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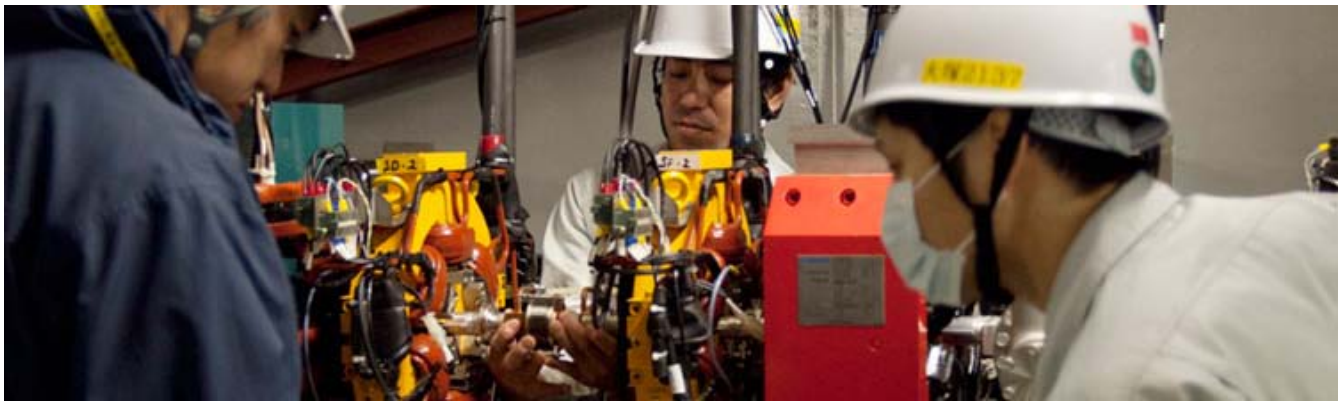
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FEATURE

KEK continues to work for the ILC

Natural disasters have not deterred KEK from looking to the future of the ILC

by Rika Takahashi



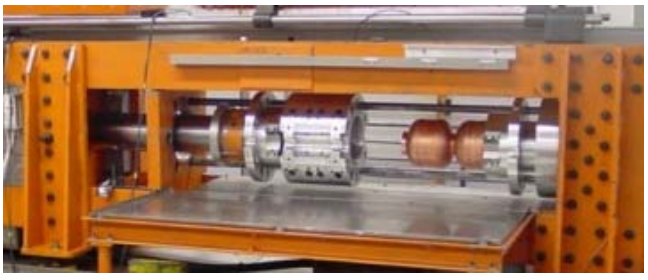
Atsuto Suzuki, director general of KEK in Tsukuba, Japan, states that despite the devastating earthquake and tsunami that hit Japan on 11 March, no changes have been made to KEK's ILC-related plans.

FEATURE

Seamless cavity performance

Laboratories in the US begin to take a serious look at hydroforming as a method for creating ILC-type cavities.

by Leah Hesla



Fermilab and Jefferson Lab redouble efforts on hydroformed cavities through R&D and industrialisation.

DIRECTOR'S CORNER

ILCSC reviews GDE progress and plans

by Barry Barish



The International Linear Collider Steering Committee met in Beijing in February and carried out their review of the Global Design Effort progress. They also had lively and informative discussions regarding the future of the worldwide efforts towards the ILC and beyond 2012.

IMAGE OF THE WEEK



Power recovery at KEK, Japan

Image: KEK

Power cable being recovered at the Accelerator Test Facility at KEK in Japan (April 2011).

IN THE NEWS

From NIU Today
6 April 2011
Dhiman Chakraborty: Particle path-breaker
Chakraborty has led design of calorimeters and software that would be used at the proposed International Linear Collider, a next generation accelerator.

From New York Times
5 April 2011
At Particle Lab, a Tantalizing Glimpse Has Physicists Holding Their Breaths
Physicists at the Fermi National Accelerator Laboratory are planning to announce Wednesday that they have found a suspicious bump in their data that could be evidence of a new elementary particle or even, some say, a new force of nature.

