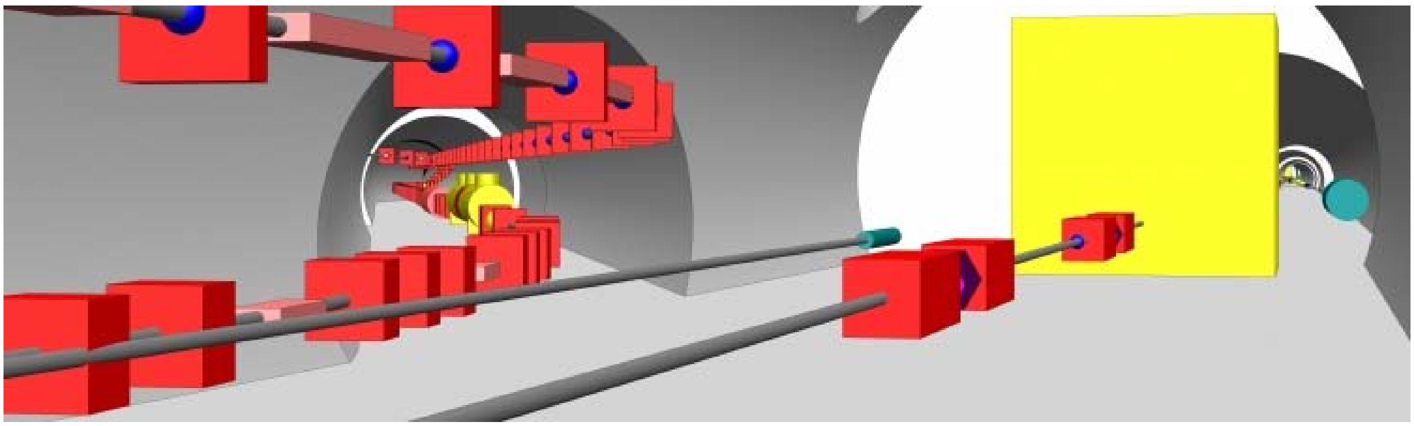
ilc newsline

 13 SEPTEMBER 2012

FEATURE

A trip down main linac lane

by Barbara Warmbein



A team at DESY has created a complete virtual-reality three-dimensional ILC. They have combined information from various computer-aided design systems and about all areas of the ILC together in one model that you can now walk through. This model can highlight problems before they become costly and is a great motivator for the owners of the individual systems.

IMAGE OF THE WEEK

European community discusses the future of particle physics

by Barbara Warmbein

LHC upgrades, linear colliders, muon colliders, neutrino experiments, even theory - the list of projects to discuss on the strategy list was long. The nearly 500 participants at CERN Council's Open Symposium on European Strategy for Particle Physics did however manage to cover all of those and more. A briefing book will summarise the results of the discussions. Read the CERN Press Release

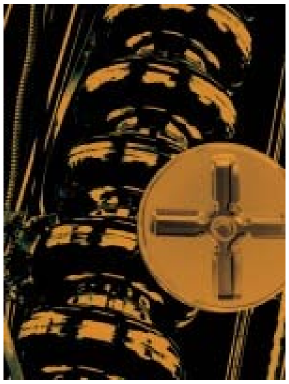
DIRECTOR'S CORNER

SLAC celebrates 50 years

by Barry Barish

SLAC has had a remarkable first 50 years, which were celebrated in a special event this past month. Although the theme of that event focused on the next 50 years, the achievements of the past inform the future plans and prospects. In that regard, the physics achievements of SLAC were duly noted at the event because the American Physical Society named it an APS Historic Site and awarded the lab a plaque.

AROUND THE WORLD



Linear collider event during IEEE symposium in Anaheim

There will be a special linear collider event during this year's IEEE Nuclear Science Symposium in Anaheim, US. Industry, accelerator experts and linear collider researchers from around the world gather to discuss technologies and possibilities.

IN THE NEWS

from *Phys.org*
10 September 2012
Higgs boson: Landmark announcement clears key hurdle
The announcement two months ago that physicists have discovered a particle consistent with the famous Higgs boson cleared a formal hurdle on Monday with publication in a peer-reviewed journal.

from *Science News*
7 September 2012
FOR KIDS: Higgs — at last!
Physicists capture the long-sought Higgs particle, which explains why other particles have mass.

