

Minutes from the September 11, 2003 Meetings of the Linear Collider Subcommittee of the  
Fermilab Long Range Planning Group

Present: E. Fisk, S. Holmes, Y-K. Kim, R. Patterson, S. Tkaczyk

Absent: J. Butler, M. Carena, D. Finley, R. Kephart, A. Kronfeld, S. Nagaitsev

Guests: S. Mishra

**Discussions of Goals and Required Resource/Detector R&D**

Gene Fisk presented:

Major Design Issues

- Tracking
  - Looking for  $\Delta P_T/P_T^2 \leq 5 \times 10^{-5}$
  - 5  $\mu\text{m}$  spatial resolution
  - Reduced detector thickness
  - Technologies: CCD's? Others?
- Calorimetry
  - Looking for  $\Delta E_J/E_J \sim (0.3-0.4)/\sqrt{E_J}$
  - Want to separate di-jets.
- Muons
  - Include hadron calorimetry because the Hcal is thin
  - Technologies: Wire chambers, resistive plate chambers, scintillator

R&D at Fermilab and universities/current and projected

- Tracking
  - CCD ASICs readout chip
- Calorimetry
  - Digital HCAL (@NIU)
  - Energy flow algorithms (NIU)
  - Scintillator strip calorimeter (Colorado)
  - Digital HCAL with gaseous electron multiplier readout
- Muons
  - Scintillator based systems (NIU, ND, UC Davis, Wayne State)

Fermilab Capabilities and Facilities

ASICs design  
Computing and software  
Lab 8 Gerber  
Lab 6 scintillator R&D  
Lab 5 scintillator extruder

Test beams

What could/should Fermilab be doing over the next six year/associated resources

- Detector and Physics simulations software 5 FTE
- Vertex detector pixel R&D 4-8 FTE
- Calorimeters/beam tests 6 FTE
- Muons 5 FTE
- Solenoid conceptual design 6 FTE
- Test beam operations 3 FTE
- Management 4-6 FTE
- Contingency (30%) 10 FTE

TOTAL 46±3 FTE

Manpower and Costs

Call this 50 FTE. Assume linear ramp up to this number by 2007 based on 2015 start of operations. (Current effort is estimated at 6 FTE). Assume \$200K/FTE (salary + M&S). Then,

$\Sigma = \$20M$  over four years (FY04-07); \$10M/year thereafter.

**Discussions of Goals and Required Resource/Accelerator R&D**

Shekhar Mishra presented representing discussions among himself, Dave Finley, and Bob Kephart. The view is shorter term: establishing a viable program (defined as moving into an intellectual leadership role) over the next two years.

As a strategic framework assume that we will have a (new) Proton Driver nearing operation in ~2009 with a linear collider starting operations in ~2014.

Current Activities

- Accelerating structures
- Civil and siting studies
- Fermilab/NICADD Photoinjector Laboratory  
Includes 3<sup>rd</sup> harmonic upgrade
- Accelerator Physics in support of the above  
Relatively minimal at present

Goal is to involved in 30% of the subsystem topics in '04, 50% in '05.

Proposal to USLCSG for construction of an Engineering Test Facility at Fermilab

Start with parallel warm/cold concepts

Increase the number of staff working on accelerator physics

Strengthen connections with universities and international community  
Expand public relations effort

### Scope of Effort

Accelerator physics	4-6 FTE
Familiarize ourselves with all systems	
Injector	
Damping Rings	
Bunch compressor	
Main linac	
Beam delivery system	
Choose two to concentrate on	
Damping rings	
Main linac	
Engineering Test Facility (ETF)	8 FTE (design phase)
Develop warm and cold concepts and propose to USLCSG	
Warm concept exists (from 2001) based on old (DLDS) rf configuration	
Structures and Support girders	6 FTE
Structure industrialization	
Girders	
Includes development of ETF	
Civil/Siting	3 FTE
Accelerator Infrastructure	2 FTE
Computing, grid, simulations, data storage & distribution, etc	

### Resources and Costs

Significant resources are shown coming off Run II upgrades at the end of FY05.  
Use FY04-05 to get LC/ETF/Proton Driver plans together and launch in FY06.

=> Need 20-25 FTE assigned the '04-'05 period.

=> Accelerator R&D budget needs to be \$5M in FY04, \$6-8M in FY05

Beyond FY05 will depend on ETF, but most likely rises into several × \$10M/year.

### Laboratory Organization

Shekhar: Propose LC group at Fermilab, situated in TD

Accelerator and detector R&D efforts.

Requires support from BD, PPD, and CD.

Gene: We should have departments distributed among the participating divisions with some sort of central coordination. A dedicated LC Division or Section is premature. Directorate engagement must be visible.

Steve: Agree with Gene. Suggest this should either be an Associate Director for LC or an LC Office within the Directorate. Person in the Directorate has to be full time on this. Reactions?

Gene: Thinks this is basically right.

Shekhar: Agrees we need someone on this full time in Director's Office.

Steve: What fraction of the FTE's assigned to LC need to be 100%?

Shekhar: One third of the people need to be full time. No one should be less than 10%.

Gene: Need to think more in context of a real plan recognizing the international context.

### **Summary**

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

- There are natural areas/opportunities for Fermilab to assume a leading role in LC R&D.
- Fermilab should identify a limited number (like two) areas in which to concentrate its accelerator physics effort with a goal of establishing leadership:
  - Damping ring
  - Main linac
- Fermilab should strive to assume leadership of the technology demonstration project for the linear collider.
- ETF and the linac based Proton Driver might be configured to be the same thing if LC is superconducting.
- Achieving this is going to require a significant increase in resources devoted to linear collider.
- Achieving this will require visible coordination of divisional activities, by a full time dedicated person at the Directorate level.
- Balance between accelerator and detector in the early years (1:2) looks wrong to me.

### **Next Meeting**

September 18, 10:30-Noon, in the Comitium. "Fermilab as an International Laboratory"

Agenda:

1. Discussion of ramifications of Fermilab as host to an international facility (Joel and Young-Kee)
2. Preliminary discussion of our public presentation (Steve, assuming I'm ready)