Engagement by U.S. University Groups With International Linear Collider R&D Projects

A report to the Vice Chancellor for Research, University of Illinois at Urbana-Champaign

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Executive summary

We have made a first measurement of the U.S. university-based high energy physics community's level of engagement with research leading towards the International Linear Collider. We did this by assembling a list of the 104 colleges and universities with at least one faculty member who self-identifies as an experimental elementary particle physicist and conducting telephone interviews with a contact person at the majority of the

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universities. Taken in combination with information about university participation in the "Linear Collider Research and Development Working Group" (LCRD) and the "University Consortium for Linear Collider R&D" (UCLC) we were able to draw conclusions about the level of ILC engagement for 81 of the 104 colleges and universities on our list.

We found that

- 53 of 104 universities (51%) have participated in one or more LCRD/UCLC ILC proposals;
- 62 of the 81 universities about which we obtained information (77%) are participating in ILC work through LCRD/UCLC proposals or else have developed clear plans for ILC activities that will commence sometime during the next few years;
- 13 of the 81 universities about which we obtained information (16%) are not currently participating in ILC work and have not developed clear plans for ILC activities. In spite of this, these universities do plan to incorporate an ILC activity into their group's efforts sometime in the near future;
- 75 of 81 universities (93%) are either participants in LCRD/UCLC proposals, have clear plans for ILC involvement, or expect to develop a plan for ILC involvement in the near future;
- Physicists at more than half the universities in our list would be interested in collaborating on accelerator physics R&D projects, even though their previous work has concentrated on detector physics R&D.

In spite of the encouraging level of interest in ILC participation, many of our colleagues were unsure how they might get started: how they might identify lines of work in need of pursuit, how they might identify likely sources of support for their projects, and how they might go about learning enough accelerator physics to work productively on a non-detector project.

We propose possible remedies to these problems.

A brief history

In January 2002 the University of Chicago hosted a Linear Collider workshop[1] "following the extensive discussion of future initiatives held at the DPF/DPB [Division of Particles and Fields; Division of Particle Beams—divisions of the American Physical Society] sponsored Snowmass 2001 Workshop…" The Chicago meeting was intended to "play a special role in presenting physics potential and the detector issues to a wider group than [had] heretofore been involved." The organizers had hoped that the workshop would "be an excellent opportunity for all to become more involved in shaping a future LC program, and to become more familiar with the issues that surround it."

At that time significant linear collider R&D in the United States was taking place primarily at, or in association with, national laboratories. SLAC was largely focused on the "NLC," an X-band linac built from warm copper structures. Cornell worked on the

[1] *The Chicago Linear Collider Workshop*, Chicago, IL, http://lcworkshop.uchicago.edu/ (2002).

"TESLA" superconducting linac design in collaboration with the German lab DESY. Fermilab participated in R&D for both machine designs. There was some involvement on the part of university high energy groups, primarily in detector simulation studies. Many (probably most) of those groups were already collaborating on the SLD experiment at SLAC, making it natural for them to participate in NLC work.

In order to increase the participation of university groups not already engaged in linear collider R&D, a number of us organized workshops, first at Fermilab[2], and then at Cornell[3] and SLAC[4], in April and May 2002. We requested that presenters focus on concrete issues so that participants would return home with ideas for projects they could undertake later that spring. Tom Himel (SLAC) and a number of his colleagues prepared an especially useful database of accelerator R&D projects.

In parallel with this, the directors of the U.S. particle physics laboratories asked Jim Brau and Mark Oreglia to assume leadership roles in organizing the North American physics and detector community; Oreglia and Brau worked with an executive committee nominated by the directors that evolved into the American Linear Collider Physics Group (ALCPG), a subgroup of the U.S. Linear Collider Steering Group (later renamed the Linear Collider Steering Group of the Americas, LCSGA).

During the summer of 2002 U.S. university-based physicists organized the "Linear Collider Research and Development Working Group" (LCRD) and the "University Consortium for Linear Collider R&D" (UCLC) to generate a series of proposals for the funding agencies based on initial expressions of interest written after the Fermilab, Cornell, and SLAC workshops. Coordination of the projects, in part to avoid duplication of effort, was done with the help of LCSGA and ALCPG. Most LCRD member groups held base grants funded by the Department of Energy while UCLC groups were generally supported by base grants from the National Science Foundation.

Even so, the two consortia joined together to produce a single project document[5] of 545 pages, comprising 71 projects proposed by groups at 47 universities in 22 states, in collaboration with six national (and industrial) labs and eleven foreign institutions. The work spanned a wide range of topics in both accelerator and detector physics. The level of university participation in linear collider R&D increased by roughly 50% thanks to the LCRD/UCLC projects. The project document was submitted simultaneously to the DOE and NSF in October 2002, slightly more than six months after the organizational workshops at Fermilab and Cornell. Both agencies ultimately provided funding for a number of the proposed investigations.

