NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

FEATURE

ILC Ink

A summer intern at Jefferson Laboratory is excited about the ILC – and he's got the tattoo to prove it.

by Julianne Wyrick

How many people do you know with ILC tattoos? We know one, and he interned with Jefferson Lab's Electron Gun Group this summer.

FEATURE

Common ground in ILC and CLIC detector concepts

by Daisy Yuhas

The Compact Linear Collider and International Linear Collider will accelerate particles and create collisions in different ways. Nonetheless, the detector concepts under development share many commonalities.

DIRECTOR'S CORNER

Strategy for linear colliders

by Steinar Stapnes

It has been another summer with discussions about future strategies for international particle physics. After work on the European Strategy last summer, the US strategy is on the table this summer. For the linear collider work the strategy processes have been positive, reports Steinar Stapnes, Associate Director for CLIC in the Linear Collider Collaboration. Researchers are closely following decisions being made in Japan.

VIDEO OF THE WEEK

Japanese candidate site for ILC will be announced on 23 August

by Rika Takahashi

The site evaluation committee of Japan, set up under the Japan ILC Strategy Council, will hold a press conference on 23 August 2013, at 9:30 a.m. (Japan Standard Time) to announce the site selected as candidate site for the ILC. The press conference will be streamed live.

IN THE NEWS

from *Jiji press*
16 August 2013
東北か九州か、　日発表　次世代加速器の建設候補地
「国際リニアコライダー　　」について、岩手・宮城両県の北上山地と、福岡・佐賀両県の脊振山地のどちらが建設候補地となるか、　日午前に東京大で発表されることになった。(The choice for the ILC construction site in Japan between Kitakami and Sefuri will be announced on 23 August at the University of Tokyo)

from *SLAC Today*
16 August 2013
From the Director of PPA: Snowmass and Future Directions for Particle Physics
My assessment is that Snowmass has been very successful in laying the foundation for the next phase of budget-constrained planning for the U.S. high energy physics program. It is anticipated that a subpanel of the High Energy Physics Advisory Panel (HEPAP) – the Particle Physics Project Prioritization Panel, or P5 – will be launched in September by the Department of Energy and the National Science Foundation, with a charge to provide a long-range strategy for high energy physics under various budget scenarios. Steve Ritz from UC-Santa Cruz has already been designated chair of the subpanel and the full membership of P5 will be finalized over the coming weeks.

from *Nikkei*
12 August 2013
宇宙の起源探る次世代加速器、財源確保焦点に
「国際リニアコライダー」　　の国内誘致の是非を検討してきた日本学術会議の有識者会議は12日、　　年をかけて計画を精査し判断すべきだとの意見をまとめた。文部科学省は今回の意見を参考に総合判断するが、誘致に前向きな姿勢を崩していない。(The committee under the Science Council of Japan, which discussed the significance of the ILC, framed their response on 12 August that the project should be examined further over few years. The Ministry of Science, Education, Sports and Technology will take this recommendation into account, but retains the positive attitude toward invitation)

from *NPR*
12 August 2013
Particle Physicists Want A New Collider To Study The Higgs
High on the agenda is a new collider to study the newly found Higgs particle. The Higgs was discovered at the Large Hadron Collider, a 17-mile underground ring that smashes protons together with an incredible amount of energy. The LHC is the perfect machine for finding the Higgs because when protons crash into each other, they create sprays of different particles, including the elusive Higgs.

But to study the Higgs in depth — and to produce only Higgs — researchers need to smash electrons and anti-electrons together, and this can only happen inside a new kind of collider.

from *Kahoku Shinpo*
09 August 2013

政府の　　誘致表明「秋の臨時国会以降に」文科相

下村博文文部科学相は　日、閣議後の記者会見で、超大型加速器「国際リニアコライダー　　」の誘致に関する政府の意思表明が、予定していた秋の臨時国会よりさらに遅れるとの見通しを示した。(Science minister of Japan, Hakubun Shimomura said on 8 August that government's statement on the ILC invitation will be postponed. He said earlier that government will make statement in the extraordinary Diet session this fall.)