CALENDAR

UPCOMING EVENTS

XXVI International Linear Accelerator Conference (LINAC 12)

Tel-Aviv, Israel
09- 14 September 2012

CERN Council Open Symposium on European Strategy for Particle Physics
Crakow, Poland
10- 13 September 2012

12th International Workshop on Accelerator Alignment (IWAA 2012)
Fermilab
10- 14 September 2012

CALICE collaboration meeting
Emmanuel College, Cambridge, UK
16- 19 September 2012

5th International Workshop on Top Quark Physics (TOP 2012)
Winchester, UK
16- 21 September 2012

52nd ICFA Advanced Beam Dynamics Workshop on High-Intensity and High-Brightness Hadron Beams
Beijing, China
17- 21 September 2012

PREPRINTS

ARXIV PREPRINTS

1209.2214
Neutral Triple Gauge Boson production in the large extra dimensions model at linear colliders

1209.0547
Single top quark polarization at O(alpha_s) in t t-bar production at a polarized linear e^+ e^- collider

View complete calendar

FEATURE

A trip down main linac lane

Barbara Warmbein | 13 September 2012

There aren't many people in the world who can say of themselves that they have walked the whole length of the ILC's accelerator tunnels and stood in the detector cavern looking up at the ILC detector. In fact, there's probably only one person in the world who has done all this: Benno List. He is the hub of the integration team at DESY, which has spent the last years collecting and putting together all available Computer-Aided Design (or CAD) models of the ILC's accelerator systems and their components, and combining it with a symbolic three-dimensional visualisation of the actual accelerator layout (the "lattice"). These models come from engineers working in universities and laboratories around the world. And mind you, there are different CAD systems and different designs for the individual systems as well. The goal of this exercise: put together a three-dimensional virtual ILC that you can actually walk through, provided you are at DESY and willing to wear 3D glasses with funny antennae that capture your movements, so you can duck under the beampipe and peer into cryomodules as realistically as that is possible for a machine that does not exist yet.

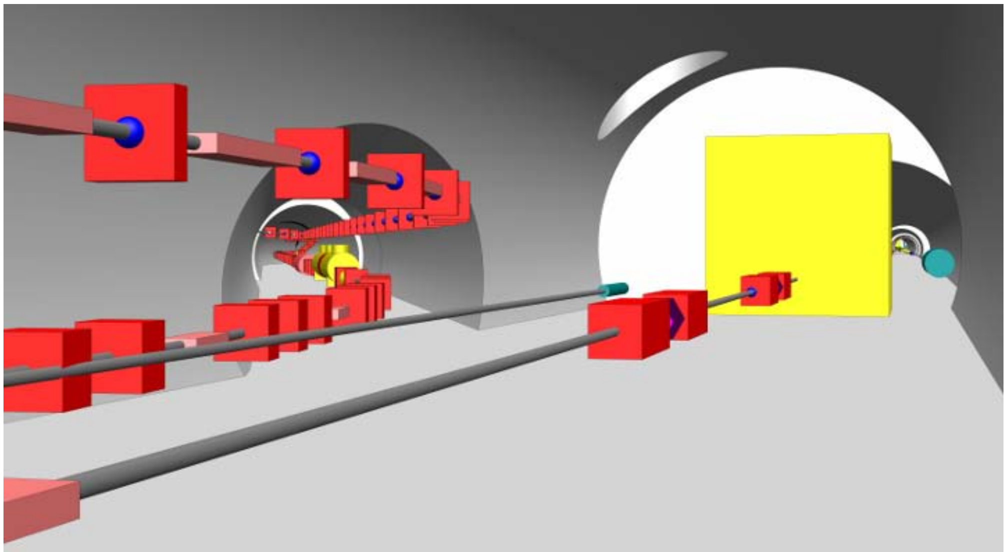
As much fun as that is, there's a serious purpose behind it. Combining all accelerator systems in their detailed models can highlight faults, missing stretches of accelerator, space problems, crossing systems or pieces of tunnel wall sticking out.

