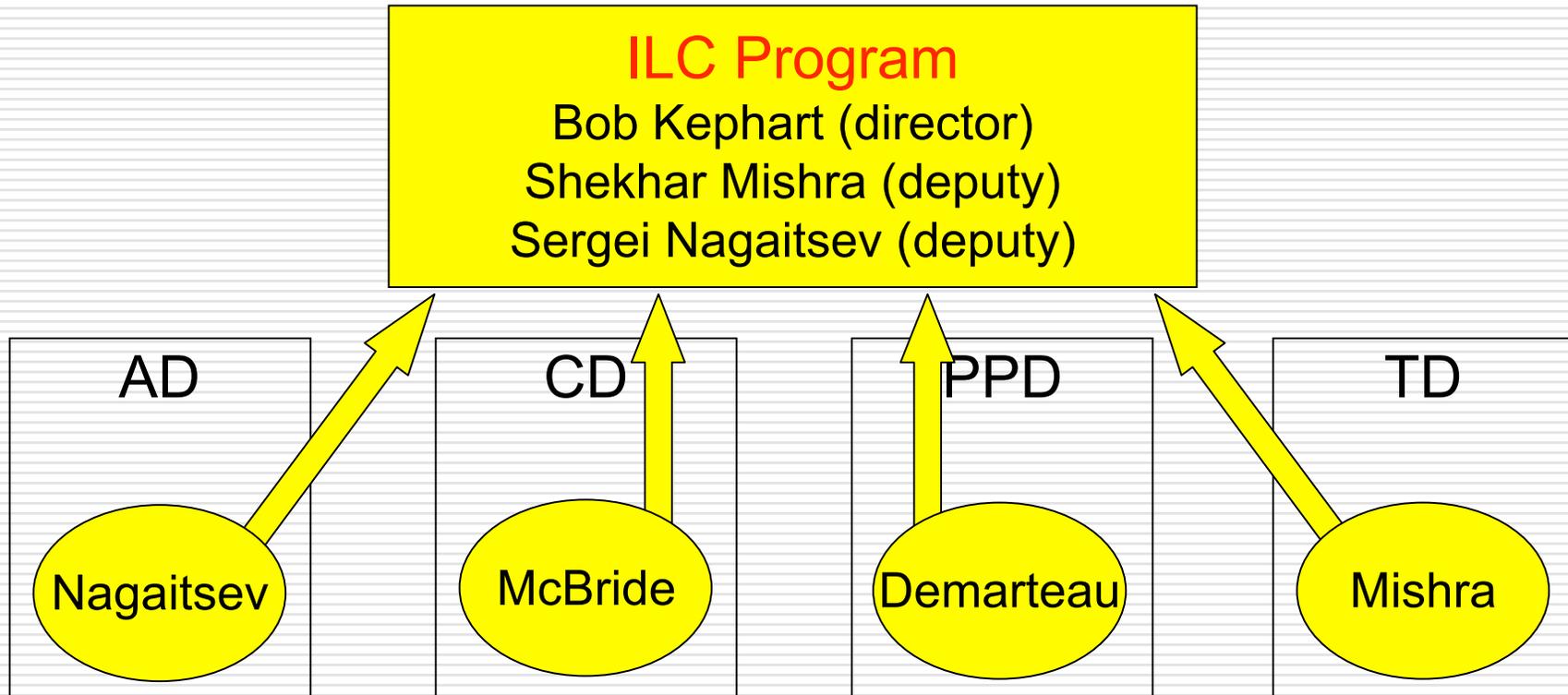


ILC Efforts at Fermilab

Focus on Particle Physicists' Involvement and Issues

ILC Organization and R&D Activities at Fermilab



- Machine Design
- Development of SCRF Technology and Infrastructure
- Conventional Facility & Site Studies for a US ILC site
- Industrialization & Cost Reduction
- Physics, Detector R&D
- Support activities of and build partnerships with lab.s and universities

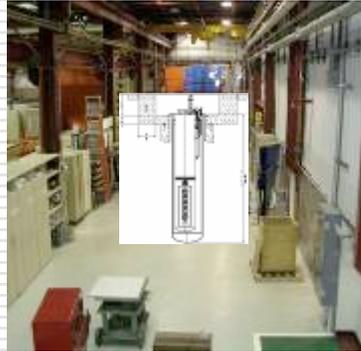
Fermilab ILC Infrastructure (Accelerator)



