## Chapter 3. Fermilab and the ILC

The ILC promises extraordinary power in the study of the Terascale. The annihilation of an electron and its antiparticle, the positron, allows the understanding of collisions to an unparalleled level of detail and precision. As others have comprehensively documented1, the ILC view of the Terascale, complementary to the LHC's perspective, makes the ILC an essential tool for unraveling new phenomena discovered at these extreme energies. It makes the ILC the top priority at Fermilab for a future global facility.



**A superconducting ILC cavity**
*Credit: Fermilab Visual Media Services*

The ILC's opportunities for discovery have motivated the global particle physics community to come together in an effort to design the accelerator and its experimental program. The completion of the *Reference Design Report* in early 2007 and the structuring of a collaborative worldwide R&D program represent successful community efforts. Fermilab has contributed strongly to this effort: the design of the accelerator; the development of superconducting radio-frequency, or SCRF, technology in the U.S.; the design of the physics and experimental program; the site studies necessary for hosting the ILC at or near Fermilab; and the establishment of a test-beam facility for the development of ILC detectors. The ILC and related SCRF efforts at Fermilab make up by far the laboratory's largest future program.

In the next phase of the ILC effort, Fermilab's aim is to be a leader in the global engineering design and in the development of the SCRF technology, steps necessary to reach a decision early in the next decade to build the ILC. Fermilab is building the required infrastructure and test facilities and is coordinating the national efforts in the development of SCRF technology, in collaboration with national and international partners in Europe, Asia and the U.S. To these efforts Fermilab brings strong engineering capability, accelerator physics expertise and technology development skills.

Innovative detectors will be key to exploiting the ILC physics opportunities. In general, an improvement in resolution of both tracking and calorimetric detectors over the present state-of-the-art detectors will allow experimenters to distinguish the signals of new physics from backgrounds much more efficiently. Fermilab has a strong instrumentation development effort in collaboration with laboratories and universities across the world. Just as important for the global ILC effort, Fermilab has developed and will operate a flexible high-energy test beam to provide a variety of particles and energies for testing detector technologies.



**A simulation of the decay of a *Z* + Higgs to four jets in an ILC detector**
*Credit: Norman Graf*

Fermilab's goal is to host the ILC. Geographically and geologically, the site is nearly optimal and could house the central facilities of the ILC, such as damping rings and experimental halls. Two important aspects of Fermilab's activities over the next three years are the study of the site and the design of conventional facilities necessary for the engineering design and working with the neighboring communities on issues associated with hosting the ILC in the region. Fermilab has vigorously collaborated with local residents over the last two years, first with the Community Task Force and currently with the ILC Citizens' Task Force and the Envoy Program. These activities will strengthen over the next three years of engineering design.

Finally, Fermilab is strengthening its engineering capabilities as the laboratory moves toward the design of global accelerators. Unlike the case of the detector community, which is accustomed to building detectors collaboratively across continents, much less collaboration has taken place in the development of global accelerators. The ILC is breaking new ground in this regard, and it is important that Fermilab have the strongest engineering capabilities and systems in place in order to lead in the integration of components produced around the world into a functioning accelerator.

The ILC is key to the future of U.S. particle physics and to Fermilab's future.

1 <http://physics.uoregon.edu/~lc/wwstudy/>