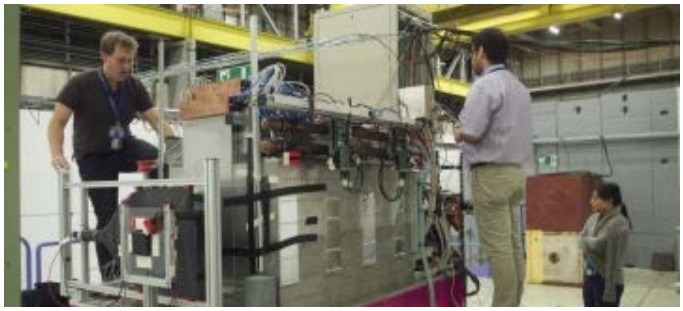
NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

Calorimeters enjoy beam time

by Barbara Warmbein



Test beam season has started again. Two potential prototypes for future ILC detectors are being tested in a beamline at CERN that delivers hadrons from the proton synchrotron, CERN's workhorse accelerator. The CALICE collaboration is looking forward to getting its hands on the fresh test beam data.

DIRECTOR'S CORNER

Science for Peace

by Hitoshi Murayama

Hitoshi Murayama, Deputy Director of the Linear Collider Collaboration and Director of the Physics and Mathematics of the Universe will give a keynote speech at an event about "Science for Peace and Development" next week at UN headquarters in New York. This event takes place in the framework of CERN 60th anniversary, and his fellow speakers include UN Secretary-General Ban Ki-moon, Nobel Laureates Kofi Annan and Carlo Rubbia and CERN DG Rolf Heuer. Follow the event live by webcast.

VIDEO OF THE WEEK

#mylinearcollider: keep them coming

The #mylinearcollider campaign continues and the communicators are recording and receiving many various video messages, all in support of the linear collider. Watch a few videos if you need inspiration and, if you think that a video message is a bit too much, why not take a picture of yourself?

FEATURE

Full ILC-type cryomodule makes the grade

by Joykrit Mitra

All eight cavities in an ILC-type cryomodule achieved the accelerating gradient specified for the International Linear Collider earlier this month. The cryomodule, CM2, was developed and assembled to advance superconducting radio-frequency technology and infrastructure at Americas-region laboratories.

IN THE NEWS

from *The Mancunion*
14 October 2014
Interview: Professor Fred Loebinger
“We’re also in working parties involved in looking at the next high energy accelerators,” Prof. Loebinger tells me. “The International Linear Collider which is being proposed, and more recently, there’s the very large collider that’s being proposed at CERN. The LHC is 27km in circumference, but the one that people are now muttering about and starting to work on would be 100km! Manchester’s involved in all of these.

from *Vesti online*
12 October 2014
Srpska nauka i božja čestica
Institut za nuklearne nauke Vinča bio je od 6. do 10. oktobra domaćin međunarodne naučne konferencije o linearnim akceleratorima. Linear Collider Workshop 2014 je godišnja konferencija koja okuplja oko 200 vrhunskih naučnika, fizičara iz celog sveta, koji su uključeni u istraživanja u vezi sa linearnim akceleratorima u oblasti fizike visokih energija.

from *Iwate Nippo*
10 October 2014
医療通訳者を育成へ 奥州市国際交流協会
奥州市国際交流協会は、同市水沢区の県立胆沢病院と連携し、外国人が来院した際に会話などを補助する医療通訳者の育成を始める。国際リニアコライダー　　の誘致も見据え、外国人が安心して訪れ、暮らすことのできる環境整備を進める。(Oshu International Relations Associations launched the program to train medical interpreters who will provide a support to foreign patient. City aim to improve the living environment where foreign resident can live with peace of mind, putting the ILC construction in perspective)

from *Kahoku Shinpo*
8 October 2014
　　、東北学院大も推進協設置へ
東北学院大が、岩手、宮城両県にまたがる北上山地が候補地の超大型加速器「国際リニアコライダー　　」の実現に向け、学内に推進組織「　　まちづくり連絡協議会」　仮称　を設置することが、　日分かった。(Tohoku Gakuin University set up new department that will promote the urban development toward ILC construction)

from *Blic*
6 October 2014
Predsednik Srbije otvorio naučni skup u oblasti fizike visokih energija
Jedan od najvećih svetskih skupova u oblasti fizike “Linear Collider Workshop 2014” (LCWS 14), posvećen projektima budućih linearnih akceleratora ILC i CLIC svečano je otvoren u Beogradu.

