

Minutes from the August 28 and September 4, 2003 Meetings of the Linear Collider
Subcommittee of the Fermilab Long Range Planning Group

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

Absent: S. Nagaitsev

Guests: B. Dobrescu, E. Eichten, A. Freitas, A. de Gouvea

Discussions of Physics Opportunities

The session was organized by Marcela and extended over two meetings. Presentations were made by Marcela, Bogdan, Ayres, and Andre. I will only summarize the broad picture as I understand it—more details can be found in the talks posted on the following: (Marcela, send me web addresses when you have them)

The Big Issues in Particle Physics (Marcela)

- Origin of EWSB
- Stabilization of the mass hierarchies
- Integration of gravity
- Standard model known to be incomplete

Capabilities of the Linear Collider and Relation to the LHC (Marcela and Bogdan)

“LHC will be good at finding new particles, LC will be good at interpreting what they are.” (But don’t underestimate the cleverness of the experimenters at LHC.)

LC can differentiate between different theories with similar signatures, e.g. SUSY vs. extra dimensions.

LC is good at unraveling non-standard scenarios, e.g. composite Higgs.

Of course the LC would be most valuable if LHC did not find a Higgs at all!

Capabilities on Direct Searches for Z' (Ayres)

Contrary to popular (or at least my) belief, the LC does have a capability in the search for direct production of narrow resonances. Because of the spread in collision energies introduced by beamstrahlung a linear collider operating at 500 GeV has extremely good sensitivity (much better than LHC) looking for Z' down to 100-200 GeV. Indirect searches (virtual Z' below the mass threshold) are also possible with good sensitivity.

Giga-Z possibilities (Andre)

Assume 50 fb^{-1} at $E_{\text{CM}}=M_Z$

- Measurements profit greatly from having polarized e- and e+
- Reduction of $\sim \times 2$ in $\Gamma_{\text{invisible}}$ (sensitivity to non-standard Z- ν couplings)

- Comparison with $\Gamma_{\text{invisible}}$ from $e^+e^- \rightarrow \gamma + \text{nothing}$
- Measurement of g_L and g_R (not well constrained at present) from $e^+e^- \rightarrow \gamma + \text{nothing}$ at 90 GeV and 170 GeV.

Running at $W+W^-$ threshold yields $5\times$ improvement in ΔM_W .

Discussion

Marcela: What are we trying to achieve in this section of the report?

Steve: We are not trying to derive desired performance parameters—this has been done (and published) by the American Linear Collider Physics Group. What we would like to do is summarize the key points in a manner that can be understood by, and hopefully excite, the Fermilab scientific staff.

Marcela: What can the subcommittee say that will get the staff well informed?

Steve: Do we perceive that the lack of excitement on the part of our staff derives from lack of information or lack of interest?

Andreas: Feedback from CDF colleague(s) is that on the timescale of their professional lives, LC is not real. Staff would be more receptive if the second floor could convince people of the (potential) reality of this.

Ritchie: Not just the second floor (thanks Ritchie!), the committee can do this by elucidating a credible plan for the laboratory.

Gene: Problem is not the 2nd floor (thanks Gene!). The problem is budgets—there is no support for anyone who wants to actually do something.

(Steve: People are waiting for the agencies to give some indication that they are going to support this. It's been 18 months since the HEPAP report and there has been little visible response from Washington.)

Potential proto-recommendation: Funding for LC within Fermilab is going to have to increase if LC is going to happen.

Ritchie: We need to lay out a plan identifying particular steps. Some of the steps may be modest.

Gene: Detector R&D doesn't require a lot of M&S.

Bob: We ought to be announcing our desire/intention to host the essential technology demonstration project (sometimes known as ETF).

Another proto-recommendation: Fermilab should start working on a proposal (to be submitted to the USLCSG) for siting of the ETF (either warm or cold incarnations) at Fermilab.

(There was a side discussion about the rather dismal number of Fermilab scientific staff who have signed the world-wide consensus document in support of the linear collider. The number was purported to be ten, out of a staff of ~300. I have visited the website and counted 35 Fermilab signatures on the document—not exactly stellar, but a lot better than 10. It is interesting to note that several members of our subcommittee have not signed. For those of you who are missing because you forgot, rather than because you remain unconvinced, you can add your support at <http://flc25.desy.de/lcsurvey/>)

Short Discussion on the Public Presentation

Each of the LRP Subcommittees will be giving a public presentation over the next two months. The first (LHC) presentation is this afternoon and committee members are urged to attend. Elements of our presentation should include:

Presentation of Goals: 1. Prepare Fermilab to be the most attractive host lab for the linear collider. 2. Prepare Fermilab to be make a significant contribution if built elsewhere.

Presentation should emphasize what the subcommittee believes it will take to achieve goals, rather than dwelling on current status of effort.

Should develop a preliminary list of “why Fermilab?”

Talk about the sorts of recommendations we are considering.

Summary

As notes editor here is my attempt to make it sound like we had a coherent discussion. I believe the major point were:

- The physics case goes beyond “complementarity with LHC”.
- The laboratory needs to do a better job of fostering discussion of the physics case within the scientific staff.
- The establishment of a coherent plan for establishing Fermilab as the most attractive site for a linear collider would help a lot with getting our staff to take this seriously.
- Establishing Fermilab as the site of the technology demonstration project would be a great step towards meeting our goals.

Next Meeting

September 8, 10:30-Noon, in the Comitium. “Resource and Organization”

Agenda:

1. Future accelerator R&D activities and required resources (Mishra)
2. Future detector R&D and required resources (Fisk)
3. Organization of the Fermilab effort (all)