From Interactions
1 April 2011
EMMA milestone beams its way to a world first
Scientists from across the world are celebrating the successful start up of the pioneering EMMA accelerator which is set to impact fundamental science and change the way such particle accelerators across the world are designed and built in the future.

From Nature
1 April 2011
The amazing disappearing antineutrino
A revised calculation suggests that around 3% of particles have gone missing from nuclear reactor experiments.

From physorg.com
31 March 2011
Getting to know the strong force, one of the four fundamental forces of the universe
In new work, high-energy physicists have observed two long-sought quantum states in the bottomonium family of sub-atomic particles. The result will help researchers better understand one of the four fundamental forces of the universe - the strong

force - that helps govern the interactions of matter.

From physicsworld.com
31 March 2011
Rivalry drives Higgs hunt
This video report for physicsworld.com brings an update from the particle-physics lab near Geneva on the search for the Higgs and new physics beyond the Standard Model.

From symmetry breaking
30 March 2011
Rare particle decays could indicate presence of new physics
Physicists at the LHCb experiment at the Large Hadron Collider recently reported the first observations of a new way that particles called Bs mesons decay into other particles. Studying this particular decay could provide clues as to why the universe is made up of matter rather than antimatter.

CALENDAR

UPCOMING EVENTS

Linear Collider Power Distribution and Pulsing workshop
LAL, Orsay, France
09- 10 May 2011

UPCOMING SCHOOLS

Joint US-CERN-Japan-Russia School on Particle Accelerators
Course on Synchrotron Radiation and Free Electron Lasers
Ettore Majorana Foundation and Center for Scientific Culture, Erice, Sicily, Italy
06- 15 April 2011

View complete calendar

BLOGLINE

6 April 2011
Paul Jackson
Results from the first published search for supersymmetry at ATLAS have arrived

31 March 2011
Symmetry Breaking
A new bottomonium particle makes its debut

23 March 2011
Frank Simon
Linear Colliders in the Pacific North-West

PREPRINTS

ARXIV PREPRINTS

1103.6076
Collider signatures of the SO(5) x U(1) gauge-Higgs unification

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FEATURE

KEK continues to work for the ILC

Natural disasters have not deterred KEK from looking to the future of the ILC

Rika Takahashi | 7 April 2011



Scientists and engineers at KEK in Japan check the damage of the Accelerator Test Facility. Image: KEK

Almost four weeks have passed since the worst disaster that has ever hit northeast Japan. KEK has been evaluating damage to its facilities and buildings and is planning to release the official disaster report soon. Recovery activities that do not require much electricity consumption have begun already as KEK employees work to return operations to normal as quickly as possible.

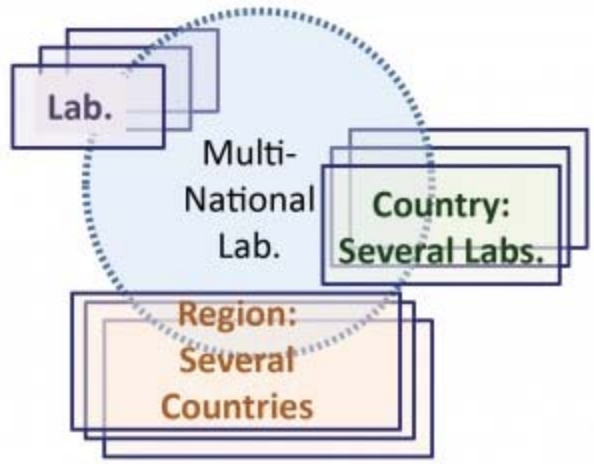
“First of all, I would like to state that KEK won’t change any plans related to ILC activities”, said Atsuto Suzuki, director general of KEK. “The priority there now is to recover activities for the Accelerator Test Facility (ATF) and the Superconducting RF Test Facility (STF),” he said, stating his strong will to resume ILC R&D at KEK’s test facilities.

Scientists all over the world are now working hard to carry out the critical R&D programme needed to build the ILC.

The Global Design Effort is currently working to complete a *Technical Design Report* (TDR) for accelerator design by the end of 2012. The Research Directorate is also writing up the *Detailed Baseline Design Report* (DBD) on detector design. These documents may be used as the basis of funding proposals to collaborating governments.