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[2] *Research and Development Opportunities for the Linear Collider*, Fermilab, Batavia, IL, http://www.hep.uiuc.edu/LC/html_files/workshop_04_05_02_main.html (2002).
[3] *LCCOM: Linear Collider Consortium Organizational Meeting*, Cornell University, Ithaca, NY http://www.lns.cornell.edu/public/LCCOM/ (2002).
[4] *Linear Collider R&D Opportunities Workshop*, SLAC, Menlo Park, CA, http://www-conf.slac.stanford.edu/lcrd02/ (2002).
[5] *A University Program of Accelerator and Detector Research for the Linear Collider*, Linear Collider R&D Working Group and University Consortium for the Linear Collider, http://www.hep.uiuc.edu/LCRD/html_files/proposal.html (2002).

The details of funding, management, oversight, and review have evolved over the last several years. The most recent project document for the university-based R&D effort[6] is 881 pages long. It holds progress reports from existing projects as well as proposals for new work. Its 366 authors are based at 51 different U.S. universities, eight laboratories, and 25 foreign institutions. The document describes 72 projects, half of which are in the area of accelerator physics. Coordination of detector R&D is done by ALCPG; the current North American university-based detector R&D effort is now structured as an umbrella grant for the Linear Collider Detector R&D group (LCDRD) and administered by the University of Oregon.

It is natural to ask how the level of U.S. university participation in R&D towards the International Linear Collider compares with the maximum that community resources could support, and how the current level of participation actually relates to the level of domestic interest in ILC research. What fraction of U.S. university-based experimental high energy physics groups are actually participating in ILC work? What fraction would if more resources were to be made available?

U.S. university-based experimental HEP and LCRD/UCLC participation

In order to gauge the interest in ILC participation in the U.S. university community we identified colleges and universities that had at least one Physics Department faculty member who describes herself /himself as a high energy experimentalist. Our goal was to telephone someone at as many of the schools as possible to ask about ILC involvement on their campus.

We constructed a roster of HEP universities by inspecting the collaboration lists of most current high energy physics experiments and merging the information with the list of URA member universities. (Universities Research Associates, Inc. is the organization that manages Fermilab.) We believe that the resulting list of 104 schools, shown in Appendix 1, includes all, or nearly all of the U.S. universities participating in experimental HEP. As shown in Figure 1, universities in 35 states (as well as Puerto Rico) host experimental high energy physics groups.

[6] *A University Program of Accelerator and Detector Research for the International Linear Collider (vol. IV)*, G.D. Gollin, ed. (2006). http://www.hep.uiuc.edu/LCRD/LCRD_UCLC_proposal_FY06/

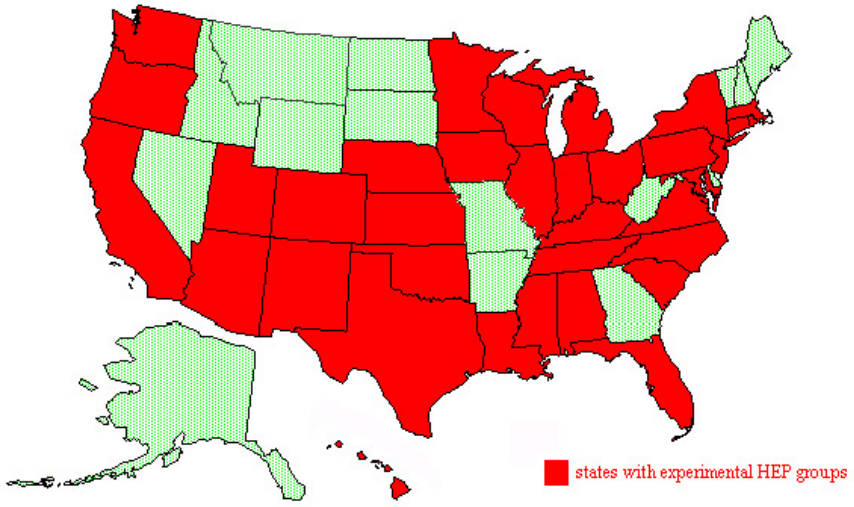

Figure 1: Universities in thirty-five states, as well as Puerto Rico, host experimental HEP groups.

We found that 77 of 83 universities that belong to URA host experimental HEP groups. Some (but not all) URA member universities without an experimental group do host a high energy theory group or a particle astrophysics group.[7] We do not include these schools in Appendix 1 even though their faculties certainly have an interest in matters relating to the ILC. As shown in Table 1, approximately half of all URA member universities are participants in one or more ILC R&D proposals submitted via UCLC and LCRD. It is interesting to see that URA membership does not correlate with participation in ILC: half the schools that are not URA members still host groups that are LCRD/UCLC participants.

