

NEWSLINE

THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

DIRECTOR'S CORNER



Of cavity performance, tiny beams and official roles: progress in a maturing project

by Akira Yamamoto

Regional Director Akira Yamamoto reports from the Americas Workshop on Linear Colliders (AWLC) 2014 held last month at Fermilab, US. A new official structure gives weight to contributions from scientists who used to juggle linear collider work and their projects “at home”, and in general he observes that big progress is common when a technology hasn’t reached a certain stage of maturity, but once it has, the steps become smaller, but almost more important.

AROUND THE WORLD

Expert panel for hosting the ILC in Japan meets for the first time

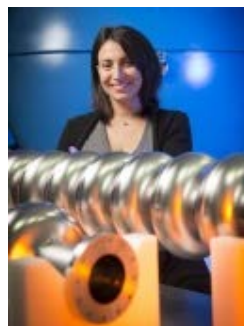
by Rika Takahashi



The expert panel to discuss whether to invite the International Linear Collider to Japan held its first meeting in Tokyo last week. The 17 experts reviewed the challenges pointed out in the recommendation submitted by the committee under the Science Council of Japan last summer, which pointed out the issues to be clarified for a decision to host the ILC in Japan. Their final report to Japan’s Ministry of Education, Culture, Sports, Science and Technology will be prepared in the fiscal year 2015.

AROUND THE WORLD

From Fermilab Today: Anna Grassellino receives \$2.5 million DOE award for research on SRF cavities



Thanks to science, we get more for less. We get more features on a newer car model, more data and information stored on a computer, and all for the same or lowered cost.

That same principle applies to accelerator R&D, where improving the performance and lowering the cost can help open doors to new ideas.

The Department of Energy recently named Fermilab physicist and 2013 Peoples Fellow Anna Grassellino as a recipient of the prestigious Early Career Research Award for her work to develop particle accelerator cavities that have improved performance and are less expensive to operate.

ANNOUNCEMENTS

Next International Workshop on Future Linear Colliders (LCWS): 6 to 10 October in Belgrade



The **2014 International Workshop on Future Linear Colliders (LCWS14)** will take place from 6 to 10 October in Belgrade, Serbia and will be hosted by the Vinca Institute of Nuclear Sciences. The workshop will start Monday morning and run until Friday around 13:00. The registration will open soon. Additional satellite meetings will take place in connection to the workshop, such as the FCAL workshop on 12 and 13 October.

This Linear Collider Workshop is the sixteenth in the series that started in 1991. It will be devoted to the study of the physics cases for future high energy linear electron-positron colliders, taking into account the recent results from LHC, and to review the progress and future plans for the ILC and CLIC detector and accelerator projects.

IN THE NEWS

from **NTV News**

3 June 2014

[達増知事が要望「誘致を明確に」](#)

達増知事は文部科学省に対し、岩手県が誘致を進めている国際リニアコライダーについて、日本に誘致する方針を明確にし、国内体制を整えるよう要望した。(Tatsuya Tasso, the governor of Iwate prefecture filed petition to MEXT asking the Japanese government to clearly indicate Japan's intention of inviting the ILC to Japan, and to prepare the framework in Japan.)

from **Illustrert Vitenskap**

2 June 2014

[Ny partikkelakselerator ser nærmere på higgspartikkelen](#)

I 2012 klarte fysikerne endelig å finne den: higgspartikkelen. Nå skal en ny partikkelakselerator videreføre arbeidet og fingranske partikkelen som er ansvarlig for å gi alle andre partikler masse. International Linear Collider, ILC, skal sende elektroner og positroner på kollisjonskurs fra hver sin ende av det 31 kilometer lange anlegget.

from **Illustrerad Vetenskap**

2 June 2014

[Ny partikelaccelerator zoomar in Higgspartikeln](#)

Jakten på kunskaper om universums minsta byggsten fortsätter i en ny anläggning som ska ta över när acceleration i Cern gjort sitt. Se hur den ska fungera här.

