

RESUME: DR. DELBERT J. LARSON, PH.D. (PHYSICIS)

PHONE: (972)-617-2051

E-MAIL: DELBERT_LARSON@YAHOO.COM

EXPERIENCE

2012-present. President, Larson Technical Solutions, Inc. Investigated fully relativistic, magnetic moment inclusive, quantum mechanical model for the Hydrogen atom. Evaluated the "Higgs Signature" in terms of the ABC Preon Model.

2014-present. Executive Vice President and Director of Marketing, Particle Beam Lasers, Inc. Wrote commercialization plan in support of a successful Phase II proposal to continue PBL's work on high temperature superconducting magnet technology. Did market search and vendor outreach in an effort to find sales partners. Wrote a patent application concerning the proper alignment of high temperature superconducting tape within high field dipole magnets.

2002-2011. President, Larson Technical Solutions, Inc. Developed the design for ECOFusion, an electron cooled, colliding beam device for the purpose of controlled fusion power generation. Developed new accelerator physics models for the case of highly neutralized beams. Developed means to handle the optics of beam halo produced in highly neutralized beams. Completed full analysis of ECOFusion device.

2008-2011. Research Professor of Physics, University of Texas at Arlington. Working on obtaining funding for ECOFusion, an electron cooled, colliding beam device for the purpose of controlled fusion power generation.

2000 - 2001. President, Larson Technical Solutions, Inc. Worked on the design of a proton therapy synchrotron. Responsible for both the transverse and longitudinal design. Completed full beamline design from accelerator through switchyards and gantries to the patient targeting area.

1998 - 1999. Senior Scientist, SAIC. Worked on the design of a proton therapy synchrotron. Responsible for both the transverse and longitudinal design. Evaluated existing design and made comments, corrections and improvements. Evaluated space charge limit of the system and made proposals to increase the stored current by a factor of four over existing proton therapy accelerators. Developed computer code to calculate the lateral dose and penumbra of a wobbled bigaussian proton beam.

1995 - 1997. President, Integrated Accelerator Technologies (IAT). Served as head of accelerator physics on the PET project, a collaborative effort to construct a 10.5 MeV, RFQ based, He³ Accelerator for use in the production of radioactive isotopes for positron emission tomography (PET). The PET project involved scientists, engineers, technicians and support staff from Fermilab, Scientific Applications International Corporation, the University of Washington and the Biomedical Research Foundation of Shreveport Louisiana. Activities on the PET project included: a modeling of the ion optics of the entire device, from ion source to target; development of a new means to strip, rebunch, and then match a bunched beam coming from one RFQ into a second downstream RFQ; specification of magnetic tolerances for all components of the matching system; specification of machining tolerances based on the magnetic tolerances; commissioning of the system; operation, repair, and upgrades of the entire accelerator. Developed specialized computer codes for analysis, run both specialized codes and standard physics codes, wrote detailed reports, reviewed blueprints, and finally used oscilloscopes, spectrum analyzers and hand tools to analyze, construct, test and repair various portions of the system. The system operated successfully in agreement with the designs.

1995. President, IAT. Served as a consultant to SAIC on the design of a recirculating proton accelerator for use in resonant production of gamma rays.

1991-1994. Applications Physicist III at the Superconducting Super Collider. Responsible for the design and operation of the longitudinal physics aspects of the High Energy Booster accelerator. Investigated

longitudinal dynamics, wrote paper containing derivations of all of the physics formulas used in longitudinal analysis of particle accelerators and storage rings, wrote ELVIRA computer code that generates graphs of longitudinal variables during the acceleration ramp, specified the scenario for cogging of the HEB to Collider beam transfer. Specified rf cavity design requirements for operation of the HEB, which included the effects of steady state and transient beam loading as well as specifying global requirements for low level rf controls and feedback systems. Served on numerous review panels and committees.

1988-91. Research Associate at the Center for Research in Electro-Optics and Lasers. Investigated the electron optics, electrical, and mechanical design of several electrostatic accelerator free electron laser systems. Investigated the possible use of an electrostatic FEL as a power source for future linear colliders. Installed and ran the Los Alamos accelerator design codes. Completed detailed design of CREOL compact FEL. Managed all electron optics related activities of the CREOL compact FEL.