Eddy Current Scanner



Cavity Vertical Test Stand



LLRF



Cavity String Assembly Clean Room
Class 10/100



RF Measurement & Tuning



Horizontal Test Stand

1.3 GHz Cavity at 2 K



Cryomodule Assembly @ MP9



BCP Facility at ANL



Fermilab Photo-injector



ILCTA @ Fermilab



Concerns on Physicists' Involvement in the ILC



- FNAL, the proposed US site for the ILC
 - has significantly increased its program in ILC R&D in recent years.
- A growing concern at Fermilab and in the US ILC community.
 - Fermilab particle-physics community has not participated accordingly.
- FNAL, the nation's only lab. devoted solely to particle physics
 - must assume a national leadership role.
 - have to strengthen the synergy between itself and other laboratories and universities and strive to involve international partners.

- Actions taken



Building an ILC Scientist Team at Fermilab

- Formed an ILC physicist “group” (loosely bound) - mid June
 - The Directorate met “preselected” Scientist staff one-on-one.
 - ~40 physicists

- Group activities organized by Bob Tschirhart and Joe Lykken
 - Weekly (Wednesday) lunch
 - Round-table discussion on various ILC issues
 - Place to inform/educate FNAL scientists world-wide ILC activities
 - Seminars, Detector simulation tutorials, ...
 - by bringing experts from around the world

- This group will
 - evolve to working together in well defined ILC high priority R&D projects.



Fellowships and Guest Scientists

- Instituted “International Fellowship” program to improve connections to scientists and institutions world-wide.
<http://www.fnal.gov/pub/forphysicists/fellowships/international/>
 - 2 CDF (1 postdoc from Mexico, 1 faculty from Cyprus)
 - 2 DØ (1 student from UK, 1 faculty from China)
 - 2 ILC (1 postdoc from UK, 2nd offer will go out soon)

- Strengthened Guest Scientist program to attract experts/support ILC comm.
 1. Wolf Dietrich Muller (DESY) - cavity / Vertical Testing system expert
 2. Claire Antoine (Saclay) - Electro Polish expert
 3. Yagmu Torun (IIT Assoc Scientist joint appointment) - SCRF cavities
 4. Jinjian Li (IIT grad student) - cavity 3.9 GHz
 5. Nigel Lockyer (Penn) - tuner collaboration
 6. George Gollin (UIUC)
 7. Kirti Ranjan (University of Delhi)
 8. Phillipe Piot (NIU)
 9. Oleg Nezhevenko (Budker INP) - RF
 10. Noriaki Nakao (SLAC) - accelerator
 11. Two students (NIU) - RF studies



Offices, Infrastructure, Workshops, ...

- Reassign offices for better communication and higher efficiency
 - e.g. WH12 and WH13
 - Neutrino groups: WH12, WH13 → WH12 (neutrino)
 - Accelerator group and ILC: WH12, WH13 → WH13 (toward ILC)

- Computing Division
 - Establishing infrastructure for detector and physics simulation and software
 - Will strengthen Detector R&D efforts, and support the university community
- Improve equipments in the SiDet Facility.

- Host workshops to bring together communities at Fermilab
 - Hadronic Shower Simulation workshop: Sept. 6-8, 2006
 - ILC Test Beam workshop: January 17-19, 2007
 - TTC (SCRF collaborations) meeting: March 2007
 - LHC-ILC Synergy “The LHC early phase for the ILC”: April, 2007
 - Pixel 2007: Spring 2007
 - Joint ALCPG and GDE: October 22-26, 2007



Test Beam Facilities for Detector R&D

□ Few test beams in the world today

- Fermilab has the opportunity to contribute in a very significant way.



