We describe the operation and commissioning of the Jefferson Lab UV FEL using a CW SRF ERL driver. Based on the same 135 MeV linear accelerator as the Jefferson Lab 10 kW IR Upgrade FEL, the UV driver ERL uses a bypass geometry to provide transverse phase space control, bunch length compression, and nonlinear aberration compensation necessitating a unique set of commissioning and operational procedures. Additionally, a novel technique to initiate lasing is described. To meet these constraints and accommodate a challenging installation schedule, we adopted a staged commissioning plan with alternating installation and operation periods. This report addresses these issues and presents operational results from on-going beam operations. A 499 MHz parallel bar superconducting deflecting cavity has been designed and optimized for a possible implementation at the Jefferson Lab. Previously the mechanical analysis, mainly stress, was performed. Since then pressure sensitivity was studied further and the cavity parts were fabricated. The prototype cavity is not completed due to the renovation at Jefferson Lab which resulted in the temporary shutdown of the electron beam welding facility. This paper will present the analysis results and facts encountered during fabrication. The unique geometry of the cavity and its required mechanical strength present interesting manufacturing challenges.

This book contains the Proceedings of the 24th International Free Electron Laser Conference and the 9th Free Electron Laser Users Workshop, which were held on September 9-13, 2002 at Argonne National Laboratory. Part I has been reprinted from Nucl. Instr. and Meth. A 507 (2003), Nos. 1-2. This volume contains the refereed and selected contributions from the International Conference on Quark Nuclear Physics.
(QNP2002), held from 9 to 14 June 2002 in Jülich, Germany. Supported with 119 illustrations, this milestone work discusses key optical imaging techniques in self-contained chapters; describes the integration of optical imaging techniques with other modalities like MRI, X-ray imaging, and PET imaging; provides a software platform for multimodal integration; presents cutting-edge computational and data processing techniques that ensure rapid, cost-effective, and precise quantification and characterization of the clinical data; covers advances in photodynamic therapy and molecular imaging, and reviews key clinical studies in optical imaging along with regulatory and business issues.

The 23 "rd" International Free Electron Laser Conference and the 8 "th" FEL Users Workshop were held on August 20-24 "th" 2001 at the Technische Universität Darmstadt (TUD) in Germany. This conference is one of a series of FEL conferences administered by an International Executive Committee. It was organized by the Institute of Nuclear Physics of the TUDD at which in 1996 the first free electron laser in Germany went into operation, the super-conducting Darmstadt electron linear accelerator.

One of the key components for the superconducting RF Energy Recovery Linac, (ERL) under development in the Collider Accelerator Department at Brookhaven National Laboratory, is the Linac cavity and cryomodule. The cavity is a 5 cell accelerating cavity designed to operate at 703.75 MHz, and to accelerate 2 MeV electrons from the photoinjector up to 15-20 MeV, allow them to make a single pass around the ERL loop and then decelerate them back down to 2 MeV prior to sending them to the beam dump. This cavity was designed by Rama Calaga and Ilan Ben-Zvi at BNL and fabricated by Advanced Energy Systems in Medford, NY. The cavity was then delivered to Thomas Jefferson Laboratory in VA for chemical processing, testing
and assembly of the hermetic string assembly suitable for shipment back to BNL. Once at BNL it was built into a complete cryomodule, installed in the ERL test facility and commissioned. This paper will review the key components of the cavity and cryomodule and discuss the present status of the cryomodule commissioning. The BNL 5 cell accelerating cavity has been designed for use in our high average current Energy Recovery Linac, a proof of principle machine to demonstrate key components necessary for the future upgrades to RHIC as well as applications for future ampere class high current, high brightness ERL programs. The cavity has been tested at greater than 20 MV/m with a Q0 of 1e1°, meeting the design specifications for use at full energy in the ERL. This paper will review the cavity design and specifications as well as the RF measurements that have been made both in the VTA at Jefferson Lab as well as during the commissioning in the ERL test cave at BNL. Finally the future plan for cavity testing and measurements prior to its use in ERL operations will be reviewed. The general physics parameters for the cavity can be found in table 1, and the reader is referred to Rama Calaga's Thesis for a much more detailed review of the cavity geometry and design. There are several different parameters that make this cavity design very unique. The first is the 17 cm diameter cavity iris and 24 cm diameter beampipe. The geometry, along with the cavity design, results in a cavity with no trapped higher order modes, and a BBU threshold is > 2 amperes. Another feature of the geometry of this particular cavity is the fact that the lowest mechanical resonance is at H'00 Hz, thus making it much less susceptible to microphonics.

