

DIRECTOR'S CORNER

How to become an accelerator physicist

by Barry Barish



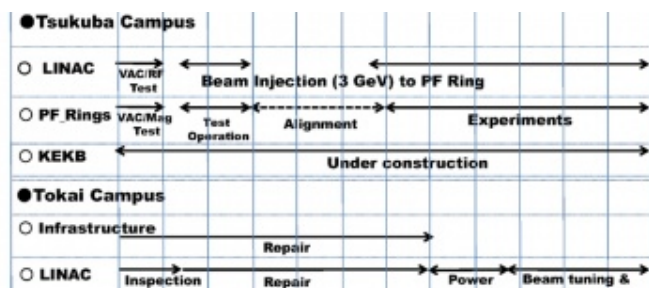
The Sixth International Accelerator School for Linear Colliders will take place at the Asilomar Conference Center, Pacific Grove, California, USA from 6 to 17 November 2011.

AROUND THE WORLD

News from KEK: Damage caused by the recent earthquake and recovery prospects

Reports on the main damage and the recovery plan at KEK after Japan's major earthquake of 11 March and its consequences ever since

by Atsuto Suzuki



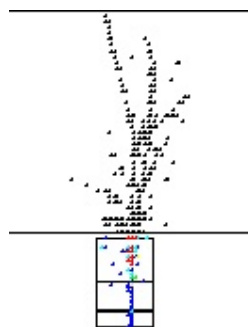
As of now, our highest priority is the restoration of both campuses so that they can resume scientific activities as the Japanese Inter-University Research Institute Corporation and one of the world's leading accelerator-science research laboratories.

FEATURE

The DHCAL expansion

New additions to the Digital Hadron Calorimeter expand the perspective through which scientists may view hadron showers.

by Leah Hesla



channels.

The Digital Hadron Calorimeter offers high-resolution images of particle showers. With the help of hundreds of thousands of readout pads, tiny pieces of each charged particle's path within hadronic showers are recorded. The DHCAL brings scientists not only detailed images, but now also complete ones, having expanded its potential in recent months by tens of thousands of additional readout

IMAGE OF THE WEEK



Former President of India gives talk at Fermilab

Image: Reidar Hahn

Dr. A.P.J. Abdul Kalam, former President of India, gives a [talk](#) at Fermilab.

IN THE NEWS

from **Discovery News**

9 May 2011

[Particle Physics Can Help Fight Cancer](#)

And now another tool from particle physics is emerging as a boon to cancer imaging and treatment.

from **Scientific American**

6 May 2011

[WIMP Wars: Astronomers and Physicists Remain Skeptical of Long-Standing Dark Matter Claim](#)

An Italian research group has for years trumpeted a cyclical ebb and flow in particulate activity that the researchers ascribe to dark matter. But support for the claim has been hard to come by

CALENDAR

UPCOMING EVENTS

[CALICE collaboration meeting](#)

CERN, Geneva, Switzerland

19- 21 May 2011

[ILD Workshop 2011](#)

Orsay, France

23- 25 May 2011

[Second Workshop on linac operation with long bunch trains](#)

DESY, Hamburg, Germany

06- 08 June 2011

[Technology and Instrumentation in Particle Physics 2011 \(TIPP 2011\)](#)

Chicago, IL

09- 14 June 2011

PREPRINTS

ARXIV PREPRINTS

[1105.1409](#)

Nu-Two Higgs Doublet Model and its Collider Phenomenology

[1105.0756](#)

Top quark pair production via e^+e^- collision in the littlest Higgs model with T-parity at the ILC

[1105.0672](#)

A new CP violating observable for the LHC

UPCOMING SCHOOLS

École IN2P3 - Pays Méditerranéens des Accélérateurs de
Particules

Gammarth-Tunis, Tunisia

09- 14 May 2011

USPAS sponsored by Stony Brook University

Melville, New York

13- 24 June 2011

[View complete calendar](#)

DIRECTOR'S CORNER

How to become an accelerator physicist

Barry Barish | 12 May 2011



School poster for the Sixth International Accelerator School for Linear Colliders.

