LC NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

From metal sheet to particle accelerator (part 2 of 3)

Into the cold: cavities for the European XFEL put to the test

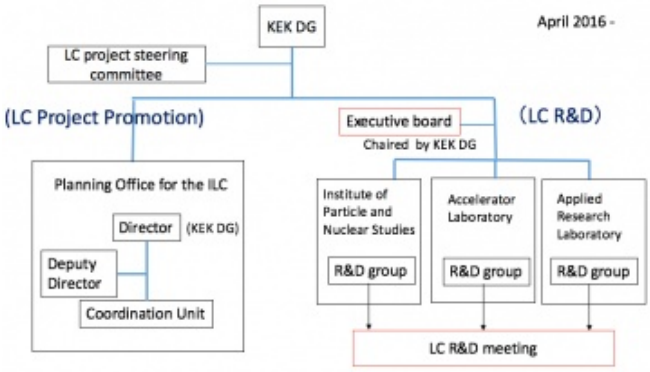
by Ricarda Laasch

If you're an electron, a ride in a cavity is pretty much the coolest thing that can happen to you. If you're an accelerator and you need huge numbers of cavities you better make sure they're all of outstanding quality – which is what the X-ray free-electron laser European XFEL under construction in Hamburg has just finished. In a series first published in DESY inForm, we look at how a niobium sheet turns into a curvy beauty. Part two describes the series of tests cavities have to undergo before making their way into an accelerator module.

AROUND THE WORLD

KEK changes organisational structure towards realisation of the ILC

by Rika Takahashi



With the future in mind, Japan's High Energy Accelerator Research Organisation, KEK has made a change to its organisational structure regarding the ILC project. By doing so, KEK is getting ready for the "green light" from Japanese government.

AROUND THE WORLD

Akira Yamamoto awarded the Medal with Purple Ribbon

by Rika Takahashi

On 28 April, the Japanese government announced the winners of the "Medal with Purple Ribbon" for 2016, and Akira Yamamoto, professor of KEK and Regional Director for Asia of Linear Collider Collaboration, is one of them. He receives the Medal for his contribution to the advancement of superconducting technology. This medal is awarded to individuals who have contributed to academic and artistic developments, improvements and accomplishments.

DIRECTOR'S CORNER

Looking into the crystal ball

by Brian Foster

LINEAR COLLIDER COLLABORATION

The Linear Collider Collaboration comes to the end of its mandate at the end of this year. A working group made up of lab directors from Europe, the US and Japan is looking at options for a new management structure, and in his corner, European Regional Director Brian Foster gives some (unsolicited) advice.

IN THE NEWS

from *Iwate Nippo*
23 April 2016
ＩＬＣ生かし国際都市に　奥州・まちづくり策定委
国際リニアコライダー（ＩＬＣ）を生かした奥州市の将来像を示す「市ＩＬＣまちづくりビジョン」の策定委員会は２２日、ビジョン案をまとめ、小沢昌記市長に提出した。産業振興や外国人研究者らの生活支援、国際人材の育成策などを盛り込んだ。ＩＬＣがもたらす多くの可能性をまちづくりにつなげる。(Planning Committee for ILC urban development vision published the vision paper and handed it to Masaki Ozawa, Mayor of Oshu city. The paper includes recommendations on industrial development, support measures for foreign residents, and development of internationally oriented human resource)

from *symmetry magazine*
22 April 2016
LHC data at your fingertips
The CMS collaboration has released 300 terabytes of research data.

from *Kahoku Shinpo*
22 April 2016
＜政投銀＞東北の復興策提言
日本政策投資銀行は、東日本大震災から５年の節目に合わせ、東北経済復興の方策を提言するリポートをまとめた。・・「国際リニアコライダー」（ＩＬＣ）など加速器産業に関し「経済落ち込みが本格化する前のＩＬＣ立地決定が重要」と指摘し、国への働き掛けを促し（Development bank of Japan issues a report to recommend measures to revitalise economy in Tohoku. The report recommends to encourage the government's reaction saying "it is important to make positive decision on the ILC before the economic downturn start in earnest")

from *The Conversation*
20 April 2016
What the European Union can learn from CERN about international co-operation
Can Europe work? This is the real question being asked of British people on June 23. Behind the details of subsidies, regulations and eurozones lies a more fundamental puzzle: can different nationalities retain their own identities and work together, without merging into some bland United States of Europe?

from *Cern Courier*
15 April 2016
The ILC project keeps its momentum high
Although no decision has been taken so far as to whether or not the proposed new particle accelerator should be built, the R&D programme on key aspects of its design doesn't stop.

