



U.S. DEPARTMENT OF
ENERGY

Office of
Science

ILC Status in the U.S.

Jim Siegrist

Associate Director

for High Energy Physics

Office of Science, U.S. Department of Energy

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A GLOBAL VISION FOR HEP

A Long-term Strategy to Enable Discovery

- *How do we address the science drivers and enable the next discovery in particle physics?*
- **The Particle Physics Project Prioritization Panel (P5) report is the culmination of years of effort by the U.S. particle physics community**
 - 2012 – 2013: American Physical Society’s Division of Particles and Fields organized a year-long community planning exercise (“Snowmass”)
 - 2013 – 2014: DOE and NSF charged the High Energy Physics Advisory Panel (HEPAP) to convene P5 to develop an updated strategic plan
 - **Plan to be executed over a ten year timescale in the context of a 20-year global vision for the field**
 - In May, 2014, HEPAP unanimously approved a P5 report that presents a strategy that enables discovery and maintains the U.S. position as a global leader in particle physics
- **U.S. particle physics community enthusiastically supports the new plan**
 - 2,331 community members signed a letter of support to DOE and NSF



Particle Physics Is a Global Field

From Chapter 1 of the P5 Report

- “The scientific program required to address all of the most compelling questions of the field is beyond the finances and the technical expertise of any one nation or region.”
- “The capability to address these questions in a comprehensive manner is within reach of a cooperative global program.”
- “The field is at a juncture where the major players each plan to host one of the large projects most needed by the worldwide scientific community.”

Japan
*International
Linear Collider*

Fermilab
*Long-Baseline
Neutrino
Facility*

CERN
*Large
Hadron
Collider*

P5 Report: Scientific Interest in ILC

- The interest expressed in Japan in hosting the International Linear Collider (ILC), a 500 GeV e^+e^- accelerator upgradable to 1 TeV, is an exciting development
 - Following substantial running of the HL-LHC, the cleanliness of the e^+e^- collisions and the nature of particle production at the ILC would result in significantly extended discovery potential
 - Mainly through increased precision of measurements such as for Higgs boson properties
 - The ILC would then follow the HL-LHC as a complementary instrument for performing these studies in a global particle physics program, providing a stream of results exploring three of our [science] Drivers for many decades
 - Use the Higgs boson as a new tool for discovery
 - Identify the new physics of dark matter
 - Explore the unknown: new particles, interactions, and physical principles

P5 Report: Leadership Roles in ILC Design Effort

- Continued U.S. intellectual contributions to the ILC accelerator and detector design are still necessary to enable a site-specific bid proposal
 - Take advantage of U.S. accelerator physics expertise such as:
 - Positron source design
 - Beam delivery
 - Superconducting RF
 - Accelerator-detector interface
- Particle physics groups in the U.S. also led the design of one of the two ILC detector concepts
 - The required capabilities of the detectors to perform precision measurements are challenging and need continued technology development
- Support for both the accelerator and advanced detector development efforts would enhance expertise and ensure a strong position for the U.S. within the ILC global project



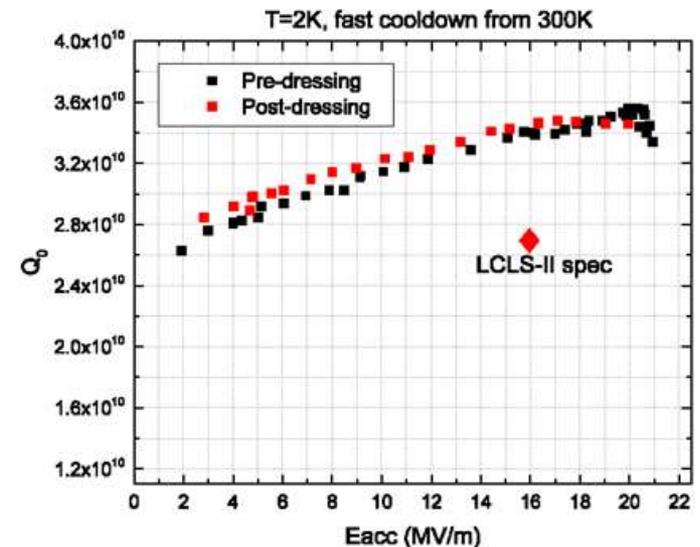
INTERNATIONAL LINEAR COLLIDER

DOE Goals for ILC Work

- Japan has expressed interest in hosting the International Linear Collider (ILC) and is actively working through a decision making process
- As recommended in the P5 strategic plan, DOE plans to provide modest and appropriate support through the period of Japanese decision making
 - U.S. has played key roles in the design of the ILC accelerator, including leadership in the Global Design Effort
 - Continued intellectual contributions to the accelerator and detector design are still necessary to enable a site-specific bid proposal
 - P5 recommended ILC support at some level in all budget Scenarios through a decision point within the next 5 years
- DOE is making an effort to maintain ILC accelerator activities in balance with other programmatic priorities

R&D Highlight: Superconducting RF Cavities

- Fermilab developed Low-Loss Superconducting Radio-Frequency (SRF) Cavities using nitrogen doping process
- Improved technology will benefit future accelerators:
 - Lower loss (higher Q_0) SRF cavities will reduce cryogenic plant capital cost and long-term operating cost of future accelerators
 - LCLS-II will be the first beneficiary



Cavity performance exceeds LCLS-II spec.

