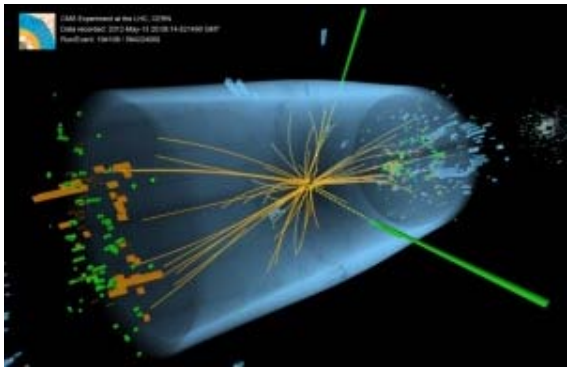
LC NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

FEATURE

From CERN: New results indicate that particle discovered at CERN is a Higgs boson



Geneva, 14 March 2013. At the Moriond Conference today, the ATLAS and CMS collaborations at CERN1's Large Hadron Collider (LHC) presented preliminary new results that further elucidate the particle discovered last year. Having analysed two and a half times more data than was available for the discovery announcement in July, they find that the new particle is looking more and more like a Higgs boson, the particle linked to the mechanism that gives mass to elementary particles. It remains an open question, however, whether this is the Higgs boson of the Standard Model of particle physics, or possibly the lightest of several bosons predicted in some theories that go beyond the Standard Model. Finding the answer to this question will take time.

LCPEDIA

Final focus

by Daisy Yuhas

What makes the ILC beams far smaller than a human hair? A series of magnets referred to as the 'final focus,' designed to maximise chances of collision at the heart of the ILC detectors.

DIRECTOR'S CORNER

Forming a united front of the LC physics and detector community

by Hitoshi Yamamoto

Recently appointed Associate Director for Physics & Detectors in the new Linear Collider structure, Hitoshi Yamoto discusses his mandate and solicits inputs from the linear collider community.

IMAGE OF THE WEEK

Japanese diet members focus on ATF2

by Rika Takahashi

Twelve members of the Japanese Federation of Diet members to promote the realisation of the ILC visited KEK on 4 and 18 March. They spent the longest time at ATF, KEK's test facility for the linear collider. They also toured KEKB, Belle, and the Photon Factory.

IN THE NEWS

from ***Libération***
21 March 2013
Planck révèle les paramètres de l'univers
Il faut toutefois souligner, note François Bouchet, que l'inflation repose sur un concept physique de champ scalaire… identique à celui du champs de Higgs. Jusqu'à la découverte de ce dernier, un tel champ demeurait un objet théorique, or, les physiciens disposent désormais d'une réalité expérimentale avec le boson de Higgs.

from ***Scienze Fanpage***
21 Mars 2013
Il nuovo universo svelato da Planck
"Un'attenta analisi condotta sia a livello teorico che sui dati presenti e futuri di LHC e di Planck potrà dirci se l'artefice delle dimensioni e dell'età dell'odierno Universo (cioè la particella, 'inflatone', che ha prodotto l'inflazione) possa essere identificabile con quella particella, il bosone di Higgs, che ha fornito la massa delle particelle presenti nel plasma primordiale", prosegue Masiero.

from ***Iwate Nippo***
19 March 2013
復興庁にＩＬＣ誘致要望 県商工会議所連合会
県商工会議所連合会と県国際リニアコライダー（ＩＬＣ）推進協議会は１８日、復興庁を訪れ、一日も早い復興への取り組みとＩＬＣの東北誘致を要望した。The local Chamber of Commerce and Industry members and ILC promotion association of Iwate prefecture visited the Minister of the Reconstruction Agency on 18 March, asking for making efforts toward earliest possible recovery and invitation of the ILC to Tohoku area)

from ***Saga Shimbun***
15 March 2013
ＩＬＣ、国内候補地一本化へ「今夏正念場」
宇宙の謎に迫る素粒子物理学の次世代加速器「国際リニアコライダー（ＩＬＣ）」構想で、脊振山地への誘致を目指す動きが活発化している。(The activities to invite the ILC to Sefuri mountain is picking up the momentum)