1989-1990. President, IAT. Wrote successful 1990 Phase I SBIR proposal for the design of a portable antiproton storage ring. Wrote successful 1989 Phase I SBIR proposal for an electron cooler for a portable antiproton storage ring. Served as PI for the successful completion of those two efforts. Completed a design study for a portable antiproton storage ring. Efforts on these projects typically included studies in some or all of the following: charged particle optics in the presence of space charge, injection and extraction, beam heating and cooling, vacuum requirements and related technology, magnetic field tolerances, magnetic component specification, diagnostic equipment specification, correction element design, evaluation of possible instabilities, scattering analyses, power supply specification, system integration, hardware design.

1987-1988. Adjunct Assistant Professor, UCLA. Investigated electron cooling for positron, electron, proton, and antiproton sources. Studied linac production, phase space rotation, and high efficiency moderation techniques for positron production. Assisted in the formation of the UCLA accelerator physics group. Taught the introductory graduate level accelerator physics courses. Guided research activities of graduate students.

1986-1987. Research Associate, University of Wisconsin-Madison. Completion of assembly and successful initial operation of the NEC DC recirculating electron beam project. Coordinated activities of the UW accelerator physics group.

1986. Vice President, Particle Beam Lasers, Inc. Wrote successful grant proposal, and served as Principle Investigator on the development of an electron beam collector capable of collecting electron beams with a wide energy spread. Consultant on the design of an electrostatic accelerator for use as an MeV energy electron beam source for use as a Cherenkov Laser. Consultant on the design of an electrostatic accelerator for use as an injector for a proton therapy synchrotron. Consultant on the upgrade of the Fermilab linac concerning emittance growth in the system.

1982-5. Research Assistant, University of Wisconsin-Madison. Worked on research and development of a 3MV Ampere intensity recirculating electron beam system for use in the intermediate energy electron cooling of antiproton sources. Participated in the collector design for the electron beam. Completed optics design of the entire system, which included solving the problem of electron optics in the presence of space charge, emittance and acceleration. Calculated the expected performance of intermediate energy electron cooling as applied to the Fermilab Antiproton Source. Completed Free Electron Laser design using the DC electron beam system. Directed the research of several undergraduates and coordinated research efforts of the accelerator R&D group. Participant in the Beatwave and Wakefield Plasma accelerator effort at the UW.

1982. National Electrostatics Corporation. Experience in operation and repair of Pelletron electrostatic electron accelerator. Redesigned and assembled terminal electronics. Designed emittance measurement device for the system, measured Pelletron emittance and recirculation.

1981-82. Teaching Assistant, University of Wisconsin-Madison. Taught the full sophomore physics program for math, engineering, and physics majors.

1981. Fermilab. Experience in computer aided beamline design calculations, design and theoretical evaluation of target depletion experiment including beamline and diagnostics.

EDUCATION:

PhD, University of Wisconsin, 1986. Major in Physics, thesis entitled "Intermediate Energy Electron Cooling for Antiproton Sources". Minor in Nuclear Engineering. Top score on PhD Qualifying examination.

B.A., University of Wisconsin, 1980. Graduated Phi Beta Kappa with applied math major, emphasis in physics and economics. Freshman Honor Society member. Second score in university-wide freshman chemistry test.

High School valedictorian, 1975. Ashland High School, Ashland WI.

CONTRIBUTIONS TO ACCELERATOR PHYSICS COMPUTER CODES:

Wrote SCAT - A Space Charge and Acceleration inclusive Twiss parameter integrator. Code calculates the evolution of normalized Twiss parameters which includes the effect of electrostatic acceleration, as well as space charge and emittance. Code handles dipoles with internal gradients, quadrupoles, a thin lens solenoid approximation, edge effect of dipole with finite gaps with or without pole face rotation, electrostatic acceleration units, and effects of wiggler magnets. Code calculates betatron functions, beam sizes, transition energy, beam tunes, dispersion function, and betatron phase advance.

Wrote BEAMPIC - Converts SCAT input files into picture of beam line, showing beampipes, acceleration sections, dipoles, quads, solenoids and wiggler magnets.

Wrote CSTWISS - Converts many different sets of input beam matching data to arrive at the beam input data for other codes. Input values are calculated for SCAT, TRANSPORT, TRACE 3-D and PARMTEQ.

Wrote TRACKER - Tracks an ensemble of particles through a magnet to determine beam phase space growth caused by sextupole error in a single pass system.

