

Division of Physics of Beams newsletter

A Division of the American Physical Society
Edited by Ilan Ben-Zvi, *Secretary-Treasurer*

February 2001

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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Election Results for the 2001 DPB Executive Committee

The elections for the 2001 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). The election has been completed on September 15, 2000. Most of the ballots were electronic. 17 were received by mail. The fraction of voters was 342 out of 1256, or 27%, up from last year's of 312 votes, 22.4% of the membership.

The members elected are: Ronald Ruth for Vice-Chair; William Barletta and Gerald Dugan for Members-at-Large (3 years).

As a result of the election, the Member-at-Large position of Ron Ruth will become vacant effective June 2001. Therefore, in accordance with the DPB Bylaws, the Executive Committee appointed Kathy Harkay to complete the term of Ron Ruth. It is noted that she stood for elections in August-September 2000 and came in third place for Member at Large.

The DPB Councilor, Bob Siemann, has turned in his resignation as Councilor for personal reasons. Following the procedure described in the DPB Bylaws, the Executive Committee nominated Alex Chao to fill the remaining term.

The membership of the 2001 DPB Executive Committee will therefore be:

Chair: Ronald Davidson (4/02)

Chair-Elect: Alex J. Dragt (4/02)

Vice-Chair: Ronald Ruth (4/02)

Past Chair: Alexander Chao (4/02)

Divisional Councilor: Alexander Chao (12/01)

Secretary-Treasurer: Ilan Ben-Zvi (4/02)

Members-at-Large:

Patrick Colestock (4/02)

Shyh-Yuan Lee (4/01)

Helmut Wiedemann (4/03)

Chan Joshi (4/03)

Kathy Harkay (4/02)

Ex-Officio Members

Yanglai Cho PAC01 Chair (12/01)

Gerald Jackson PAC01 Program Chair (12/01)

Matthew Allen NPSS/IEEE Rep (12/01)

Each term of office, except for the office of Divisional Councilor, begins in May 2000 on the last day of the Division's Regular Meeting 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.

Membership, 2001 DPB / DPB-Related Committees

Executive Committee (see "Election Results" above)

Nominating Committee: Chair Alex Dragt, John Galayda, Michiko Minty, Thomas Roser, Richard Briggs, Steve Holmes, Bruce Carlsten, Nan Phinney.

Fellowship Committee: Ron Ruth (chair), Charles Brau, James Rosenzweig, Todd Smith, Eric Esarey, Bill Weng, Henry Freund.

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

Education Committee: Dominick Chan (Chair), Swapan Chattopadhyay, George Gillespie, George Caporaso, David Rubin, Jonathan Wurtele.

Wilson Prize Committee: Pief Panofsky (Chair), Y. Y. Lau (Vice-Chair), Henry Blosser, Kwang-Je Kim, Maury Tigner.

Doctoral Research Award Committee: Robert Gluckstern (Chair), James Rosenzweig, John Carey, Robert Ryne, Shyh-Yuan Lee.

2001 DPB Annual Meeting Program Committee: Ronald Davidson (Chair),

PAC'01 Organizing Committee: Yanglai Cho (Chair).

PAC'01 Program Committee: Gerald Jackson (Chair), Ronald Davidson (Vise Chair).

Prize Winners in Beam Physics and Accelerator Technology Announced

2001 APS Robert R. Wilson Prize to Recognize and Encourage Outstanding Achievement in the Physics of Particle Accelerators

A 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. Awarded to *Claudio Pellegrini*, “For his pioneering work in the analysis of instabilities in electron storage rings, and his seminal and comprehensive development of the theory of free electron lasers.”

The prize will be presented at the “Awards Reception & Ceremony” on June 19 at the 2001 Particle Accelerator Conference, in Chicago, Illinois. We congratulate Professor Pellegrini for the well-deserved honor.

2001 APS Award for Outstanding Doctoral Thesis Research in Beam Physics

An award of the American Physical Society sponsored by the Division of Beam Physics, Universities Research Association, Southern Universities Research Association and Brookhaven Science Associates. Awarded to Shyam Prabhakar, “for his pioneering development of beam instability formalisms and diagnostics based on transient-domain beam measurements.”

Thesis Advisor: John Fox, SLAC.

The award will be presented at the “Awards Reception & Ceremony” on June 19 at the 2001 Particle Accelerator Conference, in Chicago, Illinois. We congratulate Shyam Prabhakar for the well-deserved honor.

DPB Members Appointed as APS Fellows

The APS Council at its November 1999 meeting has elected to fellowship the following members recommended by the DPB:

Yanlai Cho, Argonne National Laboratory, “For continuing excellent contributions to high energy physics experiments and technology, and to the design and commissioning of large accelerator facilities.”

Efim Gluskin, Argonne National Laboratory, “For his contributions to the development, construction and characterization of insertion devices for 3rd generation synchrotron radiation sources and free-electron lasers.”

Shin-ichi Kurokawa, High Energy Accelerator Research Org. (KEK) “For major contributions to accelerator development, including synchrotrons and colliders; for his leadership of the Japanese B-Factory; for fostering accelerator education; and for promotion of international collaboration in accelerator science.”

Patrick G. O’Shea, University of Maryland, “For pioneering experiments in the development of the physics, technology, and applications of high-brightness ion and electron beams, and free-electron lasers.”

Tor O. Raubenheimer, Stanford Linear Accelerator Center, “For significant contributions to understanding the physics of electron storage rings and linear accelerators and leadership in the design and development of electron-positron linear colliders.”

Michael S. Zisman, Lawrence Berkeley National Laboratory, “For his key role in storage ring designs of synchrotron radiation sources and electron-positron factories, authoring the ZAP design code and in the design, construction and commissioning of the PEP-II/LER.”

The Fellowship awards will be presented at the “Awards Reception & Ceremony” on June 19 at the 2001 Particle Accelerator Conference, in Chicago, Illinois. We congratulate the new DPB fellows for the well-deserved honor.

DPB Annual Business Meetings

The Division Business Meeting will take place on Monday, June 18 from 5:30 to 6:30 pm at the PAC’01 site, Hyatt Regency hotel, Chicago.

The next DPB Annual Meeting will take place at the 2002 APS April Meeting.

2001 APS April Meeting (Ron Davidson, Chair, Program Committee)

The April 2001 APS Meeting will take place on April 28 - May 1, 2001, at the Renaissance Hotel, Washington, DC. Please look up the meeting details at <http://www.aps.org/meet/APR01/>.

While PAC 2001 will be the DPB's principal scientific meeting in 2001, it is also important that we participate in the April 2001 APS Meeting in a meaningful way (although, of course, at a greatly reduced level relative to our participation in 'even-numbered' years).

