NEWSLINE
THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

DIRECTOR'S CORNER

The 2014 ICFA seminar in Beijing

by Harry Weerts

The recent ICFA seminar addressed many topics and chartered the future physics landscape to fine and, if in the further future, less fine detail, says Harry Weerts, Americas Regional Director for the Linear Collider Collaboration. But he thinks one important thing is lacking: a mechanism on how to achieve consensus on what constitutes the global programme for particle physics in the future.

IMAGE OF THE WEEK

Governor of Iwate prefecture visits CERN

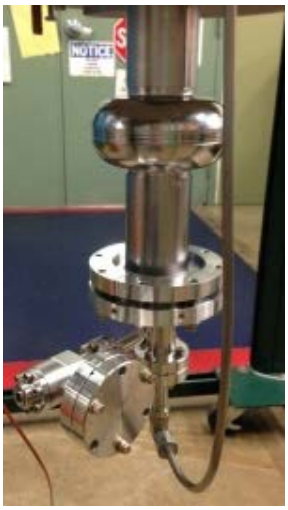
Image: Kenichi Yoshida

Takuya Tasso, Governor of Iwate Prefecture in Japan, visited CERN on 10 November. He wanted to see CERN's activities as a laboratory at the frontier of particle physics and its contribution to world-wide science and education, as well as learn about its social impact.

AROUND THE WORLD

From Fermilab Today: New technique for generating RF power may dramatically cut linac costs

by Troy Rummler



A team at Fermilab has developed a new technique to use a magnetron to power a superconducting radio-frequency accelerating cavity, potentially saving hundreds of millions of dollars in the construction and operating costs of future linear accelerators.

IN THE NEWS

from *Iwate Nippo*
10 November 2014
CERN側「ILC国の早い決断を」 達増知事がスイス訪問
達増知事は　日、　　を訪問した。　　の計画実現に向け、ロルフ・ディエター・ホイヤー所長、　　国際研究者のトップで、リニアコライダー・コラボレーション　　のディレクターのリン・エバンス氏と意見交換した。エバンス氏は「北上に向けて設計のデザインを始めている。日本政府の早い決断が必要」と対応を急ぐべきだと強調した。Iwate prefecture governor, Tatsuya Tasso visited CERN on 10 November, and discussed with CERN Director general, Rolf Heuer, and LCC Director, Lyn Evance about the realisation of the ILC. Evans said “We are on the site specific design for the construction at Kitakami site. We are waiting for the decision by Japanese government.”

from *Science*
7 November 2014
Physicists crank up current in new type of accelerator
A kilometers-long particle accelerator may epitomize big science, but a team of physicists has taken a key step toward doing the same job with a much smaller machine.

from *The Conversation*
5 November 2014
Cheaper, more compact particle accelerators are a step closer
Scientists working on an experiment at the SLAC National Accelerator Laboratory in the US have taken a step forward in developing a technology which could significantly reduce the size of particle accelerators.

from *nature*
5 November 2014
Plasma-surfing machine brings mini-accelerators closer
Surfing ‘wakefield’ waves boosts electron energies over short distances.

CALENDAR

Upcoming events

8th Annual Helmholtz Alliance Workshop on "Physics at the Terascale"
DESY, Hamburg, Germany
01- 03 December 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

1411.2355
Study of single top production at high energy electron positron colliders

1411.2040
Confronting Higgs couplings from D-term extensions and Natural SUSY at the LHC and ILC

ANNOUNCEMENTS

2015 Latin-American School of High-Energy Physics

The 2015 Latin-American School of High-Energy Physics will be held in Ibarra, Ecuador from 4 to 17 March 2015. The lectures will cover a broad range of HEP topics at a level suitable for students working for a PhD in experimental particle physics. Note that financial support may be available for Latin-American students attending the School. Although the School is targeted particularly at students from Latin-American countries, it is open to self-funding students coming from other regions.

Details and application deadline can be found here.

1411.1450
Upper bounds on sparticle masses from muon g-2 and the Higgs mass and the complementarity of future colliders

1411.1335
Discrimination of dark matter models in future experiments

1411.1054
Possible Futures of Electroweak Precision: ILC, FCC-ee, and CEPC

1411.0088
Search for Dark Matter at Colliders

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The 2014 ICFA seminar in Beijing

Harry Weerts | 13 November 2014

Participants at the recent ICFA Seminar i Beijing, from which Harry Weerts reports. Image: IHEP

The ICFA seminar is a meeting held every three years, rotating through the Americas, Asia and Europe. The last meeting in 2011 was held at CERN, and the most recent one in Asia at the Institute for High Energy Physics (IHEP) in Beijing from 27 to 30 October. The next meeting in 2017 will be in Vancouver, Canada.