Take for example the muon shield between main linac and beam delivery system. It's essential for the detectors' efficiency because it catches stray muons from the linac tunnel and stops them mingling with the particles from the interactions, it's just not a very complicated piece of engineering. This means that it was always there in every drawing, but the CAD systems had simply put return beamlines and magnets through what will eventually be a five-metre thick wall of magnetised iron. During the Baseline Technical Review meeting last October at DESY, this problem was identified with the help of the integrated 3D model, which led to a complete redesign of how the transfer lines to and from the damping rings are arranged with respect to the main linac and the particle sources.

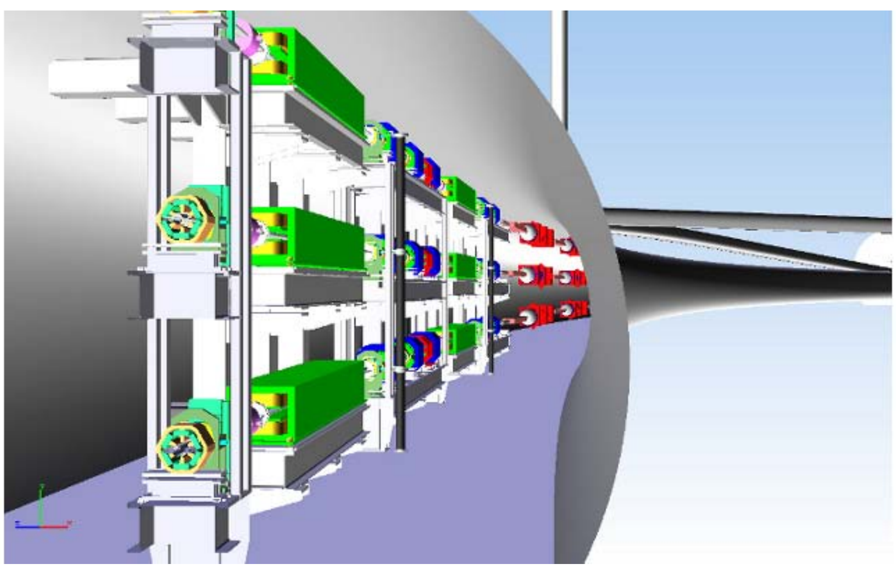
Having all varieties of designs also allows the experts to play around. For example, there's one stretch of tunnel that's in the Kamaboko configuration, Benno List can switch from one cavern design to the next and can also tune the level of precision for magnets and cryomodules – from big colourful blobs to detailed pieces of engineering down to the last screw. "It also works the other way round," says List. "When the CERN experts started to lay out the European tunnel design, we already had the complete the magnet configuration. So we sent the lattice details to the civil engineers at CERN and they created the perfect tunnel around it."

The ILC is not the first accelerator that has gone through this virtual creation process – DESY's IPP group also has the complete European XFEL in its system. The head of the team, Lars Hagge, says that seeing one's project in 3D also has a non-negligible psychological effect. "Accelerator physicists and engineers know their area of expertise extremely well, and they are happy with excel sheets and CAD models. But when they enter our virtual-reality room and explore their components in their full context, some so far hidden challenges or tiny details may suddenly become clearly obvious," he says. People often leave with new ideas for resolving complexity in interfaces or for optimising installation procedures. . "This leads to updated designs, whereby the tool turns into a process," says Hagge.

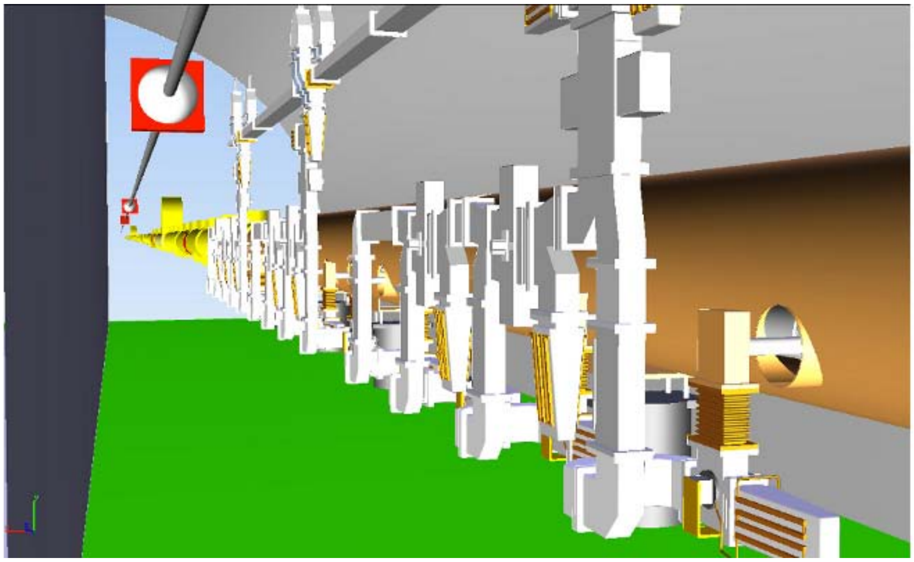
When new designs become available, the team adds them – the recently designed remote handling proposal from China, for example. However, they consider the current status mature and complete enough to create a full 5-minute flythrough movie of the ILC. Again, it's not fun only: "The systems experts can see their system in the big picture without having to come to DESY," says Hagge. For education – or fun – the movie will of course be featured in *ILC NewsLine.*