CALENDAR

Upcoming events

POSIPOL 2013
Argonne National Lab
04- 06 September 2013

LC13 Workshop
Villazzano (Trento), Italy
16- 20 September 2013

16th International Conference on RF Superconductivity (SRF 2013)
Paris, France
22- 27 September 2013

ILD meeting
Cracow, Poland
24- 26 September 2013

Linear Collider Forum 2013
DESY, Hamburg, Germany
09- 11 October 2013

SiD Workshop
SLAC, USA
14- 16 October 2013

Upcoming schools

Linear Collider Physics School 2013
DESY, Hamburg
07- 09 October 2013

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1308.3726
Luminosity Upgrades for ILC

1308.3652
Top quark anomalous couplings in the two-Higgs-doublet models

1308.3487
Projections for Two Higgs Doublet Models at the LHC and ILC: A Snowmass White Paper

1308.3047
Perspectives of Micro-Pattern Gaseous Detector Technologies for Future Physics Projects

1308.2738
Diagnosis of a New Neutral Gauge Boson at the LHC and ILC for Snowmass 2013

1308.2674
Higgs CP properties using the tau decay modes at the ILC

1308.2325
CESR Test Accelerator

1308.1636
Methods and Results for Standard Model Event Generation at $\sqrt{s}$ = 14 TeV, 33 TeV and 100 TeV Proton Colliders (A Snowmass Whitepaper)

1308.1461
Simplified SUSY at the ILC

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FEATURE

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Julianne Wyrick | 22 August 2013

Gabriel Palacios shows off his ILC tattoo at his Jefferson Lab office. Photo: Matt Poelker

From a wave function equation to a CERN bubble chamber image, the tattoos physics enthusiasts sport are wide-ranging. But is the ILC represented? Thanks to Gabriel Palacios, a physics engineering student who interned at Jefferson Lab (US) this summer, it is.

Palacios, who currently studies at Mexico City's Metropolitan Autonomous University, had the ILC accelerator design inked on his right arm this summer, after being selected to intern with the Electron Gun Group at Jefferson Laboratory, which is working on an electron gun design for the future ILC.

For several years, Palacios had been thinking about getting a celebratory tattoo, looking ahead to earning his bachelor's degree, which he will receive in a few months. But it was only when he found about his ILC-related internship that he decided on the ILC design.

"One of my main goals since I started studying physics was working at a collider," Palacios said. "Being here at Jefferson Lab was achieving just the first stage of that dream."

The dream began in high school with a physics teacher who fascinated Palacios with stories of colliders, an unheard-of topic in his small Mexican hometown of 50,000.

"He was talking magic to us," Palacios said.

Years later, in December 2012, Palacios applied to a summer programme hosted by the Mexican Physical Society's Division of Particles and Fields. A committee of professors and researchers selected Palacios, along with four other physics undergraduates from across Mexico, to intern at an international high-energy physics lab. For Palacios, that lab was Jefferson Lab in Newport News, Virginia.

A closer look at Palacios' ILC tattoo. Photo courtesy of Gabriel Palacios

"He impressed everyone with his knowledge, his motivation, his open and confident personality," said Carlos Hernandez-Garcia, a scientist for the Free Electron Laser Program at Jefferson Lab who helped choose the five students.

At Jefferson Lab, Palacios worked with the Electron Gun Group, a team whose job is to generate the electron beam for the lab's particle

accelerator, the Continuous Electron Beam Accelerator Facility (CEBAF). Generating an electron beam requires an electron gun. In the gun, a laser beam shines on a photocathode, releasing electrons that are then grouped together and accelerated using electric fields. Palacios' project involved evaluating new photocathodes that could be used for CEBAF's electron gun or for the group's ILC's electron gun design.

"He's a really good worker and so enthusiastic, it doesn't really surprise me (that he got an ILC tattoo)," said Matt Poelker, head of the Electron Gun Group at Jefferson Lab.