Below are the three DPB-related invited paper sessions and speaker nominees for the April 2001 APS meeting. Two sessions are shared with the Division of Particles and Fields. One of these is a joint Prize Session, and the other has been developed together with Stan Wojcicki on behalf of DPF. The third session is sponsored by the DPB, and Nan Phinney has played a key role in organizing this session. All invited speaker nominees have been contacted, and have responded in the affirmative to a formal invitation to speak by the APS.

The three sessions and invited speaker nominees are:

1. Joint DPF-DPB Prize Session (DPF and DPB each contribute ½ session)
2. Joint DPF-DPB Session on Next-Generation High Energy Accelerators and Colliders (DPF and DPB each contribute ½ session)

- a. Snowmass 2001 Objectives and Plans - Chris Quigg (Fermilab)
- b. Large Hadron Collider Status - Lyn Evans (CERN)
- c. Next Linear Collider - Tor Raubenheimer (SLAC)
- d. Neutrino Factory - Jonathan Wurtele (UC Berkeley)
- e. Very Large Hadron Collider - Peter Limon (Fermilab)
3. DPB Session on High Energy Accelerators and Colliders
 - a. Challenges of High Luminosity B Factories - Mike Sullivan (SLAC)
 - b. Relativistic Heavy Ion Collider - Thomas Roser (Brookhaven)
 - c. Accelerator Physics Issues for Spallation Neutron Sources - Jie Wei, (Brookhaven)
 - d. Recent Progress in Free Electron Lasers - Steve Milton (Argonne)
 - e. Developments in Laser and Plasma-Based Acceleration - Mike Downer (U. Texas, Austin)

Let me thank the members of the DPB Executive Committee for the nominations that you have made. Also, I am particularly grateful to Alex Chao, Stan Wojcicki, and Nan Phinney for their efforts and helpful suggestions.

These should be excellent sessions!

DPB Membership

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. Here are our membership numbers for the last five years, as measured on December 31 of the previous year:

| Year | DPB Membership | % of APS Membership |
|------|----------------|---------------------|
| 1996 | 1316 | 3.22 |
| 1997 | 1272 | 3.19 |
| 1998 | 1244 | 3.12 |
| 1999 | 1240 | 2.97 |
| 2000 | 1234 | 2.91 |

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.ORG and on the WWW at <http://www.aps.org>.

News from APS Headquarters **(Judy Franz, APS Executive Officer)**

As DPB members you have much to be proud of. Among many other things, the Fermilab upgrade is progressing well and on schedule, the B factory at SLAC is now taking data, RHIC has begun to produce exciting results, and the SNS is underway. It's clear that you have all been busy. We hope that the APS-sponsored Snowmass meeting this summer will be a significant milestone in helping the DPF and DPB communities to plan for the best new future accelerator. We're pleased that our new electronic journal PR-STAB is growing continuously and, under Bob Siemann's able leadership, seems to be providing you with a useful way of communicating your results.

Bill Herrmannsfeldt is now a member of the APS Committee on Membership and he is committed to helping us increase APS membership. This is important, particularly for our lobbying activities: the larger APS is, the more our voice gets heard in Washington. So please help Bill attract more members from among your colleagues. Our lobbying efforts depend critically not just on numbers, but on enhanced member activity as well. We'd like everyone to take time to tell members of Congress how important physics is, and how crucial it is for the long-term economic health of the country. This kind of participation by our members played a big role in turning around last year's budget, especially for DOE's Office of Science, and there is no reason to think that with the new

administration we can afford to take it any easier this year.

APS has been working hard to get more physics to the public. We now have a media coordinator, Randy Atkins, who helps plan and place stories about physics in newspapers and on TV. In addition we've created PhysicsCentral, an exciting new web site for the public. Check it out at www.physicscentral.com and tell your non-physicist friends and relations about it too. Let us know what you think—you can use the "Contact Us" button on the site or e-mail Jessica Clark at clark@aps.org.

Among the new services we are offering is an email alias system, which allows you to keep the same e-mail address even if you change jobs or internet providers. It will be described in the February issue of APS News. If you are interested in spending some time in an industrial lab, you can take advantage of our industrial fellows program. We are working with industry to provide fellowship opportunities for faculty members, as described in the January APS News. You can also sign up on the APS Technical Network and share some of your expertise on line with other APS members.

In providing these and other benefits and services, our goal is to offer you what you need and want. If you have any comments or ideas for additional services we could be providing, we would be delighted to hear from you.

SNOWMASS 2001 **(Ron Davidson, DPB Chair-Elect, & Co-Chair,** **Snowmass 2001 Organizing Committee)**

On behalf of the Division of Physics of Beams (DPB) Snowmass 2001 Organizing Committee, I would like to take this opportunity to encourage you to participate in the Snowmass 2001 meeting, which will take place in Snowmass, Colorado, on June 30 - July 21. As you know, this will be an extremely important forum for bringing the accelerator and high energy physics communities together to assess the present status of the field and to develop plans for future initiatives. Your active participation at Snowmass will be critical to the success of the meeting.

Appended to this message (below) is the list of DPB Working Groups, the names and e-mail addresses of the conveners, and the charges developed by the DPB Organizing Committee. Let me encourage you to review this material, identify the appropriate Working Group for your participation, and contact directly the corresponding convener to indicate your interest. Doing this as soon as possible is particularly important since

advance preparation by the Working Groups will greatly enhance their effectiveness at Snowmass.

In addition, as information becomes available on local arrangements, schedules for Working Group sessions, etc., it will be posted on the Snowmass web server. So be sure to consult <http://snowmass2001.org> (or <http://www.snowmass2001.org>) on a regular basis.

Finally, let me encourage you to read the briefing by Chris Quigg, Division of Particles and Fields (DPF) Co-Chair of the Snowmass 2001 Organizing Committee, which provides an excellent overview of the scope and objectives of the Snowmass meeting. This briefing is posted on the snowmass2001.org website identified in the previous paragraph.

I very much hope that you will include the Snowmass meeting in your plans for this summer. Your active participation in this important meeting is essential for its success.

If you have any questions, don't hesitate to contact me or other members of the DPB Organizing Committee listed below.

