Division of Physics of Beams newsletter

A Division of the American Physical Society

Edited by Ilan Ben-Zvi, *Secretary-Treasurer*

February 2002

A Note Concerning Electronic Communications

To help us keep you updated with news and provide better opportunities to play a role in the life of the Division, please update your address in the APS Members Directory. It is easy to do by e-mail to units@aps.org, or write to

APS Membership Department
One Physics Ellipse
College Park, MD 20740
301-209-3280 301-209-0867 (fax)

Please visit our homepage on the WWW, http://www.aps.org/units/dpb/ and see information and deadlines for prizes and awards, fellowships, meetings and much more. For all other APS information, including membership and meeting forms, go to the APS homepage at: http://www.aps.org.

Questions? Comments?
Visit the DPB web site at http://www.aps.org/units/dpb/

Or contact the Secretary-Treasurer:
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IN THIS ISSUE

Election Results for the 2002 DPB Executive Committee

The elections for the 2002 Division of Physics of Beams (DPB) Executive Committee were carried according to the DPB bylaws Article VII Section 3.

The elections were announced by e-mail, web and by regular mail (to members whose e-mail returned as undeliverable) and closed down on October 20th 2001 as scheduled. The results are provided below. Our new members for 2002 are:

Vice-Chair Elect: Nan Phinney.
Secretary Treasurer: Michael Zisman.
Division Councilor: Steve Holmes.
Members at Large: Fulvia Pilat and Katherine Harkay.

The results have been declared valid, in accordance with ARTICLE VII of our bylaws, on October 21 by DPB Chair Ron Davidson and are thus final. The composition of the 2002 Executive Committee (start serving at the end of the Committee's April Meeting, except for the Councilor, who starts serving on January 1, 2002) is provided below.

2002 DPB Executive Committee

Chair: Alex J. Dragt (4/03)
Chair-Elect: Ronald Ruth (4/03)
Vice-Chair: Nan Phinney (4/03)
Past Chair: Ronald Davidson (4/03)
Divisional Councilor: Steve Holmes (1/06)
Secretary-Treasurer: Michael Zisman (4/05)

Member-at-Large:
Fulvia Pilat (4/05)
Katherine Harkay (4/05)
William Barletta, LBNL (4/04)
Gerald Dugan, Cornell, (4/04)
Helmut Wiedemann (4/03)
Chan Joshi (4/03)

Non-Voting Member
Robert Siemann PAC03 Chair (12/03)
Alan Jackson PAC03 Program Chair (12/03)
Bruce Brown NPSS/IEEE Representative (12/03)

Each term of office, except for the office of Divisional Councilor, begins and ends on the last day of the Division's Regular Meeting of the year indicated. The Chair-Elect will become Chair and the Vice-Chair will become Chair-Elect in the following year.

We would like to express our appreciation to all who agreed to run for DPB office this year. We were fortunate to have an excellent slate of candidates.

Membership, 2001 DPB/ DPB-Related Committees

Executive Committee (see "Election Results" above)

Nominating Committee: Ron Ruth (Chair), Martin Berz, Sally Dawson, John Galayda, Norbert Holtkamp, Arlene Lennox, Michiko Minty, Thomas Roser.

Fellowship Committee: Nan Phinney (chair), Ilan Ben-Zvi, Charles Brau, George William Foster, James Rosenzweig, John Seeman, Todd Smith.

Publications Committee: Dinh H. Nguyen (Chair), John Byrd (Vice-chair), Swapan Chattopadhyay, Richard Temkin (PRE Board of Ed), Kwang-Je Kim (PRL Div. Ass. Ed), Robert Siemann (PRST-AB Ed).

Education Committee: Helmut Wiedemann (Chair), Dominick Chan, George Caporaso, Swapan Chattopadhyay, George Gillespie, Linda Spentzouris.

Wilson Prize Committee: Norbert Holtkamp (Chair), Michael Harrison, Claudio Pellegrini. Two more members will be nominated in the April 2002 meeting.

Doctoral Research Award Committee: Robert Ryne (Chair), Joseph Bisognano, John Carey, Warren Mori, James Rosenzweig, , Robert Siemann.

PAC'03 Chair, Organizing Committee: Bob Siemann.

PAC'03 Chair, Program Committee: Alan Jackson.

Prize Winners in Beam Physics and Outstanding Doctoral Thesis Announced

The 2002 APS Robert R. Wilson Prize and the 2002 APS Award for Outstanding Doctoral Thesis Research in Beam Physics award will be presented at the APS April Meeting, Albuquerque NM (April 20-23).

The Robert R. Wilson prize of the American Physical Society

Sponsored by the APS Division of Physics of Beams, the APS Division of Particles and Fields and the Friends of R.R. Wilson, will be Awarded to *A.N. Skrinsky, Director of the Budker Institute of Nuclear Physics "For his major contribution to the invention and development of electron cooling and for his development and for his contributions to the physics of the electron-positron colliders at the Budker Institute."*

The Robert R. Wilson prize will be presented at the Albuquerque APS Meeting, during the Joint DPB/DPF Prize Session, on Monday, 22 April, from 10:45-13:45.

The Award for Outstanding Doctoral Thesis Research

Sponsored by the Division of Beam Physics, Universities Research Association, Southern Universities Research Association and Brookhaven Science Associates.

This year the award goes to *Boris Podobedov, with the citation: "The award thesis is an experimental study of the microwave instability in the SLC damping rings using a streak camera to correlate each event to the RF. The development of this sophisticated technique provides a powerful tool for the study of non-linear instabilities above threshold."*

Thesis Advisor: Robert Siemann, SLAC.

The Award for the Outstanding Doctoral Thesis Research will be presented at the Albuquerque APS Meeting, during the Joint DPB/DPF Prize Session on Monday, 22 April, from 10:45-13:45. In addition, the winner will present an invited talk in the DPB Thesis Award; Future Accelerators Invited Talks session on Tuesday, 23 April, 8:00-11:00.

DPB Members Appointed as APS Fellows

Colson William Boniface, Naval Postgraduate School, Monterey, CA "For outstanding theoretical contributions to the fundamental understanding of Free Electron Lasers. These theoretical concepts, first put forward over 20 years ago, are widely applied throughout the world today."

Krafft Geoffrey Arthur, Thomas Jefferson National Accelerator Facility "For his pioneering contributions in establishing the stability and operational foundation of superconducting and recirculating electron accelerators."

Leemans Wim Pieter, Lawrence Berkeley National Laboratory "For pioneering experiments on the interaction of relativistic electron beams, lasers and plasmas, including femtosecond x-ray generation using Thomson scattering, plasma lens focusing, laser-plasma accelerators and advanced diagnostic techniques."

McIntyre Peter Mastin, Texas A & M University "In recognition of his contributions to the physics and technology of hadron colliding beams, including a succession of superconducting magnet technologies to push the energy frontier in hadron colliders."