from **Tokio Keizai online**

2 June 2014

[スケールがケタ違い CERNに行ってきた ジュネーブ郊外にある素粒子物理学の総本山](#)

今、日本では国際リニアコライダー ILC の建設計画が進められている。CERNのLHCが環状であるのに対して、ILCは直線状だ。国内建設候補地は岩手県を中心に広がる北上山地。これが実現すれば、スイス・フランスのLHCと日本のILCを両輪に、宇宙の起源を究める実験が行える。(Currently, the plan to construct the ILC in Japan is underway. While the LHC at CERN is circular shape, ILC is linear. The candidate site in Japan is Kitakami mountains in Iwate prefecture. If the ILC comes true, ILC will pursue the study to uncover the mystery of the universe together with the LHC)

from SLAC Today

29 May 2014

From the Director of PPA: A New Strategic Plan for Particle Physics in the U.S.

The report comes at a time when the field is confronted by exciting science questions and a wealth of possible experimental approaches to learning more about the universe around us. It also comes at a time when funding is very tight, necessitating tough decisions and clear priorities among these many excellent investment opportunities.

from Nature

28 May 2014

Seven days: 23–29 May 2014

US physics plan High-energy physics in the United States must emphasize international collaborations to remain vibrant in the face of tight budgets, says a 22 May report from the US Department of Energy's Particle Physics Project Prioritization Panel. It stresses the need for the United States to remain a key player in the Large Hadron Collider at CERN, Europe's particle-physics lab near Geneva, Switzerland, and to stay involved in the proposed International Linear Collider in Japan. The panel also recommends recasting a proposed neutrino facility at the Fermi National Accelerator Laboratory in Batavia, Illinois, as an internationally funded effort. See go.nature.com/fo5b8f for more

from IBC News

27 June 2014

の早期実現を国に要望

国際リニアコライダーについて、東北の産学官で組織する団体が国に早期実現を要望しました。(The industry-academic-government organization in northeast region of Japan, the Tohoku Conference for the promotion of ILC submitted the petition calling for the early realisation of the ILC to Japanese government.)

from physicsworld.com

23 May 2014

US particle-physics panel presents plan for the future

Top priorities over the next two decades include the US playing a vital role in upgrades to the Large Hadron Collider (LHC) at CERN in Switzerland and building a long-baseline neutrino facility based at Fermilab near Chicago. The report also calls for US participation in the planned International Linear Collider (ILC), should the project commence.

CALENDAR**Upcoming events****Technology and Instrumentation in Particle Physics 2014
(TIPP 2014)**

Amsterdam, the Netherlands

02- 06 June 2014

5th International Particle Accelerator Conference (IPAC'14)

Dresden, Germany

15- 20 June 2014

**37th International Conference on High Energy Physics
(ICHEP 2014)**

Valencia, Spain

02- 09 July 2014

**ICFA Workshop on High Order Modes in Superconducting
Cavities**

Fermilab

14- 16 July 2014

Upcoming schools**The 2014 European School of High-Energy Physics**

Garderen, the Netherlands

18 June- 01 July 2014

[View complete calendar](#)

NEWSLINE

THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

DIRECTOR'S CORNER

Of cavity performance, tiny beams and official roles: progress in a maturing project

Akira Yamamoto | [5 June 2014](#)

From 12 to 16 May, the Americas Workshop on Linear Colliders (AWLC) 2014 was held at Fermilab in the US. AWLC is one of the series of regional linear collider workshops held around the world.

The purpose of this workshop was the continued development of the physics case, and advancing detector and accelerator designs for a high-energy linear electron-positron collider. This meeting particularly addressed the developments for the International Linear Collider (ILC), which Japan is showing the interest to host.

Even though the scale of the workshop was rather small, with about 300 participants, I believe that this meeting was significant. It was the first meeting after the completion of the LCC-ILC accelerator organisation chart, presented by Mike Harrison, the LCC-ILC director in the opening plenary session of AWLC. This chart lists the group leaders and also KEK's group leaders for 15 technical sub-groups, such as accelerator design, superconducting radiofrequency, or cryogenics. You may think it is just a chart, but I believe it is one of the most important proofs of progress of LCC's strategic planning since its establishment in February 2013.