Completion of the TDR and DBD in 2012 marks the conclusion of the present mandate for the Global Design Effort (GDE) and the Research Directorate (RD), and that has led to ongoing, extensive discussion on ILC governance after 2013.

Members of the ILC Steering Committee (ILCSC), the body that oversees GDE activities, have received a draft of the Comprehensive Project Design Guidance (CPDG). In this document, four possible governance models were discussed without making a choice among them. Members of the ILCSC siting work group – Joachim Mnich (DESY), Pier Oddone (FNAL) and Suzuki – drafted the CPDG.

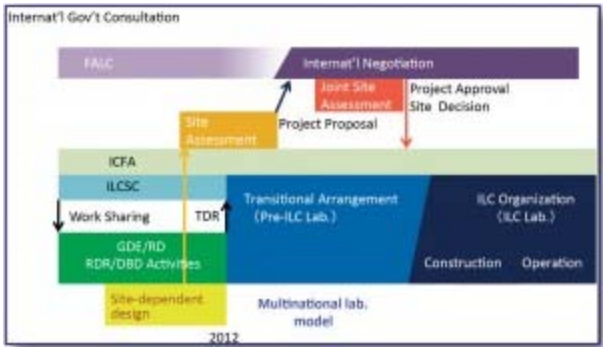


Concept of a Multinational Laboratory model.

One of the four governance models described in the CPDG is the Multinational Laboratory model: a laboratory formed by member countries, regions, laboratories and universities that contribute various resources such as human resources, accelerator elements and equipment and funds. The laboratory’s main campus will physically exist in some country and members will have branches on the campus. The members will maintain their own activities in each country as well as keep up activity at the ILC lab.

“I think the governance model called the Multinational Laboratory model will be the best fit for the future ILC laboratory,” said Suzuki. “The world community has agreed to establish a pre-ILC lab, the precursor body for the ILC organisation that will manage ILC activities after 2013. Also, there is a consensus that the pre-ILC lab should be started as a multinational laboratory.”

“The key words are partnership and decentralisation. We believe that the formation of a pre-ILC lab based on the Multinational Laboratory model can be relatively smooth with expansion of the present management bodies,” said Suzuki.



Post-2013 plan with a Multinational Laboratory model.

At that point, the ILCSC, together with GDE and RD, will be dissolved into the new laboratory to coordinate the remaining technical and engineering efforts in both the accelerator and the physics and detector areas.

“KEK is committed to working on the establishment of a pre-ILC lab, and there is no schedule change on these activities,” Suzuki said.

CPDG | ILCSC | KEK | MULTINATIONAL LABORATORY

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FEATURE

Seamless cavity performance

Laboratories in the US begin to take a serious look at hydroforming as a method for creating ILC-type cavities.

Leah Hesla | 7 April 2011

Researchers in the US may soon be pumping their cavities into shape.

Last year Fermilab scientists put out a call to industrial companies to propose a procedure for hydroforming ILC-type cavities. They hope that by next year, the selected company will provide Fermilab with three hydroformed nine-cell cavities for testing.



DESY's hydroforming machine. Before being placed in the machine, a 150-mm-diameter tube is, at prescribed points along its length, 'necked', or spun, to a diameter of 78 mm. This forms the irises, or narrow parts, of the cavity. The necked tube is then placed in the hydroforming machine, and water in the tube presses against the metal. As a result, the tube between the irises swells to a diameter of 208 mm. Image courtesy of Waldemar Singer.

"Hydroforming's a good idea whose time has come," said Fermilab scientist Andy Hocker, who has led the lab's effort in hydroforming research.

To hydroform ILC cavities, a seamless tube of niobium with the right mechanical properties is set in a cavity-shaped die. Water, pressurised to hundreds of atmospheres, is pumped into the tube and pushes out against the tube wall until it conforms to the mould. In ten minutes, the metal is shaped into the cavity's familiar beads-on-a-string form.