Neil George R., Thomas Jefferson National Accelerator Facility "For contributions to the development of physics and technology of Free Electron Lasers and for his leadership in demonstrating a high average power FEL."

Peggs Stephen G., Brookhaven National Laboratory "For his important contributions to the study of nonlinear dynamical effects in accelerators and for his contributions to the successful design, construction and operation of the Relativistic Heavy Ion Collider."

Young Lloyd Martin, Los Alamos National Laboratory "For his invention, development, and beam operation of the resonantly coupled RFQ structure, and for the new methods used to tune it and other RFQ structures."

The Fellowship awards will be presented at the Albuquerque APS Meeting, during the Joint DPB/DPF Prize Session, on Monday, 22 April, from 10:45-13:45.

We congratulate the Wilson Prize winner, Outstanding Thesis Award winner and new DPB fellows for the well-deserved honor.

2001 APS April Meeting
(Alex Dragt, Chair, Program Committee)

The 2002 April APS meeting will last for 4 days (20-23 April) and will be held in Albuquerque, NM. Please look up the meeting details at: http://www.aps.org/meet/APR02/.

With regard to DPB sessions, there are multiple 3-hour parallel Sessions of Invited/Contributed talks on each of the 4 days. (Invited talks are 36 minutes long including questions. Contributed talks are 12 minutes long including questions. If other formats are proposed, time is allocated in 12-minute blocks.) There are also Poster Sessions that cover all areas of Physics at the same time.

Let me thank the members of the DPB Executive Committee for the nominations that they have made. These should be excellent sessions!

The DPB Portion of the April 2002 APS Meeting:

C6 Saturday, 20 April, 10:45-13:45

Chair: Katherine Harkay

Invited Talks on Intense/Bright Hadron Sources and Numerical Simulation.

- •High-Power Linac for the Spallation Neutron Source D.J. Rej (LANL)
- •Measurements of Halo Generation in an Intense Proton Beam P. L. Colestock (LANL)
- •Optical Stochastic Cooling V. Yakimenko (BNL)
- •Charged-particle Gun Design with 3D Finite-element Methods Stanley Humphries (Field Precision)
- •Proton Radiography C. T. Mottershead (LANL)

E6 Saturday, 20 April, 14:30-17:30

Chair: C. Joshi (UCLA). Joint with DPF

Teach-In on Advanced Methods for Acceleration: Invited Pedagogical Talks with Emphasis on Recruiting other Physicists into the Field.

- •Beam and Laser Driven Advanced Accelerators R. Siemann (SLAC)
- •All-Optical Electron Injector D. Umstadter (U. Michigan)
- •Plasma Beat-Wave Acceleration C. Clayton (UCLA)
- •Simulation of Beam and Laser-Driven Plasma Waves T. Katsouleas (USC)
- •Laser driven acceleration of electrons and ions W. Leemans (LBNL)

I7 Sunday, 21 April, 10:45-13:45

Chair: D.J. Dean (ORNL). Joint with DNP, DCOMP, DPF

The Science of Monte Carlo Simulations

- •Lattice QCD with Dynamical Quarks S. Gottlieb (FNAL/Indiana U.)
- •Quantum Monte Carlo for Electronic Systems S. Zhang (Wm. and Mary)
- •QMC Calculations of Light Nuclei S. Pieper (ANL)
- •Stochastic Methods Employed in Beam Physics S. Habib (LANL)

K16 Sunday, 21 April, 14:30-17:30

Chair: T. Wangler (LANL)

Beam Physics and Technology

- •Longitudinal Beam Dynamics Constraint on Accelerating Gradient in a Proton Superconducting Linac T. Wangler (LANL)
- •Macro-Particle Simulations of LEDA Experiments J. Qiang (LBNL)
- •Beam Coupling Impedances of Traveling-Wave Ferrite-Free Extraction Kickers S. Kurennoy (LANL)
- •Electron Beam Current From a Coaxial Diode Revisited E. Schamiloglu (UNM)
- •Ion-Hose Instability in a High Current, Long-Pulse Accelerator T. Hughes, (MRC)
- •Experiments and Simulations on the Scaling of Space-Charge Waves in Intense Beams S. Bernal (UMD)
- •Beam emittance measurements using optical diffraction-transition radiation interferometry R. Fiorito (TR Research)
- •Oscillation in FEL Self-Amplified Spontaneous Emission A. Bakhtyari (Dartmouth)
- •Nonsingular Integral Equation for Stability of a Bunched Beam R. Warnock, (SLAC)
- •A New Model for the Strong—Strong Beam—Beam Interation J. Ellison (UNM)
- •First-Order Averaging Principles for Maps with Applications to Beam Dynamics in Particle Accelerators H. Dumas (U. Cincinnati)
- •Exact Analytical Solutions for the Invariant Spin Field in Storage Rings S. Mane (Convergent Computing Inc.)
- •Flux-Coupled Isochronous Cyclotron Stack as Driver for Thorium-Cycle Fission P. McIntyre (Texas A&M),
- •The Beam Line of MiniBooNE J. Cao (U. Michigan)

Monday, 22 April, 10:45-13:45

Chairs: A. Dragt & S. Wojcicki.

Joint DPB/DPF Prize Session.

A. Sirlin: Sakurai Prize 1 Invited Talk

Y. Totsuka: Panofsky Prize 1 Invited Talk

B. Knuteson: Tanaka Award Invited Talk

A. Skrinsky: Wilson Prize Invited Talk

Ceremony for new DPB and DPF Fellows

Note: *Other Sakurai and Panofsky Prize Winners will talk at other special award sessions.*

S5 Monday, 22 April, 14:30-17:30

Chair: N. Phinney

Invited Talks on Frontier Linear Accelerators and Light Sources

- Linear Colliders: Achieving High Beam Power C. Adolphsen (SLAC)
- Linear Colliders: Achieving High Luminosity G. Dugan (Cornell U. / LBNL)
- Providing Bright-Hard X-ray Beams from a Lower Energy Light SourceD. Robin (LBNL)
- Photoinjected Energy Recovery Linac I. Ben-Zvi (BNL)
- Generation of Femtosecond Pulses for Ultra-Fast X-ray Science A. Zholents (LBNL)

U5 Tuesday, 23 April, 8:00-11:00

Chair: M. Zumbro (LANL)

DPB Thesis Award; Future Accelerators

- DPB – Thesis Award – Winner talk: Saw-tooth Instability Studies in the SLC Damping Rings. B. Podobedov (BNL)
- Rare Isotope Accelerators G. Savard (ANL)
- The Linac Coherent Light Source (LCLS) H. Winick (SLAC)
- Status of and Plans for e+e- B-Factories M. Sullivan (SLAC)
- Experiments with Space Charge Dominated Beams P. O'Shea (U. Maryland)

Note of Appreciation for Ilan Ben-Zvi

On behalf of the members of the Division of Physics of Beams and the DPB Executive Committee, I would like to take this opportunity to thank Ilan Ben-Zvi for his extraordinary service to the DPB and the American Physical Society.