CALENDAR

Upcoming events

ECFA Linear Collider Workshop
Santander, Spain
30 May- 05 June 2016

Upcoming schools

The 2016 European School of High-Energy Physics
Skeikampen, Norway
15- 28 June 2016

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1604.07740
Baryogenesis from leptomesons

1604.07524
Measurement of the Higgs boson mass and e+e−→ZH cross section using Z→μ+μ− and Z→e+e− at the ILC

1604.07358
New Physics at the TeV Scale

1604.06100
Mixed Dark Matter in Left-Right Symmetric Models

1604.05324
The Higgs Portal and Cosmology

1604.04552
Collider Constraints and Prospects of a Scalar Singlet Extension to Higgs Portal Dark Matter

1604.04550
Resistive Plate Chamber Digitization in a Hadronic Shower Environment

1604.04076
Production and Decay of Di-photon Resonance at Future e+e− Colliders

NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

From metal sheet to particle accelerator (part 2 of 3)

Into the cold: cavities for the European XFEL put to the test

Ricarda Laasch | 28 April 2016

In the preparation area, six vessels can be equipped with four cavities each. Images: Dirk Nölle, DESY

Eight hundred superconducting cavities for the European XFEL have to be passed through the hands of experts. Their industrial production which was completed in September was covered in the previous issue. However, it is still a long way to go for DESY and its partners to a complete particle accelerator. In this issue, you can read more about the sophisticated inspection of the finished cavities and why these tests are meticulously documented.

Red and green containers with resonating cavities reach DESY by lorries and are unloaded in the so- called Accelerator Module Test Facility (AMTF). The red containers come from the company Research Instruments in Bergisch Gladbach, the green ones come a long way from E. Zanon in Italy. In the AMTF hall, which was custom-built for the testing of accelerator modules, the cavities are delivered to Jacek Swierblewski and his 40-member team of technicians and engineers. The whole team comes from the Institute of Nuclear Physics of the Polish Academy of Science (IFJ-PAN) in Cracow, Poland. The team working at DESY represents an in-kind contribution of the institute providing labour to the construction of the European XFEL. The team settled in easily: “Collaboration with DESY is working out well, the important contact partners are always present and open for questions,” said Swierblewski. An important contact partner at DESY is Detlef Reschke. As the so-called Cavity Owner, he always keeps an eye on all delivered cavities. “My work goes hand in hand with the Polish team,” said Reschke. “The team carries out the cavity measurements and I evaluate the results and decide how to further proceed with each cavity.” However, Detlef Reschke does not have to do the job alone, he too gets support from the AMTF team and from DESY experts in order to cope with the large amount of cavities and measurements. A clearly defined structure and sequence provides for an equal inspection and testing of each individual cavity.

After a cavity has been delivered, the first step is an incoming inspection carried out by the AMTF team. “Now, the cavity’s mechanical manufacturing is tested,” explains Swierblewski. “Length, circumference, fit of bolts and position of all other components are checked with millimetre precision. If everything is allright mechanically, we control radio frequency and vacuum. This is followed by the real test.” The cavity is equipped with all electrical connections and, together with three other cavities, is lowered into one of the two large underground cryostats in the AMTF hall. The cryostat is filled with helium to cool down the cavity to its operating temperature of minus 271 degrees celsius. Only this way is it possible to test its accelerating qualities.

“During a vertical RF test, two important parameters of the cavity are measured: quality and accelerator gradient,” says Reschke. Its quality (or: quality factor) is used as a standard for future thermal loss. This means that the higher the quality of the cavity, the less thermal loss is to be expected in future operation – which means lower operating costs.

The accelerator gradient indicates how much energy a particle will gain when traversing the cavity. This is defined by particle acceleration; however, the particle does not increase its speed but its energy, as even particles have a speed limit: the speed of light. This can be compared with a lorry driving on a German autobahn at a speed of 80 km/h. When the lorry is more heavily loaded, it gains weight and transports more goods to its final destination. Similarly, the additional energy of the particles can be used later on. Therefore, it is necessary to accelerate particles, i.e. load them with energy, just like empty lorries rarely travel on the autobahn.

The cold test itself takes about two and a half hours; if you count assembly and disassembly, it takes several days. When a cavity fulfils the accelerator gradient and quality requirements, it will be sent directly to CEA/Irfu in Saclay near Paris. If not, it will get a follow-up treatment in the clean room. Almost 70 percent of the cavities delivered by the firms meet the required standards at the first RF test and can be transferred right away.

