NLC News -

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Program Director's Corner:

David Burke

Welcome to this first edition of the NLC News, a monthly newsletter intended to provide general information to a broad audience. The style and content will reflect a newspaper-like mix of reports of on-going activities, highlights of technical progress, and will list recent publications and upcoming events. If you have items to be included in an edition, please contact NLC News Editor Albe Larsen (amlarsen@slac.stanford.edu).

The past year has been full of noteworthy activity. The addition of Fermilab to the Collaboration has brought needed strength and breadth. Fermilab's commitment to a full evaluation of the NLC provides new views of important aspects of NLC. Collaboration strength was evident as the Directors of SLAC and Fermilab joined forces to defend successfully the NLC FY00 R&D budget. A standing international Machine Advisory Committee (MAC), chaired by Satoshi Ozaki of Brookhaven, has been formed and were briefed in depth at a recent meeting of the Collaboration. (See the following story.) The Collaboration welcomes this new guidance.

International collaboration continues to prove essential. Experiments at KEK made substantial steps toward design performance of the ATF damping ring, and accelerator structures developed by SLAC and KEK met key tolerances required for the collider luminosity. LC99, hosted by Frascati, continued the series of international meetings begun in 1988, and the world's experts gathered in smaller topical workshops to attack a variety of problems.

The U.S. Physics and Detectors study groups began to evaluate detector strategies and options, and to provide feedback to the collider design.

The upcoming year promises to continue the excitement. The NLC R&D program will continue to attack aggressively the costs of components and systems. In the U.S., community-wide discussions will be held at SNOWMASS next summer, and a HEPAP Subpanel is expected to make recommendations on directions and priorities for the field. Internationally, important reports will be produced in Japan and Europe. We'll stay up to date in this Corner.

Machine Advisory Committee Attends its First Meeting with the US Next Linear Collider Collaboration

Peter Tenenbaum and Ted Lavine

The US Collaboration for the Next Linear Collider met at the Fermi National Accelerator Laboratory (Fermilab) from May 31 to June 2, 2000. The newly constituted Machine Advisory Committee (MAC) heard an overview of the NLC design and reports on R & D progress at each of the participating institutions (Dave Finley for FNAL, Chris Adolphsen for SLAC, John Corlett for LBNL and Karl van Bibber for LLNL) as part of their introduction to the NLC program.
The meeting began with a welcome from Fermilab Director Michael Witherell, and an overview of the NLC status by Project Director David Burke of SLAC. Burke reported **recent changes to the evolving accelerator configuration** adopted in the recent past:

- New design choices have been recommended for most of the injector linacs.
- Based on tests at SLAC of the 75-MW klystron with periodic Permanent Magnet (PPM) focusing, the klystron pulse length has been increased from 1.5 microseconds to 3.0 microseconds, resulting in a 50% reduction in total klystrons for the main linacs
- Most of the DC magnets in the injector and first half of the main linac have been replaced with hybrid iron/permanent magnets which have been developed with FNAL and are derived from magnet designs for the recently commissioned Fermi Main Injector (these use permanent magnet materials instead of electrical windings); this resulted in the elimination of power supplies and many cables for these magnets, with reduced heat load and cost, and improved magnet reliability.
- The high-energy collimation system has been completely redesigned for shorter length (1.2 km per side rather than 2.5 km per side), and lower cost.
- The final focus system redesign has reduced the length and number of magnets in the final focus by roughly a factor of 4 while increasing the free space between the last magnet and the detector.
- In many instances electronics have been redesigned and moved into the tunnel to reduce cable plant cost.

The practical upshot of these changes is a significant reduction in estimated cost for a 500 GeV center-of-mass-energy NLC.

R&D progress and issues were highlighted in the institutional reports and working group parallel sessions:

- Damping ring design, solid-state modulators, permanent magnets, and high-power klystron programs are all moving quickly, and a prototype hybrid quadrupole iron core was passed around during a discussion on magnet technology.
- Francois Ostiguy of Fermilab reported on his software for calculation of RF structure long-range wakefields. He uses advanced matrix techniques to shorten the time to compute these wakefields from 8 hours to under 1 minute. Many of his techniques have been incorporated into the SLAC programs for wakefield calculation, and results from the two programs converge when given identical inputs, considered a good sign.
- Chris Adolphsen, Main Linac group leader from SLAC, described an aggressive program of short-structure tests designed to understand the high-power degradation of structure surfaces in the Next Linear Collider Test Accelerator (NLCTA) at SLAC.
- Paul Czarapata and Court Bohn of Fermilab introduced for general collaboration discussion the concept of building an NLC Engineering Test Facility at Fermilab. One possible location, 1200 feet of muon beamline on the Fermilab site, was introduced, and various uses for the facility discussed. These include RF waveguide (DLDS) performance, installation planning, high power RF operation, and beam studies using the Fermilab AO gun technology.
- David Schultz (SLAC NLC Sources) discussed the issue of target damage and catastrophic failure in positron production, pointing out that the SLC positron target was destroyed in a few years of operation by a much lower power load than the NLC target will experience; he discussed some possible engineering changes which might address the problem, and also some more exotic positron production technologies, including one which would permit polarized positrons.