from *Mainichi Shimbun*
6 Octiber 2014
奥州市:　　誘致へ国際化推進員に 米国出身女性採用
奥州市は宇宙の謎に迫る大型加速器「国際リニアコライダー」　　の誘致のため、米国出身のアンナ・トーマスさん　　を同市　　国際化推進員として今月採用した。(Oshu city newly hired US born Anna Thomas whi will be in charge for promotion

of internationalisation with an eye to the approval of ILC project)

from ***B92.net***
4 October 2014
Najveći fizičari sveta stižu u Beograd
Beograd će naredne sedmice biti domaćin jednom od najvećih svetskih naučnih skupova u oblasti fizike “Linear Collider Workshop 2014″.

CALENDAR

Upcoming events

The 11th ICFA Seminar on Future Perspectives in High-Energy Physics 2014
IHEP, Beijing, China
27- 30 October 2014

Upcoming schools

The Second Asia-Europe-Pacific School of High-Energy Physics
Puri, India
04- 17 November 2014

Joint International Accelerator School: Beam Loss and Accelerator Protection
Newport Beach, California, USA
05- 14 November 2014

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1410.3246
The Higgs Physics Programme at the International Linear Collider

1410.3165
Top-quark forward-backward asymmetry in e+e- annihilation at NNLO in QCD

1410.2883
Hunting composite vector resonances at the LHC: naturalness facing data

1410.2787
Heavy Higgs Decays into Sfermions in the Complex MSSM: A Full One-Loop Analysis

1410.2225
Constraining the Higgs-Dilaton with LHC and Dark Matter Searches

1410.1532
Prospects for observing charginos and neutralinos at a 100 TeV proton-proton collider

1410.1485
Searching for Lepton Flavor Violation at a Future High Energy Electron-Positron Collider

1410.0869
Measuring mass and spin of Dark Matter particles with the aid energy spectra of single lepton and dijet at the e+e− Linear Collider

NEWSLINE
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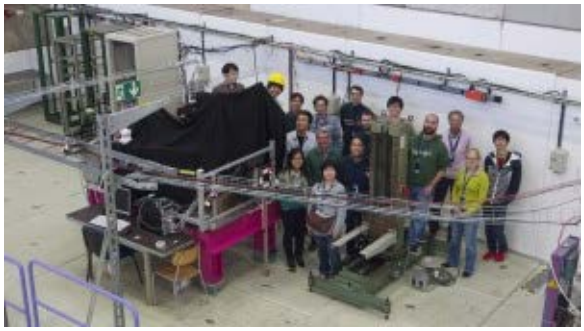
AROUND THE WORLD

Calorimeters enjoy beam time

Barbara Warmbein | 16 October 2014

There are prototypes and there are prototypes. Some are needed to verify that a chosen detection technology actually works, some help scientists test one technology against another, some help them design sturdy detector infrastructure with little material budget, working power supply and cooling, while others set out to prove that it is possible to have full detector functionality with all electronics set up like in the final detector. And then there are those that do it all at the same time.



CALICE crowd around detector setup in the T9 beamline at CERN. All images by Katsushige Kotera

The CALICE collaboration's analogue hadronic calorimeter, or AHCAL, is an example of the last type. It is a prototype for a calorimeter – a subdetector that measures the energies of passing particles – that might one day be part of the ILD detector. It would work together with trackers, electromagnetic calorimeter and muon system to record, reconstruct, track and identify every particle produced in the collisions at the future ILC. The CALICE scientists are currently testing a prototype that takes a close look at detector infrastructure like cooling and power supply while at the same time comparing different kinds of silicon photomultipliers or SiPMs. These do the actual job of detection, and the collaboration is testing the latest and much advanced commercial silicon photomultipliers (SiPMs) from Russia, Ireland, Japan and Germany.