The resulting shape, sculpted from a single piece of metal, is without seams or welds. Scientists see this as the method's primary advantage over the standard procedure for forming cavities. There, 18 cup-shaped half-cells are each welded by an electron beam to the next, forming the nine-cell structure.

"The weld is such a trouble spot," Hocker said. Welding is a complicated process, each step of which invites error. Also, most of the consequential defects in the cavity appear near welds (especially those at the equator, the widest part of the cell). "They're a headache. Everybody would love to be rid of them."

Being rid of them could also mean potential cost savings in fabrication and improved reproducibility in performance.

The process of hydroforming cavities from niobium tubing has been extensively researched at DESY. Waldemar Singer has led this effort within the Coordinated Accelerator Research in Europe programme. Kenji Saito has led similar R&D at KEK in Japan. Both laboratories have successfully fabricated multi-cell cavities with their developed-in-house hydroforming machines. The DESY effort, in particular, is at a stage where industrialisation is the next logical step.

But until recently, US laboratories made no notable strides towards building their own facility. Scientists at Jefferson Lab were among those who saw promise in the method.

"I've become quite interested in seamless cavities because their performance is good," said Jefferson Lab's Peter Kneisel, who is gathering additional statistics on the process by testing multiple hydroformed cavities.

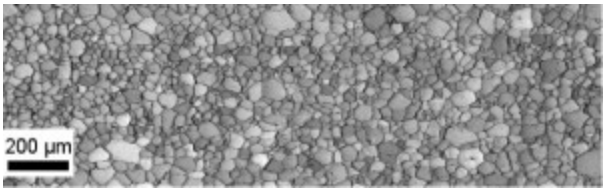
Two years ago, Kneisel tested three 3-cell hydroformed cavities fabricated at DESY. The results were favorable – each yielded a gradient of about 32 megavolts per metre (MV/m).

The three have since been welded together at DESY to form a single nine-cell cavity (these welds are at the irises, which are far less troublesome than those at the equators). Kneisel is currently testing its performance at various points in the ILC baseline cavity-treatment process.

Having undergone an initial buffered chemical polish, it has already achieved 26 MV/m with no quench. Another two-cell hydroformed cavity from DESY achieved 36 MV/m after the same polish. Kneisel has another batch of three 2-cell cavities, also from DESY, waiting in the wings to be tested over the coming months.

A company in Jefferson Lab's backyard also contributed to the US hydroforming effort. With the support of a Small Business Innovative Research grant, Black Labs in Virginia worked to produce a seamless, uniformly pliable and smooth niobium tube.

"The key to designing a tube for hydroforming was to have a very fine grain size," said Roy Crooks, metallurgist at Black Labs. Crooks had already worked developing highly formable, fine-grain metallic materials for aerospace applications. He learned from DESY's Waldemar Singer and others that one of the biggest nuisances for hydroforming was the metal's coarse grain size.



Grain structure of a Black Labs/ATI Wah Chang fine-grain niobium tube. The average grain size is 20 micrometres. The image was obtained in a scanning electron microscope. Image courtesy of Roy Crooks.

Coarse grain size implies an alignment of metallic crystals. Alignment may sound like a happy trait, but a metal's ductility is more uniform if its crystals are oriented randomly. The finer the grain size, the more likely its crystals will lie in all different directions.

Black Labs worked with ATI Wah Chang, an Oregon-based niobium manufacturer, to produce fine-grain niobium tubes. The recipe involved deforming the metal at the right temperature, which caused new crystals to be born, resulting in many fine-grain crystals that crowd out larger-grain ones. The resulting grain size was 20 micrometres, much smaller than the 200-micrometre grains of tubes tested in earlier experiments.

The metal was also significantly smoother.

"The internal surface was more like a polished piece of furniture, rather than an orange peel," Crooks said.

In 2009 Crooks and Hocker visited DESY. Together with Singer's team, they hydroformed tubes produced under the Black Labs/ATI Wah Chang collaboration. The tubes were formed into several three-cell units.

The cavities have since shipped to Jefferson Lab and, along with the aforementioned DESY-fabricated cavities, will be subjected to the usual spate of tests.

One of the three-cell products achieved a 21 MV/m gradient.