Now that his ten weeks at Jefferson Lab are complete, Palacios plans to finish his bachelor's degree and then attend graduate school. Working on an ILC-related project in the future would be the next phase of his original dream.

"It's about participating in this amazing project that gets people from around the world together to study something that is going to give us a huge clue of what the universe is about," Palacios said.

As for future tattoos, Palacios said a particle collision is next on his list—the burst of energy located squarely in the middle of his chest.

CEBAF | ELECTRON GUN | ILC DESIGN | JEFFERSON LAB

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FEATURE

Common ground in ILC and CLIC detector concepts

Daisy Yuhas | 22 August 2013

The Compact Linear Collider and International Linear Collider will accelerate particles and create collisions in different ways. Nonetheless, the detector concepts under development share many commonalities.

Under scrutiny in the DESY test beam with the help of the beam telescope: timepix chips.

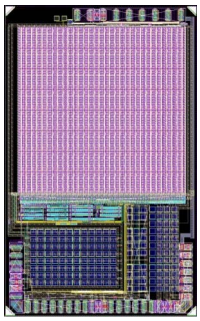
CERN physicist Dominik Dannheim explains that CLIC detector plans are adaptations of the ILC detector designs with a few select modifications. “When we started several years ago, we did not want to reinvent the wheel,” says Dannheim. “The approved ILC detector concepts served as an excellent starting point for our designs.”

Essential differences

Both CLIC and ILC scientists foresee general-purpose detectors that make measurements with exquisite precision. These colliders, however, have very different operating parameters, which will have important consequences for the various detector components. The ILC’s collision energy is set at 500 GeV (with option to upgrade to 1 TeV), while CLIC will collide at up to 3 TeV. And the bunch structure is very different, too. The main difference is in the timing of the collisions. At the ILC electrons and positrons collide in bunch crossings spread out over bunch trains of almost a millisecond. At CLIC these bunch trains last for only 156 nanoseconds. So CLIC detectors will have a tougher job disentangling the rare physics events from the collision background.

The higher energy will give CLIC a greater physics reach, but will also create more unwanted background events with less time to disentangle background from more interesting phenomena. “Simulations have shown that a time resolution at the nanosecond level is needed for most sub-detectors at CLIC,” says Dannheim. “In this respect they will be similar to the ones currently in operation at the LHC, yet aiming for much higher granularity and measurement precision.”

Vertex detector



The detector component closest to the interaction point, where collisions occur, is the vertex detector. ILC concepts place a paper-thin pixel detector near the interaction point to improve the resolution of short-lived particles created in collisions.

The harsher background conditions at CLIC required a redesign of the inner detectors, which included moving the vertex detector further away from the interaction point. CLIC scientists are developing a different type of pixel detector for this region, where thin sensors are coupled to dedicated ultra-fast low-power readout chips (called CLICpix). This technology will help limit the number of overlapping background particles that inevitably blur the result. First prototypes of the newly developed CLICpix readout chip and of 50-µm-thin sensors have recently been

produced, marking important milestones for the CLIC vertex detector project. The ultra-thin sensors will be under scrutiny in the DESY test beam telescope in the next two weeks.

Two trackers

There are two detector concepts under consideration for the ILC, the International Linear Detector (ILD) and the Silicon Detector (SiD). CLIC scientists are also evaluating and modifying both ILD and SiD concepts.

In the ILD concept, a large chamber of argon gas –called a time projection chamber– will serve as the main tracker. When charged particles pass through, the surrounding gas ionises. The ionisation charge then drifts in an electric field to the chamber's edge where it is amplified and recorded. This form of tracking offers more detail in seeing the full path of particles and could be advantageous in identifying long-lived particles that decay leaving a V-shape pattern. However, a time projection chamber takes a long time to receive a signal and the chamber itself requires more than 40 cubic metres of space.

The SiD tracker has a different setup. In this concept, a silicon tracker with five layers of silicon sensors offers a good resolution while interacting minimally with particles. This technology also offers a much faster response time, even if it creates a less detailed picture of certain particle decays. Options are open for a future CLIC detector.