Ron Davidson

DPB Chair-Elect, and Co-Chair, Snowmass 2001 Organizing Committee

DPB Snowmass 2001 Organizing Committee Members:

Alex Chao, SLAC, achao@slac.stanford.edu, 650-926-2985

Ron Davidson, PPPL, rdavidson@pppl.gov, 609-243-3552

Alex Dragt, University of Maryland,

dragt@physics.umd.edu

Ron Ruth, SLAC, rruth@slac.stanford.edu, 650-926-3390

Chan Joshi, UCLA, joshi@ee.ucla.edu, 310-825-7219

Gerald Dugan, Cornell University, gfd1@cornell.edu, 607-255-5744

Norbert Holtkamp, Fermilab, holtkamp@fnal.gov, 630-840-6429

Tom Roser, Brookhaven, roser@bnl.gov

Jim Strait, Fermilab, strait@fnal.gov

John Seeman, SLAC, seeman@slac.stanford.edu, 650-926-3566

SNOWMASS 2001 Working Groups

M1 : Working Group on Muon-Based Systems

Working Group Conveners:

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A. Sessler, amsessler@lbl.gov

Intense muon sources have been discussed as a starting point for very high-energy colliders and even more in recent years as a source of very intense and well-collimated neutrino beams. This working group should identify, but clearly distinguish, the main accelerator physics aspects of both the Muon Collider and the Neutrino Source. Even more, it is crucial to understand for the high energy physics community, how much a Neutrino Source represents a first step to a muon collider and what are the additional burdens. Given the variety of technologies that require R&D makes it necessary to have the group present a risk assessment of the various sub-components, their R&D goals and the time scale on which the R&D could be realized. The more recent refocus of the collaboration towards Neutrino Sources should reflect in the main topics of the discussion. The different approaches: CERN, KEK-JAERI, and the Muon Collaboration (including the Fermilab and Brookhaven locations) should be compared in performance, risk and (if possible) schedule. A discussion on whether a Muon Cooling experiment is necessary and/or viable is absolutely required and should be presented by the group. For the Muon Colliders, the technical performance, especially for a low energy (Higgs collider) machine should be addressed. Technical performance (power consumption, risk assessment, luminosity etc) should be compared to linear colliders in the same energy range. Input here will be required from the High Energy physicists to define the measure of performance for these two concepts (MC, LC). For the long-term R&D the advantages compared to e+e- accelerators should be worked out and quantified as much as possible.

Organizing Committee Contacts: N.Holtkamp, T. Roser

M2: Working Group on Electron-Positron Circular Colliders

Working Group Conveners:

K. Oide, katsunobu.oide@kek.jp

J. Seeman, seeman@slac.stanford.edu

S. Henderson, stu@mail.lns.cornell.edu

Perform a survey of the present status as well as the vision of the future promises of the various electron-positron circular colliders. The colliders to be covered include those currently in operation, currently under construction, or envisioned as a possibility of the future, and in the US and abroad. Special emphasis should be placed on the clear identification of the beam physics limits and accelerator technology limits, and an examination of the extent that they have been addressed by past research or need to be addressed by further research. Identify new and promising ideas even though they may need additional work. These issues should be addressed for all of the leading technical realizations of the circular electron-positron colliders. Finally, the group should summarize in a brief report (a few pages) the highest priority research topics for different technological realizations of circular electron-positron systems and give an approximate timetable for key R&D development. The group is also asked to provide comprehensive presentations to high-energy and accelerator physicists in plenary sessions during the Snowmass workshop.

Organizing Committee Contacts: A. Chao, J. Seeman

M3: Working Group on Linear Colliders

Working Group Conveners:

R. Brinkman, brinkman@mail.desy.de

N. Toge, toge@lcdev.kek.jp

T. Raubenheimer, tor@slac.stanford.edu

The linear collider group should give a vision of the potential of linear colliders both in the near and far term. Special emphasis should be placed on the clear identification of the beam physics limits and accelerator technology limits and an examination of the extent that they have been addressed by past research or need to be addressed by future research.

These issues should be addressed for all the leading possible technical realizations of a Linear Collider. Finally, the Linear Collider group should summarize the highest priority research topics for different technological realizations of both the near term proposals and longer-term concepts and give a rough time scale for key calculations, experiments or technology developments. In particular, we would like the linear collider group to pay special attention to the NLC/JLC design, the TESLA design for possible near term projects. For the longer term, the group should examine the upgradability of each design with extensions of the proposed technology. The group should also examine two-beam ideas as either an upgrade option or a stand alone technology for higher energy linear colliders.

Organizing Committee Contacts: N. Holtkamp, R. Ruth

M4: Working Group on Hadron Colliders

Working Group Conveners:

S. Peggs, peggs@bnl.gov

M. Syphers, syphers@fnal.gov

A long-term goal of the US high energy physics program is to regain the energy frontier after the start of LHC operation. A very high energy, high luminosity hadron collider is the only sure way to accomplish this goal. The Working Group on Hadron Colliders should develop a vision and a long-term plan for the US hadron collider program. In particular, it should examine the physics and technology issues central to the design of very high energy, high luminosity hadron colliders and specify the most critical accelerator physics and engineering issues that determine the performance of the machine; identify the technology developments and accelerator physics experiments needed to prove the machine feasible, and evaluate and estimate the technological and physics limitations on ultimate energy and luminosity in hadron colliders.

The results of the recently completed VLHC study of a staged collider in a large-circumference tunnel should be evaluated and compared with other potential approaches to building and operating very large hadron colliders.

Finally, an R&D plan that will accomplish the goals set out above should be developed. This plan should prioritize the areas of technology R&D that will provide maximal benefit to a future VLHC in terms of performance and cost-effectiveness, and should include an estimated cost and schedule for the R&D.

Organizing Committee Contacts: G. Dugan, J. Strait

M5: Working Group on Lepton-Hadron Colliders

Working Group Conveners:

I. Ben-Zvi, ilan@bnl.gov

G. Hoffstaetter, georg.hoffstaetter@desy.de

Perform a survey of the present status as well as the vision of the future promise of the various lepton-hadron colliders.

The colliders to be covered include those currently in operation, currently under construction, or envisioned as a possibility for the future, and in the US and abroad. Special emphasis should be placed on the clear identification of the beam physics limits and accelerator technology limits and an examination of the extent that they have been addressed by past research or need to be addressed by further research. Identify new and promising ideas even though they may need additional work. These issues should be addressed for all of the leading technical realizations of the lepton-hadron colliders. Finally, the group should summarize in a brief report (a few pages) the highest priority research topics for different technological realizations of lepton-hadron systems and provide an approximate schedule for key R&D developments. The group is also asked to provide comprehensive presentations to high-energy and accelerator physicists in plenary sessions during the Snowmass workshop.

Organizing Committee Contacts: A. Chao, G. Dugan

M6: Working Group on High Intensity Proton Sources

Working Group Conveners:

W. Chou, chou@cns40.fnal.gov

J. Wei, wei@bnl.gov

Several present and future high-energy physics facilities are based on high intensity secondary particle beams produced by high intensity proton beams.