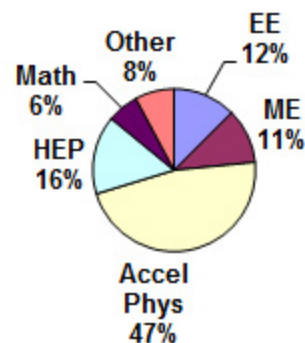
I am pleased to announce the [Sixth International Accelerator School for Linear Colliders](http://www.linearcollider.org/school/2011) that will be held from 6 to 17 November 2011. The Global Design Effort has both been a sponsor and contributed lecturers to the first five schools in this series. The last school was held in Villars-sur-Ollon, Switzerland last autumn. This year's school will again focus on subjects in accelerator physics related to teraelectronvolt-scale lepton colliders, including the ILC, Compact Linear Collider (CLIC) study and the muon collider. We encourage young physicists to apply. In particular we welcome those physicists who are considering changing to a career in accelerator physics.

Very few universities have a PhD programme in accelerator physics. As a result, most accelerator physicists become interested in the field following

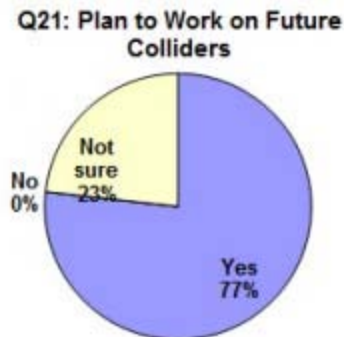
their academic studies. High-energy physics laboratories around the world provide opportunities for scientists and engineers to become involved in accelerator physics and technology projects. In addition, accelerator schools provide more academic learning opportunities for students interested in becoming involved more deeply in this area. The ongoing work towards a next-generation lepton collider involves many of the leading accelerator physicists in the world and involves many challenging and forward-looking accelerator issues and technologies.

The Linear Collider Accelerator School is responsive to the worldwide needs of the high-energy physics community to develop the next generation of accelerator physicists for future high-energy physics projects, as well as to produce experts for work on the broader accelerator applications in research, medicine and industrial applications. For our school, we accept graduate students, postdoctoral fellows and junior researchers from around the world, and we welcome applicants who are considering making a career change to accelerator physics.

The [curriculum](#) for the school takes an in-depth approach, enabling students who took part in a previous school to apply more specialised learning. The school will consist of a series of lectures by different experts covering the most interesting and challenging high-energy linear collider accelerator science topics. Each lecturer will assign homework problems and take part in the evening problem session associated with those problems.



The technical fields of the 2010 students



Future plans of 2010 students

The main themes of this year's school will be the following:

- Overview of teraelectronvolt (TeV)-scale future lepton colliders (ILC, CLIC and the muon collider)
- Accelerator physics for sources, damping rings, linacs and beam delivery systems
- Superconducting and warm radiofrequency (RF) technology, low-level RF and high-power RF, and beam instrumentation

There will be an eleven-day programme, including an excursion, a site visit and an examination. The first two days will be an introductory course with an overview of proposed future lepton colliders (ILC, CLIC and the muon collider). This will be followed by two elective courses, one on accelerator physics and the other on RF technology. Both of these will run in parallel for 6 days. Each student is required to take the introductory course and one of the electives. There will be homework assignments and a final examination that will help measure student progress, but no university credits.

I have lectured at the linear collider school the past few years and have found the quality of the student and the interactive learning environment to be very stimulating. I am happy to be able to participate once again at this year's school, giving the opening introduction where I will motivate TeV-scale lepton colliders, as well as give the performance requirements that will enable reaching the physics goals. I will also give the introductory lecture on the International Linear Collider, giving an overview of the various systems and challenges. The other lecturers will consist of many of the leaders in the fields making up the course curriculum. This will provide a unique opportunity to learn directly from the accelerator scientists in the field. We have had many applicants from all over the world for the past schools, assuring a set of about 70 (our maximum) very good students.



The students during lecture session during the 2010 linear collider school.

I enthusiastically encourage all those interested to visit the [LC school website](#) and to apply for this year's school.

[ACCELERATOR SCHOOL FOR LINEAR COLLIDERS](#) | [LC SCHOOL](#) | [LINEAR COLLIDER SCHOOL](#)

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DG's Corner

Damage caused by the recent earthquake and recovery prospects

09 May 2011



Atsuto Suzuki
Director General

First of all, I would like to express my deepest appreciation for the messages of concern, sympathy and encouragement that we received from all over the world since the major earthquake of March 11th. We are working to restore KEK as quickly as possible to its original condition so it can once again function as the exceptional research facility it was hitherto. Your messages do help a great deal in this difficult time.

Both the KEK-Tsukuba and KEK-Tokai (J-PARC) sites experienced tremors exceeding 6 on the Japanese seismic intensity scale, even though we are some 300 km away from the epicenter. This has caused a significant amount of damage to both facilities.

