

# NEWSLINE

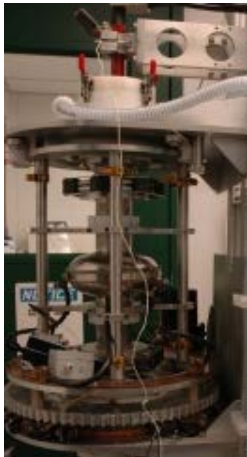
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

## AROUND THE WORLD

### No more HF?

Fermilab and Faraday Technology Inc. are developing an environmentally and worker friendly electropolishing technique for SRF cavities

by Julianne Wyrick



In June, Fermilab researchers finished successfully processing and testing the second single-cell, ILC-type cavity that was electropolished with a new technique. The water-based process, which doesn't require the use of strong acids as the standard technique does, was developed to be more environmentally and worker-friendly.

## DIRECTOR'S CORNER

### Doors open wide

by Lyn Evans



Dialogue with the general public is important for good relations with the neighbours of research labs. This weekend, CERN holds its Open Days to share the excitement of science and life at a lab with an estimated 50,000 visitors per day. Let's keep this tradition up.

## VIDEO OF THE WEEK



### A guided tour around the CLIC test facility

Video: CERN

Ever wanted a personal tour around the CLIC Test Facility (CTF3)? Then this video is for you. You will follow and listen to Frank Tecker, responsible for CTF3 operations, who will guide you around the scaled-down version of the Compact Linear Collider acceleration principle.

## IN THE NEWS

from *Nikkei*

20 September 2013

[文科相「リニアコライダー誘致、調査検討が必要」](#)

下村博文文部科学相は20日の閣議後の記者会見で「国際リニアコライダー（ILC）」の国内誘致について「まずは調査検討が必要」と述べた。「来年度にすぐ誘致に手を挙げる段階にはない」と語った。(Japan's Science Minister, Hakubun Shimomura said in the general press conference on 20 September that the government will make extensive study on the ILC. "Japan is not yet at the position of raising hand immediately, and it won't happen in the next fiscal year,"he said.)

from *Tanko Dairy*

17 September 2013

[受け入れ議論加速 北上山地選定で岩手県、態勢構築へ検討分科会](#)

国際リニアコライダー（ILC）の国内候補地に北上山地が選ばれたことを受け、岩手県内では受け入れ態勢など今後の取り組みに関する議論が加速しそうだ。岩手県は18日、ILC庁内ワーキンググループ内に分科会を設置。主要テーマ別に国際学術研究都市形成に向けた具体的な検討をスタートさせる。(Following the recommendation by ILC site evaluation council of Kitakami mountain as a ILC construction candidate site of Japan, Iwate prefecture started its preparation efforts such as social systems to accept foreign scientists and their family. The prefectural government will set the sectional committees in the ILC working groups, and start the discussions on the specific items toward the creation of the international science city)

from *Iwate Nippo*

17 September 2013

[9千本の花でビッグバン花壇 一関でILC題材に](#)

一関市千厩町清田地区に「ふれあい花壇」を整備。今年には国際リニアコライダー（ILC）を題材にした。約800平方メートルに35種類9千本の花を植えた。図柄は「児童が話題のILCを勉強中、花壇の地下で電子と陽電子が衝突し、びっくりした」という設定で、衝突点を赤いサルビア、電子と陽電子をマリーゴールドやセンニチコウで表現した。(The "Big Bang" flowerbed was crated in Ichinoseki, Iwate prefecture. This year's theme was the ILC. The local elementary school students planted 9000 flowers in the 800-square-meter garden, portraying the collision of electron and positron with Salvia splendens, marigolds, and bachelor's buttons)

## CALENDAR

### Upcoming events

[16th International Conference on RF Superconductivity \(SRF 2013\)](#)

Paris, France

22- 27 September 2013

[ILD meeting](#)

Cracow, Poland

24- 26 September 2013

[CLIC Detector and Physics Collaboration Meeting](#)

CERN, Switzerland

01- 02 October 2013

[FCAL workshop](#)

DESY, Zeuthen

07- 08 October 2013

[Linear Collider Forum 2013](#)

DESY, Hamburg, Germany

09- 11 October 2013

[SiD Workshop](#)

SLAC, USA

14- 16 October 2013

[LCWS 2013](#)

The University of Tokyo, Japan

11- 15 November 2013

## PREPRINTS

### ARXIV PREPRINTS

[1309.5615](#)

Higgs Phenomenology in the Two-Singlet Model

[1309.5495](#)

The lepton flavor violating signal of the charged scalar  $\phi^{\pm}$  and  $\phi^{\pm}$  in photon-photon collision at the ILC

[1309.4819](#)

Constraining anomalous HVV interactions at proton and lepton colliders

[1309.4171](#)

CP mixed property of the Higgs-like particle in the decay channel  $h \rightarrow Z Z^* \rightarrow 4l$

[1309.3140](#)

MSSM Higgs Self-Couplings: Two-Loop  $O(\alpha_t \alpha_s)$  Corrections

[1309.3065](#)