Wrote ELVIRA - Calculates the longitudinal parameters associated with circular particle accelerators. Prints out the following cycles for ramped devices: magnetic field, RF voltage, longitudinal emittance, central momentum and energy, RF frequency, synchronous phase, synchrotron frequency, synchrotron tune, beam energy and momentum spread, bunch length, bucket height, bucket width, bucket area, adiabaticity and bunching factor.

Discovered bug in TRACE 3-D R56 element. Derived correct element from first principles; contacted code author; code fixed.

Discovered reason for outer ray crossings in EGUN; communicated this to author.

CONTRIBUTIONS TO ACCELERATOR PHYSICS:

Designed a small electron cooled storage ring predicted to allow copious production of gamma rays for resonant nuclear interrogation based on the Nitrogen gamma resonance.

Development of a new means to match the output of one bunched beam accelerator (such as an RFQ or linac) into the input of another, while allowing sufficient room for a gas jet charge stripper. Designed, oversaw construction, and commissioned the device.

Completed design for a Free Electron Laser System appropriate for tunable, efficient Electron Cyclotron Resonant Heating of fusion plasmas.

Invented the Free Electron Accelerator Concept. Uses Space charge fields of relativistic free electron beams to efficiently generate electric accelerating fields predicted to be in excess of 100 GV/m.

Specified the parameters associated with the HEB longitudinal dynamics issues for the SSC. Work included cavity specifications, RF joint specifications, instability analysis and computational tool development.

Originated the idea of using antiproton production techniques to improve positron production. Originated the idea of electron cooling of positrons for linear colliders. Completed a detailed calculation of an electron cooled positron ring. Experimentally demonstrated one of the enabling technologies.

Originated the concept of using electrostatic FELs as a power source for future linear colliders, completed rough design of such a system and experimentally demonstrated one of the enabling technologies.

Calculation of the effect of electron cooling on the Fermilab antiproton accumulator.

Experimental demonstration of 2 MeV 0.1 ampere DC electron beam system.

Extension of Courant and Snyder Twiss parameterization of particle beams to include space charge and acceleration effects.

PATENTS

[1] U.S. Patent No. 5,854,531. Title: Storage Ring System and Method for High-Yield Nuclear Production.

[2] U.S. Patent No. 7,501,640 Title: A Low Energy Electron Cooling System and Method for Increasing the Phase Space Intensity and Overall Intensity of Low Energy Ion Beams

[3] U.S. Patent No. 8,063,390 Title: Electron Cooling System and Method for Increasing the Phase Space Intensity and Overall Intensity of Low Energy Ion Beams of Ion Beams in Multiple Overlap Regions

PUBLICATIONS OF DR. DELBERT LARSON:

[1] "A Derivation of Maxwell's Equations From a Simple Two-Component Solid-Mechanical Aether", D.J. Larson, Physics Essays, vol. 11, no. 4, (1998).

[2] "The A-B-C Preon Model", D.J. Larson, Physics Essays, vol. 10, 27-34, (1997).

[3] "Spooks", D.J. Larson, Galilean Electrodynamics, vol. 7, 118, (1996).

[4] "Common Sense, Again", D.J. Larson, Galilean Electrodynamics, vol. 6, 120, (1995).

[5] "Pathological Amplifications", D.J. Larson, Galilean Electrodynamics, vol. 8, 96, (1997).

[6] "An Absolute Theory for the Electrodynamics of Moving Bodies", D.J. Larson, Physics Essays, vol. 7, 476-489, (1994).

[7] "A Method for Free Electron Acceleration of Particle Beams", D.J. Larson, Physical Review Letters, Vol. 71, 851-854, (1993).

[8] "An Absolute Theory of Doppler Shifts and the Michelson Morley Null Result", D.J. Larson, Physics Essays, Vol. 6, 66-78 (1993).

[9] "Calculation of the Twin Paradox: A Correction to 'A Note Regarding Relativity' ", D.J. Larson, Physics Essays, Vol. 5, 545-549, (1992).

[10] "The FELSTRON: An Electrostatic Accelerator FEL Oscillator Power Source for Linear Colliders", D.J. Larson and L.R. Elias, NIM, Vol. A318, 472-476, (1992).

[11] "Comment on 'Electron-Beam Cooling by Stimulated Synchrotron Emission and Absorption' ", D.J. Larson, Phys. Rev. Lett., Vol. 68, 133 (1992).