The group is to perform a survey of the beam parameters of existing and planned multi GeV high intensity proton sources and compare with the requirements of high energy physics users of secondary beams. The group should then identify areas of accelerator R&D needed to achieve the required performance. This should include simulations, engineering and possibly beam experiments. The level of effort and time scale should also be considered.

Organizing Committee Contacts: T. Roser, J. Strait

T1: Working Group on Interaction Region

Working Group Conveners:

T. Markiewicz, twmark@slac.stanford.edu

F. Pilat, pilat@bnl.gov

Perform a survey of the interaction region designs of recently completed colliders and those of proposed colliders both under construction and in future planning. The interaction region issues for both the accelerator and the interface between the detector and accelerator should be covered. Special emphasis should be placed on identifying the needed beam physics, technology limits, and detector requirements and reviewing the extent that they have been addressed in past research. Identify new and promising ideas even if they are in early stages. The group should summarize in a brief report the highest priority research topics and give an approximate time scale for key R&D developments.

Organizing Committee Contacts: A. Dragt, J. Seeman

T2: Working Group on Magnet Technology: Permanent Magnets, Superconducting Magnets, Power Supplies

Working Group Conveners:

S. Gourlay, sagourlay@lbl.gov

V. Kashikan, kash@fnal.gov

(i) Superconducting magnets, and associated cryogenic and vacuum systems.

Review the forefront technological issues in the development of superconducting magnets, together with their associated cryogenic and vacuum systems, for the next generation of high-energy particle accelerators. Examine in detail the most important and challenging aspects of these technologies, both from the point of view of performance and cost-effectiveness. These aspects should include the development and use of superconducting materials (including high temperature superconductors), magnet design for high field quality, magnet fabrication, cryogenic systems and their integration with the magnets, and cold beam vacuum issues. *Identify practical and “fundamental” limitations on magnet performance and cost.* Prioritize the R&D efforts, in terms of the potential to provide maximal performance and/or cost-effectiveness; determine the major cost drivers for the magnet, cryogenic, and vacuum systems; and establish a technology-limited time line, and the resource requirements, for the R&D efforts.

(ii) Permanent magnets

Review the leading issues in the development of high-performance, low cost permanent magnet systems for the next generation of high-energy particle accelerators. *Both high performance magnets for specialized applications and lower cost technologies for large-scale applications should be addressed.* Specify the principal R&D activities required to address the most challenging issues, prioritize these activities, and establish a technology-limited time line for accomplishing the R&D.

(iii) Magnet power supplies

Examine the principal technical challenges that must be met for magnet power supply systems needed for the next generation of high-energy particle accelerators. Define the principal R&D activities required to meet these challenges, and specify a technology-limited time line for accomplishing the R&D.

Organizing Committee contacts: G. Dugan, J. Strait

T3: Working group on RF Technology

Working Group Conveners:

C. Adolphsen, star@slac.stanford.edu

N. Holtkamp, holtkamp@fnal.gov

H. Padamsee, hsp3@cornell.edu

Any of the next generation accelerators will need high power rf sources and rf accelerating systems that transfer ac power to beam power efficiently. The challenges though span a wide range of technologies and rf wavelength. From very

low frequency cavities used in Muon Colliders (70 MHz) to very high frequency cavities in Multi TeV linear colliders (30 GHz and more), many of the designs are based on experience and where experience is missing, scaling laws are used. How does Breakdown scale with electric field strength, pulse length and frequency? What limits peak power and efficiency modern power sources?

The experts in this field should generally try to answer these questions and therefore give guidance to the accelerator designers. Limits on fields, peak powers and efficiencies should therefore be an outcome of the working group. Given the experience in the ongoing R&D programs for normal and superconducting cavities the performance achieved today should be described, as well as the limitations and possible cures. The time scale for establishing these cures should be summarized as well. For both, the normal conducting and the superconducting case the subsystems (Modulators, Klystrons, (Pulse Compression systems) and cavities should be addressed independently with a description of present status and of the progress being made over the last five years to allow some extrapolation. For the power sources itself, a very active field only partially driven by accelerator builders, future trends and new directions of improvements should be described.

This group should also describe the likely spinoffs of these different technologies into other(and which) fields, coming out of the technical developments being done in the HEP research environment.

Organizing Committee Contacts: N. Holtkamp, R. Ruth

T4: Working Group on Particle Sources: Positron Sources, Antiproton Sources, Secondary Beams-

Working Group Conveners:

J. Sheppard, jcs@slac.stanford.edu

N. Mokhov, mokhov@fnal.gov

S. Werkema, werkema@fnal.gov

(i). Positron and antiproton sources

High performance positron sources will be required for the next generation of linear colliders. Antiproton sources are a source of antimatter for proton-antiproton colliders and can provide copious numbers of low energy antiprotons for fundamental research. Review the forefront technological issues in the development of the next generation of positron and antiproton sources. Examine in detail the most important and challenging aspects of these technologies, both from the point of view of performance and cost-effectiveness. What are the new ideas and avenues for sources? Prioritize the R&D efforts, in terms of the potential to provide maximal performance and/or cost-effectiveness; establish a technology-limited time line, and the resource requirements, for the R&D efforts.

(ii). Secondary beams

Although collider experiments dominate the current high-

energy physics landscape, high intensity secondary beams of particles still form the basic tools for some important experiments. Review the leading issues and limiting technologies for the development of high-performance secondary beams potentially available from the next generation of high-energy particle accelerators. Identify the secondary beams of interest to the community. Identify the most important R&D efforts that could lead to significant advances in the performance of such secondary beams.

Organizing Committee Contacts: G. Dugan, J. Seeman

T5: Working Group on Beam Dynamics

Working Group Conveners:

M. Blaskiewicz, blaskiewicz@bnl.gov

K.-J. Kim, kwangje@aps.anl.gov

S.Y. Lee, shylee@indiana.edu

Perform a survey of our present understanding of the beam dynamics problems facing the high energy accelerators and colliders, linear or circular, which are currently in operation, currently under construction, or envisioned as a possibility of the future. The specific beam dynamics areas to be covered are:

- Collective effects
- Beam lifetime
- Nonlinear effects
- Beam-Beam interaction
- Beam polarization
- Beam cooling

It is the job of the group to identify the key beam dynamics issues of each of the areas above. Be specific in pointing out which types of accelerators or colliders each identified beam dynamics issue will impact, and give an evaluation of the magnitude of the impact. Identify the R&D activities in theoretical, experimental, as well as by numerical simulation, to be carried out to resolve or at least to improve the understanding of these effects. An estimate of the required effort level and/or time scale would be very useful. A brief summary report (a few pages) is expected at the end of the Snowmass workshop of the conclusions by the group.