Table 1: ILC R&D participation by URA member universities		
1	Number of URA member universities	83
2	Number of URA member universities hosting an experimental high energy physics group	77 (93% of row 1)
3	Number of URA member universities hosting an experimental high energy physics group that have participated in ILC R&D proposal(s) through LCRD/UCLC since 2003	42 (55% of row 2)
4	Non-URA universities with experimental HEP groups	22
5	Non-URA universities with experimental HEP groups that have participated in ILC R&D proposal(s) through LCRD/UCLC since 2003	11 (50% of row 4)

Table 1: URA member university participation in ILC research and development. Note that 77/83 = 93% of URA universities host experimental HEP groups, while 42/77 = 55% of those groups have participated in ILC R&D proposal(s) through LCRD/UCLC.

Polling the university-based experimental particle physics community about ILC

We picked a contact person in each school's experimental high energy physics group in an unscientific fashion, generally choosing someone one (or both) of us knew. We

[7] See, for example, http://wuphys.wustl.edu/Research/ResearchInfoDocs/ElementaryParticle.php.

broadcast the mail message shown in Appendix 2 to all the contact people we had selected in order to let them know we were going to call.

We used a short, standard form with four questions for our phone interviews, and gave our colleagues a chance to tell us whatever else they wanted to say while we took notes. Since we were also interested in the possibility of cooperation among university administrations on ILC advocacy, we asked about the identity of the senior research officer on each campus.

As shown in Table 2, approximately half of the 104 schools in our master list have already shown interest in ILC participation through one or more ILC R&D proposals submitted via UCLC and LCRD.

Table 2: ILC R&D participation by all U.S. universities		
1	Number of U.S. universities identified as hosting an experimental high energy physics group	104
2	Number of U.S. universities that have participated in ILC R&D proposal(s) through LCRD/UCLC since 2003	53 (51% of row 1)

Table 2: U.S. university participation in ILC research and development without regard for URA membership. Note that 53/104 = 51% of U.S. universities that host experimental HEP groups have participated in ILC R&D proposal(s) through LCRD/UCLC.

We made our phone calls during the summer and fall of 2006, playing games of non-convergent "telephone tag" with some of our colleagues, but ultimately speaking to a physicist at 64 of the 104 schools on our list as shown in Table 3a.

Table 3a: Interview contact statistics		
1	Number of U.S. universities identified as hosting an experimental high energy physics group	104
2	Number of university groups we attempted to telephone	82 (79% of row 1)
3	Number of telephone interviews we were able to conduct	64 (62% of row 1)

Table 3a: Overall telephone interview contact statistics.

Note that we were able to obtain some information about ILC participation both through phone interviews and through a group's decision to participate in one or more LCRD/UCLC R&D proposals. As a result, we are able to draw conclusions about ILC engagement for 81 of the 104 universities on our list. For statistical purposes we assumed that we had no information about an HEP group that we did not interview and that was not participating in an LCRD/UCLC proposal.

Tables 3b and 3c show the connection between interview contact statistics and LCRD/UCLC participation. As indicated in Table 3b we were somewhat more likely to interview a physicist at a school participating in LCRD/UCLC than we were to speak to someone at a school not participating (36/53 = 68% *vs.* 28/51 = 55%).

The order in which calls were placed was unplanned: sometimes calls were done in alphabetical order by school name, since our telephone log was alphabetical. Other times we would tend to place calls to people we knew before we made calls to strangers.

Table 3b: Interview contact statistics for universities participating in ILC R&D through LCRD/UCLC		
4	Number of U.S. universities that have participated in ILC R&D proposal(s) through LCRD/UCLC since 2003	53 (51% of row 1)
5	Number of universities participating in ILC R&D through LCRD/UCLC that we DID interview	36 (68% of row 4)
6	Number of universities participating in ILC R&D through LCRD/UCLC that we DID NOT interview	17 (32% of row 4)
Interview contact statistics for universities NOT participating in ILC R&D through LCRD/UCLC		
7	Number of U.S. universities NOT participating in ILC R&D proposal(s) through LCRD/UCLC	51 (49% of row 1)
8	Number of universities NOT participating in ILC R&D through LCRD/UCLC that we DID interview	28 (55% of row 7)
9	Number of universities NOT participating in ILC R&D through LCRD/UCLC that we DID NOT interview	23 (45% of row 7)

Table 3b: Telephone interview contact statistics sorted by participation in LCRD/UCLC.

Table 3c: Interview contact statistics for university groups that we DID interview		
10	Number of telephone interviews we were able to conduct	64 (62% of row 1)
11	Number of universities participating in ILC R&D through LCRD/UCLC that we DID interview	36 (56% of row 10)
12	Number of universities NOT participating in ILC R&D through LCRD/UCLC that we DID interview	28 (44% of row 10)
Interview contact statistics for university groups that we DID NOT interview		
13	Number of university groups that we DID NOT interview	40 (38% of row 1)
14	Number of universities participating in ILC R&D through LCRD/UCLC that we DID NOT interview	17 (43% of row 13)
15	Number of universities NOT participating in ILC R&D through LCRD/UCLC that we DID NOT interview	23 (58% of row 13)

Table 3c: LCRD/UCLC participation sorted by success in conducting a telephone interview.

