

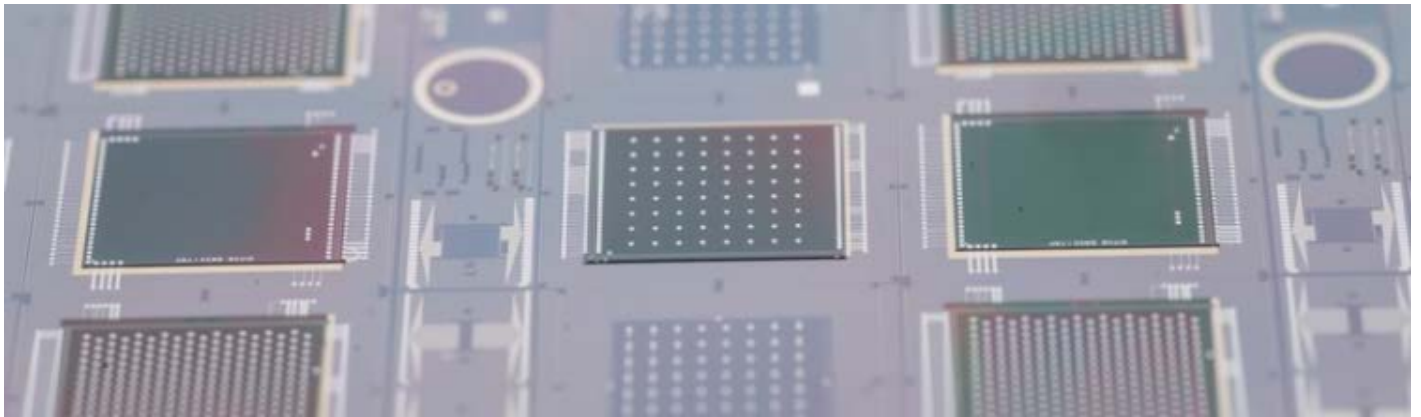
# NEWSLINE

THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

## AROUND THE WORLD

### Vertical wonder

by Joykrit Mitra



US scientists, with assistance from private industry have designed the newest iteration of a special chip with a 3D integrated circuit, for the ILC's vertex detector that will help measure properties of incoming particles at a higher resolution than previously achievable. The ILC is now another step closer to being an engineering reality.

## FEATURE

### CERN-KEK offices established



CERN and the Japanese high-energy accelerator research laboratory KEK have a long history of collaboration. An agreement signed at KEK on 21 November puts this on even firmer ground: both labs will establish CERN-KEK offices to increase the collaborative effort on accelerator R&D and construction projects of mutual interest.

## DIRECTOR'S CORNER

### A successful Linear Collider workshop in Belgrade - and planning the main LC workshops in 2015

by Steinar Stapnes



After a successful linear collider workshop last month, which saw progress in site-specific studies for the ILC and detector optimisation for both ILC and CLIC detectors (and more), Steinar Stapnes is looking ahead to next year's workshops in

Japan and Canada.

## IMAGE OF THE WEEK

### Summer students reunite at test beam

by Barbara Warmbein



Four consecutive generations of former DESY summer students had an unplanned reunion at CERN recently: they were all around for the test of the prototype of the analogue hadronic calorimeter for the ILC's ILD detector. They had all worked on this project as summer students.

## VIDEO OF THE WEEK

### They want the ILC! #mylinearcollider

IFIC Spanish group in Valencia shares its support to the ILC project

Video: ©2014 IFIC



The particle physics group at IFIC in Valencia, Spain, shares its enthusiasm for the ILC. You too can contribute by participating in the #mylinearcollider video campaign.

## IN THE NEWS

from *Sankei news*

20 November 2014

東北に加速器施設「[ILC](#)」を産業・雇用創出で復興期待

岩手県の北上山地に次世代加速器、国際リニアコライダー

の施設を誘致する計画が熱を帯びている。合言葉は「東北を科学の拠点に」。民間団体の援軍も現れ、誘致を呼びかけている。(The expectation to build the ILC, the next generation accelerator, in Kitakami is raising high. The catchphrase is "Make the Tohoku into a science hub." The supporters from public are calling for the invitation of the ILC.)

from *CNET*

19 November 2014

GPS joins the hunt for dark matter in time-warping cosmic kinks

Timey-wimey, wibbly-wobbly: scientists reckon satellites and dead stars could hold the key to the mystery of dark matter.