To carry out the work in a timely fashion, it will be necessary to start the organization work prior to Snowmass. It may be more efficient to form subgroups, each for one of the subtopics listed above. In that case, each subgroup would have its own set of coordinators during the three-week period.

Organizing Committee Contacts: A. Chao, A. Dragt, T. Roser

T6: Working group on Environmental Control (Civil Construction, Ground Motion, Installation, Alignment)

Working Group Conveners:

W. Bialowons, Wilhelm.Bialowons@desy.de

C. Laughton, laughton@fnal.gov

A. Seryi, seryi@slac.stanford.edu

For the next generation of large accelerators, the civil engineering of accelerator tunnels and associated underground enclosures will be a major component of the technical challenge of building such machines. Because of the large scale involved, the engineering will be required to be as cost-effective as possible, and issues such as ground motion and artificial sources of vibration in the environment will need to be carefully considered. Installation and alignment of the machine components will be tasks of unprecedented scope, and will require unprecedented precision. Examine in detail the most important and most difficult aspects of these challenges, both from the point of view of performance and cost-effectiveness. In particular, identify what the site requirements are for the different machines under discussion (NLC, TESLA, VLHC, Muon source), and describe how tunneling methods are affected by them. Identify, for the different types of accelerators, the different length scales that are involved in defining the alignment tolerances, and what are the tolerances over that length scale.. Specify the R&D efforts needed to define the scope of the most critical challenges, and prioritize the efforts, in terms of the potential to provide maximal performance and/or cost-effectiveness. Establish a technology-limited time line, and the resource requirements, for the most important of these efforts.

Organizing Committee Contacts: G. Dugan, N Holtkamp

T7: Working Group on High Performance Computing

Working Group Conveners:

K. Ko, kwok@slac.stanford.edu

N. Ryne, ryne@lanl.gov

Computers have played a larger and larger role in the theory, design and development of accelerators and the associated technologies. Some examples are calculations of beam optics, simulation of instabilities, electromagnetic field calculations, simulation of space-charge dominated beams and halo formation, beam-beam simulations, start-to-end simulations of systems, real-time modeling of accelerators, and simulations of new accelerator ideas such as those involving lasers and plasmas. This group should explore the impact that advanced computational techniques using the most powerful computers would have on research and development in particle beams and accelerator technology. The group should document past success and look at the immediate and long term future of high performance computing as applied to particle beams and accelerator technology. In particular the group should outline a program of proposed research which will bring the world's most powerful computers, and the hardware and software technologies associated with them, to bear on the most challenging and important problems in our field.

Organizing Committee Contacts: C. Joshi, R. Ruth

T8: Working Group on Advanced Acceleration Techniques

Working group Conveners:

C. Joshi, joshi@ee.ucla.edu

P. Sprangle, sprangle@ppd.nrl.navy.mil

This group is formed to explore new beam physics and new accelerator technology that are at the forefront of advanced accelerator research and identify those concepts which might open new opportunities for advancement of the energy and luminosity frontier for high energy physics. The group should explore laser-plasma devices, beam-plasma devices, high frequency RF techniques, laser driven accelerators, laser driven particle sources and any other new ideas appropriate to the charge. Finally, the group should identify general research directions that might be especially promising for high-energy physics applications and explore the research necessary to fulfill this promise.

Organizing Committee Contacts: C. Joshi, R. Ruth

T9: Working Group on Diagnostics

Working Group Conveners:

R. Pasquinelli, pasquin@fnal.gov

M. Ross, mcrec@slac.stanford.edu

Perform a survey of diagnostic systems for high energy particle accelerators and test accelerators for future machines. This group should discuss with other groups to find new and needed diagnostic systems for future accelerators. Special emphasis should be placed on identifying the needed beam physics and technology limits and reviewing the extent that they have been addressed in past research. Identify new and promising ideas even if they are in early stages. The group should summarize in a brief report the highest priority research topics and give an approximate time scale for key R&D developments.

Organizing Committee Contacts: T. Roser, J. Seeman

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

PRST-AB has just finished its third successful year with the closing Volume 3. The numbers of submissions and publications continue to grow, and there are initiatives underway to improve the ties with and importance to the accelerator community. 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.

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. Forty-nine percent of the submissions and 41% of the publications are from outside the US. The attached Volume 3 Table of Contents gives the titles and authors of published papers and shows the scope of *PRST-AB*. There continue to be many positive comments from authors about improvement of their work that has come from refereeing. This appreciation of the efforts of the referees is gratifying, and it speaks to the added value that comes from peer review.

| | 1998 | 1999 | 2000 |
|-----------------|-----------------|-----------------|-----------------|
| Submissions | 54 | 73 | 140 |
| | Volume 1 | Volume 2 | Volume 3 |
| Publications | 24 | 48 | 66 |
| Published Pages | 174 | 570 | 580 |

A new home page and improvements of “mechanics” have brought *PRST-AB* into conformance with other APS journals.

There have been “special editions” associated with the EPAC 2000 and ICAP 2000 conferences, and there will be one for PAC 2001. These special editions offer an opportunity for conference participants to expand upon and enhance their work, to have it reviewed, and, if accepted, published in *PRST-AB* with the paper included in both the regular table-of-contents and a special edition table-of contents associated with the conference. I am anxious to have these special editions flourish because they encourage peer-reviewed publication of accelerator physics and technology. Please contribute to the PAC 2001 Special Edition!

R&D News from Accelerator Centers (Collected and Edited by Bill Herrmannsfeldt)

Photo-injected Energy Recovery Linac R&D at BNL

I. Ben-Zvi

National Synchrotron Light Source and Collider Accelerator Departments, Brookhaven National Laboratory

Research is being done at Brookhaven National Laboratory on a number of applications of the Photoinjected Energy Recovery Linac (PERL). The applications include an electron cooler for RHIC, a high-brightness, short pulse light source and a polarized electron - polarized proton (or ion) collider.

The Energy Recovering Linac (ERL) was proposed initially by Tigner for high-energy physics applications in 1965. In an energy recovering linac, a beam is accelerated to the energy required for the application and returned to the linac 180 degrees out of phase with respect to the accelerated electrons. In this way the returning high-energy electrons are decelerated, and they recycle their energy to the RF field to provide most of the power necessary to accelerate the new entering electrons. Thomas Jefferson National Accelerator Facility has recently demonstrated the efficacy of the principle, for an infrared FEL application, in producing a 5 mA average current in a 45 MeV linac with an essentially undetectable power loss in the linac.