We found that the most significant factor in our success in conducting a telephone interview was whether or not we were already acquainted with the person we selected as contact person for a particular school. (See Table 3d.) This introduces some amount of bias into our results: we were, for example, less likely to call a school with a small HEP group or a school whose HEP group had worked at neither SLAC nor Fermilab.

Table 3d: Interview contact statistics interview statistics sliced by whether or not we knew the interviewee		
16	Number of universities where we were already acquainted with the person we chose to contact	78 (75% of row 1)
17	Number of interviews conducted with universities where we were already acquainted with the person we chose to contact	61 (78% of row 16)
18	Number of universities where we were already acquainted with the person we chose to contact and never succeeded in performing an interview	17 (22% of row 16)
19	Number of universities where we were NOT already acquainted with the person we chose to contact	26 (25% of row 1)
20	Number of interviews conducted with universities where we were NOT already acquainted with the person we chose to contact	3 (12% of row 19)
21	Number of universities where we were NOT already acquainted with the person we chose to contact and never succeeded in performing an interview	23 (88% of row 19)

Table 3d: Interview contact statistics grouped by our degree of acquaintance with the interviewee.

Interview results

The questions we asked our colleagues were these:

1. What is your group's present and anticipated (over the next few years) ILC involvement?
2. Would members of your group consider an accelerator project, even if you view yourselves as detector physicists?
3. Does your university have strengths outside the HEP group whose practitioners might become interested in ILC work if they knew about the ILC (e.g., an RF engineering group)?
4. Who is your equivalent of the UIUC Vice Chancellor for Research in case our administration should want to contact your administration concerning a university administration effort for ILC advocacy?

Responses to "What is your group's present and anticipated ILC involvement?"

We found that most university HEP groups have proposed (or joined) an ILC R&D project already, or have well defined plans to add an ILC activity to their efforts within the next few years. Other groups would like to participate but have not begun to identify resources that they might commit to an ILC project. Only a small fraction of university groups do not expect to participate in any sort of ILC activity. The results are shown in Table 4. Of note is the fact that 93% (75 out of 81) of the U.S. experimental HEP groups that we learned about have joined ILC R&D project proposals, or expect to begin an ILC effort during the next few years. As shown in Figure 2, these 75 universities span 32 states.

Table 4: “What is your group’s present and anticipated ILC involvement?”		
1	Number of university groups responding and/or known to be participating in an LCRD/UCLC proposal	81
2	Number of universities participating in ILC R&D through LCRD/UCLC or that have developed clear plans for ILC involvement to commence during the next few years	62 (77% of row 1)
3	Number of universities NOT participating in ILC R&D that DO want to participate, but have not begun serious planning for an ILC effort	13 (16% of row 1)

Table 4: U.S. HEP group planning for ILC R&D participation.

The responses we heard were generally unsurprising. Some of our colleagues were concerned about the cumbersome funding process for new ILC efforts—the time from proposal submission to receipt of funds through LCRD/UCLC could be a year or more. Some were skeptical of the funding agencies’ expressions of support for ILC work at universities. Some were concerned that funding levels were not adequate for the hiring of postdoctoral researchers.

We found there to be a kind of chicken-and-egg problem here: physicists in the university community are not confident that the effort associated with generating a research proposal is justified by the likelihood that funds will be made available. The impression we receive from conversations with the funding agencies is that they are unsure of the level of enthusiasm in the university community for the ILC. Perhaps a more predictable mechanism of support, in which universities receive funding as subcontractors to national laboratories for clearly defined projects, can help resolve this issue. In reality, it seems as much a problem of perception as anything else.

A separate problem is the low level of funding that has been made available to support university-based ILC R&D efforts. For example, the first year’s joint LCRD + UCLC R&D document contained 71 projects proposed by 47 universities. The funding that was eventually released to the universities in the first year was ~$750k. Over the next three years the level of support increased, but not dramatically. Many of the awards are insufficient to cover the cost of a graduate research assistant: some of our colleagues feel that this also suggests a certain tentativeness on the part of the funding agencies.

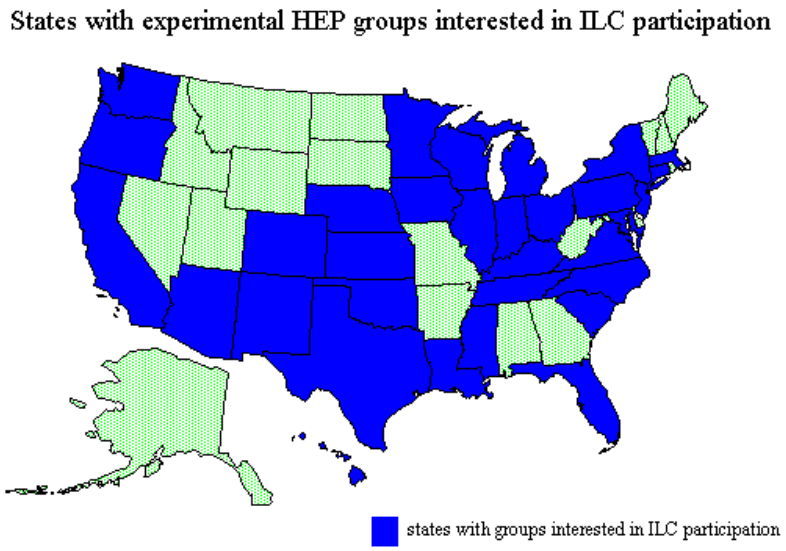

Figure 2: Universities in thirty-two states host experimental HEP groups that are (or anticipate) undertaking ILC projects.