Personnel positioning is one of the biggest issue for the realisation of the ILC. World researchers are having their fingers in two pies; working on ILC design in parallel with working

and responsibilities on the running projects at their own laboratories. To get their working time for the ILC, we needed to establish the official structure approved by each laboratory. This had not been an easy job, but it was made possible by in-depth, multiple communications between labs and LCC.

Because we have this chart completed, many younger researchers at KEK who will lead the real ILC construction work could attend the meeting. They made important presentations, and their presence made the discussion truly substantive. LCC also welcomed five sub-leaders from CERN on the chart. This is a significant change from the Global Design Effort, the former organisation promoting the ILC, which did not have multiple involvement of CERN. Their official participation will also work as a driving power for the realisation of the ILC.

LCC-ILC Director: M. Harrison, Deputies: N. Walker and H. Hayano			LCC-ILC Project Office Head: A. Yamamoto		
Sub-Group	Global Leader Deputy/Contact P.	KEK Leader* Deputy	Sub-Group	Global Leader Deputy/Contact P.	KEK Leader* Deputy
Acc. Design Integr.	N. Walker (DESY) K. Yokoyama (KEK)	K. Yokoyama	SRF	H. Hayano (KEK) C. Gindzburg (Fermi), E. Moreschini (CERN)	H. Hayano Y. Yamamoto
Source (e- and p+)	W. Gai (ANL) M. Kuroki (Brookhaven U)	J. Hoshino T. Otsori	RF Power & Control	S. Michizono (KEK) T. Otsori (ANL), ILO	Michizono T. Mutsumoto
Damping Ring	D. Rubin (Cornell) N. Tamura (KEK)	N. Tamura	Cryogenics (incl. RF gas system)	H. Naka (KEK) T. Fukunishi (Fermi), D. Delkarri (CERN)	H. Naka Cryog. Center
IT/ML	S. Karada (KEK) A. Luttrell (CERN)	S. Karada	GPS	A. Esomoto (KEK) V. Kuchel (Fermi), J. Colson (CERN)	A. Esomoto M. Miyahara
Main Line (incl. A Comp. R.F. Research)	N. Sefiani (Fermi) K. Kubo (KEK)	K. Kubo	Radiation Safety	T. Saragai (KEK) TDO (ANL), ILO	T. Saragai T. Sasaki
RFQ	B. White (SLAC) H. Tamas (CERN) T. Ohgaki (KEK)	T. Ohgaki	Electrical Support (Power Supply etc.)	TDO	TDO
RFH	K. Binstler (DESY) T. Tsuchi (KEK)	T. Tsuchi	Mechanical S. (Duct, S. others)	TDO	TDO
			Detector Programs, Sub-det. Facilities	TDO	H. Hayano T. Sasaki

LCC-ILC accelerator organisation chart

Many impressive reports were made in the workshop. The presentation which impressed me the most was the development at the Accelerator Test Facility (ATF) at KEK laboratory, Japan. ATF is a test accelerator focused on generating the super low-emittance beam that is one of the essential techniques to realise the ILC. The scientists at ATF are working on the technologies to squeeze the beam to nanometre scales. The target size is 37 nanometres. Because of the difference in the energy between ILC and ATF, a 37-nanometre beam size at ATF is equivalent to the 6-nanometre beam at ILC. They reported that they have realised a beam size as small as 55 nanometres, and the record is improving. They did not only realise the very small size but are also showing high reproducibility, and this is really important progress. This means that the technology is becoming increasingly convincing.

Another impressive technological advancement is that of superconducting radiofrequency (SRF) systems. In the past we used to experience the degradation of the performance of the superconducting cavities. When the cavities were assembled into the system, their performances were lowered by about 10 percent on average. But now, both DESY in Germany and Fermilab accomplished good records, and the degradation fell within the five percent range. At KEK, most of the cavities are showing good performance of accelerating gradients and exceed the ILC specification, and we are expecting a good result of the system test in this autumn.