This book is dedicated to superconducting technology and its applications, including superconducting magnets (SC magnets) and superconducting radio-frequency (SRF) cavities.
We have produced and measured for the first time second harmonic oscillation in the infrared region by the high average power Jefferson Lab Infrared Free Electron Laser. Although such lasing is ideally forbidden, since gain is zero on axis for a perfect electron beam in an infinite wiggler, the finite geometry and beam emittance allows sufficient gain for lasing to occur. We were able to lase at pulse rates up to 74.85 MHz and could produce over 4.5 watts average and 40 kW peak of IR power in a 40 nm FWHM bandwidth at 2925 nm. In agreement with predictions, the source preferentially lased in a TEM01 mode. We present results of initial source performance measurements and comparisons of gain as calculated by different approaches.

The papers collected in this book represent an exciting contribution to the growing body of experimental and theoretical research into exotic hadrons. The prime focus of the volume is the latest work on pentaquark baryons. The in-depth experimental reports cover both positive and negative evidence for the existence of various combinations of particles, and photo-electro production, hadronic production and high-energy processes are discussed in detail. Important theoretical areas of current interest are considered, including chiral solitons, constituent quarks, the QCD sum rule, lattice QCD, production reactions, and the determination of spin and parity. The volume features the work of two pioneering theorists, H Lipkin and D Diakonov, among the comprehensive coverage of the latest theoretical ideas in the field. The proceedings have been selected for coverage in:

- Index to Scientific & Technical Proceedings® (ISTP® / ISI Proceedings)
- Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings)
- CC Proceedings — Engineering & Physical Sciences

A key technology issue on the path to high-power FEL operation is the demonstration of reliable, high-brightness,
photo-cathode injector operation. The physics and engineering conceptual design of a high-current superconducting RF injector has been completed and will be presented. The system, which is an outgrowth of the existing injector on the Jefferson Lab IRFEL[1], consists of an integrated room temperature DC photocathode gun and a 500 MHz superconducting RF accelerator. The device is compact and produces high-brightness beams. After DC acceleration in the gun, emittance compensation techniques are utilized to reduce the rms normalized emittance by over a factor of two to (approximately)2-1/4 mm-mrad at the output of the RF accelerator. The design is based upon the existing geometry of the Jefferson Lab DC gun and will be capable of operation at 100 mA average beam current.

This volume contains the proceedings of the IX International Conference on Hypernuclear and Strange Particle Physics (HYP 2006). This conference series is devoted to the progress of our knowledge about strangeness flavor in hadron and nuclear physics. Besides the traditional topics such as hadron structure, hypernuclear spectroscopy and weak decay of hypernuclei, a particular focus of this conference was on the properties of strange mesons and their binding in nuclear systems.

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.