Responses to "Would members of your group consider an accelerator project…?"

Our experience at the University of Illinois is that productive accelerator physics R&D can be done by groups that normally work on detector physics projects. Further, accelerator physics work is ideally suited to participation by undergraduate research assistants, helping us avoid the complication of mentoring graduate students on projects that might not naturally lead to PhD theses.

We were curious if our colleagues at other universities (most of whom are detector physicists) had thought about the possibility of undertaking an accelerator project. As before, we combined information about ILC interest from phone interviews and from a group's decision to participate in one or more LCRD/UCLC R&D proposals. We assumed that we had no information about interest in accelerator projects for an HEP group that we did not interview and that was not participating in an LCRD/UCLC accelerator proposal.

Note that we did not assume that uninterviewed groups participating only in LCRD/UCLC detector proposals were uninterested in accelerator projects. Since the LCRD/UCLC process was proposal driven, it required physicists new to accelerator R&D to learn enough about an unfamiliar subject to write an acceptable proposal. A different funding model, in which university work could be funded through subcontracts to national labs, might increase participation in accelerator work. Because of this, we did not feel that the choice to participate in a detector proposal but not an accelerator proposal should be taken as an indicator of low interest in accelerator R&D.

An analysis of responses is shown in Table 5.

Table 5: "Would members of your group consider an accelerator project…?"		
1	Number of university groups responding and/or known to be participating in an LCRD/UCLC proposal	81
2	Number of universities participating in an LCRD/UCLC proposal	53
3	Number of universities participating in an LCRD/UCLC accelerator R&D proposal	31 (58% of row 2)
4	Number of universities participating in an LCRD/UCLC detector proposal but NOT participating in an accelerator proposal	22 (42% of row 2)
5	Number of universities that we interviewed that are NOT participating in any kind of LCRD/UCLC proposal	28
6	Number of universities that we interviewed that are NOT participating in any kind of LCRD/UCLC proposal AND that are involved in, or would seriously consider participation in, accelerator physics R&D	15 (54% of row 5)
7	Number of universities that we interviewed that are NOT participating in any kind of LCRD/UCLC proposal AND that are unlikely to participate in accelerator R&D	13 (46% of row 5)
8	Number of universities that we did NOT interview that are participating in an LCRD/UCLC proposal, either detector or accelerator	17
9	Number of universities that we did NOT interview that are participating in an LCRD/UCLC accelerator proposal	9 (53% of row 8)

Table 5: U.S. experimental HEP group receptiveness to ILC accelerator R&D work.

We were surprised to see that about half of our colleagues were receptive to the possibility of pursuing accelerator projects. We found that more than half of the universities participating in LCRD/UCLC proposals are engaged in accelerator R&D (31/53 = 58%), but other measures are consistent with this. For example, more than half the schools we interviewed that were not participating in an LCRD/UCLC proposal (15/28 = 54%) were seriously considering pursuit of ILC accelerator R&D work.

Responses to "Does your university have strengths outside the HEP group whose practitioners might become interested in ILC work…?"

We are well aware of our own far-from-perfect knowledge of research pursued by our colleagues in other departments. We expected to find that our colleagues at other institutions were also spotty in their knowledge of activities outside their departments so that answers to this question would not yield reliable leads for additional contacts concerning future ILC R&D projects.

That is essentially what we found: 40 of 64 respondents had at least a general idea of other groups that might show an interest ("the plasma physics people might be interested since they think about beam issues"), but it was rare for us to receive more specific information than that.

An effort to generate wider university interest in ILC participation than just inside physics departments is likely to require the participation of university research officers who can be expected to better understand the details of the research efforts being carried on at their universities.

Comments and concerns from our colleagues

Most people we spoke to felt they could give us a rough summary of their entire HEP group's ILC activities. A few felt a need to be cautious though, wanting to discuss matters with their colleagues before speaking about anything other than their own research efforts.

It was common to hear worries about the difficulty of balancing near-term efforts with more speculative ILC projects: some physicists had adopted a "wait-and-see" attitude, hoping for a more clear indication of federal commitment to ILC construction before participating. Some physicists viewed the problems of obtaining support for student and postdoctoral participation in ILC projects undertaken by universities as an indication of the tentativeness of U.S. funding agencies towards the ILC.

