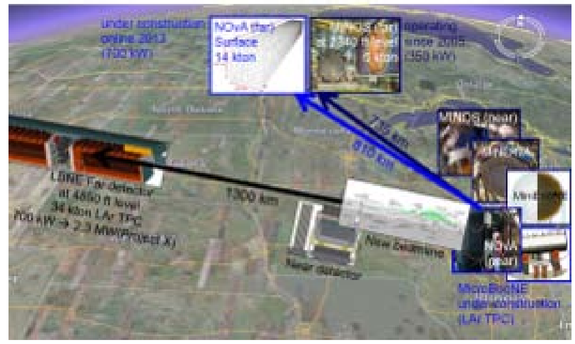
ilc newsline

4 OCTOBER 2012

DIRECTOR'S CORNER

HEPAP discusses reconfigured options for the proposed US long-baseline neutrino experiment

by Barry Barish



The High Energy Physics Advisory Panel met on 27 and 28 August in Rockville, Maryland, US. A central focus of this meeting was the proposed Fermilab Long Baseline Neutrino Experiment. The meeting included presentations on the physics potential, the reconfiguration options in response to Department of Energy guidance, and perspectives from Fermilab, the collaboration and the DOE.

IMAGE OF THE WEEK

Getting it all straight

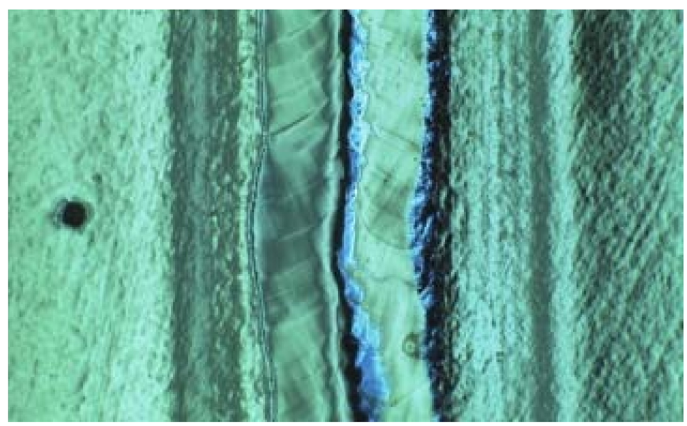
Image: DESY

Linear collider detector experts get it straight - a vision of the XFEL tunnel that is. CLIC detector engineers from CERN visited DESY last week to discuss detector challenges such as earthquake stability, alignment, assembly planning and the construction of the detector's magnet yoke with their colleagues from the ILC's ILD detector. They also visited the tunnel for the European XFEL that is currently being constructed.

LCPEDIA

Quench

by Daisy Yuhas



What is a quench? Everything has a limit—superconducting cavities are no exception. Physicists put voltage in their superconducting cavities to boost the energy of particles. But it’s possible to ask for too much from a cavity. When this happens, the cavity fails: the superconducting material becomes normal-conducting, the voltage collapses and the energy escapes. This is called a quench.

IN THE NEWS

from ***BBC Radio 3***
October 2012
Essential Classics
In World Space Week, Rob Cowan’s guest on Essential Classics is the distinguished British physicist Professor Brian Foster OBE, who is currently European Director of the Global Design Effort for the International Linear Collider at CERN in Switzerland.

from ***PopSci***
1 October 2012
After The LHC: The Next Really Big Experiments In Particle Physics
Sure, the Large Hadron Collider has another two decades of cutting-edge science left in it, but physicists are already designing the high energy experiments of the future.

from ***CERN***
1 October 2012
SCOAP3 Open Access Initiative launched at CERN
Representatives from the science funding agencies and library communities of 29 countries are meeting at CERN[1] today to launch the SCOAP3[2] Open Access initiative.

from ***Saga Shimbun***
26 Sep 2012
商議所連合会、 項目の経済対策を要望
佐賀県商工会議所連合会 会長・井田出海佐賀商議所会頭 は 日、古川康知事に、地域経済対策 項目を要望した。中小企業の金融対策や国際リニアコライダー の誘致、社会資本の整備促進などを求めている。(Saga Prefecture’s Federation of Chamber of Commerce and Industry submitted a 25-item-proposal to revitalize the local economy to Governor Yasushi Furukawa. The proposal include a call for the financial measure for small businesses, to attract International Linear Collider (ILC), and to promote the development of the social infrastructure.)