Probing Bino Contribution to Muon  $g-2$

## Upcoming schools

[Linear Collider Physics School 2013](#)

DESY, Hamburg

07- 09 October 2013

[View complete calendar](#)

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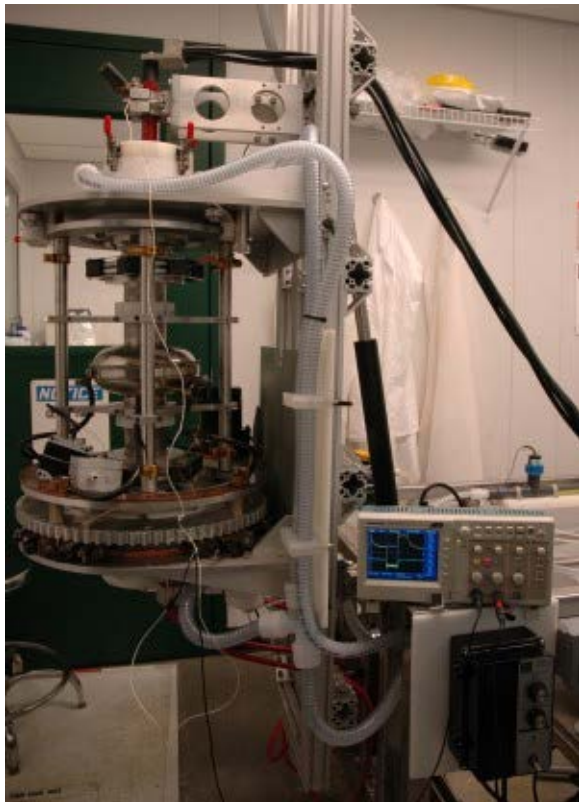
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AROUND THE WORLD

## No more HF?

Fermilab and Faraday Technology Inc. are developing an environmentally and worker friendly electropolishing technique for SRF cavities

[Julianne Wyrick](#) | [26 September 2013](#)



*The vertical setup used for the new environmentally friendly electropolishing process developed by Fermilab and Faraday Technologies. Photo: Allan Rowe*

The standard electropolishing process for SRF cavities requires a mixture of strong, potentially hazardous acids to smooth the inner surfaces of the cavities, allowing them to reach high gradients. Researchers at Fermilab and Faraday Technology Inc. have developed a new water-based process that would be both safer for workers and more environmentally friendly.

In June, the Fermilab team finished successfully testing the second high-gradient, single-cell, 1.3-GHz cavity electropolished with the new process. They found the tested cavity's performance to be almost equivalent to the performance of cavities polished using the ILC baseline technique, based on harsh, concentrated acids. In addition to using a safer solution, the new method uses a more controllable electric current to drive the polishing process. It also requires a simpler setup.

"If you can dramatically reduce the process risk by eliminating the hydrofluoric acid while still maintaining process performance, everyone would benefit," said Allan Rowe, the project's principal investigator at Fermilab. "We haven't had any worker exposures using the baseline recipe, but it's always a possibility."

In the currently used electropolishing process, the cavity rotates around an aluminum rod — the cathode — while the cavity's inner wall is partially immersed in a concentrated electrolyte solution of hydrofluoric and sulfuric acid. Then, an operator applies a negative direct current voltage to the rod.

The current in conjunction with the viscous electrolyte solution smooths atomic-scale roughness on the surface of the cavity wall. During the process, an oxide layer builds up on the cavity wall. To achieve the required surface smoothness, this layer must be removed – which is the primary function of the hydrofluoric acid.

In the new technique, an operator applies a pulsed reverse current, rather than a direct current, to the rod. Unlike the direct current, this current cycles between pulses of positive and negative voltages at specific times about 10 times a second. By adjusting the timing and intensity of the pulses, the technician can use the positive pulses to smooth the cavity and the negative pulses to remove the oxide layer without requiring viscous and strong acids.

“Rather than using the concentrated sulfuric-plus-hydrofluoric acid chemistry, which is required for the direct-current applications, the pulsed reverse (current) enables us to use a very simple water chemistry with a low concentration of about 5 percent sulfuric acid,” said E. Jennings Taylor, founder and chief technical officer of Faraday Technology, the company that initially developed the new technique. Various aspects of the process are the subject of US and foreign patents and patents pending.

Fermilab and Faraday were also able to simplify the electropolishing setup. Polishing with strong viscous acids requires cavities to be rotated in a horizontal orientation – a position that is more prone to leaks and requires a complicated rotating and tipping mechanical system. The new technique, using a non-rotating vertical setup, produces better polishing on single-cell cavities than the rotating horizontal setup.

“It’s much more amenable to an industrial-scale process,” Taylor said.

Fermilab partnered with Faraday Technology around three years ago to begin this project, which is funded by the American Recovery and Reinvestment Act. Faraday Technology had developed a similar technique for electropolishing automobile gears and semiconductor valves. After the partners adapted the process for SRF cavities, the Fermilab team tested the performance of two single-cell cavities polished with this method.