As Secretary-Treasurer of the DPB for the past three years, Ilan has exercised a level of enthusiasm and attention to detail that have been essential to the continued intellectual health and financial prosperity of the Division.

I am personally very grateful for Ilan's wise counsel during the past year, and I expect that the DPB Secretary-Treasurer-Elect, Mike Zisman, and the DPB Vice-Chair, Alex Dragt, will find Ilan a very valuable source of 'corporate memory' in the months ahead.

Thanks and best wishes to Ilan!

Ronald C. Davidson
Chair
Division of Physics of Beams

DPB Membership

The membership of DPB as a fraction of the APS membership shows a steady decline trend, with the exception of the transition from FY99 to FY00:

FY96	FY97	FY98	FY99	FY00	FY01
3.22%	**3.19%**	**3.12%**	**2.97%**	**2.96%**	**2.92%**

The absolute number as of now is 1214, down from 1262 members in FY00.

The DPB membership has declined to below 3% of APS membership. The APS established a system where divisions are represented in the APS council in proportion to their membership. If a division's membership is above 3%, it is entitled to be represented in the APS council. However, if divisional membership falls below 3% of the total APS membership, the division may lose its councilor and may no longer be represented in the Council.

We should strive to change this trend. Please help us to achieve this goal by encouraging your colleagues to join. Members of DPB play a part in electing the division's officers and councilor and have a voice in the affairs of the division.

Joining is easy. The APS Membership Department: phone 301-209-3280, e-mail MEMBERSHIP@APS.ORGn and on the WWW at http://www.aps.org .

Snowmass Summer Study on the Future of Particle Physics

One of the important outputs of the Snowmass Summer Study on the Future of Particle Physics is the '2001 Snowmass Accelerator R&D Report', prepared by the DPB Snowmass Organizing Committee, with Alex Chao and Thomas Roser ably serving as report Editors. This report can be accessed at: **http://www.hep.anl.gov/pvs/dpb/Snowmass.pdf.**

This report provides an excellent overview of technical accomplishments and future research opportunities in accelerator R&D for high-energy physics, and it incorporates the Executive Summaries of the fifteen DPB Working Group as an integral part of the report. I encourage you to read it and share it with your colleagues.

As DPB Co-Chair of the Snowmass Organizing Committee, I am particularly grateful to the Working Group conveners, the participants at Snowmass, and the DPB Snowmass Organizing Committee for their dedicated efforts in making the Snowmass meeting such a great success.

It is evident that input from the Snowmass meeting played an important role in the deliberations of the DOE-NSF Subpanel on Long Range Planning for U.S. High Energy Physics. The HEPAP subpanel has prepared an excellent report on the future of high-energy physics, and the DPB Executive Committee has issued the statement included below in support of the subpanel's findings and recommendations.

Ronald Davidson
Chair, Division of Physics of Beams

Statement by the American Physical Society Division of Physics of Beams Executive Committee on the DOE-NSF HEPAP Subpanel Report on Long Range Planning for U.S. High Energy Physics

January 29, 2002

The Executive Committee of the American Physical Society's Division of Physics of Beams (DPB) wishes to commend the DOE-NSF HEPAP Subpanel on Long Range Planning for U.S. High Energy Physics for its very thorough and thoughtful report. This report is based in significant part on input from the 2001 Snowmass Summer Study on the Future of Particle Physics, cosponsored by the Division of Physics of Beams and the Division of Particles and Fields.

The Subpanel Report emphasizes the critical role of accelerators that extend the limits of present technology in supporting future progress in high energy physics, and contains a strong endorsement of a vigorous long-term accelerator R&D program aimed toward future high energy accelerators. The DPB Executive Committee underscores the important role that extensive advances in fundamental accelerator technologies have played in laying the groundwork for the Subpanel's vision of the future of U.S. high energy physics. If that vision comes to fruition, it will result in the most advanced accelerator facility ever built, utilizing technologies developed by members of the Division of Physics of Beams, and constructed through the dedicated efforts of many members of the DPB community. The Division of Physics of Beams Executive Committee remains strongly committed to the tradition of active partnership in the development of major accelerator-based initiatives, for applications to high energy physics and other branches of scientific research.

Members of the DPB Executive Committee:

William Barletta, Lawrence Berkeley National Laboratory
Ilan Ben-Zvi, Brookhaven National Laboratory
Alex Chao, Stanford Linear Accelerator Center
Pat Colestock, Los Alamos National Laboratory
Ronald Davidson, Princeton University
Alex Dragt, University of Maryland, College Park
Gerald Dugan, Cornell University
Katherine Harkay, Argonne National Laboratory
Steve Holmes, Fermilab National Accelerator Laboratory
Chan Joshi, University of California, Los Angeles
Nan Phinney, Stanford Linear Accelerator Center
Fulvia Pilat, Brookhaven National Laboratory
Ronald Ruth, Stanford Linear Accelerator Center
Helmut Wiedemann, Stanford University
Michael Zisman, Lawrence Berkeley National Laboratory

DPB Snowmass 2001 Organizing Committee Members:

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Report on Physical Review Special Topics (Robert Siemann, Editor)

PRST-AB (http://prst-ab.aps.org) publishes articles in accelerator science and technology. It was started through an initiative of the Division of Physics of Beams, and another successful year of operation has just ended with the closing of Volume 4. Submission and publication statistics are in the table below. The acceptance rate is approximately 70%, and the time from submission to publication is averaging 140 days. *PRST-AB* continues to evolve and grow in importance. A new section containing review articles is being added (the announcement is imminent), and *PRST-AB* is now included in the ISI Web of Science Citation Index.

	Volume 1 (1998)	Volume 2 (1999)	Volume 3 (2000)	Volume 4 (2001)
Submissions	54	73	140	101
Publications	24	48	66	71
Pages Published	174	570	580	672

Eight US national laboratories sponsor *PRST-AB*. They recognize the importance of scholarly publication for the accelerators on which their programs are so strongly dependent. The generosity this has led to is greatly appreciated and has allowed the APS to distribute *PRST-AB* on the WWW (http://prst-ab.aps.org/) without subscription or author charges.