CALENDAR

UPCOMING EVENTS

2012 International Workshop on Future Linear Colliders (LCWS12)
University of Texas at Arlington, Texas, USA
22- 26 October 2012

Special Linear Collider Event at the 2012 IEEE NSS/MIC
Disney Hotel, Anaheim, California
29- 30 October 2012

2012 IEEE Nuclear Science Symposium and Medical Imaging Conference
Disney Hotel, Anaheim, California
29 October- 03 November 2012

UPCOMING SCHOOLS

The first Asia-Europe-Pacific School of High-Energy Physics (AEPSHEP2012)
Fukuoka, Japan
14- 27 October 2012

CERN Accelerator School: Introduction to Accelerator Physics

University of Granada, Granada, Spain
28 October- 09 November 2012

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1210.0205
Hidden-Sector Higgs Bosons at High-Energy Electron-Positron Colliders

1210.0202
The Physics Case for an e+e- Linear Collider

1210.6545
Modified frequentist determination of confidence intervals for Poisson distribution

1209.6401
$WWZ/γ$ production in large extra dimensions model at LHC and ILC

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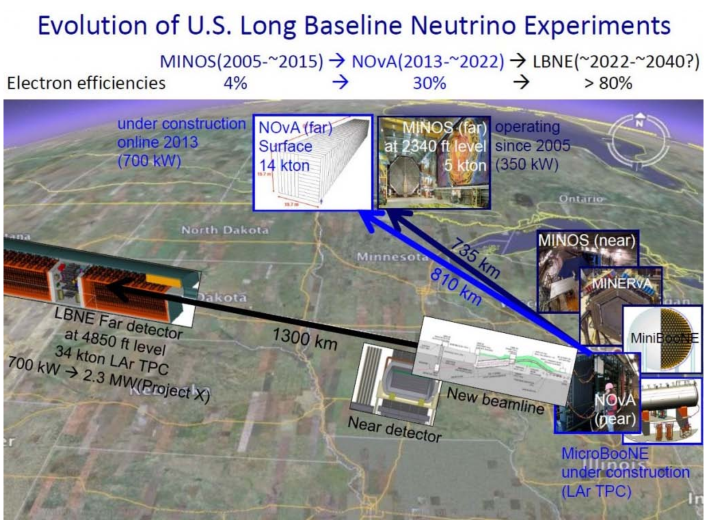
HEPAP discusses reconfigured options for the proposed US long-baseline neutrino experiment

Barry Barish | 4 October 2012



A long-range view of the evolution of intensity frontier neutrino facilities from Fermilab

The future of the US high-energy physics (HEP) programme depends on having both viable collaborations on the leading worldwide projects, especially the LHC, and developing, in parallel, important new forefront facilities in the US. Fermilab and the US neutrino community are proposing to concentrate on the intensity frontier by developing next-generation long-baseline neutrino experiments (LBNE) that will be capable of addressing the hierarchy problem, CP violation in the neutrino sector and other forefront physics. To accomplish these goals, Fermilab and the collaboration made a proposal to the Department of Energy (DOE) to build a new high-intensity neutrino beamline to the Homestake gold mine in South Dakota and developing an underground facility capable of housing a large-scale neutrino detector.

Young-Kee Kim, Deputy Director of Fermilab

Upon evaluating this proposal, the DOE determined that the projected HEP funding levels for the coming years would not be sufficient to accommodate the LBNE programme the way it was originally proposed. In a letter dated 19 March 2012, Bill Brinkman, Director of the DOE Office of Science, stated that the DOE "cannot support the LBNE project as presently configured," and he went on to say that the peak costs "cannot be accommodated in the current budget climate or that projected for the next decade." Brinkman concluded by inviting Fermilab "to lead the development of an affordable and phased approach that will enable important science results at each phase." Separately, an additional guideline was transmitted by DOE that the costs of the first phase should be reduced to ~ $700-800 million.