- T926: RICE completed
- T927: BTeV Pixel completed
- T930: BTeV Straw completed
- T931: BTeV Muon completed
- T932: Diamond Detector Signed
- T933: BTeV ECAL completed
- T935: BTeV RICH completed
- T936: US/CMS Forward Pixel data
- T941: U Iowa PPAC Test completed
- T943: U. Hawaii MA PS Detector completed
- T950: Kaon Vacuum Straw Tracker analyzing
- T951: ALICE EMCAL Prototype Test analyzing
- T953: U. Iowa Cerenkov Light Tests analyzing
- T955: RPC Detector Tests (ANL) Taking data
- T956: ILC Muon Detector (Indiana) Taking data
- T957: ILC Tail Catcher (NIU) Taking data

□ MTest - being upgraded to meet ILC detector R&D requirements

- Broader momentum band, Better particle identification

□ Mcenter(neutron, K_L beam) - problems (e.g. magnet coil) being fixed

- Candidate for an additional testbeam area



ILC-HEP Task Force:

- Commissioned Task Force mid May 2006
 - led by Michael Lindgren
- Received an Interim Report mid July 2006
- Received the “Draft” Final Report on October 18, 2006

- Charge:

Building the International Linear Collider (ILC) is the highest priority for the future of high-energy physics beyond the LHC. Preparing a bid to host the ILC in US requires major involvement and intellectual leadership by US scientists and engineers in all aspects of the design and construction of ILC. The ILC, unlike the LHC, will involve particle physicists in accelerator as well as detector development. [Fermilab, the proposed US site for the ILC, has significantly increased its program in ILC R&D in recent years. However, its particle-physics community has not participated accordingly. This is a growing concern at Fermilab and in the US ILC community.](#)

ILC-HEP Task Force: Charge (cont.)

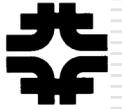


Fermilab will soon become the nation's only laboratory devoted solely to particle physics and must assume a national leadership role. It will have to strengthen the synergy between itself and other laboratories and universities and strive to involve international partners. A possible first step in this process is to increase the involvement of the community of high-energy physicists in ILC research at Fermilab.

The committee should [present a plan on how to increase laboratory particle physicists' involvement in the ILC](#). The committee should also [identify areas appropriate for collaboration between Fermilab and the high-energy physics community](#). The challenge for the committee is to recommend well-defined projects where the laboratory particle and accelerator physicists can work side-by-side with university groups (faculty, postdocs and students). Examples of such areas include accelerator technologies, beam instrumentation, accelerator simulation, detector R&D, detector and physics simulation, and test beam facility to test prototype detectors.

We would like an interim report from the committee by July 15, 2006, and the final report by September 15, 2006.

ILC-HEP Task Force: Membership



* not Fermilab staff

Franco Bedeschi – INFN-Pisa *

Joel Butler – Fermilab PPD

Dhiman Chakraborty – Northern Illinois University *

Andreas Kronfeld - Fermilab PPD

Marcel Demarteau – Fermilab PPD

George Gollin – University of Illinois, Urbana-Champaign *

Terry Grimm – Michigan State University *

John Jaros – SLAC *

Aurelio Juste – Fermilab PPD

Michael Lindgren – Fermilab PPD (Chair)

Ted Liu – Fermilab PPD

Nigel Lockyer – University of Pennsylvania *

Patty McBride – Fermilab CD

Shekhar Mishra – Fermilab TD

Vaia Papadimitriou – Fermilab AD

Kevin Pitts – University of Illinois, Urbana-Champaign *

Marc Ross – SLAC *

Harry Weerts – Argonne National Laboratory *

Christopher White – Illinois Institute of Technology *

Jae Yu – University of Texas, Arlington *

Bob Kephart – Fermilab ILC (Ex Officio)

Young-Kee Kim – University of Chicago / Fermilab (Ex Officio)



Recommendations by ILC Task Force

- 1) Complete the bottoms-up estimate of the scientific and engineering labor resources required to staff the minimum essential efforts, and highly desirable ones, as part of the development of a comprehensive research plan that covers the next several years, paying due attention to ILC/GDE priorities. Communicate these requirements to the Division and Section leadership and the scientific staff, and provide resources to help coordinate and manage staff activities.
- 2) Continue and expand efforts to increase the awareness of lab scientists and users to ILC science, and ongoing ILC activities and plans. Engaging a core of scientists and having a regular series of well publicized talks and workshops to establish an intellectual basis for involvement and eventual leadership is critical, and needs to be continued. One suggestion is to have an all-hands meeting for half a day led by the Director, and run by division heads, on what their divisions are doing and how people can get involved. A workshop on R&D opportunities at Fermilab would bring in university researchers. One result of the survey was that some colleagues do not believe the physics case. Charge a prominent theorist at the laboratory to lead an effort to solve that problem by communicating the case.