The use of a photoinjector combined with an energy recovery linac opens up a number of applications where a high-power, high brightness electron beams are needed (provided the beam is not 'damaged' too much in the interaction, as is the case in the above mentioned cases).

Electron cooling: The cooling of RHIC imposes many new aspects that have not been done before in electron coolers. First, the energy. The RHIC beams, such as 100 GeV/nucleon gold, require electron cooler energy of about 50 MeV, well above the reach of any electrostatic machine and thus requiring a PERL. Then, this would be the first case for cooling a bunched beam and the first case of cooling a collider. The work on this project is done in close collaboration with the Budker Institute of Nuclear Physics in Novosibirsk.

Light sources: The National Synchrotron Light Source at BNL is studying the application of PERL technology to a synchrotron light source with properties that are superior to storage rings based sources. Electron storage rings currently provide the vast majority of the light employed in synchrotron radiation based research. One persistent boundary in these machines is bunch-length; no practical means has been found to allow bunches of less than a few picoseconds duration to be stored. The properties of linear accelerator beams are quite different, and it has been demonstrated that electron bunches down to 100 femtoseconds can be produced.

Electron-Ion Collider: An electron-proton/ion collider with center-of-mass energies between 14 GeV and 100 GeV (protons) or 63 GeV/A (ions), luminosities at the 10^{33} cm⁻²s⁻¹ level, and both electron and proton beams polarized is a subject of considerable interest and there have been a number of workshop dedicated to the subject, at Indiana, BNL, Yale and MIT as well as in Europe. The linac-ring concept was first proposed for the B-factory but is not competitive with a ring-ring design without linac energy recovery. With the recent JLAB demonstration and continuing development of energy recovery in recirculating linacs, the electron linac-ion ring scenario becomes viable and offers several potential advantages over the ring-ring scenario with respect to electron beam spin manipulation, and potentially higher luminosity at high energies. BNL is collaborating with a number of other laboratories in the effort to develop the Electron Collider (EIC).

Advanced Photon Source (APS)

K. Harkay, J. Lewellen, S. Milton

Argonne National Laboratory (ANL)

The APS Accelerator and FEL Physics Group, in collaboration with other groups both within the APS as well as outside ANL, is engaged in a number of R&D projects in accelerator physics, several of which support next-generation light source R&D. The projects include: bunch compression; electron cloud effects; converging x-ray source and low emittance lattice designs; impedance and instabilities; feedback (global and local); bunch cleaning; beam top-up; linac modeling; gun and magnet design; and various theoretical topics such as FEL theory, ionization cooling for muons, and Smith-Purcell radiation. In the interest of space, three of our research topics are highlighted below. Details of our other accelerator physics R&D will be given in future issues of this newsletter. For more information, see <http://www.aps.anl.gov/asd/physics>.

Electron Cloud Effects

Electron cloud interactions with high-energy beams are believed responsible for various undesirable effects such as vacuum degradation and collective beam instabilities. Specially constructed electron detectors, using designs based on those first implemented at the APS storage ring, have been installed or are planned at a number of labs to directly measure the properties of the electron cloud: PSR (LANL), KEKB (KEK), BEPC (IHEP, China), AGS Booster (BNL), and PEP-II (SLAC). Simulations carried out in collaboration with LBNL show close agreement with the APS measurements of the electron cloud provided certain critical input parameters, especially relating to the secondary emission yield, are carefully chosen. The goal of these benchmark studies is to enable

better prediction of conditions leading to electron cloud effects in the APS and other rings.

Low-Energy Undulator Test Line (LEUTL) Facility

The LEUTL facility consists of a string of nine, 2.4-m-long undulators with beam being provided by a photocathode rf gun and the APS 650-MeV linac. LEUTL has achieved saturation when operating as a self-amplified spontaneous emission-based free-electron laser (SASE-FEL), with output wavelengths of 530 and 385 nm and has obtained gain lengths of less than 1 m. These results represent world records for saturated operation of SASE-FELs. Agreement with simulation and theory is also quite good. One of a number of unique capabilities at LEUTL includes the ability to directly measure and characterize the SASE-FEL gain and related processes as a function of distance along the undulator line. Besides achieving saturation, other ongoing and planned experiments include shorter wavelengths, higher-harmonic SASE-based lasing, measurements of the SASE-FEL drive beam microbunching using coherent transition radiation, detailed verification of SASE-FEL theory, and exploring various methods of performance and gain optimization. Initial experiments to make use of the unique tunability and pulse structure of the SASE-FEL are in the planning phase.

Bunch Compression

The success of the LEUTL operation is the culmination of R&D work in many areas. One of the most essential was installation of a bunch compression chicane in the APS linac. Several high-resolution diagnostics were also added to the APS linac, including an electron spectrometer (bend plane perpendicular to the chicane bend plane) and a three-screen emittance measurement station immediately downstream of the chicane. These will allow detailed study of emittance degradation due to coherent synchrotron radiation (CSR) generated by the beam as it is compressed within the chicane. The chicane magnets are mounted on a rail system, and a planned upgrade to the chicane vacuum chambers will allow the chicane geometry to be varied remotely. This will allow a thorough exploration of the effects of chicane geometry and bunch compression on beam quality. Initial studies are showing reasonable agreement with simulation.

Stella Experiment

*Wayne D. Kimura and Arie van Steenbergen
STI Optronics and Brookhaven National Laboratory*

Last year the Staged Electron Laser Accelerator (STELLA) experiment at the BNL Accelerator Test Facility successfully demonstrated for the first time staging between two laser accelerators. STELLA is a collaborative effort between STI Optronics, Inc., Bellevue, Washington, and BNL and UCLA. This accomplishment is important for eventually developing practical laser accelerators.

In STELLA, two inverse free electron laser (IFEL) accelerators were driven by the ATF carbon dioxide laser with the laser beam separated into two separate beams driving each

IFEL. The first IFEL prebunched the electrons into ~ 2 fs microbunches and the second IFEL accelerated these microbunches.

A number of noteworthy accomplishments occurred during the STELLA program:

1. First demonstration of a laser-driven prebuncher staged together with a laser-driven accelerator.
2. First direct measurement of ~ 2 fs microbunches produced by a laser external to a wiggler,
3. First demonstration of acceleration of laser-generated microbunches with stable phase control maintained over periods of many minutes.
4. First demonstration of laser-accelerated microbunches where a large portion of the electrons receive maximum energy gain.

This last accomplishment is particularly noteworthy since the accelerated electrons in laser acceleration experiments to date typically exhibit wide energy distributions with only a relatively small number of electrons experiencing a narrow energy gain.