from ***Iwate Nippo***
14 March 2013
ILC誘致へ県議会に議連発足 国などに協力要請へ
国際リニアコライダー（ＩＬＣ）の北上山地（北上高地）への誘致に向けた県議会国際リニアコライダー東北誘致議員連盟を設立した。議員連盟には議員全員が参加。東北各県や国に対して東北誘致に向けた協力を要請し、誘致実現を目指す。(Iwate prefectural assembly established the federation of local assembly members to invite ILC to Kitakami mountain. All the assembly member participated in the federation, and will make presentation to the government)

from ***Iwate Nippo***
13 March 2013
県、ILC誘致へ宮城県と連携強化 推進部会を設置
県は超大型加速器・国際リニアコライダー（ＩＬＣ）の北上山地（北上高地）への誘致に向けて、本県と宮城県との連携をさらに強化するため、両県の課長級で構成する事務レベル会議「岩手・宮城ＩＬＣ推進部会」を設置、１４日に初会合を開くことを明らかにした。(Iwate prefecture will set up the ILC promotional body with Miyagi prefecture toward the invitation of the ILC to Kitakami mountain)

from ***symmetry magazine***
11 March 2013
Linear collider focus gets down to size
In a display of timing worthy of a blockbuster movie, a multinational team of accelerator physicists focused a beam of electrons down to the tiny size needed for a future linear collider the same week that the linear collider board formed.

from ***RKB News***
13 March 2013
「ILC」誘致プロジェクトチーム
ILC＝国際リニアコライダーの誘致活動を強化しようと福岡県はきょう、プロジェクトチームを発足させました。(Fukuoka prefecture established the project team to strengthen the effort to invite the ILC)

from ***Kahoku Shinpo***
3 March 2013
復興の土台着々 被災３県知事、現状と課題語る
達増知事は復興の象徴に国際リニアコライダー（ＩＬＣ）誘致を挙げ「岩手にとって『開国』と言えるほどの国際化になる」と話した。(Iwate prefecture's governor, Tasso said "ILC will have an effect in similar degree to the opening up the country for Iwate prefecture.

CALENDAR

Upcoming events

CALICE Collaboration Meeting
DESY, Hamburg, Germany
20- 22 March 2013

Calorimetry for the High Energy Frontier (CHEF2013)
Paris, France
22- 25 April 2013

Upcoming schools

Excellence in Detectors and Instrumentation Technologies (EDIT 2013)
KEK, Japan
12- 22 March 2013

CERN Accelerator School: Course on Superconductivity for Accelerators
Erice, Sicily, Italy
24 April- 04 May 2013

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1303.4256
Muon g-2 vs LHC in Supersymmetric Models

1303.3845
Unique heavy lepton signature at e^+e^- linear collider with polarized beams

1303.3759
Druid, event display for the linear collider

1303.3758
Top quark mass measurements at and above threshold at CLIC

1303.3187
Forward tracking at the next \boldmath{e^+e^-} collider Part II: experimental challenges and detector design

1303.3040
Dark Matter and Higgs Bosons in the MSSM

1303.2625
Potential of a Linear Collider for Lepton Flavour Violation studies in the SUSY seesaw

1303.2307
$WW\gamma/Z$ production in the Randall-Sundrum model at LHC and CLIC

1303.1526
Modified Higgs Sectors and NLO Associated Production

CERN press office

New results indicate that particle discovered at CERN is a Higgs boson

14 Mar 2013

Geneva, 14 March 2013. At the Moriond Conference today, the ATLAS and CMS collaborations at CERN[1]'s Large Hadron Collider (LHC) presented preliminary new results that further elucidate the particle discovered last year. Having analysed two and a half times more data than was available for the discovery announcement in July, they find that the new particle is looking more and more like a Higgs boson, the particle linked to the mechanism that gives mass to elementary particles. It remains an open question, however, whether this is the Higgs boson of the Standard Model of particle physics, or possibly the lightest of several bosons predicted in some theories that go beyond the Standard Model. Finding the answer to this question will take time.