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 invited 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
Recent polarization-based precision measurements of the nucleons' elastic electric form factors have led to surprising results. The measurement of the ratio of the proton's electromagnetic form factors, $\mu_p G_E^p/G_M^p$, was found to drop nearly linearly with $Q^2$ out to at least $5 \text{GeV}^2$, inconsistent with the older Rosenbluth-type experiments. A recent measurement of $G_E^n$, the neutron's electric form-factor saw $G_E^n$ does not fall off as quickly as commonly expected up to $Q^2 \approx 1.5 \text{GeV}^2$. Extending this study, a precision measurement of $G_E^n$ up to $Q^2=3.5 \text{GeV}^2$ was completed in Hall A at Jefferson Lab. The ratio $G_E^n/G_M^n$ was measured through the beam-target asymmetry $A_{\perp}$ of electrons quasi-elastically scattered off polarized neutrons in the reaction ${}^3\text{He}(e, e'n)$. The experiment took full advantage of the electron beam, recent target developments, as well as two detectors new to Jefferson Lab. The measurement used the accelerator's 100\% duty-cycle high-polarization (typically 84\%) electron beam and a new, hybrid optically-pumped polarized ${}^3\text{He}$ target which achieved in-beam polarizations in excess of 50\%. A medium acceptance (80msr) open-geometry magnetic spectrometer (BigBite) detected the scattered electron, while a geometrically matched neutron detector observed the struck neutron. Preliminary results from this measurement will be discussed and compared to modern calculations of $G_E^n$. Jefferson Lab is constructing a 350 kV direct current high voltage photoemission gun employing a compact inverted-geometry insulator. This photogun will produce polarized electron beams at an injector test facility intended for low energy nuclear physics experiments, and to assist the
development of new technology for the Continuous Electron Beam Accelerator Facility. A photogun operating at 350kV bias voltage reduces the complexity of the injector design, by eliminating the need for a graded-beta radio frequency "capture" section employed to boost lower voltage beams to relativistic speed. However, reliable photogun operation at 350 kV necessitates solving serious high voltage problems related to breakdown and field emission. This study focuses on developing effective methods to avoid breakdown at the interface between the insulator and the commercial high voltage cable that connects the photogun to the high voltage power supply. Three types of inverted insulators were tested, in combination with two electrode configurations. Our results indicate that tailoring the conductivity of the insulator material, and/or adding a cathode triple-junction screening electrode, effectively serves to increase the hold-off voltage from 300kV to more than 375kV. In conclusion, electrostatic field maps suggest these configurations serve to produce a more uniform potential gradient across the insulator.

This book deals with the latest developments in the area of three-quark systems. Emphasis is given to the discussion of new experimental results in the areas of form factors, unpolarized and polarized structure functions, and baryon structure and spectroscopy. Of particular interest are the new theoretical developments in the area of generalized parton distributions and lattice quantum chromodynamics.

We have produced and measured for the first time second harmonic oscillation in the infrared region by the high average power Jefferson Lab Infrared Free
Electron Laser. Although such lasing is ideally forbidden, since gain is zero on axis for a perfect electron beam in an infinite wiggler, the finite geometry allows sufficient gain in this situation for lasing to occur. We were able to lase at pulse rates up to 74.85 MHz and could produce over 4.5 watts average and 40 kW peak of IR power in a 40 nm FWHM bandwidth at 2925 nm. In agreement with predictions, the source preferentially lased in a TEM-01 mode. We present results of initial source performance measurements and comparisons of gain as calculated by different approaches.

This book contains the proceedings of the third international workshop on From Parity Violation to Hadronic Structure and More. The many applications of parity violation are way beyond the scope of what Lee and Yang could have imagined fifty years after their proposal. For the physics topics discussed during this workshop, the application of parity violation has become a standard work horse allowing for the extraction of many physics topics in different experiments.

We report on the design, construction, commissioning, and performance of a threshold gas Cerenkov counter in an open configuration, which operates in a high luminosity environment and produces a high photo-electron yield. Part of a unique open geometry detector package known as the Big Electron Telescope Array, this Cerenkov
counter served to identify scattered electrons and reject produced pions in an inclusive scattering experiment known as the Spin Asymmetries of the Nucleon Experiment E07-003 at the Thomas Jefferson National Accelerator Facility (TJNAF) also known as Jefferson Lab. The experiment consisted of a measurement of double spin asymmetries $A$. This book focuses on the physics of exclusive processes at high momentum transfer and their description in terms of generalized parton distributions, perturbative QCD, and relativistic quark models. It covers recent developments in the field, both theoretical and experimental. Contents:

- Perspectives on Exclusive Processes in QCD (S J Brodsky)
- High-t Meson Photo- and Electroproduction: A Window on Partonic Structure of Hadrons (J-M Laget)
- Nucleon Hologram with Exclusive Leptoproduction (A Belitsky & D Muller)
- QCD Factorization for the Pion Diffractive Dissociation into Two Jets (D Yu Ivanov)
- GPDs, Form Factors and Compton Scattering (P Kroll)
- Real Compton Scattering from the Proton (A Nathan)
- Resonance Exchange Contributions to Wide-Angle Compton Scattering: The D-Term (T Oppermann)
- Proton-Antiproton Annihilation into Two Photons at Large $s$ (C Weiss)
- Quark--Hadron Duality Studies at Jefferson Lab; An Overview of New and Existing Results (C Keppel)
- Novel Hard Semiexclusive Processes and Color Singlet Clusters
in Hadrons (M Strikman et al.); and other papers. Readership: Theoretical and experimental researchers in nuclear and elementary particle physics.

We describe the design of the SRF Energy-Recovering Linac (ERL) providing the CW electron drive beam at the Jefferson Lab UV FEL. Based on the same 135 MeV linear accelerator as and sharing portions of the recirculator with the Jefferson Lab 10 kW IR Upgrade FEL, the UV driver ERL uses a novel bypass geometry to provide transverse phase space control, bunch length compression, and nonlinear aberration compensation (including correction of RF curvature effects) without the use of magnetic chicanes or harmonic RF. Stringent phase space requirements at the wiggler, low beam energy, high beam current, and use of a pre-existing facility and legacy hardware subject the design to numerous constraints. These are imposed not only by the need for both transverse and longitudinal phase space management, but also by the potential impact of collective phenomena (space charge, wakefields, beam break-up (BBU), and coherent synchrotron radiation (CSR)), and by interactions between the FEL and the accelerator RF system. This report addresses these issues and presents the accelerator design solution that is now in operation.
Practice Makes Perfect! Get the practice you need to succeed on the ACT! Preparing for the ACT can be particularly stressful. McGraw-Hill: 10 ACT Practice Tests, Sixth Edition explains how the test is structured, what it measures, and how to budget your time for each section. Written by renowned test prep experts, this book has been fully updated to match the latest test. The 10 intensive practice tests help you improve your scores from each test to the next. You'll learn how to sharpen your skills, boost your confidence, reduce your stress—and to do your very best on test day. Features Include: • 10 complete sample ACT exams, with full explanations for every answer • Updated content matches the new test requirements • In-depth explanatory answers for every question • Scoring worksheets to help you calculate your total score for every test • Free access to additional practice ACT tests online

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The three quadrupoles of a High Resolution Spectrometer (Jefferson Lab., hall A) were mapped using an array of 10 coils of well-defined geometry. The Q1 quadrupole has a 30 cm diameter bore and was measured over 1.6 m. The dimensions for Q2 and Q3 are 60 cm and 3.2 m. The results for Q1 are compared to an integral coil measurement. Detailed maps are extracted using a 3D harmonics analysis and the reference to filament models of the quadrupoles. The typical accuracy achieved is 0.1 mm (in radius) and 1 Gauss in the mapping volume, for a maximum field of 1.25 Tesla.

The Banff NATO Summer School was held August 14-25, 1989 at the Banff Centre, Banff, Alberta, Canada. It was a combination of two venues: a summer school in the annual series of Summer School in Theoretical Physics sponsored by the Theoretical Physics Division, Canadian Association of Physicists, and a NATO Advanced Study Institute. The Organizing Committee for the present school was composed of G. Kunstatter (University of Winnipeg), H.C. Lee (Chalk River Laboratories and University of Western Ontario), R. Kobes (University of Winnipeg), D.I. Toms (University of Newcastle Upon Tyne) and Y.S. Wu (University of Utah).

Thanks to the group of lecturers (see Contents) and the timeliness of the courses given, the school, entitled PHYSICS, GEOMETRY AND TOPOLOGY, was popular from the very outset. The number of applications outstripped the 90 places of accommodation reserved at the Banff Centre soon after the school was announced. As the eventual total number of participants was increased to 170, it was still necessary to turn away many deserving applicants. In accordance with the spirit of the school, the geometrical and
topological properties in each of the wide ranging topics covered by the lectures were emphasized. A recurring theme in a number of the lectures is the Yang-Baxter relation which characterizes a very large class of integrable systems including: many state models, two-dimensional conformal field theory, quantum field theory and quantum gravity in 2 + 1 dimensions.