Imaging calorimeters

Perhaps the most exciting element of both CLIC and ILC detector designs is the use of high-resolution calorimeters. The calorimeters will boast an unprecedented number of channels, allowing physicists to identify particle showers with greater accuracy than ever before.

The prototype of the tungsten digital hadronic calorimeter for CLIC.

"These are imaging calorimeters," says Argonne scientist Marcel Demarteau. "They can take pictures layer by layer." This kind of calorimetry is the current design of choice for many future detectors at electron-positron colliders, enabled by advances in technology that allow embedded integrated electronics and computing to handle the massive flow of data from millions of channels.

While sharing most parts of the calorimeter concepts with the ILC detectors, CLIC requires important changes to the hadronic calorimeters. Specifically, because of the high energy particles created at CLIC, a very dense material will be needed to efficiently absorb these particles. CLIC scientists are currently investigating tungsten, more than twice as dense as the commonly used steel, as an absorber material.

Overall, the ILC and CLIC detector concepts share many of the same technological challenges. Dannheim points out that scientists involved with CLIC and ILC are collaborating in many areas, such as simulation and reconstruction software, calorimeter development and mechanical integration. "There are many opportunities for synergy," Dannheim says. "Though some of the technical challenges of the two projects are different, we all share the excitement of pushing the limits of detector technology, developing devices that can make a contribution to the future of particle physics."

CALORIMETER | CLIC | DETECTOR R&D | TEST BEAM | TRACKER | VERTEX DETECTOR

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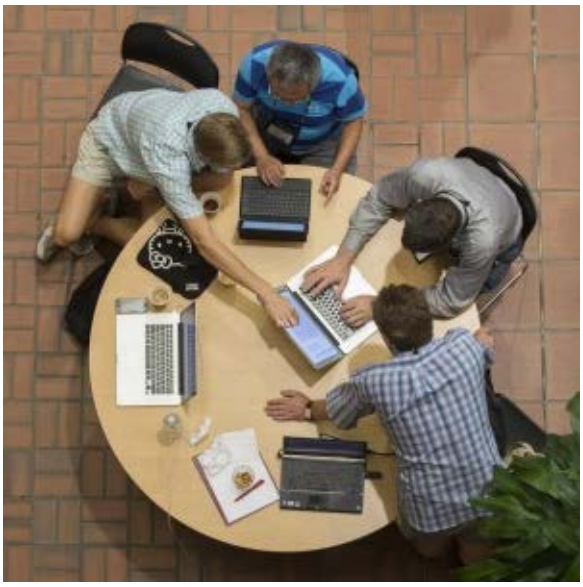
DIRECTOR'S CORNER

Strategy for linear colliders

Steinar Stapnes | 22 August 2013



Discussions during the recent Snowmass meeting in Minneapolis. Image: Reidar Hahn, Fermilab.

After last summer's preparation for the European Strategy process – in the meantime successfully concluded into an approved document by the CERN Council – this summer has been dedicated to the Snowmass process in the US, as well as hectic ILC preparations and discussions in Japan. In all regions linear collider projects are high on the priority lists, and a lot of work of the linear collider community has gone into preparing input documents for these processes. No major surprises seem to emerge – as far as I can tell. The physics motivation for a linear collider based on ILC technology primarily aimed at mapping out the Higgs sector, and the further physics potential of a higher energy machine using CLIC technology remain convincing.

The same can be said for the full exploitation of the LHC including luminosity upgrades in the future. It may seem obvious, but it should be reiterated as it is a large and demanding programme on its own, and most of us hope that more than the Higgs will ultimately emerge from the LHC programme and that we can finally and truly move beyond the Standard Model.

Even though most of the LCC directorate's attention is firmly on the ongoing political and site selection process in Japan related to ILC, I will concentrate on some of the discussions and developments that have followed the European Strategy process. Already in May this year the CERN Council approved the 2014 CERN budget, the first budget after the approval of the European Strategy. Can we see an implementation taking shape? After all strategy papers are fine but real action is more convincing.