from *Iwate Nippo*

17 November 2014

ILC、政府の対応遅れ懸念 CERN所長・ホイヤー氏に聞く

のロルフ・ホイヤー所長は岩手日報社の単独インタビューに対し「長い間、日本政府の決断がなされない場合、このプロジェクトはゼロになる」と対応の遅れに強い懸念を表した。(CERN's Director General Rolf Heuer said "If the Japanese government takes too long to make decision on the ILC, all bets may be off," expressing concern over the delay of the Japanese government's reaction.)

from *Videnskab*

15 November 2014

Ivy League – nobelpriser og selvmordsnet

Det er også Cornell-forskere der byggede Arecibo Observatoriet, der blandt andet leder efter liv i rummet, og flere af Mars roverne. De var de første til at lave crashtest med biler, og de er involveret i at designe LHC'ens kollega International Linear Collider (ILC).

from *Iwate Nippo*

8 November 2014

[超党派議連、議員外交を強化 まず日米、欧州3カ国とも](#)

超党派の議員によるリニアコライダー国際研究所建設推進議員連盟 河村建夫会長 の総会は 日、国会内で開かれ、国際リニアコライダー 誘致に向けて日米などの議員外交を強化することを確認した。早ければ来年 1 月にも日米の議員が話し合う場を設ける方針。議連として欧州のフランス、英国、ドイツの 3カ国とも個別に協議を始める考えで、国際的な資金分担を後押ししていく。(The general meeting of the Federation of Diet Members for Promotion of the ILC in Japan was held on 7 November, cognizing that they will bolster up the diplomatic activities by Diet members toward the realisation of the ILC. They will set up the meeting with US congress mans as early as January next year. They also will start bi-lateral negotiations between France, UK, and Germany, to push the discussion on international sharing.)

## ANNOUNCEMENTS

### Early edition of LC NewsLine this week

Because of the Thanksgiving holiday in the United States this Thursday, we are publishing an early edition of *LC NewsLine* this week. The publication will return to its normal schedule in December.

## CALENDAR

### Upcoming events

[8th Annual Helmholtz Alliance Workshop on "Physics at the Terascale"](#)

DESY, Hamburg, Germany  
01- 03 December 2014

[View complete calendar](#)

## PREPRINTS

### ARXIV PREPRINTS

[1411.6556](#)

Exotic leptons at future linear colliders

[1411.5800](#)

Collider phenomenology of the 4D-composite Higgs model

[1411.4924](#)

ECFA Detector R&D Panel, Review Report

[1411.4874](#)

A Multi-MW Proton/Electron Linac at KEK

[1411.4709](#)

Terahertz-driven linear electron acceleration

[1411.4431](#)

Performance of fully instrumented detector planes of the forward calorimeter of a Linear Collider detector

[1411.3295](#)

Beam Dump problem and Neutrino Factory Based on a e+e- Linear Collider

[1411.2974](#)

A Holographic Twin Higgs Model

[1411.2920](#)

Investigation of Neutralino Pair Production in Photon-Photon Collider at ILC

[1411.2840](#)

$h_0 \rightarrow c\bar{c}$  as a test case for quark flavor violation in the MSSM

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# NEWSLINE

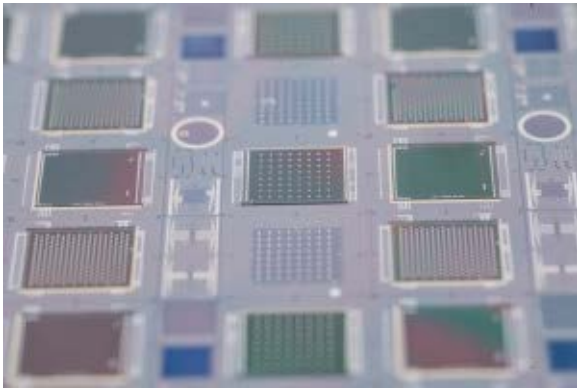
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

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AROUND THE WORLD

## Vertical wonder

Joykrit Mitra | [26 November 2014](#)



*Fermilab's vertically stacked chips bonded onto sensor wafers. Photo Credit: Reidar Hahn*

In 2006, Fermilab's Particle Physics Division teamed up with MIT's Lincoln Labs to start work on the first iteration of a new kind of chip for the proposed International Linear Collider's vertex detector. A new way to slim down chips was emerging in the semiconductor industry, one that could potentially make it easier to measure the properties of incoming particles. Eight years and several iterations later, the chip is now close to being complete, and the ILC vertex detector is another step closer to being an engineering reality.