- [12] "Operation of a Prototype Intermediate Energy Electron Cooler", D.J. Larson, et al., NIM, A311, 30-33 (1992).
- [13] "An Absolute Theory Based on Coupled Spatial and Temporal Travel", D.J. Larson, Physics Essays, Vol. 4, 373-383 (1991).
- [14] "Technological Requirements for a Continuous Wave Free Electron Laser", D.J. Larson, Proceedings of the Eleventh International Free Electron Laser Conference held in Naples, Florida, North Holland publishers, 701-706, (1990).
- [15] "A Modified Twiss Parameter Optical Treatment for Space Charge Dominated Electrostatic Accelerator Free Electron Lasers", D.J. Larson, Proceedings of the Eleventh International Free Electron Laser Conference held in Naples, Florida, North Holland publishers, 732-735, (1990).
- [16] "Design of TEAFEL, a Tandem Electrostatic Accelerator Free Electron Laser", D.J. Larson and L.R. Elias, Proceedings of the Eleventh International Free Electron Laser Conference held in Naples, Florida, North Holland publishers, 728-731, (1990).
- [17] "Intermediate Energy Electron Cooling For Intense Positron Sources", D.J. Larson, Particle Accelerators, Vol. 24, No. 2, 63-89, (1989).
- [18] "Design of an Electrostatic Accelerator for use in Intermediate Energy Electron Cooling", D.J. Larson, Particle Accelerators, Volume 23, pp. 239-254, 1988.
- [19] "Electron Cooling for Positron Sources", D.J. Larson, Physical Review Letters, Vol. 60, No. 13, pp. 1274-1277, March 1988.
- [20] "A Modified Two Beam Accelerator Driven by a DC Pelletron Free Electron Laser", D.J. Larson, IEEE Trans. Nucl. Sci., Vol. NS-32, No. 5, pp. 3548-3550, October 1985.
- [21] "Beam Envelope Solution of a Finite Emittance Beam Including Space Charge and Acceleration", D.J. Larson, F.E. Mills, and F.T. Cole, IEEE Trans. Nucl. Sci., Vol. NS-32, No. 5, pp. 2433-2435, October 1985.
- [22] "Intermediate Energy Electron Cooling for Antiproton Sources Using a Pelletron Accelerator", D.B. Cline and D.J. Larson et al., IEEE Trans. Nucl. Sci., Vol. NS-30, No. 4, August 1983.

COAUTHOR OF THE FOLLOWING PUBLICATIONS:

- [23] "A compact cw free electron laser", L.R. Elias, et al., submitted to the 1990 International Free Electron Laser Conference, Paris, France.
- [24] "Luminosity Enhancement in Linear Colliders Using a Short Focal Length Plasma Lens", J.B. Rosenzweig, et al., Particle Accelerators.
- [25] "Progress Report on Construction and testing of a 3 MeV, DC, Ampere Intensity Electron Beam Recirculation System", J.R. Adney et al., IEEE Trans. Nucl. Sci., Vol. NS-32, No. 5, pp. 1841-1843, October 1985.
- [26] "Intermediate Energy Electron Cooling of Antiprotons to Improve the Luminosity of Antiproton-proton Colliders", D.B. Cline et al., IEEE Trans. Nucl. Sci., Vol. NS-32, No. 5, pp. 2430-2432, October 1985.

CONFERENCE PROCEEDINGS:

- [27] "Production of PET Radionuclides Using a 10.5 MeV 3-He RFQ Accelerator", Jeanne M. Link, et al., Denton Conference on Uses of Particle Accelerators in Industry, 1998.
- [28] "A 3-He RFQ for PET Isotope Production", Kenneth A. Krohn, et al., 215th American Chemical Society, Division of Nuclear Chemistry and Technology, Dallas, TX, March 29 - April 2, 1998.
- [29] "Ion Optical Design of the BRF-FNAL-SAIC-UW PET Accelerator", D.J. Larson et al., to be published in the 1997 PAC Conference Proceedings, paper 4V.18.
- [30] "Magnet Development for the BRF Positron Emission Tomography Accelerator", N. Chester et al., to be published in the 1997 PAC Conference Proceedings, paper 2P.9.
- [31] "Charge stripper and MEFT for the 3He RFQ accelerator", F. M. Bieniosek et al., to be published in the 1997 PAC Conference Proceedings, paper 7P.111.
- [32] "Progress Update on the Development of the He-3 Linac for PET isotope production", P.E. Young, et al., 18th International Linac Conference Proceedings, Geneva, Switzerland (Aug. 25-30, 1996).
- [33] "Electron Cooling at the SSC", D.J. Larson, AIP Conference Proceedings 326, AIP Press, 543-559, (1995).
- [34] "Electron Cooling of Electrons", D.J. Larson, Proceedings of CERN Beam Cooling Workshop (1993).
- [35] "An Absolute Theory of Space, Time and Electrodynamics", D.J. Larson, April Washington DC APS Meeting, Bulletin of the Am. Phys. Soc., Vol. 38, No. 2, 967 (1993). (Abstract only).
- [36] "The Development of an Electron Cooling System for the SSC Medium Energy Booster (MEB)", S. Nagatsiev, et al., April Washington DC APS Meeting, Bulletin of the Am. Phys. Soc., Vol. 38, No. 2, 967 (1993). (Abstract only, included as author post-deadline).
- [37] "FELSTRON: An FEL Oscillator Power Source for Linear Colliders", D.J. Larson and L.R. Elias, Intense Microwave and Particle Beams III, SPIE Vol. 1629 566-576 (1992).
- [38] "Emittance Control Using Electron Cooling", D.J. Larson, Intense Microwave and Particle Beams III, SPIE Vol. 1629 501-512 (1992).
- [39] "Electron Cooling of Electron Beams", D.J. Larson, Intense Microwave and Particle Beams III, SPIE Vol. 1629 446-457 (1992).
- [40] "CFEL-I: A Compact Free Electron Laser", L.R. Elias, et al., IEEE Proc. of 1991 Particle Accelerator Conference, 2757-2759 (1991).
- [41] "An Electrostatic Accelerator FEL Amplifier as a Possible Microwave Power Source for Linear Colliders", L.R. Elias, D.J. Larson and I. Boscolo, submitted to the 1991 Particle Accelerator Conference, San Francisco.
- [42] "A Compact Free Electron Laser", L.R. Elias, et al., submitted to the 1991 Particle Accelerator Conference, San Francisco.
- [43] "Successful DC Recirculation of a 2 MeV Electron Beam at Currents More than 0.1 Ampere", J.R. Adney, et al., IEEE Proceedings of the 1989 Particle Accelerator Conference, 348-350, (1989).

- [44] "Scaleup of Antiproton Production Facilities to 1 milligram per year", D.J. Larson, Proceedings of the RAND Workshop on Antiproton Science and Technology, pp. 202-219, World Scientific, Singapore, 1988.
- [45] "Progress in the Design of a DC FEL Power Source Using a Pelletron Driver", D.J. Larson, et al., published in AIP conference proceedings of the Washington DC Particle Accelerator Conference, 1987.
- [46] "Operation of a 3 MeV Ampere Intensity DC Electron Recirculation System", M.L. Sundquist, et al., published in AIP conference proceedings of the Washington DC Particle Accelerator Conference, 1987.
- [47] "Tunable Two Frequency Free Electron Laser using a Pelletron as a Driver for a Plasma Beatwave Accelerator", D.J. Larson, et al., Proceedings of SPIE, Vol. 664, pp. 42-49, 1986.
- [48] "Toward Multi-GeV electron cooling", D.J. Larson, et al., AIP Conference Proceedings No. 150, pp. 366-370, 1986.
- [49] "Intermediate energy electron cooling applied to the Fermilab antiproton source", D.J. Larson, D.B. Cline, and F.E. Mills, "Low Energy Antimatter", World Scientific, pp. 167-183, 1986.
- [50] "Plasma Wake Field Accelerator: A Proposed Experimental Test", J.B. Rosenzweig et al., AIP Conference Proceedings No. 130, pp. 226-233, 1985.
- [51] "High Efficiency Recovery of an Ampere Intensity 3 MeV Electron Beam", D.J. Larson, F.E. Mills, and F.T. Cole, published in the conference proceedings of ECOOL84, 1985.
- [52] "Construction of a 3 MeV Ampere Intensity Recirculating Electron Beam System: A Progress Report", M.L. Sundquist et al., published in the conference proceedings of ECOOL84, 1985.