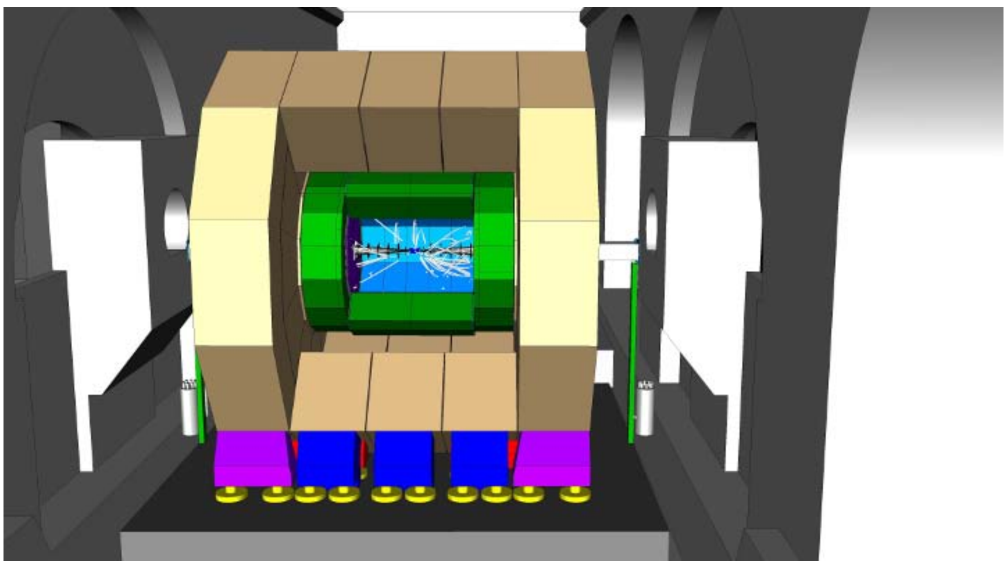
The branch-off of the transfer tunnel between main tunnel and the damping rings, with the European tunnel design. On the ceiling, low-energy electrons from the damping rings are transported to the start of the main accelerator, while on the floor positrons are guided towards the damping rings. To the right, high-energy electrons pass through the yellow muon stop on their way to the detector hall. The cyan cylinder on the far right is the water volume of the main dump for the high energy positrons. Tunnel and accelerators fit together already without overlaps or collisions; now, accessibility for installation, maintenance and escape routes can be further optimised. It can be challenging to find viable transportation routes between such a maze of beamlines. [Tunnel by A. Kosmicki and J. Osborne, CERN, lattice visualization B. List, DESY, lattices by A. Vivoli, N. Solyak, FNAL, W. Liu, ANL, D. Angal-Kalinin, STFC Daresbury]



Detailed model of the damping ring arc magnets, together with the symbolic lattice representation and the European tunnel design. All fit together seamlessly. [Damping ring magnet model by J. Conway, Cornell, lattice by D. Rubin, Cornell.]