Whether or not it is a Higgs boson is demonstrated by how it interacts with other particles, and its quantum properties. For example, a Higgs boson is postulated to have spin 0, and in the Standard Model its parity – a measure of how its mirror image behaves – should be positive. CMS and ATLAS have compared a number of options for the spin-parity of this particle, and these all prefer no spin and positive parity. This, coupled with the measured interactions of the new particle with other particles, strongly indicates that it is a Higgs boson.

"*The preliminary results with the full 2012 data set are magnificent and to me it is clear that we are dealing with a Higgs boson though we still have a long way to go to know what kind of Higgs boson it is." said CMS spokesperson Joe Incandela.*

"The beautiful new results represent a huge effort by many dedicated people. They point to the new particle having the spin-parity of a Higgs boson as in the Standard Model. We are now well started on the measurement programme in the Higgs sector," said ATLAS spokesperson Dave Charlton.

To determine if this is the Standard Model Higgs boson, the collaborations have, for example, to measure precisely the rate at which the boson decays into other particles and compare the results to the predictions. The detection of the boson is a very rare

event - it takes around 1 trillion (10^{12}) proton-proton collisions for each observed event. To characterize all of the decay modes will require much more data from the LHC.

Footnote(s)

1. CERN, the European Organization for Nuclear Research, is the world's leading laboratory for particle physics. It has its headquarters in Geneva. At present, its member states are Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. Romania is a candidate for accession. Cyprus, Israel and Serbia are associate members in the pre-stage to membership. India, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO have observer status.

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LCPEDIA

Final focus

Daisy Yuhas | 21 March 2013

These quadrupoles at the ATF2 test facility at KEK in Japan get the beam down to the required size. Image: KEK

As hundreds of particle bunches pass through an accelerator, physicists need to steer them into collision at specific locations within the detector's centre. But given how tiny these particles are, it can happen that beams of particles cross and yet no collisions occur. To maximise the chances of collision at the interaction point, the beams are focused by a series of quadrupole magnets as they approach the desired collision location. Physicists refer to the series of magnets that create this focus as the 'final focus.'

You can imagine the need for focusing by envisioning a street corner. If this is an intersection of two wide avenues, people can probably walk past each with little chance of collision. But if it's a very narrow space with just enough of a crowd, people may be forced into each other. As it's these collisions that scientists are after, the particle bunches need to travel in a tight pathway to increase the collisions achieved. For a more scientific analogy of how this funnelling of the beam's path is achieved, Fermilab scientist Elvin Harms likens final focus to a telescope. "You might say the final focus quadrupole circuits are like a telescope. There is strong focusing near the collision point—much like an objective lens—and weaker focusing—like an eyepiece—further away," Harms says.

This series of quadrupole magnets spans roughly a kilometre of space in the International Linear Collider design with the interaction point at its centre. Scientists can adjust each magnet to either focus or defocus, winnowing down or expanding space within the vertical or horizontal planes. At the ILC a doublet—or two quadrupole magnets—will be placed on either side of the interaction point. By the time particles collide they will each travel in a stream far smaller than a human hair, a scant 5.9 nanometres vertically and 474 nanometres horizontally.

ATF2 is a test facility at the KEK laboratory in Japan which contains a prototype of an advanced optics design of the final focus for use at any future linear collider. In December last year, scientists achieved a squeezed beam size as small as 70 nanometeres at ATF2. Scientists aim to achieve as final goal a spot size of 37 nanometres – the beam size to meet the ILC requirements.

Read also Linear collider focus gets down to size in *symmetry magazine.*

ACCELERATOR R&D | ATF2 | KEK

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DIRECTOR'S CORNER

Forming a united front of the LC physics and detector community

Hitoshi Yamamoto | 21 March 2013

The global ILC and CLIC communities, including Physics and Detectors, met last time in Arlington, US, for the LCWS12 workshop in October 2012. Image: University of Texas Arlington.

The Linear Collider Collaboration (LCC) officially started at the Vancouver Linear Collider Board (LCB) meeting in February 2013, and the new organisation is slowly taking shape. I was appointed Associate Director for the Physics & Detector portion of the new structure. LCC director Lyn Evans told us that he thought the task assigned to this post would be the most difficult one.