In a special session on **ground motion and site criteria**, Andrei Seryi and Vladimir Shiltsev discussed the models and measurements of ground motion which have been carried out around the world, and announced a workshop on the topic, to be held in November at SLAC. John Ives presented an overview of a typical NLC site in California that would be amenable to cut-and-cover construction; Vic Kugler then presented a typical site near Fermilab, a north-south oriented deep-tunnel site in the legendary Illinois Dolomite. Evaluation of these construction techniques supports the total R&D effort and will assist technical decision-making. One highlight of the meeting was a field trip to a nearby quarry to do a hands-on investigation of this dolomite.

A pair of back-to-back talks on main linac beam dynamics demonstrated that this remains a challenging topic with rich R & D opportunities for enterprising physicists and engineers. These were followed by presentations on linac configurations that follow the curvature of the earth (rather than being set straight as a laser, which implies that the ends of the linac are "higher" than the middle according to gravity). Fermilab physicists Mike Syphers and Leo Michelotti showed that the curved linac has an energy limitation, but the limit appears to be a safe several TeV per beam.

The meeting ended with brief final reports from the working groups on Friday afternoon, and adjourned to allow Collaboration and MAC members to participate in the landmark recognition of the closing of the Fermi Tevatron Fixed Target program.

ASSET Tests – June 2000

Marc Ross and Tonee Smith

The accelerator structure test area near the 1 GeV point of the SLAC linac has the unique ability to provide measurements of structure transverse wakefields. The most recently completed 1.8 m X-band linac structure assembly, RDDS-1 was installed in ASSET in late May. With almost daily improvements and records posted at the PEP-II B factory, one of the largest hurdles for this test was to avoid interference with PEP-II luminosity operation. Storage ring fills occur more than once an hour and each precision ASSET measurement takes a significant fraction of the interfill time, not counting the time required to switch back and forth between the PEP-II injector beam set up and the much more complex ASSET beam sequence.

The RDDS tests were the first to be done concurrently with PEP-II. Following preparation n April and May, the SLAC operations and NLC research staff smoothly and steadily carried out the full suite of tests on this prototype structure, providing some of the most accurate dipole wake measurements to date. There was no interference with PEP-II and the tests were completed well ahead of schedule.
Data Analysis is in progress and a detailed report of test results will appear in the August issue of NLC News.

Solid State Klystron Modulator Progress

Ray Larsen

Solid State Klystron Modulator development has advanced on two fronts: One, ten prototype induction cells, consisting of a Metglas toroid and a pair of IGBT driver cards each capable of 3000 A peak current, have been assembled as a 10-high stack, packaged and installed in the SLAC Linac Klystron Gallery to drive a single 5045 klystron tube. Figure 1 shows the "desktop" solid-state stack on a table alongside the existing PFN-Thyratron modulator. This is a test of the full power output of the cells as they will be used in the NLCTA modulator with ~eight times as many cells driving eight klystrons in parallel. The first tests, at a very low PRF due to power supply limitations, appear to meet specifications.
Two, the parts for the main modulator assembly have begun to arrive at SLAC from LLNL where they were designed and/or fabricated by the LLNL-Bechtel Nevada component of the team. The first test unit is called "4-Dog" as it will use four "doggy" near end-of-life 5045 klystrons as test loads to prove its ability to produce full power as well as protect loads from destruction due to stored energy discharge when an arc occurs in one of the loads. The main oil tank, mounting plates for klystrons and 8-pack, top stack oil tank and all mechanical supports and covering panels have all been received and installation has begun. New driver boards are in production as are the magnetic toroidal cell assemblies. A local vendor is potting the latter and approximately half have been delivered. Assembly for initial power testing on a water load is scheduled for completion in September.

Recent Linear Collider Publications

Note: If you would like an NLC-related paper listed, please send information to amlarsen@slac.stanford.edu

I. Papers Presented at EPAC[1]

II. Linear Collider Collaboration Notes

LCC-0039, SLAC-PUB-8460,"A Novel Final Focus Design for Future Linear Colliders", P. Raimondi and A. Seryi, 05/00.

[1] See NLC Technical Web site for full list http://wwwproject.slac.stanford.edu/lc/ilc/TechNotes/EPAC2000/

Figure 1 - Solid State Stack

LCC-0040, "Estimates of Dispersive Effects in a Bent NLC Main Linac," Leo Michelotti and Michael Syphers, 06/00.

LCC-0041,"Theory and Suppression of Multibunch Beam Breakup in Linear Colliders," C.L. Bohn and K-Y Ng, 06/00.

LCC-0042, "International Study Group Progress Report: On Linear Collider Development," N. Toge, ed., 04/00.

Calendar of Upcoming Events

I. Conferences

Linac2000, Monterey, CA, August 21 – 25 http://LINAC2000.slac.stanford.edu/

RADCOR, Carmel, CA, September 11 – 15, 2000, http://radcor2000.slac.stanford.edu/

5th International Linear Collider Workshop (LCWS 2000), 12-28 Oct 2000, Batavia, Illinois,http://d0server1.fnal.gov/users/hefisk/LCWS2000/Linear_Collider_Workshop_2000.htm

Nuclear Science Symposium, Lyon, France, October 15 – 20, http://NSS2000.in2p3.fr/

The 22nd Advanced ICFA Beam Dynamics Workshop, Nov. 6 – 9, 2000, SLAC, Menlo Park, CA.

II. Meetings

July 27 - 28, NLC Program Review, SLAC.

August 28 – 31, RF Breakdown Workshop, SLAC.

October 3 - 6, Collaboration /MAC Meeting, SLAC.