NATIONAL LAB INTERNAL NOTES:

- [53] "End to End PET Design - September 16, 1996 - An End to End Beam Simulation for the PET Isotope Production Accelerator", D.J. Larson, (1996).
- [54] "MEBT 1996: Updates and Changes to the MEBT 95 Design Report", D.J. Larson, (1996).
- [55] "LEBT 1996: A Low Energy Beam Transport Design for the PET Project Resulting from July, 1996 Experimental Measurements of the Low Energy Beam", D.J. Larson, et al., (1996).
- [56] "Tuning the HEBT for Uniform Beam", D.J. Larson, (1997).
- [57] "HEBT 96 - A High Energy Beam Transport Ion Optics Design Based on the Present Engineering Design", D.J. Larson and R.J. deHass, (1996).
- [58] "MEBT 95 - The Medium Energy Beam Transport System for the Helium-3 RFQ PET Accelerator", D.J. Larson, (1995).
- [59] "A Study of the HEB Longitudinal Dynamics Using the Computer Code ELVIRA: Evaluation of Longitudinal Variables in Relativistic Accelerators", D.J. Larson, SSC PMTN 0063H (1993).
- [60] "Intrabeam Scattering in the HEB", D.J. Larson, SSC PMTN 0063H (1993).

[61] "The HEB at Flat Top: Arranging for the HEB to Collider Beam Transfer", D.J. Larson, SSC PMTN 0063H (1993).

CONFERENCE AND WORKSHOP PARTICIPANT; SEMINARS AND PRESENTATIONS:

- 1) American Chemical Society, Division of Nuclear Chemistry and Technology, Conference in Dallas, April, 1998, co-author of paper on 3-He linac.
- 2) American Association for the Advancement of Science, National Meeting in Philadelphia, February, 1998. Poster paper on the A-B-C Preon Model.
- 3) National Philosophical Alliance National Meeting in Philadelphia, February, 1998. Presentation on a Derivation of Maxwell's Equations from a Simple, Two Component, Solid Aether.
- 4) Fermilab Electron Cooling Workshop. October, 1997.
- 5) Vancouver Particle Accelerator Conference. Presented two and a half poster papers. May, 1997.
- 6) Fermilab Directors Review of PET Project. Presented overview of PET accelerator operation. May, 1997.
- 7) 1997 SWARM Division Meeting of AAAS. Gave oral presentation of A-B-C Preon Model. March, 1997.
- 8) Second DOE Review of PET Project. Lengthy (two hour), detailed, oral description of ion optics through the PET accelerator. Wrote responses to questions raised by review committee. November, 1996.
- 9) Fermilab Internal Review of PET Project. Gave detailed description of ion optics through the PET accelerator. October, 1996.
- 10) First DOE Review of PET Project. Oral description of ion optics through the PET accelerator. Wrote responses to questions raised by review committee. May, 1996.
- 11) Dallas Particle Accelerator Conference. Attendee. April, 1995.
- 12) Initial PET Collaboration Workshop. Presented talk on design of an isochronous 1 MeV transfer line between two RFQ's. April, 1995.
- 13) Fermilab Electron Cooling Workshop. Gave Summary Talk from Parameters Working Group. February, 1995.
- 14) SAIC Phase I Final Reporting Review. Presented two talks on ion optics for neutron and gamma production techniques. January, 1995.
- 15) SSCL Theory Group Seminar: An Absolute Theory for the Electrodynamics of Moving Bodies. July, 1993.
- 16) 1993 Particle Accelerator Conference in Washington DC, May 1993, attendee.
- 17) APS Conference in Washington, DC. Presented one paper, co-author of second. April, 1993.
- 18) SSCL Accelerator Physics Seminar: Electron Cooling for Proton Beams, January, 1993.

