Report from the "Research and Development Opportunities for the Linear Collider" workshop at Fermilab, April 5, 2002

- Reasons for the workshop
- Immediate goals that day, also "ground rules"
- Description of what we did, and what we are doing now
- Potential strengths of the consortium
- An example
- Some data concerning participation; information we collected

Reasons for the workshop...

Observations (some from the January LC workshop in Chicago):

•University-based participants were interested, but were unclear how to start LC-related efforts at their home institutions.

•US R&D so far has concentrated on accelerator design and simulation of detectors; detector hardware R&D is taking place abroad.

•Top-down organization now seems common in HEP: individual physicists play a smaller role in determining the direction of their own research than in times past. This can lead to a diminished sense of responsibility and engagement with a project.

…reasons for the workshop...

It is interesting to contemplate going about things differently in order to allow the impetus for the initial stages of a project to come from:

•grass-roots interest in the technological and scientific challenges

•a sense of shared "ownership" of a part of the project felt by all participants

•a sense that participating individuals are able to influence the structure and organization of the collaborative effort

•participants' interest in the short/medium term tasks associated with R&D necessary for the project

…reasons for the workshop...

A possibility: smaller groups (*e.g.* university-based groups) could join together to invent a way to go about LC studies with help from centers of logistical support (*e.g.* Fermilab).

As a community, it would be sensible for us to discuss how to bring about a coherent R&D effort in which:

•a subset of us work in some sort of collaboration which includes support from Fermilab

•we actively determine the structure of the effort so that it is inclusive, open, and encourages participation by all.

Immediate goals of the workshop

•Set before participants a sketch of the current state of LC accelerator and detector designs and concepts

•Describe in some detail the shapes of ignorance: areas in which R&D is needed before we can design/build an accelerator and detector

•Provide an opportunity for participants to see what aspects of an LC accelerator/detector R&D effort would be of interest to their home groups

•Begin discussions about models for how to proceed with university-based R&D efforts

•Generate more grass-roots interest, empowerment, autonomy,...

The suggested ground rules...

1. Stay clear of political issues. Discussions should be:
   - •site-neutral when appropriate
   - •inclusive of studies needed for both TESLA and NLC/JLC.
2. Think across traditional system boundaries:
   - •required performance will couple many accelerator and detector systems' properties
   - •cool projects abound in domains you might not have thought to consider (*e.g.* the accelerator!)
   - •interesting possibilities for collaboration with colleagues in other domains (condensed matter, EE,...) exist.

What we did...

The program...

Duration	Presentation	Speaker
:15	Introduction and welcome	George Gollin (Illinois)
:40	Linear Collider [Accelerator] Overview	Tom Himel (SLAC)
:30	Linear Collider Detectors	Jim Brau (Oregon)
:45	Linear Collider [Accelerator] R&D opportunities	David Finley (Fermilab)
:45	Calorimeter issues and possible directions for R&D	José Repond (ANL)
:45	Vertex detector and central tracking: possible directions for R&D	Keith Riles (Michigan)
:45	Linear Collider Beam Instrumentation	Marc Ross (SLAC)
:30	LC Muon System R&D	Gene Fisk (Fermilab)
:30	The Fermilab/NICADD Photoinjector Laboratory: collaborative R&D	Jerry Blazey (NIU)
:30	Linear Collider R&D Workshop: Summary and Next Steps	Dan Amidei (Michigan)
:10	A Report: Linear Collider Consortium Organizational Meeting	Mats Selen (Illinois)
	Discussions	Everybody, sort of

…held an even mix of accelerator and detector presentations.

…what we did...

Speakers were advised to "...to set before participants brief (but concrete) descriptions of a large number of research and development projects that participants might choose to undertake."

Also, to

- Stay clear of political issues…
- Think across traditional system boundaries...

As delivered, the accelerator talks tended to be more concrete in their descriptions of R&D projects than were the detector talks.

Speakers did an admirable job of delivering balanced talks.

Tom Himel presented an amazing list of 80 (!!) R&D projects, of interest to the NLC design, the TESLA design, and of interest to both.

…what we did.