"Conference Editions" are proving to be successful. Conferences maintain their own WWW site with all the work presented, and, in addition, the papers that the organizers and authors consider to contain new results are sent to *PRST-AB* where they are peer reviewed just as any other submission. Accepted papers are published in a regular edition, and are brought together in a special table of contents also. There are Conference Editions for the International Computational Accelerator Physics Conference (Thomas Weiland, Special Editor) and the 21st ICFA Beam Dynamics Workshop on Laser-Beam Interactions (Igor Pogorelsky, Special Editor), and one is planned for the Mini-Workshop on Electron-Cloud Simulations for Proton and Positron Beams (Frank Zimmermann, Special Editor). Please contact Bob Siemann (Siemann@slac.stanford.edu) if you would like to consider a Conference Edition for a conference or workshop you are running.

R&D News from Accelerator Centers

11th Annual BNL Accelerator Test Facility Program Committee and Users Meeting

I. Ben-Zvi

Collider-Accelerator and National Synchrotron Light Source Departments, BNL.

The Brookhaven Accelerator Test Facility held its annual Program Committee and Users Meeting at BNL from Thursday, January 31st to Friday, February 1st. The meeting, which is the 11th ATF Users Meeting, attracted about 60 participants. C. Joshi (UCLA) chairs the current ATF's Program Committee. Other members include S. Chattopadhyay (JLAB), R. Gluckstern, (U. Maryland), M. Harrison (BNL), T. Marshall (Columbia), S. Milton (ANL), C. Pellegrini (UCLA), and R. Ruth (SLAC).

Thursday morning began with the customary welcome from BNL Interim Director Peter Paul. Chief of the Advanced Technology R&D Branch David Sutter at the US Department of Energy (DOE) followed with words on the relevance of the ATF's program for the DOE's advanced accelerator R&D program. Robert Palmer, the Head of the BNL Center for Accelerator Physics provided an introduction for the meeting. ATF Head Ilan Ben-Zvi gave an overview of the facility and its contributions to accelerator science and graduate education. Xijie Wang, ATF Deputy Head and Operations Coordinator, presented an update on ATF operations, performance and upgrades. The morning session concluded with additional presentations on ATF systems and R&D: The ATF lasers (Igor Pogorelsky, ATF), the ATF Computer Control System (Bob Malone, ATF), Small Beams and High Brightness (Vitaly Yakimenko, ATF) and Surface Roughness / Emittance vs. Uniformity experiments (Feng Zhou, UCLA / ATF).

The Thursday afternoon session was dedicated to scientific results from ATF experiments. In rapid-fire sequence the participants heard about the following:

The VISA FEL Experiment (C. Pellegrini, UCLA), in which results were presented of the saturation of this SASE FEL with a record short gain length.

The Staged Electron Laser Acceleration (K. Kusche, STI Optronics / ATF). This experiment, which achieved for the first time staging of two laser accelerators, is making progress towards a monochromatic acceleration with a new configuration and increased laser power.

The High-Gain Harmonic-Generation FEL experiment (L-H. Yu, BNL-NSLS) has demonstrated a convincing proof-of-principle for this unique FEL mechanism that provides longitudinal coherence on top of the usual transverse coherence of FELs.

A report on the Ultrafast Detection of Relativistic Charged Particles by Optical Techniques (Y. Semertzidis, BNL-Physics) experiment, in which a charged particle beam is detected by means of its electro-optical effect on the propagation of laser light in a birefringent crystal.

One of the ATF's international users, from the National Tsing-Hua University in Taiwan, reported on progress towards a Structure-Based Laser Driven Acceleration in a Vacuum (Y.-C. Huang).

An experiment that supports the development of particle detectors for a neutrino oscillation search at Fermilab is the MINOS Beam Monitoring Detectors (M. Diwan, BNL-Physics). This experiment has recently completed its mission.

The Stimulated Dielectric Wakefield Acceleration (T. Marshall, Columbia) aims at accelerating electrons by a coherent superposition of wake fields excited in a dielectric tube by an electron bunch train. This experiment is a collaboration of Columbia University with a small business, (Omega-P, New-Haven).

The LACARA Experiment (J. Hirshfield, Omega-P), is also a collaboration of Columbia University with Omega-P. In this novel experiment, a longitudinal magnetic field, generated by a superconducting solenoid, in concert with a powerful CO_2 laser beam will produce a significant acceleration to the ATF's electron beam.

After a short break, the afternoon science highlights continued with a presentation on The Compton Scattering of Picosecond Electron and CO_2 Beams (T. Hirose, Tokyo Metropolitan University), an experiment that combines (like many other ATF experiments) High-Energy Physics with Basic Energy Science themes. The x-rays produced by the scattering are investigated to serve in the generation of polarized electrons for a linear collider. The picosecond x-rays (subpicosecond with electron bunch compression) are a unique source for a variety of scientific, medical and industrial applications.

Beam Position Monitors for Linear Colliders (V. Yakimenko, ATF), is a Russian experiment that has already demonstrated about 150 nm positional-resolution in a single shot of the ATF's beam with sub-100 nm resolution to be expected in the future.

The Smith Purcell Experiment (H. Brownell, Dartmouth) carries the venerable experiment to relativistic energies. Unexpected radiation patterns were detected and discussed.

The Electron Beam Pulse Compression Based Physics experiment (J. Rosenzweig, UCLA) will open a whole range of beam physics studies in CSR wake field effects, enhancement of FEL performance and other subjects.

Photocathode R&D (T. Srinivasan-Rao, BNL-Instrumentation) is a basic ingredient for high-brightness electron beams such as the ATF and many others. This group reported on recent developments in metallic photocathodes for photoinjectors, the material upon which most SASE FELs are based.

The afternoon concluded with a tour of the ATF facility and poster presentations, followed by dinner.

Friday morning was taken by presentations of new proposals for the ATF and executive sessions of the Program Committee. The new proposals included 'Particle Acceleration by Stimulated Emission of Radiation', presented by Levi Schachter of the Technion, Israel, a stimulating approach to use the energy stored in the active medium of a laser to accelerate electrons.

The quest for ever-shorter time scales in radiation and electron bunches was given a significant boost by the proposal for 'Atto-Second Electron Bunches Production Experiment', presented by Max Zolotorev from the Lawrence Berkeley National Laboratory. If successful, the method opens up a qualitatively new class of phenomena based on the interaction of atomic electrons in the medium with a collective electric field of electron pulses and not with their individual electrons.

Innovative electron beam diagnostics are essential tools for getting better beams (and higher brightness radiation) from particle accelerators. This area was represented by the proposal to do "Optical Diffraction-Transition Radiation

DPB Annual Business Meetings

The Division Business Meeting will take place on Monday, April 22nd, 2002 in the APS April Meeting in Albuquerque, NM. The next DPB Annual Meeting will take place at the 2003 Particle Accelerator Conference in Portland, Oregon.

Interferometry Diagnostics for Low Emittance Beams", by a small business (TR Research, Silver Spring, MD) and the University of Maryland, presented by Ralph Fiorito.

The last proposal was in the area of advanced laser-based accelerators, the "In Vacuum Laser Acceleration of Electrons at BNL's ATF", presented by Vitaly Yakimenko of BNL for a large collaboration of small business and universities.