The LHC luminosity upgrade programme is the major next CERN construction project and the first priority item in the European Strategy. A shift in gear is visible in the planning and preparation – and budget allocations. Discussions with funding agencies concerning their planning and contributions are underway. The long shutdown at CERN, a pre-requisite to any upgrades, is progressing according to schedule with an impressive effort.

The second and third items in the Strategy are the most relevant for the linear collider activities. The energy frontier options with hadrons and leptons, either a higher-energy LHC in the existing tunnel or in a new 80-100 kilometer tunnel, or a linear collider based on CLIC technology, are supposed to be developed as options towards the next European Strategy update. This requires that one can compare performance, parameters, costs and schedules of these machines, and also their capabilities for various types of beyond-the-Standard-Model physics. Such common efforts are just starting up and my hope is that we can see them becoming structured over the next half a year or so. For the CLIC collaboration plans are made for next period (2013-2018) that fit into the new CERN resource planning, while the high-energy hadron options are at an earlier stage of planning in most areas. However, since the LHC is already running very well

there are many aspects of the energy-upgrade machine that can be extrapolated from the current machine. Common physics studies will be important but have yet to be organised in a serious way.

For the ILC the European Strategy is positive, welcoming further development in Japan. We are closely following the exiting processes in Japan and there will clearly be more open discussions about how the European region could participate in such a project, including the near-future developments if Japan decides to put more resources into the project as a result of the ongoing national discussions. There is still a “wait-and-see” attitude but the European communities are looking into opportunities for future support. For the common work between CLIC and ILC more firm plans are being drawn up for cooperation in certain areas and I hope that by the end of the year some activities will become true linear collider activities where the same people cover specific studies for both machines. There are good candidates among the areas where there are already combined ILC-CLIC working groups, and where common work is already ongoing.

So overall we are slowly moving forward. For the linear collider community these strategy processes have been mostly positive. For CLIC the framework for project developments is relatively well defined in the next period. For ILC the developments in Japan are evolving quickly and we are all hoping that a clear road ahead towards implementation will emerge during the second half of this year.

CLIC | EUROPEAN STRATEGY FOR PARTICLE PHYSICS | ILC | JAPAN | SNOWMASS

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VIDEO OF THE WEEK

Japanese candidate site for ILC will be announced on 23 August

Rika Takahashi | 22 August 2013

Follow the selection of the Japanese candidate site live.

The site evaluation committee of Japan, set up under the Japan ILC Strategy Council, will hold a press conference on 23 August 2013, at 9:30 a.m. Japan Standard Time (2.30 a.m. Central Europe and 7:30 p.m. Chicago) to announce the site selected as candidate site for the ILC. The ILC Strategy Council is an organisation established in 2012 by leading Japanese scientists to promote the linear collider project as a pan-Japanese community effort.

A search for an appropriate candidate site for ILC construction in Japan started in the late 90s. In 2003, scientists identified about a dozen possible construction sites, which were then narrowed down to two in 2010: one site in Kitakami (Iwate and Miyagi prefectures) and one in Sefuri (Saga and Fukuoka prefectures). The committee has now made the final choice from these two remaining sites in order to focus the design efforts and will announce their choice tomorrow. The evaluation was based on geology and other technical aspects, as well as socio-environmental issues and infrastructures.

The speakers at the press conference are Kiyotomo Kawagoe (Co-chair, Site Evaluation Committee of Japan), Hitoshi Yamamoto (Co-chair, Site Evaluation Committee of Japan), Lyn Evans (Director, Linear Collider Collaboration) by remote connection and Mike Harrison (ILC Director, Linear Collider Collaboration).

The following experts also present on site for questions:

Sachio Komamiya (Chair, Linear Collider Board), Satoru Yamashita (Chair, ILC Strategy Council), Hitoshi Murayama (Deputy Director, Linear Collider Collaboration) and Brian Foster (Regional Director for Europe in the Linear Collider Collaboration).

Live web streaming of the press conference will be available here:

www.ustream.tv/channel/ilc-eng

Consecutive interpretation will be provided.

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