The meeting is organised by the International Committee on Future Accelerators (ICFA) and attended by representatives from countries, with a total attendance of about 200. The format consists of invited plenary talks which provide high-level overviews of the current state of particle, nuclear and astrophysics and plans for future facilities around the globe. The program for the Beijing meeting can be found here. More information about all ICFA activities is here.

Instead of trying to give a summary of the whole ICFA seminar here I will concentrate on high-energy colliders, with a bias towards ILC, and presentations and discussions around this topic.

In the last decade future high-energy colliders considered were lepton colliders with centre-of-mass energies between 500 GeV and ~3TeV and they were the ILC, CLIC and the muon collider. They were developed to different degrees of realism, varying from a Technical Design Report for the ILC, a Conceptual Design Report (CDR) for CLIC and a concept for the muon collider. Recent strategic planning exercises and the discovery of the Higgs boson have fueled new ideas for future colliders. The measurement of Higgs boson properties is “a tool for discovery”, to quote the US P5 report. There is now a series of studies and design reports for several possible future colliders with varying degrees of readiness. In the next ten years the LHC and its upgraded version will be the tool to explore the Higgs and possible signs of new physics. Beyond that the picture of future facilities emerging from the ICFA seminar has become more diffuse. The P5 report in the US recommended not to pursue the muon collider concept any longer. The ILC is ready to be built and the world is waiting for a sign from Japan on whether it will offer to host. China is proposing to build a circular electron-positron Higgs factory, with centre-of-mass energies between 250-350 GeV, followed by a ~80-100TeV proton-proton collider in the same tunnel. The plan is to have a CDR for the Higgs factory around the beginning of 2015 and a preliminary time line would have the machine operational by the end of the next decade. In parallel with the on-going CLIC study, CERN has initiated a 100-TeV proton-proton collider study in a new tunnel, which might also be used to house a electron-positron Higgs factory. Although inside our field we understand the different stages of readiness and physics reach of these future facilities, it is my concern that outside of our field the difference between studies and technical design reports are not so well understood. Concerning electron-positron colliders it should also be noted that once a straight-line tunnel is constructed for, let’s say, a 500-GeV machine, the linac in such a tunnel could be upgraded in the future as new acceleration structures with much higher gradients become available

There was also a discussion at a round table about global collaboration and a globally coordinated programme. The strategic plans in all

regions that were developed in the last two years all align with a strategic global approach to particle physics in terms of building facilities. It is obvious that the LHC and its upgrades have global support and participation and it is a programme that all regions want to see realised, because it is the only energy frontier collider that will run for the next ten years. Looking beyond the LHC there are regional initiatives (neutrino programme in US, possible ILC in Japan) that are being pursued. However, there is no clear mechanism on how to achieve consensus on what constitutes THE global programme, with facilities in regions that are complementary and together form a unique and coherent approach to address the relevant questions in physics. No clear answer on how to achieve this emerged. Our community feels that it would be great if such a global programme could be put together, so that new expensive facilities can be build that cannot be realised by individual countries. Maybe the human race is simply not ready for that yet and more globalisation has to happen before this can achieved…

CEPC | CLIC | FCC | GLOBAL STRATEGY | ICFA | ILC | LHC | P5

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IMAGE OF THE WEEK

Governor of Iwate prefecture visits CERN

Image: Kenichi Yoshida | 13 November 2014

Takuya TASSO, Governor of Iwate Prefecture in Japan, visited CERN on 10 November to see CERN's activities as a leading international research laboratory cooperation in the frontier of particle physics, and its contribution to world-wide science and education, as well as learn about its social impact.

He talked about efforts in Iwate to welcome and to anticipate realising the ILC in Japan's Kitakami region, which would mean a new leading role by Iwate prefecture in advanced science and technology which would also boost Tohoku's activities to recover from the 2011 earthquake and tsunami. For example, there is a new road and transport root plan in Tohoku, which can be combined with the regional effort to support the ILC laboratory access.

They can stand the rain: LCC Director Lyn Evans, Takuya Tasso, Governor of Iwate Prefecture, and a rock with a Standard-Model equation outside the main control room at CERN. Image: Kenichi Yoshida

CERN's Director-General Rolf Heuer and the LCC Director Lyn Evans welcomed Tasso to CERN. Heuer encouraged Iwate Prefecture to continue efforts for the ILC to be realised in Japan as a complementary world-wide center for frontier particle physics.
He also emphasised the importance of centres like these for the new next generation to lead science in our future.

Lyn Evans emphasised that such a unique and important science programme can be realised in Japan only with international cooperation, and it will be our present to the next generation to work on it. He also introduced two documents, one from CERN and one from OECD , that highlight the societal impact of research centres on their environment.

Both also emphasise that Japan needs to take a decision for the offer to host the project as soon as possible in order to keep the support from the world-wide community. Evans said he would visit Tohoku in mid-January in next year for further close communication with the relevant regional persons and representatives. Tasso said that he would transfer this information and advice to the relevant persons in Japan.