A view into the detailed model of the Japanese “Kamaboko” tunnel design, together with the more schematic lattice visualisation. Short sections of the accelerator are modeled in more detail to determine the precise tunnel cross section; the overall tunnel design follows the lattice. [Kamaboko tunnel from S. Fukuda, KEK]



A view into the ILD detector (with several parts removed for better visibility) inside the detector hall of the Japanese site. Within the detector, a simulated Higgs production event can be seen. [ILD detector model by M. Jorré, LAL, IN2P3, hall by Y. Sugimoto, KEK, event display by F. Gaede, DESY]

3D MODEL | **DAMPING RING** | **DESY** | **DETECTOR HALL** | **ILD** | **LINAC** | **POSITRON SOURCE** | **VIRTUAL REALITY**

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DIRECTOR'S CORNER

SLAC celebrates 50 years

Barry Barish | 13 September 2012

SLAC has had a remarkable first 50 years, which were celebrated in a special event this past month. Although the theme of this event focused on the next 50 years, the achievements of the past inform the future plans and prospects. The physics achievements of SLAC were duly noted at the event by the American Physical Society, which designating SLAC as an APS Historic Site. As APS Past President I had the honour and distinct pleasure of presenting this award and I share below my address at the ceremony.

The APS Historic Sites Initiative was created in 2004 with the purpose of raising public awareness of physics through acknowledgement of important past scientific advances. The Society has established a distinguished Historic Sites selection committee that evaluates potential historic physics sites in the United States. The Historic Sites committee is represented today by Ben Bederson, chair of the committee, and the APS leadership by Mac Beasley, Vice President of the APS and myself. (Bob Byer, President, is in China for the 80th anniversary of their Physical Society).

Prior to SLAC, 26 sites have been selected as APS Historic Sites, including those recognising the achievements of Benjamin Franklin, Joseph Henry, J.W. Gibbs, Michelson and Morley, Rutherford and Soddy, Arthur Compton, Robert Millikan, and Carl Anderson (from my institution), as well as for the invention of the transistor, and the BCS theory of superconductivity.

Recent awardees include Maiman and Hughes Research Laboratories (Malibu) for the first demonstration of the laser some 50 years ago, Charles Keeling and Scripps Institute of Oceanography for the experiments yielding the Keeling Curve that show the rise in the level of carbon dioxide in the atmosphere and to Brookhaven Laboratory for multiple achievements in physics, much like today's award to SLAC.

As Past-President of the American Physical Society and because of my long associations with SLAC, I am especially pleased to be able to dedicate SLAC as an APS historic site.

This is a citation from the inscription on the plaque:

"In recognition of the SLAC National Accelerator Laboratory, formerly Stanford Linear Accelerator Center, established in 1962 and home of the 2-mile Stanford Linear Accelerator and the SPEAR electron storage ring. These two accelerators played instrumental roles in the discovery of quarks, the establishment of the Standard Model of particle physics, and the invention and use of high-brightness X-ray synchrotron and laser sources for the study of solid-state materials, surfaces, and biological structure."

Wolfgang K. H. (Pief) Panofsky, SLAC's first director, led the creation of the SLAC Laboratory around its centrepiece, the 2-mile linear accelerator that has led to so many discoveries in particle physics and beyond. This accelerator, motivated to a large extent by the earlier electron scattering experiments on the Stanford campus, represented a truly bold step to high energies. The initial experiments included measurements of electron and positron scattering like had been done at lower energies on campus (I participated in those experiments, then left the experiment, just before they went on to discover the spectacular scaling behaviour in what is called deep inelastic scattering.) That result was quickly interpreted as an evidence for a constituent quark-like structure in the proton for which Jerry Friedman, Henry Kendal and Dick Taylor were awarded the Nobel Prize.

Burt Richter led another bold step that has been typical of SLAC, that of initiating and building the SPEAR electron-positron colliding beam facility. We are still benefitting from the legacy of this machine that effectively represented the birth of collider physics, both in terms of a high-energy colliding beam facility, and in developing the first general-purpose 4π or full-coverage detector. This project provided the model for how to advance particle physics to much higher energy by working in the centre of mass system through colliding beams (instead of scattering off a stationary target). SPEAR has spawned several generations of accelerators around the world since that time. The physics achievements of SPEAR were truly astounding: the discovery of the J/Psi and charmed particles by Burt Richter and collaborators, as well as the discovery of our heaviest lepton, the Tau, by Marty Perl and collaborators. Both resulted in Nobel Prizes for the laboratory.

Two more generations of circular colliding beam facilities have been built and exploited at SLAC – PEP I and PEP II. PEP II, having asymmetrical beams, provided precision measurements of the CP violating parameters for B decay that established the theory put forward by Kobayashi and Maskawa and led to their Nobel Prize.