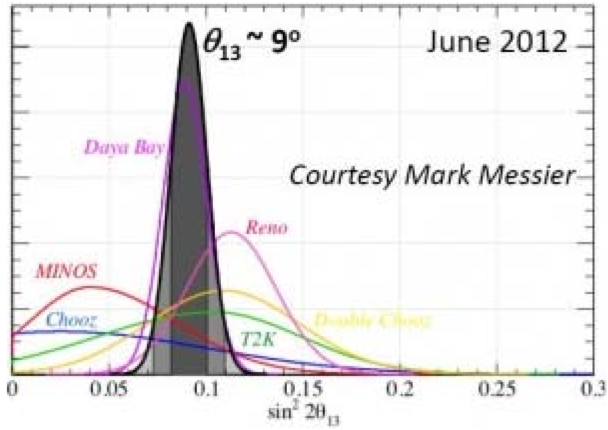
This stimulated a series of workshops and design studies, and as a result, several options for reconfiguring LBNE have emerged that satisfy the guidelines and have different strengths and weaknesses. Three options were presented to HEPAP by Young-Kee Kim, deputy director of Fermilab. One key question comes down to whether to use the existing NuMI beamline, saving the cost of a new beamline but limiting future physics reach, or whether to develop a new beamline to Homestake, reducing the resources to invest in an initial detector but preserving the long-term physics potential.

After considering the physics potential in both the short term and longer term, as well as engineering and costs, the three options that have been developed and compared are:

- *Using the existing NuMI beamline in the low-energy configuration with a 30-kiloton Liquid-Argon-TPC surface detector 14 mrad off-axis at Ash River, 810 kilometres from Fermilab. ($684M)*

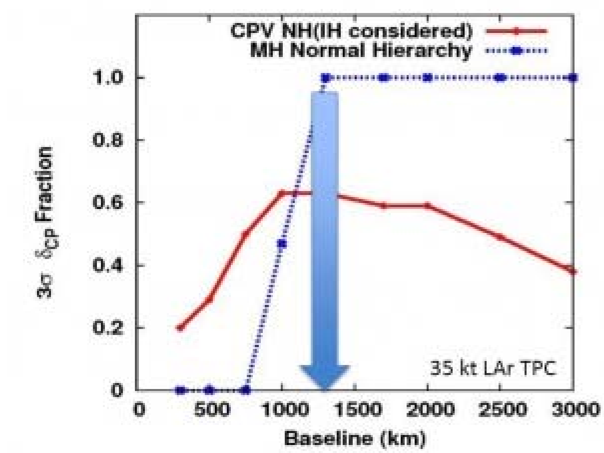
- *Using the existing NuMI beamline in the low-energy configuration with a 15-kiloton Liquid-Argon-TPC underground (at the 700-metre level) detector on-axis at the Soudan Lab, 735 kilometres from Fermilab. ($675M)*
- *Constructing a new low-energy LBNE beamline with a 10-kiloton Liquid-Argon-TPC surface detector on-axis at Homestake, 1,300 kilometres from Fermilab. ($789M)*

Young-Kee Kim concluded by stating that "while each phase-1 option is more sensitive than the others in some particular physics domain, the Steering Committee strongly favored the Homestake option (a new beamline and a 10-kiloton LAr-TPC detector on the surface)." She emphasised that this option has both significant physics potential and does not compromise the potential to reach the full goals of the original LBNE at a later time. She mentioned that the detector for the Homestake option could be put underground if an additional ~ $135M will be forthcoming through international collaboration.



The recently measured large value of the neutrino oscillation parameter θ_{13} enhances the prospects for future long baseline neutrino experiments (Image: Y.K. Kim HEPAP presentation)

Miland Diwan, Brookhaven Laboratory, speaking on behalf of the LBNE collaboration, endorsed this approach and emphasized and stressed that it is very well matched to the ultimate long-term goal of observing CP violation for neutrinos. Jim Siegrist, DOE associate director for HEP, noted the reconfiguration plans for LBNE in his opening remarks, and said the goal is now to complete CD-1 approval this year. (CD-1 is the next DOE milestone toward an LBNE construction project). Both Diwan and Siegrist noted that international collaboration will be sought, in order to strengthen the effort, by enabling the neutrino detector to be mounted underground, and/or in addition, could make it possible to add a forward detector in the initial phase.



The 1300-kilometre baseline to Homestake is at a near-optimal distance from Fermilab, considering value of θ_{13}. (Image: Y.K. Kim HEPAP presentation)

The coming year will be critical in determining the priorities of the worldwide high energy physics programme for the next decade. The LHC discovery of a Higgs-like particle, an updated strategic plan for European high energy physics, a new roadmap for KEK, Super B-factory projects underway in Japan and Italy, new projects like LBNE being developed, and upgrades to LHC are all being considered. There is indeed a rich set of opportunities available for particle physics in the future.

The missing piece for the future high-energy programme is a high-energy lepton collider to complement LHC in exploiting the energy frontier. We are completing the technical design of the ILC, new exciting results are emerging from LHC, a new linear collider organisation is being created, and there is beginning to be interest in hosting such a machine. The exciting LHC results on a Higgs-like particle at 125 GeV have stimulated discussion of staged approach to the ILC, beginning with a Higgs factory at an early date and then increasing the energy to fully exploit the TeV energy scale.