- 19) SSCL Theory Seminar: An Absolute Theory Based on Coupled Spatial and Temporal Travel, May, 1992.
- 20) CREOL Seminar: An Absolute Theory Based on Coupled Spatial and Temporal Travel, March, 1992.
- 21) APS Conference in Washington DC. Oral Presentation. April, 1992.
- 22) Los Angeles SPIE Conference. Four oral presentations. January 1992.
- 23) Sante Fe International FEL Conference. Presented poster paper. October 1991.
- 24) San Francisco Particle Accelerator Conference. Presented two poster papers. May 1991.
- 25) Edwards AFB. Seminar speaker on the design of a portable antiproton storage ring. March 1991.
- 26) Berkeley, CA 1990 workshop on application of electrostatic accelerators toward high power millimeter wave generation for particle accelerators. Oral Presentation.
- 27) Naples, Florida International Free Electron Laser Conference. Presented three poster papers. August, 1989.
- 28) Chicago IEEE Particle Accelerator Conference. Presented poster paper. March, 1989.
- 29) CERN, Geneva, Switzerland. Low Energy Antiproton Ring Electron Cooling Workshop, Invited Speaker. January, 1989.
- 30) Penn State University, Seminar. December, 1988.
- 31) SLAC, Stanford, CA, Seminar. November, 1988.
- 32) Texas A&M University. Seminar. November, 1988.
- 33) Antimatter 87, Karlsruhe, Germany. Invited Speaker. September, 1987.
- 34) Rand Workshop on Antiproton Science and Technology, Los Angeles, CA, Invited Speaker. 1987.
- 35) Intense Positron Beams Workshop, Idaho Falls, ID, Invited Speaker. 1987.
- 36) Particle Accelerator Conference, Washington DC, Presented poster paper. May, 1987.
- 37) B-Bbar factory workshop, UCLA, 1987.
- 38) 1986 Antiproton Workshop - Madison, Wisconsin. Oral Presentation. July, 1986.
- 39) 1986 Minisymposium on Critical Issues for Advanced Linear Colliders - Madison WI. Oral Presentation. July, 1986.
- 40) 1986 Symposium on Advanced Accelerator Concepts - Madison, WI. July, 1986.
- 41) 1986 SPIE Quebec International Symposium on Optical and Optoelectronic Applied Sciences and Engineering. Oral Presentation. June, 1986.
- 42) 1986 Conference on the Intersections Between Particle and Nuclear Physics - Lake Louise, Canada. Invited speaker. June, 1986.

43) 1986 Antiproton Workshop - Fermilab.

44) 1985 Particle Accelerator Workshop - Vancouver, British Columbia. Presented two poster papers. May, 1985.

45) 1985 Meeting on Joint Issues of Accelerator Physics, Plasma Physics, and Celestial Mechanics - Berkeley, California. Attendee. January, 1985.

46) ECOOL84 - Karlsruhe, Germany. Invited speaker. October, 1984.

47) 1983 Particle Accelerator Conference - Santa Fe, New Mexico. Presented poster paper. May, 1983.

ENTREPRENEURIAL ENDEAVORS

1) Serving as President of Integrated Accelerator Technologies. 1988 to Present.

2) Serving as Vice President and Secretary of Particle Beam Lasers, Inc. 1986 to Present.

3) Wrote successful DOD SBIR Phase I Proposal and Served as PI: A Portable Antiproton Source. Integrated Accelerator Technologies. Phase I Final Report Published as "A Portable Electron Cooled Antiproton Storage Ring:, PL-TR-91-3024, Phillips Laboratory, Edwards AFB, CA 93523-5000.

4) Wrote successful DOD SBIR Phase I Proposal and Served as PI: An Electron Cooler for a Portable Antiproton Source. Integrated Accelerator Technologies. Phase I Final Report Published as "An Electron Cooler for Portable Low Energy Antiproton Rings:, AL-TR-90-021, Astronautics Laboratory, Edwards AFB, CA 93523-5000.

5) Wrote successful DOE SBIR Phase I Proposal and Served as PI: An electron beam collector to enable FEL drive of a plasma beatwave accelerator. Particle Beam Lasers, Inc.

SERVICE, COMMITTEES AND REVIEWS:

1) 1989 International Free Electron Laser Conference Committee.

2) Principle Organizer for UCLA cold positron source workshop, 1987.

3) National organizing committee for the 1986 symposium on advanced accelerator concepts.

4) Local organizing committee for the 1986 symposium on advanced accelerator concepts.

5) Regular Reviewer for Relativity and High Energy Physics Papers for Physics Essays. (1 Review in 1991, 4 in 1992, 16 in 1993, 20-25 in 1994, 1995, 1996, 1997 and 1998.)

