desert 99 reviews the technology used to grow and characterize Goup IV alloy films. It covers the theory, device design, and simulation of heterojunction transistors, emphasizing their relevance in developing the technologies involving strained layers; device design and simulation of conventional silicon bipolar transistors and SiGe HBTs at room and low temperatures; and device design and simulation for MOSFETs, including SiGe and strained-

Si channel MOSFETs. The book concludes with simulations and examples of different applications. It provides a unified reference for scientists and engineers investigating the use of SiGe and strained silicon in a new generation of high-speed circuit applications. The MICE Demonstration of Muon Ionization Cooling High Field - Low Energy Muon Ionization Cooling ChannelMuon beams are generated with large transverse and longitudinal emittances. In order to achieve the low emittances required by a muon collider, within the short lifetime of the muons, ionization cooling is required. Cooling schemes have been developed to reduce the muon beam 6D emittances to ≈ 300 [mu]m-rad in transverse and ≈ 1-1.5 mm in longitudinal dimensions. The transverse emittance has to be further reduced to ≈ 50-25 [mu]m-rad with an upper limit on the longitudinal emittance of ≈ 76 mm in order to meet the high-energy muon collider luminosity requirements. Earlier studies of the transverse cooling of low energy muon beams in high field magnets showed a promising performance, but did not include transverse or longitudinal matching between the stages. In this study we present the first complete design of the high field-low energy ionization cooling channel with transverse and longitudinal matching. The channel design was based on strong focusing solenoids with fields of 25-30 T and low momentum muon beam starting at 135 MeV/c and gradually decreasing. The cooling channel design presented here is the first to reach ≈ 50 micron scale emittance beam. As a result, we present the channel's optimized design parameters including the focusing solenoid fields, absorber parameters and the transverse and longitudinal matching.High Field {u2013} Low Energy Muon Ionization Cooling ChannelMuon beams are generated with large transverse and longitudinal emittances. In order to achieve the low emittances required by a muon collider, within the short lifetime of the muons, ionization cooling is required. Cooling schemes have been developed to reduce the muon beam 6D emittances to ≈ 300 ?m–rad in transverse and ≈ 1–1.5

mm in longitudinal dimensions. The transverse emittance has to be further reduced to ≈ 50–25 ?m–rad with an upper limit on the longitudinal emittance of ≈ 76 mm in order to meet the high-energy muon collider luminosity requirements. Earlier studies of the transverse cooling of low energy muon beams in high field magnets showed a promising performance, but did not include transverse or longitudinal matching between the stages. In this study we present the first complete design of the high field-low energy ionization cooling channel with transverse and longitudinal matching. The channel design was based on strong focusing solenoids with fields of 25–30 T and low momentum muon beam starting at 135 MeV/c and gradually decreasing. The cooling channel design presented here is the first to reach ≈ 50 micron scale emittance beam. As a result, we present the channel's optimized design parameters including the focusing solenoid fields, absorber parameters and the transverse and longitudinal matching.Simulated Measurements of Cooling in Muon Ionization

Cooling ExperimentCooled muon beams set the basis for the exploration of physics of flavour at a Neutrino Factory and for multi-TeV collisions at a Muon Collider. The international Muon Ionization Cooling Experiment (MICE) measures beam emittance before and after an ionization cooling cell and aims to demonstrate emittance reduction in muon beams. In the current MICE Step IV configuration, the MICE muon beam passes through low-Z absorber material for reducing its transverse emittance through ionization energy loss. Two scintillating fiber tracking detectors, housed in spectrometer solenoid modules upstream and downstream of the absorber are used for reconstructing position and momentum of individual muons for calculating transverse emittance reduction. However, due to existence of non-linear effects in beam optics, transverse emittance growth can be observed. Therefore, it is crucial to develop algorithms that are insensitive to this apparent emittance growth. We describe a different figure of merit for measuring muon cooling which is the direct measurement of the phase space density.The MICE Demonstration of Muon Ionization CoolingMuon beams of low emittance provide the basis for the intense, well-characterised neutrino beams necessary to elucidate the physics of flavour at the Neutrino Factory and to provide lepton-antilepton collisions up to several TeV at the Muon Collider. The international Muon Ionization Cooling Experiment (MICE) will demonstrate muon ionization cooling, the technique proposed to reduce the phase-space volume occupied by the muon beam at such facilities. In an ionization-cooling channel, the muon beam traverses a material (the absorber) loosing energy, which is replaced using RF cavities. The combined effect is to reduce the transverse emittance of the beam (transverse cooling). The configuration of MICE required to deliver the demonstration of ionization cooling is being prepared in parallel to the execution of a programme designed to measure the cooling properties of liquid-hydrogen and lithium hydride. The design of the cooling-demonstration experiment will be presented together with a summary of the performance of each of its components and the cooling performance of the experiment.Electromagnetic Design of RF Cavities for Accelerating Low-Energy MuonsA high-gradient linear accelerator for accelerating low-energy muons and pions in a strong solenoidal magnetic field has been proposed for homeland defense and industrial applications. The acceleration starts immediately after collection of pions from a target in a solenoidal magnetic field and brings decay muons, which initially have kinetic energies mostly around 15-20 MeV, to 200 MeV over a distance of ≈10 m. At this energy, both ionization cooling and further, more conventional acceleration of the muon beam become feasible. A normal-conducting linac with external-solenoid focusing can provide the required large beam acceptances. The linac consists of independently fed zero-mode (TM010) RF cavities with wide beam apertures closed by thin conducting edge-cooled windows. Electromagnetic design of the cavity, including its RF coupler, tuning and vacuum elements, and field probes, has been developed with the CST MicroWave Studio, and is presented.The MICE