FUTURE | HEPAP | LONG-BASELINE | NEUTRINOS | UNITED STATES

IMAGE OF THE WEEK

Getting it all straight

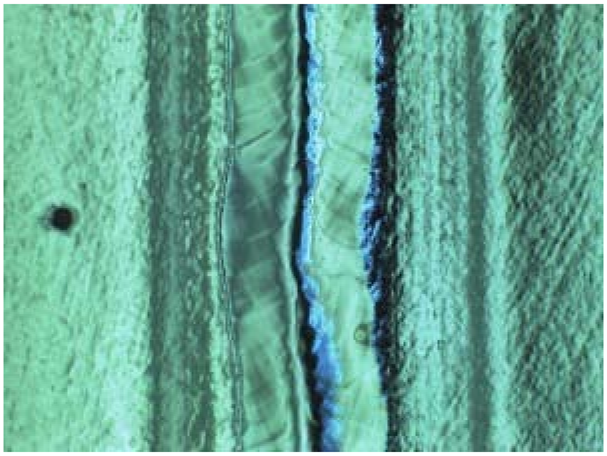
Image: DESY | 4 October 2012

Linear collider detector experts get it straight – a vision of the XFEL tunnel that is. CLIC detector engineers from CERN visited DESY last week to discuss detector challenges such as earthquake stability, alignment, assembly planning and the construction of the detector's magnet yoke with their colleagues from the ILC's ILD detector. They also visited the tunnel for the European XFEL that is currently being constructed. From left to right: Klaus Sinram (DESY), Norbert Meyners (DESY), Hubert Gerwig (CERN), Andrea Gaddi (CERN), Fernando Ramos (CERN), Robert Volkenborn, Uwe Schneekloth, Richard Stromhagen (all DESY).

CLIC | DETECTOR R&D | EUROPEAN XFEL | ILC | TUNNEL

Quench

Daisy Yuhas | 4 October 2012



This 'crater' on the left hand side of the picture would almost certainly lead to a quench very quickly. The 'Kyoto camera' spotted this spot on a cavity's interior surface. It's a remnant from the production process that couldn't be eliminated during surface treatment, which led to the chemicals reacting with the surface in a different way than normal and causing the crater. In fact the cavity quenches at 13 MV/m.

Everything has a limit—superconducting cavities are no exception. Physicists put voltage in their superconducting cavities to boost the energy of particles. But it's possible to ask for too much from a cavity. When this happens, the cavity fails: the superconducting material becomes normal conducting, the voltage collapses and the energy escapes. This is called a quench.

Even if a cavity is flawless, it will quench at a certain point. This limit is based on the material properties of the cavity. It's believed to be the point at which the strength of the magnetic fields produced by the electric current is simply too much for the cavity to handle. As a result, the metal changes phase from super- to normal-conducting. To get the most from their cavities, physicists try to get as close to this limit as possible without quenching. "We rarely reach this theoretical limit," says Jefferson Lab scientist Rongli Geng. "Although we're getting close."

More often quenches occur because of tiny defects that become part of the cavity's surface during handling. One is the inclusion of normal-conducting material, such as a microscopic speck of copper or iron. These areas cannot conduct as efficiently as the superconducting niobium, and so they will release energy as heat. This little swell of heat can spread, causing other areas to overheat and lose their superconducting power. (Remember, superconducting material needs to be kept very cool in order to carry current efficiently.) To fix this, scientists must try to improve the conducting powers of the surrounding niobium. This way when a problem spot's temperature begins to rise, the surrounding metal can carry away the excess heat.

A second problem comes from imperfections in the cavity's surface such as a hole or bump. Once again this spot creates a heat pulse. In this case the defect disrupts the current's flow, like water encountering a rock in a river, causing the current to change directions and build up extra energy that is released as heat. Luckily, with intensive polishing it's possible to reduce these surface defects, and precise inspection methods can identify possible quench inducers on a cavity surface before they become a problem.

Because cavities differ from another, physicists need to characterise each to understand how and when it will quench. Some, for example, might quench at 20 megavolts per metre (MV/m), while others could reach an impressive 40 MV/m. Ultimately, ILC scientists aim to have more than 90 percent of the collider's cavities capable of supplying 35 MV/m of acceleration to particles.

CAVITY | QUENCH | SUPERCONDUCTING RF