So what is the mandate of the Physics & Detectors Associate Director? The mandate given by the International Linear Collider Steering Committee states that initially the Associate Director would focus on building a physics case for a future linear collider, coordinate R&D on advanced detector technologies and develope validated detector concepts for both accelerator technologies (namely CLIC and ILC). Eventually, the Associate Director would coordinate the worldwide effort to develop advanced detectors that are appropriate for either accelerator technology, and would prepare the way for forming collaborations and constructing detectors when a real LC project is approved.

While describing the role of the LCC, it is important to recognise that it is an interim organisation before a real organisation is formed following the approval of a linear collider project. Since it is an interim organisation and the accelerator is not chosen yet, it is important to keep the CLIC and ILC communities together, and also to promote LC-related advanced detector R&D that mar or may not be used in the real linear collider detectors. Currently, the goal of the LCC is to realise the ILC, as the LCC Director clearly stated. However, CLIC efforts need to be promoted in parallel as it is a possible option for a post-LHC machine at CERN, and this is true even if the ILC is realised. In fact, CLIC studies would continue while the ILC moves into construction. After all, no linear collider has been approved at this point.

Now let us take a look at each of the three initial mandates for my task and briefly describe the issues involved. I will be presenting the final idea for the organisational structure at the Hamburg linear collider workshop in May, and the main purpose of this corner is to solicit input from the LC community.

1. Physics case

As the LHC keeps on producing impressing physics output, the physics case for an LC needs to be continuously updated. There is also a clear hope that further LHC running at full energy might open the doors to results beyond the Standard Model, providing significant additional opportunities within the energy range of linear colliders. The physics capabilities of the ILC and those of the CLIC option with a centre-of-mass energy below 1 TeV are very similar, and both communities can and should join their forces together for this goal. There have been many collaborative efforts up to now, both in software tool developments and physics analysis. We need, however, a more formal structure. It will contain theorists and experimentalists, and will be similar to the physics common task group that operated under

the research directorate, but there will be clear connection to both the CLIC and ILC analysis groups.

2. Detector R&D

As we move from conceptual to engineering design of the LC detectors, unfinished necessary detector R&D should be completed. Here again, there is a large area of efforts common to both CLIC and ILC, and they have to be coordinated in a more formal and visible way. In addition, the detector R&D for a linear collider has been raising the standards of the high-energy physics detector technologies in general and we should make sure that it will continue to do so. In coordinating such efforts, we should make sure that voices of detector R&D groups, including small groups, are heard effectively by the management. There will be a group of people similar to the former physics and experiment board directly under the Associate Director that will include representation of the R&D efforts. The challenge here is to come up with an arrangement where small but important groups are not ignored while keeping the number of representatives at a reasonable level.

3. Concept groups

Currently, there are two detector concept groups, ILD and SiD, for the ILC, and the CLIC physics and detector group for CLIC. Their design status has not reached a construction-ready level, and this is particularly relevant for the ILC detectors for which much engineering study remains to be done. New individuals and groups are of course very much encouraged to join any of the groups mentioned above. What if, however, a new group appears and expresses its intent to form a new concept group? Such initiative should not be rejected while a new group will clearly be in a disadvantaged position due to the late start. Here, a concrete framework to accommodate such group should be put in place.

Above are the three of key issues for the new LCC Physics & Detector organisation. The physics and detector community is diverse and usually works best when the elements in it act with self-determination, and thus the implementation of the above issues should be as bottom-up and flexible as possible where decisions have to be made by people directly involved. Impositions from above have to be kept to minimum, and we should start with minimum framework as needed to facilitate the activities. If you have any comments or suggestions on these issues, please send me an email.