Demonstration of Ionization CoolingMuon beams of low emittance provide the basis for the intense, well-characterised neutrino beams necessary to elucidate the physics of flavour at the Neutrino Factory and to provide lepton-antilepton collisions at energies of up to several TeV at the Muon Collider. The International Muon Ionization Cooling Experiment (MICE) will demonstrate ionization cooling, the technique by which it is proposed to reduce the phase-space volume occupied by the muon beam at such facilities. In an ionization cooling channel, the muon beam passes through a material (the absorber) in which it loses energy. The energy lost is then replaced using RF cavities. The combined effect of energy loss and re-acceleration is to reduce the transverse emittance of the beam (transverse cooling). A major revision of the scope of the project was carried out over the summer of 2014. The revised project plan, which has received the formal endorsement of the international MICE Project Board and the international MICE Funding Agency Committee, will deliver a demonstration of ionization cooling by September 2017. In the revised configuration a central lithium-hydride absorber provides the cooling effect. The magnetic lattice is provided by the two superconducting focus coils and acceleration is provided by two 201 MHz single-cavity modules. The phase space of the muons entering and leaving the cooling cell will be measured by two solenoidal spectrometers. All the superconducting magnets for the ionization cooling demonstration are available at the Rutherford Appleton Laboratory and the first single-cavity prototype is under test in the MuCool Test Area at Fermilab. The design of the cooling demonstration experiment will be described together with a summary of the performance of each of its components. The cooling performance of the revised configuration will also be presented.A Study of Muon Ionization Cooling at MICE.A Neutrino Factory based on a high-energy muon storage-ring is proposed to study neutrino oscillation with high precision. An emittance reduction of muon beam by ionization cooling, which has never been demonstrated in practice, is one of the critical issues for Neutrino Factory. The international Muon Ionisation

Cooling Experiment (MICE) is the first experiment to verify an effect of the ionization cooling with muons. MICE will measure a change in transverse emittance of approximately 10% with a precision of ±0.1%. In order to meet the requirements, muon trackers based on 350 [mu]m diameter scintillating fibers have been proposed. The construction of such trackers is a very challenging task and some innovative techniques are needed to realize, since there have been no trackers made with such a small diameter of scintillating fibers in the world. Upstream and downstream SciFi trackers have been successfully constructed with the international collaboration of UK, US and Japan by 2008. Both of the trackers have been tested with cosmic-rays at the RAL by 2009, at which high tracking efficiencies more than 90% are measured for both trackers. It is also confirmed that by collecting the misalignments found in both of the trackers, the requirements for the emittance measurement is met.Reviews Of Accelerator Science And Technology - Volume 10: The Future Of Accelerators Muons are unstable elementary particles that are found in space, which can also be produced in particle accelerators to an intensity a billion times greater than that occurring naturally. This book describes the various applications of muons across the spectrum of the sciences and engineering. Scientific research using muons relies both on their basic properties as well as the microscopic interaction between them and surrounding particles such as nuclei, electrons, atoms and molecules. Examples of research that can be carried out using muons include muon catalysis for nuclear fusion, the application of muon spin probes to study microscopic magnetic properties of advanced materials, electron labelling to help in the understanding of electron transfer in proteins, and non-destructive element analysis of the human body. Cosmic ray muons can also be used to study the inner structure of volcanoes.

