LC NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

## *From SLAC today*: SLAC's historic 'End Station A' hosts electron beams again

Electrons are once again streaming into SLAC's historic End Station A, setting the stage for a new user facility in the huge, concrete hall where the first evidence for quarks was discovered. Fed by billion-particle bunches of high-energy electrons diverted from the linear accelerator supply to the Linac Coherent Light Source (LCLS), the new beamline, called the End Station Test Beam (ESTB), will initially host three types of experiments: General beam physics and machine-detector interface studies for the proposed International Linear Collider and Compact Linear Collider, radiation hardness tests on detector components and R&D for high-energy physics detectors, which will use secondary particles created when the main beam hits a target.

DIRECTOR'S CORNER

## Demonstrating the ILC final focus parameters

by Barry Barish

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IMAGE OF THE WEEK

## US and Japan discuss cooperation in advanced science and technology

It's suit and tie time when high-level US and Japanese science planners meet. At the US-Japan Advanced Science and Technology Symposium, held on 30 April in Washington DC, leaders from government, academia and industry met to discuss US-Japan cooperation in science and technology, using the ILC as an example. Learn more in the next issue of LC NewsLine. On the left is a Daniel B. Poneman, Deputy Secretary of Energy, and on the right Takeo Kawamura, Member of the Lower House and Chair of the Federation of Diet members in support of the ILC.

## IN THE NEWS

**from** ***The Shorthorn***
1 May 2013
Higgs particle research stops for improvement
"Now, we need to go to the full capacity of the accelerator," Yu said. "Also, linear collider and advanced detectors are being developed for future precision measurements of Higgs and other new particles."

**from** ***CERN***
30 April 2013
CERN celebrates 20 years of a free, open web
Twenty years ago CERN1 published a statement that made the World Wide Web ("W3", or simply "the web") technology available on a royalty-free basis. By making the software required to run a web server freely available, along with a basic browser and a library of code, the web was allowed to flourish.

**from** ***Asia Policy Point***
29 April 2013
Japan speaks in Washington
In Japan, this is Golden Week. For Washington this means that there will an influx of official visitors from Japan.

**from** ***Reuters UK***
24 April 2013
UK firm buys cancer-zapping spin-off from CERN collider
The giant particle-smashing machine run by CERN outside Geneva is not only unravelling the mysteries of the universe, it may also be opening up new avenues to treat cancer.

## CALENDAR

**Upcoming events**

IPAC - 4th International Particle Accelerator Conference
Shangai, China
12- 17 May 2013

Photon 2013
Paris, France
20- 24 May 2013

European Linear Collider Workshop (ECFA LC2013)
DESY Hamburg
27- 31 May 2013

**Upcoming schools**

CERN Accelerator School: Course on Superconductivity for Accelerators
Erice, Sicily, Italy
24 April- 04 May 2013

View complete calendar

## PREPRINTS

**ARXIV PREPRINTS**

1304.7410
Limits on the quartic couplings $Zγγγ$ and $ZZγγ$ from $e^+e^-$ colliders

1304.6228
Comparison of Bulk Micromegas with Different Amplification Gaps

1304.5029
SUSY Extended Higgs Sector and SUSY Strong Dynamics

1304.4700
Classically conformal B-L extended Standard Model and phenomenology

1304.4414
Probing the indefinite CP nature of the Higgs Boson through decay distributions in the process $e^+e^-\to t\bar{t}Φ$

1304.4241
Methods for evaluating physical processes in strong external fields at e+e- colliders: Furry picture and quasi-classical approach

SLAC TODAY

U.S. DEPARTMENT OF ENERGY

# SLAC's Historic 'End Station A' Hosts Electron Beams Once Again

**April 23, 2013**

*by Mike Ross*

Electrons are once again streaming into SLAC's historic End Station A, setting the stage for a new user facility in the huge, concrete hall where the first evidence for quarks was discovered.

Fed by billion-particle bunches of high-energy electrons diverted from the linear accelerator supply to the Linac Coherent Light Source (LCLS), the new beamline, called the End Station Test Beam (ESTB), will initially host three types of experiments:

- General beam physics and machine-detector interface studies for the proposed International Linear Collider and Compact Linear Collider
- Radiation hardness tests on detector components
- R&D for high-energy physics detectors, which will use secondary particles created when the main beam hits a target.

Carsten Hast, head of the Accelerator Research Division's Test Facilities Department, said recent renovations and new equipment have been successfully tested. The first experiment, which will be carried out by SLAC researchers as part of the commissioning process, is being installed this week, and the first outside users are expected to arrive in about a month.

The new End Station Test Beam beamline nears completion within SLAC's cavernous End Station A. (*Credit: Matt Beardsley.*)

End Station A is one of two historic experimental halls at SLAC. Opened in 1966, it initially hosted experiments in which particles were slammed into fixed targets to see what came out. More recently End Station A has been used for testing scientific equipment, including the ANITA detector, headed for the South Pole, that required a 10-ton block of ice to create the right environment.

The linac upstream of End Station A feeds the LCLS X-ray laser, providing rapid-fire electron bunches that are used to generate X-rays. But in 2009, several accelerator physicists got the idea to divert some of the electron bunches from the linac into the end station without disrupting LCLS operations.

Work on the new user facility began in 2010. Crews installed two "kicker magnets" that grab electron bunches from the linac and bend them through a 24-degree left turn into a long metal pipe leading to the ESTB users' experiments.

"It's a beautiful beam, really," Hast said, "even after everything we've done to it."

A massive steel-and-concrete "beam dump" safely stops and absorbs high-energy particles after they pass through the experimental area, and a new personnel protection system safeguards users and staff. When fully operational, the test station will host about 20-30 experiments per year.