Due to a certain amount of confusion after the last talk, we didn't manage to start a town-meeting-style discussion of future directions and consortium organization before people went for the refreshments.

We had hoped to discuss the possibilities of future workshops (to learn more about the technical challenges) and to discuss the ways in which a consortium might be organized.

We are in the process of telephoning workshop participants to make up for this.

(It's good that you have scheduled the break-out discussions before the workshop wrap-up!)

What we are doing now...

Right now we are:

- contacting participants to develop a more detailed sense of their (and their colleagues’) interests, and to solicit their views on how to structure a consortium.
- thinking about how a consortium would fit into a sensible (inter)national effort to design a linear collider and associated detector

Very soon (a few weeks from now?) we will:

- begin roughing out an interests-driven framework for a consortium organization
- iterate: understand how it meshes with the ULCC, LC steering committee, NSF, and DOE; begin tuning things and writing prose

…what we are doing now.

Intentions:

•organize to submit a consortium proposal ~September;

•the proposal should contain a sensible number of focussed efforts on relevant issues;

•in spite of the "ground-up" nature of this, expect to receive guidance from LC steering committee, also accelerator and detector experts, and to coordinate our efforts with other consortia;

•it will be necessary to define some sort of process for deciding which possible projects will be included in the consortium proposal;

•encourage participants to consider widening their horizons: to suggest that detector folks consider accelerator R&D too.

Potential strengths of the consortium...

Universities have:

- large pools of expertise in areas far from traditional HEP (materials, chemistry, electronics, condensed matter, lasers...) is available
- sophisticated capabilities in a few areas which can be nicely leveraged through collaboration with other institutions
- students (at all levels) who can participate in R&D projects.

Fermilab has:

- silicon device design, fab, and test capabilities
- rf, cryogenics, beam physics, permanent magnet, wire chamber,… expertise (it's a LONG list).

Collaboration is natural, and effective.

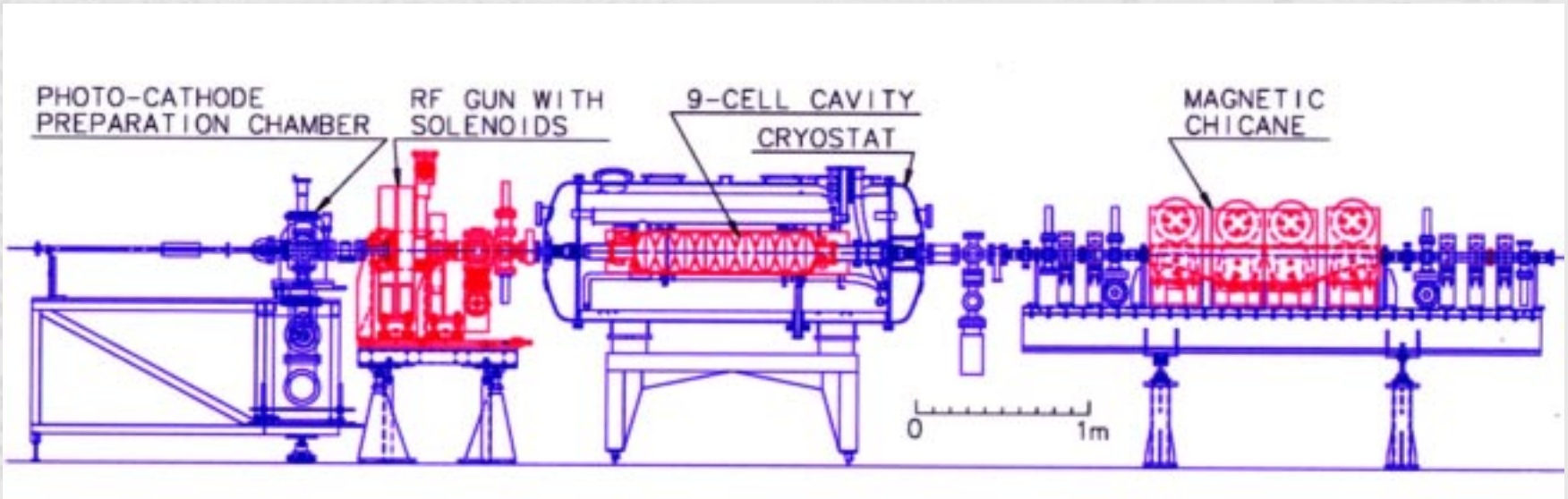
An example of a universities-Fermilab collaboration