Fermilab Advanced Accelerator Magnet and Superconductor R&D Programs

G.W. Foster, P.J. Limon and A.V. Zlobin - FNAL

Superconducting (SC) magnet R&D at Fermilab has two major programs with a common strategic goal: the construction of a future hadron collider at the ultra-high energies only available with a SC proton synchrotron. The first program targets high field magnets with advanced superconductors to obtain the highest possible energy in a fixed-size tunnel. The second program concentrates on low field magnets designed to provide the lowest cost per unit bend field using conventional materials. Both magnet types are an essential feature in a staged approach to ultra-high energies in which an initial "entry-level" machine based on low field magnets in a large tunnel is used to recapture the energy frontier in America. High field magnets in the same tunnel would eventually allow attainment of far higher energies in a series of affordable steps which provide a healthy and exciting future for high energy physics.

The development and study of a single bore cos-theta dipole models for future accelerators is our most advanced R&D initiative. Based on Nb_3Sn conductor, this magnet provides a maximum design field of 12 T of accelerator quality in a 43.5-mm diameter bore. A 1 m long model of this magnet is now under construction. Several practice coils and mechanical models have been fabricated and tested to verify the fabrication technology and magnet mechanical parameters. High temperature insulation (ceramic and S2-glass) with ceramic binder has been successfully tested during coil fabrication. Cold tests of this model are planned in March 2001. Fabrication of second and third models has been started in November 2000.

Conceptual designs (magnetic and mechanical) of double bore cos-theta dipoles with cold and warm iron

yoke approaches have been developed. These designs utilize the same coil blocks as the single bore magnet and were optimized with respect to the maximum bore field of 11-12 T, field quality and minimum yoke/magnet size. A comparison of the two approaches reveals that the cos-theta coil geometry and warm iron yoke minimizes the coil and yoke cross-section as well as the final magnet size and weight without degradation of magnet performance. Conceptual designs of a “common coil” high field dipole, based on a single layer coil and wide Nb₃Sn cable have also been developed. These designs provide a nominal field of 10-11 T with accelerator quality field in a magnet bore of 40-50 mm, and perhaps smaller. Simple single layer coils and the possible use of “wind and react” techniques offer the potential for reduced fabrication costs, and the possibility of a small-diameter coil may result in less superconductor being needed. The engineering design of a short model has been started; magnet fabrication is planned for FY2001. An experimental study of “react and wind” techniques is underway using flat racetrack coils.

The use of Nb₃Sn conductor typically results in significant coil magnetization effects in high field magnets due to large effective filament diameters. A simple passive correction technique based on thin iron strips installed in the magnet bore or inside the magnet coil has been developed in order to reduce this effect. This approach might lead to a significant increase in the dynamic range of accelerator magnets and relax the requirements on the effective filament size in Nb₃Sn strands.

The low field magnet program concentrates on cost reduction using existing SC materials in an extremely simple and lightweight “Transmission Line Magnet” configuration. This is a single-turn, warm-iron 2-in-1 superferric magnet built around a superconducting transmission line.

In the past year the transmission line conductor development has been successfully completed with the operation of a 100,000 A SC test loop. Five candidate conductors were successfully tested and a baseline design meeting all requirements was chosen. Samples tested included conventional NbTi “Rutherford” cable-in-conduit conductor, a Nb₃Al conductor that operated above 11K, and the preferred option: a novel “coaxial-braid-in-conduit” conductor suggested by our collaborators at KEK and fabricated at a job shop in Florida.

The cryogenic system for this magnet consists of cryogenic piping with superconductor swaged into the wall of the piping. This year has seen considerable development of ultra-low heat leak supports and shields for the transmission line, which reduces operating costs and allows smaller pipe sizes to deliver liquid He. If the projected low heat leak of this design is confirmed in complete system tests, the specific cryogenic power consumption of this design should be about 20 percent of the SSC or 10 percent of the LHC.

Optimization and test of the of the iron shape has arrived at a workable 2D profile which provides adequate field quality in the vicinity of 1.9 T. This design is the basis for industrially fabricated iron cores/cryopipe assemblies which have been

ordered for the multi-magnet system tests under construction in the M-West beam line at Fermilab. Development work on a 100 kA power supply and current leads for this test has begun.

Fermilab’s Short Sample Test Facility, which includes a 17 T solenoid in 2.2 K-4.2 K LHe dewar, two power supplies, control and DAQ systems, and a variable temperature insert (1.7 K – 200 K) has been in operation for the last two years reaching testing rates of 40 samples per month. It provides support for magnet R&D programs at Fermilab and contributes to the national superconductor R&D program. A scanning electron microscope (SEM) will be added to this facility early in 2001. We have purchased and studied several different types of Nb₃Sn strands with diameters from 0.3 to 1.0 mm. Strands were produced using “Internal Tin” (IT), Modified Jelly Roll” (MJR), and “Powder in Tube” (PIT) methods. Strand characterization includes measurements of I_c(B)/J_c(B), n-value, RRR, M(B), deff, SEM studies and chemical analysis. Heat treatment optimization studies indicate a possible reduction of reaction time for MJR and IT strands by factor of 2.

Rutherford-type cables made of different Nb₃Sn strands have been studied. The studies included effects of cable design and geometry, I_c degradation during cabling, and cable bending (for reacted cables) and compression. An experimental cabling machine with up to 28-strand capacity has been purchased and now is being installed at Fermilab. This facility will allow further advances in our cable studies.

Basic Accelerator R&D at the Fermilab Photoinjector.

*Don Edwards and Helen Edwards
Fermi National Laboratory*

1. “Flat Beams”

Two years ago, Ya. Derbenev invented an optics maneuver for transforming a beam with a high ratio of horizontal to vertical emittance—a “flat beam”—to one with equal emittances in the transverse degrees-of-freedom—a “round beam”. (Ya. Derbenev, *Adapting Optics for High Energy Electron Cooling*, University of Michigan, UM-HE-98-04, Feb. 1998.) His interest was in electron cooling at the TeV scale.

Last year, R. Brinkmann and K. Floettmann of DESY joined with Derbenev in a paper that reverses the process—obtain a flat beam from a round beam produced from the cathode of an electron gun. (A Flat Beam Electron Source for Linear Colliders, TESLA 99-09, April 1999.) Here, the idea was to achieve a major simplification and cost reduction in a linear collider facility by elimination of the electron damping ring. An experiment was performed at the Fermilab photoinjector to investigate these predictions.

These processes make use of axial angular momentum as a lever to adjust the transverse emittance ratio. Suppose that the cathode of an electron gun is immersed in a uniform solenoidal field. At the exit from the solenoid, the beam acquires

an angular momentum. A subsequent quadrupole channel can achieve a high emittance ratio, limited only by the thermal emittance at the cathode. To achieve a flat orientation in the normal laboratory coordinates, a skew quadrupole channel is needed.