The ESTB's electron bunches can also be smashed into either a copper or phosphor-coated aluminum screen, which creates showers of lower-energy "secondary" electrons that can be sliced, diced and collimated in energy and number by slits and apertures according to the experimenter's needs – even down to producing single electrons at various energies that are used in detector R&D.

Hast said the ESTB team is now making a cookbook-like guide to tell the linac operators how to create the specific electron energies and pulse durations the users will need. Still to come: additional optics for handling a wider range of electron energies.

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DIRECTOR'S CORNER

# Demonstrating the ILC final focus parameters

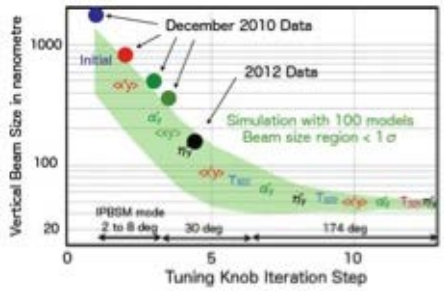
Barry Barish | 2 May 2013

*ATF-2 beamline – view looking downstream.*

A key feature of the ILC is that it is a single-pass machine. In contrast to a circular accelerator, where the beam goes around many times, the ILC beams pass through each accelerator element only once, including the interaction point. For the accelerator, this means that for each accelerating module, the machine must be very efficient at transferring wall power into the machine beam, with the added requirement that the final beam must emerge with very low emittance so that it can be focused to the very tiny beam spot required to achieve high luminosity. The ATF-2 at KEK is a special test beam line that has been built to demonstrate the ability to achieve ILC-like namometre beam spots and stabilise them. Recent tests have demonstrated beam spots that are within a factor of two of the ILC design and promise to improve in the future.

The Accelerator Test Facility (ATF) at KEK is a prototype storage ring that is being used for ILC R&D aimed at creating and demonstrating that a low emittance beam can be focused to namometre sizes, which is required to obtain ILC luminosities. Earlier final focus studies were carried out at SLAC using different beam optics.

The compact ATF-2 optics represent an improved scheme based on local chromaticity corrections that should be capable of achieving a vertical beam size of about 37 nanometres at the interaction point (IP). Once achieved, the R&D programme will shift the focus to maintaining the small spot size, controlling beam jitter and stabilising the beam at the IP at the nanometer level.




*A vertical beam size of 167.9 nanometres had been achieved at the time of the Project Advisory Committee review in December 2012*

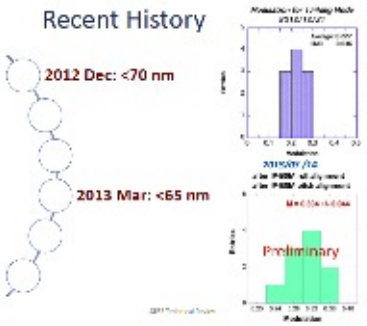
It should be emphasised that ATF-2 is an international R&D effort, being carried out with equipment contributions from all around the world. It has an international governance and a strong international presence in carrying out the R&D programme. In some ways, this collaborative programme is a successful mini-version of the type of collaboration we formed to carry out the global ILC R&D and accelerator design programmes and that will continue to implement the project.

Unfortunately, the ATF/ATF-2 programme was set-back by about one year due to the Japanese earthquake, and as a result our goals had not been achieved at the time the ILC Technical Design Report was submitted last autumn. As a result, the Project Advisory Committee (PAC) expressed concern in their technical review report and commented as follows:

*"The lack of progress towards the 37 nm ATF2 IP goal is a concern. Several issues have already been resolved, and the currently scheduled modifications should lead to significant progress towards the goal."*


*The ATF programme is being carried out by an international team*

As I indicated above, our progress had been slowed by the earthquake in Japan, however there was significant progress almost immediately following the technical review (see figure). Nevertheless, because of the importance of demonstrating the final focus of the ILC, we decided to follow up by initiating a technical review of the ATF-2 goals, progress and plans. We held the review on 3 and 4 April 2013 with the goal of assessing the present technical status and plans, as well as give guidance regarding future programme needs for the ILC. The GDE ATF-2 review report will be available soon. I summarise some key findings below.




*ATF-2 achieved a 72.8-nanometre vertical beam spot soon after the PAC review and improved further to 65 nanometres by March 2013.*

The GDE review was led very capably by Nick Walker, GDE project manager. The presentations were excellent, enabling us to make conclusions that were very positive and constructive. Some key findings of the review were the following:

*Nick Walker, chairing the GDE ATF-2 review in April*

1. the 65 nm vertical beam spot size achieved at low bunch charge is an important and encouraging accomplishment. This already demonstrates the optics and ability to control aberrations;
2. although improving the focus to the 37-nanometre goal will require a systematic stepwise programme, the committee is confident that can be achieved and uncovered no fundamental obstacles;
3. understanding emittance preservation at higher bunch charge is a new goal that has emerged from the studies to date.

The ATF/ATF-2 R&D programme is one of the central ILC R&D tasks needed to establish feasibility and to develop technologies for a linear collider (ILC and CLIC). The tests have been very successful, despite the earthquake setbacks, however not all of its ILC goals have been achieved yet. The next stages of the programme are crucial for the ILC and for establishing the even more ambitious goals for CLIC. The demanding final focus optics can only be studied at this unique facility. It was pointed out to us that the ATF programme at KEK is under severe financial stress. We hope the resources will be found to successfully continue the programme and carry out the next stages of this important and successful R&D.

ATF2 | BEAM SPOT SIZE | FINAL FOCUS | KEK | PAC

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IMAGE OF THE WEEK

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2 May 2013

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