Fermilab/NICADD Photoinjector Laboratory (FNPL)

- 17 MeV electron beam operated by Fermilab & Northern Illinois Center for Accelerator and Detector Development
- Beam Physics:
  - > Plasma Wakefield Acceleration
  - > Flat Beams
  - > Laser Acceleration
- International Facility (Chicago, Georgia, Michigan, NIU, Rochester, Fermilab, DESY, CERN, LBL) - Open to all institutions

- Reasons
- Goals, “ground rules”
- What we did / are doing
- Potential strengths
- **An example**
- Participation

Fermilab/NICADD Photoinjector Laboratory (FNPL)



See Jerry Blazey’s talk at 4/5 LC R&D workshop for more information.

A related initiative...

Proposal for a High-brightness Photoinjector

- construct and operate a high-brightness (1μm emittance, ~300 MeV) electron beam at Fermilab.
- motivation:
  - Fundamental beam & accelerator research
  - Support for the new generation of linear colliders, FELs, and synchrotron radiation sources (1 micron emittance and <270 micron pulses)
  - Build infrastructure
- five year construction, then operation...

…which is likely to play a role in the consortium proposal.

Proposal for a High-brightness Photoinjector (cont.)

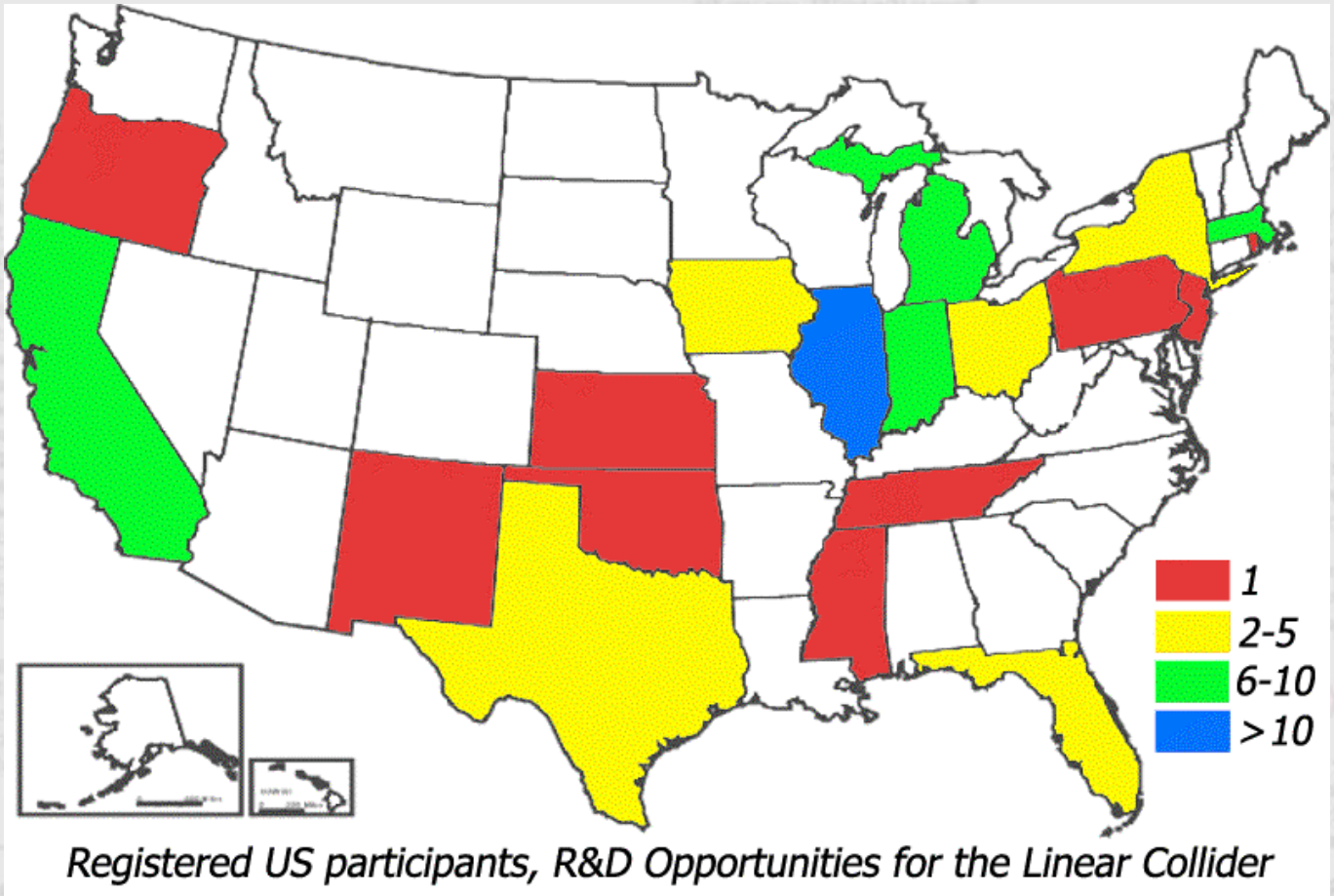
- collaboration is modeled on large detector collaborations and presently includes seven universities and three laboratories – but is open to all interested parties.
- An Expression of Intent submitted 02/11/02 to FNAL, ANL, LBNL, DOE, and NSF asking for encouragement to begin a design report. Have received encouragement from FNAL, ANL, LBNL so far.