SUMMARY OF CODES WRITTEN:

1) The SCAT family of codes, which include: AVE, BEAMPIC, BETGAM, ELECROS, FLIP, K, MERGADDZ, OFFSET, OLDSCAT, RFTRAJ, RFIX, SCAAT, SCAT, SCAT94, SCAT9390, SCAT1091, SCATEDGE, SCISCOR, SURVEY, TRANIN, TX and ZR. Description: These codes work off a common database to calculate the beam envelope evolution in a wide variety of particle beam accelerators. The code has had users world wide. Some of these codes provide support for determination and manipulation of appropriate input and output from the main code. FORTRAN, OOA/OOD.

- 2) ATRIG, COSHSINH, ERRF, GAUCOS, SINH and X. Description: These codes calculate simple math relations, such as addition, subtraction, multiplication, division, logs, and the hyperbolic and trigonometric functions. FORTRAN.
- 3) ARC, DC2PP, EGN2PP, ELLIPSE, FIGPRL, OUTPOIFX, POISTOPP, and TRANPIC. Description: These codes either transform data from one code to a form which is input compatible with PROPLOT (a third party software graphics package) or they generate PROPLOT input data from input files I specified. FORTRAN/C/C++.
- 4) FEL, FEL2, FELRESGA and PHASEFEL. Description: These codes calculate various free electron laser parameters. FORTRAN.
- 5) BUDGET, HOUSE, and SAVINGS. Description: These codes calculate mortgages, cash flow and savings growth. FORTRAN/C/C++.
- 6) BERR, BERRCART, BERRHALF, BERRQUAD, BFIELD and EFFLEN. Description: These codes take the data file designed either from another magnet design package or from one of my codes and find the expected errors in manufactured magnets, or they support such activity, or calculate the effective length of a magnet. C/C++.
- 7) DEEPAK, DIPOLE, MULT, R2SIG, and SIG2R. Description: It was found that either the SCAT family and the well known code TRANSPORT both had an error, or that the well known code TRACE3D had an error. These codes helped to determine that it was TRACE3D that had the error. C/C++.
- 8) INPUT, CSTOMKS, CSTWISS, CSPARAM, MERGEEF and T31FIX,. Description: These codes take either input or output in one form, and covert it to another form. Many accelerator physics codes exist, often with differing conventions for parameters, these codes translate from one convention to another. C/C++/OOA/OOD.
- 9) PBARCOOL. Description: Code evaluates electron temperature within antiproton beam. FORTRAN.
- 10) RESO. Description: Code calculates various tune resonant lines for circular particle accelerator and storage rings. FORTRAN.
- 11) SPC, SPE, and SPEL. Description: Codes calculate space charge growth of particle beams. FORTRAN.
- 12) DIST. Description: Calculates charge within nested ellipses with different assumed distributions. C/C++.
- 13) EMITGROW and TRACKER. Description: Codes that calculate emittance growth of beams as they pass through magnets. C/C++/OOA/OOD.
- 14) TEST, ASCII. Description: These codes check out various compiler I/O. C/C++.
- 15) SCFORM. Description: Program to calculate an analytic approximation to TRACE tabular data of Lapostolle's space charge form factor. C/C++.
- 16) EKICK. Description: Program to calculate effect of electric field on kicking a beam. C/C++.
- 17) ETOB. Description: Program to calculate the equivalence between electric and magnetic focusing elements. C/C++.
- 18) JOFR, JOFXYZ and SIXTHS. Description: Codes to calculate the electric charge as a function of position within beams of differing assumed profiles. C/C++/OOA/OOD.

- 19) MACFIX and TEST13. Description: Code translates files written in PC format on a MAC to a form which my PC can read. C/C++.
- 20) IBS. Description: Calculates intrabeam scattering growth rates in accelerators. FORTRAN.
- 21) ELVIRA. Description: Calculates RF ramp functions for particle accelerators, and outputs files capable of plotting those ramp functions. FORTRAN/C/C++.
- 22) DEDX. Description: Calculates the range of charged particles as they penetrate matter. C/C++.
- 23) DISP. Description: Code to calculate effective edge angles to enter into SCAT to mock up a vertical bend. C/C++.
- 24) SIG2ABC. Description: Code to translate TRANSPORT matrix elements into Twiss parameters. C/C++.
- 25) PENUMBRA. Description: Calculates a simple addition of gaussians. C/C++.
- 26) BIGAUSS. Description: Calculates the lateral dose and penumbra of a wobbled, bigaussian beam in two dimensions. This code is quite detailed, and involves a class hierarchy that can be reused in further coding. C/C++/OOA/OOD.