NLC - The Next Linear Collider Project

NLC Collaboration
Meeting Goals and Issues

D. L. Burke

U.S. NLC Collaboration Meeting
Fermilab
May 2002
Welcome

• Brookhaven National Laboratory
  Welcomed addition to the
  U.S. NLC Collaboration.

• Collaboration with KEK
  – RF Technology.
  – ATF.
  – Site Requirements and Options.
  – Cost Analysis.

ISG8
June 24-28 at SLAC
Expanding Linear Collider Effort

• Cornell and NSF

• Universities

  Organizational meetings at Fermilab and Cornell in April; SLAC on May 31.

  U.S. LC Physics and Detectors Workshop
  Santa Cruz, June 27-29

• NICADD and the “other DOE”

• ILC-TRC “Loew” Committee

How to leverage these efforts and coordinate goals and activities?

→ Talk by Himel.
Mission Need

The need for a linear collider to study particle physics at the TeV energy scale has been firmly stated – ACFA, ECFA, and HEPAP (Snowmass).

There is a clear definition of the mission requirements:

• Start at 500 GeV, but technology must be able to reach a TeV.
• Luminosity in excess of $10^{34}$ cm$^{-2}$ s$^{-1}$.
• Physics studies emphasize accumulation of 500 - 1000 fb$^{-1}$.
  (Note: $\pi \times 10^7$ seconds $\times 10^{34}$ cm$^{-2}$ s$^{-1}$ $\approx$ 300 fb$^{-1}$.)

Global coordination is being put into place:

• International Steering Committee initiated by ICFA to coordinate global LC activities.
• Regional Steering Committees to coordinate regional LC activities.
There is a Project Model – HEPAP “On Shore”:

- International Collaboration
- Integration of Existing HEP Resources – Lab and University Infrastructures and People
- New Money

Examples (in $B):

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<th>TPC</th>
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<th>New</th>
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<td>1.5</td>
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… with a project start “sometime around 2005”.
Two candidates left for a TeV-scale linear collider
--- TESLA and NLC/JLC.

Completion of 8-Pack test at NLCTA with high-gradient (1 TeV) structures in 2003 with operations in 2004.

Completion of the first high-gradient (800 GeV) cryo-module in 2003 with operations at TTF-II in 2004.
The prototype NLC rf system optimized for 1 TeV cms …


→ Demonstrate rf power suitable for one girder of structures.

→ Test facility for rf power system to run independently of the high-gradient structure testing.

Phase-II. Complete 8-Pack in 2004.

→ Demonstrate full power source with DLDS feeding high-gradient structures.
8-Pack Phase-I

2 Klystrons each with 75 MW for 2.4 µsecs

Completed at the end of calendar 2002 to demonstrate dual-mode capability and test DLDS components in 2003.

Cross-Potent (Cold Test Model)

Dual-Mode SLED-II

“Single-Feed” Test Section
600 MW for 400 nsec
8-Pack Phase-II


Low Level RF System
One 490 kV 3-Turn Induction Modulator
Eight 2 KW TWT Klystron Drivers (not shown)
Eight 75 MW PPM Klystrons
Reduced Delay Line Distribution System (2 Mode)

The critical test is to launch power into the longer waveguide with no recovery.

Space in the NLCTA for two sets (2 × 5.4 m) of structures.

→ Talk by Carter.
Performance still dominated by input and output rf couplers …

Structure T53VG3RA with adaptive input waveguide did not solve this problem, and it processed more slowly than T53VG3 – (etch-cleaning and vacuum firing were different).

Incorporate proven wake-field control … the “H” series.

- Iris size
- Detuning, then damping
Autopsy of T53VG3 Input Coupler
SEM Photographs
## Structure R&D Table

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<th>Structures</th>
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<th>Sept-Dec</th>
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<td>H90VG5</td>
<td>and Detuning</td>
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### High Gradient 8-Pack

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<td>SLED-II and DLDS Component Tests</td>
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<td>Produce 2 Klystrons</td>
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<td>Phase-II</td>
<td>Construct 8-Pack Modulator</td>
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<td>Produce 8 Klystrons</td>
<td>Produce DLDS Long Arm</td>
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*D. L. Burke*  
*NLC Collab Intro – May 2002*
NLC - The Next Linear Collider Project

Goal: Complete conceptual design in 2004 with R&D that is needed to support a technology choice and start of project engineering.

The process of forming an international project is not clear, so we are not including effort needed to write a CDR. But evaluations of cost and schedule are important.

Budget Assumptions:

- FY03 will be the same as FY02.
- There will be growth in FY04 and beyond.
The 8-Pack is our highest priority. Even without increased resources in FY03, we will carry out aggressive R&D on structure gradients and complete the 8-Pack. The remaining program will be squeezed to fit budget constraints.

The 8-Pack is an R&D project with substantial technical risk. The schedule is “success-oriented” and the critical path has little or no “float”.

We are working to identify where contingency resources could help assure the timely completion of Phase-I and Phase-II.

Assigning contingency dollars to the 8-Pack will require further reduction in other efforts, but it is our first priority for remaining funds.

What else must be done to support our Program Goals? How do we do it?

→ Talk by Raubenheimer.
Goals for This Meeting

  – Sharpen and define specific goals for essential R&D.
  – The combined resources of the Collaboration must be coordinated and focused on these goals.
  – Some present efforts and resources will need to be halted and/or redirected.

• Identify opportunities for expanded collaboration with U.S. and international partners.

• Topical Working Groups that span the Collaboration.
Working Groups

Structures and High Gradient Studies  (Adolphsen, Carter)

Pulsed Power  (Czarapata, Schultz)
  8-Pack and X-Band Power at Fermilab.

Magnets  (Spencer, Volk)

Conventional Facilities  (Corvin, Kuchler)
  UAB Meeting on Tuesday, May 7.

Vibration, Ground Motion, and Site Requirements  (Seryi, Shiltsev)