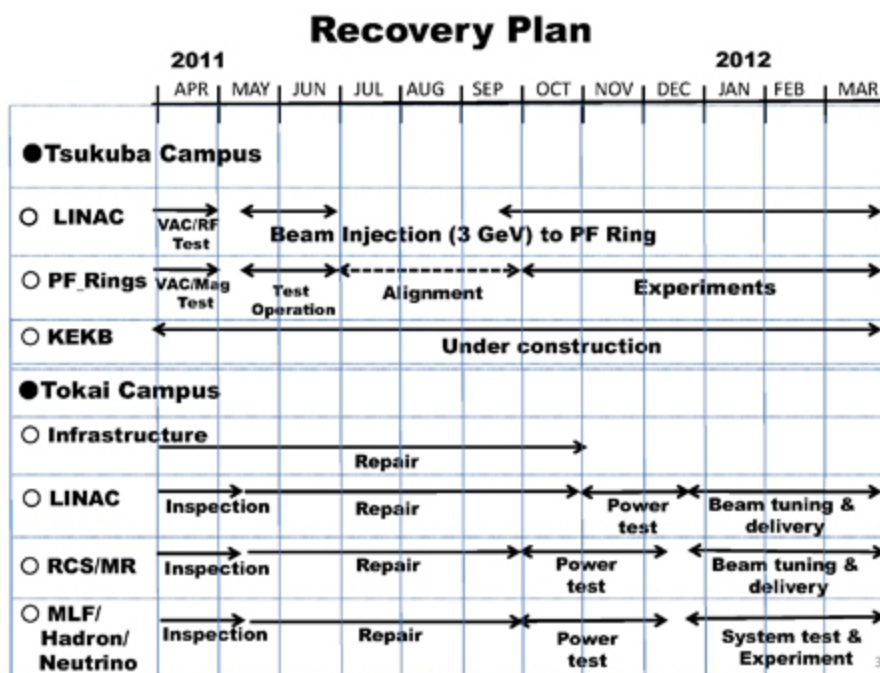
In the Tsukuba-campus, components of accelerators, detectors and peripheral became detached and fell to the ground or collided with each other. Infrastructures such as the substation to receive and distribute electric power from outside, water reservoir tanks and campus roads were also damaged. Their functions have already been partially restored with quick-fix repairs. The tsunami did not affect J-PARC although it did penetrate somewhat beyond the beach area. However, there is serious subsidence and cracks have appeared in the surrounding roads, with a partial collapse of the accelerator/detector buildings. Fortunately, there has been no observed serious damage to the accelerator and detector devices located underground. The status of the damage based on visual inspections and an operational check with electric power supplied to the device is shown in the following map and PDF files:

- * [Damage status map](#)
- * [Damage Report of KEK](#) (PDF: 2.5MB)
- * [Damage Report of J-PARC](#) (PDF: 664KB)

As of now, our highest priority is the restoration of both campuses so that they can resume scientific activities as the Japanese Inter-University Research Institute Corporation and one of the world's leading accelerator-science research laboratories. In Tsukuba, restoration work on the Linac and two photon factory facilities is planned during May and June. It is our hope that from

Fall we can begin some degree of normal operation and conduct experiments in parallel with making adjustments to the accelerators. We are making concerted efforts to ensure that construction of SuperKEKB remains on schedule. The fact that there is only minor damage to KEKB/Belle gives us some confidence that this promise should be fulfilled. Activities related to international collaboration on the advanced accelerator technologies of International Linear Collider (ILC) and Energy Recovery Linac (ERL) will resume sometime this month (May). In J-PARC, damage evaluation and repair/reconstruction of accelerators, detectors, buildings and equipment will be completed by December at the latest. At that point, commissioning for all systems will take place. The recovery schedules for Tsukuba and Tokai are shown below.

Thanks to your strong and continuous encouragement, we are moving from the inspection phase to the recovery phase. All the KEK staff are maintaining their tenacious efforts not just to restore KEK, but to create a new KEK. Once again, I would like to thank you for your support.



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FEATURE

The DHCAL expansion

New additions to the Digital Hadron Calorimeter expand the perspective through which scientists may view hadron showers.

Leah Hesla | 12 May 2011



The Tail Catcher and Muon Tracker of the CALICE collaboration's Digital Hadron Calorimeter. The absorber plates are thinner in the front (left of the picture) than in the back. Image: José Repond.

The CALICE collaboration's calorimeter has grown a head and a tail.