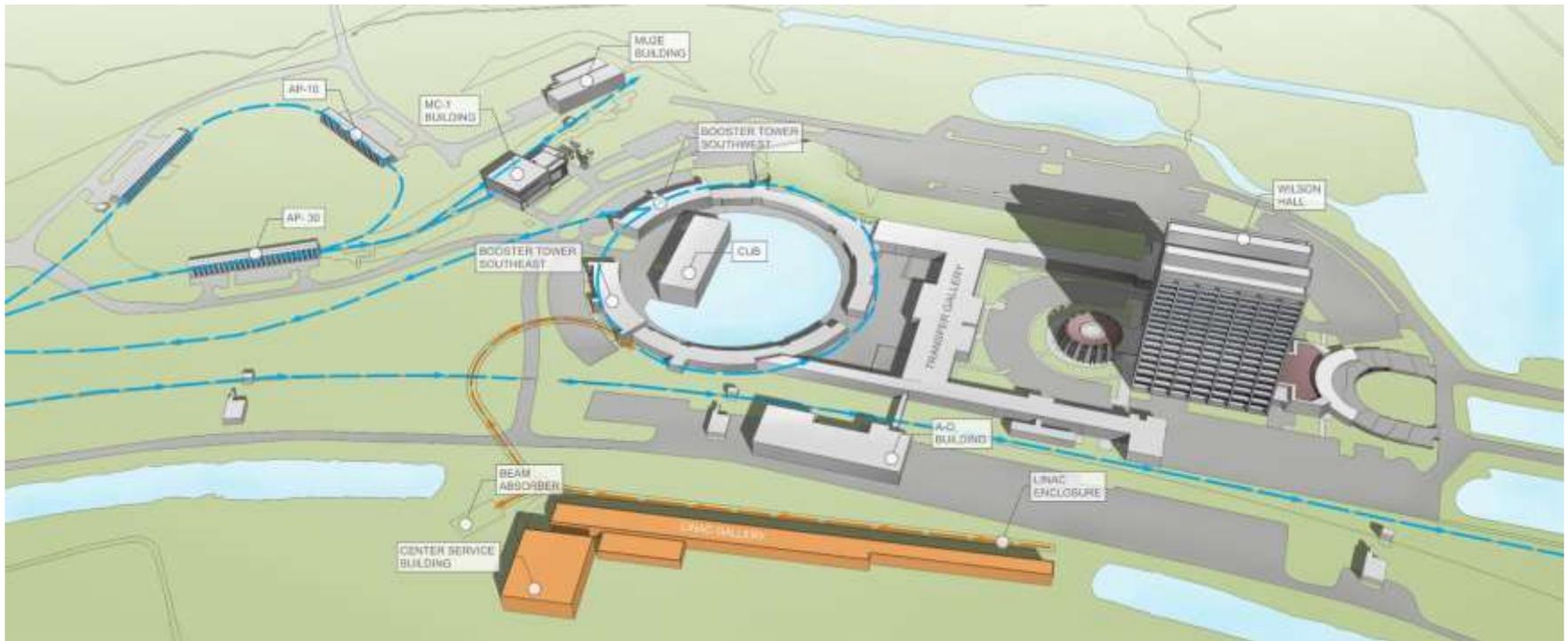
U.S. Investments Towards an ILC: LCLS-II

- Expertise from HEP is being used to fabricate the advanced SRF cavities needed for constructing the Linear Coherent Light Source II, a Basic Energy Science facility being built at SLAC
 - Joint project including FNAL, ANL, JLAB, and LBNL
 - Fermilab will advance SRF capabilities and infrastructure through LCLS-II responsibilities, including:
 - Low-loss cavity development (may lead to cost reductions)
 - Design, fabrication and testing of 17 cryomodules of varying frequencies
 - Design and fabrication of cryogenic distribution system
 - Assistance with linac accelerator physics and LLRF control



Proton Improvement Plan II (PIP-II)

- PIP-II supports longer term physics research goals by providing increased beam power to LBNF while providing a platform for the future
- Infrastructure and workforce development due to LCLS-II work at Fermilab will be leveraged in support of PIP-II, further advancing SRF capabilities



Moving Towards the ILC

- Supporting the Linear Collider Collaboration (LCC) and the common fund is important to ensuring success should the ILC move forward
- The Funding Agencies for Large Colliders (FALC) provides an important mechanism for agency oversight of current directed R&D efforts towards the ILC



LINEAR COLLIDER COLLABORATION





HEP IS GLOBAL

“The capability to address these questions in a comprehensive manner is within reach of a cooperative global program.”