Participation data

- 113 people registered in advance, 10 more at the workshop
- 94 people picked up ID badges at the workshop
- About 150 people were present at the summary/discussion
- Registrants’ home institutions spanned 19 states + Italy + Russia
- 41 registrants turned in an interest survey/questionnaire; 46 who didn’t had already described their interests when registering.
- Interests expressed:
  - both accelerator and detector 26
  - accelerator only 22
  - detector only 39

Geographical participation data

- Reasons
- Goals, "ground rules"
- What we did / are doing
- Potential strengths
- An example
- **Participation**



Registered US participants, R&D Opportunities for the Linear Collider

Registrants' home institutions spanned 19 states + Italy + Russia

Information we collected

- Reasons
- Goals, "ground rules"
- What we did / are doing
- Potential strengths
- An example
- **Participation**

Research and Development Opportunities for the Linear Collider:
survey/questionnaire

Since we would like to identify who might be interested in working with which particular R&D efforts, we would like to get a sense of your possible areas of interest. Note that we are not asking you to commit to any future obligations, but we would like to pass on information about your preferences to organizers of future working groups. It is natural that participants' interests will evolve over time as everyone learns more about the Linear Collider, so the areas which interest you now could well be different from those which attract your attention a year from now.

name	affiliation
email	phone

Please add details (or otherwise modify) "subject entries" in the following table as you see fit.

subject	Might you be interested in this R&D area?			
	yes	perhaps	probably not	no
accelerator systems				
accelerator: instrumentation				
accelerator: control systems				
accelerator-detector integration				
photoinjector				
other accelerator systems (which? software?)				
detector systems				
vertex detector				
tracking				
calorimetry				
muon system				
other detector systems (which? software?)				

Do you have comments about your specific interests, the content and form of future meetings, or anything else? We won't post these, but they are likely to be read by a handful of people. (Please continue onto the reverse side of this form.)

thanks!

- Registration form had an "interests" field
- We distributed a survey/questionnaire at the start of summary/discussions part of the workshop

A concluding slide

•There is a lot of work to be done if we are to create a consortium proposal by September.

•The process itself is important: doing it in a fair, inclusive fashion feels like a good way to go about things.

•Vigorous engagement on the part of all involved, rather than the creation of externally-imposed requirements, is likely to be an effective driving force for the effort.

•The mechanisms through which we will choose the accelerator technology and site are not yet defined. These are difficult issues to resolve. However… the way of the world (particularly evident during the last 20 years) is that fiendishly difficult (non-scientific) problems are amenable to solution with surprising frequency.