The Digital Hadron Calorimeter, or DHCAL, has acquired new active layers since scientists first began testing it last year. The additional layers, positioned at both the front and back ends of the detector, allow scientists to form more complete pictures of particle showers.

"This detector now has more readout channels than the ATLAS or CMS calorimeters *combined*," said Argonne National Laboratory's José Repond, DHCAL spokesperson, referring to two of the detectors at CERN's Large Hadron Collider. Where those giant detectors are two to three stories high, the full DHCAL detector is only a few cubic metres.

That meagre volume now contains 490,000 channels to help piece together images of particle paths in hadronic showers.

At the rear of DHCAL is the new Tail Catcher and Muon Tracker, or TCMT. The addition of this 130,000-channel section more than doubles the volume in which hadronic showers can be measured.

It captures the tail ends of pion-particle showers, which are often not completely contained in the original one-cubic metre detector. By adding the tail catcher's 13 square-metre layers to the rear of the original setup, scientists can study the last bits of the tail of hadronic showers. The TCMT is especially needed considering the hadron showers' erratic behaviour.

"Sometimes pions don't do anything for the longest time," Repond said, noting that the pions can plough through DHCAL's iron layers without incident until reaching the very back of the detector. "Then they interact. Voom! A big explosion." Without the TCMT bringing up the rear, in many cases the 'big explosion' would go undetected or only partly captured.

The 'MT' of the TCMT refers to the 'muon tracker' and indicates a second task of such a device in a colliding beam detector, the identification of muons. Muons tend to fly through large chunks of matter without ever interacting and so lose energy only very slowly, even when flying through dense iron absorbers. These unstoppable tracks are the signatures by which muons are in general identified.

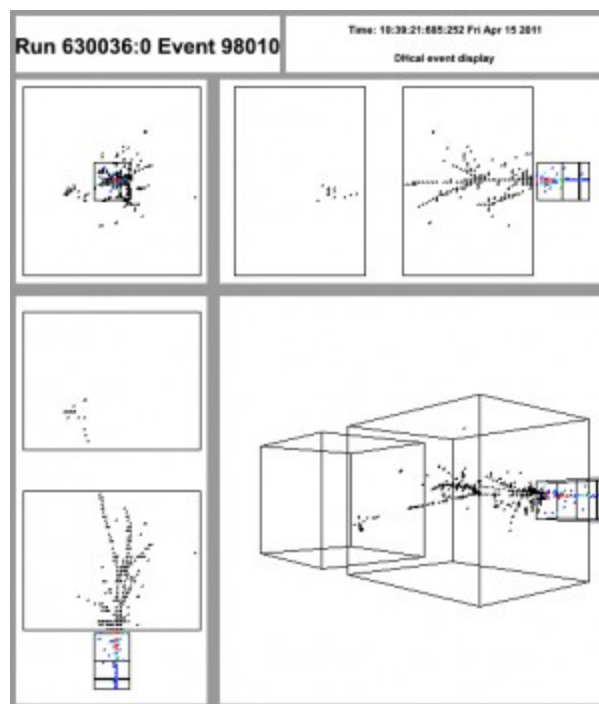
The second, front-end addition is the electromagnetic calorimeter (ECAL), a 10,000-readout channel detector that measures the energy of photons and electrons incident on the detector. About the size of a microwave oven, this calorimeter contains tungsten plates and one-square-centimetre silicon pads. Its role is to measure electromagnetic showers and the beginning of hadronic showers.

The CALICE collaboration had already tested its ECAL in 2008 at the Fermilab Test Beam Facility, together with a completed version of the DHCAL calorimeter using scintillator pads as active elements.

Scientists finished adding the two sections in early April. As they continue to test and tweak the detector, they'll ramp up the energies of the beams impinging on it.

Stay tuned to *ILC NewsLine* for future work on detector research.

[CALICE](#) | [DHCAL](#)



A recent event display of a 32-gigaelectronvolt pion in all three sections of the CALICE calorimeter, currently undergoing tests in the FTBF particle beam. The TCMT, the main section of the DHCAL, and the electromagnetic calorimeter are depicted from left to right in the top right section; the beam enters from the right. Red and blue dots indicate the energy deposited in the ECAL section. The pion shower develops in the DHCAL as shown by the black dots. Vestiges of the pion shower's tail are seen in the TCMT as a few sparse dots. Top left: front view. Top right and bottom left: top views. Bottom right: Three-quarters view. Image courtesy of Daniel Jeans.