The experiment at the Fermilab photoinjector was carried out with the participation of DESY, Fermilab, and Frascati personnel. The results were presented at the LINAC2000 Conference. (The Flat Beam Experiment At The Fnal Photoinjector, D. Edwards, H. Edwards, N. Holtkamp, S. Nagaitsev, J. Santucci, FNAL, R. Brinkmann, K. Desler, K. Floettmann, DESY-Hamburg, I. Bohnet, DESY-Zeuthen, M. Ferrario, INFN-Frascati). The results were very encouraging in that a transverse emittance ratio of about 50 was achieved. A second stage of the experiment is underway with the goal of elimination or significant reduction of space charge effects on the transverse emittance.

2. Plasma Wakefield Acceleration

In collaboration with UCLA, an experiment is underway at the photoinjector to observe plasma wakefield acceleration of a spectator bunch following a compressed high-charge density bunch in a plasma chamber. This is one of a number of studies being conducted world-wide on this subject.

The versatility of the photoinjector is well illustrated in this application. Although the arrangement of the low-emittance RF gun followed by a booster cavity, a bunch compressor, and extensive diagnostics was designed with a TESLA injector in mind, the facility has proved to be readily adaptable to other directions in accelerator R&D, as exemplified here.

This is work in progress. Significant energy transfer from the drive beam to the plasma has been observed. The leading edge of the drive bunch drops in energy by a factor of 8!

3. Other R&D Activities

Additional studies this year have included bunch field measurements using birefringence induced by these fields in a crystal detector, and observation of channeling radiation at high charge density.

Development of RF Superconductivity for High-Current Proton Linacs

K.C. Dominic Chan

Los Alamos National Laboratory

Since 1995, we have been developing superconducting RF technology for high-current proton linacs. The development work during the past few years was performed for the Accelerator Production of Tritium (APT) Project, and is now supported by the Advanced Accelerator Applications Program. The APT linac was designed to accelerate a 100-mA CW beam to 1-GeV energy. The section above 211 MeV was made up of 700-MHz elliptical superconducting cavities grouped into cryomodels. The cavity b values are 0.64 and 0.82. By November 2000, we had successfully tested several $b=0.64$ 5-cell cavities to beyond the APT performance specifications and tested prototype power couplers to 1

MW transmitted power. Documentation of designs and tests of cavities and couplers is currently being prepared. Most recently we have initiated a development program to investigate spoke cavities for accelerating high-current proton beams at lower energies. These kinds of superconducting structures, grouped into cryomodels with focusing solenoids, could provide a more efficient, reliable, and flexible accelerating scheme to handle the energy range above the RFQ and below the beginning of the APT superconducting linac design.

Details of work:

1. We have designed 5-cell 700 MHz cavities at $b=0.64$. Six cavities have been built, four by CERCA in France, one by Advanced Engineering Systems in the US, and one by Los Alamos. These cavities have been tested and achieved performance higher than the required performance of a Q-value of 5×10^9 at an accelerating gradient of 5 MV/m. Typical performance shows:

- A low-field Q-value of 2×10^{10}
- A Q-value of 2×10^{10} at an accelerating gradient of 5 MV/m
- A maximum accelerating gradient of 12 MV/m

2. We have designed and tested power couplers to deliver CW 700-MHz power; the initial specification for each coupler was 210 kW. These couplers allowed coupling-coefficient adjustment of a factor of four. They were tested to a power level of 1 MW and operated over long period at 420 kW. During tests, no significant multipacting has been observed. Our successful tests have led to an increase of our linac power coupler requirements from 210 kW to 420 kW.

3. We are presently working on a conceptual design of a spoke cavity with $b=0.175$. Such a cavity would allow us to accelerate beam with energy as low as 6.7 MeV. Depending on approval in April 2001, a cavity of this design will be fabricated and tested with beam on the APT program's Low Energy Demonstration Accelerator (LEDA), which presently provides a 6.7-MeV CW beam at 100 mA.

TRIUMF's ISAC-I Facility Reaches Full Energy

Mike Craddock

TRIUMF, Vancouver, B.C.

The new Isotope Separator and Accelerator - ISAC-I - at the TRIUMF laboratory in Vancouver has reached its full energy on schedule. Assembly of the drift-tube linac was completed in December, and on December 21 a beam of $^4\text{He}^+$ ions was accelerated through all five tanks to a measured energy of 1.5 MeV/nucleon.

The 150 keV/nucleon RFQ injector was commissioned in 1999, and the production target and separator in late 1998. Since then, an active experimental program has been underway using lower-energy radioactive ion beams for both nuclear and condensed-matter physics. The target has been run for extended periods with 10 mA beams of 500 MeV protons, and has been successfully tested at the full design current of

100 mA. The full-energy experimental program is scheduled to begin in Spring 2001.

TRIUMF's next step will be the construction of ISAC-II, an upgrade based on a superconducting linac, which will boost the energy to 6.5 MeV/nucleon and extend the mass range from A \approx 30 to A \approx 150. This received Canadian Government approval last April, and should be completed in 2006.

PEP-II Progress

Uli Wienands

Stanford Linear Accelerator Center

PEP-II had its first "real" data-taking run in 2000. In 10 months, 23.6 fb⁻¹ were delivered, more than the previous world data sample of e⁺e⁻ collisions at the Upsilon(4s) energy. Peak luminosity increased throughout the run, culminating at 3.1x10³³ cm⁻²s⁻¹ luminosity on October 29 during machine development and actually delivering to the BaBar detector at 3.0x10³³. A number of changes and improvements over the year made this success possible: The Low Energy Ring (LER) wiggler was turned off to reduce its beam size, the vertical beta function at the IP was reduced from 1.5 cm to 1.25 cm in both rings and the orbit was steered to be better centered, the detector-solenoid compensation was optimized to reduce coupling, solenoids were wound around the LER vacuum chamber in the straight sections in a successful effort to reduce the effect of photo-electrons on the positron beam size. Fill patterns with small gaps between bunch trains further reduced accumulation of photo electrons.

The peak luminosity was reached with beam currents of 850 mA in the High Energy Ring (HER, 1.55 A in the LER and 692 bunches, i.e. significantly lower LER beam current and less bunches than in the design (0.75 A HER current, 2.1 A LER current and 1652 bunches), but at almost twice the design bunch current in both rings. This success came despite some difficulties: a vacuum leak in the HER limited the electron beam current to 650 mA for most of the run, and a serious systemic failure of high-voltage capacitors in the rf power supplies which forced us to run the HER with three or four rf stations instead of the installed five.