Laboratories around the world are producing a steady flow of successes. This is very encouraging evidence that our study is succeeding. And also, it means we are entering the next stage. When the technologies are immature, making big advancement is easier. Now, the technologies have matured, advancing another step will become harder. We need to strive more than ever.

While we see the steady technological development, the politics around the ILC isn't so easy.



KEK Director General, Atsuto Suzuki giving a talk at the summary session of AWLC14 Image: Nobuko Kobayashi

As Atsuto Suzuki, Director General of KEK, said in the closing session: since when Japan has been getting the primary candidate position for hosting the ILC, the general assumption for the contribution sounds to be setting back to the Japan Linear Collider (JLC), the old linear collider initiative planned as a national project.

Many people asked us when Japan will give a go. Of course, Japanese researchers need to make their very best effort to realise the ILC, but "ILC" should be really a global project in appropriate balance of contribution. We do need strong global support to get a go sign.

It is very encouraging to receive positive message from United States in the P5 report. I would like to thank the committee member's long-term and hardest effort to reach this report. This surely will be a push for the realisation of the ILC in Japan.

[ACCELERATOR R&D](#) | [ATF2](#) | [CAVITY GRADIENT](#) | [FERMILAB](#) | [JAPAN](#)

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AROUND THE WORLD

Expert panel for hosting the ILC in Japan meets for the first time

Rika Takahashi | [5 June 2014](#)



ILC bird's-eye view. Image: Rey.Hori/KEK

The expert panel to discuss whether to invite the International Linear Collider to Japan held its first meeting in Tokyo on 8 May. This panel, chaired by Shinichi Hirano, Zhiyuan Professor and Special President Advisor at Shanghai Jiaotong University, as well as professor emeritus of Nagoya University, is composed of 17 experts from various academic fields, including sociology and science communication.

The charge of this panel is to review the challenges pointed out in the recommendation submitted by the committee under the Science Council of Japan (SCJ) last summer. The SCJ committee was asked by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) to discuss the scientific significance of the ILC, the impact of hosting ILC in Japan on the broader academic community or society, and the current status of the project.

Their [report](#) concludes “The Committee finds that the ILC is the most natural next machine for electron-positron colliders and that the *Technical Design Report* (TDR) published in June 2012 is based on the intensive and detailed study conducted by an international team of scientists”.

Taking the SCJ report into account, the panel is charged to discuss about the ILC project on 1) the concrete policy, 2) cost and international sharing, 3) manpower needed for construction and operation, 4) domestic frameworks, 5) social impacts, and other possible issues arising from hosting the ILC in Japan.

In the first meeting, Atsuto Suzuki, Director General of KEK, gave a general report on the ILC project. The panel decided to set up two sub-committees, one to further review the scientific significance, and another to verify the ILC *Technical Design Report*. The two subcommittees will make detailed investigations, and discuss about the findings at their second meeting to be held in October. The final report will be prepared in the fiscal year 2015.

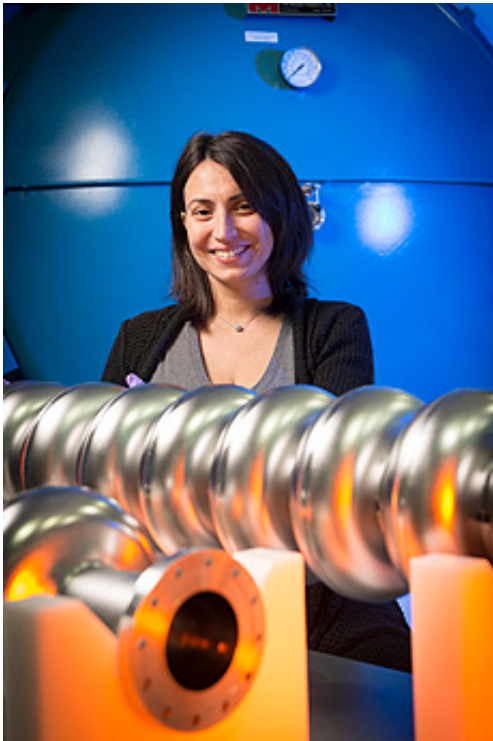
[ILC SITE](#) | [JAPAN](#) | [MEXT](#)