CLIC | DETECTOR R&D | ILC | LINEAR COLLIDER COLLABORATION | PHYSICS AND DETECTORS

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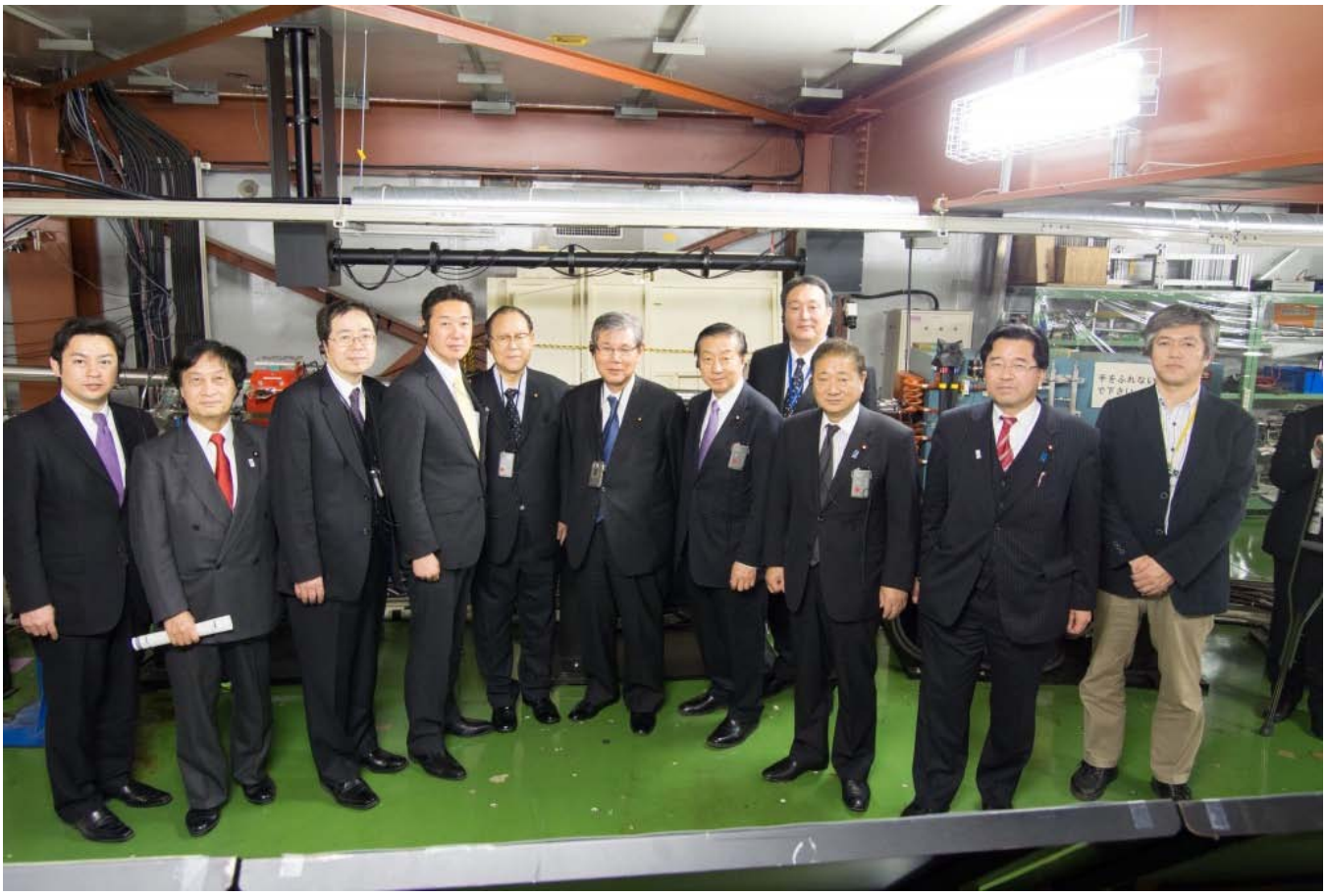
IMAGE OF THE WEEK