It is apparent that the small amount of funding available for university ILC work and the long time scale for obtaining funds after submission of a proposal, are significant issues. Given the fairly large amount of interest in undertaking ILC work that is present in the university community, this needs to be resolved quickly in order to allow the university HEP community to engage with the ILC.

One scientist pointed towards the use of ILC projects as a path for providing younger scientists with opportunities to learn to do hardware work, even while they were working on analysis of, for example, LHC data.

Some of our colleagues expressed concern over the narrowing of the U.S. program: we are focusing on large collider experiments and neutrino physics to the exclusion of smaller experiments in lepton flavor violation and rare decays. They felt that a fraction of the U.S. HEP budget could be reserved for these sorts of investigations without undue impact on the larger projects.

Some of our colleagues were interested in becoming involved in ILC accelerator work and hoped for guidance (and education!) on how to identify problems in need of solution and how to begin R&D work on those problems.

A number of scientists described the experiences of their university administrations in SSC advocacy. Some felt that the lessons learned would better allow their administrations to help with ILC advocacy.

Conclusions and recommendations

Conclusions

The Executive summary at the start of this memo shows a numerical digest of our results. We found that about half of our colleagues' HEP groups are currently working on ILC projects. Most of the other university HEP groups are developing detailed plans for ILC participation, or expecting to explore possible lines of ILC R&D in the near future. However, many of the groups are unsure how to identify relevant ILC projects well matched to their groups, how to begin initial explorations of those projects, and how to obtain stable funding for their ILC investigations. Many of our colleagues are open to

participation in projects far from areas in which they have previously worked: about half of them would consider doing accelerator R&D, for example.

Many physicists were concerned that the funding agencies were not ready to support ILC work at a level that would make it attractive for their groups to redirect some of their efforts towards ILC projects. Availability of ILC R&D funding and an expedited mechanism for releasing funds to projects would change this perception.

Our HEP colleagues generally expected that other groups at their universities (for example in material sciences or electrical engineering) would be interested in learning of possible ILC projects that were related to their own areas of research. However, they tended to be unfamiliar with research pursued outside their own departments and usually did not identify specific investigators who could be contacted.

It is important that the large level of current interest in the university community concerning ILC participation not be squandered. We feel that some of the complexities that discourage university groups from starting new ILC efforts are easily resolved.

An additional benefit of increased university engagement with the ILC would be the resulting availability of university administrative resources for political and economic outreach. At present, HEP groups at colleges and universities in at least 32 states would like to participate. The government affairs and industrial relations offices of these schools could play a useful role in ILC advocacy at the state and national level.

These are the specific issues we feel should be addressed immediately:

1. University HEP groups need assistance in identifying ILC projects that are reasonably well matched to their existing capabilities and infrastructure. They will also need help getting started.

2. A funding mechanism that is efficient, whose outcomes are predictable, and that is neutral to the source of a group's base grant should be created to support appropriate university ILC projects.

3. There is little, if any coherent state-level ILC advocacy being done by university administrations at the present time. Our universities would be able to

- identify and alert possible ILC university participants outside the school's HEP group;
- inform state governments and industries of ILC opportunities of interest to citizens of the state.

Recommendations

The mechanism for oversight of ILC projects in the United States is still evolving. The "Linear Collider Steering Group of the Americas" (LCSGA)[8], currently chaired by Maury Tigner (Cornell University), watches over both detector and accelerator activities.

[8] http://www.slac.stanford.edu/~hll/USLCSG/

Management of detector R&D projects that had been part of LCRD and UCLC is now done by the "University-based Linear Collider Detector R&D" program (LCDRD)[9]. Global ILC accelerator R&D is managed by the "Global Design Effort" (GDE)[10], chaired by Barry Barish (Caltech) with Gerry Dugan (Cornell University) serving as the North American Regional GDE Director. The GDE's R&D Board (RDB),[11] chaired by Bill Willis (Columbia University) is "responsible for assessing and providing guidance for the overall R&D program. The RDB will suggest priorities for the research facilities and R&D supporting the baseline, the R&D on alternatives to the baseline and selective R&D that could further the field in the longer term…"

It is natural to view LCDRD, RDB, and the North American component of the GDE as the entities that could generate a list of ILC R&D projects that are suitable for university involvement and present that information to the university community. This was a successful approach in 2002, when Tom Himel's impressive database of projects jump-started LCRD and UCLC.

We recommend that the University of Illinois discuss with LCDRD and GDE the possibility of producing an updated database of projects suitable for university participation. Information about the projects could be presented to the university community in workshops to be held at national laboratories near major hub airports in mid-winter 2007. Each university that hosts a high energy physics group could be encouraged to send at least one physicist as well as a university research officer (for example, an assistant vice chancellor for research) to the meeting.

We recommend that the University of Illinois discuss with LCDRD, GDE and the directorates of the national laboratories the possibility of organizing part of the R&D support (and oversight) of university projects through a subcontracting structure that would not require proposals from university groups. In effect, the laboratories would issue purchase orders for the services to be rendered by the university groups involved in R&D projects. This would expedite the delivery of funds for projects and reduce uncertainties present in the current proposal and approval process.