Flying detectors: after craning the hadronic calorimeter into its test beam destination…

The HCAL prototype consists of one module, which corresponds to a slice of one sector of the future calorimeter barrel of the final detector. It has 1000 channels per square metre and it shares the space in the test beam area with CALICE electromagnetic calorimeter prototype modules from Japan – a true collaboration that also shares the same readout electronics. It's also the first time that these calorimeters are taking data in a hadron beam after a few runs in electron beams at DESY in Germany.

"The readout isn't working on all levels yet, but that's what you've got to be prepared for when you go for test beams. So we can still take lots of useful data," says test beam coordinator Katja Krüger from DESY. "All shifters are eager to help and to get their hands on the data." "In fact, more shifters signed up for this test beam than we would need – it's a great opportunity for students to participate in this exciting commissioning phase," thinks Felix Sefkow, AHCAL leader and also from DESY. The AHCAL is a combined effort of 12 institutes from Germany, France, Russia, the US and the Czech Republic, and CERN.

…it gets installed and set up before starting its data taking run.

After a period of poring over data and improving their understanding of the prototype, the collaboration is planning another test beam at CERN at the end of November. The active modules of the HCAL will also be used for testing the tungsten hadronic calorimeter prototype for a future CLIC detector.

CALICE | CERN | CLIC | DETECTOR R&D | ILD | TEST BEAM

NEWSLINE
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DIRECTOR'S CORNER

Science for Peace

Hitoshi Murayama | 16 October 2014

The United Nations Headquarters in New York will be the venue of a Symposium on Science for Peace and Development, featuring Ban Ki-moon, Kofi Annan, Rolf Heuer, Hitoshi Murayama (and others). Image: "1 United Nations Plaza 0948" by Gryffindor – Own work. Licensed under CC0 via Wikimedia Commons.

I was very honoured when I received an invitation to speak at the United Nations Headquarters on 20 October in an event titled "Science for Peace and Development." I will be speaking right after Kofi Annan! (More about this later.) Because of this responsibility, I was eager to learn what role science has played for peace by attending many talks and the ceremony held at CERN on 29 September for its 60th anniversary under the theme "Science for Peace."

As is well known, CERN was founded as a symbol for unity of Europe in the aftermaths of WWII, an idea hatched by a small group of visionary scientists and public administrators. They identified basic research as a tool to rebuild Europe and foster peace in the war-torn region. I've heard amazing stories from the talks about those initial days. Scientists learned to set aside cultural, religious and historical prejudices to work together even though it was not easy at the beginning.

George Mikenberg from the Weizmann Institute in Israel told us that German scientists did not feel accepted at CERN at the beginning, yet eventually they became integrated because "Having well-defined projects at the edge of technology allows people to concentrate on the end products and to forget about their prejudices." When cultural relations were banned, collaboration between German and Israeli scientists was hatched in 1959 in the CERN cafeteria, and a scientific exchange programme started in 1962, three years before any diplomatic relation between the two countries was established. He said "common search for knowledge is much stronger than hate". Now both Israeli and Palestinian students come to CERN's Summer Student Programme.

Michal Turala from the Polish Academy told us about the relationship between West and East during the Cold War. It was not easy for scientists from the East to travel because it was difficult to obtain visas and permits, and also because Eastern currencies were not exchangeable. Western scientists offered financial help to them. JINR Dubna was built as the "counter weight to CERN" for political motivations, yet CERN and Dubna had joint experiments in the 60s and 70s, and started the CERN-Dubna School of Physics. At the beginning of the 1960s the number of Polish visitors at CERN was second only to Americans, and in 1964 the Polish Office for Atomic Energy managed to get permission for Poland to become an observer in the CERN Council. On the other hand, in 1968 Czechoslovakia was discussing associate membership with CERN, whose talks were

interrupted by the “friendly” invasion.

Even now, it is difficult for some countries to work together. Eliezer Rabinovici, also from Israel, told us an incredible story about the SESAME project. Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority, and Turkey are working together to build a synchrotron light source in Jordan. He emphasised the big difference between the Middle East and Europe, where the war is over and people could move on, while “In our region, the wars are not over. There are different perspectives on who won and who lost, who won yesterday and who wins tomorrow.” He said SESAME actually started in CERN cafeteria – like so many projects. Towards the building of an international laboratory designed based on the CERN model but tailored to the nations involved, it required many negotiations and compromises. I was glad to learn that LBNL and Japan also provided the project with help to go over some big hurdles. He also emphasised the importance to generate public awareness on the project because “people don’t believe Israeli, Arabs, Iranians, Pakistanis can work together… They are cynical about projects in Middle East.” Now the light source is expected to be ready in late 2015 to prove that cynicism is wrong and literally for people to “see the light”.