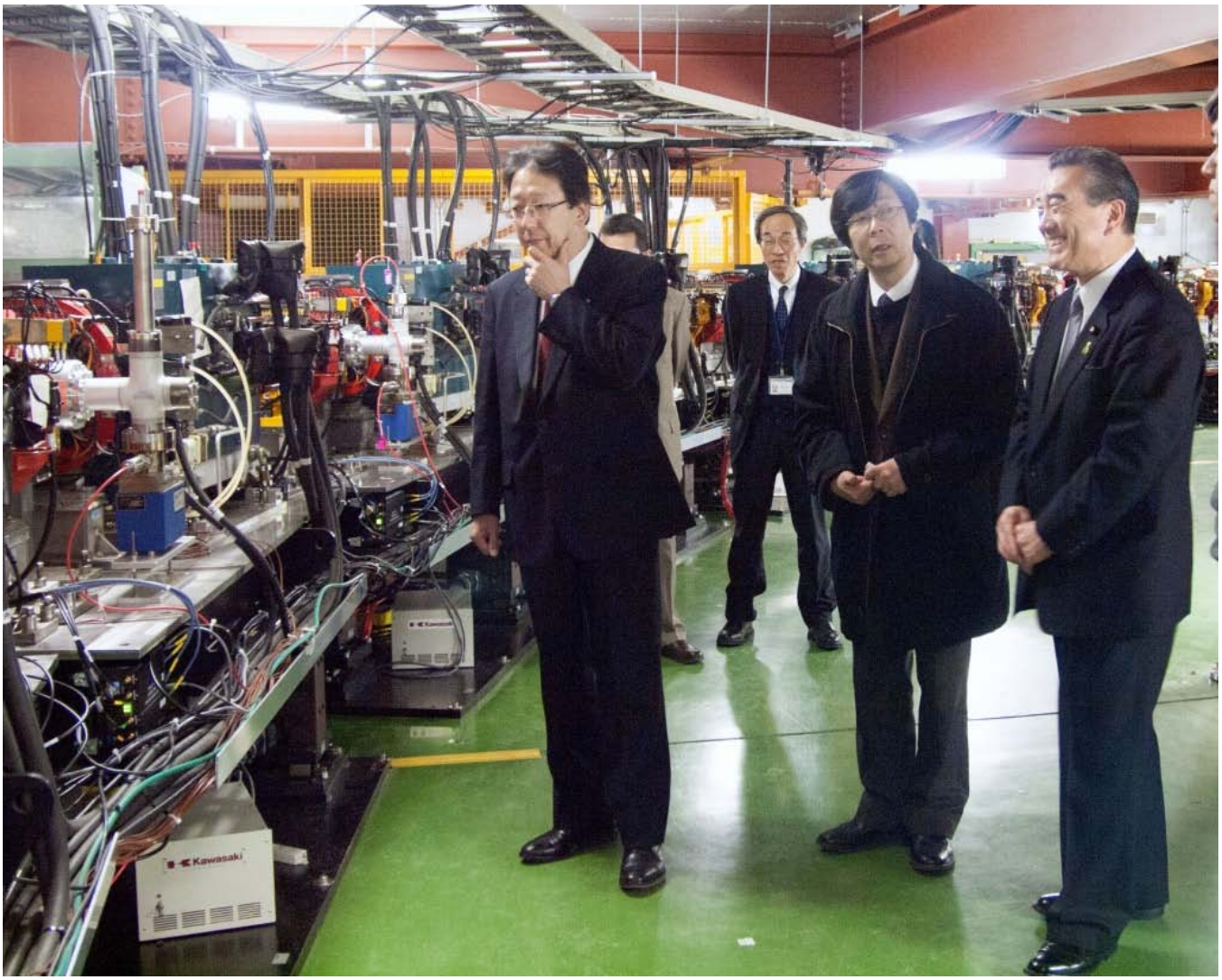
Japanese diet members focus on ATF2

Rika Takahashi | 21 March 2013

Twelve members of the Japanese Federation of Diet members to promote the realisation of the ILC visited KEK on 4 and 18 March. They spent the longest time at ATF, KEK's test facility for the linear collider. They also toured KEKB, Belle, and the Photon Factory.



10 members of the Federation of Diet members to promote the realisation of ILC visited KEK on 18 March. From left: Takamaro Fukuoka, Motoyuki Fujii, Tetsuo Saito, Hitoshi Kikawada, Koshin Fujitani, Kosuke Hori, Kenji Kosaka, Takahiro Inoue, Hiroshi Imazu, Hiroshi Sakurai. Nobuhiro Terumuma (right) guided ATF.



Minoru Kawasaki (left) and Ryo Syuhama (right) visited KEK on 4 March, listening to the explanation by KEK scientist Junpei Fujimoto (middle).

ATF2 | FEDERATION OF DIET MEMBERS | JAPAN