We recommend that the University of Illinois administration formulate a coherent State of Illinois ILC advocacy plan in cooperation with the administrations of the other Illinois research universities and then begin discussions with administrations of the other universities in the Appendix 1 table in order to create a national university-led ILC advocacy organization.

We recommend that these activities begin immediately.

[9] http://physics.uoregon.edu/~lc/lcdrd/; Jim Brau at the University of Oregon serves as the (*de facto*) chair of LCDRD.
[10] http://www.linearcollider.org/cms/
[11] http://www.linearcollider.org/cms/?pid=1000220

Appendix 1: Colleges and universities with faculty who are high energy experimental physicists

In the following table we list colleges and universities that we have identified as having at least one Physics Department faculty member who self-identifies as a high energy experimentalist. Many of these schools are members of Universities Research Associates, Inc., the organization that manages Fermilab. Approximately half of the listed schools have one or more participants in ILC R&D proposal(s) submitted through UCLC and LCRD.

We constructed the table by inspecting the collaboration lists of most of the high energy physics experiments we know about and merging it with the roster of URA member universities. We then scanned each physics department's web site to verify the presence of an experimental HEP effort. Not all schools that belong to URA support an experimental HEP group and we have removed these from the table. (An example is Washington University in St. Louis, with its four-faculty high energy theory group.[12] We do not include these schools in the table, even though their faculties certainly have an interest in matters relating to the ILC.)

We believe that the table lists all, or nearly all of the U.S. schools participating in experimental HEP.

N	Experimental HEP Institution	URA member?	UCLC/LCRD proposal participant?	We telephoned in hopes of conducting an interview?	We managed to interview someone?
1	University of Alabama - Tuscaloosa	yes	no	no	no
2	University of Arizona	yes	no	yes	yes
3	Arizona State University	yes	no	no	no
4	Baylor University	no	no	yes	yes
5	Boston University	yes	yes	yes	yes
6	Brandeis University	no	no	no	no
7	Brown University	yes	no	yes	no
8	Bucknell University	no	no	no	no
9	California Institute of Technology	yes	yes	yes	yes
10	University of California at Berkeley	yes	yes	yes	yes
11	University of California at Davis	yes	yes	yes	yes
12	University of California at Irvine	yes	no	yes	yes
13	University of California at Los Angeles	yes	yes	yes	yes
14	University of California at Riverside	yes	no	yes	yes
15	University of California at San Diego	yes	no	yes	yes
16	University of California at Santa Barbara	yes	no	yes	yes
17	University of California at Santa Cruz	no	no	yes	yes
18	Carnegie-Mellon Reserve University	yes	no	yes	yes
19	University of Chicago	yes	yes	yes	yes
20	University of Cincinnati	no	no	yes	yes
21	University of Colorado at Boulder	yes	yes	yes	yes
22	Colorado State University	no	yes	yes	yes
23	Columbia University	yes	no	yes	no

[12] See http://wuphys.wustl.edu/Research/ResearchInfoDocs/ElementaryParticle.php.

24	Cornell University	yes	yes	yes	yes
25	Duke University	yes	no	yes	yes
26	Embry Riddle Aeronautical University	no	no	no	no
27	Fairfield University	no	yes	yes	no
28	University of Florida	yes	no	yes	no
29	Florida Institute of Technology	no	no	yes	no
30	Florida State University	yes	no	yes	yes
31	Harvard University	yes	no	yes	yes
32	University of Hawaii	yes	yes	yes	yes
33	University of Houston	yes	no	no	no
34	Illinois Institute of Technology	yes	no	yes	yes
35	University of Illinois at Chicago	no	no	yes	yes
36	University of Illinois at Urbana-Champaign	yes	yes	yes	yes
37	Indiana University	yes	yes	yes	yes
38	University of Iowa	yes	yes	yes	no
39	Iowa State University	yes	yes	yes	yes
40	Johns Hopkins University	yes	no	yes	yes
41	University of Kansas	no	yes	yes	yes
42	Kansas State University	yes	yes	yes	yes
43	Langston University	no	no	no	no
44	Lehigh University	no	yes	no	no
45	Louisiana State University	yes	no	no	no
46	Louisiana Tech University	no	yes	yes	yes
47	University of Louisville	no	no	yes	yes
48	University of Maryland, College Park	yes	yes	yes	no
49	Massachusetts Institute of Technology	yes	yes	yes	yes
50	University of Massachusetts at Amherst	yes	no	yes	yes
51	University of Michigan	yes	yes	yes	yes
52	Michigan State University	yes	yes	yes	yes
53	University of Minnesota	yes	yes	yes	no
54	University of Mississippi	no	no	yes	yes
55	Mount Holyoke College	no	no	no	no
56	University of Nebraska - Lincoln	yes	no	yes	yes
57	University of New Mexico	no	yes	yes	yes
58	New Mexico State University	no	yes	no	no
59	New York University	no	no	no	no
60	State University of New York - Albany	no	no	yes	yes
61	State University of New York - Buffalo	yes	no	no	no
62	State University of New York - Stony Brook	yes	no	no	no
63	North Carolina Agricultural and Technical	no	yes	yes	yes
64	Northeastern University	yes	no	no	no
65	Northern Illinois University	yes	yes	yes	yes
66	Northwestern University	yes	yes	yes	no
67	University of Notre Dame	yes	yes	yes	yes
68	Occidental College	no	yes	no	no
69	Ohio State University	yes	yes	yes	yes
70	Ohio University	no	no	no	no
71	University of Oklahoma	yes	no	yes	yes
72	University of Oregon	yes	yes	yes	yes
73	University of Pennsylvania	yes	yes	yes	no
74	Pennsylvania State University	yes	no	yes	yes