In old-fashioned circuit boards, components are arranged side by side on a flat surface. An electrical signal has to travel a long distance to reach the processor, and generates excess electrical noise in the process, reducing the clarity of the output. To solve this problem, the semiconductor industry started vertically stacking wafer-like silicon layers — each thinner than a human hair—and bonding them together chemically. The stacked

arrangement is called a 3-D integrated circuit.

A 3-D arrangement is especially useful for the ILC vertex detector, where the chip and its associated sensor need to be as thin as practicable so as not to disrupt the path of the incoming particles too much and interfere with their properties. Furthermore, the circuitry needs to make do with limited power and still manage to capture a particle's position, time stamp of arrival and charge at a good resolution.

Lincoln Labs and Fermilab collaborated to build this kind of a chip. The first iteration, VIP I — or vertically integrated pixel chip — was assembled in Lincoln Labs with three layers stacked together. The two labs went on to design a successor, VIP II-a.

"When we originally started working on it, our goals were pretty ambitious," said Ron Lipton of Fermilab's Particle Physics Division who worked on detector R&D for the ILC and worked with the engineers designing the chip. "But it was clear that if you wanted to really make progress, you had to have commercial technology."

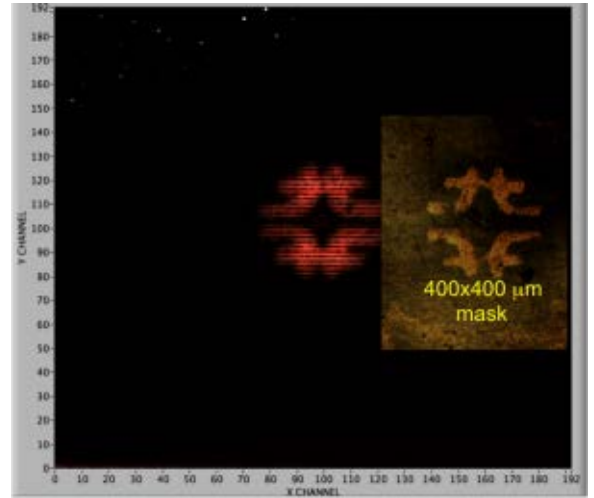
At this stage Tezzaron, based in Naperville, Illinois, and Ziptronix of Morrisville, North Carolina, were brought in to help develop VIP II-b, in which each wafer had a 192-by-192-pixel arrangement and greater resolution than its predecessors.

Tezzaron had created a working 3-D prototype in 2004 connecting two wafers with tungsten contacts embedded in the silicon, and Ziptronix had found a way to get rid of the 50-micron-thick solder bumps being used industrially to connect each pixel on a chip surface to the sensor. Ziptronix engineers had replaced the bumps with metal cylinders only 5 microns in diameter and 1 micron high embedded in a glass insulator, decreasing the distance between pixel and sensor by a factor greater than 10. These advances were integrated into the latest iteration of the VIP.

So far VIP II-b has been tested qualitatively. A mask of the Fermilab logo made of tungsten, 400 microns thick, was pressed against the chip and bombarded with a radioactive source, and the chip was able to reproduce a readout of the pattern at a high resolution with relatively low noise. The result showcases the device's abilities and serves as testament that the basic circuitry works.

Next up is detecting an actual particle beam. A collaboration between Argonne National Laboratory, Brown University and Fermilab to optimize the chip quantitatively for such a setup is under way.

"We have all of the pieces necessary to build a functional prototype for the vertex detector," Lipton said. "The next step will depend on how the ILC project proceeds."



*Tungsten mask of the Fermilab logo rendered using the VIP II-b chip. Photo Credit: Ron Lipton*

[DETECTOR R&D](#) | [FERMILAB](#) | [ILC](#) | [UNITED STATES](#) | [VERTEX DETECTOR](#)

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## FEATURE

# CERN-KEK offices established

26 November 2014



CERN and KEK have a long history of collaboration. An agreement signed at KEK on 21 November puts this on even firmer ground: both labs will establish CERN-KEK offices to increase the collaborative effort on accelerator R&D and construction projects of mutual interest.