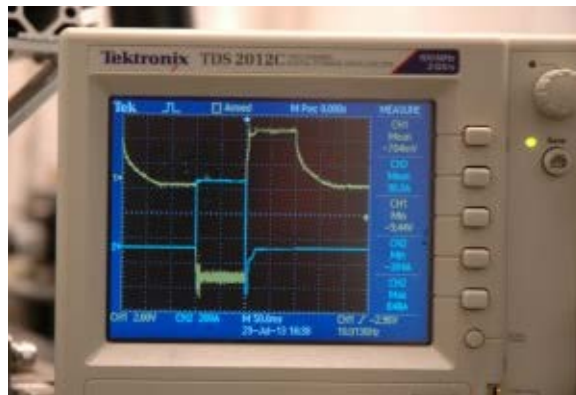
In vertical tests, the single-cell cavities demonstrated an accelerating gradient greater than 30 megavolts per metre in several instances and a quality factor above  $1.5 \times 10^{10}$ . The maximum gradients approached 45 megavolts per metre with a quality factor of  $1 \times 10^{10}$ . The ILC standards, currently achieved using the standard method, are a gradient of 35 megavolts per metre and a quality factor of  $8 \times 10^9$ .

Researchers also found that the new technique could be used as a “drop-in” technology, meaning it could be used with existing electropolishing tools — or with the simpler vertical polishing tool.

“We’ve achieved all the goals for this phase one programme,” Rowe said. “Now we’re looking for an opportunity to grow the program and test multicell cavities.”

Rowe hopes to further optimise the process with a few more single-cell cavities before moving to multicell cavities, like the nine-cell cavities needed for the ILC.

“We don’t believe there’s any technical hurdle to do that,” Rowe said of using the process with multicell cavities. “It’s an unknown, but it looks promising.”



*An oscilloscope trace of the pulsed reverse current used in the new electropolishing process. Photo: Allan Rowe*

[CAVITY](#) | [CAVITY GRADIENT](#) | [ELECTROPOLISHING](#) | [FERMILAB](#)

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DIRECTOR'S CORNER

## Doors open wide

Lyn Evans | [26 September 2013](#)



*For CERN 2008 Open Days, a total 53,000 visitors of the general public came, of which 23,000 visited underground facilities. Pictured: CMS detector. Image: CERN.*

Every few years, CERN opens its doors to the general public. The last “Open Days” took place in 2008 before the LHC startup. The present long shutdown of the CERN facilities provides an ideal opportunity to continue this tradition, which is essential in establishing trust in the local communities as well as giving the public at large the opportunity to visit areas of CERN that are not normally accessible.

The [CERN Open Days](#) will be over the weekend of 28 and 29 September. From past experience CERN expects about 50,000 visitors on each of the two days. Visitors are free to roam around the CERN campus where they can visit many of the workshops, control rooms and service stations at CERN, including the CLIC test facility, the proton and ion linacs and the antiproton decelerator. There will be a [fun zone](#) with a show of simple and amusing experiments, many of them bordering on the magical, in which many physical phenomena are demonstrated in a fun way. There will also be a [music festival](#) organised by the CERN Jazz and Music Clubs.

A great attraction will, of course, be a [visit to the underground areas](#). Here the organisational structure must be much tighter in view of the strict controls on safety, radioprotection and the sheer logistical nightmare of moving people up and down the shafts. The four LHC detectors will all be accessible as well as certain areas of the LHC ring, including the beam dump area where the beams are extracted from the machine at the end of a run, and the straight section at Point 4 of the machine which houses the superconducting cavities for acceleration. The acceleration section of the Super Proton Synchrotron will also be accessible. Access to these underground areas will only be allowed on a pre-registration basis; tickets for visits have been distributed via the [Open-Day website](#).

There will also be a number of [short presentations and public lectures](#) on science and society, explaining the work we do and also its impact on society and culture in general. I will be giving two lectures, in English on Saturday and French on Sunday in order to try to reach as wide a possible audience in explaining our work.

Dealing with so many people is a monumental task in itself. We have more than 2,000 volunteers from the laboratory staff and visitors who are prepared to give up their weekend in order to make this a success. From past experience we know that it will be hard work. But it will also be fun! Let us pray for good weather this weekend.

Open Days are not only a tradition at CERN, but at all other accelerator and physics labs around the world. [KEK](#) has just successfully held its Open Day on 8 September, welcoming about 4300 visitors, and the next one up is at [DESY](#) on 2 November, where linear collider technology and detector development will play a major role. From talking to the visitors we know that they enjoy the possibility to have a look behind doors that they normally cannot enter and are impressed with the openness and enthusiasm of the volunteering staff. They may not understand every word that they hear — but they feel that we are excited about and convinced of what we do. Let's keep this tradition up for the next generation of particle physics labs!



CERN 2013 Open Days flyer. Image: CERN

[CERN](#) | [CERN OPEN DAY](#) | [DESY](#) | [KEK](#) | [LHC](#)

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