There were many other fascinating talks, about difficulties in building international organization, negotiation with the Council to get the projects approved, but also how scientific research helped non-proliferation and disarmament. And Turala remarked, “CERN cafeteria is one of the most important places in Particle Physics” for global partnerships.

I came away completely convinced that “Science for Peace” does work. Because we scientists share the common goal to push the frontier of human knowledge, and the goal is so difficult for scientists from a single country, we must and indeed have learned to work together beyond borders. This may seem obvious to many in our fields, but is not obvious at all at wider communities including politicians.

Surely this kind of experience should spread out further. I very much hope that ILC will be another example of “Science for Peace.” Especially in Japan, the relationship with Korea and China is now strained. The ILC could pave the way for better relationships between nations as it happened in Europe. This is a dream that is contagious.

I’m still digesting what I have learned from these talks and writing my speech at UN. The event will be held under the auspices of the President of the United Nations Economic and Social Council (ECOSOC), and will be co-sponsored by the Permanent Missions of France and Switzerland to the United Nations and CERN. It will take place on 20 October 2014, 10:00am to 11:40am (EDT) at the Economic and Social Council Chamber, United Nations Headquarters – New York. The live webcast can be followed at webtv.un.org and more information can be found on CERN’s website.

Stay tuned.

CERN | SCIENCE FOR PEACE | SESAME | UNITED NATIONS

NEWSLINE
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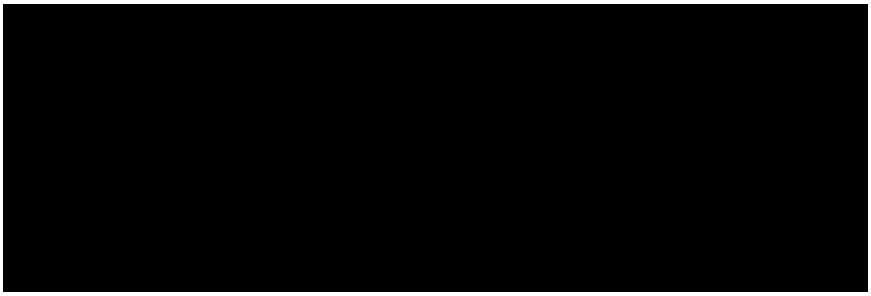
VIDEO OF THE WEEK

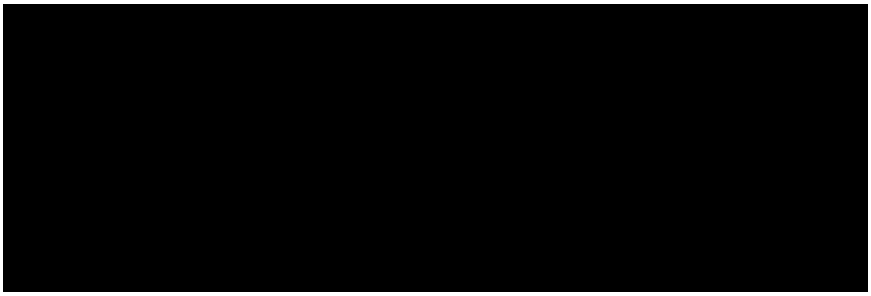
#mylinearcollider: keep them coming

16 October 2014

#mylinearcollider statements don't have to be videos – images work just as well, as Atsushi Kosuge from KEK demonstrates.

The #mylinearcollider campaign continues and the communicators are recording and receiving many video messages like these – some fun, some serious, but all in support of the linear collider. Please see last issue for more information about the campaign and how to take part. If you'd rather not record a video message, why not take a picture of yourself? Atsushi Kosuge from KEK shows how.





