The Linear Collider and the Future of Fermilab

The Linear Collider Subcommittee of the
Fermilab Long Range Planning Committee

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Subcommittee

Subcommittee Members

J. Butler
M. Carena
D. Finley
E. Fisk
S. Holmes
R. Kephart
Y-K. Kim
A. Kronfeld
S. Nagaitsev
R. Patterson
S. Tkaczyk

Participants

D. Amidei
J. Appel
G. Blazey
J. Brau
A. de Gouvea
B. Dobrescu
J. Dorfan
E. Eichten
A. Freitas
G. Gollin
J. Jackson
K-J. Kim
V. Kuchler
S. Mishra
H. Montgomery
M. Oreglia
E. Ramberg
R. Rubinstein
M. Tigner
H. Weerts
C. White
M. Witherell
V. Yarba

Outline

- Goals and Orientation (Holmes, 15 minutes)
- Accelerator R&D: Opportunities and Resources (Finley, 20 minutes)
- Detector R&D: Opportunities and Resources (Fisk, 20 minutes)
- Outreach and International (Butler, 15 minutes)
- "The Plan" (Holmes, 15 minutes)
  - Strategic elements
  - Prototype recommendations

Goals

- The linear collider subcommittee established two goals for our discussions:
  - Understand the ramifications of successfully competing to bring the linear collider to northern Illinois and make recommendations on the steps that should be taken to assure the strongest possible Fermilab presentation within the U.S. “bid to host”.
  - Understand Fermilab’s role in gaining approval for an internationally based linear collider. Outline options for Fermilab involvement in construction and operations (for both Illinois and non-Illinois sites), and make recommendations on the scope of laboratory effort that should be devoted to these activities.

⇒ As our discussions evolved we focused most strongly on understanding what is required to establish Fermilab as the most attractive LC host laboratory on the planet. (Figuring element two is a subset for sorting out by the full committee.)

Orientation

LC Subcommittee Meetings/Discussion Topics

5/22	Background/U.S. and International Steering Committees
5/29	Siting Studies
6/27	Accelerator R&D
7/10	Detector R&D
7/31	Outreach and Local Alliances
8/28, 9/4	Physics
9/11	Organization & Resources
9/18	International Lab
9/25, 10/2	Bid to Host
10/9	Discussion of Report: content and proto-recommendations
10/16	Review of Public Presentation
10/23	Public Presentation
10/30-11/30	Finalize Report content and recommendations

Orientation
Fermilab Scene

- **"We propose to the U.S. and to the international HEP community that we work together to build a linear collider at or near the Fermilab site."** M. Witherell, HEPAP Subpanel, June 12, 2001
- NLC R&D is centered in the Technical Division
  - Fabrication of accelerating structures (structures factory in IB4)
  - Development of girder designs
  - Permanent magnets (with BD)
  - Beams Division effort is nearly non-existent following diversion of personnel back onto Run II
- FNPL (aka A-0 photoinjector) provides a test bed for more fundamental beam-based R&D with components relevant to LC (warm and cold).
  - BD and TD (and local university) involvement

Orientation
Fermilab Scene

- Siting Studies in FESS
  - Three representative Illinois sites investigated over FY99-FY02
    - Two deep, one shallow; one traversing site, one to the west
  - One site is being investigated this year (FY03)
    - Deep; west; warm and cold incarnations.
  - Collaboration forming with NIU Geology Department
- Total Fermilab effort is ~$4M and has been static at this level since FY2001.
  - Represents roughly 15-20% of U.S. effort.

Orientation
National Scene

- USLCSG established and functioning

  http://www.slac.stanford.edu/~hll/USLCSG/

- Major activities include:
  - Development and implementation of a strategy for bringing an international linear collider to reality
  - Coordination of U.S. R&D activities
  - Preparation of the U.S. bid to host.
- Machine performance document released

  http://www.slac.stanford.edu/~hll/USLCSG/BidToHost/MachineScopeA30323.pdf
  - Initial energy = 500 GeV
  - Integrated luminosity first four years = 500 fb^{-1}
  - Upgrade energy = 1000 GeV
  - Two IR's
  - Beam crossing angle
  - 80% electron polarization
  - Ability to operate at 91 GeV

Orientation
National Scene

- (Technology limited) Working timeline
  - 2004 Technology down-select. Global design group formed
  - 2008 CDR and engineering design complete
  - 2009 Start construction
  - 2015 Start operations
- Funding requirements
  - Expect $0.5-1.0B (international) to get to construction start
    - (Current U.S. expenditure is ~$19M on accelerator, $1M on detector R&D)
- Warm-cold evaluation (not selection) initiated
  - Report due (to USLCSG) in December
  - Representative sites in IL and CA

⇒ **Point: Fermilab planning needs to be cognizant of, and in concert with, these actvities.**

Orientation
International Scene

- ILCSC organized and functional

  http://www.fnal.gov/directorate/icfa/International_ILCSC.html

  - Under auspices of ICFA
- Goal: Promote construction of a linear collider through world-wide collaboration
- Major activities include:
  - Preparation of world-wide "consensus document"

    sign up at: http://flc25.desy.de/lcsurvey/
  - Development of an international performance document
  - Planning for an international framework
  - Technology decision

Orientation
International Scene

- Technology Decision (aka “down-select”)
  - ITRC panel in process of being convened
    - 4 representatives from each of three regions
  - Report/recommendation will go to ILCSC
  - Shooting for recommendation by end of 2004
- International organization
  - Heavily influenced by the ITER model
    - Phases with associated international “off ramps”.
  - Global design center to coordinate preparation of the engineering design.
    - Have ready for implementation following technology decision.
    - Heavy reliance on regional design centers
  - ECFA Study on governance (“host lab/international project”)

http://committees.web.cern.ch/Committees/ECFA/Cern03KalmusReport.pdf

þ **Point: Fermilab planning also needs to respect this context**

Accelerator R&D
(D. Finley)

Detector R&D
(E. Fisk)

Outreach and International
(J. Butler)