The whole process is electronically documented. “Every step is recorded in a database,” says Swierblewski. “All data of the vertical tests, incoming inspection and every treatment of the cavity is being registered.” This includes the data of its development history which allow to trace the construction of the cavity to its source: the individual metal sheets. This accuracy and care of the whole documentation process pays off: “There are weak points in every production. With the help of the accurate documentation, it is possible to eliminate them at the right time – during the production process,” says Reschke. “In fact, so far this is the largest production of similar cavities in the field of science. We will of course evaluate the data scientifically. This will be beneficial for future projects like planned linear colliders and for the general understanding of this technology.”

The final document of a cavity provided by DESY is its outgoing inspection. “The out-going inspection is important because it determines the state of the cavity when loaded into the lorry,” says Swierblewski. The cavities that went through the acid test can finally be installed into the accelerator modules. For this purpose, they are transported to Saclay via German and French motorways.

Read about the construction of the accelerator modules in the next issue.

One of two cryostats for vertical cavity tests in the AMTF hall.

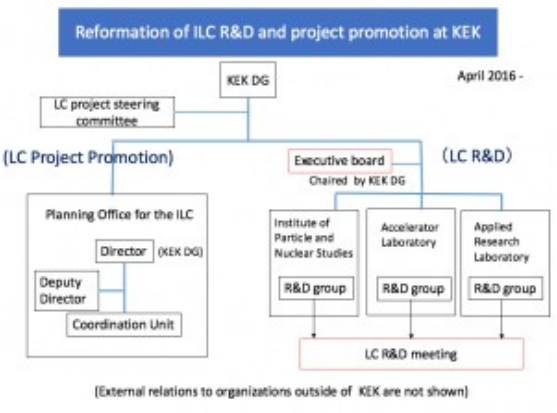
CAVITY | CEA SACLAY | DESY | EUROPEAN XFEL | RI | TEST | ZANON

NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

KEK changes organisational structure towards realisation of the ILC

Rika Takahashi | 28 April 2016



KEK's new organisational structure regarding the ILC project.

With the future in mind, Japan's High Energy Accelerator Research Organisation, KEK has made a change to its organisational structure regarding the ILC project. By doing so, KEK is getting ready for the "green light" from Japanese government.

"The main purpose of this change is to make the functions and roles clearer," said Masanori Yamauchi, Director General and the head of the Planning Office for the ILC. The Planning Office was set up in February 2014, and it has been accountable for two missions: project promotion, and technical development. The previous structure was intended to manage all ILC-related activities in KEK, and it worked to solidify the foundation to advance the ILC project in the laboratory. "Now, we are taking the next step. Two missions that the ILC Planning Office has been managing are quite different in nature, and require different expertise and manners of thinking. The new structure shares those different roles, and make them conducive to better performance," said Yamauchi.

From Japanese fiscal year 2016 starting 1 April, the Planning Office is concentrating on project promotion tasks, and accelerator R&D work is taken care of by the Accelerator Laboratory at KEK. The Institute of Particle and Nuclear Studies is in charge of physics and detector research. "The laboratory's policy making and budget allocation regarding ILC R&D will be coordinated by the executive board," says Yasuhiro Okada, executive director of KEK and deputy head of Planning Office. The members of the executive board consist of six senior scientists including the Director General and the Director of Accelerator Laboratory, Seiya Yamaguchi. "While the executive board oversees technical aspects of KEK's ILC activities, the Planning Office will take measures to issues and missions concerning various other aspects of ILC project promotion. All these efforts will help promote the project towards the realisation," he said.

"From the technical development point of view, nothing has been changed," said Shinichiro Michizono, professor at Accelerator Laboratory who is now leading the ILC-related technical efforts at KEK. "We will continue to focus on two technical challenges: superconducting radiofrequency technology, and nano-beam production and stabilisation," said Michizono.

Yamauchi also points out the advantage of the organisational change in the view of mobility of human resources. "Now those accelerator R&D activities are officially under the responsibility of the Accelerator Laboratory, and this change facilitates the migration between research programmes at KEK," he said. Because of the highly international nature of the ILC project, it had been treated as a somehow "exceptional" project at KEK. Now, the psychological barrier caused by this organisational anomaly has been cleared, and it is much easier for scientists who are engaging in other projects at KEK to get involved in ILC-related activities.

The new structure will allow the Planning Office at KEK to actually plan and prepare for the future of the ILC.

ACCELERATOR R&D | ILC | JAPAN | KEK

NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

Akira Yamamoto awarded the Medal with Purple Ribbon

Rika Takahashi | 28 April 2016

On 28 April, the Japanese government announced the winners of the “Medal with Purple Ribbon” for 2016, and Akira Yamamoto, Professor Emeritus of KEK and Regional Director for Asia of Linear Collider Collaboration, is one of them. He receives the Medal for his contribution to the advancement of superconducting technology. This medal is awarded to individuals who have contributed to academic and artistic developments, improvements and accomplishments.