There are a number of key projects that fall into this category: the LHC and its luminosity upgrade, the LHC injectors, linear collider studies and the associated accelerator test facilities ATF and ATF2, which all feature on the strategy roadmaps for the future of particle physics both in Europe and in Japan. The programmes at the Japan Proton Accelerator Complex including upgrades and KEK's future SuperKEKB accelerator involve a wide community of European researchers, and generic R&D on high-field magnets and high-gradient structures for the FCC study and CLIC are of great

importance for both labs. European scientists, including from CERN, form part of the preparation team for the International Linear Collider that is being pursued in Japan.

"CERN and KEK have many common interests, but it has been difficult to form collaborations for each of them. That's why it is important to establish these offices," says Katsuo Tokushuku, supervisor of the KEK office at CERN. The new offices do not only consist of physical office space but also of administrative help for scientists travelling to and installing themselves at the partner lab. Registration procedures at a new lab and in a new country are often tricky, and the office staff will make sure that accelerator specialists can focus on their R&D work rather than on paperwork.

CERN's Linear Collider Study Leader Steinar Stapnes supervises the CERN office at KEK and is looking forward to sending CERN researchers over to Japan, as well as welcoming more KEK accelerator scientists to CERN. "There is significant overlap of this new office agreement with an EC-funded project starting in 2015 called E-JADE (Europe-Japan Accelerator Development Exchange Programme), which supports the exchange of key researchers in the field of accelerator science between Europe and Japan," he says.

Another important aspect the offices will handle are official visits from the other lab and other regions, planning travel, arranging meetings, workshops and training and the exchange and transport of hardware components.

"With the establishment of the branch offices, we have entered into a new phase of international cooperation in which human and technological resources are shared with each other. We hope that this new scheme will gather momentum on advancing accelerator science," says Atsuto Suzuki, Director-General of KEK, who signed the Agreement together with CERN's Head of International Relations Rüdiger Voss.

See also [kek.jp/en/NewsRoom/Release/20141125114000](http://kek.jp/en/NewsRoom/Release/20141125114000)

[ACCELERATOR R&D](#) | [ATF](#) | [ATF2](#) | [CERN](#) | [CLIC](#) | [FCC](#) | [ILC](#) | [J-PARC](#) | [KEK](#) | [LHC UPGRADE](#)

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THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

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## DIRECTOR'S CORNER

### A successful Linear Collider workshop in Belgrade – and planning the main LC workshops in 2015

Steinar Stapnes | [26 November 2014](#)



The yearly international Linear Collider Workshop took place from 6 to 10 October 2014 in Belgrade, organised by the Vinca Institute of Nuclear Sciences. The workshop gathered researchers from Europe, Asia and America primarily involved in the linear collider projects ILC and CLIC. Approximately 200 participants took part from 84 institutions in 21 countries.

The President of the Republic of Serbia Tomislav Nikolic addressed the participants at the opening session, emphasising the importance of fundamental science and international co-operation. After this note the workshop continued with a format familiar to the linear collider community – plenary sessions on Monday and Friday, and parallel sessions from Tuesday to Thursday. A measure of the hectic activity is that there were 243 talks in

the course of five days, most given by young researchers presenting new studies and results. The workshop webpage and talks are available [here](#).

Both ILC and CLIC have defined several key challenges to address during the second half of 2014, and the workshop provides an excellent opportunity to discuss and conclude on some of these challenges. For ILC the ongoing process in Japan related to site-specific studies and providing the information needed to national committees and decision makers are highest on the priority list. A restructured international ILC accelerator team has been established and this team is getting up to speed on these challenges. Another key issue discussed was to establish a running/luminosity scenario addressing Higgs and top physics – to mention the two most obvious areas – in the best possible way. Detector optimisation studies were a focusing point for both ILC and CLIC detector versions. For CLIC the physics studies are moving from Higgs towards beyond-the-Standard-Model topics in preparation for whatever LHC at 13-14 TeV will unveil, and the accelerator collaboration reviewed the status and goals for next phase and in particular the rapidly increasing interest for using X-band technologies in smaller accelerator projects which will be very beneficial for the technology.

On the social side, a welcome drink, a reception, an art exhibition and reception, a dinner and a public lecture gave ample opportunity to discuss with colleagues and friends outside the workshop events.

The entire workshop was very well organised and the local organising team, led by Ivanka Bozovic-Jelisavcic was deservedly praised for their planning, efforts and hospitality.

Looking ahead to 2015 the linear collider workshops are already in planning. The yearly CLIC workshop will take place from 26 to 30 January at CERN and registration is already [open](#).