"That was an encouraging result for the first cavity made from a tube developed by American industry," Kneisel said.

Now, with Fermilab's industry bids soon coming to a close, US labs may be able to multiply the production of hydroformed cavities.

"One of our goals is to industrialise what DESY has established, and to find out whether it can be cost-effective or at least competitive with current cavity fabrication techniques," Hocker said. "We hope it will give us a path to achieving high gradient with high yield."


Cavities hydroformed at the DESY facility from nioboium tubes developed by ATI Wah Chang and Black Labs. Personnel from Black Labs, DESY and Fermilab formed the cavities. They received final assembly at Jefferson Lab and are currently being tested there. Image courtesy of Waldemar Singer.

Scientists expect that it will.

“I’ve been working in this field for 40-plus years and I’ve had my disappointments and my fun,” Kneisel said. “This work is something I believe we should really put more effort into.”

Read about the challenges of niobium materials.

CAVITY | CAVITY PROCESSING | CAVITY PRODUCTION | CAVITY TESTING | DESY | FERMILAB | HYDROFORMING | JLAB | NIOBIUM

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DIRECTOR'S CORNER

ILCSC reviews GDE progress and plans

Barry Barish | 7 April 2011



The ILC in session in Beijing

The International Linear Collider Steering Committee (ILCSC), a subcommittee of the International Committee for Future Accelerators (ICFA) that provides scientific oversight for the Global Design Effort (GDE), met in Beijing on 17 February 2011. Of special interest at this meeting were discussions of the future of the efforts towards the ILC, after the ILC *Technical Design Report* (TDR) is completed at the end of 2012. The mandate for the GDE will be completed once the report is submitted and accepted. Plans are being developed for carrying forward the preparations for the ILC in a new organisational structure to continue the enabling R&D, evolve the accelerator and detector designs, and respond to LHC results.

Beijing has been the setting for some of the most important milestones in planning a linear collider, beginning in 2004 when a special panel recommended to ICFA in Beijing that the ILC design should be based on superconducting radiofrequency technology. The GDE was created to carry out that design and that has resulted in our reference design, documented in a *Reference Design Report* presented to the ILCSC in Beijing in 2007. Therefore, it seemed highly appropriate that the crucial discussions for planning the long-term efforts for planning the ILC were once again carried out in Beijing.

Jon Bagger chaired a very busy February ILCSC meeting, which covered GDE progress and plans and dealt with the post-2012 era of the ILC. We presented our progress towards establishing the baseline for the technical design that will be carried out over the next two years leading to our final deliverable, the TDR.



Jon Bagger, chair of the International Linear Collider Steering Committee

Lyn Evans reported for the Program Advisory Committee, the technical subcommittee of the ILC, on their autumn review of GDE progress and plans. He characterised their review by saying that the “PAC was very impressed by the progress being made on the accelerator and detectors, and also by the increasing ILC-CLIC collaboration activities.” He also noted some of their key suggestions, especially with regard to developing cost-effective mass production of the SCRF main linac.

Regarding the post-2012 planning, a wide-ranging discussion was carried out beginning with a presentation led by Atsuto Suzuki (KEK). Various models for a new organisation to follow the GDE are being discussed. The initial idea was to form a multi-lab partnership in order to carry out the future work within existing and funded programmes of the laboratories. However, it became clear in the discussions that the partnership should be flexible enough to exist between entities that are best suited for each country or region.



Atsuto Suzuki, KEK director general, discussing the future ILC organisation

In the ILCSC discussions, we emphasised what we believe are the key elements of the GDE that must be preserved in a new post-2012 organisation. First and foremost,

the key technical people involved in developing both the enabling technologies and the accelerator designs need to be able to remain involved as the effort moves forward. Perhaps equally as important for whatever organisation replaces the GDE will be the continuation of its ability to set global priorities and to make key decisions that have been accepted worldwide.

Although we have a lot of work before us in developing the ILC technical design and report over the coming two years, now is not too soon to begin serious planning for what will happen once that task is accomplished and the mandate of the GDE is completed. We hope the discussions at ILCSC will lead to a well conceived plan for the post-2012 era.

GDE | ILCSC

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