17 GHz High Gradient Accelerator Research at MIT

C. Chen, I. Mastovsky, M. Shapiro, R. Temkin
MIT Plasma Science and Fusion Center
J. Haimson
Haimson Research Corp.

17 GHZ High Gradient Accelerator

The Haimson Research Corp. 17 GHz, 25 MeV, 0.5 meter accelerator has now been commissioned. It is driven by a 26 MW, 17.1 GHz traveling wave relativistic klystron. It now produces an 18 MeV electron beam, with 100 A in 150 fs bunches or 0.25A average current. This is the highest average power accelerator on the MIT campus and, to our knowledge, the highest frequency stand-alone accelerator in the world. Experiments to measure the emittance and the 150 fs bunch length are being implemented.

17 GHz RF Gun

The 17 GHz RF gun produces 1 to 2 ps bunches of 1-2 MeV, 50-100 A electrons at a 4 Hz repetition rate. Designed to produce a record high brightness of 8·1014 A/m2, the best result to date is 8·1013 A/m2. The RF gun is now tested on a separate beam line but will, in the future, operate as the injector for the 17 GHz, high gradient accelerator.

Novel Electromagnetic Structures

Research into novel accelerating structures has involved developing a photonic bandgap (PBG) cavity to replace the conventional pillbox cavity. A PBG cavity has been built and cold-tested for operation at 17 GHz. The experimental measurements closely match simulations. This novel structure may have considerable advantages over conventional microwave structures, particularly in reducing wake potentials by an order of magnitude.

R&D toward an X-Band Linear Collider

NLC US Project Team
Stanford Linear Accelerator Center, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory

The fundamental building block of rf power in the X-band Next Linear Collider design is the 8-Pack, a set of eight X-band klystrons powered by a single modulator that provides the rf power used to accelerate beams in the Main Linac. It is connected to eight girders of accelerator structures through a Delay Line Distribution System (DLDS) rf pulse compression system that adds the power of the eight klystrons together to achieve the high gradients necessary in the structures, and then distributes this power sequentially to the eight girders. Research on the high gradient structures, modulators and klystrons is described more fully below.

High Gradient Structures

Aggressive R&D is under way to develop X-band accelerator structures that reliably meet the NLC unloaded gradient goal of 70 MV/m. Contributors include several SLAC departments, the Japanese KEK JLC group on structure development, and Lawrence Livermore National Laboratory. High gradient testing for this program occurs at the NLC Test Accelerator (NLCTA) where several sets of structures can be processed simultaneously.

Six high-gradient traveling wave (TW) structures have been studied in the past year. During this time, the NLCTA delivered over 5000 hours of high-power operations (at 60 Hz repetition rate). Improvements have been introduced in the methods of manufacture and handling of these structures. Of particular importance has been the use of high-temperature H2 and vacuum processing, increased care in transport and installation, and in-situ vacuum bake-out of installed structures. Half-meter long, 3% c group-velocity TW structures were processed with 240 ns pulses to over 80 MV/m, and run extensively at 70 MV/m with 400-ns pulses needed to fill the structure and accelerate the 270 ns NLC bunch train. After processing, the observed breakdown rate was 1-3 per hour at 70 MV/m in each structure (approximately one discharge per every 100,000 rf pulses), and discharges in the input and output couplers were seen to account for essentially all of these events. The accelerating cells of these structures operate reliably with breakdown rates of one or less per eight-hour shift, which meet NLC requirements. An input coupler with lower fields and higher impedance has been designed, and incorporated into new TW structures that will be tested at the NLCTA over the 2002 calendar year.

Results from the low group-velocity TW structures are encouraging, but these have been test structures built with smaller cells than those needed to meet NLC dipole wakefield requirements. To increase the iris size while maintaining low group velocity, a higher rf phase advance per cell (150º instead of 120º) will be used together with detuning of long-range wakefields. The new structures planned for 2002 will all be of this high phase-advance type, and will incorporate cells with appropriate detuning of transverse modes. Damping slots, which are entirely in low-field regions of the accelerator cell, will be added later.

Solid-State Modulator

The new solid-state Induction Modulator (which uses power transistors similar to those used to drive electric trains) built in collaboration with LLNL and Bechtel-Nevada, is aimed at a major improvement in reliability, energy efficiency and cost, as modulators are one of the major NLC cost drivers. The first full-scale prototype consists of two stacks of Metglas cores with an Insulated Gate Bipolar Transistor (IGBT) driver card plugged into the front and back of each core. When fully populated, the stack will produce 6,000 A peak at 3 ìs at a voltage of 170 kV. With the 1:3 step-up transformer installed in October, the output of 500 kV, 2000 A peak can drive eight of the 75-MW NLC klystrons. The modulator's peak output power will be one gigawatt. Last March the modulator had initial partial power tests into a water load at a maximum voltage and current of 75 kV, 1100 A for 3 ìs, and was tested to near full voltage in October.

One problem experienced in the water-load test was the failure of a protection diode. This effect has been studied and the diode manufacturer is analyzing the failure mode. Several problems of this general nature were encountered in the course of development and each time solutions have been found. The power IGBTs in general were not characterized for fast pulse operation and neither were the diodes, so it is not surprising to find unique problems that have to be solved.

An important milestone was the completion of the prototype 1:3 transformer, which was fabricated at contract vendors. This assembly not only has to withstand 500 kV at its output, it also has to carry wires, hidden in slots in the concentric tubes that make up the turns, to feed the klystron cathode heaters and bring back signals from cathode beam current monitors The full stack is now reassembled after retrofitting for the diode problem. Testing continued using the water load, and four 5045 S-band klystrons were installed to provide more realistic testing because the number of NLC klystrons is limited.

Two of the 5045 klystrons were recently run in a diode mode. No voltage breakdowns occurred either on the 500-kV water load test, or on the 400-kV tests with the klystrons, which are limited to this voltage. Tests in FY02 will focus on breakdown protection, followed by full power testing with four klystrons. The new 500-kW, 5 kV power supply that will allow 120 Hz operation of the four klystrons has been delivered.

Eight-Pack Test

In the spring of 2002, the solid-state modulator will be moved to the NLCTA where it will be integrated with a SLAC Second Generation Energy Doubler (SLED-II) power distribution system and two prototypes of the NLC production-version 75-MW Periodic Permanent Magnet (PPM) klystron. This system will be used to test DLDS components to the full 600-MW, 400-ns pulse required to feed energy to a standard 5.4 meter-long girder of NLC structures. In 2003, the SLED-II distribution system will be replaced by a DLDS system, and the full complement of eight klystrons will be completed. At the end of calendar 2003, full-power tests of the NLC 8-Pack are expected to begin.