Yamamoto has been working on various projects including TRISTAN at KEK, BESS at NASA, U.S., the Large Hadron Collider at CERN, Switzerland, to name a few. “My carreer might seem mercurial, but I worked on my job with a single-mindedness of purpose – to advance superconducting technology for particle physics studies,” he said.

Akira Yamamoto in his office at KEK Image: KEK

He started his carrier in 1977, to develop superconducting magnet technology for the TRISTAN TOAZ detector. TRISTAN accelerator was a world first accelerator practically applied the superconducting RF technology. “We started from scratch and directly built the operating machine. This is something we can be proud of,” said Yamamoto.

Yamamoto said modestly: “I might not be talented enough as an experimental physicist, but I can say I am good at supporting the experiments from a technical development point of view. I am proud of my job to support behind the scenes. This is a great job, and hope many young scientists may have similar ways with me.”

JAPAN | KEK | SCRF

NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

DIRECTOR'S CORNER

Looking into the crystal ball

Brian Foster | 28 April 2016

What's the future of the Linear Collider Collaboration?

At its recent meeting in Japan, the International Committee for Future Accelerators (ICFA) decided that it would form a small subcommittee to discuss and recommend what structures should follow the current Linear Collider Board (LCB) and Linear Collider Collaboration (LCC) when their current (extended) mandates terminate at the end of this year. The committee consists of the leaders of experimental particle physics: the Chair of ICFA and DESY's director for particle and astroparticle physics, Joachim Mnich, the Director-General of CERN, Fabiola Gianotti, the Director of Fermilab, Nigel Lockyer and the Director-General of KEK, Masanori Yamauchi. As they muse on the future for our linear collider activities, I am taking this opportunity, as an outgoing Regional Director of LCC, to give them some unsolicited advice!

One of the comments I made in the discussion at the ICFA meeting was that the roles of those leading the successor organisation to LCC – let me call it LCC' – should be capable of being achieved. This may sound obvious but, to be honest, some of the current roles in LCC cannot be successfully carried out. For example, my own, which is substantially involved in discussions with European political and funding authorities and the European Union, cannot succeed in the absence of some sort of signal that there is a host that would like to explore the possibility of setting up a world-wide collaboration to build the International Linear Collider (ILC). As we have heard recently, this is unlikely to be forthcoming from Japan before 2018. Thus I would recommend that LCC' should not have Regional Directors, but instead have contact persons, perhaps in each of the major countries likely to want to contribute to ILC construction. These contact persons could maintain links with their funding authorities and be ready to spring into action if and when a "green light" is given to initiate concrete discussions.

The main function of LCC', it seems to me, is to maintain the Compact Linear Collider (CLIC) and ILC collaborations in healthy and working order until a concrete decision on either CLIC or ILC construction is given. This is not a trivial job. Let me concentrate on the ILC: it seems clear to me that the R&D for CLIC should continue more or less along the current lines until the next European Strategy discussion. The LCC has I think done remarkably well, with minimal resources, in maintaining a team of experts, almost all of whom are part time, working on refinement of the ILC design. As has been said many times before in these pages, the ILC is a mature technology, whose "10% prototype" (!), the European XFEL at DESY, is almost complete. Nevertheless, there is much optimisation and site-specific design that remains to be done and it has continued under the LCC with significant and, at least to me, surprising success. Nevertheless, there is a limit to the patience, availability and even longevity of the necessary experts that the current timescale of ILC is pushing to its extreme. Thus the job of LCC', in a period where it seems highly unlikely that resources can increase or even be maintained, will be very challenging indeed. From these considerations it is clear that we will continue to need Directors for the accelerator activity. I would recommend that LCC' should have an overall Director, with three Associate Directors, one for the CLIC machine, one for ILC machine and one, as now, for physics and detectors. Together with the national contact persons, I think this makes a team which has a chance of fulfilling the necessary goals.

As for the LCB, I don't see any particular reason to change the current setup. The suggestion when the LCB was set up was that it should be more "executive" than its predecessor and more active in political activities. Again, however, this does not seem possible without a green or at least an amber light from a host country. We should return to a chair that rotates around the three regions, perhaps with a two-year term.

So ends my unsolicited advice to my senior colleagues. It is essential that we maintain our linear collider collaboration in being for as long as is necessary for the funding and political authorities to come to a decision. Those of us who have been involved for decades have demonstrated our commitment and patience. Difficult though it may be, it is essential that we continue until what will hopefully be a positive decision to finally realise our linear collider dreams.

ICFA | LCC | MANAGEMENT