Recommendations by ILC Task Force



- 3) **Develop training and education programs to provide opportunities for the Fermilab staff to learn the disciplines and skills** that will be needed to develop the instrumentation and the techniques required to design, build and operate the linear collider and its experiments. This program could include formal courses, lectures, seminar series, and workshops. It could also include laboratories or projects that provide direct, hands-on training and experience. This program should take full advantage of resources available at universities.

- 4) **Recruit additional laboratory and university scientists to the development of superconducting cavity processing, cryomodule and associated hardware testing, strengthening of the existing ILC accelerator simulations effort, and participation in ILCTA test facility preparations.**

Recommendations by ILC Task Force



- 5) Appoint a coordinator who works closely with the ILC program office to foster collaborative R&D efforts at the ILCTA and other parts of the ILC program at Fermilab. The coordinator would identify tasks and R&D opportunities, recruit groups and facilitate the communication between project managers and these outside groups.

- 6) Encourage and support the efforts of physicists at national laboratories and universities in the area of BI and MDI R&D at the test facilities. Coordinated planning and partnerships that engage the laboratory staff early in the process will ensure that, for example, good ideas that lead to a Ph.D thesis also lead to their usage in the project, and make transitioning the support and operational responsibilities much easier.

Recommendations by ILC Task Force



- 7) Establish a strong simulation group to support the ongoing detector R&D by providing computing and simulation infrastructure support for ILC physics analyses, full detector simulations, and reconstruction algorithm development. We recommend that this work be performed in the context of (a) recognized detector concept(s), and that Fermilab take a strong role in helping to prepare the CDR's for those concept(s). To promote maximum utilization by the university community, we recommend all concepts have access to Fermilab facilities and expertise, even concepts which might not have actively involved Fermilab staff.

- 8) Continue to build on the strengths of centers of excellence within the Laboratory, such as the SiDet facility and the electrical and mechanical engineering departments, providing support to, and engaging in collaborative efforts with, the user community. The infrastructure at the SiDet facility should be improved to meet the challenges of developing the next generation of silicon-based detectors.



Recommendations by ILC Task Force

- 9) **The laboratory should continue to increase its funding support for ILC detector R&D.** Consider developing a competitive, peer reviewed, **Laboratory Directed Research and Development (LDRD) program** as one component of that support. Proposals by laboratory scientists which foster collaboration with URA scientists on ILC related research would have the additional benefit of strengthening the ties between Fermilab scientists and their university colleagues.

- 10) **Create tenure-track positions at Fermilab for ILC research.** Provide mentoring for people in these positions, to ensure the high quality of this research and good exposure in the international HEP community. To be attractive, the R&D must result in compelling science that leads to a strong case for promotion.

Recommendations by ILC Task Force



- 11) **Laboratory scientists working on collider physics should be recruited for part time participation in ILC R&D and their performance in both areas recognized by laboratory management.** The pool of talented collider physicists at the Tevatron and CMS is large, and with the Tevatron upgrades complete, and CMS construction finishing, those scientists can contribute vitally to the ILC R&D effort while continuing to produce physics results. To be successful, their performance in each area must be recognized and credited.

- 12) **Create options for Research Associates to participate in both ILC detector R&D and physics analysis on Fermilab or LHC experiments.** While the detector R&D would profit from fully dedicated RA's, the committee feels that ILC-only positions will not attract many candidates yet, and that physics analysis and publication are beneficial for almost all young physicists as they move to the next stage of their career.

- 13) **Use the Guest Scientist program to attract ILC experts** for periods ranging from 6 to 12 months in order to strengthen or activate BI, MDI, and detector R&D groups at Fermilab.

Recommendations by ILC Task Force



- 14) **Expand and enhance the test beam facilities based on available and planned funding, labor, and beams, to leverage the strengths of the existing facilities to meet the ILC detector R&D requirements.** Support this with on-site infrastructure for data acquisition, data storage, data access, and data analysis as well as management oversight and organization, beamline support, and visibility within the laboratory program. Large scale ILC detector beam test activities should be given experiment status and asked to present results at Fermilab Users' and All Experimenters' meetings.

- 15) **Provide office space at a single location in Wilson Hall for laboratory and university scientists working on the ILC.** This could eventually become an ILC center in the laboratory organization. For physics and detector studies it will be helpful to recruit users to assist in planning and management. Being in Wilson Hall provides the additional benefit of allowing close ties with the Theory group and easy participation by physicists working on LHC