He visited the superconducting system test facility (SM18) , the CERN Control Center CCC and the ATLAS cavern.

CERN | ILC HOSTING | IWATE PREFECTURE

LC NEWSLINE
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AROUND THE WORLD

From Fermilab Today: New technique for generating RF power may dramatically cut linac costs

Troy Rummler | 13 November 2014

If you own a magnetron, you probably use it to cook frozen burritos. The device powers microwave ovens by converting electricity into electromagnetic radiation. But Fermilab engineers believe they've found an even better use. They've developed a new technique to use a magnetron to power a superconducting radio-frequency (SRF) cavity, potentially saving hundreds of millions of dollars in the construction and operating costs of future linear accelerators.

The magnetron project members are, from left: Brian Chase, Ed Cullerton, Ralph Pasquinelli and Philip Varghese. Image: Elvin Harms, Fermilab

The technique is far from market-ready, but recent tests with Accelerator Division RF Department-developed components at the Fermilab AZero test facility have proven that the idea works. Team leaders Brian Chase and Ralph Pasquinelli have, with Fermilab's Office of Partnerships and Technology Transfer, applied for a patent and are looking for industrial partners to help scale up the process.

Both high-energy physics and industrial applications could benefit from the development of a high-power, magnetron-based RF station. The SRF cavity power source is a major cost of accelerators, but thanks to a long manufacturing history, accelerator-scale magnetrons could be mass-produced at a fraction of the cost of klystrons and other technologies typically used to generate and control radio waves in accelerators.

"Instead of paying $10 to $15 per watt of continuous-wave RF power, we believe that we can deliver that for about $3 per watt," Pasquinelli said.

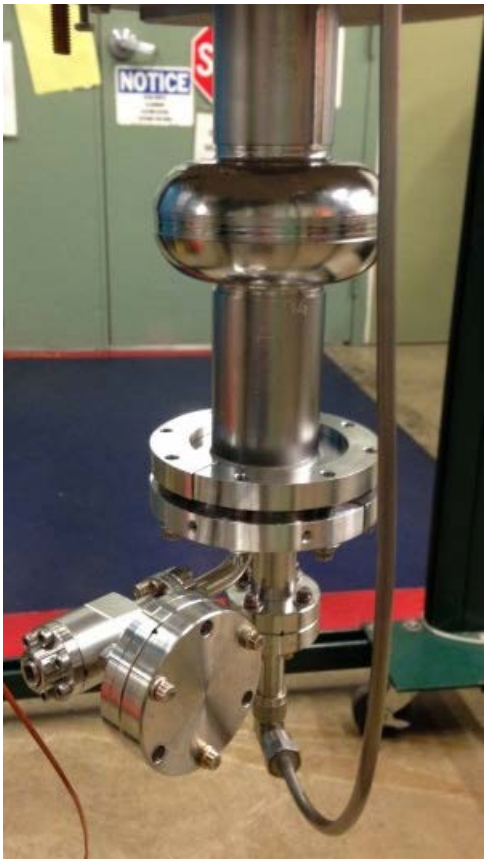
That adds up quickly for modern projects like Fermilab's Proton Improvement Plan II, with more than 100 cavities, or the proposed International Linear Collider, which will call for about 15,000 cavities requiring more than 3 billion watts of pulsed RF power. The magnetron design is also far more efficient than klystrons, further driving down long-term costs.

But the straightforward idea wasn't without obstacles.

"For an accelerator, you need very precise control of the amplitude and the phase of the signal," Chase said. That's on the order of 0.01 percent accuracy. Magnetrons don't normally allow this kind of control.

One solution, Chase realized, is to apply a well-known mathematical expression known as a Bessel function, developed in the 19th century for astronomical calculations. Chase repurposed the function for the magnetron's phase modulation scheme, which allowed for a

high degree of control over the signal's amplitude. Similar possible solutions to the amplitude problem use two magnetrons, but doubling most of the hardware would mean negating potential savings.



A team from Fermilab's Accelerator Division has successfully powered this small SRF cavity with a magnetron. Now they aim to power a large, application-specific model. Photo: Brian Chase, Fermilab

FERMILAB | POWER SOURCE | SCRF

"Our technique uses one magnetron, and we use this modulation scheme, which has been known for almost a hundred years. It's just never been put together," Pasquinelli said. "And we came in thinking, 'Why didn't anyone else think of that?'"

Chase and Pasquinelli are now working with Bob Kephart, director of the Illinois Accelerator Research Center, to find an industry partner to help them develop their idea. Inexpensive, controlled RF power is already needed in certain medical equipment, and according to Kephart, driving down the costs will allow new applications to surface, such as using accelerators to clean up flue gas or sterilizing municipal waste.

"The reason I'm not retired is that I want to build this prototype," Pasquinelli said. "It's a solution to a real-world problem, and it will be a lot of fun to build the first one."

This article first appeared in Fermilab Today.