75	University of Pittsburgh	yes	no	yes	yes
76	Prairie View A&M University	yes	no	no	no
77	Princeton University	yes	yes	yes	yes
78	University of Puerto Rico	no	no	no	no
79	Purdue University	yes	yes	yes	yes
80	Rice University	yes	no	yes	yes
81	University of Rochester	yes	no	yes	yes
82	Rockefeller University	yes	no	yes	yes
83	Rutgers, The State University of New Jersey	yes	no	yes	yes
84	Saint Mary's University of Minnesota	no	no	no	no
85	University of South Carolina	yes	yes	yes	yes
86	Southern Methodist University	yes	no	yes	yes
87	Stanford University	yes	yes	yes	yes
88	Syracuse University	yes	no	yes	yes
89	University of Tennessee at Knoxville	yes	yes	yes	yes
90	Texas A&M University	yes	yes	yes	no
91	Texas Tech University	yes	yes	no	no
92	University of Texas at Arlington	yes	no	yes	no
93	University of Texas at Austin	yes	no	yes	no
94	University of Texas at Dallas	yes	no	yes	yes
95	Tufts University	yes	yes	yes	no
96	Vanderbilt University	yes	no	yes	no
97	University of Virginia	yes	no	yes	no
98	Virginia Polytechnic Institute and State University	yes	yes	yes	yes
99	University of Washington	yes	yes	yes	no
100	Wayne State University	yes	yes	yes	no
101	Western Illinois University	no	no	yes	yes
102	College of William and Mary	yes	yes	no	no
103	University of Wisconsin at Madison	yes	yes	yes	yes
104	Yale University	yes	yes	yes	yes
	Totals	in URA 77	LCRD/UCLC 53	we phoned 82	we spoke 64

Appendix 2: Message broadcast to one physicist at each of the Appendix 1 universities

We sent the following message to one member of each of the university HEP groups listed in Appendix 1 before beginning our phone calling.

Dear Colleague,

We believe there is a growing interest in Washington to consider the role that high energy physics should play in the United States' program of basic research. Further, our sense is that HEP is being encouraged to develop plans to retain a position of leadership in the international scientific community. The planning is to include the U.S. role in the International Linear Collider. This is very encouraging!

It is important that university-based physicists play an active role in this process. Certainly we will be participating through our collaboration on projects that are often centered at a national lab. But we should also consider asking our universities to help in advocacy for the long-term goals of international high energy physics. The UIUC Chancellor, Provost, and Vice Chancellor for Research are interested in helping, and we imagine this will be true of many other schools' administrations.

Besides advocacy, participation in accelerator and detector R&D work for the ILC by groups not previously involved is another way to move things forward. Sizeable increases in ILC R&D funding for this year and next are scheduled.

Could we discuss this in a phone call sometime in the next few days? The UIUC academic year is finished so one of us should be able to call you at your convenience if you give us a range of days/times that might work.

Here are a couple of the encouraging signs that we see.

1. At the end of the Fermilab UEC /SLAC SLUO Washington trip last March, Ray Orbach (DOE Office of Science director) spoke with the UEC and SLUO chairs. Dr. Orbach would like to see a demonstration of strong support for the International Linear Collider in the U.S. community. If this comes about (and if the U.S. bid to host the ILC is successful), the DOE will support a 2011 construction start for the machine. THAT IS VERY SOON! In addition, the DOE and NSF have asked LCSGA ("Linear Collider Steering Group for the Americas") to lay the groundwork for the U.S. bid-to-host.

2. There is significant focus in Washington on problems in long-term planning intended to safeguard U.S. competitiveness in the global economy. In particular, there are three documents that appear to be receiving wide, favorable attention. They are:

The National Academies' report "Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future" (see http://www.nap.edu/catalog/11463.html)

The President's "American Competitiveness Initiative" (see http://www.whitehouse.gov/stateoftheunion/2006/aci/)

The National Academies' report "Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics" (sometimes called "EPP2010": see http://www7.nationalacademies.org/bpa/index.html).

Shall we talk?

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