The above article has been excerpted and edited from articles in Volume 2 of the NLC News, a monthly newsletter that covers work at SLAC, Fermilab, LBNL, LLNL and KEK related to the X-Band Linear Collider project. For more detail, see http://www-project.slac.stanford.edu/lc/local/Newsletter/backnumber.html.

Plasma Wakefield Experiment at SLAC

Patrick Muggli, University of Southern California (USC), and Mark. J. Hogan, Stanford Linear Accelerator Center (SLAC)

A plasma wakefield acceleration (PWFA) experiment is performed at SLAC by a collaboration between SLAC, USC, and UCLA. The goals of the experiment are to demonstrate the acceleration of particles in a large gradient PWFA, and to study the issues related to the propagation of an ultra-relativistic beam in a meter long PWFA module in the context of an actual high-energy accelerator. The 2 ps long, 28.5 GeV SLAC electron or positron beam is sent through a1.4 meter-long plasma with a density in the 0-$2{\cdot}10^{14}$ cm^{-3} range. The beam density is larger than the plasma density and the experiment is performed in the non-linear, blow-out regime. The propagation of the electron beam in the plasma is stable over the experimental parameter range, and the strong focusing force of the plasma results in multiple betatron oscillations of the bunch envelope. The corresponding spot size variations are observed as a function of the plasma density at locations downstream from the plasma using optical transition radiation and Cerenkov radiation. The synchrotron radiation emitted by the particles along their betatron motion is in the x-ray range, and could be used as a high brightness source of incoherent x-ray radiation. In 2001 the experimental apparatus has been moved to the true focus location of the Final Focus Test Beam (FFTB) line, from its previous downstream location. At this location spot sizes of the order of 10 µm (after scattering) can be produced at the plasma entrance. At the same time, six quadrupole magnets now located downstream from the plasma are used in conjunction with the FFTB dumpline dipole magnet to form an imaging energy spectrometer. The beam at the plasma exit is imaged onto a thin piece of aerogel located after the bending magnet where it is also dispersed in energy. The imaging properties of the magnetic spectrometer remove the previously observed ambiguity between energy changes imparted on the beam by the PWFA action and transverse deflections of the beam tail resulting from the strong transverse component of the plasma wake. Energy loss and gain has been measured with electrons during the Summer 2001 run of the E-162 experiment, while the recent December run was dedicated to positrons. A large amount of data has been collected, and the experimental results will be published soon.

Superconducting bend magnets extend spectral range of the Advanced Light Source

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Lawrence Berkeley National Laboratory

Constrained in size by its site on a hillside above the University of California, Berkeley campus, the Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory is based on an electron storage ring with a 198-meter circumference and maximum beam energy of 1.9 GeV. The relatively low energy, as compared to that of other so-called "third-generation" sources of synchrotron radiation, means that the facility generates the greatest flux and brightness at "soft" x-ray photon energies. While the ALS is a world-leader in providing beams of soft x rays, there has nonetheless been a steadily growing demand from synchrotron radiation users for harder x rays with higher photon energies. But how to provide these x-rays?

A very expensive option requiring a lengthy shutdown would have been to upgrade the storage ring to operate at higher energies. Both the cost and the time out of service made this course unfeasible, and it was never seriously considered. Another alternative would have been to fit the straight sections of the storage ring with several high-field, multipole wigglers. Since 1997 the ALS has in fact operated with one such wiggler, a device that provides the hard x rays for an extremely productive protein crystallography beamline. However, many wigglers would limit the number of high-brightness undulators that give the ALS its state-of-the-art soft x-ray performance and justified its construction in the first place.

In the end, the ALS adopted a proposal, originally made in1993 by Alan Jackson (Berkeley Lab) and Werner Joho (Paul Scherrer Institute), to replace some of the normal combined-function magnets in the curved arcs of the storage ring with superconducting dipoles (superbends) that could generate higher magnetic fields and thus synchrotron light with a higher critical energy. Early on, David Robin (ALS Accelerator Physics Group) conducted modeling studies showing that three superbends with fields of 5 T (compared to the 1.3 T of the original combined-function magnets), deflecting the electron beam through 10° each, could in fact be successfully incorporated into the storage ring without destroying the symmetry of the lattice.

Beginning in 1995, Clyde Taylor of Berkeley Lab's Accelerator and Fusion Research Division (AFRD) led a project to design and build a superbend prototype. By 1998, the collaboration (which included the ALS Accelerator Physics Group, the AFRD Superconducting Magnet Program, and Wang NMR, Inc.) produced a robust magnet that reached the design current and field without quenching. The basic design, which has remained unchanged through the production phase, includes a C-shaped iron yoke with two oval-shaped poles protruding into the gap. The superconducting material consists of wire made of niobium-titanium alloy in a copper matrix, over a mile long, wound over 2000 times around each pole. The operating temperature is about 4 K.

ALS Director Daniel Chemla made the final commitment to follow through with production in mid-1998. Superbends were to replace the center combined-function (gradient) magnets in Sectors 4, 8, and 12 of the ALS triple-bend achromat storage-ring lattice. Representing the first time that superconducting magnets would be retrofitted into the magnet lattice of an already operating synchrotron light source, the superbend installation and commissioning had to proceed quickly and transparently to users of the ALS. After some preparatory work during previous shutdowns, installation of the superbends began in mid-August 2001. After the installation phase, the goal was to commission the ALS with superbends and return the beam back to users by October 4. This schedule allowed the month of September to commission the ring; Superbend project leaders were bracing for up to a four-week commissioning period. Instead, it took less than two weeks after installation began before the machine was ramped up to full strength.

In early October, the ALS re-opened for users with a whole new set of capabilities. In brief, the superbends (1) extended the spectral range of the ALS to 40 keV for hard x-ray experiments, (2) do not degrade the high brightness of the ALS in the soft x-ray region for which the ALS was originally designed, (3) do not degrade other performance specs such as beam stability and lifetime,(4) do not require any straight sections be sacrificed to obtain high photon energies, and (5) are already serving the first of a new set of protein crystallography beamlines. Ultimately, 12 new beamlines for crystallography and other applications, such as micro tomography and high-pressure diamond anvil-cell experiments, will be constructed.

Effects of electron clouds in intense positively-charged ion beams

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Electron clouds have been observed to limit the performance of a number of storage rings, some having beams with beam-center to beam edge potential differences in the kilovolt range. Consequently, these programs put significant efforts into the causes, effects, and ways to mitigate the effects of electron clouds, both in experiments and in theory and modeling. In the heavy-ion inertial-fusion energy program, we have a common interest in the electron response of beams with high line-charge density.