MYLINEARCOLLIDER

NEWSLINE
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FEATURE

Full ILC-type cryomodule makes the grade

Joykrit Mitra | 16 October 2014

CM2 cryomodule being assembled at Fermilab's Industrial Center Building (2011). Photo: Reidar Hahn

For the first time, the ILC gradient specification of 31.5 megavolts per metre has been achieved on average across all of the eight cavities assembled in an ILC-type cryomodule. A team at Fermilab reached the milestone earlier this month. It is an achievement for scientists, engineers and technicians at Fermilab and Jefferson Lab in Virginia as well as their domestic and international partners in superconducting radio-frequency (SRF) technologies.

The cryomodule, called CM2, was developed and assembled to advance superconducting radio-frequency technology and infrastructure at Americas-region laboratories. The CM2 milestone achievement has been nearly a decade in the making, since US scientists started participating in ILC research and development in 2006.

"We've reached this important milestone and it was a long time coming," said Elvin Harms, who leads the cryomodule testing programme at Fermilab. "It's the first time in the world this has been achieved."

An accelerating gradient is a measure of how much of an energy boost particle bunches receive as they zip through an accelerator. Cavities with higher gradients boost particle bunches to higher energies over shorter distances. In an operational ILC, all 16,000 of its cavities would be housed in cryomodules, which would keep the cavities cool when operating at a temperature of 2 kelvins. While cavities can achieve high gradients as standalones, when they are assembled together in a cryomodule unit, the average gradient drops significantly.

The road to the 31.5 MV/m milestone has been a long and arduous one. Between 2008 and 2010, all of the eight cavities in CM2 had individually been pushed to gradients above 35 MV/m at Jefferson Lab in tests in which the cavities were electropolished and vertically oriented. They were among 60 cavities evaluated globally for the prospects of reaching the ILC gradient. This evaluation was known as the S0 Global Design Effort. It was a build-up to the S1-Global Experiment, which put to the test the possibility of reaching 31.5 MV/m across an entire cryomodule. The final assembly of the S1 cryomodule setup took place at KEK in Japan, between 2010 and 2011. In S1, seven nine-cell 1.3-gigahertz niobium cavities strung together inside a cryomodule achieved an average gradient of 26 MV/m. An ILC-type cryomodule consists of eight such cavities.

But the ILC community has taken big strides since then. Americas region teams acquired significant expertise in increasing cavity gradients: all CM2 cavities were vertically tested in the United States, initially at Jefferson Lab, and were subjected to additional horizontal tests at Fermilab. Further, cavities manufactured by private vendors in the United States have improved in quality: three of the eight cavities that make up the CM2 cryomodule were fabricated locally.

Hands-on experience played a major role in improving the overall CM2 gradient. In 2007, a kit for Fermilab's Cryomodule 1, or CM1, arrived from DESY, and by 2010, when CM1 was operational, the workforce had adopted a production mentality, which was crucial for the work they did on CM2.

"I would like to congratulate my Fermilab colleagues for their persistence in carrying out this important work and for the quality of their work, which is extremely high," said the SRF Institute at Jefferson Lab's Rongli Geng, who led the ILC high-gradient cavity project there from 2007 to 2012. "We are glad to be able to contribute to this success."

But achieving the gradient is only the first step, Harms said. "There is still a lot of work left to be done. We need to look at CM2's longer term performance. And we need to evaluate it thoroughly."

Among other tasks, the CM2 group will gently push the gradients higher to determine the limits of the technology and continue to understand and refine it. They plan to power and check the magnet—manufactured at Fermilab— that will be used to focus the particle beam passing through the cryomodule. Also in the works is a plan to study the rate at which the CM2 can be cooled down to 2 kelvins and warmed up again. Finally, they expect to send an actual electron beam through CM2 in 2015 to understand better how the beam and cryomodule respond in that setup.

CM2 in its home at Fermilab's NML building, as part of the future Advanced Superconducting Test Accelerator. Photo: Reidar Hahn

Scientists at Fermilab also expect that CM2 will be used in the Advanced Superconducting Test Accelerator currently under construction at Fermilab's NML building, where CM2 is housed. The SRF technology developed for CM2 also has applications for light source instruments such as LCLS-II at SLAC in the United States and the European XFEL and DESY's FLASH.

And it's definitely a viable option for a future machine like the ILC.

CM2 | FERMILAB | JEFFERSON LAB | SUPERCONDUCTING CAVITY