Pion Contamination in the MICE Muon Beam

World Scientific
The 32nd International Conference on High Energy Physics belongs to the Rochester Conference Series, and is the most important international conference in 2004 on high

energy physics. The proceedings provide a comprehensive review on the recent developments in experimental and theoretical particle physics. The latest results on Top, Higgs search, CP violation, neutrino mixing, pentaquarks, heavy quark mesons and baryons, search for new particles and new phenomena, String theory, Extra dimension, Black hole and Lattice calculation are discussed extensively. The topics covered include not only those of main interest to the high energy physics community, but also recent research and future plans. Contents: Neutrino Masses and MixingsQuark Matter and Heavy Ion CollisionsParticle Astrophysics and CosmologyElectroweak PhysicsQCD Hard InteractionsQCD Soft InteractionsComputational Quantum Field TheoryCP Violation, Rare Kaon Decay and CKMR&D for Future Accelerator and DetectorHadron Spectroscopy and ExoticsHeavy Quark Mesons and BaryonsBeyond the Standard ModelString Theory Readership: Experimental and theoretical physicists and graduate students in the fields of particle physics, nuclear physics, astrophysics and cosmology.Keywords:High Energy Physics;Particle Physics;Electroweak;QCD;Heavy Quark;Neutrino;Particle Astrophysics;Hadron Spectroscopy;CP Violation;Quark Matter;Future Accelerator

Physics and Technology of Linear Accelerator Systems

World Scientific

This book reviews the major physics results from the meson factories, surveys the status of the relevant fields (including pion physics, hadron physics, and electroweak physics), and explores prospects for further progress.

Simulated Measurements of Cooling in Muon Ionization Cooling Experiment

World Scientific

The ionization cooling of muons requires longitudinal acceleration of the muons after scattering in a hydrogen target. In order to maximize the accelerating voltage, we propose using linear accelerating structures with cells bounded by thin beryllium metal foils. This produces an on-axis field equivalent to the maximum surface field, whereas with beam-pipes the accelerating field is approximately half that of the peak surface field in the cavity. The muons interact only weakly with the thin foils. A [pi]/2 interleaved cavity structure has been chosen, with alternate cells coupled together externally, and the two groups of cells fed in quadrature. At present they are considering an operating temperature of 77K to gain a factor of at least two in Q-value over room temperature. The authors describe the design of the [pi]/2 interleaved cavity structure, design of an alternative [pi]-mode open structure, preliminary experimental results from a low-power test cavity, and plans for high-power testing.

Challenges And Goals For Accelerators In The Xxi Century

Taylor & Francis

Muon beams of low emittance provide the basis for the intense, well-characterised neutrino beams necessary to elucidate the physics of flavour at the Neutrino Factory and to provide lepton-antilepton collisions at energies of up to several TeV at the Muon Collider. The International Muon Ionization Cooling Experiment (MICE) will demonstrate ionization cooling, the technique by which it is proposed to reduce the phase-space volume occupied by the muon beam at such facilities. In an ionization cooling channel, the muon beam passes through a material (the absorber) in which it loses energy. The energy lost is then replaced using RF cavities. The combined effect of energy loss and re-acceleration is to reduce the transverse emittance of the beam (transverse cooling). A major revision of the scope of the project was carried out over the summer of 2014. The revised project plan, which has received the formal endorsement of the international MICE Project Board and the international MICE Funding Agency Committee, will deliver a demonstration of ionization cooling by September 2017. In the revised configuration a central lithium-hydride absorber provides the cooling effect. The magnetic lattice is provided by the two superconducting focus coils and acceleration is provided by two 201 MHz single-cavity modules. The phase space of the muons entering and leaving the cooling cell will be measured by two solenoidal spectrometers. All the superconducting magnets for the ionization cooling demonstration are available at the Rutherford Appleton Laboratory and the first single-cavity prototype is under test in the MuCool Test Area at Fermilab. The design of the cooling demonstration experiment will be described together with a summary of the performance of each of its components. The cooling performance of the revised configuration will also be presented. Hydrogen-filled RF Cavities for Muon Beam Cooling World Scientific The Muon Accelerator Program (MAP) collaboration is working to develop an ionization cooling channel for muon beams. An ionization cooling channel requires the operation of high-gradient, normal-conducting RF cavities in multi-Tesla solenoidal magnetic fields. However, experiments conducted at Fermilab?s MuCool Test Area (MTA) show that increasing the solenoidal field strength reduces the maximum achievable cavity gradient. This gradient limit is characterized by an RF breakdown process that has caused significant damage to copper cavity interiors. The damage may be caused by field-emitted electrons, focused by the solenoidal magnetic field onto small areas of the inner cavity

surface. Local heating may then induce material fatigue and surface damage. Fabricating a cavity with beryllium walls would mitigate this damage due to beryllium?s low density, low thermal expansion, and high electrical and thermal conductivity. We address the design and fabrication of a pillbox RF cavity with beryllium walls, in order to evaluate the performance of high-gradient cavities in strong magnetic fields.
Springer Science & Business Media
This book contains the Proceedings of the Fourth International Conference on Particle Physics Beyond the Standard Model - BEYOND THE DESERT 2003. Emphasis at BEYOND03 was put on supergravity, which had its twentieth birthday that year, on neutrino physics and dark matter search, and on gravitation and cosmology, and some other very important fields. The book resents a timely and valuable overview of the status and future potential and trends in theoretical and experimental particle physics, in the complementary sectors of accelerator, non-accelerator and space physics.

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