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Feature

Anna Grassellino receives \$2.5 million DOE award for research on SRF cavities



Anna Grassellino's Early Career Research Award-winning work enables the efficient, cost-effective acceleration of particle beams. Photo: Reidar Hahn

Thanks to science, we get more for less. We get more features on a newer car model, more data and information stored on a computer, and all for the same or lowered cost.

That same principle applies to accelerator R&D, where improving the performance and lowering the cost can help open doors to new ideas.

The Department of Energy recently named Fermilab physicist and 2013 [Peoples Fellow](#) Anna Grassellino as a recipient of the prestigious [Early Career Research Award](#) for her work to develop particle accelerator cavities that have improved performance and are less expensive to operate.

The \$2.5 million award, spread out over five years, will fund Grassellino's research to expand her recent discovery of the cavity surface doping effect to a wide range of applications. The research will lead to enabling technologies for future superconducting accelerators used for a broad spectrum of scientific machines, medical uses, and nuclear energy applications.

"This grant is extremely important, as it will allow me to expand our current findings and do further exploratory research that isn't always possible, as often we focus on development work that is project-targeted," Grassellino said. "But the big technological breakthroughs, which then enable new machines, are made by trying something completely new and by pursuing the fundamental understanding of the mechanisms in play. This is the exciting part of this grant — there may be more breakthroughs coming."

SRF cavities enable acceleration of beams of particles. These innermost components of an accelerator are strung together, like a strand of pearls, inside a vessel called a cryomodule, which keeps them at very cold temperatures.

To get the best performance, scientists treat a very thin layer of the cavity surface, measuring several tenths of nanometers. Traditionally, researchers believed that these cavities should be made from very pure niobium, but Grassellino discovered that the addition of a little bit of impurity, such as nitrogen gas, into the niobium surface can help to greatly increase the cavity efficiency.

By doping the niobium surface of a 1.3-gigahertz, single-cell cavity with an impurity such as nitrogen gas, Grassellino and the Fermilab SRF team increased the cavity's quality factor, or Q, the measure of how well the cavity stores energy, to previously unseen values. During recent tests, she measured a world-record value for Q, which was almost three to four times that of the next-highest reported quality factor of any accelerator cavity.

Since many particle accelerators and physics experiments require a great deal of power, more efficient cavities will bring down the cost of refrigeration, often the most expensive part of running an experiment.

The new technique can substantially lower the cost of operating high-energy particle accelerators. It can also make possible machines that use a lot of power, such as a future light source or continuous-wave beam experiments, that would otherwise be cost-prohibitive.

"We made this discovery two years ago, and it has already turned into the enabling technology for important future machines. We are very excited," Grassellino said. "This shows how this type of funding eventually pays huge dividends from unexpected discoveries and applications."

She says the next steps are to deepen the understanding of why the technique works and to explore other options.

"This award gives me the chance to extend the technique to cavities of different frequencies, to try other gases, to understand the new surface nanostructure," Grassellino said. "Most importantly, it will allow us to advance SRF science and gain new knowledge, which is power, even if the implications are not fully understood at the time of the discovery."

Hasan Padamsee, head of Fermilab's Technical Division, is a world-renowned expert in SRF technology. He finds her work intriguing.

"Now it is just a question of translating that to large-scale structures, such as cryomodules," he said.

This is the second DOE Early Career Research Award for SRF researchers in Fermilab's Technical Division in recent years. It will support Grassellino and two students and will provide funding for materials, testing and processing.

"To have good quality researchers as part of the division is an important leg for the division to stand on," Padamsee said.

—*Rhianna Wisniewski*

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[5 June 2014](#)



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