Three new high-current (0.1-1A) experiments in the US Heavy-Ion Inertial Fusion Virtual National Laboratory (HIF-VNL) are beginning or planned. These include experiments on injection (Source Test Stand-500 kV, STS-500), transport (High-Current Experiment, HCX) and focusing (Neutralized Transport Experiment, NTX). Each uses ion beams with sufficient line charge density to generate beam space charge potentials of the order of a kilovolt or more. In these potassium beams, at energies of 0.4-2 MeV (~10-50 keV/nucleon), the transportable beam current is limited by the radial space-charge forces that are much greater than those resulting from emittance.

Theory and simulations of these new high-current experiments suggest that electrons, from ionization of residual and desorbed gas and secondary electrons from vacuum walls, will be radially trapped in the ion beam potential (at the present beam energies, ion impact ionization of gas is significant). Electrons can be detrapped by acceleration backwards through an acceleration gap, gaining a kinetic energy greater than the trapping energy of the beam potential. Trapped electrons can modify the beam space charge, vacuum pressure, ion transport dynamics, and halo generation, and can potentially cause ion-electron instabilities, similar to those observed at the PSR and SPS. Within quadrupole (and dipole) magnets, the longitudinal electron flow is limited to drift velocities (E x B and grad-B) and the electron density can vary azimuthally, radially, and longitudinally. These variations can cause centroid misalignment, emittance growth and halo growth. Simulations use WARP, a highly developed particle-in-cell code, to study electron trajectories within quadrupole magnets, starting from various points on the wall and locations within the beam.

Diagnostics are being developed to measure the energy and density of electrons and gas evolved from walls, measure the net charge and gas density within magnetic quadrupoles, determine the depth of trapping of electrons, their axial and radial transport, and the effects of electrons on the ion beam. Diagnostics and beam modifications can be introduced relatively easily on these facilities, which are designed for accelerator research rather than delivering beam to a user community. The study of electron effects in injectors, transport, and final focus is a new and major thrust of the HIF program.

This thrust is important to the HIF-VNL in its emphasis on studying issues that have potential to decrease the cost of power-plant drivers. We want to minimize the diameter of the multiple-beam array within the accelerator magnetic-induction cores, because this reduces the total mass of cores (for constant volt-seconds), which is a major cost area for drivers. A significant contributor to this diameter is the space required between each beam and its beam tube. This space is necessary to reduce the beam impinging the wall to below the level where sufficient gas and electrons are generated to degrade beam performance. This space also increases the time-of-flight for desorbed gas to reach the beam. These considerations imply that the minimum-cost driver will have electron effects only slightly below the level that would cause unacceptable beam degradation.

This work is symbiotic with the electron cloud studies underway in high-energy physics accelerators. The VNL is using its experience (as well as experience gained from the magnetic fusion community) in plasma and beam diagnostics and in computation of plasma and beam physics to study electron effects, and is coordinating with researchers from LBNL who are studying these effects in the LHC and PSR. We believe that this research on electron effects in intense ion-beam accelerators presents a good opportunity for cooperation and cross-fertilization of new ideas, diagnostics, theory and simulation between the HIF and other accelerator communities.

Rare Isotope Accelerator (RIA) R&D at Argonne

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The Rare Isotope Accelerator (RIA) has been identified as the highest priority for new construction in nuclear physics by NSAC, the nuclear science advisory committee to the DOE and NSF. The RIA facility will include two linacs based on superconducting rf (SRF) technology: a 1.4 GV driver linac capable of producing 400 kW CW beams of all ions from protons to uranium, and a post-accelerator to produce beams of rare isotopes. R&D directed toward RIA is being performed at ANL in a number of categories (see http://www.phy.-anl.gov-/ria/-index.html). For this newsletter, we highlight recent work in accelerator R&D.

1. RIA Linac Design and Beam Dynamics

The RIA Driver Linac will accelerate multiple-charge-state (multi-q) beams of the heaviest ions, for which the beam current is limited by ion-source performance. Multi-q operation provides not only a substantial increase in beam current, but also enables the use of two strippers, reducing the size and cost of the driver linac. Using the existing SC heavy-ion linac ATLAS at ANL, a recent experiment demonstrated the feasibility of such a multi-q operation by successfully accel-er-ating a uranium beam containing 11 different charge states. To insure that the stringent requirements for multi-q operation can be met, we have numerically simulated the dynamics of multi-q uranium beams from the ion source through the driver linac and onto the production targets. The sim-ul-ations used three-dimensional RF electric and magnetic fields for beam ray-tracing and included random misalignments of focusing and accelerating elements, and random errors of the rf fields. The results indicate that beam emittances can be maintained well within of the (six-dimensional) acceptance of the driver linac.

A design has been developed for an injector for the driver linac which can provide two charge states directly from the ECR source, effectively doubling the beam current available for uranium. The injector uses a multi-harmonic buncher in front of a 57.5 MHz RFQ. Three-dimensional electro-magnetic, thermal, and structural analyses have been completed for the RFQ, a four-vane type structure which fits within a tank 0.56 m in diameter and 4 m long. We have also completed a preliminary design for a driver linac switchyard which, using an RF-sweeper and a set of septum-magnets, can deliver cw accelerated beam to two targets simultaneously.

We have developed a design for a low charge state injector for the RIB post-accel-erator which can accelerate singly-charged beams of any mass, including uranium. The injector is based on a novel hybrid class of RFQ (H-RFQ) formed by alternating a series of drift tubes (DTL) and RFQ sections within the same RFQ resonant structure. By de-coupling the accelerating and focusing functions, the average accel-erating gradient can be twice that of a conventional RFQ.

2. Superconducting RF Development

The RIA driver linac requires nine different types of SC cavity which span a range in velocity from 0.02 < b = v/c < 0.9. Of these nine types, the four lowest in velocity closely resemble existing cavities which have been operating for years in several existing SC heavy ion linacs. The two highest in velocity are being developed at JLAB for the SNS project. The re-main-ing three cavities types cover the relatively unexplored intermediate velocity range 0.2 < b = v/c < 0.6 and are being developed specifically for RIA. Of the three types, two are drift-tube loaded cavities, proto-types of which are under construction at ANL and will be completed in calendar 2002. One is a 345 MHz, b = 0.4, two-cell spoke-loaded cavity. The other is a 172.5 MHz half-wave structure which replaces an earlier-proposed quarter-wave loaded structure of the same frequency, in order both to reduce the peak surface magnetic field and also to eliminate beam-steering by the rf magnetic field.

Two types of single-cell spoke-loaded niobium SC cavity, operating at 350 MHz and sized for velocity v/c = 0.3 and 0.4, were constructed at ANL several years ago to deter-mine the feasibility of intermediate-velocity SC cavities. In recent, independent tests at ANL and LANL, the use of high-pressure water cleaning techniques greatly reduced electron loading and enabled operation at accel-erating gradients substantially above the nominal 5 MV/m perfor-mance goal for RIA. Subsequently one cavity was operated at ANL continuously for four weeks at an acceler-ating gradient of 7 MV/m, some 40% higher than the gradient currently specified for the RIA driver.