In the SLAC tradition, other important facilities have been developed, including especially the synchrotron X-ray radiation facility at SPEAR, where many of the techniques for high-brightness light sources were first developed, and again it yielded a rich physics programme that included the Nobel Prize work of Roger Kornberg understanding the process by which genetic information from DNA is copied to RNA. Of course, this general field of photon physics has now become the central theme of the laboratory in recent years with the development of LCLS.

This SLAC tradition of developing innovative new ambitious facilities to perform ground-breaking experiments has led to many other important discoveries in the history of the laboratory, but I would be remiss if I didn't mention the SLAC Linear Collider, which provided the first precision measurements of the Z0, and demonstrated the concept of what is my own present activity, the development through a worldwide effort to develop a design for a future linear electron-positron collider to follow and complement the CERN LHC.

SLAC is an amazing institution. It is a place where great scientists have been able to do great science! The APS is proud to be able to honour SLAC as one of our historical sites and to do it at the time of this 50th anniversary celebration. We congratulate you!

ANNIVERSARY | **APS** | **SLAC** | **SLC**

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AROUND THE WORLD

Linear collider event during IEEE symposium in Anaheim

13 September 2012

The recent discovery of a particle at the Large Hadron Collider at CERN, consistent with the long-sought Higgs boson, provides a very clear target for near-future linear collider experiments. A next-generation linear collider (LC) is currently being designed as the next large-scale experimental facility in elementary particle physics beyond the LHC. It is intended to offer a perfect environment to elucidate the nature of a Higgs particle and allows for precision studies to be conducted that may reveal the next energy scale of physics to be targeted by future big machines.

A two-day linear collider event will be part of this year's IEEE Nuclear Science Symposium

With the news of the Higgs, public interest in particle physics in general, and the LC in particular, is at an all-time high. Therefore, this year the organisers of the IEEE Nuclear Science Symposium have chosen to arrange a Special Linear Collider Event on 29 and 30 October in addition to their nominal IEEE NSS programme. The aim of the special event is to bring together academia, industry, and laboratory-based experts on accelerator and detector technologies and applications. It is an excellent opportunity to discuss linear collider technologies with the accelerator and instrumentation community at large.

Particle accelerators are widely perceived as tools for mankind in the service of science. The International Linear Collider, which is distributed among many labs, and the Compact Linear Collider (CLIC), centered at CERN, are both global projects that would collide electrons and positrons at TeV energies. However, they have different technologies, different time scales, and different energy extensibility. The two-day LC event will summarise the status of ILC and the CLIC accelerator and detector concepts, include presentations on the impact of LC technologies for different applications and provide a forum for discussion about LC perspectives.

Special attention will be given to the sessions where potential spin-offs of LC accelerator and detector technologies are discussed. In particular, they will include presentations on how accelerator technology developed by the nation’s laboratories and universities could directly translate into a competitive strength for industrial partners, as well as advance applications of accelerators for use in service to society. The status of the Advanced Accelerator Association Promoting Science and Technology (from the perspective of ‘industry-government-academia collaboration’ motivated by AAA, Japan) will be also reported. In the field of detector instrumentation, many spin-offs from ILC detector R&D look valuable for other particle physics detectors, and for detectors in other fields, in particular medical imaging (for example novel multi-modality designs in positron emission tomography).

The Linear Collider Forum Discussion will bring together directors of the world’s high-energy physics laboratories and leading experts in LC technologies, both from the academic research sector and industry, to provide an interactive discussion and insight into the long-term technology roadmap for the linear collider facility construction.

We are looking forward to seeing you in Anaheim!

The Program Committee of the "Special Linear Collider Event" (Jim Brau (University of Oregon, USA), Juan Fuster (IFIC Valencia, Spain), Ingrid-Maria Gregor (DESY Hamburg, Germany), Michael Harrison (BNL, USA), Marc Ross (FNAL, USA), Steinar Stapnes (CERN, Switzerland), Maxim Titov (CEA Saclay, France), Nick Walker (DESY Hamburg, Germany), Akira Yamamoto (KEK, Japan), Hitoshi Yamamoto (Tohoku University, Japan))

IEEE | **LC EVENT**