The design of the 12-GeV torus required the construction of six superconducting coils with a unique geometry required for the experimental needs of Jefferson Laboratory Hall B. Each of these coils consists of 234 turns of copper-stabilized superconducting cable conduction cooled by 4.6 K helium gas. The finished coils are each roughly 2 × 4 × 0.05 m and supported in an aluminum coil case. Because of its geometry, new tooling and manufacturing methods had to be developed for each stage of construction. The tooling was designed and developed while producing a practice coil at Fermi National Laboratory. This paper describes the tooling and manufacturing techniques required to produce the six production coils and two spare coils required by the project. Project status and future plans are also presented.

Almost 50 years after the proposal of Lee and Young in 1956 to test the hypothesis of parity violation in weak interactions and the subsequent experimental verification of parity violation by C. S. Wu, parity violation has today become a useful property of weak interactions. This is due to the fact that the focus nowadays has changed: parity violation in weak interactions is no more a topic of investigation but is used as a tool in many different fields ranging from nuclear physics to the search for the hidden extra dimensions requested by string theory. For our first workshop which took place June 5-8, 2002, at the Institut fiir Ke- physik of the Johannes Gutenberg-Universitat Mainz, we concentrated on the investigation of the strangeness contribution in the
nucleon. This book contains the refereed and selected papers of the second workshop "From Parity Violation to Hadron Structure and more (Part II)", which took place June 8-11, in the Laboratoire de Physique Subatomique et de Cosmologie, in Grenoble. These papers appear in EPJAdirect, the electronic-only part of EPJA, and they are accessible without restrictions. They will also appear in printed form and can be ordered through Springer. The excellent presentations show the dramatic and steady progress in the accuracy of measured parity violating asymmetries over the last few years.

The Proceedings include talks given at the 4th Workshop on Exclusive Reactions at High Momentum Transfer at Jefferson Lab, Newport News, VA, USA, the world's leading facility performing research on nuclear, hadronic and quark-gluon structure of matter. Exclusive reactions are becoming one of the major sources of information about the deep structure of the nucleons and other hadrons. The workshop focused on the application of a variety of exclusive reactions at high momentum transfer, utilizing unpolarized and polarized beams and targets, to obtain information about nucleon ground state and excited state structure at short distances. This is a subject which is central to the programs of current accelerators and especially planned future facilities. The topics include: generalized parton distributions, deeply virtual Compton scattering, deeply virtual meson production (DVMP), transverse structure of hadrons (TMD), hadron form factors - elastic and transition, quantum chromodynamics (perturbative, non-perturbative, lattice calculations), and physics to study at an Electron Ion Collider.

This volume contains Part II of the proceedings of the conference on Free Electron Lasers, held in Beijing, August 1997. Part I appears in a special issue of Nuclear Instruments and Methods A. The last 20 years has seen different stages
of FEL development. In these proceedings the reader will find descriptions of many new facilities, new experimental results, new applications, new theoretical developments and new simulation results. Attention is also focussed on the recent progress in experimental observations SASE. The contributions are from 150 scientists from 13 countries, ensuring broad, up-to-date research results from a dynamic field.

The Oregon Convention Center, Portland, Oregon, was the venue for the 1997 Cryogenic Engineering Conference. The meeting was held jointly with the International Cryogenic Materials Conference. John Barclay, of the University of Victoria, and David Smathers, of Cabot Performance Materials, were conference chairmen. Portland is the home of Northwest Natural Gas, a pioneer in the use of liquid natural gas, and Portland State University, where cryogenic research has long been conducted. The program consisted of 350 CEC papers, considerable more than CEC-95. This was the largest number of papers ever submitted to the CEC. Of these, 263 papers are published here, in Volume 43 of Advances in Cryogenic Engineering. Once again the volume is published in two books. CEC PAPER REVIEW PROCESS

Since 1954 Advances in Cryogenic Engineering has been the archival publication of papers presented at the biennial CEC!ICMC conferences. The publication includes invited, unsolicited, and government sponsored research papers in the research areas of cryogenic engineering and applications. All of the papers published must (1) be presented at the conference, (2) pass the peer review process, and (3) report previously unpublished theoretical studies, reviews, or advances in cryogenic engineering.