Beam Dynamics and Related Activities at CERN-PS on CLIC.

Gilbert Guignard
CERN

Several issues of the **injector complex** have been investigated. The electron source has been redesigned in order to produce polarized electrons with a DC gun and a photo-cathode, but not anymore with an RF gun. The positron production and polarization have been revisited in details. The beam dynamics simulations for the e+ produc-tion in the target and for the e+ capture in the matching and focusing sections allowed to define a new set of parameters for the positron production. New input parameters for the e+ pre-damping ring have been defined. Simulations with the present parameters of the damping rings showed potential severe limitations. Therefore more detailed studies have been launched in order to address the electron-cloud and the intra-beam scattering issues. Numerical tools were created for the design optimization of the isochronous modules needed in the transfer-line bends, the combiner rings and the turn-around loops. For studying the implemen-tation feasibility, the geometry of the injector complex was analyzed and a possible layout concocted with the foreseen system dimensions.

Main linac work dealt with feedbacks controlling the beam position, the evaluation of the effects of various accelerating structures on the beam stability, the depen-dence of the efficiency of the emittance-tuning bumps on their location and the development of the simulation tools. In the latter, a more realistic model of independent feed-backs has been introduced, which includes the beam-monitor resolution. The optimum gain or fraction of the correction that is implemented by the feedbacks has been evaluated in the presence of dynamical imperfections. At this gain, the multi-feedback system takes a certain time to converge towards a status where it counterbalances the imperfections with a constant efficiency. The emittance growth during this convergence time has been shown to remain small. For the accelerating structures, the effects on the main-beam stability have been simulated for different designs with a reduced ratio of surface-field to accelerating field. This helped the selection of the most promising structure-design and allowed to determine the required beam parameters in these new conditions.

The old **Power Extraction** and Transfer Structures (PETS) of the drive-beam decelerator were found to have low frequency transverse modes and insufficient damping. New PETS designs were worked out. The beam stability in the decelerators with structures of different apertures but same output power was simulated. Highest apertures turned out to be best. The high group velocity in the PETS makes the single bunch effects important and this reduces the power transfer efficiency. This can be resolved by having a PETS frequency slightly shifted with respect to the RF frequency. A simple model and program were developed in order to find the optimum frequency shift restoring the efficiency. Drive-beam stability simulations at this new frequency allowed selecting a new PETS design. The large betatron amplitudes and the low energy of the particles imply large variations of their longitudinal position within the bunch during a passage through one decelerator. This can in turn modify the RF-power production efficiency and the transverse wake-field effects. PLACET was consequently modified to include the longitudinal motion of the particles.

The **simulation** code PLACET used for the main-linacs has been extended and re-organized in order to better evaluate the effects of distorted and blown-up bunches on the performance. This required integrating linac simulations and beam-beam interactions as was shown for TESLA. In this case, it was established that the loss of luminosity associated with actual beam distortions rather than with an effective blown-up emittance could be large in the presence of static and dynamical imperfections. For CLIC, such simulations were performed by replacing the beam delivery system with a transfer matrix and indicated that the effect on the performance is more moderate than for TESLA. The study of such effects makes the use of integrated simulation tools mandatory. With such applications in mind, interfaces have been created between PLACET and the codes SIXTRACK, MAD and TRANSPORT. Work has been done with the code Geant4 to simulate the CLIC beam delivery system. Scattering and secondary generation in spoilers and collimators are included in this approach together with generation and tracking of synchrotron radiation in the beam-line elements.

First estimates of collimation efficiency for halo distributions have been obtained and comparative studies of the candidate optics are planned. The background produced by beam-beam interaction was simulated using GUINEA-PIG. A new PYTHIA based generator for the hadronic background from gg collisions was developed, but in contrast to the old generator it can be used to produce the background for a full detector simulation. A new GEANT3 based simulation code has been written to study the effect of pairs and hadrons.

The beam-beam simulation code GUINEA-PIG was modified to allow storing the necessary data to produce a visual impression of the bunches during collision. This should help understanding the strong instabilities seen in the integrated simulations. Field calculations have been improved increasing the speed of the program by up to a factor of three. Luminosity spectra were produced at different energies with realistic beams and luminosity limits studied analytically.

Preliminary investigations on the **engineering feasibility** have been carried out using a possible site near CERN. The guidelines for civil engineering are to have the main tunnel in the sandstone, to locate the interaction point and the injector complex in the same central area on the CERN site and to minimize the environmental impact and the cost.

These requirements can be met for a 40 km long tunnel lying at ~140 m below ground, which houses both the main linacs and the beam delivery systems at 3 TeV c.m. Engineering shafts are planned at every 3.2 km or 5 drive-beam units. A first study of a possible powering strategy and of a cooling and ventilation system covering the high power at stake (320 MW approximately at 3 TeV c.m.) has been done.

Main linac **accelerating structure** development efforts focused on the two main performance-limiting effects: electrical breakdown and pulsed surface heating. A picture of high-frequency breakdown, with a maximum surface electric field of 300 to 400 MV/m for copper and damage caused by electron currents generated and accelerated during breakdown, has emerged from the accumulated body of experimental data.

Using this understanding, new RF designs with reduced surface electric field have been developed and use of arc-

Secretary Treasurer bids farewell

It was my pleasure and a learning experience to serve as the DPB Secretary-Treasurer for the past three years. Due to the pressure of responsibilities at work, I had to step down from this job. The S-T position brought me into close contact with the DPB membership, for which I am grateful. I expect that I will continue to do public service in the DPB however at a slower pace. I am “passing the baton” to capable hands, to Mike Zisman and thus I can say farewell without misgivings.

resistant materials inside the accelerating structures has been investigated. Progress toward structures with lowered pulsed surface heating continued with the development of a new, very fast, technique to calculate long-range transverse wake-fields.

For the international **technical review** recently launched by ICFA on linear collider projects and studies, the CLIC design optimized at 3 TeV c.m. has been revisited for the c.m. energy of 500 GeV selected for comparison. This necessitated reconsidering several sub-systems like the damping rings, shorter linacs (4 units instead of 22 per linac), the delivery system and hardware components, keeping compatibility with the nominal 3 TeV case. As a result, a first description of the 500 GeV CLIC has been written. Both sets of parameters at 0.5 and 3 TeV center-of-mass energies have been inspected.

The CLIC notes and main **references** can be obtained from the CLIC site on the Web: http://www.cern.ch/CERN/Divisions/PS/CLIC/

September 11, 2001

The Executive Committee of the Division of Physics of Beams would like to extend our condolences to all those who lost family and friends in the terrible events of September 11. We would also like to thank our many colleagues from around the world for their expressions of sympathy and support in the difficult times that followed.

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