International Linear Collider Detectors

Description: The International Linear Collider (ILC) is a high-energy, high-luminosity electron-positron colliding beam facility. It is a centerpiece in the world roadmap for particle physics. The discovery of a Higgs-like boson at the LHC motivates a strategy to build the machine to operate initially at a center-of-mass energy of about 250 GeV, followed by an increase in steps, to 350 GeV, 500 GeV and eventually to 1 TeV.

Science: The ILC will explore physics at the TeV scale, with capabilities that are unobtainable with any other facility. It will provide measurements complementary to those from the Large Hadron Collider (LHC), emphasizing precision measurements based on a well-controlled initial state in a low background environment. The design of the ILC and its detectors anticipated the discovery of a low-mass Higgs boson and provides an ideal instrument for measuring the full array of Higgs boson properties. These include the Higgs couplings to many fermions including charm, bottom, and top, the Higgs self-coupling, and the Higgs coupling to invisible particles such as dark matter. The ILC will add significantly to the LHC searches for new physics. The ILC has unique capabilities to discover weakly interacting particles that may be hidden in the backgrounds at the LHC. Through precision measurement of two-fermion production, W pair production, and top quark production, the ILC gives access to high mass scales, typically beyond the reach of LHC direct searches. Taken together, data from the ILC and the LHC will advance a deep understanding of electroweak unification. The ILC will thus have a major impact on our knowledge of the TeV scale and our models of higher mass scales.

Collaboration: The ILC physics program has broad international consensus. Over the last decade, extensive international detector R&D programs, in the US, Europe, and Japan, reached major milestones. These R&D programs have been developed largely in support of two complementary full detector designs, ILD and SiD, that will optimize the productivity of the ILC facility. This R&D work has also resulted in important synergistic benefits outside of particle physics, for example, detectors for experiments with X-ray free electron lasers that can provide unique research opportunities for condensed matter physics, chemistry, materials science, and structural biology. Physicists in the US have developed a well-organized effort to prepare for participation in the ILC experiments in collaboration with their international partners.

Cost and Schedule: The ILC is envisioned as a fully international project. Construction of the collider and detectors could begin around 2015 and be commissioned and ready for physics in 10 years. The design and construction of the two detectors would proceed in parallel. Cost and schedules for completion of detector construction have been produced. For example, the SiD detector construction is estimated at about $400M for M&S base and in-house labor, prior to contingency and escalation costs, to be shared by the international partners. The first scientific results could be produced by the mid-2020's.

Science Classification and Readiness: The project is absolutely central for understanding the fundamental constituents of matter and the forces operating among them. It will also be at the frontier of advanced technological development and international cooperation. The ILC detectors have undergone an intense R&D phase leading to designs that are ready for starting the project engineering design now. The technologies are in hand and their ability to meet ILC goals has been verified through hardware studies and detailed simulation. However, detailed engineering remains to be done. Further R&D could lead to cost reductions and performance optimizations. A detailed baseline design report with about 1400 signatories (to date) has been written as a volume of the ILC Technical Design Report.