The measurement of the neutron electric form factor, GEn, will allow us to solve indirectly for the quark charge
distribution inside of the neutron. With the equipment at Jefferson Lab we have measured GEn at four momentum transfer values of $Q^2$ at 1.3, 2.4 and 3.4 (GeV/c)$^2$ using a polarized electron beam and polarized Helium target. The scattered electrons off of the Helium target are detected in the BigBite spectrometer and the recoiling neutrons from the Helium are detected in the Neutron Arm, which is composed of an array of scintillators. The main focus of this thesis will be devoted to the geometry, timing and energy calibrations of the Neutron Arm.

A GEM-based Radial Time Projection Chamber is being developed as a spectator-proton tracker for an experiment at Jefferson Lab. The purpose of the experiment is the study of the structure of nearly free neutrons. Interactions on such neutrons can be identified by the presence of a backward-moving proton in the final state of a beam-deuterium collision. The detector must be of very low mass in order to provide sensitivity to the slowest possible protons. The ionization electron trail left by the protons will drift radially outward to an amplification structure composed of curved GEMs, and the resulting charge will be collected on pads on the outer layer of the detector. Unique design challenges are imposed by the cylindrical geometry and the low mass requirement. The status of the project and results of prototype tests are presented.

Over the past several decades major advances in accelerators have resulted from breakthroughs in accelerator science and accelerator technology. After the introduction of a new accelerator physics concept or the
implementation of a new technology, a leap in accelerator performance followed. A well-known representation of these advances is the Livingston chart, which shows an exponential growth of accelerator performance over the last seven or eight decades. One of the breakthrough accelerator technologies that support this exponential growth is superconducting technology. Recognizing this major technological advance, we dedicate Volume 5 of Reviews of Accelerator Science and Technology (RAST) to superconducting technology and its applications. Two major applications are superconducting magnets (SC magnets) and superconducting radio-frequency (SRF) cavities. SC magnets provide much higher magnetic field than their room-temperature counterparts, thus allowing accelerators to reach higher energies with comparable size as well as much reduced power consumption. SRF technology allows field energy storage for continuous wave applications and energy recovery, in addition to the advantage of tremendous power savings and better particle beam quality. In this volume, we describe both technologies and their applications. We also include discussion of the associated R&D in superconducting materials and the future prospects for these technologies. Contents:Overview of Superconductivity and Challenges in Applications (Rene Flükiger)Superconducting Materials and Conductors: Fabrication and Limiting Parameters (Luca Bottura and Arno Godeke)Superconducting Magnets for Particle Accelerators (Lucio Rossi and Luca Bottura)Superconducting Magnets for Particle Detectors
Read Online Jefferson Lab Geometry


Readership: Physicists and engineers in accelerator science and industry. Keywords: Particle Accelerators; Superconducting; Superconducting Materials; Superconducting Technology

Reviews: “This latest volume looks at the role of superconductivity in particle accelerators and how this intriguing phenomenon has been harnessed in the pursuit of ever-increasing beam energy or intensity. It also considers the application of superconducting technology beyond the realm of accelerators, for example in medical scanners and fusion devices. As well as containing much technical detail it is also full of fascinating facts.” CERN Courier
Fermi National Accelerator Laboratory (Fermilab) fabricated the torus magnet coils for the 12-GeV Hall B upgrade at Jefferson Lab (JLab). The production consisted of six large superconducting coils for the magnet and two spare coils. The toroidal field coils are approximately 2 m × 4 m × 5 cm thick. Each of these coils consists of two layers, each of which has 117 turns of copper-stabilized superconducting cable, which will be conduction cooled by supercritical helium. Due to the size of the coils and their unique geometry, Fermilab designed and fabricated specialized tooling and, together with JLab, developed unique manufacturing techniques for each stage of the coil construction. Furthermore, this paper describes the tooling and manufacturing techniques required to produce the six production coils and the two spare coils needed by the project.

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