The Asian Linear Collider workshop is planned for 20 – 24 April in Japan, and registration is expected to open within a few weeks. This workshop, taking place at a critical time for the ILC project development, will offer a good opportunity for participants to witness the project status of the ILC in Japan. It will include an open symposium in Tokyo promoting the ILC project to a wider audience.

Finally, the 17<sup>th</sup> International Linear Collider workshop (LCWS 2015) is planned to take place in the Vancouver area, arranged by TRIUMF, during the first week of November 2015. This date is still somewhat tentative and subject to availability of facilities but we hope it can be confirmed soon.

Please mark these in your calendar and make your planning as needed to participate in these workshops.

[ACCELERATOR R&D](#) | [CLIC](#) | [DETECTOR R&D](#) | [ILC](#) | [LCWS](#) | [SITE-SPECIFIC DESIGN](#)

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## IMAGE OF THE WEEK

### Summer students reunite at test beam

Barbara Warmbein | [26 November 2014](#)



Many physicists have extremely fond memories of their time as a summer student at labs like DESY in Germany or CERN in Switzerland. Some even describe it as pivotal because they decided to choose particle physics as their area of specialisation after being immersed in a real research environment, surrounded by people with the same goals, having their own research project to work on and making lots of new friends.

One project at DESY that receives summer students every year is the [analogue hadronic calorimeter prototype](#). And it seems to be one of those that inspires students to stay in particle physics: at a recent test beam of the calorimeter at CERN, four consecutive generations of former DESY summer students (and their supervisor) were around to take shifts and data. From left to right: Lloyd Teh (University Shinshu, summer student 2014), Shion Chen

(University of Tokyo, summer student 2013), Eldwan Brianne (DESY, summer student 2012), Mathias Reinecke (DESY, AHCAL electronics and summer student supervisor), and Oskar Hartbrich (DESY, summer student 2011).

[AHCAL](#) | [CERN](#) | [DETECTOR R&D](#) | [ILD](#) | [TEST BEAM](#)

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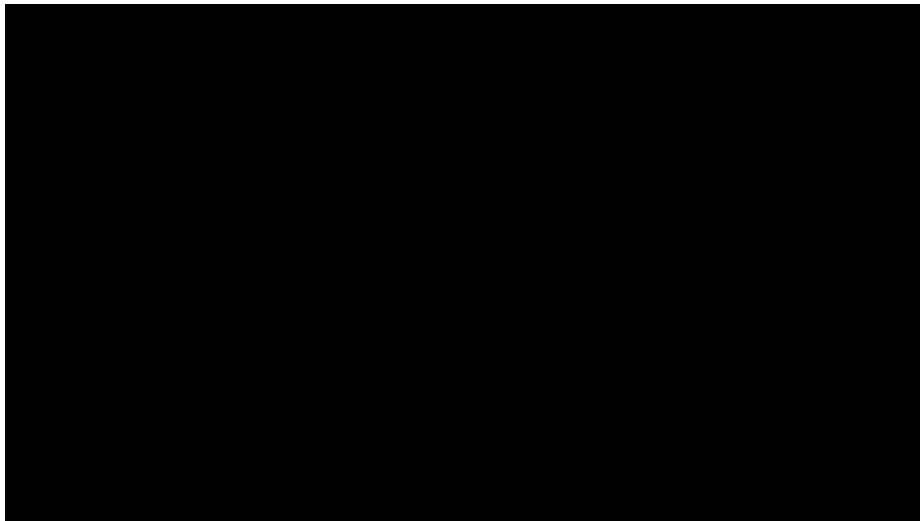
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## VIDEO OF THE WEEK

### **They want the ILC! #mylinearcollider**

IFIC Spanish group in Valencia shares its support to the ILC project

Video: ©2014 IFIC | [26 November 2014](#)



Video: ©2014 IFIC

This week we share with you the message from members of the Institute of Corpuscular Physics (Instituto de Física Corpuscular, IFIC) in Valencia, Spain.

The Linear Collider Collaboration is actively reaching out to its collaborators and supporters to participate in a #mylinearcollider video campaign. The series of short, informal videos is posted on our [Youtube channel](#) and will be shared with the relevant committees and organisations in Japan that are overseeing the evaluation process.

Your message really makes a difference. Participate in a #mylinearcollider video campaign, and ask your colleagues and friends to join, too!

[Details about the campaign and how to participate can be found here.](#)

[MYLINEARCOLLIDER](#) | [VALENCIA](#)

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